Nuclear Medicine

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105TH Scientific Assembly and Annual Meeting
December 1–6 | McCormick Place, Chicago

NM001-EB-X

Stranger Things: Multimodality Imaging of Diffuse Renal Lesions

All Day Room: NM Community, Learning Center Hardcopy Backboard

Participants
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TEACHING POINTS

1- To review the unusual infiltrative entities that affect the renal parenchyma. 2- To understand the importance of anatomic and metabolic images in the differential diagnosis. 3- To learn how to differentiate normal renal radiotracers excretion from abnormal uptake patterns in 18F-FDF PET-CT. 4- To emphasize the importance of an integral approach, including patient history in order to identify key associated findings.

TABLE OF CONTENTS/OUTLINE

- Introduction. - Normal renal characteristics in US, CT, MR and 18F-FDG PET-CT imaging. - Etiologies: Infectious Bacterial Infections. Tuberculosis Infection. Neoplastic: Lymphoproliferative Diseases. Multiple Myeloma. Metastatic Diseases. Langerhans Cell Histiocytosis. Rheumatologic and Miscellaneous Diseases. Pitfalls and mimics. - Conclusions

NM002-EB-X

The Future of Nuclear Medicine and Musculoskeletal Radiology: Fusion Imaging

All Day Room: NM Community, Learning Center Hardcopy Backboard

Participants
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TEACHING POINTS

What is fusion imaging. The utility of fusion imaging, especially in pre- and post-operative patients. How to implement fusion imaging in a practice.

TABLE OF CONTENTS/OUTLINE

How fusion imagining is performed. Which situations warrants fusion imaging. Examples of fusion imaging and how it alterated patient management. How to approach and educate other physicians regarding the utility of fusion imaging.

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NM100-ED-X

Utility of Nuclear Medicine Three Phase Bone Scan in the Evaluation of Frostbite

All Day Room: NM Community, Learning Center Digital Education Exhibit

Participants
Marlon P. Coelho, MD, Syracuse, NY (*Presenter*) Nothing to Disclose
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TEACHING POINTS

1. Three phase bone scan utlilty for evaluation of soft tissue and bone ischemia or infarct in the event of frostbite injury. 2. Use of three phase bone scan in planning surgical management and as a diagnostic and prognostic tool for second, third and fourth degree injuries.

TABLE OF CONTENTS/OUTLINE

- Introduction to three phase bone scan imaging. - Procedure of performing the study and the various phases of the scan. - General utility of the three phase bone scan in nuclear medicine imaging and the radiotracers used. - Specific utility with case based presentation on the use of three phase bone scans in the evaluation of frostbite injury. - General guidelines and recommendations for use in trauma, infection and concurrent prolonged cold exposure.

NM101-ED-X

Radionuclide Imaging of Cardiac Amyloidosis and Sarcoidosis: Demonstration of SPECT and PET Images Using Various Radiotracers

All Day Room: NM Community, Learning Center Digital Education Exhibit

Awards
Cum Laude
Identified for RadioGraphics

Participants
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TEACHING POINTS

Amyloidosis and sarcoidosis are multisystemic diseases, which can affect the heart. Evaluation of cardiac amyloidosis and sarcoidosis is important because patients' prognosis depends on cardiac involvement. The purpose of this exhibit is To review the clinical implication of radionuclide imaging for the diagnosis of cardiac amyloidosis and sarcoidosis To demonstrate the SPECT and PET images of cardiac amyloidosis and sarcoidosis using various radionuclide tracers To compare the utility of the radiotracers for the assessment of cardiac amyloidosis and sarcoidosis

TABLE OF CONTENTS/OUTLINE

Introduction Cardiac amyloidosis: 1) Pathophysiology; 2) Types; 3) Radionuclide tracers (99mTc-PYP, 99mTc-HMDP, 99mTc-Aprotinin, 123I-SAP, 11C-PiB, and 18F-Florbetaben); and 4) Cases Cardiac Sarcoidosis: 1) Pathophysiology; 2) Radionuclide tracers (67Ga-citrate, 18F-FDG, 11C-4DST, 18F-FLT, 111In-pentetreotide, and 68Ga-DOTATOC); and 3) Cases

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NM102-ED-X

Fever of Unknown Origin and the Role of 18F-FDG PET-CT: Frequently Encountered Pathology

All Day Room: NM Community, Learning Center Digital Education Exhibit

Participants
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TEACHING POINTS

