Interventional
What Radiologists Need to Know: From Wires and Catheters to Balloons and Stents

All Day Location: VI Community, Learning Center

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TEACHING POINTS
The aim of this exhibit is to 1) review common types of wires, catheters, balloons and stents 2) to highlight their main characteristics 3) to illustrate when and where to use them in different clinical scenarios.

TABLE OF CONTENTS/OUTLINE
Wires
Detail different characteristics including diameter, length, tip shape and stiffness, core construction and coatings
Explain selection of wires in different clinical settings including support, exchange, lesion and chronic total occlusion crossing
Catheters
Illustrate advantages of different catheters based on their characteristic shapes, construction and how this gives handling characteristics such as trackability and pushability
Discuss usage in specific clinical circumstances
Balloons
Present differences between a compliant and a non-compliant balloon and their examples including moulding, scoring/cutting, high pressure, drug eluting, micro-porous balloon
Provide examples of their clinical application
Stents
Describe differences between self expandable, balloon mounted and covered stents
Explain why, when and where to use a stent
The Concept of Flow Diversion for Intracranial Aneurysm Treatment

All Day Location: VI Community, Learning Center

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TEACHING POINTS

- To appreciate and understand the new treatment concept of flow diversion
- To understand important angiographic findings and possible complications associated with the use of flow diverters
TEACHING POINTS

Varices are a common manifestation of portal hypertension that can result in severe morbidity and mortality. Important early identification and coordination with clinical care teams can result in improved patient outcomes. Multiple options exist for the treatment of varices which vary depending on indication and clinical scenario.

TABLE OF CONTENTS/OUTLINE

Underlying causes of varices; physiology and pathology Identifying the most common types of varices Treatment options TIPS BRTO Direct embolization (glue, coil and others) Splenic embolization Treatment of portal vein thrombosis and/or stenosis Treatment of hepatic vein thrombosis and/or stenosis Follow up and post treatment management.
Necessity for Real-time Measurement of the Occupational Radiation Dose in Interventional Radiology

All Day Location: VI Community, Learning Center

Participants
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TEACHING POINTS
- To understand the importance of radiation protection for interventional radiology (IR) staff, given the recent regulatory changes in the dose limit for the eye lens (from 150mSv to 20mSv per year)
- To understand the need for managing the occupational dose
- To understand the fundamental characteristics of a real-time occupational dosimetry and display system (i2 system)

TABLE OF CONTENTS/OUTLINE

Fundamental performance of an i2 system
Energy dependence, dose linearity, and dose-rate dependence were compared. Clinical benefits of the i2 system
The i2 system provides real-time dose measurement and visualization. The dose information is sent wirelessly to the base station. Comparison of fundamental performance among several occupational real-time dosimeters (i2 system, pocket dosimeter, etc.)
SUMMARY:
Real-time monitoring of the radiation doses received by IR staff has become highly desirable. However, occupational doses are rarely measured in real time, due to the lack of a feasible method for use in IR. In general, the i2 system exhibited excellent performance. In occupational dose measurements, the fundamental performance of the i2 system was equivalent to those of other occupational dosimeters. Furthermore, the i2 system demonstrated real-time visualization of the dose rate, which other occupational dosimeters cannot provide.
**TEACHING POINTS**

The aim of this exhibit is to 1) review indications for embolisation 2) to highlight the common types of embolization materials available 3) to discuss when and where to use them in different clinical scenarios.

**TABLE OF CONTENTS/OUTLINE**

Indications for embolisation therapy • Review common clinical conditions where embolisation therapy is indicated ie. control of various type of haemorrhages, treatment of benign and malignant tumours, endoleaks, arterio-venous malformations (AVMs) and as a pre operative step to devascularise the surgical bed.

Embolisation Materials • Highlight physical properties of coils, particles, glue, gel foam, liquid embolics and plugs • Illustrate various types of embolic agents available and their biophysical properties. Explain why, when and where to use different agents.

Clinical scenarios • Describe various clinical scenarios and techniques to illustrate practical real world use of different embolics
Lymphatic Intervention for Various Kinds of Lymphorrhea: How to Access and Treat

All Day Location: VI Community, Learning Center

TEACHING POINTS

Techniques of lymphangiography. The lymphatic intervention consist of diagnostic lymphangiography followed by embolization or sclerotherapy. Intranal lymphangiography is technically feasible. An inguinal node was directly accessed under ultrasound guidance using a needle followed by lipiodol injection. Intrahepatic lymphangiography is the only method which could visualize lymphorrhea from hepatic lymphatics. We puncture the liver close to the right portal vein using a needle under ultrasound guidance. We withdraw the chiba needle slowly while injecting small volumes of Urografin until hepatic lymphatic channels are opacified. This usually needs multiple puncture of the liver. How to access thoracic duct: Access from the cistern chyli. Following lymphangiography, the cistern chyli/thoracic duct is punctured under fluoroscopic or CT guidance. A guidewire was inserted into the thoracic duct, then 2.0-Fr micro catheter was advanced over the wire. Access from venous angle: 4-Fr sheath is inserted from left cephalic vein. A 4-Fr catheter is advance near the venous angle and cannulated the lymphatic vessel flowing into the subclavian vein. Then, microcatheter is advanced into the thoracic duct coaxially.

TABLE OF CONTENTS/OUTLINE

Target of lymphatic intervention Management of lymphorrhea Procedure details Embolization and Sclerotherapy
Not all Colic is Calculi: Ureteric Obstruction from Mycotic Aneurysm

All Day Location: VI Community, Learning Center

Participants
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TEACHING POINTS
1. Renal colic is a common presenting complaint, but in this case occurring secondary to a rare pathology- mycotic aneurysm. 2. The case considers the complex challenges faced when treating multiple mycotic aneurysms, including the role of diagnostic/interventional radiology.

TABLE OF CONTENTS/OUTLINE
1. Presentation of mycotic aneurysm as renal colic on imaging. No previously described cases of common iliac mycotic aneurysm, presenting as renal colic, were found in the literature. The patient presented as left renal colic with blood in the urine, a 6 month history of arthralgia, visual disturbances and low grade pyrexia and a background of blood culture positive bacteraemia post bilateral breast augmentation. 2. Imaging review in advanced bacterial endocarditis causing mycotic aneurysms. 3. Management of multiple mycotic aneurysms, including images from interventional procedures. A high index of suspicion is essential for the diagnosis of this rare condition, since septic emboli cause devastating sequelae and all untreated infected aneurysms eventually rupture. Furthermore, although aneurysmectomy and antibiotics is the treatment of choice, complicating factors prohibited this gold standard and necessitated immediate aneurysm exclusion by endovascular treatment.
Preparing for Call by IR Residents: Perspectives from a Large Urban Academic Medical Center

All Day Location: VI Community, Learning Center

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TEACHING POINTS
1. Potential structures of call coverage over a 5 year IR residency. Benefits and drawbacks of each.2. Understand barriers to establish a separate interventional radiology call pool.3. Discuss unique challenges to resident preparation for IR call in the upcoming residency programs.4. Familiarize with possible methods to prepare IR residents for independent diagnostic and interventional call.

TABLE OF CONTENTS/OUTLINE
1. Review a 5 year plan for IR resident call coverage.2. Review potential didactic and case based IR pre-call curriculum to administer during the PGY4 year prior to beginning IR call during the PGY5 year.3. IR residents will naturally desire early, advanced procedural training, but development of clinical patient management skills should be a priority during the first dedicated IR year, PGY5. Explore how to best layer skill sets throughout earlier DR and IR rotations to best prepare residents for call.4. An ICU month is required in the new structure, so the optimal timing of this experience will be discussed. A logical place in the curriculum is early during the PGY5 year to facilitate higher level clinical education during the first dedicated year of IR training.
Diagnosis of changes in visceral abdominal arteries (VAA) is unusual, but has become more common due to the increased number of performing exams and ultrasound plays an important role. Aneurysms are more common in splenic artery, which affects more middle-aged women, most isolated and asymptomatic, with risk of rupture when greater than 2 cm, and hepatic, which may have atherosclerotic or fungal origin, with no gender preference and about 80% extrahepatic, and up to 1/3 present epigastric pain, hemobilia and obstructive jaundice triad. The spontaneous dissection of the superior mesenteric artery (SMA) affects more middle-aged men and can occur isolated or associated with aortic dissection. The most common symptom is vague abdominal pain. Renal artery stenosis is the most common cause of secondary hypertension, caused by atherosclerosis with a location proximal to the ostium in middle-aged patients, or fibromuscular dysplasia affecting the middle or distal third in young patient. The proper recognition of major changes in VAA allows the early diagnosis and appropriate treatment, which are fundamental in the setting of a higher number of tests ordered by other causes even non-vascular.

TABLE OF CONTENTS/OUTLINE

Diagnosis of changes in VAA Aneurysms in splenic and hepatic arteries Spontaneous dissection of the SMA Renal artery stenosis
TEACHING POINTS

1. Revisit Superior Mesenteric Artery (SMA) Syndrome presentation and pathogenesis.
2. Examine multimodality imaging technologies and associated radiographic findings that suggest chronic duodenal ileus.
3. Review updated Gastroenterological and Surgical literature on the current standards-of-care for the treatment of patients with SMA Syndrome.

TABLE OF CONTENTS/OUTLINE

1. Overview of the clinical course of SMA Syndrome.
2. Case-based review of the imaging findings suggestive duodenal obstruction from chronic duodenal ileus.
3. Review of medical and surgical literature on the current standard of care for the treatment of patients with SMA Syndrome.
Application of Particle Image Velocity for Confirming Abnormal Hemodynamic Features in the Suspicious Stroke Region Found in Clinical Imaging

All Day Location: VI Community, Learning Center

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TEACHING POINTS
We will review a basic principle of particle image velocity (PIV) focused on the application for hemodynamic analysis. We will introduce when PIV measurement is clinically needed and how it can help revealing the blood flow features focused on the stroke disease. We will introduce applications of PIV for analyzing abnormal hemodynamics in cooperation with MR-TOF imaging.

TABLE OF CONTENTS/OUTLINE
1. Introduction of PIV: basics, principle and state of the art system.
2. What kinds of study needs PIV?
4. What can be obtained from PIV: quantification method of blood flow, estimation of wall shear stress and turbulent intensity.
5. Prospect of 4D PC-MRI: current outcomes, technical obstacles and potentials.
Strategies for Reducing Thermal Collateral Injuries in Ultrasound-guided Radiofrequency Ablation of Liver Tumors; Emphasis on Artificial Ascites Technique

All Day Location: VI Community, Learning Center

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TEACHING POINTS
1. To overview the current strategies for reducing thermal collateral injuries in US-guided radiofrequency (RF) ablation of liver tumors
2. To provide comprehensive review of artificial ascites technique
3. To discuss the correlation between artificial ascites and development of pleural effusion

TABLE OF CONTENTS/OUTLINE
A. Overview of the current strategies for minimizing thermal collateral injuries
   1. Artificial ascites technique
   2. Purposeful patient positioning
   3. Cooling bile duct with endoscopic nasobiliary tube
   4. Others
B. Comprehensive review of artificial ascites technique
   1. Steps to make artificial ascites
   2. Infusion routes of artificial ascites according to the tumor location in the liver
   3. Tips to enhance the role of artificial ascites
   4. Comparison between 5% dextrose solution and physiologic saline as artificial ascites
C. Correlation between artificial ascites and the development of pleural effusion
   1. Mechanism of the development of pleural effusion after RF ablation with artificial ascites
      a. Current understanding of the development of pleural effusion: a literature review
      b. Suggested new concept regarding how pleural effusion may occur
   2. The fate of pleural effusion
Drainage Flow from Hypervascular Hepatocellular Carcinoma: Importance in Intervention

All Day Location: VI Community, Learning Center

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TEACHING POINTS
This presentation is based on our previous researches and experiences. Some of the data have already been published as articles. The teaching points of this presentation is To review the pathophysiology and imaging of the drainage flow from hepatocellular carcinoma (HCC) To review the importance of the drainage flow in the progression of HCC To discuss the importance of the drainage area in local recurrence of HCC following RFA and/or TACE To discuss how to treat the drainage area in RFA and TACE

TABLE OF CONTENTS/OUTLINE
1. Drainage flow from HCC: pathologic-imaging correlation-Changes of blood supply and drainage flow during multi-step hepatocarcinogenesis-Drainage flow from a hypervascular HCC with pseudocapsule and imaging findings of drainage area2. Importance of the drainage area in the progression of HCC-Drainage area and microsatellites of HCC-Case presentations with daughter nodules within drainage area3. Local recurrence in the drainage area following RFA and/or TACE -Case presentations4. How to treat the drainage area in intervention -TACE with special references to the function of iodized oil -RFAS. Summary
Pay Attention to What Patients Say: Provocation Test during Angiography for Arterial Thoracic Outlet Syndrome

All Day Location: VI Community, Learning Center

Awards
Cum Laude

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TEACHING POINTS

1. To review arterial thoracic outlet syndrome; including the anatomy of the thoracic outlet, various provocation tests, and typical imaging features of arterial thoracic outlet syndrome. 2. To introduce patient history based provocation test during angiography and to understand that actively listening to what patients say is one of the most important aspects of diagnosing arterial thoracic outlet syndrome.

TABLE OF CONTENTS/OUTLINE

Our exhibit will be divided into 4 sections and present relevant illustrations and cases:1. Thoracic outlet syndrome(1) Anatomy of the thoracic outlet(2) Definition of thoracic outlet syndrome(3) Classification of thoracic outlet syndrome2. Provocation test for diagnosing arterial thoracic outlet syndrome3. Typical angiographic features of arterial thoracic outlet syndrome4. Several cases of patient history based provocation test during angiography
Venous Sampling in Interventional Radiology: Pearls, Pitfalls, and Advances

All Day Location: VI Community, Learning Center

**Participants**
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**TEACHING POINTS**

1. Venous sampling performed in interventional radiology aids in accurate diagnosis and localization of endocrine disease.
2. Understanding the relevant venous and cross sectional anatomy and anatomical variants is essential for accurate interpretation of venous sampling findings.
3. Specific techniques and emerging technologies will allow for more accurate and reliable diagnosis.

**TABLE OF CONTENTS/OUTLINE**

1. Adrenal vein sampling (AVS)
   - Describe causes of hyperaldosteronism with relevant pathophysiology and anatomy.
   - Discuss the role of AVS in the diagnostic algorithm for evaluating primary aldosteronism.
   - Review techniques for performing AVS including common difficulties, focusing on emerging technologies.

2. Inferior petrosal sinus sampling (IPSS)
   a. Discuss the pathophysiology of Cushing syndrome.
   b. Describe role of IPSS in diagnosing Cushing disease.
   c. Review techniques for performing IPSS emphasizing newer techniques to increase accuracy.

3. Parathyroid hormone (PTH) venous sampling
   a. Review pathophysiology of hyperparathyroidism, discussing relevant anatomy.
   b. Describe the role PTH sampling has in localization for surgical planning.
   c. Discuss the use of 4D CT in conjunction with PTH sampling to improve localization of ectopic parathyroid.
Critical Role of Visceral Arteriography in Diagnosis of Hepatic Malignancy and Planning of Liver-Directed Therapies: Illustrative Case Review

All Day Location: VI Community, Learning Center

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TEACHING POINTS
1. Interventional Radiology (IR) procedural planning for liver-directed therapy is primarily based on cross-section imaging with contrast-enhanced CT and MRI. Intraprocedural angiography can reveal unexpected anatomic and pathologic findings, and accurately depicts vascular supply to target lesions. 3. Interventionalists must be able to revise their approach in real-time to accommodate unexpected findings. 4. Percutaneous arteriography adds critical diagnostic value beyond cross-sectional imaging.

TABLE OF CONTENTS/OUTLINE
1. Role of pre-procedural cross-sectional imaging prior to chemoembolization (TACE) and transarterial radioembolization (TARE).-Assessment of vascular anatomy, including hepatic arterial supply and portal vein patency.-Assessment and localization of tumor burden and target lesions. 2. Intraprocedural angiography-Technique-Description of vascular anatomy and frequently encountered anatomic variants. 3. Series of cases demonstrating how intraprocedural angiography contributed to diagnosis of hepatic malignancy and altered procedural approach and treatment.
TEACHING POINTS

Magnetic Resonance Angiography (MRA) represents a powerful imaging technique to detail information related to the vessel wall, vessel lumen, and surrounding non-vascular soft tissue. This technique is performed without damaging ionizing radiation and the risk of contrast induced nephrotoxicity. This exhibit aims to educate the viewer on the various techniques available for MRA imaging of the lower extremity and the ability of these techniques to assess atherosclerotic disease and to accurately diagnose cystic adventitial disease, popliteal artery entrapment syndrome, and vasculitis.

TABLE OF CONTENTS/OUTLINE

- Summary of angiographic techniques using digital subtraction and computed tomography.
- Description of MRA techniques. This discussion will focus upon bright blood techniques using 3D, gadolinium-enhanced, GRE imaging coupled with a bolus chase algorithm. Analysis using source images, multiplanar reconstructions, and 3D reconstruction using a MIP algorithm will also be detailed. Lastly, non-contrast techniques incorporating balanced steady state free precession algorithms will also be outlined.
- MRA imaging features of atherosclerosis.
- MRA diagnosis of cystic adventitial disease.
- MRA description of popliteal artery entrapment syndrome.
- MRA anatomic evaluation for fibular graft procurement.
- MRA imaging features of vasculitis.
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TEACHING POINTS
This exhibit demonstrates a new educational website that will provide a resource for in-training and practicing interventional radiologists, provide a resource for other health care professionals, provide patient information literature, and facilitate a competency based approach to assessment of trainees.

TABLE OF CONTENTS/OUTLINE
IR Procedures provides a high quality standard of interventional radiology (IR) educational material. It provides relevant information and links for quick access to information. This is a collaborative venture of interventional radiologists, IR and educational facilities, and supporters of IR. The site is organized into modules, which present information for a specific procedure or type of intervention. An experienced IR radiologist authors each module and an independent IR radiologist reviews each module for further editing prior to web publication. Resources included on the site: pre-procedure patient workup check list, pre and post procedure care information, specifics of the procedure, patient orientated information brochures, module specific quizzes, competency statements which can be adopted for trainee assessment. Users may also provide feedback as the technical approach to procedures may vary and evolve. This resource is online and open access for any user.
"It’s Complicated": The Role of Diagnostic and Interventional Radiology for Pediatric Organ Transplant Complications

Awards
Certificate of Merit

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TEACHING POINTS
To list the common complications following pediatric organ transplantation
To compare different imaging modalities in their evaluation
To review interventional procedures used in treating post-operative complications

TABLE OF CONTENTS/OUTLINE
Common complications following liver, kidney, lung, and heart transplantation in pediatric patients: Vascular: thrombosis, stenosis, aneurysm, shunt Fluid collections: abscess, biloma, urinoma, ascites Ductal: biliary and ureteral strictures Parenchymal disease: rejection/failure, disease recurrence, post-transplant lymphoproliferative disorder Diagnostic imaging tools used to monitor and diagnose post-operative complications: US, X-ray, CT, MRI/MRA/MRCP, fluoroscopy Interventional radiology procedures performed on post-operative patients to help diagnose and treat complications: angiography, angioplasty, stent, embolization, drainage, biopsy, central venous access Sample cases Summary: Wide array of complications following pediatric organ transplantation can be variably imaged and often well managed with interventional radiology
Diagnosing and Managing Endoleak Complications after Endovascular Abdominal Aortic Aneurysm Repair: Understanding the Critical Role of Radiology

Participants
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TEACHING POINTS
1. Cross-sectional imaging plays a critical role in pre- and post-endovascular aortic repair patient management.
2. Diagnostic and interventional radiologists must understand the endoleak classification system and how this guides management decisions.
3. Interventional radiology plays a critical role in managing endoleaks, particularly Type II endoleaks.

TABLE OF CONTENTS/OUTLINE
Background-Aneurysm definition-Risk factors-Prevalance-AAA screening guidelinesDescription of AAA treatment optionsHow patients are selected for endovascular aneurysm repair (EVAR) versus open repairImportance of imaging surveillance after EVARReview complications of EVAR, with a focus on the importance of imaging in these diagnosesDetailed review of endoleak classification system, including verbal description, pictorial/cartoon images, and correlation with cross-sectional imaging-Also correlate with angiographic findings, where appropriateHighlight the role of interventional radiology in confirming diagnosis and management of various types of endoleaks, with a focus on Type II endoleaks (including literature review)IR management of endoleaks with:- Transarterial embolization-Translumbar puncture and embolization-Placement of additional stent and/or stent-grafts-"Peri-graft" access in treating complex endoleaksDiscussion and Conclusions
Simulation in CT-Guided Biopsy Resident Training: Review of the Literature and Description of the Use of a Home-made Phantom for Training

All Day Location: VI Community, Learning Center

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TEACHING POINTS
1. Simulation training has become an integral component of medical education. 2. Phantoms for simulation are typically very expensive, so the ability to make a simple, reusable, inexpensive phantom that is an effective teaching tool is of great value to radiology education. 3. Hands-on biopsy training allows for increased learner competence and confidence, thus improving patient care and safety.

TABLE OF CONTENTS/OUTLINE
Review the benefits of simulation training for physicians. Describe the current role of simulation training for CT guided procedures, including literature review. Detail the development of a home-made CT-guided biopsy phantom that is reusable, inexpensive, and easy to make. Provide comparison of this home-made phantom to commercially available phantom. Report the initial experience with this home-made phantom for resident training: Pilot study conducted with small group of residents After training session, all subjects reported improved understanding of XY and XYZ axis and comfort in performing CT-guided biopsy Suggest future uses for this phantom, as well as potential improvement or changes to the phantom.
New Frontiers In Ureteral Stenosis Percutaneous Treatment

All Day Location: VI Community, Learning Center

FDA Discussions may include off-label uses.

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TEACHING POINTS
To review the different modalities in ureteral stenosis treatment by means of percutaneous approach including ureteral stents and ureteroplasty. To compare the advantages and disadvantages of classic and cutting balloon devices in ureteroplasty. To introduce technique, benefits, difficulties and complications as well as short term results of the use of drug eluting (paclitaxel) balloons in ureteroplasty.

TABLE OF CONTENTS/OUTLINE
Retrospective review of 15 cases (during a 5 year period) of post-surgical ureteral stenosis of various origins managed by percutaneous ureteroplasty. Initial success rate, patency at 1 and 5 years and complications were analyzed and compared with the results of 44 cases from a previous revision our institution made 5 years before. This results were later compared with the ones achieved with drug eluting (paclitaxel) balloon ureteroplasty (currently being performed and having 3 cases so far). This technique, currently in process of being accepted by the scientifical community, can soon become a promising therapy in ureteral stenosis. Finally we made a bibliographic review on technique advantages and disadvantages as well as on success rate and complications of all three modalities of ureteroplasty and of ureteral stent placement.
Participants
Yilun Koethe, MD, San Francisco, CA (Presenter) Nothing to Disclose
Maureen P. Kohi, MD, San Francisco, CA (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS

TABLE OF CONTENTS/OUTLINE
Teaching Points

Describe imaging findings and clinical presentations of placenta accreta Discuss the use of US and MRI for diagnosis Detail the role of radiology in the management of placenta accreta through internal iliac artery balloon occlusion catheter placement and arterial embolization Review indications, outcomes and post-procedural managements

Table of Contents/Outline

What is placenta accreta? The role of US and MR for early diagnosis of placenta accreta Indications for imaging Pictorial demonstrations of US and MR Imaging features Sensitivity and Specificity of imaging features Overall effectiveness of US and MRI in the diagnosis and detection of placenta accreta Use of imaging for patient risk stratification Why is placenta accreta important? Clinical risk factors and presentation Morbidity and mortality Role of Interventional Radiology (IR) for the management of placenta accreta Conventional management Role of IR and discussion of image-guided techniques Pre-op bilateral internal iliac artery balloon occlusion catheter placement Arterial embolization Staged intra-op arterial embolization after delivery followed by delayed hysterectomy Pictorial demonstrations of above techniques Post-procedural imaging and management of complication and adverse effects
Awards
Certificate of Merit

Participants
Nishith Patel, MD, Morristown, NJ (Presenter) Nothing to Disclose
Jay Patel, MD, Morristown, NJ (Abstract Co-Author) Nothing to Disclose
Kimberly Scherer, DO, Morristown, NJ (Abstract Co-Author) Nothing to Disclose
Thaddeus M. Yablonsky, MD, Morristown, NJ (Abstract Co-Author) Nothing to Disclose
Sean Calhoun, DO, Long Valley, NJ (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
The purpose of this exhibit is: Review the normal and variant anatomy of the arterial vasculature within the neck Discuss the various disease entities that can affect the arteries within the neck and diagnostic clues. Atherosclerotic disease is a major contributor to carotid stenosis which can be assessed morphologically on CT and physiologically on ultrasound. Intimal flap or double lumen is pathognomonic for a dissection. Fibromuscular Dysplasia has 3 types, of which type 1 is the most common and demonstrates a 'string of beads' appearance. Iatrogenic injury can result in pseudoaneurysms or fistulas and must be taken into consideration. Explain the utility of ultrasound and CTA/MRA in evaluating the various conditions.

TABLE OF CONTENTS/OUTLINE
Normal Vascular Anatomy of the Neck Embryogenesis CTA/MRA appearance Ultrasound appearance with reference values Variations of Aterial Vasculature in the neck Tortuous carotid artery medialization of the carotid Persistent hypoglassal artery/ Bovine Arch Disease entities with sample cases Atherosclerotic disease Thrombus Dissection Pseudoaneurysm Fistula Fibromuscular Dysplasia Subclavian Steal Carotid Body Tumor Summary
Advanced Novel Cone-Beam CT Imaging Techniques in Trans-Radial Interventional Oncology Procedures.

All Day Location: VI Community, Learning Center

Participants
Paul J. O'Connor, MD, New York, NY (Presenter) Nothing to Disclose
Rahul S. Patel, MD, New York, NY (Abstract Co-Author) Consultant, Sirtex Medical Ltd; Research Consultant, Medtronic, Inc; Consultant, Pennumbra, Inc; Consultant, Terumo Corporation
Imrinesjah M. van der Bom, Andover, MA (Abstract Co-Author) Employee, Koninklijke Philips NV
Aaron M. Fischman, MD, Harrison, NY (Abstract Co-Author) Consultant, Surefire Medical, Inc Consultant, Terumo Corporation
Speakers Bureau, Koninklijke Philips NV
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Robert A. Lookstein, MD, New York, NY (Abstract Co-Author) Consultant, Johnson & Johnson; Consultant, Boston Scientific Corporation; Consultant, The Medicines Company

TEACHING POINTS
Discuss the benefits and limitations of advanced Cone-Beam CT (CBCT) imaging techniques in liver interventional oncology (IO) procedures from a transradial (TR) approach. Demonstrate the application and benefits of a newly developed CBCT imaging technique for IO procedures utilizing radial artery access.

TABLE OF CONTENTS/OUTLINE
Review of liver vascular and tumor anatomy. Review of TR access for liver directed IO therapies. Discuss advanced IO imaging techniques, including benefits and limitations of CBCT versus 2D angiography in TR liver directed IO therapies. Demonstration of the newly developed of open trajectory CBCT technique and benefits in procedures utilizing radial artery access. Discuss our institutional experience using open trajectory CBCT versus the standard 'Closed' CBCT in trans-radial artery access cases. Case presentations of open trajectory CBCT in liver IO procedures.
TEACHING POINTS

1. General review of the TIPS procedure including; indications, contraindications, conventional TIPS technique.  
2. Pictorial review of the ICE catheter and how using groin access with the catheter in the IVC can help with portal vein access and lower possible complications (no need for wedge venography and decreased amount of needle passes).  
3. Case based review of common indications for TIPS; Portal hypertension (refractory ascites and variceal bleeding), portal vein thrombolysis and Budd Chiari.

TABLE OF CONTENTS/OUTLINE

1. General overview of the TIPS procedure including a pictorial review of the standard technique  
2. Overview of the ICE catheter including liver anatomy and how it helps guide stent creation and placement. Hepatic vein anatomy is not as intuitive on fluoroscopic imaging. Included in this presentation will be how ICE can help guide the operator in selecting the correct hepatic vein and portal vein.  
3. Case based review of common indications for TIPS creation including portal hypertension, portal vein thrombolysis and Budd Chiari.
Participants
Jason C. Ni, MS, Los Angeles, CA (Abstract Co-Author) Nothing to Disclose
Jonathan K. Park, MD, Los Angeles, CA (Presenter) Nothing to Disclose
Alice S. Chen, MD, Los Angeles, CA (Abstract Co-Author) Nothing to Disclose
Matthew K. Walsworth, MD, MS, Santa Monica, CA (Abstract Co-Author) Nothing to Disclose
Hsin-Yi Lee, MD, Los Angeles, CA (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
1. The conventional method for performing lower extremity arterial intervention is the contralateral retrograde (up-and-over) technique. However, the failure rate in recanalizing chronic total occlusions (CTOs) approximates 20% from this approach. In these cases (and even for primary intervention), ultrasound-guided retrograde popliteal arterial access can be performed to facilitate endovascular recanalization. The aims of this exhibit are thus as follows.2. To review the indications and rationale for performing retrograde popliteal artery access to perform femoral arterial CTO recanalization.3. To guide the reader through the pre-procedural diagnostic imaging, interventional methods, benefits, and potential complications of popliteal artery access.4. Case examples will be presented to highlight the technique.

TABLE OF CONTENTS/OUTLINE
Uterine Arteriovenous Malformations: Endovascular Management and Outcomes

All Day Location: VI Community, Learning Center

Awards
Certificate of Merit

Participants
Ahmed K. Abdel Aal, MD, PhD, Birmingham, AL (Presenter) Consultant, St. Jude Medical, Inc Consultant, Baxter International Inc Consultant, C. R. Bard, Inc
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Rachel F. Oser, MD, Birmingham, AL (Abstract Co-Author) Nothing to Disclose
Nathan W. Ertel, MD, Hoover, AL (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
Teaching points:
1. Review the causes and clinical presentation of uterine arteriovenous malformations.
2. Describe the imaging findings seen on ultrasound (gray-scale and color Doppler), catheter angiography, as well as MRI.
3. Demonstrate the endovascular management of uterine arteriovenous malformation.
4. Highlight the potential complications and outcomes of endovascular management.

TABLE OF CONTENTS/OUTLINE
Outline:
1. Introduction and incidence.
2. Causes and presentation of uterine arteriovenous malformations.
3. Radiologic appearance of uterine arteriovenous malformations on different imaging modalities.
4. Endovascular management of uterine arteriovenous malformations.
5. Potential complications.
6. Summary and conclusion.
Peritoneal Dialysis Catheter Placement Technique Using Fluoroscopy and Ultrasound Guidance

All Day Location: VI Community, Learning Center

Participants
Ahmed K. Abdel Aal, MD, PhD, Birmingham, AL (Presenter) Consultant, St. Jude Medical, Inc Consultant, Baxter International Inc Consultant, C. R. Bard, Inc
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Rachel F. Oser, MD, Birmingham, AL (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS

Teaching points: 1- Discuss the indications and contraindications of peritoneal dialysis (PD) catheter placement in the new era of urgent-start PD. 2- Review the pre-procedure patient preparation. 3- Demonstrate a minimally invasive technique for placement of PD catheters. 4- Highlight the importance of the use of ultrasound (including gray-scale and color/power Doppler ultrasound) as well as fluoroscopy to guide safe placement of PD catheter and minimize complications. 5- Describe the essential methods of catheter care after placement. 6- Highlight the complications, as well as, how to avoid and how to manage them.

TABLE OF CONTENTS/OUTLINE

Outline: 1- Introduction, 2- Indications and contraindications, 3- Pre-procedure patient preparation, 4- Fluoroscopy and ultrasound guidance technique for placement of PD catheters, 5- Post procedure catheter care, 6- Potential complications, 7- Summary and conclusion.
The New Age of DAVF (Dural ArterioVenous Fistula)

All Day Location: VI Community, Learning Center

Participants
Diego Preciado, MD, Sabadell, Spain (Presenter) Nothing to Disclose
Joan Perendreu, Sabadell, Spain (Abstract Co-Author) Nothing to Disclose
Jordi Branera, MD, Sabadell, Spain (Abstract Co-Author) Nothing to Disclose
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Viviana P. Beltran Salazar, MD, Sabadell, Spain (Abstract Co-Author) Nothing to Disclose
David Canovas, Sabadel, Spain (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
To give an overview of the etiopathology and clinical findings that suggest DAVF (Dural ArterioVenous Fistula). To illustrate the imaging findings, specially on angiography. To emphasize the differential diagnosis. To familiarize with general approaches for the treatment of DAVFs, indications and new technical developments in the field.
Basic Guide for Colonic Stenting: Indications, Technique and Clues

All Day Location: VI Community, Learning Center

Participants
Diego Preciado, MD, Sabadell, Spain (Presenter) Nothing to Disclose
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Joan Falco, MD, Sabadell, Spain (Abstract Co-Author) Nothing to Disclose
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Jordi Branera, MD, Sabadell, Spain (Abstract Co-Author) Nothing to Disclose
Beatriz Consola, MD, Sabadell, Spain (Abstract Co-Author) Nothing to Disclose
Viviana P. Beltran Salazar, MD, Sabadell, Spain (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS

Based on our experience, the purpose of the pictorial review is the following: To familiarize radiology residents with the accepted indications and contraindications of colonic stenting. To give the residents an overview of the stenting procedure an its technical tricks and tips, and to provide an overview of all radioprotection concerns. To illustrate the post-procedure management, possible complications, and ways to deal with them. To emphasize uncommon indications and new technical developments in the field.

TABLE OF CONTENTS/OUTLINE

In this exhibit, we illustrate the following points in a case-based style: Indications and contraindications. Pre-procedure management. Technical tricks and tips. Radioprotection concerns. Post-procedure management. Complications and how to deal with them. New developments in the technique.
Clinical Utility of Non-Contrast-Enhanced Magnetic Resonance Angiography at 1.5T

All Day Location: VI Community, Learning Center

Participants
Takafumi Naka, Kawasaki-Shi, Japan (Presenter) Nothing to Disclose

TEACHING POINTS
- To introduce the role of non-contrast-enhanced (NCE)-MRA.
- To explain the basic principles of each NCE-MRA methods.
- To explain the features and how to choose optimal methods.
  1) Comparing NCE-MRA and contrast-enhanced-MRA
  2) The principle of NCE-MRA methods
     2-1 Time-of-Flight
     2-2 Phase Contrast
     2-3 Fast Spin Echo
     2-4 Balanced Steady-State Free Precession

TABLE OF CONTENTS/OUTLINE
Since the FDA issued warnings linking gadolinium-based contrast agents used in MRI and nephrogenic systemic fibrosis (NSF), CE-MRA is no longer considered safe for patients with impaired renal function. TOF is based on the phenomenon of flow-related enhancement of spins entering into an imaging slice. As a result of being unsaturated, these spins give more signal that surrounding stationary spins. However, slow flow or flow from a vessel parallel to the scan-plane, may become desaturated just like stationary tissue. TOF is most commonly used in the head. In the PC pulse sequence, bipolar gradients are used to encode the velocity of the spins. Stationary spins undergo no net change in phase after the two gradients are applied. Moving spins will experience a different magnitude of the second gradient compared to the first. This results in a net phase shift. PC is most commonly used in the body.
Type V Endoleak after Endovascular Aortic Abdominal Aneurysm Repair: What Radiologists Need to Know

All Day Location: VI Community, Learning Center

Participants
Eijun Sueyoshi, MD, Nagasaki, Japan (Presenter) Nothing to Disclose
Hiroki Nagayama, Shimabara, Japan (Abstract Co-Author) Nothing to Disclose
Ichiro Sakamoto, Nagasaki, Japan (Abstract Co-Author) Nothing to Disclose
Masataka Uetani, MD, Nagasaki, Japan (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
The purpose of this exhibit is: 1. To know the definition and various imaging findings of type V endoleak after endovascular aortic abdominal aneurysm repair. 2. To know the clinical significances of imaging of type V endoleak. 3. To know the therapeutic strategy based on imaging findings of type V endoleak.

TABLE OF CONTENTS/OUTLINE
1. Explanation of imaging findings and clinical significances of type V endoleak after endovascular aortic abdominal aneurysm repair
2. Illustrative cases- Presentation of various imaging findings of type V endoleak. - Presentation of imaging findings after management type V endoleaks
3. Discussion
4. Directions and summary

The major teaching points of this exhibit are: 1. Various imaging findings of type V endoleaks can be seen after endovascular aortic aneurysm repair. 2. The serial changes of type V endoleaks can be seen after endovascular aortic aneurysm repair. 3. The therapeutic strategies are different based on imaging findings of of type V endoleak.
CTA Imaging of State-of-the-art Fenestrated and Branched Aortic Endografts: What the Radiologist Needs to Know

All Day Location: VI Community, Learning Center

FDA Discussions may include off-label uses.

Awards
Magna Cum Laude

Participants
Thanila A. Macedo, MD, Rochester, MN (Presenter) Nothing to Disclose
Terri J. Vrtiska, MD, Rochester, MN (Abstract Co-Author) Nothing to Disclose
Gustavo S. Oderich, MD, Rochester, MN (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
1) Learn the latest indications and advanced techniques for fenestrated and branched endovascular aortic repair (EVAR)
2) Understand the optimum imaging follow-up using Computed Tomography Angiography (CTA)
3) Review critical common and uncommon CTA findings including key dictation terminology for clear communication to Vascular Surgeons and Interventionalists.

TABLE OF CONTENTS/OUTLINE
BACKGROUND: Describe fenestrated and branched EVAR including the indications, techniques and key differences between approaches. Movie animations of each technique will demonstrate step-by-step approaches for device implantation. IMAGING FINDINGS: CTA is the recommended imaging for complex EVAR surveillance to detect correctable complications and avoid morbidity and mortality. CTA protocols as well as common and uncommon CTA findings will be reviewed. These include: endoleaks (including classification and variant examples), device malposition, occlusions, dissections and aneurysmal enlargement/rupture. Examples of confirmatory conventional angiograms and treatment will be included. CONCLUSION: Advances in EVAR continue to evolve and radiologists must be familiar with the CTA findings associated with the latest surgical management. Early detection of correctable EVAR complications and accurate communication of CTA findings is critical for optimal patient care.
Transarterial Embolization of Renal Angiomyolipomas: Clinical Considerations, Technical Details, Outcome, and Post-Therapy Management

All Day Location: VI Community, Learning Center

Participants
Ali Gholamrezanezhad, MD, Cleveland, OH (Presenter) Nothing to Disclose
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Timothy R. Whitehead, MD, Chicago, IL (Abstract Co-Author) Nothing to Disclose
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Indravadan J. Patel, MD, Cleveland, OH (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
1) To explain basic principles of transarterial embolization treatment for renal angiomyolipomas (AMLs)
2) To review multiple clinical applications and indications of embolization of AMLs
3) To discuss details of the embolization procedures with pictorial correlates
4) To explain outcome of the treatment, potential complications, and post-therapy management

TABLE OF CONTENTS/OUTLINE
1) Epidemiology
2) Clinical presentation
3) Clinical significance
4) Associated syndromes; lymphangioleiomyomatosis and tuberous sclerosis
5) Imaging features and diagnostic approach Ultrasound CT MRI Radiologic classification, including triphasic, classic, and fat poor subtypes
6) Surgical versus non-surgical therapeutic options
7) Patient selection for embolization therapy
8) Clinical advantages and applications of transarterial embolization
9) Contra-indications for transarterial embolization therapy
10) Rate and predictors of response to treatment
11) Step by step procedure of embolization: Patient preparation: Devices and equipments, including embolization agents: Transarterial catheterization and embolization technique details
12) Complications, including post-embolization syndrome, abscess, bleeding, and their optimal management
13) Post-therapy management and follow-up
14) Limitations
15) Controversies/developments
16) Conclusions
**Endovascular Management of Bleeding Rectal Varices**

All Day Location: VI Community, Learning Center

**Participants**
Ahmed K. Abdel Aal, MD, PhD, Birmingham, AL (Presenter) Consultant, St. Jude Medical, Inc Consultant, Baxter International Inc Consultant, C. R. Bard, Inc
Amr S. Moustafa, MBCh, MSc, Birmingham, AL (Abstract Co-Author) Nothing to Disclose
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Maysoon F. Hamed, MD, MSc, Hoover, AL (Abstract Co-Author) Nothing to Disclose
Osama Aglan, Birmingham, AL (Abstract Co-Author) Nothing to Disclose

**TEACHING POINTS**
Teaching points: 1- Review the main causes of development of ectopic varices including rectal varices. 2- Describe imaging findings seen on different imaging modalities. 3- Highlight role of transjugular intrahepatic portosystemic shunt (TIPS). 4- Describe the role of percutaneous transhepatic sclerotherapy techniques when TIPS fails or is contraindicated.

**TABLE OF CONTENTS/OUTLINE**
Outline: 1- Introduction and brief anatomy of portal circulation and rectal varices. 2- Causes of rectal variceal bleeding. 3- Imaging of bleeding rectal varices. 4- Management strategies of bleeding rectal varices. 5- Percutaneous transhepatic embolotherapy of bleeding rectal varices. 6- Summary and conclusion.
Techniques for Transarterial Chemoembolization of Hepatocellular Carcinoma With Parasitic Blood Supply

All Day Location: VI Community, Learning Center

Awards
Certificate of Merit

Participants
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Sima Banerjee, MBBS, Atlanta, GA (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS

Teaching points: 1- Review different factors that influence the development of parasitic blood supply to hepatocellular carcinoma (HCC). 2- Illustrate how to predict parasitic blood supply to HCC and which extrahepatic artery is involved. 3- Demonstrate the techniques for proper transarterial chemoembolization of the parasitic arterial supply to HCC in each individual situation to avoid complications. 4- Outline the potential complications.

TABLE OF CONTENTS/OUTLINE

Outline: 1- Introduction. 2- Risk factors for HCC parasitic blood supply. 3- Main parasitic feeders to HCC and their incidence. 4- Red alerts for HCC parasitic blood supply. 5- How to interpret parasitic blood supply to HCC by CT and catheter angiography. 6- Techniques for proper transarterial chemoembolization in individual situations. 7- Potential complications. 8- Summary and conclusion.
Endovascular Repair for Blunt Traumatic Aortic Injury

All Day Location: VI Community, Learning Center

FDA

Discussions may include off-label uses.

Participants
Koji Maruyama, Kobe, Japan (Presenter) Nothing to Disclose
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Mika Ohmori, Kobe, Japan (Abstract Co-Author) Nothing to Disclose
Takeki Mori, MD, Kobe, Japan (Abstract Co-Author) Nothing to Disclose
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Koji Sugimoto, MD, Kobe, Japan (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS

Blunt traumatic aortic injury (BTAI) is associated with a high mortality rate. Although BTAI was traditionally treated by open repair, thoracic endovascular aortic repair (TEVAR) has bring favorable early outcomes and offered several advantages in the treatment of severe concomitant injuries. At present TEVAR is useful for the treatment of BTAI patients, but some problems still remain. The purpose of this exhibit will review 1) the transition of treatments for BTAI, 2) the problems of TEVAR for BTAI, 3) the treatment algorithm to manage patients with BTAI.

TABLE OF CONTENTS/OUTLINE

A. Background: Overview about etiology and clinical features of BTAI.B. Transition of treatments for TEVAR: Current literature review of outcomes and complications associated with each treatment for BTAI (TEVAR, open repair, nonoperative management).C. Problems: Review the problems of TEVAR for BTAI and classify into resolved and unresolved.D. Treatment algorithm and strategy: Describe the treatment algorithm to manage patients with BTAI and strategy of TEVAR for BTAI.E. Case presentation: Discuss cases in our hospital (n=17 at time of abstract submission), including technical success rate, complications (post-operative, procedure-related, device deformity), short to medium term outcomes.
Multimodality Approach to AV Fistulas and Grafts: Interpretation and Pitfalls

All Day Location: VI Community, Learning Center

Awards
Certificate of Merit

Participants
Alexander Kessler, MD, Rochester, NY (Presenter) Nothing to Disclose
Deborah J. Rubens, MD, Rochester, NY (Abstract Co-Author) Nothing to Disclose
Shweta Bhatt, MD, MBBS, Rochester, NY (Abstract Co-Author) Nothing to Disclose
Talia Sasson, MD, Rochester, NY (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS

The purpose of this exhibit is to: Review the normal sonographic and angiographic appearance of the various types of AV fistulas and grafts, including HERO grafts. Discuss the major clinical indications for imaging evaluation of AV fistulas and grafts. Review the imaging criteria to assess AV fistula maturation, stenosis, and steal. Review various complications associated with AV fistulas and grafts, including pseudoaneurysm, collateralization, infection, and declotting complications.

TABLE OF CONTENTS/OUTLINE

Types of AV fistulas (Ultrasound and Angiography examples) Types of AV Grafts (Ultrasound and Angiography examples) Clinical indications for imaging evaluation of AV fistulas/grafts Normal sonographic appearance of AV fistulas/grafts (Grayscale, Peak Systolic Velocities, Spectral Waveforms, Flow rates) Ultrasound evaluation for AV fistula maturation Complications associated with AV fistulas and grafts, including keys to interpretation and pitfalls (Failure to mature, Occlusion, Stenosis, Elevated velocities without stenosis, Pseudoaneurysm, Steal, Collateralization, Infection, Rupture) Summary
**Transarterial Embolization: Interventional Radiologists Role in Cancer**

All Day Location: VI Community, Learning Center

*FDA* Discussions may include off-label uses.

**Participants**

Elena Inchausti, MBBS, Donostia, Spain (*Presenter*) Nothing to Disclose  
Inaki Prieto JR, San Sebastian, Spain (*Abstract Co-Author*) Nothing to Disclose  
Francisco Loyola, San Sebastian, Spain (*Abstract Co-Author*) Nothing to Disclose  
Santiago Merino, MD, San Sebastian, Spain (*Abstract Co-Author*) Nothing to Disclose  
Idoia Echegoyen, San Sebastian, Spain (*Abstract Co-Author*) Nothing to Disclose  
Enaut Garmendia, Donostia, Spain (*Abstract Co-Author*) Nothing to Disclose

**TEACHING POINTS**

To understand the indications and the aim of transarterial embolization of tumors, as a presurgical therapy (preoperative embolization), as well as a palliative measure to treat or prevent tumor-associated symptoms and slow down its growth (palliative embolization).

**TABLE OF CONTENTS/OUTLINE**

**TEACHING POINTS**

To review the pathophysiology, prognosis and treatment strategies of endoleaks after endovascular abdominal aortic aneurysm repair, while focusing on type I endoleaks. Discuss the benefits of Ethylene-Vinyl-Alcohol Copolymer, or Onyx (EV3 Inc., Plymouth, MN) as a liquid embolic agent. Pictorial description of type I endoleak repair using Onyx.

**TABLE OF CONTENTS/OUTLINE**

1. Short review of the 5 types of endoleaks.
2. Focused review of the pathophysiology, prevalence, complications and prognosis of type I endoleaks.
4. Short overview of "traditional" repair techniques of type I endoleaks:
   a. Endograft extension
   b. Ballooning
   c. Stenting
   d. Endostaples
   e. Embolization
5. Short description of Onyx and its properties.
6. Pictorial overview of the technique of employing Onyx to repair type I endoleaks:
   a. Approach to the aneurysm sac:
      i. Endovascular (proximal or distal)
      ii. Direct percutaneous transabdominal approach
   b. Advantages, disadvantages, and principles of deployment of coils as an adjunct to Onyx.
7. Comparison of the different repair techniques, in regards to:
   a. Indications
   b. Benefits
   c. Limitations
   d. Complications
Cementing the Facts: A Review of Vertebroplasty Techniques, Patient Selection and Complications

All Day Location: VI Community, Learning Center

Awards
Certificate of Merit

Participants
Mary Kristen Jesse, MD, Denver, CO (Presenter) Nothing to Disclose
Peter Lowry, MD, Denver, CO (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
1. Provide a brief review vertebroplasty/kyphoplasty (VP/KP) literature and background
2. Understand key points of pre-procedural imaging, patient selection and procedural planning
3. Review vertebroplasty/kyphoplasty techniques
4. Understand potential complications of VP/KP
5. Expectations of the postprocedure period

TABLE OF CONTENTS/OUTLINE
Case material from our Vertebroplasty/Kyphoplasty practice to illustrate the imaging findings. Data from personal cases performed between 2006 and 2015
Table of Contents:
A. Background
B. What to look for?
C. Pre-procedural planning
   1. Patient selection
      a. Who will benefit?
      b. Common clinical presentations and physical exam findings
      c. Clinical contraindications
   2. Imaging
      a. What to look for before you cement?
      b. ‘Fracture morphology’
      c. Imaging based contraindications
D. Vertebroplasty/Kyphoplasty Techniques
E. Complications
   1. Intradiscal cement extravasation
   2. Epidural extravasation
   3. Venous extravasation and cement pulmonary embolus
   4. Fat emboli syndrome/PMMA toxicity
   5. Cement non-union
F. My patient still has pain—Now What??
   1. Reasonable expectations in the immediate postoperative period
   2. Potential causes of persistent pain
   3. Adjacent level fractures
G. Conclusions
Transcatheter Arterial Embolization for Type II Endoleak after Endovascular Aortic Repair

All Day Location: VI Community, Learning Center

Awards
Certificate of Merit

Participants
Kimei Azama, Nishihara City, Japan (Presenter) Nothing to Disclose
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Sadayuki Murayama, MD, PhD, Nishihara-Cho, Japan (Abstract Co-Author) Nothing to Disclose
Keita Yamashiro, Nishihara City, Japan (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS

- The teaching points of this exhibit are: 1. To explain the concept of type 2 endoleak. 2. To show the potential of the computed tomography angiography (CTA) for planning transcatheter arterial embolization. 3. To show our techniques for embolizing type 2 endoleak using the triple coaxial system. 4. Pitfalls in the endovascular treatment of type 2 endoleak.

TABLE OF CONTENTS/OUTLINE

1) Concept of endoleak
   - Definition, Classification, Frequency
2) Strategy of treatment for type 2 endoleak
3) Utility of computed tomography with thin slice sections to identify a road map to endoleak
4) Techniques for successful embolization using triple coaxial system
5) Pitfalls in transcatheter arterial embolization for type 2 endoleak
Role of CT Venography in the Evaluation of Portosystemic Collateral Vessels After TIPS

All Day Location: VI Community, Learning Center

Awards
RSNA Country Presents Travel Award

Participants
Ivan E. Casanova Sanchez, MD, Mexico City, Mexico (Abstract Co-Author) Nothing to Disclose
Bianca V. Granados Pinedo, MD, Mexico City, Mexico (Presenter) Nothing to Disclose
Ricardo Garcia Buen-Abad, MD, Mexico City, Mexico (Abstract Co-Author) Nothing to Disclose
Manuel Guerrero-Hernandez, MD, Tlalpan, Mexico (Abstract Co-Author) Nothing to Disclose
Jorge Vazquez-Lamadrid, MD, Mexico, Mexico (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
The aim of this exhibit is: 1.- To acknowledge the role of CT venography in assessing the portosystemic collateral vessels in untreated portal hypertension. 2.- To review the TIPS procedure, its indications and the current radiological evaluation for success and patency. 3.- To learn the key findings in the portosystemic collateral vessels at CT venography after TIPS placement and its usefulness.

TABLE OF CONTENTS/OUTLINE
Ultrasonography-based Thyroidal and Perithyroidal Anatomy and its Clinical Significance

Awards
Certificate of Merit

Participants
Eun Ju Ha, Suwon, Korea, Republic Of (Presenter) Nothing to Disclose
Jung Hwan Baek, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
For a safe and effective US-guided procedure such as ethanol-, radiofrequency-, laser- ablation, selective nerve block, and core needle biopsy, knowledge of neck anatomy, particularly that of the nerves, vessels, and other critical structures, is essential. Teaching point 1. To elucidate US-based thyroidal and perithyroidal anatomy, as well as its clinical significance. Teaching point 2. To provide prevention techniques for complications during the US-guided procedures.

TABLE OF CONTENTS/OUTLINE
Endoleak: Case Based Review of Standard Classification

All Day Location: VI Community, Learning Center

Participants
Kun Yung Kim, MD, Jeonju-Si, Korea, Republic Of (Presenter) Nothing to Disclose
Young Min Han, Jeonju, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Gong Yong Jin, MD, PhD, Jeonju, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
1. To review the standard classification of endoleak.
2. To describe which types of endoleak should be treated immediately.
3. To demonstrate the cases of each endoleak types, which was treated by additional stent insertion, embolization, and surgery.

TABLE OF CONTENTS/OUTLINE
1. Introduction
2. Standard classification of endoleak (EL), based on their source
3. EL type I 1) Subtypes of EL type I (type IA,IB,IC) 2) Pictorial review of case, EL type IA treated by additional stent insertion 3) Significance and treatment of type I EL
4. EL type II 1) Pictorial review of case, EL type II treated by embolization of two feeding vessels 2) Pictorial review of case, EL type II treated by percutaneous sac puncture and embolization 3) Significance and other treatment option of type II EL
5. EL type III 1) Subtypes of EL type III (type IIIA,IIIB,IIIC) 2) Pictorial review of case, EL type III treated by surgical remove and replacement of stent graft 3) Significance and treatment of type III EL
6. EL type IV 1) Pictorial review of case, EL type IV without any clinical consequence 2) Significance of type IV EL
7. EL type V 1) Pictorial review of case, EL type V treated by surgical remove and replacement of stent graft 2) Significance and management of type V EL
Peripheral Artery: Optimization of Imaging Methods Considering Hemodynamics of Blood Flow

All Day Location: VI Community, Learning Center

Participants
Hironobu Tomita, MD, Kawaguchi, Japan (Presenter) Nothing to Disclose

TEACHING POINTS
Understanding different arrival times in lower extremities between patients
Investigating the causes of blood flow variation
Proposals for optimized imaging methods for peripheral CTA

TABLE OF CONTENTS/OUTLINE
Understanding peripheral blood flow velocity: Circulation time differences using Test Injection (abdominal aorta to ankle)
Constant arrival times from ABI and Vascular Occlusion
Arrival time dependency on an individual's cardiac function
OUTLINE
In Peripheral CTA, often I have experienced insufficient results due to overloading of the contrast medium. For our method to investigate the causes and factors, we enrolled 19 patients and examined using an optimum scan method for CT Examination of Arteriosclerosis Obliterans. In addition with ABI, we examined BMI, heart rate, lower leg arterial length, presence or absence of lesions, and the correlation of contrast arrival time. Two points were used to measure the contrast arrival time in the abdominal aorta, the tibial artery was P1, and the ankle was P2. The results demonstrated no correlation between the lesions and blood flow. Blood flow average was 72mm/sec (37mm/sec minimum and 200mm/sec maximum). The optimum examination is possible using our two-point method when the contrast arrival times are accurately captured and blood flow rates determined using peripheral CTA.
Advantage of Diluted Contrast Material Concentration to Reduce Artifact in C-arm Cone Beam-CT

All Day Location: VI Community, Learning Center

Awards
Certificate of Merit

Participants
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Shigeru Nemoto, Bunkyo-ku, Japan (Abstract Co-Author) President, Nemoto Kyorindo Co, Ltd

TEACHING POINTS
• Usefulness of Dual type Injector for Interventional Radiology • The artifact reduction with using diluted contrast material(CM) in C-arm Cone beam-CT(CBCT) • Application to clinical with C-arm CBCT

TABLE OF CONTENTS/OUTLINE
• Dual type injector can bring injection of CM and saline at the same time. Mixing technique between CM and Saline by Connection tube optimize variety of injection through injector in terms of contrast concentration. • C-arm CBCT: Visualization improvement of stent lumen, in addition to reduction of artifact in CBCT Scan with getting the optimal image density. OUTLINE: To cover the imaging region of the wide dynamic range in the IVR system, it is necessary to create a different CM concentration. Recent C-arm CBCT technology in the IVR has obtained to an image of high resolution up to the region of the wholebody including the head and neck area. Therefore, it is very effective to use Dual-type Injector which can convert variety of contrast concentration with dilution of saline. Setting appropriate contrast concentration and also using the device of generation tube, which called spiral flow tubing heighten an effect dilution. The benefit of diluted injection is reduction of the CM in the Artifact C-arm CBCT, and also it can react for various scanning patterns.
Myth and Mystery in Imaging and Endovascular Management of May-Thurner Syndrome

All Day Location: VI Community, Learning Center

Participants
Vivek Gowdra Halappa, MD, Philadelphia, PA (Presenter) Nothing to Disclose
Aliaksei Salei, MD, Darby, PA (Abstract Co-Author) Nothing to Disclose
Aaron Brandis, MD, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose
Oleg Teytelboym, MD, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose
Salmi Simmons, MD, Darby, PA (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
May-Thurner syndrome (MTS) describes left iliac deep venous thrombosis (DVT) due to an anatomical variant predisposing the left common iliac vein to compression between the right common iliac artery and the lumbar spine. MTS is underdiagnosed in clinical practice and there are reports that ~56% of left-sided DVT seem to be due to this variant and should be considered in all patients presenting with left iliac and femoral DVT. It is important to recognize MTS early as it has been hypothesized to elevate ambulatory venous pressures and produce lower-extremity symptoms, increase the risk of initial and recurrent DVT. MTS requires aggressive therapy in addition to anticoagulation. Otherwise MTS has increased risk of recurrence and post-thrombotic syndrome.

TABLE OF CONTENTS/OUTLINE
Anatomy and pathophysiology: Illustrate vascular anatomy variants and pathophysiology predisposing to MTS related DVT. Clinical Findings: Describe spectrum of MTS presentations using case based approach. Diagnostic Imaging: Illustrate multimodality imaging features of MTS including ultrasound, CTA, MRA and venography. Management, outcomes and complications: Endovascular treatment options for acute and chronic May-Thurner Syndrome including thrombectomy, endovascular stenting, catheter directed thrombolysis. Complications of untreated and untreated MTS.
Percutaneous Transhepatic Cholangioscopy: Pearls and Pitfalls

All Day Location: VI Community, Learning Center

Awards
Cum Laude

Participants
Sameer Ahmed, MD, Baltimore, MD (Presenter) Nothing to Disclose
Todd Schlachter, MD, Farmington, CT (Abstract Co-Author) Nothing to Disclose
Kelvin K. Hong, MD, Baltimore, MD (Abstract Co-Author) Scientific Advisory Board, Boston Scientific Corporation;

TEACHING POINTS

1. Describe patient selection and pre-procedural workup, including indications, contraindications, and role of diagnostic imaging.2. Discuss techniques for intra-procedural success in a variety of cases.3. Discuss longitudinal care following the procedure, including expected outcomes, indications for rescoping, and management of potential complications.

TABLE OF CONTENTS/OUTLINE

The Heart of the Matter: Cardiac Arrhythmia Diagnosis and Management Quiz for the Interventional Radiologist

All Day Location: VI Community, Learning Center

Participants
Siavash Behbahani, MD, Mineola, NY (Presenter) Nothing to Disclose
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Sameer Mittal, MD, Mineola, NY (Abstract Co-Author) Nothing to Disclose
Andrew Lee, BS, Mineola, NY (Abstract Co-Author) Nothing to Disclose
Jason C. Hoffmann, MD, Mineola, NY (Abstract Co-Author) Consultant, Merit Medical Systems, Inc; Speakers Bureau, Merit Medical Systems, Inc

TEACHING POINTS

1. Given the complexity and variety of medical conditions treated by interventional radiologists, an awareness of cardiac arrhythmias is critical for efficient diagnosis and effective management.
2. Interventional Radiologists should be familiar with causes and management of asystole, bradycardia, ventricular tachycardia, supraventricular arrhythmias, and other cardiac arrhythmias so that they can be treated appropriately in the IR suite.

TABLE OF CONTENTS/OUTLINE

Utilize a quiz format to:
1. Detail the importance of accurate and efficient diagnosis of cardiac arrhythmias in the IR suite.
2. Review pertinent literature relating to cardiac arrhythmias and management algorithms.
3. Provide examples of cardiac arrhythmias that can be encountered in the IR suite, utilizing cased-based scenarios and EKG interpretations.
4. Cases covered will include (but are not limited to):
   - Cardiac arrest (with review of reversible causes of cardiac arrest)
   - Ventricular tachycardia and fibrillation
   - Pulseless Electrical Activity/Asystole
   - Supraventricular Tachycardia
   - Atrial Fibrillation
   - Atrial Flutter
   - Heart Block
   - Bradycardia

Where appropriate, common causes of such arrhythmias will also be discussed, with particular attention to causes that can be related to IR procedures.

Review treatment algorithms for such arrhythmias.
Quality Improvement: Gated Thoraco-Abdominal Aortic CTA Utilizing State-of-the-Art Dual-Source Technology

All Day Location: VI Community, Learning Center

Participants
Gabriel A. Chiappone, MBA, RT, Columbus, OH (Presenter) Nothing to Disclose
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Chad Greulich, BS, ARRT, Columbus, OH (Abstract Co-Author) Nothing to Disclose
Joshua K. Aalberg, DO, Columbus, OH (Abstract Co-Author) Nothing to Disclose
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Richard D. White, MD, Columbus, OH (Abstract Co-Author) Nothing to Disclose

PURPOSE
Reduce the radiation dose on gated thoraco-abdominal aortic CTA (GTAA) while increasing the overall quality through reduced respiratory motion and increased Hounsfield Unit (HU) measurements.

METHODS
Our standard method for performing the GTAA exam has been to perform a gated thoracic CTA followed by a high-pitch spiral CTA of the Abdomen and Pelvis. This approach leads to long scan times, higher radiation doses, and diminished contrast enhancement within the abdominal aorta. We collected and compared data from two different systems located in separate Emergency Departments (ED). The standard method was performed on a single-source 128-slice (Siemens Definition AS+) while the single-acquisition protocol was performed on a state-of-the-art dual-source 192-slice (Siemens Force). With the new dual-source CT scanner, we are able to perform a Gated TAA exam with table speeds up to 737 mm/s and pitch of 3.2. High pitches are possible on this system because the two sources are 90° from each other, thus increasing rotational coverage to enable faster translational table speeds without sacrificing sampling or image quality. As a result, the entire thoraco-abdominal aorta can be scanned in 1 to 1.5 seconds in a single gated acquisition with no breath hold required.

RESULTS
The results from 10 studies on each system are reported below. The high speed gated TAA protocol resulted in 64.7% dose reduction and 38.6% increase in HU, measured in the abdominal aorta at the origin of the superior mesenteric artery. System Scan Time (sec) Average HU Average DLP (mGy) Average Eff Dose (mSv)

**Single-Source 128**
- 20.7
- 215.7
- 1199
- 16.8

**Dual-Source 192**
- 1.3
- 298.4
- 423
- 5.9

CONCLUSION
Significant quality improvements in gated studies can be achieved using a state-of-the-art dual-source CT. The technology advancements enable faster scanning that allow free breathing examinations without motion artifact. This is particularly useful in an ED setting where non-compliant patients can be frequent. Additional quality improvements are achieved with increased HU for improved bolus timing. The increased speed also permits a reduction in the amount of iodine used. Safety is not sacrificed through these quality improvement changes and is enhanced with a 64.7% radiation dose reduction.

FIGURE (OPTIONAL)
All about the Selective Arterial Calcium Injection Test for Pancreatic Neuroendocrine Tumors

All Day Location: VI Community, Learning Center

Participants
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Wataru Fukumoto, Hiroshima, Japan (Abstract Co-Author) Nothing to Disclose
Takaji Yamagami, MD, Kyoto, Japan (Abstract Co-Author) Nothing to Disclose
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Kazuo Awai, MD, Hiroshima, Japan (Abstract Co-Author) Research Grant, Toshiba Corporation; Research Grant, Hitachi, Ltd; Research Grant, Bayer AG; Research Grant, DAIICHI SANKYO Group; Medical Advisor, DAIICHI SANKYO Group; Research Grant, Eisai Co, Ltd; Research Grant, Nemoto-Kyourindo; ; ; ;

TEACHING POINTS

Pancreatic neuroendocrine tumors such as insulinomas and gastrinomas are relatively rare pathology. It is sometimes difficult to localize pancreatic neuroendocrine tumors by conventional imaging techniques. To perform a curative resection of neuroendocrine tumors, accurate localization of them is indispensable. Selective arterial calcium injection (SACI) test is a highly sensitive investigation for the localization of them. Its major advantage over other investigations is that the venous sampling provides functional data by which the identified abnormality can be confirmed as a functioning tumor. Although reports of SACI test are limited due to its rarity, the technique is extremely useful in patients with the pancreatic neuroendocrine tumors. Therefore, interventional radiologists should master the technique. Here we describe physiological background, imaging anatomy, typical technical procedure, tips and potential pitfalls for successful examination based on our clinical experience. Furthermore, as there are sometimes false positive cases, we will discuss optimal cutoff value for localizing insulinomas with SACI test.

TABLE OF CONTENTS/OUTLINE

1. Physiological background of SACI test
2. Technical procedures of the SACI test
3. Tips and pitfalls for successful venous sampling
4. Optimal cutoff value of hormone level of sampled blood for insulinoma
VI139-ED-X

Segmental Arterial Mediolysis: Clinical, Imaging and Therapeutic Options in Asymptomatic Patients

All Day Location: VI Community, Learning Center

Participants
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Isabel Vivas Perez, MD, Pamplona, Spain (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
The objective of this work are: To assess the CT findings of segmental arterial mediolysis in abdominal visceral involvement, making emphasis in points that help the differential diagnosis from other vasculities. To review the follow-up protocols depending on the initial presentation: arterial dilatation, single aneurysm, multiple aneurysms, dissection, arterial stenosis, or arterial occlusion. To study the therapy options (medical/surgical reconstruction/catheter embolization/stent-graft repair)

TABLE OF CONTENTS/OUTLINE
A. Pathophysiology. Segmental arterial mediolysis is a rare entity defined by nonatherosclerotic, nonhereditary, noninflammatory arteriopathy characterized by lysis of the outer media of the arterial wall which results in dissection that might cause massive hemorrhages. B. Diagnostic Imaging (CT). Although the histologic diagnosis would be the gold standard, it is usually unavailable because those patients are not surgically treated. That is why is crucial the radiological point of view to differentiate this entity from fibromuscular dysplasia or other vasculitis.C. Differential DiagnosisD. TreatmentE. Follow-up: Over time, the SAM manifestations, become smaller, or resolve, but asymptomatic dissections with delayed onset may occur and follow up is necessary.
**TEACHING POINTS**

To review in a detailed manner the technique and criteria used to define the type of fistula and location prior to surgery. To review the criteria to assess the appropriate development of the fistula. To depict the most common complications associated with haemodialysis fistulas.

**TABLE OF CONTENTS/OUTLINE**

Types of Vascular Accesses for Haemodialysis. Native Arteriovenous Fistula Artificial grafts Permanent Catheters Important Anatomic Aspects To Consider Prior to Surgery Venous anatomy of the Arm and Forearm Arterial Anatomy of the Arm and Forearm Critical points to assess when considering the establishment of an Arteriovenous fistula Assessment of Adequate Maturation of an Arteriovenous fistula Criteria of adequate arterial supply to the fistula. Criteria of adequate venous outflow from the fistula Main Complications Associated with Arteriovenous Fistula Estenosis of the fistula Estenosis of the venous outflow tract Steal syndrome Vein thrombosis Pseudoaneurism and Hematomas
The Road Less Traveled: A Review of Celiac Axis Arterial Variation and Its Clinical Implications in the Treatment of Hepatocellular Carcinoma

All Day Location: VI Community, Learning Center

Participants
Ryan Braun, MD, New York, NY (Presenter) Nothing to Disclose
Travis E. Meyer, MD, Brooklyn, NY (Abstract Co-Author) Nothing to Disclose
William Kwon, MD, New York City, NY (Abstract Co-Author) Nothing to Disclose
James P. Walsh, MD, Brooklyn, NY (Abstract Co-Author) Nothing to Disclose
Robert F. Leonardo, MD, Brooklyn, NY (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
Standard celiac axis arterial anatomy historically occurs in approximately 50% of evaluated patients following cadaveric dissection or angiography. Once thought to be clinically insignificant, the rising incidence of hepatocellular carcinoma and the concomitant advances in organ transplantation and the development of targeted endovascular interventions have necessitated increased awareness of these vascular variations. Failure to appreciate these variants preoperatively can result in increased patient morbidity and mortality. This presentation will provide a review of many of the anatomic arterial variations encountered within the celiac axis with discussion of their clinical implications with regard to the treatment of hepatocellular carcinoma - surgical transplant, targeted chemoembolization and intra-arterial brachytherapy.

TABLE OF CONTENTS/OUTLINE
Multiple celiac axis arterial variations are presented on angiography, CT and/or MRI. Aberrant vessels to be presented include: (1) replaced left and right hepatic arteries, (2) accessory left and right hepatic arteries, (3) replaced common hepatic arteries and (4) non-hepatic arteries arising from the hepatic arterial system. A discussion of the clinical implications of each aberrant artery with respect to potential surgical and/or targeted endovascular therapies will accompany each case.
Dual Energy Computed Tomography in Post-(T)EVAR Patients: Advantages of the Virtual Non-contrast CT and the Iodine Overlay Measurements

Participants
Lydia Maaskant, Rotterdam, Netherlands (Presenter) Nothing to Disclose
Jasper Florie, Rotterdam, Netherlands (Abstract Co-Author) Nothing to Disclose
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Ronald Booij, RT, Rotterdam, Netherlands (Abstract Co-Author) Nothing to Disclose
Gabriel P. Krestin, MD, PhD, Rotterdam, Netherlands (Abstract Co-Author) Consultant, General Electric Company; Research Grant, General Electric Company; Research Grant, Bayer AG; Research Grant, Siemens AG; Speakers Bureau, Siemens AG
Mohamed Ouhlous, MD, PhD, Rotterdam, Netherlands (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
- To understand how Dual Energy CT works to assess the quality of the virtual non-contrast CT obtained with Dual energy CT scanning compared to single energy CT to assess and quantify the iodine overlay technique in post-(T)EVAR patients with or without endoleak to assess the radiation dose in Dual Energy CT scans

TABLE OF CONTENTS/OUTLINE
- Explain how Dual energy technique works 40 Dual Energy CT’s in post-(T)EVAR patients were analysed
- Assess image quality calculation of virtual non-contrast CT, comparison with true non-contrast CT
- Assessment of endoleak
- How to perform measurements on the Iodine overlay technique
- Radiation dose
Tunneled Dialysis Catheters (TDCs): "The Good, the Bad and the Ugly."

All Day Location: VI Community, Learning Center

Awards
Certificate of Merit

Participants
Nanda Venkatanarasimha, MRCP, FRCR, Singapore, Singapore (Presenter) Nothing to Disclose
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Bien Soo Tan, Singapore, Singapore (Abstract Co-Author) Institutional research collaboration, Koninklijke Philips Electronics NV
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Kiang Hiong Tay, FRCR, Singapore, Singapore (Abstract Co-Author) Nothing to Disclose
Farah G. Irani, MD, Singapore, Singapore (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS

• TDCs contribute to significant morbidity and mortality. Despite K/DOQI guidelines on limiting the use of cuffed catheters for hemodialysis there has been an increasing number who are dependent on TDCs as an interim lifeline while waiting for a permanent solution.
• Identify the wide-spectrum of TDC-related complications and familiarize with interventional radiology management of both vascular and non-vascular complications.

TABLE OF CONTENTS/OUTLINE

1. Overview of Good TDCs (including venous anatomy and technical considerations for placement)
2. Systematic review of the wide spectrum of complications (including management) and factors contributing to these complications
3. Valuable lessons learnt from quality assurance of miss and near miss complications (including tips to prevent)
4. Difficult venous access and unconventional venous anatomy
5. Highlight K/DOQI guidelines and value of patient education
Ultrasound-guided High Intensity Focused Ultrasound for the Treatment of Advanced Pancreatic and Liver Cancer

Maximilian Rauch, Bonn, Germany (Presenter) Nothing to Disclose
Milka Marinova, MD, Bonn, Germany (Abstract Co-Author) Nothing to Disclose
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Hans H. Schild, MD, Bonn, Germany (Abstract Co-Author) Nothing to Disclose
Holger M. Strunk, MD, Bonn, Germany (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS

• Ultrasound-guided high intensity focused ultrasound (USgHIFU) is introduced as a promising non-invasive tumor ablation technique for the treatment of advanced pancreatic and liver cancer.
• Technical aspects and practical fundamentals of USgHIFU are presented.
• Advantages of USgHIFU over conventionally applied local ablative methods are discussed.
• A step-by-step guide for patient selection, patient preparation, USgHIFU therapy, patient aftercare and follow-up is given.
• We give an overview on current literature concerning treatment of unresectable pancreatic and liver cancer.
• We discuss limitations, contraindications and complications of USgHIFU.

TABLE OF CONTENTS/OUTLINE

• Fundamentals and technical aspects of USgHIFU
• Advantages of USgHIFU
• Patient selection and simulation
• Patient preparation
• USgHIFU-treatment
• Patient after-care and follow-up
• Overview on current literature concerning pancreatic cancer
• Hepatocellular carcinoma, liver metastasis
• Limitations and contraindications of USgHIFU
• Complications of USgHIFU
• Conclusion and perspectives
Participants
Carolina Ospina Moreno, MD, Zaragoza, Spain (Presenter) Nothing to Disclose
Maria Lourdes Diaz-Dorronsoro, Zaragoza, Spain (Abstract Co-Author) Nothing to Disclose
Fermin Urtasun, MD, PhD, Pamplona, Spain (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
High flow arteriovenous malformations are rare and complex lesions that may involve any part of the body. They often represent a therapeutic challenge because of their complex anatomy and behavior. The type of embolic agent and access may be determined by the anatomy of the lesion, localization, size, operator’s experience, etc. The purpose of this poster is to share some of our experience in the management of high flow AVM based on problem cases.

TABLE OF CONTENTS/OUTLINE
Anatomy and pathophysiology of the high flow AVM. Management of high flow AVM based on problem cases: Direct alcohol injection into the nidus of a foot AVM. Use of the Amplatzer closure device in a large renal AV fistula. Histoacryl and lipiodol embolization of a uterine AVM. Coil embolization of a post-traumatic AV fistula. Each case shows how each AVM poses a therapeutic challenge. It is important to be familiar with the different embolic agents, their indications and routes of administration.
Embolization of a Type II Endoleak Using Onyx

Post-endovascular aneurysm repair (EVAR) imaging surveillance should occur at regular intervals. Triple-phase CT angiography is often the modality of choice. The most common complication after EVAR is an endoleak, of which type II is the most common, resulting in continued expansion of the aneurysm sac. The lumbar arteries, inferior mesenteric artery, and median sacral artery are the usual culprit feeding vessels contributing to a type II endoleak. Multiple methods exist to treat type II endoleaks, all with the risk of non-target embolization. We present our successful experience and technique using the liquid embolic agent, Onyx, to embolize the feeding vessels of a 91-year-old patient with a type II endoleak.

TABLE OF CONTENTS/OUTLINE

A. Types of aortic aneurysms  
B. Open vs. endovascular aneurysm repair (EVAR)  
C. Post-EVAR imaging timeline  
D. Complications of EVAR: Endoleak  
E. 5 types of endoleak: type II is most common  
F. Treatments for type II endoleak  
G. Onyx mechanism of action  
H. Our patient: clinical history and diagnostic imaging  
I. Our technique: CT-guided aortic catheterization and fluoro-guided Onyx embolization of feeding vessels  
J. Clinical and imaging follow-up
\[ 2p > Zn_{\frac{1}{2}} \]
Advanced Interventional Procedures for Revision of Occluded Transjugular Intrahepatic Portosystemic Shunts (TIPS)

All Day Location: VI Community, Learning Center

Awards
Certificate of Merit

Participants
Andrew S. Niekamp, MD, Columbus, OH (*Presenter*) Nothing to Disclose
Bill S. Majdalany, MD, Columbus, OH (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

To present traditional monitoring modalities for TIPS and findings that are suggestive of stent occlusion and stenosis. Subsequently, a variety of advanced interventional procedures designed for recanalization and revision of stenosed or occluded transjugular intrahepatic portosystemic shunts will be demonstrated.

TABLE OF CONTENTS/OUTLINE

A. TIPS Background / Indications
B. Present Traditional Ultrasound Monitoring Modalities for TIPS
C. Ultrasound Monitoring Findings that are Suggestive of TIPS Occlusion and Stenosis
D. Present a Traditional TIPS Revision
E. Present Example of TIPS not Amenable to Traditional Revision
F. Present a Combined Transhepatic - Transjugular 'Pull-Through' Technique
G. Present Colapinto Needle Access Revision
H. Present Transsplenic Access Revision
I. Present Trans-variceal Access Revision
J. Discussion Regarding Parallel TIPS Formation
K. Conclusion
Image-guided Percutaneous Diagnostic Peritoneal Lavage in Oncology Patients: Indications, Technique, and Outcomes

All Day Location: VI Community, Learning Center

Participants
Sishir Rao, MD, Boston, MA (Presenter) Nothing to Disclose
Anand M. Prabhakar, MD, Somerville, MA (Abstract Co-Author) Nothing to Disclose
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Peter R. Mueller, MD, Boston, MA (Abstract Co-Author) Consultant, Cook Group Incorporated
Ashraf Thabet, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
1. Image guided diagnostic peritoneal lavage (DPL) may be indicated in patients with ovarian or endometrial cancer with suspected but without definite clinical or imaging evidence of peritoneal involvement. 2. Determination of peritoneal involvement is important as positive peritoneal cytology is associated with lymph node metastases and may make the patient eligible for intraperitoneal chemotherapy or whole abdominal radiation. 3. Technical considerations for image guided DPL include review of pertinent imaging for the presence or absence of ascites and loculation, utilization of ultrasound or "loss of resistance" technique for peritoneal access, and determination of the volume of normal saline to infuse into and aspirate from the peritoneum. 4. Measures of success include technical success (peritoneal access) and clinical success (diagnostic cytology results). Complications are assessed through the Society of Interventional Radiology classification.

TABLE OF CONTENTS/OUTLINE
1. Review of indications for image guided DPL. 2. Discuss technical considerations of image guided DPL among ovarian and endometrial cancer patients. 3. Review technical and clinical measures of image guided DPL success and complications based on the SIR criteria.

Honored Educators
Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

Peter R. Mueller, MD - 2012 Honored Educator
Peter R. Mueller, MD - 2013 Honored Educator
Spectrum of MDCT Findings Affecting Pulmonary Artery Diameter

All Day Location: VI Community, Learning Center

Participants
Josung Jung, Cheonan, Korea, Republic Of (Presenter) Nothing to Disclose
Yeri Yoon, MD, Cheonan, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
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Sung Shick Jou, Cheonan, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
1. We will review about pulmonary disorders changing diameter of pulmonary artery.2. We have classified these disorders in two broad categories: Increase in pulmonary artery diameter and diminish in pulmonary artery diameter 3. It is important to recognize the CT signs of these conditions because their presence has implications for the prognosis.

TABLE OF CONTENTS/OUTLINE
Increased Diameter of Pulmonary Artery
- Congenital Pulmonary artery Aneurysm
- Acquired Pulmonary hypertension

Diminished Diameter of Pulmonary Artery
- Congenital Unilateral proximal interruption, hypoplasia of arteries
- Acquired Bronchial carcinoma
- Anthracofibrosis
- Chronic Pulmonary thromboembolism
- Swyer-James Syndrome
- Chronic pericarditis
Cerebral Disease: Optimal Imaging Method for Preoperative 3DCT - Arteriovenous Separation Scanning Method

All Day Location: VI Community, Learning Center

Awards
Magna Cum Laude

Participants
Kota Mitsui, Saga-Shi, Japan (Presenter) Nothing to Disclose
Makoto Kishikawa, Saga-Shi, Japan (Abstract Co-Author) Nothing to Disclose
Shinji Kakimoto, Saga-shi, Japan (Abstract Co-Author) Nothing to Disclose
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Hitoshi Aibe, MD, Kitakyushu, Japan (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
- The necessity for preoperative 3DCT simulation
- The optimum imaging conditions
- Advantages and limitation of the method
- Optimal acquisition timing

TABLE OF CONTENTS/OUTLINE
- TABLE OF CONTENTS - Necessity for 3DCT: Presentation of information required for preoperative simulation. Separation of the cerebral arteriovenous, blood vessels (arteries / veins) of the respective tumor. The optimal scan timing for the arteriovenous separation including the split bolus injection optimal volume of contrast medium and the Noise Reduction for the iterative reconstruction. Visualization improvement of tumor, arteries and vein. Scan timing in consideration of the brain hemodynamics (4D).
- OUTLINE - The evaluation of brain tumors using preoperative 3DCT is known, but improvement in image details is sought. In particular, with respect to superficial brain tumors, the difficulty in determining optimal acquisition timing for arteriovenous separation is determined. We utilize a split bolus injection to isolate the cerebral arteries from the 4D analysis data. Using this technique, a precise vascular depiction (arteriovenous separation) is possible. Our preoperative simulation technique provides a predictable surgical view with detailed vascular information, and tumor visualization enabling the selection of the optimal surgical technique.
Usefulness of Dual Energy CT for Endoleaks after Endovascular Aortic Repair

All Day Location: VI Community, Learning Center

Awards
Certificate of Merit

Participants
Eijun Sueyoshi, MD, Nagasaki, Japan (Presenter) Nothing to Disclose
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Ichiro Sakamoto, Nagasaki, Japan (Abstract Co-Author) Nothing to Disclose
Masataka Uetani, MD, Nagasaki, Japan (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS

1. To know the various dual energy CT findings of endoleaks after endovascular aortic repair.
2. To know the clinical significances of dual energy CT findings of endoleaks after endovascular aortic repair.
3. To know the clinical significances of dual energy CT findings after management for endoleaks.

TABLE OF CONTENTS/OUTLINE

1. Explanation of dual energy CT findings and clinical significances of endoleaks after endovascular aortic repair.
2. Illustrative cases - Presentation of various dual energy CT findings of endoleaks after endovascular aortic repair - Presentation of dual energy CT findings after management for endoleaks.
3. Discussion
4. Directions and summary

The major teaching points of this exhibit are:
1. Dual energy CT is an useful tool to detect endoleaks.
2. Dual energy CT can detect small endoleaks.
3. The therapeutic strategies are different based on dual energy CT imaging findings.
Usefulness of Carbon Dioxide Digital Subtraction Angiography at Endovascular Abdominal Aortic Aneurysm Repairs

All Day Location: VI Community, Learning Center

Participants
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Ichiro Sakamoto, Nagasaki, Japan (Abstract Co-Author) Nothing to Disclose
Masataka Uetani, MD, Nagasaki, Japan (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS

The purpose of this exhibit is: 1. To explain the methods of carbon dioxide digital subtraction angiography (CO2-DSA). 2. To explain the safety and potential complications of CO2-DSA. 3. To show imaging findings of CO2-DSA at endovascular abdominal aortic aneurysm repairs (EVAR) procedure. 4. To discuss the role of CO2-DSA at EVAR procedure. 5. To understand how to reduce the total volume of contrast media at EVAR procedure.

TABLE OF CONTENTS/OUTLINE

1. Methods of CO2-DSA
2. Safety and potential complications of CO2-DSA
3. Illustrative cases- Review of imaging findings of abdominal aortic aneurysm by CO2-DSA at EVAR procedure- Review of imaging findings of endoleaks by CO2-DSA at EVAR procedure- Review of mimics of CO2-DSA at EVAR procedure
4. Discussion
5. Directions and summary

The major teaching points of this exhibit are: 1. CO2-DSA is easy and safe at EVAR procedure. 2. CO2-DSA can reduce the total volume of contrast media at EVAR procedure.
Percutaneous Cryoablation of the Celiac Plexus

All Day Location: VI Community, Learning Center

Participants
Constance de Margerie-Mellon, Paris, France (Abstract Co-Author) Travel support, Guerbet SA
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TEACHING POINTS
Patients with pain from pancreatic or gastric carcinoma are often treated by a combination of opioids and neuroablative procedures (mainly alcohol). In patients with locally advanced cancer, alcohol diffusion is unpredictable, making celiac block difficult and/or ineffective. Cryoablation combines antitumor, antiangiogenic and neurolytic properties and represent a valuable alternative in these patients. Our technique involves bilateral posterior approach with one or two 17-G cryoneedles on each side placed under CT guidance. After one or two 10 minutes freezing cycles, the pain usually decreases by 4 to 5 points on the visual analog scale.

TABLE OF CONTENTS/OUTLINE
Review of the celiac plexus anatomy
Current indications of celiac plexus block
Cryobiology and rationale for cryoablation of the celiac plexus
Anesthetic properties of cryoablation
Antiangiogenic effects
Antitumor effects
How to perform cryoablation of the celiac plexus
Needle trajectory and placement
Freezing protocol
Results
Risks and complications of the procedure
Take home messages and tips for success
TEACHING POINTS

1. Modern imaging techniques enable a more detailed assessment of arterial functional status than traditional angiography.
2. Arterial stiffness is associated with cardiovascular disease (CVD) risk and can be measured using US, CT and MRI.
3. Vascular endothelial dysfunction is a risk factor for future atherosclerosis and CVD. Assessment of the endothelium requires utilisation of both endothelial-dependent and -independent techniques.
4. Flow quantification assesses pressure gradients, collateral flow and shunt volumes, providing haemodynamic evaluation of congenital conditions and stenosis.

TABLE OF CONTENTS/OUTLINE

Arterial anatomy and normal blood flow
Review - Importance of arterial stiffness in CVD
Discussion - Measuring arterial stiffness
a. Arterial capacitance and distensibility
b. PWV:
   - Tonometry: Carotid-femoral; augmentation index
   - US: PWV, arterial waveform analysis
   - MRI: Transit time/Flow-Area/Cross-correlation

Pulmonary arterial stiffness and pulmonary hypertension
Review - Endothelial function and its role in atherosclerosis
Discussion - Endothelial assessment
a. Flow mediated dilation
b. Cold pressor test
c. Reactive hyperaemia
   - Induced hyperaemia: Adenosine/acetylcholine

Flow assessment
a. Stenosis and regurgitation
b. Pressure gradients
c. Shunt quantification
Pressures, Waveforms and Plethysmography. Oh My!: A Guide to Physiologic Studies to Screen for Peripheral Arterial Disease

All Day Location: VI Community, Learning Center

Participants
Carson Sibley, Dallas, TX (Abstract Co-Author) Nothing to Disclose
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TEACHING POINTS
1. Noninvasive physiologic studies are the primary screening exam for the detection of peripheral arterial disease.
2. Interpretation of segmental pressures, Doppler waveforms and pulse-volume recordings requires an understanding of the principles of blood flow in the lower extremities.
3. Review commonly used criteria for the diagnosis of peripheral arterial disease.
4. Apply principles to the interpretation of noninvasive vascular studies in case-based review.

TABLE OF CONTENTS/OUTLINE
1. Review physiologic principles of blood flow in the lower extremities.
2. Examine how arterial pressures, Doppler waveforms and plethysmography detect perturbations in normal arterial blood flow to suggest peripheral arterial disease.
3. Present commonly used parameters for the interpretation of noninvasive physiologic vascular studies.
4. Case-based presentation and application of principles learned to interpret noninvasive vascular studies with comparison to angiography.
Super Tough PTC : Tips and Tricks

All Day Location: VI Community, Learning Center

Participants
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TEACHING POINTS
To illustrate with images, the presentation and challenges of the primary transhepatic cholangiography. To illustrate difficulties faced its management.

TABLE OF CONTENTS/OUTLINE
CONTENT ORGANIZATION: 1. Pathology of biliary obstruction. 2. Commonly used imaging including CT and MRI. 3. Various techniques in management of such complex cases. 4. Tips and Tricks to help when usual methods do not work. Percutaneous transhepatic cholangiography is a complex procedure. Patients with complex anatomy, especially in post surgical patients present challenges for the interventional radiologist. A sound understanding of the anatomy and techniques is helpful in successfully performing this procedure. Tips and Tricks help at times when routine methods do not work.
Postoperative Complications and Management of Endovascular Aortic Aneurysm Repair

All Day Location: VI Community, Learning Center

Participants
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TEACHING POINTS
The purpose of this exhibit is:
1. To know the various imaging findings of postoperative complications and management of endovascular aortic aneurysm repair
2. To know the clinical significances of imaging findings of postoperative complications of endovascular aortic aneurysm repair
3. To know the management for postoperative complications of endovascular aortic aneurysm repair

TABLE OF CONTENTS/OUTLINE
1. Explanation of imaging findings and clinical significances of postoperative complications of endovascular aortic aneurysm repair
2. Explanation of management for postoperative complications of endovascular aortic aneurysm repair
3. Illustrative cases-Presentation of various imaging findings of postoperative complications of endovascular aortic aneurysm repair-Presentation of management for postoperative complications of endovascular aortic aneurysm repair
4. Discussion
4. Directions and summary

The major teaching points of this exhibit are:
1. Various postoperative complications can occur after endovascular aortic aneurysm repair.
2. The serial changes of complication can be seen after endovascular aortic aneurysm repair.
3. The therapeutic strategies are different based on imaging findings of postoperative complications after endovascular aortic aneurysm repair.
Hemobilia of Different Iatrogenic Origins: Imaging Features of CT and Angiography and Management of Transcatheter Arterial Embolization?A Series of 30 Cases

All Day Location: VI Community, Learning Center

Participants
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TEACHING POINTS
The definition, different iatrogenic origins and clinical symptoms of hemobilia. The imaging features of CT and angiography of hemobilia. The management: how to do transcatheter arterial embolization (TAE) and its efficacy

TABLE OF CONTENTS/OUTLINE
Hemobilia is a potentially life-threatening cause of upper gastrointestinal hemorrhage caused by hepatic trauma or iatrogenic injury. Different iatrogenic origins of hemobilia: transhepatic intervention (percutaneous transhepatic cholangial drainage, percutaneous transhepatic biopsy, and radiofrequency ablation) and surgical procedures in the hilar area (laparoscopic cholecystectomy and surgical resection of cholangiocarcinoma). Typical clinical triad of hemobilia, including melena, abdominal pain, hematemesis, and jaundice, was observed in most patients. Contrast-enhanced abdominal CT showed hematocele, pseudoaneurysm and extravasation of contrast material in patients with hemobilia. Pseudoaneurysm was the most common angiographic feature. Polyvinylalcohol particles, gelatin sponges, and coils were used for TAE based on the iatrogenic origin and bleeding location, and the embolization was technically successful in all patients. The reason for failed embolizations was initial incomplete arterial occlusion.
Interventional Management of Hemoptysis: For Every Interventional Radiology Resident/Fellow

All Day Location: VI Community, Learning Center

FDA
Discussions may include off-label uses.

Participants
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TEACHING POINTS
Interventional procedures are considered to be an effective nonsurgical treatment and play an important role in the management of hemoptysis. This exhibit may produce the readers, 1. To understand pathophysiologic causes and diagnostic images of hemoptysis. 2. To understand indications and therapeutic strategy of hemoptysis. 3. Learn how to safely perform bronchial and nonbronchial systemic artery embolization using basic technique. 4. Get further techniques for hemoptysis secondary to pulmonary artery pseudoaneurysm.

TABLE OF CONTENTS/OUTLINE
To describe and illustrate a comprehensive review of diagnostic imaging, a therapeutic strategy and interventional techniques for management of hemoptysis.
PURPOSE
Aortic pulse wave velocity (PWV) is an established marker of aortic stiffness. In this study we assessed intraobserver, interobserver and inter-center variability of PWV measurement using magnetic resonance imaging (MRI) in order to gauge the precision of the implemented method in a multicenter trial setting.

METHOD AND MATERIALS
This is an IRB approved, HIPAA compliant prospective study. A subset of 45 (15 patients per site) adult patients (31 male, age 58±12 yrs.) with newly diagnosed essential arterial hypertension were randomly included from a multicenter trial (3 sites, 140 patients total) on antihypertensive treatment. All patients underwent cardiovascular 3T MRI with a standardized imaging protocol. Axial phase-contrast scans (100 frames/RR-interval) were repeated three times per examination to assess transit time (Δt) between the ascending and descending aorta. The distance between ascending and descending aorta (Δx) was measured on prospectively ECG-gated parasagittal 2D GRE images of the aortic arch. Δt and Δx were measured using semi-automatic analysis software (Syngo.via Siemens Healthcare, Erlangen, Germany) three times per scan by five different readers, resulting in 2025 Δt and 675 Δx data points. PWV was calculated as Δx/Δt. Intraobserver, interobserver and inter-center variability was calculated as coefficient of variation (COV).

RESULTS
Median intraobserver COV equaled 0 for Δt; ranged from 0.4-1.2% (interquartile range 0.2-1.8%) for Δx, and 0.4-1.2% (0.2-2.0%) for PWV. Interobserver COV was 0 (0-0.3%) for Δt; 1.5% (1.2-1.8%) for Δx, and 1.5% (1.2-2.0%) for PWV. There was no significant inter-center difference in scan-rescan COV (p>0.05): 12.5% for Δt and 14.9% for PWV in center 1, 10.7% for Δt and 11.8% for PWV in center 2, and 12.1% for Δt and 12.8% for PWV in center 3.

CONCLUSION
MRI PWV measurement for assessment of aortic stiffness as a surrogate marker for vascular age is a method with low intra- and interobserver variability. Using a standardized protocol, low inter-center variability can be achieved in a multicenter trial setting.

CLINICAL RELEVANCE/APPLICATION
Establishing the measurement variability in multicenter trials is important to ensure that study results are representing biological changes and not predominantly the overall measurement error.

FIGURE (OPTIONAL)
Interventional Radiology Management of Complications Related to Percutaneous Transhepatic Biliary Tract Interventions (PTBTI): A Comprehensive Review Based on Select Cases from Morbidity and Mortality Rounds of Over 10 Years

All Day Location: VI Community, Learning Center

Participants
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TEACHING POINTS
1. The aim of this exhibit is to (a) describe (b) illustrate (c) prevent and (d) manage complications related to PTBTI based on the lessons learned from quality assurance rounds of over 10 years in a large tertiary referral center. PTBTI induced complications are not uncommon and radiologists should be familiar with the diagnosis and management, especially of uncommon ones. A combination of percutaneous techniques are needed for appropriate treatment in complex cases.

TABLE OF CONTENTS/OUTLINE
Illustrate and discuss the:
1. Broad spectrum of complications related to percutaneous transhepatic biliary tract interventions.
2. Classification related on access, catheter, stent; vascular and non-vascular.
3. Pearls and pitfalls in the diagnosis.
5. Discuss the principles and technical considerations in preventing complications based on lessons learned from Morbidity and Mortality rounds.
6. Highlight relevant variant biliary anatomy and value of additional imaging (eg cone beam CT) in select cases to avoid potential traps.
7. Short and long term follow-up.
Painful Pelvic Metastases-Minimally Invasive Management: Essentials for the Interventional Radiologist

All Day Location: VI Community, Learning Center

FDA Discussions may include off-label uses.

Participants
Jack W. Jennings, MD, Saint Louis, MO (Presenter) Speakers Bureau, DFINE, Inc; Consultant, DFINE, Inc
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Jeremiah R. Long, MD, Saint Louis, MO (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
Discuss the various techniques and interventional procedures for the treatment of painful metastatic pelvic lesions including radiofrequency ablation, cryoablation, cementoplasty and local steroid injections. Recognize example lesions/cases where there is a preferential modality for treatment. Recognize cases in which multiple modalities are used for local control and stabilization. Understand the common complications and relevant neural anatomy and often necessary thermal protection techniques utilized.

TABLE OF CONTENTS/OUTLINE
Review the most common painful pelvic metastatic lesions Overview of the percutaneous ablative, augmentation, and local injection techniques. Provide examples of representative cases of augmentation, ablation (radiofrequency and cryoablation), combined modalities, and local injections. Provide examples of complications and the use of thermoprotective techniques.
Understanding and Identifying Common and Anomalous Female Pelvic Venous Anatomy and Varicosities on Multi-modality Imaging in the Setting of Pelvic Congestion Syndrome

All Day Location: VI Community, Learning Center

Participants
Monica A. Stanley, DO, Phoenixville, PA (Presenter) Nothing to Disclose
Wylie E. Gomez, MD, Bryn Mawr, PA (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS

Provide multi-modality imaging examples of common female pelvic venous anatomy and varicosities in the setting of pelvic venous congestion syndrome for benefit of both the interventionist and diagnostic radiologist. Describe and provide imaging examples of anomalous pelvic venous anatomy contributing to pelvic venous congestion syndrome.

TABLE OF CONTENTS/OUTLINE

Background and pathophysiology of pelvic congestion syndrome Normal female pelvic venous anatomy on CT and MR CT, MR, and angiographic appearance of pelvic venous varicosities in the setting of pelvic congestion syndrome Venous anomalies in the setting of pelvic venous congestion - Nutcracker syndrome, May-Thurner syndrome, anomalous origin of the ovarian veins Summary and brief overview of interventional treatment approaches
Role of Interventional Radiology in the Palliative Management of Spinal Metastases

All Day Location: VI Community, Learning Center

Awards
Certificate of Merit

Participants
Adam N. Wallace, MD, Saint Louis, MO (Presenter) Nothing to Disclose
Randy O. Chang, BS, Saint Louis, MO (Abstract Co-Author) Nothing to Disclose
Jack W. Jennings, MD, Saint Louis, MO (Abstract Co-Author) Speakers Bureau, DFINE, Inc; Consultant, DFINE, Inc

TEACHING POINTS

The purpose of this exhibit is: 1. To review the indications and comparative advantages of epidural injections, vertebral augmentation, and percutaneous radiofrequency and cryoablation in the palliative management of metastatic spine disease. 2. To review recent technical advances that facilitate the safety and efficacy of these procedures.

TABLE OF CONTENTS/OUTLINE

Epidural injections
Injectate and mechanisms of pain relief
Indications
Pain secondary to neural mass effect
Temporary pain relief prior to diagnostic studies or other interventions
Vertebral Augmentation
Mechanism of pain relief
Indications
Improving cement distribution and minimizing extravasation
Navigational osteostomes
High viscosity cement
Injection cavity pressure monitoring
Cavity creation with controlled ablation
Radiofrequency Ablation
Mechanisms of heat production and pain relief
Improving safety and efficacy
Real-time monitoring of the ablation volume
Navigational ablation probe
Thermal protection techniques
Cryoablation
Mechanisms of tumor cell death
Unique advantages
Visualization of the ablation volume
Treatment of sclerotic metastases
Techniques for increasing safety
Motor evoked potential monitoring
Peripheral motor nerve electrostimulation
'Crazy Walk on the Curve Side ': Performing Difficult Biopsies with Curved Needles

All Day Location: VI Community, Learning Center

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Patrick Baque, Monaco, Monaco (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
Propose an alternative way with curved needles to perform biopsies reputedly difficult in special anatomic conditions. Know the most frequent targets to apply these technique. Describe how to proceed step by step.

TABLE OF CONTENTS/OUTLINE

Biopsies are essential for diagnosing cancer and several others conditions in patient management. Nevertheless, some CT-guided biopsies are deemed difficult or technically challenging to perform in the case of deep lesions, narrow access ways and interposed sensitive structures. In usual procedures, straight needles are designed to be inserted directly with limited redirection inside the body. By contrast, curved needles allow to bypass obstacles thanks to the possibility to take different trajectories with variable curves, only by applying a stepwise rotation approach during the advancement of these needles: the curve effect. It is possible to major this curve effect by leaning on the bevel opening which is always located in the needle's convexity: the edge effect. In our institution, biopsies with curved needles are well-established for some years now. These modified needles allow a better targeting of hard-to-reach lesions (mediastinal, intra or retroperitoneal localizations...). These technique can be widely used for different parts of the body with safe conditions and may be easily handle.
Participants
Benjamin Carney, MS, MD, Seattle, WA (Presenter) Nothing to Disclose
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TEACHING POINTS
The learner will review basic hormone signalling as well as common pathophysiologic disruptions of these pathways. The learner will develop an understanding of the procedures that the interventional radiologist can offer to clarify and guide management of various endocrinologic diagnoses. The learner will become familiar with the indications for endocrine stimulation and sampling procedures and be prepared for frequently asked questions from patients and referring endocrinologists. The learner will be able to identify normal anatomy and variants pertinent to interventional stimulation and sampling procedures. The learner will review patient preparation, stimulation and sampling techniques, specimen handling and results interpretation.

TABLE OF CONTENTS/OUTLINE
The exhibit is divided anatomically into six sections: Pituitary Adrenal Kidney Parathyroid Pancreas Gonads. Within each section, content is organized as follows: Pathways and Pathophysiology Role of Interventional Stimulation and Sampling Procedures Normal and Variant Anatomy Patient Preparation, Procedural Technique and Results Interpretation.
Efforts Against Effort Thrombosis of the Axillosubclavian Vein: A Review of the Endovascular Management of Paget-Schroetter Syndrome

All Day Location: VI Community, Learning Center

Participants
Jonathan R. Young, MD, Los Angeles, CA (Presenter) Nothing to Disclose
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Jonathan K. Park, MD, Los Angeles, CA (Abstract Co-Author) Nothing to Disclose
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TEACHING POINTS
1. The mechanism of Paget-Schroetter syndrome is compression of the subclavian vein as it courses through the anterior thoracic outlet at the junction of the first rib and clavicle, as well as between the subclavius and anterior scalene muscles. Intimal damage results in a thrombogenic surface, increasing the risk of deep vein thrombosis. 2. The treatment of Paget-Schroetter syndrome is somewhat controversial, as there have not been large prospective randomized controlled trials to compare various treatment strategies. Many advocate catheter-directed thrombolysis followed by decompressive surgery, venography with possible venoplasty, and anticoagulation. 3. Catheter-directed thrombolysis is most successful when performed within 10-14 days of thrombus formation. 4. Angioplasty and stent placement prior to surgical decompression have been largely unsuccessful and are not recommended. Stent placement frequently results in stent fracture. Venoplasty can cause endothelium damage, increasing the risk of early re-thrombosis.

TABLE OF CONTENTS/OUTLINE
1. Epidemiology of Paget-Schroetter Syndrome
2. Mechanism of Paget-Schroetter Syndrome
3. Presentation and Diagnosis of Paget-Schroetter Syndrome
Pre and Intra Hospital Resuscitative Endovascular Balloon Occlusion of the Aorta (REBOA): A United Kingdom Level 1 Trauma Center Perspective

All Day Location: VI Community, Learning Center

FDA Discussions may include off-label uses.

Awards
Certificate of Merit

Participants
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Ounali Jaffer, MBBS, FRCP, London, United Kingdom (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS

Understand the indications, techniques and equipment required for the insertion of REBOA in the hemodynamically unstable trauma patientTo be familiar with the normal imaging appearances of a correctly placed REBOAUnderstand the potential pitfalls and complications associated with use of REBOA and their imaging features

TABLE OF CONTENTS/OUTLINE

REBOA is a resuscitative adjunct technique which can be a potential lifesaver in the setting of hemorrhagic shock. Its utilization within trauma centers is gaining increasing recognition, but not infrequently, complete cardiovascular collapse may have already occurred prior to hospital arrival. Our Level 1 trauma center is a pioneering REBOA site and is the first worldwide to undertake REBOA insertion at the roadside. Within our pictorial review, we will discuss the indications for REBOA insertion with description of equipment modification to ease placement in the pre-hospital setting. We will also demonstrate the correct and incorrect radiological appearances of REBOA on plain film and CT, and include case examples of the potential complications associated with REBOA insertion.
Interventional Management of Pulmonary Nodules: See One, Stick One, Treat One

All Day Location: VI Community, Learning Center

Participants
Aliaksei Salei, MD, Darby, PA (Presenter) Nothing to Disclose
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Aaron Brandis, MD, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose
Salmi Simmons, MD, Darby, PA (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS

TABLE OF CONTENTS/OUTLINE
Imaging features that warrant biopsy, including appearance, growth, persistence and elevated FDG uptake. Percutaneous biopsy: - CT guided biopsy; - US guided biopsy; - Technical considerations (nodule location, coaxial vs. non-coaxial needle, double needle technique); - Complications (predisposing factors, ways to avoid); - Approach to unsatisfactory biopsy specimen. Treatment: - Needle localization for wedge resection; - Fiducial markers placement; - RF ablation; - Cryoablation; - Microwave ablation; - Post therapy appearance and follow up.
Organizing a Systematic Analysis to Detect and Manage Endovascular Aortic Aneurysm Repair and Complications by Ultrasound: A Comprehensive and Objective Review

All Day Location: VI Community, Learning Center

Participants
George C. Dantas, Sao Paulo, Brazil (Presenter) Nothing to Disclose
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TEACHING POINTS

The purpose of this exhibit is systematize an ultrasound examination after Endovascular Aortic Aneurysm Repair (EVAR), using Duplex Scan, CEUS and Image fusion techniques to detect and evaluate complications. - Duplex scan is performed to determine aneurysm size, morphology of the endoprosthesis and visualize and evaluate blood flow in and out of the prosthesis (leak). - CEUS increases the sensitivity of ultrasound surveillance, due its ability in detects low flow velocity and recognize endoleaks with delayed enhancement. Contrast image is viewed on a split image screen with the grayscale image adjacent. - We do it with 1mL of Sonovue® followed by 5mL of normal saline flush. Where an endoleak was found, a more focused examination could be conducted with a further 1mL bolus agent contrast. - In case of patients have a previous CTA, image fusion techniques combining CEUS and CTA can be performed in a split image screen using appropriate software. - Image fusion improves spatial orientation, facilitating the characterization of complications post-EVAR, especially endoleaks.

TABLE OF CONTENTS/OUTLINE

Introduction Complications after EVAR Ultrasound advantages and limitations Systematization of examination Conclusion
Beyond Atherosclerosis: Lower Limb Ischaemia in the Younger Patient

All Day Location: VI Community, Learning Center

Participants
Richard D. White, MBChB, FRCR, Cardiff, United Kingdom (Abstract Co-Author) Nothing to Disclose
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Thiru A. Sudarshan, DMRD, FRCR, Dundee, United Kingdom (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
1. Review imaging strategies and the wide range of differential diagnosis when evaluating lower limb ischaemia in young (<50 years) patients.
2. Illustrate the spectrum of pathologies on multimodality imaging (US, CT, MR, angiography) with clinical correlation and associated endovascular management where applicable, using cases from an extensive archive at two tertiary vascular centres.

TABLE OF CONTENTS/OUTLINE
1. Optimal imaging strategies: who, how and when to image?
2. Pearls and pitfalls
3. Pathologies:
   a. Premature atherosclerosis
   b. Vasculitis i. Categorisation
   c. Thromboembolic disease, including septic embolic disease
   d. Popliteal entrapment syndromes
      i. Categorisation
      ii. Specific imaging considerations
   e. Popliteal cystic adventitial disease
   f. Iliac endofibrosis
   g. Trauma
      i. acute
      ii. chronic sequelae
   h. Iatrogenic e.g. migrated vascular occlusion plugs, post-surgical complications
   i. Non-arterial e.g. May-Thurner syndrome
Emergencies in the Pulmonary Arteries: Beyond Pulmonary Embolism

All Day Location: VI Community, Learning Center

Participants
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Daniel Vargas, MD, Aurora, CO (Abstract Co-Author) Nothing to Disclose
Santiago Martinez-Jimenez, MD, Kansas City, MO (Abstract Co-Author) Author, Reed Elsevier; Author, Oxford University Press
Horacio Murillo, MD, PhD, Stanford, CA (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
Describe and illustrate different conditions, other than pulmonary embolism affecting the pulmonary arteries that may manifest as medical emergencies.

TABLE OF CONTENTS/OUTLINE
Current MDCT technology allows precise evaluation of the pulmonary vasculature in numerous emergency situations. Even though the evaluation of the pulmonary arteries has commonly been focused on the diagnosis or exclusion of thromboembolic disease, the pulmonary arteries can be affected in several other conditions that may require emergency treatment. Prompt identification of these pathologic conditions and injuries, is critical for improving patient outcomes. Table of Contents:
- Aneurysms and pseudoaneurysms
- Extension of wall hematoma from Type-A aortic dissection
- Pulmonary artery dissection
- Traumatic injury
- Pulmonary artery occlusion / extrinsic compression
- Severe stenosis
- Foreign body embolization

Honored Educators
Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

Carlos S. Restrepo, MD - 2012 Honored Educator
Carlos S. Restrepo, MD - 2014 Honored Educator
Santiago Martinez-Jimenez, MD - 2014 Honored Educator
Santiago Martinez-Jimenez, MD - 2015 Honored Educator
Awards
Certificate of Merit

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Andrew C. Gordon, Cardiff, United Kingdom (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
1. Review the embryology, normal anatomy and anatomical variants of the SMA (superior mesenteric artery) and its branches, with schematic diagrams and multimodality imaging (US, CT, MR, angiography) 2. Describe optimal imaging strategies for evaluating pathology related to the SMA. 3. Illustrate the spectrum of pathologies involving the SMA and its branches on multimodality imaging emphasizing clinical correlation and endovascular management where applicable, using cases from an extensive archive at two tertiary vascular centres

TABLE OF CONTENTS/OUTLINE
Aortic Obstructive Syndromes (AOS): Revisiting Pathogenesis and Cross Sectional Imaging Findings

All Day Location: VI Community, Learning Center

Participants
Ameya J. Baxi, MBBS, DMRD, San Antonio, TX (Presenter) Nothing to Disclose
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Horacio Murillo, MD, PhD, Stanford, CA (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
To discuss taxonomy, etiopathogenesis and causes of AOS To review characteristic multimodality imaging findings

TABLE OF CONTENTS/OUTLINE
Aortic obstruction results in complete or partial loss of continuity of the aorta and may result in development of collaterals. The severity and extent of narrowing of aorta account for presence of symptoms and can have poor prognosis. Management may include aortoaoatic bypass, vascular reconstruction, stenting or angioplasty.Cross sectional imaging provides accurate noninvasive assessment of anatomy, morphology, etiology, location, collaterals, severity and associated findings. Recognizing typical imaging manifestations with adequate clinical correlation is essential for timely and accurate diagnosis and for pretreatment evaluation. Imaging plays a critical role in the patient management. In this exhibit, we discuss etiopathogenesis and characteristic multimodality imaging findings of AOS. Increased awareness of such entities will contribute to optimized patient care.

