Nuclear Medicine

NM002-EB-X

Next Generation Digital Detector PET/CT: The Medical Physics Basis for the Clinical Applications

All Day Location: S503AB

FDA Discussions may include off-label uses.

Participants
Jun Zhang, PhD, Columbus, OH (*Presenter*) Nothing to Disclose
Katherine Binzel, PhD, Columbus, OH (*Abstract Co-Author*) Nothing to Disclose
Michael Miller, Highland Heights, OH (*Abstract Co-Author*) Employee, Koninklijke Philips NV
Philip Bardos, Columbus, OH (*Abstract Co-Author*) Nothing to Disclose
Michelle I. Knopp, Columbus, OH (*Abstract Co-Author*) Nothing to Disclose
Michael V. Knopp, MD, PhD, Columbus, OH (*Abstract Co-Author*) Nothing to Disclose
Chadwick L. Wright, MD, PhD, Lewis Center, OH (*Abstract Co-Author*) Nothing to Disclose
Piotr J. Maniawski, MSc, Cleveland, OH (*Abstract Co-Author*) Employee, Koninklijke Philips NV

TEACHING POINTS

To introduce the fundamentals of solid state, digital photon counting in PET and the replacement of the photomultiplier To demonstrate performance differences of a next generation solid state digital detector chain in clinical PET/CT compared to current technology photomultiplier detectors To visualize the effects of improving resolution and quantitative accuracy on the image characteristics in phantoms in order to understand the underlying biophysical principles To review representation phantom images from current and digital PET acquisitions

TABLE OF CONTENTS/OUTLINE

A. Introduction to the PET detector chain - What is changing with solid state?B. The physics of solid state digital photon countingC. Comparing performance characteristicsD. Which digital characteristics can we leverage in image reconstruction?E. What is changing in the images, a phantom based demonstrationF. Review phantom acquisition from analog and digital PET

NM003-EB-X

Multimodal Imaging of Neuro-Endocrine Tumor: What the Radiologist Should Know?

All Day Location: S503AB

Participants
Laura Rozenblum Beddok, Villejuif , France (*Presenter*) Nothing to Disclose
Laurent Dercle, MD, Villejuif, France (*Abstract Co-Author*) Nothing to Disclose
Samy Ammari, Villejuif, France (*Abstract Co-Author*) Nothing to Disclose
Marie Terroir, Villejuif, France (*Abstract Co-Author*) Nothing to Disclose
Desiree Deandreis, MD, Villejuif, France (*Abstract Co-Author*) Nothing to Disclose
Caroline Caramella, MD, Villejuif, France (*Abstract Co-Author*) Nothing to Disclose
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Jean Lumbroso, MD, Villejuif, France (*Abstract Co-Author*) Nothing to Disclose
Martin Schlumberger, Villejuif, France (*Abstract Co-Author*) Nothing to Disclose
Eric Baudin, Villejuif, France (*Abstract Co-Author*) Nothing to Disclose
Sophie Leboulleux, Villejuif, France (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

Neuroendocrine tumors (NET) are a heterogeneous group of neoplasms: aggressiveness, symptoms, topographies are highly variable and thus each subgroup of NET requires a dedicated imaging protocol. Several facts illustrate this inhomogeneity: NET range from slow-growing to highly aggressive tumors; they may be functioning (overproduction of bioactive substances) or not; they may be sporadic or inherited; a wide range of anatomical sites are involved.A large range of imaging techniques are advocated in the literature for the localization of the primary disease and the detection of metastases and significant improvements have been made by the fusion of imaging modalities and the development of new radiotracers. The aim of this focus is to highlight what the radiologist should know to propose the accurate modality (staging, recurrence, eligibility to treatment) regarding the tumor's characteristics (including molecular abnormalities such as SDH) and to provide pertinent report for the clinician.

TABLE OF CONTENTS/OUTLINE

I. INTRODUCTIONII. NEUROENDOCRINE TUMORS 1. NEUROECTODERM ORIGIN 2. ENDODERM ORIGIN III. DIAGNOSTIC PROCEDURES 1. SRS 2. MIBG SCINTIGRAPHY 3. F-FDG 4. F-DOPA 5. 68Ga-DOTATOC/OCTREOTATE 6. CT-SCAN 7. MRI IV. TREATMENT

NM005-EB-X

Getting to the Bottom of Things: Lymphatic Drainage Patterns of the Skin in Patients with Melanoma

All Day Location: S503AB

Participants
Quang Nguyen, MD, Brookline, MA (*Presenter*) Nothing to Disclose
George J. Watts, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Elisa Franquet, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Kevin J. Donohoe, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

Lymphoscintigraphy is an imaging technique often used for mapping lymphatic drainage to assist with the staging of malignancies. While lymphatic drainage generally follows a pattern defined by Sappey and others in the early 19th century, variation in the standard drainage pattern occurs frequently enough that individual drainage should be mapped when possible. Mapping of individual lymphatic drainage pathways will allow for more accurate localization of nodes that drain the specific primary neoplastic lesion and therefore more accurate nodal staging.Upon completion of this educational exhibit, participants will be able to: 1. Review the typical anatomy of cutaneous lymphatic drainage. 2. Review the lymphoscintigraphy technique for mapping of cutaneous lymphatic drainage pathways. 3. Apply lymphatic mapping to identify common and variant sentinel lymph nodes and drainage on cutaneous lymphoscintigraphy. 4. Identify common variants seen on lymphoscintigraphy such as in-transit lymph nodes and lymphatic lakes.

TABLE OF CONTENTS/OUTLINE

I. Anatomy of the cutaneous lymphatic systemII. Lymphoscintigraphy methods: planar imaging, SPECT-CTIII. Patterns of lymphatic drainage of the skinIV. Sample CasesV. Summary

NM006-EB-X

Following the Bumpy Road, Node by Node: Mapping the Lymphatic System through PET CT

All Day Location: S503AB

Awards
RSNA Country Presents Travel Award

Participants
Ana M. Lopez, MD, Mexico City, Mexico (*Presenter*) Nothing to Disclose
Mary C. Herrera-Zarza, MD, Mexico City, Mexico (*Abstract Co-Author*) Nothing to Disclose
Luis A. Ruiz Elizondo, MD, Mexico City, Mexico (*Abstract Co-Author*) Nothing to Disclose
Yean P. Silva Hidalgo, MD, Mexico, Mexico (*Abstract Co-Author*) Nothing to Disclose
Jose L. Criales, MD, Huixquilucan, Mexico (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

The purpose of this exhibit is to:Provide a tool to help us identify every lymph node region because it has a significant radiologic finding, with important implications for treatment and prognosis. Routine evaluation of lymph nodes has become a reliable source to help us identify a large number of neoplastic, inflammatory, and infectious processes, in fact in some pathologies it may be the only indicator of an underlying process. Knowledge of the location of these lymph node chains is essential for successful analysis of CT and MR scans.The combination of CT and PET can be helpful, CT demonstrates an excellent anatomic detail but does not provide functional information like PET. PET CT provides exquisite sensitivity and specificity in the detection of nodal diseases. Our objective is to describe and illustrate the anatomy and nomenclature of every lymph node region and correlate through PET CT. Help us approach the lymphatic system on our daily routine and learn to associate with different pathologies according to its anatomy.

TABLE OF CONTENTS/OUTLINE

Maps of the following lymphatic regions with CT and PET CT correlation: Head and neck Thorax Abdomen Pelvis Sample cases with PET CT

NM101-ED-X

Usual and Unusual Dementia Imaging on SPECT

All Day Location: S503AB

Participants
Jun Isogai, MD, Asahi, Japan (*Presenter*) Nothing to Disclose
Naoki Harata, Asahi, Japan (*Abstract Co-Author*) Nothing to Disclose
Katsuya Yoshida, MD, Asahi, Japan (*Abstract Co-Author*) Nothing to Disclose
Tassei Nakagawa, MD, PhD, Asahi, Japan (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

To review typical and atypical imaging in a wide spectrum of dementia on SPECT and MRI.

TABLE OF CONTENTS/OUTLINE

A. Degenerative dementias on SPECT Alzheimer disease (AD) Dementia with Lewy bodies (DLB) 1) Frontotemporal dementia (FTD), 2) Corticobasal degeneration (CBD), 3) Progressive supranuclear palsy (PSP), 4) Amyotrophic lateral sclerosis (ALS) with dementiaB. Secondary dementias on SPECT or MRI 1) Vascular dementia (VaD), 2) Cerebral autosomal dominant arteriopathy with subcortical Infarcts and leukoencephalopathy (CADASIL), 3) Amyloid angiopathy, Idiopathic normal pressure hydrocephalus (NPH) 1) Creutzfeldt-Jakob disease (CJd), 2) Herpes simplex encephalitis (HSE), 3) HIV encephalopathy, 1) Anti N-methyl-D-aspartate (NMDA) receptor encephalitis, 2) Antiphosphoid syndrome, 3) Paraneoplastic syndrome of esophagus cancer

NM102-ED-X

Y90 Selective Internal Radiation Therapy Focus On Imaging

All Day Location: S503AB

Participants
Silvia Tomas Hernandez, MBBS, MRCP, Sutton Coldfield, United Kingdom (*Presenter*) Nothing to Disclose
Kevin M. Bradley, MRCP, FRCR, Oxford, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Philip Boardman, MBChB, Oxon, United Kingdom (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

1 Understanding indications for SIRT and technique 2 Importance of imaging pre as well as post therapy and to identify crucial extra-hepatic activity

TABLE OF CONTENTS/OUTLINE

1 Indications and patient selection2 Treatment planning:- Cross sectional imaging tumour volume (case examples)- Angiogram and coiling (case examples)- TC99m MAA including SPECT CT and lung shunt (case examples)3 Treatment- Sir -spheres/Therasphere-Treatment delivery (case examples)- Post treatment imaging including bremsstrahlung and PET (case examples)4 Precautions, side effects and follow up

NM103-ED-X

Frostbite: The Spectrum of Imaging Findings and How They Impact Management

All Day Location: S503AB

Awards
Cum Laude
Identified for RadioGraphics

Participants
John D. Millet, MD, Ann Arbor, MI (*Presenter*) Nothing to Disclose
Benjamin Levi, MD, Ann Arbor, MI (*Abstract Co-Author*) Nothing to Disclose
Richard K. Brown, MD, Ann Arbor, MI (*Abstract Co-Author*) Nothing to Disclose
Jon A. Jacobson, MD, Ann Arbor, MI (*Abstract Co-Author*) Consultant, BioClinica, Inc; Royalties, Reed Elsevier; ; ;
Ka Kit Wong, MBBS, Ann Arbor, MI (*Abstract Co-Author*) Nothing to Disclose
Milton D. Gross, MD, Ann Arbor, MI (*Abstract Co-Author*) Nothing to Disclose
Casey Kraft, BS, Ann Arbor, MI (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

The purpose of this exhibit is to:Review the characteristic findings of frostbite on plain radiographs, angiography, multiphase bone scanning, and SPECT/CTLearn how SPECT/CT can be utilized to demarcate the interface between viable and non-viable tissueUnderstand the role of diagnostic imaging in the management of frostbite

TABLE OF CONTENTS/OUTLINE

The management of frostbite is dependent on the severity of the cold-induced injury. Treatment ranges from conservative medical management in mild cases to amputation in patients with severe irreversible tissue injury. Multiphase bone scanning combined with SPECT/CT can be used to determine the precise location of the deep tissue damage relative to the cutaneous necrosis. This exhibit reviews how the combination of findings from plain radiographs, angiography, multiphase bone scanning, and SPECT/CT can be used by the surgeon to ultimately determine the appropriate management of the frostbite patient.

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/

Jon A. Jacobson, MD - 2012 Honored Educator

NM105-ED-X

Musculoskeletal Imposters: Common Mimickers of Malignancy on 18F-FDG PET - Teaching Points

All Day Location: S503AB

Participants
Gregory G. Schaiberger, MD, Augusta, GA (*Presenter*) Nothing to Disclose
Yulia Melenevsky, MD, Augusta, GA (*Abstract Co-Author*) Nothing to Disclose
Darko Pucar, MD, PhD, Martinez, GA (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

Positron emission tomography is a diagnostic technique that utilizes fluorine-18 fluoro-2-deoxyglucose (18F-FDG) to aid in the identification and evaluation of malignancies. Although 18F-FDG PET has a high sensitivity/negative predictive value, the technique has a relatively low specificity/positive predictive value and as a result, has its pitfalls. FDG uptake can occur in various benign musculoskeletal processes including degenerative and inflammatory arthritis, muscle and bone injuries, osteonecrosis, etc. A knowledge of normal and benign processes resulting in increased FDG uptake can improve diagnostic accuracy and avoid pitfalls that may lead to unnecessary additional work-up and patient anxiety.

TABLE OF CONTENTS/OUTLINE

We present cases of FDG PET/CT performed in patients with known malignancy, which were found to have incidental non-malignant musculoskeletal pathology. Categories of incidental findings include: Trauma - fracture, muscle injury, tendinitis Arthritis - degenerative, inflammatory, crystal-induced Osteonecrosis - avascular necrosis and bone infarcts Benign bone lesions Miscellaneous - erythropoetic marrow, bursitis, enthesopathy

NM107-ED-X

Study of the Axial Image Angle Definition Using Frontal Lobe Bottom and Cerebellum Tuber Vermis Line of Dopamine Transporter Scan SPECT/CT

All Day Location: S503AB

FDA Discussions may include off-label uses.

Participants
Yasuhiro Inokuchi, RT, Tokyo, Japan (*Presenter*) Nothing to Disclose
Masahiro Nakano, MSc,MENG, Tokyo, Japan (*Abstract Co-Author*) Nothing to Disclose
Tetuji Takeuchi I, RT, Tokyo, Japan (*Abstract Co-Author*) Nothing to Disclose
Yasuhiro Ote I, RT, Tokyo, Japan (*Abstract Co-Author*) Nothing to Disclose
Masahiro Uematsu, Tokyo, Japan (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

The AC-PC line is difficult to determine on SPECT images or low-resolution CTAC images. Frontal lobe bottom and Cerebellum tuber vermis (FLB-CTV) line can be used as an alternative clue to set axial angle parallel to the AC-PC line.

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To evaluate dopamine transporter (DAT) SPECT imaging, it is necessary to visualize the caudate nuclei and the putamen on the same axial image parallel to the AC-PC line. However it is difficult to define the AC-PC line on SPECT images or low-resolution CT attenuation correction (CTAC) images. The present study proposes that Frontal lobe bottom and Cerebellum tuber vermis (FLB-CTV) line on CTAC images is useful to determine axial angle parallel to the AC-PC line. Firstly, angular differences between the AC-PC line and the FLB-CTV line on midsagittal brain MR images of 100 patients were measured, and the mean and standard deviation were -1.36 degree and 1.41 respectively. Secondly, maximum diameter, area and counts of SPECT images of striatal phantom were assessed for both images determined by the FLB-CTV line and by the AC-PC line, and the differences were less than 4%. To summarize study, the FLB-CTV line can be used to determine axial image angle when the AC-PC line is difficult to determine. The proposed FLB-CTV line is useful for not only DAT imaging but also other brain SPECT imaging.

NM109-ED-X

All that Glitters is not Malignant. Benign, Physiological and False Positive Findings in PET-CT Studies in the Thorax

All Day Location: S503AB

Participants
Alex R. Ramirez, MD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Marta Garcia, Madrid, Spain (*Presenter*) Nothing to Disclose
Rosa Couto Caro, Madrid, Spain (*Abstract Co-Author*) Nothing to Disclose
Ana P. Martinez, Madrid, Spain (*Abstract Co-Author*) Nothing to Disclose
Juan Arrazola, Madrid, Spain (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

At the conclusion of this activity, participants will be able to: Recognize the physiological uptake of FDG in the thorax and the normal variants that may affect the interpretation of PET-CT studies Review the most common benign conditions that may resemble malignant lesions in PET-CT studies, with pathological correlation Identify some frequent therapeutic procedures that can produce false-positive results on PET-CT

TABLE OF CONTENTS/OUTLINE

Physiological uptake of FDG in the thorax Inflammatory conditions such as atelectasis, interstitial lung and connective tissue diseases, vasculitides, pneumoconiosis, sarcoidosis, thymic rebound hyperplasia, pulmonary embolism, atherosclerotic-related disease, gastroesophageal reflux, degenerative disease and chest trauma. Thoracic infectious diseases that may target the lung parenchyma, mediastinum or chest wall including osteomyelitis, abscess, endocarditis, aortitis, pulmonary granulomatosis, pneumonia and septic pulmonary emboli. Therapeutic and diagnostic changes, including radiation and drug-related, postbiopsy and postoperative, central lines, pacemakers and defibrillators, chest tubes, gastrostomy tubes, percutaneous needle biopsy, and postradiation-induced inflammation.

NM110-ED-X

A Sneak Preview of the 2014 ATA Guidelines for Thyroid Cancer Radioiodine Remnant Ablation- Radioactive Iodine is Safe and Effective if Used Wisely and Learn New Treatment Options for Radioiodine Resistant and Refractory Differentiated Thyroid Cancer

All Day Location: S503AB

Participants
Dmitriy N. Kazimirko, MD, Madison, MS (*Presenter*) Nothing to Disclose
Christian A Koch, MD, PhD, Jackson, MS (*Abstract Co-Author*) Advisory Board, Bayer AG Advisory Board, Ipsen SA Advisory Board, Corcept Therapeutics Inc Speakers Bureau, Ipsen SA Spouse, Employee, Merck & Co, Inc Research Grant, Otsuka Holdings Co, Ltd Editor, Springer Science+Business Media Deutschland GmbH Royalties, Springer Science+Business Media Deutschland GmbH Editor, BioMed Central Ltd Speaker, BioMed Central Ltd Consultant, Gerson Lehrman Group, Inc
Vani Vijayakumar, MD, Ridgeland, MS (*Abstract Co-Author*) Investigator, General Electric Company

TEACHING POINTS

Preview the new ATA (2014) guidelines of thyroid cancer management with radioactive iodineReview new agents (TK/VEGF inhibitos) in the management of metastatic thyroid cancer and collaboration strategies with Endocrinologist and Medical Oncologist

TABLE OF CONTENTS/OUTLINE

To mainstream a treatment decision algorithm, the American Thyroid Association (ATA) has last updated the management guidelines of radioactive iodine treatment of differentiated thyroid cancer in 2009, with new 2014 guidelines in the works. According to recently published study, there is continued concern that as high a as a quarter of thyroid cancer patients still receive radioactive ablation unnecessary, especially in a community setting, and caution to err on the side of conservatism. The shifting paradigm of "Less is More" has been years in the making, with a change in standard of treatment demonstrated by similar results in low risk thyroid cancer with either low or high dose RAI post thyroidetomy by two large studies including HiLo and Strategies of RAI in patient with Low-Risk Thyroid Cancer, reported in NEJM in 2012. Continued developments and broadening of armamentarium warrants reexamination of our practices with discussion of newer therapeutic agents like Soratenib, Lenvatinib (Approved) , Pazopanib,Vandetanib, and Cabozantinib. Sneak preview 2014 ATA guidelines attached.

NM112-ED-X

Moelcular Imaging and Lung-RADS: Utility of Radiopharmaceutical Imaging for Pulmonary Nodules and Lung Cancer Grading, Staging, and Therapeutic Management

All Day Location: S503AB

Participants
Ephraim E. Parent, MD, PhD, Saint Louis, MO (*Presenter*) Nothing to Disclose
Sanjeev Bhalla, MD, Saint Louis, MO (*Abstract Co-Author*) Nothing to Disclose
Jonathan E. McConathy, MD, PhD, Saint Louis, MO (*Abstract Co-Author*) Research Consultant, Eli Lilly and Company; Research Consultant, Blue Earth Diagnostics Ltd; Research Consultant, Siemens AG; Research support, GlaxoSmithKline plc

TEACHING POINTS

1. Role of FDG-PET/CT for subsequent evaluation Lung-RADS detected pulmonary nodules.2. FDG-PET/CT guided biopsy identification 3. Non-FDG PET radiotracer imaging and molecular radiotherapy of lung lesions.

TABLE OF CONTENTS/OUTLINE

In reported studies, up to 51% of smokers 50 years or older have pulmonary nodules on CT examination. Given the recent Medicare coverage of low-dose screening CT examination in high risk patients for lung cancer, it is expected that numerous, previously occult, pulmonary nodules will be identified. We will present molecular imaging approaches to characterizing these nodules including: which lesions are candidates for FDG-PET/CT imaging, grading and staging with FDG-PET/CT, and therapeutic options (e.g., conservative management, tissue sampling, targeted radiotherapy) based on the metabolic profile of the lesion. Risks and limitations of FDG-PET/CT interpretation including false negative and false positive mimics of lung cancer will be included. Molecular imaging guidance of biopsy site selection will be addressed. Finally, we will present selection criteria and imaging characteristics for non-FDG PET/SPECT molecular imaging of pulmonary lesions and therapeutic management options including molecular targeted radiotherapy.

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/

Sanjeev Bhalla, MD - 2014 Honored Educator

NM113-ED-X

Multimodality Imaging of Nonosseous Findings on 18F-NaF PET/CT Bone Scans

All Day Location: S503AB

Participants
Sarah Bastawrous, DO, Seattle, WA (*Presenter*) Nothing to Disclose
David R. Haseley, MD, Seattle, WA (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

Teaching Points:1. To illustrate multimodality imaging appearances of nonosseous findings on 18F-NaF PET/CT bones scans. 2. To demonstrate the impact of these findings on disease course and treatment options. 3. Assist the viewer in pattern recognition for correct diagnosis of nonosseous findings and necessary follow up imaging.

TABLE OF CONTENTS/OUTLINE

Background and pharmacokinetics of 18F-NaF as a radiotracer. Clinical indications of 18F-NaF PET/CT bone scans. Normal biodistribution of 18F-NaF. Multimodality case based illustrations of physiologic and pathologic nonosseous 18F-NaF uptake, including periarticular, solid parenchymal organ, pulmonary, soft tissue, central nervous system, vasculature, gastrointestinal tract and genitourinary tract. Most common physiologic mechanisms that cause nonosseous uptake. Role of correlative radiographic/CT/MR imaging and PET/CT fusion in interpretation of nonosseous findings. Emerging roles 18F-NaF PET/CT in nonosseous imaging.

NM115-ED-X

The Skeleton on FDG PET/CT: The Good, The Bad, and The Occultly Fractured

All Day Location: S503AB

Participants
Molly P. Hogan, MD, New York, NY (*Presenter*) Nothing to Disclose
Gary A. Ulaner, MD, PhD, New York, NY (*Abstract Co-Author*) Research support, General Electric Company; Research support, F. Hoffmann-La Roche Ltd

TEACHING POINTS

1. FDG PET in sensitive for osseous malignancy; however, specific histologies of malignancy are less FDG avid. CT can complement FDG PET to prevent overlooking osseous malignancy.2. Treatment effects may cause lesions to appear larger, despite successful treatment. FDG PET imaging can complement CT to prevent overdiagnosis of osseous malignancy.3. Many causes of osseous FDG-avidity are benign. CT can complement FDG PET to prevent over diagnosis of osseous malignancy.

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1. True Positives on FDG PET: FDG avid osseous malignancyFDG PET/CT is sensitive for osseous metastases, which may be missed on other imaging modalities (Nucl Med Com 2010;31:597-603). 2. True Negatives on FDG PET: Non-FDG-avid treated malignancyTreated osseous metastases may become larger, but resolution of FDG avidity helps demonstrate treatment effect (Radiology 2008; 247:189-96). 3. False Negatives on FDG PET: Non-FDG-avid but active osseous malignancySpecific histologies of malignancy are less FDG avid. CT/MR can complement FDG PET to prevent overlooking osseous malignancy. 4. False Positives on FDG PET: FDG-avid but non-malignant osseous lesions A. Degenerative changes B. Fractures C. Avascular Necrosis D. Infections E. Paget disease F. Brown tumor G. Non-ossifying fibroma H. Enchondroma

NM116-ED-X

Quantitative Multimodal Liver Imaging for Evaluation of Liver Tumor Response to Therapy

All Day Location: S503AB

Participants
Yun Zhou, PhD, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Xueqi Chen, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Li Huo, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Mahadevappa Mahesh, MS, PhD, Baltimore, MD (*Abstract Co-Author*) Author with royalties, Wolters Kluwer nv
Eleni A. Liapi, MD, Baltimore, MD (*Presenter*) Nothing to Disclose

TEACHING POINTS

By viewing this exhibit, the learner will accomplish the following:1. Identify and study patterns of tumor and liver enhancement with the quantitative parametric techniques of wide-array CT perfusion and dynamic dual-tracer(18F-FDG and 11C-Acetate) dynamic PET for evaluating liver tumor response to therapy.2. Compare the advantages and disadvantages of dynamic dual-tracer and CT perfusion techniques for assessing tumor response to various targeted therapies.

TABLE OF CONTENTS/OUTLINE

In this educational review with study data we will focus on:A. Wide-array CT perfusion of liver-Contrast medium kinetic modeling-Radiation exposure modifications-Examples of liver tumor response to targeted therapiesB. Dynamic dual-tracer (18F-FDG and 11C-Acetate) PET perfusion of liver-Tracer kinetic modeling-Radiation exposure modifications-Examples of liver tumor response to targeted therapiesC. Comparison of wide-array CT and dual-tracer PET perfusion quantitative parametric imaging methods-Temporal sampling comparisons-Volumetric (VOI) versus area of interest (ROI) comparisons-Comparisons of parametric and semi-parametric methods of perfusion quantification.

NM117-ED-X

A Canadian Perspective on Early Experiences and Challenges in Implementing an I-131 MIBG Therapy Program

All Day Location: S503AB

Participants
Nancy Ribeiro, BSC, Toronto, ON (*Abstract Co-Author*) Nothing to Disclose
Susan McQuattie, Toronto, ON (*Presenter*) Nothing to Disclose
Yusuaf Omarkhail, Toronto, ON (*Abstract Co-Author*) Nothing to Disclose
Amer Shammas, MD, Toronto, ON (*Abstract Co-Author*) Nothing to Disclose
Reza Vali, MD, Toronto, ON (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

Neuroblastoma (NBL) is a common malignant extra-cranial tumor of childhood with 50-70 new cases diagnosed annually in Canada (http://neuroblastoma.ca/). Although the initial response of NBL to therapy is good, it often relapses with poor prognosis for children with refractory or recurrent disease. I-131 MIBG Therapy has been used as an effective and relatively well-tolerated therapeutic agent for refractory NBL. In early 2014 Sick Kids became 1 of 2 sites to offer this therapy in Canada. This presentation discusses: The complexities of planning and implementing aTherapy Program, including regulatory licenses and approvals, room design, procurement of radiopharmaceutical, and development of Standard Operating Procedures (SOP) The need for cooperation and communication among multiple disciplines, including oncologists, radiation safety officers, nuclear medicine, nurses and childlife The need for an effective Radiation Safety Training program

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Abstract Planning/Development Licensing SOP's/Documents BudgetRadiation Safety Education/Training Room Design Infusion Waste Removal Radiation MonitoringPediatric Specific Challenges Anxiolytics/Sedation Catheterization Childlife SupportOutcomes Post therapy scans Side effects Efficacy of treatment

NM121-ED-X

What to do When Your Sphincter's a Bit Oddi? HIDA and Secretin Enhanced MRCP Imaging in Sphincter of Oddi Dysfunction

All Day Location: S503AB

Participants
Rohit S. Malliwal, MBBS, London, United Kingdom (*Presenter*) Nothing to Disclose
Arman Parsai, MD, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Hikmat Jan, MD, MBChB, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

- Understand the pathophysiology of:sphincter of Oddi dysfunction (SOD), gallbladder akinesia/dyskinesia and chronic pancreatitis- Appreciate the different subtypes of SOD according to the classic Milwaukee classification- Gain an understanding of how Secretin enhanced (SE) MRCP and:HIDA:imaging are performed-:Interpret the typical appearances of SEMRCP and:HIDA:imaging in normal patients and in pathological conditions such as SOD, gallbladder akinesia/dyskinesia and chronic pancreatitis

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SEMRCP and:HIDA:imaging can be used to investigate a variety of conditions including SOD, pancreatic :exocrine insufficiency, pancreas divisum, duct strictures and gallbladder akinesia/dyskinesiaOutline:- Define SOD, gallbladder akinesia/dyskinesia and chronic pancreatitis- Outline:HIDA:and SEMRCP imaging techniques- Using specific clinical examples, demonstrate the imaging appearances in pathological conditions, such as :SOD, biliary akinesia/dyskinesia:and chronic pancreatitis in correlation with other imaging modalities

NM122-ED-X

Vascular PET/CT: When This Unusual PET Application Can Look Beyond Conventional Vascular Anatomic Imaging Methods? A Pictorial Essay

All Day Location: S503AB

Participants
Jose Leite, MD, Rio de Janeiro, Brazil (*Presenter*) Nothing to Disclose
Cintia E. Pires, Rio de janeiro, Brazil (*Abstract Co-Author*) Nothing to Disclose
Ricardo B. Carneiro, MD, Rio De Janeiro, Brazil (*Abstract Co-Author*) Nothing to Disclose
Luis F. Costa, MD, Rio de Janeiro, Brazil (*Abstract Co-Author*) Nothing to Disclose
Romeu C. Domingues, MD, Rio De Janeiro, Brazil (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

The anatomic aspects of vascular diseases have been studied for decades, and conventional imaging methods, such as computed tomography (CT), magnetic resonance imaging (MRI), and ultrasound (US), are excellent tools for evaluating morphologic changes. Nonetheless, during this last decade, scientists have gained important new insights into the molecular biology of common vascular disease, such as atherosclerosis, aneurysm formation, vasculitis, graft infection etc. Molecular imaging by positron emission tomography (PET) differs from other imaging modalities, since it has the ability to noninvasively detect molecular and cellular process/alteration, identifying diseases before manifestations of gross anatomic features.

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The purpose of this exhibit is: Understand key issues of the pathophysiology of most common vascular diseases, such as atherosclerosis, aneurysm formation, vasculitis, graft infection, etc., and how PET can track these alterations in an earlier and more specially manner compared to other imaging modalities. Describe when and why conventional anatomic imaging methods have limitations to evaluate the diseases cited above. Illustrate through a series of vascular PET cases compared to conventional anatomic methods, when molecular imaging identifies abnormalities not seen on conventional imaging modalities.

NM123-ED-X

FDG PET/CT Evaluation of Extramedullary Myeloma: A Pictorial Review of the Unusual Presentation of Multiple Myeloma with Multimodality Imaging and Pathologic Correlation

All Day Location: S503AB

Awards
Certificate of Merit

Participants
Ronald J. Schmitt, MD, Aurora, CO (*Presenter*) Nothing to Disclose
Phillip J. Koo, MD, Aurora, CO (*Abstract Co-Author*) Advisory Board, Bayer AG; ; ;
Brian M. Bagrosky, MD, MS, Castle Pines, CO (*Abstract Co-Author*) Nothing to Disclose
Julie Rosser, Aurora, CO (*Abstract Co-Author*) Nothing to Disclose
Clayton Smith, Aurora, CO (*Abstract Co-Author*) Nothing to Disclose
Jennifer J. Kwak, MD, Denver, CO (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

1. Describe the types of extramedullary myeloma as defined by mode of dissemination 2. Discuss important distinctions between primary extramedullary plasmacytoma and extramedullary multiple myeloma in terms of diagnosis, prognosis and treatment 3. Identify the role of FDG PET/CT imaging in the evaluation of myeloma 4. Demonstrate the various imaging presentations of extramedullary myeloma

TABLE OF CONTENTS/OUTLINE

I. Types of extramedullary myeloma: primary extramedullary plasmacytoma, local growth, hematogenous dissemination, iatrogenic II. Epidemiology and pathophysiology of extramedullary myeloma: rising incidence of extramedullary myeloma, prognosis and treatment, pathophysiology of medullary and extramedullary myeloma III. Role of FDG PET/CT in the evaluation of myeloma IV. Case presentations: imaging examples illustrating the utility of FDG PET/CT in the evaluation of myeloma and systematically organized imaging examples demonstrating the various imaging presentations of extramedullary myeloma with multimodality imaging and pathologic correlates

NM124-ED-X

Cardiac and Paracardiac FDG Uptake in Oncologic FDG PET/CT

All Day Location: S503AB

Participants
Takashi Norikane, Kita-gun, Japan (*Presenter*) Nothing to Disclose
Yuka Yamamoto, MD, PhD, Kagawa, Japan (*Abstract Co-Author*) Nothing to Disclose
Yoshihiro Nishiyama, MD, Kagawa, Japan (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

The major teaching points of this exhibit are: 1. It is important to recognize the normal FDG uptake in cardiac structures. 2. Knowledge of patterns of cardiac uptake is important for recognition of benign and malignant lesions encountered during interpretation of oncologic FDG PET/CT. 3. Precise localization with fusion PET/CT is important in preventing misinterpretation.

TABLE OF CONTENTS/OUTLINE

Content Organization Cardiac and paracardiac FDG uptake Normal physiologic uptake in cardiac structures Benign lesions - Myxoma - Fibroma - Lipoma - Lipomatous hypertrophy of the interatrial septum (LHIS) - Constrictive pericarditis - Amyloidosis - Sarcoidosis Malignant lesions - Rhabdomyosarcoma - Mesothelioma - Metastasis

NM125-ED-X

Radiology of Dementia with Lewy Bodies: Diagnostic Performance of Combined 123I-IMP Brain Perfusion SPECT and 123I-MIBG Myocardial SPECT

All Day Location: S503AB

Participants
Naoki Kodama, PhD, Takasaki, Japan (*Presenter*) Nothing to Disclose
Yasuhiro Kawase, MD, Sanjyo, Japan (*Abstract Co-Author*) Nothing to Disclose
Kouichirou Okamoto, MD, Niigata, Japan (*Abstract Co-Author*) Nothing to Disclose
Hiroshi Takeuchi, PhD, Takasaki, Japan (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

The purpose of this exhibit is: 1. To explain about dementia with Lewy bodies (DLB) and the importance of distinguishing DLB as early as possible. 2. To review of 39 cases in probable DLB (22 male, 19 female; mean age +/- SD, 80.6 +/-5.7 y). 3. To explain the diagnostic usefulness in 123I-IMP brain perfusion SPECT and cardiac sympathetic nerve function by 123I-MIBG for patients with probable DLB.

TABLE OF CONTENTS/OUTLINE

1. Learn approach for the diagnosis of probable DLB. 2. Appreciate DLB on 123I-IMP brain perfusion SPECT and 123I-MIBG myocardial SPECT. 3. Review cases with the conversion to DLB from MCI. 4. Results of diagnostic performance by 123I-IMP brain perfusion SPECT and 123I-MIBG myocardial SPECT. 5. Relationship between clinical features and 123I-IMP brain perfusion SPECT. 6. Relationship between clinical features and 123I-MIBG myocardial SPECT. 7. Summary

NM126-ED-X

Clinical Application of F-18 FLT PET for the Evaluation of Brain Tumors

All Day Location: S503AB

Participants
Yuka Yamamoto, MD, PhD, Kagawa, Japan (*Presenter*) Nothing to Disclose
Yoshihiro Nishiyama, MD, Kagawa, Japan (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

The nucleoside analogue 3'-deoxy-3'-18F-fluorothymidine (FLT) with PET has been introduced for imaging cell proliferation.The purpose of this exhibit is:1. To assess the clinical value of FLT PET in patients with brain tumors2. To compare the uptake of C-11 methionine (MET) PET

TABLE OF CONTENTS/OUTLINE

-FLT PET imaging in patients with brain tumors WHO grade II glioma WHO grade III glioma WHO grade IV glioma CNS lymphoma Metastatic brain tumor Meningioma - Follow-up FLT PET imaging after therapy - Tumor recurrence vs. radiation necrosis

NM127-ED-X

Multiple Myeloma-Incremental Value of FDG PET-MR in Phenotypic Assessment and Management

All Day Location: S503AB

Participants
Jorge D. Oldan, MD, Cleveland, OH (*Abstract Co-Author*) Nothing to Disclose
Hakan Ilaslan, MD, Pepper Pike, OH (*Abstract Co-Author*) Nothing to Disclose
Frederic Reu, MD, Cleveland, OH (*Abstract Co-Author*) Nothing to Disclose
Shetal N. Shah, MD, Broadview Heights, OH (*Presenter*) Nothing to Disclose

TEACHING POINTS

*PET-MR may be used to assess marrow involvement in multiple myeloma. *PET-MR may also be used to simultaneously assess for extramedullary involvement.

TABLE OF CONTENTS/OUTLINE

PurposeThe aims of this exhibit are:1) To review the application of PET in multiple myeloma2) To explore the addition of PET-MRContent1) Introduction2) Staging of multiple myeloma3) Imaging testsa) Radiographyb) PET-CTc) MRId) PET-MRIConclusions*PET-MRI can be useful in staging multiple myeloma*PET and MRI can complement each other, with the improved registration of a simultaneous technique.

NM128-ED-X

Pictorial Review of False Positive Results in Radioiodine Scintigraphy

All Day Location: S503AB

Awards
Certificate of Merit

Participants
Amy Chudgar, MD, Philadelphia, PA (*Presenter*) Nothing to Disclose
Jagruti Shah, MD, philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

Radioiodine is frequently used for staging and treating differentiated thyroid cancer. Awareness of causes of false-positive results on radioiodine scans with diagnostic and therapeutic doses of radioiodine is imperative to prevent interpreting false positives as metastatic thyroid cancer. The purpose of this exhibit is to describe the physiologic uptake and biodistribution of radioiodine on whole body scans and discuss causes of false-positive findings with illustrative examples and interpretative pointers from our experience with correlative cross-sectional images.

TABLE OF CONTENTS/OUTLINE

Discussion of normal physiologic uptake and distribution of radioiodine Pictorial examples of false-positive results in radioiodine scintigraphy using multimodality imaging, available labs, clinical history and physical examination divided into the following categories: Functional/physiologic uptake in non-thyroidal tissue: Uptake secondary to expression of sodium-iodine receptor (NIS) and uptake secondary to metabolism or retention of excreted radioiodine, such as uptake in breast tissue, thymus, sebaceous cysts. Uptake in non-thyroidal neoplasms, such as Warthin's tumor, breast fibroadenoma Uptake secondary to non-neoplastic causes, such as infectious and inflammatory and trauma related uptake Other, such as contamination by physiologic secretions.

NM129-ED-X

Dual Kidney Transplantation: Post Transplant Complications and Challenges in Nuclear Medicine Renal Scan Interpretation in Conjunction with Other Imaging Modalities

All Day Location: S503AB

Participants
Ramya Rao, Bronx, NY (*Abstract Co-Author*) Nothing to Disclose
Gopi Nayak, MD, New York, NY (*Presenter*) Nothing to Disclose
Kwang J. Chun, MD, Bronx, NY (*Abstract Co-Author*) Nothing to Disclose
Mansi Shah, MD, Bronx, NY (*Abstract Co-Author*) Nothing to Disclose
Leonard M. Freeman, MD, Bronx, NY (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

The purpose of this exhibit is to describe the clinical course of patients post dual renal transplant from expanded criteria donors (ECD). Teaching points include: 1. Review the definition of expanded criteria kidney donors (ECD) and the rationale for using ECD 2. Familiarize readers with the presentation of dual renal transplant cases through nuclear medicine scan, ultrasound, laboratory findings, abdominal CT scan and biopsy results when available 3. Using examples, discuss the clinical course of dual renal transplant cases, including complications and challenges in renal scan interpretation.

TABLE OF CONTENTS/OUTLINE

1. Introduction with aims and definition of ECD. 2. Review of results from nuclear medicine scan and other imaging modalities. 3. Discussion of clinical course in case examples. 4. Future directions and summary.

NM130-ED-X

Immune Modulation Therapy for Cancer Treatment and Immune-Related Tumor Response Assessment

All Day Location: S503AB

Awards
Certificate of Merit

Participants
Mehdi Taghipour, MD, Baltimore, MD (*Presenter*) Nothing to Disclose
Sara Sheikhbahaei, MD, MPH, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Jennifer Xiao, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Tyler J. Trahan, MS, Mount Pleasant, MI (*Abstract Co-Author*) Nothing to Disclose
Esther Mena, MD, Bethesda, MD (*Abstract Co-Author*) Nothing to Disclose
Charles Marcus, MD, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Rathan M. Subramaniam, MD, PhD, Baltimore, MD (*Abstract Co-Author*) Travel support, Koninklijke Philips NV

TEACHING POINTS

Mechanism of immune modulation therapy in cancer treatment Different kinds of immune modulation agents Discuss benefits, drug interactions, and possible adverse effects of immune modulation agents. Value of immune therapy in different cancers (Melanoma, Lung cancer, Renal cell carcinoma) Case illustration of therapy assessment and effects of immune modulation therapy.

TABLE OF CONTENTS/OUTLINE

The molecular mechanism of immune modulation therapy Immune modulation agents Value of immune modulation agents on treatment of different cancers Immune-related response criteria (irRC) RECIST versus irRC Impact of immune-related response criteria on patients management Different radiological modalities (CT, MRI, PET/CT) in therapy assessment of immune modulation therapy

NM131-ED-X

FDG-PET/CT for Laryngeal and Hypopharyngeal Cancers- An Anatomical Approach

All Day Location: S503AB

Awards
Certificate of Merit

Participants
Marcelo A. Queiroz, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Felipe T. Pacheco, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Felipe D. Barbosa, MD, Oberengstringen, Switzerland (*Abstract Co-Author*) Nothing to Disclose
Giovanna Carvalho, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Rafael F. Nunes, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Romulo H. do Vale, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose
Rodolfo F. Nunes, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Artur Coutinho, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Carlos A. Buchpiguel, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

• Review imaging anatomy of PET/CT of the larynx and hypopharynx;• Identify the presentations of laryngeal and hypopharyngeal tumors according to their location and patterns of spread;• Illustrate the role of FDG-PET/CT before and after treatment.

TABLE OF CONTENTS/OUTLINE

• Technical considerations for PET/CT imaging of laryngeal and hypopharyngeal tumors.• Patterns of spread of cancers of larynx and hypopharynx:- Supraglottic- Glottic- Subglottic- Hypopharynx• PET/CT before treatment - Whole-body staging- Radiotherapy planning• PET/CT after treatment- Therapy response assessment- Follow-up- Treatment related complications (surgery and radiotherapy)- Potential pitfalls• Future directions - PET/MR and new tracers• Summary

ED010-SU

Nuclear Medicine Sunday Case of the Day

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

NM

AMA PRA Category 1 Credit ™: .50

Participants
Murray D. Becker, MD, PhD, New Brunswick, NJ (*Presenter*) Nothing to Disclose
Levi Sokol, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Prapti Y. Shingala, MD, Edison, NJ (*Abstract Co-Author*) Nothing to Disclose
Jamil Shaikh, MD, New Brunswick, NJ (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

1) The case will demonstrate the typical characteristics of sarcoid on FDG PET and cardiac MRI. The learner will understand the role of these modalities in the work up of patients with suspected cardiac sarcoid. 2) The case will demonstrate focal hot spots in the periphery of the lungs on MAA perfusions scan. The learner will be able to identify this finding as an artifact related to the technique of injection. 3) The case will deomonstrate the typical characteristics of pleural talcosis on FDG PET. The exhibit will teach the learner how to seperate benign from neoplastic causes of update in the pleural space.

SSA15

ISP: Nuclear Medicine (PET/CT for Oncology)

Sunday, Nov. 29 10:45AM - 12:15PM Location: S505AB

CT NM

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

FDA Discussions may include off-label uses.

Participants
Andrew Quon, MD, Los Angeles, CA (*Moderator*) Nothing to Disclose
Johannes Czernin, MD, Los Angeles, CA (*Moderator*) Stockholder, Sofie Biosciences; Founder, Sofie Biosciences; Stockholder, Momentum Biosciences LLC; Founder, Momentum Biosciences LLC; Stockholder, Triangle Pharmaceutics; Founder, Triangle Pharmaceutics; ;

Sub-Events

SSA15-01 Nuclear Medicine Keynote Speaker: Targeting PSMA for Imaging Cancer

Sunday, Nov. 29 10:45AM - 11:05AM Location: S505AB

Participants
Martin G. Pomper, MD, PhD, Baltimore, MD (*Presenter*) Shareholder, CTS, Inc; Board Member, CTS, Inc; Research Grant, CTS, Inc; Advisor, CTS, Inc; Institutional license agreement, Progenics Pharmaceuticals, Inc

SSA15-03 Next Generation Digital PET/CT: A Phase I Intra-Individual Comparison with Current Photomultiplier TOF PET/CT

Sunday, Nov. 29 11:05AM - 11:15AM Location: S505AB

Participants
Michael V. Knopp, MD, PhD, Columbus, OH (*Presenter*) Nothing to Disclose
Katherine Binzel, PhD, Columbus, OH (*Abstract Co-Author*) Nothing to Disclose
Philip Bardos, Columbus, OH (*Abstract Co-Author*) Nothing to Disclose
Michelle I. Knopp, Columbus, OH (*Abstract Co-Author*) Nothing to Disclose
Chadwick L. Wright, MD, PhD, Lewis Center, OH (*Abstract Co-Author*) Nothing to Disclose
Jun Zhang, PhD, Columbus, OH (*Abstract Co-Author*) Nothing to Disclose
Veena A. Nagar, MD, Dublin, OH (*Abstract Co-Author*) Nothing to Disclose
Nathan C. Hall, MD, PhD, Columbus, OH (*Abstract Co-Author*) Nothing to Disclose
Piotr J. Maniawski, MSc, Cleveland, OH (*Abstract Co-Author*) Employee, Koninklijke Philips NV

PURPOSE

To objectively assess the oncologic imaging characteristics of a next generation solid state digital PET detector system compared to current state of the art photomultiplier based time of flight PET/CT imaging.

METHOD AND MATERIALS

A next generation, solid state, digital PET/CT system (Vereos 64 TF, Philips Healthcare) operated in pre-factory release was used to compare image characteristics in 25 clinical care patients to current photomultiplier detector based time of flight PET/CT. The order of imaging (placement on the system) was randomized with the SOC imaging at 75 min and investigational at 55 and 95 min p.i. Image characteristics were assessed by blinded readers (3) using a scoring system and blinded quantitative ROI analysis

RESULTS

All matched exams were rated evaluable with decay corrected higher count intensity on all digital PET images. Image quality and detection ability was consistently rated significantly higher ($p<.01$) on the digital PET images. Comparing different reconstruction approaches, 2mm whole body, PSF with Gaussian filtering achieved the highest image quality score. Confidence of lesion detectability was rated significantly higher on the digital PET when evaluating lesions of <15 mm. While larger lesions and soft tissue presented equivalent SUV readouts at ROI analysis, smaller (<15 mm) and metabolic active lesions revealed substantially higher SUV values suggestive that also in vivo the improved recovery coefficent will lead to more correct, precise metabolic activity readouts. Tracer dose simulations indicate that no impact on quality and detectability was found while reducing the count equivalency from 13 mCi FDG to 6mCi.

CONCLUSION

The digital PET system demonstrated higher count sensitivity, improved spatial and contrast resolution that led to better lesion detection and improved quantification especially of small, metabolic active lesions. This Phase I trial suggests, that the next generation PET detection technology has the opportunity to substantially advance the visual and quantitative quality, accuracy and measurement reproduciblity for clinical PET imaging. Furthermore, substantially reduced tracer dose appear feasible in clinical PET.

CLINICAL RELEVANCE/APPLICATION

This presentation introduces the clinical capabilities of the next generation digital detector PET/CT technology for oncologic PET imaging and present initial clinical findings on improved lesion visualization, detection and quantification.

SSA15-04 Staging of Patients with Advanced Melanoma - CT or PET/CT? Impact of Imaging on Decision Making and Survival Analysis of Patients with Stage III and IV Melanoma

Sunday, Nov. 29 11:15AM - 11:25AM Location: S505AB

Participants
Christina Pfannenberg, MD, Tuebingen, Germany (*Presenter*) Nothing to Disclose
Susann-Cathrin Schuele, Tuebingen, Germany (*Abstract Co-Author*) Research Grant, Siemens AG
Thomas Eigentler, Tuebingen, Germany (*Abstract Co-Author*) Nothing to Disclose
Christian la Fougere, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose
Konstantin Nikolaou, MD, Tuebingen, Germany (*Abstract Co-Author*) Speakers Bureau, Siemens AG Speakers Bureau, Bracco Group Speakers Bureau, Bayer AG
Claus Garbe, Tuebingen, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To compare the therapy management based on CT alone vs. 18F-FDG-PET/CT in patients with metastatic stage III/IV melanoma and to evaluate the 5-year long term survival

METHOD AND MATERIALS

Patient-related re-assessment of CT and 18F-FDG-PET/CT scans of 64 patients with advanced melanoma, primarily evaluated by a lesion-based analysis at our institution. The study cohort included 52 primary and 12 restaging examinations. For each patient it was defined if PET/CT caused a change in therapy in comparison to the decisions based on CT alone. Therapy modifications ranged from "major" (e.g. surgery instead of systemic therapy) to "minor" (e.g. change in systemic therapy). Patient outcome was evaluated by calculation of the 5-year survival rates according to Kaplan-Meier.

RESULTS

PET/CT resulted in a change of therapy in 54% of patients of the entire group including "major" changes in 45%. The highest number of PET/CT-induced therapy shifts occurred in the primary staging group with 52% major changes. The corresponding data for the restaging group were 33% therapy changes (4/12 patients), thereof 2 patients with a major shift. In 16 patients already planned for metastasectomy based on CT alone PET/CT CT excluded metastases in 13 patients and revealed further metastases in 3 patients making an operation futile. The 5-year survival rate of the entire cohort was 30%, with an increase to 34% in the primary staging and a decline to 17% in the surveillance group. Comparing overall survival of patients in which metastases could be excluded by PET/CT or in which metastases could be completely removed (n=43) with those patients not eligible for surgery (n=21), a significant overall survival benefit for the first group could be revealed (40.5 % vs. 10.0; p=0.000185).

CONCLUSION

FDG-PET/CT affects surgical decision making in patients with metastatic melanoma mainly by the proper selection of patients for a complete metastasectomy, which is associated with increased long time survival.

CLINICAL RELEVANCE/APPLICATION

FDG-PET/CT significantly influences therapeutic management in patients with advanced melanoma, thereby increasing the long-time survival of this patient group.

SSA15-05 Comparison of Pulmonary Nodule Detection in Lung Cancer Patients Using Whole Body FDG PET/CT, High Resolution Lung Reformat of FDG PET/CT, or Diagnostic Breath Hold Chest CT

Sunday, Nov. 29 11:25AM - 11:35AM Location: S505AB

Participants
Robert R. Flavell, MD, PhD, San Francisco, CA (*Presenter*) Nothing to Disclose
Spencer C. Behr, MD, Burlingame, CA (*Abstract Co-Author*) Research Grant, General Electric Company; Consultant, General Electric Company
Marc C. Mabray, MD, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose
Miguel Hernandez Pampaloni, MD, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose
David M. Naeger, MD, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Previous reports have documented that pulmonary nodules can be missed on the non-breath hold CT portion of FDG PET/CTs. We evaluated the image quality and rate of pulmonary nodule detection of whole body PET/CT (WB PET/CT), high-resolution sharp lung reconstruction of PET/CT (HR PET/CT), and diagnostic breath hold chest CT (BH CT).

METHOD AND MATERIALS

A cohort of 25 patients was identified who had a history of lung cancer as well as a PET/CT staging or re-staging scan and a diagnostic chest CT within 15 days of each other. Per our standard protocol, all PET/CTs included a high resolution lung reformat with sharp reconstruction filter and 2 mm slice thickness. WB PET/CT, HR PET/CT, and BH CT were reviewed by 3 radiologists, and the number and size of pulmonary nodules detected were recorded, as was a subjective assessment of image quality. Statistical significance of differences between reader and modality groups was analyzed by two-way repeated measures ANOVA.

RESULTS

On average, 2.84 nodules were found per patient with WB PET/CT, 3.93 nodules with HR PET/CT, and 3.91 nodules with BH CT. When only nodules less than or equal to 8 mm in size were considered, BH CT (2.86) and HR PET/CT (2.95) revealed more nodules per patient than WB PET/CT (1.99). While statistically significantly more nodules and nodules less than 8 mm were detected by HR PET/CT and BH CT than WB PET/CT ($p<0.001$) no difference was noted between the two higher resolution modalities. Comparisons of image quality revealed reader preference for BH CT over HR PET/CT ($p = 0.01$), and HR PET/CT over WB PET/CT ($p<0.001$).

CONCLUSION

More pulmonary nodules are detected using HR PET/CT reformats than the standard WB PET/CT images, and overall image quality was rated as higher. The ability to detect nodules was indistinguishable from dedicated BH CTs. These data suggest that use of high-resolution reformats of PET/CT images of the lungs increases sensitivity for pulmonary nodule detection, approaching that of dedicated Chest CT.

CLINICAL RELEVANCE/APPLICATION

Routine application of a high-resolution lung reformat to PET/CT images may increase the rate of pulmonary nodule detection to rates comparable to routine chest CT.

SSA15-06 Value of FDG PET/CT for Systemic Staging of Newly Diagnosed Invasive Lobular Breast Cancer (ILC) as Compared with Invasive Ductal Breast Cancer (IDC)

Sunday, Nov. 29 11:35AM - 11:45AM Location: S505AB

Participants
Molly P. Hogan, MD, New York, NY (*Presenter*) Nothing to Disclose
Brittany Dashevsky, MD, DPhil, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Maxine S. Jochelson, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Monica Morrow, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Debra A. Goldman, MS, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Mithat Gonen, PhD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Clifford Hudis, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Gary A. Ulaner, MD, PhD, New York, NY (*Abstract Co-Author*) Research support, General Electric Company; Research support, F. Hoffmann-La Roche Ltd

PURPOSE

While NCCN guidelines consider FDG PET/CT for systemic staging of newly diagnosed stage III breast cancer patients, factors in addition to stage may influence PET/CT utility. For example, primary ILC demonstrates lower conspicuity on FDG PET than the more common IDC. We evaluated utility of PET/CT systemic staging of newly diagnosed patients with ILC as compared to IDC.

METHOD AND MATERIALS

A retrospective study was performed under IRB waiver. Our Hospital Information System was screened for ILC patients who underwent PET/CT 2006-2013 prior to systemic or radiation therapy. Initial stage was determined from records of physical exam, mammography, ultrasound, MRI and/or surgery. PET/CT was evaluated to identify unsuspected distant metastases. A cohort of patients with stage III IDC was evaluated for comparison. Upstaging rates were compared using chi square test and the relative risk with 95% CI was calculated.

RESULTS

146 ILC patients fulfilled inclusion criteria. PET/CT revealed unsuspected distant metastases in 12 patients (8%): 0 of 8 initial stage I, 2 of 50 (4%) stage II, and 10 of 88 (11%) stage III. All patients upstaged to IV were confirmed by pathology. 3 of the 12 upstaged patients were upstaged only by the CT component of the PET/CT, as metastases were non-FDG-avid. In the comparison stage III IDC cohort, 22% (20 of 89) of patients were upstaged to IV by PET/CT. All 20 demonstrated FDG avid metastases. The relative risk of PET/CT revealing unsuspected distant metastases in stage III IDC patients was 1.98 times (95% CI 0.98-3.98) that of stage III ILC patients (p=.049). For FDG-avid metastases, the relative risk of PET/CT revealing unsuspected FDG-avid distant metastases in stage III IDC patients was 2.82 times (95% CI 1.26-6.34) that of stage III ILC patients (p=.007).

CONCLUSION

FDG PET/CT is more likely to reveal unsuspected distant metastases in stage III IDC patients than in stage III ILC patients. In addition, some ILC patients were upstaged only by the CT component of PET/CT, as the metastases detected on CT were not FDG-avid. As PET/CT may have lower impact on systemic staging of ILC patients, ILC patients should not be pooled with IDC patients when exploring the utility of PET/CT.

CLINICAL RELEVANCE/APPLICATION

NCCN guidelines and planned studies may need to consider histologic subtype of breast cancer. FDG PET/CT may have less impact on systemic staging of newly diagnosed ILC than IDC.

SSA15-07 FDG PET/CT and Recurrent Colorectal Cancer Patient Survival: FDG Avidity and Tumor Burden

Sunday, Nov. 29 11:45AM - 11:55AM Location: S505AB

Participants
Wael M. Marashdeh, MBBS, MD, Baltimore, MD (*Presenter*) Nothing to Disclose
Charles Marcus, MD, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Mehdi Taghipour, MD, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Se Jin Ahn, MD, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Rathan M. Subramaniam, MD, PhD, Baltimore, MD (*Abstract Co-Author*) Travel support, Koninklijke Philips NV

PURPOSE

The aim of the study was to assess the value of quantitative PET parameters in the prediction of survival in recurrent colorectal cancer patients.

METHOD AND MATERIALS

This was a retrospective study of 126 patients with biopsy proven colorectal cancer recurrence from 2000 to 2012. Maximum and peak standardized uptake values (SUVmax, SUVpeak), metabolic tumor volume (MTV) and total lesion glycolysis (TLG) were measured for each biopsy confirmed recurrent lesion using gradient segmentation method. The median follow up period was 32.1 months. The primary outcome was overall survival (OS). Kaplan-Meier survival plots and Cox regression analyses were performed.

RESULTS

The mean ± SD SUVmax, SUVpeak, total TLG and total MTV of the study population were 7.1 ± 4.3, 5.3 ± 3.2, 378.3 ± 917.1g and 234.2 ± 420.8mL, respectively. Multivariate cox regression analysis showed total TLG (p=0.001) and total MTV (p=0.001) were associated with OS. Kaplan-Meier survival analysis was performed and SUVmax (threshold=5.9, HR=2.5; 95%CI:1.4-4.2; p<0.0001), SUVpeak (threshold=4.31, HR=2.1; 95%CI:1.2-3.5; p=0.005), total TLG (threshold=137.1g, HR=2.9; 95%CI:1.7-4.8; p<0.0001) and

total MTV(threshold=32.17mL, HR=2.5; 95%CI:1.5-4.2; p<0.0001) were significant predictors of survival during follow-up. An integrated risk stratification model using SUVmax and total MTV to stratify patients into three subgroups predicted patient survival outcomes (HR=2.1, 95% CI:1.5-2.9; log-rank p<0.0001).

CONCLUSION

FDG PET SUVmax, SUVpeak, TLGtotal, MTVtotal and an integrated risk stratification with FDG avidity and tumor burden provide significant prognostic information in patients with biopsy proven recurrent colorectal cancer.

CLINICAL RELEVANCE/APPLICATION

FDG PET/CT in recurrent colorectal cancer can help stratify patients in different groups for which different treatment stratigies can be applied.

SSA15-08 Association between Prognosis and FDG-PET Parameters, ADC of MRI and Oncogene Expression in Pancreas Cancer

Sunday, Nov. 29 11:55AM - 12:05PM Location: S505AB

Participants
Shigeki Nagamachi, MD, PhD, Miyazaki, Japan (*Presenter*) Nothing to Disclose
Ryuichi Nishii, MD, PhD, Miyazaki, Japan (*Abstract Co-Author*) Nothing to Disclose
Youichi Mizutani, Miyazaki, Japan (*Abstract Co-Author*) Nothing to Disclose
Nobuhiro Shibata, Miyazaki, Japan (*Abstract Co-Author*) Nothing to Disclose
Jiro Ohuchida, Miyazaki, Japan (*Abstract Co-Author*) Nothing to Disclose
Kazuhiro Kondo, Miyazaki, Japan (*Abstract Co-Author*) Nothing to Disclose
Toshinori Hirai, MD, PhD, Miyazaki, Japan (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The study was done to determine the significant prognostic factor among FDG-PET parameters, apparent diffusion coefficients (ADC) of MRI and various oncogenes expression in pancreas cancer.

METHOD AND MATERIALS

Sixty-five pancreas invasive ductal cancer patients those underwent F-18 FDG PET/CT and subsequent surgical resection were evaluated. The maximum standardized uptake value (SUVmax), the peak of standardized uptake value (SUVpeak), metabolic tumor volume (MTV), and total lesion glycolysis (TLG) were calculated on 18F-FDG PET/CT in both early (1hr) and delayed (2hr) examinations. The threshold value for calculating MTV was 40% of SUVmax. In addition, apparent diffusion coefficient (ADCmean and ADCmin) of MRI, various oncogenes expressions including EGFR, VEGFA, Ki-67, HIF-1, KRAS, BRAF, CDH13 were evaluated. Among various clinical parameters including imaging parameters, independent significant prognostic factors for overall survival (OS) were determined by multivariate analysis with Cox proportional hazards model. Among various significant prognostic parameters, univariate analysis with mantel-cox test was done for comparing OS.

RESULTS

The pathologic T (pT) stage, TLG on early PET image, SUV max on delayed images and ADCmean was significant prognostic factor for OS (<0.05). Regarding gene expressions, only KRAS was significant predictive factors (P <0.05). In univariate analysis, patients of larger TLG (>=55) showed higher cumulative survival rate compared with that of smaller TLG group (<55). Similarly, lower ADCmean (<1300) showed shorter OS than that of higher ADCmean (>=1300).

CONCLUSION

Both FDG parameters (TLG on early PET image, SUV max on delayed images) and ADCmean were significant parameters for predicting OS, in addition to pT stage and KRAS expression. Thus, both 18F-FDG PET/CT and MRI diffusion images can provide useful prognostic information for patients undergoing resection of pancreatic cancer.

CLINICAL RELEVANCE/APPLICATION

In the prediction of prognosis of invasive ductal pancreas cancer after surgical operation, TLG of FDG-PET and ADCmean of MRI were useful imaging parameters.

SSA15-09 Body Weight-based Protocols during Whole Body FDG PET/CT Significantly Reduces Radiation Dose without Compromising Image Quality

Sunday, Nov. 29 12:05PM - 12:15PM Location: S505AB

Participants
Charbel Saade, PhD, Beirut, Lebanon (*Presenter*) Nothing to Disclose
Mohamad B. Haidar, MD, Beirut, Lebanon (*Abstract Co-Author*) Nothing to Disclose
Ahmad Ammous, Beirut, Lebanon (*Abstract Co-Author*) Nothing to Disclose
Mukbil H. Hourani, MD, Beirut, Lebanon (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To investigate radiation dose reduction during head to mid thigh fluorodeoxyglucose (FDG) positron emission tomographic (PET)/computed tomography by employing weight based protocols.

METHOD AND MATERIALS

520 consecutive patients were referred for FDG PET/CT study using a 16-detector PET/CT. Patients were allocated to one of two scanning protocols: Group A, the conventional protocol; 120 kVp, 120 mAs, 0.5 sec rotation time, pitch 0.8mm/rot across all body weights; Group B, employed a 4 tier body weight protocol: protocol A: ≤ 60 kg: 140 kVp, 35 mAs, 0.75 sec rotation time, pitch 0.8mm/rot; group B: 60 - 80 kg: 140 kVp, 50 mAs, 0.75 sec rotation time, pitch 0.8mm/rot; group C: 80 - 100 kg: 140 kVp, 65 mAs, 0.75 sec rotation time, pitch 0.8mm/rot; group D: > 100 kg: 140 kVp, 100 mAs, 0.75 sec rotation time, pitch 0.8mm/rot all protocols employed tube current modulation. Patient demographics were measured. Age and sex-specific lifetime attributable risk

(LAR) of individual cancers were estimated using the approach of BEIR VII and summed to obtain whole body LAR.

RESULTS

mean patient demographics demonstrated no significant difference. Mean effective dose CTDIvol and DLP significantly reduced in protocol B (CTDIvol; 4.60 ± 1.49, DLP; 823.35 ± 280.70 mSv) compared to A (CTDIvol; 7.36 ± 1.79, DLP; 1260.96 ± 304.7 mSv) ($p<0.0001$). Mean FDG administration demonstrated no significant differences in each protocol ($p=0.873$). Contrast to noise ratio demonstrated no differences between each group ($p<0.21$). Mean LAR cancer risk was significantly reduced for females by 35% and males 125% in protocol B compared to A ($p<0.04$).

CONCLUSION

Significant reduction in radiation dose can be achieved using patient-specific body weight based protocols during whole-body FDG PET/CT without compromising image quality.

CLINICAL RELEVANCE/APPLICATION

FDG and PET/CT have revolutionized the practice of medicine. With the expanding use of PET/CT, ionizing radiation may eventually result in an increased incidence of cancer in the exposed population. This problem can be minimized by optimizing the CT protocol to achieve optimal image quality with the lowest possible radiation dose

NMS-SUA

Nuclear Medicine Sunday Poster Discussions

Sunday, Nov. 29 12:30PM - 1:00PM Location: S503AB

NM

AMA PRA Category 1 Credit ™: .50

FDA Discussions may include off-label uses.

Participants
Andrew Quon, MD, Los Angeles, CA (*Moderator*) Nothing to Disclose

Sub-Events

NM203-SD-SUA9 FDG PET/CT Imaging Protocol for Head and Neck Cancer: Is Abdominal and Pelvic Imaging Needed?

Station #9

Participants
Daniella F. Pinho, MD, Dallas, TX (*Abstract Co-Author*) Nothing to Disclose
Julie C. Bulman, MD, Dallas, TX (*Presenter*) Nothing to Disclose
Jason W. Wachsmann, MD, Dallas, TX (*Abstract Co-Author*) Nothing to Disclose
Orhan K. Oz, MD, PhD, Dallas, TX (*Abstract Co-Author*) Nothing to Disclose
Fangyu Peng, Dallas, TX (*Abstract Co-Author*) Nothing to Disclose
Dana Mathews, MD, PhD, Dallas, TX (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Conventional staging of head and neck cancer by computer tomography (CT) includes imaging of the head and neck (H&N) and thorax through the level of the adrenal glands, given the usual pattern of regional lymph node and distant metastatic involvement to the lungs. Standard PET/CT protocols include scanning from the midbrain to midthigh, however there is little data supporting the need and benefit for the extra coverage. The purpose of this study was to determine the rate of detection of additional metastatic lesions with the extended abdomen and pelvic coverage obtained in standard PET/CT protocols.

METHOD AND MATERIALS

Institutional review board approval was obtained and informed consent was waived for this on-going HIPAA-compliant study. It included the retrospective review of 83 consecutive reports of patients that underwent a standard of care protocol of PET/CT for H&N SCC (24 patients for staging and 59 for follow up studies) in a 4-month period. The H&N protocol includes images from the midbrain to proximal thighs. The reports were reviewed for findings in the abdomen and pelvis (indeterminate, metastatic disease or nonrelated severe findings). The patients' electronic health records were reviewed for primary tumor location, size, standard uptake value, histologic grade, positivity for p16 at immunohistochemistry and TNM staging. Patient's demographics were also noted.

RESULTS

Metastatic disease was found in two follow up studies, one patient in the abdomen (metastatic liver lesions, stage III) and one patient in the pelvis (left ischium metastasis, stage IV), with overall incidence of 2.4%. Indeterminate findings were seen in 8 patients in the abdomen and no indeterminate findings in the pelvis. A single nonrelated severe finding was seen in the abdomen as well as one in the pelvis.

CONCLUSION

Our study showed very low incidence of metastatic disease in the abdomen and pelvis in patients with SCC of the H&N (2.4%).

CLINICAL RELEVANCE/APPLICATION

Elimination of abdomen and pelvis acquisition in FDG PET-CT for H&N SCC of patients with initial staging or tumor below stage II may reduce the study time, radiation dose and improve efficiency.

Honored Educators

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Daniella F. Pinho, MD - 2015 Honored Educator

NM104-ED-SUA10 A Primer on Interpreting Ga-68 DOTA-TOC PET/CT and How it Changes Patient Management

Station #10

Awards
Certificate of Merit

Participants
Robert R. Flavell, MD, PhD, San Francisco, CA (*Presenter*) Nothing to Disclose
Emily Bergsland, MD, San Francisco, CA (*Abstract Co-Author*) Research funding, Novartis AG Research support, F. Hoffmann-La Roche Ltd Consultant, Pfizer Inc Consultant, Lexicon Pharmaceuticals, Inc Consultant, Novartis AG
Eric Nakakura, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose
Miguel Hernandez Pampaloni, MD, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose
Spencer C. Behr, MD, Burlingame, CA (*Abstract Co-Author*) Research Grant, General Electric Company; Consultant, General Electric

Company
Carina Mari Aparici, MD, Palo Alto, CA (*Abstract Co-Author*) Nothing to Disclose
Judy Yee, MD, Clayton, 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

TEACHING POINTS

1) The results of Ga-68 DOTA-TOC PET can commonly impact patient management, usually by aiding detection of unknown primaries or distant metastasis.2) The normal biodistribution of Ga-68 DOTA-TOC includes the liver, spleen, renal collecting system, bladder, pituitary, thyroid and adrenal glands.3) Common false positives include infection/inflammation, splenules, and activity in the pancreatic head.

TABLE OF CONTENTS/OUTLINE

Introduction to Ga-68 DOTA TOC- Mechanism of action and Ga-68 as a PET radionuclide- Review of normal biodistribution- Comparison with 111In Pentetreotide, in terms of patient convenience and improved detection How Ga-68 DOTA-TOC can change patient management- Detection of unknown primary in patients with metastatic disease- Detection of local recurrence and distant metastasis- Case examples: distant bone metastasis, liver metastases, recurrence at surgical marginsPitfalls in interpreting Ga-68 DOTA-TOC PET/CT- False positive: infection/inflammation, splenules, pancreatic head activity- False negative: De-differentiated tumorFuture applications- Imaging with integrated PET/MRI system

NMS-SUB

Nuclear Medicine Sunday Poster Discussions

Sunday, Nov. 29 1:00PM - 1:30PM Location: S503AB

NM

AMA PRA Category 1 Credit ™: .50

Participants
Andrew Quon, MD, Los Angeles, CA (*Moderator*) Nothing to Disclose

Sub-Events

NM204-SD-SUB7 Bayesian Penalized-likelihood Iterative Reconstruction Improves C11-Choline PET/CT Evaluation of Lymph Nodes Compared to Time-of-Flight Reconstruction

Station #7

Participants
Jacob D. Waxman, MD, Rochester, MN (*Presenter*) Nothing to Disclose
Brad Kemp, PhD, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Mark A. Nathan, MD, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Val J. Lowe, MD, Rochester, MN (*Abstract Co-Author*) Research Grant, General Electric Company Research Grant, Siemens AG Research Grant, Eli Lilly and Company Advisory Board, Bayer AG
Robert C. Murphy, MD, PhD, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Stephen M. Broski, MD, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Christopher H. Hunt, MD, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Daniel McConnell, ARRT, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Geoffrey B. Johnson, MD, PhD, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

C11-choline PET/CT is sensitive for the detection of metastatic prostate cancer. Recently FDA approved Bayesian penalized-likelihood iterative reconstruction (BPIR) promises to improve signal to background ratio (SBR) on PET images. We examined the benefit of this new reconstruction algorithm on diseased lymph nodes in patients with early biochemically recurrent prostate cancer.

METHOD AND MATERIALS

A single tertiary care center database was retrospectively reviewed for patients who underwent C11-choline PET/CT between 7/2014 and 12/2014 for initial evaluation of biochemically recurrent prostate cancer. Each patient was scanned on a GE Discovery 710 PET/CT system and PET images were reconstructed using standard 3D-OSEM IR (non-TOF), time-of-flight (TOF) IR and BPIR with TOF. Patients with prior evidence of metastases or no choline-avid lymph nodes were excluded. The size and SUVmax of choline avid lymph nodes were measured. A ratio of nodal SUVmax to background fat SUVmax was used to determine SBR. Statistical analysis was performed utilizing JMP software.

RESULTS

212 patients were reviewed. 13 met inclusion criteria. Mean PSA was 3.6 +/- 2.8 (SD) with a range of 0.19-10.7. 25 choline avid nodes which were considered likely pathologic were measured. These nodes measured on average 7.0 +/-2.0 mm by 9.0 +/-3.0 mm, with a mean SUVmax of 3.3 +/- 1.8 (BPIR), 2.8 +/- 1.1 (TOF), and 2.3 +/- 0.8 (non-TOF). Nodal SUVmax was 18% higher on BPIR than TOF ($p<0.05$), 43% higher on BPIR than non-TOF ($p<0.001$), and 22% higher on TOF than non-TOF ($p<0.0001$). The background SUVmax decreased with BPIR. Nodal SBR was 6.0 +/- 2.6 for BPIR, 4.4 +/-1.5 for TOF, and 3.1+/-1.1 for non-TOF. Nodal SBR was 36% greater for BPIR than TOF ($p<0.001$), 94% greater for BPIR than non-TOF ($p<0.0001$), and 42% greater for TOF than non-TOF ($p<0.0001$).

CONCLUSION

C11-choline PET/CT reconstructed with BPIR increases SUVmax in diseased nodes and decreases background SUVmax for increased signal to background ratio. The magnitude of this increase with BPIR over TOF was similar to the magnitude of TOF over standard 3D-OSEM non-TOF IR.

CLINICAL RELEVANCE/APPLICATION

BPIR significantly increases SBR on C11-choline PET/CT, which can aid in the detection of prostate cancer with lymph node metastases.

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Geoffrey B. Johnson, MD, PhD - 2015 Honored Educator

NM205-SD-SUB8 Utilization of C-11 Acetate Positron Emission Tomography/Computed Tomography (PET/CT) in Detecting Prostate Cancer Lymph Node Metastases

Station #8

Participants
Nasiem M. Niroumand, MD, Kansas City, KS (*Presenter*) Nothing to Disclose
Christopher McClinton, MD, Kansas City, KS (*Abstract Co-Author*) Nothing to Disclose

Veer Shah, MBChB, Kansas City, KS (*Abstract Co-Author*) Nothing to Disclose
Amie Robinson, BS, RT, Kansas City, KS (*Abstract Co-Author*) Nothing to Disclose
Jacqueline Hill, MPH, Kansas City, KS (*Abstract Co-Author*) Nothing to Disclose
Xinglei Shen, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Reginald W. Dusing, MD, Kansas City, KS (*Abstract Co-Author*) Advisory Board, Quintiles Inc

PURPOSE

To evaluate the effectiveness of 11C-acetate PET/CT in detecting local or regional lymph node spread in patients with suspected biochemical recurrence of prostate cancer that would otherwise be missed on standard cross sectional imaging modalities.

METHOD AND MATERIALS

A retrospective analysis was conducted on male patients with prostate cancer who underwent C-11 acetate PET/CT scans at our institution between 2007 and 2014. Patients with lymph node positive disease were included in this study. On the node-positive scans, individual lymph nodes were characterized by location, size on corresponding CTAC imaging, and standardized uptake value (SUV) on C-11 acetate PET/CT. Positive lymph nodes on standard CT imaging were defined by short axis diameter greater than 1 cm.

RESULTS

A total of 125 patients were reviewed of which 99 had one or more positive scans. Of these, 63 patients (64%) had at least one positive lymph node (range: 1-X nodes), for a total of 197 positive nodes. Patients were an average of 60.8 years, with a median total PSA of 3.73 (range: 0.08-35.7) and median Gleason score of 7 (range: 3-10). One-quarter of positive nodes (n=51) would have been detected on anatomic cross-sectional imaging, as they were at least 1cm in size, while three-quarters (n=146) of positive nodes were only detected on C-11 acetate PET/CT molecular imaging. Mean short axis diameter of the positive nodes on CTAC (n=51) was 1.29 cm (range: 1.0-2.2 cm) with an average SUV of 4.1 (range 1.15-19.4), while mean short axis diameter of positive lymph nodes on C-11 acetate PET/CT only (n= 146) was 0.68 cm (range: 0.3-0.9) with an average SUV of 2.75 (range: 1.52-14.8).

CONCLUSION

In our patient population, only 25% of positive lymph nodes that were detected on 11C-Acetate PET/CT would have been detected on anatomical imaging. Because this imaging modality is not limited by size criteria, our study suggests there is value in using molecular imaging to manage prostate cancer treatment, which is particularly important in patients with local or suspected recurrence of prostate cancer as detection of nodal metastatic disease may alter management technique in these patients.

CLINICAL RELEVANCE/APPLICATION

CT and MRI used to evaluate recurrent prostate cancer are inadequate in detection of early nodal metastases. Use of molecular imaging may detect recurrence in locations not noted on standard imaging.

NM206-SD-SUB9 Comparison of I-123 IMP SPECT, F-18 FDG PET, and F-18 FDOPA PET in Detection of choroidal Malignant Melanoma

Station #9

Participants
Katsuhiko Kato, MD, PhD, Nagoya, Japan (*Presenter*) Nothing to Disclose
Toshinobu Kubota, MD, Nagoya, Japan (*Abstract Co-Author*) Nothing to Disclose
Shinji Abe, RT, Nagoya, Japan (*Abstract Co-Author*) Nothing to Disclose
Saki Tsuchiya, Nagoya, Japan (*Abstract Co-Author*) Nothing to Disclose
Yumiko Koshiba, Nagoya-Shi, Japan (*Abstract Co-Author*) Nothing to Disclose
Hiroko Terasaki, MD, PhD, Nagoya, Japan (*Abstract Co-Author*) Nothing to Disclose
Shinji Naganawa, MD, Nagoya, Japan (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Previously we showed that I-123 IMP SPECT is a sensitive and accurate method for the detection of choroidal malignant melanoma. The feasibility and usefulness of F-18 FDOPA PET for detection of choroidal malignant melanoma have not yet been established. The purpose of this study is to compare the usefulness of I-123 IMP SPECT, F-18 FDG PET, and F-18 FDOPA PET for detection of choroidal malignant melanoma.

METHOD AND MATERIALS

Forty-six patients with suspected choroidal malignant melanoma were examined by I-123 IMP SPECT, F-18 FDG-PET/CT, and F-18 FDOPA PET/CT.

RESULTS

In 29 of 46 study patients, I-123 IMP SPECT showed markedly increased uptake in the site corresponding to the ocular tumor. In 26 of the 29 patients showing increased uptake of I-123 IMP, the ocular tumors were confirmed histopathologically or clinically to be choroidal malignant melanoma. The ocular tumors in the other 3 patients showing increased uptake of I-123 IMP was diagnosed as small choroidal melanocytic lesions. The 17 I-123 IMP SPECT-negative cases comprised 7 small melanocytic lesions, 1 choroidal hemangioma, 1 adenoma, and 2 melanocytoma, 2 metastases, 3 hemorrhages, and 1 unknown benign lesion. Nineteen of 20 of choroidal malignant melanoma showed positive uptakes in F-18 FDG PET and F-18 FDOPA PET. The uptakes of both F-18 FDG and F-18 FDOPA were much weaker than that of I-123 IMP. The range and mean ± SD of SUVmax for F-18 FDG and F-18 FDOPA in choroidal malignant melanoma were 1.70-10.35, 3.78 ± 0.88 and 0.74-4.63, 1.18 ± 0.06, respectively. The difference between the uptakes of both tracers was statistically significant. Thus the uptake of F-18 FDOPA was weaker than that of F-18 FDG.

CONCLUSION

I-123 IMP SPECT is superior to F-18 FDG and F-18 FDOPA PET for the detection of choridal malignant melanoma. Efficacy of F-18 FDOPA PET for the detection of choroidal malignant melanoma is low compared with F-18 FDG PET because of its weak uptake into choroidal malignant melanoma.

CLINICAL RELEVANCE/APPLICATION

I-123 IMP SPECT is a sensitive and accurate method for the detection of choroidal malignant melanoma, whereas the efficacy of F-18 FDG PET for this purpose is low due to a high incidence of false negative results. The efficacy of F-18 DOPA PET/CT for detection of choroidall malignant melanoma is low.