The purpose of this exhibit is:1. To understand the concept of fever of unknown origin 2. To explain the utility of 18F-FDG PET-CT in the diagnosis3. To make an album of frequent pathology encountered

TABLE OF CONTENTS/OUTLINE

Definition of fever of unknown originWhen to perform a 18F-FDG PET-CTMost frequently encountered differential diagnosis

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NM103-ED-X

Ga-68 Dotatate PET/CT: Case-Based Review from the First Few Years of Use at a Large Academic Center

All Day Room: NM Community, Learning Center Digital Education Exhibit

Participants
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Donald R. Neumann, MD, PhD, Cleveland, OH (*Abstract Co-Author*) Nothing to Disclose
Ruchi Yadav, MD, Beachwood, OH (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

Through multiple-choice question, case-based format:• Identify the normal biodistribution of Ga-68 Dotatate radiotracer.• Compare modalities for similar imaging with FDG PET/CT and Indium-111 Octreotide.• View and troubleshoot cases of common errors in exam execution.• Review cases of common primary indications for Ga-68 Dotatate PET/CT including neuroendocrine tumors and metastases, treatment response and progression.• Test knowledge of abnormal radiotracer uptake in unique cases of other benign and syndromic conditions.

TABLE OF CONTENTS/OUTLINE

Background info on Ga-68 Dotatate and labeling. • Normal Ga-68 Dotatate biodistribution and mechanism.• Comparison to In-111 Octreotide.Abnormal biodistribution:o Bad labeling and skin contamination cases.o Fusion window/leveling (spleen metastasis case).'Bread and Butter' Cases:o Pancreatic NET.o Isolated duodenal carcinoid and multifocal small bowel carcinoid.Metastatic Diseaseo Distant, unusual or CT occult mets including bony, calvarial and RP metastases. Ex. Orbital met case.o Treatment response/progression.Benign Bony Uptakeo Hemangioma.o Rib Fx/Trauma.o Degenerative endplate uptake.Special Caseso MEN syndrome.o Paragangliomas and Familial Paraganglioma syndrome.o Splenule.o Meningioma.

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NM104-ED-X

DaTscan Quantitation Improving the Confidence of Visual Interpretation

All Day Room: NM Community, Learning Center Digital Education Exhibit

Participants
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TEACHING POINTS

Presentation of Parkinsonian syndromes on SPECT imaging Comparison between DaTscan and Trodat Use of quantitation software for detection of dopaminergic neurons loss.

TABLE OF CONTENTS/OUTLINE

Parkinsonian syndromes are a group of movement disorders characterized by tremor, bradykinesia, and rigidity. They are most frequently due to primary neurodegenerative disease, resulting in loss of dopaminergic nerve terminals along the nigrostriatal pathway, as occurs in idiopathic Parkinson disease (PD), multiple system atrophy, progressive supranuclear palsy, corticobasal degeneration, and dementia with Lewy bodies. SPECT imaging enables differentiation of neurodegenerative causes of parkinsonism, where typically patients will have different abnormal scan patterns and grading , from other movement or tremor disorders where typically the SPECT study will be normal DaTscan (123-I-ioflupane) and Trodat (99m TC) are the 2 currently used radiopharmaceuticals all over the world. DaTQUANT Software application enables quantification of 123I-ioflupane (DaTscan) images to normal age matched databases to enhance the visual interpretation confidence in detecting loss of functional dopaminergic neuron terminals in the striatum, which is correlated with Parkinson's disease.

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NM105-ED-X

An Update of Radioactive Iodine Therapy Guidelines in Pediatric Patients with Thyroid Cancer

All Day Room: NM Community, Learning Center Digital Education Exhibit

Participants
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Vani Vijayakumar, MD, Jackson, MS (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

To discuss radioactive I 131 therapy guidelines to treat pediatric thyroid cancer patients. To show any differences in requirements between adults and pediatric thyroid cancer indications and specific side effects related to children. To review gentle use of different imaging modalities in the era of the image wisely concept.