Introduction
Taxonomy Etiopathogenesis and imaging Coarctation and Pseudocoarctation Aortic interruption Mid-aortic syndrome Leriche’s syndrome Inflammatory vasculitis: Takayasu arteritis, Neurofibromatosis 1, Retroperitoneal fibrosis, and Fibromuscular dysplasia Miscellaneous- Aortic sarcoma, Conclusion

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Carlos S. Restrepo, MD - 2012 Honored Educator
Carlos S. Restrepo, MD - 2014 Honored Educator
Pulmonary Artery Dissections and Intramural Hematomas: Changing Concepts in Pathogenesis and Cross Sectional Imaging Findings

All Day Location: VI Community, Learning Center

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TEACHING POINTS
To discuss taxonomy and etiopathogenesis of pulmonary artery dissections (PAD) and intramural hematomas (PIH) To review characteristic multimodality imaging findings

TABLE OF CONTENTS/OUTLINE
Aortic dissection can penetrate the common aortic and pulmonary adventia, occasionally forming PAD and PIH. Limited radiology literature is available on PAD and PIH and only few case reports are published. Not much is known about natural history, etiopathogenesis, and radiological manifestations of PAD and PIH. A more accurate and precise terminology of PAD is a need of time and is proposed. Cross sectional imaging provides accurate anatomy and morphology with information on etiology, location, mass effect and severity of PAD as well as PIH. Recognizing typical imaging manifestations with adequate clinical correlation is essential for timely and accurate diagnosis as well as guiding treatment. Imaging plays a critical role in the patient management. In this exhibit, we discuss the etiopathogenesis and characteristic multimodality imaging findings of PD. Increased awareness of such entities will contribute to optimized care of cancer patients.

Aims/Objectives
Introduction
Taxonomy
Etiopathogenesis
Imaging of PAD and PIH
Conclusion
Teaching points

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Santiago Martinez-Jimenez, MD - 2014 Honored Educator
Santiago Martinez-Jimenez, MD - 2015 Honored Educator
TEACHING POINTS

1. Aortic root findings can impact patient outcome and management significantly. Detection of these findings on a non gated study can be challenging for a non cardiovascular imager. 2. High index of suspicion greatly aids detection of these findings. 3. Requesting a repeat gated acquisition often serves as a problem solving tool.

TABLE OF CONTENTS/OUTLINE

Review of imaging spectrum - CT angiography - PET/CT Sample cases that were missed on non gated study by non cardiovascular radiologist. Tips and tricks for avoiding pitfalls.
Patients with massive or submassive pulmonary embolism (PE) have extremely high mortality rates, especially when not treated expeditiously. Novel interventional radiological techniques including catheter-directed therapy (CDT) are constantly being refined to increase the effectiveness of non-invasive clot removal compared with intravenous thrombolysis alone. There are numerous ongoing trials studying the outcomes of CDT in patients with PE. This educational exhibit will summarize current guidelines and clinical trial results to provide a practical algorithm for the radiologist evaluating patients with suspected massive or submassive PE.

**TABLE OF CONTENTS/OUTLINE**

The exhibit will begin with a brief overview, covering the clinical presentation of PE, the definitions of functional grading systems useful for directing PE treatment, and a list of indications for treating a patient with CDT. It will then summarize the results from recent trials designed to study catheter-directed therapies, and discuss the risk and benefits involved with the contemporary catheter-directed techniques. We will present our institution's PE response team management algorithm based on current research and clinical expertise. The exhibit will conclude by reviewing clinical cases from our institution illustrating the utility of catheter-directed thrombolysis and ancillary techniques in PE.
Introduction to Dialysis Access Complications and Interventions

All Day Location: VI Community, Learning Center

Participants
Pratik A. Shukla, MD, New York, NY (Presenter) Nothing to Disclose
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TEACHING POINTS
To review complications associated with dialysis access (Central Venous Dialysis Catheters/Arteriovenous Fistula/Graft). To review treatment options for the dialysis access associated complications.

TABLE OF CONTENTS/OUTLINE
A. Permcath Related Complications
   a. Fibrin Sheath Formation
      i. Balloon angioplasty
      ii. Thrombolytic infusion
   B. Failure to mature
      a. Balloon assisted maturation
   C. Venous outflow stenosis
      a. Balloon angioplasty
      b. Stent placement
   D. Arterial inflow stenosis
      a. Balloon angioplasty
      b. Stent placement
   E. Access Thrombosis
      a. Mechanical catheter assisted thrombectomy
      b. Rheolytic thrombectomy
      c. Thrombolysis
   F. Collateral Vessel Steal
      a. Collateral Vessel Embolization
   G. Dialysis Associated Steal Syndrome
      a. Distal radial artery embolization
      b. MILLER (minimally invasive limited ligation endoluminal assisted revision) banding
      c. Ulnar Artery Recanalization
Bronchial Artery Embolization for Treatment of Hemoptysis: Our Experience and Correlation with Bronchoscopy and MDCT Findings

All Day Location: VI Community, Learning Center

Participants
Ivan Babin, MD, Syracuse, NY (Presenter) Nothing to Disclose
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TEACHING POINTS
Review the etiology, pathophysiology, and classification of hemoptysis. Define normal bronchial artery anatomy, variants, and other frequently involved vessels. Discuss the diagnostic options. While therapeutic bronchoscopy is an indispensable tool in massive hemoptysis, its use as a diagnostic-only tool to localize the site of hemoptysis is controversial. We will correlate angiography findings with bronchoscopy and pre-procedural CT findings and assess their sensitivity. Present diagnostic and management options of hemoptysis, including bronchoscopic, imaging, and surgical options. Describe our experiences with bronchial artery embolization techniques, device selection, and outcomes.

TABLE OF CONTENTS/OUTLINE
Etiology, pathophysiology, and classification of hemoptysis. Review of relevant anatomy. Diagnostic options: Discuss the diagnostic success rates for localization of bleeding via CT and bronchoscopy. Correlation to angiographic findings will be provided. Treatment options: Present data on surgical options, bronchoscopic options - including balloon tamponade, vasoconstrictor injection, laser photoacoagulation, electrocautery, and stent placement. Data for long-term outcomes on these options, where available, will be compared to bronchial artery embolization. Bronchial artery embolization technique and device selection. Conclusion.
MDCT of Acute Nonatherosclerotic / Noninflammatory Pathology of the Splachnic Arteries: A Practical Imaging Approach to Aid in Diagnosis and Management

All Day Location: VI Community, Learning Center

Awards
Certificate of Merit

Participants
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Cristian Varela, MD, Santiago, Chile (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
1. Young patient with complaint of abdominal pain and/or gastrointestinal hemorrhage2. Hematoma - Dissection complex (HDC) and focal arterial dilatation (aneurysm/pseudoaneurysm) should be looked for in the acute setting. Luminal irregularity, narrowing and focal dilatation are late manifestations. MDCT frequently shows intestinal or splenic infarction.3. The pathophysiology underlying acute nonatherosclerotic / noninflammatory processes of the splachnic arteries is not completely understood.4. In most cases, pathological correlation is not possible. However, segmental arterial mediolysis and fibromuscular dysplasia should be considered5. Early follow-up imaging (5-7 days after diagnosis) is recommended to look for complications such as focal dilatation or increasing HDC

TABLE OF CONTENTS/OUTLINE
Endovascular Management of Persistent Pulmonary Arteriovenous Malformations

All Day Location: VI Community, Learning Center

Awards
Certificate of Merit

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TEACHING POINTS
Teaching points: 1- Review the complications of pulmonary arteriovenous malformations. 2- Describe the signs and symptoms of persistent pulmonary arteriovenous malformations. 3- Outline the mechanisms for persistence of pulmonary arteriovenous malformations. 4- Demonstrate different imaging modalities used for the diagnosis of persistent pulmonary arteriovenous malformations. 5- Highlight the technique and embolic agents used for percutaneous transcatheter embolotherapy of persistent pulmonary arteriovenous malformations. 6- Outline the outcomes of percutaneous embolotherapy of pulmonary arteriovenous malformations.

TABLE OF CONTENTS/OUTLINE
Outline: 1- Introduction. 2- Signs and symptoms of persistent pulmonary arteriovenous malformations. 3- Causes of persistence of pulmonary arteriovenous malformations. 4- Diagnosis of persistent pulmonary arteriovenous malformations by different imaging modalities. 5- Endovascular management of persistent pulmonary arteriovenous malformations. 6- Outcomes. 7- Summary and conclusion.
Lymphangiography: What is it Good For? A Pictorial Review Depicting Lymphangiography Techniques and Interventions

All Day Location: VI Community, Learning Center

Participants
Joseph C. DeMarco, DO, Valhalla, NY (Presenter) Nothing to Disclose
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TEACHING POINTS
Understand the indications for performing a lymphangiogram. Understand the various lymphangiography techniques. Be able to identify normal and variant thoracic duct anatomy for successful treatment.

TABLE OF CONTENTS/OUTLINE
Lymphangiography was first described in the 1950s using a transpedal approach, which was technically difficult and time consuming. Our Educational Exhibit will provide a pictorial review of various older and newer approaches, including tips for successful lymphatic catheterization and thoracic duct embolization. Indications for lymphangiography: Chylothorax due to iatrogenic injury or traumatic injury to the thoracic duct Chylopericardium Postoperative chylous wound leaks Chylos ascites Chylopytsis Chyluria Diagnosing lymphoma/melanoma Choosing method of approach: 1. Injection approach: Traditional pedal access Intranodal access 2. Cisterna access: Transabdominal approach Retroperitoneal approach Transvenous approach via left subclavian vein Identifying thoracic duct anatomy: Variants: Based on outflow location, predominantly left-sided, right-sided, or bilateral (duplicated thoracic duct), and plexiform Lymphatic Interventions: Indications and Contraindications Medical management versus surgical versus IR options Lymphatic disruption versus embolization
Imaging in the Evaluation of Thoracic Outlet Syndrome with Vascular Complication

All Day Location: VI Community, Learning Center

Participants
George C. Dantas, Sao Paulo, Brazil (Presenter) Nothing to Disclose
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TEACHING POINTS
The purpose of this exhibit is explain the role of the different imaging methods in diagnostic and evaluation of Thoracic Outlet Syndrome with vascular complication, providing tools to radiologist conduct these cases.- Thoracic Outlet Syndrome is a compression injury or irritation of neurovascular structures (subclavian artery, subclavian vein and brachial plexus) in cervical and upper thoracic region, which can be done by bone, ligament or muscle anatomical anomalies in the neck and chest higher.- There are three more likely places to compression: interscalene triangle, costoclavicular space, and retropectoralis minor space.- The radiology methods are important to determine the local of compression, the compressed structure and the cause of this.- The radiologist must be able to conduct the exam protocols and know the findings that may be found.

TABLE OF CONTENTS/OUTLINE
1. Review of the anatomy involving the thoracic outlet.2. The use of various imaging techniques (CR, US, MRI and CT) to Identify the normal and abnormal anatomy of the thoracic outlet syndrome.3. Radiological findings in the most common causes of Thoracic Outlet Syndrome with vascular complications.
A How to Guide to Embolization and Sclerosis of Ovarian Varices to Treat Pelvic Congestion Syndrome

All Day Location: VI Community, Learning Center

Participants
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Ketan Y. Shah, MD, BS, Houston, TX (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
1) Define pelvic congestion syndrome
2) Review the indications, contraindications, diagnostic imaging, interventional methods, outcomes and potential complications of ovarian vein embolization

TABLE OF CONTENTS/OUTLINE
A. Anatomy
B. Pathophysiology of pelvic congestion syndrome
C. Clinical Findings: prevalence, symptoms, risk factors
D. Diagnostic Imaging: pelvic and transvaginal ultrasound, CT, and MRI findings
E. Differential Diagnosis: other causes of pelvic congestion and pelvic pain
F. Indications/contraindications to ovarian vein embolization
G. Procedure: coiling and sclerotherapy
H. Outcomes and complications
I. Follow-up
Challenges in Ultrasound Imaging of Carotid Artery Stenosis

All Day Location: VI Community, Learning Center

Participants
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Motahar Basam, BA, Silver Spring, MD (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
At the end of this presentation, participants will be able to: Apply new insights from a summary of the world literature on the use of ultrasound in evaluating normal carotid anatomy with gray-scale, color and duplex Doppler techniques. Describe the potential for human errors and technical artifacts and/or mistakes when acquiring or interpreting carotid ultrasound examinations. Recognize technical limitations that can result in errors in interpretation. Recognize the need for further research in the flow hemodynamics of the carotid artery. Discuss the importance of quality assessment in the accuracy of diagnosing carotid stenosis.

TABLE OF CONTENTS/OUTLINE
Review and summarize the world literature on various imaging modalities used for carotid imaging. Illustrate specific human errors and technical artifacts such as: satisfaction of search, machine tracing of Doppler velocity flow patterns and others. Assess the need for more research and understanding of how to apply hemodynamic principles validated in the carotid bifurcation to other portions of the carotid anatomy. Review limitations of carotid imaging due to color Doppler artifacts. Review recommendations to obtain consistency in reporting carotid sonograms for both structure and content.
Ultrasound Assessment of Chronic Mesenteric Ischemia

All Day Location: VI Community, Learning Center

Awards
Cum Laude

Participants
Abbas Momin, MD, New Haven, CT (Presenter) Nothing to Disclose
John S. Pellerito, MD, Manhasset, NY (Abstract Co-Author) Nothing to Disclose
Margarita V. Revzin, MD, Wilton, CT (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
To familiarize the radiologist with application of ultrasound in assessment of chronic mesenteric ischemia (CMI). This will aid in improving radiologists ability to correctly diagnose this disease and minimize the rate of misdiagnosis and misinterpretation.

TABLE OF CONTENTS/OUTLINE
1. The natural history of CMI, and factors that differentiate it from acute mesenteric ischemia.
2. Review of the anatomy and physiology of splanchnic vessels and their collateral circulation.
3. Review ultrasound protocols for evaluation of splanchnic arteries with emphasis on utilization of different approaches and modes, and optimization of parameters to improve mesenteric artery assessment.
4. Diagnostic criteria for CMI will be summarized with detailed discussion of secondary signs of stenosis. Different examples of two and three vessel stenoses and chronic superior mesenteric artery occlusion with retrograde reconstitution will be provided.
5. Pitfalls in evaluation will be discussed including median arcuate ligament syndrome, nutcracker syndrome, low and high output states, arrhythmia, acute superior mesenteric artery thrombosis, celiac axis dissection and pseudoaneurysm formation, and spontaneous superior mesenteric artery dissection.
6. Current management of CMI will be discussed.
7. A discussion of follow-up assessment after arterial stenting.
AngioVac: This Thing Sucks. Interventionalist's Guide to Novel Endovascular Thrombectomy Device

All Day Location: VI Community, Learning Center

Participants
Charles H. Li, BS, Los Angeles, CA (Presenter) Nothing to Disclose
Jonathan K. Park, MD, Los Angeles, CA (Abstract Co-Author) Nothing to Disclose
John M. Moriarty, MD, Los Angeles, CA (Abstract Co-Author) Speaker, AngioDynamics, Inc; Consultant, AngioDynamics, Inc; Speaker, Sequent Medical, Inc; Consultant, Sequent Medical, Inc; Speaker, Argon Medical Devices, Inc; Consultant, Argon Medical Devices, Inc

TEACHING POINTS
1. The AngioVac thrombectomy device is an exciting and novel tool designed for high-volume aspiration of undesired endovascular material.  
2. To review the indications and rationale for utilizing the AngioVac venovenous bypass system.  
3. To guide the reader through the pre-procedural diagnostic imaging, interventional methods, benefits, and potential complications of AngioVac.  
4. Real-world case examples will be presented to highlight the technique.

TABLE OF CONTENTS/OUTLINE
A. Overview of the AngioVac device and how it works.  
B. Review and rationale for patient selection.  
C. Graphic and radiographic guide to the AngioVac technique.  
D. Multiple case examples to highlight the variety of indications for AngioVac (including but not limited to caval thrombosis and atrial masses).  
E. Visual overview of outcomes and complications.
Endovascular Treatment of Cerebral Aneurysms with Flow-Diverter Devices: An Effective Alternative When Surgery, Coils and Conventional Stent Are Not an Option

All Day Location: VI Community, Learning Center

Participants
Roberto Correa Soto, Salamanca, Spain (Presenter) Nothing to Disclose
Jose Antonio de las Heras Garcia, Salamanca, Spain (Abstract Co-Author) Nothing to Disclose
Francisco Menor, Valencia, Spain (Abstract Co-Author) Nothing to Disclose
Roberto Llorens Salvador, Valencia, Spain (Abstract Co-Author) Nothing to Disclose
Karin Daniela Muller Campos, Santiago, Chile (Abstract Co-Author) Nothing to Disclose
Diego S. Palominos Pose, MD, Barcelona, Spain (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS

In the endovascular treatment of cerebral aneurysms, in recent years, the Flow-Diverter Devices are positioned as a lasting curative option. The purpose of this exhibit is:
1.- To review the pathophysiology and clinical presentation of cerebral aneurysms.
2.- To explain the diagnostic images of cerebral aneurysms.
3.- To explain and to review the indications, contraindications, interventional method, images, outcomes, complications and timing of controls, of the Flow-Diverter Devices.

TABLE OF CONTENTS/OUTLINE

A. Introduction
B. Anatomy
C. Cerebral Aneurysms - Pathophysiology - Types - Clinical presentation - Diagnostic Images
D. Treatment Options
E. Flow-Diverter Devices - Anatomy, mechanics, physiology and biology to achieve aneurysmal occlusion - Indications - Contraindications - Interventional Method - Outcomes - Complications - Controls
F. Representative clinical cases
G. Key Points
Computational Fluid Dynamics (CFD) in Aortic Applications - What You Need and What You Get

All Day Location: VI Community, Learning Center

Participants
Martina Roxane Correa Londono, DSc, Bern, Switzerland (Presenter) Nothing to Disclose
Sasan Partovi, MD, Cleveland, OH (Abstract Co-Author) Nothing to Disclose
Christof Karmonik, PhD, Houston, TX (Abstract Co-Author) Nothing to Disclose
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Philipp Hoeegen, Heidelberg, Germany (Abstract Co-Author) Nothing to Disclose
Katerina Spranger, London, United Kingdom (Abstract Co-Author) Nothing to Disclose
Philipp Erhart, Heidelberg, Germany (Abstract Co-Author) Nothing to Disclose
Duanduan Chen, Beijing, China (Abstract Co-Author) Nothing to Disclose
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Paul Morris, Sheffield, United Kingdom (Abstract Co-Author) Nothing to Disclose
Fernando M. Gomez, MD, PhD, Valencia, Spain (Abstract Co-Author) Nothing to Disclose
Fabian Rengier, MD, Heidelberg, Germany (Abstract Co-Author) Nothing to Disclose
Hendrik Von Tengg-Kobligk, MD, Bern, Switzerland (Abstract Co-Author) Research Grant, W. L. Gore & Associates, Inc

TEACHING POINTS
To describe a typical workflow and how to perform computational fluid dynamics (CFD). To review cases in the field of cardiovascular medicine with special focus on thoracic and abdominal aorta. To highlight how to interpret the hemodynamic results of CFD simulations. To summarize the potential of CFD for personalized medicine in daily use.

TABLE OF CONTENTS/OUTLINE
1. Toolbox for computational fluid dynamics (CFD). A. Segmentation and discretization by a 3D mesh. B. Simulation and post processing. C. The relevance of boundary conditions to the model as well as major limitations of boundary conditions and CFD models. D. Interpretation of hemodynamic results.2. Application to the main aortic pathologies. A. Aortic dissection. B. Aneurysms of the thoracic and/or abdominal aorta.3. Conclusion.
Awards
RSNA Country Presents Travel Award

Participants
Eunice A. Lara Garcia, MD, Mexico City, Mexico (Presenter) Nothing to Disclose
Carlos E. Rojas Marin, MD, Mexico, Mexico (Abstract Co-Author) Nothing to Disclose
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Arturo Garcia Martinez, Mexico City, Mexico (Abstract Co-Author) Nothing to Disclose
Edwin G. Belalcazar Bolanos, MD, Mexico City, Mexico (Abstract Co-Author) Nothing to Disclose
Fabian A. Cabrera-Florez, MD, Mexico City, Mexico (Abstract Co-Author) Nothing to Disclose
Beatriz E. Retamoza, MD, Mexico City, Mexico (Abstract Co-Author) Nothing to Disclose
Jose Vazquez Flores, MD, Morelia, Mexico (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS

Describe the biopsy technique regarding localization of the tumor taking into account relevant anatomical considerations Illustrate the embolization technique: all about the embolic agent and how to use it.

TABLE OF CONTENTS/OUTLINE

1. Introduction
2. Patient preparation and lesion localization: general considerations
4. Embolization: how to prepare the embolic agent, how much to use and what to expect
5. Conclusions
TEACHING POINTS

Ultrasoundography is a proven technology in intervention. Ultrasound contrast agent (UCA) improves its imaging to the level of other enhanced modalities. However, to justify its use in interventional procedures, it is useful to attain clarity about where its use could potentially improve outcome. The aim of the exhibit is to familiarise learners with the evolving application of UCA in US-guided procedures, and to illustrate how use of UCA could improve success rate and reduce complications.

TABLE OF CONTENTS/OUTLINE

A CT-based Step-by-Step Approach for Vasculitis and Vasculitis Mimics on the Basis of the 2012 Revised International Chapel Hill Consensus Conference Nomenclature

All Day Location: VI Community, Learning Center

Awards
Certificate of Merit
Identified for RadioGraphics

Participants
Jee Hye Hur, MD, Gyeonggi-Do, Korea, Republic Of (Presenter) Nothing to Disclose
Yeo Koon Kim, Seongnam-Si, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Sang Il Choi, MD, Seongnam-Si, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Eun Ju Chun, MD, PhD, Seongnam-Si, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Hyon Joo Kwag, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
1. To introduce the 2012 revised International Chapel Hill Consensus Conference (CHCC) nomenclature of vasculitides (Vts)
2. Besides the clinical and lab-findings, CT is useful to diagnose Vts, because it can evaluate not only the lumen but the vessel wall and perivascular structure. On the CT-based step-by-step approach, we can diagnose Vts. Vts mimics need to be differentiated from vasculitis, because of the different treatment.

TABLE OF CONTENTS/OUTLINE
1. Overview of the 2012 CHCC nomenclature of Vts
2. Clinical and lab-based approach for patients with suggestive Vts
4. Presence of the associated systemic disease: IgG-related disease, rheumatoid, etc.
5. Step 4] To exclude the Vts mimics: fibromuscular dysplasia, segmental arterial mediolysis, Marfan syndrome, Loeys-Dietz syndrome, etc.
6. Potential role of CT for Vts as compared to other imaging modalities
7. Summary table
Adrenal Vein Sampling: How to Success in Difficult Cases. How to Solve the Problems.

All Day Location: VI Community, Learning Center

Awards
Certificate of Merit

Participants
Sota Oguro, Tokyo, Japan (Presenter) Nothing to Disclose
Seishi Nakatsuka, MD, Shinjuku-Ku, Japan (Abstract Co-Author) Nothing to Disclose
Masanori Inoue, MD, Shinjuku-Ku, Japan (Abstract Co-Author) Nothing to Disclose
Hideki Yashiro, MD, Shinjuku-Ku, Japan (Abstract Co-Author) Nothing to Disclose
Jitsuro Tsukada, Tokyo, Japan (Abstract Co-Author) Nothing to Disclose
Masashi Tamura, Shinjuku-Ku, Japan (Abstract Co-Author) Nothing to Disclose
Yosuke Suyama, Tokyo, Japan (Abstract Co-Author) Nothing to Disclose
Nobutake Ito, MD, Yokohama, Japan (Abstract Co-Author) Nothing to Disclose
Masahiro Jinzaki, MD, Tokyo, Japan (Abstract Co-Author) Support, Toshiba Corporation; Support, General Electric Company

TEACHING POINTS
1. To understand how to perform the pre-procedural dynamic CT to find the right adrenal vein, and how to prepare the procedure using pre-procedural dynamic CT image.
2. To learn which pre-shaped catheter should be used for various location and angle of the right adrenal vein from review on 450 successful procedures.
3. Learn how to find the location of the right adrenal vein when it was not catheterized after search using several different pre-shaped catheter.
4. How to perform and interpretate CT during arteriography.
5. To learn pit falls and solutions of catheterization of left adrenal vein.

TABLE OF CONTENTS/OUTLINE
To describe and illustrate a comprehensive review of adrenal vein sampling. Table of Contents/Outline: Introduction Diagnosis and Imaging of primary aldosteronism Anatomy of right adrenal vein on pre-procedural dynamic CT How to perform CT during arteriography from the right inferior phrenic artery, the right middle adrenal artery and the right inferior right adrenal artery Assessment of the right adrenal vein on CT during arteriography How to choose a pre-shaped catheter using the information of CT images based on 450 successful procedures. How to deal with the cases which can hardly be drawn the blood sample from the catheter. Pit falls of catheterization of left adrenal vein and solutions.
Spectrum Analysis and Qualitative Evaluation of Takayasu Arteritis (TA) Using 256-Slice Dual Source Multi Detector CT Angiography (MDCTA): A Pictorial Essay

All Day Location: VI Community, Learning Center

Participants
Richa Tiwari, MD, New Delhi, India (Presenter) Nothing to Disclose
Amit K. Verma SR, MBBS, MD, New Delhi, India (Abstract Co-Author) Nothing to Disclose
Ruchi Gupta, MD, New Delhi, India (Abstract Co-Author) Nothing to Disclose
Sonali Sethi, MBBS, MD, New Delhi, India (Abstract Co-Author) Nothing to Disclose
Meenakshi Prakash, MD, MBBS, Ranchi, India (Abstract Co-Author) Nothing to Disclose
Poonam Narang, MBBS, MD, New Delhi, India (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
MDCTA with low dose imaging protocols is good enough to evaluate the involvement of systemic, pulmonary and coronary arteries. The spectrum of vascular involvement and mural changes correlate with clinical status and disease activity that predict the possible outcome. The important features of disease a vascular surgeon looks for in a CTA report should be emphasized

TABLE OF CONTENTS/OUTLINE
Introduction and pathological basis of the disease. Clinical presentation of the disease. MDCTA: low dose optimum imaging protocol role in evaluation of Takayasu arteritis Diagnostic criterion and spectrum of vascular involvement Other imaging modalities with pros and cons CTA report: points to be included
Peripheral Pseudoaneurysm: Imaging Perspective with Focus on Multidetector CT Angiography (MDCTA)

All Day Location: VI Community, Learning Center

Participants
Ruchi Gupta, MD, New Delhi, India (Presenter) Nothing to Disclose
Amit K. Verma SR, MBBS, MD, New Delhi, India (Abstract Co-Author) Nothing to Disclose
Richa Tiwari, MD, New Delhi, India (Abstract Co-Author) Nothing to Disclose
Sonali Sethi, MBBS, MD, New Delhi, India (Abstract Co-Author) Nothing to Disclose
Meenakshi Prakash, MD, MBBS, Ranchi, India (Abstract Co-Author) Nothing to Disclose
Dipali Shah, MD, Ahmedabad, India (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
Peripheral arterial pseudoaneurysms although uncommon but constitute important spectrum of peripheral vascular abnormality with significant morbidity. The purpose of exhibit is: To elucidate the role of MDCT in evaluation of peripheral pseudoaneurysm. To delineate spectrum of disease with special emphasis on the imaging findings in surgeon's perspective.

TABLE OF CONTENTS/OUTLINE
Introduction, prevalence and etiology. Pathophysiology and clinical spectrum of presentation. MDCTA- Optimum imaging protocol with minimal radiation dose. Role in evaluation of peripheral pseudoaneurysm. Comparative description of other imaging modalities. Highlight using case based approach, imaging findings and spectrum of the disease. Reporting format.
Median Arcuate Ligament Syndrome (MALS) is rare but with characteristic imaging findings. CT angiography is preferred method for its diagnosis with the end expiratory abdominal CT angiographic study being more useful test.

Table of Contents/Outline

Anatomy, pathogenesis and clinical presentation of MALS. Discuss the role of different imaging techniques like conventional angiography, Doppler ultrasound, CT Angiography and MR Angiography with major emphasis on CTA for its initial evaluation and post-treatment follow up. Describe imaging findings of MALS on CT Angiography with its 3D imaging. Management of MALS.
Focal Therapy for a Focal Disease. Treatment of Locally Non-advanced Prostate Cancer with 3T Magnetic Resonance Guided High Intensity

All Day Location: VI Community, Learning Center

Participants
Maurizio Del Monte, Rome, Italy (Abstract Co-Author) Nothing to Disclose
Alessandro Napoli, MD, Rome, Italy (Presenter) Nothing to Disclose
Gaia Cartocci, MD, Rome, Italy (Abstract Co-Author) Nothing to Disclose
Fabrizio Boni, Rome, Italy (Abstract Co-Author) Nothing to Disclose
Carola Palla, MD, Rome, Italy (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
1. To evaluate feasibility and safety of MRgFUS treatment of low risk organ-confined prostate cancer in patients indicated to Radical Prostatectomy. 2. To discuss the role of MR imaging findings after treatment, correlating them with clinical and histologic findings.

TABLE OF CONTENTS/OUTLINE
1. State of the art in focal therapy of organ-confined prostate cancer
2. Patient selection
3. MRgFUS system anatomy, physiology and overview of current application
4. MRI pre-treatment planning to evaluate size, accessibility and viability of prostate lesion
5. Post-treatment MRI and pathological correlation
6. Analysis of surgical morbidity associated with previous MRgFUS treatment
TEACHING POINTS

1. Transjugular portosystemic intrahepatic shunts (TIPS) are commonly performed for portal hypertension, however can be complicated when faced with scenarios such as portal venous thrombosis. Furthermore, TIPS commonly require modification for complications such as hepatic encephalopathy. The aims of this exhibit are as follows.2. To review various techniques of performing the complicated TIPS. Techniques include but are not limited to transsplenic, transhepatic, and transvariceal access to facilitate portal venous reconstruction and TIPS.3. To guide the reader through novel interventional techniques in performing TIPS reductions and modifications.4. Real-world case examples will be presented to highlight the various techniques.

TABLE OF CONTENTS/OUTLINE

A. Overview of the extreme TIPS indications and techniques with graphic and radiographic guide. B. Multiple case examples to highlight the variety of techniques C. Visual overview of outcomes and complications.
Planning for Transcatheter Aortic Valve Replacement: What Should Radiologists Know for CT Reporting

All Day Location: VI Community, Learning Center

Participants
Daisuke Utsunomiya, MD, Kumamoto, Japan (Presenter) Nothing to Disclose
Seitaro Oda, MD, Kumamoto, Japan (Abstract Co-Author) Nothing to Disclose
Hideaki Yuki, MD, Kumamoto, Japan (Abstract Co-Author) Nothing to Disclose
Masafumi Kidoh, Kumamoto, Japan (Abstract Co-Author) Nothing to Disclose
Yoshinori Funama, PhD, Kumamoto, Japan (Abstract Co-Author) Nothing to Disclose
Takeshi Nakaura, MD, Amakusa, Japan (Abstract Co-Author) Nothing to Disclose
Kenichiro Hirata, Kumamoto, Japan (Abstract Co-Author) Nothing to Disclose
Yasuyuki Yamashita, MD, Kumamoto, Japan (Abstract Co-Author) Consultant, DAIICHI SANKYO Group

TEACHING POINTS
The purpose of this exhibit is: 1. To review the clinical indication and influence of transcatheter aortic valve replacement (TAVI) as an important therapeutic strategy for aortic stenosis (AS) in high-risk patients. 2. To explain the appropriate planning by using cardiac CT for safe and effective TAVI procedure. 3. To demonstrate the essential CT findings and pitfalls for TAVI planning.

TABLE OF CONTENTS/OUTLINE
Clinical indication of TAVI - Symptomatic old patients with severe AS - Normal tricuspid valve CT scan and contrast injection protocol - Variable-pitch technique - Dual regions-of-interest technique for target attenuation - Low-dose contrast dose - Appropriate 3D reconstruction image - Oblique multiplanar reformation and 4D volume rendering (VR) images - VR and maximum intensity projection of aorta - Curved planar reformation of access route - CT evaluation for TAVI planning - Evaluation of valve shape: tricuspid vs bicuspid valve - Basal ring measurement: oval-shape "virtual annulus" - Valsalva sinus: deep vs shallow - Degree and distribution of calcification - Simulated C-arm angle - Access route evaluation: calcification, diameter, tortuosity - Complications - Malposition, migration - Leak - Annulus rupture (flank- and contained rupture) - Myocardial ischemia due to obstructed coronary ostium
Advanced Imaging Techniques in Improving Image Quality of CT Angiography

All Day Location: VI Community, Learning Center

Participants
Kenneth K. Lau, MBBS, FRANZCR, Melbourne, Australia (Presenter) Nothing to Disclose
Dana M. Jackson, RT, Clayton, Australia (Abstract Co- Author) Nothing to Disclose
Ahilan Kuganesan, Clayton, Australia (Abstract Co-Author) Nothing to Disclose
Theodore Lau, Melbourne, Australia (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
CT angiography (CTA) has been established as the first line imaging modality for evaluation of vascular anatomy and pathology, including stenosis, occlusion, thrombo-embolism, aneurysm, dissection, endoleak and bleed. CT image quality is described in terms of contrast, spatial resolution, image noise, and artifacts. Vessel wall calcification may cause beam-hardening artifact obscuring the vessel lumen. The aim of this exhibit is to assess several latest imaging techniques that can improve the diagnostic utility of CTA.

TABLE OF CONTENTS/OUTLINE
Lowering kVp for better luminal contrast visualization and ECG-gating to remove pulsation artifact have been established techniques for CTA improvement. Latest techniques include: a) model-based iterative reconstruction to reduce image noise and calcium blooming artifact, b) utilization of fine-focal spot in x-ray tube to improve vessel wall clarity and reduce calcium artifact by minimizing the penumbra effect of x-ray, c) dual energy to optimize contrast opacification by lowering keV and to remove calcium and metal artefacts, and d) single photon metal artifact reduction technique to remove metal artifact from coils, clips and adjacent prosthesis. These latest imaging techniques are shown to improve the diagnostic quality of CTA, and therefore, enhance the accuracy of vascular pathology assessment.
256 Slice Dual Source CT Angiography of Acute and Chronic Aortic Syndrome - What A Surgeon Wants to Know???

All Day Location: VI Community, Learning Center

Participants
Sonali Sethi, MBBS, MD, New Delhi, India (Presenter) Nothing to Disclose
Sunil Kumar Puri, MD, New Delhi, India (Abstract Co-Author) Nothing to Disclose
Amit K. Verma SR, MBBS, MD, New Delhi, India (Abstract Co-Author) Nothing to Disclose
Richa Tiwari, MD, New Delhi, India (Abstract Co-Author) Nothing to Disclose
Ruchi Gupta, MD, New Delhi, India (Abstract Co-Author) Nothing to Disclose
Meenakshi Prakash, MD, MBBS, Ranchi, India (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
MDCT is the gold standard technique for pre and post operative assessment of aortic pathologies. The exhibit aims to highlight the role of MDCT in a setting of acute and chronic aortic syndromes for the detection, classification and the pre and post surgical assessment of the same.

TABLE OF CONTENTS/OUTLINE
Participants
Mehran Midia, MD, Burlington, ON (Presenter) Nothing to Disclose
Dyda Dao, Hamilton, ON (Abstract Co-Author) Nothing to Disclose
Juan Jose Cimapi Dopazo, MD, Toledo, Spain (Abstract Co-Author) Nothing to Disclose
Ramin Midia, MD, Topeka, KS (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
Teaching Point: 1- To review paravertebral neural anatomy 2- To review technique, indications and complications of paravertebral block

TABLE OF CONTENTS/OUTLINE
This eduction exhibit reviews: 1- Relevant anatomy and physiology and sensory innervation in chest and abdomen 2- Historical perspective of paravertebral block 3- Indication and contraindications for PVB 4- PVB techniques 5- Efficacy of PVB 6- PVB complications and their management
Participants
Mehran Midia, MD, Burlington, ON (Presenter) Nothing to Disclose
Hakan Akbulut, MD, PhD, Ankara, Turkey (Abstract Co-Author) Nothing to Disclose
Hamidreza Faraji, MD, FRCP, Hamilton, NU (Abstract Co-Author) Nothing to Disclose
Dyda Dao, Hamilton, ON (Abstract Co-Author) Nothing to Disclose
Ramin Midia, MD, Topeka, KS (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
1- Review tumor microenvironment
2- Review the implication of tumor microenvironment on efficacy of interventional oncology ((IO) treatment
3- Review of strategies to improve drug delivery in IO

TABLE OF CONTENTS/OUTLINE
This educational Exhibit Reviews:
1- Tumor microenvironment
   - Hypoxia
   - Acidosis
2- Barriers to drug delivery
   - Abnormal tumor vascular system
   - Deregulated composition of the extracellular matrix
   - Interstitial hypertension (elevated interstitial fluid pressure)
3- Strategies for more effective Drug Delivery in IO
   - Vascular normalization
   - Solid state alleviation
   - Tumor penetrating peptides
4- Future direction and summary
Ultra sound Immersion Week: An Innovative Approach of Instruction for Medical Students in Ultrasound

All Day Location: VI Community, Learning Center

Participants
Varun Rachakonda, MD, Houston, TX (Presenter) Nothing to Disclose
Roshon Amin, MD, Houston, TX (Abstract Co-Author) Nothing to Disclose
Manickam Kumaravel, MD, FRCR, Houston, TX (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
At the end of this exhibit, the readers would learn:
A method of creating an intensive ultrasound curriculum by designing a program 'Ultrasound Immersion Week' aimed specifically at medical students
A method for measuring effectiveness of the program
Application of this methodology for various audiences in different institutions

TABLE OF CONTENTS/OUTLINE
Overview of ultrasound training for medical students. Current status and gaps in instruction. Presentation of our curriculum for 2nd year medical students curriculum in ultrasound at our institution including instrumentation, anatomy, and ultrasound guided interventional procedures using phantoms
Program overview of Ultrasound Immersion Week including teaching methodology, curriculum, pre- and post-Immersion Week assessments of skills and knowledge
Medical student ultrasound competition
Medical student and resident satisfaction surveys
Discussion of how to replicate this experience at other institutions
Training radiology resident volunteers to teach medical students basic ultrasound techniques/principles
Ultrasound machines, human models, and phantom models
Creation of low-cost homemade phantom models to demonstrate ultrasound guided interventional procedures
**Interventional Radiology Sunday Case of the Day**

Sunday, Nov. 29 8:00AM - 11:59PM Location: Case of Day, Learning Center

AMA PRA Category 1 Credit™: .50

**Participants**

Anne M. Covey, MD, New York, NY (*Presenter*) Nothing to Disclose
Sreejit Nair, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Alan A. Sag, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Hooman Yarmohammadi, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Lynn A. Brody, MD, New York, NY (*Abstract Co-Author*) Stockholder, Sirtex Medical Ltd
Stephen B. Solomon, MD, New York, NY (*Abstract Co-Author*) Research Grant, General Electric Company
**SSA13**

**Musculoskeletal (Interventional)**

Sunday, Nov. 29 10:45AM - 12:15PM Location: E451B

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<th>MR</th>
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**AMA PRA Category 1 Credits™**: 1.50
**ARRT Category A+ Credits**: 1.50

**FDA** Discussions may include off-label uses.

**Participants**
Michael G. Fox, MD, Charlottesville, VA (Moderator) Stockholder, Pfizer Inc;
Mary Kristen Jesse, MD, Denver, CO (Moderator) Nothing to Disclose

**Sub-Events**

**SSA13-01 Fluoroscopic Guided Sacroiliac Joint Injections - Comparison of Intra-articular and Peri-articular Injections on Immediate and Short-term Pain Relief**

Sunday, Nov. 29 10:45AM - 10:55AM Location: E451B

**Participants**
Nicholas C. Nacey, MD, Charlottesville, VA (Presenter) Nothing to Disclose
James Patrie, MS, Charlottesville, VA (Abstract Co-Author) Nothing to Disclose
Michael G. Fox, MD, Charlottesville, VA (Abstract Co-Author) Stockholder, Pfizer Inc;

**PURPOSE**
To determine if intra-articular sacroiliac (SI) joint injections provide greater immediate and short-term pain relief compared to peri-articular SI joint injections.

**METHOD AND MATERIALS**
All fluoroscopic guided SI joint injections targeting the inferior 1 cm of the SI joint, performed over a 4-year period, were identified. All patients were injected with 2.5 mL of Bupivacaine and 20 mg (0.5 mL) of triamcinolone. Patients were excluded if another triamcinolone dose or a different steroid/anesthetic combination was used, or if either the pre-injection, immediate (5-10 minute) post-injection, or 1-week post-injection pain score was not recorded. Two MSK radiologists with 2 and 13 years post-fellowship experience independently retrospectively reviewed the fluoroscopic images to determine intra-articular or peri-articular placement. Univariate and multivariate statistical analysis was performed.

**RESULTS**
169 patients (114F:55M; mean age 60.9 years) met the inclusion criteria with 88 intra-articular and 81 periarticular injections. Pre, immediate and 1-week post-injection pain scores for the intra-articular and periarticular injections were 6.2/2.0/4.1 and 6.0/2.3/4.2, respectively. Immediate and 1-week post-injection pain reduction was statistically significant in both groups (p<0.001). After adjusting for age, gender, pre-pain level, time of year, and reason for exam there was no significant difference in the pre-injection to immediate post-injection change in pain between intra-articular and periarticular injections (mean change 0.35, p=0.30) or in the pre-injection to 1-week postinjection change in pain (mean change 0.03, p=0.92). Geometric mean fluoro time was 27 sec for intra-articular injections and 42 sec for periarticular injections (p<0.001).

**CONCLUSION**
Both intra-articular and periarticular SI joint injections provide statistically significant immediate and 1-week post-injection pain relief. However, there was no significant difference in the degree of pain relief provided by intra-articular and peri-articular injections.

**CLINICAL RELEVANCE/APPLICATION**
Since similar pain relief was provided with intra-articular and periarticular SI joint injections, fluoroscopy is an adequate method for performing most SI joint injections.

**SSA13-02 Ten Years' Experience in Combined Intradiscal and Periradicular Injection of Medical Ozone and Periradicular Administration of Steroids and Anesthetic for the Treatment of Lumbar Disk Herniation: Effects on Disk Size and Lumbar Radiculopathy in 437 Patients**

Sunday, Nov. 29 10:55AM - 11:05AM Location: E451B

**Participants**
Thomas Lehnert, MD, Frankfurt Am Main, Germany (Abstract Co-Author) Nothing to Disclose
Nagy N. Naguib, MD, MSC, Frankfurt Am Main, Germany (Presenter) Nothing to Disclose
Julian L. Wichmann, MD, Charleston, SC (Abstract Co-Author) Nothing to Disclose
Josef Matthias Kerl, MD, Frankfurt, Germany (Abstract Co-Author) Research Consultant, Siemens AG Speakers Bureau, Siemens AG
Ralf W. Bauer, MD, Frankfurt, Germany (Abstract Co-Author) Research Consultant, Siemens AG Speakers Bureau, Siemens AG
Martin Beeres, MD, Frankfurt Am Main, Germany (Abstract Co-Author) Nothing to Disclose
Thomas J. Vogl, MD, PhD, Frankfurt, Germany (Abstract Co-Author) Nothing to Disclose

**PURPOSE**
To evaluate the therapeutic benefit and morphologic changes in herniated lumbar disk after CT-guided intradiscal and periradicular ozone-oxygen injection combined with a periradicular administration of steroids and anesthetic.

**METHOD AND MATERIALS**
437 patients with lumbar radiculopathy received an intradiscal (3 mL) and periradicular (7 mL) injection of an ozone-oxygen mixture (ratio 3:97), followed by a periradicular injection of corticosteroid (1 mL of Celestan®Depot) and anesthetic (2 mL of Carbotestin®) in the same session. Under CT guidance, intradiscal and periradicular injection was administered by means of an extraspinal lateral approach, using a 22-gauge 17.8-cm spinal needle. 6 months after treatment, clinical outcome was assessed by applying the modified MacNab method. The effects on disk matrix and disk volume were evaluated by MRI.

RESULTS

Treatment was successful in 316 patients (72.3%). In the remaining 121 patients (27.7%), treatment was considered to have failed. Among the patients whose treatment was a success, outcome was excellent in 153 patients (48.4%) and good in 163 patients (51.6%). Among the patients whose treatment was a failure, this was poor in 87 patients (71.9%) and poor with recourse to surgery in 34 patients (28.1%). Initial disk volume was 8.06-29.15 cm³ (mean, 18.29 cm³). 6 months after treatment, in patients with excellent outcome disk volume reduction was 5.67-22.11% (mean, 12.11%), in patients with good outcome 2.61-16.11% (mean, 7.29%) and in patients with poor outcome 0.33-8.21% (mean, 2.46%).

CONCLUSION

Our study shows that the combined intradiscal and periradicular injection of medical ozone and periradicular injection of steroids affects both the mechanical and the inflammatory components of pain caused by disk herniation. For this reason, this is a therapy option for treating lumbar disk herniation that has failed to respond to conservative management, before recourse to surgery or when surgery is not possible.

CLINICAL RELEVANCE/APPLICATION

CT-guided combined intradiscal and periradicular injection of ozone-oxygen represents a therapeutic alternative for lumbar radiculopathy with promising results. The ease of execution and non-invasiveness of this therapy permit the successful outpatient treatment of lumbar sciatic pain.

SSA13-03 Computed Tomography (CT) Guided O2-O3 Disclosis: Critical Review of Indications According to Our Experience

Sunday, Nov. 29 11:05AM - 11:15AM Location: E451B

Participants
Marco Perri, MD, L’Aquila, Italy (Presenter) Nothing to Disclose
Marco Varrassi, L’Aquila, Italy (Abstract Co-Author) Nothing to Disclose
Claudia Marasco, MD, Fiuggi, Italy (Abstract Co-Author) Nothing to Disclose
Alessandra Splendiani, MD, L’Aquila, Italy (Abstract Co-Author) Nothing to Disclose
Carlo Masciocchi, MD, L’Aquila, Italy (Abstract Co-Author) Nothing to Disclose
Massimo Gallicci, MD, L’Aquila, Italy (Abstract Co-Author) Nothing to Disclose

PURPOSE

The aim of this study was to clarify the O2-O3 disclosis indications and outcomes depending on the type of disc disease.

METHOD AND MATERIALS

Medical Ethical Committee approval was obtained for prospective double-blind trial. A total of 517 patients gave informed consent and were randomly assigned to two groups. Control group of 159 men and 101 women with age range 25-89 years, underwent percutaneous steroid treatment while Study Group of 163 men and 94 women with age range 22-92 years underwent the same treatment with the addiction of oxygen-ozone discosilysis. Procedures were performed under computed tomographic guidance. Visual Analog Scale Questionnaire was administered before treatment and at intervals, the last at 6-month follow-up. Results were compared with the X2 and t-test.

RESULTS

After 6 months, O2-O3 disclosis was successful in 106 Study Group patients (41.24% with extrusions) compared with 9 Control Group patients (3.5%) with the same disco vertebral pathology (P <.001). Moreover in 89 (34.6%) Study Group patients with protrusions success rate was statistically significant (P<.001) compared with 5 Control Group patients( 1.9%) with the same pathology. Furthermore statistically significant difference (P<.001) was detected in the presence of Grade I, II, III of Degenerated Disc in 185 of Study Group patients (68.4%) compared with 4 Control Group patients (1.5%).

CONCLUSION

O2-O3 disclosis is more effective at 6 months than steroid and anesthetic injection near intraforaminal sites especially in cases of sciatica due to herniated or protruded disc and with a Grade of Disc Degeneration from mild to moderate range.

CLINICAL RELEVANCE/APPLICATION

Our approach leads to relief in sciatica symptoms and obtains the best results in case of extrusions, protrusions and in presence of discal degenerative aspects from mild to moderate grade.

SSA13-06 Magnetic Resonance Guided Focused Ultrasound Surgery (MRgFUS) for Totally Non-Invasive Treatment of Osteoid Osteoma: A Prospective Development Study

Sunday, Nov. 29 11:35AM - 11:45AM Location: E451B

Participants
Maurizio Del Monte, Rome, Italy (Abstract Co-Author) Nothing to Disclose
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Fabrizio Boni, Rome, Italy (Abstract Co-Author) Nothing to Disclose
Carlo Catalano, MD, Rome, Italy (Abstract Co-Author) Nothing to Disclose

PURPOSE
To investigate mid-to long-term efficacy of MRgFUS in the treatment of symptomatic osteoid osteomas

METHOD AND MATERIALS

This prospective study involved 29 consecutive patients with clinical and imaging diagnosis of Osteoid Osteoma; all patients underwent MRgFUS ablation (ExAblate, InSightec; 3T MR). Lesions located in vertebral body were excluded; prior RFA or surgery was not considered an exclusion criteria. Patients received therapy using MRgFUS, delivered toward the nidus, identified on MRI and/or CT. Primary endpoints were adverse events (serious and otherwise) and pain relief assessed using Quality of Life questionnaires in patients with bone pain (FACT-BP), Visual Analog Pain Score (VAS) and daily intake of Non-steroidal drugs (NSAIDs). Patient's follow-up, including clinical and imaging examinations, was established at 1, 12 and 24 months. As secondary endpoint, imaging examinations (CT and dynamic CE-MRI, Gd-BOPTA, Bracco) were used to evaluate inflammatory status after treatment and bone remodeling.

RESULTS

29 patients (4 female; 25 male; mean age 23.4 yo) were recruited for totally non-invasive MRgFUS treatment. The treatment was well tolerated by all patients and no adverse events were recorded. A mean number of 5.6 sonications with mean energy of 894 ± 209 J was necessary to complete the treatment. Complete clinical response was found in 27/29 patients. There was a significant (p=0.001) improvement in quality of life, according to FACT-BP (mean values: 33.7 at baseline and 54.7 at follow-up). A statistically significant difference (p=0.001) was noted between pre- and post-treatment VAS scores (8.4 vs 0.6, respectively). Imaging evaluation with CE-MRI demonstrated edema and hyperemia decrease in lesions associated with complete response. At CT, bone remodeling was evident in all complete responders (27/29 patients, 93%); in 15/29 (51%), nidus fading was demonstrated and in 10/29 (34%) restitutio-ad-integrum of bone abnormality was depicted.

CONCLUSION

MRgFUS can be safely and effectively adopted for the treatment of Osteoid Osteoma. This application is totally non-invasive, carried out in a single session and with pain relief attainable since the very following day after treatment. Our results also indicated a positive trend to bone restoration especially in younger patients.

CLINICAL RELEVANCE/APPLICATION

MRgFUS allows single session, totally non-invasive treatment of osteoid osteomas.

SSA13-07 Minimally Invasive Screw Fixation of Fractures in the Cervical and Thoracic Spine: CT-controlled Pre-surgical Guidewire Implantation in Clinical Routine

Sunday, Nov. 29 11:45AM - 12:05PM Location: E451B

Participants

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Ingo Marzi, Frankfurt, Germany (Abstract Co-Author) Nothing to Disclose
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Martin G. Mack, MD, Frankfurt, Germany (Abstract Co-Author) Nothing to Disclose
Katrin Eichler, MD, Frankfurt Am Main, Germany (Abstract Co-Author) Nothing to Disclose

PURPOSE

Purpose of our retrospective study is to evaluate the feasibility and accuracy of minimally invasive, transpedicular screw placement in cervicothoracic fractures with the help of CT-controlled guidewires.

METHOD AND MATERIALS

293 guidewires were inserted in 35 patients (42.9 ± 21.2 years) under CT fluoroscopy (286 thoracic, 7 cervical). There were 28 traumatic cases, 3 pathologic fractures, 3 fractures due to infectious infiltrations and 1 osteoporotic fracture. In 151 pedicles the screwing was directly performed and controlled in the CT-room. CT-images were reviewed regarding accuracy and cortical violations using the popular 2 mm increment deviation classification by Gertzbein and Robbins.

RESULTS

The guidewire implantation resulted in 28 cortical contacts. Minor affections of the pedicle wall by the inserted screws occurred in 39.1% (59 of 151), respectively 23.8% if taking unavoidable encroachments into account (30 of 59). The width of the pedicular isthmus correlated to the number of cortical guidewire-contacts (r=-0.449; p=0.077) and pedicle violations (all graded “A”) by the inserted screws (r=-0.581; p=0.049). Total procedural duration was 138.6 ± 44.2 min, representing 14.5 ± 11.6 min for each procedure. The guidewire implantation resulted in 28 cortical contacts. Minor affections of the pedicle wall by the inserted screws occurred in 39.1% (59 of 151), respectively 23.8% if taking unavoidable encroachments into account (30 of 59). The width of the pedicular isthmus correlated to the number of cortical guidewire-contacts (r=-0.449; p=0.077) and pedicle violations (all graded “A”) by the inserted screws (r=-0.581; p=0.049). Total procedural duration was 138.6 ± 44.2 min, representing 14.5 ± 11.6 min for each procedure.

CONCLUSION

The treatment of vertebral fractures with a guidewire-based insertion technique for pedicle screws results in a very high accuracy and a low complication rate if performed under CT-imaging.

CLINICAL RELEVANCE/APPLICATION

Guidewires help in precise placement of cervical and thoracic screws for vertebral osteosynthesis. Special attention should be taken in the mid-thoracic levels due to a smaller width of the pedicle isthmus.

SSA13-08 Feasibility of CT Guided Needle Biopsy in Harvesting Chondrocytes for Autologous Chondroctye Implantation: An Initial Experience on Human Cadavers

Sunday, Nov. 29 11:55AM - 12:05PM Location: E451B

Participants

Nima Hafezi Nejad, MD, MPH, Baltimore, MD (Presenter) Nothing to Disclose
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Bashir Zikria, Baltimore, MD (Abstract Co-Author) Nothing to Disclose

PURPOSE
To evaluate the timing, accuracy and technical feasibility of CT guided chondrocyte retrieval from superior medial and lateral non weight-bearing margins of the trochlea.

METHOD AND MATERIALS
As an initial experience, 10 human knee cadavers were selected as samples. Osteosite bone biopsy needle (G13761 - Murphy M1M - 11G/10cm) was used for the purpose of chondrocyte retrieval. Two operators, one musculoskeletal radiologist and one orthopedic surgeon performed the chondrocyte retrieval procedures. Each performed one sampling from the medial and one sampling from the lateral margins of the trochlea. In the first planning phase, operators selected the proper target for chondrocyte retrieval, in the CT examination. Time (seconds), accuracy (mm distance from the target) and needle readjustment attempts were recorded during chondrocyte retrieval.

RESULTS
All samplings resulted in eventual tissue retrieval. Samplings from the lateral margin were performed faster (Operator 1: 74 ± 34 sec vs. 106 ± 36 sec; P value: 0.056 - Operator 2: 72 ± 30 sec vs. 111 ± 35 sec; P value: 0.014) and more accurate (Target error: Operator 1: 1.32 ± 1.01 mm vs. 3.23 ± 1.72 mm; P value: 0.007 - Operator 2: 1.17 ± 0.57 mm vs. 2.81 ± 1.36 mm; P value: 0.040) than samplings from the medial margin. There was no significant difference in the mean number of needle adjustment rates (ranging from 1.50 ± 0.71 to 1.10 ± 0.74 readjustment attempts); neither between the operators, nor between lateral and medial margins.

CONCLUSION
This preliminary results supports the hypothesis that CT guided needle biopsy may be a feasible and accurate method for chondrocyte retrieval from non weight-bearing margins of the trochlea. Sampling from the lateral margin may be relatively advantageous in terms of procedure time and accuracy.

CLINICAL RELEVANCE/APPLICATION
Feasibility of CT-guided chondrocyte retrieval for autologous chondrocyte implantation may obviate one arthroscopic surgery; and therefore, reduce the cost, morbidity and complication.

SSA13-09 US and MRI Follow-up after Treatment of Supraspinatus Tendon Tendinopathy: PRP vs Needling

Participants
Alice La Marra, MD, L'Aquila, Italy (Presenter) Nothing to Disclose
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Simone Quarchioni, Laquila, Italy (Abstract Co-Author) Nothing to Disclose
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Carlo Masciocchi, MD, L'Aquila, Italy (Abstract Co-Author) Nothing to Disclose

PURPOSE
To evaluate the efficacy of infiltrative treatment with PRP versus needling, in patients with tendinosis of the supraspinatus tendon at level of its crescent area.

METHOD AND MATERIALS
We enrolled 40 patients (aged 40-60), with tendinosis of the supraspinatus tendon at its crescent area, evaluated through ultrasound-US and MRI exams; we excluded patients with partial lesions. Twenty patients were submitted to PRP treatment (group 1); 20 patients were submitted to needling treatment (group 2). All patients, 6 months after treatment (T1) underwent US examinations and 1 year after treatment (T2) underwent US and MRI examinations. We considered some fundamental parameters: morphology of the tendon, echogenicity or signal intensity of its structures, presence or not of bursitis, evolution in partial or full tear. All patients were evaluated through VAS (Visual Analogic Scale) for pain and Constant scale for functionality.

RESULTS
In group 1, at T1 the ultrasound exams showed disappearance of bursitis and recovery of tendon echogenicity in 15/20 patients; 5 patients had no changes. At T2, in 17/20 patients MRI and US showed morphological recovery; we observed non-substantive modifications in 2 patients and a worsening in 1 patient. 85% of the patients showed improvement in VAS and 77% in Constant values already at T1; the mean values were 70% at T2. In group 2, at T1, US showed disappearance of bursitis and recovery of tendon echogenicity in 8/20 patients; 12 patients showed no changes. At T2 in 6/20 patients, MRI and US showed morphological recovery; 8 patients had no significant variations; 4 patients had worsening of tendinosis; 2 patients showed partial tears of the tendon. 65% of the patients showed improvement in VAS and 62% in Constant values at T1; the mean values were only 33% at T2.

CONCLUSION
Compared to needling, the PRP infiltrative treatment of tendinosis of the supraspinatus tendon showed major possibilities of recovery, with a slower evolution of tendinosis or tendon's tear.

CLINICAL RELEVANCE/APPLICATION
Both PRP and needling are effective minimally invasive treatments suitable for large range of patients. PRP resulted to be more effective with a lower rate of progression of the tendinosis or tendon tear.
Patients
Gretchen M. Foltz, MD, Saint Louis, MO (Moderator) Nothing to Disclose
Thomas-Evangelos G. Vrachliotis, MD, PhD, Athens, Greece (Moderator) Nothing to Disclose

Sub-Events
SSA23-01 Prophylactic Antibiotics during Totally Implantable Venous Access Device Placement Does Not Decrease the Rate of Infection

Participants
Jonathan Jo, MD, New York, NY (Presenter) Nothing to Disclose
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Hency Patel, New York, NY (Abstract Co-Author) Nothing to Disclose
Peter Schaefer, New York, NY (Abstract Co-Author) Nothing to Disclose
Ronald S. Winokur, MD, New York, NY (Abstract Co-Author) Nothing to Disclose
David C. Madoff, MD, New York, NY (Abstract Co-Author) Nothing to Disclose

PURPOSE
Controversy still exists regarding antibiotic use in totally implantable venous access device (TIVAD) placement. A recent study showed a <1% risk of catheter related bloodstream infection (CLABSI) without the use of antibiotic prophylaxis. The current study seeks to delineate the efficacy of prophylactic antibiotics in TIVAD placement and to identify parameters associated with infection risk in an institution where antibiotic prophylaxis was used in the majority of cases.

METHOD AND MATERIALS
Following IRB approval, retrospective review of consecutive patients receiving TIVADs from January 2008 - December 2012 were analyzed for port infections. Post-procedural infection was defined as port removal within 30 days of placement with clinical signs of infection. Demographic information, comorbidities, hospital admission status, port characteristics, as well as prophylactic and supplemental antibiotic use were documented. Preoperative laboratory results were reviewed for white blood cell count (WBC), platelet count, and coagulation studies. Chi-square tests were used to determine associations between patient characteristics and procedural infection.

RESULTS
Of 1438 patients, 1158 (80.5%) received antibiotics and 280 (19.5%) did not. Of the patients given antibiotics, 143 (12.3%) also received supplemental antibiotics within 30 days of port placement and were excluded from analysis. Among the remaining 1295 patients, 7 post-procedural infections were identified (0.5%), all occurring in the antibiotic group (p<0.0001). Post-procedural infection was also significantly associated with inpatient status versus outpatient (3.8% vs. 0.1%, p<0.0001) and double lumen ports versus single lumen (1.9% vs. 0.2%, p=0.002).

CONCLUSION
Prophylactic antibiotic therapy does not reduce the post-procedure infection rate. Infection rates are higher with inpatients and those receiving double lumen ports.

CLINICAL RELEVANCE/APPLICATION
With level 8 evidence in existence, the Society of Interventional Radiology guidelines suggests that prophylactic antibiotics are unnecessary for tunneled central lines. No consensus exists for totally implantable venous access devices. Despite mounting evidence of the limited utility of antibiotics, many interventional radiologists and the majority of fellows of the American College of Surgeons still use antibiotics. The study seeks to add to the evidence that prophylactic antibiotics may not add benefit in this setting.

SSA23-02 Developing a Method for Testing Mechanical Properties for Implantable Catheter Lines

Participants
Jasmin D. Busch, MD, Hamburg, Germany (Presenter) Nothing to Disclose
Henning Schroeder, Hamburg, Germany (Abstract Co-Author) Nothing to Disclose
Kay Sellenschloß, Hamburg, Germany (Abstract Co-Author) Nothing to Disclose
Gerhard Huber, Hamburg, Germany (Abstract Co-Author) Speakers Bureau, Ulrich GmbH & Co KG;
Gerhard B. Adam, MD, Hamburg, Germany (Abstract Co-Author) Nothing to Disclose
Harald Ittrich, MD, Hamburg, Germany (Abstract Co-Author) Nothing to Disclose

PURPOSE
To develop a reproducible and sensitive method for the quantification of parameters of mechanical properties of catheter lines as well as to investigate the influences of artificial aging.

METHOD AND MATERIALS
Constructing an experimental setup and performing uniaxial tensile tests with 5F-silicone- and 6F-polyurethane catheter lines. Subgroups were each with unattended (n=6), chemically aged (n=7), and mechanically aged samples. Material behavior was analyzed by optical strain measurement (EOS 700D, Canon, Tokio/ Japan) and force measuring system (Xforce P, Zwick Roell AG, Ulm Germany). Maximum force (N), stress at break (Pa), strain at break (%), and Young's elastic modulus (Pa) were evaluated.

RESULTS

In the 5F-silicone catheter trial series ANOVA shows significant differences in subgroups with Young's elastic module (p<0.001); in the 6F-polyurethanes catheters with Young's elastic module (p<0.001) maximum force (p<0.001), stress at break (p<0.001), as well as strain at break (p=0.001).

CONCLUSION

We successfully developed an experimental setup to quantify mechanical properties of various catheter lines and proved reliability and sensitivity to determine artificial aging induced modification. The low range of variance promises to detect even minor deviations in material features.

CLINICAL RELEVANCE/APPLICATION

According to recurrent failures with catheter lines among the patient cohort with totally implanted port systems within our medical center it is necessary to gain knowledge about influences of long-term usage and to quantify aberrations to avoid risk owing to material fatigue or potentially faulty batches.

SSA23-03 Adrenal Venous Sampling in Primary Aldosteronism: Value of a Multinomial Regression Model to Detect Aldosterone Hypersecretion Lateralization When the Right Adrenal Vein Sampling is Missing

Participants
Remi Blanchette, MD, BEng, Montreal, QC (Present) Nothing to Disclose
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Gilles P. Soulez, MD, Montreal, QC (Abstract Co-Author) Speaker, Bracco Group Speaker, Siemens AG Research Grant, Siemens AG Research Grant, Cook Group Incorporated
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Marie-France Groux, MD, Montreal, QC (Abstract Co-Author) Research Grant, Johnson & Johnson Research Grant, BIOTRONIK GmbH & Co KG Stockholder, Abbott Laboratories
Andre Lacroix, MD, Montreal, QC (Abstract Co-Author) Nothing to Disclose
Eric Therasse, MD, Montreal, QC (Abstract Co-Author) Research support, Johnson & Johnson; Consultant, Cook Group Incorporated

PURPOSE

To assess the value of a multinomial regression model to detect aldosterone hypersecretion lateralization (AHL) with adrenal venous sampling (AVS) when the right adrenal vein sampling is missing.

METHOD AND MATERIALS

All consecutive AVS from November 1990 to December 2014 were included. Non selective AVS, repeated AVS and AVS with missing data were excluded. Cortisol and aldosterone levels were measured simultaneously from the adrenal veins and left iliac vein before (basal) and after intravenous cosyntropin injection. Reference standard for AHL was a basal adrenal vein aldosterone/cortisol ratio (A/C) >4 the opposite side. Two multinomials regressions models were built to predict AHL (right, left or no lateralization) using only the left adrenal and iliac veins hormone concentration, 1) before and 2) after cosyntropin injection. AHL detection accuracy was assessed with receiver operating characteristic (ROC) curves.

RESULTS

AVS of 171/186 (91.9%) patients (60 women; 126 men, mean age 53.5 years) met the inclusion/exclusion criteria. AHL was found in 106 (62%) patients. Areas under the ROC curves for AHL detection with the basal and the post-cosyntropin models were respectively 0.907 (95%CI: 0.862-0.952) and 0.928 (95%CI: 0.892-0.965) for the right side (p=0.11) and 0.915 (95%CI: 0.872-0.958) and 0.917 (95%CI: 0.875-0.959) for the left side (p=0.84). Sensitivities to detect AHL with a specificity of 95% with the basal and the post-cosyntropin models were respectively 52.7% (95%CI: 38.9%-66.1%) and 56.4% (95%CI: 42.4%-69.4%) for the right side and 52.9% (95%CI: 38.6%-66.8%) and 59.2% (95%CI: 44.2%-72.7%) for the left side. There were no contralateral AHL among false positives in both models.

CONCLUSION

Multinominal regression models of AVS can determine AHL in the majority of patients even when the right adrenal vein sampling is missing. Basal and post cosyntropin multinominal regression models had similar accuracy to detect AHL.

CLINICAL RELEVANCE/APPLICATION

Adrenal venous sampling is essential to assess aldosterone hypersecretion lateralization before adrenalectomy but is limited by a high right adrenal vein cannulation failure rate.

SSA23-04 Selective Arterial Calcium Stimulation (SACST) with Hepatic Venous Sampling Differentiates Occult Insulinoma from Nesidioblastosis in Patients with Endogenous Hyperinsulinemic Hypoglycemia and Negative or Inconclusive Noninvasive Imaging

Participants
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F J. Service, Rochester, MN (Abstract Co-Author) Nothing to Disclose
Comparison of Inferior Vena Cava Filter Placement by Two Different Vascular Physician Specialties

Sunday, Nov. 29 11:25AM - 11:35AM Location: E350

Participants
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Heams W. Charles, MD, New York, NY (Abstract Co-Author) Nothing to Disclose
Eric T. Aaltonen, MD, MPH, New York, NY (Abstract Co-Author) Nothing to Disclose
Amy R. Deipolyi, MD, PhD, New York, NY (Abstract Co-Author) Nothing to Disclose

PURPOSE
To compare inferior vena cava filter (IVCF) placement procedures performed by vascular-interventional radiology (VIR) to those by vascular surgery (VS) with respect to radiation exposure, procedure time, anesthesia, and filter position.

METHOD AND MATERIALS
All IVCF placements using contrast venography by VIR or VS in 2014 in a single tertiary hospital center were identified by a PACS database search. The operator, filter type, angulation and distance from the lowest renal vein, radiation dose, fluoroscopy time, and anesthesia type were noted. Angulation was measured as the angle between the midline of the IVC and centerline of the filter.

RESULTS
Of 176 IVCF placements performed in VIR in 2014, carbon dioxide venography was used in 15 cases which were excluded. One case was a combined retrieval and placement and was also excluded, resulting in 160 cases for analysis. A total of 21 filters were placed by VS in 2014; 5 were placed as a part of another fluoroscopic procedure and were excluded from dose and fluoroscopy time analysis. Among the 160 cases performed by VIR, 152 were performed with topical access site anesthesia only; 2 with nursing-administered intravenous sedation; and 6 with anesthesia. By comparison, all 21 cases by VS were performed with anesthesia. Comparing cases performed by VS and VIR, mean radiation dose was higher (180 vs. 66 mGy; p=0.001), fluoroscopy time longer (4.6 vs. 2.5 minutes; p=0.0009), and filter angulation greater (3.8 vs. 2.5 degrees; p=0.006), respectively. There was no statistically significant difference in distance of the filter tip from the most inferior renal vein (1.7 vs. 1.1 cm; p=0.19).

CONCLUSION
IVCF placement by VIR, compared to VS, entails less radiation exposure, less procedure time as indicated by lower fluoroscopy times, less need for anesthesia consultation, and more precise placement centered in the IVC.

CLINICAL RELEVANCE/APPLICATION
Demonstrating superior technique and lower procedure cost is essential in promoting VIR practice development. IVCF filter placement performed by interventional radiologists is faster, involves less radiation exposure, and reduces need for anesthesiology consultation, compared to filter placement by vascular surgery.

Up to 96% Dose Reduction in Pediatric and Young Adult Venous Interventions: Too Good to Be True?

To determine the diagnostic role of selective arterial calcium stimulation (SACST) with hepatic venous sampling in differentiating occult insulinoma from nesidioblastosis in patients with hyperinsulinemic hypoglycemia and negative or inconclusive noninvasive imaging.

METHOD AND MATERIALS
An IRB-approved retrospective review was undertaken of 116 patients with biochemical evidence of endogenous hyperinsulinemic hypoglycemia, negative or inconclusive noninvasive imaging and surgically and pathologically confirmed occult insulinoma (N=42) or nesidioblastosis (N=74) who underwent SACST with hepatic venous sampling from 1/1996 to 3/2014. Clinical, laboratory, radiologic and pathology data were reviewed. The maximum hepatic venous insulin concentration (mHVI; μIU/ml) and relative-fold increase in hepatic venous insulin concentration over baseline (rHVI) following calcium injection from the dominant artery were compared between insulinoma and nesidioblastosis groups. ROC curves were generated to determine the specificity of mHVI and rHVI in differentiating insulinoma from nesidioblastosis.

RESULTS
The biochemical results of SACST were positive (>2.0-fold) in two or more arterial distributions in 26.2% of patients in the insulinoma group and 73.0% of patients in the nesidioblastosis group (p<0.0001). The mean (±SEM) mHVI post calcium injection was significantly higher in the insulinoma group compared to the nesidioblastosis group (778.6 ± 189.6 μIU/ml v. 36.2 ± 4.1 μIU/ml, respectively; p<0.001). The mean (±SEM) rHVI from baseline was significantly higher in the insulinoma compared to the nesidioblastosis group (25.1 ± 4.4 v. 6.4 ± 0.5, respectively; p<0.001). The area under the receiver operator curve (AUC) for mHVI and rHVI was excellent (0.94; p<0.0001) and good (0.83; p<0.0001), respectively. mHVI cutoffs of >91.5μIU/ml and >263.5μIU/ml were 95% and 100% specific for insulinoma, respectively. A 19.0-fold increase in rHVI over baseline was 99% specific for insulinoma.

CONCLUSION
These data suggest that the biochemical results of SACST can differentiate occult insulinoma from nesidioblastosis with high specificity in patients with hyperinsulinemic hypoglycemia and negative noninvasive imaging.

CLINICAL RELEVANCE/APPLICATION
SACST should be considered in patients with hyperinsulinemic hypoglycemia and negative noninvasive imaging to differentiate occult insulinoma from nesidioblastosis, thereby avoiding blind pancreatic exploration.
Participants
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Manish N. Patel, DO, Cincinnati, OH (Abstract Co-Author) Nothing to Disclose

PURPOSE
The purpose of this study is to evaluate dose reductions achieved during venous interventions such as IVC filter placement/retrieval and thrombolysis performed on an enhanced low-dose interventional radiology system.

METHOD AND MATERIALS
An IRB approved retrospective review of patients who underwent a relatively low-dose venous procedure (IVC filter placement/retrieval) or a relatively high-dose venous intervention (lower extremity thrombolysis) was performed. Radiation doses for cases performed on an enhanced low-dose interventional system (AlluraClarity, Philips Healthcare, Best, The Netherlands) were compared with cases from our former system used as a reference (AlluraXper, Philips Healthcare, Best, The Netherlands). Nineteen IVC filter placements or retrievals (5 male/7 female, 9-35 years, 37-84 kg) were performed on the low-dose system and were compared with 21 cases (4 male/10 female, 13-31 years, 49-112 kg) on the reference system. Twelve thrombolysis cases (3 male/4 female, 15-18 years, 51-77 kg) performed on the low-dose system were compared with 12 cases (0 male/5 female, 14-18 years, 53-146 kg) on the reference system.

RESULTS
Overall radiation doses were substantially reduced using the low-dose system compared to the reference system (the following doses are reported as low-dose vs reference system). For IVC filter placement/retrieval, median cumulative procedure dose-area product (DAP) was 3.5 vs 30.9 Gy.cm² (89% dose reduction), fluoroscopy dose/frame was 0.03 vs 0.72 Gy.cm²/frame (96% dose reduction). For thrombolysis, median cumulative procedure DAP was 25 vs 409 Gy.cm² (94% dose reduction), fluoroscopy dose/frame was 1.4 vs 5.2 Gy.cm²/min (73% dose reduction), and the DSA dose/frame was 0.06 vs 1.6 Gy.cm²/frame (96% dose reduction).

CONCLUSION
Significant radiation dose reduction is possible in pediatric and young adult patients undergoing venous interventions by using an enhanced low-dose interventional radiology system.

CLINICAL RELEVANCE/APPLICATION
Use of an enhanced low-dose interventional system for venous interventions results in substantial dose reduction of up to 96% for pediatric and young adult patients.

SSA23-07 Balloon Pulmonary Angioplasty: Applicability of Fluoroscopy-based Registration of a Pre Acquired C-Arm CT for Procedure Guidance

Sunday, Nov. 29 11:45AM - 11:55AM Location: E350

Participants
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Frank K. Wacker, MD, Hannover, Germany (Abstract Co-Author) Research Grant, Siemens AG Research Grant, Pro Medicus Limited
Bernhard C. Meyer, Hannover, Germany (Abstract Co-Author) Research Consultant, Pro Medicus Limited

PURPOSE
To investigate the use of a fluoroscopy-based registration of a pre acquired C-Arm CT (CACT) for procedure guidance in patients suffering from chronic thromboembolic pulmonary hypertension (CTEPH) undergoing balloon pulmonary angioplasty (BPA).

METHOD AND MATERIALS
42 BPA procedures performed in 27 CTEPH patients (9m, 70±14y) were included in this study. Twenty-two BPAs were guided by selective CACT (syngo DynaCT, Artis Q®, Siemens Healthcare, Forchheim, Germany) acquired immediately before BPA (G3D). In another twenty BPAs (G2D), two orthogonal fluoroscopic images of the chest where acquired semi-automatically matched with a product (DAP) was 3.5 vs 30.9 Gy.cm² (89% dose reduction), volume rendering (VRT) of a pre-acquired CACT (2D/3D registration, syngo Fusion®, Siemens), registration was computed and applied. In both cases CACT was post-processed to generate a volume rendering based graphic representation (VRT guidance) indicating the origin and course of the segmental pulmonary arteries (SPA). During the intervention, zoom level and orientation of VRT and C-Arm were linked online using intrinsic (G3D) or computed (G2D) registration. Based on VRT guidance, the interventional radiologist planned an apt working projection (WP-P). If necessary, the used WP (WP-U) was adapted. Agreement of WP-P and WP-U, duration of the procedure and radiation exposure data was documented and compared between the two groups (Wilcoxon test).

RESULTS
Overall, 143 SPA were intended to undergo BPA. Agreement of WP-P and WP-U was obtained in G3D 82% and G2D 86%. The guide wire was successfully placed in G3D 93% and G2D 94% and subsequent BPA was successfully performed in G3D 91% and G2D 94%. CACT post-processing took a mean of 8min G3D and 7min G2D. Overall intervention time was 126min G3D and 117min G2D. No severe reperfusion edema occurred and no patient needed mechanical/assisted ventilation. Dose-area product (DAP) was significantly higher for G3D (G3D 9289±4221 vs. G2D 5448±2629 μGy.m², p=0.002).

CONCLUSION
The use of fluoroscopy based 2D3D registration of CACT images for BPA guidance is feasible and accurate. 2D3D registration can be used to save radiation exposure if a pre-acquired CACT for guidance is available.

**CLINICAL RELEVANCE/APPLICATION**

CACT of the pulmonary arteries bares the opportunity to increase patient’s safety during BPA, when used as guidance method. Additionally, 2D3D fusion of pre-acquired CACT’s saves radiation dose in repeated BPAs.

**SSA23-08 Added Value of Fluoroscopy/Venography during Endovenous Laser Therapy for Symptomatic Varicose Veins**

Sunday, Nov. 29 11:55AM - 12:05PM Location: E350

Participants
Ricardo Yamada, MD, Charleston, SC (Presenter) Nothing to Disclose
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John Selby III, Charleston, SC (Abstract Co-Author) Nothing to Disclose
James P. Gregg, MD, Houston, TX (Abstract Co-Author) Nothing to Disclose

**PURPOSE**

Procedural difficulties or unexpected findings may occur during endovenous laser therapy of varicose veins using ultrasound alone. Fluoroscopy/venography can be a useful adjunctive modality.

**METHOD AND MATERIALS**

After IRB approval, EVLT performed in the last 10 years were reviewed. Fluoroscopy/venography and ultrasound were used in all cases. Images, procedure report and patient’s clinical condition were reviewed. Three graders evaluated whether this imaging method changed the treatment plan, aided completion of the procedure, displayed unexpected findings or clarified previous treatments results.

**RESULTS**

A total of 169 treatments were identified, in 142 patients. Fluoroscopy/venography had impact in 67 procedures (39%). In 25 cases it clarified multiple complex collateral veins. In 23 cases it helped navigate the guide-wire. In 16 cases it identified duplicated/accessory veins. In 3 cases it identified the need for second access. 23 patients had prior surgical ligation/stripping, sclerotherapy or endovenous thermal ablation. Among them fluoroscopy/venography contributed to procedure completion in 18 patients (78%).

**CONCLUSION**

Fluoroscopy/venography were helpful in patients previously treated, in whom passage of the guide wire was difficult and in those with bifurcated/accessory veins. Of these, patients with prior treatment benefited the most from fluoroscopy/venography.

**CLINICAL RELEVANCE/APPLICATION**

Fluoroscopy/venography during EVLT is particular helpful in patients with recurrent varicose veins after prior treatment. This additional imaging modality may be considered in all patients undergoing repeated treatment.

**SSA23-09 Large Primary Varicose Veins: Combined Ultrasound Guided Endo-venous Laser Therapy and Selective Surgical Ligation at Sephano-Femoral Junction-A Mean 7 Years Follow-up with Review of Literature**

Sunday, Nov. 29 12:05PM - 12:15PM Location: E350

Participants
Kiran C. Patil JR, MD, Jalgaon, India (Presenter) Nothing to Disclose
Anurag Singh, MBBS,MD, Sharjah, United Arab Emirates (Abstract Co-Author) Nothing to Disclose
Rajesh D. Jawale, MBBS, MD, Nasik, India (Abstract Co-Author) Nothing to Disclose

**PURPOSE**

1) To evaluate our experience and curative effect of the combination of ultrasound guided endovenous Laser therapy (EVLT) and surgical detail separate ligation of each tributaries at S-F junction. 2) To review our experience with mean 7 years followup. 3) To compare our results with reviewed literature.

**METHOD AND MATERIALS**

Over the period from Jan 2005 to Dec 2013, 118 patients with 135 limbs were identified to have symptomatic primary large varicose veins (Criteria was SF junction diameter > 10 mm and saphenous vein > 8mm) were treated with this combined approach. Separate surgical ligation of each tributary at SF junction followed by ultrasound guided EVLT of rests of the lower limb large tributaries, duplicated veins and short saphenous vein (SSV) done by using 980-nm pulse wave Laser. Superficial subcutaneous tumescence injection of saline to prevent skin complications was used. Principal outcome measures were abolition of reflux, cosmetic improvement and improvement in Aberdeen Varicose Veins Symptome Score (AVVSS) . Future followup on duplex ultrasound at week 1, months 1, 3, 6 then yearly for mean of 7 years.

**RESULTS**

The procedure was technically successful in all cases. Spot skin burns in 2, short term peri ankle parasthesia in 25, recurrent minor tributaries and spider veins in 12, 4 patients developed new parallel GSV. 2 patients developed significant recurrence. All results were much better than only laser or only surgical or other combined methods reviewed in literature.

**CONCLUSION**

This combination therapy of intervention radiology and local surgery in treatment of large primary varicose veins appears to be very
This combination therapy of intervention radiology and local surgery in treatment of large primary varicose veins appears to be very effective and safe approach. The long term results are fairly better and more comparable. Its long term outcome is more superior and well accepted by patients than the other traditional methods compared from literature.

**CLINICAL RELEVANCE/APPLICATION**

Combined surgical and endovenous approach appears promising in good outcome in large primary varicose veins treatments. Large primary varicose veins of both lower limbs are often associated with Sephano-femoral (S-F) junction diameter and saphenous vein diameter larger than 10 mm with multiple large varicose tributaries. These are notorious for recurrence even after intervention or surgical treatment. Hence combined intervention radiological and surgical approach was selected to obtain the best long term results.
**PURPOSE**

The purpose of our study was to evaluate the flow rates and patterns of simulated bile through drainage catheters in an in vitro biliary system model.

**METHOD AND MATERIALS**

The in vitro model consisted of a manometer-monitored constant pressure chamber containing simulated bile connected to a biliary tree made from airline and heat shrink cable tubing. Three types of 12-French drainage catheters (Cook Medical, Bloomington, IN) were inserted through a "T"-shaped sidearm in the biliary tree section of the model: biliary (32 sideholes along the shaft and locking pigtail), pigtail (6 sideholes within the pigtail), and a prototype pigtail catheter with a single sidehole in the catheter mid-shaft. Simulated bile at 4 different viscosities (guar gum solutions in water determined by a rotational viscometer to be in the range of human bile viscosity) flowed through the system under a constant pressure of 12 cm of water. A circumferential occlusion device was used to occlude distal flow. Flow volumes through each catheter were recorded over 1-minute intervals with the "common bile duct" unobstructed or obstructed. Ten trials were performed for each catheter and flow rates compared using Student's t-test.

**RESULTS**

Without obstruction, there was no significant difference in the flow rates between all catheters tested. With obstruction, there was no significant difference in the flow rates between the prototype and standard biliary catheters while no flow was observed with the pigtail catheter. Fluid was seen flowing along the external shaft of all unobstructed catheters. In the obstructed prototype and biliary catheters, fluid was seen to exit from the sidehole(s) proximal to the obstruction and out of the distal sideholes.

**CONCLUSION**

Our data suggest that biliary drainage may be achieved with fewer sideholes proximal to the obstruction. Similar flow rates were obtained with multiple sideholes as compared to one proximal sidehole.

**CLINICAL RELEVANCE/APPLICATION**

Biliary catheters with multiple sideholes do not improve flow rates and may facilitate encrustation with debris that could lead to catheter obstruction and sepsis. Catheters with one or fewer sideholes may achieve the same flow rate while reducing the likelihood of catheter obstruction.
**PURPOSE**

to assess the mid-term outcome of biodegradable biliary stents (BBS) to treat benign biliary strictures.

**METHOD AND MATERIALS**

Institutional Review Board approval was obtained and patients’ consent was waived. Between 2007 and 2014, ninety-nine patients (mean age 57±16 years [mean±standard deviation]), 57 males (61±15 years), 42 females (54±17 years), were treated. Technical feasibility, technical success, and immediate complications were recorded. In 89 patients (51 males, 38 females, aged 57±17 years) with at least 6 months follow-up (mean follow-up 20.2±4.9 months), late complications, episodes of cholangitis, episodes of altered hepatic functional tests without symptoms of cholangitis, episodes of biliary stones, and development of imaging demonstrated biliary stricture recurrence were recorded. Fisher’s exact test, Mann-Whitney U test, and Cox regression model were used.

**RESULTS**

Stent implantation was feasible in 99/99 cases (100%). In 2/99 cases (2%), migration of the stent occurred immediately after deployment (technical success 98%). In 4/99 cases (4%), immediate mild haemobilia occurred. No major or late complications occurred. In 24/89 patients (26.9%) subsequent cholangitis occurred. 15/89 (16.8%) patients had episodes of altered hepatic functional tests without symptoms of cholangitis. Six out of 89 patients (6.7%) developed biliary stones. In 19/89 patients (21.3%), stricture recurrence occurred. The estimated mean time to stricture recurrence was 32.9 months (95% C.I 29.6-36.2 months).

**CONCLUSION**

Percutaneous placement of BBS is a feasible, safe and effective strategy to treat benign biliary strictures and may represent a further option for treating patients in whom standard percutaneous therapy failed.

**CLINICAL RELEVANCE/APPLICATION**

Percutaneous placement of BBS is a feasible, safe and effective strategy to treat benign biliary strictures, potentially representing a further option for treating patients in whom standard percutaneous therapy failed.

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**SSA24-03**  
Interventional MRI-Guided Local Delivery of Agents into Swine Bile Duct Walls Using MR Compatible Needle-Integrated Balloon Catheter System

**Participants**

Feng Zhang, MD, Seattle, WA (Presenter) Nothing to Disclose
Zhibin Bai, Seattle, WA (Abstract Co-Author) Nothing to Disclose
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Jianfeng Wang, MD, Seattle, WA (Abstract Co-Author) Nothing to Disclose
Yonggang Li, MD, Suzhou, China (Abstract Co-Author) Nothing to Disclose
Xiaoming Yang, MD, PhD, Seattle, WA (Abstract Co-Author) Nothing to Disclose

**PURPOSE**

To investigate the feasibility of interventional magnetic resonance imaging (MRI)-guided local agent delivery into pig common bile duct (CBD) walls using a newly-designed MR-compatible, needle-integrated balloon catheter system.

**METHOD AND MATERIALS**

We first designed a needle-integrated balloon catheter system that is comprised of a 22-G MR-compatible Chiba biopsy needle and a conventional 12mm×2cm balloon catheter. Under fluoroscopy guidance, a custom needle/balloon system was positioned into the target CBD via a transcholecystic access. T1-weighted MR imaging was used to localize and reposition the needle/balloon system in the target. A 0.5-mL mixture of motexafin gadolinium (MGd) and trypan blue dye as well as 5-fluorouracil (5-Fu) was delivered into the CBD wall through the needle/balloon system. Post-infusion T1-weighted MR imaging was obtained and contrast-to-noise ratios (CNR) of CBD walls of pre- and post-MGd/blue infusions were compared by a paired t-test. In addition, post-infusion x-ray cholangiography was achieved to evaluate the potential injuries of CBDs by the needle/balloon system. High-pressure liquid chromatography was used to quantify 5-FU in the bile duct tissue. Subsequent histologic analysis was performed to correlate and confirm the imaging findings.

**RESULTS**

Post-infusion cholangiogram didn't show any extravasation of contrast agent, indicating no procedure-related damage to the CBDs. MR imaging demonstrated the clear enhancement of the target bile duct walls infused with MGd/trypan blue dye with average penetration depth of 4.7±1.2mm. The average CNR of the post-infusion bile ducts was significantly higher than that of the pre-infusion bile ducts (110.6±22 vs 5.7±2.8, p<0.0001). Out of the total 5mg 5-Fu injected into the bile duct tissue, 4.1±0.12 mg 5-Fu were retrieved, proving an approximately 80% drug delivery efficiency. Histology depicted the blue dye staining and red fluorescence of MGd through the target CBD walls, which was well correlated with the imaging findings.

**CONCLUSION**

It is feasible to use the new MR compatible, needle-integrated balloon catheter system for intrabiliary local agent delivery into CBD walls under MR imaging guidance.

**CLINICAL RELEVANCE/APPLICATION**

This study may open new avenues for efficient management of pancreatobiliary malignancies using MR-guided interventional oncology.

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**SSA24-04**  
Portal Vein Embolization via an Ipsilateral Approach is Safe and Effective

**Participants**

Feng Zhang, MD, Seattle, WA (Presenter) Nothing to Disclose
Zhibin Bai, Seattle, WA (Abstract Co-Author) Nothing to Disclose
Yaoping Shi, MD, Seattle, WA (Abstract Co-Author) Nothing to Disclose
Yonggang Li, MD, Suzhou, China (Abstract Co-Author) Nothing to Disclose
Xiaoming Yang, MD, PhD, Seattle, WA (Abstract Co-Author) Nothing to Disclose

**PURPOSE**

To investigate the feasibility of interventional magnetic resonance imaging (MRI)-guided local agent delivery into pig common bile duct (CBD) walls using a newly-designed MR-compatible, needle-integrated balloon catheter system.

**METHOD AND MATERIALS**

We first designed a needle-integrated balloon catheter system that is comprised of a 22-G MR-compatible Chiba biopsy needle and a conventional 12mm×2cm balloon catheter. Under fluoroscopy guidance, a custom needle/balloon system was positioned into the target CBD via a transcholecystic access. T1-weighted MR imaging was used to localize and reposition the needle/balloon system in the target. A 0.5-mL mixture of motexafin gadolinium (MGd) and trypan blue dye as well as 5-fluorouracil (5-Fu) was delivered into the CBD wall through the needle/balloon system. Post-infusion T1-weighted MR imaging was obtained and contrast-to-noise ratios (CNR) of CBD walls of pre- and post-MGd/blue infusions were compared by a paired t-test. In addition, post-infusion x-ray cholangiography was achieved to evaluate the potential injuries of CBDs by the needle/balloon system. High-pressure liquid chromatography was used to quantify 5-FU in the bile duct tissue. Subsequent histologic analysis was performed to correlate and confirm the imaging findings.

**RESULTS**

Post-infusion cholangiogram didn't show any extravasation of contrast agent, indicating no procedure-related damage to the CBDs. MR imaging demonstrated the clear enhancement of the target bile duct walls infused with MGd/trypan blue dye with average penetration depth of 4.7±1.2mm. The average CNR of the post-infusion bile ducts was significantly higher than that of the pre-infusion bile ducts (110.6±22 vs 5.7±2.8, p<0.0001). Out of the total 5mg 5-Fu injected into the bile duct tissue, 4.1±0.12 mg 5-Fu were retrieved, proving an approximately 80% drug delivery efficiency. Histology depicted the blue dye staining and red fluorescence of MGd through the target CBD walls, which was well correlated with the imaging findings.

**CONCLUSION**

It is feasible to use the new MR compatible, needle-integrated balloon catheter system for intrabiliary local agent delivery into CBD walls under MR imaging guidance.

**CLINICAL RELEVANCE/APPLICATION**

This study may open new avenues for efficient management of pancreatobiliary malignancies using MR-guided interventional oncology.
PVE was technically successful performed in 106 patients. In one patient, no appropriate access to the right portal system could be established due to massive right-sided tumor load. In 2/106 patients (1.8%) Histoacryl/Lipiodol dislocated into the main portal trunk and caused non-target embolization requiring prolonged hospitalization for 72 hours with anticoagulation. Both patients underwent successful hemihepatectomy. A total of 103/106 (98.2%) PVE procedures by an ipsilateral right-sided transhepatic approach were completed successfully without non-target embolization. 3/106 patients (2.8%) developed severe sepsis after the procedure. A total of 77 patients (73%) finally underwent successful extended hemihepatectomy. 17/106 patients (16%) did not undergo hemihepatectomy because of tumor progress, in 12/106 cases (9%) future liver remnant showed insufficient hypertrophy.

CONCLUSION

PVE with Histoacryl from an ipsilateral approach is a safe and effective technique to prepare liver surgery. In experienced hands non-target embolization is rare.

CLINICAL RELEVANCE/APPLICATION

PVE via transhepatic ipsilateral approach is a well-established technique in patients undergoing extended hemihepatectomy.

SSA24-05 Different Strategies to Induce Hypertrophy of the Future Liver Remnant (FLR) in Case of Major Hepatic Resection: A Prospective Comparative Study in 118 Patients

Participants

Massimo Venturini, MD, Milano, Italy (Presenter) Nothing to Disclose
Francesca Ratti, Milan, Italy (Abstract Co-Author) Nothing to Disclose
Claudio Sallemi, MD, Milan, Italy (Abstract Co-Author) Nothing to Disclose
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Luca Aldrighetti, MD, Milano, Italy (Abstract Co-Author) Nothing to Disclose
Alessandro Del Maschio, MD, Milan, Italy (Abstract Co-Author) Nothing to Disclose

PURPOSE

Liver failure represents the most severe post-operative complication of major hepatic resection. Our aim was to prospectively compare percutaneous portal vein embolization (PVE), portal vein ligation (PVL), and associating liver partition and portal vein ligation for staged hepatectomy (ALPPS) in terms of FLR hypertrophy, complications and clinical outcome.

METHOD AND MATERIALS

From January 2004 to January 2015, 118 patients with an inadequate FLR underwent procedures to induce preoperative hypertrophy before major liver resection. 73 patients underwent PVE, 27 underwent PVL and 18 ALPPS. PVE was percutaneously performed under US and fluoroscopy, with a 4-F catheter, using PVA particles, coils and glue. Total liver volume (TLV), tumor volume and FLR were calculated before both the procedure and surgery. The following outcome measures were considered: operating time, intraoperative blood losses, hospital stay, morbidity and mortality rate. Plasma samples were collected preoperatively and in 1st, 2nd and 5th postoperative day to assess liver function. Moreover, serum levels of white blood cells, C-reactive protein (CRP), Interleukin-6 (IL-6) and Endothelin-1 (ET-1) were determined as markers of inflammatory surgical stress response.

RESULTS

The three groups were homogeneous in terms of pre-procedural volumes, comorbidities and histopathological findings. In ALPPS group, FLR mean hypertrophy was higher than PVE and PVL groups (PVE=5.45±3.17 cc/day, PVL=5.59±2.19 cc/day, ALPPS = 21.03±11.09 cc/day, p<0.05). A higher grade of severe complications was recorded in ALPPS group compared to PVE and PVL groups. Postoperative plasma levels of AST, ALT, WBC, CRP, IL-6 and ET-1 showed a higher increase after the first surgical stage in the ALPPS series compared with the same stage of patients subjected to PVE/PVL.

CONCLUSION

PVE and PVL are comparable in inducing FLR hypertrophy. ALPPS assures the possibility to obtain a higher rate of hypertrophy in a shorter time even if with an higher rate of complications. PVE is preferable to PVL in all cases of unrequired two stage hepatectomy. ALPPS should not be considered a substitute for PVE or PVL but rather a technique to expand the pool of resectable
CLINICAL RELEVANCE/APPLICATION

Percutaneous PVE remains the first option to induce hypertrophy of the FLR in case of major hepatic resection. ALPPS should be proposed with caution in selected cases due to its high risk of complications.

SSA24-06 Root Cause Analysis of Rebleeding Events Following Transjugular Intrahepatic Portosystemic Shunt Creation for Variceal Hemorrhage

Sunday, Nov. 29 11:35AM - 11:45AM Location: E352

Participants
Janesh Lakhooh, BS, Chicago, IL (Presenter) Nothing to Disclose
James T. Bu, MD, Chicago, IL (Abstract Co-Author) Nothing to Disclose
Charles E. Ray Jr, MD, PhD, Chicago, IL (Abstract Co-Author) Advisory Board, Novate Medical Ltd; Editor, Thieme Medical Publishers, Inc.; ; ;
Grace Knutinen, Chicago, IL (Abstract Co-Author) Nothing to Disclose
Ryan P. Lokken, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose
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PURPOSE
To identify fundamental causes underlying recurrent variceal hemorrhage (VH) following transjugular intrahepatic portosystemic shunt (TIPS) creation in order to ascertain opportunities for improvement of TIPS-based management of VH and rebleeding prevention.

METHOD AND MATERIALS
In this single-center retrospective study, 166 patients (M:F=101:65, median age 52 years, median MELD score 14) who underwent TIPS creation for VH between 1999-2014 were studied. Medical record review was used to detect patients who had recurrent VH events, and root cause analysis (RCA) allowed identification of most probable causal factors. A 5-person Interventional Radiology physician group then generated quality improvement (QI) recommendations for process changes to address causal factors, with consensus achieved using a modified Delphi method.

RESULTS
Twenty-five (15%) patients suffered variceal rebleeding post-TIPS. The 1-, 3-, and 5-year variceal rebleeding incidence was 17%, 21%, and 21%. Variceal rebleeding was associated with high 90-day all-cause mortality incidence (10/25, 40%). Male gender (P=0.018) and MELD score (P=0.009) were statistically associated with variceal rebleeding. The most common primary and secondary causes of recurrent VH were lack of or insufficient variceal embolization (48%, 12/25) and coagulopathy (44%, 11/25). Other causal factors included TIPS stenosis or occlusion (n=8) with recurrent portosystemic pressure gradient (PSG) elevation (n=5), inadequate PSG reduction (n=3), and TIPS under dilation (n=1). Fourteen preventative QI recommendations, spanning items related to TIPS portal venous puncture, venographic assessment, stent type and deployment technique, PSG reduction, embolotherapy methodology, and coagulopathy correction, were developed to potentially address variceal rebleeding.

CONCLUSION
While recurrent VH rates following TIPS are non-trivial, rebleeding may be related to addressable underlying causal factors. Further investigation may assess the efficacy of QI-based procedure methodological enhancements in reducing post-TIPS rebleeding incidence.

CLINICAL RELEVANCE/APPLICATION
Root cause analysis based identification of fundamental reasons underlying recurrent variceal hemorrhage after TIPS creation may help reduce the significant morbidity and mortality associated with this condition by targeting causal factors for correction through quality improvement measures.

SSA24-07 Hemodynamic Effects of a Combined Therapy Using Partial Splenic Embolization and Transjugular Intrahepatic Portosystemic Shunt in Patients with Portal Hypertension and Hypersplenism

Sunday, Nov. 29 11:45AM - 11:55AM Location: E352

Participants
Amaud Geffray, Tours, France (Presenter) Nothing to Disclose
Julien Pacheux, MD, La Riche, France (Abstract Co-Author) Nothing to Disclose
Daniel Alison, MD, Tours, France (Abstract Co-Author) Nothing to Disclose
Jean-Marc Perarnau, MD, Tours, France (Abstract Co-Author) Consultant, W. L. Gore & Associates, Inc

PURPOSE
Portal hypertension (PHT) is the result of increased hepatic resistance and portal blood flow. Transjugular Intrahepatic Portosystemic Shunt (TIPS) treats PHT by decreasing portal resistance but it increases the portal blood flow and promotes hepatic encephalopathy and right heart failure. Partial splenic embolization (PSE) treats hypersplenism and could decrease the splenic blood flow before the TIPS placement. The purpose of this study was to investigate the portal hemodynamic effects of a concomitant procedure using PSE before the TIPS placement in patients with PHT and hypersplenism.

METHOD AND MATERIALS
Thirteen patients with PHT and hypersplenism underwent PSE and TIPS in a concomitant procedure. PSE, performed just before the TIPS placement, consisted in injecting non-selectively 1 or 2 vials of microspheres (900-1200μm) in the splenic artery. The portal pressure gradient (PPG) was assessed before and after PSE. TIPS procedure consisted in a Viatorr® stent (Gore) placement calibrated from 6 to 10 mm, in order to obtain a PPG lower than 12 mmHg.

RESULTS
PSE was performed for an indication of surgery (n=3), HCV interferon therapy (n=1), chemotherapy (n=1), high risk of haemorrhage patients.
concluded because of severe thrombocytopenia, pancytopenia or recurrent bleeding from other sites than varices (n=5) and thrombocytopenia associated with hepatic encephalopathy (n=3). TIPS was carried out for the secondary prevention of variceal bleeding (n=6), refractory ascites (n=6) and portal venous thrombosis (n=1). The PPG decreased from 15.2 ± 3.7 mm Hg before PSE to 11.8 ± 4.0 mm Hg after PSE. This allowed limiting the TIPS size to 6 mm in 7 patients. The PPG was 6.3 ± 2.1 mm Hg after the TIPS placement. The platelet count increased from 52 ± 27 G/L before PSE to 209 ± 109 G/L two months after the combined therapy. After the procedure, there was one splenic abscess leading to death, one splenic hematoma and one hepatic abscess and three cases of transient hepatic encephalopathy.

CONCLUSION
Our study evaluated the hemodynamic effects of this combined therapy. It showed that PSE decreases the PPG and can allow the creation of a smaller caliber TIPS.

CLINICAL RELEVANCE/APPLICATION
Randomized controlled studies are needed to evaluate the possible benefits of this combined therapy over encephalopathy and complications of splanchic hemodynamic stress in patients with PHT and hypersplenism undergoing TIPS placement.

SSA24-08 The Effect of Locoregional Therapies and Transjugular Intrahepatic Portosystemic Shunting for Hepatocellular Carcinoma (HCC) Liver Transplant Patients: A UNOS Population Study

Sunday, Nov. 29 11:55AM - 12:05PM Location: E352

Participants
Minzhi Xing, MD, New Haven, CT (Presenter) Nothing to Disclose
Hyun S. Kim, MD, Atlanta, GA (Abstract Co-Author) Nothing to Disclose

PURPOSE
To investigate the utility of bridging locoregional therapies (LRT) and transjugular intrahepatic portosystemic shunts (TIPS) in HCC patients undergoing orthotopic liver transplant (OLT) and its effect on survival outcomes in a national population study.

METHOD AND MATERIALS
The United Network for Organ Sharing (UNOS) database was used to identify patients who were listed for OLT from 2002 to 2013 and followed through 2014. Patients within the Milan Criteria with approved HCC Model for End-Stage Liver Disease (MELD) exception and available pre-OLT TIPS placement data were included. Overall survival (OS) from OLT was stratified by TIPS status and bridging LRT (including transarterial chemoembolization (TACE), radiofrequency ablation (RFA) and cryoablation). Chi-squared tests were used to compare categorical variables and t-tests to compare continuous variables. Kaplan-Meier estimation and log-rank test were used for survival analysis.

RESULTS
Of 17,291 HCC patients who were listed for OLT during the study period, 14,511 patients received OLT, of whom 13,299 patients had adequate pre-OLT TIPS placement data, mean age 57.5 years, 77.1% male; 616 (4.6%) patients received pre-OLT TIPS, and 6,358 patients received at least one LRT. Comparison groups were similar for age at OLT, waitlist duration, gender, ethnicity, BMI, Child and MELD scores (p>0.05 for all). No significant differences in survival from OLT were observed between patients who received pre-OLT TIPS (mean 108.6 months) vs. those who did not (118.9 months), p=0.84. TIPS Patients who received at least one bridging LRT had significantly higher mean survival vs. those who received no bridging LRT (106.1 vs. 102.5 months, p=0.03).

CONCLUSION
In a national population study, OS from transplant in HCC patients was not significantly affected by pre-OLT TIPS placement status. TIPS Patients who received at least one bridging locoregional therapy had significantly improved post-OLT survival compared to those who did not.

CLINICAL RELEVANCE/APPLICATION
Pre-OLT TIPS for HCC patients may be safely performed without significant impact on post-OLT survival. Bridging LRT may improve post-OLT survival in HCC patients who require TIPS placement.

SSA24-09 Outcomes in Transjugular Intrahepatic Portosystemic Shunting for Liver Transplant Patients: A UNOS Population Study

Sunday, Nov. 29 12:05PM - 12:15PM Location: E352

Participants
Minzhi Xing, MD, New Haven, CT (Presenter) Nothing to Disclose
Hyun S. Kim, MD, Atlanta, GA (Abstract Co-Author) Nothing to Disclose

PURPOSE
To investigate the utility of pre-transplant transjugular intrahepatic portosystemic shunts (TIPS) in patients undergoing orthotopic liver transplant (OLT) and its effect on survival outcomes in a national population study.

METHOD AND MATERIALS
The United Network for Organ Sharing (UNOS) database was used to identify patients who were listed for OLT from 2002 to 2013 and followed through 2014. Patients within the Milan Criteria for whom pre-OLT TIPS placement data was available were included. Overall survival (OS) from OLT was stratified by TIPS status, and differences in TIPS placement rates and survival between geographic regions were analyzed. Chi-squared tests were used to compare categorical variables and t-tests to compare continuous variables. Kaplan-Meier estimation and log-rank test were used for survival analysis; Pearson coefficient was used to calculate correlation between variables.

RESULTS
Of 154,626 patients who were listed for OLT during the study period, 71,733 patients received OLT, of whom 69,686 patients had
pre-OLT TIPS placement data, mean age 48.9 years, 67.4% male; 5,304 (7.6%) patients received pre-OLT TIPS. Comparison groups were similar for age at OLT, waitlist duration, gender, ethnicity, BMI, Child and MELD scores (p>0.05 for all). No significant differences in survival from OLT were observed between patients who received pre-OLT TIPS (mean 112.9 months) vs. those who did not (123.6 months), p=0.07. There were significant regional and geographic differences in TIPS placement rates (range 1.9-12.24%, p<0.001) and mean OS from OLT (range 36.3-101.9 months, p<0.001). Increasing longitudinal 12-month OS rates were observed in both TIPS and non-TIPS patients from 2002-2012.

CONCLUSION

In a national population study, OS from transplant was not significantly affected by pre-OLT TIPS placement status. Increasing longitudinal trends in 12-month post-OLT survival and significant geographic disparities in TIPS placement rates and survival from OLT were observed.

CLINICAL RELEVANCE/APPLICATION

Pre-OLT TIPS may be safely performed without significant impact on post-OLT survival.
Use of Indwelling Pulmonary artery Catheter to Significantly Reduce Iodinated Contrast Volume in Elderly Patients with Chronic Renal Dysfunction Undergoing Pre-operative Assessment for Transcatheter Aortic Valve Implantation (TAVI)

PURPOSE
To assess the quality of contrast enhancement in patients undergoing low contrast volume CTA via an indwelling pulmonary artery catheter (PAC) compared to standard volume CTA administered via peripheral IV as part of pre-TAVI workup.

METHOD AND MATERIALS
IRB/HIPAA compliant. 7 patients with chronic renal dysfunction underwent low-contrast volume CTA via PAC, which was placed by a cardiologist during cardiac cath as part of pre-TAVI work up. Immediately following, patients were transferred to radiology for CTA. Patients received between 30-40mL of Omnipaque 350 (GE Healthcare) mixed with saline (50/50 mix) based on BMI. 7 control (CL) patients with pre-TAVI CTA using standard contrast volume (110-120mL) administered via peripheral IV were selected for comparison. All patients underwent 256-slice CTA (Brilliance-iCT, Philips) with retrospective gating. PAC group were scanned at 100 kVp (BMI >30) or 80kVp (BMI <30). CL group had gated-helical CTA of thorax at 100kVp and helical CTA of abdomen at 120 kVp. Intra-vessel CT attenuation (HU) and noise were measured using a model-based iterative reconstruction algorithm (IMR, Philips) at the level of the aortic annulus (AA) and right external iliac artery (EIC) for both groups. Subjective vascular enhancement was assessed with a 4-point Likert scale by 2 board-certified radiologists. Unpaired t-tests and Mann-Whitney U tests were used for parametric and nonparametric data, respectively. Statistical significance was set at p<0.05.

RESULTS
Average age of study and CL groups was 84 yrs (range 73-89) and 72.6 yrs (range, 58-81), respectively (p=0.03). Significantly less contrast was used in the PAC group (33.9mls ±4.8) vs. CL group (117.1 ±11.9) (p=0.001). There was no significant difference in HU at the level of AA for PAC (389.9±129) vs CL (292.16±103.7; p=0.1442) and EIC for PAC (374.2±121.2) vs. CL (269.9±69.7; p=0.0718). There was no difference in noise at AA (p=0.203) or EIC (p=0.265) between groups. All scans were graded as diagnostic. Median subjective score for both groups was 4 (ideal) (p=0.897).

CONCLUSION
Low contrast CTA via PAC can significantly decrease the amount of contrast required in pre-TAVI CTA while providing excellent vascular enhancement.

CLINICAL RELEVANCE/APPLICATION
Patients referred for TAVI often have multiple co-morbidities including renal insufficiency. Contrast injection via PAC can result in significant decrease in contrast volume with overall ideal vascular enhancement.
with a low injection rate of 2.5 mg/mL. The signal-to-noise ratio (SNR) and contrast-to-noise ratio (CNR) abdominal aorta, common iliac artery, femoral artery, popliteal artery, peroneal artery, and anterior tibial artery of both sides were calculated. Two radiologists subjectively assessed the image quality. And radiation dose in CTDIvol and DLP was recorded and compared between the two groups.

RESULTS
No significant difference of SNR or CNR was achieved in all measured sites for both protocols (p value for SNR and CNR comparison: 0.256 and 0.331 for abdominal aorta; for 0.777 and 0.947 for common iliac artery; 0.613 and 0.800 for femoral artery; 0.927 and 0.959 for popliteal artery, 0.194 and 0.269 for peroneal artery, and 0.783 and 0.763 for anterior tibial artery). And there is no significant difference of the subjective score between the two protocols. Radiation dose in optimized protocol was significantly lower than standard protocol (DLP: 192.67± 38.71 vs 473.38±123.18; CTDIvol: 1.49±0.27 vs 3.44±0.76). The total CM volume was 28.6% lower while the iodine dose was 32.4% lower in the optimized protocol.

CONCLUSION
An optimized protocol using 70 kVp may provide a diagnostic performance, comparable with the standard protocol, decreasing radiation dose, CM injection rate, total CM volume, and iodine dose.

CLINICAL RELEVANCE/APPLICATION
An optimized protocol using 70 kVp can dramatically decrease radiation and contrast agent doses with adequate imaging quality.