NM214-SD-SUB10 Use of FDG PET/CT to Predict Onset of Bleomycin Pulmonary Toxicity in Patients with Hodgkin's Lymphoma Treated with ABVD

Station #10

Participants
Morgan P. McBee, MD, Cincinnati, OH (*Presenter*) Nothing to Disclose
Bruce Mahoney, MD, Cincinnati, OH (*Abstract Co-Author*) Nothing to Disclose
Jennifer L. Scheler, MD, Cincinnati, OH (*Abstract Co-Author*) Nothing to Disclose
Akshiv Malhotra, Cincinnati, OH (*Abstract Co-Author*) Nothing to Disclose
Tahir Latif, Cincinnati, OH (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Doxorubicin, bleomycin, vinblastine, and dacarbazine (ABVD) is the standard of care for treatment in patients with Hodgkin's lymphoma, and these patients are frequently followed with FDG PET/CT. There have been case reports of bleomycin-induced pulmonary toxicity on PET/CT, but no formal studies have been performed to our knowledge. The purpose of this study was to determine whether FDG PET/CT correlates with the onset of bleomycin pulmonary toxicity before onset of clinical symptoms.

METHOD AND MATERIALS

All adult Hodgkin's lymphoma patients treated with ABVD at a single urban academic cancer center from 2012-2014 were included. Patients without PET/CT scans or with evidence of underlying pulmonary disease were excluded. The images were evaluated by a radiology resident and a fellowship trained nuclear radiologist who were blinded to the clinical information.For each patient, the CT and PET images were first evaluated qualitatively to assess for signs of active lung disease. The PET images were also evaluated semi-quantitatively by determination of the maximum standardized uptake values (max SUV) of the lungs.

RESULTS

11 patients were included with 54 total FDG PET/CT scans. 5/11 patients developed clinical pulmonary bleomycin toxicity. 2/5 patients with toxicity had diffuse groundglass opacities with increased FDG uptake. 3/5 patients had more focal areas of consolidation or groundglass opacity with increased FDG uptake. 1 patient had diffuse groundglass opacities with increased FDG uptake and did not develop clinical toxicity. The other 5 patients had no signs of toxicity on imaging and did not develop clinical toxicity.The patients who developed pulmonary bleomycin toxicity had a max SUVs ranging from 1.8-3.7 within either focal or diffuse opacities. The patients who did not develop pulmonary toxicity had a max SUVs ranging from 0.4-1.9.

CONCLUSION

Findings on FDG PET/CT imaging correlate with the development of clinical bleomycin toxicity in Hodgkin's lymphoma patients treated with ABVD therapy. Any focal or diffuse areas of increased lung uptake on FDG PET imaging during ABVD therapy should be considered suspicious for toxicity.

CLINICAL RELEVANCE/APPLICATION

Bleomycin is a commonly used chemotherapeutic agent with known pulmonary toxicity, and routine FDG PET/CT used for treatment response may be useful to monitor for the development of this toxicity.

NM106-ED-SUB11 The Role of Advanced Imaging Utilizing F18-FDGPET/MR and F18-FDGPET/CT in Multiple Myeloma - A Pictorial Review

Station #11

Participants
Etan Dayan, MD, New York, NY (*Presenter*) Nothing to Disclose
Livnat Uliel, MD, MSc, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Panagiotis A. Sideras, MD, PhD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Sherif I. Heiba, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Ajai Chari, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Samir Parekh, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Lale Kostakoglu, MD, MPH, New York, NY (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

The purpose of this exhibit is to: Recognize the varying appearances of multiple myeloma (MM) on PET/MR and PET/CT. Understand the complementary roles of PET/MR and PET/CT in the management of MM. Review the different patterns of bone marrow infiltration on MRI and PET. Review treatment related changes that may be confounded with disease (pharmacologic, surgical, radiation, etc). Understand the limitations and added values of PET/MR and PET/CT.

TABLE OF CONTENTS/OUTLINE

Introduction - Current recommendation for hybrid imaging in MM and recommended imaging protocols. Appearances of MM - Illustrative cases of simultaneous PET/MR and PET/CT of the same patient. Bone marrow infiltration - Patterns of bone marrow infiltration as seen on MR and PET in MM - Normal appearance, focal, homogeneous diffuse, combined diffuse and focal, salt-and-pepper. Extramedullary disease and solitary bone plasmacytoma. Post treatment imaging findings - fatty infiltration, bone marrow stimulation, red marrow reconversion, delayed post-treatment appearance. MM mimics and pitfalls - avascular necrosis, post procedure findings (e.g. vertebroplasty, biopsy), osteoporotic fractures, infection, tumors. Discussing the added value of hybrid imaging for both metabolic and anatomic assessment of MM, MR limitations, PET/CT limitations.

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Lale Kostakoglu, MD, MPH - 2012 Honored Educator

RC111

Head and Neck Cancer PET Interpretation with Case Examples (An Interactive Session)

Sunday, Nov. 29 2:00PM - 3:30PM Location: S505AB

HN NR CT NM OI

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

Participants

LEARNING OBJECTIVES

Please bring your charged mobile wireless device (phone, tablet or laptop) to participate.

Sub-Events

RC111A Practical Approach for Interpreting Head and Neck PET/CT

Participants
Rathan M. Subramaniam, MD, PhD, Baltimore, MD, (rsubram4@jhmi.edu) (*Presenter*) Travel support, Koninklijke Philips NV

LEARNING OBJECTIVES

1) To understand the value of PET/CT in the care process of managing head and neck cancer. 2) To learn common pathways of tumor spread in head and neck. 3) To review illustrative cases and pitfalls of interpretation.

ABSTRACT

RC111B PET/CT for Head and Neck Cancer: Clinical Applications and Case Studies

Participants
Eric M. Rohren, MD, PhD, Houston, TX (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Review head and neck anatomy and physiologic sites of FDG uptake. 2) Review the impact of FDG-PET/CT on the management of patients with head and neck malignancies.

ABSTRACT

FDG-PET/CT provides valuable information in the assessment of the patient with cancers of the head and neck. The metabolic information determined by FDG is complimentary and additive to the anatomic information from CT, and can be used to direct surgery, plan radiation therapy, and evaluate response to systemic or localized treatment. In this presentation, the role of FDG-PET/CT in the management of head and neck cancer will be presented, using case examples to illustrate the utility of PET as well as common pitfalls.

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Eric M. Rohren, MD, PhD - 2015 Honored Educator

RC111C The Head and Neck Surgeon's Perspective: What I Need to Know

Participants
Nishant Agrawal, MD, Baltimore, MD (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Review the indications of PET/CT in head and neck cancer. 2) Review the impact of PET/CT on staging in head and neck cancer. 3) Review the role of PET/CT in the evaluation of the unknown primary. 4) Review the role of post-treatment PET/CT.

RC118

Imaging Cancer Treatment Complications

Sunday, Nov. 29 2:00PM - 3:30PM Location: N229

CT NM OI

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

Participants

Sub-Events

RC118A Identifying and Distinguishing Treatment Complications on FDG PET/CT

Participants
Gary A. Ulaner, MD, PhD, New York, NY, (ulanerg@mskcc.org) (*Presenter*) Research support, General Electric Company; Research support, F. Hoffmann-La Roche Ltd

LEARNING OBJECTIVES

1) Identify iatrogenic causes of FDG-avidity on FDG PET/CT and distinguish them from FDG-avid malignancy. Iatrogenic causes of FDG-avidity include changes caused by surgery (inflammation at sites of incision, pleurodesis inflammation, transposition of ovaries/testes), radiation (pneumonitis, esophagitis, hepatitis), and drugs (bleomycin pneumonitis, bisphosphonate osteonecrosis, ipilimumab enterocolitis). Familiarity with usual and unusual causes of iatrogenic FDG-avidity will improve accuracy of FDG PET/CT reporting.

ABSTRACT

Fluorine 18 fluorodeoxyglucose (FDG) positron emission tomography / computed tomography (PET/CT) is increasingly used in the initial staging, evaluation of treatment response and surveillance of many malignancies. Uptake of FDG is substantially increased in most malignancies compared with its uptake in normal tissues, and FDG-avidity often leads to cancer detection earlier than abnormalities on anatomic imaging. However, FDG is not a cancer-specific agent, and FDG-avidity can be seen in many benign processes. It can be particularly challenging to discriminate malignancy from benign FDG-avid changes caused by surgery and procedures, radiation, and chemotherapy. FDG-avid lesions caused by surgery and procedures includes inflammation at sites of incision or dissection, inflammation from vascular compromise or surgical retraction, surgical transposition of structures with physiologic FDG-avidity (such as ovaries or testes), and pleurodesis inflammation. Radiation may induce FDG-avid pneumonitis, esophagitis, or hepatitis, as well as osteoradionecrosis or fractures. FDG-avid chemotherapy complications include pneumonitis, osteonecrosis, enterocolitis, and pancreatitis. Granulocyte Colony Stimulating Factor for treatment of bone marrow suppression after chemotherapy induces temporary increases of FDG-avidity in the bone marrow and spleen. In this review we illustrate common and unusual iatrogenic causes of FDG-avidity that can confound FDG PET/CT interpretation. Familiarity with these cases will improve accuracy of FDG PET/CT interpretation.

RC118B Imaging Musculoskeletal Complications

Participants
Brooke R. Beckett, MD, Portland, OR (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To recognize the osseous and soft tissue complications of tumor treatment, specifically those caused by radiation, chemotherapy, and surgery. These include radiation osteitis, osteonecrosis, insufficiency fractures, secondary malignancy, myositis and myonecrosis, and muscle denervation changes.

ABSTRACT

Musculoskeletal complications of tumor treatment are relatively common, often symptomatic, and therefore, an important cause of morbidity in the posttreatment cancer patient. Radiation causes local marrow changes such as osteitis, osteonecrosis and osteopenia, predisposing to insufficiency fractures. It may also cause local muscle damage, most commonly myositis, but occasionally myonecrosis. A rare but especially dreaded complication of radiation is secondary bone or soft tissue sarcoma, which will also be described. Chemotherapy, particularly protocols that include high doses of steroids, predisposes to osteonecrosis. And finally, surgical resection of extremity tumors, either primary or metastatic, may lead to muscle denervation changes. The bones and soft tissues should be carefully reviewed on all surveillance imaging, be it radiographs, CT or MRI, to exclude the presence of these often treatable complications.

RC118C GI Complications

Participants
Priya R. Bhosale, MD, Houston, TX (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To recognize the complications caused by chemotherapy and radiation specifically those that occur in the GI tract including the liver and the pancreas. These include perforations, abscess formation, radiation enteritis, insufficiency fractures and secondary malignancy.

ABSTRACT

Several complications can occur in the GI tract following surgery. Similarly chemotherapy can cause a myriad of complications such as perforation, abscesses and enteritis. Radiation therapy can result in radiation enteritis and occurrence of radiation induced

cancer

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Priya R. Bhosale, MD - 2012 Honored Educator

RC118D Pulmonary Complications

Participants
Michelle S. Ginsberg, MD, New York, NY (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To recognize complications in the postoperative thoracic patient in both immediate and late periods. In the immediate period this will include lobar collapse, hemorrhage, pulmonary edema, pneumonia, as well as rarer complications such as bronchopleural fistula, chylothorax and lung torsion. In the later period it is important to follow these patients and to recognize and distinguishing recurrent tumor from treatment changes and new primary tumors.

ABSTRACT

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RC123

Molecular Imaging Mini-Course: Basics of Molecular Imaging

Sunday, Nov. 29 2:00PM - 3:30PM Location: E451A

CT MI NM PH

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

FDA Discussions may include off-label uses.

Participants

Sub-Events

RC123A Developing Molecular Imaging Agents

Participants
Julie L. Sutcliffe, PhD, Sacramento, CA, (jlsutcliffe@ucdavis.edu) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Describe the ideal properties of a molecular imaging agent. 2) Describe the in vitro validation of the molecular imaging agent. 3) Describe specific examples of successful molecular imaging agents.

RC123B Instrumentation (PET and CT) and Image Reconstruction

Participants
John Sunderland, PhD, Iowa City, IA, (john-sunderland@uiowa.edu) (*Presenter*) Research Grant, Siemens AG

LEARNING OBJECTIVES

1) Identify the primary design components of a modern PET/CT system. 2)Design and implement a PET/CT quality control program to assure high quality and quantitatively accurate clinical imaging. 3) Describe commonly used PET reconstruction algorithms and the practical impact of reconstruction parameters upon image quality and quantitation.

ABSTRACT

Handout:John Sunderland

http://abstract.rsna.org/uploads/2015/15002826/RSNA Physics Recon Talk.pdf

RC123C Basic Clinical Applications

Participants
Hubert J. Vesselle, MD, PhD, Seattle, WA (*Presenter*) Consultant, MIM Software Inc

ABSTRACT

ED010-MO

Nuclear Medicine Monday Case of the Day

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

NM

AMA PRA Category 1 Credit ™: .50

Participants
William Sherk, MD, Ann Arbor, MI (*Abstract Co-Author*) Nothing to Disclose
Jadranka Stojanovska, MD, MS, Northville, MI (*Abstract Co-Author*) Nothing to Disclose
David Brandel, MD, Ann Arbor, MI (*Abstract Co-Author*) Nothing to Disclose
Richard K. Brown, MD, Ann Arbor, MI (*Presenter*) Nothing to Disclose
Jamil Shaikh, MD, New Brunswick, NJ (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

1) The case will demonstrate the typical characteristics of sarcoid on FDG PET and cardiac MRI. The learner will understand the role of these modalities in the work up of patients with suspected cardiac sarcoid. 2) The case will demonstrate focal hot spots in the periphery of the lungs on MAA perfusions scan. The learner will be able to identify this finding as an artifact related to the technique of injection. 3) The case will deomonstrate the typical characteristics of pleural talcosis on FDG PET. The exhibit will teach the learner how to seperate benign from neoplastic causes of update in the pleural space.

SPSH20

Hot Topic Session: PET/MR and Hyperpolarized MR for GU Imaging

Monday, Nov. 30 7:15AM - 8:15AM Location: E450B

GU MR NM OI

AMA PRA Category 1 Credit ™: 1.00
ARRT Category A+ Credit: 1.00

Participants
Zhen J. Wang, MD, Hillsborough, CA, (jane.wang@ucsf.edu) (*Moderator*) Nothing to Disclose

LEARNING OBJECTIVES

1) To become familiar with current PET-MR imaging strategies. 2) To learn the current and future applications of PET-MR in genitourinary oncology including gynecological cancers and prostate cancer. 3) To understand the principles of hyperpolarized carbon-13 MR metabolic imaging 4) To learn the clinical utility of hyperpolarized carbon-13 MR for measuring prostate cancer aggressiveness and response to therapy

ABSTRACT

URL

Sub-Events

SPSH20A PET/MRI of Gynecological Malignancies

Participants
Raj M. Paspulati, MD, Cleveland, OH (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) PET-MRI protocol and workflow for Gynecological cancer. 2) Role of PET-MRI in Gynecological cancer staging, treatment planning and follow up for treatment response. 3) PET-MR Imaging pit falls and limitations.

SPSH20B Imaging of Prostate Cancer: Potential of PET/MRI with Tracers beyond FDG

Participants
Matthias Roethke, MD, Heidelberg, Germany (*Presenter*) Speaker, Siemens AG

LEARNING OBJECTIVES

View learning objectives under main course title.

Handout:Matthias Roethke

http://abstract.rsna.org/uploads/2015/15006404/Roethke Prostate RSNA handout.pdf

SPSH20C Hyperpolarized 13C MR Clinical Trials of Prostate Cancer

Participants
John Kurhanewicz, PhD, San Francisco, CA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

RC211

Nuclear Medicine Series: Assessment of Cancer Treatment Response: Updates

Monday, Nov. 30 8:30AM - 12:00PM Location: S505AB

BQ NM OI

AMA PRA Category 1 Credits ™: 3.25
ARRT Category A+ Credits: 3.75

Participants
Terence Z. Wong, MD, PhD, Chapel Hill, NC (*Moderator*) Nothing to Disclose
Haesun Choi, MD, Houston, TX (*Moderator*) Nothing to Disclose

Sub-Events

RC211-01 Imaging Response - Earning Biomarker Status

Monday, Nov. 30 8:30AM - 9:15AM Location: S505AB

Participants
Terence Z. Wong, MD, PhD, Chapel Hill, NC (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Compare and contrast prognostic, predictive, and pharmacodynamic biomarkers. 2) Understand the difference between integrated and integral biomarkers in clinical trials. 3) Discuss advantages and limitations of imaging biomarkers.

ABSTRACT

Serum, pathological, and imaging biomarkers are becoming increasingly important to define potential biological targets, select which patients may benefit from a particular targeted agent, and to follow patients during and following therapy. Traditionally, imaging has not been formally recognized as a biomarker, and standardization of quantitative imaging techniques remains a major challenge. However, functional and quantitative imaging techniques are now being used routinely to evaluate early response to therapy. Unlike conventional cytotoxic chemotherapy, targeted therapy can be cytostatic and selects only susceptible populations of cells. Imaging response criteria is therefore often different from standard anatomic (RECIST, WHO) criteria, and the response may be heterogeneous. In the future, both serum and imaging biomarkers will have an increasingly important role in managing patients undergoing conventional and targeted therapy.

RC211-02 Can Interim [18F]-FDG-PET or Diffusion-weighted MRI Predict End-of-Treatment Outcome in MALT Lymphoma after Immunotherapy? A Prospective Study in 15 Patients

Monday, Nov. 30 9:15AM - 9:25AM Location: S505AB

Participants
Marius E. Mayerhoefer, MD, PhD, Vienna, Austria (*Presenter*) Nothing to Disclose
Georgios Karanikas, MD, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose
Kurt Kletter, MD, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose
Matthias Pones, MD, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose
Michael Weber, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose
Markus Raderer, MD, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To determine whether, in in patients with MALT lymphoma, quantitative changes of glycolytic activity on interim [18F]-FDG-PET, or quantitative changes of cell density on interim diffusion-weighted MRI (DWI), relative to pre-therapeutic scans, can predict the end-of-treatment (EOT) outcome after immunotherapy.

METHOD AND MATERIALS

Our prospective IRB-approved study included patients with untreated, histologically proven, FDG-avid MALT lymphoma that underwent whole-body [18F]-FDG-PET/CT and DWI at three time-points: before treatment (baseline); after three cycles (interim); and after six cycles of rituximab-based immunotherapy (EOT). The up to three largest nodal or extranodal lymphoma lesions that were visible on both [18F]-FDG-PET and DWI were defined as target lesions at baseline. Maximum and mean SUVs (SUVmax, SUVmean), and minimum and mean apparent diffusion coefficients (ADCmin, ADCmean) were measured, and their rates of change between baseline and interim examinations (ΔSUVmax, ΔSUVmean, ΔADCmin, and ΔADCmean) were compared, using ANOVAs, between the four EOT outcomes: complete remission (CR), partial remission (PR), stable disease (SD), or progressive disease (PD). The relationship between ΔSUVs and ΔADCs was also assessed by Pearson correlation coefficients (r).

RESULTS

Fifteen patients with 25 lesions were included. Lesion-based post-hoc tests showed significant differences between CR and PR for ΔSUVmax (P<0.001), ΔSUVmean (P<0.001), and ΔADCmin (P=0.044); and between CR and SD for ΔSUVmax (P<0.001), ΔSUVmean (P<0.001), ΔADCmin (P=0.021), and ΔADCmean (P=0.022); but not between CR and PR for ΔADCmean (P=0.012); and also not between PR and SD for ΔSUVmax (P=0.98), ΔSUVmean (P=0.96), ΔADCmin (P=0.85), or ΔADCmean (P=0.99). No lesion showed PD at EOT. A substantial and significant, negative correlation between ΔSUVmax and ΔADCmin (r=-0.71, P<0.001), and ΔSUVmean and ΔADCmean (r=-0.70, P<0.001), was observed.

CONCLUSION

Both quantitative interim [18F]-FDG-PET measures and interim DWI measures may be able to predict lesion-based complete response to immunotherapy at end-of-treatment in MALT lymphoma.

CLINICAL RELEVANCE/APPLICATION

[18F]-FDG-PET and DWI may be useful for early treatment outcome prediction in patients with MALT lymphoma undergoing rituximab-based immunotherapy.

RC211-03 Whole-Body FDG-PET/MRI vs. Whole-Body MRI with DWI vs. Integrated FDG-PET/CT with Brain CE-MRI: Capability for Recurrence Assessment in Patients with Postoperative Non-Small Cell Lung Cancer

Monday, Nov. 30 9:25AM - 9:35AM Location: S505AB

Participants
Yoshiharu Ohno, MD, PhD, Kobe, Japan (*Presenter*) Research Grant, Toshiba Corporation; Research Grant, Koninklijke Philips NV; Research Grant, Bayer AG; Research Grant, DAIICHI SANKYO Group; Research Grant, Eisai Co, Ltd; Research Grant, Terumo Corporation; Research Grant, Fuji Yakuhin Co, Ltd; Research Grant, FUJIFILM Holdings Corporation; Research Grant, Guerbet SA;
Shinichiro Seki, Kobe, Japan (*Abstract Co-Author*) Nothing to Disclose
Hisanobu Koyama, MD, PhD, Kobe, Japan (*Abstract Co-Author*) Nothing to Disclose
Kota Aoyagi, Otawara, Japan (*Abstract Co-Author*) Employee, Toshiba Corporation
Hitoshi Yamagata, PhD, Otawara, Japan (*Abstract Co-Author*) Employee, Toshiba Corporation
Takeshi Yoshikawa, MD, Kobe, Japan (*Abstract Co-Author*) Research Grant, Toshiba Corporation
Sumiaki Matsumoto, MD, PhD, Kobe, Japan (*Abstract Co-Author*) Research Grant, Toshiba Corporation;
Masao Yui, Otawara, Japan (*Abstract Co-Author*) Employee, Toshiba Corporation
Yoshimori Kassai, MS, Otawara, Japan (*Abstract Co-Author*) Employee, Toshiba Corporation
Katsusuke Kyotani, RT, Kobe, Japan (*Abstract Co-Author*) Nothing to Disclose
Kazuro 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

PURPOSE

To compare the diagnostic performance for postoperative lung cancer recurrence assessment among whole-body FDG-PET/MRI, MRI with diffusion weighted imaging (DWI) and integrated FDG-PET/CT with brain contrast-enhanced (CE-) MRI in non-small lung cancer (NSCLC) patients.

METHOD AND MATERIALS

96 consecutive postoperative NSCLC patients (52 men, 44 women; mean age 72 years) prospectively underwent whole-body MRI with and without DWI at 3T MRI system, integrated PET/CTs and conventional radiological examinations as well as follow-up examinations. When recurrence was suspected in each NSCLC patients, pathological examination was performed. Then, all patients were divided into recurrence (n=17) and non-recurrence (n=79) groups based on pathological and follow-up examinations. All co-registered PET/MRIs were generated by means of our proprietary software. Then, probability postoperative recurrence in each patient was visually assessed on all methods by means of 5-point visual scoring system. To compare diagnostic performance among all methods, receiver operating characteristic analyses were performed. Finally, diagnostic accuracy of each factor and clinical stage was statistically compared each other by using McNemar's test.

RESULTS

Area under the curves (Azs) of whole-body PET/MRI (Az=0.99) and MRI with DWI (Az=0.99) were significantly larger than that of PET/CT (Az=0.92, $p<0.05$) and conventional examination (Az=0.91, $p<0.05$). When applied feasible threshold values, specificities (SPs) and accuracies (ACs) of PET/MRI (SP: 96.2 [76/79] %, and AC: 96.8 [93/96] %) and MRI with DWI (SP: 100 [79/79] %, and AC: 96.8 [93/96] %) were significantly higher than those of PET/CT with CE-brain MRI (SP: 81.0 [64/79] %, $p<0.05$; AC: 84.4 [81/96] %, $p<0.05$) and conventional radiological examination (SP: 79.7 [63/79] %, $p<0.05$; AC: 83.3 [80/96] %, $p<0.05$).

CONCLUSION

Whole-body PET/MRI and MRI with DWI have better potential for recurrence evaluation than PET/CT with CE-brain MRI and conventional radiological examination in postoperative NSCLC patients.

CLINICAL RELEVANCE/APPLICATION

Whole-body PET/MRI and MRI with DWI have better potential for recurrence evaluation than PET/CT with CE-brain MRI and conventional radiological examination in postoperative NSCLC patients.

RC211-04 Lung Cancer: PET/CT Interpretation (Hopkins Criteria) for Therapy Assessment and Survival Outcome Prediction

Monday, Nov. 30 9:35AM - 9:45AM Location: S505AB

Participants
Rick Wray, MD, Baltimore, MD (*Presenter*) Nothing to Disclose
Charles Marcus, MD, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Sara Sheikhbahaei, MD, MPH, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Rathan M. Subramaniam, MD, PhD, Baltimore, MD (*Abstract Co-Author*) Travel support, Koninklijke Philips NV

PURPOSE

The aim of the study was to test a simple, reproducible, qualitative, therapy response interpretation method (Hopkins Criteria) that can be implemented on the post treatment 18F-FDG PET/CT study and to evaluate its impact on prognosis in patients with lung cancer.

METHOD AND MATERIALS

This was a retrospective study of 204 biopsy-proven lung cancer patients, who underwent a post treatment PET/CT study after completion of primary treatment from 2003 to 2012. The median follow-up was 12.1 months. The PET/CT studies were interpreted using a qualitative 5-point scoring system - Hopkins Criteria. The primary outcome was overall survival (OS), which was analyzed by Kaplan-Meier plots with a Mantel-Cox long-rank test.

RESULTS

Of the 204 patients, 88 were women and 116 were men. A total of 140 (68.6%) patients died during the follow-up period. There were 123 (61.3%) with a positive Hopkins Criteria score for residual disease and 81 (39.7%) patients with a negative score. The median survival time for patients with a positive score was 29.6 months in comparison to 51.2 months in those with a negative score (p<0.001). There was a significant difference in the OS between patients with a positive score versus those with a negative score (HR 2.01; 95%CI: 1.42-2.84; Logrank P<0.001). The Kaplan-Meier analysis also showed a significant difference in OS between patients with a positive and negative score who were treated with surgery (HR 4.72; 95%CI: 1.84-12.08; Logrank P<0.001) and those treated with chemoradiation alone (HR 1.62; 95%CI: 1.11-2.37; Logrank P=0.012). There was also a significant difference in the OS between patients with scores 1 and 2 versus score 3 versus score 4 and 5 (Logrank P<0.0001).

CONCLUSION

The 5-point qualitative therapy response Hopkins Criteria provides valuable prognostic information in patients with lung carcinoma.

CLINICAL RELEVANCE/APPLICATION

The 5-point qualitative therapy response Hopkins Criteria can predict survival outcome in post therapy patients with lung carcinoma and is recommended for surveillance in this population.

RC211-05 Response Assessment Recommendations in Solid Tumors: RECIST vs PERCIST

Monday, Nov. 30 9:45AM - 10:30AM Location: S505AB

Participants
Heather Jacene, MD, Boston, MA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To compare anatomic and metabolic imaging for response assessment. 2) To discuss limitations of current widely used criteria for assessing response. 3) To discuss the benefits and limitations of metabolic imaging for response assessment.

ABSTRACT

RC211-06 Challenges of Solid Tumor Measurements and Techniques to Address This

Monday, Nov. 30 10:45AM - 11:30AM Location: S505AB

Participants
Haesun Choi, MD, Houston, TX (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) The currently available response evaluation criteria of solid tumors and its limitations. 2) New concept of response evaluation of solid tumors. 3) Future of response evaluation of solid tumors.

ABSTRACT

RC211-07 Is There an Influence of the PERCIST Analysis Approach Used with FDG PET/CT for Evaluation of Tumor Response on Outcome Prediction in Stage IV Breast Cancer Patients?

Monday, Nov. 30 11:30AM - 11:40AM Location: S505AB

Participants
Katja Pinker, MD, New York, NY (*Presenter*) Nothing to Disclose
Christopher C. Riedl, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Leonard Ong, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Maxine S. Jochelson, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Gary A. Ulaner, MD, PhD, New York, NY (*Abstract Co-Author*) Research support, General Electric Company; Research support, F. Hoffmann-La Roche Ltd
Maura Dickler, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Wolfgang A. Weber, MD, New York, NY (*Abstract Co-Author*) Consultant, Endocyte, Inc

PURPOSE

PET Response Criteria in Solid Tumors (PERCIST) 1.0, is a framework for the evaluation of tumor response to therapy by FDG PET/CT. PERCIST recommends measuring changes in tumor FDG uptake of 1-5 lesions as measured by SUVpeak normalized for body weight. The purpose of this study was to compare analysis of 1 lesion (PERCIST_1) to analysis of up to 5 lesions (PERCIST_5) and to changes of tumor/liver ratio (TLR) of one lesion for prediction of progression-free (PFS) and disease-specific survival (DSS) in stage IV breast cancer patients under systemic therapy.

METHOD AND MATERIALS

This HPAA compliant IRB approved retrospective study included 65 patients with stage IV breast cancer who received 1st or 2nd line systemic therapy in clinical trials and had a FDG PET/CT at baseline and within 3 months after therapy initiation. Treatment response according to PERCIST_1, PERCIST_5 and TLR was correlated with PFS and DSS using Kaplan-Meier analysis/log-rank tests.

RESULTS

Response classifications using PERCIST_1, PERCIST_5 and tumor/liver ratio analysis are summarized in Table 1. All three approaches resulted in highly significant (p<0.01) differences between responders (CR+PR) and nonresponders (SD+PD) for both PFS and DSS (Figure 1). When comparing the PFS and DSS of responders there were no significant differences for PERCIST_1 vs PERCIST_5 (p=0.74), PERCIST_1 vs TLR (p=0.88) and PERCIST_5 vs TLR (p=0.64). There were also no significant differences of PFS in the group of nonresponders: (PERCIST_1 vs PERCIST_5, p=0.3; PERCIST_1 vs TLR, p=0.54; and PERCIST_5 vs TLR, p=0.62).

CONCLUSION

In metastatic breast cancer a metabolic response according to PERCIST_1, 5 and TLR is highly significantly correlated with PFS and

in metastatic breast cancer a metabolic response according to PERCIST 1, 5 and PLR is highly significantly correlated with PFS and DSS. The exact definition of a metabolic response does not have a major impact on the prognostic value of response assessment.

CLINICAL RELEVANCE/APPLICATION

Response assessment by FDG PET/CT appears to be a robust approach for monitoring tumor response to therapy in patients with metastatic breast cancer.

RC211-08 Assessment of Early Response to Treatment Using FDG PET/CT in Patients with Advanced Melanoma Receiving Immune Checkpoint Inhibitors

Monday, Nov. 30 11:40AM - 11:50AM Location: S505AB

Participants
Steve Cho, MD, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
Evan J. Lipson, MD, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Hyung-Jun Im, MD,PhD, Madison, WI (*Presenter*) Nothing to Disclose
Esther Mena, MD, Bethesda, MD (*Abstract Co-Author*) Nothing to Disclose
Steven P. Rowe, MD, PhD , Parkville, MD (*Abstract Co-Author*) Nothing to Disclose
Drew M. Pardoll, MD, PhD, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Suzanne Topalian, MD, Baltimore, MD (*Abstract Co-Author*) Consultant, Bristol-Myers Squibb Company Research Grant, Bristol-Myers Squibb Company
Richard L. Wahl, MD, Saint Louis, MO (*Abstract Co-Author*) Research Consultant, Nihon Medi-Physics Co, Ltd;

PURPOSE

Immune checkpoint inhibitors (ICI) have demonstrated antitumor activity and prolonged survival in patients with advanced melanoma. Evaluation of response to early treatment response with these agents using standard CT imaging can be challenging. A recent report of FDG-PET/CT after two cycles of ICI has been reported to be highly predictive of the final outcome. We evaluated the use of FDG-PET/CT scans as early predictors of response to therapy in patients with melanoma receiving ICI.

METHOD AND MATERIALS

Twenty patients with advanced melanoma treated with ICI therapy underwent FDG PET/CT prior to initiation of therapy (day -28 to 0; SCAN1), at day 23-28 (SCAN2) and at 16 weeks (SCAN3). FDG-PET scans were evaluated for changes in maximum standardized uptake value (SUVmax), peak SUV (SUVpeak), metabolic tumor volume (MTV), and total lesion glycolysis (TLG). CT images were used to evaluate response according to RECIST 1.1 and immune-related response criteria (irRC). Receiver-operating characteristic (ROC) analysis for prediction of tumor response used area under curve (AUC) to compare baseline SCAN1 and the percent change in PET and CT parameters between SCAN1 and SCAN2. These values were also compared to the standard RECIST 1.1 response at SCAN3.

RESULTS

Twenty evaluable patients who had completed SCAN1 and SCAN2 and had a documented radiologic and/or clinical outcome were evaluated. By RECIST 1.1 criteria 2 had partial responses (PR) and 2 complete responses (CR) at 16 weeks. One patient had stable disease >6 months and 15 had progressive disease (PD). SUVmax and SUVpeak at SCAN1 and SUVmax and SUVpeak percent change from SCAN1 to SCAN2 were not strongly predictive of tumor response, with AUC of 0.480, 0.547, 0.680, and 0.680, respectively. CT-based irRC and RECIST 1.1 were also not strongly predictive of tumor response with AUC of 0.760 and 0.787, respectively. Analyses of PET based MTV and TLG parameters are in progress.

CONCLUSION

Standard parameters of PET and CT response at baseline and early in the course of ICI therapy were not strongly predictive for response to ICI treatment in patients with advanced melanoma. These findings require further validation in a larger cohort of patients.

CLINICAL RELEVANCE/APPLICATION

Standard PET and CT parameters of early tumor response to ICI therapy are not sufficient for predicting response to therapy, and therefore development of improved imaging metrics and methods are needed.

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/

Richard L. Wahl, MD - 2013 Honored Educator

RC211-09 Analysis of PET/CT Patterns of Response to Ipilimumab in Patients with Metastatic Melanoma

Monday, Nov. 30 11:50AM - 12:00PM Location: S505AB

Participants
Brandon A. Howard, MD, Durham, NC (*Presenter*) Nothing to Disclose
Bhavana Singh, Durham, NC (*Abstract Co-Author*) Nothing to Disclose
April Salama, Durham, NC (*Abstract Co-Author*) Consultant, Bristol-Myers Squibb Company; Advisory Board Member, Bristol-Myers Squibb Company; Institutional Research Grant, Bristol-Myers Squibb Company; Institutional Research Grant, Merck & Co, Inc
Brent Hanks, MD,PhD, Durham, NC (*Abstract Co-Author*) Nothing to Disclose
Mustafa R. Bashir, MD, Cary, NC (*Abstract Co-Author*) Research support, Siemens AG; Research support, Bayer AG; Research support, Guerbet SA; Research support, General Electric Company; Consultant, Bristol-Myers Squibb Company
Tracy A. Jaffe, MD, Durham, NC (*Abstract Co-Author*) Nothing to Disclose
Andrew R. Barina, MD, Durham, NC (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Melanoma is a serious public health problem with rising incidence worldwide. Although surgery is efficacious for early stage disease, prognosis is poor for metastatic melanoma, with median survival of less than 1 year. Previous therapies, such as interleukin-2 and chemoradiation, have had minimal impact on survival. Ipilimumab (Ipi; Bristol- Meyers Squibb, Princeton, NJ), a human monoclonal antibody against the cytotoxic T-lymphocyte associated antigen 4 (CTLA-4), was recently introduced and demonstrates improved survival in metastatic melanoma. CTLA-4 is a negative regulator of T cell activation and is exploited by melanoma cells to evade T cell immune- mediated destruction. CTLA-4 blockade by Ipi enhances host anti-tumor response. F-18 fluorodeoxyglucose PET-CT is routinely used in melanoma, however is subject to false positives when inflammatory or immune mediated processes are involved. It has recently been reported that in the setting of Ipi therapy, certain findings such as colitis, lymphadenopathy, inflammatory fat stranding may portend a favorable prognosis. We aim to further characterize the spectrum of PET/CT findings relevant to response to ipilimumab in our population.

METHOD AND MATERIALS

Patients who underwent FDG PET-CT from 2005 through Sept. 2014, and received at least one cycle of Ipi were retrospectively reviewed. PET/CT results, including unusual findings (i.e. those neither clearly malignant or benign on imaging) were recorded and correlated with clinicopathologic records and subsequent imaging.

RESULTS

103 patients met criteria for the study. Indeterminate findings on PET-CT included FDG-avid lymphadenopathy, diffuse thyroid uptake, subcutaneous nodularity, gallbladder uptake, and intracardiac uptake. A mixed pattern of response was often reported.

CONCLUSION

The most common PET/CT findings in metastatic melanoma patients on ipilimumab were FDG- avid lymphadenopathy, thyroid uptake, and subcutaneous nodularity, which did not correlate with an adverse outcome. A mixed response was often noted. Further analysis of clinical outcome data and clinical benefit analysis will be performed, including Kaplan-Meier analysis, to determine whether these correlated with improved outcomes.

CLINICAL RELEVANCE/APPLICATION

Characteristic patterns on PET/CT may imply a favorable outcome to treatment with ipilimumab in melanoma. Care must be taken not to interpret FDG uptake in lymph nodes, thyroid, and subcutaneous fat as progression.

RC223

Molecular Imaging Mini-Course: Advanced Molecular Imaging

Monday, Nov. 30 8:30AM - 10:00AM Location: E350

MI MR NM PH

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

FDA Discussions may include off-label uses.

Participants

Sub-Events

RC223A Novel Tracers

Participants
Timothy R. DeGrado, PhD, Rochester, MN (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Identify the major considerations when developing a novel molecular imaging probe. 2) Compare the strengths and weaknesses of the various imaging modalities with regard to probe development and implementation. 3) Define appropriate experiments for probe validation. 4) Gain an understanding of the process of translation of a probe to clinical practice.

ABSTRACT

Molecular imaging is rapidly advancing as new imaging biomarkers are invented to allow noninvasive assessment of biochemical function. Those who embark on the process of developing novel probes come to know the excitement of imaging biological processes for the first time, but are also well aware of the great effort and many pitfalls that can impede progress. This introductory lecture will provide an overview of the process of molecular imaging probe conception, development, preclinical validation, and translation. Specific examples will be used to illustrate the presenter's experience with meeting these challenges.

RC223B Novel Instrumentation (PET/MR)

Participants
Ciprian Catana, MD, PhD, Charlestown, MA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Distinguish the technical approaches that have been proposed for integrating PET and MRI for the purpose of simultaneous data acquisition. 2) Evaluate the latest methodological developments in PET/MRI for improving PET data quantification. 3) Incorporate simultaneous PET/MRI techniques into research and clinical projects.

ABSTRACT

RC223C Molecular Imaging with MR

Participants
Bruce R. Rosen, MD, PhD, Charlestown, MA, (bruce@nmr.mgh.harvard.edu) (*Presenter*) Research Consultant, Siemens AG

RC225

Physics Series: Quantitative Imaging Mini-Course: Image Modality Specific Issues

Monday, Nov. 30 8:30AM - 12:00PM Location: S403B

BQ CT MR NM PH

AMA PRA Category 1 Credits ™: 3.25
ARRT Category A+ Credits: 3.75

FDA Discussions may include off-label uses.

Participants
Michael F. McNitt-Gray, PhD, Los Angeles, CA (*Director*) Institutional research agreement, Siemens AG; Research support, Siemens AG; ; ; ; ;
Edward F. Jackson, PhD, Madison, WI, (efjackson@wisc.edu) (*Moderator*) Nothing to Disclose
Paul L. Carson, PhD, Ann Arbor, MI (*Moderator*) Research collaboration, General Electric Company; Research collaboration, Light Age, Inc

Sub-Events

RC225-01 Quantitative Imaging for Computed Tomography: Applications and Future Directions

Monday, Nov. 30 8:30AM - 9:00AM Location: S403B

Participants
Samuel G. Armato III, PhD, Chicago, IL, (s-armato@uchicago.edu) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Describe the role of computed-tomography-based quantitative imaging in the clinical and research settings.

ABSTRACT

RC225-02 Quantification of Vascular Response in Rodent Brown Adipose Tissue Using Spectral CT

Monday, Nov. 30 9:00AM - 9:10AM Location: S403B

Participants
Xin-Gui Peng, MD,PhD, Nanjing, China (*Presenter*) Nothing to Disclose
Zhen Zhao, Nanjing, China (*Abstract Co-Author*) Nothing to Disclose
Di Chang, Nanjing, China (*Abstract Co-Author*) Nothing to Disclose
Shenghong Ju, MD, PhD, Nanjing, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Brown adipose tissure (BAT) has abundant mitochondrion, uncoupling protein 1 and vascularizaiton to provide sufficient energy compared to white adipose tissure (WAT). Our study is to assess the changes of iodine/water base material concentration in BAT after injecting norepinephrine (NE).

METHOD AND MATERIALS

The animal study was approved by the institutional Committee on Animal Research. Spetral CT scan (GE, Discovery CT750) was performed to measure the iodine/water concentration based on base material mapping in the BAT (interscapular) and WAT (visceral) of Wistar rat (n=6, 14 weeks, 304g±12g) at baseline condition. To induce the blood flow increase, animals were given NE (1μg/kg/min, 10min, totle 1ml) or saline (1ml) from caudal vein. The enhanced CT imaging (6ml/kg, iopromide 300) was performed after the injection of the drug. The iodine/water concentraction of BAT and WAT, the BAT/Arota and WAT/Arota ratio were calculated. Statistical analysis was performed with independent sample t test and paired sample t test .

RESULTS

There was no difference in mean base iodine (water) material concentration of BAT and WAT at the baseline condition between the NE and saline groups (P>0.05). After injecting NE, the base iodine material concentration of BAT increased significantly compared to controls (NE: -5.41±1.20mg/cm3 and 23.57±8.71mg/cm3; saline: -7.66±2.01mg/cm3 and 8.71±3.68mg/cm3, respectively; P<0.001) (Fig.A). However, there were no statistically significant changes observed in iodine and water material concentration of WAT between both groups. The BAT/Arota ratio, WAT/Arota ratio of iodine concentration and BAT/Arota ratio of water concentration after injection NE increased significantly (iodine: BAT/Arota ratio, 0.26±0.96 and 0.10±0.04, WAT/Arota ratio, -0.12±0.04 and -0.16±0.03; water: BAT/Arota ratio:1.06±0.02 and 0.93±0.04, respectively; P<0.001) (Fig.B). There was no difference of WAT/Arota ratio in water concentration imaging between both groups (P>0.05) (Fig.C).

CONCLUSION

The iodine/water base material concentration detected the pharmacologic activation of BAT. Energy spectrum CT has protential to evaluate the change of BAT and WAT after treatment.

CLINICAL RELEVANCE/APPLICATION

Spectral CT provided a new noninvasive method to be translated to a clinical setting for evaluation the difference of adipose tissue and monitoring the responses to specific therapeutic strategies.

RC225-03 Determinants of the Accuracy of the Quantification of Glandularity and Iodine Uptake in Contrast-Enhanced Digital Mammography

Monday, Nov. 30 9:10AM - 9:20AM Location: S403B

Participants
Kristen C. Lau, MS, Philadelphia, PA (*Presenter*) Nothing to Disclose
Moez K. Aziz, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Young Joon Kwon, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Andrew D. Maidment, PhD, Philadelphia, PA (*Abstract Co-Author*) Research support, Hologic, Inc; Research support, Barco nv; Spouse, Employee, Real-Time Radiography, Inc; Spouse, Stockholder, Real-Time Radiography, Inc

PURPOSE

To develop a method for determining breast tissue composition in dual-energy (DE) contrast-enhanced digital mammography (CE-DM). The motivation for this arises from our difficulty to resolve contrast uptake at the boundaries of the breast in DE subtraction.

METHOD AND MATERIALS

Phantoms were constructed using 1 cm thick uniform blocks of 100% glandular-equivalent and 100% adipose-equivalent materials (CIRS, Norfolk, VA). The thickness of the phantoms ranged from 3 to 8 cm, in 1 cm increments. For a given thickness, the glandular/adipose composition of the phantom was varied using different combinations of blocks. The phantoms were imaged using a prototype DE Hologic Selenia Dimensions DBT system. A 0.3 mm copper filter is used for the high-energy (HE) x-rays (49 kVp) and a 0.7 mm aluminum filter is used for the low-energy (LE) x-rays (32 kVp). X-ray energies were chosen so the k-edge of the contrast agent was in the range spanned by the LE and HE x-ray spectra. DE images were obtained by a weighted logarithmic subtraction of the HE and LE image pairs. The images were smoothed using a 2D convolution with a 4x4 matrix prior to quantitative analysis. LE and HE signal intensities were normalized by the mAs, and mean and standard deviation values were calculated for the normalized log HE and log LE images.

RESULTS

The mean LE and HE values varied with phantom thickness and glandularity. The log LE and log HE signals decrease linearly with increasing glandularity for a given thickness. The signals decrease with increasing phantom thickness; for a given glandularity, the x-ray signal decreases linearly with thickness. As the thickness increases, the attenuation difference per additional glandular block decreases, indicating beam hardening. Using these data, we have created a mapping between signal intensity and breast thickness. These data facilitate the subtraction of tissue in the periphery of the breast, and aid in discriminating between contrast agent uptake in glandular tissue and subtraction artifacts.

CONCLUSION

We have shown that breast thickness and composition can be predicted based on signal intensities in DE CE-DM. This has implications for the weighting factor used in DE subtraction.

CLINICAL RELEVANCE/APPLICATION

DE CE-DM can be improved by taking into account breast thickness and composition. Combining these techniques into a single procedure is a powerful tool for the detection and diagnosis of breast cancer.

RC225-04 Mapping of Medullar Adiposity of the Lumbar Spine in MRI

Monday, Nov. 30 9:20AM - 9:30AM Location: S403B

Participants
Nicolas Demany, Brest, France (*Abstract Co-Author*) Nothing to Disclose
Julien Ognard, MD, MSc, Brest, France (*Presenter*) Nothing to Disclose
Jawad Mesrar, MD, Brest, France (*Abstract Co-Author*) Nothing to Disclose
Serge Ludwig Aho-Glele, Dijon, France (*Abstract Co-Author*) Nothing to Disclose
Alain Saraux, Brest, France (*Abstract Co-Author*) Nothing to Disclose
Douraied Ben Salem, MD, PhD, Brest, France (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The bone medullar adiposity is a marker of bone quality to the point that it should be better to know the factors which influence or not the density and distribution of this fat in the spine, especially at the lumbar level.

METHOD AND MATERIALS

A sagittal sequence IDEAL IQ (MRI GE 1.5T) was performed on the lumbar spine of 46 subjects without bone disease (21 women and 25 men, aged 18 to 77 years old). Medulla adiposity was determined directly from the measurement of the fat fraction of each vertebral body (T12 to S1) obtained on the fat cartography automatically generated by the IDEAL sequence.

RESULTS

Average vertebral fat fraction was 36.48% (DS 12.82 ; 14.69% - 72.8%], increasing with age, and it is higher among men. We observed a craniocaudal gradient of the fat fraction (B = 1,37 ; p < 0,001 ; DS 0,06) increasing with age in the lumbar spine from T12 to L5. Through a multivariate analysis, this gradient was independent of sex, weight and height of subjects.

CONCLUSION

This study shows the existence of a physiological craniocaudal gradient of vertebral medullar adiposity from T12 to L5. This gradient increases with age but it is independent of sex or BMI. The IDEAL sequence allows quick and reproducible measurement of the spine vertebral medullar adiposity.

CLINICAL RELEVANCE/APPLICATION

IDEAL IQ is a Rapid sequence, Allowing easy and reproducible measurements with ROIs. The need is to recruit a wider population to establish standards fat percentage by age strata and compare them with bone mineral density obtained by densitometry. For example, in an attempt to establish thresholds for a subject to beconsidered as osteopenic or osteoporotic. The IDEAL IQ sequence allows a fast and reproductible measure of the bone marrow fat of the spine, that could easily completing a lumbar MRI assessment

RC225-05 Automatic Quantification of Iodine and Calcium using Monoenergetic Virtual Images Generated by

Spectral Detector Dual-Layer CT: A Phantom Study

Monday, Nov. 30 9:30AM - 9:40AM Location: S403B

Participants
Isaac Leichter, PhD, Jerusalem, Israel (*Presenter*) Nothing to Disclose
Tzvi Lipschuetz, Jerusalem, Israel (*Abstract Co-Author*) Nothing to Disclose
Tzvi Vichter, Jerusalem, Israel (*Abstract Co-Author*) Nothing to Disclose
Zimam Romman, Haifa, Israel (*Abstract Co-Author*) Employee, Koninklijke Philips NV
Jacob Sosna, MD, Jerusalem, Israel (*Abstract Co-Author*) Consultant, ActiViews Ltd Research Grant, Koninklijke Philips NV

PURPOSE

To use Monoenergetic Virtual images generated by Spectral Detector Dual-Layer CT (SDCT) for automatic reliable identification and concentration calculation of calcium and iodine solutions.

METHOD AND MATERIALS

Tubes of 11.1 mm diameter filled with iodine and calcium solutions at concentrations of 10 to 60 mg/ml and 100 to 1000 mg/ml, respectively, were inserted in a water-equivalent anthropomorphic CT phantom (QRM, Moehrendorf, Germany). The phantom, of two sizes (25×35 cm and 30×40 cm), was scanned with a SDCT (Philips Healthcare, Cleveland, OH, USA) at 120kVp and 200 mAs. Software was developed to calculate the relationship between gray-level values of pixels containing iodine and calcium solutions in the monoenergetic virtual images generated by SDCT. The relationship obtained for the image of the small phantom was used to create spectral maps that uniquely characterize the material in the pixel, independently of its concentration. For any given image, the software searched and identified pixels which fitted into the spectral map equations of calcium and iodine and displayed them in different colors. In order to evaluate the effect of beam hardening, iodine and calcium was searched in images of both phantom sizes. The concentration of each solution identified by the software was evaluated.

RESULTS

In the small phantom (98.9±1.6)% of the pixels containing iodine or calcium were correctly identified and displayed in different colors. In the large phantom the identification accuracy was (92.7±10.4)%. The calculated solution concentrations in the small phantom were higher by (4.6±2.6)% from the actual concentrations, and lower by (5.7±4.6)% in the large phantom.

CONCLUSION

SDCT can differentiate between calcium and iodine solutions in a phantom model and calculate their concentrations with good accuracy on a pixel by pixel analysis. Beam hardening effects had only a small impact on the results which depended very slightly on the phantom size or the solution location within the phantom.

CLINICAL RELEVANCE/APPLICATION

By the use of Spectral Detector CT, contrast agents in blood and tumors may be reliably differentiated from adjacent skeletal components, and their concentration can be accurately assessed.

Honored Educators

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Jacob Sosna, MD - 2012 Honored Educator

RC225-06 Quantitative Imaging for PET-CT: Applications and Future Directions

Monday, Nov. 30 9:40AM - 10:10AM Location: S403B

Participants
Robert Jeraj, Madison, WI (*Abstract Co-Author*) Founder, AIQ Services
Tyler Bradshaw, Madison, WI (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Describe the role of PET/CT-based quantitative imaging in the clinical and research settings.

RC225-07 Quantitative Imaging for DCE-MRI: Applications and Future Directions

Monday, Nov. 30 10:25AM - 10:55AM Location: S403B

Participants
Yue Cao, PhD, Ann Arbor, MI (*Presenter*) Research Grant, Siemens AG; Speaker, Siemens AG

LEARNING OBJECTIVES

1) Describe the role of quantitative DCE MR imaging in the clinical and research settings.

RC225-08 Measuring Blood Velocity with Doppler-CT (part 1): Theoretical Aspects and Simulations

Monday, Nov. 30 10:55AM - 11:05AM Location: S403B

Participants
Johannes G. Korporaal, PhD, Forchheim, Germany (*Abstract Co-Author*) Employee, Siemens AG
Rainer Raupach, PhD, Forchheim, Germany (*Abstract Co-Author*) Employee, Siemens AG
Thomas G. Flohr, PhD, Forchheim, Germany (*Abstract Co-Author*) Employee, Siemens AG
Bernhard Schmidt, PhD, Forchheim, Germany (*Presenter*) Employee, Siemens AG

PURPOSE

Measuring blood velocity with computed tomography (CT) has been subject of numerous studies, most of which used the time-of-flight technique. With that method, data acquisition should be performed with a stationary table (sequence mode) and the clinical applicability and measurement accuracy are limited by the detector size. The purpose of this study is to introduce Doppler-CT as a new method of measuring blood velocity by describing the theory, simulating its expected behavior and deriving clinical acquisition strategies.

METHOD AND MATERIALS

In general, the speed v [m/s] of a wave with wavelength λ [m] and frequency f [1/s] is given by $v = f*\lambda$. When considering a straight vessel segment and assuming a linear increase in contrast enhancement after injecting an iodinated contrast agent, the blood velocity can be analogously calculated from the spatial [m/HU] and temporal [HU/s] contrast gradients within the vessel. In case the observer O (the scan plane of the CT scanner) and the source S (the human heart) are moving with respect to each other, i.e. during a spiral acquisition, the well-known Doppler-equations can be applied, e.g. $fO = fS(1 \pm v/c)$ [eq.1], with fO being the measured temporal gradient [HU/s] of the spiral scan, fS the temporal gradient [HU/s] produced by the heart, ±v the table speed and c the blood velocity. For table velocities of ±70cm/s and blood velocities of ±100cm/s, fO was simulated as fraction of fS, since the relative change in fO is independent of fS.

RESULTS

With a known direction of table movement, the direction of the blood flow can be qualitatively determined, since the relative gradient of fO is centrally symmetric. With increasing table speed and decreasing blood speed, the deviation of fO from fS increases, indicating better quantitative measurement accuracy. For equal image noise, low tube voltages and high iodine delivery rates will further improve the measurement sensitivity.

CONCLUSION

High table speed and low blood velocity are favorable for quantifying blood velocity with Doppler-CT. Implementation in clinical routine can be simple, e.g. with two (or more) sweeps of a dynamic scan mode with alternating scan direction (part 2) or with a bolus tracking scan followed by a CT angiography (part 3).

CLINICAL RELEVANCE/APPLICATION

Measuring blood velocity is no longer reserved for wide-detector CT-systems in sequence mode, but can also be performed with CT-systems with smaller detectors in spiral scan mode.

RC225-09 Quantification of Hepatic Tumor Viability in Multi-phase MDCT Images

Monday, Nov. 30 11:05AM - 11:15AM Location: S403B

Participants
Wenli Cai, PhD, Boston, MA (*Presenter*) Nothing to Disclose
Anand K. Singh, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Yin Wu, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Gordon J. Harris, PhD, Boston, MA (*Abstract Co-Author*) Medical Advisory Board, Fovia, Inc

PURPOSE

The purpose of this study was to develop a quantitative imaging biomarker, denoted as hepatic tumor viability (HTV), for quantification of viable and necrotic tumor volumes in addition to the size of liver and tumors in the assessment of tumor progression and treatment responses for patients with hepatocellular carcinoma (HCC) and metastasis.

METHOD AND MATERIALS

Based on the pattern analysis of time-intensity curve (TIC) in multi-phase MDCT images, we developed the automated HTV scheme for segmentation of liver and liver tumors, and classification of viable and necrotic tumor regions. To depict a TIC pattern, a group of TIC features was extracted including the peak CT value, the time to peak (TTP), the area under the curve (AUC), the AUC of wash-in/out, the max/average wash-in/out derivative, and a group of spatiotemporal textures: skewness, kurtosis, energy, and entropy. A K-mean cluster was applied to classify each voxels into four different types of materials: vessel, normal liver tissue, tumor tissue, and necrotic tissue. Liver, liver tumor and viable regions were segmented using the likelihood to each material. Forty (40) IV-contrast enhanced hepatic multi-phase MDCT cases with biopsy-confirmed HCC or metastases were used for evaluation of the proposed HTV biomarker. The MDCT imaging parameters settings were: 2.5-5 mm collimation, 1.25-2.5 mm reconstruction interval, 175 mA tube current, and 120 kVp tube voltage.

RESULTS

In reference to the liver and tumor segmentation by manual-contouring of two radiologists, the volumetric size of these 40 HCC or metastasis livers ranged from 1079.2 CC to 4652.3 CC, in which the tumor volume percentages ranged from 1.77% to 53.54%. The proposed HTV scheme achieved a liver volumetric difference of 3.27±2.58% and tumor percentage difference of 1.33±1.44%. Viable tumor volume showed significant better performance than RECIST and total tumor volume in prediction of treatment response in the case of overall and progression-free survival.

CONCLUSION

Our HTV biomarker can achieve accurate and reliable quantification results in segmentation of liver and liver tumors, classification of viable and necrotic tumor regions, and thus provides a better prediction of treatment response.

CLINICAL RELEVANCE/APPLICATION

Our HTV biomarker can provide an accurate and reliable tumor quantification for assessment of tumor progression and treatment response for HCC and liver metastasis.

RC225-10 Fully Automated Quantitative Analysis of Myocardial Perfusion in First-pass MR Images

Monday, Nov. 30 11:15AM - 11:25AM Location: S403B

Participants
Luan Jiang, PhD, Shanghai, China (*Presenter*) Nothing to Disclose
Shan Ling, Shanghai, China (*Abstract Co-Author*) Nothing to Disclose
Jichao Yan, Shanghai, China (*Abstract Co-Author*) Nothing to Disclose
Qiang Li, PhD, Shanghai, China (*Abstract Co-Author*) Patent agreement, General Electric Company Patent agreement, Hologic, Inc Patent agreement, Riverain Technologies, LLC Patent agreement, MEDIAN Technologies Patent agreement, Mitsubishi Corporation

PURPOSE

We are developing a fully automated scheme for quantitative analysis of myocardial perfusion in short-axis first-pass MR images.

METHOD AND MATERIALS

We obtained 8 short-axis myocardial perfusion MR scans from xxx Hospital in xxx with an xxx 1.5-T MR scanner. Each MR scan has 40 time frames with slice thickness 8 mm and in-plane resolution 1.37 mm × 1.37 mm. Our automated method consists of three steps, i.e., cardiac registration, myocardium segmentation, and empirical indexes quantification. Based on the region of interest (ROI) automatically identified from the image at the reference time phase with better contrast of left ventricle and myocardium, a multiscale affine transformation using Sobel gradient information and a non-rigid Demons registration using pseudo ground truth images were sequentially applied to correct the deformations caused by respiratory and cardiac motion. We then further used fuzzy c-means clustering method in the reference image and dynamic programming method in the maximum intensity projection image of all time phases to delineate, respectively, the endo- and epicardial boundaries of the myocardium. Finally, several empirical perfusion indexes (peak signal intensity, time to peak, and maximum upslope) were quantified from the time-intensity curves of segments of myocardium.

RESULTS

Dice index based on apical, midventricular, and basal slices was improved from 78.4% ± 12.5% to 85.9% ± 5.3% using cardiac registration, and Dice index of 82.2% ± 5.9% was achieved for myocardium segmentation. Subjective judgment showed that the empirical indexes were able to identify the ischemia in myocardium.

CONCLUSION

Our fully automated scheme for quantitative analysis of myocardial perfusion MR images would be useful for myocardium perfusion assessment and early diagnosis of myocardium with ischemia.

CLINICAL RELEVANCE/APPLICATION

Our CAD scheme could help the radiologists to quantitatively analyze myocardium perfusion and to improve the accuracy and efficiency for diagnosis of myocardium with ischemia.

Active Handout:Luan Jiang

http://abstract.rsna.org/uploads/2015/15016295/RC225-10.pdf

RC225-11 Laws Textures: A Potential MRI Surrogate Marker of Hepatic Fibrosis in a Murine Model

Monday, Nov. 30 11:25AM - 11:35AM Location: S403B

Participants
Baojun Li, PhD, Boston, MA (*Presenter*) Nothing to Disclose
Hei Shun Yu, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Hernan Jara, PhD, Belmont, MA (*Abstract Co-Author*) Patent holder, qMRI algorithms Research Grant, General Electric Company Royalties, World Scientific Publishing Co
Jorge A. Soto, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Stephan W. Anderson, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To study the effect of disease progression on liver parenchymal Laws textures of ex vivo murine liver specimens imaged using 11.7 Tesla MRI. To compare Laws textures to other imaging-based surrogate markers (T2, PD, ADC, and degrees of inflammation).

METHOD AND MATERIALS

This animal study was IACUC approved. Seventeen male, C57BL/6 mice were divided into control (n=2) and experimental groups (n=15). The latter were fed a 3,5-dicarbethoxy-1, 4-dihydrocollidine (DDC) supplemented diet to induce hepatic fibrosis. Ex vivo liver specimens were imaged using an 11.7T MRI scanner, from which the parametric proton density (PD), T2, and ADC maps were generated from spin-echo pulsed field gradient and multi-echo spin-echo acquisitions. The PD maps were first preprocessed to eliminate the low-intensity histogram bias arisen from partial volume effect. The PD maps were further corrected by mean and standard deviation in order to minimize discrimination by overall graylevel variation, which is unrelated to liver parenchymal texture. Laws textures were extracted from the PD maps. Degrees of fibrosis and inflammation were assessed by an experienced pathologist (subjective scores) and digital image analysis (DIA, %Area Fibrosis). Scatterplot graphs comparing Laws texture, T2, PD, ADC, inflammation score to degrees of fibrosis were generated and correlation coefficients were calculated.

RESULTS

Hepatic fibrosis and Laws textures were strongly correlated with higher %Area Fibrosis associated with higher Laws textures ($r=0.89$, $p<0.001$). Strong correlation also existed between T2 and Laws textures ($r=0.85$, $p<0.01$). Moderate correlations were seen between %Area Fibrosis and PD ($r=0.65$), ADC ($r=0.67$), and Subjective Fibrosis Score ($r=0.51$). The Subjective Inflammation Score was poorly correlated with hepatic fibrosis ($r=0.20$). Without proposed corrections, there was only a moderate correlation between %Area Fibrosis and Laws textures ($r=0.70$).

CONCLUSION

Higher degree of hepatic fibrosis is associated with increased liver parenchymal Laws textures. Laws textures may be more accurate than PD, ADC, and subjective fibrosis and inflammation scores in assessing degrees of fibrosis. The proposed corrections are critical.

CLINICAL RELEVANCE/APPLICATION

Laws textures are potentially accurate surrogate marker for diagnosing and staging hepatic fibrosis.

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Hernan Jara, PhD - 2014 Honored Educator
Jorge A. Soto, MD - 2013 Honored Educator
Jorge A. Soto, MD - 2014 Honored Educator
Jorge A. Soto, MD - 2015 Honored Educator

RC225-12 Grading of Diffuse Liver Diseases Using Phase-Contrast-Imaging

Monday, Nov. 30 11:35AM - 11:45AM Location: S403B

Participants
Marco Armbruster, Munich, Germany (*Presenter*) Co-Founder of medical software company.
Blaz Zupanc, MA, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose
Emmanuel Brun, Grenoble, France (*Abstract Co-Author*) Nothing to Disclose
Alberto Mittone, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose
Wieland H. Sommer, MD, Munich, Germany (*Abstract Co-Author*) Founder, QMedify GmbH
Wolfgang Thasler, MD, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose
Maximilian F. Reiser, MD, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose
Paola Coan, Grenoble, France (*Abstract Co-Author*) Nothing to Disclose

CONCLUSION

X-ray PCI allows grading of diffuse liver diseases, is correlated to histopathology and might be a valuable technique for non-invasive diagnosis and grading of liver fibrosis and steatosis.

Background

Diffuse liver pathologies like steatosis, fibrosis or cirrhosis are an increasing cause of morbidity and mortality worldwide. Liver biopsy is currently the gold standard for the diagnosis and monitoring of disease progression and is essential both for treatment decisions and the prognosis of patients. However, liver biopsy has non-negligible risks, is prone to sampling erros and cannot be used as a screening method.Therefore, the purpose of this study was a proof-of-concept that high resolution X-ray phase contrast imaging (PCI) in computer tomography mode is able to directly visualize pathological changes of the microstructure and that grading of diffuse liver diseases is feasible using PCI-CT.

Evaluation

Synchrotron-based PCI-CT volumetric imaging was performed for human, ex-vivo liver samples from 20 patients (male: 12, female: 8, age: 62+-12 yrs). Histopathological workup included hematoxylin-and-eosin-, elastica-van-Gieson-, and iron-straining. For PCI-CT, propagation based imaging technique was used with X-ray of 30 keV and a sample-to-detector distance of 11m. Images were acquired at a spatial resolution of 8 microns.All dataset were graded for the presence of fibrotic changes and the amount of fatty vacuoles. PCI-CT- and histopathological grading of fibrosis and steatosis was correlated using pearson's correlation-coefficient. Both fatty vacuoles, portal, and septal fibrougenous deposites were identifiable in PCI-CT. Visual grading of fibrosis and steatosis correlated moderatly but significantly to the histopathological assessment ($r=0.682$; $p<0.05$ for fibrosis; $r=0.764$; $p<0.05$ for steatosis).

Discussion

In this study we used X-ray PCI for a direct visualization of microstructural changes within the liver tissue of patients suffering from diffuse liver diseases. Detailed grading of fibrosis and steatosis was feasible. Due to the three-dimensionality of PCI datasets this technique has the potential to decrease interobserver variability and sampling errors in the grading of diffuse liver diseases.

RC225-13 Question and Answer

Monday, Nov. 30 11:45AM - 12:00PM Location: S403B

Participants

NMS-MOA

Nuclear Medicine Monday Poster Discussions

Monday, Nov. 30 12:15PM - 12:45PM Location: S503AB

NM

AMA PRA Category 1 Credit ™: .50

Participants
Ukihide Tateishi, MD, PhD, Setagaya-Ku, Japan (*Moderator*) Nothing to Disclose

Sub-Events

NM208-SD-MOA7 Comparison of Two Methods for 177Lu-DOTATATE Kidney Dose Calculation

Station #7

Participants
Robin de Nijs, MSc, PhD, Copenhagen, Denmark (*Presenter*) Nothing to Disclose
Peter Oturai, MD, Copenhagen, Denmark (*Abstract Co-Author*) Nothing to Disclose
Thomas L. Klausen, MSc, Copenhagen, Denmark (*Abstract Co-Author*) Nothing to Disclose
Mette Helene B. Frederiksen, BMedSc, Copenhagen, Denmark (*Abstract Co-Author*) Nothing to Disclose
Jann Mortensen, Copenhagen, Denmark (*Abstract Co-Author*) Nothing to Disclose
Soren Holm, PhD, MSc, Copenhagen, Denmark (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To compare two methods of determining kidney absorbed dose in 177Lu-DOTATATE Peptide Receptor Radionuclide Therapy (PRRT).

METHOD AND MATERIALS

Kidney dosimetry was performed in 90 patients with multiple treatments resulting in 584 kidney dose estimates. After administration of 7.4 GBq 177Lu-DOTATATE on day 0, patients were scanned on day 1 (for first treatment also on day 4 and 7) on a dual head Philips Precedence SPECT/CT with medium energy collimators and 208 keV 20% width energy windows in a 128x128 4.66 mm pixels matrix at 128 angles (20 s). Reconstruction was performed with Astonish (4 iterations, 16 subsets), and included scatter and CT-based attenuation correction. Absorbed dose was determined in two ways: by drawing (1) a 4 mL VOI inside the kidney (a published method) and (2) a slightly too large VOI around the entire kidney with a 0.75 empirical volume correction factor. Counts were converted into activity by a calibration factor. Absorbed dose was calculated based on an exponential fit of the time activity curve of the first treatment and a scalar energy deposition factor. For 15 kidneys in 8 patients the VOIs were redrawn by a different operator.

RESULTS

Mean kidney dose (±SD) was 4.2±1.6 Gy. The correlation coefficient (R2) between the two methods was 0.75, and the slope with forced zero-intercept was 1.012±0.006. A Bland-Altman plot revealed an almost negligible bias of 0.09±0.04 Gy, but a rather large SD of 0.87 Gy making the 5% confidence interval 3.4 Gy.Interobserver variability was shown by the SD of the differences, which was 0.78 Gy for method 1 and 0.11 Gy for method 2. Bias(±SD) was -0.45±0.20 Gy and 0.06±0.03 Gy, respectively.

CONCLUSION

Our results indicate that there are significant differences between the two methods for individual patients, and that these differences are mainly caused by the variability of the 4 mL VOI method. This variability can be explained by the combination of non-uniform distribution of activity in the kidney and arbitrary positioning of the 4 mL VOI by different operators. Our recommendation is to use the entire kidney VOI, so that both bias and variability are minimized.

CLINICAL RELEVANCE/APPLICATION

Individual dosimetry of critical organs in PRRT is warranted. Improving kidney dose estimation is important for dose assessment, studying the dose effect on kidney function and optimizing treatment.

NM209-SD-MOA8 Usefulness of Grading for Primary Brain Tumors using 18F-fluoromisonidazole Positron Emission Tomography

Station #8

Participants
Masafumi Kanoto, Yamagata, Japan (*Presenter*) Nothing to Disclose
Kazukuni Kirii, MD, Yamagata, Japan (*Abstract Co-Author*) Nothing to Disclose
Takaaki Hosoya, MD, PhD, Yamagata, Japan (*Abstract Co-Author*) Nothing to Disclose
Toshitada Hiraka, MD, Yamagata, Japan (*Abstract Co-Author*) Nothing to Disclose
Yuuki Toyoguchi, Yamagata, Japan (*Abstract Co-Author*) Nothing to Disclose
Yukio Sugai, MD, Yamagata, Japan (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Tumor growth causes an imbalance between oxygen supply and demand, resulting in a hypoxic area in the tumor, and hypoxia, in turn, causes hypoxia-inducible factor-1 (HIF-1) and enhancement of tumor growth. 18F-fluoromisonidazole positron emission tomography (FMISO-PET) has been used for hypoxic imaging of tumors and thus the purpose of this study is to evaluate the usefulness of FMISO-PET in the grading of primary brain tumors.

CONCLUSION

We determined that both T/Nmax and T/Nmean in FMISO-PET have a positive correlation with primary brain tumor grading and that

FMISO-PET is useful for diagnosing the malignancy of primary brain tumors.

CLINICAL RELEVANCE/APPLICATION

18F-fluoromisonidazole positron emission tomography is correlated with WHO tumor grade and is useful for evaluating hypoxic imaging and for distinguishing malignancy in primary brain tumors.

NM211-SD-MOA10 Detection of Head and Neck Squamous Cell Carcinoma using 4'-[methyl-11C]thiothymidine PET/CT for Proliferation Imaging: Comparison with 18F- FDG PET/CT

Station #10

Participants
Katsuya Mitamura, Kita-gun, Japan (*Presenter*) Nothing to Disclose
Yuka Yamamoto, MD, PhD, Kagawa, Japan (*Abstract Co-Author*) Nothing to Disclose
Yoshihiro Nishiyama, MD, Kagawa, Japan (*Abstract Co-Author*) Nothing to Disclose
Jun Toyohara, Tokyo, Japan (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

A new tracer, 4'-[methyl-11C]-thiothymidine (4DST), has been developed as an in vivo cell proliferation marker based on the DNA incorporation method. The purpose of this study was to investigate the feasibility of 4DST PET/CT for the detection of head and neck squamous cell carcinoma, in comparison with 2-deoxy-2-18F-fluoro-D-glucose (FDG) PET/CT, and determined the degree of correlation between two radiotracers and proliferative activity as indicated by Ki-67 index.

METHOD AND MATERIALS

A total of 44 patients with newly diagnosed head and neck squamous cell carcinoma were examined with both 4DST and FDG PET/CT studies. Tumor lesions were identified as areas of focally increased uptake, exceeding that of surrounding normal tissue. For semi-quantitative analysis, the maximal standardized uptake value (SUV) was calculated.

RESULTS

In all 44 patients, head and neck squamous cell carcinoma were detected by both 4DST and FDG PET/CT studies. The mean (±SD) SUV for 4DST (6.65±2.37) was significantly lower than that for FDG (15.10±10.23) ($p<0.001$). A significant correlation was observed between SUV in the tumor on 4DST PET/CT and FDG PET/CT ($r=0.546$, $P<0.001$). There was no significant correlation between Ki-67 index and either 4DST SUV or FDG SUV.

CONCLUSION

These preliminary results indicate that 4DST PET/CT is a potentially useful tracer for detecting head and neck squamous cell carcinoma, although uptake of 4DST was significantly lower than that of FDG. Neither of two radiotracers used was correlated with proliferative activity.

CLINICAL RELEVANCE/APPLICATION

4DST PET/CT is a potentially useful tracer for detecting head and neck squamous cell carcinoma, although uptake of 4DST was significantly lower than that of FDG.

NM108-ED-MOA11 Clinical Utility of PET-MRI in Neuro-Oncology

Station #11

Participants
Ammar A. Chaudhry, MD, Corona, CA (*Presenter*) Nothing to Disclose
Maryam Gul, Mineola, NY (*Abstract Co-Author*) Nothing to Disclose
Abbas A. Chaudhry, BSc, Westbury, NY (*Abstract Co-Author*) Nothing to Disclose
Mubashir Sheikh, Corona, CA (*Abstract Co-Author*) Nothing to Disclose
Lev Bangiyev, DO, Stony Brook, NY (*Abstract Co-Author*) Nothing to Disclose
Robert Matthews, MD, Stony Brook, NY (*Abstract Co-Author*) Nothing to Disclose
Jared Dunkin, MD, Stony Brook, NY (*Abstract Co-Author*) Nothing to Disclose
Luboslav Woroch, DO, Miami, FL (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

1. Review physical principles and techniques of PET-MRI. 2. Clinical applications of PET-MRI including neuro-oncology. 3. Discuss key imaging findings that help exclude mimics resulting from neurodegenerative disorders and inflammatory conditions. 3. Review common pearls and Pitfalls of PET-MRI. 4. Future role of PET-MRI in neuroradiology.

TABLE OF CONTENTS/OUTLINE

1. Physical principles and techniques of PET-MRI: Relevant concepts involving image acquisition, postprocessing and interpretation will be provided. 2. Overview of clinical applications of PET-MRI in neuro-oncology patients: An overview of initial tumor diagnosis, discussion of tumor biology and its effect on tumor imaging (e.g., tumor metabolism, angiogenesis, cellularity, etc.), post-treatment follow-up imaging evaluation and its role in therapy selection will be provided. 3. Role of PET-MRI in evaluation of neurodegenerative and inflammatory conditions (including MS). 4. Pearls and Pitfalls: Common pitfalls and controversies regarding PET-MRI in neuroradiology will be discussed. 5. Future of PET-MRI: A discussion of future applications and challenges facing PET-MRI in neuroradiology, specifically neuro-oncology and neurodegenerative disorders will be provided.

NMS-MOB

Nuclear Medicine Monday Poster Discussions

Monday, Nov. 30 12:45PM - 1:15PM Location: S503AB

NM

AMA PRA Category 1 Credit ™: .50

Participants
Ukihide Tateishi, MD, PhD, Setagaya-Ku, Japan (*Moderator*) Nothing to Disclose

Sub-Events

NM233-SD-MOB7 Dynamic Antral Scintigraphy Identifies Patterns of Contractility in Patients with Upper GI Motility Disorders: Comparison to Conventional Gastric Emptying Scintigraphy

Station #7

Participants
Jesus R. Diaz, MD, El Paso, TX (*Presenter*) Nothing to Disclose
Jabel Makiyil, El Paso, TX (*Abstract Co-Author*) Nothing to Disclose
Luis A. Alvarado, MS, El Paso, TX (*Abstract Co-Author*) Nothing to Disclose
Alok K. Dwivedi, PhD, El Paso, TX (*Abstract Co-Author*) Nothing to Disclose
Irene Sarosiek, MD, El Paso, TX (*Abstract Co-Author*) Nothing to Disclose
Marvin Friedman, PhD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Richard W. McCallum, MD, El Paso, TX (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

1) Correlate frequency, rhythm, coordination, and amplitude of antral contractions, luminal obliteration, and motility index to conventional GES results. 2) Characterize antral contractility and identify its role in patients with rapid gastric emptying (RGE) and delayed gastric emptying (DGE).3) Describe antral contractility patterns in patients with UGIMD and normal gastric emptying (NGE) and role in explaining symptoms.

METHOD AND MATERIALS

Age, clinical presentation, gender, diabetes mellitus, other comorbidities, and ethnicity were documented in 10 patients who underwent GES and DAS from October to November of 2014. All patients ingested a standardized low-fat meal (255 kCal) labeled with 2 mCi of Tc-99m SC, obtaining 1-minute static images in the anterior and posterior projections immediately, 30, 60, 120, 180 and 240 minutes after meal ingestion. The DAS methodology comprised simultaneous acquisition of 512 0.5-second dynamic images in the anterior projection at 15, 30, 45, 60, 90, 120, 180 and 240 minutes after meal ingestion. The data was analyzed to derive the following mean parameters of antral motility: a) Frequency, rhythm, coordination and amplitude of contractions, representing the cyclic variation of labeled meal, b) Obliteration or fraction of labeled meal that leaves the antrum during each contraction and c) Motility index or fraction of contents leaving the antrum per minute (product of obliteration and frequency).

RESULTS

The mean age was 53 years (21-67), 8 females, 3 had diabetes mellitus. Two patients with DGE had the highest contraction frequency, but the lowest contraction amplitude, obliteration and motility index. Two patients with RGE had the lowest contraction frequency, but the highest amplitude, obliteration, and motility index. The remaining 6 patients had normal GE with contraction parameters values in between those patients with DGE and RGE.

CONCLUSION

1) In patients with UGIMD and DGE, the antral contraction DAS parameters are < 1/2 the values of NGE patients and 2) RGE patients had nearly 3 times higher contraction parameters than DGE patients, having longer coordinated, more forceful contractions resulting in faster emptying despite a lower contraction frequency.

CLINICAL RELEVANCE/APPLICATION

DAS data complements GES results offering important additional assessment of antral motility characteristics and parameters that have direct implication to patient care and treatment choices.

NM207-SD-MOB8 Added Value of FDG-PET/CT in Detecting Non-peritoneal Metastases in Patients with Gastric Carcinoma

Station #8

Participants
Mohamed I. Elshikh, MBBCh, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Rodrigo Bazaes, MD, PhD, Santiago, Chile (*Abstract Co-Author*) Nothing to Disclose
Naveen Garg, MD, Houston, TX (*Abstract Co-Author*) Consultant, Document Storage Systems, Inc; CEO, Garglet LLC;
Beth Chasen, MD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Eric M. Rohren, MD, PhD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Raghunandan Vikram, MBBS, FRCR, Houston, TX (*Presenter*) Nothing to Disclose

PURPOSE

Most cross sectional imaging modalities, including FDG-PET/CT, have limitations in detection of peritoneal metastasis from gastric carcinoma, and therefore laparoscopic staging is commonly performed in most centers prior to surgical intervention. Our primary aim was to determine the sensitivity and specificity of FDG-PET/CT in detecting metastases in patients with gastric carcinoma with and without peritoneal metastases. Our secondary aim was to categorize these results based on histopathological subtype.

METHOD AND MATERIALS

We evaluated 155 patients with gastric carcinoma who were evaluated with FDG-PET/CT at our institution. Demographic, histopathological, radiological, and clinical findings were tabulated. All PET/CT findings were confirmed for accuracy with pathology reports where available and with review of serial radiological studies, and clinical notes when imaging follow up was not available. All patients had at least 6 months follow up.

RESULTS

Patient characteristics were: 86 males and 69 females; 74 with signet cell carcinoma vs. 81 with non-signet cell carcinoma. 17 patients were excluded due to incomplete follow up. Overall sensitivity, specificity, NPV, and PPV of FDG-PET/CT were 61%, 75%, 56%, and 78%; 50%, 72%, 46%, 75% in signet and 73%, 77%, 68%, 81% in non-signet respectively. Peritoneal metastases were the most common cause for a false negative study. When peritoneal metastasis was excluded, the overall sensitivity, specificity, NPV, and PPV was 81%, 75%, 80%, 76% and 66%, 72%, 72%, 66% in signet cell, 94%, 77%, 92%, 81% and in non-signet respectively.