TABLE OF CONTENTS/OUTLINE

While pediatric thyroid cancer is a rare disease, children who receive appropriate therapy have an excellent prognosis. Children more often present with more advanced stages of differentiated thyroid cancer than adults do. Children are also at a higher risk of recurrence and are more likely to present with nodal involvement. Radioactive I 131 therapy is given as treatment to pediatric patients with differentiated thyroid cancer in order to lower the risk of recurrent thyroid cancer and to eliminate residual iodine avid disease. The administration of Radioactive I 131 also allows for concurrent whole body imaging to localize any residual tissue, in addition to the treatment effects. The indications for treatment with RAI, the dose of RAI recommended, the imaging recommended for follow up, and the side effects encountered, all vary significantly between pediatric and adult patients. These differences will be further discussed. Please see attached.

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NM106-ED-X

"State-of-the-Art" Imaging of Neuroendocrine Tumors: How to Incorporate High-end Anatomic, Somatostatin Receptor, and Metabolic Imaging

All Day Room: NM Community, Learning Center Digital Education Exhibit

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TEACHING POINTS

1. Understand the biology and heterogeneity of neuroendocrine tumors (NETs). 2. Describe 'state of the art' anatomic Imaging of NETs that must include multiphase post-contrast CT or MRI of the abdomen. 3. Understand the most common indications and appropriate use criteria of DOTATATE PET/CT. 4. Recognize the role of FDG PET/CT in tumor prognostication and treatment planning.

TABLE OF CONTENTS/OUTLINE

1. Overview of the most recent classification of NETs (WHO 2017 classification). 2. Importance of having multiphase CT and MRI imaging of the abdomen to allow detection of arterially enhancing lesions (on the arterial phase), and hypoenhancing lesions (on the portal venous and delayed phases). 3. Somatostatin receptor imaging of NETs using Ga-68 DOTATATE PET/CT: a. Case based review of appropriate use criteria published by the SNMMI in Jan 2018 and most common indications. b. Most common pitfalls and how to avoid them (such as islet cells clusters in the uncinate process and ectopic splenic tissue in the pancreatic tail). c. Role in imaging of less common forms of NETs (such as pheochromocytoma, paraganglioma and medullary thyroid carcinoma). 4. Use of FDG PET/CT: a. Role in tumor grading, prognostication, and treatment planning. b. When we should think of getting an FDG PET/CT in addition to DOTATATE PET/CT.

NM107-ED-X

TI-201 Scintigraphy of Various Musculoskeletal Tumor According to WHO 2013 Classification

All Day Room: NM Community, Learning Center Digital Education Exhibit

FDA Discussions may include off-label uses.

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TEACHING POINTS

To reconsider the oncological applications of Thallium-201(Tl-201) scintigraphy To review Tl-201 scintigraphy of various MSK tumor according to WHO 2013 classification To understand the clinical utilityof Tl-201 to assess the response to chemotherapy

TABLE OF CONTENTS/OUTLINE

Pharmacokinetics of Tl-201 Chloride Normal distribution of Tl-201 Tl-201 scintigraphy of various MSK tumor according to WHO 2013 classification Benign and malignant tumors Comparison of scintigraphic appearance with FDG-PET/CT Non-tumoral conditions which show abnormal Tl-201 uptake 4.Clinical applications to predict histological responses to chemotherapy

NM108-ED-X

Lutetium Lu-177 Dotatate Challenges: Side Effects, Complications, and Disease Progression

All Day Room: NM Community, Learning Center Digital Education Exhibit

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TEACHING POINTS

1. Understanding the immediate & long term side effects of lutetium Lu-177 dotatate PRRT (Peptide Receptor Radionuclide Therapy) 2. Learning management strategies for Lu-177 dotatate side effects, illustrated with case examples 3. Describing complications of Lu-177 dotatate with imaging findings 4. Analysis of cases, with important imaging findings, that did not appear to benefit from Lu-177 dotatate therapy 5. Gaining familiarity with clinical examples of patients who could not complete all four cycles of Lu-177 dotatate and understanding of the underlying clinical and pathophysiologic factors preventing patients from completing therapy, through clinical examples

TABLE OF CONTENTS/OUTLINE

A. Background about Lu-177 dotatate a. How Lu-177 dotatate works b. Treatment eligibility c. Day of therapy d. Follow up B. Possible side effects with case examples a. Predictors of potential side-effects b. Immediate side effects and management c. Long term side effects and management C. Complications and unexpected findings during Lu-177 dotatate therapy with case examples D. Clinical examples of patients who had modified Lu-177 dotatate therapy E. Treatment outcomes a. Treatment response evaluation b. Examples of cases that did not appear to benefit from Lu-177 dotatate therapy F. Clinical examples of patients who could not complete Lu-177 dotatate therapy