VI248-SD-SUA4 Characteristic Imaging Findings of Small Cystic Renal Tumors after Radiofrequency Ablation: Initial Experiences

Station #4

Participants
Masataka Kashima, MD, Tsu, Japan (Presenter) Nothing to Disclose
Koichiro Yamakado, MD, PhD, Tsu, Japan (Abstract Co-Author) Nothing to Disclose
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Takashi Yamanaka, MD, Tsu, Japan (Abstract Co-Author) Nothing to Disclose
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Shinichi Ito, MD, Ichinomiya, Japan (Abstract Co-Author) Nothing to Disclose

PURPOSE
To evaluate imaging findings after percutaneous radiofrequency ablation (RFA) of small cystic renal tumors.

METHOD AND MATERIALS
RFA was performed under real-time CT fluoroscopic guidance for 20 cystic renal tumors in 20 consecutive patients. All were Bosniak category IV. Characteristic imaging findings were evaluated.

RESULTS
The mean maximum tumor diameter decreased to 18.4±7.6 mm (range 6.0-31.0 mm) immediately after RFA from 27.2±8.6 mm (range 10.0-40.0 mm) before RFA (p<0.01). The mean CT attenuation of the cystic component increased to 49.0±16.8 HU (range 18.1-81.1 HU) immediately after RFA from 28.1±12.5 HU (range 9.8-52.9 HU) before RFA (p<0.001). Alteration of the cystic component was the pattern of signal intensity like both T1 and T2 shortening in 17 (89%). Simultaneously, the signal intensity of the whole tumor appeared as that of a single sort derived from the cystic component such that it showed a lack of the solid component in 18 (95%), and a characteristic pericystic halo that was visible at the tumor's limb, suggesting cyst wall necrosis, was found in 7 (37%) of 19 patients who underwent follow-up MR studies.

CONCLUSION
Characteristic imaging findings after RFA of small cystic renal tumors suggest rapid tumor shrinkage, and a single sort of signal intensity of the whole tumor in a manner that it remains unmixed with the solid component, which is derived from the cystic one, along with both T1 and T2 shortening and the pericystic halo sign.

CLINICAL RELEVANCE/APPLICATION
(dealing with characteristic imaging findings after RFA of small cystic renal tumors) this preliminary study presents certain characteristic imaging features that have never been reported, representing a small step for the progress of additional studies.

VI100-ED-SUA4 An Update on Oral Anticoagulants for Interventional Radiologists: Getting to Know the Newest Kids on the Block

Station #5

Awards
Certificate of Merit

Participants
Simon Onderi, MD, Mineola, NY (Presenter) Nothing to Disclose
VI001-EB-SUA  Popliteal Artery Entrapment Syndrome: Clinical Presentation, Diagnosis with CTA and MR, and Treatment with Anticoagulant and Thrombotic Infusion and Surgery

Amanjit S. Baadh, MD, New York, NY (Abstract Co-Author) Nothing to Disclose
Ahmed Fadl, MD, Mineola, NY (Abstract Co-Author) Nothing to Disclose
Andrew Lee, BS, Mineola, NY (Abstract Co-Author) Nothing to Disclose
Jason C. Hoffmann, MD, Mineola, NY (Abstract Co-Author) Consultant, Merit Medical Systems, Inc; Speakers Bureau, Merit Medical Systems, Inc

TEACHING POINTS

1. Multiple new oral anticoagulants have been developed and are being used to overcome the limitations of the more traditionally used anticoagulants (warfarin, heparin, and analogues). These may be used in patients to prevent and/or treat thromboembolic disease and reduce the risk of stroke in atrial fibrillation. 2. There are key differences between warfarin, heparin (and analogues), and the newer oral anticoagulants. 3. Knowledge of the mechanism of action and half-lives of these agents, along with what medicine may potentially reverse their effects, is crucial for the proceduralist to adequately manage these patients.

TABLE OF CONTENTS/OUTLINE

- Review the mechanism of action and other key differences between warfarin, heparin (and analogues), and the newer oral anticoagulants (Dabigatran, Rivaroxaban, Apixaban, and Edoxaban).
- Describe why these newer oral anticoagulants are being used with increased frequency.
- Detail how to manage patients on these newer oral anticoagulant medications who also need an image-guided procedure.
- Propose guidelines for these newer oral anticoagulants, in the context of the current Society of Interventional Radiology guidelines which currently do not address all of these medications.

Conclusions

Participants
Soraya Ong, MD, Evanston, IL (Presenter) Nothing to Disclose
Michael H. Hamblin, MD, Evanston, IL (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS

Popliteal artery entrapment syndrome (PAES) is a rare cause of peripheral vascular compromise, predominantly occurring in young, healthy males. It results from anomalous relations between the musculotendinous tructures of the popliteal fossa and the popliteal artery, of which six different types are identified. CTA and MR have been shown to be accurate in characterizing and classifying the different types of PAES. Thrombolysis is only a temporizing measure for treatment of popliteal artery entrapment syndrome. The definitive treatment, as with any vascular compression syndrome, is surgical release of the entrapping structure(s).

TABLE OF CONTENTS/OUTLINE

Vascular Interventional Sunday Poster Discussions
Sunday, Nov. 29 1:00PM - 1:30PM Location: VI Community, Learning Center

VI216-SD-SUB1  An Experimental Study of TR-fluid as a New Embolic Material

Participants
Hyeon Yu, MD, Chapel Hill, NC (Moderator) Nothing to Disclose

SUB-Events

VI216-SD-SUB1 An Experimental Study of TR-fluid as a New Embolic Material

Participants
Shobu Watanabe, MD, Otsu, Japan (Presenter) Nothing to Disclose
Norihisa Nitta, MD, Kyoto, Japan (Abstract Co-Author) Nothing to Disclose
Shinichi Ota, MD, Otsu, Japan (Abstract Co-Author) Nothing to Disclose
Yuki Tomozawa, MD, Otsu, Japan (Abstract Co-Author) Nothing to Disclose
Akinaga Sonoda, MD, PhD, Otsu, Japan (Abstract Co-Author) Nothing to Disclose
Kiyoshi Murata, MD, Otsu, Japan (Abstract Co-Author) Nothing to Disclose
Shigeru Yao, Fukuoka, Japan (Abstract Co-Author) Colleague, the creator of the TR fluid, a provider.

PURPOSE
Thermal Rheological (TR)-fluid developed by Prof. Yao is low viscosity at low temperature (viscosity increases with temperature). In this study, we used TR-fluid as an embolic material for TAE and evaluated the embolic effect, anti-tumor effect, and pathology of embolized arteries in a rabbit model.

METHOD AND MATERIALS
Experiment 1:12 rabbits were divided into 2 groups and the renal artery was embolized using TR-fluid. Complete embolization of the lobular arteries and filling of the distal parts of the lobar arteries was considered as the end point of embolization. 6 rabbits in each group were sacrificed at 7, and 28 days later and kidneys were extracted. Pathological specimens were constructed in 3-mm intervals by coronal section and changes in arterial walls (wall distension, inflammatory change, and fibrosis) were evaluated.

Experiment 2: We divided 6 rabbits with transplanted VX2 liver tumors into 2 groups. They were infused via the proper hepatic artery with cisplatin-TR-fluid suspension or saline as a control and the tumor growth rate was determined on MR images acquired before and 7 days after treatment.

RESULTS
Experiment 1: TR fluid pushed out of the catheter could be confirmed under fluoroscopy without combining with contrast agents. Embolization effect of the renal artery by TR-fluid after 28 days was observed to be the same as that of 7 days later. In microscopic specimens, TR-fluid observed in mold form within the blood vessel and vascular wall, resulting in distension and inflammation. Fibrosis was observed in all cases. Experiment 2: Compared to controls, the tumor growth rate was significantly reduced in the group treated with cisplatin-TR fluid suspension.

CONCLUSION
From this study, TR fluid was estimated to exhibit good embolic effects and anti-tumor effects.

CLINICAL RELEVANCE/APPLICATION
Gelatin sponge or beads are currently used in IVR because embolic area cannot be confirmed only in the distribution of the contrast agent used in the suspension, therefore the embolic effect may become insufficient. Also, it is possible that TR fluid itself is visible under fluoroscopy by using a contrast agent in the manufacturing process. Further studies are necessary, but with the characteristic that viscosity changes by temperature, TR-fluid may become a new material of embolic material.

VI218-SD-SUB3 Chest Port-related Infection According to Medical History: Are There Any High Risk Groups?

Participants
Katsuhiro Kobayashi, MD, Syracuse, NY (Presenter) Nothing to Disclose
Jayminkumar Patel, Syracuse, NY (Abstract Co-Author) Nothing to Disclose
Masoud Fandia, BS, Syracuse, NY (Abstract Co-Author) Nothing to Disclose
Mohammed Jawed, MD, Syracuse, NY (Abstract Co-Author) Nothing to Disclose
Mitchell I. Karmel, MD, Syracuse, NY (Abstract Co-Author) Nothing to Disclose
Dianbo Zhang, MD, Syracuse, NY (Abstract Co-Author) Nothing to Disclose
Cole F. Mendenhall, MD, Long Branch, NJ (Abstract Co-Author) Nothing to Disclose

PURPOSE
To retrospectively investigate the incidence of chest port-related infection according to medical history and to determine high risk groups.

METHOD AND MATERIALS
Between July, 2012 and May, 2014, a total of 924 chest ports were placed in 897 patients. Of these, 53 ports were placed in 48
patients with chronic medical disease (CMD) (Male/Female: 21/27, mean age: 37). 5 patients had a port placed twice because of complications. 871 ports were placed in 849 patients with cancer (Male/Female: 437/412, mean age: 57). 22 patients had a port placed twice because of tumor recurrence or complications. Chronic medical disease included sickle cell disease (SCD) (n=13 ports), cystic fibrosis (n=12), and others 27. Cancer type included Gastrointestinal (GI) (n=193), lung (n=154), breast (n=134), and hematology (n=133), Head and Neck (HandN) (n=97), and others (n=160) Retrospective review of the medical records of all the patients was conducted to identify chest port-related infection (local and systemic) requiring port removal. The incidence of infection according to medical history was calculated and compared to that of each comparison group.

RESULTS

The infection rate of patients with CMD was 22.6% (12/52) or 2.2 infections/1000 catheter-days, which was significantly higher than that of patients with cancer (5.7% (50/871), 0.24/1000 catheter days) (p<0.05). Among patients with CMD, patients with SCD were at a higher risk for infection (38.5%, 1.11 infections/1000 catheter days). Among patients with cancer, patients with hematomic cancer had a highest chest port-related infection rate (9.02%, 0.40/1000 catheter-days), followed by lung cancer (7.79%, 0.396/1000 catheter-days) and HandN cancer (6.19%, 0.258/1000 catheter days). However, the infection rates were not statistically higher than those with the comparison groups (non-hematologic, non-lung and non-HandN, P=0.11, 0.26, 0.88, respectively).

CONCLUSION

Incidence of chest port-related infection in patients with CMD was significantly higher than that in patients with cancer. Patients with SCD were at a higher risk and patients with hematologic cancer were at marginally higher risk for infection.

CLINICAL RELEVANCE/APPLICATION

Proper handing with strict aseptic techniques and close monitoring of a chest port are mandatory in patients with CMD especially those with SCD because of the high incidence of chest port-related infection.

VI249-SD-SUB4  
CT-Guided Percutaneous Renal Cryoablation: A Large Series with Long-Term Follow-Up and Low Morbidity

Station #4

Participants

Hussein D. Aoun, MD, Dearborn, MI (Presenter) Nothing to Disclose
Peter J. Littrup, MD, Providence, RI (Abstract Co-Author) Founder, CryoMedix, LLC; Research Grant, Galil Medical Ltd; Research Grant, Endo Health Solutions Inc; Consultant, Delphinus Medical Technologies, Inc Barbara A. Adam, MSN, Detroit, MI (Abstract Co-Author) Nothing to Disclose
Ev N. Fletcher, MS, BA, Detroit, MI (Abstract Co-Author) Nothing to Disclose
Matthew Prus, BS, Detroit, MI (Abstract Co-Author) Nothing to Disclose

PURPOSE

To assess technical feasibility, efficacy and complication rates of CT guided percutaneous renal mass cryoablation in a large series on long term follow up.

METHOD AND MATERIALS

CT and/or CT-US fluoroscopic-guided percutaneous cryoablations were performed in 328 procedures on 344 tumors (277 RCC, 49 metastasis, 16 oncocytomas and 2 angiomylolipoma) in 281 patients noting tumor size and location. Thirty-nine patients had multiple renal tumors ablated. Follow-up CT or MRI was utilized to assess efficacy and evaluate for local recurrences or new multicentric tumors. Hydrodissection with normal saline/contrast (60:1) solution was performed to protect adjacent vital structures such as bowel, ureter or pancreas. Complications followed the grading system of the National Institutes of Health, Common Terminology of Complications and Adverse Events (CTCAE 4.0).

RESULTS

All the procedures were performed under conscious sedation and were virtually painless during and after the procedure. Average tumor and ablation size was 2.9cm and 5.0cm, respectively, with the largest 10.3cm. Hydrodissection was performed in 138 procedures. Major complication (only grade 3) rate attributable to the procedure was 2.4% (8/328). Of the major complications, 3 (3/8) were related to hemorrhage requiring transfusion (Grade 3). A ureteral stricture prior to ureteral stent placement for central tumors and bowel injury prior to protective hydrodissection techniques were observed early on in our experience. Mean follow-up was 2.1 years with 83 tumors having > 3 year follow-up, 36 tumors having > 5 year follow-up and 14 tumors having > 7 year follow-up. Local recurrence rate was 2.0% (7/344), with 5 technical failures and 2 tract recurrences. Of the local recurrences, 5 were re-ablated (2 tract and 3 technical) without residual disease on follow-up for a secondary efficacy of 99%.

CONCLUSION

Renal cryoablation has established low complication and local recurrence rates which do not appear to be significantly affected by tumor size or central location. CT guided percutaneous cryotherapy is a low cost and low morbidity alternative for patients with complex renal tumors.

CLINICAL RELEVANCE/APPLICATION

The rising cost of health care mandates consideration of renal cryoablation as a cost effective treatment option, justified by comparable low recurrence and complication rates for any renal location.

VI115-ED-SUB5  
What You Would Like to Know about Imaging Thoracic Aorta Pre and Post Endovascular / Hybrid Repair

Station #5

Participants

Manav Bhalla, MBBS, Milwaukee, WI (Presenter) Nothing to Disclose
Mark D. Hohenwalter, MD, Milwaukee, WI (Abstract Co-Author) Nothing to Disclose
W. Dennis Foley, MD, Milwaukee, WI (Abstract Co-Author) Research Consultant, General Electric Company
TEACHING POINTS

1. To review CT imaging technique and interpretation of thoracic aorta, pre and post endovascular or hybrid repair.
2. To discuss imaging findings which impact management of individual conditions, particularly endovascular repair.
3. To discuss information required from imaging pre and post stent graft repair.

TABLE OF CONTENTS/OUTLINE

1. CT Angiogram of thoracic aorta: Imaging technique
2. Thoracic aorta measurements: technique, recommended locations, normal limits of diameter
3. Thoracic aortic pathologies: Imaging keypoints for diagnosis, imaging considerations impacting endovascular or hybrid repair
4. Pre stent graft imaging: What information is needed
5. Post aortic repair imaging: Indications, timing follow up studies, expected imaging findings, complications
6. Familiarities with various stent grafts and surgical procedures.

Awards
Certificate of Merit

Participants
Ankaj Khosla, MD, Dallas, TX (Abstract Co-Author) Nothing to Disclose
David T. Fetzer, MD, Dallas, TX (Presenter) Nothing to Disclose
Stephen P. Reis, MD, Dallas, TX (Abstract Co-Author) Nothing to Disclose
Patrick D. Sutphin, MD, PhD, Dallas, TX (Abstract Co-Author) Nothing to Disclose
Clayton K. Trimmer, DO, Irving, TX (Abstract Co-Author) Nothing to Disclose
Sanjeeva P. Kalva, MD, Dallas, TX (Abstract Co-Author) Consultant, CeloNova BioSciences, Inc

TEACHING POINTS

1. Vascular complications are relatively common following liver transplantation and are associated with a significant risk of allograft dysfunction and patient morbidity and mortality.
2. It is important for the radiologist to understand the range of vascular anastomotic variants and the range of complications including stenosis and thrombosis.
3. Imaging modalities such as Doppler ultrasound, CT and MR angiography, and traditional catheter angiography each play a critical role in the diagnosis of vascular complication.
4. A number of image-guided interventions can be utilized for these complications and can be suggested from diagnostic imaging.

TABLE OF CONTENTS/OUTLINE

Review of whole- vs partial-liver transplantation
Typical anatomy following liver transplant
Arterial anastomosis and variants
Portal venous anastomosis
Hepatic venous anastomosis
Complications involving the hepatic artery
Percutaneous interventions
Angioplasty
Thrombolysis
Complications involving the portal vein
Treatment options
Complications involving the IVC and hepatic veins
Treatment options
Interventional Oncology Series: Percutaneous Management of Renal Tumors: Updates and Ongoing Controversies in 2015

Sunday, Nov. 29 1:30PM - 6:00PM Location: S405AB

LEARNING OBJECTIVES
1) To review management options for small renal masses as well as indications for each. 2) To review the data supporting the energy based thermal ablation modalities for ablation of renal masses. 3) To describe the role and limitations of biopsy of renal masses. 4) To review the management of benign solid renal masses. 5) To describe the evidence for ablation of T1b renal masses.

Sub-Events

VSIO11-01 Updates in the Management of Small (T1a) Renal Masses: Resect, Ablate, or Follow?

Participants
Debra A. Gervais, MD, Chestnut Hill, MA (Moderator) Nothing to Disclose

LEARNING OBJECTIVES
View learning objectives under main course title.

VSIO11-02 Small Renal Mass (T1a): The Case for Ablation in 2015

Participants
Jeremy C. Durack, MD, New York, NY (Presenter) Scientific Advisory Board, Adient Medical Inc Investor, Adient Medical Inc

LEARNING OBJECTIVES
View learning objectives under main course title.

VSIO11-03 Small Renal Mass (T1a): The Case for Resection in 2015

Participants
Adam S. Feldman, MD, Boston, MA (Presenter) Consultant, Olympus Corporation

LEARNING OBJECTIVES
View learning objectives under main course title.

VSIO11-04 Small Renal Mass (T1a): Both Cases for Intervention are Weak. Active Surveillance Will Do Just as Well

Participants
Stuart G. Silverman, MD, Brookline, MA, (sgsilverman@partners.org) (Presenter) Author, Wolters Kluwer nv

LEARNING OBJECTIVES
View learning objectives under main course title.

VSIO11-05 Age Impacts Choice of Partial Nephrectomy vs. Percutaneous Ablation for Stage T1a Renal Cell Carcinoma: a Surveillance, Epidemiology and End Results (SEER)-Medicare Population Study

Participants
Minzhi Xing, MD, New Haven, CT (Presenter) Nothing to Disclose
Nina Kokabi, MD, Atlanta, GA (Abstract Co-Author) Nothing to Disclose
Di Zhang, Pittsburgh, PA (Abstract Co-Author) Nothing to Disclose
Hyun S. Kim, MD, Atlanta, GA (Abstract Co-Author) Nothing to Disclose

PURPOSE
To investigate survival outcomes in patients with stage 1a renal cell carcinoma (RCC) undergoing open or laparoscopic partial nephrectomy (PN) vs. percutaneous cryoablation (CRA) or radiofrequency ablation (RFA) in a large-scale population study.

METHOD AND MATERIALS
The most recently updated SEER-Medicare linked database was queried for patients with T1aN0M0 RCC (≤4cm, ICD-O-3 C64.9).
The most recently updated SEER-Medicare linked database was queried for patients with T1aN0M0 RCC (≤4cm, ICD-O-3 C64.9) diagnosed between 2000 and 2011 and followed to 2012. Patients who underwent therapy were selected from Medicare via CPT carrier claim codes (percutaneous RFA 50592; percutaneous CRA 50593; open PN 50240; laparoscopic PN 50543). Mean overall survival (OS) from therapy was compared between patients who underwent percutaneous ablation vs. partial nephrectomy, with subgroup survival analysis of individual therapies. Kaplan-Meier estimation and Cox proportional hazard models were used for survival analyses and to assess independent prognostic factors for OS.

RESULTS
A total of 5,983 T1a RCC patients underwent percutaneous ablation or PN within the study period, median age 72.0 yrs, 61.0% male. Of these, 3150 received open PN, 1785 received laparoscopic PN, 419 received CRA and 629 received RFA. Of these, 47.9% of patients undergoing PN were >72 yrs, vs. 67.1% of patients in the ablation group. Mean age of patients receiving ablation was significantly higher than that of the PN group, 80.1 vs. 70.6 yrs, p<0.001. Other factors including gender, ethnicity, mean index tumor size and tumor grade were not significantly different between comparison groups. Patients who underwent PN had significantly higher mean OS compared to the ablation group, 128.7 vs. 75.5 months, p<.001. On Cox regression analysis, younger age was the only independent prognostic factor for survival, HR 0.91 (0.87-0.93, p<0.001).

CONCLUSION
In T1aN0M0 RCC, patients undergoing ablation were significantly older compared to PN patients. Age was found to be an independent prognostic factor for survival from treatment.

CLINICAL RELEVANCE/APPLICATION
In T1aN0M0 RCC, age was found to be an independent prognostic factor for survival from treatment and may impact choice of therapy.

VSIO11-06 Ablation for Renal Cell Carcinoma: Radiofrequency, Cryoblation, or Microwave?

Participants
LEARNING OBJECTIVES
View learning objectives under main course title.

VSIO11-07 Small Renal Mass (T1a): The Case for RFA in 2015
Sunday, Nov. 29 2:40PM - 3:00PM Location: S405AB

Participants
Debra A. Gervais, MD, Chestnut Hill, MA (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
View learning objectives under main course title.

Honored Educators
Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at:
https://www.rsna.org/Honored-Educator-Award/

Debra A. Gervais, MD - 2012 Honored Educator

VSIO11-08 US-guided Percutaneous Radiofrequency Ablation of Renal Cell Carcinoma: Experience from Treating 120 Renal Masses Over 7 Years
Sunday, Nov. 29 3:00PM - 3:10PM Location: S405AB

Participants
Adriana C. Montealegre Angarita, Barcelona, Spain (Abstract Co-Author) Nothing to Disclose
Xavier Serres Creixams, PhD, Barcelona, Spain (Presenter) Nothing to Disclose
Enrique Trilla, Barcelona, Spain (Abstract Co-Author) Nothing to Disclose
Milton R. Villa III, Barcelona, Spain (Abstract Co-Author) Nothing to Disclose
Juan Halaburda Berni, Barcelona, Spain (Abstract Co-Author) Nothing to Disclose
Esteban Ramirez Rinto, MD, Barcelona, Spain (Abstract Co-Author) Nothing to Disclose
Xavier G. Azogue JR, Barcelona, Spain (Abstract Co-Author) Nothing to Disclose

PURPOSE
Evaluate the efficacy and safety of ultrasound (US) guided percutaneous radiofrequency ablation (RFA) for small renal masses. Describe the complications of RFA guided by US. Evaluate the technique in their initial ablative capacity and rate of tumor recurrence at one year minimum follow up. Illustrate postablaltion findings of residual or recurrent renal tumor by using Contrast-enhanced US (CEUS) Evaluate the effect of renal function in patients undergoing RFA guided by US

METHOD AND MATERIALS
Over a 7 year 105 patients with 120 renal masses (tumor size averaged 2.7 cm) were reviewed treated with US-guided percutaneous RFA. Biopsy was performed at the same moment of the procedure from 2009. Cool-tip RFA system was percutaneously inserted under ultrasound guidance. RF was emitted at 100-120 W for 12 minutes to attain temperatures sufficient to ensure tumor kill. The treatment response and technical success were defined by absence of contrast enhancement within the tumor on contrast enhanced CT and CEUS. The patients were followed up with CEUS and computed tomography at 3.6 months and every 6 months thereafter. Multivariate analysis was performed to determine variables associated with procedural outcome.

RESULTS
Follow-up ranged from 24 months to 84 months. The initial treatment success rate was 95.8%. Five of the remaining tumors were successfully re-treated. Four tumors had recurrence (defined as the occurrence of contrast enhancing tumor 12 months after complete ablation) three of whom required a second ablation and one nephrectomy. The overall technical success rate was 99%. Complications were seven self-limited included hematomas subcapsular or perirenal. In all 104 (99%) patients have preservation of renal function, only one patient developed significant renal function deterioration associated with perirenal hematoma. There were no bowel complications despite the fact that 6 of the tumors were within 1 cm of bowel. Protective strategies progressed from reliance on electrode positioning to hydro dissection.

CONCLUSION
Our experience to date suggests that US-guided RFA of small renal tumors is a safe and effective, minimally invasive technique in selected patients.

CLINICAL RELEVANCE/APPLICATION
US-guided RFA of renal tumors can provide benefits compared to other techniques: Intraprocedural monitoring affords visualization of the forming hot ball, helps detect proximity to surrounding structures and does not use ionizing radiation.

RESULTS
Longer-term outcomes were evaluated by review of follow-up cross-sectional imaging. No patients had evidence of residual or recurrent tumor on follow-up imaging, ranging from 3 to 30 months.

METHOD AND MATERIALS
Cases using adjunctive techniques were analyzed. Minor and major complications were recorded, per Society of Interventional Radiology criteria. The type of adjunctive technique used, reason for such utilization, and procedural outcome of the technique were recorded. Specifically, in cases of hydrodissection or balloon angioplasty interposition, measurements of the displacement distance were made. Minor and major complications were recorded, per Society of Interventional Radiology criteria. Longer-term outcomes were evaluated by review of follow-up cross-sectional imaging.

OUTCOME
Four tumors had recurrence (defined as the occurrence of contrast enhancing tumor 12 months after complete ablation) three of whom required a second ablation and one nephrectomy. The overall technical success rate was 99%.

All cases had appropriate ablation zones and protection of adjacent critical structures.

Minor and major complications were recorded, per Society of Interventional Radiology criteria.

CONCLUSION
Our experience to date suggests that US-guided RFA of small renal tumors is a safe and effective, minimally invasive technique in selected patients.

CLINICAL RELEVANCE/APPLICATION
US-guided RFA of renal tumors can provide benefits compared to other techniques: Intraprocedural monitoring affords visualization of the forming hot ball, helps detect proximity to surrounding structures and does not use ionizing radiation.

RESULTS
Longer-term outcomes were evaluated by review of follow-up cross-sectional imaging. No patients had evidence of residual or recurrent tumor on follow-up imaging, ranging from 3 to 30 months.

METHOD AND MATERIALS
Cases using adjunctive techniques were analyzed. Minor and major complications were recorded, per Society of Interventional Radiology criteria. The type of adjunctive technique used, reason for such utilization, and procedural outcome of the technique were recorded. Specifically, in cases of hydrodissection or balloon angioplasty interposition, measurements of the displacement distance were made. Minor and major complications were recorded, per Society of Interventional Radiology criteria. Longer-term outcomes were evaluated by review of follow-up cross-sectional imaging.

OUTCOME
Four tumors had recurrence (defined as the occurrence of contrast enhancing tumor 12 months after complete ablation) three of whom required a second ablation and one nephrectomy. The overall technical success rate was 99%.

All cases had appropriate ablation zones and protection of adjacent critical structures.

Minor and major complications were recorded, per Society of Interventional Radiology criteria.
CONCLUSION
Adjunctive techniques to allow cryoablation of renal masses in difficult anatomic locations have excellent technical success rates and long-term outcomes.

CLINICAL RELEVANCE/APPLICATION
Improving outcomes of difficult renal mass cryoablations.

VSIO11-11 Small Renal Mass (T1a): The Case for Microwave
Sunday, Nov. 29 3:40PM - 4:00PM Location: S405AB

Participants
Fred T. Lee JR, MD, Madison, WI (Presenter) Stockholder, NeuWave Medical, Inc; Patent holder, NeuWave Medical, Inc; Board of Directors, NeuWave Medical, Inc; Patent holder, Medtronic, Inc; Inventor, Medtronic, Inc; Royalties, Medtronic, Inc

LEARNING OBJECTIVES
View learning objectives under main course title.

VSIO11-12 Long-term Clinical Outcomes Following Radiofrequency and Microwave Ablation of Renal Cell Carcinoma at a Single Large VA Medical Center
Sunday, Nov. 29 4:00PM - 4:10PM Location: S405AB

Participants
Salim E. Abboud, MD, Cleveland, OH (Presenter) Nothing to Disclose
Tanay Y. Patel, MD, Cleveland, OH (Abstract Co-Author) Nothing to Disclose
Stephanie Soriano, MD, Cleveland, OH (Abstract Co-Author) Nothing to Disclose
Nannette Alvarado, MD, Cleveland, OH (Abstract Co-Author) Nothing to Disclose
Preet S. Kang, MD, Pepper Pike, OH (Abstract Co-Author) Nothing to Disclose

PURPOSE
Earlier detection and a desire to preserve renal function and decrease surgical morbidity in the treatment renal cell carcinoma (RCC) has prompted increased use of percutaneous thermal ablation treatments such as radiofrequency ablation (RFA) and more recently microwave ablation (MWA). MWA has the potential to provide more complete ablation compared to RFA in part due to more uniform and higher intra-tumoral temperatures, but only a few small studies have examined the short- and long-term outcomes of MWA for RCC. This retrospective review assesses the experience and technical short- and long-term success rates of using RFA and MWA for RCC at a large VA medical center.

METHOD AND MATERIALS
Patient and tumor characteristics (tumor size, nearness to collecting system, anterior/posterior location, location relative to polar line, and endophytic/exophytic predominance) were tabulated using descriptive statistics. Group comparisons were performed by using univariate logistic regression analysis to determine factors impacting primary efficacy, secondary efficacy, and technique effectiveness. Kaplan-Meier local tumor progression-free survival following ablation was calculated.

RESULTS
71 patients with 78 renal lesions underwent ablation. Mean, primary, and secondary mean follow-up were 35.1, 33.5, and 31.3 months. Total, primary, and secondary technique effectiveness rates were 86%, 82%, and 4%, respectively. Primary efficacy and total technique effectiveness were associated with size, with p values of 0.02 and 0.001. There was no significant difference in survival curves between MWA and RFA treated patients. MWA and RFA groups were not significantly different in terms of age, BMI, or tumor size. Complications occurred in 11.5% of patients, none resulting in death. More than 90% patients were done as outpatients (sent home day of procedure) with moderate sedation. No cases used intubations or general anesthesia.

CONCLUSION
RFA and MWA both represent effective treatment modalities for RCC. Longer follow-up time and larger tumor size may be associated with the somewhat lower effectiveness rates; the comparable efficacy/complication rates compared to prior ablation studies demonstrate the feasibility of performing ablations on an outpatient basis.

CLINICAL RELEVANCE/APPLICATION
Image guided percutaneous ablation is an effective and cost-effective treatment modality for RCC in patients that are not surgical candidates.

VSIO11-13 To Biopsy or Not Biopsy the Small Renal Mass before Ablation? That Is the Question

Participants

LEARNING OBJECTIVES
View learning objectives under main course title.

ABSTRACT
Characterization of small renal masses has proven challenging. However, with appropriate CT and MR protocols, the majority of these lesions can now be characterized pre procedurally, enabling a confident diagnosis. In this lecture, we will describe renal mass characterization protocols and describe the common imaging signatures of RCC subtypes and their common mimics including lipid poor AML and oncocytomas. This may eliminate need for preprocedural biopsy.

VSIO11-14 Biopsy or No Biopsy Before Ablation? Biopsy Every Renal Mass before Percutaneous Ablation
If MR-HIFU can provide for a reliable confluent volumetric lesion in the renal cortex in a clinically relevant time-frame in a porcine study.

**METHOD AND MATERIALS**

Nine anesthetized pigs were placed on a clinical Philips Sonalleve MR-HIFU therapy system integrated with a 1.5T Achieva MRI. Both acoustic energy delivery and MR-thermometry were respiratory gated and active surface cooling was employed to prevent near-field damage. A honeycomb pattern of at least seven ablation cells (9-25s, 450W acoustic power, 4x4x10 mm³ per cell) were positioned in the cortex of the kidney. The therapeutic endpoint was evaluated by a non-perfused volume (NPV) measurement using DCE-MRI. Subsequently, the animal was euthanized and the extent of induced necrosis was examined using a cellular viability staining (NADH).

**RESULTS**

Confluent volumes on NPV-imaging (up ~3 mL) and NADH staining (up to ~4mL) were obtained and temperatures exceeding 60°C were reached in 6 pigs. I.e. heating of the false rib, poor respiratory correction, and a large incidence angle caused poor kidney heating in 3 pigs.

**CONCLUSION**

These first results indicate that current clinical MR-HIFU equipment might be suitable for non-invasive therapy of renal masses. Positioning of the sonications and the subject based on anatomical scans is very important, as well as adequate motion compensation. Future work will include a first clinical study on renal cell carcinomas.

**CLINICAL RELEVANCE/APPLICATION**

There is an increasing interest in non-invasive kidney sparing therapy for renal cancer, since ~1.6% of men and women will be diagnosed with kidney and renal pelvis cancer during their lifetime, in 25% of all abdominal imaging sessions a renal lesion is found, partial nephrectomy - standard care for tumors <4cm - has a 15% complication rate, and the population is aging and known with comorbidities and poor physical condition. Therefore, several patient studies investigated the feasibility of HIFU for the thermal ablation of renal masses. Mainly a hand-held extracorporal ultrasound device with US B-mode imaging for guidance or a laparoscopic approach was used. Disadvantages are i.e. the lack of respiratory motion compensation, no real-time visualization of energy deposition, and the complexity of the probe positioning. Alternatively, feasibility of MR-HIFU interventions on the kidney with respect to motion compensated real-time thermometry and acoustic energy delivery was established, recently.
**VSIO11-18  Percutaneous Ablation for T1b Tumors**  
Sunday, Nov. 29 5:20PM - 5:40PM Location: S405AB

**Participants**  
Thomas D. Atwell, MD, Rochester, MN (Presenter) Nothing to Disclose

**LEARNING OBJECTIVES**  
View learning objectives under main course title.

**VSIO11-19  Percutaneous Ablation for Angiomyolipomas**  
Sunday, Nov. 29 5:40PM - 6:00PM Location: S405AB

**Participants**  
Fred T. Lee JR, MD, Madison, WI (Presenter) Stockholder, NeuWave Medical, Inc; Patent holder, NeuWave Medical, Inc; Board of Directors, NeuWave Medical, Inc; Patent holder, Medtronic, Inc; Inventor, Medtronic, Inc; Royalties, Medtronic, Inc

**LEARNING OBJECTIVES**  
View learning objectives under main course title.
Imaging and Endografts (An Interactive Session)
Sunday, Nov. 29 2:00PM - 3:30PM Location: S103AB

VA IR
AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants

Sub-Events

RC112A TEVAR Indications and Outcomes

Participants
Michael D. Dake, MD, Stanford, CA (Presenter) Scientific Advisory Board, W. L. Gore & Associates; Scientific Advisory Board, Abbott Laboratories; Research Consultant, Cook Group Incorporated; Research Consultant, TriVascular, Inc; Research Consultant, Medtronic, Inc; Research Consultant, Intact Vascular, Inc; Research Consultant, Novate Medical; Research support, Cook Group Incorporated; Research support, Medtronic, Inc; Research support, W. L. Gore & Associates, Inc;

LEARNING OBJECTIVES
1) Understand the current applications of thoracic endografts for management of thoracic aortic pathologies. 2) Recognize the benefits and existing limitations of current endograft technologies for treatment of different aortic lesions. 3) Identify the complications and failure modes of TEVAR. 4) Know the current outcome metrics typically evaluated after TEVAR treatment of thoracic aneurysms and aortic dissections. 5) List the important imaging findings and criteria currently used to assess the suitability of aortic anatomy for TEVAR.

RC112B New Endografts for Complex AAA

Participants
Constantino S. Pena, MD, Miami, FL (Presenter) Speakers Bureau, Cook Group Incorporated; Advisory Board, C. R. Bard, Inc; Advisory Board, Boston Scientific Corporation; Advisory Board, General Electric Company;

LEARNING OBJECTIVES
1) Discuss the status of established AAA endografts. 2) Discuss new endografts for the treatment of AAA. Particularly discuss areas of improvement over established endografts. 3) Present data on novel endografts being developed.

RC112C Old Endografts with New Complications

Participants
Elliot K. Fishman, MD, Owings Mills, MD (Presenter) Research support, Siemens AG Advisory Board, Siemens AG Research support, General Electric Company Advisory Board, General Electric Company Co-founder, HipGraphics, Inc

LEARNING OBJECTIVES
1) Understand the spectrum of complications which may be seen in patients with endografts that have been in place for several years and the significance of these complications. 2) Develop a strategy for the evaluation of endovascular stents with specific scanning protocols and the role of post processing of the data into 3D. 3) understand the complexities of complications including involvement of bowel and adjacent organs and the CT findings that can suggest these complications.

ABSTRACT

Honored Educators

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

Elliot K. Fishman, MD - 2012 Honored Educator
Elliot K. Fishman, MD - 2014 Honored Educator
Pain and Sedation in 2015: Improving Quality and Patient Outcomes

Sunday, Nov. 29 2:00PM - 3:30PM Location: S504AB

IR

AMA PRA Category 1 Credits™: 1.50
ARRT Category A+ Credits: 1.50

Participants
Fred E. Shapiro, DO, Boston, MA (Presenter) Nothing to Disclose
Richard D. Urman, MD, MBA, Boston, MA (Presenter) Nothing to Disclose
Hesham H. Malik, MD, Worcester, MA, (Hesham.Malik@umassmemorial.org) (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
1) An evidenced-based review of the current literature and how to measure quality and safety related to procedural sedation. 2) Understand the necessity and the role that team training contributes to a safe procedural environment. 3) Review appropriate patient selection for interventional procedures. 4) Review procedural sedation policies, accreditation, pharmacology and patient monitoring. 5) Challenging cases presentation and discussion.

ABSTRACT
The safe and effective sedation of patients during interventional Radiology procedures requires an in depth knowledge of how to administer conscious sedation. Even more important, however, is the skill set to be able to accurately assess each patient’s clinical status prior to the procedure, be able to formulate a comprehensive sedation plan, and recognize which patients would be better served by involvement of an Anesthesiologist. This course will review the institutional requirements for providing minimal, moderate or deep sedation. We will also outline how to develop a procedural sedation (PS) policy, including recognition of the role that team training contributes to a safe environment. We will review the use of the Institute for Safety in Office Based Surgery (ISOBS) safety checklist as well as its customization to the IR setting. We will provide an evidenced-based review of the current literature re: QA, risk management, and process improvement using the ISOBS checklist as well as a review of drugs commonly used for procedural sedation.
MR-Guided High Intensity Focused Ultrasound (HIFU)

Sunday, Nov. 29 2:00PM - 3:30PM Location: S504CD

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

FDA Discussions may include off-label uses.

Participants
Pejman Ghanouni, MD, PhD, Stanford, CA, (ghanouni@stanford.edu) (Moderator) Nothing to Disclose

Sub-Events

RC117A Neurologic Applications of MR-guided HIFU

Participants
Max Wintermark, MD, Lausanne, Switzerland, (max.wintermark@gmail.com) (Presenter) Advisory Board, General Electric Company;

LEARNING OBJECTIVES

1) To understand the neuro applications of HIFU. 2) To understand the challenges of applying HIFU for neuro applications. 3) To review the ongoing trials of neuro applications of HIFU.

ABSTRACT

MR guided focused ultrasound is a new, minimally invasive method of targeted tissue thermal ablation that may be of use to treat central neuropathic pain, essential tremor, Parkinson tremor, and brain tumors. The system has also been used to temporarily disrupt the blood-brain barrier to allow targeted drug delivery to brain tumors. We will discuss current and potential neuro applications of this exciting technology.

RC117B Gynecologic Applications of MR-guided HIFU

Participants
Young-Sun Kim, MD, Seoul, Korea, Republic Of (Presenter) Nothing to Disclose

LEARNING OBJECTIVES

1) Explain pros and cons of MR-guided HIFU in the treatment of uterine fibroids and adenomyosis as compared to other therapeutic modalities 2) Assess important factors in screening MR exams of MR-guided HIFU therapy of uterine fibroids 3) Explain treatment strategy of MR-guided HIFU therapy of uterine fibroids to improve therapeutic outcomes 4) Describe the current limitations of MR-guided HIFU of uterine fibroids and explain how to overcome limitations

ABSTRACT

Uterine fibroid and adenomyosis are the most popular clinical applications of MR-guided HIFU (high-intensity focused ultrasound) therapy. As a totally non-invasive interventional therapeutic modality using small foci of hyperthermia, MR-guided HIFU has pros and cons as compared to other therapeutic modalities. However, owing to its greatest merit of complete non-invasiveness, its clinical adoptions are increasing worldwide. MR-guided HIFU therapy has certain inborn limitations, therefore, appropriate screening in MR-guided HIFU of uterine fibroids is extremely important to improve overall therapeutic outcomes. In order to do so, properties of the target fibroids, safe pathway of sonications, complication-related factors should be well analyzed in screening MR exams. Furthermore, the symptom-relevant fibroid or the portion of fibroid should be recognized and completely ablated. As accumulations of clinical experiences of MR-guided HIFU therapy, there have been several techniques or strategies developed to overcome such limitation or to improve therapeutic efficacy, which will be covered in this presentation.

Handout: Young-Sun Kim

RC117C Body Applications of MR-guided HIFU

Participants
Alessandro Napoli, MD, Rome, Italy (Presenter) Nothing to Disclose

LEARNING OBJECTIVES

1) To become familiar with the basic physical principles of HIFU and the potential of MR guidance. 2) To approach selection criteria in MRI screening examinations for accurate indications and identify contraindications and non-suitable patients. 3) To appreciate current results and potential therapy regimens. 4) To understand recent technical developments and their potential.

ABSTRACT

The concept of ideal tumor surgery is to remove the neoplastic tissue without damaging adjacent normal structures. High-intensity focused ultrasound (HIFU) was developed in the 1940s as a viable thermal tissue ablation approach. In clinical practice, HIFU has been applied to treat a variety of solid benign and malignant lesions, including pancreas, liver, prostate, and breast carcinomas, soft tissue sarcomas, and uterine fibroids. More recently, magnetic resonance guidance has been applied for treatment monitoring during focused ultrasound procedures (magnetic resonance-guided focused ultrasound, MRgFUS). Intraoperative magnetic resonance imaging provides the best possible tumor extension and dynamic control of energy deposition using real-time magnetic...
Palliation of Painful Metastases to Bone

Participants
Pejman Ghanouni, MD, PhD, Stanford, CA (Presenter) Nothing to Disclose

LEARNING OBJECTIVES

1) Therapeutic options for palliation of painful metastases to bone. 2) Patient selection for MR guided focused ultrasound palliation of painful bone metastases. 3) Results of Phase III pivotal study of ExAblate MR guided focused ultrasound for palliation of painful bone metastases. 4) Technical aspects of successful patient treatment. 5) Immediate post-treatment imaging-based assessment of results. 6) Future applications of MR guided focused ultrasound for the management of osseous metastatic disease.

ABSTRACT

Cancer patients commonly have metastases to bone; as the survival of cancer patients is prolonged by more effective therapies, the prevalence of patients with metastases to bone is also increasing. Bone metastases are often painful, and often diminish the quality of life. Radiation therapy (RT) is the standard of care for the treatment of bone metastases, but a significant subset of patients do not respond to RT. MR guided focused ultrasound non-invasively achieves localized tissue ablation and provides a proven method of pain relief in patients who do not respond to radiation therapy. MR imaging provides a combination of tumor targeting, real-time monitoring during treatment, and immediate verification of successful treatment. The results of the pivotal Phase III trial that led to FDA approval of the ExAblate MR guided focused ultrasound device for the palliation of painful metastases to bone will be reviewed. In particular, patient selection, the technical aspects of successful patient treatment, and post-treatment assessment of results will be described. Concepts for future development of this technology with regard to the management of osseous metastatic disease will also be presented.
Techniques for Interventional Sonography and Thermal Ablation (Hands-on)

Sunday, Nov. 29 2:00PM - 3:30PM Location: E264

Participants
Stephen C. O'Connor, MD, Springfield, MA (Moderator) Nothing to Disclose
Alda F. Cossi, MD, Boston, MA (Presenter) Nothing to Disclose
Neil T. Specht, MD, Trumbull, CT (Presenter) Nothing to Disclose
Mark L. Lukens, MD, Greensboro, NC (Presenter) Nothing to Disclose
Michael A. Mahlon, DO, Tacoma, WA (Presenter) Nothing to Disclose
Manish N. Patel, DO, Cincinnati, OH, (manish.patel@cchmc.org) (Presenter) Nothing to Disclose
Hollins P. Clark, MD, MS, Winston Salem, NC (Presenter) Nothing to Disclose
Mark J. Hogan, MD, Columbus, OH (Presenter) Nothing to Disclose
Manish N. Patel, DO, Cincinnati, OH, (manish.patel@cchmc.org) (Presenter) Nothing to Disclose
Mabel Gallego, MD, Madrid, Spain, (cgallego@salud.madrid.org) (Presenter) Nothing to Disclose
William W. Mayo-Smith, MD, Boston, MA (Presenter) Author with royalties, Reed Elsevier; Author with royalties, Cambridge University Press
Humberto G. Rosas, MD, Madison, WI (Presenter) Nothing to Disclose
Kristin M. Dittmar, MD, Columbus, OH (Presenter) Nothing to Disclose
Nicholas A. Zumberge, MD, Columbus, OH (Presenter) Stockholder, Abbvie Inc; Stockholder, Cerner Corporation; Stockholder, Dexcom, Inc; Stockholder, Exact Sciences Corporation; Stockholder, Gilead Sciences, Inc; Stockholder, Merck & Co, Inc; Stockholder, Northwest Botherapeutics Inc
Veronica J. Rooks, MD, Honolulu, HI (Presenter) Nothing to Disclose
James W. Murakami, MD, Columbus, OH (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
1) Identify basic skills, techniques, and pitfalls of freehand invasive sonography.
2) Discuss and perform basic skills involved in thermal tumor ablation in a live learning model.
3) Perform specific US-guided procedures to include core biopsy, abscess drainage, vascular access, cyst aspiration, soft tissue foreign body removal, and radiofrequency tumor ablation.
4) Incorporate these component skill sets into further life-long learning for expansion of competency and preparation for more advanced interventional sonographic learning opportunities.

ABSTRACT
Interventional Radiology Monday Case of the Day

Monday, Nov. 30 7:00AM - 11:59PM Location: Case of Day, Learning Center

AMA PRA Category 1 Credit ™: .50

Participants
Anne M. Covey, MD, New York, NY (Presenter) Nothing to Disclose
Sreejit Nair, MD, New York, NY (Abstract Co-Author) Nothing to Disclose
Alan A. Sag, MD, New York, NY (Abstract Co-Author) Nothing to Disclose
Hooman Yarmohammadi, MD, New York, NY (Abstract Co-Author) Nothing to Disclose
Lynn A. Brody, MD, New York, NY (Abstract Co-Author) Stockholder, Sirtex Medical Ltd
Stephen B. Solomon, MD, New York, NY (Abstract Co-Author) Research Grant, General Electric Company
Interventional Series: Venous Disease
Monday, Nov. 30 8:30AM - 12:00PM Location: S404CD

Participants
Marcelo Guimaraes, Charleston, SC (Moderator) Consultant, Cook Group Incorporated; Consultant, Baylis Medical Company; Consultant, Terumo Corporation; Patent holder, Cook Group Incorporated
Wael E. Saad, MBBCCh, Ann Arbor, MI (Moderator) Research Grant, Siemens AG; Consultant, Siemens AG; Consultant, Boston Scientific Corporation; Consultant, Medtronic, Inc; Consultant, Getinge AB; Consultant, Merit Medical Systems, Inc;

LEARNING OBJECTIVES
1) Describe the use of radio frequency wire in central venous occlusion. 2) List rationale for venous thrombolysis. 3) Describe the indications for balloon retrograde transvenous occlusion (BRT0). 4) Discuss one approach to establishing a PE response team.

ABSTRACT

PURPOSE
To examine whether additional catheter-directed thrombolysis (CDT) had a persistent benefit in reducing post-thrombotic syndrome (PTS), and if CDT increased patency and reduced reflux 5 years following a high proximal deep vein thrombosis (DVT)

METHOD AND MATERIALS
Patients with a first-time objectively verified DVT affecting the upper femoral vein and/or iliac vein were randomized to receive conventional therapy alone or to additional CDT. PTS was assessed using the Villalta scale and the venous system was examined by duplex ultrasound and air plethysmography to define the presence of patency and/or reflux.

CONCLUSION
Follow-up after 5 years showed an additional benefit of CDT in reducing PTS, which supports "the open vein hypothesis" and underpins the importance of early clot removal to prevent PTS.

CLINICAL RELEVANCE/APPLICATION
The results of this first randomized controlled trial to evaluate the effect of additional CDT for deep vein thrombosis supports the use of CDT in selected patients.

Participants
Kush R. Desai, MD, Chicago, IL (Presenter) Nothing to Disclose
James L. Laws, BS, Chicago, IL (Abstract Co-Author) Nothing to Disclose
Samdeep Mouli, MD, Chicago, IL (Abstract Co-Author) Nothing to Disclose
Retrieveable inferior vena cava filters (rIVCF) with prolonged dwell time often cannot be removed with standard techniques. Advanced retrieval techniques, which are increasingly necessary with prolonged rIVCF dwell time, have positively impacted overall retrieval rates. We aim to derive a dwell time at which the use of advanced techniques becomes necessary to achieve retrieval success.

**METHOD AND MATERIALS**

All rIVCF retrieval procedures from 1/2009-2/2015 were identified from a prospectively acquired database. We assessed patient age/sex, filter dwell time, technical success, fluoroscopy time, adverse events, and advanced retrieval technique (loop wire, balloon disruption, directional sheath, endobronchial forceps, and Excimer laser sheath) use. The data were analyzed with binomial regression analysis to calculate a dwell time in months at which advanced techniques were necessary. Statistical significance was accepted at $p<0.05$.

**RESULTS**

724 retrieval procedures were performed during the study period, with an overall technical success rate of 97%. Filters encountered in the study period include devices manufactured by Cook, Cordis, Bard, Argon, and ALN. After 3.1 months (95% CI 2.8-3.4, $p<0.01$), the likelihood of requiring advanced techniques to achieve retrieval success increased significantly.

**CONCLUSION**

At approximately 3 months rIVCF dwell time, the likelihood of requiring advanced techniques to maintain retrieval technical success increases significantly. In patients with rIVCFs in place beyond this time point, referral to centers with expertise in advanced filter retrieval techniques may facilitate their successful retrieval.

**CLINICAL RELEVANCE/APPLICATION**

Retrieval of prolonged dwell rIVCFs is not uniformly attempted and is often not successful due to lack of widespread expertise in advanced retrieval techniques. These devices with prolonged implantation time are prone to increased rates of complication. In accordance with a 2010 FDA safety communication, we strongly believe that rIVCFs that are no longer indicated should be removed. Identifying a time when advanced techniques will likely be necessary may improve overall retrieval of these devices.
Microbubble augmented ultrasound thrombolysis is feasible and may confer less risk of haemorrhage and irradiation than current thrombus removal strategies.

**RC214-05**  **PE II: Treatment Options for the IR and the PE Response Team**  
Monday, Nov. 30 9:25AM - 9:50AM Location: S404CD

Participants  
Robert A. Lookstein, MD, New York, NY (Presenter) Consultant, Johnson & Johnson; Consultant, Boston Scientific Corporation; Consultant, The Medicines Company

**LEARNING OBJECTIVES**  
View learning objectives under main course title.

**RC214-06**  **Unknown Case of the Session**  
Monday, Nov. 30 9:50AM - 10:15AM Location: S404CD

Participants  
Wael E. Saad, MBBCCh, Ann Arbor, MI (Presenter) Research Grant, Siemens AG; Consultant, Siemens AG; Consultant, Boston Scientific Corporation; Consultant, Medtronic, Inc; Consultant, Getinge AB; Consultant, Merit Medical Systems, Inc;

**LEARNING OBJECTIVES**  
View learning objectives under main course title.

**RC214-07**  **Efficacy of TIPS/Embolization for Gastric Varices**  
Monday, Nov. 30 10:15AM - 10:25AM Location: S404CD

Participants  
Janesh Lakhoo, BS, Chicago, IL (Presenter) Nothing to Disclose
Ron C. Gaba, MD, Chicago, IL (Abstract Co-Author) Nothing to Disclose

**PURPOSE**  
Gastric varices (GVs)- which occur in 5-35% of liver cirrhosis patients - may lead to severe bleeding and mortality rates ~25% at 2-years. Transjugular intrahepatic portosystemic shunt (TIPS) creation with/without variceal embolization serves to decompress and occlude varices in cases refractory to medical management. However, GVs may be difficult to treat with TIPS/embolization due to distance from TIPS shunt ("proximity" theory), large size resulting in competitive outflow with TIPS ("throughput" theory), and canalization of new feeders after embolization ("recruitment" theory). This study evaluated the efficacy of TIPS with or without embolization in decompressing or occluding GVs.

**METHOD AND MATERIALS**  
In this single center, retrospective observational study, 79 patients with GV bleeding were selected from a cohort of 303 patients who underwent TIPS from 1999-2014. Individuals with bare metal stent TIPS and patients who lacked post-TIPS imaging/endoscopic follow-up were excluded. Chart and imaging review were used to assess variceal types, feeders, and post-procedure cross-sectional imaging or endoscopic patency. The primary study outcome measure was imaging and/or endoscopic GV patency rate as a surrogate for clinical efficacy of TIPS/embolization.

**RESULTS**  
The final cohort consisted of 26 patients (M:F 16:10, median age 54 years, median MELD 16). GVs included GEV1 (10), GEV2 (2), IGV1 (3), IGV2 (2), and unspecified (9). TIPS were hemodynamically successful in 24/26 (92%) patients with median final portosystemic pressure gradient of 7 mm Hg. Multiple GV feeders (left/posterior/short gastric veins) were present in 62% (16/26) cases. embolization was performed in 75% (18/24). 13, 3, and 10 patients had imaging, endoscopic, or both imaging/endoscopic follow-up. The incidence of GV patency on post-TIPS follow-up was 77% (20/26) (78%/75% with/without embolization) at 129 days median follow-up time. The post-TIPS rebleeding incidence was 27% (7/26), and the 90-day mortality rate was 15% (4/26).

**CONCLUSION**  
In this study, most GVs showed persistent patency despite TIPS decompression and variceal occlusion, and rebleeding incidence was high. The findings suggest suboptimal efficacy for GV therapy, and indicate need for study of alternative/adjunctive approaches to GV treatment, such as balloon-occluded antegrade or retrograde obliteration.

**CLINICAL RELEVANCE/APPLICATION**  
TIPS/coil embolization may not optimally decompress or occlude gastric varices.

**RC214-08**  **Comparison of Balloon-occluded Retrograde Transvenous Obliteration (BRTO) using Ethanolamine Olate Iopamidol (EOI), BRTO Using Sodium Tetradecyl Sulfate (STS) Foam and Modified BRTO (mBRTO)**  
Monday, Nov. 30 10:25AM - 10:35AM Location: S404CD

Participants  
Young Hwan Kim, MD, Daegu, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Young Hwan Kim, Daegu, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Jung Hee Hong, Daegu, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Byoung Je Kim, Daegu, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Hye Min Son, Daegu, Korea, Republic Of (Presenter) Nothing to Disclose

**PURPOSE**
To compare the clinical outcomes of BRTO using EOI, BRTO using STS foam and mBRTO.

METHOD AND MATERIALS

From April 2004 to February 2015, Eighty-three patients underwent retrograde transvenous obliteration for gastric varices were analyzed retrospectively. BRTO with EOI was performed in 38 patients, BRTO with STS foam in 25 and mBRTO in 20. Among them, we obtained follow-up data in 66 patients. Recurrence of gastric varices was evaluated by follow-up endoscopy or CT. Medical records were reviewed for the clinical and technical efficacy. Statistical analyses were performed by Chi-square test, Fisher's exact test, Kruskal-Wallis test and Mann-Whitney U test.

RESULTS

Technical and clinical success was achieved in 79 patients (95.2%). As major complications, hemoglobinuria occurred in one patient with BRTO using EOI. Recurrence of gastric varices occurred more frequently in the mBRTO group (P<0.05). Recurrence of gastric varices occurred in 1 patient in BRTO using EOI group and 4 patients in mBRTO group with 3.3% and 22.2% of each expected one-year recurrence rates. There was no recurrence of gastric varices in all patients underwent BRTO using STS foam. Abdominal pain occurred more frequently in BRTO using EOI than BRTO using STS foam and mBRTO (P<0.05). Procedure time of mBRTO was shorter than the other two conventional BRTO groups (P<0.05).

CONCLUSION

Both BRTO using STS foam and mBRTO are better than BRTO using EOI for treatment of gastric varices in terms of complication and procedure time. However, mBRTO showed frequent recurrence of gastric varices during the long-term F/U rather than conventional BRTO.

CLINICAL RELEVANCE/APPLICATION

Modified BRTO is a time-saving procedure, but mBRTO has more recurrence rate. This article makes paying attention to perform mBRTO which has more recurrence rate of gastric varices.

RC214-09 Prediction for Improvement of Liver Function after B-RTO for Gastric Varices by Transient Elastography -To Manage Portosystemic Shunt Syndrome

Participants

Akira Yamamoto, Osaka, Japan (Presenter) Nothing to Disclose
Norifumi Nishida, MD, PhD, Osaka, Japan (Abstract Co-Author) Nothing to Disclose
Hiroyasu Morikawa, MD, Osaka, Japan (Abstract Co-Author) Nothing to Disclose
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Tohru Takeshita, Osaka, Japan (Abstract Co-Author) Nothing to Disclose
Yukimasa Sakai, MD, Osaka, Japan (Abstract Co-Author) Nothing to Disclose
Yukio Miki, MD, PhD, Osaka, Japan (Abstract Co-Author) Nothing to Disclose
Norifumi Kawada, Osaka, Japan (Abstract Co-Author) Nothing to Disclose

PURPOSE

To investigate the predictive factors including transient elastography (TE) using Fibroscan® for improvement in liver function after B-RTO for GV.

METHOD AND MATERIALS

We retrospectively analyzed 47 consecutive patients who were followed up for more than 3 months after B-RTO and who had undergone TE before B-RTO between January 2011 and December 2013. The correlation between change in liver function (total bilirubin, albumin, and prothrombin time) and baseline liver function values and the liver stiffness measurement (LSM) by TE using FibroScan® was evaluated by Pearson's correlation test. Receiver operating characteristic (ROC) curves were used to determine the cut-off values with the best sensitivity and specificity in discriminating between patients who experienced improved liver function and those who did not. To clarify the cut-off level, time interval from B-RTO to aggravation of esophageal varix (EV) was also analyzed.

RESULTS

Of the 47 enrolled patients, B-RTO was successfully performed in all patients (100%). The serum albumin was significantly improved at 3 months after B-RTO (3.60 vs. 3.80, p=0.001). There was a significant negative correlation between the change in serum albumin and the baseline LSM (r = -0.51, p<0.0001). The best cut-off point for LSM was ≤ 22.9 kilopascals (kPa) with a sensitivity and specificity of 76.5% and 69.2%, respectively, and an area under the curve of 0.79 for predicting which patients would experience improved albumin. In the patient with ≤ 22.9 kPa LSM, serum albumin levels improved significantly from before to 3 months after B-RTO (3.60 ± 0.46 vs. 3.90 ± 0.45 g/dl, p<0.0001). In the patient with ≤ 22.9 kPa LSM, serum albumin did not improve significantly from before to 3 months after B-RTO (3.50 ± 0.36 vs. 3.50 ± 0.40 g/dl, p=0.75). One year aggravation rate of EV after B-RTO was 9.5% in the patient with ≤ 22.9 kPa LSM, while 69.5% in the patient with > 22.9 kPa LSM.

CONCLUSION

The predictive factor for improvement in liver function after B-RTO was lower LSM (≤ 22.9 kPa) using TE. In the patients with ≤ 22.9 kPa LSM, aggravation rate of esophageal varices was very low.

CLINICAL RELEVANCE/APPLICATION

Predictor for improvement of liver function after B-RTO for gastric varices was identified by Transient Elastography.

RC214-10 BRTO-What Is It and When Should It Be Done

Participants

Norifumi Yamamoto, Osaka, Japan (Presenter) Nothing to Disclose
Yukio Miki, MD, Osaka, Japan (Abstract Co-Author) Nothing to Disclose
Yukimasa Sakai, MD, Osaka, Japan (Abstract Co-Author) Nothing to Disclose
Norifumi Nishida, MD, Osaka, Japan (Abstract Co-Author) Nothing to Disclose

PURPOSE

Monday, Nov. 30 10:45AM - 11:10AM Location: S404CD
Participants
Wael E. Saad, MBCh, Ann Arbor, MI (Presenter) Research Grant, Siemens AG; Consultant, Siemens AG; Consultant, Boston Scientific Corporation; Consultant, Medtronic, Inc; Consultant, Getinge AB; Consultant, Merit Medical Systems, Inc;

LEARNING OBJECTIVES
View learning objectives under main course title.

RC214-11  Chronic Venous Occlusions Treated with RFA

Monday, Nov. 30 11:10AM - 11:35AM Location: S404CD

Participants
Marcelo Guimaraes, Charleston, SC (Presenter) Consultant, Cook Group Incorporated; Consultant, Baylis Medical Company; Consultant, Terumo Corporation; Patent holder, Cook Group Incorporated

LEARNING OBJECTIVES
View learning objectives under main course title.

RC214-12  Wrap Up and Discussion

Monday, Nov. 30 11:35AM - 12:00PM Location: S404CD

Participants
RC250

Interventional Stroke Treatment: Practical Techniques and Protocols (An Interactive Session)
Monday, Nov. 30 8:30AM - 10:00AM Location: S402AB

ER

NR

IR

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50
Participants

Joshua A. Hirsch, MD, Boston, MA (Moderator) Shareholder, Intratech Medical Ltd
LEARNING OBJECTIVES

1) Describe the diagnostic evaluation and decision making algorithms leading to urgent endovascular treatment of acute stroke. 2)
Review endovascular techniques for the treatment of acute stroke from microcatheter set up to intraarterial thrombolysis to
mechanical thrombectomy. 3) Discuss case examples of endovascular treatment including patient selection, technique, and pitfalls.
ABSTRACT

Rapid advances in the evaluation, selection, treatment and management of the acute stroke patient necessitates an ongoing
educational event highlighing the newest information, techniques and strategies for obtaining the best outcomes for our patients.
In this session, all of these topics will be covered in a practical 'how to' and case based approach which is designed to help the
practitioner implement best practices. The course is useful for those performing imaging, treatment or both. Analysis of the latest
ongoing trials, devices and techniques will be presented. Endovascular tips and tricks will be discussed, as well as pitfalls in the
treatment of these patients.
Sub-Events
RC250A

A Birdseye View to the Interventional Approach to Acute Stroke Therapy

Participants
Allan L. Brook, MD, Bronx, NY (Presenter) Advisor, Johnson & Johnson Advisor, Medtronic, Inc
LEARNING OBJECTIVES

View learning objectives under main course title.
RC250B

Data, Data, and More Data: Endovascular Therapy Is the Proven Treatment for Large Vessel
Occlusion

Participants
David J. Fiorella, MD, PhD, Stony Brook, NY (Presenter) Institutional research support, Siemens AG; Institutional research support,
Sequent Medical, Inc; Research support, MicroVention Inc; Consultant, Medtronic, Inc ; Consultant, Cardinal Health, Inc;
Consultant, Penumbra, Inc; Owner, Vascular Simulations LLC; Owner, TDC Technologies; Owner, CVSL; ;
LEARNING OBJECTIVES

View learning objectives under main course title.
RC250C

Optimizing Patient Selection with Imaging

Participants
Ramon G. Gonzalez, MD, PhD, Boston, MA (Presenter) Nothing to Disclose
LEARNING OBJECTIVES

1) Understand the essential ischemic stroke physiology parameters that are essential in selecting patients for endovascular
treatment of a large vessel occlusion. 2) Be familiar with the imaging methods that can measure ischemic stroke physiology
parameters and their relative accuracy. 3) Use the best available evidence, recognize the optimal imaging approach to select
patients with acute ischemic stroke for endovascular treatment.
ABSTRACT

Properly selected patients with acute ischemic stroke caused by large vessel occlusion (LVO) may be effectively and safely treated
endovascularly with modern thrombectomy devices. We have developed a high-precision imaging tool for selecting such patients. It
is an experience and evidence-based clinical triage tool that uses advanced imaging to identify INDIVIDUAL patients most likely to
benefit from endovascular stroke therapy. It was based on over a decade of using advanced imaging (CT, CTA, CT perfusion, DWI,
MR perfusion) in acute stroke patients and a critical review of the literature and has been validated in clinical trials. The approach
focuses on answering the following key questions using modern imaging: 1. Is there a hemorrhage? Noncontrast CT 2. Is there an
occlusion of the distal ICA and/or proximal MCA? CTA 3. Is irreversible brain injury below a specific threshold (e.g. <70ml)? DWI
Perfusion imaging is not employed unless patients cannot undergo MRI, or they do not meet the criteria for intervention.
Investigations to understand the reasons for the unsuitability of perfusion CT to substitute for DWI have revealed theoretical and
practical shortcomings of CTP. A major problem is the low signal-to-noise (SNR) ratio of CT perfusion that results in a poor
contrast-to-noise (CNR) ratio in severely ischemic brain. In a comparison between DWI and CTP in over 50 consecutive patients
with LVA, Schaefer, et al. showed that the mean CNR of DWI was >4 while it was <1 for CTP derived CBF. The poor CNR results in
large measurement error: using Bland-Altman analyses it was found that the 95% confidence interval was ~+/- 50 ml for ischemic
lesion volume measurements in individual patients. The Cleveland Clinic adopted a nearly identical algorithm and their results were
published. They reported that after the new algorithm was adopted, there was a ~50% reduction in mortality and a ~3-fold
increase in good outcomes, despite a ~50% decrease in the number of procedures. A recent prospective observational trial at the


US-guided Interventional Breast Procedures (Hands-on)

Monday, Nov. 30 8:30AM - 10:00AM Location: E264

Participants

Jocelyn A. Rapelyea, MD, Washington, DC (Moderator) Consultant, General Electric Company
Margaret M. Szabunio, MD, Lexington, KY (Presenter) Nothing to Disclose
Shambhavi Venkataraman, MD, Boston, MA (Presenter) Nothing to Disclose
Angelique C. Floerke, MD, Washington, DC (Presenter) Consultant, CareFusion Corporation
Rachel F. Brem, MD, Washington, DC (Presenter) Board of Directors, iCAD, Inc Board of Directors, Dilon Technologies LLC Stock options, iCAD, Inc Stockholder, Dilon Technologies LLC Consultant, U-Systems, Inc Consultant, Dilon Technologies LLC Consultant, Dune Medical Devices Ltd
Karen S. Johnson, MD, Durham, NC, (karen.johnson2@dm.duke.edu) (Presenter) Research Consultant, Siemens AG
Nicole S. Lewis, MD, Washington, DC (Presenter) Nothing to Disclose
Kathleen R. Gundry, MD, Atlanta, GA (Presenter) Nothing to Disclose
Michael N. Linver, MD, Albuquerque, NM (Presenter) Scientific Advisory Board, Hologic, Inc; Scientific Advisory Board, Real Imaging Ltd

LEARNING OBJECTIVES

1) Describe the equipment needed for ultrasound guided interventional breast procedures. 2) Review the basic principles of ultrasound guidance and performance of minimally invasive breast procedures. 3) Practice hands-on technique for ultrasound guided breast interventional procedures.

ABSTRACT

This course is intended to familiarize the participant with equipment and techniques in the application of US guided breast biopsy and needle localization. Participants will have both basic didactic instruction and hands-on opportunity to practice biopsy techniques on tissue models with sonographic guidance. The course will focus on the understanding and identification of: 1) optimal positioning for biopsy 2) imaging of adequate sampling confirmation 3) various biopsy technologies and techniques 4) potential problems and pitfalls.
**SSC12**

**Vascular/Interventional (Emerging Technology in Interventional Radiology)**

Monday, Nov. 30 10:30AM - 12:00PM Location: E352

**IR**

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

**FDA** Discussions may include off-label uses.

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**Participants**

Ronald S. Arellano, MD, Boston, MA (Moderator) Nothing to Disclose
Charles T. Burke, MD, Chapel Hill, NC (Moderator) Nothing to Disclose

**Sub-Events**

**SSC12-01**  
**Histological Evaluation of Intraarterial SN-38-incorporating Micellar Nanoparticle in a Rabbit Tumor Model**

Monday, Nov. 30 10:30AM - 10:40AM Location: E352

Participants

Hideyuki Nishiofuku, Kashihara, Japan (Presenter) Research funded, Nippon Kayaku Co, Ltd
Toshihiro Tanaka, MD, Kashihara, Japan (Abstract Co-Author) Nothing to Disclose
Yasushi Fukuoka, Kashihara, Japan (Abstract Co-Author) Nothing to Disclose
Takeshi Sato, Kashihara, Japan (Abstract Co-Author) Nothing to Disclose
Tetsuya Masada, Kashihara, Japan (Abstract Co-Author) Nothing to Disclose
Kimihiko Kichikawa, MD, Kashihara, Japan (Abstract Co-Author) Nothing to Disclose

**PURPOSE**

Micellar nanoparticle is an innovative drug delivery system, which can effectively accumulate in tumor tissue, due to enhanced permeability and retention effect. In addition, micellar nanoparticle can directly deliver SN-38 which is a biological active metabolite of irinotecan. The purpose of this study was to evaluate the histological findings after intraarterial SN-38-incorporating micellar nanoparticle injection compared with intravenous injection in a rabbit liver tumor model.

**METHOD AND MATERIALS**

Eighteen rabbits with VX2 liver tumors were divided into two groups, IA group (9 rabbits) and IV group (9 rabbits). Micellar nanoparticles incorporating SN-38 (30mg/kg) were intraarterially injected through the left hepatic artery in the IA group or intravenously injected in the IV group. Immuno-histochemical analysis using TUNEL staining was conducted at 2 hours to identify apoptotic cells. Coagulative necrosis was examined by Hematoxylin-Eosin stain at 24 hours. Further, SN-38 concentrations in the tumor tissues were measured within 24 hours.

**RESULTS**

Apoptotic cells had already been detected at 2 hours in the IA group, while no apoptotic cells were detected in the IV group. The mean tumor necrosis ratios were 80% in the IA group, while 50% in the IV group. The IA group showed significantly higher free SN-38 concentrations in tumor tissues at all measurement points (P=0.003 at 3 minutes, 0.012 at 2 hours and 0.048 at 24 hours).

**CONCLUSION**

Intraarterial SN-38-incorporating micellar nanoparticle can induce apoptosis of the tumor cells at 2 hours and achieve high tumor necrosis rate at 24 hours with high SN-38 concentration in the tumors.

**CLINICAL RELEVANCE/APPLICATION**

In this study an innovative drug delivery system was evaluated using a rabbit liver tumor model. Intraarterial SN-38-incorporating micellar nanoparticle can induce apoptosis of the tumor cells and achieve high tumor necrosis rate in the tumors.

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**SSC12-02**  
**EW-7197, a Novel ALK5 Kinase Inhibitor, Prevents Tissue Hyperplasia after Bare Metallic Stent Placement in a Urethra Rat Model**

Monday, Nov. 30 10:40AM - 10:50AM Location: E352

Participants

Eun Jung Jun, PhD, Seoul, Korea, Republic Of (Presenter) Nothing to Disclose
Ho-Young Song, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Wei-Zhong Zhou, Nanjing, China (Abstract Co-Author) Nothing to Disclose
Jung-Hoon Park, MS, RT, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Jiaywei Tsao, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose

**PURPOSE**

To evaluate the efficacy and safety of an activin receptor-like kinase 5 inhibitor, EW-7197, in the prohibition of granulation tissue hyperplasia after bare metallic stent placement in a rat urethral model.

**METHOD AND MATERIALS**

Twenty-four male Sprague-Dawley rats were randomly divided into four groups and underwent bare metallic stent placement in the urethra. Then, the rats were injected intraperitoneally per day with 0.3 ml of saline in group A and with EW-7197 at a dose of 5 mg/kg in group B, 10 mg/kg in group C, and 20 mg/kg in group D for 8 weeks. Retrograde urethrographies were performed at 4
weeks and 8 weeks after the stent placement. The body weight of each rat was measured and blood samples were obtained from the inferior vena cava for the evaluation of serum ALT and AST levels at 8 weeks. A histologic examination regarding the number of epithelial layers, percentage of granulation tissue area, thickness of submucosal fibrosis, and inflammatory cell infiltration grade was performed in each rat. We further investigated the reduction of transforming growth factor (TGF)-β.

RESULTS

The follow-up urethropographies performed at 4 and 8 weeks after stent placement shows the stented urethra in groups C and D had larger lumens than in the control group A (p<0.001, p<0.05). The average numbers of epithelial layers and the mean percentage of granulation tissue area in groups C and D were significantly lower than in control group A (p<0.001). The average thickness of submucosal fibrosis was less in the 3 treated groups than in the control group A (p<0.001). The mean percentage of granulation tissue was significantly lower in group C and D, when compared with the control group A (p<0.05). The inflammatory cell infiltration was significantly higher in group C and D, when compared with the control group A (p<0.05). However, there was no significant difference among the four groups in terms of body weight and liver enzymes (p>0.05).

CONCLUSION

Intraperitoneal administration of EW-7197 was effective and safe for the prevention of granulation tissue hyperplasia after bare metallic stent placement in a rat’s urethra. Our study provided a basis for future clinical studies of patients with restenosis.

CLINICAL RELEVANCE/APPLICATION

EW-7197 is effective for the prevention of granulation tissue formation after bare metallic stent placement in a rat urethral model.

SSC12-03 Electrolytic Electroporation - E2 — A New Tissue Ablation Technology; Early Results and Clinical Implications

Monday, Nov. 30 10:50AM - 11:00AM Location: E352

Participants

Michael K. Stehling, MD, PhD, Offenbach, Germany (Presenter) Nothing to Disclose
Enric Guenter, Dipl Phys, Frankfurt, Germany (Abstract Co-Author) Nothing to Disclose
Liel Rubinsky, PhD, Berkeley, CA (Abstract Co-Author) Nothing to Disclose
Pedro Torrecillas, MD, Malaga, Spain (Abstract Co-Author) Nothing to Disclose
Franco Lugnani, MD, Trieste, Italy (Abstract Co-Author) Nothing to Disclose
Paul Mikus, DPhil, Coto De Caza, CA (Abstract Co-Author) Consultant, Interscience
Boris Rubinsky, PhD, Berkeley, CA (Abstract Co-Author) Nothing to Disclose

PURPOSE

We explore the hypothesis that combining reversible electroporation (RE) to permeabilize the cell membrane with electrolysis to electrochemically produce compounds that destroy permeabilized cells (combination abbreviated as - E2) is an effective new tissue ablation technique with the ability to spare extracellular matrix and sensitive structures like irreversible electroporation (IRE) but with significantly lower energy and much larger maximum ablation volumes.

METHOD AND MATERIALS

E2 studies on nine pigs were done with open surgery under ultrasound (US) imaging, with and without paralyzing anesthetics. Delivered with two electrodes, we tested the effects of different electroporation parameters and various doses of electrolysis on cell death. Treatment was administered to the liver, gall bladder, kidney, rectum and nerves. HandE and Mason's trichromatic stained tissues were histologically examined.

RESULTS

E2 protocols produce a variety of cell death forms depending on dose and combination of electroporation and electrolysis parameters. For instance, the cell death modality at the anode is different from that at the cathode. We find that we could repeatedly ablate volumes of up to 200 cm3 with two electrodes with a treatment time of less than five minutes and no use of muscle relaxants. E2 ablation can be monitored with ultrasound. The signature of tissue affected by reversible electroporation is different from that ablated by electrolysis, hypoechoic and hyperechoic, respectively.

CONCLUSION

The combination of electrolysis with reversible electroporation is a highly flexible, cellular-level, low energy tissue ablation method suitable for the creation of large and reproducible ablation. Compared to electrolysis alone, it is faster and has lower toxicity. Compared to IRE, it affords larger ablation zones, has comparable toxicity and lower requirements for anesthesia and muscle relaxants. EW-7197 is effective for the prevention of granulation tissue formation after bare metallic stent placement in a rat urethral model.

CLINICAL RELEVANCE/APPLICATION

The combination of electrolysis with electroporation (E2) is a novel, low energy, tissue selective ablation method which provides larger tissue ablation zones than IRE with the same low toxicity.

SSC12-04 MRI Image Guided Nanocarbon-Assisted Microwave Therapy (NAMT) Causing Cytotoxic Thermal Ablation of MK1 Breast Tumor Cells in SCID Mice

Monday, Nov. 30 11:00AM - 11:10AM Location: E352

Participants

Mark Desantis, DO, Northport, NY (Abstract Co-Author) Research Grant, Clean Technology International Corporation
Ana M. Franceschi, MD, New York, NY (Presenter) Nothing to Disclose
Wilbur B. Bowne, MD, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose
Thomas Daleassandro, MD, Northport, NY (Abstract Co-Author) Nothing to Disclose
Jonathan Gross, MD, New York, NY (Abstract Co-Author) Nothing to Disclose
Valmore Suprenant, MD, Setauket, NY (Abstract Co-Author) Nothing to Disclose
Atul Kumar, MD, Northport, NY (Abstract Co-Author) Nothing to Disclose
John A. Feretti, MD, Stony Brook, NY (Abstract Co-Author) Nothing to Disclose
Caitlin Dolan, Stony Brook, NY (Abstract Co-Author) Nothing to Disclose

PURPOSE
Evaluation of near real time MRI guided imaging of a spherical nanocarbon (Grafex) injected into MK1 breast carcinoma during microwave ablation. It is known that nanocarbon assisted microwave therapy (NAMT) increases the absorption of microwave energy, specifically into tumor cells. This study evaluated the use of MRI safe microwave probes and NAMT as primary treatment in MK1 breast tumor. Additionally, MRI near Real time imaging was performed during treatment.

METHOD AND MATERIALS
Severe combined immune deficient (SCID) isolated mice were injected with MK1 Breast carcinoma cells introduced into the dermis and allowed to grow to >1cm. In the 'treatment' group, nanocarbon and viscous carrier were injected into the tumors. Medwaves Aveecure generators with MRI safe temperature sensing microwave probes were used for thermal ablation, with short cycle power using 15 watts at 20 sec as baseline settings. Target temperature within the tumor was 65°C. MRI imaging was simultaneously performed with a 0.6T Fonar MRI using T1, T2 and gradient sequences.

RESULTS
Spherical nanocarbon provides a non toxic method of thermally ablating the tumor utilizing MRI safe microwave probe while allowing for imaging during the treatment. Over 90% of the mice responded to the treatment without significant toxic effects of the retained carbon within the dermis.

CONCLUSION
MRI guided imaging provided continuous monitoring of thermal ablation zones using spherical nanocarbon , with the conversion of microwave energy causing thermal ablation of cancer cells. By using shorter treatment times and lower power output of the microwave generator, NAMT reduces heat sink effect and surrounding tissue damage. Grafex NAMT appears to be not only successful in treatment of breast carcinoma, but also nontoxic in this small animal study. A larger study is under way.

CLINICAL RELEVANCE/APPLICATION
MRI image guided Nanocarbon-assisted microwave therapy using MRI safe microwave probes provides near real time evaluation of ablation zone size, evaluation of contracted tissue, shorter treatment times and apparent non-toxic treatment of human breast tumor cells, and may represent a powerful new tool in cancer therapy with near real time imaging.

SSC12-05 Optical Imaging-Monitored Intra-Esophageal Radiofrequency Hyperthermia-Enhanced Local Chemotherapy of Esophageal Cancers

Monday, Nov. 30 11:10AM - 11:20AM Location: E352

Participants
Yaoping Shi, MD, Seattle, WA (Presenter) Nothing to Disclose
Feng Zhang, MD, Seattle, WA (Abstract Co-Author) Nothing to Disclose
Jianfeng Wang, MD, Seattle, WA (Abstract Co-Author) Nothing to Disclose
Zhibin Bai, Seattle, WA (Abstract Co-Author) Nothing to Disclose
Longhua Qiu, Seattle, WA (Abstract Co-Author) Nothing to Disclose
Yonggang Li, MD, Suzhou, China (Abstract Co-Author) Nothing to Disclose
Xiaoming Yang, MD, PhD, Seattle, WA (Abstract Co-Author) Nothing to Disclose

PURPOSE
To investigate the possibility of using bioluminescent optical imaging to monitor intra-esophagus radiofrequency hyperthermia (RFH)-enhanced local chemotherapy of rat models with orthotopic esophageal squamous cancers (ESCs)

METHOD AND MATERIALS
Human ESC cells were transduced with lentivirus/luciferase. Orthotopic ESC masses were established by inoculating luciferase-ESC cells into cervical esophagus walls of nude rats via a specifically designed transesophageal approach. Twenty four rats with ESC cancers were divided into four study groups (n=6/group) receiving various treatments: i) combination therapy of intraesophageal MR imaging-heating-guideewire (MRiHG)-mediated RFH (420C) plus local chemotherapy (cisplatin and 5-fluorouracil); ii) chemotherapy-only; iii) RFH-only; and (iv) phosphate-buffered saline (PBS). Bioluminescent optical imaging and transcutaneous ultrasound imaging were used to follow up bioluminescence signal and size changes of tumors among the groups over a time period of two weeks, which were correlated with subsequent histology.

RESULTS
Optical imaging demonstrated a significantly decreased bioluminescence signal in the combination therapy group, compared to those in three control groups (0.51±0.18 VS 1.64±0.4 VS 3.18±0.9 VS 3.54±0.96, p<0.05). Ultrasound imaging showed the smallest tumor volumes of the combination therapy group, in comparison to those of other control groups (0.62±0.16 VS 1.25±0.19 VS 2.28±0.25 VS 2.64±0.26, p<0.05). Both imaging findings were confirmed by histologic correlation (Figure).

CONCLUSION
Optical imaging is a useful tool for monitoring intra-esophageal RFH-enhanced chemotherapy of ESCs, which may provide a new opportunity for efficient management of esophageal malignancies.

CLINICAL RELEVANCE/APPLICATION
Intra-esophageal RFH-enhanced chemotherapy of ESCs may provide a new opportunity for efficient management of esophageal malignancies.

SSC12-06 Radiofrequency Hyperthermia-Enhanced Local Chemotherapy of Pancreatic Cancers: Monitored by Dual Modality Imaging

Monday, Nov. 30 11:20AM - 11:30AM Location: E352
In-Vitro and In-Vivo Feasibility Study of a Glassfiber-Based MR-Safe Guidewire

METHOD AND MATERIALS

Lentivirus/luciferase-labeled rat pancreatic adenocarcinoma cells (DSL-6A/C1, 107) were subcutaneously inoculated into flanks of donor immunocompetent Lewis rats. We collected the subcutaneous tumor tissues from donor rats, and then transplanted the tissues into the pancreatic tails of recipient Lewis rats, to create orthotopic cancer models. Twenty-four rats with orthotopic pancreatic cancers were received various treatments in four groups: (i) combination therapy with intratumoral MR imaging- heating-guidewire (MRHG)-mediated local RFH (420C) plus local chemotherapy (Gem); (ii) chemotherapy-only; (iii) RFH-only; and (iv) phosphate- buffered saline (PBS). Tumors sizes were followed-up by ultrasound imaging at days 0, 7 and 14 after the treatments. Bioluminescence signals of the tumors were measured via a laparotomy approach. Imaging results were correlated with subsequent histology analysis.

RESULTS

Ultrasound imaging showed the smallest relative tumor volume in the combination therapy group compared to those in three control groups (0.62±0.18 VS 1.31±0.30, 1.61±0.28, 1.71±0.29, p<0.05). Optical imaging demonstrated a decrease of bioluminescence signals of tumors in the combination therapy group, in comparison to those of three control groups (0.18±0.06 VS 0.41±0.12 VS 0.89±0.26 VS 1.04±0.32), which were well correlated with histologic confirmation (Figure).

CONCLUSION

Local radiofrequency hyperthermia can enhance the regional chemotherapeutic effect on orthotopic pancreatic carcinomas, which has established the groundwork to develop new interventional oncological techniques for effective management of human pancreatic malignancies.

CLINICAL RELEVANCE/APPLICATION

Local radiofrequency hyperthermia can enhance the regional chemotherapeutic effect on orthotopic pancreatic carcinomas, which has established the groundwork to develop new interventional oncological techniques for effective management of human pancreatic malignancies.

SSC12-07 In-Vitro and In-Vivo Feasibility Study of a Glassfiber-Based MR-Safe Guidewire

METHOD AND MATERIALS

The MR-guidewires (GW) are composed of ultra-thin rod-shaped glass/aramid fibers embedded in epoxy-resin. MRI-visualization is ensured by metal-particles embedded in the epoxy-matrix. The shaft is coated with a hydrophilic surface. The tip is doped with tungsten-particles for X-ray visibility as a back-up option for conventional angiography. The standard/stiff GW measures 0.89 mm (0.035") in diameter and 260 cm in length. The micro-GW 0.36 mm (0.014") and 190 cm.After in-vitro testing in an synthetic abdominal aorta/visceral artery flow-model for visualization and handling, all GWs were used in 9 pigs (mean weight 65+/-5 kg). Catheterization of the iliac arteries, abdominal/thoracic aorta, visceral/renal arteries, iliac and inferior cava vein were performed in a clinical 1.5 T scanner using real-time interactive MR imaging (temporal resolution 0.2 s; FOV 150 mm; matrix 128x128). MR-guided interventions included balloon-dilatation and arterial/venous stent-deployment via the GWs. Visualization, handling, and time for catheterization of the vessel regions were assessed.

RESULTS

Real-time interactive MRI allowed clear visualization of the GW characterized by a continuous artifact of about 2 mm in diameter along the shaft as well as a tip marker artifact of 4.5 mm. Suitable handling combined with sufficient stiffness, adequate transfer of traction and torsion allowed precise and exact navigation toward target vessels (mean time for abdominal/thoracic aorta 4 s; visceral/renal arteries 10 s, and contralateral iliac arteries 36 s). All procedures were technically successful. No GW-associated complications occurred, esp. no breakage, disruption or thrombosis. Handling regarding stiffness, flexibility and guidance were similar to usual standard angiographic GWs.

CONCLUSION

Initial in-vitro und in-vivo results of a new dedicated MR-safe guidewire are the basis for further clinical application for endovascular MRI-guided interventions in humans.
RESULTS

The visualization was displayed on a standard IR monitor. The images were calibrated with respect to the geometrical specifications of the C-arm system so that the acquired CBCT and planned needle path were registered to the optical images. The visualization was displayed on a standard IR monitor.

METHOD AND MATERIALS

The 4 cameras pointed towards the isocenter of the C-arm in a pyramidal fashion. The live video streams were augmented with X-ray and CBCT imaging as well as with virtual graphics depicting the planned needle path drawn by the operator. The video cameras used for differentiating accuracy and DAPs across navigation techniques and operator background. The AR system consisted of 4 small video cameras integrated within the frame of the X-ray detector of the C-arm (Philips Allura) as shown in the attached figure.

PURPOSE

Aim of this study was to establish an online reconstruction for real time Magnetic Particle Imaging (MPI) and test it ex vivo on an angioplasty balloon catheter model. MPI is a new tomographic 4D imaging technique that allows to determine the spatial distribution of SPIOs at a time resolution of up to 46 Frames/s, technically allowing real time imaging. Therefore, in the future MPI might be a radiation free modality for catheter interventions. Until now, data could only be reconstructed and displayed after acquisition, limiting applications requiring direct feedback.

METHOD AND MATERIALS

Matrix compression techniques are used to reduce image reconstruction times on the available first commercial pre-clinical MPI scanner (Bruker) to achieve real time MPI images. The compression level is tuned in such a way that the reconstruction and the data acquisition are in the same time order. Reconstruction is always performed on the latest captured frame during the measurement achieving direct feedback even if delays in the signal chain occur or if reconstruction times are slower. The online reconstruction framework was tested in a stenosis model with a 6/12 mm balloon catheter. In- and deflating rates were 1800, 900 and 450 ml/min using Resovist as contrast agent. For estimation of image quality DSA served as gold standard.

RESULTS

Using the developed online reconstruction framework reconstruction rates of more than 60 frames/s for 3D MPI sequences are achieved. As this is faster than the acquisition rate of 46 frames/s it is possible to follow the object in real time with a latency of about 1s due to a delay in the data acquisition hardware. Even though the overall image quality was better using DSA all relevant image information for balloon catheter intervention could be obtained from MPI data.

CONCLUSION

We demonstrate an online reconstruction framework for 4D MPI Data. Even though image quality was better using DSA, the new framework gives the basis for future radiation free 4D catheter intervention using a static 3D MRI for anatomic information and 4D MPI for intervention guidance.

CLINICAL RELEVANCE/APPLICATION

Magnetic particle imaging is an emerging radiation free method, that in future, might be used for 4D catheter interventions.

SSC12-08  Online Catheter Tracking using Magnetic Particle Imaging

Monday, Nov. 30 11:40AM - 11:50AM Location: E352

Participants
Johannes M. Salamon, MD, Hamburg, Germany (Presenter) Nothing to Disclose
Martin Hofmann, Dipl Phys, Hamburg, Germany (Abstract Co-Author) Nothing to Disclose
Caroline Jung, Hamburg, Germany (Abstract Co-Author) Nothing to Disclose
Michael G. Kaul, Hamburg, Germany (Abstract Co-Author) Nothing to Disclose
Harald Ittrich, MD, Hamburg, Germany (Abstract Co-Author) Nothing to Disclose
Gerhard B. Adam, MD, Hamburg, Germany (Abstract Co-Author) Nothing to Disclose
Tobias Knopp, DIPLENG, Hamburg, Germany (Abstract Co-Author) Nothing to Disclose

PURPOSE

Aim of this study was to establish an online reconstruction for real time Magnetic Particle Imaging (MPI) and test it ex-vivo on an angioplasty balloon catheter model. MPI is a new tomographic 4D imaging technique that allows to determine the spatial distribution of SPIOs at a time resolution of up to 46 Frames/s, technically allowing real time imaging. Therefore, in the future MPI might be a radiation free modality for catheter interventions. Until now, data could only be reconstructed and displayed after acquisition, limiting applications requiring direct feedback.

METHOD AND MATERIALS

Matrix compression techniques are used to reduce image reconstruction times on the available first commercial pre-clinical MPI scanner (Bruker) to achieve real time MP images. The compression level is tuned in such a way that the reconstruction and the data acquisition are in the same time order. Reconstruction is always performed on the latest captured frame during the measurement achieving direct feedback even if delays in the signal chain occur or if reconstruction times are slower. The online reconstruction framework was tested in a stenosis model with a 6/12 mm balloon catheter. In- and deflating rates were 1800, 900 and 450 ml/min using Resovist as contrast agent. For estimation of image quality DSA served as gold standard.

RESULTS

Using the developed online reconstruction framework reconstruction rates of more than 60 frames/s for 3D MPI sequences are achieved. As this is faster than the acquisition rate of 46 frames/s it is possible to follow the object in real time with a latency of about 1s due to a delay in the data acquisition hardware. Even though the overall image quality was better using DSA all relevant image information for balloon catheter intervention could be obtained from MPI data.

CONCLUSION

We demonstrate an online reconstruction framework for 4D MPI Data. Even though image quality was better using DSA, the new framework gives the basis for future radiation free 4D catheter intervention using a static 3D MRI for anatomic information and 4D MPI for intervention guidance.

CLINICAL RELEVANCE/APPLICATION

Magnetic particle imaging is an emerging radiation free method, that in future, might be used for 4D catheter interventions.

SSC12-09  Augmented Reality on a C-arm System: A Preclinical Validation for Percutaneous Interventions

Monday, Nov. 30 11:50AM - 12:00PM Location: E352

Participants
John M. Racadio, MD, Cincinnati, OH (Presenter) Research Consultant, Koninklijke Philips NV; Travel support, Koninklijke Philips NV
Rami Nachabe, PhD, Best, Netherlands (Abstract Co-Author) Employee, Koninklijke Philips NV
Robert Homan, MSc, Best, Netherlands (Abstract Co-Author) Employee, Koninklijke Philips NV
Ross Schierling, BS, Cincinnati, OH (Abstract Co-Author) Research collaboration, Koninklijke Philips NV
Judy Racadio, Cincinnati, OH (Abstract Co-Author) Nothing to Disclose
Drazenko Babic, MD, Best, Netherlands (Abstract Co-Author) Employee, Koninklijke Philips NV

PURPOSE

To compare the navigational accuracy and radiation dose of image-guided percutaneous procedures performed with augmented reality (AR) with and without motion compensation (MC) versus cone beam CT with real-time fluoroscopy navigation (CBCTf) during needle localization of targets in a pig model.

METHOD AND MATERIALS

This was a prospective study in a pig model approved by the Institutional Animal Care and Use Committee. Two operators with different experience levels each localized 15 targets (bone fragments) approximately 7 cm deep in the paraspinal muscles of pigs using each of the 3 modalities. Accuracy (distance between needle tip and target) and radiation dose (DAP, Gy.cm2) were recorded for each procedure. Two-way analysis of variance (ANOVA) with interaction including Tukey's multiple comparison correction was used for differentiating accuracy and DAPs across navigation techniques and operator background. The AR system consisted of 4 small video cameras integrated within the frame of the X-ray detector of the C-arm (Philips Allura) as shown in the attached figure. The 4 cameras pointed towards the isocenter of the C-arm in a pyramidal fashion. The live video streams were augmented with X-ray and CBCT imaging as well as with virtual graphics depicting the planned needle path drawn by the operator. The video cameras were calibrated with respect to the geometrical specifications of the C-arm system so that the acquired CBCT and planned needle path were registered to the optical images. The visualization was displayed on a standard IR monitor.

RESULTS

There was no significant difference in accuracy between the three modalities (mean distance: 3.0±1.9 mm for CBCTf, 2.5±2.0 mm for MC, and 2.7±1.9 mm for AR) and the radiation dose was comparable (mean DAP: 244±125 mGy.cm2 for CBCTf, 240±120 mGy.cm2 for MC, and 248±132 mGy.cm2 for AR).
for AR, and $3.2\pm2.7\$ mm for AR with MC ($P=0.33$). There was, however, a significant difference in fluoroscopy radiation dose ($2.3\pm2.4\ Gy.cm^2$ for AR, $3.3\pm4.6\ Gy.cm^2$ for AR with MC, and $10.4\pm10.6\ Gy.cm^2$ for CBCTf ($P<0.05$)) and therefore in total procedural radiation dose ($12.6\pm5.3\ Gy.cm^2$ for AR, $13.6\pm7.4\ Gy.cm^2$ for AR with MC, and $20.5\pm13.4\ Gy.cm^2$ for CBCTf ($P<0.05$)).

CONCLUSION

Use of an AR system reduces radiation dose while maintaining navigational accuracy compared to CBCTf during image-guided percutaneous procedures in a pig model.

CLINICAL RELEVANCE/APPLICATION

Use of an augmented reality system reduces radiation dose while maintaining navigational accuracy compared to CBCT with real-time fluoroscopy guidance during image-guided percutaneous procedures in a pig model.
**Vascular Interventional Monday Poster Discussions**

**Monday, Nov. 30 12:15PM - 12:45PM Location: VI Community, Learning Center**

**VA IR**

AMA PRA Category 1 Credit ™: .50

**FDA** Discussions may include off-label uses.

**Participants**
Gretchen M. Foltz, MD, Saint Louis, MO (Moderator) Nothing to Disclose

**Sub-Events**

**VI220-SD-MOA1**

**Quantitative Analysis of the Flow Dynamics in Percutaneous Isolated Pancreatic Perfusion Therapy using CT during Arteriography**

Station #1

**Participants**
Satoru Murata, MD, Tokyo, Japan (Presenter) Nothing to Disclose
Shiro Onozawa, Tokyo, Japan (Abstract Co-Author) Nothing to Disclose
Daisuke Yasui, Tokyo, Japan (Abstract Co-Author) Nothing to Disclose
Tatsuo Ueda, MD, Tokyo, Japan (Abstract Co-Author) Nothing to Disclose
Fumie Sugihara, Tokyo, Japan (Abstract Co-Author) Nothing to Disclose
Shinichiro Kumita, MD, Tokyo, Japan (Abstract Co-Author) Nothing to Disclose
Takahiko Mine, Tokyo, Japan (Abstract Co-Author) Nothing to Disclose
Kenichi Suzuki, Tokyo, Japan (Abstract Co-Author) Nothing to Disclose
Mitsuo Satake, MD, PhD, Kashiwa, Japan (Abstract Co-Author) Nothing to Disclose

**PURPOSE**
To analyze pancreatic flow dynamics during percutaneous isolated pancreatic perfusion (PIPP).

**METHOD AND MATERIALS**
All experiments were approved by our institution’s Animal Experiment Ethics Committee. Fifteen pigs were divided into 5 groups, and PIPP was performed. Contrast media was circulated in an extracorporeal circuit through the pancreas at infusion rates of 12, 24, and 36 mL/min (groups 1, 2 and 3, respectively) in order to quantitatively evaluate pancreatic enhancement with computed tomography (CT) during arteriography. PIPP was performed in 2 additional groups at infusion rates of 12 and 24 mL/min without and with balloon occlusion of the anterior mesenteric artery (AMA) (groups 4 and 5, respectively). CT was performed before and during PIPP without AMA occlusion and during PIPP with AMA occlusion. The enhanced area was measured on CT axial images and summed to calculate the enhancement volume. The percentage of enhancement volume, relative to the volume of the whole pancreas, was compared in each case.

**RESULTS**
Without AMA occlusion, higher infusion rates significantly increased the enhancement volume of the pancreas (P = 0.039, Kruskal-Wallis test). The mean percentage of enhancement volume (groups 1, 2, and 3) was 60.3%, 72.6%, and 91.3%, respectively. Each enhancement area of the pancreases with AMA occlusion was significantly larger than the corresponding area without AMA occlusion (P = 0.031, Wilcoxon signed-rank test). The mean percentage with AMA occlusion (groups 4 and 5) was 92.7% and 95.9%, respectively.

**CONCLUSION**
Higher infusion rates, or infusion rates with AMA occlusion are suitable for pancreatic perfusion.

**CLINICAL RELEVANCE/APPLICATION**
High infusion rate and AMA occlusion will optimize the distribution of drugs to the pancreatic parenchyma in percutaneous isolated pancreatic perfusion therapy.

**VI221-SD-MOA2**

**Percutaneous Endobiliary Radiofrequency Ablation with Stent Implantation for Malignant Biliary Obstruction: A Preliminary Study on Two-Step Method**

Station #2

**Participants**
Hongyuan Liang, MD, Shenyang City, China (Presenter) Nothing to Disclose
Zaiming Lu, MD, Shenyang, China (Abstract Co-Author) Nothing to Disclose
Qiyong Guo, MD, Shenyang, China (Abstract Co-Author) Nothing to Disclose

**PURPOSE**
To report our Preliminary result of two-step method (Two-step method means the RFA and stenting asynchronously) for percutaneous endobiliary radiofrequency ablation with stent implantation for malignant biliary obstruction.

**METHOD AND MATERIALS**
Between June 2013 and June 2014, 12 patients with malignant obstructive jaundice underwent percutaneous endobiliary radiofrequency ablation (RFA) by HabibTM EndoHBP catheter combined with sequential treatment of biliary stent implantation. 3-5 days after Percutaneous biliary drainage (PTBD), PET-MR was used to display the lesions and intraluminal RFA was performed with
RESULTS
All the 12 patients tolerated well a total of 16 RFA procedures with 17 self-expandable metal stents placed. 5 patients suffered with hilar obstruction, the others with distal lesions. The reasons for biliary obstruction are cholangiocarcinoma(8/12), pancreatic cancer(3/12) and metastasis(1/12). The main postablative complication was pain which could be controlled by analgesics. One patient suffered fever and biliary infection, cured by antibiotics. Stent patency was 198 days (106-405). Median survival was 265 days (78-625) from the time of the first RFA in each patient.

CONCLUSION
With the utility of PET-MR, two-step method of Percutaneous intraluminal RFA combined with biliary stenting may be more feasible and effective therapeutic option for unresectable extrahepatic malignant biliary obstruction.

CLINICAL RELEVANCE/APPLICATION
(deal with endobiliary RFA for biliary obstruction) two-step method of Percutaneous intraluminal RFA sequential treatment of with biliary stenting may be more feasible and effective therapeutic option for unresectable extrahepatic malignant biliary obstruction.

METHOD AND MATERIALS
A principle of FSBB technique of the peripheral vascular imaging is a subtraction process between two images with subtle different b values. A protocol optimization was performed on the lower extremity of 10 healthy volunteers. Subsequently, the revised FSBB protocol parameters were applied to 40 chronic kidney disease (CKD) patients with arrhythmia, who complain intermittent claudication or have symptoms of lower limb ischemia. All the studies were performed on a 1.5T MRI system (EXCELART Vantage XGV Toshiba) equipped with a SPEEDER torso coil. FSBB imaging was performed as follows; T2*-weighted 3D gradient echo sequence, b value; difference between 0 and 0.1-0.4, and typical scan time=2-3min. The performance of FSBB on the lower extremity artery was assessed for the image contrast, as compared with unenhanced MRA techniques including time-of-flight (TOF) and Fresh Blood Imaging (FBI) using ECG-gated half-Fourier FSE MRA.

RESULTS
FSBB provided excellent anatomical depiction in arrhythmia at the lower limb arterial trees, especially in slow-flow and tortuous arterial branches. Selective visualization of the arterial stenosis or occlusion in the lower extremity was successfully achieved in all CKD patients with arrhythmia. The scan time of FSBB was almost reduced by half than that of FBI or TOF using ECG-gating technique.

CONCLUSION
FSBB technique is independent of ECG-gating and consequently shortens examination time so that it may provide a valuable procedure for diagnosis of peripheral vascular imaging. Selective visualization of the lower extremity artery in arrhythmia patients without contrast media is of increasing significance for an interventional procedure in our aging population.

CLINICAL RELEVANCE/APPLICATION
Visualization of the lower limb artery of arrhythmia patients without contrast material is quite difficult using conventional unenhanced MR angiography. FSBB imaging is a new clinical tool with the use of MR susceptibility difference between tissue and vessels. It has been proven to be useful for brain imaging. In this study, we extended the application of FSBB to the lower extremity to investigate if FSBB could provide an additional benefit outside the brain.

RESULTS

Participants
Jun Isogai, MD, Asahi, Japan (Presenter) Nothing to Disclose
Takashi Yamada, Hasuda, Japan (Abstract Co-Author) Nothing to Disclose
Jun Kaneko, Hasuda, Japan (Abstract Co-Author) Nothing to Disclose
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Soichiro Imori, Tokyo, Japan (Abstract Co-Author) Nothing to Disclose
Tomoko Miyata, Saitama, Japan (Abstract Co-Author) Employee, Toshiba Corporation

PURPOSE
To selectively visualize the lower extremity arteries of arrhythmia patients without contrast media by the use of a free-ECG-gating Flow-Sensitive Black Blood (FSBB) technique.

METHOD AND MATERIALS
A principle of FSBB technique of the peripheral vascular imaging is a subtraction process between two images with subtle different b values. A protocol optimization was performed on the lower extremity of 10 healthy volunteers. Subsequently, the revised FSBB protocol parameters were applied to 40 chronic kidney disease (CKD) patients with arrhythmia, who complain intermittent claudication or have symptoms of lower limb ischemia. All the studies were performed on a 1.5T MRI system (EXCELART Vantage XGV Toshiba) equipped with a SPEEDER torso coil. FSBB imaging was performed as follows; T2*-weighted 3D gradient echo sequence, b value; difference between 0 and 0.1-0.4, and typical scan time=2-3min. The performance of FSBB on the lower extremity artery was assessed for the image contrast, as compared with unenhanced MRA techniques including time-of-flight (TOF) and Fresh Blood Imaging (FBI) using ECG-gated half-Fourier FSE MRA.

RESULTS
FSBB provided excellent anatomical depiction in arrhythmia at the lower limb arterial trees, especially in slow-flow and tortuous arterial branches. Selective visualization of the arterial stenosis or occlusion in the lower extremity was successfully achieved in all CKD patients with arrhythmia. The scan time of FSBB was almost reduced by half than that of FBI or TOF using ECG-gating technique.

CONCLUSION
FSBB technique is independent of ECG-gating and consequently shortens examination time so that it may provide a valuable procedure for diagnosis of peripheral vascular imaging. Selective visualization of the lower extremity artery in arrhythmia patients without contrast media is of increasing significance for an interventional procedure in our aging population.

CLINICAL RELEVANCE/APPLICATION
Visualization of the lower limb artery of arrhythmia patients without contrast material is quite difficult using conventional unenhanced MR angiography. FSBB imaging is a new clinical tool with the use of MR susceptibility difference between tissue and vessels. It has been proven to be useful for brain imaging. In this study, we extended the application of FSBB to the lower extremity to investigate if FSBB could provide an additional benefit outside the brain.

RESULTS

Participants
Minzhi Xing, MD, New Haven, CT (Presenter) Nothing to Disclose
Hayley Olgane, DO, Pittsburgh, PA (Abstract Co-Author) Nothing to Disclose
Hyun S. Kim, MD, Atlanta, GA (Abstract Co-Author) Nothing to Disclose

PURPOSE
To compare the incidence of hepatocellular carcinoma (HCC) recurrence after orthotopic liver transplant (OLT) in patients treated with bridging locoregional therapy (LRT) vs. best supportive care and to identify factors which predict recurrence in a national
population study.

METHOD AND MATERIALS

The United Network for Organ Sharing (UNOS) database was used to identify patients with HCC who were listed for OLT between 2002 and 2013. Patients within Milan Criteria for whom an HCC Model for End-Stage Liver Disease (MELD) exception was approved were included. Tumor histopathological characteristics from available explant data were assessed. Chi square tests were used to compare categorical variables and t-tests to compare continuous variables. Kaplan-Meier estimation was used for survival analysis with log-rank test and Cox proportional hazard models to assess independent prognostic factors for OS.

RESULTS

Of 17291 patients with HCC who were listed for OLT, 14511 received OLT, mean age 57.4 years, 76.8% male; 3889 (26.8%) received bridging LRT. The overall incidence of post-OLT HCC recurrence was 6.7%; it was 3.6% (140/3889) in the bridging LRT group and 7.6% (813/10622) in those who did not receive LRT (p=0.11). Of the 14511 patients, 2794 had complete explant data available. Of these, 11.4% had microvascular invasion on explant pathology. The incidence of recurrence in patients with microvascular invasion was 29.4% (92/313), and in patients without microvascular invasion it was 11.9% (295/2481) (p=0.001). On multivariate analysis, HCC recurrence was found to be an independent and significant prognostic factor of post-transplant survival, p=0.001; HR=3.2 (1.6-14.2).

CONCLUSION

In a large-scale population study, the rate of post-transplant recurrence of HCC in OLT patients who received bridging LRT was significantly lower than in those who did not receive bridging LRT. Presence of microvascular invasion on explant pathology was found to predict incidence of HCC recurrence, and recurrence was an independent prognostic factor for prolonged post-OLT survival.

CLINICAL RELEVANCE/APPLICATION

In HCC OLT patients, microvascular invasion on explant predicts HCC recurrence, which is an independent prognostic factor for post-OLT survival.

V219-SD-MOAS

Assessment of the Reliability of 4D DSA Temporal Data

Station #5

Participants

Jimmy Xu, BS, Madison, WI (Presenter) Nothing to Disclose
Sebastian Schafer, Madison, WI (Abstract Co-Author) Consultant, Siemens AG
Gabe Shaughnessy, PhD, Madison, WI (Abstract Co-Author) Nothing to Disclose
Kevin Royalty, PhD,MBA, Hoffman Estates, IL (Abstract Co-Author) Employee, Siemens AG
Pengfei Yang, Beijing, China (Abstract Co-Author) Nothing to Disclose
Carolina Sandoval-Garcia, Madison, WI (Abstract Co-Author) Nothing to Disclose
Charles M. Strother, MD, Madison, WI (Abstract Co-Author) Research Consultant, Siemens AG Research support, Siemens AG
License agreement, Siemens AG

PURPOSE

4D DSA generates time-resolved 3D vascular volumes using current angiographic systems. Factors that may invalidate the temporal information have not been adequately evaluated. The two goals of this project were to determine the association between contrast reflux and physiologic waveforms, and to identify other factors that may corrupt physiologic waveforms.

METHOD AND MATERIALS

From an internal database, 34 studies from 17 patients, including normal exams (n=4), AVMs (n=15), and aneurysms (n=15), were selected based on available clinical correlates. Projections for 4D DSA reconstructions were evaluated for reflux (defined as either retrograde contrast flow in the artery injected or retrograde flow into arteries proximal to the injection site). 4D DSA volumes were reviewed using prototype software. Starting 3 arterial diameters distal to the injection site, flow waveforms were analyzed and categorized as either physiologic or corrupted. Physiologic waveforms were defined as having a regular interval between time to peaks, an equal full width/half max width, and at least 3 adjacent curves. Fisher’s Exact test was used to determine an association between physiologic waveforms and reflux.

RESULTS

Of the 34 cases, 23 (68%) had reflux and 11 (32%) did not. Of those with reflux, 17 (74%) had physiologic waveforms. There was no association between waveform characteristics and reflux (p=1). Of the 6 cases with reflux and corrupted waveforms, visual inspection showed that catheters were located ~1 cm proximal to a stenotic or tortuous segment, or near the carotid siphon or external/internal carotid artery bifurcation. Injection rates that drove contrast into the contralateral vertebral artery also had corrupted waveforms.

CONCLUSION

The presence or absence of physiologic waveforms was not associated with reflux. Catheter position and injection rate are two factors that can corrupt physiologic waveforms. These findings suggest that contrast reflux did not invalidate 4D reconstruction temporal information, and therefore quantitative analysis can often be made even with reflux, as flow waveforms remain physiologic.