CONCLUSION

PET/CT has good sensitivity and specificity for gastric carcinoma metastases, and a high negative predictive value when peritoneal metastases are excluded. Performance is better in patients with non-signet cell carcinoma compared to signet cell subtype.

CLINICAL RELEVANCE/APPLICATION

This data will be useful in clinical decision making in the management of patients with gastric carcinoma, and will be valuable to investigators considering inclusion of FDG-PET/CT into clinical trials in gastric cancers.

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/

Eric M. Rohren, MD, PhD - 2015 Honored Educator
Raghunandan Vikram, MBBS, FRCR - 2012 Honored Educator

NM215-SD-MOB9 Is It Me or Is This Scan Hot?: Qualitative Assessments of the Thyroid Bed with Radioactive Iodine Scan after Thyroidectomy: How Good are They?

Station #9

Participants
Sania Rahim-Gilani, MD, New Haven, CT (*Presenter*) Nothing to Disclose
Eric M. Rohren, MD, PhD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Mike Spektor, MD, New Haven, CT (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

There has been a recent push towards the inclusion of quantitative assessment of iodine uptake on radioactive iodine scanning based on the assumption that quantitative analysis is able to improve accuracy. We sought to evaluate the accuracy of the physician performed visual assessments of the post-thyroidectomy thyroid bed using the computer generated quantitative assessments as the gold standard. We also wished to evaluate the variability of assessments between independent physician readers.

METHOD AND MATERIALS

The images of 208 eligible consecutive patients who underwent Iodine-131 Whole Body Diagnostic scanning after thyroidectomy were collected. Planar imaging had been performed with a large FOV gamma camera after the administration of either I-123 or I-131. The images were evaluated independently by each physician and uptake within the thyroid bed was assigned a value of 0 - 5. Images with either a value of '0' or '1' were described as negligible to low uptake; '2' or '3' had moderate uptake and '4' or '5' had severe uptake. After assessment was completed the results were recorded and the results were compared between the physicians. When the results differed a consensus value was obtained, and the consensus value was then compared to the quantitative assessments.

RESULTS

Spearman correlation was used to assess the association between quantified uptake and visual assessment level, All statistical analyses were performed using SAS 9.3 for Windows. A statistically significant difference was obtained between the overall quantitative values corresponding to each visual assessment categories. The overall spearman correlation coefficient between visual assessment and quantitative assessment was 0.83784. Pearson correlation as used to assess the association between the readers on the visual assessment scale. The correlation coefficient was 0.89642.

CONCLUSION

We found that visual assessment had excellent correlation with the values obtained by quantitative assessment, both overall and within each assessment level (i.e. low, moderate, and high). Inter-reader variability was low with excellent and statistically significant correlations between the independent results of the readers.

CLINICAL RELEVANCE/APPLICATION

These results demonstrate that visual assessment is still a powerful tool and in absence of the availability of quantitative values it may be used to evaluate thyroid activity with confidence.

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/

Eric M. Rohren, MD, PhD - 2015 Honored Educator

NM216-SD-MOB10 Comparative Effectiveness: FDG PET/CT versus CT for Post-treatment Follow-up of Patients with Lung Cancer

Station #10

Participants
Sara Sheikhbahaei, MD, MPH, Baltimore, MD (*Presenter*) Nothing to Disclose
Se Jin Ahn, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Mehdi Taghipour, MD, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Brenda Young, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Charles Marcus, MD, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Rathan M. Subramaniam, MD, PhD, Baltimore, MD (*Abstract Co-Author*) Travel support, Koninklijke Philips NV

PURPOSE

The aim of this study was to evaluate the efficiency of follow-up positron emission tomography/computed tomography (PET/CT) in the detection of local, regional and distant metastatic diseases in comparison with CT in lung cancer patients.

METHOD AND MATERIALS

Post-treatment follow-up PET/CT and CT pairs of biopsy-proven lung cancers which were performed with an interval between two scans less than a month (median=2 days, range 0-31 days) and no treatment in between were included. PET/CT and CT (211 contrast enhanced [CE] and 55 non-CE) were reviewed retrospectively. Histopathology or clinical and imaging follow-up of at least 6 months were considered as reference standard. Diagnostic performance was evaluated on a per-scan basis. The percentage agreement between two techniques was calculated. Statistical analysis was performed using SPSS 22.0.

RESULTS

Of a total of 266 PET/CT and CT scans in 153 patients (69 male, 84 female, mean age of 64), 47.4% (126) was performed without prior clinical suspicion of recurrence or residual disease. The two techniques showed the concordance of 81.6% (Kappa =0.68) for local disease, 84.6% (Kappa=0.68) for regional, and 79.7% (Kappa= 0.57) for distant metastasis. Overall, PET/CT identified more lesions than CT scan both in the regional lymph nodes (164 vs. 115 regional zone involvement) and distant metastasis (145 vs. 95 metastasis sites). PET/CT was more sensitive than CT in the detection of local disease (88.4 vs. 83.1%), regional nodes (89.4 vs. 71.2%) and distant metastasis (83.3 vs. 66.0%). Whereas the specificity of the PET/CT was slightly lower than CT imaging in the identification of local disease (92.5 vs. 95.2%), regional (88.6 vs. 93.1%) and distant metastasis (90.9 vs. 93.5%). The similar trends were observed when the scans were sub grouped according to the prior suspicion of disease.

CONCLUSION

The sensitivity of PET/CT is superior to CT particularly for the detection of regional and distant metastasis while having comparable specificity. PET/CT can identify more lesions, some in the locations not usually covered by CT, which could help in the treatment decision and designing the radiation therapy fields.

CLINICAL RELEVANCE/APPLICATION

The higher sensitivity and comparable specificity of FDG-PET/CT in relation to CT could support its use in the clinical practice for follow-ups of lung cancer.

NM217-SD-MOB11 Postablation Radioiodine Scintigraphy SPECT/CT: Functional and Anatomic Correlation

Station #11

Participants
Ana M. Franceschi, MD, New York, NY (*Presenter*) Nothing to Disclose
Robert Matthews, MD, Stony Brook, NY (*Abstract Co-Author*) Nothing to Disclose
Lev Bangiyev, DO, Stony Brook, NY (*Abstract Co-Author*) Nothing to Disclose
Dinko Franceschi, MD, Stony Brook, NY (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

SPECT/CT was utilized to localize radioiodine uptake in thyroid carcinoma patients status post radiodine ablation. Anatomic correlation with central neck uptake evident on planar I-131 scintigraphy was assessed.

METHOD AND MATERIALS

In this retrospective study, one nuclear medicine physician and one neuroradiologist reviewed SPECT/CT findings to assess accuracy of radioiodine uptake localization on planar whole-body images in the central neck region. Inclusion criteria included thyroid carcinoma patients at our institution who underwent postablation planar and SPECT/CT I-131 scintigraphy from October 1, 2013 to June 1, 2014. Radioiodine dose was 50-200 mCi.

RESULTS

44 consecutive patients were included in the study (10 male, 34 female). Age range was 20 - 74. Most of the patients, 40 (91%) had obvious foci of radioiodine uptake in the central neck on planar and SPECT imaging, while remaining 4 patients had no significant radioiodine uptake in the neck. Of the patients with radioiodine uptake in the neck, 12 (27%) had uptake within the thyroid bed region only, 13 (30%) had focal uptake corresponding just to the thyroglossal duct remnant, and 15 (34%) had uptake within both, thyroid bed region and thyroglossal duct remnants. Therefore, majority of the patients with central neck uptake 28/40 (70%) had visualization of the thyroglossal duct remnant activity.

CONCLUSION

The anatomic CT correlation with planar and SPECT images demonstrated the majority of the focal radioiodine uptake to be located

exclusively within the thyroid bed and thyroglossal duct remnant.

CLINICAL RELEVANCE/APPLICATION

In low risk patients with thyroid cancer, our findings may support low dose consideration prior to radioiodine ablation.

NM111-ED-MOB12 FDG-PET/CT Pitfalls in Gynecological and Genitourinary Oncological Imaging

Station #12

Awards
Certificate of Merit
Identified for RadioGraphics

Participants
Amish Lakhani, FRCR, London, United Kingdom (*Presenter*) Nothing to Disclose
Sairah Khan, MBBS, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Nishat Bharwani, MBBS, FRCR, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Victoria Stewart, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Andrea G. Rockall, MRCP, FRCR, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Tara D. Barwick, MBChB, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Sameer Khan, MBBS, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

Purpose of the exhibit:1.to understand the role of FDG-PET/CT imaging in the multimodality investigation of gynecological and genitourinary cancers.2.to describe the mechanism of action and technical pitfalls of FDG-PET/CT.3.to highlight key imaging features of physiological and non-physiological FDG uptake and show how this is essential for interpretation of gynecological and genitourinary FDG-PET/CT studies.4.to review the pathophysiological mechanisms leading to potentially false-positive and false-negative assessments.

TABLE OF CONTENTS/OUTLINE

•Introduction of FDG-PET/CT:oMechanism of actionoRole in gynecological and genitourinary oncological imagingoFDG-PET/CT imaging protocols•False positives in gynecological and genitourinary oncological imaging:oPhysiological FDG-PET uptake - pictorial examples of uptake in endometrium and ovariesoNon-physiological FDG-PET uptake - pictorial examples of pelvic inflammatory disease, fibroids, endometriosis•False negatives in gynecological and genitourinary oncological imaging:oPhysiological FDG-PET uptake - pictorial examples of urinary excretion masking malignant lesionsoNo/low FDG uptake - pictorial examples of necrotic lymphadenopathy and low grade tumoursoArtefacts •Pearls explaining how to minimize false interpretation

SSE16

Nuclear Medicine (Endocrine and Gastrointestinal Imaging)

Monday, Nov. 30 3:00PM - 4:00PM Location: S505AB

GI HN NR CT NM

AMA PRA Category 1 Credit ™: 1.00
ARRT Category A+ Credit: 1.00

FDA Discussions may include off-label uses.

Participants
M. Elizabeth Oates, MD, Lexington, KY (*Moderator*) Nothing to Disclose
Samuel E. Almodovar-Reteguis, MD, Birmingham, AL (*Moderator*) Nothing to Disclose

Sub-Events

SSE16-01 Parathyroid Imaging with Simultaneous Acquisition of Tc-99m-Sestamibi and I-123: The Relative Merits of Pinhole Collimation and SPECT-CT.

Monday, Nov. 30 3:00PM - 3:10PM Location: S505AB

Participants
Paraag R. Bhatt, MD, Aurora, CO (*Presenter*) Nothing to Disclose
William C. Klingensmith III, MD, Englewood, CO (*Abstract Co-Author*) Nothing to Disclose
Brian M. Bagrosky, MD, MS, Castle Pines, CO (*Abstract Co-Author*) Nothing to Disclose
Jacob C. Walter, MD, Denver, CO (*Abstract Co-Author*) Nothing to Disclose
Kim McFann, PhD, Aurora, CO (*Abstract Co-Author*) Nothing to Disclose
Robert McIntyre Jr., MD, Aurora, CO (*Abstract Co-Author*) Nothing to Disclose
Christopher Raeburn, MD, Aurora, CO (*Abstract Co-Author*) Nothing to Disclose
Phillip J. Koo, MD, Aurora, CO (*Abstract Co-Author*) Advisory Board, Bayer AG; ; ;

PURPOSE

To determine the relative localization utility of three state-of-the-art parathyroid imaging protocols: 1) single time point simultaneous acquisition of Tc-99m-sestamibi and I-123 images with pinhole collimation in the anterior and bilateral anterior oblique projections, 2) single time point simultaneous acquisition of Tc-99m-sestamibi and I-123 images with SPECT-CT, and 3) the combination of protocols one and two.

METHOD AND MATERIALS

Fifty-nine patients with surgical proof of parathyroid adenomas were evaluated retrospectively. All three protocols included perfectly co-registered subtraction images created by subtracting the I-123 images from the Tc-99m-sestamibi images, plus an anterior parallel hole collimator image of the neck and upper chest. The pinhole protocol was performed first followed by the SPECT-CT protocol. Three image sets were derived from each study in each patient according to the above protocols. Two experienced observers recorded the size, location and degree of certainty of any identified lesion.

RESULTS

The 59 patients had sixty-one adenomas. For the two observers combined, the localization success rate was 88% for the pinhole protocol, 69% for the SPECT-CT protocol, and 81% for the combined protocol. The pinhole protocol detected more adenomas than the SPECT-CT protocol and missed fewer adenomas than either the SPECT-CT protocol or the combined pinhole and SPECT-CT protocol ($P < 0.01$). The two protocols that included SPECT-CT provided superior anatomic information relative to the location and size of the parathyroid adenomas.

CONCLUSION

Overall, the pinhole protocol localized significantly more adenomas than the SPECT-CT protocol. However, the protocols that included SPECT-CT provided more anatomic information than pinhole imaging alone.

CLINICAL RELEVANCE/APPLICATION

Accurate preoperative identification and localization of parathyroid adenoma(s) allows surgeons to perform image guided minimally invasive surgery with improved success rates, shorter operating times, and less morbidity. Consequently, it is important to optimize the accuracy of preoperative imaging in determining the presence, size, and location of parathyroid adenomas. Our hope with this study is to determine the most accurate imaging protocol with current available imaging modalities to overall optimize patient outcomes.

SSE16-02 Influence of Multigland Parathyroid Disease on Tc-99m-Sestamibi SPECT/CT Sensitivity

Monday, Nov. 30 3:10PM - 3:20PM Location: S505AB

Participants
Kenneth Nichols, PhD, New Hyde Park, NY (*Presenter*) Royalties, Syntermed, Inc;
Gene G. Tronco, MD, New Hyde Park, NY (*Abstract Co-Author*) Nothing to Disclose
Christopher J. Palestro, MD, New Hyde Park, NY (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Tc-99m-sestamibi (MIBI) imaging is a mainstay for preoperative parathyroid lesion localization in pts with primary hyperparathyroidism (PHP). Decreased sensitivity in multigland disease (MGD) compared to single gland disease (SGD) is a well recognized phenomenon for planar and SPECT protocols, but few data are available on the effect of MGD on the sensitivity of MIBI parathyroid SPECT/CT.

METHOD AND MATERIALS

We retrospectively analyzed 272 pts (220 female pts, 52 male pts, age = 59±13 years) with PHP who underwent preoperative MIBI SPECT/CT. We used surgical and pathology reports to confirm numbers and weights of excised parathyroid lesions. Two experienced physicians read SPECT/CTs on 2 separate occasions without reference to each other's readings or final diagnoses. Lesion certainty was graded on a 5-point scale (0 = normal, 1 = probably normal, 2 = equivocal, 3 = probably abnormal, 4 = definitely abnormal). Mean scores were obtained for the 2 observers. Readings were compared for MGD and SGD lesions matched by weight and location.

RESULTS

230 pts had SGD, 42 had MGD (28 pts with 2 lesions, 11 pts with 3 lesions and 3 pts with 4 lesions). Lesion weight decreased progressively with increasing numbers of lesions (888±941 mg for 1 lesion, 436±570 mg for 2 lesions, 395±686 mg for 3 lesions, 89±120 mg for 4 lesions, $\rho = -0.43$, $p < 0.0001$). It was possible to match equal numbers of SGD and MGD lesions by weight for 132 lesions, with similar mass (526±678 versus 525±686 mg, $p = 0.99$), and similar location distributions ($p = 0.47$). Despite being matched by weight and location, reading confidence was significantly lower for MGD than SGD lesions (2.0±1.4 versus 3.4±0.8, $p < 0.0001$); confidence decreased progressively with increasing lesion numbers (2.2±1.3 for 2 lesions, 1.8±1.5 for 3 lesions, 1.0±0.9 for 4 lesions, $\rho = -0.51$, $p < 0.0001$). Sensitivity was significantly lower for MGD than SGD lesions (64% versus 98%, $p < 0.0001$); sensitivity decreased progressively with increasing lesion numbers (67% for 2 lesions, 65% for 3 lesions, 25% for 4 lesions, $\rho = -0.45$, $p < 0.0001$).

CONCLUSION

As with planar and SPECT MIBI, in PHP,Tc-99m-MIBI SPECT/CT reading confidence and sensitivity are significantly lower in multigland disease than in single gland disease.

CLINICAL RELEVANCE/APPLICATION

MIBI SPECT/CT is less sensitive for detecting lesions in MGD than lesions in SGD and therefore it must be used together with rapid intraoperative parathyroid hormone assay to ensure that all offending lesions are removed.

SSE16-03 Prognostic Value of FDG-PET/CT in Papillary Thyroid Cancer with the TENIS Syndrome

Monday, Nov. 30 3:20PM - 3:30PM Location: S505AB

Participants
Kunihiro Nakada, Sapporo, Japan (*Presenter*) Nothing to Disclose
Hiroki Sugie, MD, Sapporo, Japan (*Abstract Co-Author*) Nothing to Disclose
Ysushi Furuta, MD, PhD, Sapporo, Japan (*Abstract Co-Author*) Nothing to Disclose
Hiromasa Takahashi, Sapporo, Japan (*Abstract Co-Author*) Nothing to Disclose
Naoya Hattori, MD, PhD, Sapporo, Japan (*Abstract Co-Author*) Nothing to Disclose
Masayuki Sakurai, Sapporo, Japan (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Postsurgical papillary thyroid cancer (PCA) with thyroglobulin elevation and negative iodine scintigraphy (TENIS) generally show resistance to high-dose I-131 therapy. However, prognostic factors for PCA with the TENIS syndrome have not been well established.. The aim of the study was to determine whether FDG uptake is linked with clinical behavior of the tumor in the TENIS syndrome.

METHOD AND MATERIALS

93 patients with PCA, who had previously underwent total thyroidectomy and remnant tissue ablation and were diagnosed as the TENIS syndrome, underwent FDG-PET/CT. Serum Tg levels at PET/CT ranged 2.9- 225.4(ng/ml). Uptake of FDG was visually assessed and classified as positive or negative. When FDG uptake was positive, semi-quantitative analysis (SUVmax) was performed. If a patient had multiple tumors, average of SUVmax in the 2 largest tumors were used for evaluation. Patients were followed up for 28-83 months (median 46). Tg levels were measured at least 5 times or more after imaging of FDG-PET/CT. to determine Tg doubling time (Tg-DT). As a rule, changes in the tumor size were evaluated based upon RECIST1.1.

RESULTS

Of 93 patients, 74 showed positive FDG uptake while the remaining 19 showed negative FDG uptake. In the FDG positive group, 21 (28%) showed Tg-DT of < 1yr. Progressive disease (PD) was observed in 32 pts. (42%). SUVmax was significantly higher in patients with PD than others (6.7 vs.4.1, $p<0.01$). 5 pts. died of PCA. In contrast, all patients in the FDG negative group had Tg-DT of either >= 3yrs. or minus value regardless of baseline Tg value. PD was seen in only 1(5%). Cancer-associated death was not observed in any of the patients. There was an inverse correlation between SUVmax and Tg-DT in the positive FDG uptake group ($r=-0.56$).

CONCLUSION

Positive FDG uptake in the TENIS syndrome indicates shorter Tg-DT and higher risk of PD. In contrast, negative FDG uptake is associated with longer Tg-DT and gentle behavior of the tumor. FDG-PET/CT is helpful in characterizing prognosis of postsurgical PCA with the TENIS syndrome

CLINICAL RELEVANCE/APPLICATION

In patients with TENIS who have high FDG uptake, early start of additional therapies such external radiation, local ablation therapy such as RFA or PEI, or chemotherapy using sorafenib or lenvanitib may improve their prognosis. In contrast, the majority of patients with negative FDG uptake do not require aggressive additional treatments.

SSE16-04 Effectiveness of Semi-quantitative Analysis in I-123 Metaiodobenzylguanidine Scintigraphy for Diagnosing Pheochromocytoma

Monday, Nov. 30 3:30PM - 3:40PM Location: S505AB

Participants
Yoshiyuki Kitamura, Fukuoka, Japan (*Presenter*) Nothing to Disclose

Shingo Baba, Fukuoka, Japan (*Abstract Co-Author*) Nothing to Disclose
Takuro Isoda, Fukuoka, Japan (*Abstract Co-Author*) Nothing to Disclose
Yasuhiro Maruoka, Fukuoka, Japan (*Abstract Co-Author*) Nothing to Disclose
Keiichiro Tahara, Fukuoka, Japan (*Abstract Co-Author*) Nothing to Disclose
Akihiro Nishie, MD, Fukuoka, Japan (*Abstract Co-Author*) Nothing to Disclose
Masayuki Sasaki, Fukuoka, Japan (*Abstract Co-Author*) Nothing to Disclose
Hiroshi Honda, MD, Fukuoka, Japan (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

I-123 Metaiodobenzylguanidine (MIBG) scintigraphy is a sensitive and specific imaging tool for the diagnosis of suspected adrenal pheochromocytoma. Hybrid single photon emission computed tomography / computed tomography (SPECT/CT) is expected to provide additional anatomical information and more efficient diagnostic capability. Visual evaluation is usually used to diagnose the abnormality. However, evaluation standard is not yet established. In addition, the appearance of fusion image of SPECT /CT is largely depend on the window level of SPECT image. This may lead to equivocal or wrong diagnosis. In this study, we introduced a semi-quantitative method for the evaluation of I-123 MIBG. The purpose of this study is to evaluate the performance of this method with that of conventional visual evaluation.

METHOD AND MATERIALS

Twenty six patients (Male/Female=17/9, Age=57.5±14.4) with suspected pheochromocytoma were incorporated in this study. I-123 MIBG scintigraphy and adrenal SPECT/CT was performed in all patients. Twelve pheochromocytomas and 14 cortical adenoma were diagnosed histopathologically or based on the clinical course including MRI. For semi-quantitative analysis, tumor-to-liver ratio (T/L) was defined as ratio of maximum count of adrenal mass divided by maximum count of normal liver of right lobe. For visual evaluation of planar scintigraphy and SPECT/CT fusion image, aderenal uptake was classified as visual score (1 = lower than liver, 2 = equal to liver and 3 = higher than liver). Diagnostic performances of the three methods (T/L: SPECT, visual: planar and visual: SPECT/CT) were compared using receiver operating characteristic (ROC) analyses.

RESULTS

In ROC analysis, AUC of SPECT, planar and SPECT/CT were 0.98, 0.67 and 0.76 with cut-off value of 2.26, 3 and 3, respectively. There were significant difference between SPECT and planar ($p < 0.01$), SPECT and SPECT/CT ($p < 0.01$). No significant difference between planar and SPECT/CT ($p = 0.50$).

CONCLUSION

Semi-quantitative method using SPECT/CT was more sensitive and specific than visual evaluation in the diagnosis of pheochromocytoma in patients with adrenal tumor.

CLINICAL RELEVANCE/APPLICATION

Semi-quantitative method using SPECT/CT was more sensitive and specific than visual evaluation in the diagnosis of pheochromocytoma in patients with adrenal tumor.

SSE16-05 Postablation Radioiodine Scintigraphy SPECT/CT: Functional and Anatomic Correlation

Monday, Nov. 30 3:40PM - 3:50PM Location: S505AB

Participants
Ana M. Franceschi, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Robert Matthews, MD, Stony Brook, NY (*Presenter*) Nothing to Disclose
Lev Bangiyev, DO, Stony Brook, NY (*Abstract Co-Author*) Nothing to Disclose
Dinko Franceschi, MD, Stony Brook, NY (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

SPECT/CT was utilized to localize radioiodine uptake in thyroid carcinoma patients status post radiodine ablation. Anatomic correlation with central neck uptake evident on planar I-131 scintigraphy was assessed.

METHOD AND MATERIALS

In this retrospective study, one nuclear medicine physician and one neuroradiologist reviewed SPECT/CT findings to assess accuracy of radioiodine uptake localization on planar whole-body images in the central neck region. Inclusion criteria included thyroid carcinoma patients at our institution who underwent postablation planar and SPECT/CT I-131 scintigraphy from October 1, 2013 to June 1, 2014. Radioiodine dose was 50-200 mCi.

RESULTS

44 consecutive patients were included in the study (10 male, 34 female). Age range was 20 - 74. Most of the patients, 40 (91%) had obvious foci of radioiodine uptake in the central neck on planar and SPECT imaging, while remaining 4 patients had no significant radioiodine uptake in the neck. Of the patients with radioiodine uptake in the neck, 12 (27%) had uptake within the thyroid bed region only, 13 (30%) had focal uptake corresponding just to the thyroglossal duct remnant, and 15 (34%) had uptake within both, thyroid bed region and thyroglossal duct remnants. Therefore, majority of the patients with central neck uptake 28/40 (70%) had visualization of the thyroglossal duct remnant activity.

CONCLUSION

The anatomic CT correlation with planar and SPECT images demonstrated the majority of the focal radioiodine uptake to be located exclusively within the thyroid bed and thyroglossal duct remnant.

CLINICAL RELEVANCE/APPLICATION

In low risk patients with thyroid cancer, our findings may support low dose consideration prior to radioiodine ablation.

SSE16-06 Evaluate Correlation of Duodenogastric Reflux Detected on Tc-99m Mebrofenin Hepatobiliary Scintigraphy with Symptomatic Gastroesophageal Reflux Disease: A Retrospective Study

Monday, Nov. 30 3:50PM - 4:00PM Location: S505AB

Participants
Ammar A. Chaudhry, MD, Corona, CA (*Abstract Co-Author*) Nothing to Disclose
Maryam Gul, Mineola, NY (*Abstract Co-Author*) Nothing to Disclose
Abbas A. Chaudhry, BSc, Westbury, NY (*Abstract Co-Author*) Nothing to Disclose
Robert Matthews, MD, Stony Brook, NY (*Presenter*) Nothing to Disclose

PURPOSE

GERD is thought to result primarily from gastric acid reflux. Recent literature suggests that symptomatic GERD also occurs from duodenogastric reflux of bile acids. This has been termed alkaline variant GERD and appears to be more damaging to the esophagus and has a more symptomatic clinical course. We aim to evaluate whether the presence of duodenogastric reflux (DGR) seen on Tc-99m mebrofenin hepatobiliary scintigraphy (MHBS) correlates with presence of clinical GERD and whether degree of DGR seen correlates with clinical severity of GERD.

METHOD AND MATERIALS

300 Tc-99m MHBS exams conducted from January 2011-December 2014 were included in this study and were evaluated for presence of DGR. Patients' chart were reviewed to identify for clinical diagnosis of GERD and the severity of GERD that was determined using clinical data points including endoscopic evaluation of GERD, oral medications for treatment of GERD and presence/absence Barrett's esophagus, etc.

RESULTS

83 patients (45 females and 38 males) with mean age 47.9 (range: 13 - 93 years old) were identified to have evidence of DGR. Of these patients, 31.3% patients were diagnosed with cholecystitis and 7.2% patients were diagnosed with biliary colic. 25.3% patients had only clinical history of GERD and no additional significant history. Of the patients with clinical evidence of GERD, 42.9% patients had evidence of severe DGR, 38.1% had moderate DGR and 19% had mild DGR noted. 4.7% patients with GERD and severe DGR had histopathologic evidence of Barrett's esophagus.

CONCLUSION

DGR is easily detected and frequently identified on Tc-99m MHBS. Our study shows 25% of patients with otherwise unremarkable Tc-99MHBS scintigraphy have evidence of DGR and majority of these have moderate to severe GERD. As emerging literature is demonstrating stronger correlation between bile acid reflux and symptomatic GERD, DGR is an important diagnostic consideration as the cause of patients presenting symptoms in an otherwise normal HIDA study.

CLINICAL RELEVANCE/APPLICATION

DGR is easily detected and frequently identified on Tc-99m MHBS and a significant proportion patients with scintigraphic evidence of DGR have GERD. Reporting severity of reflux in report can facilitate patient management by alerting clinician to DGR as an important diagnostic consideration as the cause of patients presenting symptoms in an otherwise normal HIDA study.

SSE21

Physics (Nuclear Imaging)

Monday, Nov. 30 3:00PM - 4:00PM Location: S403A

MR NM PH

AMA PRA Category 1 Credit ™: 1.00
ARRT Category A+ Credit: 1.00

FDA Discussions may include off-label uses.

Participants
Chien-Min Kao, PhD, Chicago, IL (*Moderator*) Stockholder, Walgreens Boots Alliance, Inc
Tinsu Pan, PhD, Houston, TX (*Moderator*) Nothing to Disclose

Sub-Events

SSE21-01 Algorithm-Enabled Reduction of Detector Crystals in Advanced PET System

Monday, Nov. 30 3:00PM - 3:10PM Location: S403A

Participants
Zheng Zhang, MA, BS, Chicago, IL (*Presenter*) Nothing to Disclose
Jinghan Ye, San Jose, CA (*Abstract Co-Author*) Employee, Koninklijke Philips NV
Buxin Chen, MSc, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Amy Perkins, Philadephia, PA (*Abstract Co-Author*) Employee, Koninklijke Philips NV
Andreia Trindade, PhD, Eindhoven, Netherlands (*Abstract Co-Author*) Employee, Koninklijke Philips NV
Pedro Rodrigues, PhD, Eindhoven, Netherlands (*Abstract Co-Author*) Employee, Koninklijke Philips NV
Chien-Min Kao, PhD, Chicago, IL (*Abstract Co-Author*) Stockholder, Walgreens Boots Alliance, Inc
Emil Y. Sidky, PhD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Xiaochuan Pan, PhD, Chicago, IL (*Abstract Co-Author*) Research Grant, Koninklijke Philips NV; Research Grant, Toshiba Corporation;

PURPOSE

As detector crystals constitute a large portion of a modern PET system cost, it is of significance to design a PET scanner with a reduced number of detectors without sacrificing the image quality. In this study, we investigate algorithm-enabled PET systems design with a 50% reduction of detector crystals.

METHOD AND MATERIALS

We employ a digital PET scanner to collect IEC phantom data with initial total activity of 53 MBq. The phantom contains 6 spheres of 10, 13, 17, 22, 28, and 37 mm diameter. The activity in the smallest four spheres is 4 times the background and zero in the other two. We design a sparse PET configuration with 50% of crystals, which is to remove odd-numbered tiles in the odd-numbered rings, and even-numbered tiles in the even-numbered rings. We use an iterative algorithm based on Chambolle-Pock framework to solve a constrained-TV-minimization problem. We reconstruct images from full data by using the row-action maximum likelihood algorithm (RAMLA) as references. Scatter and random corrections are applied in the reconstruction. Images are evaluated by use of contrast of 4 hot spheres with the instruction in NEMA NU 2-2012.

RESULTS

Reconstructions with the new algorithm from both full and sparse data exhibit lower background noise compared to the RAMLA result. The contrast of a hot sphere of size 22 mm is 71.7%, 66.7%, and 68.5% in the full-data TV image, the sparse-data TV image, and the full-data RAMLA result, respectively. In the same order, the contrasts of the hot sphere of size 17 mm is 63.2%, 60.8%, and 59.0%; of the hot sphere of size 13 mm is 58.4%, 54.1%, and 47.3%; and of the hot sphere of size 10 mm is 32.1%, 20.6%, and 17.5%.

CONCLUSION

Advanced algorithms can reconstruct PET images from full data with quality improved over the RAMLA results in terms of contrast and background noise, and can yield images from data with 50% crystal reduction with potential practical utility.

CLINICAL RELEVANCE/APPLICATION

This work suggests that PET images of practical utility may be obtained by use of advanced algorithms from sparse-crystal data, which can be exploited for enabling crystal/cost reduction.

SSE21-02 Respiratory Motion Compensation for Simultaneous PET/MR Based on Measurements of Strongly Undersampled Radial MR Data

Monday, Nov. 30 3:10PM - 3:20PM Location: S403A

Awards
RSNA Country Presents Travel Award

Participants
Christopher M. Rank, MSc, Heidelberg, Germany (*Abstract Co-Author*) Nothing to Disclose
Thorsten Heusser, Dipl Phys, Heidelberg, Germany (*Abstract Co-Author*) Nothing to Disclose
Andreas Wetscherek, Heidelberg, Germany (*Abstract Co-Author*) Nothing to Disclose
Marc Kachelriess, PhD, Heidelberg, Germany (*Abstract Co-Author*) Nothing to Disclose
Sebastian Sauppe, Heidelberg, Germany (*Presenter*) Nothing to Disclose

PURPOSE

We propose a new method for PET/MR respiratory motion compensation (MoCo), which employs strongly undersampled measured MR

We propose a new method for PET/MR respiratory motion compensation (MoCo), which employs strongly undersampled measured MR data. These MR measurements can be interlaced with clinical MR sequences and can be acquired with measurement times as short as 30 s per bed position.

METHOD AND MATERIALS

MR data covering the thorax and abdomen of free-breathing volunteers were acquired with a Siemens Biograph mMR system. We applied a 3D encoded radial stack-of-stars sequence with a golden angle radial spacing. Two highly undersampled datasets consisting of 300 and 600 spokes were created corresponding to acquisition times of 30 s and 60 s, respectively. Respiratory motion amplitudes were derived from measured k-space centers allowing for a retrospective gating into 20 overlapping motion phase bins with a width of 10%. For all volunteers, MoCo 4D MR images and corresponding motion vector fields were generated for both highly undersampled datasets using our newly-developed method for joint motion estimation and iterative image reconstruction. Subsequently, 4D PET volumes of the volunteers with four artificial hot lesions (10 mm diameter) in the lungs and the abdomen were simulated. 3D PET and MoCo 4D PET images based on the two sets of motion vector fields derived from MR were reconstructed and compared to a reference gated 4D reconstruction with ten-fold PET acquisition time.

RESULTS

Compared to the 3D PET reconstructions, MoCo 4D PET reconstructions could reduce image blurring for both MR acquisition times. Due to its large motion amplitude, one lesion showed a double structure in the 3D reconstruction which could not be seen in the MoCo 4D reconstructions. For quantitative evaluation, SUVmean values were measured for all lesions in the end-exhale motion phases. In comparison to the reference, deviations of SUVmean were 36.7%, 24.5%, 21.5% on average for the 3D, MoCo 4D (30 s) and MoCo 4D (60 s) reconstructions, respectively.

CONCLUSION

It was demonstrated that motion compensation of PET images based on measurements of strongly undersampled radial MR data acquired during normal respiration could outperform 3D PET reconstructions in terms of image quality and quantification.

CLINICAL RELEVANCE/APPLICATION

The proposed method could be potentially integrated into clinical PET/MR to improve PET image quality and quantification, thus, increasing the diagnostic value of PET/MR.

SSE21-03 The Automated Determination of Universal Image Quality Indices for PET Scanners

Monday, Nov. 30 3:20PM - 3:30PM Location: S403A

Participants
Yaniv Rotem, BSc, MSc, Nesher, Israel (*Abstract Co-Author*) Employee, Koninklijke Philips NV
John A. Kennedy, PhD, Haifa, Israel (*Presenter*) Nothing to Disclose

Background

Evaluation of PET image quality phantom tests routinely requires deliberation and subjective decision-making. Commonly-used metrics of PET image quality do not always reflect perceptual quality differences. An automated method of measuring the structural similarity index (SSIM) reflecting known characteristics of the human visual system (HVS) has been developed to aid in the fast, objective evaluation of such tests.

Evaluation

Monthly image quality tests were performed (n=26) using an American College of Radiology (ACR) approved PET phantom (Esser flangeless) in a time-of-flight PET/CT. Scans comprised approximately 123e6 prompt counts and 19e6 random counts. An in-house MATLAB code analyzed 9.81 mm thick transaxial slices through the hot cylinders by comparing them with a digital model adjusted to known hot-to-background ratios. Registration of the digital model was performed using correlation of the outer phantom edges, and then rotating the images to maximize SSIM. In additional trials, SSIM was determined for a misregistered phantom (by 13 mm between CTAC and PET) exhibiting attenuation correction artifacts and for a list mode acquisition divided into 16 virtual acquisitions incrementing the scan time by 30 s to total of 8 minutes. SSIM was compared to a non-HVS metric, mean square error (MSE). Ideally, higher SSIM or lower MSE indicate superior image quality.

Discussion

Over approximately a two-year period, SSIM was 0.748 ± 0.007 (mean ± S.D., n=26) on ACR-approved PET phantoms. All cold and hot features were evident but highest (0.764) and lowest (0.733) SSIM were the visually better and worse images respectively. For the 16 virtual acquisitions, SSIM increased (from 0.56 to 0.74) monotonically with scan time, a known determinant of image quality. The misregistered phantom was superior to the 90 s acquisition by visual assessment, which was reflected in the SSIM (0.68 vs. 0.65, respectively) but not in the MSE (0.072 vs 0.065).

Conclusion

Automated PET quality control using structural similarity to model the human visual system efficiently provides an objective index to reflect small perceptual quality differences among images and can be used to ensure diagnostic accuracy.

SSE21-04 Performance Evaluation of a Prone Dedicated Breast Ring PET Scanner Designed for Improved Visualization of Posterior Breast Tissue

Monday, Nov. 30 3:30PM - 3:40PM Location: S403A

Participants
Andrew Polemi, Charlottesville, VA (*Presenter*) Institutional research agreement, Hologic, Inc
Heather R. Peppard, MD, Charlottesville, VA (*Abstract Co-Author*) Consultant, Siemens AG; Research Grant, Hologic, Inc
Stan Majewski, MD, Morgantown, WV (*Abstract Co-Author*) Research Grant, General Electric Company; Research Grant, ONCOVISION
Alexander Stolin, PhD, Morgantown, WV (*Abstract Co-Author*) Nothing to Disclose
Patrice K. Rehm, MD, Charlottesville, VA (*Abstract Co-Author*) Nothing to Disclose
Mark B. Williams, PhD, Charlottesville, VA (*Abstract Co-Author*) Institutional research agreement, Hologic, Inc.

PURPOSE

To report the design and performance of a novel dedicated breast ring positron emission tomography (BRPET) system measured using a modified NEMA NU4-2008 protocol.

METHOD AND MATERIALS

The BRPET scanner consists of a ring of 12 detector modules. Each detector consists of a pixelated LYSO crystal connected to a position sensitive photomultiplier tube using a fiber optic light guide. The detector ring is mounted below a modified Lorad prone breast biopsy table for pendant geometry imaging. The detector light guides extend from the photomultiplier tubes at an angle to permit closer crystal access to posterior breast tissue near the patient's chest wall. Performance metrics evaluated include spatial resolution, sensitivity, and noise equivalent count rate. These tests were adapted from the National Electrical Manufacturers Association (NEMA) NU4-2008 protocol. Two additional phantom tests were performed to assess the amount of posterior breast tissue that cannot be imaged by the scanner due to the thickness of the table.

RESULTS

Spatial resolutions of 1.8, 1.6, and 1.9 mm FWHM were measured at the center of the field of view in the axial, radial, and tangential directions, respectively. The peak absolute system sensitivity was 13.2% and scatter fraction of 25.4% using an energy window of 420 - 600 keV. The peak noise equivalent counting rate and peak true rates at 3.86 MBq were 0.75 kcps and 1.23 kcps, respectively. The scanner can image to within 6.25mm of the plane defined by the top surface of the table and has the capability to scan a total of 19 cm along the central axis of a pendant breast.

CONCLUSION

The BRPET system can produce high-resolution PET images at clinically relevant count rates. Compared to other prone breast PET systems it has superior coverage of the posterior breast.

CLINICAL RELEVANCE/APPLICATION

Novel dedicated breast ring PET scanner with high spatial resolution and better visualization of posterior breast tissue compared to current breast PET systems.

SSE21-05 A Hybrid Imaging Phantom for Quality Assurance and Research

Monday, Nov. 30 3:40PM - 3:50PM Location: S403A

Participants
Philipp Mann, MSc, Heidelberg, Germany (*Presenter*) Nothing to Disclose
Thorsten Heusser, Dipl Phys, Heidelberg, Germany (*Abstract Co-Author*) Nothing to Disclose
Hugo de las Heras, PhD, Zorneding, Germany (*Abstract Co-Author*) Research Consultant, QUART GmbH
Ricardo d. Weigel, MA, Zorneding, Germany (*Abstract Co-Author*) Officer, QUART GmbH
Marc Kachelriess, PhD, Heidelberg, Germany (*Abstract Co-Author*) Nothing to Disclose
Peter Bachert, PhD, Heidelberg, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To construct and test a phantom that mimics the human pelvis for quality assurance, research, and performance measurements in both PET/CT and PET/MR devices.

METHOD AND MATERIALS

The phantom is enclosed in a PMMA box that can be filled with different liquids and radioactive tracers to simulate background signal. Refillable inserts mimic bladder, thigh bones, and prostate (including eight separate cells which can be filled with dissolved metabolites and radioactive tracers). The inserts were produced using 3D printing based on CAD models or MRI data from healthy volunteers. Activity introduced into the bladder model yields realistic PET signals while the thigh bones can be filled with fat- or bone-equivalent materials to obtain different attenuating properties. Additionally, an insert for an endorectal RF coil allows to perform MR spectroscopy (MRS). The phantom was used to check co-registration: the center of mass of the signals obtained by CT or MR within a single cell of the prostate insert was calculated and compared to the corresponding signal obtained by PET. The phantom was also used for research projects including MRS (e.g., quantification of creatine, citrate, and choline) and PET studies comparing reconstructions of data obtained with PET/MR and PET/CT scanners. Since the phantom is available as 3D voxel phantom all experiments can be cross-checked by simulations.

RESULTS

The misalignment of the co-registration of data from the employed PET/CT and PET/MR were 0.57 ± 0.30 pixels and 0.57 ± 0.20 pixels, respectively. The MRS analysis showed that all ^{1}H MR resonances of metabolites in the model solutions can be resolved. Offline PET simulations agree well with the outcome of phantom measurements (SUVmean differences < 5 %). PET image distortions caused by false MR-based attenuation maps can be accurately reproduced using simulations based on the 3D voxel phantom.

CONCLUSION

The phantom is a flexible tool to study the performance of PET/CT and PET/MR systems. It can verify co-registration in a straightforward way. In addition, there is a variety of research applications, ranging from MR sequence testing to evaluations of new PET reconstruction algorithms.

CLINICAL RELEVANCE/APPLICATION

The phantom and its digital 3D version can help to improve quality assurance in clinical PET/CT and PET/MR scanners and offer simple approaches to test and evaluate new PET reconstruction algorithms.

SSE21-06 Statistical Methods to Verify Lesion Detection in Low Count Environments

Monday, Nov. 30 3:50PM - 4:00PM Location: S403A

Participants
Kenneth Nichols, PhD, New Hyde Park, NY (*Presenter*) Royalties, Syntermed, Inc;

Fritzgerald Leveque, New Hyde Park, NY (*Abstract Co-Author*) Nothing to Disclose
Christopher J. Palestro, MD, New Hyde Park, NY (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

It can be helpful to quantify lesion-to-background contrast in resolving cases of questionable visual lesion detection. For low-count data this becomes problematic due to statistical uncertainty. This study was undertaken to determine whether curve fitting at potential lesion locations overcomes these difficulties.

METHOD AND MATERIALS

Algorithms were written in IDL to automatically identify likely locations of solid spheres and to sample neighboring uniform background volumes in multipurpose plastic and water phantoms used for routine SPECT quarterly quality assurance tests. Data were processed for 12 phantoms loaded with 370-925 MBq Tc-99m for acquisitions ranging from 11-27 seconds/projection for 64-128 projections. Each high-count acquisition was paired with low-count acquisitions for the same phantoms imaged for only 1 second/projection. Algorithms generated counts versus radii curves and counts versus angles curves, through which 3rd order polynomials were fit by minimizing $\chi 2$ variance. Similar plots were formed for 6 background volumes. Contrast was computed as (maximum-minimum)÷(maximum+minimum) for both raw counts and fitted curves. One physicist read all images and graded sphere detection confidence on a 5-point scale for each sphere. The Kolmogorov-Smirnov test determined whether continuous variables were normally distributed, based on which the t-test or Wilcoxon test determined significance of differences between means.

RESULTS

Total counts were significantly greater for high-count than low-count acquisitions (32±19 versus 3±2 Million counts, $p < 0.0001$). Fitted contrast agreed with visual scores with higher accuracy (ROC area) than raw contrast (85±3% versus 61±5%, $p<0.0001$), for both low counts (84±5% versus 67±7%, $p=0.001$) and high counts (88±4% versus 75±6%, $p=0.003$). Contrast was significantly different between high-count and low-count paired acquisitions for raw counts (41±23% versus 74±24%, $p < 0.0001$), but not for fitted contrast (37±32% versus 35±32%, $p = 0.27$). Raw contrast was correlated with total counts ($r = -0.51$, $p<0.0001$), but fitted contrast was not ($r = 0.02$, $p = 0.79$).

CONCLUSION

Compared to straightforward contrast measurement, curve fitting provided better agreement with visual assessment and more stable measurements that were independent of acquired counts.

CLINICAL RELEVANCE/APPLICATION

Our results suggest that radial count curve fitting may be useful to verify lesion detection in low count environments.

ED010-TU

Nuclear Medicine Tuesday Case of the Day

Tuesday, Dec. 1 7:00AM - 11:59PM Location: Case of Day, Learning Center

NM

AMA PRA Category 1 Credit ™: .50

Participants
Murray D. Becker, MD, PhD, New Brunswick, NJ (*Presenter*) Nothing to Disclose
Levi Sokol, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Prapti Y. Shingala, MD, Edison, NJ (*Abstract Co-Author*) Nothing to Disclose
Jamil Shaikh, MD, New Brunswick, NJ (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

1) The case will demonstrate the typical characteristics of sarcoid on FDG PET and cardiac MRI. The learner will understand the role of these modalities in the work up of patients with suspected cardiac sarcoid. 2) The case will demonstrate focal hot spots in the periphery of the lungs on MAA perfusions scan. The learner will be able to identify this finding as an artifact related to the technique of injection. 3) The case will deomonstrate the typical characteristics of pleural talcosis on FDG PET. The exhibit will teach the learner how to seperate benign from neoplastic causes of update in the pleural space.

MSCC31

Case-based Review of Nuclear Medicine: PET/CT Workshop-Head and Neck Cancers (In Conjunction with SNMMI) (An Interactive Session)

Tuesday, Dec. 1 8:30AM - 10:00AM Location: S406A

HN NR CT NM OI

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

Participants
Janis P. O'Malley, MD, Birmingham, AL (*Director*) Nothing to Disclose
Jonathan E. McConathy, MD, PhD, Saint Louis, MO (*Presenter*) Research Consultant, Eli Lilly and Company; Research Consultant, Blue Earth Diagnostics Ltd; Research Consultant, Siemens AG; Research support, GlaxoSmithKline plc

LEARNING OBJECTIVES

1) Participants will use FDG-PET/CT more effectively in their clinical practice through better understanding of the anatomy, clinical scenarios, and differential diagnoses relevant to the diagnostic imaging of head and neck cancers.

RC311

Imaging Alzheimer's Disease -The Search for the Holy Grail

Tuesday, Dec. 1 8:30AM - 10:00AM Location: S505AB

NR MR NM

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 0

Participants

LEARNING OBJECTIVES

1) Discuss the potential roles and limitations of PET imaging for amyloid and tau protein in evaluating patients with dementia. 2) Describe anatomic and functional MRI techniques for evaluating Alzheimer's disease. 3) Understand the clinical challenges of diagnosing and managing patients with dementia.

Sub-Events

RC311A PET Imaging, Tracers

Participants
Terence Z. Wong, MD, PhD, Chapel Hill, NC (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

RC311B MRI and fMRI

Participants
Jeffrey R. Petrella, MD, Durham, NC (*Presenter*) Advisory Board, Johnson & Johnson Speakers Bureau, Quintiles Inc Advisory Board, Piramal Enterprises Limited

LEARNING OBJECTIVES

View learning objectives under main course title.

RC311C Clinical Examples

Participants
P. M. Doraiswamy, MD, Durham, NC (*Presenter*) Research Consultant, Bristol-Myers Squibb Company Research Consultant, Eli Lilly and Company Research Consultant, Neuronetrix, Inc Research Consultant, Medivation, Inc Research Grant, Bristol-Myers Squibb Company Research Grant, Eli Lilly and Company Research Grant, Neuronetrix, Inc Research Grant, Medivation, Inc Stockholder, Sonexa Therapeutics, Inc Stockholder, Clarimedix, Inc Speaker, Forest Medical, LLC

LEARNING OBJECTIVES

View learning objectives under main course title.

RC317

PET-MR/Hyperpolarized MR

Tuesday, Dec. 1 8:30AM - 10:00AM Location: S504CD

MR NM BQ

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

FDA Discussions may include off-label uses.

Participants
Heike E. Daldrup-Link, MD, Palo Alto, CA (*Moderator*) Nothing to Disclose

Sub-Events

RC317A Hyperpolarized 13C MR-A Complementary Method to PET for Imaging in Vivo Metabolism

Participants
Daniel M. Spielman, PhD, Stanford, CA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Assess the basic principles of hyperpolarized 13C MRS, including sample preparation, image acquisition, and data analysis. 2) Differentiate metabolic parameters measurable by hyperpolarized 13C MRS from though obtained with PET. 3) Compare PET versus hyperpolarized 13C MRS sensitivities, spatial resolution, and temporal resolution.

RC317B PET/MR: Applications in Clinical Imaging

Participants
Karin A. Herrmann, MD, PhD, Cleveland, OH (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To understand technical limitations, workflow and current challenges of PET/MR compared to PET/CT. 2) To learn about most successful applications of PET/MR in clinical practice. 3) To be informed about the incremental value of PET/MR over current imaging strategies in selected clinical scenarios. 4) Identify appropriate clinical indications for PET/MR in current clinical practice. 5) Understand and manage procedural and logistic challenges of PET/MR.

RC317C The Emerging Clinical Role of Hyperpolarized ^{13}C MR in Prostate Cancer Imaging

Participants
John Kurhanewicz, PhD, San Francisco, CA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Understand the clinical need and biochemical rationale for the use of hyperpolarized [1-13C] pyruvate for prostate cancer imaging. 2) Demonstrate a multi-hyperpolarized probe approach for simultaneously measuring prostate cancer metabolism and tumor micro-environment. 3) Demonstrate the utility of hyperpolarized 13C MR for measuring prostate cancer aggressiveness and response to therapy. 4) Demonstrate the safety, clinical feasibility, sensitivity and resolution, and future availability of clinical hyperpolarized 13C MR.

MSCC32

Case-based Review of Nuclear Medicine: PET/CT Workshop-Cancers of the Thorax (In Conjunction with SNMMI) (An Interactive Session)

Tuesday, Dec. 1 10:30AM - 12:00PM Location: S406A

CH CT NM OI

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

Participants
Janis P. O'Malley, MD, Birmingham, AL (*Director*) Nothing to Disclose
Katherine A. Zukotynski, MD, Toronto, ON (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Apply basic anatomic, pathologic, and physiologic principles to the interpretation of PET/CT with emphasis on cancers of the thorax. 2) Identify artifacts that can influence interpretation of PET/CT studies and analyze factors that can improve image quality while minimizing patient risk. 3) Demonstrate understanding of issues on current and future practice patterns.

ABSTRACT

SSG11

Nuclear Medicine (PET/MRI for Oncology)

Tuesday, Dec. 1 10:30AM - 12:00PM Location: S505AB

CT MR NM

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

Participants
Farrokh Dehdashti, MD, Saint Louis, MO (*Moderator*) Nothing to Disclose
Samuel E. Almodovar-Reteguis, MD, Homewood, AL (*Moderator*) Nothing to Disclose

Sub-Events

SSG11-01 Outcome of Missed Lung Nodules in 18F-FDG-PET/MRI Compared to 18F-FDG-PET/CT in Cancer Patients

Tuesday, Dec. 1 10:30AM - 10:40AM Location: S505AB

Participants
Lino Sawicki, MD, Dusseldorf, Germany (*Presenter*) Nothing to Disclose
Johannes Grueneisen, Essen, Germany (*Abstract Co-Author*) Nothing to Disclose
Benedikt M. Schaarschmidt, MD, Dusseldorf, Germany (*Abstract Co-Author*) Nothing to Disclose
Philipp Heusch, MD, Duesseldorf, Germany (*Abstract Co-Author*) Nothing to Disclose
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PURPOSE

To evaluate the clinical relevance of small pulmonary nodules missed by 18F-fluordesoxyglucose positron emission tomography/magnetic resonance (18F-FDG PET/MR) imaging compared to 18F-FDG PET/computed tomography (18F-FDG PET/CT).

METHOD AND MATERIALS

Fifty cancer patients (mean age: 56.4 years, range: 18-84, 29 female, 21 male) who underwent 18F-FDG-PET/CT and 18F-FDG-PET/MRI for tumor staging on the same day were retrospectively enrolled. 18F-FDG-PET/CT and 18F-FDG-PET/MRI datasets were analyzed by two independent readers in random order in seperate session with a minimum of four weeks apart. Presence, location, size and presence of focal tracer uptake was noted for each lung detected on 18F-FDG-PET/CT and on 18F-FDG-PET/MRI using T1w VIBE with fat saturation as morphological dataset. Follow-up CT or 18F-FDG-PET/CT (mean time-to-follow-up 11 months, range: 3-11) was used as reference standard to define each nodule as benign or malignant based on changes in size and under consideration of administered therapies. A nodule-to-nodule comparison between 18F-FDG-PET/CT and 18F-FDG-PET/MRI was performed using descriptive statistics.

RESULTS

Forty-two lung nodules detected on 18F-FDG-PET/CT were missed on 18F-FDG-PET/MRI. Average size of missed nodules was 4 mm +/- 1.3 mm; range: 2 mm - 7 mm. None of the missed lung nodules presented with increased tracer uptake. Of the 42 lung nodules missed on 18F-FDG-PET/MRI 33 (79%) nodules were rated benign, while 9 (21%) nodules were rated malignant according to follow-up examinations.

CONCLUSION

Even though the majority of small lung nodules missed on 18F-FDG-PET/MRI was rather benign, there was a relevant number of undetected potential metastases. The impact of these small additional metastases on therapeutic decisions and prognosis still has to be evaluated

CLINICAL RELEVANCE/APPLICATION

Lower detection rate of PET/MRI vs. PET/CT for small lung nodules must be considered in cancer staging. Our data indicate that there is a small but relevant number of undetected potential metastases.

SSG11-02 PET/MR versus PET/CT in the Initial Staging of Head and Neck Cancer

Tuesday, Dec. 1 10:40AM - 10:50AM Location: S505AB

Participants
Tetsuro Sekine, MD, PhD, Zurich, Switzerland (*Presenter*) Nothing to Disclose
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Irene A. Burger, New York, NY (*Abstract Co-Author*) Nothing to Disclose
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Gustav K. Von Schulthess, MD, PhD, Zurich, Switzerland (*Abstract Co-Author*) Research Grant, General Electric Company; Speaker, General Electric Company;
Patrick Veit-Haibach, MD, Zurich, Switzerland (*Abstract Co-Author*) Research Grant, Bayer AG; Resaarch Grant, F. Hoffmann-La Roche Ltd; Research Grant, General Electric Company
Martin W. Huellner, MD, Zurich, Switzerland (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To compare the diagnostic accuracy of PET/MR with PET/CT for newly diagnosed head and neck cancer.

METHOD AND MATERIALS

This prospective study was approved by the institutional review board and by national government authorities. In this study,

This prospective study was approved by the institutional review board and by national government authorities. In this study, sequential contrast-enhanced PET/CT-MR was performed in 27 patients (median age 66, 16 males) with newly diagnosed head and neck cancer. MR sequences were:LAVA-Flex (whole body); axial T2-weighted, axial T1-weighted with and without contrast, sagittal and coronal T1-weighted with contrast, and DWI (head and neck). PET/CT and PET/MR were evaluated separately, and the TNM stage and factors that could impact on the potential resectability were assessed. Wilcoxon signed-ranks test was used.

RESULTS

The T/N/M staging by PET/CT was correct in 17 patients (63.0%) / 19 (70.4%) / 22 (81.5%), equivocal in 8 patient (29.6%) / 3 (11.1%) / 3 (11.1%), and incorrect in 2 patients (7.4%) / 5 (18.5%) / 2 (7.4%). The T/N/M staging by PET/MR was correct in 20 patients (74.1%) / 21 (77.8%) / 26 (96.3%), equivocal in 6 patients (22.2%) / 2 (7.4%) / 1 (3.7%), and incorrect in 1 patient (3.7%) / 4 (14.8%) / 0 (0%). Consistently, the TNM staging by PET/MR was comparable to PET/CT (T: $p = 0.331$, N: $p = 0.453$, M: $p = 0.034$). The sensitivity/specificity/accuracy of resectability-defining factors by PET/CT and PET/MR were 0.68/0.93/0.97, and 0.80/1.00/0.99, respectively.

CONCLUSION

Whole-body staging with PET/MR yields equal diagnostic accuracy as PET/CT in determining the stage of head and neck cancer.

CLINICAL RELEVANCE/APPLICATION

Patients with newly diagnosed head and neck cancer may be effectively staged with contrast-enhanced PET/MR instead of contrast-enhanced PET/CT.

SSG11-03 Added Value of PET/MRI to MDCT for the Assessment of Preoperative Staging and Resectability in Gastric Cancer

Tuesday, Dec. 1 10:50AM - 11:00AM Location: S505AB

Participants
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Se Hyung Kim, Seoul, Korea, Republic Of (*Abstract Co-Author*) Research Grant, Mallinckrodt plc; Research Grant, Samsung Electronics Co Ltd
Bo Yun Hur, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Joon Koo Han, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To investigate whether PET/MRI can improve the diagnostic performance of TNM staging and can help making accurate decision for resectability in patients with gastric cancer compared to MDCT alone.

METHOD AND MATERIALS

The institutional review board of our hospital approved this retrospective study. Twenty-nine patients with histologically confirmed gastric cancers underwent preoperative MDCT and PET/MRI for staging and decision of resectability. Two abdominal radiologists independently assessed MDCT without and with PET/MRI and determined preoperative TNM staging as well as resectability of gastric cancer. The diagnostic performance using MDCT without and with PET/MRI was compared by using McNemar test and receiver operating characteristic analysis.

RESULTS

Diagnostic accuracies for assessing T and N staging were not significantly improved by adding PET/MRI in both readers. However, PET/MRI showed significantly improved diagnostic accuracy for M staging in one reader (P=0.031) and marginal improvement in the other reader (P=0.063) compared to MDCT alone. Regarding resectability of gastric cancer, the diagnostic accuracy of MDCT with PET/MRI was significantly higher than that of MDCT alone in both readers (P=0.016 for reader 1 and P=0.004 for reader 2). Additional seven patients (7/23, 30.4%) in reader 1 and nine patients (9/23, 39.1%) in reader 2 were correctly classified according to the resectability of gastric cancer by adding PET/MRI.

CONCLUSION

PET/MRI could significantly improve the diagnostic accuracy for preoperative M staging as well as resectability of gastric cancer compared to those of MDCT alone, and additional one-third of patients were correctly classified according to the resectability by using PET/MRI.

CLINICAL RELEVANCE/APPLICATION

PET/MRI could significantly improve the diagnostic accuracy for preoperative M staging as well as resectability of gastric cancer compared to those of MDCT alone, and additional one-third of patients were correctly classified according to the resectability by using PET/MRI.

SSG11-04 Combined Reading of PET and MR Datasets in Integrated PET/MR: A Comparison of Different MR Sequences in Whole-body Oncological Imaging

Tuesday, Dec. 1 11:00AM - 11:10AM Location: S505AB

Participants
Benedikt M. Schaarschmidt, MD, Dusseldorf, Germany (*Presenter*) Nothing to Disclose
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Gerald Antoch, MD, Duesseldorf, Germany (*Abstract Co-Author*) Nothing to Disclose
Christian Buchbender, Duesseldorf, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To compare the performance of different magnetic resonance (MR) sequences in tracer uptake allocation and visual detectability in integrated [18]F-fluorodeoxyglucose ([18]F-FDG) positron emission tomography (PET)/MR examinations intraindividually and with

computed tomography (CT) from PET/CT.

METHOD AND MATERIALS

Whole-body, contrast-enhanced PET/CT and subsequent PET/MR was performed in 61 patients for an oncological tumor staging. In PET/MR, the protocol comprised the following sequences: T2, turbo inversion recovery magnitude (TIRM), non-enhanced T1, contrast-enhanced T1, and diffusion-weighted imaging (DWI). Per patient, visual lesion detectability and anatomical allocation of the PET finding were assessed using a four-point ordinal scale (scored from 0 to 3) in a maximum of ten [18]F-FDG-avid lesions in the different MR sequences and in CT from PET/CT. Malignancy of each lesion was confirmed using radiological follow-up and histopathology as standard of reference. Differences in each category were analyzed using Wilcoxon rank sum tests. To prevent α-error accumulation, Bonferroni-Holm correction was performed

RESULTS

A total of 225 PET positive lesions were analyzed. 156 lesions were confirmed as malignant by radiological follow up and 69 by histopathology. T2 (mean 2.4±0.9), TIRM (mean 2.5±0.9), DWI (mean 2.5±1.0), and CT (mean 2.5±0.9) had a comparable visual detectability and were superior to non-enhanced T1 (mean 2.2±1.0). Anatomic allocation of the PET finding was similar in T2 (mean 2.6±0.7), TIRM (mean 2.8±0.7), and CT (mean 2.6±0.7) but was significantly higher compared to non-enhanced T1 (mean 2.4±0.8) and DWI (mean 2.1±1.0).

CONCLUSION

In whole-body imaging, T2, TIRM and contrast-enhanced T1 provide a lesion detectability and an anatomical allocation of a PET finding that is comparable to PET/CT. While non-enhanced T1 may be omitted, the necessity of DWI has to be investigated further in specific diagnostic problems.

CLINICAL RELEVANCE/APPLICATION

The results of this study help to optimize PET/MR protocols, leading to reduced examination times, improved workflow and increased patient comfort in every day clinical practice.

SSG11-05 Evaluation of a FAST-protocol for Simultaneous 18F-FDG PET/MR Imaging for the Evaluation of Patients with Lymphoma

Tuesday, Dec. 1 11:10AM - 11:20AM Location: S505AB

Participants
Johannes Grueneisen, Essen, Germany (*Presenter*) Nothing to Disclose
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Christian Buchbender, Duesseldorf, Germany (*Abstract Co-Author*) Nothing to Disclose
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Thomas C. Lauenstein, MD, Essen, Germany (*Abstract Co-Author*) Nothing to Disclose
Lale Umutlu, MD, Essen, Germany (*Abstract Co-Author*) Consultant, Bayer AG

PURPOSE

PET/CT with 18F-FDG is widely accepted as the diagnostic standard of care for patients with lymphoma. The purpose of this study was to evaluate the diagnostic performance of a FAST-protocol for integrated PET/MR imaging, used for pretreatment staging, therapy monitoring and surveillance of patients with lymphoma in comparison to PET/CT.

METHOD AND MATERIALS

44 consecutive lymphoma patients were prospectively enrolled for a clinically indicated PET/CT and a subsequent PET/MR examination. For PET/MRI readings, a whole-body FAST-protocol was implemented, comprising (1) a transversal DWI (EPI) sequence, (2) a transversal T2w HASTE sequence and (3) a transversal post-contrast T1w VIBE sequence. Two readers separately evaluated both examinations and were instructed to identify all tumor lesions. Furthermore, the standardized uptake value (SUV) for all 18F-FDG-avid lesions was determined in PET/CT and PET/MRI, using volume of interest (VOI) analysis. Agreement between PET/CT and PET/MRI regarding SUVmax and SUVmean was tested using Pearson's product-moment correlation.

RESULTS

Malignant lesions were present in 24 of the 44 patients. Both, PET/CT and PET/MRI correctly identified disease presence in all 24 patients. Furthermore, all PET-positive lesions that were visible on PET/CT were also detectable on PET/MRI. Determined SUVs were significantly higher in PET/MRI than in PET/CT (SUVmax 9.8 vs 7.2, $p<0.001$; SUVmean 5.3 vs 4.2, $p<0.001$), however, there was a strong correlation between SUVmax and SUVmean of the two imaging modalities ($R=0.89$, $p<0.001$ and $R=0.90$, $p<0.001$). Estimated scan duration of one whole-body PET/CT examination as well as for the standard and fast protocol for whole-body PET/MR imaging amounted to 18.5 ± 1.0 min and 27.5 ± 2.0 min, respectively. Furthermore, calculated mean effective-dose for a whole-body PET/CT scan was 66.5% higher than for a FAST-PET/MRI examination.

CONCLUSION

The FAST-protocol for PET/MR imaging offers an equivalently high diagnostic performance for staging lymphoma patients in comparison to PET/CT with only a slightly prolonged examination time.

CLINICAL RELEVANCE/APPLICATION

With regard to patient comfort related to scan duration and a markedly reduced radiation exposure, FAST-PET/MRI may serve as a powerful alternative to PET/CT for a diagnostic work-up of patients with lymphoma.

SSG11-06 Diagnostic Accuracy of Whole-body 18F-FDG PET/MRI and Whole-body DWI/MRI for the Evaluation of Patients with Lymphoma

Tuesday, Dec. 1 11:20AM - 11:30AM Location: S505AB

Participants

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Michael Forsting, MD, Essen, Germany (*Abstract Co-Author*) Nothing to Disclose
Lale Umutlu, MD, Essen, Germany (*Abstract Co-Author*) Consultant, Bayer AG

PURPOSE

To prospectively evaluate the diagnostic performance of integrated 18F-FDG PET/MRI for whole-body staging of patients with lymphoma in comparison to DWI/MRI.

METHOD AND MATERIALS

42 consecutive patients underwent a whole-body 18F-FDG PET/MRI (Biograph mMR, Siemens) including diffusion-weighted imaging (DWI) for pretreatment staging as well as for therapy monitoring and surveillance of lymphoma disease. Two radiologists separately evaluated the DWI/MRI datasets, followed by a second reading of 18F-FDG PET/MRI datasets. Both readers were instructed to identify the total number of tumor lesions. Apparent diffusion coefficients (ADC) and standardized uptake values (SUV) were determined and served as an orientation for a differentiation between malignant and benign lesions. Sensitivity, specificity, positive predictive value, negative predictive value and diagnostic accuracy in the detection of malignant lesions were calculated for DWI/MRI and 18F-FDG PET/MRI.

RESULTS

Malignant lesions were present in 23 of 42 patients. 18F-FDG PET/MRI enabled correct identification of all 23 (100%) patients and was true negative in 18/19 (95%) cases. DWI/MRI detected disease presence in 20/23 (87%) patients and was true negative in 17/19 (89%) patients. Furthermore, the calculated sensitivity, specificity, positive predictive value, negative predictive value and diagnostic accuracy of 18F-FDG PET/MRI for the detection of malignant lesions were 97%, 91%, 97%, 91% and 95%, respectively. The respective values for DWI/MRI were 80%, 74%, 89%, 59% and 79%.

CONCLUSION

The results demonstrate the superiority of 18F-FDG PET/MRI in detecting malignant and benign lesions in lymphoma patients in comparison to DWI/MRI alone.

CLINICAL RELEVANCE/APPLICATION

The present study underlines the usefulness of 18F-FDG PET data as a valuable additive to MR imaging for a more accurate evaluation of patients with lymphomas, enabling a reduction of false-positive findings.

SSG11-07 [18F]-FDG-PET/MR versus [18F]-FDG-PET/CT for the Assessment of Lymphoma: A Prospective Study in 30 Patients

Tuesday, Dec. 1 11:30AM - 11:40AM Location: S505AB

Participants
Chiara Giraudo, MD, Vienna, Austria (*Presenter*) Nothing to Disclose
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Marius E. Mayerhoefer, MD, PhD, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To assess and compare the diagnostic performances of [18F]-FDG-PET/MR and [18F]-FDG-PET/CT in patients with Hodgkin (HL) and Non-Hodgkin lymphoma (NHL).

RESULTS

Thirty patients were included: MALT lymphoma, n=14 patients; mantle cell lymphoma, n=4; nodal marginal zone lymphoma, n=3; Burkitt, follicular lymphoma, and HL, n=2 respectively; and DLBCL, T-cell, and post-transplant NHL, n=1, respectively. Five patients were scanned twice: 3 for staging and restaging and 2 twice for restaging. Overall 35 examinations were available for this study. PET/MR showed 100% Se and Sp (95%CI, 86.7-100%; and 72.2-100%; respectively). PET/CT showed 80% Se and Sp (95%CI, 60.9-91.1%; and 49-94.3%; respectively). The region-based agreement between PET/MR and PET/CT was 98.9%. Three patients were upstaged by PET/MR (stage I instead of 0; all MALT lymphomas).

CONCLUSION

[18F]-FDG-PET/MR showed a higher diagnostic value for the detection of lymphoma than PET/CT, particularly for MALT lymphoma.

CLINICAL RELEVANCE/APPLICATION

[18F]-FDG-PET/MR showed a higher diagnostic value for lymphoma than PET/CT. Since PET/MR also offers a lower radiation exposure, it may possibly become the preferred imaging technique for lymphoma.

SSG11-08 PET/MRI versus PET/CT: Qualitative and Quantitative Assessment of Bone Lesion Conspicuity

Tuesday, Dec. 1 11:40AM - 11:50AM Location: S505AB

Participants
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Jonathan E. McConathy, MD, PhD, Saint Louis, MO (*Abstract Co-Author*) Research Consultant, Eli Lilly and Company; Research Consultant, Blue Earth Diagnostics Ltd; Research Consultant, Siemens AG; Research support, GlaxoSmithKline plc

PURPOSE

Because standard MRI-based attenuation correction (AC) does not account for the effects of cortical bone on PET photons, PET/MRI may have reduced sensitivity for FDG-avid focal bone lesions (FFBLs). In contrast, the CT-based AC used in PET/CT does correct for cortical bone attenuation. This study evaluates whether MRI-based AC compromises detection of FFBLs, by comparing their conspicuity on PET/MRI versus PET/CT.

METHOD AND MATERIALS

190 general oncology patients underwent whole-body PET/CT followed by whole-body PET/MRI, utilizing the same FDG dose. Thirteen patients with a total of 50 FFBLs were identified. Using auto-contouring software, a region of interest (ROI) was generated for each FFBL and for an adjacent region of normal background bone (BB). For each ROI, SUV-max and SUV-mean were determined. Lesion-to-background SUV ratios served as quantitative metrics of conspicuity. Additionally, two blinded readers evaluated the relative conspicuity of FFBLs on PET images derived from MRI-based AC versus CT-based AC. The visibility of FFBLs on corresponding CT and MR images was also assessed.

RESULTS

As expected, the average SUV-mean was lower on PET/MRI for both FFBLs (-8.8%, $p = 0.009$) and BB (-22.7%, $p < 0.001$). The average SUV-max was lower on PET/MRI for BB (-14.3%, $p = 0.002$) but not for FFBLs (-7.4%, $p = 0.068$). On average, the ratio of FFBL SUV-mean to BB SUV-mean was higher for PET/MRI (+29.5%, $p < 0.001$). 40 of 50 lesions (80%) were visually deemed to be of equal or greater conspicuity on PET images derived from PET/MRI. 35 of 50 FFBLs (70%) had CT correlates, while 40 of 50 FFBLs (80%) had correlates on at least one MRI sequence. The mean tracer-to-image time was longer ($p < 0.001$) for PET/MRI (127 v. 62 min).

CONCLUSION

Both FFBLs and BB had lower mean SUVs on PET/MRI. This discrepancy was likely due to differences in the handling of cortical bone by MRI-based AC versus CT-based AC. Despite this systematic bias, FFBLs had greater conspicuity on PET/MRI, when assessed both qualitatively and quantitatively. This difference was at least in part due to the longer tracer-to-image time for PET/MRI, which allowed for more tracer accumulation by FFBLs and more tracer washout from BB.

CLINICAL RELEVANCE/APPLICATION

Our results suggest that whole-body PET/MRI and PET/CT provide comparable sensitivity for detection of FDG-avid focal bone lesions.

SSG11-09 Simulation of Tracer Dose Reduction in PET by Retrospective Undersampling of PET Listmode Data

Tuesday, Dec. 1 11:50AM - 12:00PM Location: S505AB

Participants
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Konstantin Nikolaou, MD, Tuebingen, Germany (*Abstract Co-Author*) Speakers Bureau, Siemens AG Speakers Bureau, Bracco Group Speakers Bureau, Bayer AG
Nina Schwenzer, MD, Tuebingen, Germany (*Abstract Co-Author*) Nothing to Disclose
Holger Schmidt, PhD, Tuebingen, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To implement and validate a method for simulation of low-dose PET images.

METHOD AND MATERIALS

In order to simulate a reduction of PET tracer dose, PET images acquired in list mode data were retrospectively undersampled by random deletion of predefined proportions of PET events. The resulting undersampled PET data were then reconstructed resulting in PET images simulating PET images acquired at lower tracer doses. In order to validate this proposed approach, phantom experiments were performed using a dedicated PET phantom according to the National Electrical Manufacturers Association (NEMA). Phantom compartments were filled with different activity concentrations of 18F-Fluoride. PET data were acquired at different time points corresponding to decreasing tracer dose concentrations (according to the radioactive decay of 18F) on a combined PET/MR scanner (Biograph mMR, Siemens). Reduced-dose PET images were additionally derived from the measured data set with the highest activity concentration (first measurement) using the proposed method. Measured and corresponding simulated PET images were compared by visual inspection and by quantification of image quality metrics signal-to-noise ratio (SNR), background variability (BV) and contrast recovery coefficients (CRC).

RESULTS

PET images acquired by measurement at different activity concentrations were visually equivalent to the corresponding simulated PET images. Quantitative analysis of the measured image quality metrics also revealed a high similarity between measured and simulated low-dose PET images. Deviations of SNR, BV and CRCs were lower than 20 % for all activity concentrations.

CONCLUSION

Simulation of low-dose PET images is possible by retrospective undersampling of PET list mode data and enables the generation of PET images with similar characteristics as PET images actually measured at low activity concentrations.

CLINICAL RELEVANCE/APPLICATION

The proposed approach will enable the simulation and comparison of different tracer dose regimes in a clinical setting. Thus, it will be possible to derive optimal dose regimes with minimal diagnostic radiation exposure and sufficient diagnostic image quality.

NMS-TUA

Nuclear Medicine Tuesday Poster Discussions

Tuesday, Dec. 1 12:15PM - 12:45PM Location: S503AB

NM

AMA PRA Category 1 Credit ™: .50

Participants
Ukihide Tateishi, MD, PhD, Setagaya-Ku, Japan (*Moderator*) Nothing to Disclose

Sub-Events

NM218-SD-TUA7 Influence of PET Reconstruction Technique and Matrix Size on Lung Lesion Detection and SUV Quantification in Clinical Practice: Results in 37 Cancer Patients

Station #7

Participants
Georg J. Riegler, MD, Vienna, Austria (*Presenter*) Nothing to Disclose
Georgios Karanikas, MD, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose
Albert Hirtl, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose
Ivo Rausch, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose
Karem El-Rabadi, MD, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose
Marius E. Mayerhoefer, MD, PhD, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate the influence of point spread function (PSF)-based PET reconstruction and different matrix sizes for PET on (1) lung lesion detection and (2) standardized uptake values (SUV).

METHOD AND MATERIALS

Our prospective IRB-approved study included oncological patients that underwent [18F]-FDG-PET/CT for staging. Four [18F]-FDG-PET datasets were reconstructed with a 2D-ordered subset expectation maximization (OSEM) algorithm on the one hand, and a PSF-based algorithm (TrueX) on the other hand, each with two different matrix sizes (168x168 and 336x336). The four PET datasets (TrueX-168, OSEM-168, TrueX-336, and OSEM-336) were read independently, and PET-positive lesions (i.e., focal tracer accumulations) were recorded. Blinded to PET, lesions with diameters of >4mm were assessed on the respective chest CTs. Following the independent PET and CT readings, the co-registered PET and CT images were reviewed side-by side in consensus, to assign the focal tracer accumulations to their CT morphological correlates. Lesion-based PET sensitivities of the four datasets/reconstructions were calculated, and their respective SUVmax and SUVmean values were compared using ANOVAs.

RESULTS

Thirty-seven consecutive patients with 206 lung lesions were included. Lesion-based sensitivities revealed significant differences between sequences (P<0.001) and matrices (P=0.022). Sensitivities were 88.3% for TrueX-168; 67.0% for OSEM-168; 94.2% for TrueX-336; and 67.8% for OSEM-168. Higher matrix sizes significantly (P<0.001) increased the SUVmax (by up to +33.7%) and SUVmean (by up to +26.6%) in comparison to lower matrix sizes, and were the main factor responsible for SUV variability. Notably, SUV variability was more pronounced for lesions >20mm than for lesions <20mm (P<0.001 for SUVmax and SUVmean).

CONCLUSION

The PSF-based PET reconstruction algorithm TrueX appears to be superior to the standard OSEM algorithm, in terms of sensitivity for detection of malignant lung lesions. SUV values are sensitive to matrix size variations and choice of reconstruction algorithm; in particular, a larger matrix size leads to a considerable increase of both SUVmax and SUVmean values.

CLINICAL RELEVANCE/APPLICATION

The PSF-based PET reconstruction algorithm TrueX is superior to the OSEM algorithm for detection of malignant lung lesions, and may thus be recommended for routine PET/CT of oncological patients.

NM219-SD-TUA8 Exploring of Primary Brains Tumor Heterogeneity at a Voxel Level with Dynamic 18F-fluoro-ethyl-tyrosine (18F-FET) Positon Emission Tomography

Station #8

Participants
Cyril Jaudet, PhD, Brussel, Belgium (*Presenter*) Nothing to Disclose
Peggy Gandia, Toulouse, France (*Abstract Co-Author*) Nothing to Disclose
Hendrik Everaert, MD, PhD, Brussels, Belgium (*Abstract Co-Author*) Nothing to Disclose
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AnneMarie VanBinst, Brussel, Belgium (*Abstract Co-Author*) Nothing to Disclose
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Bart Neyns, MD,PhD, Brussel, Belgium (*Abstract Co-Author*) Nothing to Disclose
Laurent Dercle, MD, Villejuif, France (*Abstract Co-Author*) Nothing to Disclose
Guy A. Storme, MD, PhD, Brussels, Belgium (*Abstract Co-Author*) Nothing to Disclose
Johan De Mey, Jette, Belgium (*Abstract Co-Author*) Nothing to Disclose
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Didier Concordet, Toulouse, France (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

18F-fluoro-ethyl-tyrosine (18F-FET) is an artificial amino acid that allows the diagnosis of primary brain tumors (pBT) with good-contrast images in both high- and low-grade tumors. It is the preferred PET tracer and provides distinct information that is complementary to MRI. Dynamic PET acquisition through time-activity-curves (TAC) helps in differentiating low- from high-grade tumors. However despite the fact the pBT are inherently heterogeneous, TACs are usually resulting from regions-of-interest define by a 90% SUVmax isocontour of the whole volume of the lesion. We present an original methodology in order to explore tissue heterogeneity: an algorithm that extract TACs for each individual voxel and translates them into a parametric map from FET dynamics for the entire brain.

METHOD AND MATERIALS

Ten patients with pBT were prospectively included. 180MBq FET was injected. The dynamic PET/CT acquisition started at 15 min (6 frames of 5 min). A voxel-based dynamic approach was used in order to estimate the pharmacokinetic parameters of each voxel associated with a linear mixed effects modeling that both performs partial volume effect correction in Fourier space and classification. The TAC-differences in slope and intercept is used to classify each voxel; no input function is required. The resulting parametric map was compared visually and semiquantitatively (Dice index; volume of the largest lesion) with static PET data as reference.