NM109-ED-X

Peptide Imaging with Somatostatin Analogs for Therapy Response Assessment of Neuroendocrine Tumors

All Day Room: NM Community, Learning Center Digital Education Exhibit

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TEACHING POINTS

1. To review NETs types. 2. To discuss the treatment modalities and the time interval between treatment and response assessment imaging3. To illustrate multimodality molecular imaging that may be used to assess response4. To highlight the teaching points via a case-based review

TABLE OF CONTENTS/OUTLINE

1. NETs types. 2. Therapy options to low- and high-grade NETs. 3. Somatostatin analogs imaging methods include 111In-octreotide whole-body scan, 177Lu-octreotate post-treatment whole-body scan and 68Ga-DOTATATE PET/CT. 4. Somatostatin analogs imaging methods are compared to 123I-MIBG whole-body scan, bone scan and 18F-FDG PET/CT. 5. Pancreatic NET showing complete response. 6. Ileum NET showing partial response. 7. Pancreatic NET showing progressive disease. 8. Paraganglioma showing partial response. 9. Neuroblastoma showing partial response. 10. Breast NET showing partial response. 11. Lung NET showing long term recurrence. 12. Ileum and cecum NET showing persistent disease after surgical treatment.

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NM110-ED-X

Review of Imaging of Neuroendocrine Tumors Utilizing 68Ga-DOTATATE PET/CT

All Day Room: NM Community, Learning Center Digital Education Exhibit

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TEACHING POINTS

1. Review pathophysiology of neuroendocrine tumors and normal biodistribution of 68-Ga-DOTATATE uptake on PET2. Describe the role of DOTATATE PET versus FDG PET in characterizing well- and poorly differentiated tumors3. Illustrate how multimodality imaging with a combination of anatomic imaging such as CT and MRI, and functional imaging with DOTATATE PET and FDG PET, can produce optimal results in detection of NET tumors 4. Review implications in patient management

TABLE OF CONTENTS/OUTLINE

Background/Introduction Case-based examples of the teaching pointsSummary

NM111-ED-X

Lutetium (Lu-177) Radiolabeled Somatostatin Receptor Agonist Therapy in Neuroendocrine Tumors

All Day Room: NM Community, Learning Center Digital Education Exhibit

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Certificate of Merit

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Adil Al-Nahhas, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

Purpose of the exhibit: 1. To understand the role of Lutetium 177 labelled peptide receptor radionuclide therapy (PRRT) in the management of malignant neuroendocrine tumors. 2. Patient inclusion and exclusion criteria and where PRRT is placed in the treatment pathway. 3. Overview of the method of administration and timeline of therapy at our institution. 4. To review the response of Lu-177 therapy on pre-, peri- and post treatment imaging.

TABLE OF CONTENTS/OUTLINE

• Introduction to peptide receptor radionuclide therapy (PRRT)-Lutetium 177 therapy Mechanism of action Role of Gallium-68 DOTA PET in pre and post treatment imaging and outline of the Krenning Score Inclusion criteria for treatment including tumor differentiation and proliferation rates • Overview of the treatment regimen with typical timing intervals • Specifics of treatment including patient preparation and therapy administration • Post therapy SPECT/CT imaging • Ga68 DOTA- PET/CT imaging before and after treatment examples

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NM112-ED-X

Tumor-Induced Osteomalacia: What an Imaging Physician Should Know?

All Day Room: NM Community, Learning Center Digital Education Exhibit

Participants
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TEACHING POINTS

After reviewing the exhibit, the learner should: Become familiar with clinical and laboratory presentation of a rare disorder, tumor induced osteomalacia (TIO) Understand the pathophysiology and natural history of TIO Recognize features of anatomic and molecular imaging studies to guide imaging strategy

TABLE OF CONTENTS/OUTLINE

What is TIO? Pathophysiology and Natural History Each slide demonstrating features of multimodality imaging Pathologic correlation

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NM113-ED-X

State-of-the-Art of PET/MR for Rectal Cancer: The Added Value to Conventional Imaging Work-Up

All Day Room: NM Community, Learning Center Digital Education Exhibit

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TEACHING POINTS

i. Discuss the PET/MR protocol, selecting the appropriate MR sequences and clinical workflow ii. Recognize the role of PET/MR in different clinical scenario of rectal cancer in comparison to conventional imaging iii. Highlight the potential clinical impact of PET/MR over other imaging modalities