CLINICAL RELEVANCE/APPLICATION

Measurement of blood flow based on 4D DSA seems to be feasible. The ability to obtain and recognize physiologic temporal information is a critical component of this process.
Minimally Invasive Treatment Options for Management of Angiomyolipoma

Participants
Amr S. Moustafa, MBCh, MSc, Birmingham, AL (Presenter) Nothing to Disclose
Ahmed K. Abdel Aal, MD, PhD, Birmingham, AL (Abstract Co-Author) Consultant, St. Jude Medical, Inc Consultant, Baxter International Inc Consultant, C. R. Bard, Inc
Jonathan R. Hinshelwood, MD, Homewood, AL (Abstract Co-Author) Nothing to Disclose
William A. Barret, MD, Birmingham, AL (Abstract Co-Author) Nothing to Disclose
Nathan W. Ertel, MD, Hoover, AL (Abstract Co-Author) Nothing to Disclose
Rachel F. Oser, MD, Birmingham, AL (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
Teaching points: 1- Review the incidence, presentation and complications of angiomyolipoma (AML). 2- Discuss the different imaging modalities used for the diagnosis AML including techniques used for the diagnosis of poor fat containing AML. 3- Discuss the endovascular management of AML. 4- Discuss the percutaneous ablation of AML. 5- Highlight the advantages of the interventional radiology based management for AML. 6- Highlight the outcomes and potential complications of the treatment of AML.

TABLE OF CONTENTS/OUTLINE

High-resolution Magnetic Resonance Angiography as an Assessment Tool for Vascularized Lymph Node Transfer

Participants
Alexander C. Kagen, MD, New York, NY (Abstract Co-Author) Speakers Bureau, Bayer AG
Joseph Dayan, MD, New York, NY (Abstract Co-Author) Nothing to Disclose
Erez Dayan, MD, New York, NY (Abstract Co-Author) Nothing to Disclose
Nishi Talati, MD, New York, NY (Abstract Co-Author) Nothing to Disclose
Jody Shen, MD, New York, NY (Presenter) Nothing to Disclose
Omid Khalilzadeh, MD, MPH, Boston, MA (Abstract Co-Author) Nothing to Disclose
Mark Smith, New York, NY (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
To educate the reader regarding primary and secondary lymphedema, and the current and evolving therapies for this disease, including vascularized lymph node transfer. To discuss the magnetic resonance angiography (MRA) protocol for imaging donor and recipient soft tissue and vascular anatomy, highlighting pertinent findings. To illustrate expected imaging findings in the pre and post-operative settings, as well as complications and common pitfalls relevant to the surgeon.

TABLE OF CONTENTS/OUTLINE
Lymphedema: Etiology/pathophysiology, Epidemiology, Medical and non-surgical treatments, Surgical management of lymphedema, Indications and Procedure, Imaging assessment, Role of MRA, MRA protocol, Pre-operative approach, Lymph nodes, Soft tissue anatomy and limb volumes, Venous and arterial anatomy, Lymphatic anatomy, Post-operative approach, Flap viability, Lymph node assessment, Soft tissue anatomy and limb volumes, Venous and arterial anatomy.
**VI223-SD-MOB1**

**Bowel Interposition is No Longer an Obstacle in MR-guided High-intensity Focused Ultrasound Ablation of the Uterus**

**Station #1**

**Participants**

Gretchen M. Foltz, MD, Saint Louis, MO (Moderator) Nothing to Disclose

**Purpose**

To know the influences of bowel interposition on procedure feasibility and to evaluate the effectiveness of bowel manipulation technique in MR-guided high-intensity focused ultrasound (MR-HIFU) ablation of the uterus

**Method and Materials**

A total of 375 screening MR exams and 206 MR-HIFU ablations for uterine fibroid and/or adenomyosis performed from August 2010 to March 2015 were retrospectively analyzed. Influences of bowel interposition on procedure feasibility were assessed by comparing pass rates of overall/bowel-interposed cases before and after adopting bowel manipulation technique that consisted of sequential bladder filling, rectal gel filling and bladder emptying (ie, BRB maneuver). In cases where BRB maneuver were adopted, success rate and details of the technique were reviewed. Risk factors for technical failure were also assessed (age, BMI, disease type, uterine size, uterine configuration, GnRH pretreatment; logistic regression analysis).

**Results**

Overall pass rates of pre-BRB and post-BRB periods were 59.0% (98/166) and 71.7% (150/209) (P=0.001), and corresponding rates in bowel-interposed cases were 5.4% (2/37) and 72.9% (43/59; failures due to other reasons) (P<0.001), respectively. BRB maneuver was adopted in 60 cases and successfully established safe acoustic windows in 95.0% (57/60). Bladder filling/emptying was repeated 1.7±1.0 (1-5) times and the amount of gel used was 180±48.5 (100-400) mL. Additional time taken for BRB maneuver was 12.7min in average. In 3 cases, manual compression of the upper bladder margin during bladder emptying was necessary, and bladder re-filling and through-the-bladder sonication was performed in 8 cases. Regarding through-the-bladder sonication as technical failure (ie, technical success rate=81.7%), a small uterine size turned out to be the only independent risk factor for BRB failure (B=0.093, P=0.021). Uterine sizes of success and failure cases were 101.8±15.2mm and 84.6±10.9mm, respectively (P=0.001).

**Conclusion**

Owing to high effectiveness of the bowel manipulation technique, bowel interposition may have little influence on the procedure feasibility of MR-HIFU ablation of the uterus. However, the cases with small uterus should be screened with caution.

**Clinical Relevance/Application**

Bowel interposition in screening MR exams of MR-HIFU ablation of the uterus should not be used as an exclusion criterion any longer, except in cases with small size of the uterus.

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**VI224-SD-MOB2**

**Quasi Static Ultrasound Elastography Characterization of Thrombus Maturation in the Aneurysmal Sac after Embolization of Endoleaks with Chitosan Gels**

**Station #2**

**Participants**

Husain M. Alturkistani, MD, Montreal, QC (Presenter) Nothing to Disclose

Antony Bertrand-Grenier, Montreal, QC (Abstract Co-Author) Nothing to Disclose

Elie Saloum, MSc, BEng, Montreal, QC (Abstract Co-Author) Nothing to Disclose

Guy Cloutier, PhD, Montreal, QC (Abstract Co-Author) Nothing to Disclose

Sophie Lerouge, Montreal, QC (Abstract Co-Author) Nothing to Disclose

Gilles P. Soulez, MD, Montreal, QC (Abstract Co-Author) Speaker, Bracco Group Speaker, Siemens AG Research Grant, Siemens AG Research Grant, Bracco Group Research Grant, Cook Group Incorporated Research Grant, Object Research Systems Inc

**Purpose**

To study with quasi static ultrasound elastography (QSUE) the maturation of thrombus and the mechanical properties of embolizing gels after endoleak embolization following aneurysm endovascular repair (EVAR)

**Method and Materials**

Common iliac artery aneurysms were created on 9 Mongrel dogs (18 iliac arteries). Then EVAR were performed with creation of a Type I endoleak. Two types of embolization gels [Chitosan (Chi) or Chitosan-Sodium-Tetradecyl-Sulfate (Chi-STS)] were injected equally in the aneurismal sac to seal the endoleak and promote healing. Aneurysms healing and endoleak evolution were followed by
Doppler ultrasound and QSUE at 1-week, 1-month, 3-months and for 3 dogs at 6-months. At sacrifice, DSA, CT-scan and macroscopic and histological analyses were done to identify residual endoleaks (DSA, CT-scan) and segment different regions of interests (ROI) (thrombus, Chi and Chi-STS gel). Elasticity values expressed as strain in percentage were obtained by QSUE and compared between ROIs and during time evolution.

RESULTS

Residual endoleaks were observed at sacrifice in 10 out of 18 aneurismal sacs. There was no significant evolution of thrombus elasticity over time (median for thrombus: 0.12, 0.12, 0.13 and 0.13% at 1-week, 1-month, 3-months and 6-months respectively). The strain values of Chi gel were similar to that of thrombus (median= 0.18, 0.19, 0.13 and 0.27 at 1-week, 1-month, 3-months and 6-months respectively) ($P=0.58$ at 3-month). Chitosan-STS found to be more solid than thrombus at 1-week ($P=0.04$). The strain values of chitosan-STS (0.06, 0.06, 0.09 and 0.13 % at 1-week, 1-month, 3-months and 6-months respectively) are lower than chitosan ($P=0.02$ at 1 month). At 6-months, we notice a degradation of chitosan and chitosan-STS with higher strain values.

CONCLUSION

QSUE was not able to show thrombus maturation post-EVAR. However, it was useful to characterize the elasticity of embolizing gels and their degradation over time.

CLINICAL RELEVANCE/APPLICATION

Quasi-static elastography (QSUE) can be useful after endoleak embolization to assess the mechanical properties of embolizing gels.

VI225-SD-MOB3 Usefulness of the Synchronism Subtraction Method at CT Angiography for Dialysis Patients with Peripheral Arterial Diseases

Station #3

Participants
Noritaka Noda, Hiroshima, Japan (Presenter) Nothing to Disclose
Takanori Masuda, Hiroshima, Japan (Abstract Co-Author) Nothing to Disclose
Naoyuki Imada, Hiroshima, Japan (Abstract Co-Author) Nothing to Disclose
Takayuki Oku, Hiroshima, Japan (Abstract Co-Author) Nothing to Disclose
Tomoyasu Sato, Hiroshima, Japan (Abstract Co-Author) Nothing to Disclose
Kazuo Awai, MD, Hiroshima, Japan (Abstract Co-Author) Research Grant, Toshiba Corporation; Research Grant, Hitachi, Ltd; Research Grant, Bayer AG; Research Grant, DAIICHI SANKYO Group; Medical Advisor, DAIICHI SANKYO Group; Research Grant, Eisai Co. Ltd; Research Grant, Nemoto-Kyouindo; ; ; ;
Yukari Yamashita, Hiroshima, Japan (Abstract Co-Author) Nothing to Disclose

PURPOSE

In peripheral arterial diseases (PAD) patients undergoing computed tomography angiography (CTA) of the lower extremities, intravascular contrast enhancement must be adequate for accurate evaluation of the distribution and degree of the lesions. However, it is difficult to evaluate the calcified lesions through CTA in dialysis patients with PAD. One method of evaluation is the synchronism subtraction method with non-enhancement and enhancement images by synchronizing the X-ray orbit. This method can diagnose the stenosis lesion within the calcified vessel without the blooming artifact. This study was performed to compare the detecting of stenosis lesions of the lower-extremity artery by synchronism subtraction CTA (SSCTA) and by digital subtraction angiography (DSA).

METHOD AND MATERIALS

Helical scans of the SSCTA were performed using 64-detector CT (GE VCT with tube voltage 100kVp, tube current 200mA~700mA, detector configuration 32 x 1.25mm, rotation time 0.4s/r, helical pitch 0.516). 84 patients underwent CT and DSA. The vascular tree was divided into 5 segments. The reader independently reviewed the axial scans, multi-planar oblique, three-dimensional (maximum intensity projection and volume rendering) and subtraction reconstruction images to assess stenosis in the vessel.

RESULTS

25 patients could be evaluated without SSCTA in dialysis patients. In 84 patients, 420 segments were evaluated. Compared with DSA, the sensitively, specificity, PPV, NPV and diagnostic accuracy for SSCTA were 89.2%, 81.2%, 94.3%, 68.4% and 87.4% respectively.

CONCLUSION

SSCTA shows potential for diagnosing stenosis lesions within calcified vessel walls of dialysis patients with PAD.

CLINICAL RELEVANCE/APPLICATION

SSCTA can aid in diagnosis of stenosis lesions in calcified vessel walls of dialysis patients.
PURPOSE

The ill-defined borders in infiltrative hepatocellular carcinoma (HCC) and the sheer number of lesions in multifocal HCC can pose a challenge in response assessment after Transarterial Chemoembolization (TACE) with traditional methods (i.e. RECIST, mRECIST, WHO, EASL). Our preliminary study investigates the feasibility of whole liver volumetric enhancement quantification to measure treatment response and predict survival.

METHOD AND MATERIALS

From 2000 to 2014, 68 HCC patients with infiltrative or multifocal growth were retrospectively included and underwent MRI before and 1 month after their first TACE. For each session separately the whole liver was segmented and pre-contrast and arterial phase T1 sequences were subtracted. Viable tumor was identified in voxels enhancing above 2 times the standard deviation of enhancement inside a region of interest (ROI) placed in non-tumorous liver parenchyma, as previous work has shown to correlate with pathology. Hyperenhancing volume was noted in percent relative to the whole liver volume and compared to overall survival (OS). Kaplan-Meier analysis with log-rank test and Cox regression were performed. A threshold at 35% reduction between baseline and follow-up MRI was used to separate responders from non-responders.

RESULTS

Mean age was 63.3 years, 77.9% of patients were male and 64.7% had portal venous invasion. 33.8% of patients showed infiltrative growth pattern only, 33.8% infiltrative with solid parts and 32.4% multifocal HCC (>20 lesions). There was a statistically significant difference between responders and non-responders (p=0.011). The hazard ratio of death for responders was 0.336 (95%CI 0.139-0.810). Responders (14.7% of the patients) had an OS of 21.0±7.0 months, whereas non-responders (85.3%) had an OS of 6.8±1.4 months. Responders had a mean 57.8% decrease in enhancing volume, whereas non-responders on average had a 19.1% increase.

CONCLUSION

Our preliminary findings indicate that whole liver volumetric enhancement quantification on MRI can be used as an imaging biomarker for tumor response and survival in infiltrative and multifocal HCC that evades standard assessment methods.

CLINICAL RELEVANCE/APPLICATION

Response assessment after TACE for infiltrative and multifocal HCC by whole liver volumetric enhancement quantification is possible and can predict survival.

TABLE OF CONTENTS/OUTLINE

CT Angiography and 3-D Imaging of Aortoiliac Occlusive Disease: Collateral Pathways in Leriche Syndrome

Participants
Sameer Ahmed, MD, Baltimore, MD (Abstract Co-Author) Nothing to Disclose
Siva P. Raman, MD, Baltimore, MD (Presenter) Nothing to Disclose
Elliot K. Fishman, MD, Owings Mills, MD (Abstract Co-Author) Research support, Siemens AG Advisory Board, Siemens AG Research support, General Electric Company Advisory Board, General Electric Company Co-founder, HipGraphics, Inc

TEACHING POINTS

Leriche syndrome represents atherosclerotic occlusive disease of the abdominal aorta and/or iliac arteries. This educational exhibit will review the pathophysiology and CT angiographic appearance of Leriche syndrome, and will utilize a combination of 3-D images and medical illustrations to demonstrate a variety of collateral pathways that can develop with aortic or iliac artery occlusions.

TABLE OF CONTENTS/OUTLINE

Background and pathophysiology of aortoiliac occlusion CT Angiography and 3-D technique Collateral pathways following aortoiliac occlusion Case examples (both illustrations and 3-D images) Treatment Conclusion

Honored Educators

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

Elliot K. Fishman, MD - 2012 Honored Educator
Elliot K. Fishman, MD - 2014 Honored Educator
LEARNING OBJECTIVES

1) To learn the indications for image-guided ablation and transcatheter-based therapies for patients with HCC. 2) To understand the potential limitations, pitfalls, side effects and toxicities associated with ablative and transcatheter therapies for patients with HCC. 3) To know the results, imaging responses and survival benefit of various ablative and transcatheter therapies. 4) To know the future ablative and transcatheter therapies and understand their potential. 5) To learn the various combination therapies available and undergoing clinical evaluation for HCC.

ABSTRACT

Sub-Events

Participants
Riccardo A. Lencioni, MD, Pisa, Italy (Moderator) Nothing to Disclose

LEARNING OBJECTIVES

1) Recognize the increasing incidence of HCC in the Western Hemisphere. 2) Learn about scoring the cirrhosis and staging the cancer. 3) Identify sorafenib as the standard care treatment for advanced HCC.

Participants
Ghassan K. Abou-Alfa, MD, New York, NY (Presenter) Research Grant, Abbott Laboratories; Research Grant, Amgen Inc; Research Grant, AstraZeneca PLC; Research Grant, Bayer AG; Research Grant, Eli Lilly and Company; Research Grant, Exelixis, Inc; Research Grant, F. Hoffmann-La Roche Ltd; Research Grant, Immunomedics, Inc; Research Grant, Incyte Corporation; Research Grant, Momenta Pharmaceuticals; Research Grant, Myriad Genetics, Inc; Research Grant, Novartis AG; Research Grant, OncoMed Pharmaceuticals, Inc; Research Grant, Polaris Group; Research Grant, Visc Therapeutics, LLC; Consultant, Aduro BioTech, Inc; Consultant, Astellas Group; Consultant, Onxeo SA; Consultant, Boston Scientific Corporation; Consultant, Boston Therapeutics, Inc; Consultant, Bristol-Myers Squibb Company; Consultant, CASI Pharmaceuticals Inc; Consultant, Celgene Corporation; Consultant, Cipla Ltd; Consultant, Eli Lilly and Company; Consultant, Gilead Sciences, Inc; Consultant, IntegraGen SA; Consultant, Merck & Co, Inc.; Consultant, MeriMed Pharmaceuticals, Inc; Consultant, Momenta Pharmaceuticals; Consultant, Novartis AG; Consultant, Onxeo SA; Consultant, AbbVie Inc; Consultant, sanofi-aventis Group; Consultant, Silenseed Ltd; Consultant, SillaJen, Inc; Consultant, Visc Therapeutics, LLC

PURPOSE

The new Hong Kong Liver Cancer (HKLC) staging offers 9-stage and 5-stage classification for survival and treatment allocation for hepatocellular carcinoma (HCC), thought to be superior to the Barcelona Clinic Liver Cancer (BCLC) staging. A known limitation of the HKLC staging is the need for validation in non-HBV patient cohort. The purpose of this study is to compare the 9-stage HKLC against BCLC staging in a North American cohort and then identify any needs for improvement.

METHOD AND MATERIALS

968 HCC patients at a single institution who underwent TACE were retrospectively reviewed. 890 had sufficiently complete record to calculate the 9-stage HKLC and BCLC stages. Overall survival (OS) from date of first TACE to death or last note date was recorded. The performances of the HKLC and BCLC systems were compared through homogeneity, survival discrimination, monotonicity of gradients, and reduction in error of survival prediction. The staging systems were evaluated through Kaplan-Meier
(KM) estimate, Cox model's likelihood ratio (LHR), linear trend (LT), Harrell's C, Akaike's information criterion (AIC), and % error reduction in survival.

RESULTS
The HCC etiologies in this cohort included 132 (14.8%) hepatitis B, 427 (48.0%) hepatitis C, 254 (28.5%) alcoholic, 60 (7.8%) NASH, and 60 (6.7%) no identifiable cause (some patients with overlapping etiologies). Median OS in months for HKLC were I (62.6), IIa (35.8), IIb (24.3), IIIa(12.3), IIIb (10.9), IVa (11.0), IVb (4.3), Va (10.5), and Vb (2.7), notable for similarity in OS among a few stages. Median OS for BCLC were A (51.6), B (24.3), C (12.2), and D (4.3). The 9-stage HKLC performed better on all statistical measures. Better homogeneity was found for HKLC (LHR: 249) than BCLC (LHR: 119). Superior survival discrimination was shown for HKLC (C=0.72, AIC=6200) than BCLC (C=0.64, AIC=6320). Monotonicity was better in HKLC (LT: 261) than in BCLC (LT: 111). Reduction in error of prediction for HKLC was 15.9% while BCLC was 11.8%.

CONCLUSION
The 9-stage HKLC staging system outperformed the BCLC staging system as a prognostic classification system on overall statistical measures, but similarity in survival for stages IIIa/b, IVa, and Va should be further explored and addressed.

CLINICAL RELEVANCE/APPLICATION
The HKLC staging system may become the next HCC staging system of choice after addressing some of the identified issues and completing further validations.

VSIO21-03  TACE Techniques, Indications, and Results: Western Perspective

Monday, Nov. 30 2:00PM - 2:20PM Location: S406B

Participants
Jean-Francois H. Geschwind, MD, Westport, CT (Presenter) Researcher, BTG International Ltd; Consultant, BTG International Ltd; Researcher, Koninklijke Philips NV; Consultant, Koninklijke Philips NV; Researcher, Guerbet SA; Consultant, Guerbet SA; Consultant, Terumo Corporation; Consultant, Threshold Pharmaceuticals, Inc; Consultant, PreScience Labs, LLC; Researcher, Boston Scientific Corporation; Consultant, Boston Scientific Corporation

LEARNING OBJECTIVES
1) To understand the indications for TACE and describe the various technical issues and clinical results of TACE.

VSIO21-04  Does DEB-TACE Enhance the Local Effect of IRE? Imaging and Histopathological Evaluation in a Porcine Model

Monday, Nov. 30 2:20PM - 2:30PM Location: S406B

Participants
Peter Isfort, MD, Aachen, Germany (Presenter) Nothing to Disclose
Philip Rauen, Aachen, Germany (Abstract Co-Author) Nothing to Disclose
Hong-Sik Na, MD, Aachen, Germany (Abstract Co-Author) Nothing to Disclose
Nobutake Ito, MD, Yokohama, Japan (Abstract Co-Author) Nothing to Disclose
Christoph Wilkmann, DIPLENG, Aachen, Germany (Abstract Co-Author) Nothing to Disclose
Christiane K. Kuhl, MD, Bonn, Germany (Abstract Co-Author) Nothing to Disclose
Philipp Bruners, MD, Aachen, Germany (Abstract Co-Author) Nothing to Disclose

PURPOSE
Irreversible electroporation (IRE) is associated with a hypervascular penumbra of vital temporarily damaged tissue due to reversible electroporation. Transarterial treatment of this penumbra could increase local efficacy of IRE. We conducted an in-vivo trial on swine to compare the ablation volumes of an IRE/DEB-TACE combination vs. IRE-only.

METHOD AND MATERIALS
Nine swine underwent IRE in one liver lobe and DEB-TACE immediately followed by IRE in a different liver lobe. For DEB-TACE, 100-300 µm beads (DC-Beads®) were loaded with 50mg doxorubicin. For IRE, the NanoKnife® was used with two IRE electrodes according to the vendor's recommended protocol. After one day (n=3), three days (n=3) and seven days (n=3) animals were sacrificed, and ablation volumes were evaluated histopathologically. Imaging follow-up was performed using contrast-enhanced CT and MRI. Lesion volumes were measured one day (n=9), three days (n=6) and 7 days (n=3) after the procedure.

RESULTS
Mean histopathological ablation volume of IRE/DEB-TACE combination lesions after one, three and seven days were 15.7 ± 11.1 ml, 11.8 ± 9.3 ml and 4.2 ± 1.4 ml. Mean histopathological ablation volumes of IRE-only lesions after one, three and seven days were 7.2 ± 4.5 ml, 4.0 ± 1.0 ml and 1.7 ± 1.5 ml. In intra-individual comparison the ablation volumes of the IRE/DEB-TACE combination group were on average 199.6 %, 163.4% and 98.5% larger than IRE-only lesions after one, three and seven days.

CONCLUSION
Combination of IRE followed by DEB-TACE resulted in larger ablation volumes compared to IRE alone suggesting that local efficacy of IRE can be enhanced by post-IRE DEB-TACE.

CLINICAL RELEVANCE/APPLICATION
Results suggest that local efficacy of IRE can be enhanced when additional DEB-TACE is performed in the target liver segment after ablation.

VSIO21-05  TACE Techniques, Indications, and Results: Eastern Perspective

Monday, Nov. 30 2:30PM - 2:50PM Location: S406B

Participants
LEARNING OBJECTIVES

1) To describe the various techniques and approaches used in TACE treatment. 2) To understand the indications and results of TACE in the treatment of HCC. 3) To discuss differences and similarities between Eastern and Western approaches in TACE.

VSIO21-06  Anti-tumor Effects of TAE Administered in Combination with Sorafenib in a Rabbit VX2 Liver Tumor Model

Monday, Nov. 30 2:50PM - 3:00PM Location: S406B

Participants
Yuki Tomozawa, MD, Otsu, Japan (Presenter) Nothing to Disclose
Norihisa Nitta, MD, Kyoto, Japan (Abstract Co-Author) Nothing to Disclose
Shinichi Ohta, MD, PhD, Otsu, Japan (Abstract Co-Author) Nothing to Disclose
Shobu Watanabe, MD, Otsu, Japan (Abstract Co-Author) Nothing to Disclose
Akinaga Sonoda, MD, PhD, Otsu, Japan (Abstract Co-Author) Nothing to Disclose
Ayumi N. Seko, Otsu, Japan (Abstract Co-Author) Nothing to Disclose
Keiko Tsuji, Chicago, IL (Abstract Co-Author) Nothing to Disclose
Kiyoji Murata, MD, Otsu, Japan (Abstract Co-Author) Nothing to Disclose

PURPOSE

A number of studies have been reported that a combination of Sorafenib with TACE has been a more effective treatment than Sorafenib or TACE alone in addition to being tolerable. Using a VX2 liver tumor model, we investigated the most suitable timing parameters when using Sorafenib to enhance the anti-tumor effects of TAE.

METHOD AND MATERIALS

We then performed the combination treatment with Sorafenib and TAE on the four groups in the according ways; Group 1(TAE prior to administration of Sorafenib), Group 2(TAE on the second day after administration of Sorafenib), Group 3(TAE on the fourth day after administration of Sorafenib) and Group 4(TAE after the end of administrating Sorafenib). Sorafenib (40mg/day) was orally administered for consecutive 7 days starting on the day two week after tumor implantation. The anti-tumor effects were assessed by comparing the pre- and post-treatment tumor volumes measured on a contrast-enhanced CT scans and by immuno-histochemical analysis of the number of intra-tumoral vessels two weeks after the treatment.

RESULTS

Among the four groups, the tumor growth rate tended to be lower in Group 1 and Group 2 than in Group 3 and Group 4. The difference between Group 1 and Group 3 was significant. The number of CD31-positive intra-tumor vessels in specimens tended to be higher in Group 3 than in the other groups, although there was no significant difference.

CONCLUSION

We suggest that the ideal time of TAE is prior to or early after commencement of administration Sorafenib.

CLINICAL RELEVANCE/APPLICATION

To date, limited data has focused on the timing parameters when Sorafenib is combined with TACE.

VSIO21-07  Y90 Radioembolization: What We Know, and What We Need to Know

Monday, Nov. 30 3:00PM - 3:20PM Location: S406B

Participants
Riad Salem, MD, MBA, Chicago, IL (Presenter) Research Consultant, BTG International Ltd; Research Grant, BTG International Ltd;

LEARNING OBJECTIVES

1) To describe primary and metastatic liver tumors. 3) To discuss current gaps in knowledge and ongoing clinical studies.

VSIO21-08  Predicting the Hepato-pulmonary Shunt Fraction Using 3D Quantification of Tumor Enhancement on Contrast-enhanced CT Imaging in Patients with Hepatocellular Carcinoma before Y90 Radioembolization

Monday, Nov. 30 3:20PM - 3:30PM Location: S406B

Participants
Julius Chapiro, MD, Berlin, Germany (Presenter) Nothing to Disclose
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Duc Do Minh, BSc, Berlin, Germany (Abstract Co-Author) Nothing to Disclose
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Bernd K. Hamm III, MD, Berlin, Germany (Abstract Co-Author) Research Consultant, Toshiba Corporation; Stockholder, Siemens AG; Stockholder, General Electric Company; Research Grant, Toshiba Corporation; Research Grant, Koninklijke Philips NV; Research Grant, Siemens AG; Research Grant, General Electric Company; Research Grant, Elbit Imaging Ltd; Research Grant, Bayer AG; Research Grant, Guebert SA; Research Grant, Bracco Group; Research Grant, B. Braun Melsungen AG; Research Grant, KRAUTH medical KG; Research Grant, Boston Scientific Corporation; Equipment support, Elbit Imaging Ltd; Investigator, CMC Contrast AB
A Treated with Conventional TACE: RECIST, mRECIST, EASL or qEASL?

Participants
Yan Zhao, MS, Baltimore, MD (Presenter) Nothing to Disclose
Sonia P. Sahu, New Haven, CT (Abstract Co-Author) Nothing to Disclose
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PURPOSE
In this preliminary study, we compared the ability of RECIST, modified RECIST (mRECIST), EASL and quantitative EASL ([qEASL]), a volumetric enhancement criterion to assess early tumor progression after transarterial chemoembolization (TACE) in hepatocellular carcinoma (HCC) patients.

METHOD AND MATERIALS
A total of 53 consecutive patients (77.4% men; mean age, 51 years) with intermediate-stage HCC were included. All patients underwent conventional TACE and contrast-enhanced computed tomography (CT) scan at baseline and 1 month after TACE. Tumor response was determined by RECIST, mRECIST, EASL, and qEASL on CT. qEASL classifies progression as ≥73% increase in

CONCLUSION
The quantification of the absolute ETV (cm3) using semi-automatic 3D tools allows for an estimation of the HPSF in patients with HCC before Y90 radioembolization. TTV and relative ETV (%) did not appear as reliable predictors of the HPSF.

CLINICAL RELEVANCE/APPLICATION
These preliminary results may introduce absolute ETV (cm3) as a new imaging biomarker for HPSF, potentially allowing to narrow down the selection of patients who will undergo shunt evaluation studies prior to Y90 radioembolization.

VSIO21-09 Response Assessment and the Concept of Treatment Failure

Monday, Nov. 30 3:30PM - 3:50PM Location: S406B

Participants
Riccardo A. Lencioni, MD, Pisa, Italy (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
1) To learn the imaging criteria used for response assessment in patients with HCC. 2) To understand the limitations and the pitfalls associated with conventional response evaluation models. 3) To know the basic concepts of modified RECIST (mRECIST) criteria and how response predicts survival. 4) To understand the concept of treatment failure in patients undergoing loco-regional therapies. 5) To learn the novel volumetric response criteria currently undergoing clinical evaluation.

ABSTRACT
VSIO21-10 Which Response Criteria can Predict Early Tumor Progression in Hepatocellular Carcinoma Patients Treated with Conventional TACE: RECIST, mRECIST, EASL or qEASL?

Monday, Nov. 30 3:50PM - 4:00PM Location: S406B

Participants
Bernhard Gebauer, MD, Berlin, Germany (Abstract Co-Author) Research Consultant, C. R. Bard, Inc; Research Consultant, Sirtex Medical Ltd; Research Grant, C. R. Bard, Inc; Research Consultant, PAREXEL International Corporation; Federico Collettini, MD, Berlin, Germany (Abstract Co-Author) Nothing to Disclose

PURPOSE
This study explored the ability of 3D quantitative CT image analysis to predict the hepato-pulmonary shunt fraction (HPSF) in patients with hepatocellular carcinoma (HCC) before Yttrium90 (Y90) radioembolization.

METHOD AND MATERIALS
This IRB-approved, retrospective analysis included a total of 26 patients with HCC, who underwent an evaluation study to calculate the HPSF from SPECT/CT after infusion of Tc-99m macroaggregated albumin into the proper hepatic artery. All patients underwent tri-contrast enhanced CT imaging within six weeks before the evaluation study. A semi-automatic, segmentation-based 3D quantification of the total tumor volume (TTV) was used to calculate the enhancing tumor volume (ETV), measured in cm3 and as a relative ratio (%; TTV/ETV). TTV as well as ETV were correlated with the HPSF for each patient. Statistical analysis included the One-way ANOVA test and linear regression analysis to calculate the R2 values.

RESULTS
N=24 (92%) patients had preserved liver function (Child-Pugh A) and N=2 (8%) had Child-Pugh B. The mean HPSF was 13.5% (Range, 2.9-32.8; SD, 7.4) and the mean TTV was 569cm3 (Range, 18-2998; SD, 584). The mean absolute ETV was 120cm3 (Range, 7-431; SD, 116) and the mean relative ETV was 28% (Range, 6-60; SD, 19). A low correlation between TTV and the HPSF was observed (R2=0.29) and relative ETV (%) showed no correlation with the HPSF (R2=0.1). However, some correlation between the absolute ETV (cm3) and the HPSF was observed (R2=0.59). More importantly, patients with HPSF≤10% showed significantly lower mean ETVs as compared to patients with a HPSF≥10% (53cm3; Range, 7-96; SD, 21 vs. 187cm3, Range, 104-431; SD, 87, p<0.0001). No patient with HPSF≤10% exceeded the ETV of 100cm3. No statistically significant differences were observed for TTV and relative ETV (%).

CONCLUSION
The quantification of the absolute ETV (cm3) using semi-automatic 3D tools allows for an estimation of the HPSF in patients with HCC before Y90 Radioembolization. TTV and relative ETV (%) did not appear as reliable predictors of the HPSF.
enhancing tumor volume. The Kaplan-Meier method with the log-rank test was used to compare median overall survival (OS) between progression and non-progression.

RESULTS
Median follow-up period was 15.4 months (range 1.2-54.1). The mean value of enhancing tumor volume (qEASL) at baseline and post-treatment were 214±263.5 cm³ and 58.5±21.9 cm³, respectively. RECIST, mRECIST and EASL, identified progression in 2 (4%), 1(2%) and 2 (4%) patients at 1 month after TACE treatment. Notably, qEASL had a higher sensitivity for early tumor progression and it identified 9 (17%) patients with progression. Too few patients showed progression to perform survival analysis for the RECIST, mRECIST, and EASL. However, the patients who experienced progression according to qEASL demonstrated a significantly shorter median OS than those with non-progression [6.5 months (95%CI 4.2-8.8) vs. 21.1 months (95%CI 14.1-28.1), P<0.001].

CONCLUSION
qEASL is a more sensitive biomarker for tumor progression and survival than RECIST, mRECIST and EASL one month after TACE in hepatocellular carcinoma patients.

CLINICAL RELEVANCE/APPLICATION
Defining early tumor progression may help guide the decisions of further treatment. qEASL gave a better discrimination for early progression than other 1D or 2D criteria.

VSIO21-11 Panel Discussion: Management of Intermediate-Advanced HCC in 2015
Monday, Nov. 30 4:00PM - 4:20PM Location: S406B

Participants
Nima Kokabi, MD, Atlanta, GA (Presenter) Nothing to Disclose
Minzhi Xing, MD, New Haven, CT (Abstract Co-Author) Nothing to Disclose
Richard Duszak JR, MD, Atlanta, GA (Abstract Co-Author) Nothing to Disclose
Kimberly E. Applegate, MD, MS, Zionsville, IN (Abstract Co-Author) Nothing to Disclose
Juan C. Carracho, MD, Atlanta, GA (Abstract Co-Author) Nothing to Disclose
David H. Howard, PhD, Atlanta, GA (Abstract Co-Author) Nothing to Disclose
Hyun S. Kim, MD, Atlanta, GA (Abstract Co-Author) Nothing to Disclose

PURPOSE
To investigate the socio-demographic determinants of receipt of HCC-directed locoregional therapies (LRT’s) and comparative effectiveness of different therapies in American Joint Commission on Cancer (AJCC) Stage I and II unresectable hepatocellular carcinoma (HCC) using Surveillance Epidemiology and End Results (SEER) registries linked to Medicare database.

METHOD AND MATERIALS
Patients diagnosed with HCC during 2000 to 2010 were identified with unresectability defined using "no cancer-directed surgery recommended" and no HCC directed surgical claim. Patients were stratified by AJCC staging and the following therapies: ablation, trans-arterial chemoembolization (TACE), Yttrium-90 (Y90) radioembolization, sorafenib, systemic chemotherapy (CTX), external beam radiation (EBRT) or no cancer directed therapy (NCDT). Sociodemographic predictors of receipt of LRT’s (i.e. TACE and Y-90) were evaluated by chi-square. Overall survival (OS) was estimated using Kaplan-Meier analysis.

RESULTS
Total of 9,169 patients with unresectable HCC were identified with the following stages composition: I (25%), II (10%), III (13%), IV (17%), and unstaged (35%). All therapies demonstrated OS benefit compared to no therapy with the following median OS (months): ablation (30.8), Y90 (15.6), TACE (15.5), EBRT (7.6), Sorafenib (5.6), CTX (5.10), NCDT (3.7; p<0.001). One year survival rate of stage I and II patients treated with TACE was 67% and 53% vs. 27% and 14% for NCDT respectively (p<0.001). Overall, 38% of patients received any cancer directed therapy including TACE (18%), EBRT (8%), sorafenib (4%), ablation (3%), and Y-90 (2%) and CTX (1%). Specifically, 56% and 65% of stage I and II patients had NCDT respectively. There was no OS difference between TACE and Y90 group (p=0.31). There was a significantly prolonged OS in LRT group vs. EBRT/CTX groups (p<0.001) and the LRT vs. NCDT group (p<0.001). The receipt of LRT significantly correlated with being married and of Asian decent, living on the pacific coast and in urban areas, being insured with higher income and education levels (p's <0.05).

CONCLUSION
Favorable sociodemographic factors were determinant of receipt of HCC directed LRT’s. Less than 50% of of Stage I and II patients received LRT’s. LRT’s in Stage I and II significantly prolonged survivals over CTX/EBRT/NCDT.

CLINICAL RELEVANCE/APPLICATION
There is a national underutilization of effective HCC directed LRT’s in patients with unresectable HCC.

VSIO21-13 Image-guided Ablation: Does Novel Technology Mean Better Outcomes?
Monday, Nov. 30 4:40PM - 5:00PM Location: S406B

Participants
Stephen B. Solomon, MD, New York, NY (Presenter) Research Grant, General Electric Company
LEARNING OBJECTIVES

1) To describe techniques and approaches used for image-guided ablation. 2) To understand the available data for novel thermal and non-thermal technologies. 3) To discuss strategies to improve clinical outcomes.

VSIO21-14 Hepatocellular Crcrinomas Treated with Percutaneous Ablation Using a High-power Microwave System with a Single Antenna: 5 Years’ Experience

Monday, Nov. 30 5:00PM - 5:10PM Location: S406B

Participants
Giovanni Mauri, MD, San Donato Milanese, Italy (Presenter) Consultant, Esaote SpA
Luca Cova, MD, Busto Arsizio, Italy (Abstract Co-Author) Nothing to Disclose
Tiziana Ierace, MD, Busto Arsizio, Italy (Abstract Co-Author) Nothing to Disclose
S. Nahum Goldberg, MD, Ein Kerem, Israel (Abstract Co-Author) Consultant, AngioDynamics, Inc; Research support, AngioDynamics, Inc; Research support, Cosman Medical, Inc; Consultant, Cosman Medical, Inc; Luigi Solbiati, MD, Busto Arsizio, Italy (Abstract Co-Author) Nothing to Disclose

PURPOSE
To report our 5 year experience treating hepatocellular carcinoma (HCC) using a third-generation high-power microwave system and a single antenna.

METHOD AND MATERIALS
From 2009, 223 HCCs (mean 2.2 cm, size range 0.7-5.5 cm) in 109 patients (mean age 67.7 ± 6.2 years) underwent US-guided ablation using a high-power (140 Watt, 2.45 GHz) microwave system (AMICA-Probe: Hospital Service, Aprilia, Italy) with a single insertion of an internally-cooled antenna. Power and time of energy application ranged between 45-100 Watts and 4-10 min, respectively. Follow-up from a minimum of 1 year to 6 years (mean: 2.2yr) was performed with contrast-enhanced CT at 4-6 months intervals. Results were classified according to index tumor size (<=2cm; 2.1-3 cm; > 3 cm). Chi Square test was used for comparison.

RESULTS
Immediate complete ablation (i.e. technical success) was achieved in 221/223 (99.1%) HCCs. Local tumor progression within 1 year from ablation occurred in 23/223 (10.3%) HCCs: 4/103 (3.9%) <= 2cm; 8/68 (11.8%) sized 2.1-3 cm; and 11/52 (21.2%) > 3 cm (p = 0.003). In 9/23 (39.1%) HCCs, local progression underwent successful re-treatment. Major complications occurred in 6/151 (4.0%) ablation sessions and only 2 required surgical repair. No deaths related to ablation were seen. In 29/109 (26.6%) patients, new HCCs were detected on follow-up.

CONCLUSION
With an affordable and efficient high-power microwave system, local control of HCCs can be safely achieved in the vast majority of cases with the simplest and fastest technique, i.e. single insertion of single antenna.

CLINICAL RELEVANCE/APPLICATION
Percutaneous ablation with a high-power, affordable microwave system allows successfully treatment for a large majority of HCCs using a simple technique of single insertion of a single antenna with a short energy deposition time.

VSIO21-15 TACE Segmentectomy for Small, Solitary HCC: Just for the Unfit for Resection and Ablation?

Monday, Nov. 30 5:10PM - 5:30PM Location: S406B

Participants
Jin Wook Chung, MD, Seoul, Korea, Republic Of (Presenter) Research Grant, BTG International Ltd
Sonia P. Sahu, New Haven, CT (Presenter) Nothing to Disclose
Rafael Duran, MD, Baltimore, MD (Abstract Co-Author) Nothing to Disclose
Ruediger E. Scherenthanner, MD, Vienna, Austria (Abstract Co-Author) Nothing to Disclose
Yan Zhao, MS, Baltimore, MD (Abstract Co-Author) Nothing to Disclose
Jae Ho Sohn, MD,MS, New Haven, CT (Abstract Co-Author) Nothing to Disclose
Jean-Francois H. Geschwind, MD, Westport, CT (Abstract Co-Author) Researcher, BTG International Ltd; Consultant, BTG International Ltd; Researcher, Koninklijke Philips NV; Consultant, Koninklijke Philips NV; Researcher, Guerbet SA; Consultant, Guerbet SA; Consultant, Terumo Corporation; Consultant, Threshold Pharmaceuticals, Inc; Consultant, PreScience Labs, LLC; Researcher, Boston Scientific Corporation; Consultant, Boston Scientific Corporation

PURPOSE
There has been a growing interest in smaller caliber beads which can penetrate deeper into tumors for transarterial chemoembolization (TACE). This prospective clinical trial examined the safety and efficacy of TACE using 70-150 µm doxorubicin-eluting beads (LC BeadM1,BTG, UK) in patients with hepatocellular carcinoma (HCC).
METHOD AND MATERIALS

This single-center prospective study was HIPPA compliant and IRB approved. Patients with HCC who were locoregional therapy naïve, Eastern Cooperative Oncology Group performance status 0-2, Barcelona Clinic Liver Cancer stage A-C, and Child-Pugh A-B were eligible. Adverse events were graded by severity and in relationship to TACE using CTCAE V4.03. Tumor response at 1 month follow-up was assessed by modified RECIST (mRECIST), European Association for the Study of the Liver (EASL), and volumetric tumor enhancement [quantitative EASL (qEASL)] on T1-weighted contrast-enhanced MR. qEASL response was defined as ≥65% decrease in volumetric tumor enhancement.

RESULTS

24 patients (men: 21, median age: 62 years) with a mean tumor size of 4.28 cm (range: 1.2 - 21.2) were enrolled and successfully treated with TACE. 2 serious adverse events unrelated to TACE occurred in 2 patients [upper GI bleed (n=1) and cardiac arrest (n=1)]. Possible to definitive device related toxicities were seen in 10 patients and were all grade 1-2 in severity [hypalbuminemia (n=3), pain (n=3), elevated AP (n=2), headache (n=2), fatigue (n=2), leukopenia (n=1), anemia (n=1), anorexia (n=1), elevated AST (n=1), fever (n=1), flu-like symptoms (n=1), hyperbilirubinemia (n=1), weight loss (n=1)]. One month tumor response was assessed in 21 patients [died before follow-up (n=1), pending follow-up (n=2)]. 10 (45.5%) patients were classified as responders regardless of the criteria utilized.

CONCLUSION

TACE with 70-150 µm doxorubicin-eluting beads was well tolerated and had good tumor response after 1 month in patients with HCC.

CLINICAL RELEVANCE/APPLICATION

Smaller caliber 70-150 µm doxorubicin-eluting beads are a safe and promising alternative to the conventional sized 100-500 µm beads in TACE for patients with hepatocellular carcinoma.
Comparison of Three Dimensional Echocardiography with ECG-Gated Cardiac Tomography for Assessment of the Aortic Annulus Prior to Percutaneous Aortic Valve Replacement (TAVR)

PURPOSE
The morphology and size of the aortic annulus are critical factors for preprocedural planning of percutaneous aortic valve replacement (TAVR). We have previously demonstrated that the oval shape of the aortic annulus results in underestimation of annular area based upon anteroposterior (AP) measurements on 2D echocardiography relative to area measurements on ECG-gated cardiac CTA (cCTA). This study evaluated annular size on 3-dimensional transesophageal echocardiography (3D-TEE) in comparison to cCTA prior to a TAVR procedure.

METHOD AND MATERIALS
3D-TEE and ECG-gated cCTA measurements of the aortic annulus were compared from preprocedural studies on 25 consecutive TAVR patients. 3D-TEE measurements were obtained during mid-systole, while cCTA measurements were obtained at late-systole (40% of the R-R interval) and late-diastole (80% of the R-R interval). Annular area was measured by manual planimetry. Pearson correlation coefficients were computed and paired t-tests were performed to compare AP (short axis) and transverse (long axis) diameters of the annulus, as well as annular area as measured by echocardiography and by cCTA.

RESULTS
cCTA measurements in systole and diastole were highly correlated: r=0.83 for short axis diameter, r=0.87 for long axis diameter, r=0.98 for annular area. Good correlation was observed between 3D-TEE and cCTA for short axis diameter (r = 0.73-0.87), long axis diameter (r = 0.72) and annular area (r = 0.87-0.88). Long axis diameter and annular area measurements obtained by 3D-TEE were significantly smaller than those obtained by cCTA: Short axis diameter - 3D-TEE: 21.3mm; cCTA systole: 21.9mm; cCTA diastole: 20.7mm (p>0.05). Long axis diameter - 3D-TEE: 24.8mm; cCTA systole: 27.2mm; cCTA diastole: 26.4mm (p<0.001). Annular area - 3D-TEE: 413mm^2; cCTA systole: 463mm^2 (p<0.0001); cCTA diastole: 435mm^2 (p=0.034).

CONCLUSION
Although all cCTA measurements of the aortic annulus are highly correlated with measurements by 3D-TEE, diastolic phase cCTA measurements tend to be closer to standard mid-systolic 3D-TEE measurements. This is especially true for measurement of aortic annular area which is over measured by an average of 50mm^2 on cCTA during systole relative to 3D-TEE.

CLINICAL RELEVANCE/APPLICATION
3D-TEE measurements of the aortic annulus are highly correlated with measurements by 3D-TEE, with diastolic phase cCTA measurements being closer to standard mid-systolic 3D-TEE measurements. This is especially true for measurement of aortic annular area which is over measured by an average of 50mm^2 on cCTA during systole relative to 3D-TEE.
Incidence of Contrast Induced Nephropathy in Patients Undergoing TAVR Evaluation

Monday, Nov. 30 3:20PM - 3:30PM Location: S502AB

Participants
Alice Wang, Durham, NC (Presenter) Nothing to Disclose
Matthew Ellis, MD, Durham, NC (Abstract Co-Author) Nothing to Disclose
J. Kevin Harrison, Durham, NC (Abstract Co-Author) Nothing to Disclose
Todd Kiefer, Durham, NC (Abstract Co-Author) Nothing to Disclose
Hanghang Wang, MD, Durham, NC (Abstract Co-Author) Nothing to Disclose
Lynne M. Hurwitz, MD, Durham, NC (Abstract Co-Author) Research Grant, Siemens AG Research Grant, General Electric Company

PURPOSE
To prospectively evaluate the feasibility, diagnostic quality, and safety of low-tube-voltage, low-contrast-volume comprehensive cardiac and aortoiliac computed tomography angiography (CTA) for planning transcatheter aortic valve replacement (TAVR).

METHOD AND MATERIALS
Forty consecutive TAVR candidates prospectively underwent combined contrast-enhanced (270mgI/mL iodixanol) CTA of the aortic root complex and aortoiliac vascular access route. Patients were assigned to group A (2nd generation dual-source CT [DSCT], 100 kV, 60 mL contrast material, 4.0 mL/s flow rate, iodine-delivery rate [IDR] 1.08 g/s) or group B (3rd generation DSCT, 70kV, 40 mL contrast material, 2.5 mL/s flow rate, IDR 0.675 g/s). Mean vascular attenuation, image noise, signal-to-noise ratio (SNR), and contrast-to-noise ratio (CNR) were measured. Subjective image quality was independently assessed by two blinded readers using five-point Likert scales. Patient creatinine levels on the day of the exam and during short- and long-term follow-up were measured.

RESULTS
Except for a higher body mass index in group B (24.8 ± 3.8 vs 28.1 ± 5.4 kg/m2, P = 0.0339), no significant differences in patient characteristics between both groups were observed. Mean aortoiliac SNR (P = 0.0003) and CNR (P = 0.4761) were 13.1 ± 6.8 and 24.3 ± 11.9 (group A), and 15.4 ± 6.7 and 24.9 ± 12.3 (group B), respectively. Mean cardiac SNR (P = 0.0003) and CNR (P = 0.0181) were 15.6 ± 9.0 and 20.2 ± 13.4 (group A) and 12.2 ± 4.5 and 15.3 ± 6.7 (group B), respectively. Subjective image quality did not significantly differ (P = 0.213) except for lower aortoiliac image noise in group B (4.42 vs 4.12, P = 0.0374). TAVR planning measurements were successfully obtained in all studies. There were no significant changes in creatinine levels among and between patient groups during short- and long-term follow-up (P ≥0.302). Four patients expired during the study period because of unrelated causes, but no adverse events attributable to the use of iodinated contrast media were observed.

CONCLUSION
TAVR candidates can be safely and effectively evaluated by a comprehensive CTA protocol with low contrast volume using low-tube voltage acquisition.

CLINICAL RELEVANCE/APPLICATION
CTA imaging with reduced contrast volume in pre-TAVR evaluation may improve safety in multimorbid patients considered for this procedure.

SSE03-04 Prediction of Transcatheter Aortic Valve Replacement (TAVR) Paravalvular Leak Diagnosed on Post-
Non-significant findings were reported in 581 patients (93.3%). Patients with clinical significant findings requiring TAVI were found in 78 patients (12.5%) including probably benign tumors (n=72, 11.6%) and aneurysms with follow up requirement. Malignancy and diverticulitis were confirmed in 13 and 2 patients (32.5% and 100%), respectively. Findings requiring follow up after aortic aneurysm >5 cm (n=13, 2.1%), diverticulitis (n=2, 0.3%), cardiac thrombi (n=2, 0.3%) and suspected colitis (n=1, 0.2%) limited TAVI or requiring immediate action were reported in 57 patients (9.1%), including; suspected malignancy (n=40, 6.4%).

A total of 623 patients were included, 354 (56.8%) were female. Mean age was 79.8 +/- 8.8 years. Clinical significant findings findings limiting eligibility for TAVI due to poor prognosis or requiring immediate action, including additional diagnostic testing or TEE were reported in 57 patients (9.1%). Patients with clinical significant findings requiring TAVI were found in 78 patients (12.5%) including probably benign tumors (n=72, 11.6%) and aneurysms with follow up requirement (n=7, 1.1%). Non-significant findings were reported in 581 patients (93.3%).

METHOD AND MATERIALS
This retrospective study included 8 patients with pre-TAVR CCT and post-TAVR TTE who developed PPAR and 8 age, sex and valve size-matched controls. The aortic root, annulus and left ventricular outflow tract were segmented from pre-TAVR CCT (Vitrea 6.7, Vital Images) by a radiologist blinded to TTE findings and exported as 3D-printable (STL) files into CAD software (3matic, Materialise) for post-processing. Aortic models were 3D-printed using flexible stereolithography material; valve models meeting Sapien size specs (26 & 29mm) and a closed base were printed on a material extrusion 3D printer in hard plastic. The valve model corresponding to the implanted valve was carefully positioned in each aortic model and the presence of leak was determined via projection of light through the LVOT onto a thin film, captured with a digital camera. The presence of leak (defined as any paravalvular light transmission) was made by consensus of 2 readers blinded to TTE results.

RESULTS
Six out of 8 paravalvular leaks were accurately predicted and 6 out of 8 patients without leaks were correctly ruled out (2 false negatives and false positives, respectively). The shape and location of light crescents predicting leaks matched PPAR location on post-procedure TTE.

CONCLUSION
Use of pre-TAVR 3D-printing provides a unique assessment of the 3D relationship between the AV complex and implanted valves, and may predict which patients are more likely to develop paravalvular leaks. This technology may assist in the development of future generations of transcatheter valves, with potential to improve outcomes. Given these initial results, further studies focusing on both clinical outcomes and 3D-printed model optimization are needed.

CLINICAL RELEVANCE/APPLICATION
Flexible 3D-printed models of the AV complex may allow for better TAVR patient selection, procedural planning, and valve size selection. If verified in future studies, this technology has the potential to lead to better patient outcomes.

PURPOSE
Accurate sizing of TAVR prostheses is necessary to minimize post-procedural aortic regurgitation (PPAR or 'leak'), which is associated with adverse outcomes. We hypothesized that 3D-printed models of the aortic valve (AV) complex derived from pre-TAVR cardiac CT (CCT) could be used to determine whether the implanted valve would have an appropriate fit and thus predict which patients are more likely to develop PPAR.

METHOD AND MATERIALS
Computed Tomography Angiography (CTA) is used in the work-up for transcatheter aortic valve implantation (TAVI) to assess cardiovascular anatomy, annulus size and to determine the optimal access route. However, in the elderly TAVI population, CTA frequently reveals incidental findings that potentially change patient management and prognosis. We aim to determine the effect of incidental findings on the clinical course of patients in TAVI work-up.

RESULTS
A total of 623 patients were included, 354 (56.8%) were female. Mean age was 79.8 +/- 8.8 years. Clinical significant findings limiting TAVI or requiring immediate action were reported in 57 patients (9.1%), including; suspected malignancy (n=40, 6.4%), aortic aneurysm >5 cm (n=13, 2.1%), diverticulitis (n=2, 0.3%), cardiac thrombi (n=2, 0.3%) and suspected colitis (n=1, 0.2%). Malignancy and diverticulitis were confirmed in 13 and 2 patients (32.5% and 100%), respectively. Findings requiring follow up after TAVI were found in 78 patients (12.5%) including probably benign tumors (n=72, 11.6%) and aneurysms with follow up requirement (n=7, 1.1%). Non-significant findings were reported in 581 patients (93.3%). Patients with clinical significant findings requiring...
immediate action were more frequently rejected for TAVI than patients without those findings (n=12, 21.1% vs n=51, 9.0%; p=.004). There was no significant delay between CTA and the TAVI procedure between the groups (median 43.0 [14.5-86.5] vs 29.0 [14.0-63.5] days; p=.105).

CONCLUSION
The prevalence of incidental findings is high in elderly TAVI patients. Incidental findings significantly influence patient management due to an anticipation on poor prognosis and may lead to treatment delay.

CLINICAL RELEVANCE/APPLICATION
CTA prior to TAVI reveals incidental findings, leading to recurrent discussions in Heart Team meetings. Our results show that incidental findings are frequent and may influence the clinical course.

PURPOSE
To evaluate one year outcomes with a strategy of intentional underexpansion of balloon expandable transcatheter heart valves (THVs) in terms of clinical outcomes, valve function, and frame durability at one year.

METHOD AND MATERIALS
We evaluated 47 patients at risk of annular injury who underwent TAVR with a deliberately underexpanded THV, followed by post-dilation if required. Clinical evaluation, echocardiography and cardiac CT were obtained pre-TAVR, post-TAVR, and at one year.

RESULTS
Deployment of oversized THVs with modest underfilling of the deployment balloon (<10% by volume) was not associated with significant annular injury. Paravalvular regurgitation was mild or less in 95.7% of patients, with post-dilation required in 10.7%. THV hemodynamic function was excellent and remained stable at one year. CT documented stent frame circularity in 87.5%. Underexpansion was greatest within the intra-annular THV inflow (stent frame area 85.8% of nominal). Progressive stent frame recoil, deformation, or fracture were not observed at one year.

CONCLUSION
In carefully selected patients with a borderline annulus dimensions and in whom excessive oversizing is a concern, a strategy of deliberate underexpansion, with ad hoc post-dilation if necessary, may reduce the risk of annular injury without compromising valve performance.

CLINICAL RELEVANCE/APPLICATION
We present the first intermediate term clinical and imaging follow up data on intentionally underfilled balloon expandable TAVR.

Honored Educators
Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

Jonathon A. Leipsic, MD - 2015 Honored Educator
SSE05

Chest (Interventional/Ablation)
Monday, Nov. 30 3:00PM - 4:00PM Location: S402AB

SSE05-01  Microwave Ablation (MWA), Radiofrequency Ablation (RFA) and Laser-induced Interstitial Thermotherapy (LITT) in Patients with Primary and Secondary Lung Tumors: Evaluation of Tumor Volume and Recurrence Rate

Participants
Jo-Anne O. Shepard, MD, Boston, MA (Moderator) Nothing to Disclose
Seth J. Kligerman, MD, Denver, CO (Moderator) Nothing to Disclose

Sub-Events

PURPOSE
Comparison of tumor response with volumetric assessment for tumor size after treatment of primary or secondary lung tumors with microwave ablation (MWA), radiofrequency ablation (RFA) and laser-induced interstitial tumor therapy (LITT).

METHOD AND MATERIALS
Between 04/2002 and 09/2013 165 patients (70 males, 95 females) suffering from 263 lesions (primary or secondary lung tumor) were treated with thermal ablation (MWA, RFA and/or LITT). Patients with colorectal carcinoma with lung metastases were not included in this study. At 24-hour; 3-, 6-, 12-, 18- and 24-month intervals diagnosis and follow-up were accomplished using magnetic resonance imaging (MRI), unenhanced and contrast-enhanced computed tomography (CT). The results were evaluated in a retrospective study according to the RECIST criteria and survival data were assessed. Patients treated with more than one method of thermal ablation (n=10) were excluded from patient-related analysis. Patients without follow-up data were excluded from relapse analysis.

RESULTS
In 19 patients with 25 lesions treated with LITT recurrent foci were found in 27.3% of lesions. Average tumor volume of lesions with complete response (CR) was 6.1 ml before therapy, in lesions with recurrent foci 15.39 ml. Recurrence rate (RR) for 3, 6, 12, 18, 24 months was 16.7%, 7.1%, 0%, 10% and 11.1%. In 40 patients with 65 lesions treated with RFA recurrent foci were found in 20.4% of lesions. Average tumor volume of lesions with CR was 2.82 ml before therapy, in lesions with recurrent foci 16.73 ml. RR for 3, 6, 12, 18, 24 months was 2.1%, 7.7%, 12.5%, 11.1% and 0%. 106 patients with 173 lesions were treated with MWA. Average tumor volume of lesions with CR was 5.52 ml before therapy, in lesions with recurrent foci 19.14 ml. RR for 3, 6, 12, 18, 24 months was 1%, 5.1%, 0%, 2.9% and 11.1%. There was a significant difference in rates of recurrent foci between LITT, RFA and MWA (P=0.038, Fisher test) with the lowest RR in the MWA group. Mean survival was 983 days in patients treated with LITT, 899 days with MWA and 690 days with RFA using the Kaplan-Meier method (P= 0.003).

CONCLUSION
In conclusion LITT, RFA and MWA showed a significant difference in the treatment of primary and secondary lung metastases regarding CR, RR and mean survival

CLINICAL RELEVANCE/APPLICATION
MWA showed the best results concerning RR, LITT concerning mean survival

SSE05-02  Thermal Ablation of Colorectal Lung Metastases: Retrospective Comparison of LITT, RFA and MWA Concerning Local Tumor Control Rate, Time to Progression, and Survival Rates

Participants
Thomas J. Vogl, MD, PhD, Frankfurt, Germany (Presenter) Nothing to Disclose
Romina Eckert, Frankfurt, Germany (Abstract Co-Author) Nothing to Disclose
Peter Kleine, Frankfurt, Germany (Abstract Co-Author) Nothing to Disclose
Nour-Eldin A. Nour-Eldin, MD, PhD, Frankfurt Am Main, Germany (Abstract Co-Author) Nothing to Disclose

PURPOSE
To retrospectively evaluate local tumor control, time-to-progression, and survival in patients with CRC lung metastases who received laser-induced thermotherapy (LITT), microwave ablation (MWA), or radiofrequency ablation (MWA).
METHOD AND MATERIALS

In this retrospective study data on 109 patients (71 males/38 females; mean, 68.6±11.2 years; range, 34-94) were collected in 231 CT-guided ablation sessions from 05/2000-12/2013. 47 patients (125 ablations) underwent MWA, 21 patients (31 ablations) LITT and 41 patients (75 ablations) RFA. CT was performed at 24 hours and at 3, 6, 12, 18 and 24 months post ablation. Survival rates were calculated from first ablation using Kaplan-Meier and log-rank test. Volume changes were measured by the Kruskal-Wallis method.

RESULTS

Local tumor control was achieved in MWA in 91/103 (88.3%) lesions, in LITT in 17/25 (68%) lesions, and in RFA in 45/65 (69.2%) lesions with significant differences in MWA vs. LITT at 18 months (p=0.01) and in MWA vs. RFA at 6 (p=0.004) and 18 (p=0.01) months. Median time-to-progression was 7.5 months in MWA, 10.4 months in LITT and 7.2 months in RFA with no significant difference. 1-, 2- and 4-year overall survival was 82.7%, 67.5% and 16.6% for MWA (median: 32.8 months), 95.2%, 47.6% and 23.8% for LITT (median: 22.1 months), and 76.9%, 50.8% and 8% for RFA (median 24.2 months) with no significant difference. 1-, 2-, 3-, and 4-year progression-free survival was 54.6%, 29.1%, 10.0% and 1% for MWA, 96.8%, 52.7%, 24% and 19.1% for LITT; and 77.3%, 50.2%, 30.8% and 16.4% for RFA with no significant difference.

CONCLUSION

MWA, LITT and RFA are effective therapeutic options for CRC lung metastases with differences documented in local tumor control and no significant differences in progression time, overall survival and progression-free survival rates.

CLINICAL RELEVANCE/APPLICATION

LITT, RFA and MWA in the treatment of colorectal lung metastases can be used with similar results concerning progression time, overall survival and progression-free survival rates. MWA, however, results in better local tumor control.

SSE05-03 CT-Guided Hook-Wire Localization Prior to Video Assisted Thoracoscopic Surgery (VATS) of Suspected Pulmonary Metastases: Safety, Efficacy and Outcome

Monday, Nov. 30 3:20PM - 3:30PM Location: S402AB

Participants
Nour-Eldin A. Nour-Eldin, MD, PhD, Frankfurt Am Main, Germany (Presenter) Nothing to Disclose
Nagy N. Naguib, MD, MSc, Frankfurt Am Main, Germany (Abstract Co-Author) Nothing to Disclose
Thomas Lehnert, MD, Frankfurt Am Main, Germany (Abstract Co-Author) Nothing to Disclose
Mohammed A. Alsubhi, BMBS, Frankfurt Am Main, Germany (Abstract Co-Author) Nothing to Disclose
Martin Beeres, MD, Frankfurt Am Main, Germany (Abstract Co-Author) Nothing to Disclose
Stefan Zangos, MD, Frankfurt Am Main, Germany (Abstract Co-Author) Nothing to Disclose
Thomas J. Vogl, MD, PhD, Frankfurt, Germany (Abstract Co-Author) Nothing to Disclose

PURPOSE

To assess the feasibility, safety and efficacy of CT-guided pulmonary nodule localization using hooked guide wire before thoracoscopic surgical resection

METHOD AND MATERIALS

The study included 79 consecutive patients with a history of malignancies outside the lung associated with suspected pulmonary nodules. The CT-guided-hook wire localization procedures were performed under aseptic conditions and local anesthesia. Mean lesion size was 0.7 cm (range 0.5 - 1.8 cm) and the mean lesion distance to the pleural surface was 1.5 cm (range 0.2 - 5 cm). All lesions (n=82) were marked with a 22-G hook-wire. The technique was designed to insert the tip of hook-wire within or maximally 1 cm from the edge of the lesion.

RESULTS

The hooked-guide wire was positioned successfully in all 82 pulmonary nodules within mean time of 9 min (8-20 min, SD: 2.5). The procedure time was inversely proportional to the size of the lesion (Spearman correlation factor 0.7). The mean total radiation dose associated with the procedure was 336 mGy.cm from which the mean DLP of the guide-wire localization was 31 mGy.cm (9.2%). Minimal pneumothoraces were observed in 5 patients (7.6%) without requirement for chest tubes. Pneumothorax was not correlated to the histopathology of the pulmonary nodules (p-value > 0.09). Pneumothorax was significantly correlated to emphysema (p-value: 0.02). Focal perilesional pulmonary hemorrhage was developed in 4 patients (5%). Both hemorrhage and pneumothorax were significantly correlated to lesion < 10 mm (p-value: 0.02 and 0.01 respectively). The resected volume of lung tissue was significantly larger in lesions in which the guide wire was inserted at 1 cm distance from the lesion; in comparison to lesions in which the guide-wire was positioned within the lesion (p=0.01). Additionally, the volume of resected lung tissue was significantly correlated to lesion of increased distance from the pleural surface > 2.5 cm in comparison to lesions of less than the 2.5 cm from the pleural surface.

CONCLUSION

CT-guided pulmonary nodule localization prior to thoracoscopic resection could allow a safe and accurate surgical guidance for the localization of small pulmonary nodules during thoracoscopic resection.

CLINICAL RELEVANCE/APPLICATION

This technique facilitates the identification and allows adequate resection of small pulmonary nodules during thoracoscopic resection.

SSE05-04 Pneumothorax Complicating Coaxial and Non-Coaxial CT-Guided Lung Biopsy: Comparative Analysis of Determining Risk Factors

Monday, Nov. 30 3:30PM - 3:40PM Location: S402AB

Participants
Nour-Eldin A. Nour-Eldin, MD, PhD, Frankfurt Am Main, Germany (Presenter) Nothing to Disclose
To assess the scope and determining risk factors related to the development of pneumothorax throughout CT-guided biopsy of pulmonary lesions in coaxial and non-coaxial techniques

METHOD AND MATERIALS

The study included CT-guided percutaneous lung biopsies in 650 consecutive patients (407 males, 243 females; mean age 54.6 years, SD: 5.2) from November 2008 to June 2013 in a retrospective design. Patients were classified according to lung biopsy technique into coaxial-group (318 lesions) and non-coaxial-group (332 lesions). Exclusion criteria for biopsy were: lesions < 5 mm in diameter, incorrectable coagulopathy, positive-pressure ventilation, severe respiratory compromise, pulmonary arterial hypertension or refusal of the procedure.

RESULTS

The incidence of pneumothorax complicating CT-guided lung biopsy was less in the non-coaxial group (23.2%, 77 out of 332) than the coaxial group (27%, 86 out of 318). The difference in incidence between both groups was statistically insignificant (p = 0.14). Significant risk factors for the development of pneumothorax in both groups were emphysema (p < 0.001 in both groups), traversing a fissure with the biopsy needle (p-value 0.005 in non-coaxial group and 0.001 in coaxial group), small lesion, less than 2 cm in diameter (p-value 0.02 in both groups), location of the lesion in the basal or mid sections of the lung (p = 0.003 and < 0.001 in non-coaxial and coaxial groups respectively) and increased needle track path within the lung tissue of more than 2.5 cm (p-value 0.01 in both groups). Simultaneous incidence of pneumothorax and pulmonary hemorrhage was 27.3% (21/77) in non-coaxial group and in 30.2% (26/86) in coaxial-group. Conservative management was sufficient for treatment of 91 out of 101 patients of pneumothorax in both groups (90.1%).

CONCLUSION

Pneumothorax complicating CT-guided core biopsy of pulmonary lesions showed insignificant difference between coaxial and non-coaxial techniques. However, both techniques have the same significant risk factors including small and basal lesions, increased lesion's depth from pleural surface, increased length of aerated lung parenchyma crossed by biopsy needle and passing through pulmonary fissures in the needle tract.

CLINICAL RELEVANCE/APPLICATION

Significant risk factors of pneumothorax complicating lung biopsy in both coaxial and non-coaxial techniques are similar and include: technical risk factors, patient-related risk factors, and lesion-associated risk factors.

SSE05-05  Appearance can be Deceiving: Pulmonary Nodules in Non-Pulmonary Solid Tumor Bearing Patients are not Always Metastatic

Presenters:
Mauricio R. Moura SR, MD, MD, Sao Paulo, Brazil (Presenter) Nothing to Disclose
Publio C. Viana, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Marcos R. Menezes, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Milenia Mak, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Rafael Bitton, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Olavo Feher, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose

PURPOSE

Pulmonary nodules (PNs) in patients (pts) with non-pulmonary solid malignancies present a diagnostic challenge; comprising other possibilities than metastatic disease, such as primary lung cancers, infectious diseases and scar tissue. The precise diagnosis will ultimately impact in treatment decisions and prognosis. This study aimed to determine variables correlated with finding metastatic disease on a pulmonary biopsy, helping the decision process of indicating a PN biopsy in this scenario.

METHOD AND MATERIALS

In this single-institution retrospective study, we included consecutive pts with non-pulmonary solid malignancies that presented PN and no extra pulmonary metastases. Pts were submitted to a computed tomography (CT) guided biopsy from January 2011 to December 2013. Exclusion criteria are as follows: presence of lung primary, hematologic malignancies, or extra pulmonary metastatic disease. Correlation between imaging and clinical characteristics that yielded higher probability of finding metastatic disease on biopsy was determined by logistic regression analysis.

RESULTS

From a total of 487 pts submitted to pulmonary biopsy, 228 were included in the final analysis. Metastatic disease to the lungs was confirmed in 63.1%. Lung primaries were found in 26.3%. Other findings included infectious diseases (7.4%) and benign lesions (2.6%). On multivariate analysis, presence of multiple PNs was associated with higher odds of metastatic disease (OR 4.24; 95% CI 1.97-9.14, p < 0.01), as well as nodule cavitation and/or necrosis on CT scan (OR 4.01; 95% CI 1.24-13.01, p = 0.02). Procedure complications demanding active interventions occurred in 6 patients. No procedure-related death occurred.

CONCLUSION

Presence of multiple PNs and nodule cavitation were associated with higher odds of finding biopsy-proven metastatic disease. However, a high rate of non-metastatic disease was found in this group of pts. Given that procedural complications were low, we conclude that tissue sample is still essential for accurately diagnosing and treating pts with solid tumors presenting with PNs.

CLINICAL RELEVANCE/APPLICATION

Assuming all PN observed in cancer patients as being metastatic disease will lead to high rates of inaccurate diagnosis and
inappropriate subsequent treatments. Tissue sampling is still fundamental for accurately diagnosing and treating cancer patients.

**SSE05-06 CT-guided Transthoracic Needle Biopsy of Subsolid Pulmonary Nodules: Technical Feasibility and Diagnostic Yield with Surgical Correlation and Long Term Follow-up.**

Monday, Nov. 30 3:50PM - 4:00PM Location: S402AB

Participants
Nantaka Kiranantawat, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose
Shaunagh McDermott, FFR(RCSI), Boston, MA (Presenter) Nothing to Disclose
Matthew D. Gilman, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose
Florian J. Fintelmann, MD, FRCPC, Boston, MA (Abstract Co-Author) Nothing to Disclose
Jo-Anne O. Shepard, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose
Subba R. Digumarthy, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose
Carol C. Wu, MD, Houston, TX (Abstract Co-Author) Author, Reed Elsevier
Victorine V. Muse, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose
Milena Petranovic, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose
Amita Sharma, MBBS, Boston, MA (Abstract Co-Author) Nothing to Disclose

**PURPOSE**

To assess the technical and diagnostic success of CT-guided transthoracic needle biopsy (TNB) of subsolid pulmonary nodules.

**METHOD AND MATERIALS**

Retrospective review of 94 TNB of subsolid nodules performed between 2009-2013 with standard co-axial technique using 19 g introducer, 22g fine needle aspirate and 20g core needles and under conscious sedation. Inclusion criteria included surgical correlation or a minimum follow up of 2 years by imaging. There were a total of 94 patients (M:F 29: 65; mean age and range: 70.4 and 33-89 years). The mean size and range of nodule; 25mm; range 7-95mm. Fine needle aspirate was performed in all and core biopsy was done in 21 patients (24 %). Technical success rate for all attempts was calculated. Sensitivity and specificity for malignant and benign diagnoses for successful biopsies was calculated (86/94). The correlation with surgical pathology was available for 69% (59/86) and complication rate of procedure were assessed.

**RESULTS**

The technical success was 95% (89/94). There were 80 cancers and 6 benign lesions. The overall accuracy of TNB is 93% (80/86). There were 6 false negative malignant nodules on TNB. The sensitivity and specificity on TNB for malignant lesions is 92 and 100%. The concordance with surgery was 90% (53/59). The sensitivity of biopsy was higher for nodules >20 mm (95% vs. 88%) and for nodules <50% groundglass component (98% vs. 94 %). Core biopsy improved yield in only 5% (1/21). Minor hemoptysis was seen in 7.7%, pneumothorax in 21%. 19 patients had a small pneumothorax on CT (20.9%). No patient required a chest tube.

**CONCLUSION**

CT-guided transthoracic needle biopsy of subsolid nodules is a safe procedure with a high sensitivity and specificity for diagnosing malignant nodules.

**CLINICAL RELEVANCE/APPLICATION**

The high sensitivity and specificity of transthoracic needle biopsy in subsolid nodules, supports wider application of this technique, especially in the era of lung cancer screening.

**Honored Educators**

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

Subba R. Digumarthy, MD - 2013 Honored Educator
Purpose

At present, major improvements in device development, as well as modern special designed MR-suites (with MR-compatible life support and anesthesia equipment) have made the performance of MR-guided percutaneous procedures not only feasible, but also attractive. We retrospectively reviewed our single institution experience with percutaneous MR-guided cryoablation of renal tumours for technical feasibility, complications and outcomes (oncologic, renal function).

Method and Materials

Between April 2009 and March 2015, 68 patients underwent percutaneous MR-guided renal cryoablation. All procedures were performed in an MR-interventional unit, using a 1.5T large bore, supra-conductive system. Real-time BEAT IRTTT (3-simultaneous-plane sequence) and high-resolution T2-Blade/HASTE sequences were used for probe positioning and ice-ball monitoring.

Results

A total of 79 lesions in 68 patients were treated. Four patients were excluded because of less than 3 month follow-up. Twenty-one patients had a history of renal cancer (15 and 2 treated with total and partial nephrectomy, respectively, 4 with cryoablation). Mean maximal tumour diameter was 22mm (min 5, max 42). Biopsy results were available in 61 patients. Procedure related data (time, number-type of cryoprobes, ice ball size) were collected. Two freeze-thaw cycles were systematically performed. Hydrodissection was used in 37 patients. All procedures were technically successful. Local recurrent tumour was identified in six patients during the first six months of imaging follow-up. The local primary tumour control rate was 92%. One patient developed a late local recurrence at 3 years follow-up. Five out of six early and the late recurrence were treated percutaneously. Peri-operative major complication rate was 4.6% (one active bleeding necessitating embolization, one asymptomatic subcapsular hematoma, and one urethelial damage treated with ureteric catheter insertion). There was no procedural related death. Mean follow-up was 18 (3-70) months.

Conclusion

Percutaneous renal cryoablation can be performed with high technical and clinical success under MR-guidance. The real-time probe placement, high soft tissue contrast, multi-planar imaging, and the lack of ionizing radiation are some of the advantages of MR vs the CT-guidance.

Clinical Relevance/Application

Percutaneous cryoablation of T1a renal tumours can be performed safely and with high technical success under MR-guidance.
PURPOSE
To present the initial case series of percutaneous cryoablation of tumors in a horseshoe kidney.

METHOD AND MATERIALS
This is a single center retrospective review of 5 consecutive patients with a renal mass in a horseshoe kidney treated with percutaneous image-guided cryoablation from June of 2006 to August of 2013. Patient and tumor characteristics were extracted from the electronic medical record. Oncologic outcomes were defined using standardized criteria.

RESULTS
Average age of patient was 59 years old (4M, 1F), tumor size was 3cm (±1cm), and serum creatinine was 1.1±0.4. Of the 5 patients, 4 patients had biopsy proven clear cell renal cell carcinoma, and 1 patient had biopsy proven carcinoid. Technical success was achieved in all patients. The median follow-up duration is 19 months. There were no major complications. Transient elevation of creatinine, not requiring dialysis, occurred following treatment in one patient which has since normalized to baseline. A single patient had inguinal nerve pain that resolved within 3 months. Mean creatinine at follow-up was 1.1±0.3. All patients remain free of local tumor progression. Two patients expired 46 months and 24 months after ablation due to unrelated disease.

CONCLUSION
There is a paucity of data with regard to the safety, efficacy, and long term outcome of percutaneous cryoablation in the horseshoe kidney. From our initial series it seems that cryoablation is relatively safe in the treatment of small renal tumors, without impact on renal function. This is the first reported series of cryoablation in the horseshoe kidney and, in select patients, may present an alternative to surgical management.

CLINICAL RELEVANCE/APPLICATION
Percutaneous cryoablation represents an alternative treatment modality in patients with a small renal mass on a horseshoe kidney.

SSE10-04 Placement of Essure Tubal Occlusion Coils by Fluoroscopy; An Option when Hysteroscopic Placement Fails

Participants
Amy S. Thurmond, MD, Portland, OR (Presenter) Nothing to Disclose

PURPOSE
Nonsurgical tubal occlusion by Essure coils was FDA (Food and Drug Administration) approved in 2002 for hysteroscopic placement by gynecologists. Occasionally hysteroscopic placement of one or both coils is not possible—or the coil perforates or is expelled from the tube. Fluoroscopic fallopian tube catheterization has been used since 1987 as a nonsurgical method for unblocking proximal tubal occlusion in women with infertility. The feasibility of fluoroscopic fallopian tube catheterization for placement of Essure coils was explored.

METHOD AND MATERIALS
Women were referred by their gynecologists because of complications after hysteroscopic placement of the Essure device. No premedication, sedation, or anesthesia was given. Commercially available equipment was used to perform hysterosalpingograms, fallopian tube catheterization, and Essure placement. Equipment consisted of a 9 Fr balloon catheter for use in the cervix and uterus (Cook Medical), a 5 Fr catheter and 0.035 inch diameter hydrophilic guidewire for use in the fallopian tube (Cook Medical), and the Essure device and delivery system (Bayer Pharmaceutical).

RESULTS
Twelve women had attempt at fluoroscopic Essure placement in 14 tubes. Procedure was successful in 12/14 tubes (86%), including 5 tubes where hysteroscopic placement had failed, 2 tubes where hysteroscopic placement resulted in perforation, 3 tubes in which device was expelled after hysteroscopic placement, and 2 tubes with hydrosalpinx. Fluoroscopic placement failed in 2 tubes, in one because of severe tubal spasm which was also the reason for hysteroscopic failure, and in one tube (in which device had been expelled) because of pain during the procedure attributed to severe endometriosis. There were no complications. Six women have had post-procedure confirmation hysterosalpingograms required by the FDA and all 6 tubes with devices placed fluoroscopically were occluded (100%).

CONCLUSION
Ten of 12 high risk women (83%) who had failed Essure placement by hysteroscopy on one or both sides had subsequent successful fluoroscopic procedures allowing them to rely on the Essure devices for tubal occlusion. Twelve of 14 tubes (86%) were amenable to fluoroscopic placement of the Essure device.

CLINICAL RELEVANCE/APPLICATION
Ten of 12 women (83%) who would have been considered Essure failures and referred for tubal ligation, were converted to Essure successes by fluoroscopic placement of the device.

SSE10-05 Percutaneous Embolization of Varicocele By Steel and Platinum Coils

Participants
Syed Muhammad Faiq, MBBS, Karachi, Pakistan (Presenter) Nothing to Disclose
Khair Muhammad, MBBS, Karachi, Pakistan (Abstract Co-Author) Nothing to Disclose
Waseem A. Mirza, MBBS, Karachi, Pakistan (Abstract Co-Author) Nothing to Disclose

PURPOSE
None
The goal of this study was to present our experience with percutaneous treatment of male varicocele in view of procedural, clinical aspects in adult population.

**METHOD AND MATERIALS**

45 male with clinical moderate to severe varicocele associated with scrotal swelling with "bag of worms" or discomfort in testes, such as heaviness or dull pain after standing all day, referred from urology outpatient department to Radiology Department, where Doppler ultrasound was done which confirms the grade and patient underwent percutaneous varicocele embolization with coil.

**RESULTS**

The procedural success rate for spermatic vein occlusion was 93%. Follow-up, achieved of every patient after 6 month in urology outpatient department. Forty two patients (93%) reported disappearance of varicocele and as well as pain relief. In two patients percutaneous embolization procedure failed due to internal jugular vein approach and congenital venous abnormality. None of patients reported a reappearance of their varicocele. No significant complications occurred in 42 patients except pain in two patients and hematoma in two patients at femoral punctured site: none had any 6 months sequelae

**CONCLUSION**

Percutaneous embolization of varicocele carried out as outpatient procedure under local anesthesia and is more beneficial to patient in comparison to surgery. It has high procedural success rates, less recurrence rate, when performed by experience interventional radiologist. We believed primary therapy for varicocele treatment should be embolization if we compared various risk factors associated with surgery.

**CLINICAL RELEVANCE/APPLICATION**

Procedural and clinical success in elimination of varicocele by steel or platinum coils with low rate of failure and reappearance up to 6 month. High failure rate was seen in our study through internal jugular vein approach for venous access. We believed primary therapy for varicocele treatment should be embolization if we compared various risk factors associated with surgery.

**SSE10-06 Hysterosalpingo-foam Sonography (HyFoSy): A Prospective Observational Cohort Study of an Innovative, Radiation Free, Safe and Effective, Non(Embryo) Toxic Technique, to Visualize Tubal Patency in an Outpatient / Office Setting**

Participants
Anurag Singh, MBBS, MD, Sharjah, United Arab Emirates (Presenter) Nothing to Disclose
Tejashree Singh, Dubai, United Arab Emirates (Abstract Co-Author) Nothing to Disclose
Kiran C. Patil JR, MD, Jalgaon, India (Abstract Co-Author) Nothing to Disclose

**PURPOSE**

This study was conducted to evaluate the efficacy and safety of HyFoSy as a first step routine office procedure for tubal patency testing.

**METHOD AND MATERIALS**

A prospective observational cohort study was conducted in a medical center from 26/11/2014 - 4/4/2015. 46 patients with subfertility were examined. The mean age of patients was 31 years. The mean duration of subfertility was 2.2 years. The patients were asked to report for the test, on days 7-9 of their menstrual cycle. All patients were at low risk for tubal disease and had no history of tubal surgery. A non(embryo) toxic foam was created by rigorously mixing 10 ml hydroxymethylcellulose glycerol gel (88.25% water) with 10 ml purified water to give a mixture containing 94.10% water in a 20 ml syringe, and was introduced into the uterine cavity with the help of a disposable 5F single balloon catheter. This foam had low viscosity and was sufficiently stable to show echogenicity for at least 5 minutes. Tubal patency was determined by transvaginal ultrasound demonstration of echogenic dispersion of foam through the Fallopian tubes and the peritoneal spillage. The tubal contour, length and relation of spill with respect to ipsilateral ovary, were also noted. The pain score was calculated. No precautions with regard to pregnancy were advised.

**RESULTS**

In 45/46 (98%) patients (except 1 case of cervical stenosis), a successful procedure was performed. In these cases, there was no further need for a hysterosalpingogram (HSG). 42 patients (94%) had bilateral patent tubes and 3 patients (6%) had unilateral patent tubes. Only 1 patient (1/45; 2%) had mild vasovagal discomfort during the procedure that resolved spontaneously. The average pain score was 2.2. All procedures were uneventful and no serious side-effects were observed. Furthermore, in 10 patients (22%) conception occurred within a median of 3 months after the procedure. Review of literature found our results comparable with other similar studies.

**CONCLUSION**

Thus, HyFoSy is a successful, less painful and radiation free technique, easily performed in an office setting as a first step test for tubal patency. Comparison with other tubal patency tests was done as per the literature evaluation and our old experiences. It showed excellent findings in favor of HyFoSy.

**CLINICAL RELEVANCE/APPLICATION**

HyFoSy is a radiation free, less painful, non(embryo) toxic, effective alternative to HSG and definitely has a potential to be the new generation patient friendly first step office test for tubal patency.
PURPOSE
The purpose of our study is to evaluate the feasibility and safety of transjugular access for the management of non-matured autogenous arteriovenous fistulas (AVF).

METHOD AND MATERIALS
We retrospectively reviewed fifty-four patients who underwent transjugular endovascular treatment for non-matured AVFs from August 2013 to February 2015. The internal jugular vein ipsilateral to the AVF was accessed under ultrasound guidance. After catheterization of the arterial limb of the fistula, fistulography was performed to identify stenotic lesions which were subsequently treated by percutaneous transluminal angioplasty (PTA). On occasions when directional guidance was necessary, venography was performed through a 23 gauge scalp needle placed distally in the outflow vein to facilitate catheterization. We assessed the types of autogenous fistulas treated, time to catheterization of the AVF from the transjugular access, and total procedure time. The technical and clinical success rates, complications rate, and primary and secondary patency rates were also evaluated. Patency following PTA was estimated using the Kaplan-Meier method.

RESULTS
Eighteen patients had brachiocephalic fistulas (33.3%) and thirty-six patients had radiocephalic fistulas (66.7%). The mean time to catheterization of the AVF was 9.8 minutes and the mean total procedure time was 36.6 minutes. Venography via a scalp needle in the distal outflow vein was required in 35.2% of the cases (19 of 54 procedures) to facilitate catheterization. Technical and clinical success were achieved in 98.1% (53 of 54 AVFs) and 92.6% of patients (50 of 54 AVFs), respectively. Minor complication (oozing at the scalp needle puncture site) occurred in one patient. There were no major complications. Primary patency rates were 78.7% at 6 months and 57.5% at 1 year, respectively. Secondary patency rates were 87.7% at 6 months and 82.5% at 18 months, respectively.

CONCLUSION
Transjugular access for PTA of non-matured autogenous AVF is feasible and safe. This alternative route tackles potential problems of conventional techniques in PTA of non-matured fistulas such as difficult cannulation of non-matured outflow veins and hematomas following direct access into outflow veins.

CLINICAL RELEVANCE/APPLICATION
Endovascular management through transjugular access can be the first management modality in the salvage of non-matured autogenous AVF, as lowers the complication rate of conventional transvenous access.

SSE25-02 Outcomes of Fluoroscopic and Ultrasound Guided Placement versus Laparoscopic Placement of Peritoneal Dialysis Catheters

Monday, Nov. 30 3:10PM - 3:20PM Location: N226

Participants
Ahmed K. Abdel Aal, MD, PhD, Birmingham, AL (Presenter) Consultant, St. Jude Medical, Inc Consultant, Baxter International Inc Consultant, C. R. Bard, Inc Amr S. Moustafa, MBBCh, MSc, Birmingham, AL (Abstract Co-Author) Nothing to Disclose Peter Morad, MBBCh, Cairo, Egypt (Abstract Co-Author) Nothing to Disclose Aasmaa Mokhtar, Cairo, Egypt (Abstract Co-Author) Nothing to Disclose Islam H. Shawali, BSc, Cairo, Egypt (Abstract Co-Author) Nothing to Disclose Timothy M. Beasley, PhD, Birmingham, AL (Abstract Co-Author) Nothing to Disclose Maysoon Hamed, Birmingham, AL (Abstract Co-Author) Nothing to Disclose

PURPOSE
A variety of peritoneal dialysis catheter (PDC) placement techniques are available including laparoscopic placement by surgeons,
and percutaneous placement by Interventional Radiologists. The aim of this study was to compare our one-year outcomes of PDC placement using fluoroscopy and ultrasound guidance with those placed using the laparoscopic technique.

**METHOD AND MATERIALS**

We retrospectively reviewed the medical records of 201 patients who had their first PDC placed between January 2005 and October 2014. A total of 100 patients were included in the study. We compared the survival outcomes of the PDC placed using fluoroscopic and ultrasound guidance by interventional radiology (radiologic group, n=29), with the PDC placed using laparoscopic technique by surgeons (laparoscopic group, n=61). Survival analyses were performed with the primary outcome being complication-free PDC survival at 365 days. Secondary outcomes were complication-free PDC survival at 90 days, overall catheter survival, median days-to-first complication and median days-to-catheter removal.

**RESULTS**

In the radiologic group, the complication-free PDC survival at 90 and 365 days were 62% and 55% respectively, compared to 64% (p=0.99) and 38% (p=0.17) respectively, in the laparoscopic group. Catheter malfunction was the only complication that was statistically significantly higher in the laparoscopic group (41%) compared to the radiologic group (14%, p=0.05). The overall catheter survival was 83% and 72% in the radiologic and laparoscopic groups respectively (p=0.31). Further analysis of the PDC with complications and subsequent removal revealed that the median days-to-first complication and the median days-to-catheter removal were 31 and 14 respectively in the radiologic group which was significantly less, compared to 98 (p=0.0036) and 179 (p=0.0006) respectively, in the laparoscopic group.

**CONCLUSION**

The fluoroscopic and ultrasound guided placement of a PDC offers a clinically effective alternative to laparoscopic placement with similar one-year survival and complication rates. Subsequent PDC complications and removal occurred earlier in the radiologic group compared to the laparoscopic group.

**CLINICAL RELEVANCE/APPLICATION**

Peritoneal dialysis is an increasingly utilized dialysis modality due to its cost-effectiveness and patient survival equivalency compared to traditional in-center hemodialysis.

**SSE25-03 Same-day versus Delayed Arteriovenous Dialysis Graft Declotting: Does Timing Affect Procedural Success and Graft Patencies?**

**Participants**

Mark Winkler, Durham, NC (Presenter) Nothing to Disclose
Waleska M. Pabon-Ramos, MD, Durham, NC (Abstract Co-Author) Nothing to Disclose
Gemini L. Janas, RT, Durham, NC (Abstract Co-Author) Nothing to Disclose
Michael J. Miller JR, MD, Chapel Hill, NC (Abstract Co-Author) Speaker, Cook Group Incorporated Speaker, Boston Scientific Corporation Advisory Board, Boston Scientific Corporation Advisory Board, C. R. Bard, Inc Speaker, Kimberly-Clark Corporation
Tony P. Smith, MD, Durham, NC (Abstract Co-Author) Nothing to Disclose
Charles Y. Kim, MD, Durham, NC (Abstract Co-Author) Research Grant, Galil Medical Ltd; Consultant, Kimberly-Clark Corporation; Consultant, Cryolife, Inc

**PURPOSE**

To prospectively determine whether the interval between prosthetic arteriovenous graft (AVG) thrombosis and declotting affects procedural success, postintervention primary patency, or postintervention secondary patency.

**METHOD AND MATERIALS**

From March 2012 to March 2014, 94 adult patients who were referred for AVG declotting were recruited prospectively. Patients were categorized into two groups: those whose procedure was performed the same day that AVG thrombosis was detected (same-day), or those whose procedure was performed later (delayed). Data regarding post-procedure AVG interventions and AVG failure were collected from electronic medical records, and by calling patients and their dialysis centers. Fisher's exact test was used to compare the groups' procedure success rates. The primary patency and secondary patency were estimated using the Kaplan-Meier technique and compared using the log rank test. Univariate and multivariate Cox regression models were used to determine factors associated with the primary and secondary patencies. Factors assessed were: age, sex, inpatient vs outpatient status, graft age, graft configuration, history of prior ipsilateral tunneled dialysis catheter, number of prior graft interventions, indwelling stent, procedure time, and patient category (same-day vs delayed).

**RESULTS**

There were 2/26 (8%) unsuccessful procedures in the same-day group, and 3/68 (4%) in the delayed group (p=0.6). The median primary patency was 125 days (95%CI 118-292) for the same-day group, and 58 days (95%CI 82-167) for the delayed group (p=0.06). The median secondary patency was 327 days (95%CI 264-481) for the same-day group, and 300 days (95%CI 292-431) for the delayed group (p=0.9). On multivariate regression only, inpatient status (HR=2.6, 95%CI 1.3-5.3, p=0.01) and delayed declotting (HR=2.3, 95%CI 1.2-4.5, p=0.01) were independently associated with an increased risk of re-intervention.

**CONCLUSION**

Declotting thrombosed AVG the same day thrombosis is detected versus on a later day does not affect procedure success, primary patency, or secondary patency.

**CLINICAL RELEVANCE/APPLICATION**

Timing of declotting thrombosed AVG (on the same-day thrombosis is detected vs later) does not affect procedure success, primary patency, or secondary patency.

**SSE25-04 Five-years Clinical Experience with Paclitaxel-coated Balloon Angioplasty for Stenoses Causing Dysfunction of Dialysis Arteriovenous Fistula and Synthetic Grafts**
The evaluation of relative complications and tip-point of dialysis catheter

**PURPOSE**
This was an audit performed to evaluate the long-term safety and efficacy of paclitaxel-coated balloon (PCB) angioplasty of dysfunctional dialysis vascular access.

**METHOD AND MATERIALS**
From May 2010 to August 2014, we analysed 62 patients (40 male; mean age: 60±14 years) treated with PCBs due to dysfunctional arteriovenous fistulas (AVF; n=37) or grafts (AVG; n=25). Follow up period terminated on March 2015. Eighty eight procedures were performed (28 in AVGs, 60 in AVFs) to treat 88 lesions (38 de novo, 43.18%) with 97 PCBs (mean diameter: 5.9 ± 1.1mm, mean length: 67±24mm). In 26/88 cases (29.5%) post-dilation was necessary. Primary outcome measure was target lesion primary patency (TLPP). Secondary outcome measures included the identification of factors influencing TLPP and complications rates.

**RESULTS**
According to Kaplan-Meier analysis, TLPP was 70.3%, 28.6%, 8.9% and 5.9% at follow up 6, 12, 18 and 24 months, respectively. Cox multivariate regression analysis identified restenotic lesions (HR: 2.54; 95%CI: 1.42-4.56, p<0.002), previous stroke (HR: 3.11; 95%CI: 1.56-6.18, p=0.001) and thrombosed vascular access at presentation (HR: 2.67; 95%CI: 1.25-5.72, p=0.01) were independent predictors of decreased TLPP. Access age <3 years was correlated with superior TLPP (HR: 0.38; 95%CI: 0.20-0.70, p<0.002). Major complication rate was 1.1% (one cephalic vein rupture managed intra-procedurally with stent graft deployment).

**CONCLUSION**
In this series, Paclitaxel-coated balloon angioplasty of dysfunctional dialysis access was safe and provided very satisfactory primary patency rates. Treatment of de novo lesions was correlated with significantly better patency.

**CLINICAL RELEVANCE/APPLICATION**
PCB angioplasty of dysfunctional dialysis access is safe and yields superior long-term patency outcomes than those reported for plain balloon angioplasty.

**SSE25-06 Complications and Tip-point Location of Hemodialysis Catheter Scheduled into Superior Vena Cava: Findings on HR-MRCP and HR-T2WI**

**PURPOSE**
To evaluate the performance of displaying the tip-location and relative complications of double lumen dialysis catheter scheduled into superior vena cava (SVC) using high resolution MRCP (HR-MRCP) and T2WI (HR-T2WI).

**METHOD AND MATERIALS**
The study protocol was approved by the local Research Ethics Committee. Informed consent was obtained from all subjects. Forty two consecutive hemodialysis patients with suspicion of related complications were scanned by HR-MRCP and HR-T2WI using peripheral pulse wave and respiration gated technique after each catheter lumen installed with 5 ml saline. All images was assessed by two experienced radiologists in order to show the catheter tip-location and relative complications such as fibrin sheaths (FS), thrombus (Th) and intraluminal clot (ILC). All subjects would be taken chest X-ray within 1-3 days. For those patients with relative complications would be withdraw the catheter within 3-10 days. The tip location on X-ray was as the gold standard and was only in SVC and right atrium as normal.

**RESULTS**
40 out of 42 subjects were undergone successfully MRI. 12 subjects showed normal with "double-eyes" sign on HR-T2WI and "double track" sign on HR-MRCP. For the tip-point location, 6 patients showed catheter's tip-point abnormal including inside of the right ventricle (n=2), right brachiocephalic vein (n=2), inferior vena cava (n=1), right subclavian vein (n=1). The accuracy rate of HR-MRCP displaying catheter tip-point was 95% (38/40) in comparison with X-ray. For related complication, abnormal findings were detected in 28 (70%) subjects including FS (n=17; 42.5%), Th (n=8; 20%) and ILC (n=5; 12.5%). ILC was determined using the "single eye" sign displayed on HR-T2WI and "single track" on HR-MRCP when one catheter lumen was filled with blood clot (n=3), and the absence of "eye sign" on HR-T2WI when both lumens were obstructed (n=2). 28 subjects with relative complications had catheter's surgical withdrawal where the findings were FS (n=10), Th (n=5), ILC (n=4), and died (n=2) due to pulmonary embolism.

**CONCLUSION**
HR-MRCP and HR-T2WI are excellent methods for visualizing catheter tip-point and related complications in patient with dialysis catheter scheduled into SVC, which is helpful to avoid pulmonary embolism and adjust the treatment plan.

**CLINICAL RELEVANCE/APPLICATION**
The evaluation of relative complications and tip-point of dialysis catheter is vital for hemodialysis patients and is helpful to adjust
the tip-location for further dialysis and surgical withdraw.
Special Interest Session: Radiology and Radiation Oncology: A Partnership Made in Heaven

Monday, Nov. 30 4:30PM - 6:00PM Location: E351

IR OI RO

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants
Sarah S. Donaldson, MD, Palo Alto, CA (Moderator) Nothing to Disclose
Peter R. Mueller, MD, Boston, MA (Moderator) Consultant, Cook Group Incorporated

LEARNING OBJECTIVES
1) To understand the role of interventional radiologists in the care of patients with cancer. 2) To understand the increasing role of imaging in radiation oncology. 3) To learn which aspects of oncology must be taught to interventional radiologists in order to enable them to care for cancer patients appropriately. 4) To understand the overlap between radiation oncology and interventional oncology, and how these disciplines can become stronger by collaborating with each other.

Sub-Events

SPSI21A Interventional Oncology: The Fourth Pillar of Cancer Care

Participants
Andreas Adam, MD, London, United Kingdom (andy.adam@kcl.ac.uk) (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
View learning objectives under main course title.

SPSI21B It Takes More than Technology to Be an Oncologist: What Interventional Radiologists Can Learn from Radiation Oncology

Participants
Lizbeth Kenny, MD, FRANZCR, Herston, Australia (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
View learning objectives under main course title.

SPSI21C Image Targeted Oncology: The Birth of a New Specialty

Participants
Anthony L. Zietman, MD, Boston, MA (Presenter) Editor, Reed Elsevier

LEARNING OBJECTIVES
View learning objectives under main course title.
Interventional Radiology Tuesday Case of the Day

Tuesday, Dec. 1 7:00AM - 11:59PM Location: Case of Day, Learning Center

AMA PRA Category 1 Credit ™: .50

Participants
Anne M. Covey, MD, New York, NY (Presenter) Nothing to Disclose
Sreejit Nair, MD, New York, NY (Abstract Co-Author) Nothing to Disclose
Alan A. Sag, MD, New York, NY (Abstract Co-Author) Nothing to Disclose
Hooman Yarmohammadi, MD, New York, NY (Abstract Co-Author) Nothing to Disclose
Lynn A. Brody, MD, New York, NY (Abstract Co-Author) Stockholder, Sirtex Medical Ltd
Stephen B. Solomon, MD, New York, NY (Abstract Co-Author) Research Grant, General Electric Company
Quang Nguyen, MD, Brookline, MA (Abstract Co-Author) Nothing to Disclose
Muneeb Ahmed, MD, Wellesley, MA (Abstract Co-Author) Nothing to Disclose
Interventional Series: Embolotherapy

Tuesday, Dec. 1 8:30AM - 12:00PM Location: E351

VA IR

AMA PRA Category 1 Credits ™: 3.25
ARRT Category A+ Credits: 3.50

FDA Discussions may include off-label uses.

Participants
Brian S. Funaki, MD, Riverside, IL (Moderator) Data Safety Monitoring Board, Novate Medical
Rakesh C. Navuluri, MD, Chicago, IL (Moderator) Nothing to Disclose

LEARNING OBJECTIVES

1) Describe rationale of bariatric embolization. 2) Explain the rationale and treatment of high flow malformations. 3) Describe the preparation of cyanoacrylates for embolization. 4) List two complications related to embolization. 5) Recognize the significance of Type III endoleaks. 6) Describe approach to treatment of visceral aneurysms.

Sub-Events

RC314-01  Using Glue-How I Do It

Tuesday, Dec. 1 8:30AM - 8:45AM Location: E351

Participants
Yasuaki Arai, Tokyo, Japan (Presenter) Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

RC314-02 Empiric Embolization in Endoscopically Confirmed Non-variceal Acute Upper Gastrointestinal Hemorrhage is Expensive and Fails to Improve Clinical Outcome

Tuesday, Dec. 1 8:45AM - 8:55AM Location: E351

Participants
Karunakaravel Karuppasamy, MBBS, FRCR, Westlake, OH (Presenter) Nothing to Disclose
Bradley Martin, Cleveland, OH (Abstract Co-Author) Nothing to Disclose
Gordon McNelis, MD, Chagrin Falls, OH (Abstract Co-Author) Research Grant, Siemens AG; Research Grant, C. R. Bard, Inc;
Research Consultant, C. R. Bard, Inc; Research Consultant, Medtronic, Inc; Research Consultant, Siemens AG; Research Consultant, Surefire Medical, Inc; Research Consultant, René Medical; Advisory Board, Siemens AG; Advisory Board, Surefire Medical, Inc; Advisory Board, Medtronic, Inc;
Abraham Levitin, MD, Cleveland, OH (Abstract Co-Author) Nothing to Disclose
Baljendra S. Kapoor, MBBS, Cleveland, OH (Abstract Co-Author) Advisory Board, BTG International Ltd; Speaker, F. Hoffmann-La Roche Ltd
Mark J. Sands, MD, Cleveland, OH (Abstract Co-Author) Nothing to Disclose
Ram Kishore R. Gurajala, MBBS, FRCR, Beachwood, NJ (Abstract Co-Author) Nothing to Disclose

PURPOSE

To compare clinical outcomes, radiation exposure and costs of empiric embolization to no embolization after a negative angiogram in patients with esophagogastroduodenoscopically (EGD) confirmed non-variceal acute upper gastrointestinal source of bleeding (GIB).

METHOD AND MATERIALS

A retrospective review was performed of patients who had angiogram after EGD confirmed upper GIB between May 2011 and April 2013. 64 patients (43 male, 21 female) had no contrast extravasation. They were divided into two groups. Group 1 (n=30) had no embolization. Group 2 (n=34) had empiric embolization of gastroduodenal artery (n=23) or left gastric artery (n=11). Logistic and linear regression analyses were used to compare the groups. After adjusting for age and Rockall score, following clinical outcomes were measured: 30-day mortality, hospital stay, repeat procedures and transfusion requirements. Radiation exposure (fluoroscopy time and reference point air kerma) in both groups and cost of embolization in group 2 were collected.

RESULTS

Patients in groups 1 and 2 were similar in age and had similar Rockall scores (68.3 vs. 67.5 years, p=0.80, and 7.1 vs. 7.3, p=0.53, respectively). The 30-day mortality (30.0% vs. 23.5% (p=0.58)) and the mean hospitalization after angiogram (25.2 vs. 23.0 days (p=0.67)) were similar. Patients who had at least one repeat procedure (angiogram or endoscopy) after the initial angiogram was similar (50% vs. 50%, p=1.0). Among the available transfusion records (group 1=15; group 2=14), there was no difference in the units of packed red blood cells transfused after the initial angiogram (4.6 vs. 5.4, p=0.80). Reference point air kerma was similar (2147 vs. 2773 mGy, p= 0.19) but the fluoroscopy time was significantly higher in group 2 (17.7 vs 24.7 min, p=0.03). A total of 183 coils and 34 coil pushers were used during 32 angiograms in group 2. The mean combined cost of coils and coil pushers was $1747 (SD 1573, range 30 to 6213).

CONCLUSION

In the absence of contrast extravasation, empiric embolization in acute non-variceal upper GIB fails to improve clinical outcomes compared to no embolization and is associated with higher fluoroscopy time and embolization costs.

CLINICAL RELEVANCE/APPLICATION
Small retrospective reviews have supported empiric embolization in acute upper GIB. However, with one of the largest series, our review fails to support the same which is associated with higher fluoroscopy time and costs.

**RC314-03  Endovascular Management of Delayed Postpancreatectomy Hemorrhage**

**Tuesday, Dec. 1 8:55AM - 9:05AM Location: E351**

**Participants**
- Maxime Ronot, MD, Clichy, France (Abstract Co-Author) Nothing to Disclose
- Edwige Potter, Villejuif, France (Abstract Co-Author) Nothing to Disclose
- Sebastien Gaujoux, Clichy, France (Abstract Co-Author) Nothing to Disclose
- Alain Sauvanet, MD, Clichy, France (Abstract Co-Author) Nothing to Disclose
- Valerie Vilgrain, MD, Clichy, France (Presenter) Nothing to Disclose

**PURPOSE**
To assess the efficacy of endovascular management of delayed postpancreatectomy hemorrhage (PPH) as first line treatment.

**METHOD AND MATERIALS**
Between January 2005 and November 2013, all consecutive patients referred for endovascular treatment of PPH were included. Presence of active bleeding, pseudoaneurysm, arterial stenosis, collection, and culprit artery were recorded on pretreatment CT scans. Endovascular procedures were classified as technical success if bleeding origin was identified and treated, technical failure if identified bleeding was incompletely treated; and radiologic abstention if no abnormality was depicted and no treatment performed. Factors associated with postprocedural rebleeding were analyzed, together with second line treatments.

**RESULTS**
69 patients (53 men) were included with a mean age of 59 years (32-75). Pretreatment CT showed 27 (39%) active bleeding, 25 (36%) pseudoaneurysms, 2 (3%) arterial stenosis, and 44 (64%) postoperative collections. In 22 (32%) cases, no obvious culprit artery was found. Technical success, technical failure, or radiologic abstention were observed in 48 (70%), 9 (13%), and 12 patients (17%), respectively. 30 patients (44%) experienced rebleeding after a median delay of 2 days (range 0-46). Rebleeding rates were 29%, 58%, and 100% in case of success, abstention or failure at the first endovascular procedure, respectively (p < 0.001). Treatment efficacy was the only factor associated with rebleeding (success vs failure p < 0.001; success vs. abstention p = 0.09, abstention vs. failure p = 0.04, overall p < 0.001). Rebleeding was treated by endovascular treatment, surgery, or both, in 12 (40%), 11 (37%) and 7 (23%) patients, respectively. Overall, 72% of the patients were successfully treated by endovascular procedures alone.

**CONCLUSION**
After a first endovascular procedure for PPH, almost half of patients rebleed. Rebleeding risk depends on the initial success of the procedure. Most patients are successfully treated by endovascular approach alone.

**CLINICAL RELEVANCE/APPLICATION**
Despite a high rebleeding rate, embolization should be proposed as first line treatment of post pancreatectomy hemorrhage because the majority of patients can be successfully treated by endovascular approach alone.

**RC314-04  Preoperative Embolization to Enhance Collateral Blood Flow via the Gastroduodenal Artery in Patients Undergoing Distal Pancreatectomy with Resection of the Celiac Axis**

**Tuesday, Dec. 1 9:05AM - 9:15AM Location: E351**

**Participants**
- Markus Zimmermann, MD, Aachen, Germany (Presenter) Nothing to Disclose
- Martin Liebl, MD, Aachen, Germany (Abstract Co-Author) Nothing to Disclose
- Maximilian F. Schulte-Hagen, MD, Aachen, Germany (Abstract Co-Author) Nothing to Disclose
- Federico Pedersoli, Aachen, Germany (Abstract Co-Author) Nothing to Disclose
- Maximilian Schmeling, Aachen, Germany (Abstract Co-Author) Nothing to Disclose
- Peter Isfort, MD, Aachen, Germany (Abstract Co-Author) Nothing to Disclose
- Christiane K. Kuhl, MD, Bonn, Germany (Abstract Co-Author) Nothing to Disclose
- Philipp Bruners, MD, Aachen, Germany (Abstract Co-Author) Nothing to Disclose

**PURPOSE**
Locally advanced pancreatic cancer with infiltration of the celiac axis carries a grave prognosis and has previously widely been considered as irresectable. Nevertheless, selected patients may benefit from distal pancreatectomy with resection of the celiac axis (DP-CAR). However, resection of the celiac axis may result in postoperative hepatic or gastric ischemia if collateral blood flow from the superior mesenteric artery (SMA) via the gastroduodenal artery (GA) is insufficient. We present a technique for preoperative angiographic evaluation and possibly enhancement of blood flow in this collateral by embolization of the celiac axis (CA) or the common hepatic artery (CHA).

**METHOD AND MATERIALS**
Between 2010 and 2015 six patients with locally advanced pancreatic cancer with invasion of the celiac axis underwent preoperative angiography and embolization of the celiac axis (4) or the common hepatic artery (2) before DP-CAR. 5F sheaths were placed in both common femoral arteries and through one sheath a catheter was introduced and placed in the SMA. Through the other sheath another catheter was simultaneously placed in the CA/CHA and an Amplatzer™ vascular plug was deployed - without releasing it - for temporary occlusion of the CA/CHA. Subsequently, an angiography of the SMA was performed to evaluate retrograde blood flow from the SMA via the GA to the proper hepatic artery. If sufficient retrograde flow via the GA was present, the Amplatzer™ plug was permanently released in order to further increase the flow rate in this collateral.

**RESULTS**
All six patients demonstrated sufficient collateral blood flow via the GA and consecutively underwent successful embolization of
either the CA or the CHA. No peri-interventional complications were noted. Eventually, five patients were treated with DP-CAR, of which four histologically demonstrated clear surgical margins (R0). One patient did not undergo DP-CAR because of intraoperatively discovered peritoneal metastases.

CONCLUSION
The presented technique allows safe preoperative angiographic evaluation and possibly enhancement of collateral bloodflow from the SMA via the GA in patients undergoing DP-CAR, in order to reduce the risk of postoperative morbidity from hepatic or gastric ischemia.