RESULTS

Visual analysis demonstrated excellent correlation of the parametric maps and static data in terms of tumor identification and localization. The lesion extent identified on the parametric maps however was systematically larger. These observations are confirmed by semiquantitative analysis, showing a median dice index of 0.85 and on median 6.5% increase on the largest lesion on parametric maps compared to static PET image.

CONCLUSION

A voxel-based parametric map can be obtained with our algorithm using TACs for each voxel within the brain. It can be anticipated that detailed parametric maps will be of particular interest in the management of patients with pBT, tumours that are inherently heterogeneous.

CLINICAL RELEVANCE/APPLICATION

Innovative dynamic FET PET treatment allow to define extent and to caracterize heterogeneity of primary brain tumor adding information to standard examination.

NM220-SD-TUA9 Improved PET/DWI Registration Quality in PET/MR Hybrid Scanner: Zoomed DWI vs. Conventional DWI

Station #9

Participants
Koji Sagiyama, MD, Fukuoka, Japan (*Presenter*) Nothing to Disclose
Yuji Watanabe, MD, Fukuoka, Japan (*Abstract Co-Author*) Research Grant, Koninklijke Philips NV Research Grant, Bayer AG
Ryotaro Kamei, MD, Fukuoka, Japan (*Abstract Co-Author*) Nothing to Disclose
Shingo Baba, Fukuoka, Japan (*Abstract Co-Author*) Nothing to Disclose
Hiroshi Honda, MD, Fukuoka, Japan (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

PET/MR hybrid system provides simultaneous molecular information from PET and diffusion-weighted EPI images (DWI). However, severe image distortion is often observed in conventional DWI (cDWI) and the registration quality is degraded. Zoomed DWI (z-DWI) exploits spatially selective RF excitation and is expected to improve image distortion by shortening the EPI echo train. The aim of this study was to compare z-DWI with c-DWI in the evaluation of PET/DWI registration quality with a PET/MR hybrid scanner.

METHOD AND MATERIALS

All image acquisitions were performed with the Ingenuity TF PET/MR (Philips, Cleveland, OH) system and image evaluations were performed on a commercially available workstation (Intellispace Portal 6.0, Philips, Cleveland, OH). Twenty-one patients with known or suspected malignancy (62.2 ± 16.3 year-old, 13 males and 8 females) were assessed in this study. FDG-PET imaging, c-DWI, and z-DWI were simultaneously performed with the system. Thirty-two lesions positive in both PET and DWI, which were 50 mm2 or larger in size, were included and fusion images were generated. Two radiologists performed qualitative assessment of registration quality. In addition, quantitative assessment was performed on the maximum overlapping area with the following matching index: [matching area (%) = overlapping area of PET- and DWI/PET-positive areas]. Paired t-test was used for statistical analysis.

RESULTS

Tumors were located in the region of head/neck (n = 4), chest (n = 12), abdomen (n = 10) and bone/soft tissue (n = 6). The mean EPI factor was significantly lower in z-DWI than c-DWI (43.1 ± 15.6 vs. 62.0 ± 10.1, $p < 0.001$). Registration quality with PET visually improved in z-DWI. In quantitative analysis, z-DWI improved segmentation accuracy in 30 of 32 lesions (94%) and the mean matching index obtained in z-DWI was significantly larger than in c-DWI (79.8 ± 18.1 % vs. 61.8 ± 22.9 %, $p < 0.0001$).

CONCLUSION

Zoomed DWI sequence could reduce image distortion, and exhibit more accurate registration with FDG-PET imaging.

CLINICAL RELEVANCE/APPLICATION

We exploit zoomed DWI with spatially-selective RF pulse in PET/MR hybrid system. Reduced FoV and EPI factor without aliasing can suppress image distortion and improve registration with PET imaging.

NM221-SD-TUA10 Discrimination between Brown and White Adipose Tissue in Adults using a Two-point Dixon Water-fat Separation Method in Simultaneous PET/MRI

Station #10

Participants

Daniela Franz, Munich, Germany (*Presenter*) Nothing to Disclose
Dimitrios C. Karampinos, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose
Ernst J. Rummeny, MD, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose
Michael Souvatzoglou, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose
Stephan G. Nekolla, PhD, Muenchen, Germany (*Abstract Co-Author*) Nothing to Disclose
Markus Schwaiger, MD, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose
Matthias J. Eiber, MD, Muenchen, Germany (*Abstract Co-Author*) Speakers Bureau, Johnson & Johnson

PURPOSE

To evaluate signal-fat-fraction-analysis based on a two-point Dixon water-fat-separation method in whole-body simultaneous PET/MRI in adults for detection of brown adipose tissue (BAT) and discrimination from white adipose tissue (WAT).

METHOD AND MATERIALS

19 PET/MRI (Siemens Biograph mMR) examinations of 14 adult patients (3 male, 11 female; mean age 33.3) with metabolically active brown supraclavicular adipose tissue were retrospectively enrolled in the study. PET/MRI acquisition included a two-point Dixon water-fat separation-method (TR/TE 3.60/1.23,2.46, SL 3.12, matrix 191x121, FOV 500) used for attenuation correction. In each patient regions of interest (ROIs) were placed into supraclavicular and subcutaneous (thoracal or gluteal) fat depots bilaterally and MRI-signal intensities on fat and water images as well as PET-based SUVmean were determined. Signal-fat-fraction was calculated from the ratio of the fat MRI-signal over the summed water- and fat MRI-signal. Standard of reference for metabolically active brown supraclavicular fat was at least one PET examination showing 18F-FDG-uptake.

RESULTS

Signal-fat-fraction was significantly lower ($p<0.0001$) in supraclavicular BAT (range: 0.61-0.88, mean: 0.78) compared to subcutaneous WAT (range: 0.68-0.97, mean: 0.93). Mean SUVmean for BAT was 3.81 (range: 0.32-19.19), for WAT 0.27 (range: 0.08-0.81). No significant correlation between SUVmean and signal-fat-fraction could be observed for BAT ($R=-0.24$, $p=0.15$).

CONCLUSION

Signal-fat-fraction-analysis based on a two-point Dixon water-fat-separation method in simultaneous PET/MRI can potentially be used to identify regions of brown adipose tissue and differentiate between brown and white adipose tissue in adults. Metabolic activity as determined by SUV-analysis showed no correlation with signal-fat-fraction.

CLINICAL RELEVANCE/APPLICATION

1) A two-point Dixon-based signal-fat-fraction-analysis of different fat depots in adults can help identify regions of BAT and differentiate BAT from WAT. 2) Signal-fat-fraction is independent from metabolic activity of BAT in adults, making it a robust parameter for its identification.

NM222-SD-TUA11 Comparison of SUV Measurements between Time of Flight (TOF) PET/CT and Sequential (TOF) PET/MRI in Initial Evaluation of Breast Cancer Patients Imaged in Prone Position

Station #11

Participants
Peter F. Faulhaber, MD, Cleveland, OH (*Presenter*) Speaker, Koninklijke Philips NV; Grant, Koninklijke Philips NV; Medical Advisor, MIM Software Inc
Kuan-Hao Su, Shaker Heights, OH (*Abstract Co-Author*) Research Grant, Koninklijke Philips NV
Courtney A. Garlick, MD, Cleveland, OH (*Abstract Co-Author*) Nothing to Disclose
Jenny Wang-Peterman, MD, Cleveland, OH (*Abstract Co-Author*) Nothing to Disclose
Raymond Muzic, PhD, Cleveland, OH (*Abstract Co-Author*) Research Grant, Koninklijke Philips NV
Nelly Salem, MD, Cleveland, AL (*Abstract Co-Author*) Nothing to Disclose
Donna M. Plecha, MD, Strongsville, OH (*Abstract Co-Author*) Advisory Board, Hologic, Inc;

PURPOSE

To compare SUV values in breast lesions with CT based attenuation correction (AC) in PET/CT to MRI based AC (T1 3 segment mu map) in PET/MR with 4 and 2 mm voxels.

METHOD AND MATERIALS

Patients referred for FDG-PET/CT and diagnostic breast MRI were asked to undergo dynamic contrast-enhanced MRI (DCE-MRI) of the breast on the PET/MRI with PET images following the PET/CT. The PET/CT protocol included images of the breasts in the prone position. The approximate delay from FDG injection on PET/CT and PET/MRI of the breast was 85 minutes and 125 minutes respectively. Regions of interest (ROI) were drawn of FDG activity for suspicious lesions with 4 mm and 2 mm voxel reconstructions using an edge detection method (PET Edge, MIM software). SUVmax, SUVmean and Total Glycolic Volumes (TGV) were calculated.

RESULTS

25 patients were enrolled in the protocol with a total of 60 lesions identified on MRI. MRAC was challenging in some cases due to truncation artifact of the posterior chest wall with the patient in the breast coil. Truncation compensation was performed modeling the body contour from the TOF PET images without AC (NAC). Large breast masses with heterogeneous activity had variable contours; one was chosen for measurement in such cases. The SUVmean and max were significantly higher with MRAC vs CTAC, 11 and 9%, at 4mm voxels though not with 2mm. SUVmean and max were higher with both AC methods with 2mm vs 4mm voxel. There were no significant differences in TGV with MRAC vs CTAC at both 4 and 2mm voxels. However, TGV was higher with 2mm voxels vs 4mm for either AC method.

CONCLUSION

SUV can change with time due to physiologic variation in FDG metabolism. SUVmean and max with MRAC were higher than with CTAC with 4mm voxels. However, there were no significant differences at 2mm voxels nor with TGV with either AC method. These findings suggest that the MRAC method in the prone position results in similar soft tissue attenuation values as with CTAC with the time delay between having only a minor effect. The increased SUVmean, SUVmax, and TGV with 2mm vs 4mm would be expected with the change in voxel size. Such a difference implies an increase in lesion conspicuity at 2mm which could increase the

sensitivity of PET/MRI.

CLINICAL RELEVANCE/APPLICATION

PET/MRI has the potential of replacing PET/CT in staging breast cancer with the ability to perform accurate attenuation in the prone position and 2mm voxels rather than 4mm may improve lesion detection.

NM114-ED-TUA12 Role of F-18 FDG-PET/CT in the Diagnosis of Mediastinal Tumors

Station #12

Participants
Tomohiko Yamane, MD, PhD, Hidaka, Japan (*Presenter*) Nothing to Disclose
Akira Seto, MD, PhD, Hidaka, Japan (*Abstract Co-Author*) Nothing to Disclose
Ichiro Matsunari, MD, PhD, Moroyama, Japan (*Abstract Co-Author*) Nothing to Disclose
Ichiei Kuji, MD, PhD, Hidaka, Japan (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

The purpose of this exhibit is: 1) to compare the characteristics of F-18 FDG-PET/CT findings in various kinds of mediastinal tumors, 2) to identify the role of F-18 FDG-PET/CT in the differential diagnosis of mediastinal tumors, and 3) to identify the role of F-18 FDG-PET/CT in the clinical staging and speculation of pathological classification in thymic epithelial tumors.

TABLE OF CONTENTS/OUTLINE

A) F-18 FDG-PET/CT findings of mediastinal tumors; thymoma, thymic carcinoma, thymic cyst, Hodgkin's lymphoma, primary mediastinal large B-cell lymphoma, T-cell lymphoblastic lymphoma, small cell carcinoma, carcinoid tumor, neurofibromatosis, mediastinal thyroid, teratoma, seminoma and Castleman's disease. B) Role of F-18 FDG-PET for speculating the histology of the mediastinal tumor. C) Role of F-18 FDG-PET in the clinical staging and pathological classification in thymic epithelial tumors.

NMS-TUB

Nuclear Medicine Tuesday Poster Discussions

Tuesday, Dec. 1 12:45PM - 1:15PM Location: S503AB

NM

AMA PRA Category 1 Credit ™: .50

FDA Discussions may include off-label uses.

Participants
Ukihide Tateishi, MD, PhD, Setagaya-Ku, Japan (*Moderator*) Nothing to Disclose

Sub-Events

NM237-SD-TUB7 Revisiting the Utility of 18F-FDG PET/CTA in Large-vessel Vasculitis

Station #7

Participants
Alexander S. Misono, MD,MBA, Boston, MA (*Presenter*) Nothing to Disclose
Yingbing Wang, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Rahmi Oklu, MD, PhD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Anand M. Prabhakar, MD, Somerville, MA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

18F-Fludeoxyglucose positron emission tomography (PET) coupled with CT angiography (CTA) is increasingly used in the evaluation of large-vessel vasculitis, with literature sensitivity values ranging 77% to 92%, and specificity values ranging 89% to 100%. In a tertiary care setting, referral and medical decision making patterns may not allow for similar test performance. This study aims to evaluate the sensitivity, specificity, negative predictive value (NPV), and positive predictive value (PPV) of 18F-FDG PET/CTA in the diagnosis of large-vessel vasculitis.

METHOD AND MATERIALS

In this IRB-approved, HIPAA compliant study, all index PET/CTA examinations performed for assessment of vasculitis were collected from 2006-2014. Reports were assessed for findings of vasculitis and, where applicable, post-operative findings. Medical records were then reviewed for biopsy and pathology findings to establish diagnosis of large-vessel vasculitis.

RESULTS

Since 2006, 90 patients underwent PET/CTA exams for assessment of vasculitis. Average age was 66.8 (range 37-83, SD 11.5) with 12 (34%) males and 23(66%) females in the cohort. 35 (39%) studies were included for analysis, with the remainder excluded due to lack of biopsy/pathology (43%) and being a repeat exam of an study already included for analysis (18%). Prevalence of biopsy-proven vasculitis in these patients who underwent both PET/CTA and biopsy was 43%. PET/CTA demonstrated sensitivity 20%, specificity 85%, NPV 59%, PPV 50%. Several studies were limited or confounded by post-operative changes, limiting assessment for vasculitis. When these were excluded, PET/CTA demonstrated sensitivity 43%, specificity 85%, NPV 81%, PPV 50%.

CONCLUSION

Diagnostic utility of PET/CTA in evaluating for vasculitis is primarily driven by its high specificity and NPV, particularly when performed in patients without confounding post-operative findings.

CLINICAL RELEVANCE/APPLICATION

Complexity of 18F-FDG PET/CTA in assessing vasculitis in a tertiary care setting may limit traditionally excellent test performance.

NM224-SD-TUB8 Reference Tissue Normalization in Longitudinal 18F-Florbetapir PET and Comparison to Cerebrospinal Aß

Station #8

Participants
John W. McKay, MD, Nashville, TN (*Presenter*) Nothing to Disclose
Sepideh Shokouhi, PhD, Nashville, TN (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The objective of our study is to evaluate the effect of reference tissue selection in a longitudinal 18F-Florbetapir SUVR study. The temporal correlations between PET outcomes and cerebrospinal (CSF) Aß were calculated in a late mild cognitive impairment cohort from ADNI. In addition to the mean/median SUVR, we also implemented a recently developed analysis, the weighted two-point correlation function (wS2) which allows detection of more subtle longitudinal changes in Aß-PET.

METHOD AND MATERIALS

We used data from 20 ADNI subjects with baseline and 24 month Florbetapir scans as well as T1-W MRI and CSF measures, all at time points close to the PET scans. Binary gray matter (GM) and white matter (WM) masks were segmented from the MRI volumes in SPM12. The PET GM activity was normalized to cerebellar GM, cerebral WM (low, high threshold), corpus callosum and the brainstem. The wS2 analysis was perfromed to characterize the heterogeneity of the activity distribution and its changes over time. The area under the wS2 curve was used as the quantitative outcome and together with SUVR mean/median compared to CSF Aß using Speanman's correlation coefficient.

RESULTS

The correlation between all PET outcomes and CSF Aß were the lowest when PET images were normalized to the cerebellar GM. The WM mask at low threshold (WML) included the WM regions that shared borders to GM. These border regions were removed in the WM mask at high threshold (WMH). The WMH normalization gave a slightly higher corrleation values (-0.82,baseline) than the WML normalization (-0.65,baseline). The brainstem normalization was comparable to WMH at baseline (-0.82). The follow-up corleations were lower than the baseline for all reference tissue that included WM. The wS2 metric showed higher inverse correlation values at both baseline and follow-up and with all reference tissue normalizations.

CONCLUSION

The selection of a reference tissue affects the outcome of a SUVR analysis which requires the normaliztion of the activity to account for non-specific binding. While the white matter normalization improves the inverse correlation between Aß-PET and CSF Aß, specific regions within the white matter may be selected as an optimal reference tissue in a longitudinal study.

CLINICAL RELEVANCE/APPLICATION

The accuracy of SUVR analysis is relevant in longitudinal studies and clinical trials that monitor the accumulation and progression of Aß plaques or assess anti-amyloid therapies.

NM226-SD-TUB10 Imaging of Pleural Mesothelioma using Integrated [18]F-FDG PET/MR: Initial Results

Station #10

Participants
Benedikt M. Schaarschmidt, MD, Dusseldorf, Germany (*Presenter*) Nothing to Disclose
Lino Sawicki, MD, Dusseldorf, Germany (*Abstract Co-Author*) Nothing to Disclose
Benedikt Gomez, Essen, Germany (*Abstract Co-Author*) Nothing to Disclose
Philipp Heusch, MD, Duesseldorf, Germany (*Abstract Co-Author*) Nothing to Disclose
Gerald Antoch, MD, Duesseldorf, Germany (*Abstract Co-Author*) Nothing to Disclose
Christian Buchbender, Duesseldorf, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To compare staging results between [18]F-fluordeoxyglucose ([18]F-FDG) positron emission tomography/computed tomography (PET/CT) and positron emission tomography/magnetic resonance (PET/MR) imaging in malignant pleural mesothelioma (MPM) and investigate a potential correlation between ADC and SUV in therapy-naive patients.

METHOD AND MATERIALS

Contrast-enhanced PET/CT (performed on a Biograph mCT) and subsequent thoracic PET/MR (performed on a Biograph mMR) including DWI was performed in six patients with MPM after [18]F-FDG injection (mean activity: 290 MBq). In separate sessions, thoracic TNM-stage was assessed in accordance with the 7th Edition of the AJCC staging manual by two readers for PET/CT and PET/MR on a dedicated OsiriX (Pixmeo SARL, Bernex, Switzerland) workstation. Then, freehand polygonal regions of interest (ROIs) were drawn by one reader around each pleural lesion at its maximum diameter. Afterwards, ROIs were copied to the corresponding PET image and the ADC-map. SUVmax, SUVmean, ADCmin and ADCmean were computed automatically by Osirix.For staging results, explorative data analysis was performed for PET/CT and PET/MR. Pearson correlation coefficients were calculated between SUVmax and ADCmean, SUVmax and ADCmin, SUVmean and ADCmean as well as SUVmean and ADCmin. IBM SPSS Statistics 22 (IBM, Armonk, NY, USA) was used for statistical analysis, $p<0.05$ indicated statistical significance.

RESULTS

PET/CT and PET/MR provided the same TNM-Stage in all six patients (tree patients suffering from Stage III and Stage IV disease, respectively). Thirteen therapy-naive pleural lesions were analyzed. Pearson correlation coefficients were -0.52 between SUVmax and ADCmean, -0.63 between SUVmax and ADCmin, -0.56 between SUVmean and ADCmean and -0.63 between SUVmean and ADCmin ($p<0.05$, respectively).

CONCLUSION

In this initial study, PET/CT and PET/MR provide the same staging results in MPM. Furthermore, a strong, inverse correlation between ADC and SUV was observed in therapy-naive pleural lesions.

CLINICAL RELEVANCE/APPLICATION

The long latency after asbestos exposition will lead to an increase in the incidence of malignant pleural mesothelioma. These initial results indicate that PET/MR is a possible alternative to PET/CT.

NM227-SD-TUB11 PET Measurements on Dual-Phase PET/CT Scans in Differentiating the Malignant from the Benign 18F-FDG-avid Pulmonary Lesions: A Prospective Study

Station #11

Participants
Haiping Liu, BSD, MS, Guangzhou, China (*Abstract Co-Author*) Nothing to Disclose
Peng Hou, Guangzhou, China (*Abstract Co-Author*) Nothing to Disclose
Qing-kui Liu, Guangzhou, China (*Abstract Co-Author*) Nothing to Disclose
Yulei Jiang, PhD, Chicago, IL (*Abstract Co-Author*) Consultant, Quantitative Insights, Inc; Research Agreement, QView Medical, Inc
Ping Chen, MD, Guangzhou, China (*Abstract Co-Author*) Nothing to Disclose
Yonglin Pu, MD, PhD, Chicago, IL (*Presenter*) Nothing to Disclose

PURPOSE

To prospectively evaluate the utility of several measurements from dual-phase PET/CT scans for distinguishing malignant from benign 18F-FDG-avid pulmonary lesions.

METHOD AND MATERIALS

This prospective study was approved by our institutional review board and informed consent was obtained from all patients. A consecutive series of patients suspected of lung cancer underwent PET/CT scan at two time points: 60 and 120 min after

intravenous injection of 18F-FDG. Five measurements of suspect pulmonary lesions were obtained at both time points semi-automatically with the PETedge tool of the MIMvista software, and retention index (RI) between the two scans was calculated: metabolic tumor volume (MTV), SUVmax, SUVmean, SUVpeak, and total lesion glycolysis (TLG). The reference standard was pathology (n = 157) or follow-up imaging (n = 8). Receiver operating characteristic (ROC) analysis and area under the ROC curve (AUC) were used to assess diagnostic utility.

RESULTS

There were 165 patients (107 men, 58 women; mean age, 61 years), of which 148 had malignant tumor. At 60 min, the AUC values for malignant vs. benign differentiation were: SUVmax, 0.810, 95% CI, [0.742-0.867], P<0.0001; SUVmean, 0.813 [0.745-0.870], P<0.0001; SUVpeak, 0.796 [0.722-0.857], P<0.0001; TLG, 0.650 [0.572-0.722], P= 0.0325; and MTV, 0.521 [0.442-0.599], P=0.7765. At 120 min, the corresponding AUC values were: SUVmax, 0.814 [0.747-0.871], P<0.0001; SUVmean, 0.813 [0.745-0.870], P<0.0001; SUVpeak, 0.799 [0.725-0.860], P<0.0001; TLG, 0.647 [0.569-0.719], P=0.0409; and MTV, 0.526 [0.447-0.604], P=0.7385. The AUC values for RI were: SUVmax, 0.550 [0.471-0.628], P=0.4469; SUVmean, 0.524 [0.445-0.602], P=0.7739; SUVpeak, 0.511 [0.427-0.595], P=0.8766; TLG, 0.590 [0.511-0.666], P=0.3002; and MTV, 0.540 [0.461-0.618], P=0.6679.

CONCLUSION

SUV measurements appear to be better than TLG or MTV in differentiating malignant from benign 18F-FDG-avid pulmonary lesions in early or delayed PET/CT scan. Dual-phase 18F-FDG PET/CT scans are not superior to routine single-phase scan.

CLINICAL RELEVANCE/APPLICATION

MTV on dual-phase 18F-FDG PET/CT could not differentiate the malignant from the benign 18F-FDG-avid pulmonary lesions.

NM118-ED-TUB12 Initial Experience in PSMA PET/CT for Prostate Carcinoma

Station #12

Participants
Gowri L. Kanthan, MBBS, Sydney, Australia (*Presenter*) Nothing to Disclose
James Drummond, MBBS, Sydney, Australia (*Abstract Co-Author*) Nothing to Disclose
Geoff Schembri, MBBS, Sydney, Australia (*Abstract Co-Author*) Nothing to Disclose
Edward Hsiao, MD, Cleveland, OH (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

1. Imaging options for prostate carcinoma. 2. Normal appearance of PSMA PET/CT scan. 3. Appearance of primary and metastatic prostate carcinoma on PSMA PET/CT. 4.Potential pitfalls in PSMA PET Technique and timing of PSMA PET/CT. 5. Comparison with other imaging modalities and PET tracers. 6. Disease extent and correlation with PSA levels

TABLE OF CONTENTS/OUTLINE

A. Overview of prostate carcinoma and current challenges in management. B. Correlating PSMA PET/CT with other imaging modalities for prostate carcinoma (i) Bone scan (ii) CT scan (iii) MRI prostate (iv) FDG PET/CT (v) F18 Fluoride PET/CT (vi) F18 Choline PET/CT. C. Normal distribution of PSMA expression in the body (i) Salivary and lacrimal glands (ii) Liver, spleen and gut (iii) Urinary activity in the kidneys, ureter and bladder (iv) Celiac ganglion and others. D. Expression of PSMA in other pathology. E. Comparing early and late PSMA PET imaging. F. Correlation of disease extent on PSMA scan with PSA level. G. Future direction

MSCC33

Case-based Review of Nuclear Medicine: PET/CT Workshop-Cancers of the Abdomen and Pelvis (In Conjunction with SNMMI) (An Interactive Session)

Tuesday, Dec. 1 1:30PM - 3:00PM Location: S406A

GI GU CT NM

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

Participants
Janis P. O'Malley, MD, Birmingham, AL (*Director*) Nothing to Disclose
Ciaran J. Johnston, MD, Dublin, Ireland (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Identify the utility of PET CT in staging a wide variety of primary and recurrent GI, GU and gynecological cancers. 2) Differentiate patterns of physiological FDG uptake from pathologic processes. 3) Expalin the importance of CT correlation for selected cancer subgroups. 4) Describe the role of PET CT in assessing patient response to radiation therapy and chemotherapy, including early assessment and PET influenced treatment strategies.

MSRO36

BOOST: CNS Tumor Board-Case-based Review of PET/MR Imaging and Role in the Clinical Treatment Management of Brain Tumors (An Interactive Session)

Tuesday, Dec. 1 3:00PM - 4:15PM Location: S103CD

NR MR NM RO

AMA PRA Category 1 Credits ™: 1.25
ARRT Category A+ Credits: 1.50

Participants
Christina I. Tsien, MD, Saint Louis, MO (*Moderator*) Speaker Bureau, Merck & Co, Inc
Soonmee Cha, MD, San Francisco, CA (*Presenter*) Nothing to Disclose
Michael Vogelbaum, MD, Cleveland, OH (*Presenter*) Stockholder, Infuseon Therapeutics, Inc
Patrick Y. Wen, MD, Boston, MA (*Presenter*) Research support, Agios Pharmaceuticals, Inc; Research support, Angiochem Inc; Research support, AstraZeneca PLC; Research support, Exelixis, Inc; Research support, F. Hoffmann-La Roche Ltd; Research support, GlaxoSmithKline plc; Research support, Karyopharm Therapeutics, Inc; Research support, Novartis AG; Research support, sanofi-aventis Group; Research support, Regeneron Pharmaceuticals, Inc; Research support, Vascular Biogenics Ltd; Advisory Board, AbbVie Inc; Advisory Board, Cavion; Advisory Board, Celldex Therapeutics, Inc; Advisory Board, Merck & Co, Inc; Advisory Board, F. Hoffmann-La Roche Ltd; Advisory Board, Midatech Pharma; Advisory Board, Momenta Pharmaceuticals; Advisory Board, Novartis AG; Advisory Board, NovoCure Ltd; Advisory Board, Sigma-Tau Pharmaceuticals, Inc; Advisory Board, Vascular Biogenics Ltd; Speaker, Merck & Co, Inc

LEARNING OBJECTIVES

1) Present latest advances in imaging of brain tumors with special emphasis on PET/MR Imaging. 2) Review strengths, pitfalls, and limitations of the advanced imaging methods in a case-based format. 3) Discuss key imaging methods and features to differentiate recurrent tumor and treatment effect and to identify brain tumor mimics.

SSJ02

Breast Imaging (Nuclear Medicine/Molecular Imaging)

Tuesday, Dec. 1 3:00PM - 4:00PM Location: E450A

BR MI MR NM

AMA PRA Category 1 Credit ™: 1.00
ARRT Category A+ Credit: 1.00

Participants
Priscilla J. Slanetz, MD, MPH, Belmont, MA (*Moderator*) Nothing to Disclose
Donna M. Plecha, MD, Strongsville, OH (*Moderator*) Advisory Board, Hologic, Inc;

Sub-Events

SSJ02-01 Multiparametic Evaluation of Breast Lesions with 18-Fluorodeoxyglucose Positron Emission Tomography Magnetic Resonance Imaging

Tuesday, Dec. 1 3:00PM - 3:10PM Location: E450A

Participants
Courtney A. Garlick, MD, Cleveland, OH (*Presenter*) Nothing to Disclose
Jenny Wang-Peterman, MD, Cleveland, OH (*Abstract Co-Author*) Nothing to Disclose
Peter F. Faulhaber, MD, Cleveland, OH (*Abstract Co-Author*) Speaker, Koninklijke Philips NV; Grant, Koninklijke Philips NV; Medical Advisor, MIM Software Inc
Kuan-Hao Su, Shaker Heights, OH (*Abstract Co-Author*) Research Grant, Koninklijke Philips NV
Raymond Muzic, PhD, Cleveland, OH (*Abstract Co-Author*) Research Grant, Koninklijke Philips NV
Maryam Etesami, MD, Cleveland, OH (*Abstract Co-Author*) Nothing to Disclose
Nelly Salem, MD, Cleveland, AL (*Abstract Co-Author*) Nothing to Disclose
Donna M. Plecha, MD, Strongsville, OH (*Abstract Co-Author*) Advisory Board, Hologic, Inc;

PURPOSE

To assess the performance of multiparametric 18-Fluorodeoxyglucose positron emission tomography magnetic resonance imaging (MP PET-MRI) using dynamic contrast-enhanced MRI (DCE-MRI), diffusion weighted imaging (DWI) and FDG-PET in differentiating between benign and malignant abnormalities identified on DCE-MRI.

METHOD AND MATERIALS

28 newly diagnosed breast cancer patients were prospectively enrolled in this Institutional Review Board (IRB) approved study. 25 patients underwent FDG PET-MRI imaging. Breast abnormalities identified in these patients on DCE-MRI were assessed for their likelihood of malignancy for each individual parameter (DCE-MRI, DWI and PET) as well as for combinations of the parameters. Malignancy vs. benignity of each lesion was then determined by histopathology or, in some cases where final pathologic diagnosis was not available, by pre- and post-chemotherapy imaging. If an abnormality showed a response to chemotherapy, it was presumed malignant. Sensitivity, Specificity, PPV and NPV were then measured.

RESULTS

60 lesions were identified, of which 6 had no pathology or imaging follow-up, 11 were deemed benign and 43 malignant (6 presumed malignant). MP PET-MRI significantly improved specificity over DCE-MRI (100% vs 45%, p=0.012) and DCE-MRI combined with PET (100% vs 36%, p=0.004) or DWI (100% vs 44%, p=0.011). There was a trend toward increased PPV with MP PET-MRI vs DCE-MRI (100% vs 88%), but was not statistically significant. Further, there was no statistically significant differences in sensitivity or NPV (p>0.05).

CONCLUSION

Multiparameter 18FDG PET-MRI increases specificity and decreases false positives of DCE-MRI without significant loss of sensitivity.

CLINICAL RELEVANCE/APPLICATION

MP PET-MRI improves specificity of DCE-MRI which may lead to more accurate staging, decreasing false positives and unnecessary biopsies.

SSJ02-02 Visualization of Primary Breast Cancer Lesions with a Dedicated PET for Hanging Breast Imaging in Comparison to PET/CT

Tuesday, Dec. 1 3:10PM - 3:20PM Location: E450A

Participants
Suzana Teixeira, MD, Amsterdam, Netherlands (*Presenter*) Nothing to Disclose
Jose Ferrer Rebolleda, MD, Valencia, Spain (*Abstract Co-Author*) Nothing to Disclose
Bastiaan Koolen, MD, Amsterdam, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Jelle Wesseling, Amsterdam, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Raul Sanchez Jurado, Valencia, Spain (*Abstract Co-Author*) Nothing to Disclose
M P. Stokkel, MD,PHD, Leiden, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Maria Del Puig Cozar Santiago, MD, Valencia, Spain (*Abstract Co-Author*) Nothing to Disclose
Vincent van der Noort, PhD, Amsterdam, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Emiel Rutgers, Amsterdam, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Renato Valdes Olmos, Amsterdam, Netherlands (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Evaluate the performance of a dedicated PET for hanging breast imaging (MAMMI-PET) for the visualization of breast cancer lesions

in two European hospitals while comparing the results obtained with whole body PET/CT.

METHOD AND MATERIALS

After institutional review board approval we prospectively included 230 female patients (age: mean 52 y, range 24-82y) with >= 1 histologically confirmed primary breast cancer lesion (=index lesion) between March 2011 and March 2014. All patients that gave written informed consent were scanned with the MAMMI-PET (Oncovision, Valencia, Spain) after injection of 180-240 MBq and following standard whole body PET/CT. All index lesions on the MAMMI-PET scored 0, 1 or 2 for quantity of FDG uptake, which was tested in relation to histological (ductal, lobular) and molecular (ER/PR/Her2) breast cancer subtype, tumor grade, breast length, maximal tumor diameter and affected breast quadrants. We also compared the visibility score of the primary tumor between MAMMI-PET with standard PET/CT.

RESULTS

Totally 234 affected breasts were scanned with proven primary breast cancer lesions (diameter 5-170 mm). The MAMMI-PET sensitivity was 98.6% for lesions located within the device scanning range. Twenty-three lesions (9.8%) near the pectoral muscle did not reach the scanning range and where therefore not visualised by MAMMI-PET. Of 11 index lesions smaller than 1 cm 9 where visualised by MAMMI-PET. Lesion visibility was not influenced by tumor grade (p=0.21) or cancer subtype (p=0.8345). In comparison to PET/CT MAMMI missed 19 lesions of which 18 were outside its scanning range. However PET/CT was not able to detect 15 index lesions visualized by MAMMI (p=0.61). MAMMI-PET detected 41 additional lesions of which 16 where proven malignant (39%), 15 (36.6%) seen on other modalities, and 14 (34,2%) only visible on MAMMI-PET.

CONCLUSION

Without limitations due to tumor size, grade or histological subtype the MAMMI-PET is able to detect almost all breast cancer index lesions located within its scanning range and is for this lesion category more sensitive than PET/CT.

CLINICAL RELEVANCE/APPLICATION

With the dedicated MAMMI-PET it is possible to visualise primary breast cancer lesions in prone position without compression without the limitation known for PET/CT of tumor size and histological subtype.

SSJ02-03 Pretreatment Prediction of Response to Preoperative Chemotherapy by Multiparametric F-18 Fluorodeoxyglucose Positron Emission Tomography - Magnetic Resonance Imaging in Breast Cancer Patients

Tuesday, Dec. 1 3:20PM - 3:30PM Location: E450A

Participants
Maryam Etesami, MD, Cleveland, OH (*Presenter*) Nothing to Disclose
Peter F. Faulhaber, MD, Cleveland, OH (*Abstract Co-Author*) Speaker, Koninklijke Philips NV; Grant, Koninklijke Philips NV; Medical Advisor, MIM Software Inc
Courtney A. Garlick, MD, Cleveland, OH (*Abstract Co-Author*) Nothing to Disclose
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Kuan-Hao Su, Shaker Heights, OH (*Abstract Co-Author*) Research Grant, Koninklijke Philips NV
Nelly Salem, MD, Cleveland, AL (*Abstract Co-Author*) Nothing to Disclose
Donna M. Plecha, MD, Strongsville, OH (*Abstract Co-Author*) Advisory Board, Hologic, Inc;

PURPOSE

To assess whether multiparametric [F-18]fluorodeoxyglucose (FDG) positron emission tomography (PET) - magnetic resonance imaging (FDG-PET/MR) using dynamic contrast-enhanced MRI (DCE-MRI), diffusion-weighted imaging (DWI), and FDG-PET is able to predict response to preoperative chemotherapy in breast cancer patients. A pilot study.

METHOD AND MATERIALS

A prospective, IRB approved study including twenty seven female patients with biopsy proven primary breast cancer underwent breast-specific PET/MR using Philips Ingenuity TF, 3T system. Patients treated with preoperative chemotherapy followed by surgery or post chemotherapy imaging were enrolled. Patients who had evidence of systemic metastases were excluded. DCE-MRI, DWI, and FDG-PET were qualitatively and semiquantitatively analyzed. The response to chemotherapy was assessed by the pathologic analysis of surgical specimen, or post chemotherapy imaging in two patients awaiting definitive surgery, and then correlated with PET/MR data.

RESULTS

Eighteen patients met the criteria to be enrolled in the study. Response to chemotherapy was complete in 4 (22%), partial in 8 (44%), and no response in 6 (33%) patients. On MRI, the apparent diffusion coefficient (ADC) value for responders to chemotherapy (partial or complete) (mean=0.78 x 10^{-3} mm^2/s) was significantly higher than for non-responders (mean=0.56 x 10^{-3} mm^2/s) (p=0.45). All the responders had ADC value of greater than 0.65 x 10^{-3} mm^2/s. With FDG-PET, there was no significant difference in maximum standardized uptake value (SUVmax) in responders (mean=7.38) versus non-responders (mean= 6.87) (p=0.85). The DCE-MRI kinetic curves and morphology showed no significant difference between responders and non-responders.

CONCLUSION

In our pilot study, DCE-MRI with DWI was found to be valuable for pretreatment prediction of response to chemotherapy in breast cancer. Higher ADC values were associated with response. With limited number of patients, there was no proven benefit of PET/MR over DCE-MRI in the prediction of response to chemotherapy. Further studies with larger cohorts and evaluating imaging characteristic changes after an early dose of chemotherapy would be helpful.

CLINICAL RELEVANCE/APPLICATION

DCE-MRI with DWI may improve the ability to predict response to preoperative chemotherapy in patients with breast cancer.

SSJ02-04 Insights in Physiology of Breast Parenchyma: Is There a Correlation of Breast Parenchymal Uptake of 18FDG, Breast Parenchymal Enhancement on DCE-MRI, Amount of Fibroglandular Tissue and Age?

Tuesday, Dec. 1 3:30PM - 3:40PM Location: E450A

Participants
Doris Leithner, Frankfurt am Main, Germany (*Presenter*) Nothing to Disclose
Pascal A. Baltzer, MD, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose
Heinrich Magometschnigg, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose
Georg J. Wengert, MD, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose
Thomas H. Helbich, MD, Vienna, Austria (*Abstract Co-Author*) Research Grant, Medicor, Inc; Research Grant, Siemens AG; Research Grant, C. R. Bard, Inc
Katja Pinker-Domenig, MD, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To assess and correlate breast parenchymal uptake (BPU) in 18FDG PET-CT with breast parenchymal enhancement (BPE) and amount of fibroglandular tissue (FGT) with 3T DCE-MRI and to determine the influence of patient age on BPU, BPE and FGT.

METHOD AND MATERIALS

In this IRB-approved prospective study 129 patients with a BIRADS 4/5 lesion underwent 18FDG PET-CT and 3T DCE-MRI. Examinations were no longer than six days apart. Patients were injected with approximately 300 MBq 18FDG. After 60 min a prone PET-CT dataset over the breasts was acquired and CT data was solely used for attenuation correction. For DCE-MRI a contrast-enhanced high resolution 3D-T1-weighted sequence before and after application of a standard dose of 0.1 mmol/kg Gd-DOTA (Dotarem®) was employed. BPU and BPE were assessed in the healthy contralateral breast. BPU was calculated quantitatively using SUVmax. FGT and BPE were qualitatively assessed by two independent readers using the revised ACR BI-RADS® classification. To assess reproducibility all measurements were repeated by reader 1. Appropriate statistical tests were used to assess correlation of FGT, BPE, BPU, inter- and intra-reader agreement.

RESULTS

There was no BPE in 58, mild in 54, moderate in 14 and marked in 3 patients. SUVmax for patients with no BPE was 1.57 (SD 0.6), for mild BPE 1.93 (SD 0.6), for moderate BPE 2.42 (SD 0.5), and for marked BPE 1.45 (SD 0.3). There were highly significant correlations between age, BPU, BPE and FGT.Correlation coefficients ranged between moderate and strong. While BPE, BPU and FGT were positively correlated with each other, all of these parameters were negatively correlated with age (Figure 1). The intraclass correlation coefficient for BPU measurements was excellent with 0.973. Inter-reader and intra-reader agreement for BPE was very good with a Kappa-value of 0.860 and 0.822 respectively.

CONCLUSION

BPU of normal breast parenchyma can be reproducibly assessed using SUV metrics and is positively correlated with BPE and FGT in DCE-MRI. There is a negative correlation of BPU, BPE and FGT with age.

CLINICAL RELEVANCE/APPLICATION

BPU, BPE and FGT provide insights in tumor physiology and decrease with age. In patients with dense breasts a possible masking effect of lesions by BPU/BPE must be considered.

SSJ02-05 Clinical Comparison of MBI and BSGI for Low Dose Breast Imaging

Tuesday, Dec. 1 3:40PM - 3:50PM Location: E450A

Participants
Zaiyang Long, PhD, Rochester, MN (*Presenter*) Nothing to Disclose
Carrie B. Hruska, PhD, Rochester, MN (*Abstract Co-Author*) Institutional license agreement, Gamma Medica, Inc
Michael K. O'Connor, PhD, Rochester, MN (*Abstract Co-Author*) Royalties, Gamma Medica, Inc

PURPOSE

Breast specific gamma imaging (BSGI) and molecular breast imaging (MBI) are promising techniques for supplemental imaging in women with dense breast tissue. This study compares the performance of such systems at administered doses of Tc-99m sestamibi that are acceptable for low dose imaging.

METHOD AND MATERIALS

The BSGI system comprised a single-head multi-crystal NaI system (pixel size 3.2×3.2 mm) equipped with a hexagonal-hole lead collimator. The MBI system comprised a dual-head cadmium zinc telluride detector system (pixel size 1.6×1.6 mm) equipped with registered tungsten collimators. System sensitivity, uniformity, energy and spatial resolution were measured using NEMA methods. A 6-cm thick contrast detail (CD) phantom with 48 hot spots (3-10 mm diameter) was used to assess contrast-noise-ratio (CNR) using average background count densities observed in clinical studies at 4mCi dose. 25 patients receiving 4-8mCi doses were imaged on both systems under IRB approval.

RESULTS

The BSGI and MBI systems had integral uniformities of 6.1% and 3.8%, and energy resolution (at 140 keV) of 13.1% and 4.3%, respectively. System sensitivity was 403 cpm/uCi (BSGI) and 790 cpm/uCi (MBI) using a standard +/-10% energy window. In clinical use, MBI employs an energy window of 110-154 keV, yielding a sensitivity of 1042 cpm/uCi. At distances of 1, 3 and 5 cm from the collimator, spatial resolution was 4.1, 5.1 and 6.2 mm on BSGI, and 2.0, 4.7 and 7.3 mm on MBI, respectively. However, with the dual head configuration of MBI, spatial resolution at 5 cm distance from one detector is equivalent to 1cm from the opposing detector for the most frequently observed compressed breast thickness of 6cm. Application of the Rose criterion for lesion detection (CNR>3) to images of the CD phantom showed that for BSGI, 9 hot spots at 4mCi were undetectable. For MBI, 5 hot spots at 4mCi were undetectable. In the 25 patient studies, 5 lesions (CNR>3) were identified on MBI whereas 3 were identified on BSGI.

CONCLUSION

Over the clinical range 0-6 cm, the MBI system demonstrated better spatial resolution than the BSGI system while yielding a 2.6-

fold greater sensitivity. This resulted in improved lesion detection and allows MBI to be utilized at lower doses than BSGI.

CLINICAL RELEVANCE/APPLICATION

Molecular breast imaging (MBI) system demonstrated better performance characteristics than BSGI system. MBI is more suitable for low dose breast imaging.

SSJ02-06 Correlation of Semi-Quantitative Breast-Specific Gamma Imaging Findings with Dynamic Contrast-Enhanced MRI Parameters assessed by a Computer-Aided Evaluation Program and Prognostic Factors of Breast Cancers

Tuesday, Dec. 1 3:50PM - 4:00PM Location: E450A

Participants
Saemee Ahn, MD, PhD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Hye Ryoung Koo, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Jeong Seon Park, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Soo-Yeon Kim, MD, Guri, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To investigate whether a correlation exists between the semi-quantitative breast-specific gamma imaging (BSGI) findings and dynamic contrast-enhanced (DCE) MRI parameters assessed by a computer-aided evaluation program or prognostic factors of breast cancers

METHOD AND MATERIALS

Semi-quantitative index of lesion to non-lesion ratio (L/N) in BSGI and DCE-MRI parameters assessed by a computer-aided evaluation program and histopathologic prognostic factors of 47 invasive breast cancers were obtained. Correlation between L/N ratio and DCE-MRI parameters assessed by a computer-aided evaluation program, including tumor size (cm), angio-volume (cc), degree of initial peak enhancement (%), persistent enhancement proportion (%), washout enhancement proportion (%), or prognostic factors, including axillary nodal status, histologic grade, expression of estrogen receptor (ER), progesterone receptor (PR), human epidermal growth factor receptor 2 (HER2) and Ki-67 were analyzed.

RESULTS

The mean L/N ratio of 47 tumors was 3.63 ± 2.19 (range: 1-13.1). The L/N ratio was higher in tumors with larger tumor size ($P<0.001$), increased angio-volume ($P<0.001$), higher degree of initial peak enhancement ($P<0.001$), increased washout enhancement proportion ($P=0.003$), high histologic grade ($P=0.013$), and higher Ki-67 ($P=0.002$). The calculated multiple correlation coefficient was 0.80 ($P<0.001$).

CONCLUSION

There was a strong multiple correlation between the semi-quantitative L/N ratio in BSGI with DCE-MRI parameters assessed by a computer-aided evaluation program and prognostic factors of breast cancers.

CLINICAL RELEVANCE/APPLICATION

The relationship between the radiotracer uptake in molecular imaging and DCE-MRI parameters may offer an in-depth understanding into the characterization of breast cancer.

SSJ17

Nuclear Medicine (Quantitative Imaging and Image Processing)

Tuesday, Dec. 1 3:00PM - 4:00PM Location: S505AB

BQ CT NM

AMA PRA Category 1 Credit ™: 1.00
ARRT Category A+ Credit: 1.00

FDA Discussions may include off-label uses.

Participants
Chadwick L. Wright, MD, PhD, Lewis Center, OH (*Moderator*) Nothing to Disclose
Andrew C. Homb, MD, Louisville, KY (*Moderator*) Nothing to Disclose

Sub-Events

SSJ17-01 The Prognostic Value of Volumetric FDG PET/CT Parameters and Partial Volume Effect Correction in Patients with Locally Advanced Non-Small Cell Lung Cancer: A Secondary Analysis of ACRIN 6668/RTOG 0235 Trial

Tuesday, Dec. 1 3:00PM - 3:10PM Location: S505AB

Awards
Trainee Research Prize - Resident

Participants
Ali Salavati, MD, MPH, Philadelphia, PA (*Presenter*) Nothing to Disclose
Fenghai Duan, PhD, Providence, RI (*Abstract Co-Author*) Nothing to Disclose
Sina Houshmand, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Benjapa Khiewvan, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Adam Opanowski, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Bradley S. Snyder, MS, Providence, RI (*Abstract Co-Author*) Nothing to Disclose
Bo Wei, Providence, RI (*Abstract Co-Author*) Nothing to Disclose
Murat Sadic, Ankara, Turkey (*Abstract Co-Author*) Nothing to Disclose
Barry A. Siegel, MD, Saint Louis, MO (*Abstract Co-Author*) Consultant, Merrimack Pharmaceuticals, Inc Consultant, Siemens AG Advisory Board, General Electric Company Stockholder, Radiology Corporation of America Spouse, Speaker, Siemens AG
Mitchell Machtay, MD, Cleveland, OH (*Abstract Co-Author*) Consultant, Bristol-Myers Squibb Company; Consultant, Eli Lilly and Company; Consultant, AbbVie Inc; Speaker, Bristol-Myers Squibb Company; Speaker, Eli Lilly and Company; Speaker, AbbVie Inc
Abass Alavi, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

There is a growing body of evidence supporting the application of volumetric PET/CT parameters and partial volume effect correction (PVC) in the prognostication of patients with non-small cell lung cancer (NSCLC). The aim of this secondary analysis was to assess the ability of pretreatment volumetric PET/CT measures, along with PVC, to predict locoregional control (LRC) and overall survival (OS) in patients enrolled in ACRIN 6668/RTOG 0235.

METHOD AND MATERIALS

Patients with inoperable stage IIB/III NSCLC and evaluable pretreatment FDG-PET/CT scans were included. Pretreatment Metabolic Tumor Volume(MTV),SUVmax,SUVmean,Total Lesion Glycolysis (TLG=SUVmean*MTV), pvcSUVmean and pvcTLG(pvcSUVmean*MTV) were quantified using semiautomatic adaptive contrast-oriented thresholding and local background PVC algorithms.The relationship between PET/CT indices and patient outcomes was assessed using Cox proportional hazards regression and time-varying models.

RESULTS

Of 234 eligible patients,38 were excluded mainly due to inadequate image quality, leaving 196-151 depending on the measured PET indices. PVC parameters were very highly correlated with their non-corrected counterparts (median correlation 0.98,range 0.96 to 0.997). Pretreatment MTV, TLG and pvcTLG (both primary tumor(PT) and whole body(WB)) were independent predictors of OS, while SUVmax, SUVmean and pvcSUVmean were not prognostic using either PT or WB measures.PVC and non-PVC indices yielded similar hazard ratios of 1.17(95%CI 1.05-1.31 p=0.004),1.20(95%CI1.06-1.34 p=0.003), 1.24(95%CI1.06-1.44 p=0.007), 1.27(95%CI1.08-1.50 p=0.004) for PT TLG, PT pvcTLG, WB TLG and WB pvcTLG,respectively.Similar results were observed after subsetting the entire cohort based on tumor size.Similar to OS, MTV and TLG were independent predictors of LRC, although their prognostic ability decreased during long-term follow-up.

CONCLUSION

Pretreatment volumetric PET/CT parameters including MTV and TLG are strong predictors of OS and LRC for NSCLC;however, the association with LRC appears to diminish over time. For this particular cohort,PVC did not appear to enhance the prognostic ability of PET/CT indices.The significance of PVC in treatment monitoring remains to be clarified.

CLINICAL RELEVANCE/APPLICATION

Pretreatment volumetric FDG-PET/CT parameters are strong independent predictors of overall survival and locoregional control in patients with locally advanced NSCLC treated with chemoradiation therapy.

SSJ17-02 Impact of Point-spread Function Reconstruction on Quantitative FDG-PET/CT Imaging Parameters and Inter Reader Reproducibility in Solid Tumors

Tuesday, Dec. 1 3:10PM - 3:20PM Location: S505AB

Awards

Trainee Research Prize - Fellow

Participants
Sara Sheikhbahaei, MD, MPH, Baltimore, MD (*Presenter*) Nothing to Disclose
Charles Marcus, MD, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Rick Wray, MD, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Arman Rahmim, PhD, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Martin A. Lodge, PhD, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Rathan M. Subramaniam, MD, PhD, Baltimore, MD (*Abstract Co-Author*) Travel support, Koninklijke Philips NV

PURPOSE

Recent studies suggest that implementation of the point spread function (PSF) in the reconstruction algorithm of positron emission tomography (PET) improves the spatial resolution of PET images. However, there is little known about the influence of PSF reconstruction on volumetric measurements in PET/CT. This study aims to determine the impact of PSF reconstruction on quantitative PET/CT indices and the inter-reader reproducibility of these measurements.

METHOD AND MATERIALS

Study was approved by the Institutional Review Board under a waiver of informed consent. A total of 42 oncology patients with 89 lesions (all ≥2cm) were included. The PET/CT images were reconstructed with PSF (OSEM+TOF, 2i, 21s, all pass filter) and without PSF (OSEM+TOF, 2i, 21s, 5 mm Gaussian). For each lesion, the maximum, mean and peak standardized uptake values (SUV), total lesion glycolysis (TLG), and metabolic tumor volume (MTV) were measured by two readers (R1, R2) using a semi-automatic gradient segmentation method. Intra-class correlation coefficient (ICC) and Bland-Altman analyses were performed.

RESULTS

There was excellent correlation between non-PSF and PSF reconstruction PET/CT values [ICC≥0.950 for all parameters, P<0.0001]. Bland-Altman analyses comparing PSF with non-PSF images showed the average biases (%) of +11.14 (R1) and +11.1 (R2) for SUVmax, +7.04 (R1) and +7.54 (R2) for SUVmean, +7.03 (R1) and +7.06 (R2) for SUVpeak, -2.62 (R1) and -3.17 (R2) for TLG, and -9.61 (R1) and -10.43 (R2) for MTV. Percentage changes in PSF versus non-PSF indices were not related to the site of the lesions (P>0.05). Close agreement was observed between two readers [ICC ranged between 0.908-0.997, P<0.0001].

CONCLUSION

The PSF reconstruction increases the SUVmax, SUVmean and SUVpeak, as expected, while it tends to produce lower values for MTV and has variable effect on TLG. This can be attributed to the ability of PSF reconstruction to better discern tumor uptake from activity spill-out.

CLINICAL RELEVANCE/APPLICATION

Reconstruction method of PET/CT should be carefully considered in reporting quantitative parameters, subsequent lesion classifications and comparisons for therapy assessment.

SSJ17-03 Early Prediction of Chemotherapeutic Response with Volumetric FDG PET Parameters in Recurrent Gynecological Malignancies

Tuesday, Dec. 1 3:20PM - 3:30PM Location: S505AB

Participants
Mitsuaki Tatsumi, MD, PhD, Suita, Japan (*Presenter*) Nothing to Disclose
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Masatoshi Hori, MD, Suita, Japan (*Abstract Co-Author*) Nothing to Disclose
Noriyuki Tomiyama, MD, PhD, Suita, Japan (*Abstract Co-Author*) Nothing to Disclose
Jun Hatazawa, MD, PhD, Osaka, Japan (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate if volumetric parameters(VPs) of FDG PET were useful in predicting treatment response early after chemotherapy in recurrent gynecological malignancies.

METHOD AND MATERIALS

This study included 35 patients with recurrent gynecological malignancies(19 uterine, 12 ovarian, 2 peritoneal, and 2 others). FDG PET/CT exam was performed before(pre) and after 1 cycle of chemotherapy(post1c). Metabolic tumor volume(MTV, SUV threshold 2.5) and total lesion glycolysis(TLG) were obtained as VPs in addition to SUVmax at the hottest lesion in each exam. MTV and TLG were also obtained for whole-body(wb) lesions. Pre, post1c, and changes(expressed as Δ) of VPs as well as SUVmax were compared each other and to the treatment response after last cycle of chemotherapy, which was decided with all clinical information available including imaging data.

RESULTS

PreSUVmax ranged from 1.9 to 22.4(median:7.0) and preMTV from 0 to 161(median:8.8). All preVPs exhibited a strong correlation with preSUVmax(Rho=0.78-0.88, p<0.001). Similar results were observed between post1cVPs and post1cSUVmax and between ΔVPs and ΔSUVmax. Post1cVPs and post1cSUVmax showed a strong(Rho=0.63-0.76) and moderate(Rho=0.40-0.57) correlation with ΔVPs and ΔSUVmax, respectively. Treatment response was observed in 14 of 35 pts and it correlated moderately with post1cVPs, ΔVPs, and ΔSUVmax. Among them, ΔwbMTV or ΔwbTLG was considered the best parameter to predict response from ROC analysis(AUC:0.79). A cutoff of ΔwbMTV 121% from ROC curve yielded the sensitivity, specificity, positive- , and negative predictive value of 57%, 100%, 100%, and 61%, respectively, if non-response was defined as positive. Mean ΔwbMTV was 31% and 287% respectively in response and non-response groups(p<0.05). No significant findings were noted between preVPs or preSUVmax and treatment response.

CONCLUSION

This study demonstrated early changes of VPs in FDG PET after 1 cycle of chemotherapy were more useful than changes of

SUVmax in predicting treatment response after the last cycle in pts with recurrent gynecological malignancies. Potential of MTV and TLG dealing with whole-body lesions was also demonstrated in this study.

CLINICAL RELEVANCE/APPLICATION

Early changes of volumetric FDG PET parameters after 1 cycle of chemotherapy were useful in predicting final treatment response in pts with recurrent gynecological malignancies.

SSJ17-04 Assessment of Whole-body Metabolic Tumor Burden of Nerve Sheath Tumors in Neurofibromatosis Type 1 Using 18F-FDG PET/CT

Tuesday, Dec. 1 3:30PM - 3:40PM Location: S505AB

Participants
Johannes M. Salamon, MD, Hamburg, Germany (*Presenter*) Nothing to Disclose
Azien Laqmani, Hamburg, Germany (*Abstract Co-Author*) Nothing to Disclose
Ivayla I. Apostolova, MD, Magdeburg, Germany (*Abstract Co-Author*) Nothing to Disclose
Gerhard B. Adam, MD, Hamburg, Germany (*Abstract Co-Author*) Nothing to Disclose
Victor F. Mautner, MD, Hamburg, Germany (*Abstract Co-Author*) Nothing to Disclose
Thorsten Derlin, MD, Hannover, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To determine the metabolically active whole-body tumor volume and whole body total lesion glycolysis on 18F-fluorodeoxyglucose positron emission tomography/computed tomography (18F-FDG PET/CT) in individuals with neurofibromatosis type 1 (NF1) using a three-dimensional (3D) segmentation and computerized volumetry technique. And to compare these parameters in NF1 patients with benign (BPNSTs) and malignant peripheral nerve sheath tumors (MPNSTs).

METHOD AND MATERIALS

Eighteen NF1 patients with malignant PNSTs and 18 age- and sex-matched NF1 controls with benign PNSTs examined by 18F-FDG PET/CT were included (20 men; 16 women; age, 36.6 ± 12.3 years; range 16.5 to 68.7 years). Whole-body metabolic tumor burden (mTB), whole-body total lesion glycolysis (TLG) and a set of semi-quantitative imaging-based parameters were analyzed on a per-patient and a per-lesion basis. The Mann-Whitney U test, the Spearman correlation coefficient and ROC analysis were used for statistical analyses. Histopathological evaluation and clinical / radiological follow-up examinations served as the reference standards.

RESULTS

Whole-body mTB and whole-body TLG were significantly higher in NF1 patients with MPNSTs compared to patients with BPNSTs at different SUVmax cut-offs (2.0, 2.5, 3.5 and 4.0, $p < 0.0001$). MPNST demonstrated both a significantly higher metabolic tumor volume and TLG than BPNSTs ($p < 0.0001$). ROC analysis showed that metabolic tumor volume and TLG could be used to differentiate between benign and malignant tumors. Neither age nor gender were significantly correlated with whole-body mTB and whole-body TLG.

CONCLUSION

Whole-body mTB and whole-body TLG are different between NF1 patients with BPNST and MPNST. Moreover, malignant tumors have higher metabolic tumor volume and TLG than benign tumors. Further evaluation in prospective studies is required to determine the potential clinical impact and prognostic significance of these novel PET parameters in the context of NF1.

CLINICAL RELEVANCE/APPLICATION

New volumetric imaging parameters of peripheral nerve sheath tumors in NF1 such as mTB and TLG provide the basis for investigating biomarkers for early detection of MPNST and may help reducing unnecessary biopsies or surgery.

SSJ17-05 Determination of the Degree of Colorectal Carcinoma differentiation by Characterizing Tumor Heterogeneity with Textural Features on 18F-FDG PET/CT

Tuesday, Dec. 1 3:40PM - 3:50PM Location: S505AB

Participants
Wei Mu, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Zhe Chen, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Ying Liang, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Ning Wu, MD, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Jie Tian, PhD, Beijing, China (*Presenter*) Nothing to Disclose

PURPOSE

The aim of the study is to assess the usefulness of the tumor heterogeneity characterized by texture features and other commonly used semi-quantitative indices extracted from 18F-FDG PET images to determinate the differentiated degree of cancer cells in colorectal adenocarcinoma (CA) patients.

METHOD AND MATERIALS

We retrospectively studied the PET/CT images of 42 patients with pathologically proven CA (26 male and 15 female; mean age, 60±13 years), and the differentiation was graded on a scale of poor, moderate, or well differentiated. Firstly, the primary tumor was segmented with an improved level set method. Based on the traditional Chan-Vese (CV) model, we imposed gradient field constraint to exclude the effect of the adjacent bladder for some rectal tumors. Secondly, fifty-four 3D texture features (based on histogram analysis, concurrence matrix (CM), gray level size zone matrix (GLSZM), run length matrix (RLM), neibourhood gray level difference matrix(NGLD) and texture spectrum (TS)) were studied besides of SUVs (SUVmax, SUVmean, SUVpeak) and metabolic tumor volume (MTV). A 64-gray-level quantization was used, and local features (features based on CM and RLM) were computed over 13 directions. Then one-way analysis of variance (ANOVA) followed by multiple comparisons was employed to test the features for the statistical significance of group differences. In addition, the robustness of the features with respect to the segmentation methods was validated.

RESULTS

Three of the forty-eight features, difference variance (DV) and information correlation1 (IC1) based on CM and low gray level run emphasis (LGRE) based on GLSZM showed significant differences between any two groups (P<0.05). Through Student's test, there were no significant differences of the features between the manual segmentation and the proposed method (p>0.05).

CONCLUSION

Texture analysis of FDG PET could determinate the degree of colorectal carcinoma differentiation potentially, which also means the texture features may be another prognostic factors and can provide supplementary information for developing treatment plan.

CLINICAL RELEVANCE/APPLICATION

The texture features could determine the differentiated degree of cancer cells in colorectal adenocarcinoma (CA) patients, and could be another prognostic factors for personalized medicine.

SSJ17-06 Automatic PET Image Segmentation: A Cross-Platform and Cross-Method Evaluation

Tuesday, Dec. 1 3:50PM - 4:00PM Location: S505AB

Participants
Tram Nguyen, Odense, Denmark (*Presenter*) Nothing to Disclose
Poul-Erik Braad, Odense C, Denmark (*Abstract Co-Author*) Nothing to Disclose
Poul Flemming Hoilund-Carlsen, Odense, Denmark (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Quantitative PET relies on reproducible and accurate target delineation. This study investigated the unassessed variation between different commercial software packages that generally use threshold approaches. Method variability was also tested against in-house implemented methods.

METHOD AND MATERIALS

PET scans of the NEMA/IEC phantom with different target-to-background ratios (TBRs) (5:1, 10:1, 20:1, infinite) and human 18F-NaF PET images (6 vertebrae of various shapes and inhomogeneity with/without bone abnormalities) were used. Region-of-interest (ROI) analysis with the ROVER (ABX, Radeberg, Germany) and PETVCAR (GE Healthcare) software was performed along with in-house implementations. Cross-platform reproducibility was assessed by applying the same common 40% of peak value threshold method on all platforms. Cross-method variability was tested among the adaptive threshold (AT) method of ROVER, the estimated threshold (ET) by PETVCAR, and in-house implemented region growing with non-peak-based threshold (RG) and non-threshold level set (LS) methods.

RESULTS

Overall, consistent cross-platform results were obtained with some estimated mean activity deviations (~0.1-0.3 kBq/mL) and volume variations (~0.02-0.4 mL) at TBR5 and target size < 15 mm. At higher levels, ROVER deviated slightly from the other platforms with their near identical estimates. The peak-based method failed to segment inhomogeneous vertebrae well. Different methods yielded variations in estimated phantom activity (p ˜ 0.6-0.9) and volumes (p ˜ 0.8-0.95) that became marked at low contrast and targets < 35 mm. LS generally gave the best estimates, especially at high contrast and targets > 20 mm. Above TBR10, ET captured volumes the best, but overall underestimated activity levels the most. For vertebrae delineation, ET measurements, especially target volumes, deviated the most due to segmentation limitations.

CONCLUSION

Non-threshold or locally adaptive threshold methods had better performance range than peak-based thresholding across contrast, target size, and inhomogeneity. The cross-platform and cross-method variations introduced bias that has to be accounted for in any quantitative analysis design.

CLINICAL RELEVANCE/APPLICATION

Work like this is essential to elucidate critical aspects of quantification that will have decisive clinical impact along with the growing role of PET for prediction and therapy planning/evaluation.

MSCC34

Case-based Review of Nuclear Medicine: PET/CT Workshop-Lymphoma/Melanoma/Sarcoma (In Conjunction with SNMMI) (An Interactive Session)

Tuesday, Dec. 1 3:30PM - 5:00PM Location: S406A

CT NM OI

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

Participants
Janis P. O'Malley, MD, Birmingham, AL (*Director*) Nothing to Disclose
Samuel E. Almodovar-Reteguis, MD, Birmingham, AL (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Discuss imaging presentation and special considerations when interpreting FDG PET/CT studies for lymphoma, melanoma and sarcoma. 2) Formulate a systematic approach to interpreting PET/CT studies for this patient population. 3) Discuss pertinent correlative findings on CT for each diagnosis on a case by case basis.

ABSTRACT

RC411

Update on Radionuclide Therapies

Tuesday, Dec. 1 4:30PM - 6:00PM Location: S504CD

IR NM OI

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. 2) Review guidelines for the use of I-131 in the treatment of thyroid cancer. 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

Radium-223 is a recently approved therapy for patients with metastatic prostate cancer to bone. The use of radium-223 is increasing worldwide, and new applications are being evaluated. The objectives of this presentation are: 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.

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/

Eric M. Rohren, MD, PhD - 2015 Honored Educator

RC411C Hepatic Artery Infusion Therapy with Y90 Microspheres

Participants
Charles Y. Kim, MD, Durham, NC, (charles.kim@duke.edu) (*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.

ED010-WE

Nuclear Medicine Wednesday Case of the Day

Wednesday, Dec. 2 7:00AM - 11:59PM Location: Case of Day, Learning Center

NM

AMA PRA Category 1 Credit ™: .50

Participants
John D. Millet, MD, Ann Arbor, MI (*Abstract Co-Author*) Nothing to Disclose
Jadranka Stojanovska, MD, MS, Northville, MI (*Abstract Co-Author*) Nothing to Disclose
David Brandel, MD, Ann Arbor, MI (*Abstract Co-Author*) Nothing to Disclose
Richard K. Brown, MD, Ann Arbor, MI (*Presenter*) Nothing to Disclose
Jamil Shaikh, MD, New Brunswick, NJ (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

1) The case will demonstrate the typical characteristics of sarcoid on FDG PET and cardiac MRI. The learner will understand the role of these modalities in the work up of patients with suspected cardiac sarcoid. 2) The case will demonstrate focal hot spots in the periphery of the lungs on MAA perfusions scan. The learner will be able to identify this finding as an artifact related to the technique of injection. 3) The case will deomonstrate the typical characteristics of pleural talcosis on FDG PET. The exhibit will teach the learner how to seperate benign from neoplastic causes of update in the pleural space.

RC507

Bladder, the Forgotten Organ: Role of CT, MRI, and PET in Diagnosis, Staging, and Surveillance of Cancer

Wednesday, Dec. 2 8:30AM - 10:00AM Location: N229

GU CT MR NM

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

Participants
Stuart G. Silverman, MD, Brookline, MA, (sgsilverman@partners.org) (*Coordinator*) Author, Wolters Kluwer nv
Andrew B. Rosenkrantz, MD, New York, NY (*Presenter*) Nothing to Disclose
Homer A. Macapinlac, MD, Houston, TX (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Learn the latest developments on the role of CT, MRI, and PET/CT in the detection, diagnosis, staging, and surveillance of patients with bladder cancer. 2) Learn currently recommended CT, MRI, and PET/CT techniques and protocols and how to implement them in clinical practice. 3) Learn how to interpret CT, MRI, and PET/CT scans of the bladder with an emphasis on case review and diagnostic pitfalls.

ABSTRACT

The urinary bladder is the most common site of malignancy of the urinary tract and is imaged by radiologists on many abdominal imaging exams. However, historically the bladder has been a 'forgotten' organ and thought to be largely the purview of the urologist due to the central role that cystoscopy has played in both the diagnosis and local staging of bladder cancer. Recent advances in CT, MRI, and PET have emerged that now allow radiologists to play an important role in the detection, diagnosis, staging, and surveillance of patients with or suspected of having bladder cancer. This course will detail these advances and explain how, when, and why radiologists should be using these three modalities in clinical practice today. Using illustrative case examples, advances in knowledge such as how CT urography can be used to detect bladder cancer, how MR urography can be used to distinguish muscle-invasive from superficial tumors and evaluate the upper tracts, and how PET/CT (and the newly introduced PET/MRI) can be used to stage and follow patients. With additional advances in low dose CT, emerging MRI techniques, and novel PET agents, radiology will play an increasingly vital role in the care of patients with bladder cancer in the future.

RC511

Nuclear Medicine Series: Non-FDG PET Radiotracers in Oncology

Wednesday, Dec. 2 8:30AM - 12:00PM Location: S505AB

CT NM OI

ARRT Category A+ Credits: 3.50
AMA PRA Category 1 Credits ™: 3.25

FDA Discussions may include off-label uses.

Participants
Hossein Jadvar, MD, PhD, Los Angeles, CA, (jadvar@med.usc.edu) (*Moderator*) Nothing to Disclose
David A. Mankoff, MD, PhD, Philadelphia, PA (*Moderator*) Speaker, Koninklijke Philips NV; Consultant, General Electric Company

Sub-Events

RC511-01 Proliferation Imaging: FLT/PET in Oncology

Wednesday, Dec. 2 8:30AM - 9:00AM Location: S505AB

Participants
David A. Mankoff, MD, PhD, Philadelphia, PA (*Presenter*) Speaker, Koninklijke Philips NV; Consultant, General Electric Company

LEARNING OBJECTIVES

1) Describe the kinetics of thymidine relevant to FLT PET imaging. 2) Discuss approaches to FLT image interpretation. 3) Describe studies that have tested FLT PET as a marker cancer response to treatment.

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/

David A. Mankoff, MD, PhD - 2013 Honored Educator

RC511-02 Positron Emission Tomography (PET) Imaging of Chemokine Receptor CXCR4 in Patients with Solid Cancers: Initial Results

Wednesday, Dec. 2 9:00AM - 9:10AM Location: S505AB

Participants
Tibor Vag, MD, PhD, Munich, Germany (*Presenter*) Nothing to Disclose
Carlos Gerngross, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose
Hans-Jurgen Wester, Munchen, Germany (*Abstract Co-Author*) CEO, SCINTOMICS GmbH
Markus Schwaiger, MD, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

CXCR4 is a chemokine receptor that is overexpressed in various human cancers and is involved in tumor metastasis. In this feasibility study we performed Positron Emission Tomography (PET) imaging of CXCR4 expression in patients suffering from various solid cancers.

METHOD AND MATERIALS

21 patients with histologically proven solid tumors underwent PET imaging using the novel CXCR4 nuclear probe [68Ga]Pentixafor. Maximum standardized uptake values (SUVmax) of the liver, spleen and bone marrow were measured for determination of physiological tracer distribution. For evaluation of in vivo CXCR4 expression on tumors, SUVmax and tumor-to-background ratios (T/B ratio) were determined in a total of 43 malignant lesions including 8 primary tumors, 3 local recurrent tumors and 32 metastases. When available, SUVmax of malignant lesions was compared to corresponding SUVmax measured in standard routine [18F]FDG PET.

RESULTS

Moderate tracer uptake was detectable in the liver, bone marrow and spleen with a mean SUVmax of 3.1, 3.7 and 5.6, respectively. By visual interpretation criteria, 9 of 11 primary and local recurrent tumors were detectable, exhibiting a mean SUVmax of 4.7 (range 2.1 to 10.9) and a mean T/B ratio of 2.9. 20 of 32 evaluated metastases were visually detectable (mean SUVmax of 4.5, range 3.2 to 13.8; mean T/B ratio of 2.8). Spearman´s correlation revealed a low correlation between SUVmax and number of lesions per patient (r=0.3). Compared to [18F]FDG PET obtained in 10 patients, tracer uptake in [68Ga]Pentixafor PET revealed a lower SUVmax in all measured lesions.

CONCLUSION

PET Imaging of CXCR4 in patients with solid cancers is feasible. Based on the experience gained within this small number of patients, SUVmax of malignant solid tumors seems to be lower in [68Ga]Pentixafor PET compared to [18F]FDG PET. Moreover, CXCR4 expression in solid malignancies seems to be highly heterogeneous depending on factors, that have to be elucidated in further studies.

CLINICAL RELEVANCE/APPLICATION

Once the areas of Pentixafor imaging are more clearly defined, PET imaging of CXCR4 might prove as a valuable modality, either as a

stand alone diagnostic tool, or in combination with [18F]FDG PET, i.e. when considering [68Ga]Pentixafor for monitoring CXCR4 directed pharmacological or endoradiotherapeutic treatment.

RC511-03 Dual-tracer (11C-acetate and 18F-FDG) PET/CT in Evaluating Gastrointestinal Stromal Tumors and Predicting the Mitotic Rate

Wednesday, Dec. 2 9:10AM - 9:20AM Location: S505AB

Participants
Thomas K. Cheng, MBBS, Hong Kong, Hong Kong (*Abstract Co-Author*) Nothing to Disclose
Sirong Chen, Hong Kong, Hong Kong (*Presenter*) Nothing to Disclose
Yim Lung Leung, Hong Kong, Hong Kong (*Abstract Co-Author*) Nothing to Disclose
Ka Nin Wong, Hong Kong, Hong Kong (*Abstract Co-Author*) Nothing to Disclose
William Cheung, Hong Kong, Hong Kong (*Abstract Co-Author*) Nothing to Disclose
Chi Lai Ho, Hong Kong, Hong Kong (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

18F-FDG (FDG) PET/CT is useful in risk stratification of Gastrointestinal stromal tumors (GIST) because it provides information for 3 predictors of tumor aggressiveness: mitotic rate (MiR), tumor size and primary site of involvement. GIST typically demonstrates high FDG avidity but false negative (FN) reports are not uncommon in those with low MiR. This study explores the detection sensitivity of 11C-acetate (ACT) and FDG PET/CT in GIST, and their relationship to cellular mitotic behavior.

METHOD AND MATERIALS

From 2013-14, 10 patients (M:7, F:3; mean age=63±17y) with primary GIST and 6 patients (M:5, F:1; mean age=66±13y) with metastatic GIST (primary excised previously) underwent preoperative ACT and FDG PET/CT. Postoperative pathology confirmed all primary/secondary GIST. The MiR was categorized as low (≤5/50) or high (>5/50 mitoses/50 high-power fields) according to the mitotic index recommended by NCCN guidelines. ROC curve analysis was performed to explore the relationship of lesion SUVmax to MiR for ACT and FDG, respectively.

RESULTS

10 lesions were found in 10 patients with primary GIST (stomach:5, small bowel:4, omentum:1): 3 with high and 7 with low MiR (size:14.2±11.2 vs 3.7±0.7cm). FDG PET/CT was positive in 7/10 (70%) but FN in 3/7 lesions with low MiR. ACT PET/CT was positive in 9/10 (90%) including all 3 FDG-negative lesions. 6 metastatic GIST patients presented with 11 lesions (liver:2, adrenal:1, retroperitoneal lymph node:1, peritoneum:7): 6 with high and 5 with low MiR. FDG PET/CT was positive in 8/11 (73%) but FN in 1/6 with high and 2/5 with low MiR. ACT PET/CT was positive in all metastatic lesions (11/11:100%). The incremental value of ACT over FDG is significant for primary and metastatic GIST with low MiR (both $P<0.05$). By ROC curve analysis, a FDG SUVmax cut-off value>=4.4 and 3.1 could differentiate lesions of high from low MiR for primary and metastatic GIST, respectively (AUC=0.905 vs 0.875, both $P<0.05$).

CONCLUSION

Metabolic avidity of GIST for FDG has a predictive value for cellular mitotic behavior, but with the disadvantage of FN for lesions having low MiR. ACT PET/CT has a distinct incremental value over FDG for detecting primary/metastatic GIST, but appears to be independent of mitotic behavior.

CLINICAL RELEVANCE/APPLICATION

ACT PET/CT has a high sensitivity for both primary and metastatic GIST, particularly for lesions with low mitotic rate and non-avid for FDG. FDG avidity, however, predicts mitotic behavior of GIST.

RC511-04 Monitoring Response to Antiangiogenic Therapy of Non-Small Cell Lung Cancer using 15O-water PET: The Relationship between Tumor Blood Flow and the Prognosis

Wednesday, Dec. 2 9:20AM - 9:30AM Location: S505AB

Participants
Masahiro Yanagawa, MD, PhD, Suita, Japan (*Presenter*) Nothing to Disclose
Keiko Matsunaga, Suita, Japan (*Abstract Co-Author*) Nothing to Disclose
Hiroki Kato, Suita, Japan (*Abstract Co-Author*) Nothing to Disclose
Eku Shimosegawa, Suita, Japan (*Abstract Co-Author*) Nothing to Disclose
Jun Hatazawa, MD, PhD, Osaka, Japan (*Abstract Co-Author*) Nothing to Disclose
Noriyuki Tomiyama, MD, PhD, Suita, Japan (*Abstract Co-Author*) Nothing to Disclose
Osamu Honda, MD, PhD, Suita, Japan (*Abstract Co-Author*) Nothing to Disclose
Takashi Kijima, Suita, Japan (*Abstract Co-Author*) Nothing to Disclose
Haruhiko Hirata, Suita, Japan (*Abstract Co-Author*) Nothing to Disclose
Tomoyuki Otsuka, Suita, Japan (*Abstract Co-Author*) Nothing to Disclose
Atsushi Kumanogoh, Suita, Japan (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Bevacizumab (BEV) is a humanized monoclonal antibody that targets circulating vascular endothelial growth factor. The purposes of this study were to evaluate tumor blood flow in patients with non small cell lung cancer (NSCLC) before and after treatment of BEV using 15O-water PET and to examine the tumor blood flow change and time to tumor progression.

RESULTS

In 5 patients without BEV, median of tumor blood flow before and after treatment was 0.3506 and 0.3351, respectively. There was no significant difference (Wilcoxon test, $p=0.81$). Mean time to tumor progression after treatment was 80.4 days (range, 21 to 203). In 6 patients with BEV, median of tumor blood flow before and after treatment was 0.2785 and 0.1777, respectively. There was a significant difference ($p=0.03$). Mean time to tumor progression after treatment was 242.5 days (range, 86 to 413). The mean ratio (Fa/b) of tumor blood flow after BEV to that before BEV was 0.665 ml/cm^3/min (range, 0.231 to 0.899). There was significant correlation between Fa/b and time to tumor progression (Correlation coefficient $r=0.86$, $p=0.03$): large decrease in blood

flow early after treatment of BEV was associated with short time to tumor progression.

CONCLUSION

Mean tumor blood flow decreased within 1-2 days after administration of BEV. Large decrease in blood flow early after treatment of BEV correlated with short time to tumor progression.

CLINICAL RELEVANCE/APPLICATION

The antiangiogenic therapy might not have a benefit for patients with large decrease in blood flow early after treatment of BEV.

RC511-05 68Ga-PSMA-PET/CT in Patients with Renal Cell Cancer: Initial Results

Wednesday, Dec. 2 9:30AM - 9:40AM Location: S505AB

Participants
Lino Sawicki, MD, Dusseldorf, Germany (*Presenter*) Nothing to Disclose
Philipp Heusch, MD, Duesseldorf, Germany (*Abstract Co-Author*) Nothing to Disclose
Christian Buchbender, Duesseldorf, Germany (*Abstract Co-Author*) Nothing to Disclose
Markus Giessing, MD, Berlin, Germany (*Abstract Co-Author*) Nothing to Disclose
Hubertus Hautzel, MD, Juelich, Germany (*Abstract Co-Author*) Nothing to Disclose
Gerald Antoch, MD, Duesseldorf, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

68Gallium (68Ga) labelled prostate specific membrane antigen (PSMA) positron emission tomography / computed tomography (PET/CT) has been shown to be a reliable imaging method for the detection of prostate cancer and its metastases. Immunohistochemic studies revealed that PSMA is also expressed in the neovasculature of other solid tumors, especially renal cell cancer (RCC), making these cancers a potential target for 68Ga-PSMA-PET imaging. The aim of this study was to explore the feasibility of 68Ga-PSMA-PET/CT for detection of RCC in patients.