TABLE OF CONTENTS/OUTLINE

i. PET/MR imaging protocol and clinical workflow ii. Primary staging a. Comparison to conventional imaging work-up (MR and CT) b. Predictive value of PET/MR parameters c. Characterization of mucinous component (the difference in metabolism and cellularity) iii. Therapy response assessment to neoadjuvant therapy a. Comparison to MR iv. Detection of tumor recurrence a. Comparison to CT and MR v. Potential clinical impact of PET/MR findings

NM114-ED-X

Monitoring Treatment of Lymphoma Using 18F-FDG PET/CT: Now and Then to the Future

All Day Room: NM Community, Learning Center Digital Education Exhibit

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Ukihide Tateishi, MD,PhD, Tokyo, Japan (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

The purposes of this exhibit are as follows: 1. To learn monitoring treatment of lymphoma using imaging studies in terms of the history and development of 18F-FDG PET/CT-based criteria. 2. To learn Lugano classification which is the most popular criteria for monitoring treatment of lymphoma. 3. To learn some newly introduced criteria following some drugs in the new generation and discuss future perspectives in this field.

TABLE OF CONTENTS/OUTLINE

History of therapeutics for lymphoma Limitation of morphological imaging studies (CT/MRI): problem of 'CRu' Monitoring treatment of lymphoma using 18F-FDG PET/CT - Cheson's revised criteria (published in 2007) - Lugano criteria (published in 2014) - Newly introduced criteria (LYRIC, RECIL 2017) Future perspective

NM115-ED-X

Immune Checkpoint Inhibitor Therapy: What Every PET Reader Needs to Know

All Day Room: NM Community, Learning Center Digital Education Exhibit

Participants
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TEACHING POINTS

Recognize the positron emission tomography (PET) imaging appearance of immune checkpoint inhibitor therapy related adverse events. Recognize key differences in imaging response criteria for patients on immune checkpoint inhibitor therapy compared with standard imaging assessment of response.

TABLE OF CONTENTS/OUTLINE

Immune related therapy in oncology is an emerging treatment modality with large implications for the radiology community. This novel class of therapy is gaining favor and momentum in the clinical community and thus can be expected to become a larger part of imaging. Radiologists tasked with assessing treatment response must be equipped to recognize imaging manifestations of adverse events and to recognize key differences in response criteria to avoid inaccurate conclusions and early termination of therapy. We propose an image-rich educational exhibit to review the basics of immune therapy from a radiology perspective and focus on PET/CT appearance of potentially fatal and morbid adverse events as well as a concise review of salient points related to assessing therapeutic response to these agents.

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NM116-ED-X

PET/MRI Neck Imaging: Applications, Protocols and Institutional Experience

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Participants
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TEACHING POINTS

Describe applications and indications for PET/MRI. Discuss advantages/disadvantages of PET/MRI relative to PET/CT in lesion detection and treatment planning. Review an institutional protocol for PET/MRI Neck imaging. Case-based description of institutional experience with PET/MRI lesion detection, staging and restaging in squamous cell carcinoma of the neck. Case-based depiction of institutional experience with PET/MRI imaging of other oncologic and inflammatory states.

TABLE OF CONTENTS/OUTLINE

Indications and applications. Technique and protocols. Case series of *oncologic* lesions as seen on PET/MRI: -Primary lesion detection. -Initial staging. -Restaging and recurrence. Case series of *inflammatory* conditions seen on PET/MRI: -Initial staging. -Restaging and recurrence.

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NM117-ED-X

Therapy Assessment of Metastatic Prostate Cancer on PSMA PET Imaging: How to Recognize the Patterns of Disease Response

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TEACHING POINTS

I. Review the natural history and the main therapeutic options for prostate cancer (PCa) II. Highlight the different patterns of response of PCa using PSMA PET imaging according to the type of therapy III. Understand the concept of whole-body tumor burden on PSMA PET as a potential biomarker

TABLE OF CONTENTS/OUTLINE

1. Natural history of PCa 2. Overview of available therapies for metastatic PCa at different stages 3. PSMA PET-based therapy response assessment of metastatic PCa after: a. Metastasis-directed therapy (MDT) b. Androgen Deprivation Therapy (ADT) c. Chemotherapy d. 223Ra e. Lu177- and Ac225-PSMA f. Immunotherapy 4. Role of whole-body tumor burden on PSMA PET

NM118-ED-X

Bone Scintigraphy Overview: Flash Cards for Residents

All Day Room: NM Community, Learning Center Digital Education Exhibit

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TEACHING POINTS

1) To describe the basics of bone scintigraphy including indications, patient preparation and technique. 2) To be able to differentiate normal entities from pathology in adults and children. 3) To determine specific indications for different types of bone scans and provide appropriate differential diagnosis. 4) Examples with correlative cross-sectional imaging.