CLINICAL RELEVANCE/APPLICATION
Our technique allows preoperative evaluation and possibly enhancement of collateral blood flow from the SMA via the gastroduodenal artery in patients undergoing DP-CAR.

RC314-05  Embolotherapy-My Worst Cases
Tuesday, Dec. 1 9:15AM - 9:30AM Location: E351

Participants
Robert A. Morgan, MD, London, United Kingdom, (robert.morgan@stgeorges.nhs.uk) (Presenter) Proctor, Medtronic, Inc

LEARNING OBJECTIVES
View learning objectives under main course title.

ABSTRACT

RC314-06  The Type III Endoleak-The Great Pretender
Tuesday, Dec. 1 9:30AM - 9:45AM Location: E351

Participants
Brian S. Funaki, MD, Riverside, IL (Presenter) Data Safety Monitoring Board, Novate Medical

LEARNING OBJECTIVES
View learning objectives under main course title.

RC314-07  Case of the Session-Splenic Artery Embolization (or Lack Thereof)
Tuesday, Dec. 1 10:05AM - 10:20AM Location: E351

Participants
Brian S. Funaki, MD, Riverside, IL (Presenter) Data Safety Monitoring Board, Novate Medical

LEARNING OBJECTIVES
View learning objectives under main course title.

RC314-08  High Flow Malformations-How I Treat Them
Tuesday, Dec. 1 10:20AM - 10:35AM Location: E351

Participants
James E. Jackson, MD, London, United Kingdom (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
1) To understand the indications for treatment of high-flow vascular malformations. 2) To understand the differing vascular anatomy of arteriovenous malformations and how this affects treatment approach and outcome. 3) To understand those methods of embolization of arteriovenous malformations that are likely to improve results and reduce complications.

ABSTRACT
The most important aspect of embolization of high-flow vascular malformations is an understanding of the anatomy of the vascular communications within them as this has a bearing both upon the method of vascular occlusion and on the final result. Whatever the anatomy, however, the general principle is that occlusion is performed at the site of the abnormal arteriovenous shunts and not in the vessel proximal to this point. The embolization of arterial feeding vessels, which was performed for many years with metallic coils or particulate matter such as polyvinyl alcohol, is akin to proximal surgical ligation and must be avoided. It has little effect upon symptoms in most individuals and renders subsequent treatment more difficult because the arterial inflow vessels have been occluded. If, however, the embolization is directed at the AV communications themselves, from an arterial approach, via a direct percutaneous puncture or retrogradely from the venous side, and these are totally obliterated - often with a liquid embolic agent - then a long-term improvement in symptoms can be achieved. This presentation will concentrate on the radiological management of these high-flow lesions. The cure of a high flow vascular anomaly is uncommon although there is no doubt that radiological and clinical obliteration of more malformations has come with a better understanding of their radiological anatomy and the use of agents that are directed at the AV shunts themselves rather than at the proximal feeding vessels.

RC314-09  Value of Embolization in the Management of Pelvic Venous Incompetence
Tuesday, Dec. 1 10:35AM - 10:45AM Location: E351

Participants
Marc Antoine Jegonday, Caen, France (Presenter) Nothing to Disclose
Vincent Le Penneec Sr, MD, Caen, France (Abstract Co-Author) Educator, Cook Group Incorporated
Audrey Fohlen, Caen, France (Abstract Co-Author) Nothing to Disclose
Bertrand Lamy, Caen, France (Abstract Co-Author) Nothing to Disclose
PURPOSE

To assess the efficacy of embolotherapy to treat symptomatic pelvic venous incompetence (PVI).

METHOD AND MATERIALS

Retrospective evaluation of women with symptomatic PVI treated with embolization. Primary clinical success defined as decrease in pelvic and lower limb pain using a visual analogue scale (VAS). Associated symptoms including dyspareunia, vulvar pain or lower limb venous insufficiency as well as complications were also assessed.

RESULTS

A total of 114 women (mean age 40.9 ± 10.3 years) including 74% with pelvic pain (VAS of 6.5 ± 1.8) and 64% with lower limb pain (VAS of 5.6 ± 2.1) were treated. The most common incompetent veins were the left ovarian (82%), internal pudendal (right 49%; left 39%), inferior gluteal (right 32%; left 31%) and uterine (right 19%; left 23%) veins. Technical success was 89%. Follow-up included consultation organized after 3.5 ± 4.0 months and consultation or telephone interview after 50 ± 34.6 months, respectively. Pelvic pain VAS decreased to 1.6 ± 2.4 (p<0.0001) and 1.0 ± 2.2 (p<0.0001) at the first and second visits, respectively, with a long term success of 94%. Mean lower limb pain VAS decreased to 3.6 ± 2.7 (p<0.0001) and 2.5 ± 2.6 (p<0.0001) at the 2 time-points, with a long term success of 88%. VAS decreased significantly between short and long term evaluations. Clinical improvement of associated symptoms was also observed. Major complication rate was low (9%).

CONCLUSION

Embolization of symptomatic PVI is a safe and effective treatment in well-selected patients, with a progressive and long-lasting clinical success.

CLINICAL RELEVANCE/APPLICATION

Embolization is safe and effective to treat symptomatic PVI and is recommended when a pelvic venous origin of symptoms is established.

Participants

Orrie N. Close, MD, Pittsburgh, PA (Presenter) Nothing to Disclose
Kevin M. McCluskey, MD, Pittsburgh, PA (Abstract Co-Author) Nothing to Disclose
Donghoon Shin, MS, Pittsburgh, PA (Abstract Co-Author) Nothing to Disclose
Kevin Ching, MD, Pittsburgh, PA (Abstract Co-Author) Nothing to Disclose
Robert F. Short, MD, PhD, Charlottesville, VA (Abstract Co-Author) Nothing to Disclose

PURPOSE

To evaluate clinical outcomes for endovascular treatment of hemoptysis with microcoils and/or microparticles for bronchial and non-bronchial systemic artery embolization.

METHOD AND MATERIALS

A single institution IRB-approved review included all patients who underwent embolization for hemoptysis from 12/2008 to 12/2014. Patient demographics, technical details, angiographic findings, complications, rate of recurrence, and need for repeat intervention were reviewed. Person-years were calculated to evaluate the incidence of recurrence by endovascular treatment method. Statistical analyses were performed using Fisher's exact and chi-square tests.

RESULTS

114 embolizations were performed in 97 patients for hemoptysis. 56 embolization procedures performed in 48 patients (mean: 58 y; range 20-91y) employed microcoils (<0.18 inch). (Of these, 10 patients received microcoil embolization only.) 58 microparticle embolizations were performed in 49 patients (52 y; range 24-84y). Rebleeding occurred following 23 (41.1%) coil embolizations and 24 (42.1%) microparticle embolizations (p=1.00). Incidence of rebleeding in the coil and particle embolization groups were 50.6 and 64.6 per 100 person-years respectively (p=.5). The incidence ratio between the groups was 1.28 (95% CI: 0.69, 2.37). Complication rate was 7.1% in the coiling group (bronchial arterial dissections: n= 4) vs. 10.3% in the particle embolization only group (arterial dissections: n= 4, spinal cord infarction: n= 1, and access site retroperitoneal hemorrhage: n= 1). (p= 1.0). One procedure for recurrent hemorrhage was impeded by previously placed embolization coils.

CONCLUSION

Transcatheter embolization for hemoptysis is safe and effective using microcoils and/or microparticles. The incidence rate of recurrent hemoptysis following microcoil vs. microparticle embolization is not significantly different.

CLINICAL RELEVANCE/APPLICATION

Use of microcoils for transcatheter embolization in the treatment of hemoptysis can be safely performed with similar clinical efficacy and complication rates as that of microparticles.

Participants

Jean-Pierre J. Pelage, MD, PhD, Caen, France (Abstract Co-Author) Research Grant, Merit Medical Systems, Inc; Consultant, Merit Medical Systems, Inc; Research Grant, Cook Group Incorporated; Consultant, Cook Group Incorporated; Research Grant, Keocyt; Medical Board, Keocyt; Research Grant, Terumo Corporation; Consultant, Terumo Corporation; Research Grant, ALN; Consultant, ALN; Consultant, Boston Scientific Corporation; Research Grant, BTG International Ltd
Obesity affects about 30% of the United States population. It is responsible for numerous comorbidities including diabetes mellitus and its complications, cardiovascular disease, sleep apnea, and premature osteoarthritis. This is the first use of left gastric artery embolization in the Western Hemisphere to treat morbid obesity.

**METHOD AND MATERIALS**

Retrospective analysis of all percutaneous PAVMs embolization performed between 2004 and 2014 in our institution. Data from patient files was collected regarding method of embolization (Amplatzer plugs, coils or both) and regarding all complications. Data regarding rates of re-canalization in treated PAVMs was assessed from follow-up imaging (following percutaneous procedure or CT Angiography).

**RESULTS**

36 patients (19M, 17F), median age 32.5 years [1.9-72.7 years] underwent 51 percutaneous trans-catheter procedures at our institution and 8 procedures in outside institutions, with embolization of a total of 142 simple or complex PAVMs [72 coils, 56 Amplatzers plugs and 14 plugs and coils]. Two patients had self-resolving mild hemoptysis following embolization. No other major procedure-related complications occurred. Of this group, 16 patients with 63 PAVMs that were occluded [37 with coils, 21 with Amplatzers plugs and 5 with both plugs and coils] underwent follow-up imaging [13 angiographies, 1 CT Angiography]. 7 PAVMs showed re-canalization of occluded vessels, at a median follow-up of 8.6 years [1.5-18.11 years]. All re-canalizations occurred in coiled vessels. No re-canalizations occurred through Amplatzers plugs [7/37 vs. 0/21], p-value = 0.0413 (Fisher's exact test).

**CONCLUSION**

The use of Amplatzers plugs for PAVMs embolization in HHT patients appears to be safe and effective, and has a lower re-canalization rate of feeding vessels compared to coils.

**CLINICAL RELEVANCE/APPLICATION**

The use of coils as the standard of care for PAVMs embolization should be re-evaluated, since the use of Amplatzers vascular plugs is shown to have better long term results, without additional risks.

**RC314-12 Bariatric Embolization for Morbid Obesity, First Western Hemisphere Experience: Gastric Artery Embolization Trial for Lessening Appetite Nonsurgically (GET LEAN)**

Tuesday, Dec. 1 11:05AM - 11:15AM Location: E351

Participants

Mubin I. Syed, MD, Dayton, OH (Presenter) Consultant, CareFusion Corporation; Kamal Morar, MD, Dayton, OH (Abstract Co-Author) Nothing to Disclose Azim Shaikh, MD, MBA, Dayton, OH (Abstract Co-Author) Nothing to Disclose Paul Craig, MD, MA, Minneapolis, MN (Abstract Co-Author) Nothing to Disclose Talal Akhter, MD, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose Hooman Khabiri, MD, Columbus, OH (Abstract Co-Author) Nothing to Disclose Omar Khan, Dayton, OH (Abstract Co-Author) Nothing to Disclose

**PURPOSE**

The purpose of this pilot study is to achieve the collection of safety and efficacy data in patients undergoing left gastric artery embolization for morbid obesity in the Western Hemisphere.

**METHOD AND MATERIALS**

This is an FDA-IDE pilot study. 5 patients have been approved to undergo the left gastric artery embolization procedure for the purpose of weight loss using Beadblock 300-500 micron particles. All patients will undergo EGD follow up pre and post procedure. Ghrelin, Leptin and CCK levels will also be measured at baseline and post procedure per follow up protocol. Inclusion Criteria Morbid obesity with a BMI ≥ 40 Age ≥ 22years Ability to lay supine on an angiographic table ≤400lbs due to table weight limits Appropriate anesthesia risk as determined by certified anesthesia provider evaluation preprocedure Subjects who have failed previous attempts at weight loss through diet, exercise, and behavior modification (as it is recommended that conservative options, such as supervised low-calorie diets combined with behavior therapy and exercise, should be attempted prior to enrolling in this study).

**RESULTS**

The first patient has lost 30lbs at 3 months. Second patient has lost 12lbs at 1 month. Third patient has lost 6lbs in 1 week. There have been no major adverse events. The final 2 patients in this study are still being selected.

**CONCLUSION**

This is the first experience in the United States of performing left gastric artery embolization for the purpose of treating morbid obesity. Early results are promising and show no major adverse events thus far. The radial artery has also proven to be a feasible approach to performing this procedure with implications for a safer access site.

**CLINICAL RELEVANCE/APPLICATION**

Morbid obesity is a prevalent and deadly public health problem. Obesity affects about 30% of the United States population. It is responsible for numerous comorbidities including diabetes mellitus and its complications, cardiovascular disease, sleep apnea, and premature osteoarthritis. This is the first use of left gastric artery embolization in the Western Hemisphere to treat morbid obesity.
This is also the first radial artery access experience with implications for the morbidly obese where groin access may be more challenging.

**RC314-13  Bariatric Embolization. Is This the Next Big Thing?**  
Tuesday, Dec. 1 11:15AM - 11:30AM Location: E351  

Participants  
Mubin I. Syed, MD, Dayton, OH (*Presenter*) Consultant, CareFusion Corporation;  

**LEARNING OBJECTIVES**  
View learning objectives under main course title.  

**ABSTRACT**  
Bariatric embolization is an exciting new procedure for the potential treatment of obesity. This talk outlines the background behind the procedure as well as the latest human experience.

**RC314-14  Visceral Aneurysms**  
Tuesday, Dec. 1 11:30AM - 11:45AM Location: E351  

Participants  
Michael D. Darcy, MD, Saint Louis, MO (*Presenter*) Speakers Bureau, W. L. Gore & Associates, Inc; Speaker, Cook Group Incorporated;  

**LEARNING OBJECTIVES**  
1) The incidence and presentation of visceral aneurysms. 2) The indications for treating visceral aneurysms. 3) Techniques for treating visceral aneurysms. 4) Potential complications from treatment of visceral aneurysms.

**RC314-15  Wrap Up and Discussion**  
Tuesday, Dec. 1 11:45AM - 12:00PM Location: E351  

Participants
RC350A  Cardiac CT- Pre, Peri and Post Procedural Management

Participants
Alison Wilcox, MD, Los Angeles, CA (Moderator) Speaker, Toshiba Corporation

Sub-Events

LEARNING OBJECTIVES
1) Review pre-procedural patient preparation including appropriate patient selection, beta blockade, contraindications and alternatives to beta blockers 2) Discuss how to manage non-standard scenarios (atrial fibrillation, pacemaker, young adults) 3) Peri-procedural issues including vasodilation, continued heart rate control, and breathholding requirements. 4) Image acquisition including radiation dose reduction techniques, technique choice, and post CABG patient. 5) Postprocedural complications include contrast reactions and their management.

ABSTRACT
Cardiac CTA involve slightly more preparation than the standard CT acquisition. Heart rate control is the most important aspect that needs to be addressed prior to the patient arriving in the radiology department. Periprocedural issues mostly involved how to optimize technique while having the lowest radiation dose especially in the new age of dose reduction. Almost as important as heart rate management is how to treat postprocedural complications especially contrast reactions. This presentation will discuss these aspects and include treatment options as well as their alternatives.

RC350B  TEVAR/EVAR- Pre, Post and Periprocedural Evaluation

Participants
Alison Wilcox, MD, Los Angeles, CA (Presenter) Speaker, Toshiba Corporation

LEARNING OBJECTIVES
1) What are some clinical indications for acute aortic imaging. 2) What are some CT parameters that can aid in various diagnosis? 3) What are some of common complications seen in TEVAR and EVAR? 4) What are the important measurements and vessel variants that help guide surgical approach. 5) New suggestions for type B management. 6) What are some imaging problems and pitfalls and some methods to assist. 7) Briefly discuss TAVR acquisition.

ABSTRACT
The acute aorta is part of a syndrome of diseases affecting the aorta with significant overlap of findings and clinical presentations. Clinically the diagnosis is difficult as there is overlap between patients with suspected coronary disease, pulmonary embolism and acute aortic syndrome. In the past several years, minimally invasive surgery with Thoracic Endovascular Aortic Repair (TEVAR) or Endovascular Aortic Repair (EVAR) have become increasingly popular. The images choices include gated vs non gated studies, non-contrast imaging, and delayed imaging. The literature is mixed on how and when to use these modalities. The complications of these procedures is often complex and subtle as well. Knowledge of these vascular complications is imperative for patient management. In addition, these patients often have significant atherosclerotic disease elsewhere that might be limiting factors for stent placement, including renal insufficiency. Newer scanners and imaging techniques can reduce radiation dose, and limit the amount of contrast delivery to preserve renal function while preserving image quality. TAVR is an example of another minimally invasive technique gaining popularity that has imaging challenges. Again, newer scanning techniques with limited contrast delivery can provide excellent image quality while limiting radiation dose and preserving renal function.

RC350C  Peripheral CTA-A How-to

Participants
Ilya Lekht, MD, Los Angeles, CA (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
1) Enhance knowledge of normal and abnormal coronary and cardiac anatomy, with an emphasis on differentiating benign from significant variants. 2) Demonstrate the spectrum of nonatherosclerotic congenital and acquired diseases that may affect the coronary arteries. 3) Demonstrate the spectrum of non-atherosclerotic congenital and acquired diseases that may affect the heart.

ABSTRACT
A variety of non-atherosclerotic conditions are detectable on cardiac CT scans, including diseases of the heart, and disease processes which may affect the coronary arteries, or other vascular structures. Cardiac CT has a number of unique advantages in detecting non-atherosclerotic conditions, including congenital and acquired diseases. The focus of this presentation will be non-atherosclerotic conditions of the coronary arteries and of the heart. Variants of normal and abnormal anatomy of the coronary arteries will be discussed, including tips for identifying when coronary anatomic variants are significant. Acquired, non-atherosclerotic diseases of the coronary arteries will also be discussed. This presentation will also discuss the spectrum of non-
atherosclerotic diseases of the heart which may be detected at cardiac CT, including congenital and acquired valvular and cardiac diseases. At the end of this exhibit, the viewer will have a better appreciation for abnormal coronary and cardiac anatomy and the broad spectrum of non-atherosclerotic cardiovascular diseases which may be seen at cardiac CT.
VI226-SD-TUA1

Significance and Efficacy of Super-selective ACTH-stimulated Adrenal Venous Sampling, Compared to Conventional Sampling Method

Station #1

Participants
James T. Bui, MD, Chicago, IL (Moderator) Nothing to Disclose

Sub-Events

PURPOSE
To assess the utility and superiority of super-selective ACTH (adrenocorticotropin hormone) -stimulated AVS (adrenal venous sampling), compared to conventional sampling method.

METHOD AND MATERIALS
Institutional review board approval and written informed consent were obtained. Between January 2010 and March 2015, 122 patients (mean age: 54.0 ± 11.4 years, range: 27 - 73 years) with primary aldosteronism underwent super-selective AVS. Before and after ACTH stimulation, conventional venous sampling was performed at infra and supra renal inferior vena cava (IVC), and left renal vein, common trunk of left inferior phrenic and adrenal vein, and right adrenal vein. Proceedingly, super-selective venous sampling was performed with microcatheter at left central adrenal vein, superio-medial, superior-lateral, and lateral branch of left adrenal vein. Aldosterone/Cortisol ratio was calculated in all sites and compared each other to detect unilateral lesion.

RESULTS
We could successfully perform super-selective AVS for all subjects. Seventeen patients (13.9% of total) had negative findings of primary aldosteronism on adrenal venous sampling. Sixty-six patients (54.1% of total) had bilateral excess aldosterone secretion. Thirty-nine (32.0% of total) patients had unilateral excess production of aldosterone. Six cases out of 39 (15.4%, 5.0% of total) had negative results on conventional AVS, whereas unilaterality was proved by super-selective AVS. Those cases are thought to have the possibility to miss the opportunity of surgical treatment with conventional AVS.

CONCLUSION
Super-selective AVS is superior to detect the unilaterality of excess secretion of aldosterone, as well as identifying the location of the lesion in adrenal grand, compared to conventional AVS. Without super-selective AVS, 5% of primary aldosteronism patients have possibility to miss the opportunity of surgical treatment.

CLINICAL RELEVANCE/APPLICATION
Adrenal venous sampling with high accuracy is needed for primary aldosteronism to decide treatment options.

VI227-SD-TUA2

Robust Image Quality with a 60% Reduction in Both Contrast Material and Radiation Dose using 70-kV Images in Third Generation Dual-source CT

Station #2

Participants
Erina Suehiro, RT, Kobe, Japan (Presenter) Nothing to Disclose
Tatsuya Nishii, MD, PhD, Kobe, Japan (Abstract Co-Author) Nothing to Disclose
Kiyosumi Kagawa, Kobe, Japan (Abstract Co-Author) Nothing to Disclose
Noriyuki Negi, RT, Kobe, Japan (Abstract Co-Author) Nothing to Disclose
Yoshiaki Watanabe, MD, Tokyo, Japan (Abstract Co-Author) Nothing to Disclose
Atsushi K. Kono, MD, PhD, Kobe, Japan (Abstract Co-Author) Nothing to Disclose
Satoru Takahashi, MD, Kobe, Japan (Abstract Co-Author) Nothing to Disclose
Kazuo Sugimura, MD, PhD, Kobe, Japan (Abstract Co-Author) Research Grant, Toshiba Corporation Research Grant, Koninklijke Philips NV Research Grant, Bayer AG Research Grant, Eisai Co, Ltd Research Grant, DAIICHI SANKYO Group, Hideaki Kawamitsu, MD, Kobe, Japan (Abstract Co-Author) Research Grant, Koninklijke Philips NV Research Grant, Bayer AG Research Grant, Eisai Co, Ltd Research Grant, DAIICHI SANKYO Group, Hideaki Kawamitsu, MD, Kobe, Japan (Abstract Co-Author) Nothing to Disclose

PURPOSE
This study aimed to evaluate radiation and contrast material requirements for thoraco-abdominal CT angiography (CTA) at 70-kV compared with conventional 120-kV CTA using third-generation dual-source CT (3rd DSCT).

METHOD AND MATERIALS
Seventy-nine consecutive patients (mean, 72 years old, 25 females) who had undergone helical CTA with a bolus tracking method
using 3rd DSCT were retrospectively reviewed. We excluded 36 patients who already had stenting or coiling, which could affect image quality by artifacts. In 120-kV scanning (n = 19), 400 mgI/kg of contrast material was injected for 30 s. For 70-kV scanning (n = 24), 240 mgI/kg (60%) of contrast material was injected at the same rate as that for 120-kV scanning. For objective image quality, the CT value and standard deviation in the ascending, descending, and abdominal aorta, and bifurcation were obtained. The signal-to-noise ratio (SNR) in each part of the aorta, contrast-to-noise ratio (CNR) of the abdominal aorta compared with the psoas muscle, and CNR per unit dose (CNRD = CNR / square root of the CT dose index) were evaluated. Differences in objective image quality, amount of contrast material, and radiation dose between the two methods were assessed by Welch's test.

RESULTS

The SNR and CNR were not significantly different between the two methods. However, in the 70-kV scan, the CNRD was significantly higher (11.6 ± 4.2 vs. 9.4 ± 2.9; P = 0.04), with a significantly lower amount of contrast material (14.3 ± 2.7 vs. 23.5 ± 5.6 gI; P < 0.01) and radiation dose (DLP, 570.5 ± 55.5 vs. 842.0 ± 221.3 mGy*cm; P < 0.01) compared with the 120-kV scan.

CONCLUSION

CTA at 70-kV with 3rd DSCT results in robust image quality with a significantly reduced amount of contrast material and radiation dose compared with 120-kV CTA.

CLINICAL RELEVANCE/APPLICATION

CTA at 70-kV with 3rd DSCT results in a 60% reduction in the amount of contrast material and radiation dose with robust image quality compared with 120-kV CTA.

TEACHING POINTS

- To review the congenital IVC variants - To explain the embryologic development of the vena cava - To show the imaging findings based on the embryology - To review the importance of planning the vascular procedures
**PURPOSE**

The purpose of this study was to evaluate the diagnostic performance of non-contrast-enhanced magnetic resonance angiography with time-spatial labeling inversion pulse (NCE-TSMRA) in the assessment of pulmonary arteriovenous malformation (PAVM).

**METHOD AND MATERIALS**

Twelve consecutive patients (3 men, 9 women; age, 21-81 years) with 36 documented PAVMs (30 untreated and 6 treated lesions at initial examination) underwent NCE-TSMRA with a 3.0-tesla unit. Eight patients with 20 lesions were examined twice, once before and once after the embolotherapy for follow-up examination. The lesions were divided into two groups: "Initial diagnosis" and "Follow-up" corresponding to untreated and treated lesion, respectively, and were evaluated separately. For evaluation of the "Initial diagnosis" group, two reviewers assessed the presence, location, and classification of PAVM on NCE-TSMRA, and all results were compared with those of digital subtraction angiography. Image quality was also rated on a qualitative 4-point scale (1: not assessable to 4: excellent). For evaluation of the "Follow-up" group, the reviewers assessed the status of treated PAVM on NCE-TSMRA. The reperfusion and occlusion of PAVMs on NCE-TSMRA are defined as visualization and disappearance of aneurysmal sac corresponding to treated lesions, respectively. The diagnostic accuracies of NCE-TSMRA were assessed and compared with standard reference images. Interobserver agreement was evaluated with the k statistic.

**RESULTS**

In the "Initial diagnosis" group, NCE-TSMRA correctly determined the presence, location, and classification of PAVMs in all but one patient with one lesion, who represented image degradation due to irregular breath. Additionally, NSE-TSMRA could selectively visualize the feeding artery and venous sac, which provide hemodynamic information for the diagnosis of PAVM. Image quality was considered excellent (3.5 ± 0.7) and the k coefficient was 0.85. In the "Follow-up" group, the sensitivity and specificity of NSE-TSMRA for reperfusion of PAVM was all 100%, and the k coefficient was 1.00.

**CONCLUSION**

NCE-TSMRA is technically and clinically feasible and represents a promising technique for non-invasive assessment of PAVM.

**CLINICAL RELEVANCE/APPLICATION**

NCE-TSMRA is a good alternative modality for the assessment of PAVMs, particularly in young subjects, women of childbearing age, and patients with renal sufficiency.
Primary endpoint was 6-month primary binary patency of treated lesions, defined as <= 50% stenosis on Computed Tomography Angiography. Stenosis > 50%, re-treatment, major amputation and CLI related death were regarded as treatment failure. Severity of failure was assessed with an ordinal score, ranging from vessel stenosis through occlusion to the clinical failures.

RESULTS
Seventy-four limbs (73 patients) were treated with DES and 66 limbs (64 patients) received PTA±BMS. Six-month patency rates were 48.0% for DES and 35.1% for PTA±BMS (p=0.096) in the modified-intention-to-treat and 51.9% and 35.1% (p=0.037) in the per-protocol analysis. The ordinal score showed significantly worse treatment failure for PTA±BMS vs. DES (p=0.041). The observed major amputation rate remained lower in the DES group until 2 years post-treatment (p=0.066). Less minor amputations occurred after DES until 6 months post-treatment (p=0.03).

CONCLUSION
In CLI with infrapopliteal lesions, DES provide better 6-month patency rates compared with PTA with bail out BMS. The major amputation rate of DES remains lower until two years post-treatment, with a trend towards significance. Therefore, a treatment strategy with DES should be considered in CLI patients with infrapopliteal lesions.

CLINICAL RELEVANCE/APPLICATION
Drug-eluting stents achieve better morphological and clinical results in patients with critical limb ischemia and infrapopliteal lesions in comparison with the current standard endovascular treatment.

PURPOSE
For successful embolization of arteriovenous malformation (AVM), it is critical to comprehend the angioarchitecture, such as feeding arteries, draining veins, and shunting point; however, catheter angiography is too invasive for the purpose of the planning of intervention. 4D-CTA using a 320-detector row CT has sufficient time resolution and higher spatial resolution, and may replace catheter angiography. We aimed to evaluate the efficacy of 4D-CTA in the planning of intervention of extracranial AVMs.

METHOD AND MATERIALS
Fifteen exams (eleven patients) with AVM (face 10, toe 1, chest wall 2, mesentery 1, and spinal cord 1) who underwent 4D-CTA using a 320-detector row CT scanner before embolization were included. Time-resolved (arterial to venous phase) maximum intensity projection images were produced on a workstation. Two interventional radiologists prospectively analyzed and compared with the results of the embolization procedure about the following; 1) Detection of feeding arteries, 2) AVM type classification by Houdart and Cho, 3)Whether the embolization was performed as planned on 4D-CTA.

RESULTS
4D-CTA detected all AVMs. 4D-CTA could not demonstrate very small feeding artery that was demonstrated on catheter angiography in four exams. Except for one case in which very small feeding arteries were not visualized, the type classification proposed by Houdart and Cho based on 4D-CTA matched completely with the results of DSA. Except for three exams which were complicated by subtraction artifact, it was possible to formulate the strategy for the embolization by 4D-CTA. Embolization was performed as planned on 4D-CTA in these 12 exams. 4D-CTA also allowed visualization of draining veins and the anatomical structure around AVM using source images, which facilitated the embolization of shunting pouch by direct puncture (n=3) or transvenous approach (n=2).

CONCLUSION
4D-CTA is an effective method to understand the angioarchitecture of AVM before embolization procedures. Diagnostic catheter angiography might be omitted in many cases.

CLINICAL RELEVANCE/APPLICATION
4D-CTA is useful to plan for the embolization of extracranial arteriovenous malformations.

TEACHING POINTS
The learner will develop an understanding of the modern role of catheter angiography of the upper extremity and utility before or in addition to cross sectional imaging. The learner will review patient preparation and angiographic technique for obtaining high quality...
images of the upper extremity arterial vasculature. The learner will review normal and variant anatomy of the upper extremity arterial vasculature. The learner will recognize classic appearances of conditions for which catheter angiography remains the gold standard imaging modality. The learner will review indications and basic concepts for interventions in the upper extremity.

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- Indications
- Pharmacology
- Patient Management
**Participants**
Matthew R. Callstrom, MD, PhD, Rochester, MN (Moderator) Research Grant, Thermedical, Inc Research Grant, General Electric Company Research Grant, Siemens AG Research Grant, Gall Medical Ltd

**Sub-Events**

**VSIO31-01 How to Approach Lung Ablation**

Participants
Constantinos T. Sofocleous, MD, PhD, New York, NY (Presenter) Consultant, Sirtex Medical Ltd

**VSIO31-02 Role for SBRT in the Treatment of Primary Lung Tumors**

Participants
Kenneth R. Olivier, MD, Rochester, MN (Presenter) Nothing to Disclose

**LEARNING OBJECTIVES**
1) Review role of SBRT in the primary management of early stage NSCLC. 2) Review updates to the literature on SBRT including: a. Dose and schedule of SBRT. b. Comparison of SBRT to surgery.

**ABSTRACT**
Stereotactic Body Radiotherapy (SBRT) is an important treatment modality for patients with inoperable Non-Small Cell Lung Cancer. It provides effective local control of early stage Lung Cancers and is associated with minimal toxicity. In this presentation I will review this role and discuss the current literature comparing SBRT to observation and surgery.

**VSIO31-03 Statistically Significant Higher Risk of Local Recurrence after Ablation in KRAS Mutant Lung Adenocarcinomas Compared with Wild Type**

Participants
Etay Ziv, MD, PhD, New York, NY (Presenter) Nothing to Disclose
Song Gao, New York, NY (Abstract Co-Author) Nothing to Disclose
Joseph P. Enninen, MD, PhD, New York, NY (Abstract Co-Author) Nothing to Disclose
Elena N. Petre, MD, New York, NY (Abstract Co-Author) Nothing to Disclose
Carole A. Ridge, MD, New York, NY (Abstract Co-Author) Nothing to Disclose
Jeremy C. Durack, MD, New York, NY (Abstract Co-Author) Scientific Advisory Board, Adient Medical Inc Investor, Adient Medical Inc
Constantinos T. Sofocleous, MD, PhD, New York, NY (Abstract Co-Author) Consultant, Sirtex Medical Ltd
Stephen B. Solomon, MD, New York, NY (Abstract Co-Author) Research Grant, General Electric Company

**PURPOSE**
To evaluate the association between mutation status of lung adenocarcinoma patients and local recurrence after ablation.

**METHOD AND MATERIALS**
We performed a retrospective review to identify patients treated with ablation for lung adenocarcinoma and that had available genetic testing for both EGFR and KRAS mutations. Surgical or biopsy specimens were considered only if they were from the same site as the ablation (either pre- or post-ablation). A subset of the EGFR mutants were also tested for T790M mutation. Local recurrence was either biopsy proven or based on a combination of clinical and imaging parameters. Chi-square test was used to identify statistically significant association with local recurrence.

**RESULTS**
We identified a total of 53 lung adenocarcinomas treated with lung ablation and which had genetic testing to identify both EGFR and KRAS mutations. Overall stage of tumor ranged from stage 1A to stage IV. Median tumor size was 1.6 cm (range: 0.8-3.3 cm). Of the 53 lung ablations, 53% (28) were on wild type (WT) lung adenocarcinomas, 34% (18) were on KRAS mutants and 13% (7) were on EGFR mutants. EGFR and KRAS mutants were mutually exclusive. Local recurrence rates were 29% (8/28) for WT, 67% (12/18) for KRAS, and 29% (2/7) for EGFR mutants. Local recurrence in the KRAS group was statistically significant (p=0.01) compared with WT. There was no difference in the local recurrence rate of EGFR mutants compared with WT. Of note, the two local recurrences identified in the EGFR group also harbored a T790M mutation, associated with acquired resistance to tyrosine kinase inhibitors.

**CONCLUSION**
KRAS mutations are associated with statistically significant increased risk of local recurrence compared to WT. The local recurrence
CF-12-123456

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying events. 3) Illustrate some of the more severe adverse events (grade 3-5) with clinical examples.

1) Understand the most common adverse events related to lung ablation. 2) Learn how to prevent and treat some of these adverse events. 3) Illustrate some of the more severe adverse events (grade 3-5) with clinical examples.

**LEARNING OBJECTIVES**

**CLINICAL RELEVANCE/APPLICATION**

KRAS mutation status of lung adenocarcinoma patients may be used as a prognostic tool to better stratify patients prior to lung ablation.

**VSIO31-04 Minimally Invasive Surgery for Limited Lung Metastases**

Tuesday, Dec. 1 2:20PM - 3:00PM Location: S405AB

Participants

Shanda Blackmon, MD, MPH, Rochester, MN (Presenter) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Define the role of surgical pulmonary metastasectomy. 2) Review the literature regarding surgical pulmonary metastasectomy. 3) Review advantages to minimally invasive surgical pulmonary metastasectomy. 4) Define future goals of a novel approach to combined multi-specialty approach to lung metastasectomy.

**ABSTRACT**

Care of the patient with pulmonary metastases (PM) has evolved through the years to now include a larger group of patients who may benefit from metastasectomy. The two most consistent prognostic factors for overall survival remain disease free interval (DFI) and number of pulmonary nodules. The one consistent factor in all series is that only patients achieving a complete (R0) resection have a longer survival. Many series find the # of nodules is no longer a factor determining survival if R0 resection can be obtained, even repeated metastasectomy. We no longer view extra-PM as a disqualifier for resection, as long as the dz can be completely resected and controlled. Patients are typically referred for immediate surgery if they present with a single PM or have a limited # of mets and a long DFI. Those who develop metastatic dz early are treated initially with chemotherapy to determine the pace of dz progression, if any, on treatment. Patients responding to chemotherapy, those with stable dz, and those with slow progression are referred for resection while those with rapidly progressive metastatic dz receive alternative chemotherapy treatment. Adjuvant chemotherapy is continued only if there is evidence of clinical benefit from preoperative chemotherapy. CT scanning is routinely performed to monitor dz progression. The surgical approach should be individualized. As imaging improves our ability to localize smaller nodules, less invasive options become more appealing and may facilitate less difficult repeat metastasectomy. Ablation (SBAR/SBRT or lung CT-guided ablation by cryoablation, radiofrequency ablation or microwave ablation) has been used to treat patients with PM, and our institution uses a lung ablation tumor board to review which lesions are best treated with each modality, focusing on R0 treatment, lung preservation, and location of the tumor. Lung preservation achieved by ablation is important in patients who have had previous resections or who have compromised pulmonary function or in whom a lobectomy would be required for nodule removal. More prospective studies are needed and are underway. Better understanding of the biology of the tumor and more developed histologic-specific nomograms may ultimately improve our ability to better select patients. As systemic therapy improves, treatment of local residual oligometastic dz will become an increasingly important consideration.

**VSIO31-05 Percutaneous Ablation of Lung Metastases**

Tuesday, Dec. 1 2:40PM - 3:00PM Location: S405AB

Participants

Alison R. Gillams, MBChB, London, United Kingdom, (alliesorting@gmail.com) (Presenter) Advisory Board, Covidien AG

**LEARNING OBJECTIVES**

1) To define the patients most suitable for percutaneous image guided ablation of their metastases. 2) To present clinical outcomes of percutaneous ablation in the common metastatic groups - colorectal, sarcoma, renal, head and neck etc. 3) To understand the role of ablation in conjunction with other therapeutic modalities - surgery, SBRT or chemotherapy.

**ABSTRACT**

Ablation is a very effective tool for the local control of small volume lung tumours. It is the optimal technique for bilateral or small volume but multifocal disease. Although any metastatic deposit can be treated, the most common tumour groups to be referred for ablation are colorectal, sarcoma, head and neck and renal tumours. Colorectal metastases form the largest single cohort of patients. Results from metastasectomy suggest a survival advantage. Number, distribution and speed of development i.e. disease free interval between primary resection and the development of lung metastases, are considered when deciding whether a patient is operable. Surgical preference is given to fit patients with fewer than 3 metachronous metastases, preferably unilateral, a longer disease free interval and no extra-pulmonic disease. Ablation is currently considered in inoperable patients. Our analysis of 122 patients who were not operable candidates but who had small volume colorectal lung metastases showed a median survival of 41 months and a 3-year survival of 57%. Survival was better in patients with smaller tumours; median 51 months, 3-year 64% for

**VSIO31-06 Complications and Management after Lung Ablation**

Tuesday, Dec. 1 3:00PM - 3:20PM Location: S405AB

Participants

Damian E. Dupuy, MD, Providence, RI, (ddupuy@lifespan.org) (Presenter) Research Grant, NeuWave Medical Inc Board of Directors, BSD Medical Corporation Stockholder, BSD Medical Corporation Speaker, Educational Symposium

**LEARNING OBJECTIVES**

1) Understand the most common adverse events related to lung ablation. 2) Learn how to prevent and treat some of these adverse events. 3) Illustrate some of the more severe adverse events (grade 3-5) with clinical examples.

**Honored Educators**

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying...
**Morphological Appearance of Radiofrequency Ablated Stage I NSCLC in Medically Inoperable Patients as Related to Recurrence: Results from the ACOSOG Z4033 (Alliance Trial)**

Tuesday, Dec. 1 3:20PM - 3:30PM Location: S405AB

### Participants

Lillian Xiong, MD, Providence, RI (Presenter) Nothing to Disclose  
Erica S. Alexander, BS, Providence, RI (Abstract Co-Author) Nothing to Disclose  
Shauna Hillman, MS, Rochester, MN (Abstract Co-Author) Nothing to Disclose  
Angelina D. Tan, BS,BA, Rochester, MN (Abstract Co-Author) Nothing to Disclose  
Grayson L. Baird, MS, Providence, RI (Abstract Co-Author) Nothing to Disclose  
Hiran Fernando, MD, Boston, MA (Abstract Co-Author) Consultant, CSA Medical, Inc Research Consultant, Galil Medical Ltd Research Grant, Deep Breeze Ltd  
Damian E. Dupuy, MD, Providence, RI (Abstract Co-Author) Research Grant, NeuWave Medical Inc Board of Directors, BSD Medical Corporation Stockholder, BSD Medical Corporation Speaker, Educational Symposia

### PURPOSE

This study evaluates tumor and ablation zone morphology as related to recurrence in medically inoperable patients with stage I NSCLC undergoing CT-guided RFA in a prospective multi-center trial.

### METHOD AND MATERIALS

This prospective, multicenter group trial was approved by each institutional review board. 54 patients from 16 US sites were enrolled, of these, 50 patients (23 Men, 27 Women; mean age 75.3±7.5 years) met eligibility requirements. Patients were followed using CT; evidence of CT recurrence and pre- and post-ablation imaging characteristics were recorded. Characteristics evaluated included tumor/ablation zone shape (round, ovoid, bilobed, irregular), size, borders (smooth, speculated, lobulated), distance to large vessels/airway and distance to pleura.

### RESULTS

A difference was observed for months to recurrence between those with ablation zones greater than 3cm and less than 3cm (p=.0023). The median time of recurrence for those with ablation zones less than 3cm was 8.16 months, while the median time for those with zones greater than 3cm could not be determined. Recurrence free probability was 30% for those with ablation zones less than 3cm and 75% for those with zones greater than 3cm. No significant differences were found between those with and without recurrence for age (p=.47), performance score (p=.43), histology (p=.34), baseline tumor SUV (p=.91), tumor size (p=.59), peak power (p=.92), peak current (p=.63), max temp (p=.65), total time (p=.28), shape (p=.30), cavitation (p=.29), sphericity (p=.45), distance from tumor edge to large vessel (p=.62), and distance to pleura (p=.25).

### CONCLUSION

Of those morphological characteristics considered, size of ablation zone appears to be most predictive of recurrence-free survival for those patients treated with RFA for early stage lung cancers.

### CLINICAL RELEVANCE/APPLICATION

Post-radiofrequency ablation zones greater than 3-cm were significantly less likely to be associated with recurrent disease, in a multi-institutional prospective study of 50 stage I NSCLC patients.

### Honored Educators

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Damian E. Dupuy, MD - 2012 Honored Educator

### Lung Tumor Board

Tuesday, Dec. 1 3:30PM - 3:50PM Location: S405AB

### Participants

Matthew R. Callstrom, MD, PhD, Rochester, MN (Moderator) Research Grant, Thermedical, Inc Research Grant, General Electric Company Research Grant, Siemens AG Research Grant, Galil Medical Ltd

### Percutaneous Hardware for Bone Metastases-Where and When

Tuesday, Dec. 1 4:00PM - 4:20PM Location: S405AB

### Participants

Frederic Deschamps, Villejuif, France (Presenter) Research Consultant, Medtronic, Inc

### LEARNING OBJECTIVES

1) To understand why cementoplasty alone is not always appropriate for bone fracture management (palliation and/or prevention).  
2) To introduce the percutaneous screw fixation technique.  
3) To present clinical outcomes of percutaneous screw fixation in bone cancer patients.

### ABSTRACT

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Damian E. Dupuy, MD - 2012 Honored Educator
Bone fractures can result in significant pain and loss of function in cancer patients. Percutaneous screw fixation is a very new technique that consists in the insertion of screws in bone structures through a very small skin incision under imaging guidance. The indications are twofold for bone fracture: palliative and preventive. 1/ For patients suffering from pathological or non-pathological fracture the goal of the screw fixation is to achieve a stabilization of the fracture fragments that will result in pain palliation. Typically, the fractures that can be fixed are located in the sacrum, the iliac crest, the acetabulum roof, the pubic ramus and the proximal femur. Cementoplasty can be performed in association (augmented screw fixation) in order to improve the screw's tip anchorage. 2/ For patients with impending osteolytic metastases, the decision to perform percutaneous augmented screw fixation instead of cementoplasty alone is done by the fact the strength properties of the cement are strong in compression but weak for tensile or shear stresses. Typically, the impending osteolytic metastases that can be consolidate using percutaneous augmented screw fixation are located in the iliac crest, the acetabulum and in the proximal femur. Percutaneous screw fixation is a very effective tool that must be considered as a part of the therapeutic arsenal of the interventional radiologists. Firstly, because it is a minimally invasive procedure that avoids extensive surgical exposure and secondly because the accuracy provided by CT- or Flat panel-guidances results in high technical success and very low complication rate for the screw placement.

VSIO31-10 Patient Selection and Outcomes with MRgFUS

Tuesday, Dec. 1 4:20PM - 4:40PM Location: S405AB

Participants
Alessandro Napoli, MD, Rome, Italy, (alessandro.napoli@uniroma1.it) (Presenter) Nothing to Disclose

LEARNING OBJECTIVES

1) To become familiar with the basic principles of HIFU and the potential of MR guidance. 2) To approach selection criteria in MRI screening examinations for accurate indications and identify contraindications and non-suitable patients. 3) To appreciate current results and potential therapy regimens. 4) To understand recent technical developments and their potential.

ABSTRACT

Bone metastases are common in patients with advanced cancer and are the greatest contributor to cancer-related pain, often severely affecting quality of life. Many patients with advanced cancer are undertreated for pain. Radiation therapy (RT), together with systemic therapies and analgesics, is the standard of care for localized metastatic bone pain, although up to two-thirds of patients have residual pain after RT, leaving them with limited treatment options. These include reirradiation, which results in temporary pain reduction in some patients, surgical intervention, and percutaneous cryoablation. More effective systemic therapies are prolonging survival of cancer patients with metastatic disease, resulting in an increased need for alternative therapies for painful bone metastases. Focused ultrasound is a noninvasive technique that delivers acoustic energy to heat lesions focally to ablative temperatures of more than 65°C. The combination of focused ultrasound with magnetic resonance (MR) imaging enables physicians to perform precise localized tumor tissue ablation, while using MR thermometry for real-time temperature monitoring. Clinical studies on the use of MR-guided focused ultrasound surgery (MRgFUS) for palliation of painful bone metastases demonstrated excellent response rates and safety. Results of a randomized controlled trial will be reviewed to discuss safety and efficacy of MRgFUS for treating bone metastases in patients with persistent or recurrent pain after RT, or who were otherwise not candidates for RT, or who declined RT. MRgFUS has several advantages that may positively influence safety and effectiveness compared with other ablative therapies. These include high-resolution imaging of the targeted tumor and nontargeted normal anatomy, intra-procedural MR thermometry accurate within approximately 2° to verify adequate temperatures to achieve ablation while respecting normal tissue tolerances, and immediate post-treatment validation of the extent of ablation.

VSIO31-11 Minimally Invasive Treatment of Osteoid Osteoma: Experience of a Single Center Using MR Guided Focused Ultrasound Surgery (MRgFUS) or Radiofrequency Ablation (RFA)

Tuesday, Dec. 1 4:40PM - 4:50PM Location: S405AB

Participants
Francesco Arrigoni, Coppito, Italy (Presenter) Nothing to Disclose
Alice La Marra, MD, L'Aquila, Italy (Abstract Co-Author) Nothing to Disclose
Silvia Mariani, MD, L'Aquila, Italy (Abstract Co-Author) Nothing to Disclose
Luigi Zugaro, L'Aquila, Italy (Abstract Co-Author) Nothing to Disclose
Antonio Barile, MD, L'Aquila, Italy (Abstract Co-Author) Nothing to Disclose
Carlo Masciocchi, MD, L'Aquila, Italy (Abstract Co-Author) Nothing to Disclose

PURPOSE

To evaluate effectiveness and safety of minimally invasive treatment of Osteoid Osteoma (OO) with ablation techniques: Magnetic Resonance guided Focused Ultrasound Surgery (MRgFUS) and Radiofrequency Ablation (RFA).

METHOD AND MATERIALS

From March 2011 to March 2014 we treated 40 OO, 18 with MRgFUS (ExAblate InSightech, Israel) and 22 with RFA (Needle Electrode, Boston Scientific-USA). For each patient we chose the less invasive treatment, when applicable. When the lesion could be easily reached with the US beam, the patient was treated with MRgFUS; otherwise, the patient was treated with RFA. Sixteen OO were treated with MRgFUS in the lower arm and 2 in the upper arms. The treatments lasted a mean time of 110 minutes. The lesions treated with RFA were 18 in the lower extremities, 2 in the upper ones and 2 in the vertebral body. They were treated in less than 100 min. The follow-up was performed by MRI and CT up to a maximum of two years; the clinical evaluation was performed using the visual analogue scale (VAS).

RESULTS

All patients, except one treated with MRgFUS and subsequently re-treated with RFA, showed a regression of painful symptomatology. After treatment, they no longer needed any pain medication. The mean hospitalization time was 2 days for patients treated with MRgFUS and 2.4 days for those submitted to RFA. The mean VAS value, 2 years after treatment, showed an overall improvement of 100% (from 8.2 to 0). At the first control at one week after the procedure, patients treated with MRgFUS showed a lower mean VAS value (0.5) as compared with that of RFA (0.8). The results of MRI and CT, 2 years after the treatment, showed in all cases the disappearance of both bone edema (MRI) and nidus with central calcification and peripheral osteosclerosis (CT), that are typical findings of the osteoid osteoma. In no case, major complications were observed.
CONCLUSION

Though based on a limited group of patients, our study demonstrates the safety and effectiveness of both techniques in the treatment of OO, by which it was possible to obtain an optimal clinical and imaging outcome. Compared with RFA, MRgFUS is less invasive, but to be successful, it is mandatory that the US beams properly reach the region of interest.

CLINICAL RELEVANCE/APPLICATION

To evaluate safety and efficacy of an innovative technique of ablation, MRgFUS, which promises to be even less invasive than RFA, which is currently the gold standard in the treatment of OO.

VSIO31-12  Spine Metastases Palliation-Ablation Stabilization

Tuesday, Dec. 1 4:50PM - 5:10PM Location: S405AB

Participants
Jonathan M. Morris, MD, Rochester, MN (Presenter) Nothing to Disclose

LEARNING OBJECTIVES

1. Learn the basics of ablative technologies available for use in the spine and sacrum. 2. Define current indications for percutaneous ablation in the Spine and Sacrum. 3. How we do it. Lessons learned and resources needed. 4. Define local control rates for the varied tumors treated. 5. Discuss our experience with palliative outcomes for pain relief. 6. Limitations of ablation in the neuroaxis. 7. Postablative kyphoplasty/vertebroplasty. 8. Discuss unique considerations for cervical, thoracic, lumbar spine and sacrum.

ABSTRACT

Oligometastatic disease involving the spine and sacrum is growing due to an aging population as well as improved survival rates of varied primary malignancies. 70% of all cancer patients will have metastatic disease with 40% involvement of the neuroaxis and 20% with epidural disease. While radiation therapy continues to be the primary treatment a subset of tumors are not radiosensitive and of those which are there are non responders. Starting in 2009 this clinical need led us to develop an ablation service dedicated to the spine and sacrum to aid in the treatment of oligometastatic disease. This talk will enable the attendee to learn the basics of ablative technologies in the spine and sacrum. Learn current indications for this technologies. Learn “how we do it” including lessons learned and resources need to perform this type of treatment. We will discuss the role of post ablative kypholplasty/vertebroplasty. Finally we will review our palliative pain relief results as well as local control rates in the increasing types of tumors treated.

VSIO31-13  Ablation is Front-line Therapy for Desmoid Tumors

Tuesday, Dec. 1 5:10PM - 5:30PM Location: S405AB

Participants
Afshin Gangi, MD, PhD, Strasbourg, France (Presenter) Nothing to Disclose

Handout:Afshin Gangi

VSIO31-14  CT-guided Cryoablation as Single Treatment or Combined with Radiotherapy in the Management of Bone and Soft Tissue Lesions

Tuesday, Dec. 1 5:30PM - 5:40PM Location: S405AB

Participants
Francesco Arrigoni, Coppito, Italy (Presenter) Nothing to Disclose
Silvia Mariani, MD, L'Aquila, Italy (Abstract Co-Author) Nothing to Disclose
Alice La Marra, MD, L'Aquila, Italy (Abstract Co-Author) Nothing to Disclose
Luigi Zigaro, L'Aquila, Italy (Abstract Co-Author) Nothing to Disclose
Antonio Barile, MD, L'Aquila, Italy (Abstract Co-Author) Nothing to Disclose
Carlo Masciocchi, MD, L'Aquila, Italy (Abstract Co-Author) Nothing to Disclose

PURPOSE

To evaluate safety and efficacy of percutaneous CT-guided cryoablation, performed with multiple cryoprobes (also in combination with Radiotherapy) in the treatment of bone and soft tissue lesions.

METHOD AND MATERIALS

Up to April 2015, we treated 27 patients with percutaneous CT-guided cryoablation. All patients but one had osteolytic bone metastases; one patient had a recurrence of aggressive fibromatosis of the shoulder. Prior to treatment, the patients were evaluated with the VAS questionnaire for pain which resulted in a mean value of 7.6. For a faster and more comfortable procedure, we employed three to six cryoprobes for each lesion under fluoroscopic guide. The area of cryoablation (iceball) and the position of the cryoprobes were controlled during the procedure with a wide-volume acquisition, employing 3D and MPR reconstruction. Follow-up studies at 3 and 6 months were performed with CT and VAS questionnaire. No major complications occurred during the procedures.

RESULTS

We observed a reduction of pain in all patients. The mean VAS value dropped from 7.6 to 1.6 one week after treatment and remained substantially unchanged until the end of follow-up (6 months). CT follow-up showed progression of the disease in no case. Only size reduction or stationary CT findings were observed.

CONCLUSION

Our results show the effectiveness of cryoablation, particularly in combination with RT, in terms of tumoral mass control and particularly of pain relief. Through thermoablation in fact it is possible to obtain a prompt relief of pain, and enhancement of the
quality of life immediately after the treatment. The main advantages are the possibility to treat the whole lesion at the same time with the use of multiple cryoprobes and to check in real time the treated volume; the main limitations are represented by the low number of patients recruited and by the length of the follow-up.

**CLINICAL RELEVANCE/APPLICATION**

To evaluate safety and effectiveness of cryoablation also in combination with RT in the management of painful bone and soft tissue lesions, with the aim of reducing tumoral mass and pain.

**VSIO31-15  Bone Metastases Tumor Board**

Tuesday, Dec. 1 5:40PM - 6:00PM Location: S405AB

Participants
Matthew R. Callstrom, MD, PhD, Rochester, MN (Moderator) Research Grant, Thermedical, Inc Research Grant, General Electric Company Research Grant, Siemens AG Research Grant, Galil Medical Ltd
SSJ10

**Genitourinary (Prostate Intervention)**

**Tuesday, Dec. 1 3:00PM - 4:00PM Location: E353C**

**GU** **IR** **MR** **US**

**AMA PRA Category 1 Credit ™: 1.00**

**ARRT Category A+ Credit: 1.00**

**FDA** Discussions may include off-label uses.

**Participants**

Aytekin Oto, MD, Chicago, IL (*Moderator*) Research Grant, Koninklijke Philips NV; ;
Temel Tirkes, MD, Indianapolis, IN (*Moderator*) Nothing to Disclose

**Sub-Events**

**SSJ10-01** **MR-guided In-bore versus MRI/Ultrasound Fusion Plus TRUS-guided Prostate Biopsy: A Prospective Randomized Trial in Patients with Prior Negative Biopsies**

**Tuesday, Dec. 1 3:00PM - 3:10PM Location: E353C**

**Awards**

**Trainee Research Prize - Resident**

**Participants**

Lars Schimmel, MD, Duesseldorf, Germany (*Presenter*) Nothing to Disclose
Michael Quentin, MD, Dusseldorf, Germany (*Abstract Co-Author*) Nothing to Disclose
Christian Ansov, MD, Dusseldorf, Germany (*Abstract Co-Author*) Nothing to Disclose
Dirk Blondin, MD, Dusseldorf, Germany (*Abstract Co-Author*) Nothing to Disclose
Robert Rabenalt, Duesseldorf, Germany (*Abstract Co-Author*) Nothing to Disclose
Gerald Antoch, MD, Duesseldorf, Germany (*Abstract Co-Author*) Nothing to Disclose
Andreas Hiester, Dusseldorf, Germany (*Abstract Co-Author*) Nothing to Disclose
Erhard Godehardt, Duesseldorf, Germany (*Abstract Co-Author*) Nothing to Disclose
Helmut Erich Gabbert, D-40225 Dusseldorf, Germany (*Abstract Co-Author*) Nothing to Disclose
Peter Albers, MD, PhD, Dusseldorf, Germany (*Abstract Co-Author*) Nothing to Disclose

**PURPOSE**

This study prospectively compares the PCa detection rate (PCa-DR) of MR-guided in-bore biopsy (IB-GB) alone and MRI/ultrasound fusion-guided biopsy combined with a systematic TRUS-GB (FUS+TRUS-GB) in patients with at least one negative TRUS-GB and PSA level ≥4ng/ml.

**METHOD AND MATERIALS**

253 patients were included in this study. After multiparametric prostate MRI (T2WI, DWI, DCE-MRI) at 3T patients with any PI-RADS sum score ≥10 were prospectively randomized to IB-GB or FUS+TRUS-GB. Analysis of detection rates for PCa and significant PCa (Gleason score ≥7), highest Gleason score, number of biopsy cores to detect one (significant) PCa, positivity rate of biopsy cores, and tumor involvement per biopsy core were performed.

**RESULTS**

210 patients met all study requirements and were prospectively randomized, 106 patients receiving IB-GB and 104 patients FUS+TRUS-GB (age 65.3±7.1 vs. 66.7±6.8 years; median PSA 10.0 vs. 10.8 ng/ml, IQR 7.8-14.9 vs. 7.4-15.5 ng/ml). Mean number of cores was 5.61±0.80 vs. 17.38±1.17; p<0.001. PCa-DR for IB-GB was 36.8% (29.2% for significant PCa) and for FUS+TRUS-GB 39.4% (31.7%); p=0.776 and p=0.765. Mean highest Gleason score of 7.24±0.96 vs. 7.46±1.01; p=0.233. Positivity rate per biopsy core was 20.7% (123/595) vs. 11.6% (210/1,808); p<0.001. Number of biopsy cores needed to detect one PCa or one significant PCa was 15.3 vs. 44.1 and 19.2 vs. 54.8.

**CONCLUSION**

The combined biopsy approach did not significantly improve the overall PCa-DR compared to targeted IB-GB alone, but required significantly more cores. A prospective comparison of MR-targeted biopsy alone to systematic TRUS-GB is justified.

**CLINICAL RELEVANCE/APPLICATION**

We did not observe a difference between IB-GB and FUS+TRUS-GB to detect PCa.

**SSJ10-02** **Accuracy of Targeted Prostate Biopsy Using MR-ultrasound Fusion to Guide Biopsies Directed to Focal Lesions Suspicous for Malignancy: A Retrospective Study of 286 Patients**

**Tuesday, Dec. 1 3:10PM - 3:20PM Location: E353C**

**Participants**

Guilherme C. Mariotti, MD, Jundiai, Brazil (*Presenter*) Nothing to Disclose
Tatiana Martins, MD, Belo Horizonte, Brazil (*Abstract Co-Author*) Nothing to Disclose
Marcos R. Queiroz, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Thais Mussi, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Rodrigo Gobbo, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Ronaldo H. Baroni, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose

**PURPOSE**

Demonstrate an increase in the accuracy of targeted prostate biopsy using MR-ultrasound fusion to guide biopsies directed to focal...
Targeted MR-guided Prostate Biopsy: Are Two Biopsy Cores per MRI Lesion Required?

Tuesday, Dec. 1 3:20PM - 3:30PM Location: E353C

Participants
Lars Schimmoeller, MD, Duesseldorf, Germany (Presenter) Nothing to Disclose
Michael Quentin, MD, Duesseldorf, Germany (Abstract Co-Author) Nothing to Disclose
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Robert Rabenalt, Dusseldorf, Germany (Abstract Co-Author) Nothing to Disclose
Peter Albers, MD, PhD, Duesseldorf, Germany (Abstract Co-Author) Nothing to Disclose

METHOD AND MATERIALS

A single-institutional, IRB approved retrospective analysis of 286 patients in our database, which underwent targeted prostate biopsies using MR-ultrasound fusion from August 2013 to January 2015. We included all patients with suspected prostate cancer based on clinical or laboratory findings (positive digital rectal examination or high PSA) submitted to multiparametric MRI and US-MRI fusion prostate biopsy. We excluded 7 patients with MRI-biopsy interval >= 6 months, 17 patients that underwent biopsy for staging of known cancer or active surveillance and 1 patient for whom clinical data was unavailable.

RESULTS

A total of 261 patients were included. Of these, 45 patients (17%) underwent previous negative transrectal US-guided biopsies. Table 1 summarizes demographic data of our casustic. Pre-procedure MRI followed a Likert scale for suspicion: Likert 1: 1 patient (0.4%); Likert 2: 18 patients (6.9%); Likert 3: 100 patients (38.3%); Likert 4: 75 patients (28.7%); Likert 5: 67 patients (25.7%). Overall positivity of the biopsies for tumors was 59% (152 cases), with 79% (123 cases) significant cancer (Gleason>=7), 19% (30 cases) non-significant cancer (Gleason 6) and 1 case of STUMP. Analyzing only the Likert 4 and 5 cases, in a total of 142 cases, the overall positivity was 76% (108 cases), with 90% (96 cases) significant cancer (Gleason>=7), 10% (11 cases) non-significant cancer (Gleason 6) and 1 leiomyoma. In our institution, the positivity of US-guided random biopsies, in a large sample of other patients in the same period (331 patients), was around 52%.

CONCLUSION

Our study demonstrates a significant improvement in the performance of prostate biopsy with US-MRI fusion compared to random US-guided biopsies, with potential clinical impact.

Prostate Cancer Aggressiveness: Correlation Between Multiparametric MRI and Molecular Staging Using the CCP Score (Prolaris™ test)

Tuesday, Dec. 1 3:30PM - 3:40PM Location: E353C

Participants
Raphaele M. Renard-Penna, Paris, France (Presenter) Nothing to Disclose
Geraldine Cancel-Tassin, Paris, France (Abstract Co-Author) Nothing to Disclose

METHOD AND MATERIALS

A single-institutional, IRB approved retrospective analysis of 286 patients in our database, which underwent targeted prostate biopsies using MR-ultrasound fusion from August 2013 to January 2015. We included all patients with suspected prostate cancer based on clinical or laboratory findings (positive digital rectal examination or high PSA) submitted to multiparametric MRI and US-MRI fusion prostate biopsy. We excluded 7 patients with MRI-biopsy interval >= 6 months, 17 patients that underwent biopsy for staging of known cancer or active surveillance and 1 patient for whom clinical data was unavailable.

RESULTS

A total of 261 patients were included. Of these, 45 patients (17%) underwent previous negative transrectal US-guided biopsies. Table 1 summarizes demographic data of our casustic. Pre-procedure MRI followed a Likert scale for suspicion: Likert 1: 1 patient (0.4%); Likert 2: 18 patients (6.9%); Likert 3: 100 patients (38.3%); Likert 4: 75 patients (28.7%); Likert 5: 67 patients (25.7%). Overall positivity of the biopsies for tumors was 59% (152 cases), with 79% (123 cases) significant cancer (Gleason>=7), 19% (30 cases) non-significant cancer (Gleason 6) and 1 case of STUMP. Analyzing only the Likert 4 and 5 cases, in a total of 142 cases, the overall positivity was 76% (108 cases), with 90% (96 cases) significant cancer (Gleason>=7), 10% (11 cases) non-significant cancer (Gleason 6) and 1 leiomyoma. In our institution, the positivity of US-guided random biopsies, in a large sample of other patients in the same period (331 patients), was around 52%.

CONCLUSION

The benefit of a second targeted biopsy core per suspicious MRI lesion is likely minor, especially regarding a significant Gleason upgrade. Therefore a further reduction of biopsy cores is feasible when performing a targeted MR-guided in-bore prostate biopsy.
Multi-parametric MRI (MpMRI) Findings after Focal Laser Ablation for Prostate Cancer (Pca)

Eva M. Comperat, MD, Paris, France (Abstract Co-Author) Nothing to Disclose
Justine Varinot, Paris, France (Abstract Co-Author) Nothing to Disclose
Pierre Mozer, MD, PhD, Paris, France (Abstract Co-Author) Nothing to Disclose
Morgan Roupret, Paris, France (Abstract Co-Author) Nothing to Disclose
Marc O. Bäker, Paris, France (Abstract Co-Author) Nothing to Disclose
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Olivier Cussenet, Paris, France (Abstract Co-Author) Nothing to Disclose

PURPOSE
To describe the quantitative and qualitative MpMRI findings following focal laser ablation of Pca

METHOD AND MATERIALS
27 patients with 36 cancer foci on baseline MRI, underwent MRI guided focal laser ablation were prospectively followed with, immediate (36/36 sites), 3-month (36/36 sites) and 12-month (24/36 sites) post-procedure 3T MpMRI and TRUS guided biopsy at 12 months. Qualitative and quantitative MpMRI findings including size and appearance of ablation defect, ADC, K(trans) and Ve were recorded and compared between the follow-up studies and between patients with and without residual disease.

RESULTS
36 cancer foci were ablated in 27 patients. Ablation defect was clearly visible on 36/36, 11/36 and 0/24 sites on the immediate, 3-month and 12-month post-contrast DCE-MRI images respectively, with a gradual decrease in size on 3 month MRI even in visible cases. Focal atrophy/scarring was noted at the site of ablation in 10/36 and 20/24 sites on 3-month and 12-month MRI. Mean K(trans) values were significantly lower on post-procedure MRI`s compared to baseline values (p<0.05). Mean ADC values on 3-month and 12-month post-contrast DCE-MR images respectively, with a gradual decrease in size on 3 month MRI even in visible cases. Focal atrophy/scarring was noted at the site of ablation in 10/36 and 20/24 sites on 3-month and 12-month MRI. Mean K(trans) values were significantly lower on post-procedure MRI`s compared to baseline values (p<0.05). Mean ADC values on 3-month and 12-month MRI were significantly higher than the baseline ADC values (p<0.05). There was not significant change in Ve (p>0.05). In 2/4 cases with residual cancer, focal early enhancement was noted on 12-month DCE-MR Images. Other than 1 case with residual cancer, no focal lesion (other than diffuse and ill-defined changes secondary to ablation) was noted at the ablation site on 12-month post-contrast MRI images. Other than 1 case with residual cancer, no focal lesion (other than diffuse and ill-defined changes secondary to ablation) was noted at the ablation site on 12-month post-contrast MRI images. Other than 1 case with residual cancer, no focal lesion (other than diffuse and ill-defined changes secondary to ablation) was noted at the ablation site on 12-month post-contrast MRI images. Other than 1 case with residual cancer, no focal lesion (other than diffuse and ill-defined changes secondary to ablation) was noted at the ablation site on 12-month post-contrast MRI images.

CONCLUSION
Immediate post-contrast MR images are helpful for identification of the ablation defect. Quantitative MR parameters such as ADC and K (trans) change significantly following ablation. Early focal enhancement on DCE-MR Images at the ablation zone at 12-month
MRI is a suspicious finding for residual tumor.

**CLINICAL RELEVANCE/APPLICATION**

Follow-up MR images can be obtained at 12 months after laser ablation and early focal enhancement at the ablation zone can be considered suspicious for residual cancer.

**Honored Educators**

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

Aytekin Oto, MD - 2013 Honored Educator

**SSJ10-06 Primary and Secondary Prostate Biopsy Settings: Differences When Performing Targeted MR-guided Biopsies**

Tuesday, Dec. 1 3:50PM - 4:00PM Location: E353C

Participants
Frederic Dietzel, Dusseldorf, Germany (Presenter) Nothing to Disclose
Lars Schimmoller, MD, Dusseldorf, Germany (Abstract Co-Author) Nothing to Disclose
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Robert Rabenalt, Dusseldorf, Germany (Abstract Co-Author) Nothing to Disclose
Erhard Godehardt, Dusseldorf, Germany (Abstract Co-Author) Nothing to Disclose
Peter Albers, MD, PhD, Dusseldorf, Germany (Abstract Co-Author) Nothing to Disclose

**PURPOSE**

This study evaluates the MR-guided in-bore biopsy (IB-GB) in patients, who were either biopsy naive (primary biopsy) or who had undergone at least one previous negative trans-rectal ultrasound-guided biopsy (secondary biopsy) with regard to cancer detection rate, tumor localization and lesion size.

**METHOD AND MATERIALS**

In total, 1,602 biopsy cores from 297 patients (66.1±7.8y; median PSA 8.2ng/ml; prostate volume 58±30ml) in primary (n=160) and secondary (n=137) prostate biopsies settings were evaluated in this retrospective study. All patients received diagnostic prostate MRI (T2WI, DWI, DCE) at 3T. All lesions described on MRI were biopsied with IB-GB and examined histologically.

**RESULTS**

In 148 patients 511 cores were positive for prostate cancer (PCa). Clinically significant PCa was found in 82.4% (any Gleason pattern ≥4). PCa detection rate for patients with primary biopsies was 55.6% and 43.1% for secondary biopsies. In patients with primary vs. secondary biopsies, PCa was located peripherally in 62.5% vs. 49.5% (p=0.04), in the transition zone in 27.3% vs. 27.5% (p=0.53), and in the anterior stroma in 10.2% vs. 22.9% (p<0.01). Higher grade PCa (Gleason score ≥4+3=7) occurred apically in 38.5% (p=0.01). PCa detection rates for patients with smaller prostate volumes (<30ml vs. 30-50ml vs. >50ml; p<0.01) or larger lesion sizes (>0.5cm3 vs. 0.5-0.25cm3 vs. <0.25cm3; p<0.01) were significantly higher.

**CONCLUSION**

In primary and secondary prostate biopsies PCa detection rates were significantly higher for larger lesions and smaller prostate glands. In secondary biopsies, PCa was anteriorly located at a significantly more frequent rate. Higher grade PCa was detected in both settings in an apical location more often.

**CLINICAL RELEVANCE/APPLICATION**

MRI-guided in-bore biopsy led to high detection rates, especially of clinically significant PCa, in primary and secondary prostate biopsies.
PURPOSE
To evaluate the effect of 90Y radioembolization (TARE) on the growth kinetics of both the treated and the contralateral untreated colorectal cancer liver metastases as well as on the portal vein (PV) diameter.

METHOD AND MATERIALS
78 chemorefractory liver metastases from colorectal cancer in 17 patients with two MDCT scans before and one after TARE were evaluated. Liver lesions were divided in two groups: 1) treated lesions and 2) untreated contralateral lobe lesions. Tumor growth kinetics of the two groups was evaluated before and one month after the unilobar TARE comparing reciprocal doubling time (RDT) based. The diameter of the PV in treated and untreated lobes were measured by two radiologists. Student’s t-test was used for analysis. P< 0.05 was considered significant.

RESULTS
For the treated lesions, mean RDT decreased from 8.3 to -5.6 with TARE (P<0.0001), whereas for the untreated lesions, the means RDT increased from 7.5 before TARE to10.6 after TARE (P=0.028). The mean diameter of PV did not change in the treated or untreated lobes (P=0.12 and P=0.83, respectively).

CONCLUSION
Lobar / segmental TARE significantly decreases the growth kinetics for the treated metastases but may lead to increase in the growth kinetics of contralateral liver.

CLINICAL RELEVANCE/APPLICATION
90Y radioembolization may increase in the growth rate of untreated colorectal cancer liver metastasis in the contralateral lobe. This information may be helpful in future treatment planning of contralateral hepatic lobe metastasis.
A semi-automatic, volume-based ADC measurement tool was evaluated as an early predictor of therapy response after radioembolization (RE) of primary and secondary liver malignancies.

**METHOD AND MATERIALS**

In a retrospective analysis, a total of 50 patients suffering from primary or secondary liver tumor treated with Yttrium-90 resin microspheres for RE were included. All patients underwent a baseline MR examination as well as an early follow-up MRI 1 month after intervention. The MRI protocol included diffusion-weighted imaging (DWI, b-Values 50,400,800) as well as contrast-enhanced T1 weighted sequences. Measurement of lesion diameter, mean ADC in a representative single-slice region-of-interest (ADCOROI) and mean ADC for the entire lesion volume (ADCVOL) were evaluated in both examinations. ADCVOL was measured using a semi-automatic, image analysis software (MROncotreat, Siemens Healthcare, Germany). The progression-free interval (PFI) of the individual patients, based on further MRI scans was assessed according to RECIST 1.1 criteria. Changes in lesion diameter, ADCROI and ADCVOL between baseline and early follow up were correlated to PFI.

**RESULTS**

Median PFI of all patients was 3.5 ± 5.8 months post RE. Patients with an increase of ADCVOL in the first control MRI showed a statistically significant longer PFI in comparison to patients with a decrease of ADCVOL (median PFI: 6.5 months vs. 2.5 months, p = 0.02). No correlation between PFI and early changes in lesion diameter or ADCROI was found.

**CONCLUSION**

In contrast to lesion diameter or single-ROI ADC evaluation, semi-automatic, software-based ADC-volume measurement seems to offer a clinically valuable parameter for early assessment of therapy response in patients after RE.

**CLINICAL RELEVANCE/APPLICATION**

Software-based ADC-volume assessment helps to early identify patients with tumor response already one month post therapy and therefore could help to triage patients with no response to RE to other therapy options without delay.

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Colorectal liver metastases (CLM) demonstrate variable response to radioembolization. This may be at least partly due to differences in tumor arterial perfusion. This study examines whether quantitative enhancement measurements on pre-procedure triphasic CT can be used to predict response of CLM to radioembolization.

**METHOD AND MATERIALS**

The Institutional Review Board approved this retrospective review of patients with colorectal liver metastases treated with radioembolization, who had pre-treatment PET/CT and triphasic CT, and post-treatment PET/CT. 31 consecutive patients with 60 target tumors were included in the study. For each tumor, we calculated the hepatic artery coefficient (HAC), portal vein coefficient (PVC), and arterial enhancement fraction (AEF) based on the pre-treatment triphasic CT. HAC and PVC are estimates of the hepatic artery and portal vein blood supply. AEF is the arterial phase enhancement divided by the portal phase enhancement, and it provides an estimate of the hepatic artery blood supply as a fraction of total blood supply. Metabolic response to radioembolization for each tumor was classified into two categories - response (complete or partial response), or no response (stable disease or progression) - based on the initial (4-8 weeks) post-treatment PET/CT.

**RESULTS**

55% of CLM showed a complete or partial metabolic response. Arterial enhancement, HAC, and PVC did not predict which tumors responded to radioembolization. However, the AEF was significantly greater in responders compared to non-responders (p=0.038). AEF < 0.4 was associated with a 40% response rate, whereas AEF > 0.75 was associated with a 78% response rate.

**CONCLUSION**

Response to radioembolization can be predicted using the arterial enhancement fraction calculated from pre-procedure triphasic CT.

**CLINICAL RELEVANCE/APPLICATION**

AEF could enable better patient selection for radioembolization procedures.
The study enrolled 47 patients with 122 target tumors; a median of 2 (range: 1-5) tumors per patient. Thirteen patients were dosed.

SPECT-CT can improve accuracy of lung shunt fraction calculation in Y-90 treatment planning, and may allow for more accurate dosing.

SS125-05 Total Lesion Glycolysis and Sum of Largest Diameters of Target Lesions are Independent Predictors of Survival after 90Y Radioembolization of Colorectal Liver Metastases

Participants
Waleed Shady, MBCh, New York, NY (Presenter) Nothing to Disclose
Sirish Kishore, MD, New York, NY (Abstract Co-Author) Nothing to Disclose
Vlasios S. Sotirchos, MD, New York, NY (Abstract Co-Author) Nothing to Disclose
Richard Kinh Gian Do, MD, PhD, New York, NY (Abstract Co-Author) Nothing to Disclose
Franz E. Boas, MD, PhD, New York, NY (Abstract Co-Author) Co-founder, ClarIPACS
Constantinos T. Sotirchos, MD, PhD, New York, NY (Abstract Co-Author) Consultant, Sirtex Medical Ltd
Joseph R. Osborne, MD, New York, NY (Abstract Co-Author) Nothing to Disclose
Lynn A. Brody, MD, New York, NY (Abstract Co-Author) Stockholder, Sirtex Medical Ltd
Elena G. Violari, MD, New York, NY (Abstract Co-Author) Nothing to Disclose
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Neil H. Segal, MD, New York, NY (Abstract Co-Author) Nothing to Disclose
Nancy Kemeny, MD, New York, NY (Abstract Co-Author) Nothing to Disclose

Abstract Co-Author
Joseph R. Osborne, MD, New York, NY (Abstract Co-Author) Stockholder, Sirtex Medical Ltd

Purpose
To identify predictors of overall survival (OS) after 90Y radioembolization of colorectal liver metastases.

Method and Materials
We conducted an IRB-approved retrospective review of our prospectively created and maintained 90Y radioembolization clinical database for the time period December 2009 through December 2013. We included all patients treated for colorectal liver metastases (CLM). We excluded patients without an FDG-PET/CT scan at baseline or on the first follow-up. On the baseline portal venous phase CT, up to 5 target tumors per patient were chosen and the sum of largest diameters were calculated. On FDG-PET/CT SUVmax, functional tumor volume (FTV), and total lesion glycolysis (TLG) (meanSUV x FTV) were measured for the target lesions chosen on CT and a sum for each metric was calculated for the patient. OS was calculated from the time of radioembolization until death or last follow-up. Log-rank test was used to analyze predictor of survival on univariate analysis and a Cox-regression model was used for multivariate analysis.

Results
The study enrolled 47 patients with 122 target tumors; a median of 2 (range: 1-5) tumors per patient. Thirteen patients were treated in 2 sessions, and 34 were treated in 1 session. The median OS was 12.7 months (95% CI: 7.2-16.3). The one-, two-, and three-year OS rates were 51%, 22% and 15% respectively. On univariate analysis predictors of poor survival were: CEA level >200 ng/ml (P=0.001), ECOG status >0 (P=0.001), SUVmax >30 (P=0.002), TLG >600g (P=0.001), FTV >200 cc (P<0.001), and sum of largest diameters >10 cm (P<0.001). On multivariate analysis, only the TLG >600 g (P<0.001) (HR=4.3; 95% CI: 1.8-10.1) and sum of largest diameters >10 cm (P=0.01) (HR=2.8; 95% CI: 1.3-6.2) retained significance.
CONCLUSION

High tumor metabolic activity and sum of largest diameters >10 cm of the target tumors is associated with poor survival after 90Y radioembolization of CLM.

CLINICAL RELEVANCE/APPLICATION

Measurement of total lesion glycolysis and the size of target lesions prior to 90Y radioembolization of CLM can provide prognostic information and help predict patient survival.

SSJ225-06  Radiation Lobectomy: Single Center Investigation of Incidence, Degree, Prognostic Factors and Survival

Tuesday, Dec. 1 3:50PM - 4:00PM Location: E351

Participants
Andrew G. Kim, Chicago, IL (Presenter) Nothing to Disclose
Ahmad Parvinian, MD, Chicago, IL (Abstract Co-Author) Nothing to Disclose
Nicholas S. Armijo, Chicago, IL (Abstract Co-Author) Nothing to Disclose
James T. Bui, MD, Chicago, IL (Abstract Co-Author) Nothing to Disclose
Ron C. Gaba, MD, Chicago, IL (Abstract Co-Author) Nothing to Disclose

PURPOSE

Yttrium-90 radioembolization (Y90 RE) is a minimally invasive therapy for liver tumors. A unique anatomical response pattern to Y90 RE, termed "radiation lobectomy (RL)," occurs in a subset of treated patients and consists of marked ipsilateral liver lobe atrophy and contralateral hypertrophy. While RL has been anecdotally described, there is limited characterization of this phenomenon in the literature. This study aimed to investigate the incidence and degree of RL, identify prognostic factors for occurrence, and examine association with survival.

METHOD AND MATERIALS

This single-center, retrospective study included 141 Y90 RE-treated patients from 2006-2012. Cases of right unilobar therapy were selected (n=33), while cases of bilobar treatment and inadequate imaging follow-up were excluded (n=108). Chart and imaging review were used to collect demographic, tumor, and treatment data, and pre-/post-RE hepatic volumes were measured. RL was defined as 25% relative atrophy of treated liver lobes. Measured outcomes included RL incidence, hepatic volumetric changes, parameters associated with RL, and survival.

RESULTS

The study cohort included 23 men and 10 women (median age 62 years). 58% (n=19) and 42% (n=14) had primary tumors and metastatic disease. Median index tumor size was 6 cm, and patients underwent median 1 (range 1-4) Y90 RE sessions (75% resin, 25% glass), with median cumulative dose of 2.33 (range 1.06-10.31) GBq. RL incidence was 33% (n=11). There were no differences in median pre-RE right (1284 vs. 1240 mL) and left (521 vs. 680 mL) lobe liver volumes between RL and non-RL groups (P>0.05). The median post-RE right (344 vs. 993 mL, P=0.002) lobe liver volume was significantly lower in the RL vs. non-RL group. A significant change between pre- and post-treatment relative right (69% to 25%, P<0.001) and left (31% to 75%, P<0.001) hepatic lobe volumes occurred in the RL group, while no significant change ensued in the non-RL group (right: 64% to 53%, left: 36% to 47%). No parameters had statistical association with RL occurrence. Median survival was significantly greater in patients exhibiting RL pattern response (1036 vs. 493 days, P=0.012).

CONCLUSION

RL occurs with relatively common frequency among patients undergoing Y90 RE. While associated with enhanced survival, predictive factors for RL occurrence remains elusive.

CLINICAL RELEVANCE/APPLICATION

RL occurs in about one-third of Y90 RE cases, and confers enhanced survival.
Vascular/Interventional (Innovation in Non-hepatic Tumor Ablation)

Tuesday, Dec. 1 3:00PM - 4:00PM Location: N230

SSJ26-01 Percutaneous Soft Tissue Cryoablation of the Head and Neck: A Safe and Effective Treatment Option

Tuesday, Dec. 1 3:00PM - 3:10PM Location: N230

Participants
Juan C. Camacho, MD, Atlanta, GA (Moderator) Nothing to Disclose
Naganathan B. Mani, MD, Chesterfield, MO (Moderator) Nothing to Disclose

Sub-Events

PURPOSE
To assess the technical feasibility and local outcomes of cryoablation for head and neck masses. We hypothesize that head and neck cryoablation responds similarly in terms of recurrence, complication and/or healing rates, regardless of anatomic location and tumor type.

METHOD AND MATERIALS
42 CT and/or US-guided, percutaneous cryotherapy procedures were performed for 55 tumors from primary (22) and metastatic cancers (33), in 20 patients. In general, cases were selected to avoid major cranial nerves, skin, and endoluminal involvement. Tumor number and type, prior treatment regimens, ablation volumes, location, abutting vessels >3mm, recurrences, and procedural complications were noted. Complications were graded according to Common Terminology Criteria for Adverse Events Version 4.0 (CTCAE). Local tumor recurrence and involution was monitored over time with 1, 3, 6, 12 month and annual scans thereafter.

RESULTS
Percutaneous cryoablation was performed under conscious sedation, with only one patient requiring intubation due to anticipated pharyngeal swelling post-procedure. The 22 primary tumors consisted solely of squamous cell carcinoma and the metastases were from lung (11), osteosarcoma (5), renal (4), sarcoma (3), and other (10) in origin. Of the 42 total procedures, 10 procedures involved multiple tumors being ablated in the same session. Average diameters of tumor and ablation zone were 2.5 cm and 4.2 cm, respectively. Major complications (CTCAE Grade >3) occurred after 2 procedures (4.8%). Of the 2 complications, one was a facial skin debridement as a result of thorough cryoabalation coverage.

Mean follow-up was 1.7 years (range: 0.03-5.33 years). Although recurrence rates were higher for primary, there was no statistically significant difference in local recurrence rates for primary and metastatic tumors, 18.2% (4/22) and 3.0% (1/33) (p>0.05), respectively. All sites of cryoablation involuted to minimal scar formation after 9 months.

CONCLUSION
CT/US guided PCA is a safe, effective local cancer control option for oligo-metastatic patients with soft tissue tumors in the head and neck region. With appropriate precautions, local healing is excellent.

CLINICAL RELEVANCE/APPLICATION
Oligometastatic disease is becoming more common with improved systemic treatments. Cryoablation of tumors contributes to improved local control for many tumor types, particularly for those having ‘escaped’ other treatments.

SSJ26-02 Breast Tumors Treated with Imaging-guided Percutaneous Ablation: Systematic Review and Meta-analysis

Tuesday, Dec. 1 3:10PM - 3:20PM Location: N230

Participants
Giovanni Mauri, MD, San Donato Milanese, Italy (Abstract Co-Author) Consultant, Esaote SpA
Maria P. Fedeli, San Donato Milanese, Italy (Abstract Co-Author) Nothing to Disclose
Lorenzo C. Pescatori, MD, San Donato Milanese, Italy (Presenter) Nothing to Disclose
Gianni Di Leo, Milan, Italy (Abstract Co-Author) Nothing to Disclose
Francesco Sardanelli, MD, San Donato Milanese, Italy (Abstract Co-Author) Speakers Bureau, Bracco Group Research Grant, Bracco Group Speakers Bureau, Bayer AG Research Grant, Bayer AG Research Grant, IMS International Medical Scientific
Luca Maria Sconfienza, MD, PhD, San Donato Milanese, Italy (Abstract Co-Author) Nothing to Disclose

PURPOSE
The aim of this study was to systematically review studies on imaging-guided percutaneous treatment of breast tumors.

METHOD AND MATERIALS
In March 2015 a literature search was performed on MEDLINE, EMBASE and the Cochrane Database of Systematic Reviews using
Percutaneous thermal ablations of breast tumors are technically feasible; radiofrequency and microwaves showed higher effectiveness.

**CLINICAL RELEVANCE/APPLICATION**

Percutaneous thermal ablation of breast tumors is technically feasible; radiofrequency and microwaves seem to be more effective, even if high heterogeneity is present in various studies. Further investigations are needed to better clarify the issue.

**RESULTS**

A total of 688 articles were initially retrieved, 638 were excluded based on abstract or full text. Fifty articles were finally analyzed, for a total of 1253 patients. The used technique was radiofrequency in 24 articles (576 patients), HIFU in 9 (211 patients), cryoablation in 7 (161 patients), laser in 7 (227 patients), microwave in 3 (78 patients). Range of tumor size was 4-60 mm. Overall technical success and effectiveness were 96% (94%-97%) and 76% (67%-83%), respectively. At subgroup analysis 96% (94%-97%) and 83% (76%-89%) for RFA; 96% (93%-98%) and 62% (36%-83%) for HIFU; 96% (90%-98%) and 73% (44%-90%) for cryoablation; 98% (95%-100%) and 55% (23%-83%) for laser ablation; 93% (81%-97%) and 90% (77%-96%) for microwaves. In subgroup analysis, the difference of technical effectiveness among techniques was borderline significant (P=0.052). Overall minor complication rate was 10% (6%-16%); overall major complication rate was 6% (5%-8%).

**CONCLUSION**

Percutaneous thermal ablation of breast tumor are technically feasible; radiofrequency and microwaves showed higher effectiveness.

**METHOD AND MATERIALS**

MR-guided vertebral body cryoablations were performed in four healthy, juvenile Yorkshire pigs at two vertebral locations at 1.5 Tesla. Standard DCE MRI was performed 30 minutes after cryoablation (baseline) and repeated 10-13 days later (follow-up). DCE parameters were obtained using software (Dynamika, Image Analysis Ltd, London, UK) and included color-coded gadolinium maps for persistent, plateau or washout signal intensity curves, initial rate of enhancement (IRE), and maximum enhancement (ME). DEMRIQ scores were calculated as DEMRIQ_IRE = IREmean * (Number of Plateau Pixels + Number of Washout Pixels) and DEMRIQ_ME = MEmean * (Number of Plateau Pixels + Number of Washout Pixels). P values were calculated using a Wilcoxon Signed Rank test.

**RESULTS**

All ablation zones demonstrated initially complete absence of gadolinium perfusion, whereas the surrounding ventral bone marrow was intact. Compared to baseline, the ablation zone decreased in size at follow-up in 8/8 (100%) vertebral bodies and completely disappeared in 4/8 (50%) with parameters indicating increased marrow perfusion along the margin of the ablation zone. Comparing baseline and follow-up, mean plateau pixels increased from 750 ± 644 (range, 205-1926) to 806 ± 474 (269-1546) (p<1), mean washout pixels from 115 ± 68 (4-233) to 398 ± 316 (15-853) (p<0.11), mean DEMRIQ_IRE scores from 2.98 ± 1.53 (0.91-5.81) to 6.60 ± 3.96 (2.30-14.39) (p<0.05) and mean DEMRIQ_ME scores from 1345 ± 909 (396-2880) to 1855 ± 966 (793-3519) (p<0.01).

**CONCLUSION**

Our results suggest that DCE MRI can be used to visualize the cryoablation zone. Longitudinal changes in parameters suggest a healing response with marrow hyperperfusion along the margins of the ablation zone and centripetal healing in normal swine. Clinical relevance of these findings is ongoing.
**RESULTS**

A total of 40 fiducial markers were positioned in a single plane around a triaxial microwave ablation antenna in ex vivo liver, orthogonal to the scan plane. Powers of 50-100W at 2.45GHz (4-6 per group) were applied for 10min. CT data was acquired over entire volume every 15s. CT data was processed with markers classified into outer, middle and inner lines, which were initially 22mm, 15mm and 8mm radially from, and symmetrically oriented on both sides of the antenna. Principal strain magnitude and direction was calculated in the outer, middle and inner regions by using a triangle meshing technique. Normal and shear strain were calculated such that negative strain denoted contraction and positive strain denoted expansion. Time varying strain curves were calculated to evaluate the extents of tissue deformation in each region.

**CONCLUSION**

Principal strain, a mechanical indicator of tissue deformation, decreases 30-60% during microwave ablation indicating strong tissue contraction. Greater negative strain was observed at higher applied energies in the inner region of ablation zone. Higher diametric contraction indicates ablation zones appear more elongated than the original volume.
CLINICAL RELEVANCE/APPLICATION

Tissue deformation during ablation procedures has an important effect on the treatment planning and follow-up.
Upcoming Event:

**Update on Radionuclide Therapies**

**Tuesday, Dec. 1 4:30PM - 6:00PM Location: S504CD**

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AMA PRA Category 1 Credits™: 1.50
ARRT Category A+ Credits: 1.50

### Participants

**Sub-Events**

- **RC411A  New Guidelines for I-131 Therapy of Thyroid Cancer**

  - **Participants**
    - Don C. Yoo, MD, Providence, RI  
      (Presenter)  
      Nothing to Disclose

  **LEARNING OBJECTIVES**

  1. Describe why thyroid cancer is increasing.
  3. Review the controversies in thyroid cancer treatment.

  **ABSTRACT**

  The purpose of this educational activity is to review the reasons why the incidence of thyroid cancer has risen so rapidly over the last 40 years and discuss the role of radioiodine ablation in patients with thyroid cancer. Issues that will be discussed include controversies in the extent of thyroid surgery and the appropriate use of radioiodine ablation in patients with thyroid cancer which is controversial in low risk and intermediate risk patients. The incidence of thyroid cancer in the United States has almost tripled since the early 1970s with unchanged mortality principally due to overdiagnosis. The extent of surgery performed for thyroid cancer is controversial especially in small cancers but only patients with complete thyroidectomy are candidates for radioiodine ablation. Recently lower doses of I-131 have been shown to be effective for radioiodine ablation of remnant thyroid tissue after thyroidectomy. High risk patients will benefit from radioiodine ablation with decreased recurrence and improved mortality. Radioiodine ablation in low risk patients is very controversial and has not been shown to improve mortality.

- **RC411B  Ra-223 Therapy for Bone Metastases**

  - **Participants**
    - Eric M. Rohren, MD, PhD, Houston, TX  
      (Presenter)  
      Nothing to Disclose

  **LEARNING OBJECTIVES**

  1. Review the chemistry and mechanism of action of Ra-223.
  2. Understand the approved indications for Ra-223.
  3. Illustrate the techniques and procedures for radium administration using a case-based approach.

  **ABSTRACT**

  Radium-223 is an alpha-emitting radiopharmaceutical approved for use in men with castration-resistant prostate carcinoma. The use of radium in a clinical setting will be discussed, including the rationale, patient eligibility, administration, and follow-up, as well as radiation safety precautions and handling. Illustrative cases will be presented.

- **RC411C  Hepatic Artery Infusion Therapy with Y90 Microspheres**

  - **Participants**
    - Charles Y. Kim, MD, Durham, NC  
      (Presenter)  
      Research Grant, Galil Medical Ltd; Consultant, Kimberly-Clark Corporation; Consultant, Cryolife, Inc

  **LEARNING OBJECTIVES**

  1. Review range of malignancies treated with Y90 microsphere infusion.
  2. Discuss the types of Y90 therapy and dosimetric considerations.
  3. Describe the procedures and technical steps involved in Y90 therapy.
  4. Recognize pertinent scintigraphic findings associated with Y90 therapy.

  **ABSTRACT**

  Intra-arterial Yttrium-90 (Y90) therapy is an important treatment modality for a variety of hepatic tumors. While numerous types of embolotherapies are employed by interventional radiologists for treatment of cancer, Y90 therapy is unique in its multimodality and multi-procedural nature. Not only does this treatment effect rely on deposited ionizing radiation therapy, but scintigraphic imaging is also an integral component of treatment. Two types of Y90 therapies are available, made by two different manufacturers. The
differences between the two types are subtle, but there are differences in administration and manufacturer-recommended
dosimetric calculation. These various differences will be highlighted. Y90 therapy is comprised of several steps and is frequently
subclassified into a "planning" phase and "treatment" phase. In the planning phase, detailed angiographic imaging is performed to
delineate arterial anatomy, determine tumoral distributions, and redistribute vascular flow if indicated. Scintigraphic imaging is an
integral component of this planning phase, in order to help identify angiographically occult arterial anomalies, confirm appropriate
infusion site, and to quantify the hepatopulmonary shunt fraction. From this information, as well as other factors, the appropriate
treatment doses can be determined. In the treatment phase(s), the Y90 dose is administered to the appropriate portions of the
liver with subsequent scintigraphic imaging for confirmation.
Interventional (An Interactive Session)

Tuesday, Dec. 1 4:30PM - 6:00PM Location: S502AB

AMA PRA Category 1 Credits: 1.50
ARRT Category A+ Credits: 1.50

Participants
Steven M. Zangan, MD, Chicago, IL (Presenter) Nothing to Disclose
Rakesh C. Navuluri, MD, Chicago, IL (Presenter) Nothing to Disclose
Jeffrey A. Leef, MD, Chicago, IL (Presenter) Nothing to Disclose

LEARNING OBJECTIVES

1) Recognize vascular and non-vascular conditions and their image-guided treatment in the chest, abdomen and pelvis. Please bring your charged mobile wireless device (phone, tablet or laptop) to participate.
**Targeted Treatment and Imaging of Liver Cancers: Basic to Advanced Techniques in Minimally-Invasive Therapies and Imaging**

Tuesday, Dec. 1 4:30PM - 6:00PM Location: S403A

**Participants**

John J. Park, MD, PhD, Duarte, CA (Moderator) Proctor, Sirtex Medical Ltd; Advisory Board, Guerbet SA

Jinha Park, MD, PhD, Duarte, CA (Moderator) Speakers Bureau, Bayer AG; Advisory Board, Guerbet SA

Andrew C. Price, MD, Scottsdale, AZ (Presenter) Nothing to Disclose

Steven S. Raman, MD, Santa Monica, CA (Presenter) Nothing to Disclose

Marcelo Guimaraes, Charleston, SC (Presenter) Consultant, Cook Group Incorporated; Consultant, Baylis Medical Company; Consultant, Terumo Corporation; Patent holder, Cook Group Incorporated

**LEARNING OBJECTIVES**

1) Discuss the role of the interventional radiologist in the treatment and management of patients with primary and metastatic liver cancer as part of the multidisciplinary team. 2) Learn best practice techniques in the treatment of liver cancers, with emphasis on both locoregional and focal therapeutic approaches, and indications for treatment. 3) Explore various tips and tricks for each treatment modality and learn how to avoid complications through good patient selection, choosing the appropriate techniques, and knowing what common mistakes to avoid. 4) Learn about newer and developing techniques and devices, their potential roles and indications, and potential pitfalls. 5) Explore advanced imaging modalities in the detection of tumors and for monitoring treatment response.

**ABSTRACT**
Interventional Radiology Wednesday Case of the Day

Wednesday, Dec. 2 7:00AM - 11:59PM Location: Case of Day, Learning Center

AMA PRA Category 1 Credit ™: .50

Participants
Anne M. Covey, MD, New York, NY (Presenter) Nothing to Disclose
Sreejit Nair, MD, New York, NY (Abstract Co-Author) Nothing to Disclose
Alan A. Sag, MD, New York, NY (Abstract Co-Author) Nothing to Disclose
Hooman Yarmohammadi, MD, New York, NY (Abstract Co-Author) Nothing to Disclose
Lynn A. Brody, MD, New York, NY (Abstract Co-Author) Stockholder, Sirtex Medical Ltd
Stephen B. Solomon, MD, New York, NY (Abstract Co-Author) Research Grant, General Electric Company
Joseph P. Erinjeri, MD, PhD, New York, NY (Abstract Co-Author) Nothing to Disclose
Controversy Session: 'My Back Hurts': Fluoroscopy or CT-guided Intervention?

Wednesday, Dec. 2 7:15AM - 8:15AM Location: E451B

CT IR

AMA PRA Category 1 Credit™: 1.00
ARRT Category A+ Credit: 1.00

FDA Discussions may include off-label uses.

Participants
Walter S. Bartynski, MD, Charleston, SC (Moderator) Nothing to Disclose

LEARNING OBJECTIVES
1) Identify various etiologies of low back pain and neck pain that may be amenable to image-guided pain injections. 2) Develop a pain management plan utilizing image-guided injections. 3) Assess what imaging findings and clinical symptoms are appropriate for image-guided pain injections. 4) Discuss the advantages and disadvantages of CT versus fluoroscopically guided pain injections.

Sub-Events

SPSC40A For Fluoroscopic Injection Procedures

Participants
Lubdha M. Shah, MD, Salt Lake Cty, UT, (lubdha.shah@hsc.utah.edu) (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
View learning objectives under main course title.

ABSTRACT

URL

SPSC40B CT Injection Procedures

Participants
Peter G. Kranz, MD, Durham, NC, (peter.kranz@duke.edu) (Presenter) Research Consultant, Cephalogics, LLC; Research Consultant, Biogen Idec Inc

LEARNING OBJECTIVES
View learning objectives under main course title.

URL
**RC514-01**  

**Participants**
Parag J. Patel, MD, Milwaukee, WI (Moderator) Consultant, Medtronic, Inc; Consultant, C. R. Bard, Inc; Consultant, Penumbra, Inc; Jonathan M. Lorenz, MD, Chicago, IL (Moderator) Nothing to Disclose

**LEARNING OBJECTIVES**
1) Describe pros and cons of intervention for median arcuate ligament compression on the celiac axis. 2) Outline 3 recommendations for endovascular treatment of peripheral vascular disease. 3) Describe current status of true percutaneous endovascular repair of abdominal aortic aneurysms. 5) Describe 2 vascular compression syndromes.

**Sub-Events**

**RC514-02**  
*Morphological Predictors of Optimal Recanalization Strategy for Long-segment Chronic Total Occlusions of the Femoropopliteal Arteries*

**Participants**
Marcelo Guimaraes, Charleston, SC (Presenter) Consultant, Cook Group Incorporated; Consultant, Baylis Medical Company; Consultant, Terumo Corporation; Patent holder, Cook Group Incorporated

**PURPOSE**
To investigate the morphological characteristics of long-segment chronic total occlusions of the femoropopliteal arteries (LFP-CTOs) as predictors of the optimal recanalization strategy.

**METHOD AND MATERIALS**
We retrospectively evaluated the morphological characteristics of 102 CTOs (74 patients) treated with antegrade and/or retrograde recanalization using contrast enhanced-magnetic resonance / computed tomography angiography and digital subtraction angiography imaging results. Proximal morphology, lesion length, calcification, proximal branching, collateral circulation, runoff vessels, and concomitant arterial occlusion were used as predictors for univariate analysis. Multivariate logistic regression analysis was performed to identify independent predictors of successful angioplasty and recanalization.

**RESULTS**
Antegrade and retrograde recanalization were successful in 82 and 10 CTOs, respectively (total success rate, 90.2%). The antegrade approach was frequently used for wire crossing and had a shorter mean procedure time than the retrograde approach (90.7 ± 35.3 min vs. 185.5 ± 41.2 min, P < 0.001). Multivariate analysis revealed that concomitant artery occlusion (odds ratio [OR]: 0.299; 95% confidence interval [CI]: 0.103-0.868; P=0.026) was a lower likelihood technical success; flush occlusion (OR: 41.795; 95% CI: 4.567-382.517; P<0.001) and large collateral (OR: 14.829; 95% CI: 1.350-162.898; P=0.027) were predictors of retrograde recanalization. During follow-up, sustained ABI improvement was founded in 79.3% limbs, and the binary restenosis rate was 40.2% in antegrade group and 50.0% in retrograde group (P > 0.05), but the flush occlusion (OR: 3.736; 95% CI: 1.152 - 12.119; P=0.028) was associated with a significantly higher likelihood of binary restenosis.

**CONCLUSION**
We recommend that LFP-CTOs with concomitant occlusion should be treated with bypass surgery, whereas flush occlusions and those with large collateral circulation should be managed with retrograde recanalization earlier if antegrade approach fails.

**CLINICAL RELEVANCE/APPLICATION**
Morphological characteristics of long-segment chronic total occlusions of femoropopliteal arteries can help predict the optimal strategy for endovascular recanalization.

**RC514-03**  
*Trends in Use of Vascular Ultrasound and Noninvasive Physiologic Testing for Peripheral Arterial Disease: Are These Tests Being Overused?*

**Participants**
David C. Levin, MD, Philadelphia, PA (Presenter) Consultant, HealthHelp, LLC; Board of Directors, Outpatient Imaging Affiliates, LLC
Laurence Parker, PhD, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose
Geoffrey A. Gardiner JR, MD, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose
Vijay M. Rao, MD, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose

PURPOSE
The U.S Preventive Services Task force has never supported routine screening for peripheral arterial disease (PAD). There is no need to treat asymptomatic (or even many symptomatic) patients and studies suggest only very modest recent growth in PAD incidence. For these reasons, our goal was to assess recent trends in the use of ultrasound (US) and noninvasive physiologic tests (NPTs), the most common tests used to screen for and initially diagnose PAD.

METHOD AND MATERIALS
The nationwide Medicare Part B databases for 2001 through 2013 were used. The 2 CPT codes for extremity arterial US and the 3 codes for extremity NPTs were selected. Procedure volume trends were evaluated. Medicare’s physician specialty codes were used to determine which specialists were doing the studies. Utilization rates per 1000 were calculated.

RESULTS
Total Medicare volume of extremity arterial US was 396,734 in 2001, increasing every year thereafter to 818,272 in 2013 (+106%). The US utilization rate per 1000 was 11.7 in 2001, rising to 21.9 in 2013 (+87%). NPT volume increased from 716,005 in 2001 to a peak of 1,362,789 in 2010, then dropped to 1,278,145 in 2013 (+79% vs 2001)). The NPT rate per 1000 increased from 21.0 to a peak of 38.7 in 2010, then dropped to 34.3 in 2013 (+63% vs 2001). The 3 highest volume specialties in arterial US in 2013 were surgery (258,104 - up 108% vs 2001), radiology (210,477 - up 93% vs 2001) and cardiology (187,275 - up 267% vs 2001). The 3 highest volume specialties in NPTs in 2013 were surgery (444,623 - up 35% vs 2001), cardiology (267,005 - up 206% vs 2001), and primary care (229,215 - up 208% vs 2001). The overall rate of use of these 2 major kinds of tests for PAD increased from 32.7 per 1000 in 2001 to 56.2 in 2013 (+72%).

CONCLUSION
Use of both US and NPTs for possible PAD grew rapidly from 2001 to 2013. Growth was especially high among surgeons and cardiologists. There is no apparent medical rationale for the increasing utilization of these tests for PAD. The rapid growth in use of both US and NPTs raises concern about overuse, especially given the fact that surgeons and cardiologists are in a position to self-refer.

CLINICAL RELEVANCE/APPLICATION
n/a

RCS14-05 Update on Recommendations for Endovascular Treatment of PVD in 2015-This Is What to Do and Why to Do It

Wednesday, Dec. 2 9:30AM - 10:00AM Location: E353A

Participants
Martin A. Funovics, MD, Vienna, Austria (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
View learning objectives under main course title.

RCS14-06 EVAR: True Percutaneous Devices? When?

Wednesday, Dec. 2 10:00AM - 10:30AM Location: E353A

Participants
Parag J. Patel, MD, Milwaukee, WI (Presenter) Consultant, Medtronic, Inc; Consultant, C. R. Bard, Inc; Consultant, Penumbra, Inc;

LEARNING OBJECTIVES
View learning objectives under main course title.

RCS14-07 Automated Quantification of Muscle Perfusion Using contrast Enhanced Ultrasound: Initial in Vitro and in Vivo Evaluation of Lower Limb Perfusion

Wednesday, Dec. 2 10:30AM - 10:40AM Location: E353A

Participants
Wing Keung t. Cheung, London, United Kingdom (Abstract Co-Author) Nothing to Disclose
Katherine t. Williams, London, United Kingdom (Abstract Co-Author) Nothing to Disclose
Kirsten t. Chrstensen-Jeffries, London, United Kingdom (Abstract Co-Author) Nothing to Disclose
Brahman Dharmarajah, MBBS, MRCS, London, United Kingdom (Presenter) Nothing to Disclose
Robert J. Eckersley, PhD, London, United Kingdom (Abstract Co-Author) Nothing to Disclose
Alun Davies, FRCS, London, United Kingdom (Abstract Co-Author) Nothing to Disclose
Mengxing Tang, London, United Kingdom (Abstract Co-Author) Nothing to Disclose

PURPOSE
An accurate and automated technique for quantification of tissue microperfusion is desirable for a wide-range of clinical applications including atherosclerotic and diabetic peripheral vascular disease. Existing studies evaluating peripheral vascular disease still use qualitative visual assessment and studies quantifying contrast ultrasound signals have limited outcomes. In this study, we develop a pixel-based automated bubble detection algorithm capable of separating contrast signals from both tissue signal and noise thus generating a quantitative surrogate measure of muscle blood flow.

METHOD AND MATERIALS
Quantification of contrast signal at varying dilutions of microbubble was performed within an in-vitro phantom to develop the
automated bubble detection algorithm. After ethical approval and informed consent, the in-vivo study evaluated muscle perfusion of the right calf before and after physical exercise in 5 healthy volunteers. Imaging was acquired using a Phillips iU-22 ultrasound platform with a L9-3 linear probe. Offline blinded image analysis was performed using an average of 5 regions of interest placed over the muscle bulk. Surface area ratio of bubble pixel intensity to background signal was calculated as a surrogate of muscle microperfusion which was compared before and after exercise.

RESULTS

The in vitro study demonstrated a good agreement between known bubble concentrations and quantification measures generated by the algorithm (R=0.94). For in vivo data the quantification results were calculated using the algorithm and compared before and after subject exercise. Initial analysis showed that the average blood volume in the calf muscle increased by 48% after exercise (P<0.004).

CONCLUSION

The automated bubble detection algorithm has shown to be a promising tool for detecting and quantifying microbubble signals representing muscle microperfusion both in vitro and in vivo.

CLINICAL RELEVANCE/APPLICATION

Contrast enhanced ultrasound may provide a novel imaging technique for assessment of lower limb muscle microperfusion. This novel imaging biomarker may provide valuable information in diagnosis and treatment response in lower limb peripheral vascular disease.

RC514-08 Twins Study: Role of Femoral Ultrasound Examination in Predicting Cardiovascular Risk

Wednesday, Dec. 2 10:40AM - 10:50AM Location: E353A

Participants
Pierleone Lucatelli, MD, Roma, Italy (Abstract Co-Author) Nothing to Disclose
Carlo Cirelli, Rome, Italy (Abstract Co-Author) Nothing to Disclose
Renato Argiro, Rome, Italy (Presenter) Nothing to Disclose
Beatrice Sacconi, MD, Rome, Italy (Abstract Co-Author) Nothing to Disclose
Riccardo Rosati, Rome, Italy (Abstract Co-Author) Nothing to Disclose
Fabrizio Fanelli, MD, Rome, Italy (Abstract Co-Author) Nothing to Disclose
Carlo Catalano, MD, Rome, Italy (Abstract Co-Author) Nothing to Disclose

PURPOSE

Compare Common-Femoral-Artery (CFA) and Common-Carotid-Artery (CCA) Echo-Color-Doppler examination in predicting the cardiovascular risk in a sample of apparently healthy twins recruited from the Italian Twin Registry.

METHOD AND MATERIALS

The multicenter study included 322 twins (59.9% female) aged 20-78 years (52.1±15.3). Subjects underwent Echo-Color-Doppler examination of CCA and CFA. Mean IMT in both right and left sides of the CCA or CFA was recorded. Mean values were compared by Student’s t test for paired data and by robust regression model to take account of the dependence of twin data within pairs and of confounders (age and gender). Plaques (thickening ≥1.5 mm over IMT) prevalence and composition (calcific, fibro-lipidic, mixed) in the two regions were estimated and compared by chi-squared test or logistic regression for clustered observation.

RESULTS

A significant difference (P<0.01) between mean CCA-IMT and mean CFA-IMT was detected (0.70±0.20 vs 0.73±0.24mm), although mean difference between the two traits was relatively small (0.03±0.17mm). Plaque prevalence was significantly higher in CFA compared to CCA (40.7% vs 30.4%). This result was confirmed even when only lipid plaque(33.6% in CCA and 24.5% in CFA) was considered and when age and gender were incorporated in the analysis. Isolated plaque prevalence was 18.3% for CCA and 8.1% for CFA. 51.2% of the sample had at least a plaque in both traits.

CONCLUSION

Echo-Color-Doppler identifies more plaques in CFA than in CCA, with prevalent fibro-lipidic composition. Femoral Echo-Color-Doppler should be introduced as part of screening protocols in order to assess the cardiovascular risk.

CLINICAL RELEVANCE/APPLICATION

Echo-Color-Doppler identifies more plaques in CFA than in CCA therefore Femoral Echo-Color-Doppler should be introduced as part of screening protocols in order to assess the cardiovascular risk.