METHOD AND MATERIALS

Three male patients (mean age 66 years; range 52 - 74) with primary or metastatic RCC (n=2 clearcell RCC; n=1 papillary RCC) prospectively underwent whole body 68Ga-PSMA-PET/CT (mean Mbq: 179,3; Scanner: Siemens Biograph mCT, Siemens Healthcare, Erlangen, Germany). Quantitative assessement of tracer uptake was performed 1 hour after injection (p.i.) by measuring maximum standard uptake values (SUVmax) using isocontour VOIs in histopathologically proven tumor lesions. Additionaly, for each lesion tumor-to-background ratios were claculated.

RESULTS

All primary RCCs and known metastastic sites were detected by 68Ga-PSMA-PET/CT. Average SUVmax in clear cell and papillary RCC tumour lesions was 16.7 and 4.1, respectively. Mean tumor-to-background ratio was 18.6 for clear cell RCC lesions and was 4.1 for papillary RCC lesions.

CONCLUSION

Detection of primary tumors and metastases in RCC patients using 68Ga-PSMA-PET/CT is feasible. 68Ga-PSMA uptake is high in clear cell RCC but rather weak in papillary RCC. Thus the promising diagnostic potential of 68Ga-PSMA-PET/CT rather has to be investigated in clear cell RCC patients.

CLINICAL RELEVANCE/APPLICATION

Since RCCs have high metastatic potential exact staging is crucial. Imaging with CT, MRI but also 18F-FDG-PET/CT offers limited sensitivity. PET/CT using 68Ga-PSMA seems to be a promising alternative.

RC511-06 Hypoxia Imaging: FMISO PET Imaging in Oncology

Wednesday, Dec. 2 9:40AM - 10:10AM Location: S505AB

Participants
Kenneth A. Krohn, PhD, Seattle, WA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Understand the evolution of tumor hypoxia and its biological implications. 2) Identify the mechanistic changes in tumor biology that will result in tumor resistance and poor patient outcome. 3) Learn novel ways to image tumor hypoxia with focus on FMISO PET imaging. 4) Understand the potential approaches to overcoming the negative impact of hypoxia.

ABSTRACT

The physiological microenvironment for a tumor is largely dictated by abnormal vasculature and metabolism. Many solid tumors develop areas of hypoxia during their evolution caused by unregulated cellular growth, resulting in greater demand on oxygen for energy metabolism. Hypoxia induces a cascade of changes that reflects the homeostatic attempts (highly conserved evolutionally) to maintain adequate oxygenation that may result in tumor cells to adapt by developing more aggressive survival traits; mediated by Hypoxia Inducible Factor (HIF1a) part of the cellular oxygen sensing mechanism. Hypoxic tumors are not effectively eradicated with conventional doses of radiation and show resistance to several chemotherapy drugs. Hypoxia may also result in angiogenesis (itself a marker of tumor aggressiveness) mediated by Vascular endothelial growth factor (VEGF). While angiogenesis is a frequent consequence of hypoxia, some tumors develop extensive angiogenesis without the presence of hypoxia and vice versa. Advances in PET imaging instrumentation, coupled with the development of an increasing array of novel molecular probes, provide opportunities for imaging and selection of appropriate therapies to overcome the cure limiting effects of these two fundamental aspects of tumor microenvironment. The biology of tumor microenvironment related to hypoxia and its effect on patient outcome and developments in imaging technology and novel radiotracers for hypoxia imaging with a focus on F-18 FMISO would be reviewed.Challernges and novel treatments to overcome the cure limiting ability of hypoxia will be discussed.

RC511-07 Prostate Cancer Choline PET Imaging and Other PET Tracers

Wednesday, Dec. 2 10:30AM - 11:00AM Location: S505AB

Participants
Hossein Jadvar, MD, PhD, Los Angeles, CA, (jadvar@med.usc.edu) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Review the major biological targets that may be useful for imaging in prostate cancer. 2) Understand the need for tailoring the imaging technique to the particular clinical phase of disease. 3) Analyze the current evidence with the potential utility of PET with various radiotracers in the imaging evaluation of prostate cancer.

ABSTRACT

ABSTRACT

Recent advances in the fundamental understanding of the complex biology of prostate cancer have provided increasing number of potential targets for imaging and treatment. In this presentation, I review the experience with a number of major PET radiotracers for potential use in the imaging evaluation of men with prostate cancer.

RC511-08 Primary Tumor Detection in CUP of Neuroendocrine Origin: Additional Value of 68Ga-DOTATATE-PET/CT Compared to Contrast-enhanced CT

Wednesday, Dec. 2 11:00AM - 11:10AM Location: S505AB

Participants
Philipp M. Kazmierczak, MD, Munich, Germany (*Presenter*) Nothing to Disclose
Axel Rominger, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose
Christine Spitzweg, Munich, Germany (*Abstract Co-Author*) Advisory Board, Novartis AG; Advisory Board, Pfizer Inc; Advisory Board, Ipsen SA; Speaker, Novartis AG; Speaker, Pfizer Inc; Speaker, Ipsen SA
Christoph Auernhammer, MD, PhD, Munich, Germany (*Abstract Co-Author*) Research Grant, Novartis AG; Speaker, Novartis AG; Research Grant, Ipsen SA; Speaker, Ipsen SA; Advisory Board, Novartis AG
Maximilian F. Reiser, MD, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose
Clemens C. Cyran, MD, Munich, Germany (*Abstract Co-Author*) Research Grant, Bayer AG Research Grant, Novartis AG Speakers Bureau, Bayer AG
Carsten Rist, MD, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate the additional value of 68Ga-DOTATATE-PET/CT compared to contrast-enhanced CT for primary tumor detection in cancer of unknown primary (CUP) of neuroendocrine origin.

METHOD AND MATERIALS

Patients (n=38, 27 male, 11 female, mean age 62 years) with histologically proven metastatic disease of neuroendocrine origin undergoing contrast-enhanced 68Ga-DOTATATE-PET/CT (Biograph 64, Siemens Healthcare, Erlangen, Germany) for primary tumor detection and staging were consecutively included in this retrospective study. Two blinded readers independently evaluated the separated contrast-enhanced CT and 68Ga-DOTATATE-PET data sets and noted from which of the two imaging modalities they suspected a primary tumor. In case of divergent blinded reading results, a consensus was reached. The final diagnosis, confirmed by either histopathology (n=24) or clinical follow-up (n=14), served as standard of reference.

RESULTS

Primary tumors were suspected in n=33 patients, localized in the small bowel (n=19), the pancreas (n=12), the lung (n=1), and the thyroid gland (n=1) (mean tumor-to-spleen ratio 1.10±0.69; PET/CT: true positive n=30, true negative n=3; CT: true positive n=20, true negative n=5). In n=4 patients, no primary tumor was identified (true negative n=3). N=10 primary tumors were correctly detected by PET but not contrast-enhanced CT, resulting in a diagnostic accuracy of 87 % for the fused 68Ga-DOTATATE-PET/CT, compared to 66 % for the contrast-enhanced CT alone. High interobserver agreement was noted regarding the localization of the primary tumor (Cohen's k 0.90, $p<0.001$).

CONCLUSION

68Ga-DOTATATE-PET/CT provides a significantly higher diagnostic accuracy for primary tumor detection in CUP of neuroendocrine origin as compared to contrast-enhanced CT alone.

CLINICAL RELEVANCE/APPLICATION

The present study provides evidence for the routine use of 68Ga-DOTATATE-PET/CT in neuroendocrine CUP, allowing for a comprehensive tumor staging at improved diagnostic accuracy as compared to standard whole-body imaging.

RC511-09 Do we Need High-Dose Contrast-enhanced CT in the Detection of Extra-hepatic Metastasesusing Gallium-68-DOTATATE-PET/CT in Patients with Neuroendocrine Tumors (NET)?

Wednesday, Dec. 2 11:10AM - 11:20AM Location: S505AB

Participants
Jonas C. Apitzsch, MD, Marburg, Germany (*Presenter*) Nothing to Disclose
Dirk R. Albanus, Aachen, Germany (*Abstract Co-Author*) Nothing to Disclose
Z. Erdem, Zonguldak, Turkey (*Abstract Co-Author*) Nothing to Disclose
Oktay Erdem, MD, Zonguldak, Turkey (*Abstract Co-Author*) Nothing to Disclose
Anton F. Verburg, Aachen, Germany (*Abstract Co-Author*) Nothing to Disclose
Florian F. Behrendt, MD, Aachen, Germany (*Abstract Co-Author*) Nothing to Disclose
Felix Mottaghy, MD, PhD, Ulm, Germany (*Abstract Co-Author*) Nothing to Disclose
Andreas H. Mahnken, MD, Aachen, Germany (*Abstract Co-Author*) Nothing to Disclose
Alexander Heinzel, Aachen, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Previous studies have shown that PET/CT with 68Ga-labeled somatostatin analogues is useful in the assessment of metastatic disease in in patients with neuroendocrine tumors especially with regard to extra-hepatic lesions. It has to be noted that PET in combination with full-dose contrast-enhanced CT (ceCT) exposes the patients to a high dose of radiation whereas the non-contrast-enhanced low-dose CT (ldCT) might reduce the radiation and may in addition avoid side effects such as allergic reactions. Thus, we aimed to determine whether ceCT can be omitted from assessment for extra-hepatic metastases in patients with NET.

METHOD AND MATERIALS

We retrospectively compared the performance of PET/ldCT and PET/ceCT in 54 patients (26 male, 28 female) who underwent a Gallium-68-DOTATATE-PET/CT in our clinic. Selection criteria were as follows: available ldCT and ceCT; histologically confirmed NET; available follow-up of at least 6 months (median 12.6 months; range 6.1-23.2). PET/ldCT and PET/ceCT images were analyzed separately by four experienced physicians. The review process focused on metastases to lungs, bones and lymph nodes. Afterwards, the PET/ldCT and PET/ceCT results were compared to the reference standard consisting of clinical follow-up data to evaluate the diagnostic accuracy.

RESULTS

In PET/ceCT 139 true positive bone-lesions were detected compared to 140 in PET/ldCT, 106 true positive lymph node metastases (PET/ceCT) vs. 90 (PET/ldCT) and 26 true positive lung lesions (PET/ceCT) whereas PET/ldCT found ?? true positive lung lesions. On a per patient basis ld and ce PET-CT achieved similar sensitivity (both 100%) however, specificity was lower for PET/ldCT (89% vs. 77%). For lymph nodes PET/ceCT showed superior sensitivity and specificity (sensitivity 92% vs. 80% and specificity 83% vs. 65%). For the detection of pulmonary lesions the sensitivity of PET/ldCT was also clearly inferior (23 vs 100%) while specificity was similar (94% vs. 93%).

CONCLUSION

These results represent first evidence that ceCT should not be omitted for extra-hepatic staging using Gallium-68-DOTATATE-PET/CT in patients with neuroendocrine tumors. However, the results need to be confirmed in a prospective trial.

CLINICAL RELEVANCE/APPLICATION

PET/ldCT is sufficient in the detection of extrahepatic metastatic desease in NET. There is no further need for high-dose CeCT.

RC511-10 PSA and PSA Kinetics in Predicting 18F-NaF PET Positivity for First Bone Metastases in Patients with Biochemical Recurrence after Radical Prostatectomy

Wednesday, Dec. 2 11:20AM - 11:30AM Location: S505AB

Participants
James Yoon, BA, Los Angeles, CA (*Presenter*) Nothing to Disclose
Leslie Ballas, MD, Los Angeles, CA (*Abstract Co-Author*) Nothing to Disclose
Bhushan Desai, MBBS, MS, Los Angeles, CA (*Abstract Co-Author*) Nothing to Disclose
Lingyun Ji, MS, Los Angeles, CA (*Abstract Co-Author*) Nothing to Disclose
Susan Groshen, PhD, Los Angeles, CA (*Abstract Co-Author*) Nothing to Disclose
Hossein Jadvar, MD, PhD, Los Angeles, CA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate PSA and PSA kinetics in addition to other pathologic factors to determine their predictive value for 18F-NaF PET positivity for first bone metastases in patients with biochemical recurrence after radical prostatectomy.

METHOD AND MATERIALS

All 18F-NaF PET scans that were performed at USC between 2010 and 2014 were queried to find patients who demonstrate biochemical recurrence after radical prostatectomy. Patients with known metastatic disease at the time of 18F-NaF PET were excluded. Records were reviewed to obtain data on PSA at the time of 18F-NaF PET, PSA kinetics, and pathologic features of the prostatectomy specimen, which were then used for receiver operating characteristic (ROC) analysis to determine predictability for 18F-NaF PET positivity.

RESULTS

36 patients met our inclusion criteria. Of these, 8 (22.2%) had positive 18F-NaF PET scans. Mean values for PSA, PSA doubling time, and PSA velocity were 2.02 ng/mL (range 0.06-11.7 ng/mL), 13.2 months, and 1.28 ng/mL/yr for 18F-NaF PET negative patients and 4.11 ng/mL (range 0.04-14.38 ng/mL), 8.9 months, and 9.06 ng/mL/yr for 18F-NaF PET positive patients (p=0.07, 0.47, and 0.02 respectively). ROC analysis for 18F-NaF positivity gave AUC values of 0.634 for PSA, 0.598 for PSA doubling time, and 0.688 for PSA velocity. ROC analysis with combined models gave AUC values of 0.723 for PSA and PSA doubling time, 0.689 for PSA and PSA velocity, and 0.718 for PSA, PSA doubling time, and PSA velocity. There was no significant association found between 18F-NaF PET positivity and Gleason score, TN staging, and status of surgical margins.

CONCLUSION

18F-NaF PET detected first time osseous metastases in 22.2% of patients with PSA relapse. PSA velocity was the best single variable for predicting 18F-NaF PET positivity. Combining PSA with PSA doubling time or PSA with PSA doubling time and PSA velocity resulted in higher predictability than any variable independently.

CLINICAL RELEVANCE/APPLICATION

18F-NaF PET can detect early prostate cancer bone metastases in the post-prostatectomy setting.

RC511-11 Bone PET Imaging: NaF PET in Oncology

Wednesday, Dec. 2 11:30AM - 12:00PM Location: S505AB

Participants
Baris Turkbey, MD, Bethesda, MD (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To identify the advantages of F-18 NaF PET/CT in oncology 2) To understand the importance of a standardized imaging protocol and reporting for F18-NaF PET/CT 3) To become comfortable in differentiating benign lesions from malignant ones on F18-NaF PET/CT

ABSTRACT

F-18 NaF PET/CT has been shown to have higher sensitivity than planar 99m-Tc MDP bone scanning in several studies. The concomitant acquisition of anatomic images permits immediate correlation of any abnormal findings. Additionally, F-18 NaF PET/CT bone imaging can be quantitated, allowing bone disease to be 'measureable', increasing its utility therapy monitoring. When a consistent F-18 NaF uptake period is used, the SUV values are highly reproducible, and due to the high extraction fraction, high quality images can be obtained with a radiation dose exposure similar to that of Tc-99m MDP (including the low dose CT scan). This presentation will discuss the benefits and challenges of F-18 NaF PET/CT in oncology.

ABSTRACT

F-18 NaF PET/CT has been shown to have higher sensitivity and specificity than planar 99m-Tc MDP bone scanning in several small studies. The concomitant acquisition of anatomic images permits immediate correlation of any abnormal findings. Additionally, F-18 NaF PET/CT bone imaging can be quantitated, allowing bone disease to be "measureable", increasing its utility therapy monitoring. When a consistent F-18 NaF uptake period is used, the SUV values are highly reproducible, and due to the high extraction fraction, high quality images can be obtained with a radiation dose exposure similar to that of Tc-99m MDP (including the low dose CT scan). This presentation will discuss the benefits and challenges of F-18 NaF PET/CT in oncology.

RC513

Pediatric Series: Pediatric Oncology and Nuclear Medicine

Wednesday, Dec. 2 8:30AM - 12:00PM Location: S102AB

MR NM RO PD

AMA PRA Category 1 Credits ™: 3.25
ARRT Category A+ Credits: 3.50

FDA Discussions may include off-label uses.

Participants
Sue C. Kaste, DO, Memphis, TN (*Moderator*) Nothing to Disclose
Heike E. Daldrup-Link, MD, Palo Alto, CA (*Moderator*) Nothing to Disclose
Stephan D. Voss, MD, PhD, Boston, MA (*Moderator*) Nothing to Disclose
Robert Orth, MD, PhD, Houston, TX (*Moderator*) Research support, General Electric Company;
Whal Lee, MD, PhD, Seoul, Korea, Republic Of (*Moderator*) Nothing to Disclose

Sub-Events

RC513-01 Bone Mineral Density Changes in Survivors of Childhood Cancer

Wednesday, Dec. 2 8:30AM - 8:50AM Location: S102AB

Participants
Sue C. Kaste, DO, Memphis, TN (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Participants will learn risk factors for bone mineral density deficits in patients having been treated for childhood malignancies.

RC513-02 Bone Marrow Edema on MRI as an Indicator of Impending Bone Collapse in Pediatric Cancer Patients on High Dose Corticosteroid Therapy

Wednesday, Dec. 2 8:50AM - 9:00AM Location: S102AB

Participants
Preeti Sukerkar, MD, PhD, Palo Alto, CA (*Presenter*) Nothing to Disclose
Shanshan Bao, MD, Winston Salem, NC (*Abstract Co-Author*) Nothing to Disclose
Sandhya Kharbanda, Palo Alto, CA (*Abstract Co-Author*) Nothing to Disclose
Stuart Goodman, Stanford, CA (*Abstract Co-Author*) Nothing to Disclose
Heike E. Daldrup-Link, MD, Palo Alto, CA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Osteonecrosis (ON) is a devastating complication of pediatric cancer therapy with high dose corticosteroids, with 20 % of cases progressing to bone collapse, at which point joint conservation therapy may no longer be possible. It was recently shown in adult ON patients that the presence of bone marrow edema (BME) adjacent to epiphyseal ON is correlated with the presence of micro- or macro-fractures on histopathology, and the puprose of out study is to determine whether BME correlates with eventual bone collapse in pediatric cancer patients to help identify high risk patients who would benefit from early interventions.

METHOD AND MATERIALS

We retrospectively reviewed imaging studies of 18 pediatric leukemia patients who underwent high dose corticosteroid therapy and had findings of epiphyseal ON on magnetic resonance imaging (MRI). Two radiologists evaluated the presence of BME. Follow up imaging was reviewed to determine lesion progression. Using Fisher's exact test, the presence of BME was compared to the patient's outcome.

RESULTS

Of the 18 patients, 12 were found to have pre-collapse ON lesions with sufficient follow up imaging. A total of 36 weight-bearing and 2 non-weight-bearing lesions were identified, of which 13 progressed to collapse and 22 remained stable or improved. The presence of BME was found to be significantly correlated with eventual bone collapse, with 100% of patients who progressed to collapse demonstrating BME on initial imaging ($p < 0.0001$). The absence of BME initially was associated with lesion stability or even improvement ($p < 0.0001$). 3 lesions were identified that progressed slightly but did not collapse, of which none had BME on initial scans.

CONCLUSION

The absence of BME early on is an indicator of future stability or even improvement of an ON lesion, while the presence of BME appears to precede bone collapse. These results suggest that the presence or absence of BME can be used to help identify high-risk patients earlier so they may receive joint preserving therapies. This study is ongoing to evaluate out findings in a larger patient cohort.

CLINICAL RELEVANCE/APPLICATION

Presence or absence of edema on MRI predicts osteonecrosis progression in pediatric cancer patients and is recommended for stratifying high-risk patients for joint preservation therapy.

RC513-03 To Assess the Added Value of Intravenous Gadolinium for Pre-Surgical Evaluation of Osteosarcoma in Long Bones in Pediatric Patients and Young Adults

Wednesday, Dec. 2 9:00AM - 9:10AM Location: S102AB

Participants
Theodore T. Pierce, MD, Boston, MA (*Presenter*) Nothing to Disclose
Randheer Shailam, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Santiago Lozano Calderon, MD, PhD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Pallavi Sagar, MBBS, Boston, MA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Osteosarcoma, a malignant bone tumor, is routinely evaluated using magnetic resonance imaging (MRI) with and without intravenous (IV) gadolinium prior to surgical intervention, typically both at initial staging and following neoadjuvant chemotherapy to determine tumor extent for operative planning. A paucity of data exists showing the utility of preoperative contrast enhanced MRI for operative planning and, so far, gadolinium does not reliably help in differentiating post treatment changes from residual disease. Preoperative parameters such as intramedullary tumor length and transphyseal tumor extension are best evaluated on non-contrast T1 or STIR sequences. Uncertainty remains as to the benefit of IV contrast for evaluating neurovascular bundle involvement (NBI) and intra-articular extension (IAE), key parameters for pre-surgical evaluation.

METHOD AND MATERIALS

At 2 time points, 2 pediatric radiologist independently analyzed MRI examinations of patients between the ages of 0-25 years with pathology proven extremity osteosarcoma for two parameters, NBI and IAE. Initial evaluation analyzed these parameters using non-contrast MRI images only (PRE) and, after 1 week, subsequent evaluation included both the pre and post contrast images (POST). Inter-rater discrepancies were resolved by consensus. Cohen's Kappa and McNemar's test were calculated to assess agreement between PRE and POST image interpretations of NBI and IAE.

RESULTS

56 patients with 90 preoperative MRI examinations were analyzed. PRE and POST interpretations agreed on 47 cases of NBI, 39 cases without NBI, and had 4 discordant cases. There were 63 cases with IAE, 25 without IAE, and 2 were discordant. Kappa was 0.91 for NBI and 0.95 for IAE. McNemar's test did not show a difference between PRE and POST imaging (p=0.61 NBI; p=0.48 IAE).

CONCLUSION

No statistical difference between PRE and POST image interpretation was found. A high level of agreement between PRE and POST image interpretation suggests that non-contrast enhanced MRI may be sufficient for pre-surgical planning for long bone osteosarcoma in pediatric patients.

CLINICAL RELEVANCE/APPLICATION

Avoiding unnecessary gadolinium use limits adverse reaction risk, obviates the need for intravenous access and shortens image acquisition, all of which are of particular benefit in pediatric patients.

RC513-04 Whole Body MRI including Diffusion-weighted Imaging as the Sole Staging and Follow-up Imaging Procedure in Pediatric Tumors - Comparison with Established Imaging Modalities

Wednesday, Dec. 2 9:10AM - 9:20AM Location: S102AB

Participants
Guenther K. Schneider, MD, PhD, Homburg, Germany (*Presenter*) Research Grant, Siemens AG; Speakers Bureau, Siemens AG; Speakers Bureau, Bracco Group; Research Grant, Bracco Group;
Stefan R. Rick, Homburg, Germany (*Abstract Co-Author*) Nothing to Disclose
Peter Fries, MD, Homburg, Germany (*Abstract Co-Author*) Nothing to Disclose
Alexander Massmann, MD, Homburg/Saar, Germany (*Abstract Co-Author*) Nothing to Disclose
Arno Buecker, MD, Homburg, Germany (*Abstract Co-Author*) Consultant, Medtronic, Inc Speaker, Medtronic, Inc Co-founder, Aachen Resonance GmbH Research Grant, Siemens AG

PURPOSE

In 58 pediatric pts. with malignant tumors whole body MRI was evaluated as the sole staging procedure in comparison to established methods such as FDG-PET, MIBG or bone scintigraphy, CT and ultrasound. Findings in follow-up whole body MRI were used for evaluation of tumor response and tumor recurrence, again compared against other established imaging methods. Of particular interest was the detection of late recurrence (> 18 month post initial diagnosis) at time points, at which FDG-PET or MIBG scintigraphy are routinely not available based on actual imaging recommendations.

CONCLUSION

Whole body MRI performed with the described technique can correctly stage and diagnose a variety of malignant tumors in pediatric patients and late recurrence of disease is detected with a high accuracy at time points, at which PET or scintigraphy is routinely not performed.

CLINICAL RELEVANCE/APPLICATION

Inferior accuracy of whole body MRI using only STIR sequences or just DWI was recently published, this study demonstrates the potential of whole body MRI using more advanced techniques. Detection of late recurrence only in MRI highlights the need for advanced MRI in follow-up of pediatric malignancies.

RC513-05 Is the Whole Body MR Imaging Necessary in the Management of Children with Acute Myeloid Leukemia?

Wednesday, Dec. 2 9:20AM - 9:30AM Location: S102AB

Participants
Hee Mang Yoon, MD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Jin Seong Lee, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Ah Young Jung, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Young Ah Cho, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

Chong Hyun Yoon, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Whole body MR imaging has been frequently used for the management of children with acute myeloid leukemia (AML) because it can provide additional information besides bone marrow evaluation. In this regard, we assess the use of the whole body magnetic resonance (MR) imaging in the management of the children with AML to validate its usefulness.

METHOD AND MATERIALS

Sixty nine whole body MR scans of 40 consecutive pediatric patients with AML were evaluated by two radiologists in consensus. Whole body MR imaging was acquired for the following purposes: work-up for initial diagnosis, work-up for relapsed AML, work-up for stem cell transplant, work-up for a new sign or symptom, or follow-up of pre-existing abnormality. We estimated the presence of abnormal findings including extramedullary granulocytic sarcoma (EGS), clinically occult lesions, and lesions explaining the patient's clinical symptoms, except the bone marrow involvement by AML.

RESULTS

Total 76 EGSs were identified in eleven of 40 patients (27.5 %). Nine of eleven patients (81.8%) had multiple EGSs. Thirty eight EGSs were incidentally detected on 9 whole body MR scans in seven patients (17.5 %). Positive findings were most commonly observed on whole body MR scans performed as work-up for a new sign or symptom (14 of 15 MR scans, 93.3%). Six clinically occult non-EGS lesions found on whole body MR scans were small intracranial hemorrhage (n=1), bilateral otomastoiditis (n=1), pneumonia (n=1), knee joint inflammation with effusion (n=1) and disseminated infection/inflammation (n=2). Multiple lesions at anatomically distant regions were successfully evaluated with 18 whole body MR scans (26.1%) in a single session head-to-toe imaging.

CONCLUSION

Whole body MR imaging could be helpful to detect multiple EGSs or clinically occult lesions and be used as a problem solving tool in children with a new sign or symptom by AML in a single session study.

CLINICAL RELEVANCE/APPLICATION

Whole body MR imaging is a useful imaging modality in management of the pediatric AML patients considering tendency for multiplicity of EGSs and prevalent occult lesions as well as the intrinsic advantages of whole body MR imaging.

RC513-06 Defining Optimal Dose Regimes for Pediatric Whole-body 18F-FDG-PET/MRI

Wednesday, Dec. 2 9:30AM - 9:40AM Location: S102AB

Participants
Sergios Gatidis, MD, Tubingen, Germany (*Presenter*) Nothing to Disclose
Holger Schmidt, PhD, Tuebingen, Germany (*Abstract Co-Author*) Nothing to Disclose
Christian la Fougere, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose
Konstantin Nikolaou, MD, Tuebingen, Germany (*Abstract Co-Author*) Speakers Bureau, Siemens AG Speakers Bureau, Bracco Group Speakers Bureau, Bayer AG
Nina Schwenzer, MD, Tuebingen, Germany (*Abstract Co-Author*) Nothing to Disclose
Juergen F. Schaefer, MD, Tuebingen, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To find optimal tracer dose regimes for pediatric whole-body 18F-FDG PET/MRI with minimal radiation exposure and sufficient diagnostic quality.

METHOD AND MATERIALS

Whole-body PET data sets of 30 pediatric patients (14 female, mean age 12±6 [1-18] years) were retrospectively analyzed. PET data were acquired in list mode on a combined PET/MR scanner (Biograph mMR, Siemens) 65±14 min after injection of 3.1±0.5 MBq 18F-FDG per kg bw for 4 min per bed position.Based on the acquired list mode data, PET images of lower tracer doses (0.25 to 2.5 MBq/kg bw 18F-FDG) were simulated by retrospective undersampling of PET list mode data.Resulting data sets were analyzed quantitatively by measurement of standardized uptake values (SUVs) in healthy organs (liver, lungs, blood pool) and pathologic lesions by volume-of-interest (VOI) analysis.Qualitative analysis was performed independently by two readers experienced in pediatric nuclear medicine. To this end, PET-data sets were analyzed beginning with the lowest simulated tracer dose (0.25 MBq/kg bw) and gradually increasing tracer doses up to the original acquired PET image. Conspicuity of organ structures (such as brain, thymus, muscle, heart etc.) and detectability of focal PET lesions were recorded and finally compared to the original full-dose data set.

RESULTS

Image quality steadily improved with increasing simulated tracer doses. SUVs showed higher relative deviations of about 10 % at tracer doses below 1 MBq/kg bw. Conspicuity of physiologic organ structures improved steadily with increasing simuloatead tracer doses and was equivalent with the original acquired PET data set at simulated doses of 1-1.5 MBq/kg bw. Detectability of focal PET lesions increased continuously with increasing simultated tracer doses; all focal lesion that were detectable in the original full-dose PET were already detectable at 1.5 MBq/kg bw.

CONCLUSION

Tracer doses can be significantly reduced in pediatric PET/MRI compared to existing standard regimes. Our results suggest that doses of 1.5 MBq/kg bw FDG are sufficient for accurate diagnostic quality of PET. These results have to be validated in larger clinical studies.

CLINICAL RELEVANCE/APPLICATION

Reduced tracer doses will result in lower diagnostic radiation exposure in pediatric patients. Variation of PET acquisition times may enable further reduction of tracer doses.

RC513-07 PET/MR Compared to PET/CT in the Assessment of Pediatric Histiocytoses

Wednesday, Dec. 2 9:40AM - 9:50AM Location: S102AB

Participants
Andrew Sher, MD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Danial S. Bokhari, MD, Houston, TX (*Presenter*) Nothing to Disclose
Matthew Goette, PhD, Houston, TX (*Abstract Co-Author*) Support, Koninklijke Philips NV
Rajesh Krishnamurthy, MD, Houston, TX (*Abstract Co-Author*) Research support, Koninklijke Philips NV; Research support, Toshiba Corporation
Victor J. Seghers, MD, PhD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Compare lesion based analysis of 18F-FDG PET/MR to 18F-FDG PET/CT in pediatric Langerhans Cell Histiocytosis (LCH) and Rosai Dorfman Disease (RD).

METHOD AND MATERIALS

This prospective, HIPAA compliant study had IRB approval. Following written informed consent 18 18F-FDG PET/CT and PET/MR examinations were performed on 9 patients (6 male, 3 female, mean age 6; range: 7 months to 16 years) following a single-injection dual-imaging protocol. The indication was LCH in 11 exams and RD in 7 exams. Two readers blinded to clinical history assessed the anonymized data for metabolically active disease by consensus read. PET/CT and PET/MR were viewed simultaneously and volumes of interest were drawn over lesions, with lesions defined as non-physiologic uptake above background. SUV maximum values were recorded. Lesion detection rates and classification agreement between modalities were analyzed and compared to the reference standard (all available examinations and clinical history).

RESULTS

94 metabolically active lesions were identified on PET/MR versus 100 on PET/CT. Of the 94 lesions identified on both exams there was concordant classification in 93 (99%), representing excellent agreement, $\kappa = .97$ ($p < .001$), 95% CI (0.94-1.0). 6 lesions were identified on PET/CT but not PET/MR, 3 were foci of active disease, 1 was an inflammatory lymph node, and 2 were artifactual or physiologic. Per the standard of reference, 101 metabolically active lesions were available for analysis (80 were active disease while 21 were benign). Compared to the reference standard, the overall sensitivity (93% vs. 96%, $p>.05$) and specificity (100% vs. 95%, $p > .05$) of PET/MR vs. PET/CT, respectively, demonstrated no significant difference. The accuracies of PET/MR and PET/CT measured 94% and 96%, respectively. SUV analysis demonstrated lesions on PET/MR measuring 11% lower on average than PET/CT ($p<.001$). There was a strong correlation ($\rho = .76$) between the SUVs of the two modalities.

CONCLUSION

PET/MR demonstrates no statistical difference to PET/CT for lesion detection and classification in patients with LCH or RD. PET/MR imaging is a promising lower-radiation alternative to PET/CT for this patient population.

CLINICAL RELEVANCE/APPLICATION

PET/MR evaluation for pediatric histiocytoses demonstrates no statistical difference in sensitivity, specificity, or accuracy of lesion detection compared to PET/CT and can contribute to patient management with lower radiation dose.

RC513-08 Whole Body Imaging in Pediatric Oncology

Wednesday, Dec. 2 9:50AM - 10:10AM Location: S102AB

Participants
Stephan D. Voss, MD, PhD, Boston, MA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) The participant should understand the various whole body multi-modality imaging techniques used in Pediatric Oncology2) The participant should be able to discuss strategies and opportunities for radiation dose reduction when performing multi-modality whole body examinations3) The audience should understand the appropriate indications for whole body imaging in pediatric oncology, including the role of whole body imaging in tumor surveillance and evaluation of patients with cancer predisposition syndromes.

ABSTRACT

RC513-09 Neuroblastoma - Imaging and Therapy Update

Wednesday, Dec. 2 10:30AM - 10:50AM Location: S102AB

Participants
Adina L. Alazraki, MD, Atlanta, GA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Identify the common indications for I-131 MIBG in pediatric patients. 2) Describe the necessary considerations for pediatric patients prior to I-131 MIBG therapy. 3) Discuss imaging protocols and typical pre and post therapy imaging appearance as part of monitoring of response to therapy.

RC513-10 PET/MR Imaging in Pediatric Sarcomas and Malignant Soft Tissue Tumors: Is There a Clinical Impact?

Wednesday, Dec. 2 10:50AM - 11:00AM Location: S102AB

Participants
Juergen F. Schaefer, MD, Tuebingen, Germany (*Presenter*) Nothing to Disclose
Sergios Gatidis, MD, Tubingen, Germany (*Abstract Co-Author*) Nothing to Disclose
Ilias Tsiflikas, MD, Tuebingen, Germany (*Abstract Co-Author*) Nothing to Disclose
Guido Seitz, Tuebingen, Germany (*Abstract Co-Author*) Nothing to Disclose

Martin Ebinger, Tuebingen, Germany (*Abstract Co-Author*) Nothing to Disclose
Christian la Fougere, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose
Matthias Reimold, MD, Tuebingen, Germany (*Abstract Co-Author*) Nothing to Disclose
Nina Schwenzer, MD, Tuebingen, Germany (*Abstract Co-Author*) Nothing to Disclose
Konstantin Nikolaou, MD, Tuebingen, Germany (*Abstract Co-Author*) Speakers Bureau, Siemens AG Speakers Bureau, Bracco Group Speakers Bureau, Bayer AG

PURPOSE

To evaluate the clinical impact of PET/MRI in pediatric sarcomas and malignant soft tissue tumors.

METHOD AND MATERIALS

43 examinations in 30 patients (11 female, mean age 11.1 y ± 5.4 y) with diagnoses of Ewing sarcoma (n=6), osteosarcoma (n=4), rhabdomyosarcoma (n=6), NF 1 suspected for MPNST (n=9), others (n=5) were included. Written informed consent was obtained. Two protocols were performed: In group A, 11 examinations were carried out using PET/CT (Biograph mCT, Siemens) and PET/MRI (Biograph mMR, Siemens). Data were acquired on the same day after administration of 161±88 MBq 18F-FDG. In group B, 32 examinations were performed using PET/MRI only, after administration of 114±67 MBq 18F-FDG. Additionally, if indicated an additional low dose chest CT was carried out. In Group A, image analysis was performed by two experienced rater teams blinded for the respective different modality. In group B, image analysis was performed by an experienced rater team: first MRI followed by PET-MRI. Histopathology and follow-up served as reference standard. Findings of PET/MRI were reevaluated by the institutional pediatric tumorboard regarding further clinical management (e.g. change of diagnostic or therapeutic regime).

RESULTS

Group A: The rate of focal uptake on PET/MRI was equivalent to PET/CT (52 vs. 53). Local staging (4/11), anatomic allocation (2/11) and relevant additional findings were improved by MRI. Group B: Findings of PET/MRI affecting clinical management were found in 8 /32 examinations (e.g. change of surgical approach or no additional radiation). Compared to chest CT, PET/MRI detected equal numbers of metastases in 5 patients and lower numbers in 5 patients. MRI was negative in 4 patients with nodules smaller than 4 mm who had no evidence of metastases in follow-up. There was no evidence of pulmonary metastasis in 16 patients.

CONCLUSION

Simultaneous PET/MRI in pediatric sarcomas allows a comprehensive diagnostic for both, local and systemic tumor spread. PET/MR substantially affected the clinical management. The lower detection rate of small pulmonary nodules by MRI needs to be discussed with respect to clinical importance.

CLINICAL RELEVANCE/APPLICATION

PET/MRI improves the clinical management in pediatric soft tissue tumors and both, local and systemic staging is possible in a single approach.

RC513-11 Brain Exams in Pediatric Epilepsy: PET/MRI Compared to PET/CT

Wednesday, Dec. 2 11:00AM - 11:10AM Location: S102AB

Participants
Matthew Goette, PhD, Houston, TX (*Presenter*) Support, Koninklijke Philips NV
Erica Yang, MD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Nadia F. Mahmood, MD, Sugar Land, TX (*Abstract Co-Author*) Nothing to Disclose
Jeremy Y. Jones, MD, Bellaire, TX (*Abstract Co-Author*) Nothing to Disclose
Wei Zhang, PhD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Victor J. Seghers, MD, PhD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Andrew Sher, MD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Michael J. Paldino, MD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

PET/MR offers the potential for diverse image contrasts in a single examination. To reach its full potential, this technology will require robust attenuation correction (AC) algorithms. The goal of this study was to compare the diagnostic accuracy of FDG-PET images of the brain processed according to MR-based AC (MRAC) with that of images obtained using traditional CT-based AC (CTAC).

METHOD AND MATERIALS

IRB approval and informed consent were obtained for this study. All patients referred for clinical FDG-PET/CT exams of the brain were prospectively recruited to undergo an additional FDG-PET acquisition on a Philips Ingenuity PET/MR system. A bootstrap power calculation was used to determine the number of patients required to detect a 10% difference in diagnostic accuracy (power: 0.8). Raw FDG-PET images were processed according to vendor-provided MRAC or CTAC algorithms. Five expert readers were blinded to the method of AC and all other clinical/imaging data. Consensus between readers at unblinded re-review of all data was considered the gold standard. Any potential difference in the accuracy of PET/MR compared to PET/CT was assessed using McNemar's test. Cohen's kappa was calculated to measure agreement between each reader's interpretation of MRAC and CTAC.

RESULTS

The study population comprised 35 patients referred for a diagnosis of epilepsy (mean age: 11y; range: 2-18y), with a paired PET/CT and PET/MR exam. Compared to the reference gold standard, the overall sensitivity (71.6% and 70.2%, p>0.05) and specificity (74.7% and 85.1%, p>0.05) of the blinded interpretation of the PET/MR and PET/CT images, respectively, demonstrated no significant difference. The accuracy of MRAC-processed images did not differ significantly from those obtained using CTAC (74.7% and 76.6%, respectively, p>0.3). Overall, there was good intra-reader agreement between the interpretation of PET/MR and PET/CT (κ range: 0.55-0.78).

CONCLUSION

The accuracy of FDG-PET images generated by an MRAC algorithm was comparable to that of FDG-PET images processed by traditional CTAC. These results further support the use of integrated PET/MR systems in clinical practice.

CLINICAL RELEVANCE/APPLICATION

The evaluation of pediatric brain exams for the diagnosis of epilepsy using PET/MR demonstrated no statistical difference in sensitivity, specificity, or accuracy compared to PET/CT, and support the use of PET/MR in patient management with lower radiation dose.

RC513-12 What is the Optimal Way to Measure Neuroblastoma Response to Chemotherapy?

Wednesday, Dec. 2 11:10AM - 11:20AM Location: S102AB

Participants
Lindsey R. Klingbeil, MD, Cincinnati, OH (*Presenter*) Nothing to Disclose
Andrew T. Trout, MD, Cincinnati, OH (*Abstract Co-Author*) Advisory Board, Koninklijke Philips NV
Alex Towbin, MD, Cincinnati, OH (*Abstract Co-Author*) Author, Reed Elsevier; Consultant, Reed Elsevier; Shareholder, Merge Healthcare Incorporated; Consultant, Guerbet SA; Grant, Guerbet SA
Daniel von Allmen, MD, Cincinnati, OH (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The current recommendation for determining primary neuroblastoma tumor size and response to chemotherapy is to use 3D (anteroposterior, transverse, craniocaudal) measurements. This is in contrast to the 1D measurements recommended in RECIST 1.1 and the 2D measurements recommended for Hodgkin lymphoma. There is little evidence specific to neuroblastoma to show superiority of one measurement technique. The purpose of this study was to assess the correlation between the various measurement methods and actual tumor volume in terms of response assessment.

METHOD AND MATERIALS

We retrospectively analyzed the radiographic data of intermediate and high-risk neuroblastoma patients with either Stage 3 or 4 disease who were diagnosed between 2003 and 2012. Primary tumors were measured in 1D, 2D and 3D at the time of diagnosis and following chemotherapy with 2D and 3D measurements expressed as a product. True tumor volume at each time point was also measured by manual segmentation of the tumor. Tumor response for each measurement method was expressed in terms of a fraction of tumor size at diagnosis. Comparisons were based on Bland-Altman analyses with agreement expressed in terms of correlation coefficients.

RESULTS

Imaging from 34 patients was included in the study with comparison of tumor response to true volumes for 50 1D, 50 2D, and 39 3D measurements. A statistically significant correlation was seen between both the 2D ($p<0.05$) and the 3D ($p<0.01$) measurements and the volumetric method of tumor response assessments with the best correlation ($r=0.47$ versus 0.31) for the 3D measurements. 1D measurements had poor correlation with the volumetric response assessment ($r=0.04$). The mean difference in tumor response relative to volumetric assessment was higher for 2D measurements than 3D measurements (19% ±16% versus 10%±15%).

CONCLUSION

Correlation between single and multiplanar measurements and true tumor volume for assessment of neuroblastoma response to therapy is moderate at best likely reflecting the irregular shape and infiltrative character of these tumors. 3D measurements had the highest correlation with volumetric assessments but may over- or underestimate tumor response by 40%.

CLINICAL RELEVANCE/APPLICATION

Accurately determining the primary tumor response to chemotherapy using imaging is critical for making therapeutic decisions and surgical planning for neuroblastoma 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/

Alex Towbin, MD - 2014 Honored Educator

RC513-13 Evaluation of the Predictive Value of Doppler Ultrasonography in Children with Clinically Suspicious Hepatic Veno-occlusive Disease after Hematopoietic Stem Cell Transplantation

Wednesday, Dec. 2 11:20AM - 11:30AM Location: S102AB

Participants
Ji-Eun Park, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Young Hun Choi, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Hyun Suk Cho, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Yu Jin Kim, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Jung-Eun Cheon, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Woo Sun Kim, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
In-One Kim, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate the predictive value of Doppler ultrasonography in children with clinically suspicious hepatic veno-occlusive disease (VOD) after hematopoietic stem cell transplantation (HSCT).

METHOD AND MATERIALS

From January 2012 to January 2015, among 216 children who underwent HSCT, 56 children underwent Doppler ultrasonography for clinical suspicion of hepatic VOD (M:F = 22:34; mean age, 8.3years; age range 8months-20years). Among 56 patients, fifteen patients were confirmed as having VOD later (VOD group), while 41 patients turned out to have other conditions (acute graft-

versus-host disease, n=10; cytomegalovirus hepatitis, n=4; other virus hepatitis, n=6; aspergilosis, n=3; unrevealed cause, n=18; non-VOD group). Doppler ultrasonography was retrospectively reviewed for the following findings: hepatomegaly, splenomegaly, gall bladder(GB) wall edema, ascites, Doppler spectral parameters of the left portal vein (peak velocity, trough velocity, pulsatile index, flow inversion), Doppler spectral parameters of the left hepatic artery (peak systolic velocity, end systolic velocity, resistance index) and phasicity of the middle hepatic vein. The Doppler US findings were compared between two groups using Student t-test, Chi square test. Multivariate logistic regression was performed to reveal the significant predictor of VOD.

RESULTS

The VOD group showed significantly higher incidences of hepatomegaly (9/15, 60% vs. 10/41, 24%, p=0.016), GB wall edema (9/12, 80% vs. 9/41, 22%, p < 0.001) and ascites (12/15, 80% vs. 9/41, 22%, p < 0.001), relative to the non-VOD group. The peak systolic velocity of the left hepatic artery was significantly higher in VOD patients compared with non-VOD patients (73±33cm/sec vs. 49±21cm/sec, p=0.002). Other findings showed no statistically significant difference between the two groups. Multivariate analysis revealed that only ascites was significantly associated with VOD (ß=0.345).

CONCLUSION

The presence of hepatomegaly, GB wall edema, ascites and increased peak systolic velocity of the hepatic artery were significantly associated with progression to definite VOD in pediatric HSCT patients with clinically suspicious VOD.

CLINICAL RELEVANCE/APPLICATION

Hepatic VOD is one of the most feared complications of HSCT. Our study identified Doppler ultrasonographic findings that could be helpful in predicting progression to definite VOD.

RC513-14 Correlation between Diffusion-weighted Imaging Combined with Conventional Magnetic Resonance Imaging Parameters and Histopathologic Findings in Eyes Primarily Enucleated for Advanced Retinoblastoma: A Retrospective Study

Wednesday, Dec. 2 11:30AM - 11:40AM Location: S102AB

Awards
Trainee Research Prize - Medical Student

Participants
Yanfen Cui, Shanghai, China (*Presenter*) Nothing to Disclose
Dengbin Wang, Shanghai, China (*Abstract Co-Author*) Nothing to Disclose
Huanhuan Liu, Shanghai, China (*Abstract Co-Author*) Nothing to Disclose
Caiyuan Zhang, MD, Shanghai, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

to evaluate the diagnostic accuracy of conventional MR imaging in detecting tumor invasion of intraocular retinoblastoma and to correlate ADC values with high-risk pathological prognostic parameters of retinoblastoma.

METHOD AND MATERIALS

The accuracy of MR imaging in detecting invasion extent of 63 tumors were determined. Furthermore, ADC value with b factors of 0 and 1000 seconds/mm2 were calculated and correlated with high risk pathological prognostic parameters. Additionally, the correlation of Ki-67 expression with ADC value were analysed.

RESULTS

The accuracy of conventional MRI in detecting prelaminar and postlaminar optic nerve invasion was 85.7% , focal and massive choroidal invasion 61.9%, scleral invasion 98.4% and ciliary body invasion was 95.2%. The ADC value of well-differentiated retinoblastoma were significantly different from poorly or undifferentiated tumors (p < 0.002). There was no significant difference in the ADC value between bilateral and unilateral retinoblastomas (P=0.09) and different growth pattern (P=0.74). The ADC value of postlaminar optic nerve invasion has significantly different with no optic nerve invasion (P=0.04). There was significant difference in the ADC of retinoblastoma with or without scleral invasion (P=0.007), but has no difference in chorodial invasion (P=0.629) or ciliary body invasion (P=0.532). Additionally, the ki-67 index was inversely correlated with the ADC value (p < 0.002).

CONCLUSION

Routine MRI has limitations in reliably predicting microscopic infiltration of the retinoblastoma, where ADC correlated well with high-risk pathological prognostic parameters and Ki-67 index for retinoblastoma and may serve as a noninvasive prognostic parameter for assessment of newly diagnosed retinoblastoma.

CLINICAL RELEVANCE/APPLICATION

Routine MRI has limitations in reliably predicting microscopic infiltration of the retinoblastoma, whereas ADC correlated well with high-risk pathological prognostic parameters and Ki-67 index for retinoblastoma and may serve as a noninvasive prognostic parameter for assessment of newly diagnosed retinoblastoma.

RC513-15 Imaging of Tumor Syndromes

Wednesday, Dec. 2 11:40AM - 12:00PM Location: S102AB

Participants
Andrew T. Trout, MD, Cincinnati, OH, (andrew.trout@cchmc.org) (*Presenter*) Advisory Board, Koninklijke Philips NV

LEARNING OBJECTIVES

1) Recognize some of the tumor predisposition syndromes that present in children/young adults. 2) Name the relevant tumors for the discussed syndromes. 3) Implement currently accepted imaging protocols for the discussed syndromes.

ABSTRACT

MSCP42

Case-based Review of Pediatric Radiology (An Interactive Session)

Wednesday, Dec. 2 10:30AM - 12:00PM Location: S406A

NR NM ER PD

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

Participants
Sudha A. Anupindi, MD, Philadelphia, PA (*Director*) Nothing to Disclose

LEARNING OBJECTIVES

1)To apply a systematic approach in the evaluation of pediatric diseases. 2)To identify essential imaging features of various pediatric congenital, musculoskeletal, abdominal and neurological diseases using a multimodality approach. 3) To understand and develop best imaging practice for various pediatric diseases.

ABSTRACT

To apply a systematic approach in the evaluation of pediatric diseases To identify essential imaging features of various pediatric congenital, musculoskeletal, abdominal and neurological diseases using a multimodality approach To understand and develop best imaging practice for various pediatric diseases

Sub-Events

MSCP42A Pediatric Brain Abnormalities

Participants
Manohar M. Shroff, MD, Toronto, ON, (manohar.shroff@sickkids.ca) (*Presenter*) Consultant, Guerbet SA; Consultant, Magellan Health, Inc

LEARNING OBJECTIVES

View learning objectives under main course title.

MSCP42B Pediatric Sport Injuries

Participants
Kirsten Ecklund, MD, Boston, MA, (kirsten.ecklund@childrens.harvard.edu) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

MSCP42C Pediatric Nuclear Medicine Cases

Participants
Ruth Lim, MD, Boston, MA (*Presenter*) Consultant, Alexion Pharmaceuticals, Inc; Officer, New England PET Imaging System

LEARNING OBJECTIVES

View learning objectives under main course title.

SSK11

Molecular Imaging (Staging and Therapy Control)

Wednesday, Dec. 2 10:30AM - 12:00PM Location: S504CD

MI NM OI

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

FDA Discussions may include off-label uses.

Participants
Umar Mahmood, MD, PhD, Charlestown, MA (*Moderator*) Research Grant, Sabik Medical Inc; Advisory Board, Blue Earth Diagnostics Limited;
Suzanne E. Lapi, PhD, Saint Louis, MO (*Moderator*) Research Grant, ImaginAB, Inc

Sub-Events

SSK11-01 Noninvasive Monitoring of Early Antiangiogenic Therapy Response using RGD-conjugated Ultrasmall Superparamagnetic Iron Oxide Nanoparticles in an Orthotopic Human Nasopharyngeal Carcinoma Model

Wednesday, Dec. 2 10:30AM - 10:40AM Location: S504CD

Participants
Yanfen Cui, Shanghai, China (*Presenter*) Nothing to Disclose
Caiyuan Zhang, MD, Shanghai, China (*Abstract Co-Author*) Nothing to Disclose
Huanhuan Liu, Shanghai, China (*Abstract Co-Author*) Nothing to Disclose
Dengbin Wang, Shanghai, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Molecular imaging is merging as a powerful tool for the noninvasive imaging of the biological processes. The purpose of this study was to validate a novel integrin αvβ3-targeted ultrasmall superparamagnetic iron oxide (USPIO) nanoparticles, Fe3O4@PAA-RGD, for its ability to detect tumor angiogenesis and assess the early response of an antiangiogenesis agent Avastin® in an orthotopic human nasopharyngeal carcinoma (NPC) model.

METHOD AND MATERIALS

The specific uptake of Fe3O4@PAA-RGD in HUVECs and CNE-2 Cells was evaluated using Prussian blue staining, transmission electron microscopy (TEM).The ability of Fe3O4@PAA-RGD to noninvasively assess αvβ3 integrin positive vessels in NPC tumor xenografts was evaluated with a 3.0T MR scanner. For the assessment of antiangiogenesis therapy, the mice bearing human NPC tumor xenografts were intraperitoneally injected with Avastin® (n=12) or normal saline (n=12) three times in a week at a dose of 200 μg/mouse .T2* mapping was performed baseline and after 2 and 7 days of treatment.

RESULTS

The specific uptake of the particles was mainly dependent on the interaction between RGD and integrin αvβ3 of HUVEC, which could be competitively inhibited by addition of unbound RGD. The tumor targeting of Fe3O4@PAA-RGD was observed in the orthotopic NPC model, which demonstrates accumulation of nanoparticles exclusively at the neovasculature but not within tumor cells. The vascular accumulation of Fe3O4@PAA-RGD caused significantly higher changes of the R2* value of tumors than observed for unlabelled USPIO. Bevacizumab treatment resulted in a significant reduction of the R2* values compared with the control group both at day2 and day7, confirmed by the immunohistochemistry of MVD after treatment.

CONCLUSION

This study demonstrates that RGD-coupled, PAA-coated USPIOs efficiently label integrin αvβ3expressed on endothelial cells. Furthermore, these molecular MR imaging probes are capable of noninvasive monitoring of the tumor response to bevacizumab therapy at early stages of treatment.

CLINICAL RELEVANCE/APPLICATION

RGD-coupled, PAA-coated USPIOs efficiently label integrin αvβ3expressed on endothelial cells. Furthermore, these molecular MR imaging probes are capable of noninvasive monitoring of the tumor response to bevacizumab therapy at early stages of treatment.

SSK11-02 Point of Care Assessment of Melanoma Tumor Signaling and Metastatic Burden from μNMR Analysis of Tumor Fine Needle Aspirates and Peripheral Blood

Wednesday, Dec. 2 10:40AM - 10:50AM Location: S504CD

Participants
Michael S. Gee, MD, PhD, Jamaica Plain, MA (*Presenter*) Nothing to Disclose
Arezou Ghazani, PhD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Hakho Lee, PhD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Ralph Weissleder, MD, PhD, Boston, MA (*Abstract Co-Author*) Investor, T2 Biosystems, Inc

PURPOSE

To use μNMR technology for molecular profiling of tumor fine needle aspirates and peripheral blood of melanoma patients, in order to assess BRAF signaling compared with genetic reference and metastatic burden compared with imaging reference.

METHOD AND MATERIALS

μNMR in vitro assessment of expression of melanocyte (MelanA, HMB45) and MAP kinase signaling (pERK, pS6K) molecules was

performed in human cell lines on a miniaturized µNMR device as described (JB Haun, Sci Transl Med 2011) using nanoparticle-conjugated antibodies. Clinical µNMR validation was performed in an IRB-approved study of melanoma patients scheduled for biopsy of suspected metastasis, who also underwent tumor FNA and peripheral blood sampling for µNMR. Tumor FNA specimens were assessed for pERK and pS6K, while peripheral blood was evaluated for circulating tumor cells (CTC) as described (AA Ghazani, Neoplasia 2012). Reference standards for µNMR results included Western blot, BRAF genetic analysis, and metastatic burden on clinical imaging obtained near the time of biopsy. Student's t-test was used to assess for statistical significance.

RESULTS

µNMR in vitro analysis showed increased expression of melanocyte markers MART1 and HMB45 in human melanoma cell lines compared with nonmelanoma cells (P<0.0001). Expression of MAP kinase targets pERK and pS6K was significantly increased in BRAF mutant compared with BRAF WT melanoma cells (P < 0.01), with levels confirmed by Western blot. Ten patients in the clinical study included 5 BRAF wild-type and 5 BRAF V600E mutant melanoma patients. µNMR analysis of tumor FNA samples showed increased pERK (41.0 +/- 8.6) and pS6K (34.4 +/- 15.5) levels in BRAF mutant compared with BRAF WT (24.8 +/- 15.0 and 23.5 +/- 9.0; P= 0.009 and 0.13 respectively) melanomas. µNMR blood CTC level was significantly increased in patients with multiple metastases on imaging (90.3 +/- 57.9) compared with those with 0-1 lesions (39.3 +/- 31.5; P = 0.045). CTC threshold >60 was associated with significantly higher RECIST metastatic score on imaging and had 80% acc/83% sens/75% spec for multiple metastases.

CONCLUSION

µNMR technology provides point of care evaluation of tumor signaling in patients with cancer in a minimally invasive manner. µNMR-based blood CTC level is significantly associated with metastatic burden on imaging.

CLINICAL RELEVANCE/APPLICATION

Molecular tracking of metastatic disease is possible by serial sampling of tumor cells and peripheral blood.

SSK11-03 Optical Molecular Imaging of Mesenchymal-Epithelial Transition Factor (c-Met) for Enhanced Detection and Characterization of Primary and Metastatic Hepatic Tumors

Wednesday, Dec. 2 10:50AM - 11:00AM Location: S504CD

Awards
Trainee Research Prize - Resident

Participants
Shadi A. Esfahani, MD, MPH, Boston, MA (*Presenter*) Nothing to Disclose
Pedram Heidari, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Umar Mahmood, MD, PhD, Charlestown, MA (*Abstract Co-Author*) Research Grant, Sabik Medical Inc; Advisory Board, Blue Earth Diagnostics Limited;

PURPOSE

Primary liver cancer as well as metastatic liver disease, predominantly from colorectal cancer (CRC) are major causes of cancer death. The success of liver cancer therapy depends on accurate diagnosis at the time of biopsy and efficiency of cytoreductive surgery. c-Met is a proto-oncogene overexpressed in 74-90 % of hepatocellular carcinoma (HCC) and CRC. We assessed whether optical imaging of c-Met using a targeted fluorescence probe, can be used to delineate and characterize the liver tumors and be effectively employed for intraoperative interventions and personalized therapy.

METHOD AND MATERIALS

A modified cyanine 5-tagged peptide with high affinity to c-Met was used. Cell binding assay was performed by incubation of human HCC cells (HepG2,Huh-7), CRC cells (HT-29), and cMET-negative cells (LNCaP) with probe ± HGF. Fluorescence signal was correlated to c-Met expression level. Focal models of primary and metastatic liver cancer were generated by injection of HepG2, Huh-7, and HT-29 in hepatic subcapsular space of nude mice (n=24). Near infrared fluorescence (NIRF) imaging was performed over 8 h after probe injection. Uptake in liver and tumor, and tumor to background ratio (TBR) were calculated. Probe biodistribution was assessed by measuring NIRF signal in multiple organs. IHC evaluation of c-Met expression in human CRCs and HCCs was performed using tissue arrays.

RESULTS

Incubation of cells with probe showed enhanced fluorescence signal in c-Met expressing cells compared to LNCaP, and strong correlation between signal and c-MET expression level (R2=0.99,p<0.0001). NIRF imaging showed high uptake in subcapsularly grown tumors and greater signal compared to the liver over 8 h; TBR reached a peak of 5.46±0.46 in Huh-7, 3.55±0.38 in HepG2 and 15.93±0.61 in HT-29, 4 h post-injection. IHC of tissue arrays confirmed c-Met overexpression in 86% of CRC and 84.9% of HCC cores.

CONCLUSION

High TBR achieved in our tumor models and overexpression of c-Met in a majority of human HCC and metastatic CRC tumors suggest that optical imaging of c-Met is a promising approach for accurate delineation and characterization of liver tumors. This is a translatable advancement for intraoperative image-guided interventions and personalized treatment.

CLINICAL RELEVANCE/APPLICATION

c-MET receptor imaging helps in precise delineation and in-situ characterization of primary hepatic tumors and metastases of other cancers to the liver.

SSK11-04 Volumetric Molecular Ultrasound Imaging of Tumor Angiogenesis: Intra-Animal Comparison with Volumetric Dynamic Contrast-Enhanced Imaging

Wednesday, Dec. 2 11:00AM - 11:10AM Location: S504CD

Participants
Huaijun Wang, MD, PhD, Stanford, CA (*Presenter*) Nothing to Disclose
Dimitre Hristov, PhD, Stanford, CA (*Abstract Co-Author*) Research Grant, Koninklijke Philips NV; Partner, SoniTrack Systems, Inc

Lu Tian, Stanford, CA (*Abstract Co-Author*) Nothing to Disclose
Juergen K. Willmann, MD, Stanford, CA (*Abstract Co-Author*) Research Consultant, Bracco Group; Research Consultant, Triple Ring Technologies, Inc; Research Grant, Siemens AG; Research Grant, Bracco Group; Research Grant, Koninklijke Philips NV; Research Grant, General Electric Company

PURPOSE

To perform an intra-animal comparison between 3D ultrasound molecular imaging (USMI) using clinical grade vascular endothelial growth factor receptor 2 (VEGFR2)-targeted contrast microbubble (MBVEGFR2) and 3D dynamic contrast-enhanced (DCE)-US for assessing tumor angiogenesis and anti-angiogenic treatment effects in a murine model of human colon cancer.

METHOD AND MATERIALS

Subcutaneous human colon cancers were induced in 19 mice and randomized to either anti-angiogenic treatment (n=11; i.v. single dose of anti-angiogenic agent, bevacizumab at 10mg/kg) or vehicle treatment (n=8; saline). 3D US imaging was performed with a clinical system (IU22 xMATRIX; Philips) and a matrix array transducer (X6-1; 3.2MHz) using 2 techniques: 1) USMI was performed 4min after i.v. injection of 5×107 MBVEGFR2; and 2) DCE-US was performed with destruction-replenishment approach by constantly infusing non-targeted microbubbles at 40µL/min. VEGFR2-targeted signal intensity (SI) was quantified from USMI and 2 perfusion parameters, relative blood volume (rBV) and flow (rBF) were calculated from DCE-US. VEGFR2 expression levels and the percent area of blood vessels (PABV) were assessed ex vivo using immunofluorescence (IF) and correlated with correponding in vivo US parameters.

RESULTS

Both 3D US imaging techniques showed strong anti-angiogenic treatment effects. All 3 parameters including VEGFR2-targeted SI (58%, P=0.002), rBV (52%, P=0.002) and rBF (38%, P=0.02) significantly decreased following anti-angiogenic treatment compared to controls. IF showed significantly diminished VEGFR2 expression (P=0.03) and PABV (P=0.03) in treated tumors, while no significant change was observed in control tumors. SI was highly correlated with VEGFR2 expression (r=0.95, P=0.001), and rBV (r=0.71, P=0.08) and rBF (r=0.82, P=0.02) showed good correlation with PABV.

CONCLUSION

Both 3D USMI and 3D DCE-US provide complementary in vivo information on anti-angiogenic treatment effects and allow accurate quantification of tumor angiogenesis in human colon cancer xenografts compared to ex vivo reference gold standard techniques.

CLINICAL RELEVANCE/APPLICATION

3D imaging capabilities may further expand the future clinical role of both USMI and DCE-US in cancer imaging.

SSK11-05 Accurate Prediction of Nodal Status in Preoperative Patients with Thyroid Carcinoma Using Next-Gen Nanoparticle

Wednesday, Dec. 2 11:10AM - 11:20AM Location: S504CD

Participants
Aoife Kilcoyne, MBBCh, Boston, MA (*Presenter*) Nothing to Disclose
Roy Phitayakorn, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Gilbert H. Daniels, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Sareh Parangi, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Gregory Randolph, Bosotn, MA (*Abstract Co-Author*) Nothing to Disclose
Mukesh G. Harisinghani, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The goal of the study is to test the ability to image lymph node metastases in thyroid cancer by a novel MRI imaging agent the ferromagnetic nanoparticle Ferumoxytol (Feraheme; AMAG Pharmaceuticals, Lexington, MA), which has residual magnetic properties that are detectable by MRI. These carboxymethyl dextran-coated iron oxide ((FeO)1 - n(Fe2O3)n) nanoparticles slowly extravasate and travel through the lymphatic system to lymph nodes. The particles are subsequently internalized into macrophages, presumably through macropinocytosis. Prior studies using this approach with other malignancies (such as prostate cancer) demonstrated abnormal nanoparticle accumulation patterns which are detectable by MRI. We prospectively enrolled 12 patients with confirmed metastatic thryoid carcinoma (3 medullary, 9 papillary) undergoing surgery and compared preoperative MRI appearance of lymph nodes to post-operative histopathologic analysis. The study group consisted of 5 male and 7 female patients, with an mean of 34 nodes resected (range from 1 - 135).

METHOD AND MATERIALS

This exploratory study was performed as a prospective, single-dose pilot study and was approved by the Institutional Review Board. All patients with known thyroid cancer who were scheduled for surgical resection were eligible for enrollment in this study. Exclusion criteria included: age < 18, history of iron overload or known allergy to parenteral iron.

RESULTS

)We demonstrated 76.92% sensitivity and 95.74% specificity, 90.91% PPV (CI 70.84% to 98.88%) NPV 88.24% (76.13% to 95.56%) for the detection of central nodes. There was 82.76% sensitivity and 91.78% specificity, PPV 61.54% (CI 49.83% to 72.34%) NPV 97.1% (CI 94.73% to 98.6%) for the detection of peripheral nodes.

CONCLUSION

Lymph node metastases correlate with recurrent disease in patients with thyroid carcinoma. We currently have limited ability to image central lymph nodes prior to thyroidectomy in patients with thyroid carcinoma. This preliminary study suggests that MRI imaging following nanoparticle injection is a potentially worthwhile imaging modality. Additional studies are necessary comparing this with other established methods.

CLINICAL RELEVANCE/APPLICATION

Our study has demonstrated that nanoparticle-enhanced MRI is an accurate and safe method for pre-operatively detecting nodal metastases in patients with thyroid carcinoma.

SSK11-06 Chemical Exchange Saturation Transfer (CEST) Imaging: Comparison of Capability for Differentiation of Malignant from Benign Pulmonary Nodules and/ or Masses with FDG-PET/CT

Wednesday, Dec. 2 11:20AM - 11:30AM Location: S504CD

Participants
Yoshiharu Ohno, MD, PhD, Kobe, Japan (*Presenter*) Research Grant, Toshiba Corporation; Research Grant, Koninklijke Philips NV; Research Grant, Bayer AG; Research Grant, DAIICHI SANKYO Group; Research Grant, Eisai Co, Ltd; Research Grant, Terumo Corporation; Research Grant, Fuji Yakuhin Co, Ltd; Research Grant, FUJIFILM Holdings Corporation; Research Grant, Guerbet SA;
Masao Yui, Otawara, Japan (*Abstract Co-Author*) Employee, Toshiba Corporation
Cheng Ouyang, Vernon Hills, IL (*Abstract Co-Author*) Employee, Toshiba Corporation
Mitsue Miyazaki, PhD, Vernon Hills, IL (*Abstract Co-Author*) Employee, Toshiba Corporation
Shinichiro Seki, Kobe, Japan (*Abstract Co-Author*) Nothing to Disclose
Hisanobu Koyama, MD, PhD, Kobe, Japan (*Abstract Co-Author*) Nothing to Disclose
Takeshi Yoshikawa, MD, Kobe, Japan (*Abstract Co-Author*) Research Grant, Toshiba Corporation
Sumiaki Matsumoto, MD, PhD, Kobe, Japan (*Abstract Co-Author*) Research Grant, Toshiba Corporation;
Katsusuke Kyotani, RT, Kobe, Japan (*Abstract Co-Author*) Nothing to Disclose
Kazuro 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

PURPOSE

To directly and prospectively compare the capability of chemical exchange saturation transfer (CEST) imaging targeted to amide groups (-NH) for differentiation of malignant from benign pulmonary nodules and/ or masses with FDG-PET/CT.

METHOD AND MATERIALS

Thirty-six consecutive patients (26 men and 10 women; mean age 67 years) with pulmonary nodules and/ or masses underwent CEST imaging, FDG-PET/CT and pathological and/or follow-up examinations. According to final diagnoses, all lesions were divided into malignant (n=26) and benign (n=10) groups. To obtain CEST imaging data in each subject, respiratory-synchronized fast advanced spin-echo images were conducted following a series of magnetization transfer (MT) pulses. Then, magnetization transfer ratio asymmetry (MTRasym) was calculated from z-spectra at 3.5ppm in each pixel, and MTRasym map was computationally generated. To evaluate the capability for differentiation between two groups at each lesion, MTRasym and SUVmax were assessed by ROI measurements. Then, MTRasym was statistically correlated with SUVmax. To compare each index between two groups, Student's t-test was performed. Then, ROC-based positive test was performed to determine each feasible threshold value for differentiation of two groups. Finally, sensitivity, specificity and accuracy were compared each other by McNemar's test.

RESULTS

MTRasym had no significant correlation with SUVmax (p=0.10). Mean MTRasym (0.1±5.5%) and SUVmax (3.0±0.8) of malignant group were significantly higher than those of benign group (MTRasym: -4.2±4.4%, p=0.03; SUVmax: 2.5±0.5, p=0.04). When applied each feasible threshold value, sensitivity (SE: 80.8 [21/26] %), specificity (SP: 70.0 [7/10] %) and accuracy (77.8 [28/36] %) of MTRasym had no significant difference with those of SUVmax (SE: 69.2 [18/26] %, p=0.25; SP: 60.0 [6/10] %, p=1.0; AC: 66.7 [24/36] %, p=0.13).

CONCLUSION

CEST imaging is considered at least as valuable as FDG-PET/CT for differentiation of malignant from benign pulmonary nodules and/ or masses.

CLINICAL RELEVANCE/APPLICATION

CEST imaging is considered at least as valuable as FDG-PET/CT for differentiation of malignant from benign pulmonary nodules and/ or masses.

SSK11-07 Radiofrequency Hyperthermia (RFH)-Enhanced Herpes Simplex Virus-Thymidine Kinase/Ganciclovir (HSV-TK/GCV) Gene Therapy of Hepatocellular Carcinoma: Monitored by Ultrasound and Optical Imaging

Wednesday, Dec. 2 11:30AM - 11:40AM Location: S504CD

Awards
Molecular Imaging Travel Award

Participants
Jianfeng Wang, MD, Seattle, WA (*Presenter*) Nothing to Disclose
Feng Zhang, MD, Seattle, WA (*Abstract Co-Author*) Nothing to Disclose
Yaoping Shi, MD, Seattle, WA (*Abstract Co-Author*) Nothing to Disclose
Zhibin Bai, Seattle, WA (*Abstract Co-Author*) Nothing to Disclose
Long-Hua Qiu, Shanghai, China (*Abstract Co-Author*) Nothing to Disclose
Renyou Zhai, MD, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Xiaoming Yang, MD, PhD, Seattle, WA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To determine the possibility of using radiofrequency hyperthermia (RFH) to enhance therapeutic effect of herpes simplex virus thymidine kinase/ganciclovir (HSV-TK/GCV) on hepatocellular carcinoma (HCC).

METHOD AND MATERIALS

Human HCC cells (HepG2) were first transfected with lentivirus/luciferase. For both in-vitro confirmation and in-vivo validation, Luciferase-labeled HCC cells and HCC tumor xenografts on mice received different treatments: (i) combination therapy of intratumoral HSV-TK/GCV-mediated gene therapy plus MR imaging-heating-guidewire (MRIHG)-mediated RFH; (ii) gene therapy only; (iii) RFH only; and (iv) phosphate-buffered saline (PBS) as control. Cell proliferation was quantified by MTS assay. Tumor size and signal changes were monitored by ultrasound imaging and optical imaging before and at days 7 and 14 after treatments, which were

correlated with subsequent histology.

RESULTS

Of in vitro experiments, MTS assay demonstrated the lowest cell proliferation in combination therapy group compared with those in three control groups (29±6% VS 56±9%, 93±4%, and 100±5%, p<0.05). Of in vivo experiments, ultrasound imaging showed smaller relative tumor volume in combination therapy group than those in three control groups (0.74±0.19 VS 1.79±0.24, 3.14±0.49 and 3.22±0.52, p<0.05). Optical imaging demonstrated significant decrease of bioluminescence signals of tumors in the combination therapy group, compared to those in three control groups (1.2±0.1 VS 1.9±0.2% VS 3.3±0.6% VS 3.5±0.4%, p<0.05)(Figure). These imaging findings were correlated well with histologic confirmation.

CONCLUSION

RF-hyperthermia can enhance HSV-TK/GCV-mediated gene therapy of hepatocellular cancer, which may open new avenues for efficient management of hepatocellular carcinoma using MR/RF hyperthermia-integrated interventional gene therapy.

CLINICAL RELEVANCE/APPLICATION

RF-hyperthermia can enhance HSV-TK/GCV-mediated gene therapy of hepatocellular cancer.

SSK11-08 Identification of a Prognostic PET-miRNA Radiogenomic Signature Associated with the mir-200 Family

Wednesday, Dec. 2 11:40AM - 11:50AM Location: S504CD

Awards
Molecular Imaging Travel Award

Participants
Shota Yamamoto, MD, Los Angeles, CA (*Presenter*) Nothing to Disclose
Christopher W. Migdal, Petaluma, CA (*Abstract Co-Author*) Nothing to Disclose
Ronald L. Korn, MD, PhD, Scottsdale, AZ (*Abstract Co-Author*) Chief Medical Officer, Imaging Endpoints; Founder, Imaging Endpoints; Shareholder, Imaging Endpoints
Michael B. Gotway, MD, Scottsdale, AZ (*Abstract Co-Author*) Nothing to Disclose
Neema Jamshidi, MD, PhD, Los Angeles, CA (*Abstract Co-Author*) Nothing to Disclose
Michael D. Kuo, MD, Los Angeles, CA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To use radiogenomic analysis to define and contextualize a prognostic microRNA signature in non-small-cell lung carcinoma (NSCLC).

METHOD AND MATERIALS

Using a known prognostic PET signature, differential expression analysis using linear models of microarray data (limma) was performed on 10 NSCLC (adenocarcinoma ad squamous cell carcinoma) patients with Positron Emission Tomography (PET) and microRNA (miRNA) expression data to identify potential prognostic PET associated radiogenomic signatures. The same signature candidate was selected and analyzed on a public dataset of 105 patients with clinical outcome and miRNA expression data to confirm its prognostic value. Furthermore, the PET phenotype was validated in an independent dataset with PET and outcomes data in 21 patients.

RESULTS

Significant correlations between high SUV max lesion normalized to the SUV mean liver and the downregulation of hsa-mir-200b and hsa-miR-149 were identified (p<0.05). Low expression of the mir-200 family is a well known marker for aggressive lung cancer behavior and chemoresistance.Testing of the miRNA surrogate for SUV signature in the PET-miRNA validation was validated in the public dataset as a predictor of survival (P=0.04). The PET trait also stratified patient outcome in an independent dataset (p=0.048).

CONCLUSION

Radiogenomic analysis allows integration of multiple independent datasets thereby providing not only molecular biological context behind a given biomarker, but also enabling robust validation of biomarkers that is often not feasible with existing approaches.

CLINICAL RELEVANCE/APPLICATION

This approach allows integration of independent datasets thereby providing biological context behind a given biomarker in a cost effective way.

SSK11-09 Differential Receptor Tyrosine Kinase PET Imaging in Response to Targeted Inhibition

Wednesday, Dec. 2 11:50AM - 12:00PM Location: S504CD

Awards
Trainee Research Prize - Resident

Participants
Eric Wehrenberg-Klee, MD, Boston, MA (*Presenter*) Nothing to Disclose
Nafize S. Turker, PhD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Pedram Heidari, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Mauri Scaltriti, PhD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Umar Mahmood, MD, PhD, Charlestown, MA (*Abstract Co-Author*) Research Grant, Sabik Medical Inc; Advisory Board, Blue Earth Diagnostics Limited;

PURPOSE

The targeted AKT inhibitor GDC-0068 shows promise for the treatment of triple-negative breast cancer (TNBC). Resistance to AKT inhibition is mediated through upregulation of the receptor tyrosine kinases (RTK) EGFR and HER3, however the profile of upregulation differs across cell lines, and may be predictive of treatment response. We sought to noninvasively image these

expression changes for the purpose of therapeutic guidance.

METHOD AND MATERIALS

64Cu-DOTA-cetuximab F(ab´)2 and 64Cu-DOTA-HER3 F(ab´)2 were prepared and probe affinity for their targets assessed. The TNBC cell lines MDMBA468 and HCC70 were treated with the AKT inhibitor GDC-0068 for one day at a range of concentrations. Following treatment, uptake of EGFR probe or HER3 probe was assessed, and results compared to protein expression changes of EGFR or HER3, respectively, as assessed by Western blot. MDAMB468 mice were then treated with GDC-0068 or control for 2 days. After treatment, mice were imaged with either 64Cu-DOTA-EGFR F(ab´)2 or 64Cu-DOTA-HER3 F(ab´)2 to assess changes in EGFR or HER3 expression, respectively.

RESULTS

Treatment of the TNBC cell lines MDAMB468 and HCC70 with GDC-0068 resulted in increased EGFR Probe uptake of 6% and 88% respectively. Interrogation of the same cell lines with HER3 Probe demonstrated uptake changes of 74% and 102%. These findings correlate closely to changes in protein expression as assessed by Western blot. MDAMB468 mouse xenografts treated with control or AKT inhibitor for two days and then imaged demonstrate no significant change in SUVmean of EGFR PET Probe (0.48 vs. 0.53, $p=0.11$), however demonstrate a significant change in SUVmean of HER3 PET Probe (0.35 vs 0.73, $p<0.01$).

CONCLUSION

TNBC resistance to AKT inhibition can be mediated through increased RTK expression in a pattern that differs across cell lines and patient tumors. We demonstrate that the differential change in RTK expression can be noninvasively assessed, demonstrating in a model of TNBC that while imaged EGFR expression does not change, imaged HER3 expression increases by 108%. These noninvasively assessed differential changes in RTK expression may inform subsequent therapeutic choices.

CLINICAL RELEVANCE/APPLICATION

The pattern of RTK expression change induced by AKT inhibition is not known prior to treatment. RTK PET imaging may allow for noninvasive assessment of these changes to optimize therapeutic regimens.

NMS-WEA

Nuclear Medicine Wednesday Poster Discussions

Wednesday, Dec. 2 12:15PM - 12:45PM Location: S503AB

NM

AMA PRA Category 1 Credit ™: .50

FDA Discussions may include off-label uses.

Participants
Farrokh Dehdashti, MD, Saint Louis, MO (*Moderator*) Nothing to Disclose

Sub-Events

NM228-SD-WEA7 Alpha7 Nicotinic Receptor Imaging Using a New Fixation-free PET System

Station #7

Participants
Etsuji Yoshikawa, BA, Hamamatsu, Japan (*Presenter*) Employee, Hamamatsu Photonics KK
Ichiro Ando, Hamamatsu, Japan (*Abstract Co-Author*) Employee, Hamamatsu Photonics KK
Tsuyoshi Kosugi, Hamamatsu, Japan (*Abstract Co-Author*) Employee, Hamamatsu Photonics KK
Akihiro Kakimoto, Hamamatsu, Japan (*Abstract Co-Author*) Employee, Hamamatsu Photonics KK
Takashi Isobe, Hamamatsu, Japan (*Abstract Co-Author*) Employee, Hamamatsu Photonics KK
Kibou Ote, Hamamatsu, Japan (*Abstract Co-Author*) Employee, Hamamatsu Photonics KK
Hiroyuki Okada, PhD, Hamakita City, Japan (*Abstract Co-Author*) Employee, Hamamatsu Photonics KK
Yasuomi Ouchi, Hamamatsu, Japan (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

In general, brain PET measurement needs a firm head fixation during scan. The application to dementia patients entails a tremendous lookout for them during scans due to their restlessness. Since we developed a fixation-free PET system, we evaluated the quality of PET images of alpha7 nicotinic receptor (nAChR) in patients with Alzheimer's disease (AD) by focusing on the atrophy-prone brain regions in AD.

METHOD AND MATERIALS

The current study was approved by the ethics committee of the university. The examinee wears a head-cap with four LED markers, the locations of which are tracked every four milliseconds by two high-speed cameras with intelligent vision chips on the back of the scanner (HAMAMATSU Brain PET camera, HITS-655000). The list-mode data corrected for the head movement using the Quaternion algorithm are reconstructed by a DRAMA method. Using this system, we performed a 60-min duration PET scan for alpha7 nAChR binding using [11C]Me-QAA under no head constraint. We performed PET scans for 20 healthy subjects and 15 AD patients, and we examined the accuracy of the time activity curves of the tracer during the measurement with and without motion corrections, and evaluated changes in alpha7 nAChR binding in AD patients.

RESULTS

During scans, the maximal deviations of the head in x, y, z directions were 2.03, 4.22, 4.63mm respectively in healthy subjects, and 24.06, 53.27, 56.13mm in the patients. Using our correction method, these deviations were completely corrected to the original position, which allowed between-group comparisons accurately and generated a significant reduction in alpha7 nAChR globally in the AD brain.

CONCLUSION

This fixation-free PET scan enables to depict neuroreceptor changes in the brains of dementia patients who are generally difficult to stay put during scans. After correction of 3 dimensional motions of the head by this technique, we were able to show reduced density of alpha7 nAChR in the patient group, suggesting that global alpha7 nAChR dysfunction is pathophysiologically important in AD.

CLINICAL RELEVANCE/APPLICATION

This system helps illustrate accurately the brain physiology of not only quiet but restless neuropsychiatric patients.

NM229-SD-WEA8 Grading Meningioma: A Multi-modal Approach Using Thallium-SPECT, FDG-PET and Diffusion Imaging at 3T MRI

Station #8

Participants
Sachi Okuchi, MD, Kyoto, Japan (*Presenter*) Nothing to Disclose
Tomohisa Okada, MD, PhD, Kyoto, Japan (*Abstract Co-Author*) Nothing to Disclose
Akira Yamamoto, MD, PhD, Kyoto, Japan (*Abstract Co-Author*) Nothing to Disclose
Mitsunori Kanagaki, MD, PhD, Kyoto, Japan (*Abstract Co-Author*) Nothing to Disclose
Yasutaka Fushimi, MD, PhD, Kyoto, Japan (*Abstract Co-Author*) Nothing to Disclose
Tsutomu Okada, MD, Kyoto, Japan (*Abstract Co-Author*) Nothing to Disclose
Moritaka Yamauchi, Kyoto, Japan (*Abstract Co-Author*) Nothing to Disclose
Satoshi Nakajima, MD, Kyoto, Japan (*Abstract Co-Author*) Nothing to Disclose
Yoshiki Arakawa, Kyoto, Japan (*Abstract Co-Author*) Nothing to Disclose
Masahiro Tanji, Kyoto, Japan (*Abstract Co-Author*) Nothing to Disclose
Susumu Miyamoto, MD, PhD, Kyoto, Japan (*Abstract Co-Author*) Nothing to Disclose
Kaori Togashi, MD, PhD, Kyoto, Japan (*Abstract Co-Author*) Research Grant, Bayer AG Research Grant, DAIICHI SANKYO Group

Research Grant, Eisai Co, Ltd Research Grant, FUJIFILM Holdings Corporation Research Grant, Nihon Medi-Physics Co, Ltd Research Grant, Shimadzu Corporation Research Grant, Toshiba Corporation Research Grant, Covidien AG

PURPOSE

To make multivariate analysis of fluorine-18 fluorodeoxyglucose (FDG)-PET, thallium-201 (Tl)-SPECT and MRI for grading meningioma.

METHOD AND MATERIALS

This retrospective study was approved by the institutional review board. In the hospital information system, 75 patients (25 males and 50 females) who had FDG-PET, Tl-SPECT and MRI preoperative examinations were found with histopathologic diagnosis of meningioma. The maximum FDG uptake values of the tumors were measured, and they were standardized to the whole body (SUVmax) and normalized as gray matter ratio (SUVRmax). Mean and maximum Tl uptake ratio (TURmean, TURmax) of the tumors were measured and normalized as ratios to those of the contralateral normal brain. Minimum, mean, and max ADC values (ADCmin, ADCmean, ADCmax) were derived from diffusion imaging at 3T MRI using ROIs at solid areas. Receiver-operating characteristic (ROC) curve analyses of the 7quantitative values and multivariate analysis were conducted to investigate grading capability of the meningiomas. Correlation coefficients were calculated between these indexes and Ki-67.

RESULTS

Pathologically, 63 meningiomas were classified as grade I (low-grade), and 12 were grade II or III (high-grade). In 4 indexes of FDG-PET and Tl-SPECT, significant difference was observed between low- and high-grade meningiomas ($p<0.05$), but in 3indexes of ADC, no difference was observed. Area under the curves of ROC curve analyses were 0.783 and 0.768 (SUVmax, SUVRmax), 0.819 and 0.868 (TURmean, max), 0.521, 0.601 and 0.598 (ADCmin, mean, max). Their sensitivity and specificity were 50.0-100% and 55.6-90.5%, respectively. Multivariate analysis showed that sequential application of TURmax > 9.31 and SUVmax > 8.65 correctly graded 67 cases (89.3%). Correlation of the 4 indexes of FDG-PET and Tl-SPECT to Ki-67 was statistically significant, but coefficients were relatively low (0.280 to 0.451). Correlation of ADC to Ki67 wasn't significant.

CONCLUSION

Tl-SPECT and FDG-PET have higher diagnostic capability of meningioma grades comparable to diffusion imaging. Tl-SPECT and FDG-PET are needed for pre-surgical planning of meningioma.

CLINICAL RELEVANCE/APPLICATION

Pathologic grades of meningiomas were evaluated using multimodal methods of FDG-PET, Tl-SPECT and MRI to facilitate preoperative grading for better prognosis.

NM231-SD-WEA10 Prognostic Importance of 11C-acetate and 18F-FDG PET/CT in HCC Patients Treated by Y90-SIRT

Station #10

Participants
Sirong Chen, Hong Kong, Hong Kong (*Presenter*) Nothing to Disclose
William Cheung, Hong Kong, Hong Kong (*Abstract Co-Author*) Nothing to Disclose
Wai Tong Leung, Hong Kong, Hong Kong (*Abstract Co-Author*) Nothing to Disclose
Yim Lung Leung, Hong Kong, Hong Kong (*Abstract Co-Author*) Nothing to Disclose
Thomas K. Cheng, MBBS, Hong Kong, Hong Kong (*Abstract Co-Author*) Nothing to Disclose
Ka Nin Wong, Hong Kong, Hong Kong (*Abstract Co-Author*) Nothing to Disclose
Chi Lai Ho, Hong Kong, Hong Kong (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Selective intrahepatic radionuclide therapy (SIRT) with Yttrium-90-microspheres (Y90) is increasingly used for palliative treatment of inoperable HCC. 18F-FDG (FDG) PET/CT is usually not part of this work up because of its high false negative rate for this tumor. We aim to prospectively evaluate the prognostic role of 11C-acetate (ACT) & FDG PET/CT for Y90-SIRT in HCC patients.

METHOD AND MATERIALS

HCC patients of BCLC stage B/C with <4% extrahepatic shunting on 99mTc-MAA SPECT/CT were qualified for Y90-SIRT. They first underwent baseline ACT & FDG PET/CT for assessment of 2 pretreatment metabolic parameters: differential tracer avidities (reflection of tumor grade/aggressiveness) and metabolic tumor burden (MTB=lesion SUVmean×lesion volume). Post-treatment PET/CT was performed ~2 mo after SIRT to evaluate the response in terms of reduction in MTB. Follow-up endpoint was at 2 y or till death within 2 y. KM univariate analysis was performed on the following parameters: age, BCLC stage, MTB, HCC avidity for ACT/FDG (tumor grade/aggressiveness).

RESULTS

16 patients (M:16; mean age=59.6±16.8 y; stage B:7, stage C:9) were treated by Y90-SIRT (mean dose=2.41±0.64 GBq). On baseline PET/CT, 7/16 patients had HCC with primary tracer avidity for ACT and 9/16 for FDG. On follow-up PET/CT, all patients showed MTB reduction ranging from 18-100%. Among the 4 parameters on baseline PET/CT (HCC avidity for ACT/FDG, MTB of ACT/FDG), HCC avidity for ACT was the only parameter having significant correlation with >70% MTB reduction (Coefficient=0.61, $P<0.05$), indicating that tumor grade is the more important factor for predicting response. 8/16 patients died within 2 y. Univariate analysis identified tracer avidity as the only significant predictor for 2-y OS. The median OS for HCC patients avid by ACT or FDG was >2 y (alive) vs 11 mo ($P<0.05$). The latter OS is quite similar to the previously published data with FDG as the main tracer. Patients with stage B/C showed no significant difference for 2-y OS (median OS:>2 y vs 23 mo, $P>0.05$).

CONCLUSION

ACT PET/CT is a surrogate imaging marker that may help to select HCC patients with potential for better response to Y90-SIRT and predicts a better 2-y OS. Implementation of this imaging for work-up warrants recruitment of a larger study.

CLINICAL RELEVANCE/APPLICATION

Pretreatment ACT PET/CT has important value in patient selection and predicting favorable prognosis in Y90-SIRT planning for HCC patients.

NM232-SD-WEA11 Assessment of Vasodilatory Response to Dipyridamole in Patients with Liver Failure Undergoing 82Rb-PET/CT Myocardial Perfusion Imaging Studies

Station #11

Awards
Trainee Research Prize - Medical Student

Participants
Monique Raubenheimer, Edmonton, AB (*Presenter*) Nothing to Disclose
Jonathan T. Abele, MD, Edmonton, AB (*Abstract Co-Author*) Nothing to Disclose
Vincent Bain, MD, Edmonton, AB (*Abstract Co-Author*) Nothing to Disclose
Lucille Lalonde, MD, Edmonton, AB (*Abstract Co-Author*) Nothing to Disclose
Richard A. Coulden, MD, Edmonton, AB (*Abstract Co-Author*) Nothing to Disclose
Naji Al Hulaimi, MD, Edmonton, AB (*Abstract Co-Author*) Nothing to Disclose
Robert Warshawski, MD, Edmonton, AB (*Abstract Co-Author*) Nothing to Disclose
Randall Williams, MD, Edmonton, AB (*Abstract Co-Author*) Nothing to Disclose
Robert Dekemp, PhD, Ottawa, ON (*Abstract Co-Author*) Royalties, FlowQuant; Royalties, Jubilant Life Sciences Ltd; Consultant, Jubilant Life Sciences Ltd
Robert Beanlands, Ottawa, ON (*Abstract Co-Author*) Nothing to Disclose
Ran Klein, PhD, Ottawa, ON (*Abstract Co-Author*) Consultant, Jubilant DraxImage Inc; Shareholder, Jubilant DraxImage Inc

PURPOSE

The purpose of this study was to determine if dipyridamole induced coronary artery vasodilation used in 82Rb-PET/CT myocardial perfusion imaging (MPI) studies is affected by liver failure and if there is a correlation between severity of liver failure and degree of attenuation.

METHOD AND MATERIALS

A retrospective analysis of 82Rb-PET/CT MPI studies involving patients being assessed for liver transplant was performed. Coronary Flow Reserve (CFR) was calculated for all patients and compared to a prospective control group with a low-risk of liver failure determined by using a liver-failure risk questionnaire. In order to control for balanced ischemia, all patients with any identifiable coronary artery calcification were excluded from both groups. The study group was stratified into mild and severe liver failure groups based on a calculated MELD score determined by serological data collected at the time of imaging (defined by the median). Statistical analysis was performed using linear regression as well as 2-tailed student's t-test analysis. P-values less than 0.05 were considered statistically significant.

RESULTS

A total of 27 liver failure patients and 20 control patients without coronary calcium on CT were analyzed. Overall the liver failure group demonstrated a CFR of 1.89 (SD 0.79) which was significantly lower than the normal control group (CFR 2.79; SD 0.96) (p=0.0011). The mild liver failure subgroup (CFR 2.17; SD 0.87) approached significance when compared to the severe liver failure group (CFR 1.59; SD 0.59) (p=0.0531). Linear regression analysis of liver failure patients demonstrated a significant inverse relationship between CFR and the MELD score (slope -0.062, b=2.81, r2=0.22, p=0.0067).

CONCLUSION

Patients with liver failure have an attenuated vasodilatory response to dipyridamole as measured by CFR values on 82Rb-PET/CT MPI studies.

CLINICAL RELEVANCE/APPLICATION

In patients with liver failure, exercise or dobutamine stress may be preferred for MPI studies rather than dipyridamole or adenosine.

NM119-ED-WEA12 Do All Patients with ITP Need Splenectomy?: The Use of 111-Indium Labeled Platelet Sequestration Studies in Idiopathic Thrombocytopaenic Purpura

Station #12

Participants
Tom Campion, BMBCh, BA, London, United Kingdom (*Presenter*) Nothing to Disclose
Sophie E. West, MBBS, MSc, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Hikmat Jan, MD, MBChB, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

After reading this presentation, the reviewer should be able to: Understand the process of autologous 111In-labelled platelet sequestration studies Recognize their indications and clinical utility Understand the principles underlying their interpretation

TABLE OF CONTENTS/OUTLINE

The treatment of idiopathic thrombocytopaenic purpura (ITP) by splenectomy has been shown to be effective in approximately two-thirds of cases. Use of platelet sequestration studies allow demonstration of the main site of platelet destruction. Many different techniques have been used, with variable results in predicting the response to splenectomy by use of the site of sequestration. At our centre, 111-Indium labeled platelet sequestration studies have been performed for over two decades (one of very few centres with such extensive experience of the technique), and have proved to be a useful predictor. This educational exhibit explains the underlying physiology of ITP, and how the use of platelet sequestration studies can help us to predict response to splenectomy.We will: Outline the methodology used in platelet labeling, infusion and imaging. Explain the classification system used to categorize platelet sequestration. Demonstrate the relative proportions of platelet sequestration sites in our own dataset.

NMS-WEB

Nuclear Medicine Wednesday Poster Discussions

Wednesday, Dec. 2 12:45PM - 1:15PM Location: S503AB

NM

AMA PRA Category 1 Credit ™: .50

FDA Discussions may include off-label uses.

Participants
Farrokh Dehdashti, MD, Saint Louis, MO (*Moderator*) Nothing to Disclose

Sub-Events

NM213-SD-WEB7 Voxel-by-voxel Analyses of SUVs and ADCs of Soft-tissue Tumors with a PET/MR Hybrid System: Preliminary Results

Station #7

Participants
Koji Sagiyama, MD, Fukuoka, Japan (*Presenter*) Nothing to Disclose
Yuji Watanabe, MD, Fukuoka, Japan (*Abstract Co-Author*) Research Grant, Koninklijke Philips NV Research Grant, Bayer AG
Ryotaro Kamei, MD, Fukuoka, Japan (*Abstract Co-Author*) Nothing to Disclose
Satoshi Kawanami, MD, Fukuoka, Japan (*Abstract Co-Author*) Research Grant, Bayer AG; Research Grant, Koninklijke Philips NV
Shingo Baba, Fukuoka, Japan (*Abstract Co-Author*) Nothing to Disclose
Hiroshi Honda, MD, Fukuoka, Japan (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To investigate voxel-by-voxel comparisons of the standardized uptake value (SUV) and apparent diffusion coefficient (ADC) in soft-tissue tumors with a positron emission tomography/magnetic resonance (PET/MR) hybrid system.

METHOD AND MATERIALS

Thirteen patients with soft-tissue tumors (4 low/intermediate-grade tumors and 9 high-grade sarcomas) were scanned (Ingenuity TF PET/MR; Philips Healthcare, Cleveland, OH). T2-weighted imaging (WI) with fat suppression, diffusion WI (DWI) with spatially selective radiofrequency excitation pulses (zoomed DWI, b = 0 and 800), and 18fluoreodeoxyglucose (18FDG)-PET (3.7 MBq/kg FDG, 3-dimensional Ordered Subset Expectation Maximization + Time of Flight, 2-mm reconstruction) were simultaneously acquired. Imaging analysis (ImageJ, NIH, Bethesda, MA) was performed on a workstation (Intellispace Portal 6.0, Philips Healthcare) with image registration with rigid transformation. The in-plane image resolution was interpolated to 42 mm, and slice thickness was adjusted to that of the ADC map (5-7 mm). On T2WI, regions of interests (ROIs) were manually drawn along the border of the tumor in all slices. The ROIs were then copied onto the ADC maps and PET images. The ROI ADCs and SUVs were recorded on a voxel-by-voxel basis, and scatter plots were generated for each tumor. The variance-covariance matrix was used to evaluate the SUV and ADC correlations and variations.

RESULTS

The SUVs and ADCs of 8 of 9 (88.9%) high-grade sarcomas were significantly and negatively correlated, while the SUVs and ADCs of only 1 of 4 (25%) low/intermediate-grade tumors were significantly correlated ($P < 0.05$, Chi-square test). The Pearson correlation coefficients of the high-grade sarcomas were significantly lower (-0.46 vs. 0.027, $P < 0.01$, Student's t -test). The SUV peak (7.52 ± 5.91 vs. 7.04 ± 2.03, $P = 0.41$), ADC minimum (905.67 ± 380.07 vs. 840.54 ± 224.40, $P = 0.35$), and coefficients of variation of the mahalanobis distances (51.00 ± 3.99 vs. 55.84 ± 14.48, $P = 0.73$) did not differ between low/intermediate- and high-grade tumors.

CONCLUSION

Voxel-by-voxel SUV and ADC analyses with PET/MR hybrid systems can characterize soft-tissue tumors.

CLINICAL RELEVANCE/APPLICATION

Direct voxel-by-voxel comparisons of SUV and ADC values can exploit the coregistration advantage of PET/MR hybrid scanners and can be used to characterize soft-tissue tumors.

NM234-SD-WEB8 Value of 18F-FDG-PET/CT in Localizing Ectopic ACTH/CRH Co-secreting Tumors, Causing Cushing Syndrome (CS), in Children and Adolescents

Station #8

Participants
Georgios Z. Papadakis, MD, Bethesda, MD (*Presenter*) Nothing to Disclose
Alexander Karageorgiadis, Bethesda, MD (*Abstract Co-Author*) Nothing to Disclose
Ulas Bagci, PhD, MSc, Orlando, FL (*Abstract Co-Author*) Nothing to Disclose
Rafael Casas JR, MS,MENG, Bethesda, MD (*Abstract Co-Author*) Nothing to Disclose
Corina Millo, Bethesda, MD (*Abstract Co-Author*) Nothing to Disclose
Nicholas J. Patronas, MD, Bethesda, MD (*Abstract Co-Author*) Nothing to Disclose
Constantine A. Stratakis, MD, DSc, Bethesda, MD (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Diagnosis of ectopic adrenocorticotropic hormone (ACTH) and corticotropin releasing hormone (CRH) co-secreting tumors causing Cushing syndrome (CS) is challenging, because CRH secretion stimulates the pituitary gland causing hyperplasia, which can simulate an ACTH-secreting pituitary adenoma. Thus, diagnosis is frequently confused with Cushing Disease (CD), leading to an erroneous

decision for transsphenoidal surgery (TSS). Although, localization of these tumors is highly significant for the accurate management of these patients, the optimal imaging approach is not yet established. We aim to evaluate the contribution of 18F-FDG-PET/CT in detecting ACTH/CRH co-secreting tumors, which cause CS.

METHOD AND MATERIALS

Five patients (3 male, 2 female) with histopathologically proven ectopic ACTH/CRH co-secreting tumors causing CS, were retrospectively analyzed. Their age ranged from 10.5 to 21.3 years, with a median of 13.6 (table 1). Apart from anatomical imaging (US, CT, MRI), all patients underwent PET/CT with 18F-FDG and in one of them a 68Ga-DOTA-TATE-PET/CT study was also performed.

RESULTS

In 4 patients, PET/CT using 18F-FDG showed increased uptake by the location which was finally proven to be the source of the ACTH/CRH co-secretion. In three of these patients the tumor was localized in the pancreas, while in one of them the primary tumor was a hepatic 18F-FDG-avid neuroendocrine tumor (NET). The other 18F-FDG-positive patient had a large mediastinal mass with intense diffuse 18F-FDG uptake (Figure-1), which was histologically proven to be a poorly differentiated thymic carcinoid. In one patient, 18F-FDG did not show any site of abnormal uptake. This patient also underwent PET/CT with 68Ga-DOTA-TATE (somatostatin analogue), which showed increased tracer uptake by a small thymic nodule, which came out to be an atypical thymic carcinoid.

CONCLUSION

Ectopic ACTH/CRH co-secreting tumors causing CS are extremely rare and their localization is a challenging procedure. 18F-FDG-PET/CT is a useful complementary modality, which can guide invasive diagnostic tests such as sampling from specific veins, and contribute to tumor-detection and accurate management of these patients.

CLINICAL RELEVANCE/APPLICATION

18F-FDG-PET/CT has high potential to contribute to the demanding work-up of patients with ectopic ACTH/CRH co-secreting tumors, responsible for Cushing Syndrome, leading to accurate and individulaized patient management.

NM235-SD-WEB9 Clinical Evaluation of PET Image Quality as a Function of Acquisition Time in a New ToF-PET/MRi Compared to ToF-PET/CT - Initial Results

Station #9

Participants
Konstantinos G. Zeimpekis, DIPLPHYS, MSc, Zurich, Switzerland (*Presenter*) Nothing to Disclose
Felipe D. Barbosa, Zurich, Switzerland (*Abstract Co-Author*) Nothing to Disclose
Martin W. Huellner, MD, Zurich, Switzerland (*Abstract Co-Author*) Nothing to Disclose
Edwin ter Voert, Zurich, Switzerland (*Abstract Co-Author*) Nothing to Disclose
Helen Davison, Zurich, Switzerland (*Abstract Co-Author*) Nothing to Disclose
Patrick Veit-Haibach, MD, Zurich, Switzerland (*Abstract Co-Author*) Research Grant, Bayer AG; Resaarch Grant, F. Hoffmann-La Roche Ltd; Research Grant, General Electric Company
Gaspar Delso, PhD, Zurich, Switzerland (*Abstract Co-Author*) Employee, General Electric Company

PURPOSE

The newly introduced integrated ToF-PET/MR imaging can offer substantial improvements in clinical imaging. The purpose of this study is to compare the PET clinical performance between a ToF-PET/CT scanner and an integrated ToF-PET/MR scanner concerning image quality parameters and quantification in terms of SUV as a function of acquisition time (a surrogate of dose).

METHOD AND MATERIALS

The study includes five brain and five whole body patients. After the standard ToF-PET/CT scan, the patients were examined with the ToF-PET/MR. The ToF-PET/CT scan was used as a reference and the ToF-PET/MR acquisition time was consecutively adjusted - since the acquisition time was sufficient enough to compensate for the radionuclide decay between scans - taking into account the decay between the scans in order to expose both systems to the same amount of emitted signal. The acquisition times were then retrospectively reduced to assess the performance of both systems for lower count rates. Image quality, image sharpness, artifacts and noise were evaluated for all clinically relevant anatomical regions. SUV measurements were taken in the liver and in white matter to compare quantification.

RESULTS

Quantitative evaluation showed good correlation between ToF-PET/CT and ToF-PET/MR brain SUVs. Liver correlation was lower, with uptake underestimation in ToF-PET/MR, partially justified by bio-redistribution. The clinical evaluation showed that ToF-PET/MR offers higher image quality and sharpness with lower levels of noise and artefacts compared to ToF-PET/CT with reduced acquisition times for whole body scans while for brain scans the improvement is mostly noticeable away from the axial FOV center.

CONCLUSION

The PET-component of the ToF-PET/MR showed higher image quality compared to ToF-PET/CT as tested with reduced imaging times. Still, these results are prominent for body imaging, whereas there seems to be no significant difference in brain imaging. This overall higher image quality suggests that the acquisition time or injected activity can be reduced by at least 37% on the ToF-PET/MR scanner.

CLINICAL RELEVANCE/APPLICATION

The PET of the new ToF-PET/MR can provide higher image quality to ToF-PET/CT for oncological studies with significantly reduced injected activitiy (>=37%) or similarly acquisition times.

NM236-SD-WEB10 Initial Clinical Experience using Next Generation Digital PET/CT Technology for Imaging Yttrium-90

Station #10

Participants
Chadwick L. Wright, MD, PhD, Lewis Center, OH (*Presenter*) Nothing to Disclose
Jun Zhang, PhD, Columbus, OH (*Abstract Co-Author*) Nothing to Disclose
Katherine Binzel, PhD, Columbus, OH (*Abstract Co-Author*) Nothing to Disclose
Evan J. Wuthrick, MD, Columbus, OH (*Abstract Co-Author*) Nothing to Disclose
Piotr J. Maniawski, MSc, Cleveland, OH (*Abstract Co-Author*) Employee, Koninklijke Philips NV
Michael V. Knopp, MD, PhD, Columbus, OH (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The selection and utilization of Yttrium-90 (90Y) for targeted local radiotherapy in the liver is driven by the clinical need to embolize tumor-induced neovascularity associated with malignant/metastatic lesions while simultaneously delivering high doses of therapeutic radioactivity. Scintigraphic bremsstrahlung planar and SPECT approaches represent the current imaging standard for post-therapy assessment of 90Y biodistribution. Although conventional PET (cPET) systems can image 90Y, long image acquisition time limits its clinical use. The digital photon counting PET detector is next-generation technology to advance low-abundance PET imaging of 90Y. The purpose of this study is to assess the clinical capability of dPET/CT to efficiently and accurately image 90Y radioactivity.

METHOD AND MATERIALS

Patients following 90Y radioembolization for malignant/metastatic liver lesions were imaged using a dPET/CT system (Vereos ToF 64, Philips Healthcare) in an ongoing trial. Assessment of dPET/CT image characteristics (e.g., 90Y-to-background contrast) at various acquisition times was performed and then compared with standard bremsstrahlung SPECT/CT images (Symbia T16, Siemens Healthcare).

RESULTS

Digital PET detection of 90Y radioactivity produced evaluable images with improved qualitative assessment when compared to bremsstrahlung SPECT/CT. Initial observations indicate that shorter total acquisition times (up to 50%) are achievable with dPET/CT for 90Y.

CONCLUSION

Accurate and efficient assessment of 90Y biodistribution remains an unmet clinical need in the post-radioembolization setting. Our initial results demonstrate that dPET/CT is capable of faster image acquisition with improved imaging-based assessment of 90Y dose distribution. Further refinements in dPET image acquisition may enable even faster imaging and improved dosimetry. Research Support: This project was enabled by the Ohio Third Frontier Scholars, Wright Project and Innovation Platform project grants, the Wright Center of Innovation in Biomedical Imaging and Philips Healthcare providing the investigational pre-commercial release system.

CLINICAL RELEVANCE/APPLICATION

Next-generation digital PET/CT technology enables faster imaging of 90Y radioactivity with improved image quality when compared to current standard-of-care bremsstrahlung imaging approaches.

NM223-SD-WEB11 First Study on Automated Three-dimensional Analysis of Hot Spots in Bone Scintigraphy: Hybrid Scheme Using SPECT/CT Images

Station #11

Participants
Masakazu Tsujimoto, RT, Toyoake, Japan (*Presenter*) Nothing to Disclose
Atsushi Teramoto, PhD, Toyoake, Japan (*Abstract Co-Author*) Nothing to Disclose
Seiichiro Ota, MD, Toyoake, Japan (*Abstract Co-Author*) Nothing to Disclose
Masanobu Ishiguro, RT, Toyoake, Japan (*Abstract Co-Author*) Nothing to Disclose
Hiroshi Toyama, Toyoake, Japan (*Abstract Co-Author*) Nothing to Disclose
Hiroshi Fujita, PhD, Gifu City, Japan (*Abstract Co-Author*) Nothing to Disclose
Yutaka Kinomura, RT, Toyoake, Japan (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Recently, commercial software which automatically analyzes uptake regions in bone scintigraphy was developed. However, the present software cannot resolve the influence of overlap because it uses two-dimensional images. By using SPECT/CT images, it is possible to analyze the uptake regions in three-dimensionally while associating with the bone information obtained from the CT image; remarkable improvement of accuracy is expected compared to two-dimensional analysis. In this study, we developed a novel automated analytical technique of hot spots using the SPECT/CT images.

METHOD AND MATERIALS

First, the bone region is extracted from CT images. The bone region extracted from CT images is divided into 7 sections such as head, vertebral part, upper limbs, sternum, rib, pelvis, thigh bone. And then, hot spots are extracted from the SPECT image by using thresholding and three-dimensional labeling. Threshold value is automatically determined for each patient and bone region. Since the extracted regions include the physiological uptakes that arose outside the bone region, they are eliminated using a bone region automatically obtained from the CT images. Finally, the volume ratio of hot spots for the bone regions is calculated.

RESULTS

For initial evaluation of the proposed method, we conducted phantom evaluation and practical evaluation using clinical images. All images were collected by Symbia T6(SIEMENS). We evaluated the accuracy of proposed method using phantom. Estimation error of the volume of hot spots was less than 1%. As for the evaluation using clinical images, the difference between the measured volumes by proposed method and manual measurement volumes. Mean error of measured volume was 1.61%.

CONCLUSION

We have developed an automated analytical technique of s spot using the SPECT/CT image. This method calculates the volume of hot spots in SPECT images inside the bone region obtained by CT images. Estimation errors of the volume of hot spots were less than 2%. These results indicate that the proposed method will be useful for the quantitative evaluation of hot spots in whole-body SPECT/CT examination.

CLINICAL RELEVANCE/APPLICATION

Our computer-aided detection system may be useful for screening bone metastasis

NM004-EB-WEB **Recent Advances in Techniques for PET Image Denoising and Partial Volume Correction**

Hardcopy Backboard

Participants
Ziyue Xu, PhD, Bethesda, MD (*Presenter*) Nothing to Disclose
Mingchen Gao, PhD, Bethesda, MD (*Abstract Co-Author*) Nothing to Disclose
Ulas Bagci, PhD, MSc, Orlando, FL (*Abstract Co-Author*) Nothing to Disclose
Daniel J. Mollura, MD, Bethesda, MD (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

1. To review general background of the challenges in PET image processing and analysis2. To present current state-of-the-art methods for PET image denoising and partial volume correction3. To provide precise evaluation methods for image assessment and compare current methods in their effectiveness in addressing the challenges of functional imaging applications4. To discuss recent development with hybrid imaging techniques (PET/CT, PET/MRI) and and the use of pre-processing techniques for quantifying the image qualities

TABLE OF CONTENTS/OUTLINE

1. Introduction2. Background on PET imaging modalities and characteristics3. Challenges of PET image denoising and partial volume correction - Resolution - Noise model - Structure definition4. Denoising methods - Common denoising techniques - Noise modeling and solutions - Specific denoising methods for PET5. Partial volume correction methods - Based on functional image only - Base on both functional and anatomical images - Pros and Cons for both methods6. Recent advances and applicability for PET image analysis - Technical performance v.s. applicability in clinical data - Solution for PET image denoising, partial volume correction, and segmentation - Future of denoising and partial volume correction for fused images

SSM09

Gastrointestinal (Esophagus Imaging)

Wednesday, Dec. 2 3:00PM - 4:00PM Location: E353B

GI CT MI MR NM OI

AMA PRA Category 1 Credit ™: 1.00
ARRT Category A+ Credit: 1.00

Participants
David J. Lomas, MD, Cambridge, United Kingdom (*Moderator*) Nothing to Disclose
Lisa M. Ho, MD, Durham, NC (*Moderator*) Nothing to Disclose

Sub-Events

SSM09-01 Changes in Esophageal Dimensions during Continuous Swallowing in Healthy Adults as Detected by Magnetic Resonance Imaging

Wednesday, Dec. 2 3:00PM - 3:10PM Location: E353B

Participants
Sabarish Narayanasamy, MBBS,MD, Aligarh, India (*Presenter*) Nothing to Disclose
Mehtab Ahmad, MBBS, Aligarh, India (*Abstract Co-Author*) Nothing to Disclose
Mudit Arora, DMRD, Aligarh Ho, India (*Abstract Co-Author*) Nothing to Disclose
Faisal Janal, MBBS, Aligarh, India (*Abstract Co-Author*) Nothing to Disclose
Breethaa J. Selvamani, Aligarh, India (*Abstract Co-Author*) Nothing to Disclose
Anusha Sundararajan, Loma Linda, CA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

This study was designed to quantify the degree of fluctuation in esophageal dimensions during continuous swallowing on Magnetic Resonance (MR) Imaging.

METHOD AND MATERIALS

30 healthy volunteers (25 males and 5 females, age range: 15-45 years) were chosen for the study. MR examination was done using a 1.5 tesla magnet. Initially, the esophagus was imaged in the resting state (Resting MR). Then, the volunteer was asked drink water continuously and another set of MR images were obtained (Swallowing MR). The thoracic esophagus was divided into three segments (upper, middle and lower) based on anatomical landmarks. Diameter and the wall thickness of the esophagus were measured in each segment and the cross sectional area (CSA) was calculated.

RESULTS

The esophageal CSA increased by twofold on swallowing MR scans as compared to the resting scans [Median(interquartile range) increase in CSA in upper segment - 117.3%(61-162.2), in middle segment - 87.7%(54.3-162.9) and in the lower segment - 122.1% (78.9 - 188.1)]. The anteroposterior and transverse diameters of the thoracic esophagus increased by about 60% as compared to the resting MR scans. The mean wall thickness of the thoracic esophagus was reduced by about 25% on swallowing MR as compared to resting scan.

CONCLUSION

Our study helps to define normal changes in esophageal dimensions during continuous swallowing. The lower third of the thoracic esophagus appears to be the most distensible segment.

CLINICAL RELEVANCE/APPLICATION

Swallowing MRI has been proposed as an experimental investigative modality for motility disorders of the esophagus and knowledge of the fluctuation in esophageal dimensions during swallowing might be of clinical utility.

SSM09-02 Differentiate Esophageal Cancer Stages with Spectral CT Imaging

Wednesday, Dec. 2 3:10PM - 3:20PM Location: E353B

Participants
Yang Chuangbo, MMed, Xianyang City, China (*Presenter*) Nothing to Disclose
Yongjun Jia, MMed, Xianyang City, China (*Abstract Co-Author*) Nothing to Disclose
Xirong Zhang, Xianyang, China (*Abstract Co-Author*) Nothing to Disclose
Chenglong Ren, Shanxi, China (*Abstract Co-Author*) Nothing to Disclose
Haifeng Duan, Xianyang City, China (*Abstract Co-Author*) Nothing to Disclose
Taiping He, Xianyang, China (*Abstract Co-Author*) Nothing to Disclose
Xiaoxia Chen, MMed, Xianyang City, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To explore the value of spectral CT imaging to differentiate esophageal cancer stages.

METHOD AND MATERIALS

67 patients with esophageal cancer diagnosed by esophagoscopy underwent plain and double-phase enhanced CT scan with spectral CT mode. Patients were divided into well-to-moderately differentiated and poorly differentiated squamous carcinoma groups. The iodine-based material decomposition (MD) images were generated and analyzed with GSI Viewer software to measure the iodine concentration (IC) in tumors. Normalized iodine concentration (NIC) was obtained by dividing tumor IC to that of aorta. Data from the two cancer groups were analyzed statistically by independent-samples t test and were correlated with pathological

findings.

RESULTS

There were 32 well-to-moderately differentiated(Picture 1) and 35 poorly differentiated(Picture 2) squamous carcinoma verified by pathology. IC values of the well-to-moderately differentiated squamous carcinoma in both the arterial phase (AP) (2.66±1.07mg/ml) and venous phase (VP) (2.12±0.94mg/ml) were lower than that of the poorly differentiated squamous carcinoma (2.85±1.25mg/ml and 2.57±1.06mg/ml, respectively). The NIC value of the well-to-moderately differentiated squamous carcinoma was also lower than that of the poorly differentiated squamous carcinoma: 0.12±0.05 vs. 0.13±0.06 in AP and 0.42±0.13 vs. 0.61±0.18 in VP, respectively. Statistical differences of IC and NIC were found between the two groups in VP (both $p<0.05$) but not in AP ($p>0.05$).

CONCLUSION

There are correlation between the iodine concentration and normalized iodine concentration of esophageal cancers and their histological differentiation stages. IC and NIC parameters obtained in spectral CT for the esophageal cancer in the venous phase can be used as new indexes to differentiate esophageal cancer stages.

CLINICAL RELEVANCE/APPLICATION

Parameters such as normalized iodine concentration in esophageal cancer determined in spectral CT may be used to differentiate esophageal cancer stages.

SSM09-03 Diffusion-Weighted MRI in the Staging of Esophageal Cancer: Ready for Clinical Use? Prospective Comparison with EUS and MDCT

Wednesday, Dec. 2 3:20PM - 3:30PM Location: E353B

Participants
Francesco Giganti, MD, Milan, Italy (*Presenter*) Nothing to Disclose
Paolo G. Arcidiacono, Milan, Italy (*Abstract Co-Author*) Nothing to Disclose
Roberto Nicoletti, MD, Milan, Italy (*Abstract Co-Author*) Nothing to Disclose
Elena Orsenigo, Milan, Italy (*Abstract Co-Author*) Nothing to Disclose
Alessandro Del Maschio, MD, Milan, Italy (*Abstract Co-Author*) Nothing to Disclose
Francesco A. De Cobelli, MD, Milan, Italy (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

This pilot study was intended to prospectively compare the diagnostic performance of Diffusion-Weighted Magnetic Resonance Imaging (DW-MRI), Multidetector Computed Tomography (MDCT) and Endoscopic Ultrasonography (EUS) in the preoperative loco-regional staging of esophageal cancer.

METHOD AND MATERIALS

This study was institutional review board-approved. Eighteen patients with biopsy proved esophageal or gastro-esophageal (Siewert I) tumor (9 directly treated with surgery and 9 addressed to chemo/radiotherapy before) underwent 1.5 T DW-MRI, 64-channels MDCT and EUS before and after neoadjuvant treatment. All images were analyzed and staged blindly by dedicated operators according to the 7th TNM edition and two radiologists calculated indipendently the Apparent Diffusion Coefficient (ADC) from the initial scan. The results were then compared with histopathological findings. Statistical analysis included Spearman and intraclass correlation coefficients, Mann-Whitney U test and receiver operator characteristic curve analysis. After the population had been divided according to local invasion (T1-2 vs T3-4) and nodal involvement (N0 vs N+), sensitivity, specificity, accuracy, positive and negative predictive value were calculated and compared for each technique. Quantitative measurements from DWI were also analyzed.

RESULTS

For T staging, EUS showed the best sensitivity (100%) while MR showed the highest specificity (92%) and accuracy (83%). For N staging, MR and EUS showed the highest sensitivity (100%) but none of the three techniques showed adequate results for specificity. Overall, MR showed the highest accuracy (66%) for N stage. Mean pathological ADC was different between surgery-only and chemo/radiotherapy groups (1.90 vs 1.30 x 10-3 mm2/s, respectively; $p= 0.005$), with an optimal cut off for local invasion of 1.33 x 10-3 mm2/s ($p=0.05$).

CONCLUSION

DW-MRI could improve the current preoperative staging workup for esophageal cancer, showing characteristic advantages for both staging and initial treatment decision-making.

CLINICAL RELEVANCE/APPLICATION

DW-MRI can be useful in the preoperative workup for esophageal cancer and could help to select appropriate treatments after initial staging.

SSM09-04 The Use of 3T Multiparametric MRI in the Staging of Esophageal Cancer (EC)

Wednesday, Dec. 2 3:30PM - 3:40PM Location: E353B

Participants
Daniela A. Cenzi, MD, Verona, Italy (*Presenter*) Nothing to Disclose
Lisa Zantedeschi, MD, Verona, Italy (*Abstract Co-Author*) Nothing to Disclose
Lucia Camera, Verona, Italy (*Abstract Co-Author*) Nothing to Disclose
Giacomo Schenal, Verona, Italy (*Abstract Co-Author*) Nothing to Disclose
Massimiliano Motton, MD, Verona, Italy (*Abstract Co-Author*) Nothing to Disclose
Stefania Montemezzi, MD, Verona, Italy (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate diagnostic feasability of MP-MRI for the preoperative staging of EC and to assess its efficacy in discrimination between

responders and non-responders in those who underwent neoadjuvant treatment (NT).

METHOD AND MATERIALS

Between 2011 and January 2015, 36 patients with biopsy-proven EC underwent 3T MRI with the same approach: T2 weighted images, DWI and DCE sequences, with cardiac and respiratory gating. According to local invasion (T1-2 vs T3-4) and nodal involvement (N- vs N+), we identified 11 patients with organ confined lesion who underwent surgery: MR-staging results were compared with histopathological findings directly. 25 patients were addressed to NT and restaging MRI after treatment was compared to histological findings after surgery. Sensitivity (SE), specificity (SP), positive (PPV) and negative (NPV) predictive value and accuracy were calculated for the both groups. For NT group, changes in ACD and changes in DCE time intensity curve at MRI before and after treatment were calculated. 2 readers indipendently determined: pre-NT and post-NT ADC, percentage changes in ADC (ΔADC), DCE time intensity curves and interobserver variability.

RESULTS

Surgery group: for T staging, SE was 98 %, SP 78 %, accuracy 90%; for N staging SE was 67 %, SP 60 %, accuracy 64%. NT group after NT: for T staging SE was 80 %, SP 85 %, PPV 67%, NPV 92%, accuracy 89% and 76%, 78%, 50%, 91% and 91% respectively for N staging.Responders showed lower pre-NT ADC (1.30 vs 1.80Å~10-3mm2/s; P=0.002) and higher post-NT ADC (2.50 vs 1.64Å~10-3mm2/s; P=0.001) than non-responders and ADC increased in responders (ΔADC, 90.28 versus 11 %, respectively). A slight difference was observed in DCE curves but without a significant difference (p>0.05).Interobserver reproducibility was good both for surgery (k 0.68) and post-NT (k 0.86).

CONCLUSION

MR can correctly stage organ-confined lesions according to the high specificity (for the T stage) and to rightly assess pathological nodal involvement (for the N stage) thanks to the good SE. The ADC can be used to assess esophageal tumour response to NT treatment as a reliable expression of tumour regression.

CLINICAL RELEVANCE/APPLICATION

Preoperative staging in esophageal cancer is critical in order to prompt a surgical (T1-T2 stages without nodal involvement) or neo-adjuvant therapy (T3-T4 stages with nodal involvement).

SSM09-05 Textural Analysis of Baseline 18F-FDG PET for Predicting Treatment Response and Prognosis in Patients with Locally Advanced Esophageal Cancer

Wednesday, Dec. 2 3:40PM - 3:50PM Location: E353B

Participants
Xiaorong Sun, Jinan, China (*Presenter*) Nothing to Disclose
Lu Sun, Jinan, China (*Abstract Co-Author*) Nothing to Disclose
Ligang Xing, Jinan, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Textural features on baseline 18F-FDG PET have shown the potential role in predicting treatment response in mixed stage esophageal cancer. This study is aim to investigate the value of this new technique for locally advanced esophageal squamous cell cancer (ESCC) receiving chemoradiotherapy.

METHOD AND MATERIALS

Under a waiver from IRB, 48 patients with newly diagnosed locally advanced ESCC who treated with concurrent chemoradiotherapy were retrospectively reviewed. Thirty-nine patients with early stage ESCC were included as control. All patients underwent pretreatment whole-body 18F-FDG PET/CT. Fifty-four texture indices describing global, local, and regional features were measured in addition to 5 conventional indices as standardized uptake values (SUVs, including maximum, peak, and mean SUV), metabolic volume (MV), and total lesion glycolysis (TLG). Patients were classified as responders (R, complete or partial response) and non-responders (NR, stable or progressive disease) according to RECIST1.1. Progression-free survival (PFS) and overall survival (OS) were recorded. The prognostic significance of parameters was examined using receiver-operating-characteristic curves, Kaplan-Meier analysis, and Cox regression analysis.

RESULTS

Both intratumor heterogeneity and mean/peak intensity of FDG uptake were significantly higher in locally advanced ESCC than those in early stage. Thirty-four texture indices, MV, and TLG showed the ability to differentiate R from NR. Nine texture indices showed higher sensitivity (76.7%~86.7%) and specificity (77.8%~94.4%) than MV (76.7% and 83.3%) and TLG (73.3% and 83.3%). Ten texture indices and MV were hazard factors of PFS and OS. Large-zone emphasis, one of the regional texture indices, was the only independent predictor of survival, with hazard ratio of 4.22 (95%CI:1.83~9.72) for PFS and 3.90 (1.74~8.79) for OS. None of the SUVs could predict treatment response and survival.

CONCLUSION

FDG PET texture indices provide better predictive information than conventional parameters for locally advanced ESCC.

CLINICAL RELEVANCE/APPLICATION

The clinical application of FDG PET texture analysis could be an important step in personalized treatment of esophageal cancer.

SSM09-06 CT Signs Can Predict Treatment Response and Long-Term Survival: A Study in Locally Advanced Esophageal Cancer with Preoperative Chemotherapy

Wednesday, Dec. 2 3:50PM - 4:00PM Location: E353B

Participants
Xiao-Yan Zhang, Beijing, China (*Presenter*) Nothing to Disclose
Xiaoting Li, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Zhilong Wang, MD, Beijing, China (*Abstract Co-Author*) Nothing to Disclose

Ying-Shi Sun, MD, PhD, Beijing, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Accurate prediction of treatment response and prognosis before surgery will allow prompt therapy adjustment. This study proposed to evaluate the efficacy of CT signs on treatment response and survival for advanced esophageal squamous cell carcinoma patients with preoperative chemotherapy.

METHOD AND MATERIALS

This study retrospectively enrolled 135 consecutive patients with preoperative chemotherapy from September 2005 to December 2011. Logistic regression model was conducted to evaluate the association between pathological response and CT signs. Overall survival(OS) and disease-free survival (DFS) were estimated using Kaplan-Meier method and Cox proportional hazards model was constructed to determine associations between CT signs after neoadjuvant chemotherapy and survival outcomes.

RESULTS

The logistic regression showed the total LN number(> 6) at baseline and the CT value change rate (≤ 17%) were significant for poor response; OR were 5.07 (95% CI, 1.86 to 13.81, P = 0.002) and 2.35 (95% CI, 1.05 to 5.23, P = 0.037), respectively. In Cox analyses, preoperative tumor thickness (> 10 mm), total LN number (>6), and short diameter of the largest LN (> 10 mm) were significant for OS, HR were 2.33(95% CI, 1.36 to 4, P = 0.002), 1.88(95% CI, 1.12 to 3.17, P = 0.017) and 1.87(95% CI, 1.07 to 3.28, P = 0.028), respectively; whereas only the short diameter of the largest LN was significant for DFS, HR was 2.36(95% CI, 1.23 to 4.54, P = 0.01).

CONCLUSION

CT signs can predict therapeutic efficacy and survival outcomes and provide an opportunity to offer additional treatment options before surgery.

CLINICAL RELEVANCE/APPLICATION

This study provided the first evidence that CT signs can predict survival outcomes and therapeutic efficacy of patients with esophageal cancer who received preoperative chemotherapy. Therefore, it is of great clinical significance to perform CT examinations before and after neo-adjuvant therapies in esophageal cancer patients. The CT images interpreted before surgery could provide important information about survival and response, which would improve individualized treatment programs.

SSM14

Molecular Imaging (Inflammation/Immunology)

Wednesday, Dec. 2 3:00PM - 4:00PM Location: S504CD

MI MR NM

AMA PRA Category 1 Credit ™: 1.00
ARRT Category A+ Credit: 1.00

FDA Discussions may include off-label uses.

Participants
Michael S. Gee, MD, PhD, Jamaica Plain, MA (*Moderator*) Nothing to Disclose
Tomio Inoue, MD, PhD, Yokohama, Japan (*Moderator*) Nothing to Disclose

Sub-Events

SSM14-01 Assessment of Renal Allograft Pathology by Arterial Spin Labelling and Diffusion Weighted Imaging

Wednesday, Dec. 2 3:00PM - 3:10PM Location: S504CD

Awards
RSNA Country Presents Travel Award

Participants
Katja Hueper, Hannover, Germany (*Presenter*) Nothing to Disclose
Marcel Gutberlet, Dipl Phys, Hannover, Germany (*Abstract Co-Author*) Nothing to Disclose
Dagmar Hartung, MD, Hannover, Germany (*Abstract Co-Author*) Nothing to Disclose
Song Rong, MD, Hannover, Germany (*Abstract Co-Author*) Nothing to Disclose
Frank K. Wacker, MD, Hannover, Germany (*Abstract Co-Author*) Research Grant, Siemens AG Research Grant, Pro Medicus Limited
Faikah Gueler, MD, Hannover, Germany (*Abstract Co-Author*) Nothing to Disclose
Jan Hinrich Braesen, Hannover, Germany (*Abstract Co-Author*) Nothing to Disclose
Bennet J. Hensen, Hanover, Germany (*Abstract Co-Author*) Nothing to Disclose
Martin Meier, PhD, Hannover, Germany (*Abstract Co-Author*) Nothing to Disclose
Rongjun Chen, Hannover, Germany (*Abstract Co-Author*) Nothing to Disclose
Michael Mengel, Edmonton, AB (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Renal allograft dysfunction early after kidney transplantation (ktx) is frequent, and may be caused by ischemia reperfusion injury or acute rejection. The purpose was to investigate renal allograft pathology in a mouse model of allogenic and isogenic ktx by perfusion imaging with arterial spin labelling (ASL) and diffusion weighted imaging (DWI) in correlation to histology.

METHOD AND MATERIALS

Allograft rejection was induced by allogenic ktx of C57Bl/6 (B6)-kidneys to Balb/c-mice in n=14 animals, isogenic ktx (B6-kindeys to B6-mice) was performed in n=18 mice. Cold and warm ischemia times were 60 and 30 min, respectively, in both groups. Healthy B6-mice served as controls. MRI was performed 1 and 6 days after ktx using a 7T-scanner. Flow alternating inversion recovery (FAIR) ASL and DWI sequences (7 b-values) were acquired, and maps of renal perfusion and apparent diffusion coefficient (ADC) were calculated. Renal histology was assessed for rejection and the severity of tubular injury and cell infiltration.

RESULTS

Following allogenic ktx animals developed a T-cell-mediated rejection, whereas isogenic mice had mild tubular injury but no rejection. Renal perfusion at d1 was reduced after allogenic (262±43 ml/(min*100g)) and isogenic ktx (335±41 ml/(min*100g)) compared to normal B6-mice (483±23 ml/(min*100g), $p<0.001$). After allogenic ktx, renal perfusion further decreased until d6 and was lower than in the isogenic group (80±13 vs 260±33 ml/(min*100ml), $p<0.001$). In contrast, ADC was unchanged after isogenic ktx compared to normal B6-mice. In the allogenic group with acute rejection ADC was reduced compared to the isogenic group at d1 (1.24±0.11 vs 1.61±0.03*10^{-3}mm²/s, $p<0.001$) and d6 (1.09±0.04 vs 1.55±0.07*10^{-3}mm²/s, $p<0.001$). Higher tubular injury and inflammation scores and higher percentage of infiltrating T-cells significantly correlated with ADC reduction at d1and6 and perfusion impairment at d6.

CONCLUSION

Renal allograft rejection is associated with progressive perfusion impairment and ADC reduction representing inflammation and cell infiltration. Isogenic ktx with prolonged cold ischemia time leads to moderate perfusion impairment without ADC reduction. MRI parameters correlate with histology.

CLINICAL RELEVANCE/APPLICATION

Functional MRI with ASL and DWI allows differentiation of renal graft pathology after transplantation. Parameters correlate with histology and may improve non-invasive diagnosis in ktx patients.

SSM14-02 The Value of Whole Body Fully Integrated 18F-FDG-PET/MR in Idiopathic Retroperitoneal Fibrosis

Wednesday, Dec. 2 3:10PM - 3:20PM Location: S504CD

Awards
Molecular Imaging Travel Award

Participants
Ingo Einspieler, Munich, Germany (*Presenter*) Nothing to Disclose
Klaus Thurmel, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose

Sabine Wolfram, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose
Martin Henninger, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose
Matthias J. Eiber, MD, Muenchen, Germany (*Abstract Co-Author*) Speakers Bureau, Johnson & Johnson
Markus Schwaiger, MD, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose
Markus Essler, MD, Muenchen, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Idiopathic retroperitoneal fibrosis (IRF) is a rare inflammatory condition potentially leading to severe complications such as renal failure. Besides, there is evidence of associated large vessel vasculitis (LVV), potentially causing life-threatening consequences such as vessel stenosis and aneurysms. Therefore, early and precise assessment of both disease extent and activity is essential to guide therapy decision. Due to the lack of reliable parameters to objectively assess the degree of inflammation, imaging by whole body 18F-FDG PET/MR might help as a new approach.

METHOD AND MATERIALS

14 whole body 18F-FDG-PET/MR examinations were performed in 12 patients with IRF. T1 and T2 sequences were used for anatomical localization of FDG uptake and identification of morphological changes associated with IRF. Contrast enhanced-MRA was performed to judge changes of the vessel lumen. IRF tissue volume was calculated on MRI in cm3. FDG-uptake was assessed visually (using a 4-point scale) and quantitatively (maximal standardized uptake value [SUV max], target to background ratio [TBR]). Correlations between PET/MR findings (SUV max, TBR, visual score, IRF volume) and DAS (disease activity score), combining typical clinical symptoms for IRF, CRP/ESR/IL-6 levels and results of previous examinations by ultrasound, CT and MRI, were analyzed. Intended therapeutic management was documented before and after availability of PET/MR findings.

RESULTS

DAS classified 7 cases as having active disease and 7 as inactive. In contrast, PET/MR revealed active IRF in 10/14 cases and changed disease status according to DAS in 5 cases (36%), more specifically in 4 cases from inactive to active disease and active to inactive disease in 1 case. There was no association between DAS and the various PET/MR findings ($p > 0.05$). PET/MR showed vessel changes suggestive for active LVV in 3 cases. In addition, PET/MR imaging results had impact on therapeutic management in 6/14 cases (43%), in particular by starting or avoiding immunosuppressive therapy.

CONCLUSION

Whole body 18F-FDG-PET/MR may be considered as a useful approach for aiding in the management of patients with IRF.

CLINICAL RELEVANCE/APPLICATION

In IRF there is still a lack of reliable parameters to objectively assess the degree of inflammation and to guide therapy decisions. Imaging by whole body 18F-FDG PET/MR might help as a new approach.

SSM14-03 Glycosaminoglycan Chemical Exchange Saturation Transfer of Lumbar Intervertebral Discs in Patients with Spondyloarthritis

Wednesday, Dec. 2 3:20PM - 3:30PM Location: S504CD

Awards
Molecular Imaging Travel Award

Participants
Christoph Schleich, Dusseldorf, Germany (*Presenter*) Nothing to Disclose
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Joel Aissa, Duesseldorf, Germany (*Abstract Co-Author*) Nothing to Disclose
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Ruben Sengewein, Duesseldorf, Germany (*Abstract Co-Author*) Nothing to Disclose
Benedikt Ostendorf, Dusseldorf, Germany (*Abstract Co-Author*) Nothing to Disclose
Benjamin Schmitt, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose
Gerald Antoch, MD, Duesseldorf, Germany (*Abstract Co-Author*) Nothing to Disclose
Falk R. Miese, MD, Dusseldorf, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To assess glycosaminoglycan (GAG) content of lumbar intervertebral discs (IVD) in patients with spondyloarthritis (SpA) using glycosaminoglycan chemical exchange saturation transfer (gagCEST).

METHOD AND MATERIALS

Ninety lumbar intervertebral discs of nine patients with SpA and nine age-matched healthy controls (eight patients with ankylosing spondylitis; one patient with spondylitis related to inflammatory bowel disease; mean age: 44.1 ± 14.0 years; range: 27 - 72 years) were examined at a 3T MRI scanner in this prospective study. The MRI protocol included standard morphological, sagittal T2 weighted (T2w) images to assess Pfirrmann score of the five lumbar IVDs (L1 to S1) and biochemical imaging with gagCEST to calculate a region-of-interest analysis of nucleus pulposus (NP) and annulus fibrosus (AF). Prior to statistical testing of gagCEST effects (MTRasym values in %) in patients and controls, IVDs were classified according to the Pfirrmann score.

RESULTS

Significantly lower gagCEST values of NP and AF were found in SpA patients compared with healthy volunteers (NP: 1.41 % ± 0.41 %, $p = 0.001$; 95%-confidence interval, CI [0.600% - 2.226 %]; AF: 1.19 % ± 0.32 %, $p < 0.001$; CI [0.560 % - 1.822 %]) by comparing the differences of the means. Pooled non-degenerative IVDs (Pfirrmann 1 and 2) had significantly lower gagCEST effects in patients suffering from SpA compared with healthy controls in NP ($p < 0.001$; CI [1.176 % - 2.337 %]) and AF ($p < 0.001$; CI [0.858 % - 1.779 %]). No significant difference of MTRasym values was found in degenerative IVDs between patients and controls in NP ($p = 0.204$; CI [-0.504 % - 2.170 %]).

CONCLUSION

GagCEST analysis of morphologically non-degenerative IVDs (Pfirrmann score 1 and 2) in T2w images demonstrated significantly

lower GAG values in patients with spondyloarthritis in NP and AF possibly representing a depletion of GAG in spondyloarthritis in the absence of morphologic degeneration.

CLINICAL RELEVANCE/APPLICATION

GagCEST may be a powerful tool to access IVD composition in spondyloarthritis and to investigate therapy effects on GAG content in advanced studies.

SSM14-04 Preliminary Experience with 3T Time of Flight Simultaneous Cardiac PET/MRI in the Evaluation of Cardiac Sarcoidosis

Wednesday, Dec. 2 3:30PM - 3:40PM Location: S504CD

Awards
Trainee Research Prize - Fellow

Participants
Kate Hanneman, MD, Toronto, ON (*Presenter*) Nothing to Disclose
Andrei Iagaru, MD, Stanford, CA (*Abstract Co-Author*) Research Grant, General Electric Company; Research Grant, Bayer AG
Henry Guo, Stanford, CA (*Abstract Co-Author*) Nothing to Disclose
Amir Barkhodari, Stanford, CA (*Abstract Co-Author*) Nothing to Disclose
Mehran Jamali, Stanford, CA (*Abstract Co-Author*) Nothing to Disclose
Dawn Holley, Stanford, CA (*Abstract Co-Author*) Nothing to Disclose
Robert J. Herfkens, MD, Stanford, CA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The aim of this study is to investigate the utility of simultaneous time of flight (TOF) cardiac PET/MRI in the evaluation of cardiac sarcoidosis.

METHOD AND MATERIALS

Six consecutive patients (50% male, 53.3±12.3 years) were prospectively recruited over a 3-month period for parallel assessment of suspected cardiac sarcoidosis by standard clinical evaluation and simultaneous PET/MRI. Five healthy volunteers were initially scanned for protocol optimization. Patients first underwent standard cardiac PET/CT (Discovery 600 or 690, GE Healthcare) after administration of 9.7±0.4 mCi of 18F FDG. This was followed by a cardiac PET/MRI using a simultaneous scanner with TOF and 3T (Signa, GE Healthcare). Participants were prepared with 8-hour dietary instructions in order to suppress physiologic myocardial glucose uptake. Cardiac MRI sequences included breath-hold, ECG-triggered cine SSFP, T2-weighted, T1-mapping (pre- and post-contrast), and delayed myocardial enhanced (DME). Three experienced readers performed image analysis using an independent workstation with dedicated post-processing software.

RESULTS

PET/CT was acquired with a delay of 95.8±26.6 min, while PET/MRI had a delay of 195.5±35.6 min from 18F FDG injection. Total scan time for PET/MRI was significantly longer than for PET/CT (75.8±17.7 vs. 36.6±6.3 min, p=0.016). PET from PET/CT was positive for cardiac sarcoidosis in 50% of patients, while PET from PET/MRI was positive for cardiac sarcoidosis in 100% of patients. LV measurements by MRI were: EDV (159.3±33.5mL), ESV (87.6±50.0mL), LVEF (47.3±19.7%), pre-contrast T1 (1455.9±25.6ms), post-contrast T1 (307.0±63.6ms) and extra-cellular volume (ECV) (38.5%). DME and T2 hyper-intensity were identified in 67% and 33% of patients, respectively. There was a significant difference in effective radiation dose (ED) between PET/CT and PET/MRI (p=0.007). ED from the CT component of the PET/CT exam alone was 4.6±1.4mSv.

CONCLUSION

Simultaneous cardiac PET/MRI is feasible achieving diagnostic image quality with the added benefit of radiation dose reduction in comparison to PET/CT.

CLINICAL RELEVANCE/APPLICATION

Simultaneous cardiac PET/MRI is feasible, and provides additional information over PET/CT, potentially reducing the number of exams for patients.

SSM14-05 Role of FDG PET/CT for the Detection of Renal Infections in Cases of Pyrexia of Unknown Origin

Wednesday, Dec. 2 3:40PM - 3:50PM Location: S504CD

Participants
Sikandar M. Shaikh, DMRD, Hyderabad, India (*Presenter*) Nothing to Disclose
Hrushikesh Aurangabadkar, Hyderabad, India (*Abstract Co-Author*) Nothing to Disclose
Madhur K. Srivastava SR, MBBS, Chennai, India (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Patients with pyrexia of unknown origin were evaluated by FDG PET/CT for the detection of renal infections

METHOD AND MATERIALS

26 patients underwent FDG PET/CT for the detection of infection foci involving the kidneys. Positive FDG PET/CT findings and pathological correlation served as the main outcome measures.

RESULTS

Of the 26 study patients, 18 (70.2%) had positive FDG PET/CT findings and a total of 24 major infection foci were identified. Five patients (24.6%) had at least two infection foci on FDG PET/CT scans. Two (53.8%) of the 3 patients with primary renal infections had concurrent multiple foci. seven patients (26.9%) had their treatments modified by FDG PET/CT results. Multivariate logistic regression analysis demonstrated that leucocyte count at diagnosis along with correlation with positive FDG PET/CT results. seven patients (26.0%) landed in hemodialysis during their hospital stay, and 6 of them had positive FDG PET/CT findings (P = 0.014). Positive FDG PET/CT results were an independent predictor of mortality (hazard ratio [HR]=3.896, 95% CI=1.039-14.613, P =

0.044).

CONCLUSION

Our results suggest that FDG PET/CT is clinically useful for detecting occult infection foci in renal infections. In this population, positive FDG PET/CT findings may lead to a significant change in clinical management and independently predict mortality.

CLINICAL RELEVANCE/APPLICATION

PET-CT IS HIGHLY SENSITIVE IN EVALUATING THE RENAL INFECTION IN CONTEXT OF PYREXIA OF UNKNOWN ORIGIN.

SSM14-06 Image Monitoring of Impaired Phagocytic Activity of Kupffer Cells and Liver Oxygen Saturation in a Mouse Cholangitis Model Using Sonazoid-Enhanced US and Photoacoustic Image

Wednesday, Dec. 2 3:50PM - 4:00PM Location: S504CD

Participants
Jung Hoon Kim, MD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Seo-Youn Choi, MD, Bucheon, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Hyo Won Eun, MD, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Seunghyun Lee, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Joon Koo Han, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To investigate serial change of impaired phagocytic activity of Kupffer cells and liver Oxygen Saturation (sO2) in a mouse cholangitis model using sonazoid enhanced US (SEUS) and photoacoustic image (PI)

METHOD AND MATERIALS

Mouse cholangitis models were created by ligation of common bile duct (n=20, G1), left intrahepatic bile duct (n=19, G2-left and G2-right) and compared with control (n=14, G3). SEUS and PI were performed at 1, 2, and 4 weeks. PA images were collected at 750 and 850 nm and parametric maps of sO2 were generated. Serial change of echogenicity on the Kupffer phase and liver sO2were measured in each groups. Serial changes in each group were analyzed using one way ANOVA with Bonferroni's method. Kupffer cell fraction using CD68 immunohistochemistry stain was also compared with SEUS.

RESULTS

Serial change of sonazoid enhacement enhancement showed decreased in G1 (15.1 + 8.6 x 10-5) and G2-left (9.3+7.9 x 10-5) than G2-right (248.8+253.3 x 10-5) and control (153.7+34.7 x 10-5). However, Kupffer cell fraction showed increased in G1 (36.1+7.1%) and G2-left (26.8+5.1%) than G2-right (16.6+5.6%) and control (12.3+3.3%), suggesting impaired phagocytic activity of Kupffer cells. Liver sO2 showed decreased in G1 (24.0+8.0%) and G2-left (22.7+8.4%) than G2-right (39.1+12.0%) and control (41.7+8.1%).

CONCLUSION

SEUS and PI are useful for monitoring of serial change of impaired phagocytic activity of Kupffer cells and liver sO2 in a mouse cholangitis model.

CLINICAL RELEVANCE/APPLICATION

SEUS and PI are feasible to assess the serial change of phagocytic activity of Kupffer cells and liver sO2 in a mouse cholangitis model.

SSM16

Nuclear Medicine (Cardiovascular Imaging)

Wednesday, Dec. 2 3:00PM - 4:00PM Location: S505AB

CA CT NM

AMA PRA Category 1 Credit ™: 1.00
ARRT Category A+ Credit: 1.00

FDA Discussions may include off-label uses.

Participants
Charles M. Intenzo, MD, Philadelphia, PA (*Moderator*) Nothing to Disclose
Andrew C. Homb, MD, Louisville, KY (*Moderator*) Nothing to Disclose

Sub-Events

SSM16-01 Anthropometric-based Radiopharmaceutical Dosing to Reduce Radiation in SPECT MPI: Initial Experience

Wednesday, Dec. 2 3:00PM - 3:10PM Location: S505AB

Participants
Jie Zhang, PhD, Lexington, KY (*Presenter*) Nothing to Disclose
Vince Sorrell, MD, Lexington, KY (*Abstract Co-Author*) Nothing to Disclose
Paul Anaya, Lexington, KY (*Abstract Co-Author*) Nothing to Disclose
M. Elizabeth Oates, MD, Lexington, KY (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Myocardial perfusion imaging (MPI) using gated single photon emission computed tomography (SPECT) is a well-established approach to detect coronary artery disease and risk-stratify patients. For a typical 1-day rest/stress SPECT protocol, standard administered activities of Tc-99m sestamibi are 10 mCi (rest)/30 mCi (stress), resulting in a patient radiation dose of ~12 mSv.. The American Society of Nuclear Cardiology recommended decreasing radiation exposure to < 9 mSv in 50% of patients by 2014. To comply with this recommendation, we employed a new anthropometric-based dosage regimen.

METHOD AND MATERIALS

We investigated the relationship between administered Tc-99msestamibi activity, patient size, and image quality. Patients undergoing SPECT MPI were recruited over two consecutive weeks; measures of weight (kg), height (m), and chest circumference (cm) [ITS1] were recorded. Body Mass Index (BMI) was calculated (kg/m2). Image quality was evaluated by a board-certified nuclear radiologist and a nuclear cardiologist.

RESULTS

Thirty-one patients underwent 1-day rest/stress SPECT MPI. A convenient BMI-based 1-day rest/stress dosing regimen was developed through analyses of administered activity, patient size, and image quality. Administered activities were 6 mCi/18 mCi for BMI < 25 kg/m2, 7 mCi/21 mCi for BMI 25-30 kg/m2, 8 mCi/24 mCi for BMI30-35 kg/m2, and 10 mCi/30 mCi for BMI > 35 kg/m2. The patient radiation doses were 7.26 mSv, 8.47 mSv, 9.68 mSv and 12.10 mSv, respectively. Image quality met clinical diagnostic requirements. Scan time remained the same. With the proposed dosing regimen, radiation exposures in ~ 60% of 31 patients were < 9 mSv.

CONCLUSION

Using "older" gamma camera technology anthropometric-based dosing of Tc-99m sestamibi significantly reduces radiation exposure while maintaining diagnostic image quality.

CLINICAL RELEVANCE/APPLICATION

BMI-adjusted dosing of Tc-99m sestamibi for rest/stress SPECT MPI can significantly reduce patient radiation dose while maintaining image quality.

SSM16-02 Effect of Inflammatory Cardiac Sarcoidosis on Myocardial Blood Flow Assessed by PET/CT

Wednesday, Dec. 2 3:10PM - 3:20PM Location: S505AB

Participants
Matthew J. Kruse, MD, Baltimore, MD (*Presenter*) Nothing to Disclose
Thomas H. Schindler, MD, Geneva, Switzerland (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Inflammatory cardiac sarcoidosis, as evidenced by FDG PET/CT imaging, confers an increased risk for sudden cardiac death and onset of heart failure. Dysfunction of the coronary circulation may represent a mechanistic link between inflammatory sarcoidosis activity and adverse outcomes. In this respect, we aimed to investigate effects of inflammatory cardiac sarcoidosis on coronary circulatory function.

METHOD AND MATERIALS

Individuals were 13 patients with biopsy-proven or clinical/imaging evidence of cardiac sarcoidosis undergoing baseline and follow-up cardiac PET/CT studies (31 total studies). Quantitative myocardial blood flow (MBF) was determined at rest and during pharmacologic vasodilation with N-13 ammonia or Rb-82 PET/CT, with calculation of myocardial flow reserve (MFR). Following a sarcoid diet protocol, FDG PET/CT was additionally performed to determine the presence of abnormal FDG uptake in the heart.

Myocardial segmentation was performed using the 17-segment model. Maximum SUV and metabolic volume above previously published SUV thresholds was calculated.

RESULTS

Myocardial segments with abnormal FDG activity (n=122) demonstrated decreased MBF during vasodilation (1.96 +/- 0.86 ml/g/min vs. 2.13 +/- 0.84 ml/g/min; p=0.045, Mann-Whitney Test) and decreased MFR (2.40 +/- 0.81 vs. 2.75 +/- 1.05; p=0.002). Resting MBF was not significantly different (0.82 ml/g/min vs. 0.79 ml/g/min; p=0.305). Myocardial segments that developed abnormal FDG activity on follow-up study (n=47) demonstrated a greater decrease in MFR compared with segments that remained FDG-negative (n=200) (p=0.003). Segments that normalized on follow-up study (n=31) demonstrated decreased resting MBF compared with segments that remained FDG-positive (n=28) (p=0.013). Global MFR was not significantly correlated with maximum SUV, metabolic volumes, or clinical factors. BMI was weakly inversely correlated with both resting (Pearson r=-0.364, p=0.044) and vasodilation (r=-0.485, p=0.007) global MBF.

CONCLUSION

Myocardial segments involved with active sarcoidosis as evidenced by abnormal FDG activity demonstrate decreased vasodilation MBF and MFR, indicative of regional microvascular dysfunction that may reflect a basis for increased cardiovascular risk.

CLINICAL RELEVANCE/APPLICATION

Further studies are needed to determine if microvascular dysfunction detected by PET/CT perfusion quantitation may predict the risk of poor outcomes in cardiac sarcoidosis.

SSM16-03 The Influence of Myocardial Scar as Assessed by Myocardial Perfusion SPECT on the Development of Electrical Reverse Remodeling after Cardiac Resynchronization Therapy

Wednesday, Dec. 2 3:20PM - 3:30PM Location: S505AB

Participants
Guang-Uei Hung, MD, Lugang, Taiwan (*Presenter*) Nothing to Disclose
Ji Chen, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Cardiac resynchronization therapy (CRT) can provide cardiac reverse remodeling (RR), which may include electrical (ERR: QRS duration shortened ≥ 10 ms) and/or mechanical (MRR: ESV reduced ≥15%) reverse remodeling. However, the pathophysiological mechanism is not clear. Myocardial perfusion SPECT (MPS) provided a comprehensive evaluation of LV perfusion, function and mechanical activation. The purpose of this was to explore the mechanism of RR with MPS.

METHOD AND MATERIALS

Forty-one patients (26 men, mean age 66±10 yrs) with heart failure received CRT for at least 12 months underwent resting MPS under transient CRT-off. The patients were divided into three groups according to their RR levels: group I: MRR+ERR, group II: MRR only and group III: non-responder. Emory cardiac toolbox was used for analysis of MPS to assess myocardial scar, LV volume, EF, dyssynchrony, activation sequence and contraction delay.

RESULTS

Between the three groups of patients, there were significant differences for scar burden (15.9±9.5%, 26.8±16.1% and 45.6±15.1%, for group I, II and III, respectively, $p < 0.001$), EDV (136.6±64.9ml, 221.6±123.9ml and 351.8±216.3ml, $p = 0.002$), ESV (82.6±59.8ml, 172.3±117.2ml and 293.3±209.6ml, $p = 0.001$), LVEF (44.9±15.0%, 25.6±10.9% and 21.5±11.7%, $p < 0.001$), systolic phase SD (23.4±10.3°, 36.0±16.2° and 57.0±22.2°, $p < 0.001$) and diastolic phase SD (32.1±12.4°, 48.4±18.3° and 64.7±22.5°, $p < 0.001$). As shown on the polar map of phase analysis (see attached figures), myocardial scar interfered with the normal propagation of mechanical activation and resulted in heterogeneous activation sequences. Compared to group II, group I had significantly less initiation points (1.9 ± 1.0 vs. 2.6 ± 0.7, $p< 0.05$) and smaller maximal contraction delay (46.9 ± 12.9°vs. 58.8 ± 18.5°, $p <0.05$).

CONCLUSION

The perfusion, function and mechanical activation parameters as assessed by MPS were significantly associated with different levels of RR. The volume of myocardial scar may play a critical role in the development of electrical RR.

CLINICAL RELEVANCE/APPLICATION

The comprehensive evaluation of myocardial substrates by myocardial perfusion SPECT disclosed the pathophysiological mechanisms of different reverse remodeling patterns post CRT.

SSM16-04 Development of a Novel Software for Calculating Myocardial Flow Reserve from Dynamic Kinetic Analysis Using a Cadmium-zinc-telluride (CZT) SPECT

Wednesday, Dec. 2 3:30PM - 3:40PM Location: S505AB

Participants
Masao Miyagawa, MD, PhD, Toon, Japan (*Presenter*) Nothing to Disclose
Yoshiko Nishiyama, MD, Toon, Japan (*Abstract Co-Author*) Nothing to Disclose
Rami Yokoyama, Toon, Japan (*Abstract Co-Author*) Nothing to Disclose
Kana S. Ide, Toon, Japan (*Abstract Co-Author*) Nothing to Disclose
Ryo Ogawa, MD, Toon, Japan (*Abstract Co-Author*) Nothing to Disclose
Tomoyuki Kido, Toon, Japan (*Abstract Co-Author*) Nothing to Disclose
Akira Kurata, PhD, Toon, Japan (*Abstract Co-Author*) Nothing to Disclose
Teruhito Mochizuki, MD, Toon, Japan (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

CZT camera enables fast acquisition of serial dynamic images during the first pass of flow agents. The aims are to develop a novel

software for calculating myocardial flow reserve (MFR) and validate the utility for screening patients (pts) with multi-vessel coronary artery disease (CAD).

METHOD AND MATERIALS

Dynamic myocardial perfusion imaging (MPI) starting with 30-s bolus of Tc-99m perfusion agents was performed during adenosine stress and at-rest using a CZT camera (DNM 530c). The interval between two imaging was 3 hours and a 30-s pre-scan count was subtracted from the dynamic data at-rest. We generated 200 3-D volumes integrating 3-s time frames in the course of 600-s. Routine summed MPI were also acquired thereafter. The software allows the automatic edge detection of volume of interest for the blood pool in the left ventricle and the myocardium. Global time activity curves were fitted to a 2-compartment kinetic model (2-com), a Patlak plot analysis (PPA), and a dose uptake ratio of MPI (DUR) with input function. K1 and K2 were calculated for the stress and rest images. MFR index was calculated as follows: MFR index=K1 stress/K1 at-rest. The validation study included 45 consecutive pts who underwent CZT SPECT and coronary angiography within 2 weeks. (25 males, 68±11 y).

RESULTS

There were 17 pts with multi-vessel CAD while 28 had 0 or 1-vessel CAD. In the multi-vessel group, global MFR estimated by 2-com was 1.12±0.16 (Figure), which was significantly lower than 1.35±0.15 for pts with 0 or 1-vessel CAD ($p<0.0001$). The area under the curve (AUC) by receiver operating characteristic (ROC) analysis was 0.85, 0.73, and 0.65 for 2-com, PPA, and DUR, respectively. Using a cut-off value of 1.3, the sensitivity was 94% and specificity was 64% for diagnosing multi-vessel CAD. Moreover, multivariate analysis reveals that the global MFR by 2-com was an independent predictor of multi-vessel CAD among 11 clinical and MPI variables (chi-square: 5.46, $p=0.02$).

CONCLUSION

We developed and validated a novel software for calculating MFR from dynamic kinetic analysis using a CZT SPECT. It improves the detectability of multi-vessel CAD which causes globally decreased MFR and adds incremental diagnostic value to the standard MPI.

CLINICAL RELEVANCE/APPLICATION

Dynamic myocardial perfusion imaging with the 2-compartment analysis using the CZT SPECT enables us to estimate myocardial flow reserve and may improve the detectability of multi-vessel CAD.

SSM16-05 Physiologic Correlates of Rb-82 PET/CT Left Ventricular Mass: Volume Ratios

Wednesday, Dec. 2 3:40PM - 3:50PM Location: S505AB

Participants
Kenneth Nichols, PhD, New Hyde Park, NY (*Presenter*) Royalties, Syntermed, Inc;
Andrew Van Tosh, MD, Roslyn, NY (*Abstract Co-Author*) Consultant, Pfizer Inc; Consultant, Bracco Group; Consultant, Cardinal Health, Inc; Consultant, Ion Beam Applications, SA
Nathaniel Reichek, MD, Roslyn, NY (*Abstract Co-Author*) Nothing to Disclose
Christopher J. Palestro, MD, New Hyde Park, NY (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

MRI and echocardiography investigators have found that computing the ratio of left ventricular (LV) mass:volume, indexed to a pt's body size, is a useful means of characterizing ventricular remodeling, including aiding in predicting the likelihood of adverse cardiac events. We sought to identify the pathophysiologic mechanisms leading to abnormal M/Vi by examining whether LV myocardial blood flow (MBF) measured by Rb-82 PET/CT is also abnormal for pts with low Mi/Vi.

METHOD AND MATERIALS

We performed a retrospective investigation of data acquired for 194 pts who underwent rest/stress Rb-82 PET/CT imaging for suspected cardiac disease. LV mass indexed to body size (Mi) = 100 • resting mass/(a • height^0.54 • weight^0.61), where a = 6.82 for women, 8.25 for men. LV end-diastolic volume indexed to body (Vi) = 100 • resting end-diastolic volume/(b • height^1.25 • weight^0.43), where b = 10.0 for women, 10.5 for men. The normal range for Mi/Vi = 1.0-1.5. We compared ejection fraction (EF), myocardial blood flow (MBF), and coronary vascular resistance (CVR) against Mi/Vi. LV MBF and CVR were computed from the first pass transit of injected Rb-82 using a 2-compartment model, and volumes and EF values were computed from subsequent myocardial gated equilibrium data.

RESULTS

55 pts had Mi/Vi < 1.0 (mean 0.86±0.08) and 139 pts had Mi/Vi ≥ 1.0 (mean 1.32±0.22). Compared to pts with Mi/Vi ≥ 1.0, those with Mi/Vi < 1.0 had abnormally low rest values of EF (45±16% versus 60±15%, $p<0.0001$) and low MBF (0.58±0.25 versus 0.96±0.59 ml/g/min, $p < 0.0001$) and abnormally high CVR (182±71 versus 131±80 mm Hg/ml/g/min, $p = 0.0001$). Differences were even more pronounced at stress, with abnormally low values of EF (45±17% versus 65±14%, $p<0.0001$) and low MBF (1.06±0.61 versus 1.89 ± 0.96ml/g/min, $p < 0.0001$) and abnormally high CVR (107±49 versus 64±42 mm Hg/ml/g/min, $p = 0.0001$). For pts with Mi/Vi < 1.0, rest and stress MBF and EF were significantly lower, and CVR significantly higher, than published normal limits for these parameters.