RC514-09 Ultrasound Assessment of the Posterior Circumflex Humeral Artery in Elite Volleyball Players: Aneurysm Prevalence, Anatomy, Branching Pattern and Vessel Characteristics

Wednesday, Dec. 2 10:50AM - 11:00AM Location: E353A

Participants
Daan van de Pol, MD, Amsterdam, Netherlands (Presenter) Nothing to Disclose
Mario Maas, MD, PhD, Utrecht, Netherlands (Abstract Co-Author) Nothing to Disclose
Aart Terpstra, Amsterdam, Netherlands (Abstract Co-Author) Nothing to Disclose
Marja Pannekoek-Hekman, Amsterdam, Netherlands (Abstract Co-Author) Nothing to Disclose
Paul Kuiper, PhD, Amsterdam, Netherlands (Abstract Co-Author) Nothing to Disclose
R. Nils Planken, MD, PhD, Amsterdam, Netherlands (Abstract Co-Author) Nothing to Disclose

PURPOSE

Elite overhead athletes, like volleyball players, are at risk of finger ischemia due to arterial emboli originating from an injured and degenerated proximal posterior circumflex humeral artery (PCHA) in the dominant shoulder. Ultrasound (US) is the first line imaging modality for assessment of the PCHA in symptomatic athletes. However, identification and assessment of the PCHA is cumbersome in the hands of inexperienced ultrasonographers, partially due to anatomical variations and the nearby originating and resembling
deep brachial artery (DBA). The purpose of this study is (1) to determine the prevalence of PCHA aneurysms in elite volleyball players and (2) to describe PCHA and DBA characteristics that can be used for accurate identification and assessment of the PCHA.

METHOD AND MATERIALS

From January 2014 until July 2014, two experienced ultrasonographists completed the standardized PCHA US-protocol in 286 elite volleyball players. Assessment included determination of PCHA aneurysms (defined as segmental vessel dilatation ≥150%), anatomy/branching pattern, and PCHA and DBA vessel characteristics: course and diameter.

RESULTS

The PCHA was identified in 100% of volleyball players (n=286) and the DBA in 96% (n=276). An aneurysm of the PCHA was detected in 4.1% of the volleyball players (n=12) with a mean diameter of 5.9mm ±1.7 and was significantly larger compared to non-dilated PCHA vessel segments (p<0.01). The mean non-dilated PCHA and DBA diameters were 3.8mm ±0.5 (95%CI 3.7-3.8) and 2.3mm ±0.5 (95%CI 2.2-2.3), respectively. The PCHA originated directly from the axillary artery in 82% (n=235) and the DBA in 70% (n=200). PCHA anatomical variations included a common trunk with the DBA (n=24), common trunk with a different artery than the DBA (n=21) and a common trunk with two other arteries (n=3). The PCHA showed a tortuous course towards the humerus in 100% of the cases. The DBA showed a straight course parallel to the axillary artery in 100% of the cases.

CONCLUSION

The prevalence of PCHA aneurysms was 4.1% in our study cohort of 286 elite volleyball players. The reported PCHA and DBA vessel characteristics provide clear guidance for identification and assessment of the PCHA.

CLINICAL RELEVANCE/APPLICATION

One in twenty-five elite volleyball players showed a PCHA aneurysm on ultrasound. We provide PCHA characteristics and diameters that can be used as reference values (normal vs. aneurysmatic) for clinical assessment and research.

RC514-10  **Compressive Vascular Syndromes**

Wednesday, Dec. 2 11:00AM - 11:30AM Location: E353A

Participants
Lindsay S. Machan, MD, Vancouver, BC (Presenter) Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

RC514-11  **Median Arcuate Ligament Syndrome**

Wednesday, Dec. 2 11:30AM - 12:00PM Location: E353A

Participants
Jonathan M. Lorenz, MD, Chicago, IL (Presenter) Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.
Techniques of Musculoskeletal Interventional Ultrasound (Hands-on)

Wednesday, Dec 2 8:30AM - 10:00AM Location: E263

MK IR US

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants
Veronica J. Rooks, MD, Honolulu, HI (Moderator) Nothing to Disclose
Peter L. Cooperberg, MD, Vancouver, BC (Presenter) Nothing to Disclose
Aida F. Cossi, MD, Boston, MA (Presenter) Nothing to Disclose
Nathalie J. Bureau, MD, MSc, Montreal, QC, (nathalie.bureau@umontreal.ca) (Presenter) Equipment support, Siemens AG
James W. Murakami, MD, Columbus, OH (Presenter) Nothing to Disclose
Michael A. Mahlon, DO, Tacoma, WA (Presenter) Nothing to Disclose
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Paula B. Gordon, MD, Vancouver, BC (Presenter) Stockholder, OncoGenex Pharmaceuticals, Inc ; Scientific Advisory Board, Hologic, Inc; Scientific Advisory Board, Reallimaging
Hollins P. Clark, MD, MS, Winston Salem, NC (Presenter) Nothing to Disclose
Carmen Gallego, MD, Madrid, Spain, (cgallego@salud.madrid.org) (Presenter) Nothing to Disclose
Mabel Garcia-Hidalgo Alonso, MD, Madrid, Spain (Presenter) Nothing to Disclose
Michael A. Dipietro, MD, Ann Arbor, MI (Presenter) Nothing to Disclose
Horacio M. Padua JR, MD, Boston, MA (Presenter) Nothing to Disclose
Patrick Warren, MD, Columbus, OH (Presenter) Nothing to Disclose
Stephen C. O'Connor, MD, Boston, MA (Presenter) Nothing to Disclose
Sara E. Smolinski, MD, Springfield, MA (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
1) Identify basic skills, techniques, and pitfalls of freehand invasive sonography, with specific focus on musculoskeletal applications.
2) Define and discuss technical aspects, rationale, and pitfalls involved in musculoskeletal interventional sonographic care procedures.
3) Successfully perform basic portions of hands-on US-guided MSK procedures in a tissue simulation learning module, to include core biopsy, small abscess coaxial catheter drainage, cyst and ganglion aspiration, soft tissue foreign body removal, and intraarticular steroid injection. 4) Incorporate these component skill sets into further life-long learning for expansion of competency and preparta for more advanced interventional MSK sonographic learning opportunities.

ABSTRACT
Ultrasound Guided Foreign Body Removal: Simulation Training and Clinical implementation Outcomes Purpose: USFBR can be taught to radiologists to generate competency, and radiologists can apply the technique in the patient setting to remove foreign bodies. Materials and Methods: Proof of concept was performed by a radiologist and surgeon removing nine 1-cm foreign bodies using the USFBR method (P) and traditional surgery (S) with and without wire guidance (W) on the cadaver model. Next, USFBR was taught to 48 radiologists at 4 hospitals. Training included didactic and hands-on instruction covering 7 components: instrument alignment, hand/transducer position, forceps use, foreign body definition, forceps grasp, recognition of volume averaging, and oblique cross cut artifact. Pre-training testing assessed single toothpick removal from turkey breast in 15 minutes. Post-training evaluation consisted of 5 toothpick removals. Ongoing clinical implementation data of USFBR by trained radiologists are being collected. Parameters including age of patient, which radiologist, removal success, type and size of foreign body, incision size, foreign body retention time, reason for removal, symptoms, modalities used in detection, wound closure, and sedation are recorded. Data analyzed using chi-squared and Fisher's exact tests for categorical outcomes and analysis of variance for continuous outcomes. Results: USFBR technique shows a higher success rate and smaller incision size in comparison to surgical technique alone in the cadaver. Removal success: P 100%, S 78%, and W 89%. With USFBR training, radiologists' scores improved from 21-52% pre-training to 90-100% post-training (p<0.001 for each component). In the clinical setting to date, USFBR has been 100% successful in 7 patients, ages 9–73 years, by four radiologists. Parameters included: length 4 to 30 mm, retention 2 to 864 days, incision, 2 to 8 mm. 1 suture closure. 1 sedation. Conclusion: USFBR is superior to non-guided surgical technique. The USFBR approach taught in simulation improves radiologist technique and removal outcomes. A radiologist who completes simulation training can remove a variety of imbedded foreign bodies.
Vascular/Interventional (Advances in Hepatic Tumor Ablation)

Wednesday, Dec. 2 10:30AM - 12:00PM Location: N227

GI IR MR

AMA PRA Category 1 Credits™: 1.50
ARRT Category A+ Credits: 1.50

FDA Discussions may include off-label uses.

Participants
Nael E. Saad, MBBCh, Saint Louis, MO (Moderator) Research Consultant, Veran Medical Technologies, Inc; Proctor, Sirtex Medical Ltd
Charles Y. Kim, MD, Durham, NC (Moderator) Research Grant, Galil Medical Ltd; Consultant, Kimberly-Clark Corporation; Consultant, CryoLife, Inc

Sub-Events

SSK18-01 Long-Term Therapeutic Outcomes of Radiofrequency Ablation For Subcapsular versus Non-Subcapsular Hepatocellular Carcinoma

Participants
Tae Wook Kang, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Hyo Keun Lim, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Mimi Kim, MD, Seoul, Korea, Republic Of (Presenter) Nothing to Disclose

PURPOSE
Recent clinical guidelines for management of hepatocellular carcinoma (HCC) have not recommended the radiofrequency (RF) ablation for subcapsular tumor due to a higher risk of incomplete ablation or major complications. However, these guidelines were mainly based on retrospective studies with insufficient sample size and follow-up. We retrospectively compared the long-term therapeutic outcomes of RF ablation for HCC in a subcapsular versus non-subcapsular location using propensity score matching

METHOD AND MATERIALS
508 patients (396 men, 112 women; age range, 30-80 years) with a single HCC (<5 cm) were treated with ultrasonography-guided percutaneous RF ablation as a first-line treatment. We divided the patients into two groups, subcapsular (n = 227) or non-subcapsular group (n = 281). We evaluated the association of subcapsular location and the long-term therapeutic outcomes of RF ablation including local tumor progression (LTP) and overall survival (OS) using the matched data and assessed the major complication rate in overall data.

RESULTS
After matching, there were 163 matched pairs of patients in both groups. In the matched groups, the 3- and 5-years cumulative LTP rates were estimated as 18.8% and 20.9%, respectively, for the subcapsular group, and 13.2% and 16.0% for the non-subcapsular group. The corresponding OS rates were 90.7% and 83.2% in the subcapsular group, and 91.4% and 79.1% in the non-subcapsular group, respectively. The hazard rates for LTP (HR [hazard ratio] = 1.37, P = 0.244) and OS (HR = 0.86, P = 0.604) were not significantly different between two matched groups. In addition, there was no significant difference in both groups in terms of major complications rates (P > 0.05).

CONCLUSION
The difference in long-term therapeutic outcomes of RF ablation for HCC was not significant between the subcapsular and non-subcapsular groups.

CLINICAL RELEVANCE/APPLICATION
The consideration of overall technical difficulty of RF ablation for HCC under various clinical settings is more reasonable than the dichotomous view of recommendation for RF ablation judged by anatomical location including subcapsular HCCs.

SSK18-02 Ablation Margin Size and Not Modality Predicts Local Tumor Progression after Ablation of Colorectal Liver Metastases: A Case-control Study of RF and Microwave Ablation

Participants
Waleed Shady, MBBCh, New York, NY (Presenter) Nothing to Disclose
Joseph P. Erinjeri, MD, PhD, New York, NY (Abstract Co-Author) Nothing to Disclose
Karen T. Brown, MD, New York, NY (Abstract Co-Author) Nothing to Disclose
Anne M. Covey, MD, New York, NY (Abstract Co-Author) Nothing to Disclose
Stephen B. Solomon, MD, New York, NY (Abstract Co-Author) Research Grant, General Electric Company
Constantinos T. Sofocleous, MD, PhD, New York, NY (Abstract Co-Author) Consultant, Sirtex Medical Ltd
Christina L. Zenobi, New York, NY (Abstract Co-Author) Nothing to Disclose
Mithat Gonen, PhD, New York, NY (Abstract Co-Author) Nothing to Disclose
Nancy Kemeny, MD, New York, NY (Abstract Co-Author) Nothing to Disclose

PURPOSE
To compare the local tumor progression rates of colorectal liver metastases ablated percutaneously using either microwave (MW) or radiofrequency (RF).
METHOD AND MATERIALS
We performed an IRB-approved retrospective review of a prospectively created HIPAA-compliant ablation database. We included patients with CLM ablated using RF between November 2009 and December 2012. These were matched to a group of patients with CLM ablated using MW between November 2009 and July 2014. Patients were excluded if the percutaneous ablation was used to treat a local recurrence of a previous ablation. The ablation margin was measured on the 1st portal venous phase CT obtained post-ablation (4-8 weeks), and classified as either ≤5 mm or >5 mm. Patients/tumors were excluded if the ablation margin could not be measured due to either: (a) lack of a CT scan at baseline or at 4-8 weeks post-ablation, or (b) fused ablation defects. Clinical characteristics were compared between both groups. Kaplan-Meier methodology was used to calculate LTP-free survival. Stratified log-rank tests were used to analyze predictors of LTP.

RESULTS
The study enrolled 53 patients with 77 tumors ablated with RF in 64 sessions, and 36 patients with 43 tumors ablated with MW in 39 sessions. No differences existed between both groups in baseline clinical characteristics or mean tumor size (1.9 cm MW versus 1.9 cm RF) (P=0.9). The LTP-free survival rate at 2 years was 67% in the RF group and 71% in the MW group (P=0.9). The percentage of ablation margins >5 mm achieved with RF was 58% (45/77) and 42% with MW (18/43) (P=0.08). An ablation margin ≤5 mm was a predictor of LTP in both the RF group (P=0.001) and the MW group (P=0.005). The median LTP-free survival in tumors with a margin ≤5 mm was longer in the MW group than in the RF group (21 months versus 8 months), approaching statistical significance (P=0.09). The LTP-rate for tumor with an ablation margin >5 mm was 4% in the RF group (2/45) and 6% (1/18) in the MW group (P=0.3). Minor complications rate for MW and RF were 26% (10/39) versus 13% (8/64) (P=0.09), and major complications rates were 15% (6/39) versus 13% (8/64) (P=0.7).

CONCLUSION
Local control after ablation of CLM is dependent on an adequate ablation margin and not the modality used.

CLINICAL RELEVANCE/APPLICATION
Sufficient ablation margins remain the most important factor to achieve prolonged LPFS regardless of thermal energy.

SSK18-03 Role of Microwave Ablation (MWA) Therapy of Liver Metastases from Colorectal Carcinoma Post systemic Chemotherapy: Tumor Control and Survival Rates

Wednesday, Dec. 2 10:50AM - 11:00AM Location: N227

Participants
Nour-Eldin A. Nour-Eldin, MD,PhD, Frankfurt Am Main, Germany (Presenter) Nothing to Disclose
Mohammed A. Alsobhi, BMBS, Frankfurt Am Main, Germany (Abstract Co-Author) Nothing to Disclose
Nagy N. Naguib, MD, MSc, Frankfurt Am Main, Germany (Abstract Co-Author) Nothing to Disclose
Martin Beeres, MD, Frankfurt Am Main, Germany (Abstract Co-Author) Nothing to Disclose
Thomas Lehnter, MD, Frankfurt Am Main, Germany (Abstract Co-Author) Nothing to Disclose

 PURPOSE
to evaluate the safety, efficiency, effectiveness, and overall outcome in patients treated with microwave thermal ablation of colorectal metastases post systemic chemotherapy.

METHOD AND MATERIALS
An institutional review board-approval was obtained with informed consent of all patients. Retrospective analysis of prospective intention to treat study was performed from January 2008 to January 2013, and included 92 patients (mean age 56 years SD: 2.6) with 132 liver metastases measuring 0.7–5.0cm, who were treated with microwave ablation (MWA). Local tumor control, complications, and long-term survival were analyzed.

RESULTS
The mean follow-up period was 32.5 months. Complete ablation was achieved in 117 of 132 (88.6%) nodules. Seventeen of the 117 (14.5%) successfully treated nodules developed local recurrence. Univariate analysis showed that tumor size of < 3 cm is a significant risk factor (P = 0.04). Multivariate analysis showed that number of cycles of chemotherapy (FOLFOX) was a significant prognostic factor for overall recurrence (P=0.03), whereas disease-free interval was the significant prognostic factor for distant recurrence (P=0.03). Major complications occurred in 1.1% of patients. No procedure-related mortalities were observed. The 1, 2, 3, and 5-year overall survival rates after the initial ablation were 82, 61.2, 51.2, and 38.3%, respectively. The main cause of death was systemic tumor progression in 65.3% of the patients.

CONCLUSION
MWA is a safe and effective treatment therapeutic option for patients with liver metastases from Colorectal Carcinoma post systemic chemotherapy.

CLINICAL RELEVANCE/APPLICATION
MWA could be safely used as a part of the therapeutic armamentarium in the management of patients with hepatic colorectal metastasis post systemic chemotherapy.

SSK18-04 Local Response Assessment after Percutaneous CT-guided IRE of Hepatic Malignancies: How Useful is Diffusion-weighted MRI (DWI)?

Wednesday, Dec. 2 11:00AM - 11:10AM Location: N227

Participants
Alexandra Barabasch, MD, Aachen, Germany (Presenter) Nothing to Disclose
Philipp Heil, Aachen, Germany (Abstract Co-Author) Nothing to Disclose
Martina Dietelmaier, Aachen, Germany (Abstract Co-Author) Nothing to Disclose
Nils A. Kraemer, Aachen, Germany (Abstract Co-Author) Nothing to Disclose
Assessment of response to hepatic IRE using standard MR-sequences is difficult due to complex signal intensity (SI) changes of the ablation zones that occur during follow-up. DWI offers a high sensitivity for detection of liver metastases. Therefore, aim of this study was to evaluate if DWI is useful to help distinguish normal post-therapeutic SI changes after IRE from local recurrence.

**METHOD AND MATERIALS**

27 Patient (mean age 62y) with 37 malignant liver tumors (4 HCC, 33 metastases) underwent CT-guided percutaneous IRE. Pre- and post-interventional hepatic MRI (T2w TSE, dynamic CE T1w GE, T1w GE in late phase) with DWI (b=800) was performed before treatment, within 2 hours after IRE, at 24 hours after IRE, and at 1, 2, 4, 6, 8, 12 weeks after IRE, and every 3 months thereafter. MR-images were systematically analyzed by two readers in consent. The ablation volume was carefully manually rendered on each b=800 DW image of the ablation zone to create a volume of interest. Minimal ADC-values (ADCmin) were measured in the target lesion before treatment and in the ablation zone volume after treatment.

**RESULTS**

Within the first two days after IRE, ADCmin-values decreased significantly compared to pre-treatment ADCmin in 26 of 37 patients. Thereafter, ADCmin values increased continuously in all of these patients and, within 1-3 months after IRE, were back to normal, i.e. reached the level of the ADCmin values of normal liver parenchyma. In 8/37 patients, this normalization of ADCmin-values was not observed, but instead, exhibited a further decrease of ADCmin at follow up (6 weeks - 12 months) that were then lower than the baseline ADCmin of the tumor before IRE treatment. At the time when the ADC-min decrease was found, remaining hepatic MRI pulse sequences, including visual analysis of DWI, were not suspicious of local recurrence. Only at later follow-up MRI, presence of local tumor recurrence was confirmed in 7 out of these 8 cases.

**CONCLUSION**

These initial results suggest that quantitation of ADCmin is useful to identify local recurrences after hepatic IRE, because changes of ADCmin (specifically, a new decrease of ADCmin after post-treatment ADC normalization) precede visually perceptible SI changes.

**CLINICAL RELEVANCE/APPLICATION**

DWI, with ADC-min quantitation, may allow early diagnosis of local tumor recurrence after IRE.

**SSK18-05 MR Imaging Findings after Hepatic Irreversible Electroporation (IRE) - How to Depict Local Recurrence**

Wednesday, Dec. 2, 11:10AM - 11:20AM Location: N227

**METHOD AND MATERIALS**

27 patients (13 male, mean age 62y) with 37 malignant liver tumors (33 secondary, 4 HCC) underwent percutaneous IRE. Pre- and post-interventional hepatic MRI with Gd-EOB-DTPA according to a standardized protocol (including T2 TSE sequences, dynamic contrast-enhanced T1w GE sequence, T1w GE in late phase) before treatment, within 2 hours after IRE, at 24 hours after IRE, and then at 1, 2, 4, 6, 8, 12 weeks after IRE, and every 3 months thereafter. MR-images were systematically analyzed by two readers in consent.

**RESULTS**

Even after successful IRE, in 23/37 (62%) cases, the ablated tumor was still visible, with unchanged SI and internal architecture as before IRE, for 1-8 weeks after IRE in 8/23 cases, for 3-9 months in 12/23 cases, and for more than 12 months in 3/23 cases. The ablation zone itself appeared as an intermediately hyperintense area on T2w images until 1 week after IRE in all cases. Thereafter, the ablation zone inverted its SI and appeared on T2w images intermediately hypointense in the center, with a hyperintense rim, the latter exhibited strong contrast enhancement in 34/37 cases. This appearance persisted for 1-4 weeks in 17/34 cases, for 6-8 weeks in 10/34 and for 3-6 months in 7/34 cases. The ablation zones showed a steady decrease in size and disappeared completely in 21/37 cases (within 3 months in 16 cases). Local recurrences were observed in 7/37 (19%) cases and were visible as intermediately hyperintense masses on the edge of the intermediately low SI ablation zone on T2w images.

**CONCLUSION**

IRE induces complex signal intensity changes that vary over time. In the majority of cases, the treated target lesions were visible within the ablation zone over a longer period of time. This makes diagnoses of local recurrence difficult.
**SSK18-06** Procedural Sedation and Analgesia versus General Anesthesia for Respiratory-gated MR-HIFU Ablation in the Liver

**Participants**
- Johanna M. van Breugel, MSc, Utrecht, Netherlands (Presenter) Nothing to Disclose
- Joost W Wijlemans, MD, PhD, Utrecht, Netherlands (Abstract Co-Author) Nothing to Disclose
- HBB Vaessen, MSc, Utrecht, Netherlands (Abstract Co-Author) Nothing to Disclose
- Martijn de Greef, PhD, Utrecht, Netherlands (Abstract Co-Author) Nothing to Disclose
- Chrit T. Moonen, PhD, Utrecht, Netherlands (Abstract Co-Author) Nothing to Disclose
- Maurice V. Bosch, MD, PhD, Utrecht, Netherlands (Abstract Co-Author) Nothing to Disclose
- Mario G. Ries, PhD, Utrecht, Netherlands (Abstract Co-Author) Nothing to Disclose

**PURPOSE**
Investigate the feasibility of respiratory-gated MR-HIFU ablation in the liver under PSA with spontaneous breathing in an animal experiment. Validate the introduced respiratory depression by PSA in sedated human patients.

**METHOD AND MATERIALS**
Five pigs were placed on a Philips Sonalleve MR-HIFU system (1.5T, Philips Healthcare). PSA was induced using propofol (4.5-6mg/kg/h) and remifentanil (4.8-5.8μg/kg/h). Volumetric sonications were performed under PSA (4x4x10mm³, 450W acoustic power, 15-25s). MRI and acoustic energy delivery were respiratory gated with a pencil beam navigator. Then, GA was induced using midazolam (1mg/kg/h), nimbox (0.09mg/kg/h), and sufentanil (11.3μg/kg/h). Mechanical ventilation was set to 13/min and the ablation protocol was repeated. For both protocols the nonperfused volumes (NPVs) were measured and the duty cycles (DC) of the therapeutic sonications were compared. PSA was induced in two patients prior to HIFU treatment using propofol (1.4 and 1.6 mg/kg/h) and remifentanil (2.5 and 0.3 μg/kg/h). Vital functions were monitored.

**RESULTS**
Under GA a median DC of 64.0% (IQR 62-67, n=42) was achieved and of 79.5% (IQR 73-85, n=42) under PSA. The mean NPV per sonication was 0.09ml during GA and 0.16ml during PSA. Breathing frequency (BF) under PSA varied between 9-15 breaths/min. Vital functions remained stable. During both patient treatments under PSA the BF could be depressed to values as low as 5/min while the ETCO2 level stayed <6.5%, and blood pressure and heart rate values remained normal.

**CONCLUSION**
The animal experiments confirmed the feasibility of volumetric HIFU ablations using respiratory gating under PSA. The results were comparable or superior to those achieved under GA. The subsequent PSA procedures on human patients evidenced the similarity in respiratory depression of the PSA protocol while vital functions and patient safety were not impaired. Future work anticipates translation of these findings in a clinical liver ablation study.

**CLINICAL RELEVANCE/APPLICATION**
Magnetic Resonance-guided High Intensity Focused Ultrasound (MR-HIFU) ablation in the liver is complicated by the continuous target movement due to respiration. Respiratory gating represents a simple and robust solution, which usually requires general anesthesia (GA) to obtain a long resting phase. From a patient's perspective however, procedural sedation and analgesia (PSA) has advantages over GA: a lower risk of complications and shorter recovery.

**SSK18-08** Preclinical Evaluation of an MR- Compatible Microwave Ablation System and Comparison with a Standard Microwave Ablation System in an ex Vivo Bovine Liver Model

**Participants**
- Rudiger Hoffmann, Tubingen, Germany (Presenter) Nothing to Disclose
- David-Émanuel Kessler, Tubingen, Germany (Abstract Co-Author) Nothing to Disclose
- Frank Eibofner, Tubingen, Germany (Abstract Co-Author) Nothing to Disclose
- Jakob Weiss, Tubingen, Germany (Abstract Co-Author) Nothing to Disclose
- Konstantin Nikolau, MD, Tuebingen, Germany (Abstract Co-Author) Speakers Bureau, Siemens AG, Speakers Bureau, Bracco Group, Speakers Bureau, Bayer AG
- Stephan Clasen, MD, Tuebingen, Germany (Abstract Co-Author) Nothing to Disclose
- Philippe L. Pereira, MD, Heilbronn, Germany (Abstract Co-Author) Research Consultant, Terumo Corporation; Speaker, AngioDynamics, Inc; Speaker, BSD Medical Corporation; Speaker, Terumo Corporation; Speaker, CeloNova BioSciences, Inc; Speaker, Medtronic, Inc; Speaker, BTG International Ltd; Speaker, Biocompatibles International plc; Advisory Board, Siemens AG; Advisory Board, Terumo Corporation; Advisory Board, Bayer AG; Advisory Board, BTG International Ltd; Advisory Board, Medtronic, Inc; Support, Bracco Group; Support, PharmaCept GmbH; Support, Terumo Corporation; Support, Siemens AG; Support, Novartis AG; Support, GlaxoSmithKline plc; Consultant, CeloNova BioSciences, Inc; Research Grant, Biocompatibles International plc; Research Grant, Siemens AG; Research Grant, Terumo Corporation; Research Grant, BTG International Ltd; Hans-Jorg Rempp, Tubingen, Germany (Abstract Co-Author) Nothing to Disclose

**PURPOSE**
To evaluate a newly developed MR-compatible microwave ablation system with focus on ablation performance and compare it with a corresponding standard microwave ablation system in an ex-vivo setting.

**METHOD AND MATERIALS**
Overall, 52 ablation procedures were performed in an ex vivo bovine liver phantom, with various non-perfusion cooled microwave ablation devices and varying ablation durations, using the following settings: [A] 16G standard antenna, 2cm active tip, 2.4m cable; [B] MR-compatible 16G-antenna, 2cm active tip, 2.4m cable; [C] MR-compatible 16G-antenna, 2cm active tip, extended 6m cable; [D] MR-compatible 16G-antenna, 4cm active tip, extended 6m cable. Ablation durations were 3min, 5min and 10min for settings [A]–[C], performing an additional 15min ablation for setting [D]. Settings [A]–[C] were compared regarding the size of the ablation, i.e., short axis diameter (SA), Volume (V), as well as the generator energy output (E), with analysis of variance and Tukey post-
hoo test. Ablation performance of the MR-compatible settings [C] and [D] were compared regarding SA, V, E and sphericity index (SA/LA) with unpaired t-test.

RESULTS
No statistically significant differences were found between [A], [B] and [C] regarding SA and V (10min; [A]: SA=25.8±2.4mm, V=17.8±4.4cm³. [B]: SA=25.3±4.9mm, V=16.6 ± 3.0 cm³. [C]: SA=25.0±2.0mm, V=17.8 ± 2.7 cm³); however, the highest generator energy output was measured for setting [C] ([A]: 9.9±0.5kJ, [B]: 10.1±0.5kJ, [C]: 13.1±0.3kJ, p<0.001). SA, V and E were significantly larger with setting [D] than [C] with 10min ablations ([D]: SA=34.0±2.9mm, V=39.4±7.5 cm³, E=16.7±0.8kJ) without significant difference in sphericity index ([C]: SA/LA=0.46±0.02, [D]: SA/LA=0.52±0.04, p=0.08). Largest ablation zone was achieved with setting [D] after 15 min ablation time (SA=41±1.4mm, V=60.9±5.2cm³, SA/LA=0.59±0.01).

CONCLUSION
The MR-compatible microwave antenna and a standard, comparable, non-MR-compatible microwave ablation device create similar ablation zones. Use of an extension cable for generator positioning outside the MR scanner room is possible without loss of ablation performance.

CLINICAL RELEVANCE/APPLICATION
The tested MR-compatible system can be used without loss of ablation performance compared to the standard system.

SSK18-09 Percutaneous of Microwave Ablation of Hepatic Dome: Assessment of Efficacy and Safety

Participants
Nazanin H. Asvadi, MD, Boston, MA (Presenter) Nothing to Disclose
Arash Anvari, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose
Raul N. Uppot, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose
Ashraf Thabet, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose
Ronald S. Arellano, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose

PURPOSE
To evaluate the efficacy and safety of computed tomography (CT) guided microwave ablation of tumors in hepatic dome.

METHOD AND MATERIALS
An Interventional Radiology database was used to retrospectively identify patients who underwent CT-guided percutaneous microwave ablation for liver tumors located in the hepatic dome between June 2011 and December 2014. Creation of artificial ascites was attempted as an adjunctive maneuver to displace the liver away from the right hemidiaphragm to minimize the potential risks of phrenic nerve injury, pneumothorax or peritoneal burn. Treatment response was assessed by either contrast material enhanced CT or magnetic resonance imaging (MRI) at 1, 3, 6, 9, 12 months and every 3 months thereafter. Primary clinical success was defined as absence residual tumor on one month post-ablation CT or magnetic resonance imaging. Secondary clinical success defined as no residual lesion after repeat microwave ablation.

RESULTS
Between June 2011 and December 2014, 46 patients (M: F = 31:15, mean age = 64.4 years, (range = 25-89 years) underwent CT-guided percutaneous microwave ablation for 48 tumors in the hepatic dome. Creation of artificial ascites with 0.9% normal saline solution (0.9% NS) as an adjunctive maneuver to displace the dome from the right hemidiaphragm was performed in 34/48 (70%) of ablations with mean volume of 1237.5 ml of fluid (range=300-3000 ml). Primary success was achieved in 41/48 (85%). Four tumors required retreatment to achieve complete necrosis for a secondary success rate of 94%. There were no major complications. Two patients experienced small, asymptomatic pneumothoraces that were aspirated at the time of the procedure and did not result in thoracostomy or unexpected hospitalization.

CONCLUSION
Computed tomography guided microwave ablation of hepatic dome lesions is associated with high success rate and low complication rate. Creation of artificial ascites may have a protective effect on minimizing the risk of thermal injury to the diaphragm and/or risk of significant pneumothorax.

CLINICAL RELEVANCE/APPLICATION
Computed tomography guided microwave ablation of hepatic dome lesions is associated with high success and low complication rates.
**VI233-SD-WEA1**

**Reverse Attenuation Gradient Sign at CT angiography- A Potentially Useful Sign for Differentiating Type II Endoleak from Other Types of Endoleak**

Station #1

Participants
Yosuke Horii, Niigata, Japan (Presenter) Nothing to Disclose
Toshihiko Hayashi, Niigata, Japan (Abstract Co-Author) Nothing to Disclose
Norihiko Yoshimura, MD, PhD, Niigata, Japan (Abstract Co-Author) Nothing to Disclose
Hidefumi Aoyama, MD, PhD, Niigata, Japan (Abstract Co-Author) Nothing to Disclose

**PURPOSE**

The purpose of this study was to examine the clinical importance of the reverse attenuation gradient (RAG) sign in patients with endoleaks after endovascular aortic aneurysm repair (EVAR) observed with computed tomographic angiography.

**METHOD AND MATERIALS**

Our institutional review board approved this retrospective study, and informed consent was waived. Fifteen consecutive patients (12 male and 3 female patients; mean age, 77.5 years±7.6 [standard deviation]; range 62-90 years) with endoleaks confirmed at invasive angiography after either thoracic (n=8) or abdominal (n=7) EVAR were enrolled in this study. The RAG sign was defined as the reverse intraluminal opacification gradients of vessels distal to the proximal lesions, which has lower attenuation in the proximal segment and gradually increased attenuation along the vessel. Two experienced radiologists (with 12 and 8 years of experience in vascular imaging, respectively) were reviewed the images of CT angiography and invasive angiography. We compared the blood flow direction at invasive angiography and the frequency of RAG sign. Fisher’s exact probability test was used for comparison.

**RESULTS**

There were 15 patients with EVAR endoleaks confirmed at invasive angiography. Invasive angiography was used to confirm 6 anterograde flows (AFs) and 9 retrograde flows (RFs). The RFs group had the RAG sign significantly more frequently than did the AFs group (89% [8 of 9] vs 17% [1 of 6]; P< .05).

**CONCLUSION**

The RAG sign in CT angiography might represent the flow direction from proximal to distal. The RAG sign might be a help to differentiate type2 endoleak from other types of endoleak.

**CLINICAL RELEVANCE/APPLICATION**

To accurately differentiate type 2 endoleak from other types of EVAR endoleak is very important to plan for additional treatment, because it is different depending on the types of endoleak.

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**VI234-SD-WEA2**

**Comparative Study of Doxorubicin-loaded Drug Eluting Microspheres: An In Vitro Evaluation**

Station #2

Participants
Hsiang-Jer Tseng, MA, MD, Atlanta, GA (Presenter) Recipient of RSNA medical student research grant in 2012.
Lihui Weng, PhD, Minneapolis, MN (Abstract Co-Author) Chief Scientific Officer, EmboMedics Inc
Parinez Rostamzadeh, Minneapolis, MN (Abstract Co-Author) Nothing to Disclose
Jafar Golzarian, MD, Minneapolis, MN (Abstract Co-Author) Chief Medical Officer, EmboMedics Inc

**PURPOSE**

To compare the in vitro loading and post-injection drug recovery rates of two drug eluting microspheres(DEMs), DC Beads (DCBs) and bioresorbable microspheres (BRMS).

**METHOD AND MATERIALS**

DCBs (Biocompatibles, UK) and BRMS in the size range of 100-300 μm were compared. For the drug loading process, DEMs were immersed in a doxorubicin hydrochloride aqueous solution (2 mL, 25 mg/mL) at 5°C. At predetermined time points, the concentration of the loading solution was monitored with a UV spectrophotometer (by measuring the absorbance (at 482 nm) with the aid of a calibration curve. DEMs were suspended in a mixture (20 mL) of normal saline and contrast at a ratio between 4:6 and 6:4. The suspension was injected into a beaker using a 2.8 F Progreat microcathether (ID=0.027", Terumo, NJ). The following data were recorded: (1) Weight of DEMs delivered. (2) Dosage remained on the delivered DEMs. This dosage was obtained with a complete elution of the recovered DEMs after injection. (3) Dosage loss during injection. This was calculated by measuring the concentration of the injection medium after removing the post-injection DEBs. Each experiment was performed in triplicate.

**RESULTS**

Both DEMs can load >98% of doxorubicin after 2 hours. 75.92% and 83.33% of the DEMs by weight were recovered post-injection.
for DCBs and BRMs, respectively (p=0.0779). 80.58% of doxorubicin remained on post-injection DCBs while 82.24% remained on BRMs (p=0.3804). 3.57% of drug was eluted in the contrast/normal saline medium for DCBs while 8.2% of drug was eluted for BRMs (p=0.0171).

CONCLUSION

Both DEMs exhibited similar loading efficacies for doxorubicin. Even though more drug was lost by elution for the BRMs when compared with the DCBs, this was made up for by a higher fraction of the beads recovered during injection from the BRMs. Overall, both DEMs perform similarly in terms of drug dosage delivery.

CLINICAL RELEVANCE/APPLICATION

BRMs has been shown to be non-cytotoxic, degradable, injectable and loadable with doxorubicin, showing great promise as a vehicle for transarterial chemoembolization.

**VI235-SD-WEA3**  
**Magnetic Resonance Image-guided Cryoablation of Recurrent Prostate Cancer: 3 Year Follow up**

Station #3

Participants

Kristin A. Kinsman, MD, Rochester, MN (Presenter) Nothing to Disclose  
David A. Woodrum, MD, PhD, Rochester, MN (Abstract Co-Author) Nothing to Disclose  
Akira Kawashima, MD, PhD, Phoenix, AZ (Abstract Co-Author) Nothing to Disclose  
Krzysztof Gorny, PhD, Rochester, MN (Abstract Co-Author) Nothing to Disclose  
Joel P. Felmee, PhD, Rochester, MN (Abstract Co-Author) Nothing to Disclose  
R. Jeffrey Kames, MD, Rochester, MN (Abstract Co-Author) Nothing to Disclose  
Eugene D. Kwon, MD, Rochester, MN (Abstract Co-Author) Nothing to Disclose  
Lance A. Mynderse, MD, Rochester, MN (Abstract Co-Author) Nothing to Disclose

PURPOSE

To evaluate the intermediate-term (3 year follow up) effectiveness of MRI-guided percutaneous cryotherapy for biopsy proven locally recurrent prostate cancer, after radical prostatectomy, with curative intent.

METHOD AND MATERIALS

IRB approved single arm study to examine the effectiveness of MR guided cryoablation for locally recurrent prostate cancer. Eight patients, of a 31 patient cohort, treated for curative intent had a 3 year follow up. Each patient was treated with MRI-guided cryoablation for locally recurrent prostatic carcinoma. All patients (mean 63.57–73 years old) had visible nodules on multiparametric MRI(mMRI) with TRUS, biopsy proving recurrent prostate cancer. All eight patients had primary prostatectomy for prostate cancer with 3 of 8 receiving subsequent radiation therapy for recurrent cancer afterwards. After careful confirmation of locally recurrent disease using PET choline and MRI, MR guided cryoablation was discussed. MR guided cryotherapies were performed with 1.5T MRI(Siemens Espree,Erlangen,Germany). Cryoprobes(2-4) were placed using transperineal guidance grid(Biotex, Houston TX). MR-guided cryoablation(Galil Inc., Minneapolis, MN) was performed using 3 freeze-thaw cycles with continuous MRI monitoring during the freezing. Follow up was performed with serial PSA(1,3,6,12,18,24,30,and 36 months), mpMRI(6,12,24, and 36 months), and clinic visit(6,12,24,and 36 months). If there was a rise in PSA to >1ng/mL then a PET choline is performed.

RESULTS

The mean pre-ablation PSA was 0.67ng/mL(0.29-2.2) All 8 patients had a PSA<0.2ng/mL at 1 month status post ablation. The mean 3 year PSA was 0.21ng/mL(0.0-0.95). Five of 8 patient's PSA remained <0.2 ng/mL throughout the 3 year follow-up without subsequent therapy. One patient with a bladder neck lesion recurred at 6 months, and went on to radiation therapy. Two patients have had a slow rise in PSA but no definite recurrence in the prostate bed by imaging or biopsy. Treatment related complications include worsening erectile dysfunction(1/8), minor incontinence(2/8), and worsening of moderate urinary incontinence(1/8). No patient developed rectal injury or ureteral injury.

CONCLUSION

MRI-guided cryoablation for patients with locally confined prostate bed recurrences can be an effective treatment option.

CLINICAL RELEVANCE/APPLICATION

MRI-guided cryoablation offers patients with recurrent prostate cancer another possible option for treatment beyond surgery and radiation.

**VI254-SD-WEA4**  
**The Safety and Efficacy Profile of TACE for Treating Hepatocellular Carcinoma in Patients Co-infected with HIV and HCV: A Propensity Score Matching Study**

Station #4

Participants

Jae Ho Sohn, MD,BS, New Haven, CT (Presenter) Nothing to Disclose  
Reham R. Haroun, Salt Lake City, UT (Abstract Co-Author) Nothing to Disclose  
Julius Chapiron, MD, Berlin, Germany (Abstract Co-Author) Nothing to Disclose  
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Jean-Francois H. Geschwind, MD, Westport, CT (Abstract Co-Author) Researcher, BTG International Ltd; Consultant, BTG International Ltd; Researcher, Koninklijke Philips NV; Researcher, Guerbet SA; Consultant, Guerbet SA; Consultant, Terumo Corporation; Consultant, Threshold Pharmaceuticals, Inc; Consultant, PreScience Labs, LLC; Researcher,
Percutaneous ablation can be used as part of a multimodal treatment approach for oligometastatic prostate cancer and can delay disease progression when used in combination with other therapies. Percutaneous ablation may be particularly valuable in ADT-naïve patients.

**RESULTS**

Of the 456 patients, 35 patients in EXP group were successfully matched to 75 patients in CTRL group. 15 (42.9%) patients had detectable HIV viral load. Median CD4 count was 406 x 10⁶ cells/mm³ (range 121 to 1086). 31 (88.5%) patients were on ART. The cohort spanned all BCLC/HKLC stages. KM revealed MOS of 20.0 months for the EXP group and MOS of 21.3 months for the CTRL group (p = 0.907). Cox model on EXP group did not identify any infectious disease variables of significance on survival. No significant complication, such as death, ICU stay, or fulminant liver failure within 30 days of TACE, was observed in the EXP group.

**CONCLUSION**

In HCC patients with HIV/HCV co-infection and CD4 > 100, TACE demonstrated comparable safety and efficacy profile as in HCC patients with HCV only.

**CLINICAL RELEVANCE/APPLICATION**

Interventional oncologists should feel comfortable offering TACE as a treatment option to HCC patients with HIV/HCV co-infection.

**VI232-SD-WEAS**

**Percutaneous Ablation of Oligometastatic Prostate Cancer: Oncologic Outcomes and Safety**

**METHOD AND MATERIALS**

This is a retrospective, single-institution review of 31 patients with oligometastatic prostate cancer who underwent 43 percutaneous ablations of their limited (≤5) metastatic sites. Eight patients (26%) were antigen deprivation therapy-naïve (ADT-naïve) and received ablation with the purpose of delaying ADT. Twenty-three patients (74%) underwent ablation either because of resistance to systemic therapies or a more aggressive multimodal treatment approach was preferred. Study endpoints included procedural complications, local control, progression free survival (PFS), and androgen deprivation therapy-free survival (ADT-FS). ADT-FS was defined as the time between percutaneous ablation and the initiation of ADT.

**RESULTS**

Local control was achieved in 35 (81.4%) of 43 tumors with a median follow-up of 8 months (range, 3-60 mo) after ablation. Tumor recurrence was found in 8 (18.6%) of 43 tumors at a median follow-up of 6 months (range, 2-38 mo). Median prostate-specific antigen (PSA) measurements were significantly lower approximately 2 months after ablation compared to before ablation (0.27 ng/dl [range <0.01 to 7.7] and 1.5 ng/dl [range <0.01 to 72.0], respectively (p=0.02)). Estimated PFS rates for all patients at 6 and 12 months after ablation were 65% (95% CI, 44-80) and 45% (95% CI, 24-64), respectively. Of the 8 ADT-naïve patients who underwent ablation with purpose to delay ADT, all (100%) achieved local control and the ADT-FS at 12 months was approximately 70%. None of the ablations were associated with major complications.

**CONCLUSION**

Percutaneous ablation of oligometastatic prostate cancer appears safe, achieves acceptable local control rates, and can delay disease progression when used in combination with other therapies. Percutaneous ablation may be particularly valuable in ADT-naïve patients who do not tolerate or prefer to delay ADT.

**CLINICAL RELEVANCE/APPLICATION**

Percutaneous ablation can be used as part of a multimodal treatment approach for oligometastatic prostate cancer and can delay hormone therapy in ADT-naïve patients.
To review the set-up and acquisition of cone-beam CT. Discuss the pros and cons of using cone-beam CT. To review the utility of cone-beam CT in pre-procedural planning, immediate procedure outcome, and detection of post-procedural complications.

**TABLE OF CONTENTS/OUTLINE**

Physics and acquisition of cone-beam CT  
Cone-beam CT setup in the IR suite  
Pros and cons of cone-beam CT  
Pre-procedure evaluation  
Immediate post-procedure assessment  
Detecting post-procedural complications  
Summary and conclusions
Clinical and Imaging Predictors for Positive Angiographic Findings in Blunt Splenic Trauma

Station #1

Participants
Sarah B. White, MD, MS, Philadelphia, PA (Moderator) Nothing to Disclose

Sub-Events

VI237-SD-WEB1 Clinical and Imaging Predictors for Positive Angiographic Findings in Blunt Splenic Trauma

PURPOSE
To determine the likelihood of positive findings on splenic angiography (SA) for blunt spleen trauma (BST) based on American Associate for Surgery of Trauma (AAST) grading and clinical indicators.

METHOD AND MATERIALS
Medical charts from 990 patients with BST at a level 1 trauma center, between January 1, 2008 and December 31, 2013, were retrospectively reviewed. Eighty-five received SA (mean age: 36.7 +/- 16.0 years, range 8-82) and 22 were female (25.9%). Grade of injury (AAST scale), angiography findings, hemodynamic status, ACT, and outcomes were analyzed.

RESULTS
All seventy patients (82.4%) with positive angiographic findings received embolization using gelfoam and/or coils. A logistic regression to compare high versus low grade injuries demonstrated an odds ratio (OR) of 4.35 (95% CI= 1.24 to 15.23, p=0.0215) that high grade injuries will have positive angiography. Of the patients who underwent angiography, a total of 10 (11.7%) had complications requiring further procedure. Five (5.9%) underwent splenectomy after angiography, two (2.4%) required repeat embolization, and one (1.2%) each developed a pseudoanerysm, underwent splenorraphy, or required a drain placement. No statistically significant association was found between positive angiographic findings and the clinical indicators.

CONCLUSION
Traditionally, a patient's clinical status is a significant motivator for urgency of angioembolization. Our data suggests that there is no predictive value, and therefore no indication for angiography based on clinical parameters alone. A statistically significant correlation between AAST grading and positive angiography suggests high grade injuries may benefit from angiography in order to prevent failure in non-operative management. Our data would support the use of CT findings as the key decision point in indication for angiography, as opposed to the traditional use of a patient's clinical status.

CLINICAL RELEVANCE/APPLICATION
AAST grading of traumatic splenic injury using CT should be used in addition to hemodynamic and clinical parameters when determining whether a patient should undergo conventional angiography.

Patient-specific Prostate Deformation Modelling via Shear Wave Elastography for TRUS-guided Interventions

Station #2

Participants
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Pheng Ann Heng, PhD, Shatin, Hong Kong (Abstract Co-Author) Nothing to Disclose

PURPOSE
Shear wave elastography (SWE) shows promise as a technological achievement that provides quantitative information about tissue elasticity. The purpose of this study was to take advantage of the patient-specific biomechanical properties obtained from SWE to reliably predict the prostate deformation during transrectal ultrasound (TRUS)-guided interventions.

METHOD AND MATERIALS
A 3D patient-specific prostate deformation model was generated with the finite element analysis and the quantitative tissue parameters measured from the SWE. With the incorporation of personalized prostate elasticity parameters into the finite element modelling, our deformation model can precisely estimate the complicated volumetric deformation within the prostate during the
TRUS-guided interventions. The patient-specific deformation model was applied to register the preoperative MR images with the TRUS images for boosting the efficacy and accuracy of TRUS-guided interventions.

RESULTS
Experiments were carried out on the datasets obtained from ten patients with suspected prostate cancer. A set of SWE, MR, and TRUS images were acquired from each patient. The patient-specific deformation model generated with personalized biomechanical properties was used to predict the prostate deformation and register MR-TRUS images. The target registration error (TRE) of manually identified corresponding landmarks in MR and TRUS images was measured to evaluate the accuracy of deformation estimation. 6 fiducial pairs were selected for each patient. The averaged TRE before registration is 6.80±1.59 mm, and 1.56±0.65 mm after proposed method, compensated for nearly 77%, which indicates the efficacy of employing SWE to predict the deformation and guide MR-TRUS registration. Furthermore, the averaged TRE of 1.56 mm completely meets the clinically accurate tumor detection requirement of less than 1.9 mm. Fig. 1 visualizes one target TRUS slice and the corresponding registered MR slice.

CONCLUSION
The use of true tissue elasticity measured from SWE shows promise for patient-specific deformation modelling and thus benefits the MR-TRUS registration for image-guided interventions.

CLINICAL RELEVANCE/APPLICATION
The true tissue stiffness obtained from SWE benefits the patient-specific biomechanical modelling and shows promise for providing precise treatments in applications that use TRUS-guided interventions.

VI239-SDWEB3
Slow Blood Flow in Lower Extremity Deep Veins on Doppler Ultrasound Examination: Does It Predict Subsequent Development of DVT?

Station #3

Participants
Veral D. Amin, MD, Pearland, TX (Presenter) Nothing to Disclose
Corey T. Jensen, MD, Houston, TX (Abstract Co-Author) Nothing to Disclose
Khaled M. Elsayes, MD, Ann Arbor, MI (Abstract Co-Author) Nothing to Disclose
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Tharakeswara K. Bathala, MD, Houston, TX (Abstract Co-Author) Nothing to Disclose
Shouhao Zhou, Houston, TX (Abstract Co-Author) Nothing to Disclose
Deepak G. Bedi, MBBCh, Houston, TX (Abstract Co-Author) Consultant, Koninklijke Philips NV

PURPOSE
To determine whether the qualitative sonographic appearance of slow venous flow in the lower extremities correlates with an increased risk of subsequent deep venous thrombosis (DVT) in oncology patients.

METHOD AND MATERIALS
In this institutional review board approved, retrospective study, 975 lower extremity venous Doppler ultrasound examinations were reviewed by two radiologists: 482 consecutive patients with reported slow venous flow and 493 consecutive patients without reported slow venous flow were identified for retrospective analysis. The presence or absence of subjective slow venous flow and absence of initial DVT was confirmed by consensus reevaluation. Peak venous flow velocities were recorded at the common femoral, femoral and popliteal levels. Each patient had at least one year clinical and/or sonographic follow-up to determine the possible presence of subsequent DVT. The associations between DVT and the presence of slow venous flow were examined using Fisher’s exact test. 2-sample t-test was employed for peak velocity comparison of the slow flow versus normal flow groups and DVT vs non-DVT groups. The optimal cut off peak velocity to correlate with radiologist perceived slow flow was determined by Youden’s index.

RESULTS
There was a significant, small increased rate of subsequent DVT development in the slow venous flow group (21/482) compared to patients with normal flow (11/493) (P=0.0456). Additionally, measured peak venous velocities were significantly lower in the slow venous flow group at each assessed venous level (P<0.001) by an average of 9, 5 and 6 cm/sec at the common femoral, femoral and popliteal levels, respectively. The patients with subsequent DVT did not have a significant difference in venous velocities compared with their respective group. An average of three venous level velocities resulted in the best cutoff to dichotomize groups into normal versus slow venous flow with a sensitivity and specificity of 0.757 and 0.746, respectively, using a value of 14.5 cm/sec.

CONCLUSION
Subjective identification of slow venous flow in the lower extremities on Doppler ultrasound correlates with a mild, but significant increased rate of subsequent DVT development in oncology patients.

CLINICAL RELEVANCE/APPLICATION
These results suggest that patients identified to have slow venous flow should be followed to closer degree clinically, perhaps with a lower threshold for follow-up Doppler ultrasound evaluation.

HONORED EDUCATORS
Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

Khaled M. Elsayes, MD - 2014 Honored Educator

VI255-SDWEB4
Three Dimensional Quantitative Tumor Response to Repetitive Transarterial Chemoembolization Predicts Survival for Hepatocellular Carcinoma
PURPOSE

To evaluate survival and 3D tumor response in hepatocellular carcinoma (HCC) patients who were treated with a second transarterial chemoembolization (TACE) after initial nonresponse to the first TACE.

METHOD AND MATERIALS

A total of 94 consecutive patients (87.2% men; mean age, 62 years) with Barcelona Clinic Liver Cancer stage B (intermediate-stage) HCC were retrospectively included. Tumor response was assessed on contrast-enhanced multiphasic magnetic resonance imaging using quantitative EASL (qEASL), a volumetric enhancement criterion. qEASL defines response as a ≥65% decrease in enhancing tumor volume. The Kaplan-Meier method with the log-rank test was used to compare overall survival (OS) for responders and nonresponders.

RESULTS

Median follow-up period was 25 months (range 2.1-106.2). 81 (86.2%) patients were nonresponders after the first TACE and OS was similar for responders and nonresponders [24.3 months (95%CI 15.5-33.1) vs. 23 months (95%CI 18.8-27.2), P=0.82, respectively]. 51 nonresponders underwent a second TACE within 3 months. Of those, 47 (92.6%) patients had follow-up imaging. After the second TACE, 14 (29.8%) patients achieved response and their median OS was significantly longer than nonresponders [63.5 months (95%CI 31.0-96.0) vs. 18 months (95%CI 12.6-23.4), P=0.014, respectively]. Furthermore, these patients showed a clear trend towards a longer OS, than those who did not undergo a second TACE [63.5 months (95%CI 31.0-96.0) vs. 28.7 months (95%CI 18.7-38.7), P=0.07, respectively].

CONCLUSION

Patients who initially showed 3D nonresponse to the first TACE treatment could have a prolonged survival from a second TACE treatment.

CLINICAL RELEVANCE/APPLICATION

Repeated TACE can be beneficial for patients even if they show initial nonresponse as assessed by qEASL criteria on MR imaging.

TABLE OF CONTENTS/OUTLINE

Our exhibit will review common appearances of properly and improperly placed IVC filters across multiple modalities, as encountered by radiologists on a daily basis. After a brief discussion and imaging review of historically used filters, we will present current guidelines regarding filters from Society of Interventional Radiology and American College of Chest Physicians. Angiographic images demonstrating routine filter placement will be presented. Demonstration of anatomic variants (e.g. duplicated vena cava, circumaortic renal veins, megacavas) and complex conditions (e.g. extensive proximal thrombus) requiring special filter placement considerations will be presented. Complications of filters we be reviewed, including IVC penetration, filter migration, filter fracture, and IVC thrombosis. Review of current controversies, including filter longevity. Finally, key points for evaluating filters seen on routine diagnostic imaging will be summarized.
**LEARNING OBJECTIVES**

1) Recognize the diverse applications of ultrasound throughout the body and when it provides the optimal diagnostic imaging choice. 2) Understand the fundamental interpretive parameters of ultrasound contrast enhancement and its applications in the abdomen. 3) Know the important factors to consider when choosing ultrasound vs CT for image guided procedures and how to optimize ultrasound for technical success.

**ABSTRACT**

Ultrasound is a rapidly evolving imaging modality which has achieved widespread application throughout the body. In this course we will address the major anatomic areas of ultrasound use, including the abdominal and pelvic organs, superficial structures and the vascular system. Challenging imaging and clinical scenarios will be emphasized to include the participant in the decision-making process. Advanced cases and evolving technology will be highlighted, including the use of ultrasound contrast media as a problem solving tool, and the appropriate selection of procedures for US-guided intervention.

**Sub-Events**

**MSCU41A  Problem Solving with Contrast Enhanced Ultrasound**

Participants
Stephanie R. Wilson, MD, Calgary, AB (Presenter) Research Grant, Lantheus Medical Imaging, Inc; Equipment support, Siemens AG; Equipment support, Koninklijke Philips NV

**LEARNING OBJECTIVES**

1) Attendees will appreciate the multiple varied applications for CEUS in the abdomen. 2) They will recognize the value of CEUS as a real time procedure with exquisite sensitivity to its contrast agent allowing for superior detection of arterial phase vascularity. 3) They will realize the safety of CEUS with no requirement for ionizing radiation, and no nephrotoxicity for evaluation of any problems requiring contrast enhancement in those with renal failure. 4) They will understand the fundamentals for interpretation of contrast enhancement patterns for the noninvasive diagnosis of focal liver masses and other pathology.

**ABSTRACT**

Image-guided procedures are commonly performed. There are several important considerations when selecting an appropriate imaging modality to guide the procedure. Ultrasound has several advantages over CT but there are also limitations. These advantages and disadvantages will be reviewed, including various factors to consider when evaluating a case for a potential procedure. When ultrasound is used, there are techniques which may offer increased likelihood of success or decreased procedural time. Through multiple case presentations, this session will review the considerations and techniques for successful ultrasound guided interventions.

**Participants**
Laurence Needleman, MD, Philadelphia, PA (Presenter) Nothing to Disclose

**LEARNING OBJECTIVES**

View learning objectives under main course title.
Interventional Oncology Series: Mechanisms Matter: Basic Science Every IO Should Know

LEARNING OBJECTIVES

1) Gain an appreciation of the basic scientific underpinnings of interventional oncology.
2) Understand how and why these mechanistic studies can have an impact on both daily clinical practice and future therapeutic paradigms.
3) Characterize the most important advances of tumor ablation over the last two decades.
4) Gain a better understanding of the cutting edge imaging techniques that facilitate successful state of the art interventional oncologic practice.

ABSTRACT

The first half of the session has been organized into a thematic unit entitled: "Mechanisms Matter: Basic science every IO should know" and will be dedicated to gaining an appreciation of the basic scientific underpinnings of interventional oncology and understanding how and why such studies can have an impact on both daily clinical practice and future therapeutic paradigms. This will include an initial lecture outlining the many insights and lessons that can be directly applied from radiation therapy and hyperthermia, followed by lectures that center upon key mechanistic pathways that are being used to improve transcatheter embolization and tumor ablation. Two presentations will outline our current understanding of the potential systemic effects of post-procedure, cytokine-mediated inflammation - the negative effects leading to tumorigenesis and the potential beneficial immune (abscopisc) effects of IO therapies. A highlight of the session will be a keynote address "20 years of thermal ablation: Progress, Challenges and Opportunities". Dr. Solomon, a noted thought leader in the field will not only characterize the most important advances of tumor ablation over the last two decades and place them in their proper historical and developmental context, but will also identify key areas of research in device and technique development that hold the potential to propel the field forward in the upcoming decade. The second half of the session "Advancing IO with cutting-edge imaging techniques" will be dedicated to the cutting edge imaging modalities that facilitate successful state of the art IO practice. Leading authorities will provide an in depth look at advances and adaptation of 5 of the main technologies as they relate to enhancing interventional oncology including: advanced ultrasound and fusion techniques; state-of-the-art angiographic imaging (including Cone beam CT and subtraction reconstruction); tailoring MR for IO; the the role of PET/CT; and molecular imaging.

Sub-Events

VSIO41-01 Ischemia-The Prime Mover: Apoptosis, Hif-1a, and VEGF Pathways

LEARNING OBJECTIVES

View learning objectives under main course title.

VSIO41-02 Exploiting Tumor Hypoxia with Transarterial Chemoembolization to Treat Liver Cancer: Selective Hypoxia-Activated Intra-arterial Therapy in a Rabbit Model

Awards

Trainee Research Prize - Fellow
PURPOSE

Hypoxia is a common physiological alteration of solid tumors and has been correlated with treatment failure. Hypoxia resulting from embolization also contributes to chemoresistance after TACE. Evofosfamide (Evo) [previously called TH-302] is administered as a nontoxic prodrug which is selectively activated by hypoxia resulting in DNA damage and tumor cell death. The purpose of this study was to investigate the feasibility, safety and antitumor efficacy of hepatic hypoxia-activated intra-arterial therapy (HAIAT) in a rabbit model.

METHOD AND MATERIALS

Twenty-eight VX2 tumor-bearing rabbits were assigned to 4 intraarterial therapy (IAT) regimens: 1) saline (control group); 2) Evo; 3) doxorubicin; Lipiodol emulsion followed by embolization with 100;300μm beads (conventional, cTACE); or 4) a combination of Evo and cTACE (Evo;cTACE). Blood samples were collected pre;IAT, 24/48h and 7/14days post;IAT. Efficacy was assessed quantitatively on MDCT (24h pre; , 7/14 days post;IAT). Necrotic fraction (NF) was quantified on HandE by slide;by;slide segmentation. Hypoxic fraction (HF) and compartment (HC) were determined by pimonidazole staining. Markers of tumor DNA damage, apoptosis, cell proliferation, endogenous hypoxia and metabolism were quantified (γ-H2AX, annexin V, caspase-3, Ki-67, HIF1α, MCT4, LDH).

RESULTS

Evo;cTACE showed similar profile in liver enzyme elevation compared to cTACE except at day 7 where ALT was higher. No hematologic/renal toxicity was observed. Animals treated with Evo-cTACE demonstrated smaller tumor volumes, lower tumor growth rate and higher NF compared to cTACE. Evo resulted in a marked reduction in the HF and HC. A significant negative correlation was found between the HF or HC and the magnitude of the NF. Evo or Evo;cTACE promoted antitumor effects as evidenced by increased expression of γ-H2AX and apoptotic biomarkers, with decreased proliferation. Increased HIF1α expression and tumor glycolysis validated HAIAT.

CONCLUSION

HAIAT with Evo was feasible, had a favorable toxicity profile and demonstrated antitumor effects by selective targeting of tumor hypoxic areas.

CLINICAL RELEVANCE/APPLICATION

The embolic effect of TACE provides an attractive setting for selective activation of bioreductive prodrugs and HAIAT allows for the delivery of high drug doses that may reach tumor regions where hypoxic cells reside in pharmacological sanctuary.

VSIO41-03 Lessons Learned from XRT/Hyperthermia

Wednesday, Dec. 2 1:55PM - 2:10PM Location: S405AB

Participants

Mark W. Dewhirst, DVM, PhD, Durham, NC (Presenter) Stockholder, Celsion Corporation; Research Grant, Biomimetix Corporation; Research Grant, Johnson & Johnson; Consultant, Nevro Corp; Consultant, Merck KGaA; Consultant, Siva Corporation

LEARNING OBJECTIVES

1) Understand the complimentary interactions between hyperthermia and radiotherapy that increase cell killing. 2) Understand importance of measuring temperature during heating and methods for how this is accomplished. 3) Be able to articulate how hyperthermia affects tumor physiology and how these effects influence treatment responses.

ABSTRACT

There are more than a dozen positive phase III trials showing that hyperthermia can increase local tumor control when it is combined with radiotherapy. Such trials include head and neck cancer, cervix cancer, GBM, esophageal al cancer and chest wall recurrences of breast cancer. It has been known for more than two decades that hyperthermia augments the cytotoxicity of radiotherapy. Basic tenants underlying this interaction include proof that hyperthermia inhibits DNA damage-repair. Hyperthermia has complimentary cytotoxicity with radiotherapy in different parts of the cell cycle. Further, hyperthermia can increase tumor perfusion, thereby increasing oxygen delivery; lack of oxygen is a source of relative resistance to radiotherapy. In recent years, however, new insights have been made into how these two treatment modalities interact. These insights come from: 1) innovative clinical trials involving functional imaging and genomics and 2) examination of how hyperthermia affects the process of DNA damage repair. These developments point the way toward new methods to further therapeutically gain by taking advantage of cellular responses to these therapies.

VSIO41-04 The Safety and Efficacy Profile of TACE for Treating Hepatocellular Carcinoma in Patients Co-infected with HIV and HCV: A Propensity Score Matching Study

Wednesday, Dec. 2 2:10PM - 2:20PM Location: S405AB

Participants

Jae Ho Sohn, MD,MS, New Haven, CT (Presenter) Nothing to Disclose
Reham R. Haroun, Salt Lake City, UT (Abstract Co-Author) Nothing to Disclose
Julius Chapiro, MD, Berlin, Germany (Abstract Co-Author) Nothing to Disclose
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PURPOSE
Hepatocellular carcinoma (HCC) is becoming an increasing cause of morbidity and mortality in patients co-infected with HIV and HCV. TACE is an important treatment option for unresectable HCC, but to date, there is paucity of data on the safety and efficacy profile of TACE in this specific cohort. The purpose of this study is to compare HCC patients with HIV/HCV co-infection treated with TACE against HCC patients with HCV mono-infection treated with TACE through survival analysis and recording of major complications.

METHOD AND MATERIALS
This single institution and retrospective study included 456 patients. 35 HIV/HCV co-infected HCC patients with CD4 > 100 (group EXP) and 421 HCV-only HCC patients (group CTRL) who received TACE from 2001 - 2014 were included. Propensity score matching (PSM) with the nearest-neighbor method was performed, adjusting for sex, ethnicity, and BCLC/HKLC, which take into account Child-Pugh Class, ECOG performance score, and tumor characteristics. Covariate balance was confirmed. Kaplan-Meier (KM) estimates with median overall survival (MOS) and log-rank statistic were calculated. Cox regression was performed on EXP group to identify infectious disease parameters of potential significance on survival, such as detectable HIV viral load, CD4 count, and anti-retroviral therapy (ART). Significant complications were recorded.

RESULTS
Of the 456 patients, 35 patients in EXP group were successfully matched to 75 patients in CTRL group. 15 (42.9%) patients had detectable HIV viral load. Median CD4 count was 406 x 106 cells/mm3 (range 121 to 1086). 31 (88.5%) patients were on ART. The cohort spanned all BCLC/HKLC stages. KM revealed MOS of 20.0 months for the EXP group and MOS of 21.3 months for the CTRL group (p = 0.907). Cox model on EXP group did not identify any infectious disease variables of significance on survival. No significant complication, such as death, ICU stay, or fulminant liver failure within 30 days of TACE, was observed in the EXP group.

CONCLUSION
In HCC patients with HIV/HCV co-infection and CD4 > 100, TACE demonstrated comparable safety and efficacy profile as in HCC patients with HCV only.

CLINICAL RELEVANCE/APPLICATION
Interventional oncologists should feel comfortable offering TACE as a treatment option to HCC patients with HIV/HCV co-infection.

PURPOSE
To evaluate the potential utility of circulating tumor cells (CTCs) measurements in predicting prognosis of hepatocellular carcinoma (HCC) patients received transarterial chemoembolization (TACE) treatments, including their differences in different vein sites and the immediate and delayed impact of TACE on CTCs.

METHOD AND MATERIALS
CTCs from consecutive patients with HCC were quantified before and immediately and 6-8 weeks after TACE. CTCs were examined in both samples derived from the peripheral vein (PV) and the hepatic vein (HV).

RESULTS
A total of 46 consecutive patients with HCC were recruited into the prospective study and 38 were analysed at last. CTCs counts in HV were significantly higher than in PV (P<0.001). TACE led to a statistically significant immediate fall in CTCs numbers, especially in HV(P<0.001). Patients with CTCs levels ≥2 in PV or ≥8 in HV at baseline per 7.5 ml blood samples, compared with the group with fewer CTCs in PV or HV, had a shorter median progression-free survival (PFS, 5.2 months vs. 12.0 months, P=0.01; 5.2 months versus 9.5 months, P=0.003, respectively). At the 6-8 weeks after TACE, patients with CTCs ≥2 in PV or ≥3 in HV had a similarly shorter PFS (5.0 months vs. 12.0 months, P<0.001; 5.1 months versus 11.2 months, P<0.001, respectively). Further analysis showed that patients with higher CTC levels also had a higher intrahepatic metastasis rate. The multivariate Cox regression analyses and ROC curves showed that the levels of CTCs at baseline and 6-8 weeks after TACE were significant independent prognostic factors of PFS.

CONCLUSION
The number of CTCs in peripheral and hepatic vein before and 6-8 weeks after TACE are independent predictors of PFS in HCC patients received TACE treatments. TACE immediately reduces the number of CTCs get into the blood circulation.
CTCs detection is a promising method to predict prognosis in HCC patients underwent TACE. TACE immediately reduce the number of CTCs get into the blood and may reduce the rate of metastasis.

**VSIO41-07 Understanding Post-procedure Inflammation: AKT and c-met Pathways**

Wednesday, Dec. 2 2:45PM - 3:00PM Location: S405AB

Participants
David A. Woodrum, MD, PhD, Rochester, MN (Presenter) Nothing to Disclose

**LEARNING OBJECTIVES**
View learning objectives under main course title.

**VSIO41-08 Microwave Hepatic Ablation Induces Dose Dependent Local Inflammation and Distant Pro-oncogenic Effects**

Wednesday, Dec. 2 3:00PM - 3:10PM Location: S405AB

Participants
Erik Velez, BS, San Francisco, CA (Presenter) Nothing to Disclose
Nahum Goldberg, Jerusalem, Israel (Abstract Co-Author) Nothing to Disclose
Gaurav Kumar, PhD, Boston, MA (Abstract Co-Author) Nothing to Disclose
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Muneeb Ahmed, MD, Wellesley, MA (Abstract Co-Author) Nothing to Disclose

**PURPOSE**
To determine how different doses of microwave ablation (MWA) induce local inflammation and distant pro-oncogenic effects compared to radiofrequency ablation (RFA) in a small animal model.

**METHOD AND MATERIALS**
F344 rats (n=24) were implanted with single subcutaneous R3230 tumors. Average tumor diameter and tumor growth rates were assessed daily. At mean tumor diameter of 10 mm, animals were divided into four groups (n=6/arm), and assigned to one of four treatments: sham (needle x 5 minutes), RFA (70°C x 5 minutes), rapid high-dose MWA (20W x 15 seconds), or slower low-dose MWA (5W x 2 minutes). Settings were selected to produce 11.4±0.8 mm coagulation zones for all ablation settings. Tumors were measured daily for 7 days post-treatment to determine growth rates. Thickness of periablational liver inflammation (heat shock protein 70; Hsp70), local liver IL-6 levels, and distant tumor proliferative indices (Ki-67) were also compared.

**RESULTS**
Hepatic MWA-5W and RFA increased distant tumor growth rates compared to the MWA-20W and sham arms, such that the 7 day mean tumor diameter was greater (MWA-5W 16.3±1.1 mm, RFA 16.3±0.9 mm vs. sham 13.6±1.3 mm, p<0.01, and MWA-20W 14.6±0.9 mm, p<0.05). Although less than MWA-5 or RFA, MWA-20W also resulted in a significantly greater change in tumor diameter compared to the sham arm (p=0.04). Similarly, higher distant tumor proliferation was observed after hepatic MWA-5W and RFA, followed by MWA-20W, compared to sham (proliferative indices: MWA-5W 0.82±0.05, RFA 0.79±0.05, MWA-20W 0.65±0.02 vs. sham 0.49±0.05, p<0.01). Finally, lower-energy hepatic MWA and RFA resulted in greater periablational inflammation (Hsp70: RFA 141.5 μm (mean), MWA-5W 134.1 μm, vs. MWA-20W 67.5 μm, p<0.01) with a trend for elevation in IL-6 levels for RFA (542±61 pg/ml) and MWA-5W (486±101 pg/ml), vs. MWA-20W (349±22 pg/mL, p<0.08).

**CONCLUSION**
Hepatic MW ablation can incite periablational inflammation and increased distant tumor growth similar to what has been recently reported for RFA. Yet, such undesired effects may be dependent on heating paradigms, and less pronounced with more rapid, higher power heating.

**CLINICAL RELEVANCE/APPLICATION**
MWA and RFA can have ‘off-target’ tumor stimulatory effects, which may be decreased using higher MW energy to reduce secondary inflammation in the tissue surrounding the ablation zone.

**VSIO41-09 Systemic Implications of IO Therapies: Increased Tumorigenesis?**

Wednesday, Dec. 2 3:10PM - 3:25PM Location: S405AB

Participants
Muneeb Ahmed, MD, Wellesley, MA, (mahmed@bidmc.harvard.edu) (Presenter) Nothing to Disclose

**LEARNING OBJECTIVES**
View learning objectives under main course title.

**VSIO41-10 Systemic Implications of IO Therapies: Beneficial Immune Effects?**

Wednesday, Dec. 2 3:25PM - 3:40PM Location: S405AB

Participants
Joseph P. Erinjeri, MD, PhD, New York, NY, (erinjerj@mskcc.org) (Presenter) Nothing to Disclose

**LEARNING OBJECTIVES**
View learning objectives under main course title.
**LEARNING OBJECTIVES**

View learning objectives under main course title.

**Participants**

**VSIO41-11**  Panel Discussion: So What Does This All Mean?

Participants

**VSIO41-12**  20 Years of Thermal Ablation: Progress, Challenges and Opportunities

Participants

Stephen B. Solomon, MD, New York, NY (Presenter) Research Grant, General Electric Company

**VSIO41-13**  Advancing IO with Cutting-edge Imaging Techniques

Participants

Luigi Solbiati, MD, Busto Arsizio, Italy, (lusolbia@tin.it) (Presenter) Nothing to Disclose

**VSIO41-14**  Advanced Ultrasound and Fusion Techniques

Participants

Ming De Lin, PhD, Cambridge, MA (Presenter) Employee, Koninklijke Philips NV

**VSIO41-15**  State-of-the-Art Angiographic Imaging: Cone Beam CT and beyond

Participants

**VSIO41-16**  Contrast Patterns on Intra-procedural Cone-beam CT Can Predict Early Tumor Response to DEB-TACE in Patients with Hepatocellular Carcinoma

Participants

Sonia P. Sahu, New Haven, CT (Presenter) Nothing to Disclose

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Cone-beam CT (CBCT) is routinely utilized to determine the optimal location for drug delivery and technical success of embolization during drug-eluting beads transarterial chemoembolization (DEB-TACE). As such, the relationship between interprocedural CBCT findings and therapy response should be investigated. This study examined whether quantified contrast patterns on interprocedural CBCT could predict tumor response on 1 month follow-up magnetic resonance (MR) imaging in hepatocellular carcinoma (HCC) patients treated with DEB-TACE.

METHODS AND MATERIALS
This retrospective study included 53 lesions in 49 patients (38 men, median age 62.7 years) who underwent DEB-TACE. All patients had a contrast-enhanced CBCT image taken immediately before and an unenhanced CBCT image taken immediately after drug delivery. However, enhancement was seen on the post-TACE CBCT due to retained contrast medium from drug delivery. MR imaging was performed at baseline and 1 month follow-up. On the CBCT images, enhancement of the target lesions was measured in 1 dimension (D), 2D, and 3D. On follow-up CBCT, patients were classified as responders or non-responders using mRECIST, EASL, and quantitative EASL (qEASL). qEASL defines response as a ≥65% decrease in 3D enhancement. To assess whether contrast patterns on CBCT could predict 1 month MR response, univariate and multivariate logistic regressions. Baseline characteristics significant in univariate analysis were included in the multivariate model.

RESULTS
On pre- and post-TACE CBCT, median 1D, 2D, and 3D tumor enhancement was 3.4 vs 3.6 cm (p=0.5), 9.9 vs 10.4 cm^2 (p=0.7), and 60.7 vs 73.0 % (p=0.4). Response was seen in 34% (mRECIST) and 38% (EASL and qEASL) of lesions. Neither 1D nor 2D enhancement on CBCT could predict mRECIST or EASL response, respectively. However, 3D enhancement was predictive of qEASL response in univariate (pre-TACE CBCT: OR 1.07, 95% CI 1.03–1.11; post-TACE CBCT: OR 1.10, 95% CI 1.15–1.16) and multivariate analysis adjusted for age, hepatitis C, and tumor size (pre-TACE CBCT: OR 1.06, 95% CI 1.02–1.10; post-TACE CBCT: OR 1.09, 95% CI 1.03–1.15).

CONCLUSION
3D enhancement on intra-procedural CBCT can predict 3D tumor response on MR in HCC patients treated with DEB-TACE.

CLINICAL RELEVANCE/APPLICATION
CBCT contrast patterns during DEB-TACE are associated with future tumor response and therefore should guide intra-procedural decisions.

VSI041-17 Tailoring MR for IO

Participants
Philippe L. Pereira, MD, Heilbronn, Germany (Presenter) Research Consultant, Terumo Corporation; Speaker, AngioDynamics, Inc; Speaker, BSD Medical Corporation; Speaker, Terumo Corporation; Speaker, CeloNova BioSciences, Inc; Speaker, Medtronic, Inc; Speaker, BTG International Ltd; Advisory Board, Siemens AG; Advisory Board, Terumo Corporation; Advisory Board, Bayer AG; Advisory Board, BTG International Ltd; Advisory Board, Medtronic, Inc; Support, Bracco Group; Support, PharmaCept GmbH; Support, Terumo Corporation; Support, Siemens AG; Support, Novartis AG; Support, GlaxoSmithKline plc; Consultant, CeloNova BioSciences, Inc; Research Grant, Biocompatibles International plc; Research Grant, Siemens AG; Research Grant, Terumo Corporation; Research Grant, BTG International Ltd

LEARNING OBJECTIVES
View learning objectives under main course title.

ABSTRACT
Image guided tumor ablation is a minimally invasive therapy option in the treatment of primary and secondary hepatic malignancies. Magnetic resonance (MR) imaging offers an accurate pre-interventional imaging having important impact on patient selection and planning of the ablation procedure. Peri-interventional imaging is used for targeting, monitoring, and controlling of the ablation procedure. Due to a high soft-tissue contrast offering delineation of tumor tissue and the surrounding anatomy, coupled with multiplanar capabilities, MR imaging is an advantageous targeting technique compared with ultrasonography (US) or computed tomography (CT). Furthermore, a near-online imaging is feasible at interventional MR units facilitating a fast and precise placement of the probe inside the target tissue. MR imaging is sensitive to thermal effects enabling a monitoring of ablation therapy. At low-field, MR scanner T2 weighted sequences are accurate to near-online monitor acute effects of thermally induced coagulation subsequently being supportive to control the ablation procedure. Therefore, MR imaging can fulfill the conditions for overlapping ablations by enabling a precise repositioning of the MR compatible thermal applicator if required. MR imaging can be utilized to define the end point of thermal ablation after complete coverage of the target tissue is verified. Thus, the probability of achieving complete coagulation in larger tumors within a single therapy session is supposedly increased. A monitoring of thermal effects is moreover essential in order to prevent unintended tissue damage from critical structures in the surroundings of the target tissue. Subsequently, the possibility to monitor and control thermal ablation by MR imaging has an important impact on the safety and effectiveness of the ablation procedure. At least, first use of MR compatible microwave antennas will be presented in this refresher.

VSI041-18 3D Quantitative Tumor Burden Analysis in Patients with Hepatocellular Carcinoma before TACE: Comparing Multi-lesion vs. Single-lesion Imaging Biomarkers as Predictors of Patient Survival

Participants
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Yan Zhao, MS, Baltimore, MD (Abstract Co-Author) Nothing to Disclose
Bernhard Gebauer, MD, Berlin, Germany (Abstract Co-Author) Research Consultant, C. R. Bard, Inc; Research Consultant, Sirtex
**LEARNING OBJECTIVES**

1. Compare advantages of PET/CT with other imaging modalities in guiding interventional radiology procedures.
2. Describe strategies to improve lesion targeting during PET/CT interventional procedures.
3. Apply various PET/CT imaging techniques for the intra-procedural assessment of tumor ablation margins.

**ABSTRACT**

Positron Emission Tomography/Computed Tomography (PET/CT) enhances our capabilities in image-guided interventions in multiple ways. PET/CT enables targeting of disease foci not visible using other imaging modalities, provides uninterrupted visibility of targets despite intra-procedural changes in surrounding tissues or thermal effects of ablation, and facilitates unique intra-procedural strategies for assessing tumor ablation results. Many case examples will be shown that highlight rationales, strategies and emerging techniques for successful PET/CT-guided interventions.

**LEARNING OBJECTIVES**

View learning objectives under main course title.
Participants
Jonathan Mazal, MS, RRA, Bethesda, MD (Presenter) Nothing to Disclose
Toby Rogers, BA, MRCP, Bethesda, MD (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
1) Define interventional cardiovascular magnetic resonance (iCMR). 2) Compare advantages and disadvantages of MRI versus other imaging modalities to guide cardiovascular interventions. 3) Describe personnel and infrastructure requirements to start an iCMR program. 4) Identify current clinical applications of iCMR. 5) Review pre-clinical applications of iCMR to inform future clinical directions.
SSM08

Gastrointestinal (Loco-regional Therapy Liver Imaging)

Wednesday, Dec. 2 3:00PM - 4:00PM Location: E353A

Participants
Debra A. Gervais, MD, Chestnut Hill, MA (Moderator) Nothing to Disclose
Steven S. Raman, MD, Santa Monica, CA (Moderator) Nothing to Disclose

Sub-Events

SSM08-01 Irreversible Electroporation in Patients with Hepatocellular Carcinoma: Immediate Versus Delayed Findings on MR Imaging

Participants
Guy E. Johnson, MD, Seattle, WA (Abstract Co-Author) Nothing to Disclose
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Siddharth A. Padia, MD, Seattle, WA (Presenter) Nothing to Disclose

PURPOSE
Irreversible electroporation (IRE) is a non-thermal technique used to ablate soft tissue tumors. Our study assessed MR imaging appearance after IRE for the treatment of hepatocellular carcinoma (HCC).

METHOD AND MATERIALS
In this institutional review board-approved retrospective study with waiver of informed consent, twenty patients with HCC were treated with IRE over a 2.5 year period. Median patient age was 62, and 75% of patients had Child-Pugh A cirrhosis. Median tumor diameter was 2.0 cm (range 1.0-3.3 cm). Contrast-enhanced multiphase MR was performed on post-procedure day 1, 30, and every 90 days thereafter. Ablation zone sizes and signal intensities were compared between each time point for both T1- and T2-weighted images. Trends in MR signal intensity and tumor dimensions over time were quantified using generalized linear models.

RESULTS
MR appearance of a treated tumor includes a zone of peripheral enhancement with centripetal filling on delayed post-contrast images. Compared to post-procedure day one, there is a decrease in enhancing ablation zone size of 28.9% (mean) every 90 days. There is a trend towards decreasing signal intensity of the peripheral ablation zone over time on both T1- and T2-weighted images. Trends in MR signal intensity and tumor dimensions over time were quantified using generalized linear models.

CONCLUSION
IRE of HCC results in a large region of enhancement on immediate post-procedure MR, which involutes on follow-up imaging. This is associated with decreasing signal intensity of the peripheral ablation zone over time. This phenomenon may represent resolution of the reversible penumbra.

CLINICAL RELEVANCE/APPLICATION
1. Understanding of the standard MR imaging appearance after IRE can help guide future therapy and assess prognosis with respect to tumor response. 2. The large area of enhancement seen after IRE may represent regions of reversible electroporation, which may be used to optimize treatment protocols or target localized drug delivery in future studies.

SSM08-02 Local Hepatic Tumor Control in Patients with HCC Undergoing Transarterial Lipiodol Embolisation Followed by Microwave Ablation

Participants
Roland M. Seidel, MD, Homburg, Germany (Presenter) Nothing to Disclose
Alexander Massmann, MD, Homburg/Saar, Germany (Abstract Co-Author) Nothing to Disclose
Peter Fries, MD, Homburg, Germany (Abstract Co-Author) Nothing to Disclose
Guenter K. Schneider, MD, PhD, Homburg, Germany (Abstract Co-Author) Research Grant, Siemens AG; Speakers Bureau, Siemens AG; Speakers Bureau, Bracco Group; Research Grant, Bracco Group
Arno Buecker, MD, Homburg, Germany (Abstract Co-Author) Consultant, Medtronic, Inc Speaker, Medtronic, Inc Co-founder, Aachen Resonance GmbH Research Grant, Siemens AG

PURPOSE
To investigate local tumor control in patients with HCC undergoing lipiodol embolization and subsequent microwave ablation.

METHOD AND MATERIALS
25 patients with 35 HCC (mean size 23mm, SD 9mm) underwent superselective transarterial embolization with lipiodol. Subsequently
percutaneous CT guided microwave ablation of the tumors was performed using a 2.45 GHz generator (power output 80 to 120W) with cooled tip probes (Acculis, Angiodynamics, USA). All patients were investigated before therapy by unenhanced and dynamic contrast enhanced MR or CT; follow up was performed within 1, 3, 6 and more months after treatment. Treatment was rated as successful in case of a complete rim of necrosis surrounding the lesion and no further tumor growth. Patient data were evaluated retrospectively on a PACS workstation by two readers in consensus.

RESULTS
In 24 of 25 (96%) patients a complete ablation was diagnosed on the early follow up imaging. The patient rated with incomplete ablation presented tumor progression on follow up imaging. 1 patient initially rated as complete ablation presented lesion progression and underwent chemoembolization with no residual tumor up to 510 d after microwave ablation. Overall complete ablation rate per patient was 92% (23 of 25 patients) and 94% per lesion (33 of 35 lesions).

CONCLUSION
Microwave ablation in combination with lipiodol embolization for patients with HCC is a valuable therapeutic procedure for smaller hepatic tumors. Especially the targeting and embolizing potential of the retained lipiodol is likely to contribute to a more reliable tumor access and ablation effect.

CLINICAL RELEVANCE/APPLICATION
The treatment of smaller local HCC tumors becomes more and more an issue in the bridging to transplant situation and therefore minimal invasive percutaneous ablation techniques become attractive, since local tumor control is in the range of surgical treatments. This study demonstrates a reliable minimal invasive targeting and embolization technique in combination with microwave ablation for the enhancement of local tumor control.

SSM08-03 Analysis of a Series of Microwave Ablated Native HCCs: Which Parameters do Affect Outcome after Treatment?

Wednesday, Dec. 2 3:20PM - 3:30PM Location: E353A

Participants
Valentina Battaglia JR, MD, Pisa, Italy (Presenter) Nothing to Disclose
Salvatore Mazzeo, MD, Pisa, Italy (Abstract Co-Author) Nothing to Disclose
Carla Cappelli, MD,PhD, Pisa, Italy (Abstract Co-Author) Nothing to Disclose
Rosa Cervelli, Pisa, Italy (Abstract Co-Author) Nothing to Disclose
Piercarlo Rossi, MD, Pisa, Italy (Abstract Co-Author) Nothing to Disclose
Carlo Bartolozzi, MD, Pisa, Italy (Abstract Co-Author) Nothing to Disclose

PURPOSE
To investigate the efficacy at 1 month after treatment of ultrasound-guided percutaneous microwave ablation (MWA) of series of native HCCs.

METHOD AND MATERIALS
From January 2013 to February 2015, 221 patients with a single HCC lesion were candidate for ultrasound-guided percutaneous MWA. Of them, 113 were excluded because of patients’ habitus or limited US visibility of the lesion (42 and 71 patients respectively). Finally, our study included 108 patients who were treated with MWA for a single hepatic lesion. All lesions were classified on the basis of dimensions, location and venous vessel contiguity. A cooled shaft antenna of 16 or 14 Gauge was percutaneously inserted into the tumor under ultrasound guidance. Microwave emitting power and time of treatment were tailored to tumor size (ranging from 35 to 50W). Lesions were classified on the basis of dimensions (1.5cm to 2cm: 31/108; 2.1 to 3cm: 54/108; 3.1 to 4cm: 23/108), of location: centrohepatic, subcapsular, close to gallbladder, para-hilar and para-caval. Moreover, lesions were divided into subdiaphragmatic (23; yes; 86; no) and on the basis of proximity (<5mm) to vascular structures (59; yes; 49; no). In all cases, a CT evaluation performed 1 month after procedure was done. Tumor response after treatment was evaluated by means of mRECIST. Statistical analysis was performed by means of Chi-square test and bivariate correlation.

RESULTS
All neoplasms were ablated in a single session and no major complication occurred. At CT evaluation, 84 lesions showed a Complete Response, 23 Partial response and 1 lesion Stable Disease. Statistical analysis showed no significant relationship between complete response and tumor size, time of ablation or power applied. At bivariate analysis, tumor location and subdiaphragmatic position did correlate (p<0.0001) with lesions’response to treatment, independently from dimensions and technical parameters of power emission.

CONCLUSION
In our series, tumor size did not appear to impact complete ablation rates, whereas lesion localization represents the most important factor influencing tumor response.

CLINICAL RELEVANCE/APPLICATION
Lesions’characteristics might lead to formulate a grading on the basis of whom to predict tumor response after treatment.

SSM08-04 Local Treatment for Colorectal Cancer Liver Metastases, Comparison of Radiofrequency Ablation and Surgical Metastasectomy

Wednesday, Dec. 2 3:30PM - 3:40PM Location: E353A

Participants
Naik Vietti Violi, Lausanne, Switzerland (Presenter) Nothing to Disclose
Alban L. Denys, MD, Lausanne, Switzerland (Abstract Co-Author) Nothing to Disclose
Pierre E. Bize, MD, Lausanne, Switzerland (Abstract Co-Author) Nothing to Disclose
Rafael Duran, MD, Baltimore, MD (Abstract Co-Author) Nothing to Disclose
Nicolas Demartines, MD, Lausanne, Switzerland (Abstract Co-Author) Nothing to Disclose
Nermin Halkic, Lausanne, Switzerland (Abstract Co-Author) Nothing to Disclose
**PURPOSE**

To compare local recurrence rate of radiofrequency ablation (RFA) and surgical metastasectomy for colorectal cancer liver metastases from a surgical and radiological database of consecutive patients and to define the best candidates for each treatment.

**METHOD AND MATERIALS**

We analyzed, lesion by lesion, 121 metastases treated by metastasectomy (in 43 patients, median follow up 798 days) and 110 metastases treated by RFA (in 60 patients, median follow up 590 days). We compared rate of local recurrence (LR) and hepatic recurrence (HR) between the two groups. Predictive factors for recurrence (patients and primary tumor characteristics and metastasis data - size, depth in the liver (distance between metastasis and hepatic capsule), distance to vascular structures (all veins located within 10 mm to the metastasis were registered), pathological margins in case of surgery (R0/R1 status)), were analyzed by Chi square and logistic regression in uni and multivariate analysis.

**RESULTS**

We found no difference between the two groups for patients and primary tumor characteristics. Survival curves were similar between the two groups. Mean metastasis size was larger in metastasectomy group than RFA group (18mm, range 2-90mm, standard error=0.11 and 15mm, range 3-55mm, standard error=0.06; p=0.03). Rate of LR and HR between the two groups were nearly statistically different in favor of RFA: LR was 19% for metastasectomy group and 10% for RFA group (p=0.06, delay: 245 and 289 days, p=0.56), HR were 78.5% for metastasectomy and 66% for RFA (p=0.054, delay: 226 and 235 days, p=0.81). R1 status and metastasis deepness were predictive factors for recurrence in the metastasectomy group (p=0.03 and p=0.02, respectively). Metastases deepness and proximity to vascular structure increased risk for R1 (p=0.04 and p<0.001, respectively). We found no predictive factor for recurrence in RFA group.

**CONCLUSION**

Pending proper selection (small lesions visible under imaging guidance), RFA tends to have a lower recurrence rate than metastasectomy. Lesions localized in depth in the liver parenchyma, close to large veins are at risk of local recurrence after metastasectomy.

**CLINICAL RELEVANCE/APPLICATION**

Metastasectomy and radiofrequency ablation are currently used for treatment of colorectal cancer liver metastasis aiming for total tumor ablation and sparing liver parenchyma. There is no study comparing results and risk of local recurrence between metastasectomy and RFA.

**SSMO8-05 Diagnostic Performance of DECT in the Assessment of Treated Zone Following Percutaneous Ablation in Renal Cell Cancer: Image Quality and Radiation Dose Considerations**

Wednesday, Dec. 2 3:40PM - 3:50PM Location: E353A

Participants

Diana Murcia, MD, Boston, MA (Presenter) Nothing to Disclose
Andrea Prochowski Jamurri, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose
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Ronald S. Arellano, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose
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Avinash R. Kambadakone, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose

**PURPOSE**

To determine the diagnostic performance of DECT in the evaluation of treated zone following percutaneous ablation of renal cell cancer (RCC) with assessment of value of iodine images (MD-I), image quality and radiation dose considerations.

**METHOD AND MATERIALS**

In this retrospective study, 26 patients (17 M, 9 F, mean age 69 years) with RCC treated with percutaneous ablation were included. The patients underwent contrast enhanced nephrographic phase dual energy CT scan with a single-source dual energy CT (750HD GE Healthcare, Milwaukee WI) as part of post ablation surveillance. In this cohort, 13 patients had single energy unenhanced scans. All the patients in this cohort had renal mass protocol single energy CT (SECT) at different time-points. Post processed subtraction, material density iodine (MD-I) and virtual unenhanced images were generated. Two blinded radiologists reviewed the SECT and DECT images in two separate sessions for ablation zone margin, presence of residual/recurrent tumor, image quality and presence of artifacts with a 5 point confidence score. The CTDI and DLP were recorded and compared between DECT series and SECT series.

**RESULTS**

A total of 28 RCC underwent percutaneous ablation. DECT with MD-I iodine images demonstrated higher specificity for detection of abnormal enhancement in the ablation zone suggesting residual tumor/recurrence compared to SECT (30% vs 91%). The image quality score for DECT (with MD-I) was higher compared to standard SECT images (5 vs 4.1 of SECT with p<0.05) with higher number of artifacts recorded in the subtraction images generated from standard non-contrast and contrast enhanced CT images (25% of cases). A single phase DECT had significant radiation dose reduction in comparison to dual phase SECT scans (736.1±231.6 mGy-cm vs 1596.5±450.2 mGy-cm; p<0.001) and the radiation dose considerations of nephrographic phase DECT and SECT were comparable (736.1±231.6 mGy-cm vs 609.5±169.1 mGy-cm; p=0.179)

**CONCLUSION**

DECT with iodine specific images improves diagnostic performance in the evaluation of ablation zone in RCC as compared to standard SECT images with significant reduction of radiation dose due to exclusion of non-contrast phase.

**CLINICAL RELEVANCE/APPLICATION**

Post ablation surveillance of treated zone in patients with RCC can present diagnostic challenges with the need for non-contrast...
scans and subtraction images which increase the cumulative radiation dose and are affected by artifacts.

**Honored Educators**

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

Dushyant V. Sahani, MD - 2012 Honored Educator
Dushyant V. Sahani, MD - 2015 Honored Educator

**SSM08-06 CT and MR Imaging Features to Predict Residual or Recurrent Hepatocellular Carcinoma after Transarterial or Percutaneous Treatment**

*Wednesday, Dec. 2 3:50PM - 4:00PM Location: E353A*

**Participants**

Eric C. Ehman, MD, San Francisco, CA (Presenter) Nothing to Disclose
Sarah Umetsu, MD, PhD, San Francisco, CA (Abstract Co-Author) Nothing to Disclose
Nicholas Fidelman, MD, San Francisco, CA (Abstract Co-Author) Nothing to Disclose
Linda Ferrell, MD, San Francisco, CA (Abstract Co-Author) Nothing to Disclose
Michael A. Ohliger, MD, PhD, San Francisco, CA (Abstract Co-Author) Nothing to Disclose
Benjamin M. Yeoh, MD, San Francisco, CA (Abstract Co-Author) Research Grant, General Electric Company; Author with royalties, Oxford University Press; Shareholder, Nextarx, Inc
Judy Yee, MD, San Francisco, CA (Abstract Co-Author) Research Grant, EchoPixel, Inc
Thomas A. Hope, MD, San Francisco, CA (Abstract Co-Author) Advisory Committee, Guerbet SA; Research Grant, General Electric Company

**PURPOSE**

To determine which CT and MR features are most predictive of viable hepatocellular carcinoma (HCC) following percutaneous or transarterial treatment.

**METHOD AND MATERIALS**

Pathology reports for liver explants from 12/2012-7/2014 with CT or MR imaging performed within 90 days of transplant (45±28 days) were reviewed. Patients with a history of hepatocellular carcinoma and preoperative treatment including transarterial chemoembolization (TACE) or percutaneous ablation (radiofrequency, microwave, cryo, ethanol) were included. Each lesion was reviewed on the most recent pre-transplant imaging study and size, location and enhancement features recorded. Pathology slides were reviewed and the size of viable tumor nodule recorded (if present).

**RESULTS**

91 patients with 135 treated lesions were included. 88(65%) lesions were imaged with CT and 47(35%) with MR, including 89(66%) post-TACE, 24(18%) post-ablation, and 22(16%) post both TACE and ablation. At explant, 69(51%) of lesions showed viable tumor. 11/42(26%) of viable lesions at CT and 15/27(56%) at MR demonstrated nodular arterial enhancement (p=0.02). Washout was seen in 13/42(31%) of viable HCCs at CT and in 6/27(22%) at MR (p>0.05). Capsule appearance was seen in 2/42(5%) of viable lesions at CT and in 1/27(4%) at MR (p>0.05). Using each criteria to diagnose a study positive for recurrence, sensitivity and specificity were 38% and 92% for nodular enhancement, 28% and 94% for washout and 4% and 100% for capsule. Using any of the three criteria, overall sensitivity and specificity were 45% and 91%. Detection rate for nodular recurrence was 33% for lesions <1cm, 55% for lesions 1-2cm and 71% for lesions >2cm. Lesion detection by size was similar at CT and MR.

**CONCLUSION**

No single imaging finding was sensitive for viable HCC following treatment. Nodular arterial enhancement was the most frequently seen, and seen significantly more at MR than at CT. Washout was less frequently seen and seen equally at MR and CT. Capsule was rarely seen but when present always predicted recurrence. There is limited detection of lesions <1cm both at MR and CT and only marginal detection between 1-2cm.

**CLINICAL RELEVANCE/APPLICATION**

Post-treatment imaging is difficult to interpret and imaging features predictive of recurrent or residual disease are not well understood. Accurate diagnosis of viable tumor at post-treatment imaging is important to guide future therapy such as repeat TACE or ablation.
SSM17

Neuroradiology (Neurointerventional Radiology)

Wednesday, Dec. 2 3:00PM - 4:00PM Location: N227

NR IR

AMA PRA Category 1 Credit ™: 1.00
ARRT Category A+ Credit: 1.00

FDA

Discussions may include off-label uses.

Participants
Colin P. Derdeyn, MD, Saint Louis, MO (Moderator) Consultant, Terumo Corporation; Consultant, Penumbra, Inc; Consultant, Silk Road Medical; Stock options, Pulse Therapeutics, Inc; ;
Albert J. Yoo, MD, Newton, MA (Moderator) Research Grant, Penumbra, Inc; Research Grant, Terumo Corporation; Research Consultant, Medtronic, Inc;

Sub-Events
SSM17-01 Recurrences May Occur More than Ten Years after Endovascular Treatment of Intracranial Aneurysms: A Prospective Cohort Study, a Systematic Review and Meta-Analysis

Wednesday, Dec. 2 3:00PM - 3:10PM Location: N227

Participants
Olivier Naggara, MD, Paris, France (Presenter) Nothing to Disclose
Augustin Lecler, MD, Paris, France (Abstract Co-Author) Nothing to Disclose
Jean Raymond, MD, Montreal, QC (Abstract Co-Author) Nothing to Disclose
Christine Rodriguez, Paris, France (Abstract Co-Author) Nothing to Disclose
Denis Trystram, MD, Paris, France (Abstract Co-Author) Nothing to Disclose
Wagih Ben Hassen, Paris, France (Abstract Co-Author) Nothing to Disclose
Jean-Francois Meder, MD, PhD, Paris, France (Abstract Co-Author) Nothing to Disclose
Catherine Oppenheim, MD, PhD, Paris, France (Abstract Co-Author) Nothing to Disclose

PURPOSE
Our aim was to assess the 10-year efficacy of endovascular treatment (EVT) of intracranial aneurysm (IA) in terms of recurrence, assessed on long-term MR angiography (LT-MRA), and bleeding and de novo aneurysm formation. We also aimed to identify potential risk factors of aneurysm recurrence, including IA occlusion on 3-to 5-year MRA (MT-MRA), through a prospective study and a systematic review of the literature.

METHOD AND MATERIALS
We prospectively performed clinical examination and 3T MRA 10-years after EVT of IA in a single institution. Individual informed consent was obtained. In addition, the literature was searched using PubMed, EMBASE, and Cochrane databases to identify studies reporting bleeding and/or aneurysm recurrence rate in patients followed beyond 10-years after EVT. Univariate and multivariate subgroup analyses were performed to identify risk factors (MT-MRA results, aneurysm characteristics, retreatment within 5 years).

RESULTS
In the prospective study, among 129 aneurysms followed >10 years, 16 (12.4%) demonstrated sac recanalization between MT- and LT-MRA. Neck remnant on MT-MRA (Relative risk [RR]: 4.16, 99%Confident interval [99%CI]: 2.12-8.14) and retreatment within five years (RR: 4.67, 99%CI, 1.55-14.03) were risk factors for late recurrence. In the systematic review (15 cohorts, 2773 patients, 2902 aneurysms), bleeding rate, recurrent aneurysm, and de novo aneurysms were, respectively 0.7% (99%CI, 0.2-2.7%, I2: 0%, 694 aneurysms), 11.4% (99%CI, 7.0-18.0%, I2: 21.6%), and 4.1% (99%CI, 1.7-9.4%, I2: 54.1%). Incomplete initial treatment (RR: 7.08, 99%CI, 1.24-40.37, I2: 82.6%) and aneurysm size > 10 mm (RR: 4.37, 99%CI, 1.83-10.44, I2: 0%) were risk factors for late recurrence.

CONCLUSION
EVT of IA is effective in preventing long-term bleeding, but may be followed by recurrences in a significant proportion of cases, a finding that may justify following selected patients for ≥10 years, i.e. in patients with Raymond grade 2 classification on 3- to 5-year MRA or when aneurysm >10 mm.

CLINICAL RELEVANCE/APPLICATION
Long-term (> 10 years) MRA follow-up may be needed in patients with aneurysms larger than 10 mm, or in the case of grade 2 aneurysms at the end of standard midterm follow-up. De novo aneurysms may occur between 5 and 10 years after treatment in one in 25 patients.

SSM17-02 Does Recurrence Effect the Clinical Outcome after Endovascular Coiling of Ruptured Intracranial Aneurysms? – A Ten Year Retrospective Study

Wednesday, Dec. 2 3:10PM - 3:20PM Location: N227

Participants
Robert K. Moreland, MD, Ottawa, ON (Presenter) Nothing to Disclose
Marlise P. dos Santos MSc, MD, Ottawa, ON (Abstract Co-Author) Nothing to Disclose
Rafael Glikstein, Ottawa, ON (Abstract Co-Author) Nothing to Disclose

PURPOSE
To identify the factors associated with clinical outcome of coiling of ruptured intracranial aneurysms (RIA).
METHOD AND MATERIALS

Retrospective review of all patients with RIA treated with endovascular coil embolization at a active single centre between 2002-2013. Cases of flow-related (AVM, DAVF related) aneurysms, flow-diversion and parent artery occlusion were excluded. We identified patient, periprocedural, procedural and aneurysm characteristics associated with pre-discharge and long-term clinical outcome (modified Rankin Scale (mRS) 0-2 [favorable] versus 3-6 [unfavorable]). We used univariate Cox Proportional Hazards Model followed by multivariate regression analysis of covariates to identify risk factors associated with poor clinical outcome.

RESULTS

A total of 305 RIA in 302 patients (mean age of 55.3 years) met criteria, including 216 (70.8%) females. The mean follow-up was 34.2 months. Preoperatively, 176 cases had a mRS of 0-2, and 129 had a mRS of 3-5. Complete/near-complete occlusion was achieved in 245 (81.3%) of the RIA, and body residual in 60 (19.7%). At discharge 11 patients (3.61%) had a clinically worse mRS, 59 (19.34%) improved, and 231 (77.05%) were unchanged. Our perioperative mortality (≤30 days) was 13.8% (42). Perioperative complications occurred in 18.4% of the cases. Postprocedure vasospasm occurred in 44.9% of the cases. Target maximum aneurysm size (<=7, >7) and aneurysm width (<=7, >7) had a significant effect on clinical outcomes, while neck width and dome/neck ratio (<=2, >2) did not. Recurrence occurred 109 times (35.73%) after coiling, of which 40 (36.70%) underwent retreatment; the recoiling did not impact the clinical outcome. Mean time until retreatment was 15.7 months. Recurrence post discharge was not associated with a worsening of clinical disability (HR 1.417 CI 95% 0.722-2.779). There were four rebleeds occurring on average 30.5 months post procedure.

CONCLUSION

In our practice from 2002-2013 the safety of coil embolization of RIA was comparable to the available literature. Recurrence and baseline occlusion status did not influence clinical outcomes. The maximum aneurysm size and width impacted long term clinical results, while the neck size and dome/neck ratio did not.

CLINICAL RELEVANCE/APPLICATION

Reoccurrence post ruptured aneurysm repair with endovascular coiling does not significantly impact end patient clinical outcome.

SSM17-03 Single Center Cerebral Aneurysm Treatment with FRED and PED Flow Diverters; Initial Experience, Techniques and Comparative Outcomes

Participants

Soheil Sabet, MD, Istanbul, Turkey (Presenter) Nothing to Disclose
Nurten Andac, MD, Istanbul, Turkey (Abstract Co-Author) Nothing to Disclose
Hacer Bal, MD, Istanbul, Turkey (Abstract Co-Author) Nothing to Disclose
Feyyaz Baltacioglu, Istanbul, Turkey (Abstract Co-Author) Nothing to Disclose
Gazanfer Ekinci, Istanbul, Turkey (Abstract Co-Author) Nothing to Disclose

POURPOSE

This retrospective study of the initial institutional experience provides insight into technical challenges, clinical and radiographic outcomes, and complication rates during deployment and after the use of FRED (FRED™, TUSTIN, CA.- MicroVention, Inc.) and PED (PED™, ev3; Plymouth, Minnesota) flow-diverting stents for cerebral aneurysms.

METHOD AND MATERIALS

Informed consent was obtained from all patients. We implanted 91 flow diversion devices, including 51 PED and 46 FRED with or without adjunctive intraneurysmal embolization for treatment of a total of 95 aneurysms between February 2012-April 2015 in our institution (Forty FRED devices to treat 46 aneurysms in 35 cases and 51 Pipeline devices to treat 49 aneurysms in 36 cases.). All patients underwent an-platelet therapy. Angiographic follow-up examinations were carried out in 50 patients (Thirty of PED and 20 of FRED cases.). Median clinical follow up period was 1.33 year ;(1.81 year in PED and 0.85 year in FRED group).

RESULTS

The flow diverter was successfully deployed in 87 of 91 stents (95.6%). The complete or near-complete occlusion rate was 70% in PED and 95% in FRED cases who had angiographic follow ups. Postprocedural aneurysm hemorrhage and consequent subarachnoid bleeding occurred in 1 patients from PED group due to stent migration. Total mortality rate during study period was 0%. We experienced failure of PED expansion in two patients whereas only one early deployment of stent within normal segment of ICA occurred in FRED group. We also encountered acute stent thrombosis within one hour of FRED deployment in one case. The stent was recanalized by deployment of a Solitaire AB (ev3™, Irvine, CA, USA) stent and intraarterial Tirofiban infusion. During angiographic follow ups 1 case of each group showed evidence of asymptomatic in-stent stenosis.

CONCLUSION

Flow-diverting stents play an important role in the treatment of intracranial aneurysms. Considering our experience, easier delivery and implantation, retrievability owing to its different design and higher aneurysmal occlusion rate in FRED makes it more advantageous in treatment of cerebral aneurysms when compared with PED. The relative efficacy and morbidity of these treatment methods must be considered in the context of available alternate interventions.

CLINICAL RELEVANCE/APPLICATION

FRED flow diverter may be more advantageous in treatment of cerebral aneurysms when compared with PED.

SSM17-04 Prediction of Technical Endovascular Stent-Retriever Thrombectomy Outcome by Dynamic CT Angiography in Patients with Acute Ischemic Stroke

Participants

Kolja M. Thierfelder, MD,MSc, Munich, Germany (Presenter) Nothing to Disclose
Wieland H. Sommer, MD, Munich, Germany (Abstract Co-Author) Founder, QMedify GmbH
The aim of this study was to determine the predictive value of three different dynamic CT angiography (dynCTA) parameters - occlusion length, collateralization extent, and time delay to maximum enhancement - for latest generation stent-retriever thrombectomy recanalization outcome in patients with acute ischemic stroke.

**METHOD AND MATERIALS**

In this IRB-approved study, subjects were selected from an initial cohort of 2059 consecutive patients who had undergone multiparametric CT including whole-brain CT perfusion (WB-CTP). We included all patients with (a) a complete occlusion of the M1-segment of the MCA or the carotid T and (b) subsequent intraarterial stent-retriever thrombectomy. dynCTA was reconstructed from WB-CTP raw datasets. Technical outcome of thrombectomy was scored using the modified Thrombolysis in Cerebral Infarction (mTICI) scale. Logistic regression analyses were performed to determine independent predictors of a favorable outcome (mTICI=3).

**RESULTS**

A total of 69 patients (mean age 68±14yrs, 46% male) were included for statistical analysis. mTICI scores after recanalization were as follows: mTICI=0: 5 patients, mTICI=1: 3 patients, mTICI=2a: 6 patients, mTICI=2b: 24; mTICI=3: 31 patients. In the regression analysis, a short occlusion length was an independent predictor of favorable technical outcome (OR: 0.41, p < 0.05).

Both collateralization grade (OR: 1.00, p > 0.05) and time delay to peak enhancement (OR: 0.90, p > 0.05) failed to predict a favorable outcome.

**CONCLUSION**

A shorter occlusion length as assessed by dynCTA is associated with a better recanalization success, while collateralization grade and time delay of maximum enhancement distal to the occlusion failed to predict thrombectomy outcome.

**CLINICAL RELEVANCE/APPLICATION**

Large vessel occlusion length as determined by dynamic CT angiography is an independent predictor for the technical outcome of stent-retriever thrombectomy in patients with acute ischemic stroke and may be considered as a possible decision-making parameter for patient selection.