CONCLUSION

Our results suggest that a finding of an abnormally low indexed mass-to-volume ratio in an individual is consistent with impaired myocardial blood flow, which hampers EF response to stress.

CLINICAL RELEVANCE/APPLICATION

A finding of low indexed mass-to-volume ratio should be followed up by more specific procedures such as coronary arteriography to assess more completely arterial status.

SSM16-06 F-18 FLT PET/CT Imaging for Diagnosis of Cardiac Sarcoidosis

Wednesday, Dec. 2 3:50PM - 4:00PM Location: S505AB

Participants

Takashi Norikane, Kita-gun, Japan (*Presenter*) Nothing to Disclose
Yuka Yamamoto, MD, PhD, Kagawa, Japan (*Abstract Co-Author*) Nothing to Disclose
Yukito Maeda, Kita-Gun, Japan (*Abstract Co-Author*) Nothing to Disclose
Takahisa Noma, Kita-Gun, Japan (*Abstract Co-Author*) Nothing to Disclose
Yoshihiro Nishiyama, MD, Kagawa, Japan (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

2-deoxy-2-F-18 fluoro-D-glucose (FDG) positron emission tomography (PET) has been proposed to play a role in the diagnosis of cardiac sarcoidosis. However, assessing inflammatory lesions in cardiac sarcoidosis using FDG can be challenging because the FDG accumulates in normal myocardium. In contrast to FDG, 3'-deoxy-3'-F-18 fluorothymidine (FLT) uptake in normal myocardium is low. The purpose of this study was to investigate the feasibility of FLT PET/CT for the detection of cardiac sarcoidosis.

METHOD AND MATERIALS

Sixteen FLT PET/CT studies in 12 patients suspected of having cardiac sarcoidosis were performed. Six studies were performed before therapy and 10 studies were performed after immunosuppressive therapy. Fifty min after an intravenous injection of FLT, a 10-min emission scan of the heart was obtained. CT data for attenuation correction was obtained. Myocardial FLT uptake in cardiac sarcoidosis was defined as a "focal" or "focal on diffuse" pattern. In case of abnormal uptake, the maximal standardized uptake value (SUV) of lesions was measured. In case of no abnormal uptake, the mean SUV of myocardium was measured.

RESULTS

Five of 6 FLT studies before therapy showed a focal pattern of FLT uptake. Four of 10 FLT studies after therapy showed a focal pattern of FLT uptake. The mean (±SD) SUV after therapy (1.68±0.59) was significantly lower than that before therapy (3.02±0.90) ($p<0.02$).

CONCLUSION

These preliminary results indicate that FLT PET/CT might be a potentially useful tracer in the detection and therapy monitoring of cardiac sarcoidosis.

CLINICAL RELEVANCE/APPLICATION

FLT PET/CT might be a potentially useful tracer in the detection and therapy monitoring of cardiac sarcoidosis.

ED010-TH

Nuclear Medicine Thursday Case of the Day

Thursday, Dec. 3 7:00AM - 11:59PM Location: Case of Day, Learning Center

NM

AMA PRA Category 1 Credit ™: .50

Participants
Jason J. Bailey, MD, Ann Arbor, MI (*Abstract Co-Author*) Nothing to Disclose
David Brandel, MD, Ann Arbor, MI (*Abstract Co-Author*) Nothing to Disclose
Casey E. Bohl, MD, PhD, Memphis, TN (*Abstract Co-Author*) Nothing to Disclose
Murray D. Becker, MD, PhD, New Brunswick, NJ (*Abstract Co-Author*) Nothing to Disclose
Richard K. Brown, MD, Ann Arbor, MI (*Presenter*) Nothing to Disclose
Jamil Shaikh, MD, New Brunswick, NJ (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

1) The case will demonstrate the typical characteristics of sarcoid on FDG PET and cardiac MRI. The learner will understand the role of these modalities in the work up of patients with suspected cardiac sarcoid. 2) The case will demonstrate focal hot spots in the periphery of the lungs on MAA perfusions scan. The learner will be able to identify this finding as an artifact related to the technique of injection. 3) The case will deomonstrate the typical characteristics of pleural talcosis on FDG PET. The exhibit will teach the learner how to seperate benign from neoplastic causes of update in the pleural space.

RC611

Advances in Cardiac Nuclear Imaging: SPECT/CT and PET/CT

Thursday, Dec. 3 8:30AM - 10:00AM Location: S504CD

CA CT NM

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

Participants

LEARNING OBJECTIVES

1) Understand the technical advancements associated with new scintillation cameras and SPECT-CT and PET-CT cameras. 2) Appreciate the benefits of CT attenuation correction. 3) Appreciate the adjunctive benefits of anatomic definition provided with CT and physiologic/function information provided by SPECT and PET. 4) Improve interpretive skills related to SPECT and PET-CT.

ABSTRACT

Camera and software technology recently has rapidly advanced, providing improved SPECT image resolution and increased counting statistics. These advancements in turn have provided the possibility of reduced-time and reduced radiopharmaceutical dose image acquisitions. Moreover, increased flexibility in imaging protocols has been realized. Future development of these methods hold promise in increasing diagnostic accuracy and expanding diagnostic applications. The addition of CT to SPECT and PET has afforded the ability to perform attenuation correction, thereby minizing attenuation artifacts and increasing diagnostic specificity. With CT acquisitions of sufficient resolution, complementary anatomic diagnostic information is provided. In addition, more precise anatomic localization of SPECT and PET abnormalities significantly increases clinical applicability.

Sub-Events

RC611A Advances in Cardiac SPECT

Participants
E. Gordon Depuey, MD, New York, NY (*Presenter*) Steering Committee, Adenosine Therapeutics, LLC;

LEARNING OBJECTIVES

1) Understand software methods to cope with lower SPECT counting statistics in order to reduce scan acquisition time and/or radiopharmaceutical injected activity and their clinical impact. 2) Understand instrumentation advances that allow new cameras to perform SPECT with markedly reduced acquisition times and/or less radiopharmaceutical activity and their clinical impact. 3) Implement protocols that facilitate patient-centered imaging and that reduce patient radiation exposure.

ABSTRACT

New software methods and new innovative hardware now allow for significantly shortened SPECT acquisition times without a decrease in image quality. Advancements include iterative reconstruction, resolution recovery, and noise reduction software, and focused collimation and solid state detectors incorporated into new camera designs. Attenuation correction increases diagnostic specificity and facilitates stress-only protocols. Software advancements such such as high resolution imaging, scatter correction, and respiratory gating increase diagnostic sensitivity. There has been an intersocietal effort to promote patient-centered imaging with a focus on appropriateness guidelines, cost-containment, radiation dose reduction, and the selection of the most appropriate imaging test and protocol to suit particular patient needs. The technical advancements described above facilitate implementation of patient-centered imaging. Even with such technical advancements, however, attention to technical detail is essential to assure optimal image quality. Camera and radiopharmaceutical quality control deserve the highest priority. A systematic review of myocardial perfusion SPECT images is essential to recognize artifacts and optimize diagnostic accuracy. Case examples will be presented to reinforce this approach.

RC611B Advances in Cardiac PET

Participants
Sharmila Dorbala, MBBS, Boston, MA (*Presenter*) Research Grant, Astellas Group; Stockholder, General Electric Company; ; ; ;

LEARNING OBJECTIVES

1) Review the advantages and disadvantages of myocardial perfusion PET compared to SPECT for evaluation of coronary artery disease. 2) Learn the added value of absolute quantitative parameters derived from PET for assessment of cardiovascular disease. 3) Update of current and future clinical applications of cardiac PET imaging in cardiovascular medicine.

ABSTRACT

Novel advances in PET detectors, radiotracer availability, clinical software, as well as hybrid PET/CT and PET/MR scanners have revolutionized the clinical and investigative applications of cardiac PET. Cardiac PET myocardial perfusion imaging, in the 1970's, was a predominantly investigative tool, with home-grown software, available at select major academic centers with access to a cyclotron. Over the last decade, with easy access to PET scanners, and to positron emitting perfusion tracers, the use of cardiac PET has exploded -well beyond major academic centers to several hospitals and to large office-based practices. Commercially available software has made quantitative myocardial blood flow assessment, a main-stream clinical application. Hybrid PET/CT scanner applications- calcium score and CT based coronary angiography-have further advanced the applications of cardiac PET. PET/MR is an emerging technology with promising cardiovascular applications. Each of these exciting developments has transformed cardiac PET from a predominantly investigative tool of the 1970's to the advanced clinical tool of the 2015. The primary goal of this session is to discuss the present-day clinical and emerging applications of cardiac PET/CT and PET/MR using a practical case-based approach.

RC617

MR Neurography and New Methods to Image Pain

Thursday, Dec. 3 8:30AM - 10:00AM Location: S505AB

NR MR NM

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

Participants
Sandip Biswal, MD, Stanford, CA (*Moderator*) Co-founder, SiteOne Therapeutics Inc; Research Grant, General Electric Company; Stockholder, Atreus Pharmaceuticals Corporation

Sub-Events

RC617A MR Neurography of the Brachial Plexus and Upper Extremities

Participants
Amelie M. Lutz, MD, Stanford, CA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To understand the role of/indications for MR neurography in the multidisciplinary diagnostic work-up of brachial plexus and upper extremity nerve pathologies. 2) To understand the technical requirements and challenges of MR neurography in the brachial plexus and upper extremities. 3) To get familiar with the anatomy and normal MR imaging appearance of the brachial plexus and upper extremity nerves. 4) To recognize commonly encountered pathologies and their differential diagnoses in brachial plexus and upper extremity nerves.

ABSTRACT

Continuous improvements in magnetic resonance scanner, coil, and pulse sequence technology have resulted in the ability to perform routine, high-quality imaging of the brachial plexus and upper extremity nerves. MR neurography has evolved into a very helpful diagnostic tool in the work-up of peripheral nerve and plexus pathologies. It is commonly used for the detection and preoperative staging of neural mass lesions, in evaluating inflammatory and traumatic brachial plexus changes, confirming and/or complementing electrophysiologic exams. This talk will focus on the technical requirements for imaging the brachial plexus and upper extremities, discuss the anatomy, and demonstrate relevant examples of normal and abnormal findings.

RC617B MR Neurography of the Lumbar Plexus and Lower Extremities

Participants
Avneesh Chhabra, MD, Dallas, TX, (avneesh.chhabra@utsouthwestern.edu) (*Presenter*) Research Consultant, Siemens AG; Consultant, ICON plc

LEARNING OBJECTIVES

1) Employ new techniques for LS plexus and lower extremity evaluation. 2) Understand the differences between normal and abnormal imaging appearances of LS plexus and lower extremity peripheral nerves. 3) Discuss the differential diagnosis of various LS plexus and lower limb nerve pathologies based on available clinical history and imaging findings. 4) Learn how to incorporate the MRN modality in the diagnostic algorithm of plexopathies and related peripheral neuropathies in a multi-disciplinary fashion.

ABSTRACT

Lumbosacral plexus has a complex anatomy with a number of nerve convergences and divergencesresulting in formation of multiple essential peripheral nerves that provide motor and sensory function tothe pelvis and lower extremities. Due to the deep location and complexity, MR neurography (MRN) plays amajor role in evaluation of its normalcy and pathologic states.This talk will discuss current state of the art techniques available for LS plexus evaluation and show normal and abnormal imaging appearances of various common and uncommon pathologic states involving LS plexus and its branch nerves.The talk will specifically address new 3D techniques that suppress vessel signal effectively while preserving effective nerve visualization. Role of MRN in chronic pelvic pain, nerve injuries and its incremental value over conventional lumbar spine imaging will be discussed. Current role of functional DTI in qualitative and quantitative assessment of nerve pathology and tumors will be highlighted.

RC617C DTI of the Peripheral Nervous System

Participants
Gustav Andreisek, MD, Zurich, Switzerland (*Presenter*) Grant, Holcim Ltd; Grant, Siemens AG; Speaker, Mepha Pharma AG; Speaker, Guerbet SA; Travel support, Guerbet SA; Consultant, Otsuka Holdings Co, Ltd; Travel support, Otsuka Holdings Co, Ltd; Institutional Research Grant, Bayer AG; Institutional Research Grant, Guerbet AG; Institutional research collaboration, Siemens AG; Institutional research collaboration, Koninklijke Philips NV; Speaker, General Electric Company; Speaker, Koninklijke Philips NV; Speaker, Siemens AG; ;

LEARNING OBJECTIVES

1) Identify the basic microanatomy of peripheral nerves, main pathologic conditions, and physiologic principles of diffusion-weighted tensor imaging (DTI). 2) Apply diffusion-weighted tensor imaging (DTI) to imaging protocols for peripheral neuropathies, used for both, research and clinical practice. 3) Analyze diffusion-weighted tensor imaging (DTI) images both quantitatively and qualitatively. 4) Understand the current applications but also limitations of diffusion-weighted tensor imaging (DTI) of peripheral nerves.

ABSTRACT

Diffusion tensor imaging (DTI) is an MR imaging technique which uses the random motion (diffusion) of water molecules within biologic tissues. Due to the tissues ` distinct structural properties, the diffusion is hindered in some directions but at the same typically not hindered in other directions.DTI is a well known imaging technique in the brain and central nervous system, but its application to the periperal nerveous system was limited in the past due to multiple technical reasons. However, numerous recent studies show now that the technique cannot only be applied sucessfully to image peripheral nerves, but they also showed that the technique is very sensitive and specific for the detection of peripheral nerve injuries and other neuropathies. DTI may also serve as a biomarker for the demyelination of axons and the extend of nerve fiber loss.The refresher course will cover the basic principles of DTI, the challanges and limitations for imaging protocols, as well as the evaluation of DTI images (both quantitatively and qualitatively). MR tractography of peripheral nerves will also be covered.

RC617D PET and MR Methods to Image Pain

Participants
Sandip Biswal, MD, Stanford, CA (*Presenter*) Co-founder, SiteOne Therapeutics Inc; Research Grant, General Electric Company; Stockholder, Atreus Pharmaceuticals Corporation

LEARNING OBJECTIVES

1) Understand the challenges of current conventional imaging approaches in diagnosing peripheral pain generators. 2) Understand the basis for identifying specific molecular and cellular biomarkers of pain and how these biomarkers can be exploited with molecular and cellular imaging techniques. 3) Demonstrate both clinical and pre-clinical PET/MR or advanced MRI approaches in identifying pain generators.

ABSTRACT

Chronic pain is now the prevalent disease in the world. The chronic pain sufferer is currently faced with a lack of objective tools to identify the source of their pain. The goal of this session is to describe new clinical molecular imaging and emerging molecular/cellular imaging methods to more accurately localize chronic pain generators/drivers so that we may objectively identify and more intelligently act upon the cause in a pain sufferer. Successful imaging of pain is relying heavily upon a multidisciplinary effort that include expertise from of a number of scientists and clinicians in the fields of synthetic chemistry, radiochemistry, magnetic resonance physics/engineering, molecular pain neurobiology, clinical pain, radiology and others. A number of clinical and emerging pre-clinical approaches in positron emission tomography (PET) and magnetic resonance imaging (MRI) will be described. These imaging methods will demonstrate how the site of increased nociceptive activity is highlighted in the peripheral nervous system and spinal cord.

RC625

Radiomics Mini-Course: Oncologic Applications

Thursday, Dec. 3 8:30AM - 10:00AM Location: S103AB

BR CH NR BQ CT NM OI RO PH

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

Participants
Sandy Napel, PhD, Stanford, CA (*Director*) Medical Advisory Board, Fovia, Inc; Consultant, Carestream Health, Inc; Scientific Advisor, EchoPixel, Inc

Sub-Events

RC625A Breast Cancer with PET-CT

Participants
Richard L. Wahl, MD, Saint Louis, MO (*Presenter*) Research Consultant, Nihon Medi-Physics Co, Ltd;

LEARNING OBJECTIVES

1) Describe the FDG pet uptake characteristics before therapy of 'triple - negative' breast cancers vs other subtypes.

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/

Richard L. Wahl, MD - 2013 Honored Educator

RC625B Radiogenomics of Lung Cancer

Participants
Michael D. Kuo, MD, Los Angeles, CA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To discuss the principles behind lung cancer radiogenomics. 2) Highlight clinical applications of lung cancer radiogenomics.

ABSTRACT

RC625C Brain Cancer: Radiomics, Radiogenomics, and Big Data

Participants
Rivka R. Colen, MD, Houston, TX, (rcolen@mdanderson.org) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Define the field of radiomics and imaging genomics. 2) Apply radiomics and imaging genomics in brain tumors. 3) Describe the use of MRI as a biomarker for genomic signatures and profiles. 4) Define role of MRI in personalized medicine for target discovery of therapeutic targets. 5) Explain the use of MRI in drug development and clinical trials. 6) Assess the research available in imaging genomics and radiomics. 7) Define and describe the integration of radiomics and imaging genomics into big data platforms.

ABSTRACT

This objective of this course is to introduce the recently emerged field of radiomics and imaging genomics (radiogenomics) in brain tumors, specifically glioblastoma (GBM). Emphasis will be on radiomics with regards to the high-dimensional, high-throughput feature extraction of imaging features from medical images, specifically MRI; the second emphasis will be on the use of imaging in relation to underlying tumor genomics, how to use MRI as a biomarker, surrogate and correlate of tumor genomics as well as the use of MRI as a genomic target discovery tool and its application in therapeutic discovery and drug development. The role of radiomics and imaging genomics in the era of big data and how we can leverage the imaging-omic data will also be discussed.

SSQ02

Cardiac (PET CT, PET MRI and SPECT)

Thursday, Dec. 3 10:30AM - 12:00PM Location: S502AB

CA CT MR NM

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

FDA Discussions may include off-label uses.

Participants
Rainer K. Rienmueller, MD, Graz, Austria (*Moderator*) Nothing to Disclose
Seth J. Kligerman, MD, Denver, CO (*Moderator*) Nothing to Disclose
W. Brian Hyslop, MD, PhD, Chapel Hill, NC (*Moderator*) Nothing to Disclose

Sub-Events

SSQ02-01 Optimal Scan Timing for Transluminal Attenuation-gradient Coronary CT Angiography Using a Contrast-material Flow Phantom

Thursday, Dec. 3 10:30AM - 10:40AM Location: S502AB

Participants
Yoshinori Funama, PhD, Kumamoto, Japan (*Presenter*) Nothing to Disclose
Toshiaki Shimonobo, Kumamoto, Japan (*Abstract Co-Author*) Nothing to Disclose
Takashi Shirasaka, BS, Fukuoka, Japan (*Abstract Co-Author*) Nothing to Disclose
Daisuke Utsunomiya, MD, Kumamoto, Japan (*Abstract Co-Author*) Nothing to Disclose
Seitaro Oda, MD, Kumamoto, Japan (*Abstract Co-Author*) Nothing to Disclose
Yasuyuki Yamashita, MD, Kumamoto, Japan (*Abstract Co-Author*) Consultant, DAIICHI SANKYO Group

PURPOSE

The transluminal attenuation gradient (TAG), the gradient of intraluminal radiological attenuation, is a novel index that improves the classification of coronary artery stenosis in coronary CT angiography (CCTA). However, the quantitative TAG value affected by the scan timing after the injection of contrast material because it is calculated from the difference between the pre- and post-stenosis CT numbers. Using a flow phantom and a 320-MDCT volume scanner we investigated the quantitative TAG value at different scan timing points after contrast material injection for coronary CT angiography.

METHOD AND MATERIALS

Using a contrast-material flow phantom we performed one-volume scans on a 320-MDCT volume scanner (Aquilion ONE ViSION, Toshiba). We employed two types of connecting tubes mimicking 0% and 70% stenosis. The heart rate (HR) was set at 60 bpm, cardiac output at 2.0 and 4.0 l/min; the injection volume of contrast material was 40 ml delivered in the course of 10 sec. Flushing was with 20 ml of physiological saline. The tube voltage and rotation time were 120 kVp and 275 msec. Acquisition of the 80-mm coverage area (160 x 0.5 mm) along the z-axis was started 5.0 sec post-injection and repeated at 0.5 sec intervals for 40 sec with no table movement. We measured the CT numbers on the same slice level and calculated the time density curve (TDC) for 40 sec at 0.5-sec intervals. The TAG value was also calculated from the difference in the CT number obtained at 0% and 70% stenosis at each time point.

RESULTS

At 70% stenosis and a cardiac output of 2.0 l/min, the time to peak enhancement (PE) from the arrival time was 15.5 sec. In contrast, the time from the arrival time for the lowest TAG value was 6.5 sec at -6.6 Hounsfield units (HU)/cm, i.e. 9.0 sec earlier from the time to PE. At the same time point of 6.5 sec from the arrival time, The TAG value at 0% stenosis was -1.4 HU/cm. At 70% stenosis and a cardiac output of 4.0 l/min, the time for the lowest TAG was 6.0 sec earlier and the TAG value was -4.0 HU/cm; it was -1.7 HU/cm at 0% stenosis.

CONCLUSION

The TAG value depends on the scan timing after contrast material injection and optimal scan timing dose not correspond to the time to peak enhancement.

CLINICAL RELEVANCE/APPLICATION

The time to PE differs by 6.0-9.0 sec when the TAG value is obtained with optimal scan timing on a 320-MDCT volume scanner.

SSQ02-02 Feasibility Study of Low Tube Voltage (80kVp) Coronary CT Angiography with Knowledge Based Iterative Reconstruction on Patients with BMI 20-25

Thursday, Dec. 3 10:40AM - 10:50AM Location: S502AB

Participants
Fan Zhang, PhD, Sanya, China (*Presenter*) Nothing to Disclose
Li Yang, MD, PhD, Beijing, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To investigate the feasibility of low tube voltage (80kVp) coronary CT angiography with knowledge based iterative reconstruction (IMR, Philips Healthcare) on BMI20-25 patients by comparing to images acquired with clinical routine protocols.

METHOD AND MATERIALS

Coronary CT angiography scans were acquired using a 256-slice MSCT (Brilliance iCT, Philips Healthcare) on 94 patients with body

mass index (BMI, 20-25 kg/m2) who were randomly assigned into 2 groups. The scan protocol for group 1 was 100kVp, 600mAs with 70ml contrast medium at an injection rate of 4.5 to 5.5ml/s, and images were reconstructed by a hybrid iterative reconstruction technique (iDose4, Philips Healthcare), while the protocol for group 2 was 80kVp, 600mAs with 35ml contrast medium at an injection rate of 3.5 to 4.5ml/s, and images were reconstructed with IMR. The mean image noise and CNR of different groups were measured on CT images and compared using the paired-t test. In addition, image quality evaluation was performed by two radiologists who were blinded to scan protocol, using a five-point scale (1 [poor] to 5 [excellent]).The results of the two groups were compared between two groups with the Mann-Whitney U-test.

RESULTS

Compared to group 1, group 2 reduced the iodine delivery rate by 52.4% from 2.1±0.5 gI/s to 1.0±0.5 gI/s and the effective radiation dose by 56.4% from 5.5±1.4 mSv to 2.4±1.2mSv. The mean CT attenuation, CNRs and image quality of all segments on group2 were significantly improved compared to those on group2 (all, $p<0.01$).

CONCLUSION

By using of knowledge based iterative reconstruction technique, an ultra-low tube voltage combining with low contrast medium protocol for cCTA can reduce both radiation dose and contrast medium dose with even better image quality.

CLINICAL RELEVANCE/APPLICATION

The use of 80kV-IMR with low injection dose protocols offers even lower image noise and better image quality especially of distal segments despite a 56.4% radiation dose reduction and a 52.4% contrast medium dose reduction when compared to 100kV-HIR with standard injection dose protocols on non-obese patients.

SSQ02-03 Myocardial Triglyceride and Left Ventricular Systolic Function: A Cross-Sectional CMR Study in Post-Acute Hospitalization Heart Failure Patients

Thursday, Dec. 3 10:50AM - 11:00AM Location: S502AB

Participants
Pen-An Liao, MD, Taipei City, Taiwan (*Presenter*) Nothing to Disclose
Gigin Lin, MD, Guishan, Taiwan (*Abstract Co-Author*) Nothing to Disclose
Shang-Yueh Tsai, Taipei, Taiwan (*Abstract Co-Author*) Nothing to Disclose
Chao-Hung Wang, Keelung City, Taiwan (*Abstract Co-Author*) Nothing to Disclose
Yu-Hsiang Juan, MD, Taoyuan, Taiwan (*Abstract Co-Author*) Nothing to Disclose
Yu-Ching Lin, MD, Tao Yuan, Taiwan (*Abstract Co-Author*) Nothing to Disclose
Ming-Ting Wu, MD, Kaohsiung, Taiwan (*Abstract Co-Author*) Nothing to Disclose
Lan-Yan Yang, Guishan, Taiwan (*Abstract Co-Author*) Nothing to Disclose
Min-Hui Liu, Keelung City, Taiwan (*Abstract Co-Author*) Nothing to Disclose
Tsun-Ching Chang, Keelung City, Taiwan (*Abstract Co-Author*) Nothing to Disclose
Yu-Chun Lin, MSC, Taoyuan, Taiwan (*Abstract Co-Author*) Nothing to Disclose
Yu-Chieh Huang, Keelung City, Taiwan (*Abstract Co-Author*) Nothing to Disclose
Pei-Ching Huang, Taoyuan City, Taiwan (*Abstract Co-Author*) Nothing to Disclose
Jiun-Jie Wang, Taoyuan City, Taiwan (*Abstract Co-Author*) Nothing to Disclose
Koon-Kwan Ng, Guishan, Taiwan (*Abstract Co-Author*) Nothing to Disclose
Shu-Hang Ng, MD, Taoyuan, Taiwan (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Myocardial triglyceride (TG) is related to increased risk of heart disease. However, its relation with cardiac function in recovery status of acute heart failure (HF) has not been investigated. We aim to study the association between myocardial TG content measured on magnetic resonance spectroscopy (1H-MRS) and left ventricular (LV) function revealed on cardiac MR (CMR) in post-acute hospitalization HF patients.

METHOD AND MATERIALS

We enrolled 50 HF patients discharged from acute hospitalization 6-12 month ago and recruited 21 age- and gender-matched normal controls. Myocardial TG content as well as the left ventricular (LV) function and LV mass was measured by using a 3.0 T MR system. Myocardial TG resonances, comprising fatty acid (FA) and unsaturated fatty acid (UFA), were analyzed and normalized with water (W) signal by using the LC-Model algorithm. According to their LV ejection fraction (LVEF) at the time of CMR examination, our patients was dichotomized into the low LVEF group (LVEF < 50%) and the normal LVEF group (LVEF >= 50%).

RESULTS

There were 48 patients and 21 controls with successful 1H-MRS available for analysis. Among our 48 patients, 25 had their low LVEF (mean, 31.2%) while the other 23 had normal LVEF (mean, 60.2%). Myocardial UFA/W, but no TG/W or FA/W, showed significant differences among the low LVEF group, the normal LVEF group and the control group (7.9% vs 2.1% vs 1.4%, $p = 0.02$).Myocardial UFA/TG was strong correlated with LV mass ($r = 0.39$, $p < 0.001$) and margninally correlated with LV end-diastolic volume (LVEDV) ($r = 0.24$, $p = 0.039$), while myocardial FA/TG was negatively correlated with LV mass ($r = -0.39$, $p < 0.001$) and LVEDV ($r = -0.24$, $p = 0.039$).

CONCLUSION

Increased myocardial UFA was observed in post-acute hospitalization HF patients as compared with controls, with a significantly higher level of UFA in the low LVEF group than in the normal LVEF group. Myocardial UFA was strong correlated with LVEDV, LV mass and, to a lesser degree, cardiac output. We believe that metabolic imaging for measurement of myocardial UFA content by 1H-MRS may be useful for noninvasively evaluation for HF patients post-acute hospitalization.

SSQ02-04 13N-ammonia PET/MR Myocardial Stress Perfusion Imaging Early Experience

Thursday, Dec. 3 11:00AM - 11:10AM Location: S502AB

Participants
Amir K. Durrani, MD, St Louis, MO (*Presenter*) Nothing to Disclose

Jeffrey M. Lau, MD, PhD, Saint Louis, MO (*Abstract Co-Author*) Nothing to Disclose
Richard Laforest, PhD, Saint Louis, MO (*Abstract Co-Author*) Nothing to Disclose
Jie Zheng, PhD, Saint Louis, MO (*Abstract Co-Author*) Nothing to Disclose
Agus Priatna, PhD, Ballwin, MO (*Abstract Co-Author*) Research Consultant, Siemens AG Employee, Siemens AG
Robert J. Gropler, MD, Saint Louis, MO (*Abstract Co-Author*) Advisory Board, Bracco Group Advisory Board, GlaxoSmithKline plc Advisory Board, Pfizer Inc Advisory Board, Bayer AG Research Grant, GlaxoSmithKline plc Research Grant, Pfizer Inc Research Grant, Clinical Data, Inc Research Grant, Lantheus Medical Imaging, Inc
Pamela K. Woodard, MD, Saint Louis, MO (*Abstract Co-Author*) Research Consultant, Bristol-Myers Squibb Company; Research Grant, Astellas Group; Research Grant, F. Hoffmann-La Roche Ltd; Research Grant, Bayer AG; Research agreement, Siemens AG; Research Grant, Actelion Ltd; Research Grant, Guerbet SA; ; ;

PURPOSE

Simultaneous acquisition Positron Emission Tomography/Magnetic Resonance (PET/MR) is a new technology with potential use in cardiac perfusion imaging. Pharmacologic stress perfusion imaging with 13N-ammonia-PET and MR have previously been validated separately for detection of coronary artery disease (CAD). In this pilot study, we optimize a protocol for comprehensive cardiac PET/MR stress perfusion imaging, and evaluate its diagnostic accuracy for CAD when compared to GSPECT-MPI.

METHOD AND MATERIALS

15 patients with reversible myocardial perfusion defect on GSPECT-MPI for whom standard of care coronary angiography was planned were recruited. Patients received 400mcg Regadenoson, followed 30 seconds later by simultaneous 13N-Ammonia-PET (10.2 +/- 0.46 mCi) and gadolinium-based (0.075 mmol/Kg) contrast MR perfusion imaging. The procedure was repeated at rest. PET attenuation correction μ-map was a dual echo VIBE Dixon sequence. PET images were reconstructed with 3D-OSEM (Ordered Subset Estimation Maximization) with 3 iterations, 21 subsets and post-Gaussian filter of 4 mm. The presence and absence of ischemia and infarction were assessed by two independent readers. Areas of decreased perfusion on MRI were correlated to PET myocardial blood flows (MBF) as measured by 2-compartment modeling analysis.

RESULTS

PET/MR demonstrated excellent concordance with coronary angiographic findings. In this small data set, when compared to GSPECT-MPI, combined PET/MR demonstrated superior diagnostic accuracy (69% vs 54%). The inter-reader concordance was 77%. Using PET/MR as a diagnostic tool for CAD, in this small cohort, there is a 100% sensitivity, 100% negative predictive value, and a 64% positive predictive value.

CONCLUSION

Early experience with 13N-PET/MR perfusion imaging showed excellent diagnostic accuracy, sensitivity and specificity for CAD detection.

CLINICAL RELEVANCE/APPLICATION

Perfusion PET/MR offers a comprehensive myocardial ischemic evaluation. Potential benefits including shorter exam time than SPECT, lower radiation dose, absolute myocardial blood flow quantification, and internal validation between PET and MR findings.

SSQ02-05 Doppler-Ultrasound in Comparison to Electrocardiogram and Pulse Oximetry for Gating Cardiac MRI at 3T

Thursday, Dec. 3 11:10AM - 11:20AM Location: S502AB

Participants
Fabian Kording, Hamburg, Germany (*Presenter*) Nothing to Disclose
Jin Yamamura, MD, Hamburg, Germany (*Abstract Co-Author*) Nothing to Disclose
Gunnar K. Lund, MD, Hamburg, Germany (*Abstract Co-Author*) Nothing to Disclose
Friedrich Uberle, Hamburg, Germany (*Abstract Co-Author*) Nothing to Disclose
Caroline Jung, Hamburg, Germany (*Abstract Co-Author*) Nothing to Disclose
Gerhard B. Adam, MD, Hamburg, Germany (*Abstract Co-Author*) Nothing to Disclose
Bjoern Schoennagel, MD, Hamburg, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Electrocardiogram (ECG) triggering for cardiac magnetic resonance (CMR) may be influenced by magnetic interferences with increasing magnetic field strength. Doppler Ultrasound (DUS) is not objected to magneto-hydro-dynamic effects (MHD) and does not interact with the electromagnetic field of the MRI. The purpose of this study was to evaluate the performance of Doppler ultrasound (DUS) as a trigger technique for CMR in comparison to ECG and pulse oximetry (POX) at 3 Tesla.

METHOD AND MATERIALS

Balanced Turbo Field Echo 2D short axis cine CMR and 2D phase-contrast angiography of the ascending aorta was performed in 11 healthy volunteers using ECG, DUS and POX for CMR. The E-wave in early diastole was selected for DUS trigger time points to obtain a marker for quiescent heart phases which were subsequently compared to quiescent heart phases determined manually based on ECG triggered cine images by two observer. Trigger signals were recorded simultaneously in reference to standard ECG trigger signals and compared in terms of trigger quality. Image quality was assessed by endocardial border sharpness (EB) and functional assessment in terms of LV volumetry and aortic blood flow velocimetry.

RESULTS

The mean sensitivity of trigger recognition for all sequences was similar between DUS (99±1%), ECG (99±1%) and POX (99±1%). DUS trigger points correlated strong with manually determined cardiac quiescence (R=0.9, Obs. 1; R=0.9, Obs. 2). Mean EB averaged over the entire cardiac cycle was similar for ECG, DUS and POX with no significant differences (pECG/DUS = 0.6; pECG/POX = 0.5; pDUS/POX = 0.8). Early diastolic EB was significantly reduced for DUS compared to ECG (pECG/DUS = 0.007) and POX (pDUS/POX=0.03), but not for ECG versus POX (pECG/POX=0.3). Mean EDV (pECG/DUS=0.8, pECG/POX=0.7), ESV (pECG/DUS=0.9, pECG/POX=0.6) and mean aortic velocity (pECG/DUS=0.6, pECG/POX=0.6) were not significantly different.

CONCLUSION

This study demonstrated the feasibility of DUS for gating human CMR at 3T. With the benefit of not being influenced by

This study demonstrated the feasibility of DUS for gating human CMR at 3T. With the benefit of not being influenced by electromagnetic interferences DUS may offer an alternative trigger technique at high magnetic field environments.

CLINICAL RELEVANCE/APPLICATION

Doppler ultrasound measures physiological motion of the heart rather than electrical activation and, hence, may enable a more accurate gating, especially for higher field strength.

SSQ02-06 Hybrid Cardiac 18F-FDG PET/MRI in Patients with Suspected Myocarditis

Thursday, Dec. 3 11:20AM - 11:30AM Location: S502AB

Awards
RSNA Country Presents Travel Award

Participants
Felix Nensa, MD, Essen, Germany (*Presenter*) Nothing to Disclose
Ercan Tezgah, Essen, Germany (*Abstract Co-Author*) Nothing to Disclose
Thorsten D. Poeppel, Essen, Germany (*Abstract Co-Author*) Nothing to Disclose
Till Neumann, Essen, Germany (*Abstract Co-Author*) Nothing to Disclose
Nico Reinsch, Essen, Germany (*Abstract Co-Author*) Nothing to Disclose
Peter Krings, Essen, Germany (*Abstract Co-Author*) Nothing to Disclose
Amir Sabet, Essen, Germany (*Abstract Co-Author*) Nothing to Disclose
Juliane Schelhorn, MD, Essen, Germany (*Abstract Co-Author*) Nothing to Disclose
Kai Nassenstein, Essen, Germany (*Abstract Co-Author*) Nothing to Disclose
Thomas W. Schlosser, MD, Essen, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate the diagnostic performance of hybrid 18F-FDG PET/MRI in comparison to late gadolinium-enhancement (LGE) and T2-weighted imaging in patients with suspected myocarditis.

METHOD AND MATERIALS

A total of 60 consecutive patients (24 female, age: 35±13 y) with suspected myocarditis were prospectively assessed using integrated cardiac 18F-FDG PET/MRI (mMR Biograph, Siemens Healthcare). The MR imaging protocol consisted of functional cine images, T2-weighted triple inversion recovery images and LGE images 10 minutes after injection of gadobutrol. PET data acquisition was performed simultaneously to MR imaging. Physiological glucose uptake in the myocardium was suppressed with a high-fat, low-carbohydrate diet and i.v. administration of unfractionated heparin. Consent diagnosis by three experienced cardiologists, who were blinded to PET/MR data, was used as standard of reference.

RESULTS

PET/MRI examination was successful in 50 of 60 enrolled patients: 2 patients were excluded due to incomplete PET/MRI examinations because of claustrophobia, 8 patients were excluded due to failed inhibition of physiological myocardial glucose uptake. No significant difference in left ventricular ejection fraction was found between patients with clinical evident myocarditis and those clinically diagnosed as not having myocarditis (59.2±7.2% vs. 60.3±12.8%, p=0.298, n=50). Sensitivity and specificity of LGE for the detection of clinically evident myocarditis were 71% and 88% (80% accuracy). Sensitivity and specificity of T2-weighted imaging for the detection of clinically evident myocarditis were 58% and 88% (74% accuracy). Sensitivity and specificity of PET for the detection of clinically evident myocarditis were 75% and 88% (82% accuracy). Odd ratios for the detection of myocarditis were 5.5 for LGE, 5.0 for T2-weighted imaging and 7.0 for PET. Of all combinations, the best diagnostic performance was obtained when at least one of three parameters (LGE, T2, PET) was positive in the same patient yielding 92% sensitivity, 81% specificity, and 86% diagnostic accuracy.

CONCLUSION

Hybrid 18F-FDG PET/MRI can improve the non-invasive diagnosis in patients with suspected myocarditis.

CLINICAL RELEVANCE/APPLICATION

FDG PET/MRI might guide the therapeutic strategy in patients with suspected myocarditis by providing a more accurate diagnosis and - with FDG uptake - a surrogate parameter for the activity of inflammation.

SSQ02-07 Correlating Corrected Coronary Opacification Gradients to PET Myocardial Perfusion: CT Angiography in Functional Assessment of Coronary Lesions

Thursday, Dec. 3 11:30AM - 11:40AM Location: S502AB

Participants
Leonid Chepelev, MD,PhD, Ottawa, ON (*Presenter*) Nothing to Disclose
Ran Klein, PhD, Ottawa, ON (*Abstract Co-Author*) Consultant, Jubilant DraxImage Inc; Shareholder, Jubilant DraxImage Inc
Brittany Reiche, Ottawa, ON (*Abstract Co-Author*) Nothing to Disclose
Benjamin Chow, MD, Ottawa, ON (*Abstract Co-Author*) Research Grant, General Electric Company Support, TeraRecon, Inc
Frank J. Rybicki III, MD, PhD, Ottawa, ON (*Abstract Co-Author*) Research Grant, Toshiba Corporation;

PURPOSE

To explore the potential use of corrected coronary opacification (CCO) gradients in predicting functional severity of coronary artery disease as assessed by PET myocardial perfusion imaging.

METHOD AND MATERIALS

We retrospectively evaluated 42 consecutive patients who underwent CCTA and 82Rb PET MPI within 180 days of each other. CCO was defined as mean coronary intraluminal attenuation normalized to mean aortic attenuation within the same axial slice. Coronary artery geometries and corresponding CCO measurements were automatically derived based on expert vessel centerline annotations with a 1.5mm diameter cutoff and fused with PET perfusion polar maps using software developed by our group in Java and MATLAB. CCO gradients, corrected and uncorrected by coronary artery diameter, were measured in the distal, proximal, and entire coronary

arteries, excluding non-diagnostic, calcified, stenotic, and stented regions. The CCO gradients were correlated to PET myocardial perfusion in the immediate vessel vicinity and projected perfusion territory of a given vessel.

RESULTS

The maximal Pearson correlation coefficients were observed when considering distal 40% vessel segments and immediately adjacent (±30 degrees on polar map) perfusion territories while omitting calcific and stenotic vessel regions. For the correlation between CCO and PET myocardial perfusion in the immediate vicinity, this yielded absolute Pearson correlation coefficients of 0.71±0.18, 0.70±0.25, and 0.80±0.23 for LAD, LCX, and RCA respectively. Correction of CCO by vessel diameter at the distal 40% vessel segments yielded coefficients that were not significantly different: 0.70±0.20, 0.70±0.24, and 0.80±0.22, respectively.

CONCLUSION

The correlation between CCO gradients and PET MPI data supports their use in functional lesion assessment.

CLINICAL RELEVANCE/APPLICATION

Corrected coronary opacification gradients may supplement functional assessment of coronary artery lesions and potentially predict the functional status of the myocardium using existing CCTA data.

SSQ02-08 Quantitative Assessment of Diffuse Myocardial Fibrosis in Patients with Diabetic Cardiomyopathy by T1-Mapping: Correlates with Diabetic History

Thursday, Dec. 3 11:40AM - 11:50AM Location: S502AB

Participants
Xiao-Chun Zhang, Chongqing, China (*Presenter*) Nothing to Disclose
Shang Yongning, Chongqing, China (*Abstract Co-Author*) Nothing to Disclose
Jun Zhao, Chongqing, China (*Abstract Co-Author*) Nothing to Disclose
Tianjing Zhang, Beijing, China (*Abstract Co-Author*) Employee, Siemens AG
Jian Wang, Chongqing, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The purpose of this study was to use cardiac magnetic resonance (CMR) T1-mapping technique to evaluate diffuse myocardial fibrosis and to explore its relationship with diabetic history.

METHOD AND MATERIALS

Thirty three patients with diabetic cardiomyopathy (DCM) (16 men, 17 women, mean age 46±8 years) and 48 healthy controls were performed in Siemens Trio 3.0T, the WIP sequence. T1 Mapping was used for measurement of T1 values, ECV values were calculated from pre and post T1 values. The results' correlation with patients' diabetic history were analyzed as well.

RESULTS

Pre-contrast myocardial T1 time and myocardial extracellular volume (ECV) in patients with DCM was significantly higher than the measurement in control cases, and post-contrast myocardial T1 time in DCM patients was significantly lower than that in control cases ($p<0.001$, respectively). In DCM patients, diabetic history was correlated with pre-contrast T1, ECV and post--contrast T1 ($r=0.92$, 0.95 and -0.93, respectively. $p<0.001$).

CONCLUSION

Diffuse myocardial fibrosis in patients with DCM can be assessed by CMR T1-mapping. The study results demonstrate that increased diabetic history is likely to be a major contributor to the severity of diffuse myocardial fibrosis.

CLINICAL RELEVANCE/APPLICATION

As a new imaging modality, CMR T1-mapping can provide four dimensional data to quantitatively assess the severity of diffuse myocardial fibrosis in DCM patients, which is useful for the clinical decision.

SSQ02-09 Rate of Incidental Findings at Myocardial Perfusion Scintigraphy

Thursday, Dec. 3 11:50AM - 12:00PM Location: S502AB

Participants
Andrea O. Vergara Finger, MD, Burlington, VT (*Presenter*) Nothing to Disclose
Sean Reynolds, MD, Burlington, VT (*Abstract Co-Author*) Nothing to Disclose
Janusz K. Kikut, MD, Burlington, VT (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The SNMMI/ASNC/SCCT consensus guidelines on cardiac SPECT/CT and PET/CT advocate for reporting of incidental findings (IF) on noted on PET/CT and SPECT/CT and SPECT cardiac imaging. However, the definition of a reportable incidental finding is left to the discretion of the interpreting physician. The incidence of IF is reported at 34% in the literature; however, the incidence of clinically important findings is significantly lower, reported as around 5%. However, image quality is often quite different between SPECT/CT and PET/CT with image quality substantially better for the latter. We retrospectively evaluated the rate of IF defined as an unknown or potentially unknown new diagnosis and compared the rate in SPECT/CT as compared to PET/CT to see if the improved image quality available at PET/CT affected the IF rate.

METHOD AND MATERIALS

A total of 10,520 Sestamibi SPECT/CT and Rb-82 PET/CT cardiac studies performed at our institution in from 2011-2014 were retrospectively evaluated by querying the dedicated IF field of a NM structured reporting database (Vericis, Merge Healthcare, Chicago, IL). All IF were evaluated by ABR certified readers. Only significant findings as determined by the interpreting radiologist were placed into the field. IF were categorized into those seen on the emission scan and those seen on CT.

RESULTS

IF were discovered on 370 (3.5%) of studies. Of these, 9 (0.08%) were noted on the emission scan, while 362 (3.4%) were noted on the CT. The rate on Sestamibi SPECT/CT was 166/9446 (1.7%) while the rate on Rb-82 PET was 204/1074 (19.0%).

CONCLUSION

IF considered significant by the interpreting radiologist are more prevalent in our practice than previously reported especially when CT quality approaches diagnostic quality as with PET/CT. On hybrid imaging, they are more common on the CT portion of the study than on the emission scan. This underscores the recommendation for reporting these findings and argues for having physicians familiar with conventional CT imaging interpret the CT portion of hybrid imaging studies.

CLINICAL RELEVANCE/APPLICATION

The majority of IF at hybrid cardiac imaging appear on CT, arguing for having interpreters experienced in conventional CT review the CT portion of the study.

SSQ12

Molecular Imaging (New Tracers/Methods)

Thursday, Dec. 3 10:30AM - 12:00PM Location: S504AB

CT MI MR NM

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

FDA Discussions may include off-label uses.

Participants
Brian M. Rodgers, MD, Rockville, MD (*Moderator*) Nothing to Disclose
Bernadette V. Marquez, PhD, Saint Louis, MO (*Moderator*) Nothing to Disclose

Sub-Events

SSQ12-01 Hyperpolarized 13C MRI for Non-Invasive Assessment of Liver Injury in a Mouse Model

Thursday, Dec. 3 10:30AM - 10:40AM Location: S504AB

Participants
Michael A. Ohliger, MD, PhD, San Francisco, CA (*Presenter*) Nothing to Disclose
Irene Marco-Rius, PhD, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose
Robert A. Bok, MD, PhD, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose
Jacquelyn J. Maher, MD, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose
Cornelius Von Morze, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose
Subramaniam Sukumar, PhD, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose
Zihan Zhu, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose
Zhen J. Wang, MD, Hillsborough, CA (*Abstract Co-Author*) Nothing to Disclose
Benjamin M. Yeh, MD, San Francisco, CA (*Abstract Co-Author*) Research Grant, General Electric Company; Author with royalties, Oxford University Press; Shareholder, Nextrast, Inc;
Daniel B. Vigneron, PhD, San Francisco, CA (*Abstract Co-Author*) Research Grant, General Electric Company
John Kurhanewicz, PhD, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Liver injury and inflammation may lead to liver fibrosis, portal hypertension and cirrhosis. There is currently no method to image liver inflammation. Hyperpolarized 13C MRI is an emerging tool for imaging metabolism. Increased conversion of [13C]pyruvate to [13C]lactate has been observed in a mouse model of arthritis. We hypothesize that lactate production may be a marker of acute liver injury.

METHOD AND MATERIALS

11 male CD1 mice were treated via IP injection with either 1 ul/g of the hepatotoxin CCl4 (n=6) to induce liver injury, or with vehicle alone (n=5, control group). Mice were imaged with a 14 T preclinical MRI scanner prior to and 48 hours after treatment. 350 ul of 80mM [1-13C]pyruvic acid was polarized in a Hypersense DNP polarizer (Oxford Instruments) and injected via tail vein. Metabolite images were obtained for pyruvate, alanine and lactate at 29 s using a fast spectrally-selective 3D imaging sequence (resolution 2x2x3.3 mm). Metabolite images were overlayed onto T2 images. An ROI was drawn on the center liver slice avoiding large vessels. Ratios of lactate and alanine to pyruvate were measured. Mice were sacrificed and livers stained for histology. Liver damage graded by an experienced hepatologist blinded to the imaging.

RESULTS

Imaging was successful in all 11 mice before and after treatment. Histologic liver damage was seen in 5/6 CCl4-treated mice. Mean lactate/pyruvate ratio was significantly higher after CCl4 treatment (2.8, SD 0.9) than for untreated mice (1.8, SD 0.6, $p<0.05$) or the control group (1.7, SD 0.5, $p<0.05$). Mean alanine/pyruvate ratio was also significantly higher after CCl4 treatment (2.2, SD 0.6) than for untreated mice (1.3, SD 0.6, $p<0.05$) or the control group (1.4, SD 0.4, $p<0.05$). There was no significant difference in either ratio between the pre-treatment and the control group.

CONCLUSION

Treatment of mice with a single dose of the hepatotoxin CCl4 leads to a significant and rapid rise in hepatic lactate and alanine production measured by hyperpolarized 13C MRI. Future experiments will determine whether the observed lactate and alanine production results from activated inflammatory cells within the liver or metabolic alterations within hepatocytes themselves.

CLINICAL RELEVANCE/APPLICATION

Hyperpolarized 13C MRI is a promising tool for non-invasively imaging evaluating liver injury and inflammation.

SSQ12-02 Synthesis and Characterization of Novel Hydrophilic Molecules for 19F-MR Contrast Imaging

Thursday, Dec. 3 10:40AM - 10:50AM Location: S504AB

Participants
Eric Tanifum, PhD, Houston, TX (*Presenter*) Nothing to Disclose
Matthew Liaw, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Robia Pautler, PhD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Ananth Annapragada, PhD, Houston, TX (*Abstract Co-Author*) Stockholder, Marval Pharma Ltd Stockholder, Alzeca Biosciences LLC Stockholder, Sensulin LLC Stockholder, Abbott Laboratories Stockholder, Johnson & Johnson

PURPOSE

Conventional MRI contrast agents employ paramagnetic metal ions to generate contrast in 1H MRI scans. While this approach is

Conventional MRI contrast agents employ paramagnetic metal ions to generate contrast in 1H MRI scans. While this approach is highly sensitive, specificity and unambiguous quantification of signal is challenging and metal ion toxicity is a concern so other alternatives are sought. 19F presents a great potential for reasons including: spectroscopic properties of 19F are similar to 1H therefore existing 1H MRI hardware can be used for 19F MRI with minimal modifications; no endogenous 19F in soft tissue so the potential to generate a directly quantifiable signal with high contrast-to-noise ratio. However, almost all 19F-based agents utilize perfluorocarbons (PFCs), with several drawbacks: highly hydrophobic (limiting formulation to water emulsions) and magnetically diverse 19Fs (result in diffuse 19F MR images). We report novel hydrophilic fluorinated molecules with magnetically equivalent 19Fs, amenable to aqueous formulations for molecular imaging.

METHOD AND MATERIALS

Hydrophilic moieties were linked to fluorinated moieties with equivalent 19Fs, to generate water-soluble monomer units and then condensed to dimers and oligomers with high 19F content. Structures were confirmed by NMR and MS. Liposome formulation was achieved using standard protocols and size distribution determined by DLS. 19F content was assessed by UV-VIS and 19F NMR, and 19F MRI scans performed using a TurboRARE 3D scan in a 9.4 T Bruker instrument equipped with a 1H/19F dual-tunable volume RF coil.

RESULTS

Molecular synthesis was achieved in excellent yields, and 1H and 19F NMR indicated purity of the final products at >97%. All compounds dissolved readily in saline to give 500 mM to 1 M solutions used to prepare stable liposome formulations. 19F MR scans showed that formulations are detectable at 2-5 mM concentrations of the molecules, comparable to the high micromolar to milimolar intravoxel concentrations required for Gd contrast detection.

CONCLUSION

This is a new and facile paradigm to formulate 19F MRI contrast agents in aqueous media and their use to prepare stable liposome formulations, a proven nanoparticle platform for both passive and active delivery of contrast for molecular imaging, highlights the potential of this approach.

CLINICAL RELEVANCE/APPLICATION

We believe this approach will have significant impact on molecular imaging.

SSQ12-03 [^{11}C]Me@HAPTHI - A Novel PET-ligand for the Norepinephrine Transporter - Part 1: Target Affinity and Radiosynthesis

Thursday, Dec. 3 10:50AM - 11:00AM Location: S504AB

Participants
Christina Rami-Mark, MSc, Vienna, Austria (*Presenter*) Nothing to Disclose
Neydher Berroteran-Infante, MSc, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose
Alexander Hoepping, Radeberg, Germany (*Abstract Co-Author*) Employee, ABX GmbH
Marcus Hacker, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose
Markus Mitterhauser, Vienna, Austria (*Abstract Co-Author*) Speaker, General Electric Company
Wolfgang Wadsak, Vienna, Austria (*Abstract Co-Author*) Speaker, General Electric Company; Consultant, THP Medical; Research Grant, ABX GmbH; Research Grant, Rotem GmbH

PURPOSE

The norepinephrine transporter (NET) has been demonstrated to be relevant to a multitude of neuro-psychiatric and cardiovascular pathologies. Due to the wide range of possible applications for PET imaging of the NET together with the limitations of currently available radioligands, novel NET-PET tracers are seriously needed.

METHOD AND MATERIALS

Precursor, HAPTHI ((S)-1-(4-amino-3-hydroxybutyl)-3-phenyl-1,3-dihydrobenzo[c] [1,2,5]thiadiazole 2,2-dioxide), and reference compound, Me@HAPTHI ((S)-1-(3-hydroxy-4-(methylamino)butyl)-3-phenyl-1,3-dihydrobenzo[c][1,2,5]thiadiazole 2,2-dioxide), were custom-synthesized by ABX.For optimization of radiosynthesis conditions, small-scale reactions (< 2GBq) were performed. The influence of various reaction conditions, i.e. reaction temperature, solvent and base, precursor concentration and radiomethylation agent, was investigated. The automation of the N-^{11}C-methylation reaction was done on a TRACERlab FX C Pro synthesizer (GE Healthcare).The affinity of new radiolabeled ligand was determined in a NET-expressing membrane binding protocol.

RESULTS

In the radiochemical evaluation, best results were obtained with sodium hydroxide catalysis in 2-butanone (MEK) as solvent for 2min at 75°C using 2mg/mL precursor HAPTHI. Thereby, 54.0 ± 8.3% radiochemical incorporation yield was achieved. These optimum reaction parameters were subsequently used in the fully automated radiosynthesizer. So far, 7 large-scale radiosyntheses were performed, yielding 2.2 ± 2.0GBq (18.9 ± 13.3%, corrected for decay) of sterile, formulated [^{11}C]Me@HAPTHI within 36min. A mean specific activity of 46.8±28.5 GBq/µmol was found in the large-scale syntheses. Full radiopharmaceutical quality control took 5min and showed that radiochemical purity always exceeded 98%.Affinity of reference compounds, Me@HAPTHI, using human NET membranes evinced a Kd of 0.21 ± 0.07nM (n≥9). For determination of selectivity, additionally the affinity towards human DAT and SERT membranes were measured and revealed >10µM for DAT and 409 ± 43nM for SERT, respectively, (n≥5). Hence, selectivity of Me@HAPTHI towards NET was determined as DAT/NET>1947.6 and SERT/NET=9757.

CONCLUSION

This study confirms an outstanding affinity and selectivity of the title compound towards human NET as well as its feasible radiochemical preparation for further preclincal evaluations ans future in-vivo applications.

CLINICAL RELEVANCE/APPLICATION

N/A

SSQ12-04 [^{11}C]Me@HAPTHI - A Novel PET-ligand for the Norepinephrine Transporter - Part 2: Preclinical Evaluation

Thursday, Dec. 3 11:00AM - 11:10AM Location: S504AB

Participants
Christina Rami-Mark, MSc, Vienna, Austria (*Presenter*) Nothing to Disclose
Wolfgang Wadsak, Vienna, Austria (*Abstract Co-Author*) Speaker, General Electric Company; Consultant, THP Medical; Research Grant, ABX GmbH; Research Grant, Rotem GmbH
Cecile Philippe, PhD, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose
Chrysoula Vraka, MSc, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose
Marcus Hacker, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose
Markus Mitterhauser, Vienna, Austria (*Abstract Co-Author*) Speaker, General Electric Company

PURPOSE

The norepinephrine transporter (NET) has been demonstrated to be pivotal in many neuro-psychiatric and cardiovascular pathologies. [^{11}C]Me@HAPTHI, a novel potential NET-PET tracer, was shown to have a high target affinity and selectivity. Hence, further in vitro evaluation regarding blood-brain-barrier (BBB) penetration, stability and binding properties in autoradiography on different tissues is required.

METHOD AND MATERIALS

LogD was assessed using HPLC (Donovan and Pescatore J Chrom A, 2002). Immobilized artificial membrane (IAM) chromatography was performed using a standard method (Vraka C et al. EJNMMI, 2014) to achieve Pm (permeability) values.For evaluation of stability, incubation with human liver microsomes was performed. Plasma protein binding was determined quantifying the free fraction (ff) in human pooled plasma (Huang Y et al. J Cereb Blood Flow Metab, 2002). In vitro autoradiography was performed on human brain tissue (cortex, thalamus, hippocampus, cerebellum, and hypothalamus) as well as rat heart. Non-specific binding was determined with excess Nisoxetine (10µM). For competition, non-radioactive FMeNER-D2 and Me@HAPTHI were added. After 1h at room temperature, incubation was stopped and slices were processed on phosphor imaging films.Post-autoradiographic processing of the slices was done by Nissl staining in order to facilitate morphological mapping. Immunohistochemical (IHC) staining experiments were performed on rat and human tissue cryo-slices, vicinal to the slices used for autoradiography.

RESULTS

Excellent affinity (Kd of 0.21±0.07nM) and selectivity (DAT/NET>1940; SERT/NET=9700) were already shown for [^{11}C]Me@HAPTHI. Now, both logD (2.27±0.01) and Pm (1.15±0.25) were found to be in a range for expectable BBB penetration. After 60min incubation with human liver microsomes, 99.6±0.3% of the tracer were still intact. ff was found to be 8.2±0.3%.In the autoradiographic experiments, highest uptake of [^{11}C]Me@HAPTHI was observed in NET-rich regions identified with IHC and a concentration dependent binding displacement was seen for both competitors.(see figure)

CONCLUSION

Side from its high affinity and selectivity, we now demonstrated [^{11}C]Me@HAPTHI's stability, expectable BBB penetration and specific binding in autoradiography. This encourages us for in vivo application in small animal PET experiments and future clinical trials.

CLINICAL RELEVANCE/APPLICATION

N/A

SSQ12-05 Multimodal Imaging of Insulin-dependent Triglyceride-rich lipoprotein Uptake into Brown Adipose Tissue at 7T MRI and Intravital Microscopy

Thursday, Dec. 3 11:10AM - 11:20AM Location: S504AB

Participants
Caroline Jung, Hamburg, Germany (*Presenter*) Nothing to Disclose
Markus Heine, Hamburg, Germany (*Abstract Co-Author*) Nothing to Disclose
Gerhard B. Adam, MD, Hamburg, Germany (*Abstract Co-Author*) Nothing to Disclose
Harald Ittrich, MD, Hamburg, Germany (*Abstract Co-Author*) Nothing to Disclose
Jorg Heeren, Hamburg, Germany (*Abstract Co-Author*) Nothing to Disclose
Nils Mangels, Hamburg, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The aim was to determine the metabolic activity of brown adipose tissue (BAT) and its dependence on signalling pathway mediated by the anabolic hormone insulin using superparamagnetic iron oxide nanoparticles (SPIO - for MRI) or quantum dots (QD - for intravital microscopy (IVM)) embedded into triglyceride-rich lipoproteins (TRL).

METHOD AND MATERIALS

BAT activity of C57BL/6J wild-type was stimulated by treatment with the β3 receptor agonist CL316,243. Inhibition of insulin secretion during the course of BAT activation was performed using the potassium channel agonist diazoxide. All mice were starved for 4 hours before imaging. MRI at 7T ClinScan (Bruker) was performed before and 20 minutes after iv injection of TRL-SPIOs using a T2*w Multiecho-GRE sequence (TR/TEfirst 400/2ms, ETL 12, ES 1ms, FA 25°). ΔR2* in BAT was estimated. In addition to the MRI set up, IVM analysis was performed for real time imaging of TRL-QD uptake into BAT. In order to quantify TRL clearance, the fate of radioactively labelled TRLs were analysed under the same experimental conditions.

RESULTS

While no signal difference in BAT before and after the injection of TRL-SPIO was detectable for control mice, a significant signal drop and increase of ΔR2* (82.9s-1; p<0.001) was estimated for CL treated, BAT activated mice. Inhibition of insulin signalling resulted in a significant lower uptake of TRL-SPIO into BAT (ΔR2* = 21.1s-1; p<0.001). MRI results were confirmed by IVM analyses and by quantitative metabolic studies using radioactive lipid tracers. In both setups inhibition of insulin secretion using diazoxide abolished TRL uptake into BAT.

CONCLUSION

β3-receptor activation via CL with following acute insulin release lead to BAT activation, which can be visualised in vivo by MRI

β3 receptor activation via CL with following acute insulin release lead to BAT activation, which can be visualised in vivo by MRI using TRL-SPIO and estimating ΔR2*. Accordingly, the inhibition of insulin signalling blocks TRL uptake into BAT. Thus, MRI can visualize physiological lipid processing in the vascular endothelium of activated BAT.

CLINICAL RELEVANCE/APPLICATION

MRI in combination with nanoparticle-labelled lipoproteins can be used to noninvasively monitor the molecular pathway of insulin-dependent lipoprotein metabolism.

SSQ12-06 Using MPI as High Temporal Resolution Imaging Technique for in Vivo Bolus Tracking of Ferucarbotran in Mouse Model

Thursday, Dec. 3 11:20AM - 11:30AM Location: S504AB

Participants
Caroline Jung, Hamburg, Germany (*Presenter*) Nothing to Disclose
Johannes M. Salamon, MD, Hamburg, Germany (*Abstract Co-Author*) Nothing to Disclose
Martin Hofmann, Dipl Phys, Hamburg, Germany (*Abstract Co-Author*) Nothing to Disclose
Michael G. Kaul, Hamburg, Germany (*Abstract Co-Author*) Nothing to Disclose
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Harald Ittrich, MD, Hamburg, Germany (*Abstract Co-Author*) Nothing to Disclose
Kolja Them, Hamburg, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Magnetic particle imaging (MPI) is a new radiologic imaging method, potentially capable of rapid 3D dynamic imaging of magnetic tracer. The goal of this study was to follow and visualize the intravenous injected nanoparticles in real time through cardiovascular system at MPI.

METHOD AND MATERIALS

MPI scans of FVB mice (n=4) were carried out using a 3D imaging sequence (1 T/m gradient strength, 10 mT drive-field strength, FOV 40x40x20 mm3). After a first baseline control measurement a dynamic scan consisting of 100 000 repetitions (duration of about 35min and temporal resolution of 21.5ms per 3D volume) was performed. After the 13953th repetition 50µl ferucarbotran (Resovist, Bayer Schering Pharma AG) was injected into the tailvein via pump (53.7ml/h). As MPI delivers no anatomic information, MRI scans at 7T ClinScan (Bruker) were performed before and after MPI examination using a T2-weighted 2D turbo spin echo sequence (FOV 32mm, matrix 256x256, TR 1100ms, TE 28ms). The reconstruction was performed on the MPI console (ParaVision 6.0/MPI, Bruker). Image fusion was done using additional image processing software (Imalytics, Philips). The dynamic information was extracted using self-written software using the Julia programming environment.

RESULTS

The combined MR-MPI measurements were carried out successfully. No dislocation of the mouse was observed. In the sagittal views it is clearly visible how the tracer enters the vena cava inferior before it moves to the heart and then into the liver. (Fig. 1 shows different time points over a range of 1.5 s). By co-registration with MRI the anatomical regions were identified. Due to the frame rate of about 46 volumes per second a signal modulation with the frequency of the heart beat is detectable and a heart beat of 520bpm can be appreciated. Moreover the bloodflow velocity of approximately 5cm/s in the vena cava can be estimated.

CONCLUSION

The high temporal resolution of MPI allows real-time imaging and bolus tracking of intravenous injected nanoparticles and offers a tool to estimate blood flow velocity. MRI was successful used for anatomical informations.

CLINICAL RELEVANCE/APPLICATION

Blood flow velocity measurements by MPI may allow the estimation of luminal narrowing in atherosclerotic disease.

SSQ12-07 In Vivo Noninvasive Characterization of Brown Adipose Tissue in Rat by Spectral CT

Thursday, Dec. 3 11:30AM - 11:40AM Location: S504AB

Awards
Molecular Imaging Travel Award

Participants
Xin-Gui Peng, MD,PhD, Nanjing, China (*Presenter*) Nothing to Disclose
Zhen Zhao, Nanjing, China (*Abstract Co-Author*) Nothing to Disclose
Di Chang, Nanjing, China (*Abstract Co-Author*) Nothing to Disclose
Shenghong Ju, MD, PhD, Nanjing, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Brown adipose tissue (BAT) has lower lipid content, more abundant iron content and mitochondrion campared to white adipose tissue (WAT). Our study is to evaluate the lipid/water and iron/water content in both types of adipose tissure using material decomposition and effective atomic number of spectral CT.

METHOD AND MATERIALS

The animal study was approved by the institutional Committee on Animal Research. Six Wistar rats (14 weeks, 304g ±12g) underwent Spectral CT scan (GE, Discovery CT750 HD). Data were transmitted to AW4.6 workstation to obtain base material mappings, including fat (water) based imaging and iron (water) based imaging. The fat/water and iron/water concertraction of brown adipose tissue (interscapular) and white adipose tissue (visceral) were measured on base material mapping. In addition, we also calculate the effective atomic number of both types of adiopse tissue. Statistical analysis was performed with independent sample t test.

RESULTS

The base fat (water) material concentration of BAT was significantly lower than that of WAT (587.29 ± 187.61mg/cm3 and 1587.43 ± 70.11mg/cm3, respectively; P< 0.001). However, the water (fat) concentration of BAT was significantly higher than that of WAT (395.81±189.53mg/cm3, and -655.1 ± -69.141mg/cm3, respectively; P<0.001). The based iron (water) material concentration of BAT was significantly higher compared to WAT (-4.92±1.80mg/cm3 and -13.80 ± 0.36mg/cm3, respectively; P<0.001). Water (iron) concentration of BAT was also higher than that of WAT (989.33±7.29mg/cm3 and 951.63±-5.49mg/cm3, respectively; P<0.001). The effective atomic number of BAT was significant higher than that of WAT (6.95±0.28 and 4.7±0.11, respectively; P< 0.001).

CONCLUSION

The quantification of base material concentration and effective atomic number analysis of spectral CT revealed different characterization of both types of adipose tissue.

CLINICAL RELEVANCE/APPLICATION

It is anticipated that spectral CT provided a new noninvasive method to be translated to a clinical setting for evaluating the difference of adipose tissue and monitoring the responses to specific therapeutic strategies.

SSQ12-08 Does Iterative CT Reconstruction for Attenuation Correction Impact PET Images? A Qualitative and Quantitative Assessment for Next-Generation Digital Detector PET/CT

Thursday, Dec. 3 11:40AM - 11:50AM Location: S504AB

Awards
Molecular Imaging Travel Award

Participants
Katherine Binzel, PhD, Columbus, OH (*Presenter*) Nothing to Disclose
Jun Zhang, PhD, Columbus, OH (*Abstract Co-Author*) Nothing to Disclose
Philip Bardos, Columbus, OH (*Abstract Co-Author*) Nothing to Disclose
Veena A. Nagar, MD, Dublin, OH (*Abstract Co-Author*) Nothing to Disclose
Michael V. Knopp, MD, PhD, Columbus, OH (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Implementation of iterative CT reconstruction (ICR) allows for significant dose reduction while generating equivalent visual quality to conventional CT doses. In this study we determine if there is any quantitative impact of using ultra-low dose ICR for attenuation correction of PET data, compared to filtered back projection (FBP).

METHOD AND MATERIALS

Clinical patients received 13 mCi FDG prior to imaging on the Vereos TF 64 PET/CT (Philips). Attenuation CTs were performed using 120 kV and 50 mAs for the PET imaging volume, skull to mid-thighs. PET images were reconstructed in two different modes, standard CT FBP and iDose4 ICR. The PET images were visually and quantitatively evaluated in a blinded fashion. The quantitative assessment focused on ROI assessment in target lesions in patients and background tissues.

RESULTS

A total of 30 datasets from 15 patients were evaluated. On visual assessment of the PET images benefits from the use of ICR for attenuation correction were apparent with markedly reduced impact from streaking artifacts. The quantitative analysis revealed that the overall SUVmax of PET images with iteratively reconstructed attenuation CTs was 0.5% higher for all tissue types [non-significant difference]. In target lesions the percent difference ranged from 0.5% to 1.4% increased SUVmax's over SUVmax's determined from PET images with FBP CT, none having any lower values.

CONCLUSION

Iterative CT reconstruction enables significant reduction of the x-ray dose required to obtain attenuation correction images for PET. This study validates that there is no impact on the quantitative readout compared to FBP reconstructed attenuation CTs. The visual appearance of the PET images appeared to be improved at locations where streaking artifacts were visible on FBP reconstructed CTs. Iterative reconstructed CTs can and should be used on next-generation PET/CT systems.

CLINICAL RELEVANCE/APPLICATION

Iterative CT reconstruction enables significant reduction of the x-ray dose required to obtain attenuation correction images for PET, while simultaneously improving the appearance of image artifacts.

SSQ12-09 Generalized Syntheses of Tumor Targeted Yolk/Shell Structured Multifunctional Nanosystems

Thursday, Dec. 3 11:50AM - 12:00PM Location: S504AB

Awards
Molecular Imaging Travel Award

Participants
Christopher England, PhD, Madison, WI (*Presenter*) Nothing to Disclose
Feng Chen, PhD, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
Hao Hong, PhD, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
Shreya Goel, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
Stephen Graves, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
Todd Barnhart, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
Weibo Cai, PhD, Palo Alto, CA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The purpose of this work is to develop a generally applicable protocol for synthesizing yolk/shell structured multifunctional nanosystems to be used for tumor targeted PET image-guided drug delivery.

METHOD AND MATERIALS

Upconversion nanoparticle (UCNP, with NIR-in-NIR-out upconversion luminescence) was used as the initial example. UCNP was first coated with a dense silica (dSiO2) shell, forming UCNP@dSiO2, followed by re-growth of a shell-thickness controllable mesoporous silica nanoshell (MSN) to form UCNP@dSiO2@MSN. A Na2CO3 etching protocol was used to selectively etch away dSiO2, leaving behind yolk/shell structured nanoparticles denoted as UCNP@HMSN. A step-by-step surface engineering process was then adopted to conjugate (or label) NOTA, polyethylene glycol (PEG) linkers, TRC105 (an anti-CD105 antibody), and 64Cu to form 64Cu-UCNP@HMSN-PEG- TRC105. Both hydrophobic (i.e. Sunitinib) and hydrophilic (i.e. Doxorubicin) drugs could be loaded inside UCNP@HMSN. Systematic in vivo PET imaging and biodistribution studies were performed in 4T1 tumor-bearing mice to evaluate and confirm tumor targeting capability, validated by in vitro/ex vivo studies.

RESULTS

TEM confirmed successful synthesis of UCNP@HMSN. By changing the 'yolk' to superparamagnetic iron oxide nanoparticle (SPION) or quantum dot (QD), we confirmed the general applicability of this protocol. In vitro CD105 targeting in HUVEC (CD105+) and MCF-7 (CD105-) cells showed strong/specific binding of FITC-conjugated UCNP@HMSN-PEG-TRC105 to CD105+ cells with negligible non-specific binding. In vivo tumor targeting and PET imaging demonstrated CD105-specific targeting of 64Cu-UCNP@HMSN-PEG-TRC105 in 4T1 tumor-bearing mice, with peak tumor uptake of ~6.5 %ID/g at 6 h post-injection. CD105 specificity was confirmed by blocking and ex vivo histology studies.

CONCLUSION

This work demonstrates the feasibility of developing targeted yolk/shell structured nanosystems for in vivo imaging. With UCNP, QD, SPION, or other nanocrystals inside each yolk/shell structure, this nanoplatform is highly versatile for future tumor targeted multimodality image-guided drug delivery.

CLINICAL RELEVANCE/APPLICATION

We report the generalized syntheses of yolk/shell structured nanosystems for tumor targeted PET imaging and drug delivery, with potential future applications as theranostic agents for the concurrent imaging and treatment of cancer.

SSQ15

ISP: Nuclear Medicine (Emerging Methods and Techniques)

Thursday, Dec. 3 10:30AM - 12:00PM Location: S505AB

CT MR NM

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

FDA Discussions may include off-label uses.

Participants
Charles M. Intenzo, MD, Philadelphia, PA (*Moderator*) Nothing to Disclose
Don C. Yoo, MD, Providence, RI (*Moderator*) Nothing to Disclose

Sub-Events

SSQ15-01 Nuclear Medicine Keynote Speaker: Advances in Clinical Optical Imaging

Thursday, Dec. 3 10:30AM - 10:50AM Location: S505AB

Participants
Jan Grimm, MD, PhD, New York, NY (*Presenter*) Nothing to Disclose

SSQ15-03 Focal 18F-FDG Uptake in PET-MRI Indicates Activated Facet Arthrosis and Guides Facet Block Therapy: A Prospective Pilot Study in 11 Patients Suffering from Neck Pain

Thursday, Dec. 3 10:50AM - 11:00AM Location: S505AB

Participants
Lino Sawicki, MD, Dusseldorf, Germany (*Presenter*) Nothing to Disclose
Benedikt M. Schaarschmidt, MD, Dusseldorf, Germany (*Abstract Co-Author*) Nothing to Disclose
Philipp Heusch, MD, Duesseldorf, Germany (*Abstract Co-Author*) Nothing to Disclose
Christian Buchbender, Duesseldorf, Germany (*Abstract Co-Author*) Nothing to Disclose
Frank Floeth, Duesseldorf, Germany (*Abstract Co-Author*) Nothing to Disclose
Gerald Antoch, MD, Duesseldorf, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate the potential role of 18F-FDG-PET/MRI in detecting activated facet arthrosis and its impact on therapy.

METHOD AND MATERIALS

Eleven consecutive patients with musculosceletal neck pain (mean pain on visual analogue scale (VAS)> 7, median duration 9 months, no radiculopathy or myelopathy) were prospectively enrolled in this study. Mean and maximum standard uptake values (SUVmean/max) were measured one hour after injection of 18F-FDG in each facet joint and patient. On STIR-images bone signal intensity (SI) ratios between each facet joint and Th1 vertebral body (reference site) were measured and calculated. Post-hoc Mann-Whitney-U-Test (MWU) was performed to identify differences in SUVmean, SUVmax and bone SI ratio on STIR images between normal, arthrotic and activated arthrotic facet joints. Focal tracer uptake in a facet joint served as target for CT guided infiltration using local anesthetics and corticosteroids. In patients without focal uptake, facet blocks were performed to the segment of maximum cervical osteoarthritis. Neck pain was measured before and after the infiltration on VAS.

RESULTS

18F-FDG-PET/MRI detected focal tracer uptake along the facet joint capsule in 6 of 11 patients (average SUVmax: 3,5 +/- 0,9; average SUVmean: 2.5 +/- 0.9) with good match to the patients' pain localization. Posthoc MWU revealed significantly higher SUVmax, SUVmean and bone SI Ratio on STIR images in activated facet arthrosis than in normal or arthrotic facet joints ($p<0.001$). Correlation was strong between bone SI Ratio on STIR images and SUVmax ($P=0.66$; $p<0.001$) as well as SUVmean (0.67; $p<0.001$). Targeted facet block in patients with activated facet arthrosis led to a higher reduction of pain activity than in patients without activated facet arthrosis (VAS reduction 24h post infiltration: -5.2 +/-1.2 vs. -0.8 +/-0.4; $p=0.004$).

CONCLUSION

18F-FDG PET/MRI can detect activated facet arthrosis and thus might facilitate identification of patients suitable for successful targeted infiltration therapy.

CLINICAL RELEVANCE/APPLICATION

Identifying suitable patients for facet joint infiltration is important for therapy success. PET/MRI can detect activated facet arthrosis and thus facilitate succesful infiltration therapy.

SSQ15-04 Volumetric, Metabolic and CSF Biomarkers Profile in Different Subtypes of MCI

Thursday, Dec. 3 11:00AM - 11:10AM Location: S505AB

Participants
Artur Coutinho, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose
Fabio H. Porto, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Silvana Prando, DIPLPHYS, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Fabio L. Duran, DSc, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Livia Spindola, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Maira O. Oliveira, MSc, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Patricia H. Vale, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose

Carla R. Ono, MD,PhD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Ricardo Nitrini, MD, PhD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Sonia M. Brucki, MD,DSc, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Carlos A. Buchpiguel, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Mild cognitive impairment (MCI) is a transitional stage between normal aging and dementia, particularly Alzheimer's disease (AD). There are few reports investigating multiple biomarkers of non-amnestic MCI (naMCI) as a single group, in comparison to amnestic subtypes (aMCI) and a normal elderly control group (CG). Our study investigated: a) regional brain glucose metabolism (rBGM) with [18F]FDG-PET and volume-based morphometry with magnetic resonance imaging (MRI) of a naMCI group in comparison to CG and aMCI, and b) the profile of amyloid-β peptide, tau and p-tau proteins in the cerebrospinal fluid (CSF) of naMCI and aMCI groups.

METHOD AND MATERIALS

114 subjects composed three groups: naMCI (N = 38), aMCI (N = 46) and CG (N = 30). All subjects underwent brain MRI and [18F]FDG-PET. Imaging data was analysed with the software SPM8. A subsample (naMCI = 33, aMCI = 38) underwent a lumbar puncture in order to assess levels of amyloid-ß peptide, tau and phosphorylated tau protein levels in the CSF.

RESULTS

There was no difference in demographic characteristics and CSF biomarkers between the naMCI and aMCI groups. Both MCI groups had lower rBGM in relation to CG in the precuneus. Additional right prefrontal lobe hypometabolism was seen in naMCI. aMCI group had bilateral mesial and polar temporal lobe volume reduction in comparison to naMCI and CG. No significant volumetric reduction in mesial temporal lobes was seen in naMCI.

CONCLUSION

Amnestic MCI showed metabolic and volumetric profiles classically related to MCI due to AD, while naMCI group shared a similar metabolic pattern (reduced precuneus rBGM) and prefrontal hypometabolism, but had fewer areas of volumetric reduction.

CLINICAL RELEVANCE/APPLICATION

Non-amnestic subtypes (naMCI) present with executive, attention, visuospatial and language dysfunctions. A lower conversion rate to dementia, specially AD, is seen in naMCI than in amnestic MCI. An outstanding question is whether naMCI and aMCI have different biomarker profiles. There are few reports investigating multiple biomarkers of naMCI as a single group in comparison to aMCI and cognitively normal elderly subjects (CG). Our study characterizes naMCI as a heterogeneous group, less related to classical AD and different from aMCI. This group should be better prospectivelly investigated in order to search for specific biomarkers indicating risk of developing different kinds of neurodegenerative disorders.