**SSM17-05 Should Informed Radiation Consent Exist for Neurovascular Interventional Radiology Procedures? The Patient Perspective**

**Wednesday, Dec. 2 3:40PM - 3:50PM Location: N227**

**Participants**

- Rebecca Zener, MD, London, ON (Presenter) Nothing to Disclose
- Peter B. Johnson, MBBS, Kingston 7, Jamaica (Abstract Co-Author) Nothing to Disclose
- Amol Mujoomdar, MD, London, ON (Abstract Co-Author) Speaker, Cook Group Incorporated; Speaker, Medtronic, Inc
- Sachin Pandey, MD, Dedham, MA (Abstract Co-Author) Nothing to Disclose

**PURPOSE**

Radiation exposure is inherent in neurovascular interventional radiology (IR). A potential exposure of 1 mSv has been suggested as a cutoff for provision of risk information, as it corresponds to a 1 in 10000 increased cancer risk. Informed consent requires disclosure of rare yet potentially significant risks, yet patient and non-radiologist physician knowledge of these risks is lacking. Neurovascular IR patient perception and knowledge of these risks remains unknown. The purpose of this study is to explore neurovascular IR patient perception of cancer-related radiation risk exposure and whether radiation consent is warranted.

**METHOD AND MATERIALS**

A multiple-choice survey was administered to 42 adult patients undergoing a non-emergent neurovascular IR procedure at a tertiary care centre. 67% of patients had previously undergone a neurovascular IR procedure. Statistical analysis of with Fisher Exact test was performed based on patient past neurovascular IR history (p<0.05).

**RESULTS**

Almost all subjects (90%) wanted to be informed if the radiation-related increased cancer risk was 1 in 100. Most (82%) wanted to be informed if the risk was moderate, 1 in 1000, or low, 1 in 10000 (70%). Only half of the patients were aware that they were exposed to radiation during their procedure, irrespective of previous neurovascular IR history. The majority (74%) believed that the ordering physician should be responsible for informing patients about radiation exposure. Most (85%) believed radiation consent should include radiation-related cancer risks, and that both verbal and written radiation consent should be obtained (74%). No significant difference was present based on past neurovascular IR history (p>0.05).

**CONCLUSION**

Neurovascular IR patient awareness of radiation exposure is suboptimal. Based on this survey, most patients want to discuss cancer-related radiation risks with the ordering physician in order to make informed decisions. This is potentially concerning as non-radiologist ordering physicians may not be as knowledgeable on radiation-related cancer risks. Neurointerventional radiologists should consider obtaining informed consent for procedures with anticipated doses of 1 mSv or greater.

**CLINICAL RELEVANCE/APPLICATION**

Neurovascular IR patients want to discuss cancer-related radiation exposure risk prior to undergoing an intervention in order to help them make an informed decision.

**SSM17-06 Successful Revascularization after Mechanical Thrombectomy with Stent Retrievers: Comparison of Three New Retrieval Strategies**

Wednesday, Dec. 2 3:50PM - 3:59PM Location: N227

**Participants**

- Maximilian F. Reiser, MD, Munich, Germany (Abstract Co-Author) Nothing to Disclose
- Peter B. Johnson, MBBS, Kingston 7, Jamaica (Abstract Co-Author) Nothing to Disclose
- Felix G. Meinel, MD, Munich, Germany (Abstract Co-Author) Nothing to Disclose
- Sebastian E. Beyer, Munich, Germany (Abstract Co-Author) Nothing to Disclose
- Hendrik Janssen, MD, Dusseldorf, Germany (Abstract Co-Author) Nothing to Disclose
- Birgit Ertl-Wagner, MD, Munich, Germany (Abstract Co-Author) Nothing to Disclose

**PURPOSE**

The aim was to determine the performance of three different thrombectomy retrieval strategies (solitaire, Trevo, and Trevo Pro) compared to a control group that underwent standard mechanical thrombectomy (MT).

**METHOD AND MATERIALS**

A total of 50 patients with acute ischemic stroke were included in the study. The patients were randomly assigned to one of the three retrieval strategy groups or the control group. The primary outcome measure was successful revascularization after thrombectomy recanalization. The performance of the different retrieval strategies was compared using logistic regression analysis.

**RESULTS**

Successful revascularization was achieved in 78% of patients in the solitaire group, 84% in the Trevo group, 82% in the Trevo Pro group, and 72% in the control group. The difference between the solitaire and control groups was statistically significant (p<0.05). No significant difference was found between the Trevo and Trevo Pro groups and the control group.

**CONCLUSION**

Thrombectomy retrieval strategies other than MT may offer additional benefits to patients with acute ischemic stroke. Further studies are needed to determine the optimal retrieval strategy.
between Balloon Guide Catheter (BGC) and non-Balloon Guide Catheter (NBGC) in Acute Ischemic Stroke

Wednesday, Dec. 2 3:50PM - 4:00PM Location: N227

Participants
Aglae Velasco Gonzalez, MD, Muenster, Germany (Presenter) Nothing to Disclose
Christian Stracke, Essen, Germany (Abstract Co-Author) Nothing to Disclose
Shoma Berkemeyer, Muenster, Germany (Abstract Co-Author) Nothing to Disclose
Boris Buerke, MD, Muenster, Germany (Abstract Co-Author) Nothing to Disclose
Michael A. Stauder, Essen, Germany (Abstract Co-Author) Nothing to Disclose
Christian Cnyrim, Muenster, Germany (Abstract Co-Author) Nothing to Disclose
Wolfram Schwindt, MD, Muenster, Germany (Abstract Co-Author) Nothing to Disclose
Christian Cnyrim, Muenster, Germany (Abstract Co-Author) Nothing to Disclose
Boris Buerke, MD, Muenster, Germany (Abstract Co-Author) Nothing to Disclose
Michael A. Stauder, Essen, Germany (Abstract Co-Author) Nothing to Disclose

PURPOSE
The catheter system for mechanical thrombectomy (MT) with stent retrievers (SR) could be an important factor when it comes to successful and more rapid recanalization procedures. Multicenter retrospective data collection and comparative analysis were employed to assess the efficacy of intra-arterial mechanical thrombectomies carried out using the Balloon Guide Catheter (BGC) and the non-Balloon Guide Catheter (NBGC).

METHOD AND MATERIALS
170 consecutive patients with MCA or carotid terminus occlusions treated by SR with the BGC (N=90) or NBGC (N=80) at three stroke centers were analyzed retrospectively. Data on procedure duration, number of passes, initial and final angiographic findings were collected. The degree of vessel occlusion initially and post-intervention was defined as the Thrombolysis in Cerebral Infarction (mTICI) score. Successful revascularization was defined as a final mTICI score >=2b achieved upon conclusion of the procedure after <=3 passes. Adjuvant therapy was defined as intra-arterial thrombolysis, intracranial angioplasty, or stenting performed after a failed MT.

RESULTS
Successful recanalization (mTICI grade 3 or 2b accomplished within <=3 passes) was achieved with the BGC in 80 out of 90 thrombectomies (88.8%), significantly different from the successful recanalization rates achieved using the NBGC (67%; p<0.001). The one-pass-thrombectomy rate with BGC was significantly higher than for NBGC (62.2% vs. 35%; p<0.001). The mean number of passes for a complete recanalization (mTICI3 or 2b) was 1.5±0.8 in the BGC group and 2.0±1.1 in the NBGC group. Recanalization procedure duration for a TICI3 or 2b was significantly shorter using the BGC (24.5±15.2 min) than the NBGC (53.2 ± 37.8 min; p<=0.05). Intra-arterial thrombolysis, intracranial angioplasty, and stent placement after a failed MT were performed in 6.6% and 12.5% of the BGC and NBGC patients (BGC vs NBGC, p<=0.90).

CONCLUSION
The efficacy of mechanical thrombectomy with stent retrievers in acute ischemic stroke in the anterior circulation in terms of angiographic results and procedure duration was improved when performed in combination with BGC.

CLINICAL RELEVANCE/APPLICATION
Efficacy of mechanical thrombectomy with stent retrievers in acute ischemic stroke is improved when performed in combination with Balloon Guide Catheter.
Vascular/Interventional (Advances in Transarterial Chemoembolization)

Wednesday, Dec. 2 3:00PM - 4:00PM Location: E351

Participants
Sarah B. White, MD,MS, Milwaukee, WI (Moderator) Nothing to Disclose
Hyun S. Kim, MD, Atlanta, GA (Moderator) Nothing to Disclose

Sub-Events

SSM23-01 Transpulmonary Chemoembolization (TPCE) in Pulmonary Malignant Tumors: Evaluation of Treatment Response Using Parenchymal Blood Volume (PBV)

Wednesday, Dec. 2 3:00PM - 3:10PM Location: E351

Participants
Thomas J. Vogl, MD, PhD, Frankfurt, Germany (Presenter) Nothing to Disclose
Thomas Lehner, MD, Frankfurt Am Main, Germany (Abstract Co-Author) Nothing to Disclose
Hanns Ackermann, Frankfurt On Main, Germany (Abstract Co-Author) Nothing to Disclose
Marcus Hezel, BS, Frankfurt, Germany (Abstract Co-Author) Nothing to Disclose
Nagy N. Naguib, MD, MSc, Frankfurt Am Main, Germany (Abstract Co-Author) Nothing to Disclose

Purpose
To evaluate initial experiences with the assessment of parenchymal blood volume (PBV) of pulmonary malignant tumors by using C-arm CT for detecting early response to transpulmonary chemoembolization (TPCE) and clinical practicability.

Method and Materials
The study was approved by the institutional ethics committee. 21 patients (females: 15, males: 6; range: 41-77 years; mean: 56.77 years) were palliatively treated with TPCE. PBV and tumor diameter were analyzed and PBV maps were calculated from 3D-CTA data sets. Imaging was performed on a flat detector C-arm CT. Response groups were classified according to the RECIST criteria. Statistically significant differences were determined and PBV and diameter were correlated as parameters of response to treatment using the Pearson's regression analysis.

Results
In a mean of 4.91 sessions the median diameter increased by 18.18% (p>0.05) and PBV was reduced by 39.62% (p>0.05). Functional and anatomical response per tumor was statistically significant (p≤0.05). Correlation coefficient was r=0.058. 2/41 tumors showed partial response, 31/41 tumors stable disease and 8/41 tumors progressive disease. Highest pre-treatment PBV values were measured in decreasing tumors (206.93 mL/L), lowest values in increasing tumors (60.17 mL/L; p>0.05). Lowest values also were measured in lung cancer (53.02 mL/L) vs. uterine leiomyosarcoma (103.31 mL/L) and renal cell cancer (113.14 mL/L; p≤0.05).

Conclusion
The assessment of PBV maps by using 3D-CTA image data should be easy to integrate into the clinical routine. PBV shows a stronger response to TPCE treatment than the measurement in diameter and should be considered as a response parameter for early detection.

Clinical Relevance/Application
Parenchymal blood measurements allow optimization of TPCE treatment in pulmonary malignant tumors.

SSM23-02 Chemosaturation with Percutaneous Hepatic Perfusion of Melphalan for Hepatic Metastases from Uveal Melanoma: Multiinstitutional Evaluation

Wednesday, Dec. 2 3:10PM - 3:20PM Location: E351

Participants
Thomas J. Vogl, MD, PhD, Frankfurt, Germany (Presenter) Nothing to Disclose
Silvia Koch, Frankfurt, Germany (Abstract Co-Author) Nothing to Disclose
Bernhard Gebauer, MD, Berlin, Germany (Abstract Co-Author) Research Consultant, C. R. Bard, Inc; Research Consultant, Sirtex Medical Ltd; Research Grant, C. R. Bard, Inc; Research Consultant, PAREXEL International Corporation; Winfried A. Willinek, MD, Bonn, Germany (Abstract Co-Author) Speakers Bureau, Bayer AG Speakers Bureau, Bracco Group Speakers Bureau, General Electric Company Speakers Bureau, Koninklijke Philips NV Speakers Bureau, Lantheus Medical Imaging, Inc Advisory Board, General Electric Company Advisory Board, Lantheus Medical Imaging, Inc Advisory Board, Bayer AG Roland D. Bruening, MD, Hamburg, Germany (Abstract Co-Author) Speakers Bureau, Bracco Group; Speakers Bureau, General Electric Company; Speakers Bureau, Koninklijke Philips NV; Speakers Bureau, Delcath Systems, Inc; Shareholder Delcath Systems, Inc; Alexander Enk, Heidelberg, Germany (Abstract Co-Author) Nothing to Disclose

Purpose
This multiinstitutional evaluation intends to retrospectively evaluate the results of the treatment of non-resectable hepatic metastases of uveal melanoma using percutaneous hepatic perfusion (PHP; Hepatic CHEMOSAT® Delivery System; Delcath Systems Inc., USA).

Method and Materials
Between 2012 and 2014 fourteen patients with hepatic metastases of uveal melanoma received one to three sessions of Chemosaturation-PHP. Eleven patients were evaluated by means of RECIST criteria. Survival time analysis was performed. Adverse events and complications were registered.

**RESULTS**

Chemosaturation is well tolerated by the majority of all fourteen patients. After therapy seven patients developed leukopenia, six patients had thrombopenia and two patients showed neutropenia, infection and fever each. Out of the eleven patients evaluated by means of RECIST criteria, four patients (36%) showed PR, SD was observed in five patients (46%) and two patients (18%) had PD. Two patients underwent two further sessions. After the first session tumour response of one patient turned from SD to PR and returned to SD. The other patient’s treatment response showed PR in all three sessions. Survival time of all patients ranged from 1.5 to 23 months (median OS 6.5 months) following first Chemosaturation. Time to progression of the two patients with PD was 6.2 months in one patient. The other patient died 1.6 months after evaluation.

**CONCLUSION**

Chemosaturation-PHP has been manifested as a potential treatment for patients with non-resectable hepatic metastases of uveal melanoma.

**CLINICAL RELEVANCE/APPLICATION**

Chemosaturation-PHP provides a good treatment option in patients with unresectable liver metastases from uveal melanoma.

**SSM23-03**

**Quantitative Real-time Fluoroscopy Analysis on Measurement of the Hepatic Arterial Flow During Transcatheter Arterial Chemoembolization of Hepatocellular Carcinoma: Comparison with Quantitative Digital Subtraction Angiography Analysis**

Wednesday, Dec. 2 3:20PM - 3:30PM Location: E351

Participants

Yi-Yang Lin, MD, Taipei City, Taiwan (Presenter) Research grant, Taipei Veterans General Hospital and Siemens, Grant No. T1100200.

Rheun-Chuan Lee, MD, Taipei, Taiwan (Abstract Co-Author) Nothing to Disclose

Wan-Yuo Guo, MD, PhD, Taipei, Taiwan (Abstract Co-Author) Nothing to Disclose

Cheng-Yen Chang, MD, Taipei, Taiwan (Abstract Co-Author) Nothing to Disclose

**PURPOSE**

To quantitatively measure the hemodynamic change of hepatic artery during transcatheter arterial chemoembolization (TACE) of hepatocellular carcinoma (HCC) by subtracted fluoroscopy quantitative color-coding analysis (f-QCA) and digital subtraction angiography quantitative color-coding analysis (d-QCA).

**METHOD AND MATERIALS**

This is a prospective study performed in a single medical institution from February 2014 to March 2015. Seventeen consecutive patients (mean 70.5 years old; male 12, female 5) underwent TACE with doxorubicin and Lipiodol emulsion or with microspheres for HCC. Patients were enrolled if superselective segmental TACE was technically feasible. The endpoint of TACE was sluggish antegrade arterial flow. Real-time subtracted fluoroscopic image and digital subtraction angiography image with a bolus injection were quantitatively analyzed. The f-QCA and d-QCA (syngo iFlow; Siemens) were used to determine the maximal density time (Tmax) of selected vessels. Relative Tmax (rTmax) was defined as the Tmax at the selected vessel minus the time of contrast medium spurtung from the catheter tip. Imaging acquisition and injection protocols remained the same before and after TACE.

**RESULTS**

The pre- and post-TACE rTmax of the embolized segmental artery in f-QCA and d-QCA were 1.39 ± .52s, 2.28 ± 1.09s, p < .001 and 1.60 ± .87, 3.14 ± 1.89s, p < .001, respectively. The Pearson correlation of pre- and post-TACE rTmax of the embolized segmental artery between f-QCA and d-QCA were .65, p < .01 and .73, p < .001. The rTmax of the proximal lobar hepatic arteries and proper hepatic artery had no significant change before and after TACE in f-QCA and d-QCA.

**CONCLUSION**

The f-QCA is a fast and convenient method with lower radiation dose to quantify arterial flow change of embolized segmental artery during TACE. Flow quantification of embolized segmental artery by f-QCA has high correlation with that by d-QCA.

**CLINICAL RELEVANCE/APPLICATION**

The f-QCA is a fast and convenient method to evaluate arterial flow change during TACE. The f-QCA can potentially replace the d-QCA with lower radiation dose.

**SSM23-04**

**Transarterial Chemoembolization for the Treatment of Advanced Hepatocellular Carcinoma: A Retrospective Cohort Study with 508 Patients**

Wednesday, Dec. 2 3:30PM - 3:40PM Location: E351

Participants

Yan Zhao, MS, Baltimore, MD (Presenter) Nothing to Disclose

Jae Ho Sohn, MD,MS, New Haven, CT (Abstract Co-Author) Nothing to Disclose

Florian N. Fleckenstein, MS, New Haven, CT (Abstract Co-Author) Nothing to Disclose

Sonia P. Sahu, New Haven, CT (Abstract Co-Author) Nothing to Disclose

Rafael Duran, MD, Baltimore, MD (Abstract Co-Author) Nothing to Disclose

Ruediger E. Schernthaner, MD, Vienna, Austria (Abstract Co-Author) Nothing to Disclose

Howard Lee, New Haven, CT (Abstract Co-Author) Nothing to Disclose

Li Zhao, New Haven, CT (Abstract Co-Author) Nothing to Disclose

Susanne Smolka, New Haven, CT (Abstract Co-Author) Nothing to Disclose

Ming De Lin, PhD, Cambridge, MA (Abstract Co-Author) Employee, Koninklijke Philips NV

**PURPOSE**

Chemosaturation-PHP provides a good treatment option in patients with unresectable liver metastases from uveal melanoma.

**RESULTS**

Two patients underwent two further sessions. After the first session tumour response of one patient turned from SD to PR and returned to SD. The other patient’s treatment response showed PR in all three sessions. Survival time of all patients ranged from 1.5 to 23 months (median OS 6.5 months) following first Chemosaturation. Time to progression of the two patients with PD was 6.2 months in one patient. The other patient died 1.6 months after evaluation.
The efficacy and safety of transarterial chemoembolization (TACE) for Barcelona Clinic Liver Cancer (BCLC) class C remains controversial. We conducted a large retrospective study to summarize our available data about the treatment of TACE in advanced HCC patients over the last 15 years.

METHOD AND MATERIALS
Between November 1998 and December 2013, all advanced stage (BCLC C) HCC patients with Child-Pugh A/B and Eastern Cooperative Oncology Group score of 0-2 were consecutively enrolled. Cox proportional hazards model was used to examine risk factor association with survival. Risk scores for individual patients were calculated by combing the prognostic values with the corresponding regression coefficients. The concordance (c)-statistic [equivalent to the receiver operating characteristic (ROC) curve] was used to assess the validity of categorizing patients treated with TACE into two subgroups. Cut-off values were determined according to ROC curves.

RESULTS
Of the 508 patients, 79.3% were male and median patient age was 63 (range, 19-90). By multivariate analysis, extrahepatic metastasis (HR=2.19, 95%CI 1.44-2.46), AFP≥400ng/ml (HR=1.73, 95%CI 1.38-2.17), portal vein invasion (HR=1.62, 95%CI 1.3-2.02), Child-Pugh class B (HR=1.37, 95%CI 1.09-1.73) and number of tumor nodules ≥2 (HR=1.39, 95%CI 1.11-1.74) were significantly associated with survival. Risk scores (R) for individual patients were calculated by combining these five prognostic values with the corresponding regression coefficients. The c-statistic associate with the model in the prediction of 1 year, 2 year and 3 year survival was 0.74 (95%CI 0.69-0.78), 0.73 (95%CI 0.68-0.78) and 0.72 (95%CI 0.66-0.79), respectively. To achieve both the best sensitivity and specificity, we selected 5.5 as the cut-off value for R score. The Kaplan-Meier analysis showed that the median survival in the patients <5.5 was significantly longer than those ≥5.5 (21.6 vs. 6.9 months, P<0.001).

CONCLUSION
TACE should be considered an effective therapy for select advanced HCC patients. We suggest modification of the BCLC stage C classification to improve staging of these patients.

CLINICAL RELEVANCE/APPLICATION
Select advanced stage (BCLC stage C) HCC patients with well-preserved liver function could benefit from TACE treatment.

Feasibility of Flat-detector CT Perfusion Imaging in TACE for HCC: Implications for Treatment Planning and Response

Wednesday, Dec. 2 3:40PM - 3:50PM Location: E351

Participants
Rory O'Donohoe, MBChB, Dublin, Ireland (Presenter) Nothing to Disclose
Alexis M. Cahalane, MBChB, Dublin 4, Ireland (Abstract Co-Author) Nothing to Disclose
Aoife Hayes, Dublin, Ireland (Abstract Co-Author) Nothing to Disclose
Olivia Connolly, Dublin, Ireland (Abstract Co-Author) Nothing to Disclose
Jeffrey W. McCann, MBChB, Dublin, Ireland (Abstract Co-Author) Nothing to Disclose
Edmund Ronan Ryan, MBChB, Dublin, Ireland (Abstract Co-Author) Nothing to Disclose

PURPOSE
Intra-procedural flat-detector CT perfusion imaging performed in the angiography suite at the time of TACE now allows assessment of tumor perfusion immediately before and after chemoembolization. This study examines the significance of areas of residual increased blood volume (indicating persistent tumor perfusion) immediately following TACE through comparison with the follow-up CT or MRI.

METHOD AND MATERIALS
Flat-detector CT perfusion imaging using syngo DynaPBV Body (Siemens Heathcare AG, Forchheim, Germany) is performed using rotational angiography before and after injection of a fixed small volume of dilute iodinated contrast via a microcatheter positioned either within the proper hepatic artery or more distally. Beginning in June 2014, nine chemoembolization procedures have been performed on seven patients using syngo DynaPBV for whom follow-up imaging is now available. We reviewed the post-chemoembolization DynaPBV images from these nine procedures and performed a direct comparison with the subsequent multiphase CT or MRI. We assessed for abnormally increased perfusion immediately following treatment and correlated this with the presence or absence of residual viable tumor on follow-up imaging.

RESULTS
In five treatments, residual abnormally increased perfusion was visible on the post treatment DynaPBV images and in all cases this correlated well with residual tumor on the follow-up CT or MRI. In two treatments, there was no residual abnormally increased perfusion which was confirmed as a complete treatment response on follow-up imaging studies. In two patients, both with lesions adjacent to the liver capsule, no abnormally increased perfusion was visible on DynaPBV, but hyperenhancing tumor was visible on follow-up imaging likely due to extra-hepatic supply via the inferior phrenic artery.

CONCLUSION
Our results show flat-detector CT perfusion imaging to be accurate in detecting residual disease at the end of the TACE procedure. Challenges exist with anomalous anatomy and lesions with extra-hepatic supply.

CLINICAL RELEVANCE/APPLICATION
Flat-detector CT perfusion imaging is accurate for detecting residual viable tumor at the end of the TACE procedure and may be useful in planning further treatments without the need for intervening imaging.
Four-dimensional CT Navigation for Precise Chemoembolization of Hepatocellular Carcinoma

Wednesday, Dec. 2 3:50PM - 4:00PM Location: E351

Participants
Tianhao Su, MD, Beijing, China (Presenter) Nothing to Disclose
Long Jin, Beijing, China (Abstract Co-Author) Nothing to Disclose
Wen He, Beijing, China (Abstract Co-Author) Nothing to Disclose

PURPOSE
To describe and explore four-dimensional (4D) CT navigation prior to transarterial chemoembolization (TACE) for hepatocellular carcinoma (HCC).

METHOD AND MATERIALS
Contrast-enhanced computed tomographic imaging with volume helical shuttle (VHS) technique were prospective performed at a 64-row multidetector scanner before TACE in HCC patients. The whole liver region was selected for dynamic study of the tumor. A series of 16 phases images from pre-arterial to portal venous phase were collected and 4D CT images were reconstructed with 1.25-mm thickness on a commercial workstation. Radiologists analyzed the volumetric data, being free to use axial slices as well as postprocessing reconstruction algorithms (e.g., MIP and MPR). All 4D CT angiography (CTA) images in cine mode were compared with DSA in TACE, including anatomy of hepatic artery, tumor supplying arteries, tumor vessels, tumor staining. Embolization effect was also evaluated on DSA and follow-up CT.

RESULTS
The study included 46 independent HCC lesions in 38 patients. Normal hepatic artery anatomy was found in 24 cases (63.2%, according to Michels' classification) and variations in 14 cases (36.8%), which presented good hints for DSA selective hepatic arterial work. The diagnosis consistent rate was 100% between 4D CTA and DSA in showing the anatomy and variation of hepatic artery. 4D CTA noninvasively showed tumor supplying arteries (n = 41), tumor vessels (n = 36), and tumor staining (n = 42). DSA showed better tumor staining result and the visible rate of tumor staining in 4D CTA was 91.3% (42/46). However, 4D CTA had advantage in reproducibly delineating the three-dimension relationship between tumor and blood vessels while detecting tumor supplying arteries, especially for medium sized lesions lesions (diameter range from 3 to 7 cm). Since 4D CTA could dynamically show 3-5 levels of intrahepatic arterial branches, it provided a good navigation for effective superselective microcatheter placement. Upon 4D CT results, chemoembolization therapies were effectively performed. Successful lipiodol accumulations were achieved in specific region of liver.

CONCLUSION
Four-dimensional CT using VHS technique could be easy and helpful in evaluating hepatic artery anatomy and locating tumor supplying artery for interventional chemoembolization planning.

CLINICAL RELEVANCE/APPLICATION
Four-dimensional CT can be used as a planning and navigation tool for TACE in HCC.
SSM24-01 Evaluation of Changes in Quality of Life Related to Uterine Fibroid Embolization (UFE): Preliminary Results of the French SFICV EFUZEN Study

Participants
Sandeep Bagla, MD, Woodbridge, VA (Moderator) Consultant, Hansen Medical Inc; Consultant, NeuWave Medical, Inc; Consultant, CeloNova BioSciences, Inc; Consultant, Medtronic, Inc; Consultant, DFINE, Inc; Consultant, Boston Scientific
Charles T. Burke, MD, Chapel Hill, NC (Moderator) Nothing to Disclose

Sub-Events

PURPOSE
Main goal:- To evaluate quality of life before and one year after UFESecondary goals:- To determine impact of imaging findings (MRI data) before and 3-6 months after UFE on changes in quality of life

METHOD AND MATERIALS
Study design: prospective, multicenter (25 centers) French observational studyPatients: 264 consecutive symptomatic women referred in the center for UFE using EmbozeneÒ (Celonova) particles. Methods:Clinical data: the quality of life score was calculated using the previously validated UFS-QOL by Spies, before and one year after UFE.Imaging data: MRI were performed before and 3-6 months after UFE. Data recorded were uterine and main fibroid volume, percentage of fibroid enhancement after injection of gadolinium. Impact of imaging data before and after UFE on QOL scores was searched.

RESULTS
189 patients (85.9%) showed monorrhagia at baseline. This was reduced to 39 patients (18%) at 1 year of follow up. 171 patients (78.1%) had pelvic pressure symptoms at baseline. This was reduced to 42 patients (19.4%) after 1 year of follow up.Complete QOL study was obtained in 192 women. Improvement of QOL score at one year after UFE a was found 183/203 (90.2%) for HRQL, 163/192 (84.9%) for Symptoms Severity. The probability of presenting a profuse bleeding was significantly reduced (by 62%) among patients with high reduction of fibroid volume (>=30%), as compared to patients with low fibroid volume reduction (<30%) (OR=0.38; 95%CI: [0.18;0.80]) (p = 0.011) The Impact of percentage of uterine volume or main fibroid reduction and decrease of fibroid enhancement on change in post embolization global UFS-QOL score was not established.

CONCLUSION
At one year post embolization, UFE improves significantly quality of life

CLINICAL RELEVANCE/APPLICATION
UFE is not only an effective technique but is also considered highly satisfactory by women

SSM24-02 Vascular/Interventional Keynote Speaker: Current Status of Prostate Artery Embolization as a Treatment for BPH

Participants
Sandeep Bagla, MD, Woodbridge, VA (Presenter) Consultant, Hansen Medical Inc; Consultant, NeuWave Medical, Inc; Consultant, CeloNova BioSciences, Inc; Consultant, Medtronic, Inc; Consultant, DFINE, Inc; Consultant, Boston Scientific

SSM24-03 Percutaneous Ablation of Oligometastatic Prostate Cancer: Oncologic Outcomes and Safety

Participants
Andrew Erie, MD, Rochester, MN (Presenter) Nothing to Disclose
Jonathan M. Morris, MD, Rochester, MN (Abstract Co-Author) Nothing to Disclose
Brian T. Welch, MD, Rochester, MN (Abstract Co-Author) Nothing to Disclose
Anil N. Kurup, MD, Rochester, MN (Abstract Co-Author) Nothing to Disclose
Adam J. Weisbrod, MD, Rochester, MN (Abstract Co-Author) Nothing to Disclose
Thomas D. Atwell, MD, Rochester, MN (Abstract Co-Author) Nothing to Disclose
Grant D. Schmit, MD, Rochester, MN (Abstract Co-Author) Nothing to Disclose
Eugene D. Kwon, MD, Rochester, MN (Abstract Co-Author) Nothing to Disclose
Matthew R. Callstrom, MD, PhD, Rochester, MN (Abstract Co-Author) Research Grant, Thermedical, Inc Research Grant, General Electric Company Research Grant, Siemens AG Research Grant, Gall Medical Ltd

PURPOSE
To determine the oncologic outcomes and safety of percutaneous ablation in the treatment of oligometastatic prostate cancer.

METHOD AND MATERIALS
This is a retrospective, single-institution review of 31 patients with oligometastatic prostate cancer who underwent 43 percutaneous ablations of their limited (≤5) metastatic sites. Eight patients (26%) were antigen deprivation therapy-naïve (ADT-naïve) and received ablation with the purpose of delaying ADT. Twenty-three patients (74%) underwent ablation either because of resistance to systemic therapies or a more aggressive multimodal treatment approach was preferred. Study endpoints included procedural complications, local control, progression free survival (PFS), and androgen deprivation therapy-free survival (ADT-FS). ADT-FS was defined as the time between percutaneous ablation and the initiation of ADT.

RESULTS
Local control was achieved in 35 (81.4%) of 43 tumors with a median follow-up of 8 months (range, 3-60 mo) after ablation. Tumor recurrence was found in 8 (18.6%) of 43 tumors at a median follow-up of 6 months (range, 2-38 mo). Median prostate-specific antigen (PSA) measurements were significantly lower approximately 2 months after ablation compared to before ablation (0.27 ng/dl [range <0.01 to 7.7] and 1.5 ng/dl [range <0.01 to 72.0], respectively (p=0.02)). Estimated PFS rates for all patients at 6 and 12 months after ablation were 65% (95% CI, 44-80) and 45% (95% CI, 24-64), respectively. Of the 8 ADT-naïve patients who underwent ablation with purpose to delay ADT, all (100%) achieved local control and the ADT-FS at 12 months was approximately 70%. None of the ablations were associated with major complications.

CONCLUSION
Percutaneous ablation of oligometastatic prostate cancer appears safe, achieves acceptable local control rates, and can delay disease progression when used in combination with other therapies. Percutaneous ablation may be particularly valuable in ADT-naïve patients who do not tolerate or prefer to delay ADT.

CLINICAL RELEVANCE/APPLICATION
Percutaneous ablation can be used as part of a multimodal treatment approach for oligometastatic prostate cancer and can delay hormone therapy in ADT-naïve patients.

SSM24-04 Frequency of Penile and Rectal Collateral Flow from Prostatic Arteries during Prostatic Artery Embolization

Wednesday, Dec. 2 3:30PM - 3:40PM Location: E450B

Participants
Ari J. Isaacson, MD, Chapel Hill, NC (Abstract Co-Author) Advisory Board, BTG International Ltd
Charles T. Burke, MD, Chapel Hill, NC (Presenter) Nothing to Disclose

PURPOSE
The most common mechanism of complication during prostatic artery embolization (PAE) is non-target embolization. Avoidance of branches supplying the bladder is commonly described. Less commonly discussed are intra-prostatic collaterals supplying the penis and rectum, although they are frequently seen during PAE. Because of the risks associated with non-target embolization as a result of these shunts, it would be beneficial to have an understanding of their incidence, as well as from what prostatic artery branches they arise. The purpose of this study was to retrospectively determine the frequency of rectal and penile collateral flow from each prostatic artery branch as seen during PAE.

METHOD AND MATERIALS
DSA images from PAEs performed between April 2013 and March 2015 were evaluated by two interventional radiologists experienced in performing PAE. A consensus determination was made about which arteries were catheterized (the anterolateral prostatic artery (ALPA), the posterolateral prostatic artery (PLPA) or a common trunk (CT) of the two) and about the presence of collateral flow to the arteries supplying the penis and/or the rectum from each catheterized artery. The overall incidence of such collaterals was calculated as well as the frequency in which they arose from each prostatic artery branch.

RESULTS
During 26 PAEs, 58 prostatic arteries were catheterized (36 ALPAs, 10 PLPAs and 12 CTs). Collateral flow to arteries supplying the penis or rectum was identified in 18/26 PAEs (69%). Flow to the penile arteries was seen in 13/36 (36%) ALPA catheterizations and in 5/12 (42%) CT catheterizations. Flow to rectal branches was seen in 8/10 (80%) PLPA catheterizations and in 4/12 (33%) CT catheterizations. No flow to penile branches was observed from a PLPA, nor was there flow to a rectal branch seen from an ALPA.

CONCLUSION
Shunting to the penis and/or rectum was present during the majority of PAEs. Collateral flow to the rectum from the PLPA or from a CT was seen quite frequently and collateral flow to the penis from an ALPA or CT was seen with moderate frequency during prostatic artery catheterization.

CLINICAL RELEVANCE/APPLICATION
Understanding the incidence of rectal and penile collateral pathways from the specific branches of the prostatic arteries will allow for greater detection of these findings during PAE in order to avoid complications.
Prostate Cancer Treatment with Irreversible Electroporation (IRE): Experience, Safety and Efficacy after 4.5 Years in 222 Patients

Wednesday, Dec. 2 3:40PM - 3:50PM Location: E450B

Participants
Michael K. Stehling, MD, PhD, Offenbach, Germany (Presenter) Nothing to Disclose
Enric Guenter, Dipl Phys, Frankfurt, Germany (Abstract Co-Author) Nothing to Disclose
Nina Klein, MSC, Offenbach am Main, Germany (Abstract Co-Author) Nothing to Disclose
Stephan Zapf, Frankfurt, Germany (Abstract Co-Author) Nothing to Disclose
Ducksoo Kim, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose
Boris Rubinsky, PhD, Berkeley, CA (Abstract Co-Author) Nothing to Disclose

PURPOSE
Irreversible Electroporation (IRE) is a novel tissue ablation method. It selectively destroys cells whilst preserving tissue infrastructure and is hence an ideal method for focal prostate cancer (PCA) therapy. It preserves (or allows regeneration of) vital surrounding structures such as neurovascular bundle, inferior sphincter and rectum, thus minimizing the side-effects of PCA therapy, mainly being impotence and incontinence.

METHOD AND MATERIALS
We have employed IRE for the treatment of 222 patients with primary (stages T1-T4) and recurrent PCA after surgery (18/222), radiation therapy (4/222) and HIFU (3/222). All patients underwent mp-MRI prior to and after IRE (T2, diffusion, perfusion, in selected cases 1H spectroscopy). 44% of patients underwent additional 3D-transperineal biopsy before IRE. Treatment was carried out by rectal US-guided transperineal IRE-electrode insertion under general anesthesia and deep muscle relaxation. 161 patients had focal and 61 whole gland ablations. All patients had follow-ups with PSA and mp-MRI for documentation of local tumor control.

RESULTS
Initial tumor control was achieved in all patients. Within the follow-up period of up to 4y, the recurrence rates were 0/45 (Gleason <7), 4/103 (Gleason 7) and 5/54 (Gleason >7). There were no IRE-related complications and toxicity was extremely low: 16 patients reported a transient reduction of erectile function (EF) (recovered after 6-8m), 5 a permanent reduction and 2 a permanent loss of EF. There were no cases of IRE-related incontinence, even when the lower urinary sphincter was included in the treatment field; a partially included rectum was also remained intact. Treatment was completed within 24h in all patients with a single overnight stay in the clinic. Patients had no wound pain.

CONCLUSION
IRE treatment of PCa is safe. In the short-term follow-up with MRI and PSA (maximum 4.5y) it is effective. Toxicity is significantly lower compared to other PCa treatments. Based on our data incontinence can be avoided altogether. MRI and 3D-biopsy are suitable for pre-treatment work-up and MRI for post-treatment follow-up. IRE has the potential to become an important tool for PCA therapy.

CLINICAL RELEVANCE/APPLICATION
IRE treatment is an alternative to the current treatment options for PCA, with much lower invasiveness and toxicity. It is effective in all stages of PCa and offers treatment options in advanced and recurrent PCa not amenable to other therapies.

Phase II Clinical Trial for Evaluation of MRI-guided Laser Induced Interstitial Thermal Therapy (LITT) for Low-to-intermediate Risk Prostate Cancer

Wednesday, Dec. 2 3:50PM - 4:00PM Location: E450B

Participants
Aytakin Oto, MD, Chicago, IL (Presenter) Research Grant, Koninklijke Philips NV; ; ;
Shiyang Wang, PhD, Chicago, IL (Abstract Co-Author) Nothing to Disclose
Ambereen Youssf, MMBS, Chicago, IL (Abstract Co-Author) Nothing to Disclose
Sydeaka Watson, PhD, Chicago, IL (Abstract Co-Author) Nothing to Disclose
Tatjana Antic, Chicago, IL (Abstract Co-Author) Nothing to Disclose
Scott Eggener, Chicago, IL (Abstract Co-Author) Research Grant, Visualase, Inc Speakers Bureau, Johnson & Johnson

PURPOSE
To assess the oncologic efficacy and safety of MRI-guided laser-induced interstitial thermal therapy of biopsy confirmed and MR-visible prostate cancer.

METHOD AND MATERIALS
27 patients with biopsy proven low-to-intermediate risk prostate cancer underwent MRI-guided laser ablation of the cancer using Visualase laser ablation device. All patients had a pre-procedure endorectal MRI which showed suspicious foci concomitant with the positive sextant on TRUS-guided biopsy. The area of interest was targeted transperineally using 1.5 T Philips MRI scanner and Visualase ablation device. Ablation was monitored by real time MR thermometry using Visualase MRI thermometry software. Perioperative, early and late complications and adverse events were recorded. Follow-up was performed with 3-month MRI and MR-guided biopsy, 12-month MRI and TRUS guided biopsy and validated quality of life questionnaires to assess urinary and sexual function.

RESULTS
MRI-guided laser ablation of prostate cancer was successfully performed in all 27 patients without significant peri-procedural complications. All patients were discharged home the same day. Average duration of the procedure was 3 hours 17 minutes and average duration of a single laser ablation was 1 minute 22 seconds. Total number of ablations per patient ranged from 2-8, with a median of 4. The treatment created an identifiable hypovascular defect in all cases. Post procedure complications were minor and included urinary symptoms, perineal bruising and erectile dysfunction, all of which self- resolved. Validated quality of life urinary and sexual questionnaires obtained before and 12 months after the procedure did not reveal any significant differences (p≥0.05). 1/27 and 3/17 patients had residual cancer in the ablation zone at 3 months and 12 months respectively.
CONCLUSION

Short-term follow-up results of MRI-guided focal laser ablation for treatment of clinically localized, low-to-intermediate risk prostate cancer appear promising. It may offer a minimally invasive procedure for select patients that does not appreciably alter sexual or urinary function.

CLINICAL RELEVANCE/APPLICATION

Short-term results of our phase II trial show that MRI-guided focal laser ablation can be a safe and feasible option for treatment of low-to-intermediate risk prostate cancer.

Honored Educators

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

Aytekin Oto, MD - 2013 Honored Educator
Interventional Radiology Thursday Case of the Day

Thursday, Dec. 3 7:00AM - 11:59PM Location: Case of Day, Learning Center

Participants
Anne M. Covey, MD, New York, NY (Presenter) Nothing to Disclose
Sreejit Nair, MD, New York, NY (Abstract Co-Author) Nothing to Disclose
Alan A. Sag, MD, New York, NY (Abstract Co-Author) Nothing to Disclose
Hooman Yarmohammadi, MD, New York, NY (Abstract Co-Author) Nothing to Disclose
Lynn A. Brody, MD, New York, NY (Abstract Co-Author) Stockholder, Sirtex Medical Ltd
Stephen B. Solomon, MD, New York, NY (Abstract Co-Author) Research Grant, General Electric Company
Controversy Session: Interventional Radiology of the Future: Hoarders or Stewards?

Thursday, Dec. 3 7:15AM - 8:15AM Location: E351

Participants
Jeanne M. Laberge, MD, San Francisco, CA (Moderator) Consultant, W. L. Gore & Associates, Inc;

LEARNING OBJECTIVES
1) Describe the upcoming changes in IR training mandated by the Accreditation Council for Graduate Medical Education (ACGME). 2) List procedural areas of image-guided intervention that are sometimes performed outside of the IR section proper by radiologists who are not subspecialty trained in Vascular and Interventional Radiology (VIR). 3) Explain what the term "peri-procedural clinical care" means as applied to image-guided interventions. 4) Assess the value of the new IR residency in advancing clinical care. 5) Specify the advantages of retaining image-guided procedural expertise within areas of the Radiology department outside of IR.

ABSTRACT
In September 2014, the Accreditation Council for Graduate Medical Education (ACGME) approved the program requirements for a new training program in Interventional Radiology (IR). The new IR residency will provide training in imaging, image-guided interventions and clinical care. Preparing residents to care for patients before, during and after image-guided procedures, is a major focus of the new program. Physicians may enter training directly from medical school (after completing a clinical internship) or they may enter after completing a residency in Diagnostic Radiology. This new development in IR training may have implications for the practice of image-guided interventions outside of IR. In this course, the moderator will describe the components of the new IR training program. The speakers will explain how this new training paradigm may change the practice of image-guided interventions within the specialty of Interventional Radiology and also outside the field of IR. The potential implications of this change in IR training for the radiology department as a whole will be explored.

Sub-Events

SPSC50A This is IR Authority

Participants
John A. Kaufman, MD, Portland, OR (Presenter) Consultant, Bio2 Technologies, Inc; Consultant, Cook Group Incorporated; Consultant, Medtronic, Inc; Consultant, W. L. Gore & Associates, Inc; Consultant, Guerbet SA; Stockholder, Hatch Medical LLC; Stockholder, VuMedi, Inc; Stockholder, Veniti, Inc; Royalties, Reed Elsevier; Advisory Board, Delcath Systems, Inc; Researcher, W. L. Gore & Associates, Inc; Researcher, Guerbet SA; Researcher, BTG International Ltd; Researcher, EKOS Corporation; Stockholder, EndoShape, Inc; Advisory Board, AV Medical; Advisory Board, Javelin Medical

LEARNING OBJECTIVES
View learning objectives under main course title.

SPSC50B 'Not That Straightforward'

Participants
Susan D. John, MD, Houston, TX (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
View learning objectives under main course title.
Participants

LEARNING OBJECTIVES

1) To review the basic approach of evaluating coronary artery bypass grafts on CT. 2) To review normal surgical anatomy and pathology of coronary artery bypass graft conduits on CT.

ABSTRACT

1) Review the issues involved in detecting coronary in-stent restenosis by CT angiography. 2) Get an overview of the diagnostic accuracy of CT angiography for coronary stents. 3) Understand the potential advantages of iterative reconstruction and perfusion assessment by CT for stents.

URL

www.herz-kurs.de

Participants

Jonathan D. Dodd, MD, Dublin 4, Ireland (Presenter) Nothing to Disclose

LEARNING OBJECTIVES

1) Review the basic classification of coronary anomalies and fistulas. 2) Understand the most clinically important anomalies and fistulas.
**Interventional Series: Non-Vascular Interventions**

**Thursday, Dec. 3 8:30AM - 12:00PM**
Location: N226

**AMA PRA Category 1 Credits ™**: 3.25
ARRT Category A+ Credits: 4.00

**FDA** Discussions may include off-label uses.

**Participants**
Steven M. Zangan, MD, Chicago, IL (Moderator) Nothing to Disclose
Albert A. Nemcek Jr, MD, Chicago, IL (Moderator) Consultant, B. Braun Melsungen AG

**LEARNING OBJECTIVES**
1) Describe one technique to treat ascites.
2) Explain the rationale for genomic analysis.
3) Describe two techniques to treat refractory abscesses.
4) List pros and cons of staged non-vascular interventions.
5) Describe one MR guided intervention.
6) List two indications of percutaneous cholecystostomy.

**Sub-Events**

**RC614-01**  
_Treating Ascites: Paracentesis, TIPs, PleuRx, Denver Shunt. Which One and Why?_  
**Thursday, Dec. 3 8:30AM - 8:50AM**
Location: N226

**Participants**
Albert A. Nemcek Jr, MD, Chicago, IL (Presenter) Consultant, B. Braun Melsungen AG

**LEARNING OBJECTIVES**
View learning objectives under main course title.

**RC614-02**  
_Confocal Laser Endomicroscopy for Microscopic Characterization of Kidney and Liver Tumors during Ongoing in Vivo Percutaneous Biopsies and ex Vivo Cryoablation: Preliminary Results_  
**Thursday, Dec. 3 8:50AM - 9:00AM**
Location: N226

**Participants**
Afshin Gangi, MD, PhD, Strasbourg, France (Presenter) Nothing to Disclose
Julien Garnon, MD, Strasbourg, France (Abstract Co-Author) Proctor, Galil Medical Ltd
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**PURPOSE**
Needle-based Confocal Laser Endomicroscopy (nCLE) is an emerging imaging modality that enables visualization of histologic details during percutaneous coaxial needle procedures. This study is evaluating the nCLE technique during image-guided percutaneous biopsies or ablations for kidney and liver tumors.

**METHOD AND MATERIALS**
The confocal imaging miniprobe (diameter 0.85mm, field of view 325µm, resolution 3.5µm, imaging depth 40 to 70µm) was used in conjunction with a coaxial needle (18-gauge) in 5 patients in vivo (3 liver and 2 kidney biopsies). The coaxial needle was first positioned in the lesion under CT guidance. The miniprobe was then inserted in the coaxial needle and placed in contact with the lesion. A volume of 2.5ml of 10% fluorescein was injected intravenously before endomicroscopic imaging using a 488nm laser source. Complementary endomicroscopic and CT scan information were used to accurately adjust the needle into the targeted lesion. Biopsies were subsequently performed as per standard of care. A pathologist performed side by side histological comparison and correlation in order to define interpretation criteria. Additionally, 2 pork kidneys were imaged with nCLE ex vivo during cryoablation, following a 12-hour staining in a bath of fluorescein. The miniprobe was inserted 15 mm apart from the cryoprobe.

**RESULTS**

nCLE was successfully performed in all 5 patients with good quality images and movies. The pathologist was not yet able to give a precise histological diagnosis on nCLE in real-time but was able to recognize the difference in tissue architecture between fibrosis, necrosis, normal tissue and tumor areas (Fig.) with excellent correlation to traditional microscopy of the biopsy specimen. During cryoablation of ex vivo kidneys, nCLE was able to visualize clearly in real time the ice formation and tissue thawing at the location of the miniprobe. No adverse event has been observed in patients.

**CONCLUSION**

nCLE demonstrated distinct tissue abnormalities during percutaneous biopsy. These preliminary results suggest that nCLE is feasible and safe during interventional radiology procedures for image-guided percutaneous biopsies. This technique could be a valuable tool to help the radiologist target the lesion and monitor therapy, thus increasing biopsy yield and ablation precision.

**CLINICAL RELEVANCE/APPLICATION**

nCLE may serve as a new tool for increasing the precision of biopsies and ablations at the cellular level.
Ultrasound Guided Random Liver Biopsy: Impact of Biopsy Core Size on Specimen Adequacy and Procedural Complications

Thursday, Dec. 3 9:00AM - 9:10AM Location: N226

Participants
Mitchell E. Tublin, MD, Pittsburgh, PA (Presenter) Nothing to Disclose
Rosalind Blair, BA, Pittsburgh, PA (Abstract Co-Author) Nothing to Disclose
Joseph A. Martin, BA, BS, Pittsburgh, PA (Abstract Co-Author) Nothing to Disclose
Kristine Ruppert, Phd, Pittsburgh, PA (Abstract Co-Author) Nothing to Disclose
Anthony Demetris, MD, Pittsburgh, PA (Abstract Co-Author) Nothing to Disclose

PURPOSE
Despite recent imaging innovations, liver biopsy remains the gold standard for the evaluation of diffuse liver disease. A recent consensus document of the American Association for the Study of Liver Diseases (AASLD) has stressed the importance of obtaining sufficient size samples (> = 16G) in order to minimize sampling errors of irregularly distributed liver disease. Despite this, many centers continue to utilize smaller gauge core systems to minimize perceived increased procedural complication risks. The purpose of this study was to assess the impact of core gauge (18 vs. 16G) on specimen adequacy and procedural complications.

METHOD AND MATERIALS
149 patients referred for liver biopsy were sequentially randomized to 16 or 18G ultrasound (US) guided core biopsy under this HIPPA compliant IRB study. Patients were blinded to gauge size. Local anesthesia was administered for lateral segment biopsy. Post procedure hemorrhage was qualitatively evaluated (mild, moderate, severe) and pain was assessed using a 10 point rating scale at 1, 3 and 24 hours. Retrospective review of specimen adequacy included the # of cores obtained, length, and # of portal tracts. Based upon AASLD guidelines, specimen adequacy was defined as >/= 11 portal tracts. Differences in pathology metrics and pain scoring were assessed using Chi square and linear regression models.

RESULTS
No significant hemorrhage requiring hospitalization occurred in either group and there was no difference in grouped pain scores. Mean 16G core specimen length was less than 18G length (1.7 cm vs. 1.9 cm/ p < .05). The mean # of portal tracts obtained with 16G biopsies was greater than 18G systems (14 vs. 13) though the difference was not significant (p=.1). 81% of 16G biopsies and 71% of 18G biopsies were adequate based upon AASLD criteria, though the difference was also not significant (p=.17).

CONCLUSION
The safety profile of US guided 18G and 16G core biopsy specimens is similar; a large % of 18 or 16G core specimens are inadequate when the AASLD specimen adequacy threshold is applied, and the adequacy rate is not significantly affected by biopsy gauge.

CLINICAL RELEVANCE/APPLICATION
Similar safety profiles, and the large % of inadequate specimens obtained with 18 and 16G core devices may prompt consideration of alternative approaches to the diagnosis of diffuse liver disease, which might include routine multiple sampling or obligatory supplemental non-invasive imaging (i.e. MRE, sonoelastography).

Percutaneous Biopsy for Genomic Analysis-What You Need to Know

Thursday, Dec. 3 9:10AM - 9:30AM Location: N226

Participants
Steven M. Zangan, MD, Chicago, IL (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
View learning objectives under main course title.

Refractory Pancreatic Abscesses-The Multidisciplinary Approach

Thursday, Dec. 3 9:30AM - 9:50AM Location: N226

Participants
Rakesh C. Navuluri, MD, Chicago, IL (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
View learning objectives under main course title.

Unknown Case of the Session

Thursday, Dec. 3 9:50AM - 10:10AM Location: N226

Participants
Steven M. Zangan, MD, Chicago, IL (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
View learning objectives under main course title.

Debate: Staged Procedures
Thursday, Dec. 3 10:10AM - 10:30AM Location: N226

Participants
Steven M. Zangan, MD, Chicago, IL (Presenter) Nothing to Disclose
Charles T. Burke, MD, Chapel Hill, NC (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
View learning objectives under main course title.

Feasibility of Gallbladder Cryoablation: Proof of Concept in a Swine Model

PURPOSE
Perioperative mortality during high-risk cholecystectomy may be as high as 19%, indicating a need for a minimally invasive definitive treatment option. This study investigates the feasibility of gallbladder cryoablation (GBC) in a swine model.

METHOD AND MATERIALS
Animals: Under IACUC approval, five farm pigs (30-45 kg) were used in this acute study. Contrast enhanced CT: A contrast enhanced CT of the abdomen was acquired for planning purposes. Cryoablation: The Endocare® Cryocare® cryoablation system was used. Under CT guidance, up to 4 cryoprobes were positioned percutaneously about the gallbladder. Two freeze-thaw cycles ranging from 10 to 26 minutes were performed with intermittent CT scanning to ensure adequate ablation margins. Thermocouple probes were placed percutaneously at the gallbladder fundus, neck, free wall, and gallbladder fossa. Histology: Five hours following completion of the last freeze cycle, the pigs were sacrificed. The gallbladder and ducts were resected en bloc and fixed in formalin with the thermocouple sites marked with sutures. Histology was assessed following hematoxylin and eosin staining.

RESULTS
Cryoablation: GBC was successful in all 5 pigs using 3 to 4 cryoprobes and freeze cycles ranging from 10 to 26 minutes. All thermocouple probes reached at least -20 C. Intra- and post- procedural heart rate, blood pressure, and oxygen saturation remained stable. Intra-procedural body temperature consistently decreased to below 95 F and recovered after the procedure. Imaging: The gallbladders measured less than 6 cm in greatest dimension. A 5 mm ablation margin was achieved about the gallbladder, including the adjacent hepatic parenchyma in the gallbladder fossa. Non-target ablation occurred in 1 animal (stomach), with less than 5 mm of ice ball penetration. Histology: Histologic specimens demonstrated denudation of the gallbladder epithelium, hemorrhage and edema within the muscularis layer, and an inflammatory infiltrate within the adventitia. Sparring of the common bile duct was also noted.

CONCLUSION
GBC in swine is feasible, with transmural ablation and sparing of adjacent structures achieved. Gastric inclusion in the ablation zone will require hydrodissection or continuous lavage in future experiments.

CLINICAL RELEVANCE/APPLICATION
GBC is feasible, offering a potential minimally invasive treatment option for high-risk patients. Long-term studies are needed to further explore the safety and efficacy of GBC.

Thursday, Dec. 3 10:30AM - 10:40AM Location: N226

Percutaneous versus Open Surgical Drainage of Abdominal Abscesses: Trends in Use of the Two Approaches

PURPOSE
To compare trends in the use of percutaneous and surgical approaches to treating abdominal abscesses in recent years in a large population.

METHOD AND MATERIALS
The nationwide Medicare Physician/Supplier Procedure Summary Master Files for 2001 through 2013 were searched. This database covers over 37.3 million Medicare fee-for-service beneficiaries. It provides volume and other administrative data on every procedure code in the Current Procedural Terminology, version 4 (CPT-4) manual. CPT-4 codes were selected for the 4 types of abdominal abscesses that had distinct codes for both open surgical and percutaneous drainage - appendiceal, peritoneal, subphrenic, and liver. Medicare specialty codes were used to determine if the procedures were performed by radiologists or other nonradiologist physicians. Trends in use of the 2 approaches were compared.

Participants
David C. Levin, MD, Philadelphia, PA (Presenter) Consultant, HealthHelp, LLC; Board of Directors, Outpatient Imaging Affiliates, LLC
Laurence Parker, PhD, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose
Vijay M. Rao, MD, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose
RESULTS
In 2001, there were 14,068 abdominal abscesses drained percutaneously. This volume increased progressively every year thereafter, reaching 28,486 in 2013 (+102%). Open surgical drainage volume was 8146 in 2001, decreasing progressively to 6397 in 2013 (-21%). In 2001, 63% of all abdominal abscesses had been drained percutaneously; by 2013 this figure had risen to 82%. In 2001, radiologists performed 97% of all percutaneous abdominal abscess drainages, and this percent share remained unchanged in 2013. Of all abdominal abscesses treated in 2013 in Medicare patients, 79% were treated by radiologists.

CONCLUSION
Percutaneous drainage of abdominal abscesses has steadily gained in utilization, while that of open surgical drainage has declined. The vast majority of these abscesses are now treated percutaneously. Radiologists strongly predominate in performing the procedures. Although this database does not provide information on outcomes, percutaneous drainage is another good example of radiology-related value, in that an imaging-based interventional procedure developed by radiologists has largely replaced an older surgical approach that is more invasive, more costly, and carries greater morbidity for the patient.

CLINICAL RELEVANCE/APPLICATION
The vast majority of abdominal abscesses are now treated by percutaneous drainage.

RC614-10 Accuracy Testing of a Needle Placement Robot for Biopsy Under CT Guidance: Validation with Animal Study
Thursday, Dec. 3 10:50AM - 11:00AM Location: N226

Participants
Sang Young Oh, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Joon Beom Seo, MD, PhD, Seoul, Korea, Republic Of (Presenter) Nothing to Disclose
Namkug Kim, PhD, Seoul, Korea, Republic Of (Abstract Co-Author) Stockholder, Coreline Soft, Inc
Hongh Kim, Yongin-si, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Hee Jun Park, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose

PURPOSE
Purpose of this study is to evaluate accuracy of a needle placement robot for biopsy with swine including artificial lesions.

METHOD AND MATERIALS
The robot system including 5-axis robot arm, a mobile platform with motor controllers, dedicated workstation for planning of needle path, and the navigation system (Polaris Spectra®; NDI, Canada) was developed. It provides useful functions including such as needle path planning, respiration monitoring, laser guidance, automatic needle positioning and guiding. To evaluate the accuracy and repeatability of the system in needle placement, two swine were used. For preparation, they were anesthetized and ventilated. Under CT guidance (Sensation 16, Siemens, Germany), multiple metallic markers were inserted to the liver, kidney and paraspinal muscle. The respiration of the swine was controlled with ventilator and intravenous injection of muscle relaxant. CT scan was performed to localize the target lesion and the CT data was transferred to the system. The spatial relation between swine and the robot system was registered with navigation system. After planning the needle path on workstation, the spatial information was translated to the robotic system. The robot system automatically angulates the needle to the target and depth of insertion is determined. Total of 22 needle insertion trials to 9 artificial target lesions at different needle paths was performed. Using the CT images after the insertion, distance between the target and actual needle tip and angle between preplanned route and actual needle pathway were measured. In 12 trials, repeated insertion of needle was performed to assess reproducibility.

RESULTS
All experiment was done without complication. The procedure time between the initial CT scan and CT scan after needle insertion was 7.8±2.7minutes. The distance and angulation were 8.5±5.1mm and 7.1±5.6degree, respectively. The distance and angle of repeated insertion with same planning was reproducible (ICC=0.931, 0.914, respectively).

CONCLUSION
Developed robot system provides fast and reliable guidance of needle placement with CT imaging in animal experiment.

CLINICAL RELEVANCE/APPLICATION
Developed robot system might be useful assisted tool in CT guided biopsy and ablation therapy, providing variable functions including such as needle path planning, respiration monitoring, laser guidance, automatic needle positioning and guiding.

RC614-11 MR Guided Intervention
Thursday, Dec. 3 11:00AM - 11:20AM Location: N226

Participants
Aytekin Oto, MD, Chicago, IL, (oto@uchicago.edu) (Presenter) Research Grant, Koninklijke Philips NV; ;

LEARNING OBJECTIVES
View learning objectives under main course title.

Honored Educators
Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

Aytekin Oto, MD - 2013 Honored Educator

RC614-12 Cholecystostomy. Update for 2015 (or Do Surgeons Ever Operate on Acute Cholecystitis Anymore?)
Participants
Charles T. Burke, MD, Chapel Hill, NC  (Presenter)  Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

RC614-13  **Wrap Up and Discussion**

Thursday, Dec. 3 11:20AM - 11:40AM Location: N226

Participants
**Vertebral Augmentation (Hands-on)**

Thursday, Dec. 3 8:30AM - 10:00AM Location: E260

**Participants**
A. Orlando Ortiz, MD, MBA, Mineola, NY (Presenter) Nothing to Disclose
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Allan L. Brook, MD, Bronx, NY (Presenter) Advisor, Johnson & Johnson Advisor, Medtronic, Inc
Afshin Gangi, MD, PhD, Strasbourg, France (Presenter) Nothing to Disclose
Todd S. Miller, MD, Bronx, NY, (Tmiller@montefiore.org) (Presenter) Nothing to Disclose

**LEARNING OBJECTIVES**
1) Discuss appropriate algorithms for patient selection. 2) Review anatomic and technical considerations for vertebral augmentation. 3) Present an update of the recent advances in vertebral augmentation including sacroplasty. 4) Emphasize safety issues and how to avoid complications. 5) Understand the applications of vertebral augmentation in osteoporotic and neoplastic spine pathology. 6) Update participants with respect to advances in equipment and biomaterials.

**ABSTRACT**
1. Patient selection for vertebral augmentation
   Indications and Contraindications
2. New devices and techniques in vertebral augmentation
3. Vertebral augmentation for osteoporotic and pathologic vertebral compression fractures
4. Sacroplasty (sacral augmentation)
5. Complications avoidance
6. Efficacy

Vertebral augmentation is an image-guided (fluoroscopy or CT) percutaneous procedure in which a bone needle is inserted into a painful osteoporotic or pathologic fracture within the spinal axis. Biopsy, cavity creation or lesion ablation may then be performed under imaging guidance depending on the nature of the pathology that is being treated. Subsequently a radioopaque implant, usually an acrylic bone cement, is carefully injected into the vertebra or sacral ala under imagining guidance. These procedures have been shown to provide pain relief by stabilizing the fractured vertebra or sacrum. As with any other invasive procedure, they carry a small risk (<1%) of complication including bleeding, infection, neurovascular injury, or cement embolus. Appropriate patient selection and a detailed understanding of the technical aspects of the procedure along with active clinical patient follow-up are paramount to a successful outcome. This workshop will utilize short lectures, case examples and interactive audience participation in order to further explore critical topics in vertebral augmentation.

**URL**

Handout: Afshin Gangi

Active Handout: Todd Stuart Miller
Participants
Patrick Warren, MD, Columbus, OH (Moderator) Nothing to Disclose
Veronica J. Rooks, MD, Honolulu, HI (Presenter) Nothing to Disclose
Corrie M. Yablon, MD, Ann Arbor, MI, (cyablon@med.umich.edu) (Presenter) Nothing to Disclose
Andrada R. Popescu, MD, Chicago, IL (Presenter) Nothing to Disclose
Linda J. Warren, MD, Vancouver, BC (Presenter) Shareholder, Hologic, Inc
Hisham A. Tchelepi, MD, Los Angeles, CA (Presenter) Research Grant, General Electric Company; Research Grant, Roper Industries, Inc
John M. Racadio, MD, Cincinnati, OH (Presenter) Research Consultant, Koninklijke Philips NV; Travel support, Koninklijke Philips NV
Mahesh M. Thapa, MD, Seattle, WA (Presenter) Nothing to Disclose
Kristin M. Dittmar, MD, Columbus, OH (Presenter) Nothing to Disclose
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Kal Dulaimy, MD, Springfield, MA (Presenter) Nothing to Disclose
Christian L. Carlson, MD, MS, Cibolo, TX (Presenter) Nothing to Disclose
Andrew J. Rabe, DO, Columbus, OH (Presenter) Nothing to Disclose
Jeremiah J. Sabado, MD, Columbus, OH (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
1) Identify basic skills, techniques, and pitfalls of freehand invasive sonography. 2) Discuss and perform basic skills involved in thermal tumor ablation in a live learning model. 3) Perform specific US-guided procedures to include core biopsy, abscess drainage, vascular access, cyst aspiration, soft tissue foreign body removal, and radiofrequency tumor ablation. 4) Incorporate these component skill sets into further life-long learning for expansion of competency and preparation for more advanced interventional sonographic learning opportunities.

ABSTRACT
Ultrasound Guided Foreign Body Removal: Simulation Training and Clinical implementation Outcomes ; Purpose: USFBR can be taught to radiologists to generate competency, and radiologists can apply the technique in the patient setting to remove foreign bodies. ; Materials and Methods: Proof of concept was performed by a radiologist and surgeon removing nine 1-cm foreign bodies using the USFBR method (P) and traditional surgery (S) with and without wire guidance (W) on the cadaver model. ; Next, USFBR was taught to 48 radiologists at 4 hospitals. Training included didactic and hands-on instruction covering 7 components: instrument alignment, hand/transducer position, forceps use, foreign body definition, forceps grasp, recognition of volume averaging, and oblique cross cut artifact. Pre-training testing assessed single toothpick removal from turkey breast in 15 minutes.; Post-training evaluation consisted of 5 toothpick removals. ; Ongoing clinical implementation data of USFBR by trained radiologists are being collected. Parameters including age of patient, which radiologist, removal success, type and size of foreign body, incision size, foreign body retention time, reason for removal, symptoms, modalities used in detection, wound closure, and sedation are recorded. Data analyzed using chi-squared and Fisher's exact tests for categorical outcomes and analysis of variance for continuous outcomes. ; Results: USFBR technique shows a higher success rate and smaller incision size in comparison to surgical technique alone in the cadaver. Removal success: P 100%, S 78%, and W 89%. ; With USFBR training, radiologists; scores improved from 21-52% pre-training to 90-100% post-training (p<0.001 for each component). In the clinical setting to date, USFBR has been 100% successful in 7 (of 25 expected) patients, ages 9-73 years, by four radiologists. Parameters included: length 4 to 30 mm, retention 2 to 864 days, incision, 2 to 8 mm. 1 suture closure. 1 sedation.
SSQ18-01  Tunneled Central Venous Catheter Placement through the Subclavian Vein Results in Higher Rates of Mechanical Malfunction in Pediatric Patients: One Year Outcome Analysis at a Tertiary-Care Center

PURPOSE
To evaluate pediatric tunneled central venous catheter complication incidence and time to removal with respect to site of insertion.

METHOD AND MATERIALS
A single-institution, IRB-approved, retrospective review was undertaken of all patients who underwent tunneled central venous catheter placement by either the General Surgery or Interventional Radiology services over a one-year period. Patient electronic medical records were reviewed for technical details, complications, dwell time, indication for placement, and removal. We compared the time-to-removal of tunneled lines for mechanical failure using product limit survival estimates in order to better account for censoring and dwell time of tunneled lines.

RESULTS
288 central venous lines were placed during a one-year period. Of these, 205 (71%) were placed through the internal jugular vein and 83 (29%) were placed through the subclavian vein. Mechanical malfunction was documented as the indication for removal in 22 of internal jugular lines (11%), versus 19 of subclavian lines (23%) (p<.01). Specifically, a higher rate of left-sided subclavian vein lines were removed for mechanical malfunction compared to the right-sided subclavian vein lines (28% vs. 18%, respectively), but time to mechanical failure was not statistically different (p=.37).

CONCLUSION
Placement of tunneled subclavian central venous catheters in the pediatric population results in a higher incidence of mechanical malfunction and a decreased dwell time compared to internal jugular vein placement. Left-sided subclavian catheters tend to have a higher mechanical malfunction rate compared to right-sided subclavian catheters.

CLINICAL RELEVANCE/APPLICATION
The placement of tunneled subclavian central venous catheters in the pediatric population results in a higher incidence of mechanical malfunction and a decreased dwell time compared to tunneled internal jugular venous central catheters.

SSQ18-02  Complication Rates for PICCs Exchanged Over the Wire at a Large Children’s Hospital

PURPOSE
Long term venous access is integral to the treatment and therapy of many patients. Complications with line function other than infection can be remedied at times by exchanging the catheter over a wire for a new catheter (rewire). This retrospective study was designed to analyze PICC line complications rates after rewire compared to the overall PICC population.

METHOD AND MATERIALS
IRB approval allowed retrospective study at a large children’s hospital of the electronic medical record and PACS system, which were queried for all PICCs placed from January 2014 through June 2014. Data points collected for each patient included catheter
dwell time (in days), location of line placement, type of line securement, and complications including infection, malposition, occluded lumen. After compilation, the database was statistically analyzed using Fisher’s exact test. Comparisons were made between the total population and those patients that had their PICC exchanged over a wire.

RESULTS
A total of 665 PICCs were placed in the study period with 73 patients having a rewire of their line. In all patients the complication and infection rate were 16% and 6.4%, respectively. In rewire patients the complication rate and infection rate were 48.0% (P<0.0001) and 13.7% (NSS). The most common reasons for rewire was malposition (43.5%) and cracked catheter hub (22.4%). The two most common patient populations requiring rewrites were oncology (40.7%) and TPN dependent short gut patients (16.3%). Average catheter dwell time in all patients was 23.0 days and in rewire patients was 50 days.

CONCLUSION
The overall complication rate for catheters after rewire was higher than the entire PICC population. The infection rate was not significantly higher, even though the average dwell time of the catheter was longer in the rewire patients compared to the PICC population.

CLINICAL RELEVANCE/APPLICATION
For patients that require indefinite venous access such as certain oncology and TPN dependent patients rewire of the malfunctioning line does not incur a higher risk of subsequent infection.

SSQ18-03 Pediatric Tunneled Central Catheter Placement at A Single Tertiary-Care Center by Interventional Radiology: One Year Outcome Analysis

Thursday, Dec. 3 10:50AM - 11:00AM Location: S102C

Participants
Donghoon Shin, MS, Pittsburgh, PA (Presenter) Nothing to Disclose
Michael P. Yannes, MD, Pittsburgh, PA (Abstract Co-Author) Nothing to Disclose
Ornie N. Close, MD, Pittsburgh, PA (Abstract Co-Author) Nothing to Disclose
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Charles R. Fitz, MD, Pittsburgh, PA (Abstract Co-Author) Nothing to Disclose
John J. Crowley, MD, Pittsburgh, PA (Abstract Co-Author) Nothing to Disclose
Sabri Yilmaz, MD, Pittsburgh, PA (Abstract Co-Author) Nothing to Disclose

PURPOSE
The insertion of tunneled central catheters by Pediatric Interventional Radiology services is a daily occurrence. However, little data with respect to placement outcomes of pediatric-tunneled central catheter placement is known. We examine outcomes of all subclavian and internal jugular tunneled central venous catheters placed over a one year period.

METHOD AND MATERIALS
An IRB-approved, retrospective review was undertaken for all patients who underwent tunneled central venous catheter placement by the Interventional Radiology service over a one year period. Patient electronic medical records were reviewed for technical details, complications, dwell time, indication for placement, and reason and date of removal. Catheters which were removed due to completion of treatment were censored from the analysis.

RESULTS
192 (66% of the total hospital placements) tunneled internal jugular and subclavian central venous catheters were placed in 173 patients by the Interventional Radiology service during the study period. 187 (97%) were via the internal jugular vein; 5 (3%) were placed via the subclavian vein. The most frequent indications included chemotherapy (88 placements, 46% of total) and nutrition and frequent blood draws (73 placements, 38%). The median dwell time was 139.5 days (IQR 43-345); time to removal was significantly shorter (p<0.0005) in the nutrition/frequent blood draw group. Clinical concern for infection was the indication for removal in 31 (16%) of lines, and of these, 15 (8%) had positive blood cultures. Catheters placed for nutrition and frequent blood draws resulted in higher rates of infection (N=25) when compared to those being used for chemotherapy (N=14). 20 (10%) catheters were removed for mechanical malfunction.

CONCLUSION
Tunneled central venous catheters placed for nutrition and frequent blood draws resulted in a higher incidence of infection and decreased dwell time, specifically when compared to catheters placed for chemotherapy. Clinical concern for infection was the most common indication for removal, and mechanical malfunction was the second most common indication for line removal.

CLINICAL RELEVANCE/APPLICATION
Tunneled central venous catheters placed for nutrition and need for frequent blood draws by the Pediatric Interventional Radiology service resulted in a higher incidence of infection and decreased dwell time than lines placed for other reasons, most notably administration of chemotherapy.

SSQ18-04 Complication Rates for PICCs in Patients with AML

Thursday, Dec. 3 11:00AM - 11:10AM Location: S102C

Participants
Anoosha Moturu, Houston, TX (Abstract Co-Author) Nothing to Disclose
Daniel J. Ashton, MD, Houston, TX (Presenter) Nothing to Disclose
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Christopher I. Cassady, MD, Houston, TX (Abstract Co-Author) Nothing to Disclose

PURPOSE
Treatment of patients with Acute Myeloid Leukemia (AML) requires long-term venous access, one option for which is with a
peripherally inserted central line (PICC). This retrospective study was designed to analyze PICC line infection rates in AML patients compared to the overall PICC and the general oncology populations.

METHOD AND MATERIALS
IRB approval allowed retrospective study at a large children’s hospital of the electronic medical record and PACS system, which were queried for all PICCs placed from January 2014 through June 2014. Data points collected for each patient included catheter dwell time (in days), location of line placement, type of line securement, and complications including infection, malposition, occluded lumen. After compilation, the database was statistically analyzed using Fisher’s exact test. Comparisons were made between the total population and those diagnosed with any cancer and patients diagnosed specifically with AML.

RESULTS
A total of 665 PICCs were placed in the study period, 158 in oncology patients and 23 in AML patients specifically. In all patients the complication rate and infection rate were 16% and 6.4%, respectively. In oncology patients the complication rate and infection rate were 27.2% and 16.5%, respectively (P<0.0001 for both). In AML patients the complication rate and infection rate were 34.8% (NSS) and 30.4% (P<0.0001), respectively. Average catheter dwell time in all patients was 23.0 days, in oncology patients was 56.5 days, and in AML patients 74.8 days.

CONCLUSION
Oncology patients and, in particular, AML patients have increased rates of infection compared to the population as a whole. This is in part due to the patients’ immunocompromised states and the much longer dwell times of the PICCs used for their treatments. Interventions for decreasing infection rates should be targeted at these high risk populations.

CLINICAL RELEVANCE/APPLICATION
Acute Myeloid Leukemia patients have an increased risk of infection of PICCs. Identifying populations at high risk allows for targeting changes in practice to reduce infection rates.

SSQ18-05 How Much is Too Much? Radiation Exposure during Percutaneous Gastrojejunostomy Tube Exchanges in Pediatric Patients

Thursday, Dec. 3 11:10AM - 11:20AM Location: S102C

Participants
Matthew Hudnall, BA, San Francisco, CA (Presenter) Nothing to Disclose
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Nicholas Fidelman, MD, San Francisco, CA (Abstract Co-Author) Nothing to Disclose
Robert K. Kerlan JR, MD, Kentfield, CA (Abstract Co-Author) Nothing to Disclose
Maureen P. Kohi, MD, San Francisco, CA (Abstract Co-Author) Nothing to Disclose

PURPOSE
To evaluate the radiation exposure of pediatric patients during exchange of percutaneous gastrojejunostomy tubes.

METHOD AND MATERIALS
A retrospective review of consecutive pediatric patients undergoing percutaneous gastrojejunostomy tube exchanges from January 1, 2010 to April 1, 2015 was performed. Fluoroscopy time, cumulative air kerma (mGy) and cumulative dose area product (DAP) (mGycm2) values were obtained from procedural reports. Total number of procedures, indications, and time between procedures were also recorded. Patients were subdivided into an increased cumulative procedure group if 3 or more procedures were performed and an increased frequency group if the interval between any 2 procedures was less than 6 months during the study period.

RESULTS
In the 63-month study period, 130 exchanges of gastrojejunostomy tubes were performed on 48 patients. The median age of all patients was 52.5 months (range 2-206 months). 18 patients underwent a single procedure. Mean cumulative air kerma and DAP were 7.75 mGy (range 2-11.6) and 1353.89 mGycm2 (range 285-3000) respectively for each procedure. Mean fluoroscopy time was 3.1 minutes (range 1-7). 20 patients were categorized into the increased cumulative procedures group, with a mean of 5 procedures (range 3-8) during the study period. Mean cumulative air kerma and DAP were 53.52 mGy (range 0.4-507) and 4333.45 mGycm2 (range 102-72,479) respectively for each procedure. Mean fluoroscopy time was 8.6 minutes (range 0.2-40). 25 patients were classified into the increased frequency group, with a mean 4.3 month interval between procedures. Mean cumulative air kerma and DAP were 34.33 mGy (range 0.4-504.8) and 4105.62 mGycm2 (range 102-72,479) respectively for each procedure. Mean fluoroscopy time was 8.4 minutes (range 0.2-40).

CONCLUSION
Undergoing percutaneous gastrojejunostomy tube exchanges is necessary in many chronically ill pediatric patients but subjects them to significant radiation exposure at an early age, particularly if repeat procedures are needed. Patients requiring frequent exchanges may benefit from alternative methods to maintain enteral feedings, such as through surgical intervention.

CLINICAL RELEVANCE/APPLICATION
Radiation exposure in pediatric patients during percutaneous gastrojejunostomy tube exchanges can be significant, and may be underappreciated when considering how to maintain enteral feeding.

SSQ18-06 Incidence and Management of Oesophageal Ruptures Following Fluoroscopic Balloon Dilatation in Children with Benign Strictures

Thursday, Dec. 3 11:20AM - 11:30AM Location: S102C

Participants
Jung-Hoon Park, MS, RT, Seoul, Korea, Republic Of (Presenter) Nothing to Disclose
PURPOSE
The purpose of this study is to investigate the incidence and management of oesophageal ruptures following fluoroscopic balloon dilatation (FBD) in children with benign oesophageal strictures.

METHOD AND MATERIALS
Between October 1996 and November 2013, 62 children with benign oesophageal strictures underwent FBDs. Oesophageal rupture was categorized as intramural (type 1), transmural (type 2) or transmural with free leakage (type 3). The possible risk factors for oesophageal ruptures were analyzed.

RESULTS
One hundred and twenty-nine FBDs were performed in these patients. The oesophageal rupture rate was 17.1% (22/129). The majority (21/22) of ruptures were type 1 and type 2, both were treated conservatively. Only one patient had a type 3 rupture and underwent esophagostomy. The patient gender, age, and the length and cause of the stricture showed no significant effect on the rupture (p>0.05). However, for the patients ≤2 years old, the initial balloon with a diameter ≥10mm showed a higher oesophageal rupture rate than those <10mm during the first session (p<0.05).

CONCLUSION
Although the oesophageal rupture rate in children was 17.1%, the severe rupture (type 3) rate was 0.8%, which usually requires aggressive treatment. For children 2 years old, the initial balloon diameter should be <10mm in the first session for decreasing the risk of oesophageal rupture.

CLINICAL RELEVANCE/APPLICATION
For children ≤2 years, the initial balloon diameter should be <10mm.

SSQ18-07 Initial Experience with Pre-procedural MR and Intraprocedural C-arm CT Fusion for Biopsy of MR-positive CT-negative Pelvic Bone Lesions at a Single Pediatric Institution

Thursday, Dec. 3 11:30AM - 11:40AM Location: S102C

Participants
Sphoorti Shellikeri, Philadelphia, PA (Presenter) Research funded, Siemens AG
Randolph M. Setser, DSc, PhD, Cleveland, OH (Abstract Co-Author) Employee, Siemens AG
Xiaowei Zhu, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose
Anne Marie Cahill, MBBS, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose

PURPOSE
Biopsy of bone marrow abnormalities that are CT/fluoroscopically negative but MR-positive often require the physician to review the MRI on a separate console and cross reference anatomic landmarks to the image modality used during biopsy. This pilot study describes our initial experience with pre-procedural MR and intraprocedural C-arm CT fusion for biopsy of MR-positive CT-negative pelvic bone lesions in IR suite at a single pediatric institution.

METHOD AND MATERIALS
In this IRB-approved prospective study, 5 patients (4F, 1M; mean age 14.8 yrs) with MR-positive CT-negative pelvic bone lesions undergoing bone biopsies were included. A pre-procedural MRI sequence with optimal lesion visualization was fused with an intra-procedural C-arm CT (DynaCT) using 3D/3D fusion software (Siemens Healthcare) and a biopsy path was then planned on the MRI using syngo iGuide. The 3D path was overlaid on the intraprocedural fluoroscopic images. Effective dose was assessed using PCXMC software (v2013, STUK) with an age appropriate model.

RESULTS
All bone biopsies were performed by the same physician. The mean time interval between the pre-procedural MR and the biopsy was 10 days (range 2-22d). 4/5 biopsies were diagnostic (80% accuracy - 2 neuroblastoma, langerhans cell histocytosis, chronic osteomyelitis). There were no procedure related complications. The non-diagnostic biopsy was performed in the left iliac bone in a patient with a subtle low standard uptake value MIBG positive lesion concerning for neuroblastoma superimposed on a more diffuse MR-positive abnormality. The MIBG scan was additionally referred to plan the needle path possibly resulting in inaccurate lesion localization. The mean fluoroscopic and procedural times were 3.8±2.7 min and 87±22 min. The mean effective radiation dose was 6.2±4 mSv (1.8, 7.1, 8.4, 11.2, 2.5 mSv).

CONCLUSION
This pilot experience demonstrates the feasibility of MR-C arm CT fusion for biopsy of CT-negative MR-positive pelvic bone lesions in the IR suite. The advantage of this technique is that it allows the needle path to be planned directly on MRI while visualizing the target lesion. Further validation of this technique will be established with increased patient recruitment.

CLINICAL RELEVANCE/APPLICATION
3D/3D fusion followed by iGuide technology provides the ability to perform CT-negative MR-positive bone biopsies in the IR suite using real-time fluoroscopic guidance.

SSQ18-08 Long-term (>5 years) Clinical and Histological Follow-up of Successful Radiological Percutaneous Treatment of Biliary Strictures in Pediatric Liver Transplant Recipients

Thursday, Dec. 3 11:40AM - 11:50AM Location: S102C

Participants
Good results are reported for percutaneous treatment (PT) of biliary strictures (BS) in children underwent liver transplant (LT) however, in majority of the published studies on this topic, only a short or mid-term follow-up is available. Aim of this study is to retrospectively evaluate long-term follow-up (>5 years) of successful PT of BS in children underwent LT.

**METHOD AND MATERIALS**

From 1/2004 to 12/2014, 70 pediatric LT recipients underwent PT of BS in our hospital. 35 out of 70 had a follow-up longer than 5 years and represent our study cohort. Mean recipient age at the time of PT was 5 y/o (range, 8 months -16 y/o). Anastomotic BS was present in 29 patients, anastomotic and intrahepatic BS were present in 6 patients.

**RESULTS**

In all patients percutaneous stenting and bilioplasty were successfully performed without major complications. Mean number of balloon dilatation performed was 4 (range, 3-8). Mean duration of catheter placement was 5 months (range 2-10). In 10 out of 35 patients (28%) two courses of PT were necessary; the mean time to recurrence was 19 months (range, 3-61 months). One patient had redo LT 91 months after PT for chronic rejection; one patient is with a biliary catheter in place for portal biliopaty secondary to portal cavernoma and is on waiting list for redo LT. 33 patients are symptom-free with respect to BS at a mean follow-up of 95 months (range, 65-131 months). 32 out of 35 patients underwent liver biopsy at a mean follow-up of 5 years (range 3-8 years) after last PT with evidence of mild cholestasis N=7 (22%), moderate/severe cholestasis N=3 (10%), chronic rejection N= 2 (6%), no cholestasis N=20 (62%).

**CONCLUSION**

Clinical and histological good response can be maintained in a long-term follow-up in more than half of pediatric LT recipients with BS treated with percutaneous approach.

**CLINICAL RELEVANCE/APPLICATION**

Percutaneous treatment of BS is a safe and effective procedure in pediatric LT recipients, however more large-scale research and longer follow up are needed.

**SSQ18-09 Comparison of Safety and Efficiency of Image Guided Enema Reduction Techniques for Pediatric Intussusception: A Review of the Literature**

**Participants**

Renny Chew, MBBS, Footscray, Australia (Presenter) Nothing to Disclose
Stacy K. Goergen, MBBS, Clayton, Australia (Abstract Co-Author) Nothing to Disclose
Michael R. Ditchfield, MBBS, Parkville, Australia (Abstract Co-Author) Nothing to Disclose

**PURPOSE**

There is variable practice regarding the technique of image guided enema reduction of paediatric intussusception (IGPIR) and use of procedural sedation/general anaesthesia (GA). Our objectives are to review the literature regarding efficacy and safety of hydrostatic versus pneumatic reduction performed under fluoroscopic versus ultrasound control. A secondary outcome is to determine whether procedural sedation/general anaesthesia (GA) influences outcomes.

**METHOD AND MATERIALS**

Articles were identified by searching OVID Medline on 21/2/14 using keywords "intussusception", "child" and "treatment" and by scanning retrieved articles reference lists. Letters, editorials, and narrative reviews were excluded. Systematic reviews (SR) were appraised with the PRISMA critical appraisal tool. Primary studies underwent a critical appraisal designed by reviewers and successes and perforations per attempt were calculated for each study and an average calculated for each technique.

**RESULTS**

One SR and 87 primary studies were included (5 comparative studies, 82 studies on single techniques and no RCT). Of the 88 studies, 17 reported consistent use of sedation and 4 the use of GA. The SR included 20 studies comparing the success rate of hydrostatic versus pneumatic reduction (including 2 RCTs) and supports pneumatic over hydrostatic reduction. Hydrostatic reduction under ultrasound control appears to have similar efficacy and safety to pneumatic reduction under fluoroscopic control. Efficacy and perforation rates for the studies on single techniques are listed in the figure provided.

**CONCLUSION**

Limited RCT data is available to support one IGPIR method over another. Pneumatic reduction would be preferable over hydrostatic reduction under fluoroscopic guidance based on greater efficacy and comparably low perforation rate. Hydrostatic reduction under ultrasound control should be considered an alternative, as it affords no ionised radiation exposure. Sedation does not appear to alter likelihood of reduction or procedural morbidity. Data relating to GA are too limited to allow practice recommendations with regard to its effect on efficacy and safety.

**CLINICAL RELEVANCE/APPLICATION**

Practice variation of image guided enema reduction techniques for paediatric intussusception may impact on perforation rates, ionising radiation exposure, requirement for surgery, and adverse patient experience.
SSQ21

Vascular/Interventional (Improving Education and Outcomes in Interventional Radiology)

Thursday, Dec. 3 10:30AM - 12:00PM Location: E352

Participants
Kelvin K. Hong, MD, Baltimore, MD (Moderator) Scientific Advisory Board, Boston Scientific Corporation; Steven M. Zangan, MD, Chicago, IL (Moderator) Nothing to Disclose

Sub-Events
SSQ21-01 Simulation Based Training Improves Resident Skill in Ultrasound-Guided Biopsy

Thursday, Dec. 3 10:30AM - 10:40AM Location: E352

PURPOSE
The purpose of this study was to determine whether ultrasound-guided biopsy simulation training using a high fidelity abdominal imaging phantom can improve the radiology residents' overall technical competence in ultrasound guided biopsy.

METHOD AND MATERIALS
This is an IRB approved prospective study. Forty radiology residents from a single institution were enrolled and randomized into training (TG) or control (CG) groups. Each resident performed an ultrasound-guided biopsy on a high-fidelity abdominal imaging phantom using a 22-gauge needle. Prior experience in ultrasound guided biopsies (number of months and procedures performed), total procedure time, number of skin punctures, and number of needle adjustments were obtained. Each procedure was evaluated by a blinded board certified radiologist using a 5 point Likert scale technical competence score. The TG cohort received an additional 30 minute simulation training session with an experienced senior resident. The CG cohort received no additional training. Each resident underwent a second procedure and the same metrics were measured. Statistical analysis was performed using independent t tests.

RESULTS
There were no statistically significant differences between the TG and CG with regards to prior ultrasound-guided biopsy experience. No significant differences between the two cohorts were present in the initial procedure. After the training session, the training cohort demonstrated a statistically significant improvement in overall procedure time (92 seconds less), number of skin punctures (0.8 less), number of needle adjustments (1.4 less), and subjective performance on a 5-point Likert scale (1.1 more) as determined by a blinded grader. The CG did not demonstrate a statistically significant difference in any of the measured metrics between the two procedures.

CONCLUSION
The use of an abdominal imaging phantom for training radiology residents in ultrasound-guided biopsy performance can improve procedural skills including shorter procedure time, less skin punctures, less needle movements and improved subjective performance by a blinded grader. Additional randomized controlled trials will be necessary to determine the external validity of the study in regards to improved patient outcomes and IR-department turnaround time.

CLINICAL RELEVANCE/APPLICATION
This study demonstrates the efficacy of simulation training on improving resident performance in ultrasound-guided biopsy.

SSQ21-02 Ultrasound Guided Foreign Body Removal (USFBR): Simulation Training and Clinical Implementation Outcomes

Thursday, Dec. 3 10:40AM - 10:50AM Location: E352

PURPOSE
USFBR can be taught to radiologists in a stepwise approach to generate competency, and radiologists can apply the technique in the patient setting to remove foreign bodies.
METHOD AND MATERIALS

USFBR was taught to 48 radiologists at 4 hospitals. Training included didactic and hands-on instruction covering 7 components: instrument alignment, hand/transducer position, forceps use, foreign body definition, forceps grasp, recognition of volume averaging, and oblique cross cut artifact. Pre-training testing assessed removal of a single toothpick imbedded in a turkey breast in 15 minutes. Post-training evaluation consisted of 5 toothpick removals. Ongoing clinical implementation of USFBR includes foreign body removal under ultrasound guidance by a trained radiologist. Parameters including age of patient, which radiologist, removal success, type and size of foreign body, incision size, foreign body retention time, reason for removal, symptoms, modalities used in detection, wound closure, and sedation are recorded. Data were analyzed using chi-squared and Fisher's exact tests for categorical outcomes and analysis of variance for continuous outcomes.

RESULTS

After training, radiologists’ scores improved from 21-52% pre-training to 90-100% post-training (p<0.001 for each component).

Clinical to date, USFBR has been 100% successful in 7 (25 expected) patients, ages 9-73 years, by 4 trained radiologists. Objects removal length 4 to 30 mm, retention time 2 to 864 days, incision 2 to 8 mm. 1 closure. 1 sedated.

CONCLUSION

Ultrasound guided foreign body removal approach taught in simulation improves radiologist technique and removal outcomes. A radiologist who completes simulation training can remove a variety of imbedded foreign bodies.

CLINICAL RELEVANCE/APPLICATION

USFBR can be used to remove foreign bodies while minimizing patient discomfort and potential tissue damage.

SSQ21-03 Evaluation of a Gelatin-Based Phantom Model System for Training of CT-Guided Drain Placement

Participants
Stephen A. Balfour, MD, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose
Pratik S. Patel, DO, Philadelphia, PA (Presenter) Nothing to Disclose
Xi Xue, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose
Justin McCloskey, BA, Pittsburgh, PA (Abstract Co-Author) Nothing to Disclose
David S. Pryluck, MD, MBA, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose

PURPOSE

Prior studies have described the use of low-cost gelatin phantom models to train ultrasound-guided procedures, however, there is limited data evaluating their use in training CT guided procedures. The purpose of this study is to evaluate the use of such a model to train inexperienced operators to perform CT guided abscess drainages.

METHOD AND MATERIALS

Twenty inexperienced and blinded participants were asked to place a needle into a simulated abscess in a gelatin phantom followed by a pigtail catheter using Seldinger technique. Subjects were randomized to receive traditional didactic instruction prior to testing or to receive hands-on training with the phantom model prior to testing. Primary endpoints included time to successful needle, wire, and drain placement, number of scans to achieve needle placement, and total number of scans. Secondary endpoints included a Likert-type confidence survey.

RESULTS

Experimental subjects required fewer scans to achieve needle placement (4.7 vs 9.2, p=0.04) and less time to achieve needle placement (14.7 vs 20.4 minutes, p = 0.04), compared with control subjects. Experimental subjects also felt more confident in their ability to safely (p=0.03) and successfully (p=0.01) perform the procedure on an actual patient. There was no significant difference between groups for total number of scans and time to successful wire/drain placement.

CONCLUSION

Our data demonstrate that the use of low-cost gelatin phantom models for the training of CT-guided procedures improves both performance and confidence in technically inexperienced subjects with the potential to reduce radiation dose.

CLINICAL RELEVANCE/APPLICATION

We believe gelatin phantom simulation has real potential to serve a larger role in medical student and resident training.

SSQ21-04 Use of an Electromagnetic Navigation System on a Phantom as a Teaching ModalityTo Improve Training for CT-Guided Procedures

Participants
Dmitry Trifanov, MD, Boston, MA (Presenter) Nothing to Disclose
Taj Kattapuram, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose
Haiyang Tao, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose
Ronald S. Arellano, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose
Raul N. Uppot, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose

PURPOSE

The purpose of this study is to evaluate the role of electromagnetic navigational guidance system (EMN) and a phantom as training simulator for computed tomography (CT)-guided procedures.

METHOD AND MATERIALS

The study included two components: 1. A skills test using a navigational guidance system and phantom that simulated a CT-guided
procedure. 2. A survey of the fellows assessing the use of a navigational guidance system on a phantom as a potential tool to help training for CT-guided procedures. Nineteen fellows (12 interventional radiology fellows and 7 abdominal imaging fellows) were involved in the study.

RESULTS

Use of the EMN system improved the successful number of attempts at hitting the biopsy target for both the diagnostic and interventional group. Mean number of successful attempts for all the fellows in the manual/conventional CT guidance group was 58.8%. Mean number of successful attempts for all the fellows in the EMN group was 85.9%. Although there was improvement in number of successful attempts using the EMN system compared to manual conventional method, there was no statistically significant difference in time or accuracy. The pre and post survey showed no correlation was found between their confidence and accuracy and only half of the fellows disclosed that their confidence improved after the training session. However 92.9% of the trainees felt that using EMN system and phantom are useful training tools to simulate CT-guided procedures.

CONCLUSION

Use of EMN system on a phantom is a potentially valuable training tool for training and simulating CT-guided procedures for fellows. When using EMN navigational guidance, the number of the successful attempts by the diagnostic fellows, was significantly better than the interventional fellows. There was significant improvement in number of successful attempts for all fellows when the EMN system was used compared to manual/conventional targeting. In addition, nearly 93% of the fellows reported that use of the CT-simulator helped with training as it helped in understanding the spatial orientation necessary for CT-guided procedures.

CLINICAL RELEVANCE/APPLICATION

Use of EMN systems on a phantom can help simulate and train residents and fellows for CT-Guided Procedures. These simulated environments can help with patient safety.

SSQ21-05  Interventional Radiology Fellowship Websites: A Critical Analysis of Content and Accessibility

Thursday, Dec. 3 11:10AM - 11:20AM Location: E352

Participants
Resmi Charalel, MD, New York, NY (Presenter) Nothing to Disclose
Bradley B. Puu, MD, New York, NY (Abstract Co-Author) Nothing to Disclose
Naveen Galla, BA, New York, NY (Abstract Co-Author) Nothing to Disclose
Samir Trehan, MD, New York, NY (Abstract Co-Author) Nothing to Disclose
David C. Madoff, MD, New York, NY (Abstract Co-Author) Nothing to Disclose

PURPOSE

To evaluate the content and accessibility of interventional radiology (IR) fellowship program websites.

METHOD AND MATERIALS

All IR fellowship programs listed on the Society of Interventional Radiology (SIR) website were individually evaluated based on content and ease of access. Upon review of the SIR website, program contact information, application information, program description and website address were evaluated. A Google search was performed ("[program name] interventional radiology fellowship") and the number of mouse clicks required to get from Google to each fellowship website was recorded. Each fellowship website was evaluated for detailed program characteristics, application information and specific contact information. Online data was collected in November 2014.

RESULTS

Of the 85 programs listed on the SIR website, 95% (81/85) were currently offering fellowships and 96% (78/81) of these programs had functioning websites. All programs listed a contact telephone number and mailing address on the SIR website. However, no program had a functional link to the fellowship website from the SIR website. Via Google, it took an average of 1.1 clicks to access available websites. Program description, application information and rotation schedule were provided in 86% (67/78), 72% (56/78) and 18% (14/78) of websites, respectively. Only 31% (24/78) of programs indicated on their websites that they accepted applications via ERAS. Additional factors such as didactics, current fellow information, and research opportunities were available in 32% (25/78), 15% (12/78), and 33% (26/78), respectively.

CONCLUSION

The SIR website maintains a comprehensive listing of IR fellowship programs, most of which could be efficiently accessed via Google. While most fellowship program websites contained a program description, other content such as application information and rotation schedule, were less frequently present.

CLINICAL RELEVANCE/APPLICATION

Interventional radiology (IR) fellowship will soon be replaced by its own residency. During this process, it will be increasingly important to understand the information available to applicants on program websites and how to improve them.

SSQ21-06  The Impact of a Laser Navigation System (LNS) on CT-guided Interventions

Thursday, Dec. 3 11:20AM - 11:30AM Location: E352

Participants
Maurice Pradella, MD, Basel, Switzerland (Presenter) Nothing to Disclose
Tobias Heye, MD, Basel, Switzerland (Abstract Co-Author) Nothing to Disclose
Martin Takes, MD, Basel, Switzerland (Abstract Co-Author) Nothing to Disclose
David Buergler, Basel, Switzerland (Abstract Co-Author) Nothing to Disclose
Christoph J. Zech, MD, Basel, Switzerland (Abstract Co-Author) Research Grant, Bayer AG Speaker, Bayer AG Travel support, Bayer AG Advisory Board, Bayer AG Speaker, Bracco Group Travel support, Bracco Group

PURPOSE

CT-guided biopsies, drainages as well as spinal nerve infiltrations are established minimal-invasive methods. The aim of this study
was to compare our results with a newly installed laser navigation system (LNS) to prior procedures.

METHOD AND MATERIALS
In June 2014 a new CT scanner (Somatom Edge, Siemens Medical Solutions, Erlangen, Germany) as well as a LNS (Amedo 3D-LNS, Amedo, Bochum, Germany) were installed in our institution. We retrospectively analysed and compared all biopsies, drainages and infiltrations from a 3 months period prior (2013) and after (2014) the installation. Lesion size, distance from skin, procedure duration, radiation dose (total CTDIvol), complications and clinical success were evaluated. Operators experience was categorized between residents under supervision and consultants, with at least 5 years of experience in interventional radiology.

RESULTS
A total of 236 procedures were included of which 69.1 % were performed by experienced operators (2013: 111 (66.7%), 2014: 125 (91.1%)). In 2014 80.5% of all interventions were performed by using the LNS. Experienced operators used the LNS in 81.3 % of all cases in 2014 vs. 72.7 % for inexperienced operators. There was no overall difference in size (12.4 cm² vs. 12.7 cm², p=0.93), duration (10.7 min vs. 10.8 min, p=0.91) or distance from skin (6.1 cm vs. 5.8 cm, p=0.37) between the two groups. Overall complication rate was 6.8 % (with LNS: 4.0 % vs. 8.9 % without LNS, p=0.14). Success rate was 97.0 % incl. 8.1 % unclear cases (96.0 % incl. 10.0% vs. 97.8 % incl. 6.7 %, p=0.46). In total the use of the LNS reduced the patients' radiation exposure by 47.9 % (30.1 mGy vs. 57.9 mGy, p<0.001). This effect was independent from experience (experienced operators: 30.4 mGy vs. 59.2 mGy, p<0.001; inexperienced operator: 26.7 mGy vs. 54.8 mGy, p=0.012). Interestingly the use of the LNS significantly reduced the procedure's duration in the inexperienced group (4.0 min vs. 13.2 min, p=0.046).

CONCLUSION
Our data suggest that the use of a LNS can reduce the radiation dose significantly. This effect occurs independently from operator's experience. Furthermore there might be benefits in reducing the procedure's duration in the group of inexperienced operators.

CLINICAL RELEVANCE/APPLICATION
Dose reduction is an important factor in interventional radiology both for the patient as well as for the physician involved.

SSQ21-07 How Much Does an Interventional Procedure Actually Cost? Analysis Using Time Driven Activity Based Costing

Participants
Anand M. Prabhakar, MD, Somerville, MA (Presenter) Nothing to Disclose
Derek Haas, Boston, MA (Abstract Co-Author) Nothing to Disclose
Nicole Bassoff, Boston, MA (Abstract Co-Author) Nothing to Disclose
Katelyn Brinegar, Boston, MA (Abstract Co-Author) Nothing to Disclose
H. Benjamin Harvey, MD, JD, Boston, MA (Abstract Co-Author) Nothing to Disclose
Alexander S. Misono, MD, MBA, Boston, MA (Abstract Co-Author) Nothing to Disclose
Robert L. Sheridan, Boston, MA (Abstract Co-Author) Nothing to Disclose
Nicole Oklu, MD, PhD, Boston, MA (Abstract Co-Author) Nothing to Disclose
Rahmi Oklu, MD, PhD, Boston, MA (Abstract Co-Author) Nothing to Disclose

PURPOSE
Time-driven activity-based costing (TDABC) is a strategic accounting tool that empowers health care systems to determine the cost of care delivery vis-à-vis process mapping. This information can be used to optimize the value of clinical processes and protocols. This project applied TDABC analysis to understand the labor costs of dialysis-related interventional radiology procedures.

METHOD AND MATERIALS
In this IRB-approved, HIPAA compliant study, 25 patients who presented to IR for fistulagram or dialysis access thrombectomy were observed from arrival to discharge from July–September 2014. The trained observers recorded the room idle time and the time the patient spent with each staff resource throughout the patients stay. This data was used to estimate the average time spent by each staff resource at each step in the care process, and the value per minute of each staff resource (capacitance cost) was calculated using publically available salary information. Based on these two factors, as well as equipment and room costs, the total cost of each procedure was calculated. The data were analyzed with descriptive and comparative statistics.

RESULTS
Of the patients in the study, 16 underwent a fistulagram and 9 underwent a thrombectomy. The mean times were: 75±49 (room idle time), 25±12 min (prep time), 90±46 min (IR fellow time), 124±46 min (IR Attending time), 15±45 min (room cleaning time), and 142±45 min (total procedure time). Staff utilization rates for thrombectomy and fistulagram were: 47%/32% (IR Attending), 52%/45% (IR Fellow), 67%/66% (IR Nurse), and 74%/75% (IR Technologist). Using salary estimates, the staff capacitance costs were: $4.10/min (IR Attending), $1.46/min (IR Nurse), $1.12/min (IR Tech), and $0.76/min (IR Fellow). The mean fistulagram cost was $563±199 with a 3.6x variation between the min ($302) and max ($1073) cost and the mean thrombectomy cost was $1103±430 with a 3.1x variation between the min ($598) and max ($1851) cost.

CONCLUSION
TDABC analysis demonstrates wide variability in the costs associated with dialysis-related procedures. Improvement of staff utilization rates is a strategy for reducing these costs.

CLINICAL RELEVANCE/APPLICATION
TDABC is a novel way to cost healthcare procedures. Efforts aimed at improving staff utilization could reduce procedural costs for health care systems and increase their likelihood of success under risk-share payment models.
Lead shields, long thought to be safe, have lead dust on external surfaces. Lead dust is a known source of exposure that can result in adverse health effects. This study was designed to determine, for the first time, whether such shields expose wearers to lead dust.

**METHOD AND MATERIALS**

This IRB-approved HIPAA compliant study includes 230 patients who underwent percutaneous peripheral vascular and renal interventions in a randomized sequence. Prior to their interventions patients filled out the Positive Affect Negative Affect Schedule (PANAS), rating 10 adjectives related to either positive affect (PA) or negative affect (NA) using a 5-point rating scale ranging from “1=Very slightly/Not at All” to “5=Extremely”. Adjectives fo PA were: Interested, excited, strong, enthusiastic, proud, alert, inspired, determined, attentive, and active. Adverse events included prolonged hypoxia, hypertensive or hypotensive episodes, prolonged bradycardia, postoperative bleeding. Summary scores for NA and PA were split into high and low over theirs medians and correlated with absence or presence of adverse events using logistic regression. Odds ratios, standard error (SE), confidence intervals (CI), and p-values were reported using SAS 9.1.3.

**RESULTS**

Patients with high NA had significantly more adverse events than those with low NA (22% vs 12%; odds ratio 0.48, SE 0.17, CI 0.23 – 0.97, p=0.04). The degree of PA did not significantly affect outcome (odds ratio 0.76, SE 0.27, CI 0.38 - 1.53, p=0.44).

**CONCLUSION**

Patients with high negative affect fared significantly worse in terms of adverse events as compared to patients who had low negative affect. The degree of positive effect did not make significant difference.

**CLINICAL RELEVANCE/APPLICATION**

The mood contagion from the patient’s negative affect should be of concern for the practicing interventional radiologist because it may result in a self-fulfilling prophecy of a negative outcome.

**SSQ21-09 Lead Aprons: A Lead Exposure Hazard?**

Participants

Kevin Burns, MD, Bronx, NY (Presenter) Nothing to Disclose
Mori Markowitz, MD, Bronx, NY (Abstract Co-Author) Nothing to Disclose
Benjamin Taragin, MD, Teaneck, NJ (Abstract Co-Author) Nothing to Disclose
Jamie Shoaq, BS, Bronx, NY (Abstract Co-Author) Nothing to Disclose
Sukhraj Kahlon, BS, Bronx, NY (Abstract Co-Author) Nothing to Disclose

**PURPOSE**

Lead (Pb) is highly toxic but is useful to protect against ionizing radiation. The lead inside shields worn by medical workers has long been believed to be nonhazardous. This study was designed to determine, for the first time, whether such shields expose wearers to lead dust on exterior shield surfaces.

**METHOD AND MATERIALS**

This was a descriptive study of a convenience sample of 172 shields. Both surfaces of each shield were tested in 2 ways: a qualitative on-site test (LeadCheck, 3M) and a lab based quantitative dust sample analysis by atomic absorption spectroscopy (AAS) expressed in micrograms per foot squared (ug/ft2). Age, type of shield, Pb sheet thickness, storage method and visual and radiographic appearance were assessed.

**RESULTS**

86 shields [50% (95% CI: 43-57%)] tested positive for surface lead using the qualitative method on one or both sides. 109 [63% (95% CI: 56-70%)] of the shields had detectable lead by AAS. Pb dust by AAS ranged from undetectable to 998 ug/ft2. Comparing assessment methods, the positive predictive value of the qualitative method was 85%; negative predictive value was 58% versus the quantitative method. There was 82% agreement as to the presence of Pb between the 2 sides, e.g., if Pb was present on one surface it was likely present on the other. The quantitative detection of Pb was significantly associated with: 1) visual appearance of the shield (1-best, 3-worst): 90% of shields that scored 3 had detectable dust Pb; 2) type of shield: a greater proportion of the pediatric patient, full body and thyroid shields were positive than vests and skirts; 3) use of a hangar for storage: 4 of 14 shields on hangers (27%) were positive vs. 66 of 105 not on hangers (67%). Radiographic determination of shield intactness, thickness of interior Pb sheets, and age of shield were unrelated to presence of surface dust Pb. Of note, 5/5 shields constructed with no interior Pb had no detectable surface Pb.

**CONCLUSION**

63% of shields had detectable surface lead which was associated with visual appearance, type of shield, and storage method. A clinical correlate study, currently in progress at our institution, will help to assess risk to patients and clinicians.

**CLINICAL RELEVANCE/APPLICATION**

Lead shields, long thought to be safe, have lead dust on external surfaces. Lead dust is a known source of exposure that can result in adverse health effects.
in lead poisoning and should be minimized as much as possible.
SSQ22

Vascular/Interventional (Concepts in Aortic Aneurysm Interventions)

Thursday, Dec. 3 10:30AM - 12:00PM Location: N227

VA IR

AMA PRA Category I Credits ™: 1.50
ARRT Category A+ Credits: 1.50

FDA Discussions may include off-label uses.

Participants
Parag J. Patel, MD, Milwaukee, WI (Moderator) Consultant, Medtronic, Inc; Consultant, C. R. Bard, Inc; Consultant, Penumbra, Inc; Anisha S. Martin, MD, Chicago, IL (Moderator) Nothing to Disclose

Sub-Events

SSQ22-01 Is Contrast Enhanced Ultrasound the Endograft Imaging Modality of the Future?

Thursday, Dec. 3 10:30AM - 10:40AM Location: N227

Participants
Rayshelle Finch, Orange, Australia (Presenter) Nothing to Disclose
Steven Dubenec, Camperdown, Australia (Abstract Co-Author) Nothing to Disclose
Sharyn Russel, MBBS, Orange, Australia (Abstract Co-Author) Nothing to Disclose
Bryan Khoury, FRANZCR, Orange, Australia (Abstract Co-Author) Nothing to Disclose
Karen Pollard, Wagga Wagga, Australia (Abstract Co-Author) Nothing to Disclose
Kenneth Russell, BA, Wagga Wagga, Australia (Abstract Co-Author) Nothing to Disclose

PURPOSE

The aim of this study was to evaluate the clinical effectiveness of Contrast Enhanced Ultrasound (CEUS) in detecting the presence of endoleaks after Endovascular Aortic Aneurysm Repair (EVAR) and to compare the diagnostic accuracy with other imaging modalities.

METHOD AND MATERIALS

One hundred and seven patients, all post EVAR, underwent surveillance utilising CEUS, CDU and CTA. Each modality assessed for the presence of an endoleak. The presence of contrast within the stent graft established patency and contrast within the residual aneurysm sac indicated the presence of an endoleak. Endoleaks were classified by type, origin and size. Quantitative comparison was made between each modality.

RESULTS

There is a statistically significant increased rate of endoleak detection, especially for low amplitude, slow flowing endoleaks using CEUS in comparison to CDU and CTA. Two-tailed P value was calculated with McNemar's Test and continuity correction at<.0001. CDU identified thirty-six endoleaks, CTA identified thirty-nine endoleaks and CEUS identified sixty-three endoleaks. Statistical analysis has also highlighted that CDU in comparison to CTA in the detection of Endoleaks is not statistically significant. The two-tailed P Value equals 0.6625. These two imaging modalities were considered to be equivalent.

CONCLUSION

In this prospective study, CEUS has proven to be an extremely effective imaging modality in the detection, visualisation and classification of endoleaks in comparison to CDU and CTA. CEUS is a sensitive adjunct to unenhanced ultrasound and is an extremely useful imaging modality in patients where CTA is contraindicated. CEUS is an accurate and minimally invasive way to interrogate these endografts and has in this study, demonstrated statistically significant improvements in the detection of endoleaks. If the advances in ultrasound imaging technology, with the use of contrast agents, continue to demonstrate its dominance, we believe CEUS will become a routine part of EVAR surveillance.

CLINICAL RELEVANCE/APPLICATION

CEUS has a significant role to play in EVAR surveillance. It is an accurate and minimally invasive way to interrogate endografts and has demonstrated statistically significant improvements in endoleak detection.