SSQ15-05 The Usefulness of the Dopamine Transporter Volume Estimated by C-11 PE-2I PET/CT in Diagnosing Parkinsonism-Novel Parameter for Quantifying the Total Amount of Dopamine Transporter

Thursday, Dec. 3 11:10AM - 11:20AM Location: S505AB

Participants
Shigeki Nagamachi, MD, PhD, Miyazaki, Japan (*Presenter*) Nothing to Disclose
Ryuichi Nishii, MD, PhD, Miyazaki, Japan (*Abstract Co-Author*) Nothing to Disclose
Youichi Mizutani, Miyazaki, Japan (*Abstract Co-Author*) Nothing to Disclose
Yoshiro Umemura, MD, Miyakonojo, Japan (*Abstract Co-Author*) Nothing to Disclose
Ryuichi Ohkubo, Miyakonojyo City, Japan (*Abstract Co-Author*) Nothing to Disclose
Toshinori Hirai, MD, PhD, Miyazaki, Japan (*Abstract Co-Author*) Nothing to Disclose
Hiroshi Takashima, Kagoshima, Japan (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

In the diagnosis of Parkinsonism, C-11 PE2I (N- (3-iodoprop -2E-enyl)-2β-carbomethoxy-3β-(4-methyl-phenyl)nortropane) is useful radiopharmaceutical for its high binding selectivity and specificity to dopamine transporter (DAT) .The study was done to evaluate the usefulness of novel parameter, dopamine transporter volume (DTV) that was calculated with C-11 PE-2I PET/CT, in diagnosing Parkinsonism.

METHOD AND MATERIALS

Twenty-six patients with Parkinsonism, 15 idiopathic Parkinson diseases (PD) and 11 Parkinsonism of other cause (PS) were evaluated. All patients were done two kinds of examination, C-11 PE-2I PET/CT and iodine-123-labeled metaiodobenzylguanidine (123I-MIBG) myocardial scintigraphy. Three dimensional VOI (volume of interest) was automatically drawn around striatum respectively on C-11 PE-2I PET/CT images. Both sided maximum standardized uptake value (SUVmax) and dopamine transporter volume (DTV) were obtained. The threshold value for calculating DTV was 40% of SUVmax. On MIBG scintigraphy, Heart to mediastinum ratio (H/M) and washout ratio (WR) were calculated from early (E) and delayed (D) chest planar images. Correlation analysis between all C-11 PE-2I PET/CT parameters and MIBG parameters were done. In addition, all parameters were compared between PD and PS.

RESULTS

Both sides DTV showed positive correlation with both the early and delayed H/M (correlation coefficients were from 0.35 to 0.48). In addition, mean value of both sides DTV in PD were significantly lower compared with those in PS (Right TV: 4.26ml vs. 8.67ml, Left TV: 3.92ml vs. 9.59ml).. However, SUVmax showed no statistical significance.

CONCLUSION

Novel parameter, dopamine transporter volume (DTV), obtained from C-11 PE-2I PET/CT was useful parameter for quantifying conditions of dopamine transporters in Parkinsonism. In addition, it was also useful parameter in differentiating PD from PS.

CLINICAL RELEVANCE/APPLICATION

Dopamine transporter volume (DTV) that is calculated by C-11 PE-2I PET/CT will be additional useful indices in the differential diagnosis of Parkinsonism.

SSQ15-06 The Role of SPECT/CT for Non-visualization in Breast Cancer Sentinel Lymph Node Procedures

Thursday, Dec. 3 11:20AM - 11:30AM Location: S505AB

Participants
Bas Pouw, Amsterdam, Netherlands (*Presenter*) Nothing to Disclose
Daan Hellingman, Amsterdam, Netherlands (*Abstract Co-Author*) Employee, Oncovision
Mariette Kieft, Amsterdam, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Wouter Victor Vogel, MD, PhD, Amsterdam, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Emiel Rutgers, Amsterdam, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Renato Valdes Olmos, Amsterdam, Netherlands (*Abstract Co-Author*) Nothing to Disclose
M P. Stokkel, MD,PHD, Leiden, Netherlands (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Single Photon Emission Computed Tomography with integrated CT (SPECT/CT) is complementarily used to planar lymphoscintigraphy to depict sentinel nodes (SN) in patients with invasive breast cancer. An important indication is SN detection in breast cancer patients showing non-visualization on planar images. In our institution, SN procedures for patients with previous breast surgery and/or radiotherapy, neo-adjuvant chemotherapy led to an increase of non-visualization on planar imaging. The present study is to (re)evaluate the contribution of SPECT/CT in breast cancer patients showing no apparent drainage on planar lymphoscintigraphy in terms of SN identification rate.

METHOD AND MATERIALS

Between 1st of July 2008 and 6th of November 2014 in total 1982 patients underwent a SN breast procedure, using intratumoral tracer administration. SPECT/CT scans for non-visualization on planar lymphoscintigraphy were acquired for 298 (15%) breast cancer patients. Ninety-one (30.5%) patients had previous surgery or radiation therapy at the same breast prior to the SN procedure and 40 (13.4%) were scheduled for neo-adjuvant chemotherapy. If SN non-visualization persisted on SPECT/CT images, a second radiotracer injection with repeated scintigraphy was performed when logistics allowed this. Univariate analysis was performed to examine if specific subgroups, such as age, BMI, T-stage or previous treatment, have influence on visualization rates of SPECT/CT.

RESULTS

SPECT/CT visualized one or more SN in 22.8% (68/298). Univariate analysis of subgroups revealed no significant factors influencing SPECT/CT visualization. In patients with persistent non-visualization on SPECT/CT and having a reinjection, the SN visualization rate reached 60.3% (38/63).

CONCLUSION

The visualization rate of SPECT/CT after non-visualization on planar imaging was lower than the SN visualization after reinjection, in an evaluation including all new breast cancer SN indications. We adjusted our institutional protocol for non-visualization on planar lymphoscintigraphy, reserving SPECT/CT imaging only for patients with persistent absence of drainage after reinjection.

CLINICAL RELEVANCE/APPLICATION

The indication SN breast SPECT/CT imaging is often debated. We propose an adequate role for SPECT/CT in case of non-visualization on planar imaging and thereby safe time and money and above all improve the workflow for breast cancer patients.

SSQ15-07 Does Tc-99m Tilmanocept Offer Shorter Patient Through-Put Time Than Tc99m Sulfur Colloid for Sentinel Lymph Node Mapping in Malignant Melanoma?

Thursday, Dec. 3 11:30AM - 11:40AM Location: S505AB

Participants
Charles M. Intenzo, MD, Philadelphia, PA (*Presenter*) Nothing to Disclose
Sung M. Kim, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Adam Berger, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Tc99m tilmanocept has been recently introduced for radionuclide sentinel lymph node (SLN) mapping and intraoperative identification via hand-held gamma probes. Its rapid movement from the injection sites to the mannose receptors in tumor-draining lymph nodes theoretically should shorten the study time compared to the traditional SLN mapping tracer, Tc99m sulfur colloid (Tc99m SC). The latter had been previously used in our laboratory, which required 40 to 45 minutes after injection for visualization of all lymph nodes in patients with malignant melanoma.Our goal was to determine the minimum scan completion time that Tc99m tilmanocept requires with the objective of expediting subsequent transport to the operating suite.

METHOD AND MATERIALS

0.5 mCi of Tc99m tilmanocept were injected intradermally in 4 divided doses around the tumor. Images were acquired at 5, 10, 20, 30, and 40 minutes after injection, the same protocol used for Tc99m SC. The presence and number of lymph nodes seen at 20 minutes were compared to that seen at 40 minutes.

RESULTS

A total of 34 consecutive patients underwent SLN mapping with Tc99m tilmanocept. In all 34 patients, all lymph nodes seen in the final 40-minute image were identified in the 20-minute image.

CONCLUSION

In malignant melanoma, SLN mapping with Tc99m tilmanocept involves a total imaging time of 20 minutes, i.e. one-half of the time reuired for Tc99m SC.

CLINICAL RELEVANCE/APPLICATION

Tc99m tilmanocept is more time-efficient than Tc99m SC for SLN mapping in malignant melanoma thereby facilitating patient

through-put.

SSQ15-08 Initial Clinical Experience with Intra-procedural Bremsstrahlung Imaging using a Portable Gamma Camera during Yttrium-90 Microsphere Administration

Thursday, Dec. 3 11:40AM - 11:50AM Location: S505AB

Participants
Chadwick L. Wright, MD, PhD, Lewis Center, OH (*Presenter*) Nothing to Disclose
Bill S. Majdalany, MD, Columbus, OH (*Abstract Co-Author*) Nothing to Disclose
Ali A. Rikabi, MD, Dublin, OH (*Abstract Co-Author*) Nothing to Disclose
Michael V. Knopp, MD, PhD, Columbus, OH (*Abstract Co-Author*) Nothing to Disclose
Nathan C. Hall, MD, PhD, Columbus, OH (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The intraarterial administration of Yttrium-90 (90Y) microspheres is clinically used to specifically embolize and locally delivery high-dose radiation therapy to otherwise unresectable malignant/metastatic liver lesions. This 90Y decay produces additional bremsstrahlung radiation that can be detected and imaged with conventional gamma cameras. Typically, bremsstrahlung imaging is performed after 90Y radioembolization to qualitatively assess and verify deposition of 90Y microspheres in the liver.

METHOD AND MATERIALS

A large field-of-view portable gamma camera (LFOVPGC, Ergo, DigiRad) equipped with a medium-energy collimator was used to image 90Y bremsstrahlung radiation in the interventional suite. Pre-procedural static images of background radioactivity and patient's chest and abdomen were obtained. Dynamic chest imaging was performed during the 90Y microsphere administration to assess for any active 90Y microsphere shunting. Post-procedural static images of the chest and abdomen were also obtained. These LFOVPCG images were then compared with routine post-procedural bremsstrahlung planar and SPECT/CT images (Symbia, Siemens).

RESULTS

Three 90Y microsphere administrations were included. When compared with routine post-procedural bremsstrahlung imaging, the LFOVPCG yielded evaluable images for qualitatively assessing 90Y biodistribution. In all cases, dynamic imaging of the chest verified no active shunting of 90Y microspheres into the lungs during the radioembolization procedure. Likewise, LFOVPCG imaging confirmed 90Y microsphere deposition in the liver.

CONCLUSION

These initial findings demonstrate that 90Y bremsstrahlung radiation can be readily imaged with a LFOVPGC in the interventional suite and these images are comparable to routine post-procedural bremsstrahlung images. It appears feasible that intra-procedural LFOVPGC bremsstrahlung imaging can be integrated into the interventional workflow for the purposes of rapid verification of 90Y microsphere deposition in the liver. Further validation of this LFOVPGC imaging approach may obviate the need for subsequent post-procedural bremsstrahlung planar imaging.

CLINICAL RELEVANCE/APPLICATION

This clinical study evaluates the feasibility for LFOVPGC imaging in the interventional suite to provide real-time imaging assessment of 90Y bremsstrahlung radiation during radioembolization.

SSQ15-09 Evaluation and Clinical Quantification of Neoplastic Lesions and Physiological Structures in TOF-PET/MRI and Non-TOF/MRI – A Pilot Study

Thursday, Dec. 3 11:50AM - 12:00PM Location: S505AB

Participants
Felipe D. Barbosa, MD, Oberengstringen, Switzerland (*Presenter*) Nothing to Disclose
Gaspar Delso, PhD, Zurich, Switzerland (*Abstract Co-Author*) Employee, General Electric Company
Konstantinos G. Zeimpekis, DIPLPHYS, MSc, Zurich, Switzerland (*Abstract Co-Author*) Nothing to Disclose
Edwin ter Voert, Zurich, Switzerland (*Abstract Co-Author*) Nothing to Disclose
Martin W. Huellner, MD, Zurich, Switzerland (*Abstract Co-Author*) Nothing to Disclose
Paul Stolzmann, MD, Zurich, Switzerland (*Abstract Co-Author*) Nothing to Disclose
Patrick Veit-Haibach, MD, Zurich, Switzerland (*Abstract Co-Author*) Research Grant, Bayer AG; Resaarch Grant, F. Hoffmann-La Roche Ltd; Research Grant, General Electric Company

PURPOSE

To clinically assess a new PET/MRI technology in which the PET-component features a new PET- detector and time-of-flight (TOF) technology. Thus, we compared SUVmax/mean of neoplastic lesions and physiological structures between TOF- and non-TOF-PET/MRI imaging. We qualitatively evaluated image quality derived from TOF-PET/MRI, non-TOF-PET/MRI reconstruction and FDG-PET/CT. Lastly we did clinical measurements to evaluate the PET- detector sensitivity in order to better understand the background of our clinical results.

METHOD AND MATERIALS

Twenty-seven oncological patients were prospectively enrolled and evaluated with FDG-PET/CT and PET/MRI (15 M/ 12 F; mean age 56 ±10 y). Time between injection and PET/CT was 62.4 ±7.6 min, consecutive start of imaging of PET/MRI was 104.6 min±18.2 after injection. To assess the differences between TOF and non-TOF, all PET-images of the PET/MRI were reconstructed twice -with and without TOF. To compare lesion and tissue characterization between both reconstructions, malignant lesions as well as physiological structures were compared. Furthermore, PET image quality, artifacts, image sharpness, noise and lesion detectability were assessed as well. Count rates between both systems were also compared.

RESULTS

All malignant lesions and the majority of physiologic tissue (except the subcutaneous fat, spleen and blood pool) showed a good correlation concerning SUV (max and mean) measurements between PET/CT, non-TOF and TOF reconstructions. The general image

quality was rated statistically significant superior in non-TOF ($p<0.001$) and TOF-reconstruction in PET/MRI ($p<0.01$) compared to PET/CT. Furthermore, TOF-PET/MRI was rated superior concerning image quality ($p<0.05$) compared to non-TOF PET/MRI. The ratio of emitted/received events between both systems (PET/CT and PET/MRI) was 2.78

CONCLUSION

PET/MRI with TOF is reliable concerning SUV quantification and image quality. The technical promise of an improved sensitivity of the new PET-detector in this PET/MRI device could be confirmed in a clinical setting.

CLINICAL RELEVANCE/APPLICATION

PET/MRI with TOF demonstrates reliable SUV quantification and improved image quality compared to non-TOF based and offers superior sensitivity of the PET-detector.

NMS-THA

Nuclear Medicine Thursday Poster Discussions

Thursday, Dec. 3 12:15PM - 12:45PM Location: S503AB

NM

AMA PRA Category 1 Credit ™: .50

FDA Discussions may include off-label uses.

Participants
Akash Sharma, MD, St. Louis, MO (*Moderator*) Nothing to Disclose

Sub-Events

NM238-SD-THA7 SUVmax versus SUVpeak: Predicting Overall Survival (OS) in Stage 4 Non-small Cell Lung Cancer by FDG PET/CT

Station #7

Participants
Leonard Ong, MD, New York, NY (*Presenter*) Nothing to Disclose
Christian L. Lohrmann, MD, Freiburg, Germany (*Abstract Co-Author*) Nothing to Disclose
Olivier Rager, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Christopher C. Riedl, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Katja Pinker-Domenig, MD, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose
Wolfgang A. Weber, MD, New York, NY (*Abstract Co-Author*) Consultant, Endocyte, Inc

PURPOSE

PET Response Criteria in Solid Tumors (PERCIST) recommend peak standardized uptake values (SUVs) normalized to lean body mass (SUVpeak) for quantifying tumor FDG uptake. For historic reasons, this metric is less used in clinical practice than maximum SUVs normalized to body weight (SUVmax). The aim of this study was to determine if normalization of SUVmax and SUVpeak to lean body mass (lbm) and body weight (bw) differ in monitoring tumor response in non-small cell lung cancer (NSCLC).

METHOD AND MATERIALS

In this HPAA compliant IRB approved retrospective study 94 consecutive stage 4 NSCLC patients (pts) who had a pre and post therapeutic FDG PET/CT scans within 3 months of each other and underwent chemotherapy in between the scans were analyzed. Volumes of interest were placed over up to 5 FDG avid lesions using SUVmax and SUVpeak calculated using PET-VCAR (GE Healthcare) (5lesion) and changes in the sum of SUVs were analyzed. In a separate analysis, we only analyzed the most hypermetabolic lesion (1lesion) on the pre and post therapeutic scan. For both analyzes, SUVmax and SUVpeak were normalized to lbm and bw. Tumor response was classified according to PERCIST as complete response (CR), partial response (PR), stable disease (SD) and progressive disease (PD) and correlated with overall survival (OS) by log-rank tests.

RESULTS

Five patients were excluded due to lack of measurable disease (SUV ≤ 4.0) or for technical reasons. In the remaining 89 pts the 8 different approaches classified responses in a very similar way (table 1). Tumor response as defined by each approach was highly significantly correlated with OS.

CONCLUSION

In patients with advanced NSCLC treated with chemotherapy response assessment by SUVmax and SUVpeak is generally concordant. The exact definition of a metabolic response does not have a major impact on the prognostic value of response assessment by FDG PET/CT.

CLINICAL RELEVANCE/APPLICATION

Assessment of tumor response by various SUV metrics is prognostic for overall survival and appears to be a robust approach for monitoring tumor response to therapy in patients with advanced NSCLC.

NM239-SD-THA8 Relationship between Overall Survival and Metabolic Tumor Burden on Baseline FDG-PET Scans of Patients with Non-small Cell Lung Cancer and Prior History of Second Primary Cancer

Station #8

Participants
Xuee Zhu, MD, Nanjing, China (*Presenter*) Nothing to Disclose
Chuanhong Liao, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Feng Li, MD, PhD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Lingyun Xiong, MD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Yonglin Pu, MD, PhD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Currently, treatment and prognostic assessment for non-small cell lung cancer (NSCLC) depend primarily on TNM stage. The second primary tumors in the history of patients with NSCLC is common (about 20%). Staging and treatment of such patients is challenging due to the difficulty in distinguishing NSCLC metastasis from recurrence or metastasis of prior second primary cancer. This study was to study the relationship of the whole-body metabolic tumor burden (MTBWB) as measured with whole-body metabolic tumor volume (MTVWB) and total lesion glycolysis (TLGWB) on FDG-PET/CT scans and overall survival (OS) of such patients despite of the clinical confusion of TNM stages.

METHOD AND MATERIALS

Our IRB approved this study and waived the requirement for obtaining informed consent. A total of 156 cases with NSCLC and a history of 2nd type of the different primary cancer (72 men, 84 women; median age of 68.8 years) who had pre-therapy FDG-PET/CT scans were retrospectively reviewed. The MTVWB, TLGWB, and whole-body maximum standardized uptake value (SUVWBmax) were measured. Seventy-eight patients with adenocarcinoma, 49 patients with squamous cell carcinoma, and 29 patients with other kind of NSCLC were recruited in the study. Ninety-six of the 156 patients had died (61.5%) during follow-up. Kaplan-Meier analysis with the log-rank test and Cox regression were used for assessing the association of PET/CT measurements with OS.

RESULTS

There was a statistically significant association (P <0.001) of OS with ln(MTVWB) (HR=1.44), ln(TLGWB) (HR=1.38), and lnSUVWBmax (HR=1.99) on univariate Cox regression analysis. The HRs in the three multiple Cox regression models were 1.290 for ln(MTVWB), 1.294 for ln(TLGWB), and 2.000 for ln(SUVWBmax) after adjusting the TNM stages (P <0.001 for all), respectively. The OS differences between the groups dichotomized by the median values of MTVWB (24.06 ml), TLGWB (83.16 ml*SUVmean) and SUVWBmax (8.66) were statistically significant (P <0.001 for all).

CONCLUSION

MTBWB and SUVWBmax on pre-therapy 18F-FDG-PET are related to the OS independent TNM stage in patients with NSCLC and history of second primary cancer.

CLINICAL RELEVANCE/APPLICATION

Metabolic tumor burden and activity measured on FDG PET/CT are potential prognostic markers in patients with NSCLC and history of second primary cancer. Therefore they may affect the patient's management..

NM240-SD-THA9 123I-MIBG Myocardial Scintigraphy for the Evaluation of Lewy Bodies Disease: Are Delayed Images Essential? Is Visual Assessment Useful?

Station #9

Participants
Noriko Tsuda, Kumamoto, Japan (*Presenter*) Nothing to Disclose
Fumi Sakamoto, Kumamoto, Japan (*Abstract Co-Author*) Nothing to Disclose
Shinya Shiraishi, MD, Kumamoto, Japan (*Abstract Co-Author*) Nothing to Disclose
Hideaki Yuki, MD, Kumamoto, Japan (*Abstract Co-Author*) Nothing to Disclose
Tomohiro Namimoto, MD, Kumamoto, Japan (*Abstract Co-Author*) Nothing to Disclose
Mamoru Hashimoto, Kumamoto, Japan (*Abstract Co-Author*) Nothing to Disclose
Seiji Tomiguchi, MD, Kumamoto, Japan (*Abstract Co-Author*) Nothing to Disclose
Manabu Ikeda, Kumamoto, Japan (*Abstract Co-Author*) Nothing to Disclose
Yasuyuki Yamashita, MD, Kumamoto, Japan (*Abstract Co-Author*) Consultant, DAIICHI SANKYO Group

PURPOSE

We performed 123I-MIBG myocardial scintigraphy for the diagnosis of Lewy bodies disease (LBD) and assessed whether the early heart-to-mediastinum (H/M) ratio is diagnostic and whether visual image analysis is useful.

METHOD AND MATERIALS

Our study included 453 patients with clinically suspected LBD who had undergone 123I-MIBG myocardial scintigraphy. We evaluated semi-quantitative values (early and delayed H/M ratio, washout rate) and performed visual image analysis. The sensitivity, specificity, accuracy, and positive and negative predictive value (PPV, NPV) of both analyses were calculated.

RESULTS

The early H/M ratio exhibited the best diagnostic ability. Its overall sensitivity, specificity, accuracy, PPV and NPV were 72.2%, 93.1%, 84.3%, 88.5%, and 82.2%, respectively (cut-off value 2.2or less). However, there was no significant difference from the delayed H/M ratio or the results of visual assessment.

CONCLUSION

123I-MIBG myocardial scintigraphy differentiates accurately between patients with and without LBD and a correct diagnosis can be established based on the early H/M ratio. We also document that visual evaluation of scintigrams is useful. Therefore, patients may benefit from the single performance of the procedure because a correct diagnosis can be obtained early in the disease process and their prognosis and appropriate treatment can be determined.

CLINICAL RELEVANCE/APPLICATION

We performed 123I-MIBG myocardial scintigraphy for the diagnosis of Lewy bodies disease (LBD) and assessed whether the early heart-to-mediastinum (H/M) ratio and visual image analysis are diagnostically useful. Our findings indicate that as the early- and delayed H/M ratio are not significantly different, acquisition of the early H/M ratio is sufficient for an accurate diagnosis. We also document that visual evaluation of scintigrams is useful. We suggest that the shorter examination time eases the burden on patients, caretakers, and medical staff.

NM241-SD-THA10 Dual-tracer (11C-acetate and 18F-FDG) PET/CT Characteristics of Waldenstrom Macroglobulinaemia

Station #10

Participants
William Cheung, Hong Kong, Hong Kong (*Abstract Co-Author*) Nothing to Disclose
Sirong Chen, Hong Kong, Hong Kong (*Presenter*) Nothing to Disclose
Thomas K. Cheng, MBBS, Hong Kong, Hong Kong (*Abstract Co-Author*) Nothing to Disclose
Yim Lung Leung, Hong Kong, Hong Kong (*Abstract Co-Author*) Nothing to Disclose
Ka Nin Wong, Hong Kong, Hong Kong (*Abstract Co-Author*) Nothing to Disclose

Man Ki Cheung, Hong Kong, Hong Kong (*Abstract Co-Author*) Nothing to Disclose
Raymond Liang, Hong Kong, Hong Kong (*Abstract Co-Author*) Nothing to Disclose
Chi Lai Ho, Hong Kong, Hong Kong (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Multiple myeloma (MM) is a disease of plasma cell dyscrasia primarily involving the bone marrow while lymphoma is lymphoproliferative disease with predominant nodal involvement. Waldenstrom macroglobulinemia (WM) has features of both. Symptomatic WM patients warrant treatment and sensitive tools are needed to differentiate active from indolent disease. Dual-tracer PET/CT using 11C-acetate (ACT) and 18F-FDG (FDG) is an effective diagnostic and prognostic tool in evaluation of low-grade lymphoma and myeloma. We aim to evaluate its application in Waldenstrom Macroglobulinaemia.

METHOD AND MATERIALS

From 2012~4, 10 patients (M:4, F:6; median age:70 y, range:47-84 y) suspected of having hematological disorders were referred for dual-tracer PET/CT. They were confirmed as WM by elevated serum IgM protein and lymphoplasmacytic lymphocyte (LPL) infiltration in bone marrow by trephine biopsy within 2 wk before/after PET/CT. PET/CT parameters were recorded for metabolic features of involvement including lymph node, bone (focal), liver, spleen, and extramedullary organs, following previously published pre-defined criteria for myeloma and lymphoma. SUVmax of L3 was chosen to represent the diffuse marrow activity as a surrogate marker of plasma cell burden.

RESULTS

ACT PET/CT was positive in 8/10 patients: 6/8 with nodal involvement (LPL:39~85%, plasma cell:0~10%) and 1/8 with extramedullary involvement of lacrimal gland (LPL:65%), thus categorized as "lymphoma-like WM" features due to absence of focal bone/marrow lesions. Only 1/8 patient (LPL:25%, plasma cell:20%) showed 11 focal bone lesions (ACT-avid) and diffusely increased marrow activity (ACT SUVmax of L3=6.6), dubbed as "MM-like WM". FDG PET/CT was positive solely in the MM-like patient but only 2/11 focal bone lesions were FDG-avid and marrow activity increased (FDG SUVmax of L3=4.0). Hepatomegaly or splenomegaly is not present in this cohort.

CONCLUSION

ACT is more useful than FDG in PET assessment of the metabolic characteristics of Waldenstrom macroglobulinemia, not just in confirming the sharing features of this disease entity between lymphoma and myeloma, but also in its potential for suggesting the emphasis of treatment direction between these 2 components.

CLINICAL RELEVANCE/APPLICATION

ACT PET/CT allows visualization and metabolic quantification of nodal and extramedullary involvement to triage symptomatic from asymptomatic WM patients in initiation of treatment.

NM242-SD-THA11 Comparative Efficacy of 18Fluorine FDG PET-CT and Contrast-Enhanced CT in the Diagnosis of Large-Vessel Vasculitis

Station #11

Participants
Sriram Vaidyanathan, MBBS, FRCR, Leeds, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Arpita Chattopadhyay, MBChB, MSc, Leeds, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Sarah Mackie, MRCP, PhD, Leeds, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Andrew F. Scarsbrook, FRCR, Leeds, United Kingdom (*Presenter*) Nothing to Disclose

PURPOSE

The aim of this study was to compare the diagnostic accuracy of Fluorine-18 fluorodeoxyglucose positron emission tomography - computed tomography (FDG PET-CT) and contrast-enhanced CT (CECT) in the evaluation of a cohort of patients with primary large vessel vasculitis (LVV). The purpose was to validate the use of CECT assessment of vessel mural thickening as a surrogate to metabolic activity in a European population.

METHOD AND MATERIALS

A retrospective institutional database search for patients with suspected LVV from December 2011 to December 2014 yielded demographics, interval between CECT and PET-CT scans, treatment, serum CRP and type of vasculitis. Qualitative and quantitative analysis of PET-CT data was performed including aorta:liver FDG uptake, bespoke FDG uptake distribution scores and vascular maximum standardized uptake value (SUVmax); Quantitative assessment of CECT data for wall thickness and mural/lumen ratio was performed. ROC curves were constructed to evaluate comparative diagnostic accuracy.

RESULTS

24 adults (12 proven LVV, 12 controls without LVV) with a mean age (range) 63 (38 - 85) years of which 12 (50%) were males, were included. Time interval between CT and PET was mean (Standard deviation (SD)) 2 (1.3) months. Mean (SD) SUVmax was 2.9(1.1) and mural thickening was 2.29 (1.17) mm. Both parameters demonstrated a significant difference between patients with and without LVV with mean differences (95% confidence interval (CI)) for SUVmax 1.5 (0.9, 2.2) and mural thickening 1.48 (0.69, 2.28) mm, respectively. The area under the curve (AUC) (95% CI) for SUVmax was 0.94 (0.85-1.00), for mural thickening was 0.83 (0.61-1.00), and with a highly significant correlation (P = 0.007, R = 0.53) between the two parameters.

CONCLUSION

FDG PET-CT demonstrated excellent accuracy whilst CECT mural thickening showed good accuracy for the diagnosis of LVV, and both parameters showed highly significant correlation. In medical centers without access to FDG PET-CT or in patients unsuitable for PET-CT (e.g. uncontrolled diabetes) CECT offers a good alternative in LVV.

CLINICAL RELEVANCE/APPLICATION

In medical centers without access to FDG PET-CT or in patients unsuitable for PET-CT (e.g. uncontrolled diabetes) CECT may offer a good diagnostic alternative in assessment of large vessel vasculitis.

Participants **Next Generation Digital Detector PET/CT: What Are the Clinical Opportunities?**
THA

Hardcopy Backboard

Michael V. Knopp, MD, PhD, Columbus, OH (*Presenter*) Nothing to Disclose
Katherine Binzel, PhD, Columbus, OH (*Abstract Co-Author*) Nothing to Disclose
Chadwick L. Wright, MD, PhD, Lewis Center, OH (*Abstract Co-Author*) Nothing to Disclose
Philip Bardos, Columbus, OH (*Abstract Co-Author*) Nothing to Disclose
Michelle I. Knopp, Columbus, OH (*Abstract Co-Author*) Nothing to Disclose
Jun Zhang, PhD, Columbus, OH (*Abstract Co-Author*) Nothing to Disclose
Veena A. Nagar, MD, Dublin, OH (*Abstract Co-Author*) Nothing to Disclose
Piotr J. Maniawski, MSc, Cleveland, OH (*Abstract Co-Author*) Employee, Koninklijke Philips NV

TEACHING POINTS

To introduce how the solid state, digital photon counting technology can influence and advance the clinical imaging characteristics which can then be leveraged to improve clinical PET imaging via higher resolution, improved quantitative accuracy and sensitivityTo review by intra-individual case demonstration highlighting the differences between current photomultiplier based clinical PET/CT and the next generation digital detector PET/CT in regard to visual and quantitative differences of lesions, tissues and backgroundTo introduce refined clinical digital PET/CT protocols that use ultra-low dose, low abundance or other innovative approachesTo familiarize the viewer to differences in image characteristics between digital and conventional PET

TABLE OF CONTENTS/OUTLINE

A. Clinical Introduction to solid state digital photon counting for PET B. What can we clinically leverage from the digital detector C. Decreasing the voxel size for high resolution Imaging D. Higher sensitivity for faster imaging E. Improved recovery coefficient, how does it change my SUV F. Low dose imaging: Tracer and CT G. Molecular Theragnostics: A Y90 concept demonstration H. How do we compare digital with conventional PET images

NMS-THB

Nuclear Medicine Thursday Poster Discussions

Thursday, Dec. 3 12:45PM - 1:15PM Location: S503AB

NM

AMA PRA Category 1 Credit ™: .50

Participants
Akash Sharma, MD, St. Louis, MO (*Moderator*) Nothing to Disclose

Sub-Events

NM243-SD-THB7 Does PET/CT Imaging of Follicular Lymphoma Make the Grade?: Correlation of Follicular Lymphoma's Imaging Findings of to Its Histologic Grade

Station #7

Participants
Sania Rahim-Gilani, MD, New Haven, CT (*Presenter*) Nothing to Disclose
Eric M. Rohren, MD, PhD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Wei Wei, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Mike Spektor, MD, New Haven, CT (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The importance of histologic grade has been well established in predicting disease outcome and treatment response; however definite determination of histology is known to be difficult for technical reasons. We sought to determine an association between the histologic grade of follicular lymphoma and its PET/CT characteristics, such as SUVmax of the most FDG avid lesion, to determine whether FDG avidity of a disease can be used as a surrogate to predict outcomes in the setting of absent or indeterminate histology.

METHOD AND MATERIALS

The cases of over 3000 patients with an initial diagnosis of lymphoma were reviewed. Patients who had mixed histology, including diffuse B Cell pathology, were excluded. Patients with indeterminate histologic grade were also excluded from the study. Patients with prior treatments or with a prior history of other malignancy were also excluded. The first 70 consecutive cases of patients with follicular lymphoma and their initial staging PET/CTs were selected.PET/CTs were reviewed by trained oncologic imagers on a GE workstation. SUVmax of the most FDG avid lesion and the extent of nodal spread (defined by the number of nodal stations involved) were assessed. Imaging data was then compared to the patient's histologic grade.

RESULTS

Forty-eight out of the seventy selected patients had low grade histology (grade 1 or grade 2) follicular lymphoma. The remaining patients had high grade disease, Grade 3A or 3B, on biopsy. The mean SUVmax of the low grade group was 11.29 and the mean SUVmax of the high grade group was 12.59. A Wilcoxon rank sum test was used to calculate P values and established that there was no statistically significant difference between the two groups. The mean number of nodal groups involved was 2.33 in the low grade group and 2.23 in the high grade group, with no statistically significant difference. See Table 1.

CONCLUSION

Our study demonstrated no statistically significant correlation between the FDG avidity of the patient's lymphoma and its histologic grade; a finding which seemingly contradicts prior literature proporting FDG avidity to be a suitable predictor of outcomes.

CLINICAL RELEVANCE/APPLICATION

Our study demonstrates that FDG avidity cannot be subsituted for histology and thus cannot be utilized as a prognosticator. Further investigation is necessary to determine whether SUV values within a specified histologic grade make any impact on prognosis.

Honored Educators

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Eric M. Rohren, MD, PhD - 2015 Honored Educator

NM244-SD-THB8 Can Computer Assisted Metabolic Evaluation and Characterization of Cervical Lymph Nodes Increase Interpretation Accuracy for Metastatic Disease in Head and Neck Squamous Cell Carcinoma

Station #8

Participants
Richard A. Marshall, MD, -, MA (*Presenter*) Nothing to Disclose
Peter M. Som, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Lale Kostakoglu, MD, MPH, New York, NY (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Staging of regional lymph nodes in patients with head and neck squamous cell carcinoma remains a diagnostic challenge for the PET/CT reader. Our aim in this study, was to determine whether a semi-automated, computer assisted evaluation of the metabolic

characteristics of FDG-avid lymph nodes could improve reader accuracy for lymph node metastases.

METHOD AND MATERIALS

A total of 131 patients with head and neck squamous cell carcinoma who had received PET/CT imaging were retrospectively included. FDG avid lymph nodes were evaluated in a semi-automated process using a thresholding algorithm to delineate the FDG avid node within a reader defined three dimensional area. Computer software analysis produced estimates for SUV max (g/ml), SUV mean, Metabolic Tumor Volume (ml), and Total Lesion Glycolysis (g) within the region of interest. Histopathology within 6 weeks or serial imaging >12 months (median 17 months) were used as reference standard. ROC curves were used to calculate optimal cut-off values for each variable, and sensitivity, specificity, accuracy and odds ratio were calculated.

RESULTS

Malignancy was confirmed in 97 (51%) of the 192 total lymph nodes included. At optimal cutoffs, SUVmax, SUVmean, MTV, and TLG all were significantly correlated with malignancy in lymph nodes ($p<0.05$). At an optimal cut off of 4.1 g/ml, SUV max was the most accurate parameter with 87% sensitivity, and 72% specificity ($p <0.001$). SUVmax (cutoff 4.1) and SUVmean (cutoff 2.4) did not perform significantly differently; however, SUVmax (AUC 0.86) overall, performed significantly greater in the detection of nodal metastasis than MTV (AUC 0.64) ($p<0.001$; 95% CI 0.13 - 0.34). Complete results are in Table 1.

CONCLUSION

Evaluation of metabolically active lymph nodes with computer assisted thresholding algorithms provides clinically useful and accurate metrics for the differentiation of benign from malignant cervical lymph nodes in patients with head and neck squamous cell carcinoma. SUVmax with cutoff 4.1 g/ml and SUV mean with cutoff 2.4 g/ml were the most accurate metrics tested, and performed better than metabolic tumor volume and total lesion glycolysis.

CLINICAL RELEVANCE/APPLICATION

The results of this study will demonstrate the value of computer assisted characterization of lymph nodes, and suggest the most useful metrics for evaluating cervical lymph nodes for malignancy in patients with head and neck squamous cell carcinoma.

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/

Lale Kostakoglu, MD, MPH - 2012 Honored Educator

NM245-SD-THB9 18F-FDG PET/CT for Patients with Fever of Unknown Origin (FUO)

Station #9

Participants
Rodolfo F. Nunes, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose
Marcelo A. Queiroz, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Artur Coutinho, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Romulo H. do Vale, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Rafael F. Nunes, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Carlos A. Buchpiguel, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To assess the potential clinical contribution of 18-fluoro-2-deoxyglucose positron emission tomography/computed tomography (18F-FDG PET/CT) in the identification of the underlying cause of FUO.

METHOD AND MATERIALS

A retrospective analysis of 23 patients with FUO (13 men and 10 women; mean age 46 years, range 22-84 years) was performed. FUO was defined as fever of more than 38.3ºC for more than 3 weeks and failure to reach diagnosis after more than 1 week of inpatient investigation. The performance of PET/CT for identifying the etiology of FUO was assessed. Final diagnosis was based on histopathology and/or clinical and imaging follow-up and compared to PET/CT diagnosis.

RESULTS

Other imaging modalities were performed before PET/CT and failed to determine the etiology of FUO: radiography (86.9%), CT (82.6%), ultrasound (56.5%), MRI (13.04%) and others (17.3%). 18F-FDG PET/CT suggested the underlying cause of FUO in 21/23 patients (91.3%) and it was correct in 17/23 patients (73.9%). 18F-FDG PET/CT was considered clinical useful in 17/23 patients (73.9%), being able to precisely detect the cause of fever in 12 (52.17%) cases, guided biopsy in 3 (13.04%) cases and oriented treatment in 2 (8.7%) patients. Final diagnosis was represented by infection in 9 patients (52.94%), inflammatory disease in 7 patients (41.18%) and neoplasia in 1 patient (5.88%).

CONCLUSION

18F-FDG PET/CT represents a clinical useful imaging modality in evaluation of patients with FUO, especially after equivocal findings in others imaging modalities.

CLINICAL RELEVANCE/APPLICATION

18F-FDG PET/CT helps clinicians in management of patients with FUO and might be integrated in clinical workup owing its value to identify the etiology of FUO, guide biopsies and orient treatments.

NM246-SD-THB10 A Further Step Forward in the Patient's Journey with Ankle and Foot Pain: A Pilot Study Evaluating the Diagnostic Value of Hybrid SPECT-CT

Station #10

Participants
Arunthathi Pushparajasekaran, MBBS, MRCS, Cambridge and Luton, United Kingdom (*Presenter*) Nothing to Disclose
Preena Patel, Luton, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
David Gordon, Luton, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Simon Burtt, Luton, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
J. Charlotte Fowler, FRCR, MD, Luton, United Kingdom (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Complex ankle/foot anatomy and vague pain symptoms present significant diagnostic challenges to the clinician and radiologist. It is essential to precisely locate the affected bone, joint or soft tissue to guide appropriate management. Recently, hybrid imaging in which single photon emission computed tomography (SPECT) bone scan images are fused with multidetector CT has become available. SPECT-CT is anticipated to contribute positively to this patient group, combining the benefit of high sensitivity from SPECT with the high specificity and spatial resolution of CT. The aim of this study was to evaluate our early experience of this new technique.

METHOD AND MATERIALS

The first 25 consecutive patients referred for SPECT-CT from our centre presenting with persistent foot and ankle symptoms were included. Patients were imaged on a 16 slice hybrid SPECT- CT, 2.5 hours following injection with Technetium-99m labelled hydroxymethylene diphosphonate. Functional images were attenuation corrected then fused with 0.625mm CT images. Images were reviewed and assigned a radiological diagnostic confidence score (RDCS) ranging from 1-5 for the CT component of the study alone and the complete hybrid SPECT-CT dataset, where a score of 1 was no diagnostic confidence and 5 was complete confidence. Managing orthopaedic surgeons also assigned a clinical diagnostic confidence score (CDCS) before and after the SPECT-CT in the same way. Statistical analysis was performed using Wilcoxon paired sample test.

RESULTS

A wide range of pathologies was demonstrated, many of which were unexpected including, fractures, sesamoiditis, accessory ossicle stress injury, Sudeck's dystrophy, plantar fasciitis and focal small joint osteoarthritides. Both RDCS and CDCS increased significantly following SPECT-CT, mean scores increasing from 2.88 and 2.52 to 4.08 and 4.36, ($p<0.0001$ and $p=0.0001$) respectively.

CONCLUSION

Employing a scoring system which assessed diagnostic confidence from both radiological and clinical perspectives, this pilot study demonstrated a significant positive contribution from SPECT-CT in the correct diagnosis of patients with ankle and foot pain.

CLINICAL RELEVANCE/APPLICATION

Hybrid SPECT-CT increases the diagnostic confidence in patients with vague ankle/foot pain and is recommended for precise localisation and identification of pathology.

PS50

Thursday Plenary Session

Thursday, Dec. 3 1:30PM - 2:45PM Location: E450A

MR NM PH

AMA PRA Category 1 Credits ™: 1.25
ARRT Category A+ Credits: 1.50

Participants

Sub-Events

PS50A RSNA/AAPM Symposium: PET/MR Imaging: Translation to Practice

Participants
Paul E. Kinahan, PhD, Seattle, WA (*Moderator*) Research Grant, General Electric Company; Co-founder, PET/X LLC

LEARNING OBJECTIVES

1) Describe the motivations underlying dual-modality PET/MR imaging systems. 2) Describe the role of PET/MR imaging in clinical practice and research studies. 3) List the challenges and potential solutions of advanced PET/MR imaging.

PS50B PET/MR Imaging in Practice: A Clinical Perspective

Participants
Jonathan E. McConathy, MD, PhD, Saint Louis, MO (*Presenter*) Research Consultant, Eli Lilly and Company; Research Consultant, Blue Earth Diagnostics Ltd; Research Consultant, Siemens AG; Research support, GlaxoSmithKline plc

LEARNING OBJECTIVES

View learning objectives under main course title.

The advent of integrated PET/MRI systems suitable for clinical use represents a major technological advance and a new frontier in multi-modality imaging. Advantages of integrated PET/MRI include reduced radiation exposure, high soft tissue contrast, motion correction, and advanced MR techniques coupled with the power of molecular imaging with PET acquired in a single session. These characteristics of PET/MRI are well suited to a range of applications in oncologic, neurologic, and cardiovascular imaging. However, important issues including cost versus patient benefit, added complexity, quantitative accuracy, and physician training need to be addressed before PET/MRI becomes widely used for routine clinical imaging. This presentation will provide an update and overview of the current as well as potential future uses of clinical PET/MRI with a focus on oncology. Promising applications for oncologic imaging including pediatric populations, neuro-oncology, lymphoma, colorectal cancer, cervical cancer, prostate cancer, and multiple myeloma will be discussed. Key aspects of imaging protocols, study interpretation, limitations, and future directions based on our clinical experience as well as results from other centers will be emphasized.

PS50C PET/MR Imaging in Practice: A Research Perspective

Participants
Bruce R. Rosen, MD, PhD, Charlestown, MA (*Presenter*) Research Consultant, Siemens AG

LEARNING OBJECTIVES

View learning objectives under main course title.

Abstract

The field of molecular imaging has grown at a rapid rate in recent years, as imaging technologies enable ever-finer examination of the human brain and other organs, and as clinicians and researchers alike seek to understand the mechanisms that underlie conditions such as cancer, heart disease, brain disorders and diabetes. Early detection of disease and monitoring of potential therapeutic interventions requires technology sensitive to the subtle changes that occur at the cellular and molecular level. PET and MRI are widely used in vivo for both clinical and research applications. Used with novel MR, nuclear, and multimodal probes, these imaging modalities have begun to revolutionize the types of questions that can be asked in vivo, permitting examination of physiological and pathological functions in living cells, tissues, and organs at their most basic level. Used in combination, the individual strengths of MRI and PET can inform one another to yield new insights that expand the types of physiological information that can be gained through in vivo imaging and thus also expand the impact of human health imaging by enlarging the window of anatomical size, time scales, resolution, sensitivity, and specificity of detection for which imaging is currently used. Combined MR-PET imaging technology allows investigators to employ the benefits of MRI such as phased array coils for high speed, high resolution functional imaging, while simultaneously acquiring quantitative metabolic or receptor-specific neurochemical data. Simultaneous MR-PET imaging has the distinct advantage of spatial co-registration of biochemical function with anatomical structure. Perhaps more importantly, MR-PET allows researchers to temporally co-register physiological data using PET and functional MRI (fMRI), such that the hemodynamic information from fMRI may be used to feed quantitative analysis of PET data. Using this information, researchers can understand the interplay between blood flow, receptor occupancy, and metabolism-as well as the contributions of each in disease and therapy response. As such, combined MR-PET has significant clinical potential to impact not only all aspects of patient care, from screening to disease assessment and therapy monitoring, but also to lead to new dual-modality MR-PET probes that can provide complementary information for precise quantitative assessment of biological function not obtainable in other ways.

SPSH54

Hot Topic Session: Imaging-guided Radiation Therapy

Thursday, Dec. 3 3:00PM - 4:00PM Location: S404AB

CT MR NM RO

AMA PRA Category 1 Credit ™: 1.00
ARRT Category A+ Credit: 1.00

Participants
Lei Xing, PhD, Stanford, CA (*Moderator*) Research Grant, Varian Medical Systems, Inc

Sub-Events

SPSH54A Projection and Volumetric X-ray Imaging and Their Roles in Image-Guided Radiation Therapy

Participants
Ning Jeff Yue, PhD, New Haven, CT, (yuenj@rutgers.edu) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Describe the current status of x-ray imaging modalities that are used in radiotherapy 2) Explain the roles and importance of 2D, 3D and 4D x-ray Imaging in radiotherapy. 3) Assess the limitation of current x-ray imaging modality in radiotherapy. 4) Explore the potential imaging technical advancement in radiotherapy.

ABSTRACT

SPSH54B Recent Advancements in PET/CT and PET/CT-Guided Radiation Therapy

Participants
Stephen R. Bowen, PhD, Seattle, WA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Understand the role of 3D and 4D PET/CT in radiation therapy planning. 2) Understand the role of PET/CT in treatment response assessment for adaptive radiation therapy. 3) Describe image guidance techniques using PET/CT in charged particle therapy.

SPSH54C MRI-based Treatment Planning and Therapeutic Assessment - Where Do We Stand?

Participants
Lei Xing, PhD, Stanford, CA (*Presenter*) Research Grant, Varian Medical Systems, Inc

LEARNING OBJECTIVES

1) Present background knowledge of MR and MR simulation for radiation therapy. 2) Describe essential roles of MRI in radiation therapy treatment planning, target definition, treatment planning and verification, and therapeutic assessment. 3) Highlight recent advancements and emerging applications of MR imaging in radiation therapy.

RC711

Advances and Updates in SPECT/CT

Thursday, Dec. 3 4:30PM - 6:00PM Location: S504CD

CT NM

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

FDA Discussions may include off-label uses.

Participants

Sub-Events

RC711A SPECT/CT in Musculoskeletal Diseases

Participants
Christopher J. Palestro, MD, New Hyde Park, NY (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Describe the role of SPECT/CT in the workup of patients with malignancy. 2) Describe the role of SPECT/CT in musculoskeletal infection. 3) Use SPECT/CT to improve the accuracy of radionuclide studies for diagnosing musculoskeletal diseases.

ABSTRACT

RC711B SPECT/CT in Endocrine Disorders and Others

Participants
Esma A. Akin, MD, Washington, DC (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Through clinical case examples, this activity aims to refresh knowledge of SPECT-CT applications with emphasis on neuroendocrine disorders as well as parathyroid imaging.

ABSTRACT

RC811

Improving PET Interpretation (An Interactive Session)

Friday, Dec. 4 8:30AM - 10:00AM Location: S505AB

CT NM

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

Participants

LEARNING OBJECTIVES

Please bring your charged mobile wireless device (phone, tablet or laptop) to participate.

Sub-Events

RC811A Mimics and Interpretive Pitfalls: Advanced Tricks of the Trade

Participants
Eric M. Rohren, MD, PhD, Houston, TX (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Discuss interpretive pitfalls in FDG-PET/CT, including challenging and less-frequently encountered pitfalls. 2) Review strategies to avoid interpretive errors in FDG-PET/CT.

ABSTRACT

One of the challenges in the interpretation of FDG-PET/CT is the discovery of unexpected activity, and the determination whether such activity is related to the primary tumor, and incidental second primary tumor, or a benign process. Avoidance of 'false-positive' interpretations is critical for the development and maintenance of a robust PET/CT practice. In this presentatation, a broad range of case examples will be shown and discussed, to illustrate some of the most frequent and most challenging pitfalls encountered in a busy oncologic PET/CT practice.

Honored Educators

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Eric M. Rohren, MD, PhD - 2015 Honored Educator

RC811B Impact of Patient Preparation

Participants
Don C. Yoo, MD, Providence, RI (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Understand the patient preparation issues with performing PET/CT. 2) Review recommendations on patient preparation prior to performing PET/CT. 3) Review the issues in performing PET/CT scans on diabetic patients and learn ways to optimize the glucose level.

ABSTRACT

F18-FDG PET/CT is a valuable tool for a variety of oncologic applications. The purpose of this educational activity is to discuss the importance of appropriate patient preparation prior to performing oncologic F18-FDG PET/CT scans. The recommendations from the American College of Radiology (ACR), the Society of Nuclear Medicine and Molecular Imaging (SNMMI), and the National Cancer Institute (NCI) for patient preparation will be discussed. Issues that will be discussed include fasting, limiting exercise, hydration, sedation, low carbohydrate meals, and diabetic patients. Patients are typically asked to fast for at least 4 hours before tracer injection for oncologic PET/CT scans. The ACR and SNMMI both recommend checking glucose levels on all patients prior to administration of F18-FDG. SNMMI guidelines recommend that patients with glucose of greater than 150-200 mg/dL should usually be rescheduled. Performing PET/CT scans in poorly controlled diabetic patients can result in a PET/CT scan with an altered biodistribution limiting interpretation of the study. In a poorly controlled diabetic patient with a glucose level of greater than 200 mg/dl, the study should usually be rescheduled if it does not critically affect patient care. Hyperglycemia will dilute the FDG uptake by tumors through competitive inhibition. Subcutaneous insulin should not be administered to a diabetic patient with high glucose within 4 hours of a PET/CT scan as insulin will stimulate FDG uptake by skeletal muscle resulting in an altered biodistribution which can severely limit interpretation.

RC811C Challenging Case Examples

Participants
Esma A. Akin, MD, Washington, DC, (Eakin@mfa.gwu.edu) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) With the aid of challenging case examples, this activity aims improve PET-CT interpretation through recognition of pitfalls and variants. In addition, it aims to review typical as well as unusual examples of commonly encountered oncologic diagnoses.

ABSTRACT

SPNM61

Theranostics: Contributions of Diagnostic Nuclear Medicine and Targeted Radionuclide Therapy in Clinical Oncology (In Conjunction with SNMMI)

Friday, Dec. 4 8:30AM - 12:00PM Location: S504AB

GI HN MK NR CT MR NM OI RO

AMA PRA Category 1 Credits ™: 3.25
ARRT Category A+ Credits: 4.00

FDA Discussions may include off-label uses.

Participants

LEARNING OBJECTIVES

1) An important aspect of Nuclear Medicine and Molecular Imaging is that the same core compound of the administered radiopharmaceutical can be labeled with both gamma emitters (for diagnostic) and beta (or alpha) emitters (for therapy), allowing for the targeted treatment of lesions. This is an expression of theranostics, the combination of therapy and diagnostics that is based on the specific tumor biology of each patient's disease. This proposed session will provide several examples of such paired diagnostic studies and treatements using Nuclear Medicine methods.

Sub-Events

SPNM61A Radioactive Iodine and Thyroid Cancer - Current Use and Controversies

Participants
Douglas Van Nostrand, MD, Washington, DC, (douglas.van.nostrand@medstar.net) (*Presenter*) Speakers Bureau, sanofi-aventis Group

LEARNING OBJECTIVES

1) Define remnant ablation, adjuvant treatment, and treatment of locoregional/distant metastases. 2) Discuss the indications and controversies of 131I for each. 3) Discuss the range of prescribed activity of 131I for each.

SPNM61B Bone Scintigraphy and the Use of Radionuclides in the Management of Patients with Metastatic Castrate-Resistant Prostate Cancer

Participants
Hossein Jadvar, MD, PhD, Los Angeles, CA, (jadvar@med.usc.edu) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To review bone scintigraphy with single photon and PET radiotracers in the imaging evaluation of patients with prostate cancer. 2) To summarize the results of the ALSYMPCA clinical trial for 223Ra dichloride therapy in patients with castrate resistant metastatic prostate cancer.

SPNM61C Updates on the Use of PET/CT (and PET/MRI) and Radioimmunotherapy in NHL

Participants
Erik S. Mittra, MD, PhD, Stanford, CA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

SPNM61D Peptide Receptor Radionuclide Imaging and Therapy: Where Are We in Europe and What Shall the US Do to Catch Up?

Participants
Frederik L. Giesel, MD, MBA, Heidelberg, Germany (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To understand the concept of theragnostic. 2) Identify promising candidates for PRRT. 3) Challenges and limitations of PRRT. 4) Future perspective using alpha-emitters.

ABSTRACT

Well-differentiated neuroendocrine tumors (NETs) demonstrate modest responses to conventional chemotherapy due to their slow proliferation rate. However, the expression of somatosatin receptors by NET enables targeting with high affinity peptides. When these octreotide analgue peptides are labelled with beta emitters such as 90Y or 177Lu promising anti-tumor effects have been observed. The presentation will introduce the concept of theragnostic (68Ga-DOTATOC and 90Y/177Lu-DOTATOC) for improved patient stratefication. Today, PRRT is well established for a long time in NET-patients. However challenges and limitations will be discussed in regard to other systemic therapies such as everolimus or sunitinib. Finally, outlook will be given in regard to the novel of targeted alpha therapy in NET-patients and its implication to other tumor entities.

URL

SPNM61E Participant **Selective Internal Radiation Therapy for Hepatic Malignant Lesions**

Ghassan El-Haddad, MD, Tampa, FL, (ghassan.elhaddad@moffitt.org) (*Presenter*) Speaker Bureau, Bayer AG

LEARNING OBJECTIVES

View learning objectives under main course title.

SST08

Nuclear Medicine (Comparative Technologies)

Friday, Dec. 4 10:30AM - 12:00PM Location: S505AB

CT MR NM

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

Participants
William G. Spies, MD, Chicago, IL (*Moderator*) Nothing to Disclose
Don C. Yoo, MD, E Greenwich, RI (*Moderator*) Nothing to Disclose

Sub-Events

SST08-01 Does the Trinary Interpretation and Reporting Strategy for Lung Scintigraphy Work in a Nuclear Medicine Residency Program?

Friday, Dec. 4 10:30AM - 10:40AM Location: S505AB

Participants
Charles M. Intenzo, MD, Philadelphia, PA (*Presenter*) Nothing to Disclose
Sung M. Kim, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Andrew Newberg, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Effective 7/01/2012, we implemented the trinary interpretation system for reporting results of lung ventilation/perfusion (V/Q) scintigraphy, i.e. 'PE present', 'PE absent', or 'nondiagnostic'. Our goal was to determine the discrepancy rate between on-call preliminary V/Q scan interpretations made by the residents, vs the final interpretation made by the attending MD, using this new reporting system.

METHOD AND MATERIALS

Over a 2 year interval from 7/1/2012 to 7/1/2014, we tabulated (1) the total number of V/Q scans preliminary read by our nuclear medicine residents on call, and (2) the number of V/Q scans in which the final interpretation later made by the supervising attending was discordant with the residents' preliminary reading.

RESULTS

A total of 458 V/Q scans during the on-call hours were initially reviewed and interpreted by nuclear medicine residents in our academic 600-bed hospital over this 2 year period. Of these, 17 (3.71%) initial interpretations were changed in the final scan reports signed by the attending MD. This discrepancy rate is sigificantly lower compared to the scan interpretation based on probabilities of pulmonary embolism used previously. For example, the discrepancy rate during the academic year 7/2/2011 to 7/1/2012 was 7.66%.

CONCLUSION

Implementation of the trinary interpretation strategy for V/Q scintigraphy works very well in the academic setting of a nuclear medicine residency program.

CLINICAL RELEVANCE/APPLICATION

Adaptation of the trinary interpretation strategy for V/Q scintigraphy is feasible in the academic environment.

SST08-02 Is there a Correlation between Glycolytic on [18F]-FDG-PET and Cell Density on Diffusion-weighted MRI in Lymphoma? Results of an [18F]-FDG-PET/MR Study

Friday, Dec. 4 10:40AM - 10:50AM Location: S505AB

Participants
Chiara Giraudo, MD, Vienna, Austria (*Presenter*) Nothing to Disclose
Michael Weber, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose
Georgios Karanikas, MD, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose
Matthias Pones, MD, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose
Barbara Kiesewetter, MD, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose
Markus Raderer, MD, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose
Marius E. Mayerhoefer, MD, PhD, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To determine, using [18F]-FDG-PET/MR, whether glycolytic activity, as expressed by SUV (standardized uptake values) on [18F]-FDG-PET, and cell density, as expressed by ADC (apparent diffusion coefficients) on diffusion-weighted MRI, are correlated in newly-diagnosed, untreated Hodgkin (HL) and Non-Hodgkin lymphoma (NHL).

METHOD AND MATERIALS

Patients with histologically proven lymphoma were enrolled in this prospective, IRB-approved study and underwent [18]F-FDG-PET/MR on a fully-integrated system, for staging. Fourteen nodal and 12 extranodal regions were evaluated separately. For each involved region, the lymphoma manifestation with the largest diameter was defined as target lesion, provided that it showed a focal tracer uptake and a restricted diffusion. Maximum and mean SUVs (SUVmax, SUVmean), and minimum and mean ADCs (ADCmin, ADCmean) were recorded. Spearman correlation coefficients (r), using a significance level of $P<0.05$, were used to assess the relationship between SUVs and ADCs. Patients with HL were the most numerous (n=9) and were also analyzed separately.

RESULTS

Nine HL, 5 follicular NHL, 4 diffuse large B-cell NHL, 4 mantle cell NHL, and one post-transplant NHL were included. A total of 90 lesions were available for quantitative analysis (32 lesions in HL group, which was also analyzed separately). For HL and NHL combined, the correlations between SUVmax and ADCmin, and between SUVmean and ADCmean, were, respectively, r=0.19 (P=0.073) and r=-0.15 (P=0.89). For HL, the correlation between SUVmax and ADCmin was r=0.094 (P=0.61), and between SUVmean and ADCmean r=-0.23 (P=0.18).

CONCLUSION

Our results demonstrated no statistically significant correlation between SUVs and ADCs for all lymphomas combined. While in the HL subgroup a significant, negative correlation was observed, the degree of correlation was rather low. Thus, there appears to be no relevant relationship between the degree of glycolytic activity and cell density in untreated lymphoma.

CLINICAL RELEVANCE/APPLICATION

SUV and ADC values obtained by [18]-FDG-PET/MR do not show a clinically relevant correlation in Hodgkin or Non-Hodgkin lymphoma.

SST08-03 A Comparison Trial of 18F-FDG PET/CT vs Integrated 18F-FDG PET/MRI vs MRI Alone for Detection of Adenocystoid Carcinoma

Friday, Dec. 4 10:50AM - 11:00AM Location: S505AB

Participants
Lale Umutlu, MD, Essen, Germany (*Presenter*) Consultant, Bayer AG
Markus Ruhlmann, Essen, Germany (*Abstract Co-Author*) Nothing to Disclose
Philipp Heusch, MD, Duesseldorf, Germany (*Abstract Co-Author*) Nothing to Disclose
Thomas C. Lauenstein, MD, Essen, Germany (*Abstract Co-Author*) Nothing to Disclose
Michael Forsting, MD, Essen, Germany (*Abstract Co-Author*) Nothing to Disclose
Marc U. Schlamann, Essen, Germany (*Abstract Co-Author*) Nothing to Disclose
Verena Ruhlmann, Essen, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Adenoid cystic carcinomas (ACC) are known to most commonly arise within secretory glands of the head and neck, revealing the lung and liver as sites of most common distant metastasis. The aim of our trial was to compare the diagnostic potential of 18F-FDG PET/CT with integrated 18F-FDG PET/MRI to MRI alone for detection of ACC and potential metastases.

METHOD AND MATERIALS

A total of 35 patients suspect for ACC underwent an 18F-FDG PET/CT (Biograph mCT 128, Siemens) and a simultaneous 18F-FDG PET/MRI examination (Biograph mMR, Siemens). The PETMR scan protocol comprised: 1) HASTE, 2) DWI and a) T1 fs post-contrast FLASH sequence after the application of 0.05 mmol kg/bw Gadoteric acid (Dotarem, Guerbet). The corresponding datasets (PET/CT, PET/MRI and MRI alone) were read separately by two radiologists for identification of malignant lesions (2 point ordinal scale), localization, conspicuity (4 point ordinal scale) as well as diagnostic confidence (3 point ordinal scale). All available data (histology, prior examinations, PET/MRI, follow-up examinations) served as standard of reference. Mean values were compared using Wilcoxon rank sum test.

RESULTS

Malignant disease was present in 22 of 35 patients. 18F-FDG PET/CT and PET/MRI enabled correct identification of all 22 patients (100%), while MRI alone only allowed for correct identification of 18 patients (81,2%). PET/MRI showed significantly higher lesion conspicuity assessment of the primary ACC lesions and liver metastases over PET/CT (PET/MRI: 3.7±0.28; PET/CT: 3.3±0.35). Both hybrid imaging techniques showed superior overall ratings for detection of malignant lesions, lesion conspicuity and diagnostic confidence, when compared to MRI alone (diagnostic confidence: PET/MRI:2.7±0.3; PET/CT 2.5±0.5; MRI alone: 1.9±0.3).

CONCLUSION

Both hybrid imaging techniques provide comparably high-quality assessment of malignant disease in patients suspect for ACC, offering a significant improvement in diagnostic competence when compared to MRI alone.

CLINICAL RELEVANCE/APPLICATION

Based on the significant reduction of ionizing radiation (compared to PET/CT) and improved diagnostic competence (compared to MRI alone), integrated PET/MRI can be considered a highly valuable diagnostic tool for assessment of patients with ACC.

SST08-04 Higher Sensitivity of SPECT-CT in Sentinel Lymphnode Detection

Friday, Dec. 4 11:00AM - 11:10AM Location: S505AB

Participants
Khushboo Gupta, MD, Mumbai, India (*Presenter*) Nothing to Disclose

PURPOSE

With newer trend of minimally invasive onco-surgeries to minimise functional impairment, it is important to stage the disease in presurgery as well as intrasurgery setting. Sentinel node biopsy is one of the intrasurgical method in which the most probable draining node of the primary site is excised and studied for metastatic tumor dissemination. Identification of sentinel node is hence crucial. Various methods like methylene blue dye and sentinel node lymphoscintigraphy (planar and SPECT-CT imaging) are available. We compared these modalities at our institution.

METHOD AND MATERIALS

32 biopsy proven pre-treatment cases of breast carcinoma (24/32) and head and neck cancer (8/32: 4 patients with tongue cancer and 4 patients with buccal cancer) underwent sentinel node lymphoscintigraphy. 5 to 10 Mbq of 99mTc- sulphur colloid was injected intradermally in peritumoral region (if the primary lesion was more than a centimeter) or subcutaneously above the lesion (if

the lesion was subcentimeter in size). Both planar and SPECT-CT imaging with GE Hawkeye Gamma camera were performed, along with node identification with gamma probe pre and intraoperatively. Methylene blue dye was also used preoperatively in all the cases. The patients underwent primary excision surgery with nodal dissection. The histopathology was evaluated and results were compared with sentinel node identification data.

RESULTS

Multiple nodes were identified (54 sentinel nodes), with more than one node identified in 18 cases.Total number of nodes biopsied were 48, out which methylene blue dye could identify 31/48 nodes; Planar lymphoscintigraphy could identify 38/48 nodes whereas SPECT-CT could identify 44/48 nodes. Post operative histopathology results revealed metastatic nodes in 14 cases (11 breast carcinoma and 3 head and neck carcinoma). Results were compared with positive (for metastases) sentinel node identified by either of the above method. Methylene blue dye identified 6/14 cases (42.8%), planar imaging identified 9/14 cases (64.5%) and SPECT-CT identified 13/14 cases (92.8%).

CONCLUSION

SPECT-CT lymphoscintigraphy thus proves to have higher sensitivity in identifying the sentinel node and hence contributes in patient management.

CLINICAL RELEVANCE/APPLICATION

Sentinel node identification method with SPECT-CT lymphoscintigraphy valuably contributes to perform minimal invasive surgeries and decrease the post surgery morbidity in Stage I cancer patients.

SST08-05 18-F Fluoride PET/CT Bone Scans: Its Additional Utility Over Planar Bone Scintigraphy in the Detection of Bone Metastases from Breast Cancer Patients and Its Impact on Patient Management

Friday, Dec. 4 11:10AM - 11:20AM Location: S505AB

Participants
Randeep K. Kulshrestha, MBBS, Manchester, United Kingdom (*Presenter*) Nothing to Disclose
Sobhan Vinjamuri, MBBS,FRCPC, Liverpool, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Peter Hogg, Manchester, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Andrew England, PhD, Salford, United Kingdom (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Background: 18-F fluoride PET was first proposed as a bone scanning agent in 1962 by Blau et al (Blau M, Nageler W, Bender MA. Fluorine-18: a new isotope for bone scanning. J Nucl Med 1962; 3:332-4). Today it is undergoing a resurgence of interest by utilizing it in more readily available PET/CT scanners. It has been shown to more accurate in detecting bone metastases in breast and prostate cancer patients.Aims: To compare the sensitivity, specificity, accuracy and equivocal rates of planar bone scintigraphy with 18-F Fluoride PET/CT in detecting bone metastases in breast cancer patients. To assess reasons for any extra imaging performed.

METHOD AND MATERIALS

Retrospective review of 96 patients with breast cancer who underwent initially bone scintigraphy and then later on, an 18-F fluoride bone PET/CT scan. Gold standard was follow-up and other imaging modalities. Proportions of true positives, false positives, true negatives and false negatives were tabulated. The specific reasons for extra imaging was assessed.

RESULTS

The sensitivity, specificity, positive predictive value, negative predictive value and accuracy for planar bone scintigraphy was 85%, 75%, 57.5%, 93% and 78% and for 18-F fluoride bone PET/CT it was 93.5%, 92%, 85%, 97% and 93% respectively.Proportion of equivocal studies for bone scinitgraphy was 21/96 patients (22%), and the majority of these, 17/21 (81%) required further radiographic imaging which showed benign pathology.Proportion of equivocal studies for 18F-Fluoride PET/CT was 8/96 patients (8%), and all of these had further imaging (e.g. MR scan) which showed more serious clinical pathology (e.g. cauda equina).

CONCLUSION

18-F Fluoride PET/CT bone scans are more sensitive, specific , and accurate compared with planar bone scintigraphy, with reduced proportion of equivocal studies performed. Further imaging rates to confirm benign disease are significantly lower for 18-F Fluoride PET/CT, and this impacts on patient management with fewer anxious waits for tests. Further imaging tended to show more serious associated pathology picked up by the low dose CT component, more definitively impacting on patient management.

CLINICAL RELEVANCE/APPLICATION

18-F fluoride bone PET/CT scans are more accurate at delineating bone metastases from breast cancer compared with planar bone scintigraphy and therefore should be considered, where resources are available, in the work-up of staging of breast cancer patients.

SST08-06 Diagnostic Accuracy of [18]F-FDG PET/MR Compared to [18]F-FDG PET/CT and MRI in Squamous Cell Carcinoma of the Head and Neck Area

Friday, Dec. 4 11:20AM - 11:30AM Location: S505AB

Participants
Benedikt M. Schaarschmidt, MD, Dusseldorf, Germany (*Presenter*) Nothing to Disclose
Philipp Heusch, MD, Duesseldorf, Germany (*Abstract Co-Author*) Nothing to Disclose
Marcus Ruhlmann, Essen, Germany (*Abstract Co-Author*) Nothing to Disclose
Christian Buchbender, Duesseldorf, Germany (*Abstract Co-Author*) Nothing to Disclose
Gerald Antoch, MD, Duesseldorf, Germany (*Abstract Co-Author*) Nothing to Disclose
Axel Wetter, Essen, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To compare the the diagnostic accuracy of integrated [18]F-fluordeoxyglucose positron emission tomography/magnetic resonance

To compare the the diagnostic accuracy of integrated [18]F-fluorodeoxyglucose positron emission tomography/magnetic resonance ([18]F-FDG PET/MR) imaging to MR and [18]F-FDG positron emission tomography/computed tomography (PET/CT) imaging in histopathologically confirmed head and neck squamous cell carcinoma (HNSCC).

METHOD AND MATERIALS

In 25 HNSCC patients, [18]F-FDG PET/CT and subsequent integrated [18]F-FDG PET/MR was performed for initial tumor spread and recurrence diagnostics. Fused [18]F-FDG PET/CT, fused [18]F-FDG PET/MR and MR images alone were examined by two individual readers in random order under knowledge of the clinical indication. T- and N-Stage was determined in examinations performed for initial tumor diagnostics. In examinations performed for recurrence diagnostics, lesion were analyzed individually. Diagnostic accuracy of each modality was determined by using the histopathological results in initial tumor staging after tumor resection. In patients with undergoing imaging for cancer recurrence, follow-up and results obtained by histopathological sampling were used. Using McNemar's test, results were compared separately for T-stage, N-stage and recurrent lesions. $p<0.017$ was considered statistically significant after Bonferroni correction.

RESULTS

In twelve patients undergoing [18]F-FDG PET/CT and [18]F-FDG PET/MR for initial tumor staging, T-staging was accurate in 50% in MRI alone, 59% in [18]F-FDG PET/CT and 75% in [18]F-FDG PET/MR while N-staging was accurate in MRI alone in 75%, in 77% in [18]F-FDG PET/CT and in 71% in [18]F-FDG PET/MR. No significant differences were observed using in T- and N-staging between all three modalities ($p>0.017$, respectively). In thirteen patients undergoing hybrid imaging for cancer recurrence diagnostics, the diagnostic accuracy was 57% with MRI alone and 72% with [18]F-FDG PET/CT and [18]F-FDG PET/MR, respectively. Differences between all three modalities were insignificant ($p>0.017$, respectively).

CONCLUSION

No significant differences were observed between [18]F-FDG PET/MR, [18]F-FDG PET/CT and MRI in local tumor staging and cancer recurrence diagnostics.

CLINICAL RELEVANCE/APPLICATION

[18]F-FDG PET/MR is considered a highly accurate method in head and neck squamous cell carcinoma. Our data indicate that the advantage over MRI and [18]F-FDG PET/CT is not as obvious as expected in this initial study.

SST08-07 Correlation of the Maximum Standardized Uptake Values and Apparent Diffusion Coefficient Values with Pathologic Prognostic Factors in Breast Carcinoma

Friday, Dec. 4 11:30AM - 11:40AM Location: S505AB

Participants
Kazuhiro Kitajima, MD, Nishinomiya, Japan (*Presenter*) Nothing to Disclose
Toshiko Yamano, Nishinomiya, Japan (*Abstract Co-Author*) Nothing to Disclose
Kazuhito Fukushima, Nishinomiya, Japan (*Abstract Co-Author*) Nothing to Disclose
Yoko Igarashi, Nishinomiya, Japan (*Abstract Co-Author*) Nothing to Disclose
Takayuki Katsuura, MD, Nishinomiya, Japan (*Abstract Co-Author*) Nothing to Disclose
Kaoru Maruyama, Kobe, Japan (*Abstract Co-Author*) Nothing to Disclose
Koichiro Yamakado, MD, PhD, Tsu, Japan (*Abstract Co-Author*) Nothing to Disclose
Kumiko Ando, MD, Kobe, Japan (*Abstract Co-Author*) Nothing to Disclose
Reiichi Ishikura, MD, PhD, Nishinomiya, Japan (*Abstract Co-Author*) Nothing to Disclose
Yasuo Miyoshi, Nishinomiya, Japan (*Abstract Co-Author*) Nothing to Disclose
Arisa Nishimukai, Nishinomiya, Japan (*Abstract Co-Author*) Nothing to Disclose
Seiichi Hirota, Nishinomiya, Japan (*Abstract Co-Author*) Nothing to Disclose
Shozo Hirota, MD, Nishinomiya, Japan (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

to evaluate the combination of maximum standardized uptake values (SUVmax) of 18F-FDG PET/CT, and apparent diffusion coefficient (ADC) values of DWI with pathologic prognostic factors in breast carcinoma patients.

METHOD AND MATERIALS

The institutional review board of our hospital approved this retrospective study; the requirement for informed consent was waived. 181 patients with 183 mass-type invasive breast carcinomas (mean size 2.47 cm, range 1.0-13.0 cm) who underwent whole-body 18F-FDG PET/CT, 3-Tesla breast MRI including DWI, and immunohistochemical staining of the primary lesions before therapy. The primary tumor's SUVmax and ADC were retrospectively measured using FDG-PET/CT and DWI by two experienced nuclear medicine physicians and two experienced radiologists, respectively. Histologic analysis was done on tumor size, axillary lymph node (LN) metastasis, nuclear grade, expression of estrogen receptors (ER), progesterone receptors (PR), human epidermal growth factor receptor 2 (HER2), and Ki-67. The relationship among SUVmax, ADC values, and pathologic prognostic factors were evaluated.

RESULTS

The mean value of SUVmax and ADCmean values was 5.58±3.88 (range, 1.2-24.17) and 892±218×10-6 mm2/s (range, 452-1574×10-6), respectively. There was mild correlation between the SUVmax and ADCmean values (correlation coefficient $r=-0.37$, $p<0.0001$). SUVmax was associated with numerous prognostic factors such as tumor size ($p<0.0001$), axillary LN metastasis ($p<0.0001$), TNM staging ($p<0.0001$), histology ($p=0.00049$), nuclear grade ($p<0.0001$), and expression levels of ER ($p=0.0041$), PR ($p=0.00045$), HER2 ($p=0.00059$), and Ki-67 ($p<0.0001$). Meanwhile, ADCmean values were associated with tumor size ($p=0.013$), axillary LN metastasis ($p=0.0038$), TNM staging ($p=0.0016$), histology ($p=0.013$), and expression of Ki-67 ($p=0.0014$).

CONCLUSION

SUVmax is more useful for predicting the prognosis of breast carcinoma than ADC values.

CLINICAL RELEVANCE/APPLICATION

Primary tumor's SUVmax of pretreatment 18F-FDG PET/CT can be considered as a promising prognostic parameter that may identify highly aggressive breast carcinoma and a very important tool for determining the treatment plan.

SST08-08 Added Value of SPECT-CT over SPECT and Planar Imaging in 111-Indium Octreotide Evaluation of Neuroendocrine Tumors

Friday, Dec. 4 11:40AM - 11:50AM Location: S505AB

Participants
Elham Safaie, MD, Stony Brook, NY (*Presenter*) Nothing to Disclose
Anuj K. Rajput, MD, Stony Brook, NY (*Abstract Co-Author*) Nothing to Disclose
Kavitha Yaddanapudi, Cleveland, OH (*Abstract Co-Author*) Nothing to Disclose
Robert Matthews, MD, Stony Brook, NY (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Body neuroendocrine tumors (NET) constitute a heterogeneous group of neoplasms with a high somatostatin receptor expression. Indium-111 Octreotide provides functional information and combination with CT provides accurate localization. The purpose of this study was to evaluate additional value of SPECT-CT imaging over planar and SPECT imaging foridentifying additional foci of neuroendocrine tumors.

METHOD AND MATERIALS

This is a retrospective study reviewing 51 patients that had undergone 111-Indium for tumor localization and restaging at our institution from October 2013 to the present. Patients were imaged using initial planar imaging, SPECT, and SPECT-CT. Two experienced Nuclear Medicine physicians read each study by consensus and rated as low, moderate, or high diagnostic confidence. Number of lesions identified on SPECT-CT was compared to SPECT and planar imaging. In addition we evaluated the number of false positive lesions on planar and SPECT that could be excluded on subsequent SPECT-CT. Clinical history and pathology was reviewed.

RESULTS

There were 51 patients, 29 female and 22 males with mean age 61yrs. 109 lesions identified on SPECT-CT compared to 63 lesions identified on SPECT and 47 lesions were seen on planar images. SPECT-CT identified additional lesions, improved characterization of lesions and increased the diagnostic confidence in 20 patients (39%). On SPEC- CT the distribution of additional true positive lesions identified was as follows liver (7), pancreas (7), small bowel (2), lymph nodes(9), peritoneal carcinomatosis (3), breast uptake (1), lungs(3), bone (1). In addition benignlesions (false positive) as gynecomastia, post surgical uptake, renal cysts, thyroid uptake, adnexal uptake and skin uptake accounted for the rest and were reliably excluded.

CONCLUSION

Conclusions: SPECT combined with high quality diagnostic CT is superior to conventional planar and SPECT alone imaging in the diagnosis of neuroendocrine tumors. It increases the diagnostic confidence, improves lesion detection, localization and characterization.

CLINICAL RELEVANCE/APPLICATION

The added value of SPECT-CT over planar and SPECT imaging provides a more accurate diagnosis for the clinician and therefore better treatment for the patient.

SST08-09 Multi-modality Assessment of Bone Marrow Involvement in Lymphoma Patients: Contributions of [18F]-FDG-PET, Contrast-enhanced CT, Morphological and Diffusion-weighted MRI

Friday, Dec. 4 11:50AM - 12:00PM Location: S505AB

Participants
Ulrika Asenbaum, MD, Vienna, Austria (*Presenter*) Nothing to Disclose
Georgios Karanikas, MD, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose
Edith Porpaczy, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose
Michael Weber, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose
Barbara Kiesewetter, MD, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose
Markus Raderer, MD, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose
Marius E. Mayerhoefer, MD, PhD, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Unilateral bone marrow biopsy is still considered the standard for assessment of bone marrow involvement in lymphoma. It was therefore the goal of this study to determine the value of [18F]-FDG-PET, morphological as well as diffusion-weighted MRI (DWI), independently and in combination, for bone marrow evaluation in lymphoma patients.

METHOD AND MATERIALS

Our prospective IRB-approved study included patients with histologically-proven, untreated lymphomas that underwent whole-body [18F]-FDG-PET/CT and MRI (including T1-weighted MRI and DWI, obtained on a 3T-system, for staging. Two rater teams, each consisting of a radiologist and a nuclear medicine physician, rated all images independently. Sensitivities and specificities, using unilateral bone marrow biopsy as basis for the reference standard, were separately assessed for contrast-enhanced (CE-)CT, [18F]-FDG-PET(/CT), DWI, T1w MRI, DWI+T1w MRI, and [18F]FDG-PET+DWI. Kappa coefficients were used to assess the agreement between the two rater teams.

RESULTS

Sixty patients met our criteria for participation. Based on the results of rater team 1, sensitivities for (CE-)CT, [18F]-FDG-PET(/CT), DWI, T1w MRI, DWI+T1w MRI, and [18F]FDG-PET+DWI were 25%, 81.3%, 81.3%, 62.5%, 75%, and 81.3%; whereas specificities were 100%, 95.5%, 84.1%, 95.5%, 95.5%, and 95.5%, respectively. The corresponding kappa coefficients (interrater agreement) were 1.0, 0.64, 0.82, 0.69, 0.78, and 0.87.

CONCLUSION

The combination of [18F]-FDG-PET and DWI does not improve the detection of bone marrow involvement in lymphoma patients to a relevant degree, compared to stand-alone [18F]-FDG-PET and DWI; the combination does, however, reduce interrater variability.

CLINICAL RELEVANCE/APPLICATION

The combination of [18F]-FDG-PET and DWI may produce results that are less rater dependent, with regard to the detection of bone marrow involvement in lymphoma; thus, PET/MR may be preferrable to the stand-alone techniques.