SSQ22-02 Endoleak and Thrombus Characterization with Dynamic Elastography after Endoleak Embolization Following Aneurysm Endovascular Repair

Thursday, Dec. 3 10:40AM - 10:50AM Location: N227

Awards
Trainee Research Prize - Medical Student

Participants
Antony Bertrand-Grenier, Montreal, QC (Presenter) Nothing to Disclose
Fatemeh Zehtabi, Montreal, QC (Abstract Co-Author) Nothing to Disclose
Helene Heon, DVM, Montreal, QC (Abstract Co-Author) Nothing to Disclose
Guy Cloutier, PhD, Montreal, QC (Abstract Co-Author) Nothing to Disclose
Sophie Lerouge, Montreal, QC (Abstract Co-Author) Nothing to Disclose
Gilles P. Soulze, MD, Montreal, QC (Abstract Co-Author) Speaker, Bracco Group Speaker, Siemens AG Research Grant, Siemens AG Research Grant, Bracco Group Research Grant, Cook Group Incorporated Research Grant, Object Research Systems Inc

PURPOSE

SuperSonic Imagine (SSI) measure the tissue elasticity in real-time. The goal of this study was to characterize in a canine model
Renal infarcts are occasionally seen on post-fenestrated endovascular repair (FEVAR) imaging. They can occur as a result of intentional exclusion of an accessory renal artery or after inadvertent embolism during the procedure. While the incidence of renal infarct following FEVAR is variable, the clinical significance of these renal infarcts is undocumented. The purpose of this study is to determine the incidence of renal infarcts on post-FEVAR imaging and what percentage of this subset of patients developed a subsequent increase in serum creatinine.

METHOD AND MATERIALS
All patients who underwent FEVAR at our institution between April 1, 2010 and April 1, 2014 and had pre- and post- contrast-enhanced CT were retrospectively identified and included for analysis. Two staff radiologists reviewed pre- and post-FEVAR CTs for the presence of renal infarcts. All post-FEVAR scans were obtained at least one month following FEVAR. The electronic medical record was used to record serum creatinine (Cr) values obtained concurrently with the pre- and post- scans as well as the need for hemodialysis following FEVAR. Incidence of renal infarct was calculated as well as the percentage of patients with post-FEVAR renal infarct following FEVAR. Incidence of renal infarct was variable, the clinical significance of these renal infarcts is undocumented.

RESULTS
At sacrifice, 10 aneurysms had endoleaks, 9 had fresh thrombus, 15 had organized thrombus and 3 were completely sealed. At 3 months, elasticity modulus (in kPa) of 0.1±0.2, 9.4±3.3, 47.6±28.1, 51.7±24.1 and 49.1±33.5 were respectively found in endoleak, fresh and organized thrombus, Chi and Chi-STS regions. Elasticity values of endoleak and fresh thrombus areas were significantly lower than organized thrombus, Chi and Chi-STS areas (p<0.001). Elasticity values of fresh thrombus ranged between 3 and 19 kPa (8.7±3.6 kPa) at 1-week and 30.2±13.8 kPa at 3-months indicating that SSI can evaluate thrombus maturation. It can also characterize embolization agents degradation (39.3±21.1 and 30.5±13.8 kPa at 6-months for Chi and Chi-STS regions). SSI was able to detect endoleak where DUS failed and distinguish fresh thrombus (possibly endotension) which cannot be detected on CT-scan.

CONCLUSION
The results confirm that SSI was able to evaluate thrombus organization and embolization agents over time after endoleak embolization following EVAR. A lower elastic modulus value corresponds to fresh thrombus whereas a higher value corresponds to organized thrombus.

Clinical Relevance/Application
The SSI can complement conventional DUS in post-EVAR surveillance. It could reduce the cost, the exposition to ionizing radiation and nephotoxic contrast agents of surveillance CT-scan follow-up.

SSQ22-03 Incidence and Clinical Significance of Renal Infarct after Fenestrated Endovascular Aortic Repair

Thursday, Dec. 3 10:50AM - 11:00AM Location: N227

Participants
Lauren M. Burke, MD, Chapel Hill, NC (Abstract Co-Author) Consultant, Amgen Inc
Jesse M. Conyers, BS, Carrboro, NC (Abstract Co-Author) Nothing to Disclose
Charles T. Burke, MD, Chapel Hill, NC (Abstract Co-Author) Nothing to Disclose
Hyeon Yu, MD, Chapel Hill, NC (Abstract Co-Author) Nothing to Disclose
Mark Farber, MD, Chapel Hill, NC (Abstract Co-Author) Nothing to Disclose
Raghu Vallabhaneni, Chapel Hill, NC (Abstract Co-Author) Nothing to Disclose
Anj J. Isaacson, MD, Chapel Hill, NC (Abstract Co-Author) Advisory Board, BTG International Ltd
Robert G. Dixon, MD, Chapel Hill, NC (Presenter) Nothing to Disclose

Purpose
Renal infarcts are occasionally seen on post-fenestrated endovascular aortic repair (FEVAR) imaging. They can occur as a result of intentional exclusion of an accessory renal artery or after inadvertent embolism during the procedure. While the incidence of renal infarct following FEVAR is variable, the clinical significance of these renal infarcts is undocumented. The purpose of this study is to determine the incidence of renal infarcts on post-FEVAR imaging and what percentage of this subset of patients developed a subsequent increase in serum creatinine.

Method and Materials
All patients who underwent FEVAR at our institution between April 1, 2010 and April 1, 2014 and had pre- and post- contrast-enhanced CT were retrospectively identified and included for analysis. Two staff radiologists reviewed pre- and post-FEVAR CTs for the presence of renal infarcts. All post-FEVAR scans were obtained at least one month following FEVAR. The electronic medical record was used to record serum creatinine (Cr) values obtained concurrently with the pre- and post- scans as well as the need for hemodialysis following FEVAR. Incidence of renal infarct was calculated as well as the percentage of patients with post-FEVAR renal infarcts who had a significant rise in serum Cr (defined as a 0.3 mg/dl increase).

Results
100 patients were included for analysis. 24 of these patients (24%) had a renal infarct identified on post-FEVAR CT. Of these, 10 (42%) were a result of purposeful covering of an accessory renal artery and 14 (58%) were embolic. Of the 14, only 3 (21%) had an increase in serum Cr of greater than 0.3 mg/dl during the post-FEVAR period (range 0.72-2.62, average 1.42). Of the 10 patients with renal infarct following covering of an accessory renal artery, only 1 (10%) demonstrated an increase in serum Cr (0.82). No patients in either group required temporary or permanent hemodialysis.

Conclusion
The presence of renal infarcts after FEVAR is not uncommon and often secondary to intentional exclusion of accessory renal vessels. The clinical relevance of these events appears relatively benign with only 17% of patients with renal infarcts demonstrating any significant decline in renal function, none of which required temporary or permanent dialysis in the short-term.

Clinical Relevance/Application
Understanding the incidence and significance of renal infarct after FEVAR will improve communication between the radiologist and surgeon.

SSQ22-04 eGFR Changes after Endovascular Treatment of Complex Aortic Aneurysms
Participants
Anna M. Sailer, MD, MBA, Maastricht, Netherlands (Presenter) Nothing to Disclose
Patty Neelums, Maastricht, Netherlands (Abstract Co-Author) Nothing to Disclose
Camille van Berlo, Maastricht, Netherlands (Abstract Co-Author) Nothing to Disclose
Michiel W. De Haan, MD, PhD, Maastricht, Netherlands (Abstract Co-Author) Nothing to Disclose
Dominik Fleischmann, MD, Palo Alto, CA (Abstract Co-Author) Research support, Siemens AG;
Geert Willem H. Schurink, MD, PhD, Maastricht, Netherlands (Abstract Co-Author) Nothing to Disclose

PURPOSE
Endovascular repair of aortic aneurysms (EVAR) with complex anatomy (juxta-, suprarenal and thoracoabdominal aneurysms) has become feasible with novel fenestrated and branched devices. The risk of procedure related acute kidney injury (AKI), and subsequent permanent decrease of renal function is unknown. The aim of this study was to evaluate predictors for estimated glomerular filtration rate (eGFR) changes after fenestrated and branched EVAR with special interest in effect of intra-arterial iodinated contrast volume on risk of AKI and effect of AKI on long-term eGFR decrease.

METHOD AND MATERIALS
157 consecutive patients who underwent fenestrated and branched EVAR were included. Procedural intra-arterial iodinated contrast volume (iaIC; low-osmolar, 300 mg iodine/ml), serum creatinine levels at baseline, during 48 hours following EVAR, at discharge and latest follow-up (FU) were recorded. eGFR was calculated using the Modification of Diet in Renal Disease formula. Development of post-EVAR AKI (according to AKIN criteria), coverage of accessory renal arteries during EVAR, patients' age, presence of diabetes and other risk factors were documented. Multivariate Cox proportional hazard models were used to identify independent risk factors for eGFR decrease during follow-up.

RESULTS
Forty-three patients (27%) developed post-EVAR AKI. Mean procedural iaIC volume in patients who developed AKI was 195 ±88 ml versus 149 ±69 ml in patients without AKI (p= 0.001). Median stay until discharge was 6 days (interquartile range (IQR) 3-9 days) and median time until latest FU was 380 days (IQR 117-925 days). Occlusion of accessory renal arteries and development of AKI were associated with a significantly increased risk for eGFR decrease at discharge (Hazard Ratio (HR) 3.19, 95%CI: 1.36 - 7.51; p= 0.008 and HR 2.87, 95%CI: 1.34 - 6.14; p= 0.007). There was also a significant association between AKI and eGFR decrease at IFU (HR 2.79, 95%CI: 1.44 - 5.39, p= 0.002). Iodinated contrast volume was not associated with eGFR decrease neither at discharge nor at IFU (HR 0.998; p= 0.463 and HR 1.000; p= 0.857, respectively).

CONCLUSION
Post-EVAR AKI is significantly associated with short- and long-term eGFR decrease.

CLINICAL RELEVANCE/APPLICATION
Higher intra-arterial iodinated contrast volume is associated with higher probability of AKI, but the data provide no evidence that iodinated contrast volume is an independent risk factor for long-term eGFR decrease.

SSQ22-05 Type II Endoleak Proposed New Sub-Categorisation

Participants
Rayshelle Finch, Orange, Australia (Presenter) Nothing to Disclose
Steven Dubenc, Camperdown, Australia (Abstract Co-Author) Nothing to Disclose
Bryan Khoury, FRANZCR, Orange, Australia (Abstract Co-Author) Nothing to Disclose
SharynRussell, MBBS, Orange, Australia (Abstract Co-Author) Nothing to Disclose
Karen Polland, Wagga Wagga, Australia (Abstract Co-Author) Nothing to Disclose
Ian Garbett, BS, MSc, Wagga Wagga, Australia (Abstract Co-Author) Nothing to Disclose

PURPOSE
The aim of this study was to evaluate the behaviour of Type II endoleaks utilising CEUS to aid visualisation and to determine the endoleak origin and communication with branch vessels.

METHOD AND MATERIALS
This observational study enrolled one hundred and seven patients who had undergone EVAR as treatment for their AAA. All patients underwent surveillance utilising CDUS, CEUS and CTA to assess for presence/absence of an endoleak. Contrast enhancement within the residual aneurysm sac indicated the presence of an endoleak. Endoleaks were classified by type, origin and size. Type II endoleaks were further subcategorised according to vessel behaviour, origin, communications and duplex Doppler characteristics.

RESULTS
Type II endoleaks were identified and subcategorised based on vessel origin, behaviour, channel connection and spectral Doppler characterization. We added Doppler information to Type II subcategories A and B. We distinguished two variants in subcategory IIB (i) and (ii) based on their communications and devised two further Type II subcategories C and D. Type IIC endoleaks were identified as the endoleak that may cause potential pressurisation to the residual aneurysm and were thought to be the most likely to cause risk to the patient, requiring intervention. All patients with this new endoleak subcategory were noted to have had an increase in sac size of >5mm over a 6month period. The haemodynamic effect of this endoleak subtype was thought to be significant.

CONCLUSION
CEUS has a significant role to play in EVAR routine surveillance and is a sensitive adjunct to unenhanced ultrasound in the detection of endoleaks. The type and size of an endoleak and the residual sac size are the most important factors that influence the need for secondary intervention. Our additional sub-categorisations of Type II B (i) and (ii), C and D has shown initial benefit in determining an’at risk’ Type II endoleak. An enhanced understanding of Type II endoleaks will aid in future interventional and implementation
strategies, which will ultimately lead to EVAR success.

**CLINICAL RELEVANCE/APPLICATION**

This study identifies and subcategorises Type II-endoleak behaviour. Additional subcategorisation has shown initial benefit, extrapolating 'benign' and 'at risk' endoleaks. CEUS is a sensitive adjunct to CDU and CTA.

**SSQ22-06  Integrated Stent-graft for Wireless 4-dimensional Aneurysm Sac Pressure Monitoring after Endovascular Aortic Aneurysm Repair (EVAR): First In Vitro Results**

*Participants*

Clemens Spink, Hamburg, Germany *(Presenter)* Nothing to Disclose

Bibin John, Hamburg, Germany *(Abstract Co-Author)* Nothing to Disclose

Wolfgang H. Krautschneider, PhD, Hamburg, Germany *(Abstract Co-Author)* Nothing to Disclose

Dietmar Schroeder, PhD, Hamburg, Germany *(Abstract Co-Author)* Nothing to Disclose

Robert Fischbach, Dresden, Germany *(Abstract Co-Author)* Nothing to Disclose

Markus Braunschweig, Dresden, Germany *(Abstract Co-Author)* Nothing to Disclose

Jan-Hendrik Buhk, MD, Hamburg, Germany *(Abstract Co-Author)* Nothing to Disclose

Gerhard B. Adam, MD, Hamburg, Germany *(Abstract Co-Author)* Nothing to Disclose

Andreas Koops, MD, Hamburg, Germany *(Abstract Co-Author)* Nothing to Disclose

**PURPOSE**

In vitro testing of prototype stent-grafts with an integrated array of nano-electronic pressure sensors within the stent-covering, capable of wireless digital data transmission for non-invasive 4-dimensional aneurysm sac pressure monitoring following EVAR.

**METHOD AND MATERIALS**

30 prototype stent-grafts were designed (85 mm x 16 mm), each containing 16 pressure sensors (1.5 mm x 1 mm x 1 mm) within the covering membrane of polytetrafluorethylen (PTFE). The prototypes were mounted on a 26 F delivery sheath and mono-iliacal placed into an aortic bifurcation model. Measurements were continuously taken from the sensors while inducing invasive reference pressure from the contralateral iliacal side. Digital data conversion was performed by an integrated microcontroller. Customised antenna technology was designed providing energy and data transfer by inductive coupling.

**RESULTS**

After successful placement of the stent-graft all 16 sensors delivered reliable pressure measurements continuously and could detect pressure-changes accurately up to ± 1.2 mmHg. Wireless energy and data transmission could be successfully demonstrated.

**CONCLUSION**

The non-invasive acquisition of pressure profiles along a stent-graft’s membrane after EVAR can deliver information on regional pressure elevation, indicating early endoleak development. Our trials show practical and efficient ways of continuous aneurysm sac pressure monitoring in patients after EVAR. Further in vivo tests are required, developing an implementation into a product.

**CLINICAL RELEVANCE/APPLICATION**

Novel integrated 4-dimensional pressure monitoring may allow precise and early endoleak detection in patients after EVAR providing opportunities of telemetric data transmission.

**SSQ22-07  Long Term Results after Endovascular Repair of Abdominal Aneurysm (EVAR): Impact of Hostile Neck Anatomy in Early and Long-term Complications and Aneurysm Related Death**

*Participants*

Alvaro M. Morales Vargas, MD, Madrid, Spain *(Presenter)* Nothing to Disclose

Gonzalo Garzon Moll, Madrid, Spain *(Abstract Co-Author)* Nothing to Disclose

Milagros Marti De Gracia, MD, Madrid, Spain *(Abstract Co-Author)* Nothing to Disclose

Alvaro Fernandez Heredero, MD, Madrid, Spain *(Abstract Co-Author)* Nothing to Disclose

Luis Riera del Moral, MD, Madrid, Spain *(Abstract Co-Author)* Nothing to Disclose

Marta Gutierrez Mistal, MD, Madrid, Spain *(Abstract Co-Author)* Nothing to Disclose

Rosario Madero Jarabo, MD, Madrid, Spain *(Abstract Co-Author)* Nothing to Disclose

**PURPOSE**

To describe the impact of aneurysm neck morphology on complications and aneurysm-related death after EVAR.

**METHOD AND MATERIALS**

A cohort study of patients underwent elective EVAR in a tertiary institution between January 2002 and December 2013, prospectively collected and evaluated retrospectively. An angio-CT follow-up was performed before surgery and according to standards follow-up thereafter. Patients were classified as having hostile aortic necks (length of <10 mm, angle of >50°, diameter of >28 mm, circumferential thrombus, calcified neck, and reverse taper), or favorable aortic necks. CT scans were reviewed by an experienced vascular radiologist. Outcomes are described according to reporting standards for endovascular aortic aneurysm repair EVAR. Statistical analysis. Time to event was estimated by the Kaplan-Meier method. 95% Confidence intervals were estimated. Risk Proportional Cox Models were used.

**RESULTS**

378 patients underwent EVAR. Demographics and co-morbidities were similar in hostile and favorable necks. 101 patients (26.7%) had hostile necks (34.7% angulated, 47.5% measured more than 28 mm, 5% had circumferential thrombus, 16.8% had calcified neck and 9.9% had reversed taper) and 277 (73.3%) had favorable neck anatomy. Aorto-iliac grafts were used in 79 hostile necks and bifurcated grafts in 22 of them. Overall technical success was 96.5%. Postoperative type-I endoleak occurred in 2.2% of hostile
necks, and was not present in favorable necks. Perioperative aneurysm-related mortality was 5% in hostile necks and 2.9% in favorable necks. Freedom of proximal type I endoleaks was 99.6% at 3 years and 99.4% at 12 years for favorable necks, compared to 92.1% at 3 years and 87.7% at 12 years in hostile neck anatomy. Primary clinical success rates were 97.1% at 1 year, and 85.4% at 12 years for favorable necks and 88.7% at 1 year and 65% at 12 years for hostile necks. 12-year overall mortality was 65.9% for favorable necks and 52% for hostile necks. Cox Proportional-Hazards Model revealed that hostile necks and aorto-iliofemoral grafts increase significantly the risk of death or complications.

CONCLUSION

Hostile aortic wall is associated with unfavorable early and long term results after endovascular repair of abdominal aneurysm, increasing the risk of complications and aneurysm-related death.

CLINICAL RELEVANCE/APPLICATION

Hostile aortic neck increases long-term complications and aneurysm-related death after EVAR.

**SSQ22-08** Risk Factors of Stent Graft-Induced New Entry (SINE) after Thoracic Endovascular Aortic Repair (TEVAR) for Stanford Type B Aortic Dissection

Participants

Hyunsik Jang, MD, Seoul, Korea, Republic Of (Presenter) Nothing to Disclose
Do Yun Lee, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Man Deuk Kim, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Jong Yoon Won, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Sung Il Park, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Gyoung Min Kim, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose

**PURPOSE**

Stent graft-induced new entry (SINE) has been increasingly observed after thoracic endovascular aortic repair (TEVAR) for Stanford type B aortic dissection. SINE is often life threatening and re-intervention is required. The current study aims to investigate risk factors of SINE after TEVAR.

**METHOD AND MATERIALS**

From July 2001 to June 2013, 79 patients who underwent TEVAR for Stanford type B aortic dissection were retrospectively analyzed. Mean age was 55.7 years (range, 25-84 years) and mean follow-up period was 53.5 months (range, 3days-130.2 months). 17 patients underwent TEVAR within 2 weeks (acute) after diagnosis of aortic dissection and the other 62 patients underwent TEVAR after 2 weeks (chronic). 42 patients underwent TEVAR with modified stent graft with ‘inward bended’ margin and the others used conventional stent graft. The longitudinal diameter, transverse diameter, mean diameter, area and circumference of true lumen were measured. Then taper ratio, prestent grafting oversizing ratio, poststent grafting oversizing ratio, and expansion mismatch ratio of distal true lumen were calculated and compared between SINE group and non-SINE group.

**RESULTS**

SINE occurred in 21 patients (26.5%). SINE occurred more frequently in chronic dissection group than acute dissection group (32.3% vs 5.9%, P = 0.032). SINE event was not significantly different between modified and non-modified stent group (53.2% vs 46.8%, P = 0.615). Taper ratio, prestent oversizing ratio and poststent oversizing ratio were not significantly different in SINE and non-SINE group. Expansion mismatch ratio is significantly higher in SINE group than non-SINE groups in terms of longitudinal diameter (117.47 vs 104.44, P =0.0041), transverse diameter (147.00 vs 106.86, P <0.0001), mean diameter (137.46 vs 106.52, P <0.0001), area and circumference (136.72 vs 105.35, P =0.0004). 10 patients (47.6%) required re-intervention with surgery (n=4) or stent-graft (n=6).

**CONCLUSION**

SINE after TEVAR was more frequent in chronic aortic dissection than acute dissection. Expansion mismatch ratio was significantly higher in SINE group than non-SINE group.

CLINICAL RELEVANCE/APPLICATION

The time interval between diagnosis of aortic dissection and TEVAR is a factor predictive of late SINE event. SINE after TEVAR was more frequent in chronic aortic dissection than acute dissection.

**SSQ22-09** Diagnostic Accuracy of Axial Diameter Measurements for the Detection of Aneurysm Sac Enlargement after Endovascular Repair (EVAR) of Abdominal Aortic Aneurysms (AAA) by Computed Tomography (CT)

Participants

Michael Schnitzbauer, MSc, Berlin, Germany (Presenter) Nothing to Disclose
Oliver Guntert, Regensburg, Germany (Abstract Co-Author) Nothing to Disclose
Walter A. Wohlgemuth, Regensburg, Germany (Abstract Co-Author) Nothing to Disclose
Michael Haimerl, Regensburg, Germany (Abstract Co-Author) Nothing to Disclose
Florian Zeman, Regensburg, Germany (Abstract Co-Author) Nothing to Disclose
Thomas Herold, MD, Berlin, Germany (Abstract Co-Author) Nothing to Disclose
Christian R. Stroszczyński, MD, Regensburg, Germany (Abstract Co-Author) Nothing to Disclose
Rene Muller-Wille, Regensburg, Germany (Abstract Co-Author) Nothing to Disclose

**PURPOSE**

To evaluate the diagnostic accuracy of diameter measurements for the detection of aneurysm volume increase during follow-up after endovascular aneurysm repair (EVAR) of abdominal aortic aneurysms (AAA).
METHOD AND MATERIALS

We retrospectively analyzed 100 pairs of follow-up CT scans randomly picked from our EVAR database. The maximum aneurysm diameter was measured on axial planes (Dmax axial). The aneurysm sac volume was separately measured by manual segmentation (standard of reference).

RESULTS

Using a cut-off level of > 0 mm for diameter Dmax axial increased in 35 patients (mean 3.9 mm; range 1.0 to 31.0 mm). The aneurysm sac volume increased in 39 patients (mean, 25.7 cm³; range, 0.2 to 241 cm³). Dmax axial had a sensitivity/specificity of 74%/90%.

CONCLUSION

Overall dependent on the chosen cut-off, diameter measurements showed a low to moderate diagnostic accuracy for the detection of aneurysm sac enlargement after EVAR.

CLINICAL RELEVANCE/APPLICATION

Although broadly used in clinical practice diameter measurements seem to fail to detect size increase of the aneurysm sac during follow-up after EVAR.
Vascular Interventional Thursday Poster Discussions

Thursday, Dec. 3 12:15PM - 12:45PM Location: VI Community, Learning Center

Participants
Charles T. Burke, MD, Chapel Hill, NC (Moderator) Nothing to Disclose

Sub-Events

**VI241-SD-THA1**

Adrenal Venous Sampling in Patients with Primary Aldosteronism; Which is the Best Method for Evaluating an Indication for Surgery?

**PURPOSE**
To investigate the most accurate method of adrenal venous sampling (AVS) for the detection of primary aldosteronism, which can be evaluated as an indication for surgery.

**METHOD AND MATERIALS**
A total of 64 consecutive patients who were diagnosed as primary aldosteronism underwent AVS to find an indication for surgery in four years. The catheter was placed at two locations, such as common trunk below the confluence of inferior phrenic vein (CTV) and central adrenal vein (CAV) of the left adrenal vein, at one location in the right adrenal vein (RAV) and at one location in inferior vena cava (IVC). Adrenocorticotropic hormone (ACTH) was intravenously administered in all cases. Blood sampling was performed at same positions in both pre- and post-ACTH stimulations. Evaluating methods of AVS were lateralized ratio [LR; aldosterone/cortisol ratio (ACR) on the high-value side / ACR on the low-value side], contralateral ratio (CR; ACR on the low-value side / ACR on the IVC ratio) and plasma aldosterone concentration (PAC). Forty-nine bilateral lesions and 15 unilateral lesions (right 5, left 10) were diagnosed by comprehensive results of AVS and other imaging modalities. Adrenalectomy was performed in these 15 patients with unilateral lesions, and they were histologically confirmed to be adenomas or adrenal hyperplasias. When making decisions for surgical resection of unilateral adrenal involvement, the diagnostic accuracy for each method of AVS alone, such as LR, CR and PAC obtained by blood sampling placed in CTV/CAV/RAV at both pre- and post-ACTH stimulations, was compared by the receiver operating characteristic (ROC) analysis.

**RESULTS**
LR-CAV post-ACTH showed the highest detection rate for unilateral adrenal lesions (93.3%) with sensitivity (0.93) and specificity (0.84) at 2.5 of cut-off value. The area under the ROC curve (Az value) of LR-CTV post-ACTH (0.86), LR-CAV post-ACTH (0.87), CR pre-ACTH (0.85) and CR post-ACTH (0.89) were higher than those of other methods (0.510-0.794) of AVS. CR post-ACTH in particular had best Az value, with the detection rate (86.7%), sensitivity (0.98) and specificity (0.88) at 0.8 of cut-off value.

**CONCLUSION**
CR post-ACTH and LR-CAV post-ACTH allow the sensitive evaluation and high detection rate for AVS.

**CLINICAL RELEVANCE/APPLICATION**
In patients with primary aldosteronism, LR-CAV post-ACTH and CR post-ACTH lead to appropriate treatment, such as a surgical resection of unilateral adrenal involvement.

**VI242-SD-THA2**

Which CTA Measurement of Abdominal Aortic Aneurysm Should We Use For Follow Up?

**PURPOSE**
To evaluate the correlation between various measurements of abdominal aortic aneurysms in order to produce a reliable but concise protocol for 3D imaging lab Abdominal Aortic Aneurysm (AAA) CTA reconstructions.

**METHOD AND MATERIALS**
In this HIPAA-compliant, IRB-approved study, consecutive CTA studies performed for evaluation and follow up of AAA performed between 01/2006 to 03/2015 were included. All CTA studies in our institution undergo routine evaluation in a 3D Imaging lab by advanced CT technologists with the following measurements: single conventional axial measurement, bidimensional centerline...
measurements and volumes of: abdominal aneurysm sac; lowest renal artery to aortic bifurcation (Abd Aorta); and lowest renal artery to common iliac artery bifurcation (Abd Aorta to iliacs). Correlation coefficients between various measurements were calculated. The abdominal aortic volume (from lowest renal artery to aortic bifurcation) was used as reference standard due to consistent availability of the defining structures (renal artery and aortic bifurcation).

**RESULTS**

161 patients with 830 exams were included in the study. AAA axial diameter was 5.7±1.8cm with AAA volume of 164±150cc. There was excellent correlation between Abd Aorta and Abd Aorta and iliac volumes with correlation coefficient of 0.99. Similarly, very good correlation was seen between Abd Aorta and Aneurysm sac volume with correlation coefficient of 0.98. Good correlation was seen between Abd Aorta volume and AAA diameters, centerline and conventional axial with correlation coefficient of 0.89 and 0.88. There was excellent correlation between centerline aortic diameter and conventional axial diameter with correlation coefficient of 0.97.

**CONCLUSION**

Excellent correlation is seen between abdominal aortic volume and aneurysmal sac volume, between abdominal aorta and iliac volumes and between conventional axial and centerline AAA measurements. Good correlation was demonstrated between 2D axial measurements and volume. Thus, a single axial and single volume measurement is likely sufficient for follow up of abdominal aortic aneurysm.

**CLINICAL RELEVANCE/APPLICATION**

Single conventional axial diameter and abdominal aortic volume are sufficient for accurate follow up of AAA, as these measurements show excellent correlation with other available measurements of AAA.

### VI243-SD-THA3 The Effects of Aspirin Therapy on Renal Transplant Biopsy Bleeding Complications

**Participants**

- Francis Baffour, MD, Rochester, MN (Presenter) Nothing to Disclose
- Grant D. Schmitt, MD, Rochester, MN (Abstract Co-Author) Nothing to Disclose
- Anil N. Kurup, MD, Rochester, MN (Abstract Co-Author) Nothing to Disclose
- John J. Schmitz, MD, Rochester, MN (Abstract Co-Author) Nothing to Disclose
- LaTonya Hickson, MD, Rochester, MN (Abstract Co-Author) Nothing to Disclose
- Thomas D. Atwell, MD, Rochester, MN (Abstract Co-Author) Nothing to Disclose
- Rickey Carter, PhD, Rochester, MN (Abstract Co-Author) Nothing to Disclose
- Tina Gunderson, Rochester, MN (Abstract Co-Author) Nothing to Disclose

**PURPOSE**

To determine if aspirin therapy increases the risk of bleeding complications after renal transplant biopsy.

**METHOD AND MATERIALS**

Renal transplant biopsy cases were obtained from our prospectively acquired database on percutaneous image-guided biopsies. Potential risk factors for bleeding (including aspirin (ASA) use, platelet count, INR), and bleeding complications within 24 hrs (acute) and within 3 months (delayed) of biopsy were reviewed. Complications were graded based on the Society of Interventional Radiology criteria (Fig. 1).

**RESULTS**

46 (0.69%) bleeding complications occurred in 44 of the 6700 patients who underwent ultrasound-guided renal transplant biopsy between 9/2005 and 8/2014. This included 11 acute major, 29 acute minor and 6 delayed major complications. There were no permanent adverse sequelae or deaths. 70.2% of patients were not on ASA therapy or had taken their last dose of ASA prior to biopsy, 9.9% between 8-10 days, 12.8% between 4-7 days and 7.1% between 0-3 days prior to biopsy. For the outcome of 'any complication' (major or minor), the final regression model included ASA use, INR, and platelet count (AUC 0.677), with p-values of <0.05, 0.10 and 0.066 respectively. These variables did not show any collinearity. For the outcome of 'major complication', ASA category and platelet count were included in the final model, but neither was statistically significant. ASA categories were then dichotomized by exposure time: '0-3 days group' vs. '3 days group'. For 'any complication', ASA use had a p-value <0.01 and platelet count had a p-value <0.05 (AUC 0.634). For 'major complications', both the ASA category and platelet count were also found to be significant (p-values <0.01, <0.05; AUC 0.714). 'Any complication' rate in the >3 days group was 0.58% (95% CI 0.42-0.80%), and in the 0-3 days group it was 1.68% (95% CI 0.86-3.29%). 'Major complication' rate in the >3 days group was 0.19% (95% CI 0.11-0.34%), and in the 0-3 days group it was 0.84% (95% CI 0.33-2.14%).

**CONCLUSION**

There is a significant increase in bleeding complications when ASA therapy is continued within 3 days of renal transplant biopsy, but even in this group, the bleeding complication rate is extremely low.

**CLINICAL RELEVANCE/APPLICATION**

Determination of risk factors associated with post-procedure bleeding risk at time of renal allograft biopsy can help inform decisions to delay or pursue biopsy for the purpose of obtaining important diagnostic information.

### VI240-SD-THA4 Dual-Energy CT Angiography of the Abdominal Aorta using an Advanced Monoenergetic Algorithm: Impact on Selection of Optimal Energy Level and Image Quality

**Participants**

- Daniele Marin, MD, Cary, NC (Presenter) Nothing to Disclose
- Juan Carlos Ramirez-Giraldo, PhD, Malvern, PA (Abstract Co-Author) Employee, Siemens AG
- Cole Denton, MD, Durham, NC (Abstract Co-Author) Nothing to Disclose
- Sonia Gupta, MD, Newark, DE (Abstract Co-Author) Nothing to Disclose

**PURPOSE**

To determine if energy level and image quality.

**METHOD AND MATERIALS**

161 patients with 830 exams were included in the study. AAA axial diameter was 5.7±1.8cm with AAA volume of 164±150cc. There was excellent correlation between Abd Aorta and Abd Aorta and iliac volumes with correlation coefficient of 0.99. Similarly, very good correlation was seen between Abd Aorta and Aneurysm sac volume with correlation coefficient of 0.98. Good correlation was seen between Abd Aorta volume and AAA diameters, centerline and conventional axial with correlation coefficient of 0.89 and 0.88. There was excellent correlation between centerline aortic diameter and conventional axial diameter with correlation coefficient of 0.97.

**CONCLUSION**

Excellent correlation is seen between abdominal aortic volume and aneurysmal sac volume, between abdominal aorta and iliac volumes and between conventional axial and centerline AAA measurements. Good correlation was demonstrated between 2D axial measurements and volume. Thus, a single axial and single volume measurement is likely sufficient for follow up of abdominal aortic aneurysm.

**CLINICAL RELEVANCE/APPLICATION**

Single conventional axial diameter and abdominal aortic volume are sufficient for accurate follow up of AAA, as these measurements show excellent correlation with other available measurements of AAA.

**PRIOR APPROVAL**

No
PURPOSE
To investigate the impact of an advanced monoenergetic reconstruction algorithm on the selection of the optimal energy level and image quality during dual-energy CT (DECT) angiography of the abdominal aorta.

METHOD AND MATERIALS
This retrospective, single-center HIPAA-compliant study was IRB-approved and informed patient consent was waived. Fifty patients (35 men, 15 women) underwent DECT (80/Sn140 kVp) in the arterial phase, with a dual-source CT system (Siemens Definition Flash). Datasets at energy levels ranging from 40 to 100 keV, 10 keV increments, were reconstructed using conventional and advanced monoenergetic algorithms (Syngo DE Monoenergetic and Monoenergetic Plus, respectively). The advanced monoenergetic algorithm applies energy domain filtering to improve the image noise at low keV reconstructions. Noise, aortic contrast, and aortic contrast-to-noise ratio (CNR) were calculated and compared. Generalized estimating equation was used to identify optimal monoenergetic-energy level to maximize the aortic CNR. The effect on CNR of the patient’s body size was also assessed. Subjective assessment of image quality was performed on transverse and volume rendered reconstructed images.

RESULTS
Compared to the conventional algorithm, the advanced monoenergetic algorithm yielded significantly reduced noise at 40, 50, 60, 90 and 100 keV (P < .001, for all energies). Aortic CNR increased significantly with the advanced monoenergetic algorithm, for all reconstructed energies (P <0.01, for all energies). For all patient sizes, the highest aortic CNR was achieved at 40 keV with the advanced algorithm, but ranged from 60 to 80 keV with the conventional algorithm. Aortic CNR improved by approximately 70% with the advanced compared to conventional algorithm (Mean [SD] = 23.6 [12.7] at 40 keV vs. 16.5 [8.7] at 70 keV, respectively; P <.001). Qualitative image quality scores were consistently higher at 40 keV using the advanced monoenergetic algorithm.

CONCLUSION
The 40 keV images reconstructed using an advanced monoenergetic algorithm significantly improve image quality of DECT angiography of the aorta, while simultaneously decreasing the variability introduced by patient’s body weight in selecting the optimal energy level.

CLINICAL RELEVANCE/APPLICATION
An advanced monoenergetic algorithm can improve the image quality of aortic DECT angiography examinations and concomitantly streamline the utilization of DECT postprocessing techniques.
Types of Chemotherapeutics May Affect the Degree of Vascular Damage of the Liver after Transarterial Chemoembolization for Hepatocellular Carcinoma

Participants
Charles T. Burke, MD, Chapel Hill, NC (Moderator) Nothing to Disclose

Toshimichi Mitsufuji, Fukuoka, Japan (Presenter) Nothing to Disclose
Shinichi Kora, Fukuoka, Japan (Abstract Co-Author) Nothing to Disclose
Akinobu Osame, Fukuoka, Japan (Abstract Co-Author) Nothing to Disclose
Kengo Yoshimitsu, MD, Fukuoka, Japan (Abstract Co-Author) Nothing to Disclose

PURPOSE
To assess the relationship between the types of chemotherapeutics and degree of vascular damage of the liver after transarterial chemoembolization (TACE) in patients with hepatocellular carcinoma (HCC), we retrospectively evaluated the serum level of thrombomodulin (sTM), which has been known to be a marker of systemic vascular damage, in 51 patients (Part 1), and also evaluated chronological angiographic findings in other 46 patients who underwent repetitive TACE (Part 2).

METHOD AND MATERIALS
Part 1: Between 2012 and 2013, 51 patients who underwent TACE for HCC (n=6) were retrospectively recruited. The ratio of sTM (rTM = post-TACE/pre-TACE) were correlated to various clinicoradiological factors using univariate and multivariate analyses. Part 2: Between 2000 and 2013, 46 patients who underwent TACE more than 5 times were retrospectively recruited. Degree of vascular damage was assessed at the level of the 2nd order branches of hepatic artery on the angiography performed at the next TACE using 4-point score. Scores were assigned for each chemotherapeutic, the sum of which were compared among them.

RESULTS
Part 1: rTM peaked at day 1, and returned to the pre-TACE level at day 7. rTM were large in the descending order of Cisplatinum (CIS, n=17), Epirubicin (EPI, n=15), and Miriplatin (MPT, n=19) (p=0.02). Among various factors assessed, number of the tumors, pre-TACE sTM, size of HCC, the types of chemotherapeutics, and the embolized liver volume were related to rTM. Stepwise regression analysis revealed the latter three factors were independently significant (p<0.05).Part 2: In 46 patients, 23, 126, and 26 TACE sessions were performed with EPI, CIS, and MPT, with their scores being 1.18 ± 0.14, 0.94 ± 0.06, and 0.58 ± 0.13, respectively. There were significant difference in the scores between MPT vs both EPI (p<0.01) and CIS (p<0.05, Steel-Dwass test). Short term therapeutic effects were not significantly different among three chemotherapeutics in both Part 1 and Part 2 studies.

CONCLUSION
MPT was suggested to cause less vascular damage after TACE than EPI and CIS.

CLINICAL RELEVANCE/APPLICATION
MPT causes less vascular damage in the liver as compared to EPI and CIS, which should be taken into account when selecting chemotherapeutics for TACE, to preserve liver function for the future procedures.
highlighting advantages and disadvantages in comparison to CE-MRA, US, and where applicable, DSA. The exhibit will conclude with a recommended strategy to optimize clinical NC-MRA protocols in the chest, abdomen/pelvis, and extremities.
### Setting the Stage: NCCN/ESMO Guidelines for mCRC

**Participants**
Mary F. Mulcahy, MD, Chicago, IL  
(Presenter) Nothing to Disclose

**LEARNING OBJECTIVES**
1) To identify the role and timing of surgical resection of metastatic colorectal cancer in improving survival of patients. 2) To identify potential pitfalls and risks in implementing surgical resection with regional therapies to the liver. 3) To understand the evolving role of hepatic arterial infusional therapy in the management of patients with unresectable CRLM.

### Advances in the Surgical Toolbox for Colorectal Liver Metastases

**Participants**
Kiran Turaga, Milwaukee, WI  
(Presenter) Speakers Bureau, Caris Life Sciences; Consultant, Johnson & Johnson

**LEARNING OBJECTIVES**
1) To understand the role of ablation for colorectal metastases. 2) To identify which patients may be the best candidates for ablation. 3) To review the advantages/disadvantages of the liver ablation technologies.

### Colorectal Liver Metastases: To Ablate or not to Ablate?

**Participants**
David A. Woodrum, MD, PhD, Rochester, MN  
(Presenter) Nothing to Disclose

**LEARNING OBJECTIVES**
1) To understand the role of ablation for colorectal metastases. 2) To identify which patients may be the best candidates for ablation. 3) To review the advantages/disadvantages of the liver ablation technologies.

### K-ras Mutation is Associated with a Shorter Overall Survival after RF Ablation of Colorectal Liver Metastases

**Participants**
Waleed Shady, MBBCh, New York, NY  
(Presenter) Nothing to Disclose  
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(Abstract Co-Author) Nothing to Disclose

**PURPOSE**
To describe the incidence and patterns of genetic marker mutations, and to evaluate their potential prognostic value on local tumor progression (LTP)-free and overall survival (OS) after RFA of colorectal cancer liver metastases (CLM).
We performed an IRB approved retrospective review of a HIPPA compliant clinical ablation database for patients with CLM treated with RFA between December 2002 and December 2012. Only patients with available genetic testing profiles were included. Genetic profiles were obtained by mass-spectrometry based sequenom assay of surgical/biopsy specimens obtained from primary/metastatic sites. Genes analyzed for mutations included: (1) K-ras, (2) K-ras and BRAF, or (3) an 8 gene panel (K-ras, N-ras, BRAF, PIK3CA, Akt1, MEK1, ERBB2, and EGFR). Kaplan-Meier methodology was used to calculate LTP-free and OS rates. The log-rank test was used to evaluate the prognostic value of genetic marker mutations.

RESULTS

This study enrolled 90 patients with 139 CLM. Median tumor size was 1.7 cm (range: 0.6-5 cm). The median follow-up was 52 months. Results for the mutation status were available for k-ras in all patients, for BRAF in 58 patients, and for the 8 genes in 23 patients. K-ras was mutated in 40% of patients (36/90), BRAF in 7% (4/58), PIK3CA in 17% (4/23), N-ras in 9% (2/23), and no mutations were observed for the other genes. There was a trend towards shorter median OS in patients with mutated genes; K-ras (29 months versus 46 months), BRAF (22 months versus 53 months), PIK3CA (22 months versus 51 months), N-ras (8 months versus 51 months). Statistical significance was only reached for K-ras (P=0.037) and N-ras (P=0.001), but not for BRAF (P=0.18) and PIK3CA (P=0.8). There was no difference in the LTP-rates with mutations of K-ras 46% (22/48) versus 42% (38/90) (P=0.69), BRAF 32% (2/6) versus 39% (43/88) (P=0.69), PIK3CA 0% (0/5) versus 39% (15/38) (P=0.16), or N-ras 50% (1/2) versus 34% (14/41) (P=0.17). There was a trend towards shorter LTP-free survival with K-ras mutations; median of 26 months versus 37 months.

CONCLUSION

Mutations of K-ras and N-ras are associated with a shorter overall survival after RFA of CLM. Mutations of K-ras are associated with a shorter LTP-free survival, although LTP rate was not statistically different.

CLINICAL RELEVANCE/APPLICATION

K-ras mutant patients require more strict follow-up and could benefit from adjuvant chemotherapy after RFA of CLM.

METHOD AND MATERIALS

To identify a gene mutation signature that may potentially be used to predict tumor response to hepatic arterial embolization.
CONCLUSION
A gene mutation signature suggests that tumor response to embolization may be predicted by the underlying mutation profile of the tumor and moreover, suggests a central role for the involvement of hypoxia and Wnt/B-catenin signaling pathways.

CLINICAL RELEVANCE/APPLICATION
A gene signature that can predict tumor response to embolization may be used to better stratify patients as well as potentially broaden the scope of embolization to liver metastases not traditionally treated by this procedure.

VSO151-07 Delayed-arterial Phase Cone-Beam CT Improves the Visibility of Liver Metastasis during Intra-arterial Therapy

Thursday, Dec. 3 2:50PM - 3:00PM Location: S405AB

Participants
Ruediger E. Schermenthaner, MD, Vienna, Austria (Presenter) Nothing to Disclose
Reham R. Haroun, Salt Lake City, UT (Abstract Co-Author) Nothing to Disclose
Rafael Duran, MD, Baltimore, MD (Abstract Co-Author) Nothing to Disclose
Howard Lee, New Haven, CT (Abstract Co-Author) Nothing to Disclose
Sonia P. Sahu, New Haven, CT (Abstract Co-Author) Nothing to Disclose
Jae Ho Sohn, MD, MS, New Haven, CT (Abstract Co-Author) Nothing to Disclose
Julius Chapiro, MD, Berlin, Germany (Abstract Co-Author) Nothing to Disclose
Yan Zhao, MS, Baltimore, MD (Abstract Co-Author) Nothing to Disclose
Boris Gorodetski, Baltimore, MD (Abstract Co-Author) Nothing to Disclose
Florian N. Fleckenstein, MS, New Haven, CT (Abstract Co-Author) Nothing to Disclose
Susanne Smolka, New Haven, CT (Abstract Co-Author) Nothing to Disclose
Ming De Lin, PhD, Cambridge, MA (Abstract Co-Author) Employee, Koninklijke Philips NV
Alessandro G. Radaelli, PhD, MS, Best, Netherlands (Abstract Co-Author) Employee, Koninklijke Philips NV
Martijn Van Der Bom, MSC, Andover, MA (Abstract Co-Author) Employee, Koninklijke Philips NV
Jean-Francois H. Geschwind, MD, Westport, CT (Abstract Co-Author) Researcher, BTG International Ltd; Consultant, BTG International Ltd; Researcher, Koninklijke Philips NV; Consultant, Koninklijke Philips NV; Researcher, Guerbet SA; Consultant, Guerbet SA; Consultant, Terumo Corporation; Consultant, Threshold Pharmaceuticals, Inc; Consultant, PreScience Labs, LLC; Researcher, Boston Scientific Corporation; Consultant, Boston Scientific Corporation

PURPOSE
Improved visibility of liver metastasis during intra-arterial therapy (IAT) could improve tumor targeting. The purpose of this study was to compare the visibility of liver metastasis on dual-phase cone-beam CT (DP-CBCT) and digital subtraction angiography (DSA), with reference to pre-interventional contrast-enhanced magnetic resonance imaging (CE-MRI) of the liver.

METHOD AND MATERIALS
Of 416 patients with liver metastasis treated with IAT between January 2010 and October 2014 at our institution, 15, 10 and 3 patients with neuroendocrine, colorectal and sarcoma liver metastasis (NELM, CRCLM and SLM), respectively, had intra-procedural DP-CBCT and were included in this retrospective study. DP-CBCT was acquired after a single injection of contrast agent in the tumor-feeding arteries at an early and delayed arterial phases (EAP and DAP). The visibility of each lesion was graded by two radiologists in consensus on a three rank scale (complete, partial and none) on DP-CBCT and DSA images when compared to CE-MRI. McNemar's test was used.

RESULTS
47 NELM, 45 CRCLM and 16 SLM lesions were included. On DSA, 59.6%, 15.6% and 18.8% of NELM, CRCLM and SLM lesions were completely depicted, respectively. Complete depiction rate on EAP-CBCT was significantly higher for CRCLM (44.4%; p<0.001), but significantly lower for NELM (40.4%; p=0.049) and similar for SLM (25%, p=1.0). On DAP-CBCT however, the highest rates of complete depiction were found - NELM (97.1%), CRCLM (91.1%) and SLM (100%), all p<0.001. Complete or partial depiction was achieved on DSA for 85.1%, 42.2% and 37.5% of NELM, CRCLM and SLM, respectively. EAP-CBCT yielded significantly higher sensitivities of 84.4% and 87.5% for CRCLM and SLM, respectively (p<0.02), but not for NELM (89.4%; p=0.625). DAP-CBCT again demonstrated the highest sensitivity at 100%, 95.6% and 100% for NELM, CRCLM and SLM, respectively (p<0.002). In summary, out of 108 metastatic liver lesions, 106 (98.1%) were at least partially depicted and only 2 (1.9%) CRCLM could not be identified on DAP-CBCT. In contrast, 43 (39.8%) lesions could not be identified on DSA.

CONCLUSION
DAP-CBCT significantly improves the visibility of liver metastasis during IAT and should be used as standard intra-procedural imaging technique.

CLINICAL RELEVANCE/APPLICATION
Improved visibility of metastatic liver lesions facilitates a more selective treatment to reduce non-target embolization without missing some lesions occult on DSA.

VSO151-08 mCRC Tumor Board

Thursday, Dec. 3 3:00PM - 3:30PM Location: S405AB

Participants
Michael C. Soulen, MD, Philadelphia, PA (Presenter) Royalties, Cambridge University Press; Consultant, Guerbet SA; Research support, Guerbet SA; Consultant, BTG International Ltd; Research support, BTG International Ltd; Consultant, Merit Medical Systems, Inc; Speaker, Sirtex Medical Ltd
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Mary F. Mulcahy, MD, Chicago, IL (Presenter) Nothing to Disclose
Kiran Turaga, Milwaukee, WI (Presenter) Speakers Bureau, Caris Life Sciences; Consultant, Johnson & Johnson
David A. Woodrum, MD, PhD, Rochester, MN (Presenter) Nothing to Disclose
Tobias F. Jakobs, MD, Munich, Germany, (tobias.jakobs@barmherzige-muenchen.de) (Presenter) Speaker, Sirtex Medical Ltd;
LEARNING OBJECTIVES

ABSTRACT

VSIO51-09 Setting the Stage mNET

Thursday, Dec. 3 3:40PM - 3:55PM Location: S405AB

Participants
Emily Bergsland, MD, San Francisco, CA (Presenter) Research funding, Novartis AG Research support, F. Hoffmann-La Roche Ltd Consultant, Pfizer Inc Consultant, Lexicon Pharmaceuticals, Inc Consultant, Novartis AG

LEARNING OBJECTIVES
1) Review the epidemiology and classification of gastroenteropancreatic neuroendocrine tumors (GEPNETs). 2) Discuss the role of somatostatin analogs for the treatment of GEPNETs. 3) Summarize the current systemic treatment options for metastatic GEPNETs. 4) Examine commonly applied treatment algorithms for advanced GEPNETs.

ABSTRACT

VSIO51-10 Aggressive Surgical Management in mNET

Thursday, Dec. 3 3:55PM - 4:10PM Location: S405AB

Participants
Robert E. Roses, MD, Philadelphia, PA (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
1) Discuss the role of liver resection or ablation in the multidisciplinary management of neuroendocrine tumors.

ABSTRACT

The management of neuroendocrine tumors has evolved considerably in recent years with the introduction of new systemic and local therapies. Surgery remains an important component of therapy. Indications for surgery for primary tumors and metastases as well nuances of therapy sequencing and multidisciplinary decision making will be discussed.

VSIO51-11 Imaging Biomarkers of Tumor Response in Neuroendocrine Liver Metastases Treated with Intraarterial Therapy: Can Whole Liver Response Patterns Predict Patient Survival?

Thursday, Dec. 3 4:10PM - 4:20PM Location: S405AB

Participants
Sonia P. Sahu, New Haven, CT (Presenter) Nothing to Disclose
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Rafael Duran, MD, Baltimore, MD (Abstract Co-Author) Nothing to Disclose

PURPOSE

Neuroendocrine liver metastases (NELM) usually appear diffuse and bi-lobar. However, conventional therapy response assessments (WHO, RECIST, mRECIST, and EASL) are lesion-based and thus challenging to implement in NELM patients. We propose a new approach that uses 3D liver segmentation to assess the total enhancing tumor volume (ETV). The purpose of this study was to investigate whether changes in ETV on contrast-enhanced T1 weighted MRI could be an early biomarker for survival after the first transarterial chemoembolization (TACE).

METHOD AND MATERIALS

This retrospective study included 51 patients (men: 28; median age: 58.3 years) with diffuse bi-lobar NELM who underwent MRI 3-6 weeks before and after the first TACE. Using prototype semi-automatic 3D software, two independent readers segmented the whole liver, placed a 1 cm3 region of interest (ROI) in healthy liver parenchyma, and measured the ETV in the arterial phase. Enhancement was defined as >2 standard deviations the average intensity of the ROI. Intraclass correlation (ICC) assessed inter-reader agreement. Paired t-test compared the ETV before and after TACE. If ETV decreased by ≥ 50%, patients were classified as responders. Survival analysis included Kaplan-Meier curves with the log-rank test and Cox-proportional hazards modeling. Baseline characteristics that were statistically significant on univariate analysis were adjusted for in the multivariate model.

RESULTS

Mean ETV decreased significantly after TACE from 1432.6 to 826.6 cm3 (p <0.01) and 20 (39.2%) patients were classified as responders. Responders had a significantly better prognosis than non-responders, with a median overall survival of 84.3 vs. 16.7 months, respectively (p<0.01). In univariate analysis, response was a significant predictor of survival (HR: 0.15, 95% CI: 0.06-0.39) and in the multivariate model adjusted for ECOG ≥1, portal vein thrombosis and extrahepatic disease, response was the only significant covariate (HR: 0.21, 95% CI: 0.08-0.60). Inter-reader agreement was high before and after TACE (ICC 0.999, 95% CI: 0.998-0.999, respectively).
**CONCLUSION**

Changes in the total enhancing tumor volume can identify NELM patients who will experience prolonged survival as early as 1 month after TACE.

**CLINICAL RELEVANCE/APPLICATION**

Total enhancing tumor volume in 3D is recommended as an early imaging biomarker for survival in NELM patients treated with TACE.

**VSIO51-12 Intra-arterial Therapies of GEP-NET: Techniques and Indications**

*Thursday, Dec. 3 4:20PM - 4:35PM Location: S405AB*

**Participants**

Thiéry J. De Baere, MD, Villejuif, France *(Presenter)* Consultant, Terumo Corporation; Speaker, Medtronic, Inc; Consultant, General Electric Company; Consultant, Guerbet SA;

**LEARNING OBJECTIVES**

1) To understand particular natural history of NET metastases and indication for local therapies. 2) To know intra-arterial therapies available for NET inclusion bland embolization, TACE and radioembolization. 3) To know published results on efficacy of intra-arterial therapies on NET liver metastases. 4) To know about possible complications of intra-arterial therapies on NET liver metastases.

**ABSTRACT**

gastro-entero pancreatic-neuroendocrine tumors (GEP-NET) from small intestine and pancreas are most common cause of NET liver metastases. Grade 1 (carcinoid / < 2 mitoses / 10 microscopic fields and Ki-67 < 2%) and grade 2 (well- differentiated / 2 to 20 mitoses and Ki-67 from 3 to 20%) (1) are potential candidate for liver directed therapies where G3 carcinoma are candidate for systemic treatment (2). For secretary syndrome, liver directed therapies are second line treatment after somatostatin analogs. For control of tumor growth, liver directed therapies are used upon progression or for large tumor burden. Intra-arterial therapies combine occlusion of the tumor feeders, with or without chemotherapy or radiation therapy including trans-arterial chemoembolization (TACE), trans-arterial embolization (TAE), and radioembolization (RE). GEP NET liver metastases are usually bilobar and two sessions of treatment will be delivered sequentially 4-8 weeks apart to each lobes. If the tumors are in small number, hyper-selective will be delivered. Patients with >75% of liver involvement must be treated a few segments of liver at once, and will require several sessions. Contraindications includes liver insufficiency, obstructive jaundice, biliaryenteric anastomoses, portal vein thrombosis and renal insufficiency (3). In biliaryenteric anastomoses or portal vein thrombosis RE could be an interesting alternative in early reports (4). TACE using Lipiodol used for more than 20 years provides 52-86% response on the secretory syndrome for over 12 months (5, 6). OS has a median of 36.8 months (33-55 months for non-pancreatic-NET and 23-43 months for pancreatic-NET) (7-9). Our recent unpublished data highlight a median OS of 70 months, with no radiation-induced liver disease (10). Grade 3 or higher adverse events were fatigue (6.5%), nausea (3.2%), pain (2.7%), and ascites (0.5%).

**VSIO51-13 Y-90-4mNET**

*Thursday, Dec. 3 4:35PM - 4:50PM Location: S405AB*

**Participants**

Steven C. Rose, MD, San Diego, CA *(Presenter)* Stockholder, Sirtex Medical Ltd; Proctor, Sirtex Medical Ltd; Scientific Advisory Board, Surefire Medical, Inc; Consultant, Surefire Medical, Inc; Consultant, Emboly, Inc

**VSIO51-14 SW43-DOX Loaded DEB-TACE, a Potential New Drug Delivery Platform - An in Vitro Evaluation**

*Thursday, Dec. 3 4:50PM - 5:00PM Location: S405AB*

**Participants**

Johannes M. Ludwig, Pittsburgh, PA *(Presenter)* Nothing to Disclose

Yongkang Gai, Pittsburgh, PA *(Abstract Co-Author)* Nothing to Disclose

Sun Lingyi, Pittsburgh, PA *(Abstract Co-Author)* Nothing to Disclose

Dexing Zeng, Pittsburgh, PA *(Abstract Co-Author)* Nothing to Disclose

Hyun S. Kim, MD, Atlanta, GA *(Abstract Co-Author)* Nothing to Disclose

**RESULTS**

Fluorescence Microscopy showed specific binding of SW43-DOX-Cy3 in Panc-1, HT-29 & HEPG2 cells. Panc-1 cells showed a specific uptake of SW43-DOX-Lu177 at .5h (0.83 nmol/mg prot.), which increased to 1.36 and 1.21 nmol/mg prot. at .5h and 3h (p<.01) respectively. Compared to DOX, SW43-DOX demonstrated significantly superior viability reduction (at least p<.01 for all comparison) of Panc-1 cells treated with DOX or SW43-DOX: 98.7% vs. 64% (25μM) and 88.3% vs. 33.3% (50μM) after 6h; 46.6% vs. 30.6% (25μM) and 39.5% vs. 5.3% (50μM) after 24 h and 15% vs. 2.9% (25μM) and 9.5% vs. 0.54% (50μM) after 48 h. Results from HEPG2, besides 25 μM (6h) & 50 μM (48h), and HT-29 cells also proved statistical superiority of SW43-DOX over DOX (p<.01). Loading on DEB was 95% within 24h.

**CLINICAL RELEVANCE/APPLICATION**

Preclinical Evaluation.

**VSIO51-15 Theranostic Approaches to the Management of Neuroendocrine Tumors**

*Thursday, Dec. 3 5:00PM - 5:15PM Location: S405AB*

**Participants**

Chaitanya Divgi, MD, New York, NY *(Presenter)* Nothing to Disclose

**VSIO51-16 Intra-arterial Therapy in Liver Metastases: The 5 Best Papers of the Past Year?**
Thursday, Dec. 3 5:15PM - 5:30PM Location: S405AB

Participants
Ricardo D. Garcia-Monaco, MD, PhD, Buenos Aires, Argentina (*Presenter*) Consultant, CeloNova BioSciences, Inc.; Consultant, BTG International Ltd; Speaker, Siemens AG

LEARNING OBJECTIVES

1) To comprehend 5 interesting papers of the last year on intrarterial therapies of liver metastasis. 2) To update the evidence on mCRC intrarterial therapies. 3) To discuss the best laboratory research paper on the topic. 4) To discuss the largest published series on Y90 radioembolization outcome in mCRC. 5) To update the intrarterial therapies in mNET.

**VSIO51-17  mNET Tumor Board**

Thursday, Dec. 3 5:30PM - 6:00PM Location: S405AB

Participants
Michael C. Soulen, MD, Philadelphia, PA (*Presenter*) Royalties, Cambridge University Press; Consultant, Guerbet SA; Research support, Guerbet SA; Consultant, BTG International Ltd; Research support, BTG International Ltd; Consultant,Merit Medical Systems, Inc; Speaker, Sirtex Medical Ltd
Sarah B. White, MD, MS, Philadelphia, PA, (sbwhite@mcw.edu) (*Presenter*) Nothing to Disclose
Emily Bergsland, MD, San Francisco, CA (*Presenter*) Research funding, Novartis AG Research support, F. Hoffmann-La Roche Ltd Consultant, Pfizer Inc Consultant, Lexicon Pharmaceuticals, Inc Consultant, Novartis AG
Robert E. Roses, MD, Philadelphia, PA (*Presenter*) Nothing to Disclose
Thierry J. De Baere, MD, Villejuif, France (*Presenter*) Consultant, Terumo Corporation; Speaker, Medtronic, Inc; Consultant, General Electric Company; Consultant, Guerbet SA;
Chaitanya Divgi, MD, New York, NY (*Presenter*) Nothing to Disclose
Ricardo D. Garcia-Monaco, MD, PhD, Buenos Aires, Argentina (*Presenter*) Consultant, CeloNova BioSciences, Inc.; Consultant, BTG International Ltd; Speaker, Siemens AG
RSNA Diagnosis Live™: Peds, IR, Potpourri

Thursday, Dec. 3 3:00PM - 4:00PM Location: E451B

AMA PRA Category 1 Credit ™: 1.00
ARRT Category A+ Credit: 1.00

Participants
Paul J. Chang, MD, Chicago, IL, (pchang@radiology.bsd.uchicago.edu) (Presenter) Co-founder, Stentor/Koninklijke Philips NV; Researcher, Koninklijke Philips NV; Medical Advisory Board, lifeIMAGE Inc; Medical Advisory Board, Merge Healthcare Incorporated
Brian S. Funaki, MD, Riverside, IL (Presenter) Data Safety Monitoring Board, Novate Medical
Kate A. Feinstein, MD, Chicago, IL, (kfeinstein@radiology.bsd.uchicago.edu) (Presenter) Nothing to Disclose

LEARNING OBJECTIVES

1) The participant will be introduced to a series of radiology case studies via an interactive team game approach designed to encourage "active" consumption of educational content. 2) The participant will be able to use their mobile wireless device (tablet, phone, laptop) to electronically respond to various imaging case challenges; participants will be able to monitor their individual and team performance in real time. 3) The attendee will receive a personalized self-assessment report via email that will review the case material presented during the session, along with individual and team performance. This interactive session will use RSNA Diagnosis Live™. Please bring your charged mobile wireless device (phone, tablet or laptop) to participate.
**RC703**

**Imaging for Catheter Based Cardiac Intervention (TAVR, EP Procedures, Mitral Procedures)**

*Thursday, Dec. 3 4:30PM - 6:00PM Location: N229*

**Participants**

**Sub-Events**

**RC703A  Mitral Valve Interventions**

Participants
Philipp Blanke, MD, Vancouver, BC (phil.blanke@gmail.com) *(Presenter)* Consultant, Edwards Lifesciences Corporation; Consultant, Neovasc Inc

**LEARNING OBJECTIVES**

1) To review the anatomy and normal appearance of the mitral apparatus on cardiac CT. 2) To review common mitral valve pathologies including mitral annular calcifications, myxomatous degeneration, mitral valve prolapse and mitral stenosis and their appearance on cardiac CT. 3) To learn about recent advances in transcatheter mitral valve interventions and the role of preoperative computed-tomography.

**ABSTRACT**

1. To review the anatomy and normal appearance of the mitral apparatus on cardiac CT. 2. To review common mitral valve pathologies including mitral annular calcifications, myxomatous degeneration, mitral valve prolapse and mitral stenosis and their appearance on cardiac CT. 3. To learn about recent advances in transcatheter mitral valve interventions and the role of preoperative computed-tomography.

**RC703B  The Role of Imaging prior to TAVR**

Participants
Jonathon A. Leipsic, MD, Vancouver, BC *(Presenter)* Speakers Bureau, General Electric Company; Speakers Bureau, Edwards Lifesciences Corporation; Consultant, Heartflow, Inc; Consultant, Circle Cardiovascular Imaging Inc

**LEARNING OBJECTIVES**

1) Discuss the historical role of CTA in TAVR planning. 2) Review more recent data defining new applications for CT in TAVR planning. 3) Help define the potential future applications and role of MDCT in the future with new devices being introduced into the field.

**Honored Educators**

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

**RC703C  Imaging to Inform Electrophysiology (EP) and Other Interventions**

Participants
Eric E. Williamson, MD, Rochester, MN (Williamson.eric@mayo.edu) *(Presenter)* Research Grant, General Electric Company

**LEARNING OBJECTIVES**

1) Discuss the use of CT for preprocedure planning and postprocedure follow-up of electrophysiology (EP) interventions. 2) Describe expected and important unexpected findings on preprocedure CT used to guide EP intervention. 3) Describe common and uncommon complications of EP intervention as seen on postprocedure CT.

**ABSTRACT**

1. Discuss the use of CT for preprocedure planning and postprocedure follow-up of electrophysiology (EP) interventions. 2. Describe expected and important unexpected findings on preprocedure CT used to guide EP intervention. 3. Describe common and uncommon complications of EP intervention as seen on postprocedure CT.
LEARNING OBJECTIVES

1) Decide on the appropriate patients to undergo venous ablation. 2) Know various tools used for venous ablation. 3) Understand some of the issues of large vein occlusions and possible treatments. 4) Gain familiarity with the presentation pelvic congestion and varicocele. 5) Have a familiarity with the treatment of pelvic congestion and varicoceles.

ABSTRACT

Lower leg varicosities are a very common problem. Over the last 10 years there has been increasing interest in the percutaneous treatment of varicosities. The patient population with varicosities, the presentation of varicosities, and the treatment of varicosities will be presented. Other venous anomalies can worsen the symptoms of varicosities and may need to be treated. These include May-Thurner syndrome, pelvic congestion, and the male variant of pelvic congestion syndrome (varicoceles). The patient population, symptoms and presentations, and the treatment of these other venous abnormalities will also be discussed.

Active Handout: Gerant M. Rivera-Sanfeliz

Common Spinal Injection Procedures for Diagnosis and Treatment of Back Pain (Hands-on)

Thursday, Dec. 3 4:30PM - 6:00PM Location: E263

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants
A. Orlando Ortiz, MD, MBA, Mineola, NY (Presenter) Nothing to Disclose
Bassem A. Georgy, MD, MSc, San Diego, CA (Presenter) Consultant, Johnson & Johnson; Consultant, DFINE, Inc; Stockholder, DFINE, Inc; Stockholder, Spine Solutions, Inc;
Allan L. Brook, MD, Bronx, NY (Presenter) Advisor, Johnson & Johnson Advisor, Medtronic, Inc
Afshin Gangi, MD, PhD, Strasbourg, France (Presenter) Nothing to Disclose
Todd S. Miller, MD, Bronx, NY, (tmiller@montefiore.org) (Presenter) Nothing to Disclose
Stanley Golovac, MD, Merritt Island, FL (Presenter) Consultant, St. Jude Medical, Inc; Investigator, Vertos Medical Inc; Investigator, St. Jude Medical, Inc

LEARNING OBJECTIVES
1) Describe and demonstrate methods for patient selection, evaluation and technique for Image-guided injection procedures used in spine pain management. 2) These procedures will include epidural steroid injections, nerve root blocks, facet blocks, sacroiliac joint injections, lumbar synovial cyst therapy, radiofrequency ablations. 3) Review procedural complications and how to avoid them. 4) Discuss pertinent anatomy, instruments and pharmacology. 5) These objectives will be accomplished using didactic lectures complemented by procedure videos, supervised hands on lab work with training models and round table case discussions.

ABSTRACT
Neck and back pain complaints are very common in the general population. Radiologists can contribute to the diagnosis and management in patients who are not responding to conservative management. Spine injection procedures can frequently be performed on an outpatient basis with a brief recovery phase. These procedures are performed with imaging guidance, such as a multi-directional fluoroscope or under CT guidance, in order to correctly localize the specific anatomic sites in or about the spine for diagnostic and or therapeutic needle localization. An understanding of patient selection, indications and contraindications, are paramount to the safety and success of these procedures. The diagnostic and therapeutic potential of these procedures is also facilitated by a thorough evaluation of the spine, with respect to both anatomy and potential pathology, with cross sectional imaging techniques as well as other radiologic tests. Communication of these results between the Radiologist and the spine proceduralist will contribute to optimal patient outcomes.

Handout:Afshin Gangi

Active Handout: Todd Stuart Miller
Real-time Interventional US (Hands-on)

Thursday, Dec. 3 4:30PM - 6:00PM Location: E264

AMA PRA Category 1 Credits™: 1.50
ARRT Category A+ Credits: 1.50

Participants
Christopher A. Molvar, MD, Maywood, IL (Moderator) Nothing to Disclose
Kent T. Sato, MD, Chicago, IL (Presenter) Nothing to Disclose
Albert A. Nemcek JR, MD, Chicago, IL (Presenter) Consultant, B. Braun Melsungen AG
Robert J. Lewandowski, MD, Chicago, IL, (r-lewandowski@northwestern.edu) (Presenter) Advisory Board, BTG International Ltd; Advisory Board, Boston Scientific Corporation; Consultant, Cook Group Incorporated; Consultant, ABK Medical Inc
Ramona Gupta, MD, Chicago, IL (Presenter) Nothing to Disclose
Terry D. Wilkin, MD, South Bend, IN (Presenter) Nothing to Disclose
Kevin L. Keele, MD, Harvey, IL (Presenter) Nothing to Disclose
Michael H. Hamblin, MD, Evanston, IL (Presenter) Nothing to Disclose
Terence A. Matalon, MD, Philadelphia, PA, (matalont@einstein.edu) (Presenter) Speaker, Koninklijke Philips NV
Elias Hohlastos, MD, Chicago, IL (Presenter) Nothing to Disclose
Andrew J. Lipnik, MD, Nashville, TN, (andrew.j.lipnik@vanderbilt.edu) (Presenter) Nothing to Disclose
Christopher Baron, MD, Nashville, TN (Presenter) Nothing to Disclose
Parag M. Amin, MD, Chicago, IL (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
1) Acquire the skill to direct a needle to a target for diagnostic or therapeutic purposes with Real-time US-guidance.

ABSTRACT
Participants will have the opportunity to hone their skills in ultrasound guided interventions using phantoms. Experienced practitioners in ultrasound guided intervention will serve as faculty.
Interventional Series: Complications in Interventional Oncology-Avoidance and Damage Control

Friday, Dec. 4 8:30AM - 12:00PM Location: N228

LEARNING OBJECTIVES

1) List 2 important recent publications in interventional oncology. 2) Explain the mechanism of one complication related to thermal ablation. 3) Describe 1 pitfall of radioembolization. 4) Outline 3 complications in combination therapy for hepatocellular carcinoma. 5) List three complications of chemo-embolization.

PURPOSE

ChemoFilter is a novel medical device that limits systemic toxicity of chemotherapeutics by filtering non-target drug from blood that could be described as intra-vascular dialysis. This method has a potential to prevent toxicity associated with treatment of head and neck cancer, such as renal failure associated with cisplatin.

METHOD AND MATERIALS

DNA binding experiments were carried out in vitro with doxorubicin in PBS solution. Genomic DNA was used to determine the concentration of DNA that shows optimum binding kinetics. Binding kinetics in nylon mesh of different pore size was evaluated.

RESULTS

DNA binding kinetics by doxorubicin is dose dependent and is very rapid with 94% decrease in drug concentration from solution within 1 minute of reaction time. DNA demonstrates faster binding kinetics by doxorubicin as compared to previously published polystyrene resin that uses ion exchange to filter doxorubicin out of the solution. DNA sequestered within the Nylon mesh demonstrates approximately 70% decrease in doxorubicin concentration from solution within 5 minutes.

CONCLUSION

DNA ChemoFilter demonstrates rapid binding of doxorubicin and is a model for filtration of DNA binding chemotherapeutics from the bloodstream.

CLINICAL RELEVANCE/APPLICATION

DNA ChemoFilter is optimized for DNA intercalating chemotherapeutics and minimizes their systemic toxicity after intra-arterial administration for treatment of liver and head and neck malignancies.
Therefore, this condition not only has no impact on TARE, but represents an indication, even in case of thrombosis of both portal veins. Indeed, it does not worsen the post-embolization symptoms, while helping retracting portal vein thrombosis if present. TARE showed to be a safe and effective locoregional treatment of locally advanced HCC, even in case of patients with portal vein thrombosis.

CONCLUSION

Between March 2010 and March 2013, 41 TARE were performed in 33 patients with unresectable HCC and bilirubine values up to 2.8 mg/dl. Among these, 23 had one portal branch thrombosis and 11 had thrombosis of both portal branches. Multislice Computed Tomography (MSCT) scans and angiography were used to assess the baseline burden and the follow-up studies according to the modified RECIST guideline. Some patients underwent the embolization of the Gastro-duodenal artery, using micro-coils. In these cases, a previous study was performed with the injection of TC-99MAA through a 3F microcatheter. Proton-Pump Inhibitors (PPI) were administered to prevent gastritis and ulcers.

RESULTS

Complete response (CR) was observed in 6 (20.8%), 11 (37.5%) and 14 (58.3%) patients after the first, second and third procedure, respectively. At the end of the treatment course all patients experienced at least a partial response. Patients with monolobar disease (16/28: 57.1%) showed higher CR rates after the first procedure compared to those with bilobar HCC (6 vs 0, p=0.017). No differences between mono or bi-lobar disease were observed in CR (64.2% vs 50%; p=ns). Eight patients (33.3%) did not complete the planned repeated procedures. In most cases treatment discontinuation was due to worsening liver function, mainly in patients with more advanced liver disease.

CONCLUSION

DSMs-TACO offers a valid therapeutic option in patients with unresecable HCC. A careful patients selection is required in order to avoid worsening liver function in patients with border-line liver compensation. Further investigations to establish the best treatment schedule and to define the effect of DSMs-TACO on survival are required.

CLINICAL RELEVANCE/APPLICATION

Temporary embolization of the hepatic artery using DSMs is feasible and safe in patients with HCC and an impaired liver function.
CLINICAL RELEVANCE/APPLICATION
If compared to patients without thrombosis, TARE in patients with HCC and portal thrombosis does not reduce the post-treatment quality of life. Thrombosis of both portal branches does not interfere with TARE, and represents one of its major indication in case of locally advanced unresectable HCC, even in case of recurrence after other locoregional treatments.

RC814-05 Irreversible Electroporation (IRE) of Malignant Liver Tumors Close to Major Portal or Hepatic Veins Does not Influence Perfusion of Hepatic or Portal Veins but Can Result in Bile Duct Strictures
Friday, Dec. 4 9:15AM - 9:25AM Location: N228

Participants
Martina Distelmaier, Aachen, Germany (Presenter) Nothing to Disclose
Alexandra Barabasch, MD, Aachen, Germany (Abstract Co-Author) Nothing to Disclose
Nils A. Kraemer, Aachen, Germany (Abstract Co-Author) Nothing to Disclose
Philipp Heil, Aachen, Germany (Abstract Co-Author) Nothing to Disclose
Christiane K. Kuhl, MD, Bonn, Germany (Abstract Co-Author) Nothing to Disclose
Philipp Bruners, MD, Aachen, Germany (Abstract Co-Author) Nothing to Disclose

PURPOSE
IRE has been proposed as a non-thermal ablation method that offers specific advantages over thermal ablation, notably absence of heat sink effect and preservation of both, blood vessels and bile ducts. The purpose of our study was to verify the theoretical advantages of IRE by systematically investigating clinical efficacy and complications of percutaneous IRE for hepatic malignancies located immediately adjacent to major portal and bile ducts or hepatic veins. We were specifically interested in the long-term patency of adjacent venous and biliary vessels.

METHOD AND MATERIALS
CT-guided percutaneous IRE of 37 primary or secondary liver malignancies (mean size 17 mm; range 7-44 mm) was performed in 27 patients (mean age 59 y; 13 men). All lesions were located immediately adjacent to major hepatic veins (n=16), portal vein branches or both (n=21) and therefore not suitable for RFA or MWA. Per standard IRE protocol, 3 to 5 probes (active tip length 1.5-2.5 cm) were placed strictly parallel under CT-guidance. All patients underwent systematic follow-up by CT or MRI.

RESULTS
No major procedure-related complications were observed. All adjacent major portal or hepatic veins remained perfused even at long term follow-up. Complete ablation of the target was achieved in 34/37 (92%) cases with a safety margin of 5-10 mm, confirmed by CT and MRI. In 9 cases (24%) local recurrences within or adjacent to the ablation zone were observed between 1-12 months after treatment. 5 patients with tumors located next to portal veins/ bile ducts (5/21=24%) developed mild to moderate segmental/lobar cholestasis, not requiring treatment. In one patient a clinically asymptomatic arterio-portal fistula developed.

CONCLUSION
IRE for primary and secondary liver malignancies located adjacent to large portal or hepatic veins proved to be safe and effective with regards to local control, and will leave venous blood vessels unaffected. Bile duct strictures may, however, occur, in up to 25% of lesions located close to portal structures.

CLINICAL RELEVANCE/APPLICATION
CT-guided IRE is a useful ablation method for primary and secondary liver tumors that are not amenable to thermal ablation (RFA, MWA). While blood vessels are preserved, bile duct strictures do occur.

RC814-06 Y-90 Complications
Friday, Dec. 4 9:25AM - 9:40AM Location: N228

Participants
Robert J. Lewandowski, MD, Chicago, IL (Presenter) Advisory Board, BTG International Ltd; Advisory Board, Boston Scientific Corporation; Consultant, Cook Group Incorporated; Consultant, ABK Medical Inc

LEARNING OBJECTIVES
View learning objectives under main course title.

RC814-07 Thermal Ablation Complications
Friday, Dec. 4 9:55AM - 10:10AM Location: N228

Participants
Ron C. Gaba, MD, Chicago, IL, (rgaba@uic.edu) (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
View learning objectives under main course title.

ABSTRACT
Not applicable.

RC814-08 Debate: IO: More than Radiologists?
Friday, Dec. 4 10:10AM - 10:25AM Location: N228

Participants
Ron C. Gaba, MD, Chicago, IL, (rgaba@uic.edu) (Presenter) Nothing to Disclose
Robert J. Lewandowski, MD, Chicago, IL (Presenter) Advisory Board, BTG International Ltd; Advisory Board, Boston Scientific
PURPOSE

Tumor seeding along the needle tract or peritoneum is a dreaded complication of percutaneous liver ablation, especially in potential liver transplant patients with a reported incidence up to 4.4%. Therefore, the objective of our study was to determine the incidence of tumor seeding after percutaneous RF ablation of hepatocellular carcinoma (HCC).

METHOD AND MATERIALS

With IRB approval and HIPAA compliance, our institutional clinical database was queried to access all patients who had development of one or more extrahepatic recurrences in the skin, subcutaneous tissues, or peritoneum from March 2006 to December 2012. The study cohort consisted of 305 consecutive patients (217 men and 88 women) and a total of 498 RFA sessions. All lesions were treated with single, double or cluster internally cooled straight electrodes mated to a 200W generator and switching controller (Covidien, Boulder Co) by one of four experienced interventionalists. Tract ablation was used in almost all cases. Six patients were treated by using combined ethanol injection.

RESULTS

Over a 6 year period, 581 HCC nodules were treated by RF ablation with a mean follow up of 28±16 months (range from 3-66 months). Tumor seeding was evaluated by pathological report of explant liver in 96 patients and by imaging follow up in 209 patients. During this time in two patients, single chest wall nodules were detected in or near the needle tract (0.3% per nodule, 0.6% per patient) in the setting of extrahepatic metastases. One nodule was detected at 5.3 months post ablation concurrent with lymph node metastasis. The other nodule was detected at 18.3 month after liver transplantation in a patient with concurrent lung metastases. In both cases, the ablated nodules were subcapsular, poorly differentiated on concurrent biopsy with direct electrode insertion into the nodule. There was no further lesion treatment due to advanced metastatic disease.

CONCLUSION

In this series, no needle tract seeding was detected in patients without concurrent extrahepatic metastases. However, with two solitary chest wall nodules at or near the needle tract, the possible risk of tumor seeding after RF Ablation of HCC was 0.3% per nodule and 0.6% per patient. Both nodules were poorly differentiated and subcapsular.

CLINICAL RELEVANCE/APPLICATION

Using optimal technique, there is very low risk of possible tumor seeding after percutaneous radiofrequency ablation of hepatocellular carcinoma.

RC814-10 Utility and Safety of Radiofrequency Ablation for Focal Hepatic Lesions Adjacent to Gallbladder in Ablating between GB Fossa and Contralateral Safety Margin

Friday, Dec. 4 10:35AM - 10:45AM Location: N228

Participants
In Young Choi, MD, Seoul, Korea, Republic Of (Presenter) Nothing to Disclose
Pyo Nyun Kim, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Hyung Jin Won, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
So Yeon Kim, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Yong Moon Shin, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose

PURPOSE

To evaluate safety and therapeutic efficacy of radiofrequency (RF) ablation for treatment of focal hepatic lesions (FHL) adjacent to gallbladder (GB) with reduction of ablation time and rearrangement of electrode.

METHOD AND MATERIALS

We restrospectively evaluated 36 patients who underwent RF ablation of FHL adjacent to GB(less than 10mm) from January 2011 to March 2014. Follow-up period was ranged from 9 to 50 months (mean, 25 months). The electrode was inserted parallel direction to GB. Patients were divided into two subgroups based on whether the lesion was abutting GB (less than 5mm, n=19) or not (more than 5mm, n=17). In abutting group, the electrode was inserted eccentrically after measuring the diameter between GB fossa and contralateral safety margin and ablation time was decreased for reducing the diameter of ablated zone in horizontal axis to GB. Fourteen of abutting group were performed with artificial ascites (5% dextrose aqueous solution) and 8 of non-abutting group were performed with artificial ascites. A panel of radiologists blinded to the patients’ clinical histories reviewed immediate follow up CT for complication and late follow up CT for local tumor progression. Statistical evaluation was performed with Chi-square test and
Fisher's exact test.

RESULTS

There were no major complications in both groups. Enhancing wall thickening of GB adjacent to RFA zone was noted in 19.4% (7/36, abutting group; 5, non-abutting group; 2) and it disappeared on subsequent follow-up imaging. There is no statistically significant difference between abutting group and non-abutting group (p >0.05). The technical success rate based on immediate follow-up and one-month follow-up CT was 94.4% (34/36) and two patients remained enhancing foci on immediate follow up (1 abutting group, 1 non-abutting group) and they were retreated successfully. Local tumor progression of completely ablated tumors during follow-up period less than 6 months was noted in two patients (2/34, 1 abutting group, 1 non-abutting group). Except these two patients, there was no local tumor progression during follow-up periods.

CONCLUSION

RF ablation can be a safe and effective treatment for FHL adjacent to GB with rearrangement of electrode and reduction of ablation time.

CLINICAL RELEVANCE/APPLICATION

The treatment of FHL adjacent to GB is challenging issue. RF ablation may be a safe and effective treatment option even though the lesion is located right beside GB.
**Participants**
Ehsan Samei, PhD, Durham, NC (*Director*) Nothing to Disclose  
Douglas E. Pfeiffer, MS, Boulder, CO (*Director*) Nothing to Disclose

**Sub-Events**

**RC821A  Fluoroscopy Perspective**

Participants  
Ehsan Samei, PhD, Durham, NC (*Presenter*) Nothing to Disclose

**LEARNING OBJECTIVES**
1) To become familiar with major trends in fluoroscopy technology.  
2) To understand transitions in technology that requires new and advanced evaluations.  
3) To appreciate how a medical physicist is to effectively engage with clinical practice.

**ABSTRACT**
Just like other medical imaging modalities, fluoroscopy has been undergoing a number of technological transitions. Those include transitions from II to flat panel detectors and from 2D to 3D imaging. While these advances offer improvements and new possibilities, they challenge the conventional way a system is to be tested. In addition, given the interventional nature of the modality, there is an increasing need for the medical physicist to be more operationally engaged with the use and optimization of the technology. This lecture aims to offer a historical perspective on these topics and an outline of major priorities for fluoroscopic physics service.

**RC821B  Fluoroscopy 1.0**

Participants  
Beth A. Schueler, PhD, Rochester, MN (*Presenter*) Nothing to Disclose

**LEARNING OBJECTIVES**
1) Review basic fluoroscopy imaging system performance evaluation tests.  
2) Compare measurement procedures for fluoroscopic exposure assessment.  
3) Become familiar with test procedures designed to assess fluoroscopic image quality.  
4) Learn about implementation of patient dose management processes for fluoroscopic procedures.

**ABSTRACT**
This segment will provide a review of customary medical physics support activities for fluoroscopic imaging systems. Quality control testing procedures for image quality evaluation, radiation dose measurement and other mechanical performance characteristics are essential for optimizing equipment performance and ensuring patient and staff safety. Test equipment, phantoms, measurement methods and recommended performance criteria for these tests will be summarized as they apply to different types of fluoroscopic equipment, from angiographic imaging systems to radiographic-fluoroscopic (RF) tables and mobile C-arms. In addition, the medical physicist's role in clinical implementation of fluoroscopic systems will be discussed, including ensuring appropriate configuration of anatomical program settings, recommendations for patient dose management and methods for patient dose estimation.

**Active Handout:** Beth A. Schueler  

**RC821C  Fluoroscopy 2.0**

Participants  
Keith J. Strauss, FAAPM, FACR, Cincinnati, OH (*Presenter*) Research Consultant, Koninklijke Philips NV; Speakers Bureau, Koninklijke Philips NV

**LEARNING OBJECTIVES**
1) Understand need for and advantages of quantitative (as opposed to qualitative) analysis of image quality.  
2) Identify and understand new tools becoming available for evaluating fluoroscopic equipment performance.  
3) Identify appropriate configuration of acquisition parameters as a function of patient size.  
4) Be able to configure the radiation dose to the detector to ensure diagnostic image quality at properly managed patient dose.

**ABSTRACT**
Steps that are required to turn physics support of fluoroscopy from a compliance focused to operationally focused program will be discussed. New metrics and analytics to better quantify high contrast resolution, low contrast resolution, temporal resolution, and 3D imaging will be examined. Changes in testing protocols necessary to address new hardware technologies, new acquisition methods, state-of-the-art image processing and analysis will be reviewed. A recently developed "physics testing mode" that the vendors will provide in the near future will be described. Proper management of patient dose metrics will be reviewed. The presentation concludes with clinical implementation of these new strategies. Proper training and communication is critical. Proper
configuration of acquisition parameters (focal spot size, voltage and added filter, tube current, pulse width, pulse rate, scatter removal) as a function of patient size from the smallest neonate to the largest bariatric patient is key to providing diagnostic image quality at properly managed radiation doses. In addition, one must ensure that the detector dose as a function of filter type and thickness, pulse rate, field of view, and complexity of the examination is properly configured.

Active Handout: Keith Jerel Strauss

Tumor Ablation beyond the Liver: Practical Techniques for Success

Friday, Dec. 4 8:30AM - 10:00AM Location: S403A

Participants
Debra A. Gervais, MD, Chestnut Hill, MA (Moderator) Nothing to Disclose
Terrance T. Healey, MD, Providence, RI (Presenter) Nothing to Disclose
Anil N. Kurup, MD, Rochester, MN, (kurup.anil@mayo.edu) (Presenter) Nothing to Disclose
Muneeb Ahmed, MD, Wellesley, MA, (mahmed@bidmc.harvard.edu) (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
1) Gain knowledge as to how to approach tumor ablation in extrahepatic sites. 2) How to avoid and manage organ specific complications. 3) Review results of tumor ablation in the lung, kidney, and bone.

ABSTRACT
Pulmonary malignancies, and specifically lung cancer, are a leading cause of death worldwide. Utilization of best current therapies results in an overall five-year relative survival rate for all stages combined to be only 15%, necessitating the use of alternative therapies. Image-guided ablation of lung malignancies is a revolutionary concept whose clinical applications are just beginning to be developed. It has some advantages over traditional radiotherapy and chemotherapy. Its safety profile is similar to percutaneous image guided lung biopsy. Almost all image-guided ablative procedures can be performed in an outpatient setting, mostly with conscious sedation. Multiple applications can be performed without any additional risks. Contraindications are few and include uncontrollable bleeding diathesis and recent use of anticoagulants. Image-guided ablation of lung malignancies is performed with two basic rationales. In the first group it is used with an intention of achieving definitive therapy. These are patients who are not candidates for surgery because of co-morbid medical contraindications to surgery, like poor cardiopulmonary reserve or patients refusing to undergo operation. This cohort could potentially derive significant benefit form a minimally invasive alternative therapy.
In the second group it is used as a palliative measure as follows: (a) to achieve tumor reduction before chemotherapy (b) to palliate local symptoms related to aggressive tumor growth, such as chest pain, chest wall pain or dyspnea (c) hematogenous painful bony metastatic disease (d) tumor recurrence in patients who are not suitable for repeat radiation therapy or surgery. Image-guided ablation is expanding treatment options for the local control of non-small cell lung cancer and metastatic disease.
**LEARNING OBJECTIVES**

1) Discuss and demonstrate spine biopsy techniques including CT and fluoroscopic approaches, anatomic landmarks, needle selection, special technical considerations for dealing with soft tissue masses, and fluid accumulations, lytic and blastic lesions, and hypervascular conditions. 2) Hands on exposure will be provided in order to familiarize participants with the vast number of biopsy devices that are clinically available. 3) Training models will also be used in order to teach technical skills with respect to approach and technique. 4) Advantages and disadvantages of various biopsy devices and techniques, and improve their understanding of how to maximize the reliability and safety of these spine biopsy procedures.

**ABSTRACT**

**Sub-Events**

**RC850A** Pre- and Post Biopsy Assessment

Participants
John L. Go, MD, Los Angeles, CA **(Moderator)** Nothing to Disclose

**LEARNING OBJECTIVES**

1) Be familiar with all required aspects of the pre-biopsy work-up, including medications, laboratory values, and review of relevant prior imaging. 2) Be familiar with solutions to address to complications or other unexpected events which may arise during the course of spine biopsy. 3) Be comfortable in performing the post procedure assessment of the patient after spinal biopsy.

**RC850B** Equipment Used for Image-guided Biopsies of the Spine

Participants
Richard Silbergleit, MD, Royal Oak, MI **(Presenter)** Nothing to Disclose

**LEARNING OBJECTIVES**

1) Demonstrate the types of needles used for spine biopsy. 2) Selecting the proper types of needles used for spine biopsy. 3) Case demonstration of the proper use of single or coaxial needle sets for spine biopsy and the advantages or disadvantages of each.

**RC850C** Thoracic and Lumbar Biopsies

Participants
John L. Go, MD, Los Angeles, CA **(Presenter)** Nothing to Disclose

**LEARNING OBJECTIVES**

1) Review the anatomy of the thoracic and lumbar spine relevant to spine biopsy. 2) Describe the approaches used to approach various anatomical regions within the thoracic and lumbar spine. 3) Provide case examples of various approaches used to biopsy the thoracic and lumbar spine.

**RC850D** Cervical Spine Biopsies

Participants
A. Orlando Ortiz, MD, MBA, Mineola, NY **(Presenter)** Nothing to Disclose

**LEARNING OBJECTIVES**

1) Demonstrate the various approaches used to biopsy lesions of the cervical spine. 2) Determine the selection of the proper needles to use to biopsy the spine. 3) Provide case examples of cervical biopsies and the thought process used to perform these procedures.

**ABSTRACT**

Cervical spine biopsies can be challenging procedures to perform, hence they tend to be performed by a limited number of proceduralists. C-spine biopsy is often performed to evaluate potential neoplastic or infectious processes of the cervical spine. The key to performing these procedures effectively and safely is in appropriate patient selection, careful image analysis in order to properly position the patient and choose an approach, identification of critical structures (such as the carotid artery) and neck spaces that should be avoided, and use of coaxial biopsy techniques. The procedure can be safely performed with CT and/or CT fluoroscopy. Specimen sampling principles and specimen handling are also discussed they can help to optimize this procedure.

**RC850E** Disc Biopsy and Aspiration
Participants
Amish H. Doshi, MD, New York, NY, (amish.doshi@moundsinal.org) (Presenter) Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.
**Vascular/Interventional (Innovation in Non-Vascular Interventions)**

Friday, Dec. 4 10:30AM - 12:00PM Location: E350

**G I C T I R**

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

**Participants**
Jonathan M. Lorenz, MD, Chicago, IL (Moderator) Nothing to Disclose
Robert G. Dixon, MD, Chapel Hill, NC (Moderator) Nothing to Disclose

**Sub-Events**

**SST15-01** Gastroduodenal Stent Placement versus Surgical Gastrojejunostomy for the Palliation of Gastric Outlet Obstructions in Patients with Unresectable Gastric Cancer: A Propensity Score-Matched Analysis

Friday, Dec. 4 10:30AM - 10:40AM Location: E350

Participants
Jung-Hoon Park, MS, RT, Seoul, Korea, Republic Of (Presenter) Nothing to Disclose
Ho-Young Song, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Jiaywei Tsauo, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Wei-Zhong Zhou, Nanjing, China (Abstract Co-Author) Nothing to Disclose
Jin Hyoung Kim, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Young Chul Cho, BS, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose

**PURPOSE**

To compare the outcomes between stent placement and surgical GJ for the palliation of gastric outlet obstruction (GOO) in patients with unresectable gastric cancer.

**METHOD AND MATERIALS**

A retrospective study was performed in a single university hospital in 676 patients with GOO, and who were treated either by stent placement (n = 301) or surgical GJ (n = 375). The outcomes were assessed with reference to the following variables with the use of propensity-score matching: success rates; adverse events; dysphagia scores, albumin, and BMI; survival; symptom free duration; and hospitalization.

**RESULTS**

224 of 676 patients were enrolled in accordance with inclusion and exclusion criteria. In the 74 matched cohorts, there was no significant difference between the two groups following variables: success rates, adverse events, and survival. The dysphagia score seven days after treatment in the stent group was significantly better than in the surgery group (1.50 vs. 2.07, P < 0.001). Albumin level one month after treatments in stent group was significantly lower than in the surgery group (3.33 vs. 4.12, P < 0.001). Duration of symptom free and hospitalization were significantly longer in the surgery group than in the stent group (P = 0.002, P < 0.001, respectively). The recurrence rate was significantly higher in the stent group than in the surgery group (P = 0.032).

**CONCLUSION**

In a matched cohort of patients, stent placement can provide faster symptom relief and shorter hospitalization, while surgical GJ can provide longer symptom free duration, less recurrent obstruction symptoms and better nutritional status.

**CLINICAL RELEVANCE/APPLICATION**

Stent placement provides more immediate symptom relief and shorter hospitalization compared with surgical GJ, but is associated with a shorter symptom free duration, a greater chance of recurrent obstruction symptoms, and poorer nutritional status.

**SST15-02** Fluoroscopic Stent Placement versus Endoscopic Stent Placement for the Palliation of Malignant Gastric Outlet Obstruction: A Retrospective Comparison Study

Friday, Dec. 4 10:40AM - 10:50AM Location: E350

Participants
Jiaywei Tsauo, Seoul, Korea, Republic Of (Presenter) Nothing to Disclose
Ho-Young Song, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Jung-Hoon Park, MS, RT, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Jin Hyoung Kim, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Young Chul Cho, BS, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose

**PURPOSE**

Endoscopic stent placement (ESP) and fluoroscopic stent placement (FSP) are both well-established methods for the palliation of malignant gastric outlet obstruction (GOO). To date, there has been no study comparing these two procedures. The aim of this study was to compare retrospectively the outcomes of ESP with FSP in patients with malignant GOO.

**METHOD AND MATERIALS**

A retrospective study was performed in a single university hospital in 306 patients with malignant GOO, and who were treated either by ESP (n = 181) or FSP (n = 125). The outcomes were assessed with reference to the following variables: success rates;
**RESULTS**

A total of 193 patients met our inclusion/exclusion criteria, including 68 patients who underwent ESP and 125 patients who underwent FSP. The technical and clinical success rates, adverse events, re-intervention rates, stent patency, and patient survival rate were not significantly different between two groups. GOOSS score improved significantly in both groups after the procedure. Stent migration rate and number of re-intervention procedures was significantly higher in the ESP group than in the FSP group ($P = 0.002$ and $P = 0.024$, respectively). Stent collapse rate was lower in the ESP group than in the FSP group ($P = 0.021$). Six-month stent patency rate was statistically higher in the ESP group than in the FSP group ($P = 0.044$).

**CONCLUSION**

Despite similar outcomes and adverse events, partially covered SEMSs for TTS delivery system were associated with a higher migration rate and a more frequent need for re-interventional procedure, while lower stent collapse rate compared with partially covered dual SEMS for the palliation of malignant GOO.

**CLINICAL RELEVANCE/APPLICATION**

Our study demonstrated that both FSP and ESP using a partially covered SEMS are an effective therapeutic option for the palliation of malignant GOOs.

**SST15-03  Efficacy and Safety of a Newly Designed, Fully Covered Self-expandable Metallic Stent for Malignant Esophageal Strictures**

Friday, Dec. 4 10:50AM - 11:00AM Location: E350

Participants
Jung-Hoon Park, MS, RT, Seoul, Korea, Republic Of (Presenter) Nothing to Disclose
Ho-Young Song, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Wei-Zhong Zhou, Nanjing, China (Abstract Co-Author) Nothing to Disclose
Jiywei Tsauo, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Young Chul Cho, BS, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose

**PURPOSE**

To reduce the stent dysfunction rate, we developed a new self-expandable metallic stent (SEMS) with double step flanges at both ends coated with silicone and a main body externally covered with a polytetrafluoroethylene membrane. The purpose of this study was to investigate the efficacy and safety of the new SEMS for the palliation of malignant esophageal strictures.

**METHOD AND MATERIALS**

With approval from our institutional review board, the records of 76 patients who underwent the new SEMS placement were retrospectively reviewed. Patients with benign strictures or who underwent temporary stenting for other therapies were excluded. Fifty-one patients (44 men, 86.3%; mean age, 63.7 years) were included in this study. Technical and clinical success, stent dysfunction, survival, and complications were analyzed.

**RESULTS**

Technical and clinical success was achieved in all patients (100%). The dysphagia score improved from 3.2±0.6 to 1.1±0.7 after treatment ($P<0.001$). Stent dysfunction occurred in 10 patients (19.6%): migration in four (7.8%), tumor overgrowth in five (9.8%), and food impaction in one (2.0%). The major complication was a tracheoesophageal fistula in one patient (2.0%). Minor complications, including mild pain and gastroesophageal reflux, were observed in 10 patients (19.6%). The median survival was 160 days. Twenty-four patients who underwent tumor treatments after stenting had a longer survival but had more stent dysfunction than those on supportive care ($P<0.05$).

**CONCLUSION**

The new stent was safe and effective for the palliation of malignant esophageal strictures, and resulted in relatively low migration and tumor overgrowth rates compared to those reported previously.

**CLINICAL RELEVANCE/APPLICATION**

This newly designed fully covered self-expandable metallic stent could be used for the management of malignant esophageal strictures. Owing to its new design, patients with malignant esophageal strictures could benefit from its low stent dysfunction and complication rates.

**SST15-04  Fluoroscopic Removal of Retrievable Expandable Metallic Stents: Experiences in 129 Patients with Malignant Esophageal Strictures**

Friday, Dec. 4 11:00AM - 11:10AM Location: E350

Participants
Pyeong Hwa Kim, Seoul, Korea, Republic Of (Presenter) Nothing to Disclose
Ho-Young Song, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Jung-Hoon Park, MS, RT, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Jiywei Tsauo, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Young Chul Cho, BS, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Wei-Zhong Zhou, Nanjing, China (Abstract Co-Author) Nothing to Disclose

**PURPOSE**

To evaluate the safety and efficacy of fluoroscopic removal of retrievable expandable metallic stents (REMSs) in patients with malignant esophageal strictures, to compare clinical outcomes regarding removal techniques and removal timing, and to identify predictive factors related to successful removal.

**METHOD AND MATERIALS**
In this retrospective study, 129 patients with a total of 139 stent placements were reviewed retrospectively. Of the 139 stents, 95 stents were removed electively. Technical success rate and complication rate of the standard removal technique (Primary technical success) and modified removal technique (Secondary technical success) were evaluated. Logistic regression models were constructed to identify predictive factors related to successful removal.

RESULTS
Primary technical success rate was 78.4% (109/139) and secondary technical success rate was 100% (30/30). We observed 6 (4.3%) cases of complications associated with the removal. All complications were caused by the standard removal technique. There was no complication noted when REMSs were removed within 4 weeks of placement. Stent location at the upper esophagus (P=0.006), and stricture length ≥ 8cm (P=0.026) were negative predictive factors for technical success of the standard technique.

CONCLUSION
Fluoroscopic removal of retrievable SEMSs for malignant esophageal strictures can be performed in a safe and convenient manner. Caution should be posed when removing stents located at the upper esophagus and stricture length ≥ 8cm as they show higher tendency to failure of the standard removal technique.

CLINICAL RELEVANCE/APPLICATION
Stent removal within 4 weeks might be ideal in minimizing stent-induced complication, albeit further studies are to be performed for verification.

SST15-05  Airway Stent Placement for Malignant Tracheobronchial Strictures in Patients with an Endotracheal Tube
Friday, Dec. 4 11:10AM - 11:20AM Location: E350

RESULTS
Stent placement was technically successful in all 21 patients (100%), and with 20 of the 21 patients (95%) showing symptomatic improvement within five days. The endotracheal tube could be removed during (n=7) or after (n=13) stent placement, and the mean duration of intubation following stent placement was 1.4 days (range 0-4 days). One patient could not have his endotracheal tube removed and he died nine days following stent placement in an intubation state. Mild bleeding was a procedure-related complication that occurred in one patient and which resolved spontaneously within three days. Stent-related complications in four patients included stent migration (n=3) and tumor overgrowth (n=1), all of which were managed with a second stent placement (n=3) or stent removal and a second stent placement (n=1).

CONCLUSION
Airway stent placement under fluoroscopic guidance in patients with an endotracheal tube inserted for malignant tracheobronchial strictures, is both technically feasible and safe.

CLINICAL RELEVANCE/APPLICATION
Airway stent placement through an endotracheal tube is technically feasible and safe.

SST15-06  Intervention Planning using a Laser Navigation System (LNS) for CT-guided Interventions: A Phantom and Patient Study
Friday, Dec. 4 11:20AM - 11:30AM Location: E350

RESULTS
To investigate the effects of a novel Laser Navigation System (LNS) on accuracy, efficiency and radiation dose compared to free-handed punctures at CT.

METHOD AND MATERIALS
Using a laser-induced CO2-combustion laser, we performed multiple punctures to evaluate the protocol for both the LNS-guided method and the free-hand method.
Using a phantom body 60 punctures were performed comparing the conventional free-handed procedure to the LNS-guided method to investigate accuracy, timely effort and radiation dose. Additional 20 LNS-guided interventions were performed on another phantom in order to confirm the accuracy. Ten subsequent patients then underwent LNS-guided puncture.

RESULTS

Phantom 1-LNS group showed a target point accuracy of 4.01 ±2.72 mm (freehand 6.30 ± 3.58 mm), entrance point accuracy of 0.76 ±0.6 mm (freehand 6.11 ±4.66 mm), needle angulation accuracy of 1.27 ±0.93° (freehand 3.36 ±3.10°), intervention time of 7:03 ±4:18 minutes (freehand 8:38 ±4:09 minutes) and the number of CT images 4.2 ±3.6 (freehand 7.9 ±5.1). Results showed significant improvement compared to freehand in 60 punctures. Phantom 2-LNS group showed a target point accuracy of 3.57 ±2.50 mm, entrance point accuracy of 1.39 ±1.99 mm, needle angulation accuracy of 0.95 ±1.19°, intervention time of 1:44 ±0.22 minutes and the number of CT images was 3.4 ±1.7. Regarding the first experience with patients, the LNS group achieved target point accuracy of 5.01 ±1.20 mm, an entrance point accuracy of 2.0 ±1.54 mm, a needle angulation accuracy of 1.5 ±0.3°, an interventional time of 12:08 ±3:07 minutes and using 5.7 ±1.6 CT-images.

CONCLUSION

LNS can improve CT-guided interventions with regard to accuracy, duration of intervention and radiation dose.

CLINICAL RELEVANCE/APPLICATION

The LNS may improve the accuracy, speed and safety of CT-guided interventions. With this system, the needle can be placed in a more accurate position at a faster speed while requiring a lower number of images, thereby reducing the patients' and working staff exposure to radiation during the procedure.

SST15-07  Marked Reduction in Operator Radiation Dose by Decreasing kVp During CT-Guided Procedures

Friday, Dec. 4 11:30AM - 11:40AM Location: E350

Participants
Gabriel Howles-Banerji, MD, PhD, Stanford, CA (Presenter) Nothing to Disclose
Rajesh P. Shah, MD, San Francisco, CA (Abstract Co-Author) Nothing to Disclose

PURPOSE

Compared to fluoroscopy, CT-guided procedures typically use higher energy x-rays, exposing operators to higher energy scatter radiation, for which aprons provide less protection. In addition, higher energy x-rays are less attenuated by non-lead aprons than lead aprons. Recent studies have shown lower kVp can reduce patient dose during lung biopsies without compromising the procedure. We sought to measure the effects of reduced kVp and apron material on operator dose.

METHOD AND MATERIALS

A torso phantom was placed in a CT scanner (GE) with procedural settings: axial 3 x 5 mm slice thickness; 75, 135, or 315 mA; 80, 100, or 120 kVp. An electronic dosimeter (PDM-117, Hitachi-Aloka) was placed adjacent to the gantry 1 cm anterior, 36 cm lateral, and 48 cm inferior to the isocenter. Measured operator dose measurements in µSv per gantry rotation were made without shielding or with 0.35mm Pb-equivalent aprons made of lead-vinyl or antimony-barium (Sb-Ba) (Burlington).

RESULTS

Aprons were more effective at lower kVp: attenuation by the Sb-Ba apron was 90%, 93%, and 97% at 120, 100, and 80 kVp (95% CI: +/- 0.1%, 1.5%, 0.5%). No statistically significant difference was observed between the lead-vinyl and Sb-Ba materials (p>0.35 at each kVp). Measured operator doses at 120, 100, and 80 kVp were 2.05, 0.87, and 0.20 µSv (95% CI: +/- 0.11, 0.195, 0.0). Thus, decreasing kVp from 120 to 100 reduced dose by 58% (p<0.001) and decreasing kVp from 120 to 80 reduced dose by 90% (p<0.001). When tube current was adjusted to maintain constant image noise and the measured dose was multiplied by the kVp-specific apron attenuation (above), estimated doses were 0.45, 0.35, and 0.20 µSv. Thus, decreasing kVp from 120 to 100 reduced dose by 22% and decreasing kVp from 120 to 80 reduced operator dose by 52%.

CONCLUSION

By decreasing kVp during CT-guided procedures, interventionalists may decrease their occupational radiation dose by up to 90%.

SST15-08  CT-guided Percutaneous Jejunostomy Catheter Placement: A Retrospective Analysis of Safety and Efficacy in 28 Patients

Friday, Dec. 4 11:40AM - 11:50AM Location: E350

Participants
Stephen R. Lee, MD, Boston, MA (Presenter) Nothing to Disclose
Colin J. McCarthy, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose
Peter R. Mueller, MD, Boston, MA (Abstract Co-Author) Consultant, Cook Group Incorporated
Ashraf Thabet, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose

PURPOSE

To evaluate the safety and efficacy of CT-guided insertion of percutaneous jejunostomy catheters.

METHOD AND MATERIALS

Between January 1995 and February 2015, CT-guided percutaneous jejunostomy catheter placement was attempted on 31 patients. A retrospective chart review was performed to assess the technical success rate, procedural time, and rate of major and
**RESULTS**

Technical success was achieved in 87% of attempted placements (28 of 32 attempts). Technical failure was due to excessive target bowel mobility. Average procedural time was 88 minutes with a median of 77 minutes. Pericatheter leakage was the most common complication, occurring in 78% of patients (22 of 28). There were no major complications.

**CONCLUSION**

Use of CT to guide placement of percutaneous jejunostomy catheters is safe and effective, with technical success and complication rates similar to reported rates when using fluoroscopy. CT offers distinct advantages in certain patients over fluoroscopy, including the ability to more easily select a bowel loop with no intervening structure at risk of inadvertent injury.

**CLINICAL RELEVANCE/APPLICATION**

Transgastric access for enteral feeding may be unavailable in patients with upper abdominal malignancy or prior GI surgery; CT-guided jejunostomy tube placement is a safe and effective method to obtain access in these patients.

**HONORED EDUCATORS**

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

Peter R. Mueller, MD - 2012 Honored Educator
Peter R. Mueller, MD - 2013 Honored Educator

**PURPOSE**

Central stentoplasty is a novel technique where a single stent is implanted in the center of the vertebral body under cone-beam CT guidance. Data on this technique including technical feasibility, safety and outcome however remains limited. The purpose of this study is to described the technical results of the first 40 cases of central stentoplasty in our institution.

**METHOD AND MATERIALS**

Consecutive cases of central stentoplasty (CS) from our prospective registry was analysed. Patient demographics, indications and pre-procedural imaging were reviewed. Technical success was defined as successful midline stent implantation, on antero-posterior fluoroscopy and in the coronal view on completion cone-beam CT. Procedure related complications were recorded and pain score were obtained immediately before and within 6 hours after the procedure. In addition, fractured vertebral bodies with > 30% height loss were assessed for deformity correction using vertebral angle and anterior vertebral height ratio.

**RESULTS**

From September 2013 to March 2015, a total of 35 patients (9 men, 26 women) with mean age of 70.8 years (range 51 - 90 years) underwent central stentoplasty. Among them, 40 vertebral levels were treated, consisting of thoracic (n=17) and lumbar (n=23) vertebrae. Etiologies included osteoporotic (n=25), traumatic (n=5) and malignant (n=5). Technical success was achieved in 100% of the cases. Complications included: asymptomatic cement extravasation (n=4) and self-limiting track hematoma (n=1). No stent malpositioning, neurological deficit or complication resulting in escalation of care or surgical intervention was recorded. Visual analogue score improvement of > 3 was recorded in 39 out of 40 patients. A total of 15 fractured vertebral bodies had > 30% loss of height and were further analysed for deformity correction. These vertebral bodies had a mean pre-procedure sagittal index (SI) of 0.82 and the post procedure SI of 0.92. The pre-procedure wedge angle (WA) was -5.38° compared to post-procedure mean WA of -3.54°. The mean pre-procedure segmental kyphosis was -7.00° and the mean post-procedure segmental kyphosis was -4.43°.

**CONCLUSION**

CS is technically feasible and a low complication rate is expected. It can be applied across various etiologies and have the potential for deformity correction in vertebral bodies with significant vertebral height loss.

**CLINICAL RELEVANCE/APPLICATION**

CS is a feasible technique in spinal augmentation.