TABLE OF CONTENTS/OUTLINE

1) Bone scintigraphy technique, indications, radiation dose. 2) Charctersistic imaging findings of different pathological entities with examples. 3) Types of bone scans with illustrative examples. 4) Compilation of important facts and numbers pertaining to bone scintigraphy relevant for residents.

Printed on: 10/29/20

NM119-ED-X

PSMA PET Imaging for Detection and Primary Staging of Prostate Cancer: Incremental Value Over Conventional Imaging Work-Up

All Day Room: NM Community, Learning Center Digital Education Exhibit

Awards
Certificate of Merit

Participants
Marcelo A. Queiroz, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Rafael F. Nunes, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Jose F. Marin, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Larissa B. Costa, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Elaine C. Zaniboni, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
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Priscilla R. Dreyer, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Giovanni G. Cerri, MD,PhD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Felipe d. Barbosa, MD, Sao Paulo , Brazil (*Presenter*) Nothing to Disclose
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TEACHING POINTS

I. Understand the relation of PSMA expression and tumor biology II. Highlight the role of PSMA PET imaging before (for detection) and after the primary diagnosis (for staging) of prostate cancer III. Discuss the potential clinical impact on patient management of PSMA PET imaging in comparison to conventional imaging work-up

TABLE OF CONTENTS/OUTLINE

Table of contents/outline 1. PSMA expression and tumor biology 2. Tumor detection a. PSMA PET x MR b. PSMA PET for guiding biopsy 3. Primary Staging a. T-staging i. Localization of primary tumor ii. Characterization of Aggressiveness b. N-staging c. M-staging 4. Incremental value of PSMA PET imaging over other imaging modalities a. Changes on approach of N-disease i. Surgery vs. Radiotherapy b. Changes on approach of M-disease i. Non-metastatic vs. Oligometastasic vs. Polymetastatic

NM120-ED-X

FDG PET/CT Findings of Hepatic Tumor and Tumor-like Lesions Based on Molecule Background

All Day Room: NM Community, Learning Center Digital Education Exhibit

Awards
Certificate of Merit

Participants
Kumi Ozaki, Fukui, Japan (*Presenter*) Nothing to Disclose
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Osamu Matsui, MD, Kanazawa, Japan (*Abstract Co-Author*) Nothing to Disclose

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TEACHING POINTS

The purposes of this presentation are: 1) to review the 18F-fluorodeoxyglucose (FDG) PET/CT findings of benign and malignant hepatic tumor and tumor-like lesions; 2) to speculate the molecular mechanism underlying increased FDG uptake by immunohistochemical study; 3) to show the usefulness of FDG-PET/CT in diagnosis of hepatic lesions in addition to CT and MR imaging.

TABLE OF CONTENTS/OUTLINE

1. Introduction 2. Review the based molecular mechanism underlying increased 18F- FDG uptake 3. Focus on the construction of glucose-6-phosphatase complex 4. Case-based imaging review of FDG PET/CT findings in hepatic tumor and tumor-like lesions and their molecular mechanism 5. Focus on the negative accumulation on malignant neoplasm 6. Focus on the accumulation on the benign lesion 7. Summary of the usefulness of FDG-PET/CT in diagnosis of hepatic lesions 8. Conclusion

ED010-SU

Nuclear Medicine Sunday Case of the Day

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

AMA PRA Category 1 Credit ™: .50

Participants

Ming Yang, MD, Scottsdale, AZ (*Presenter*) Nothing to Disclose
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Geoffrey B. Johnson, MD,PhD, Rochester, MN (*Abstract Co-Author*) Research Grant, General Electric Company Research Grant, Pfizer Inc
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TEACHING POINTS

1) Recognize the association of lung malignancy and immune-mediated seizure activity. 2) Recognize incidental Thornwaldt cyst on FDG PET-CT. 3) Familiarize the scintigraphy feature of shin splint on three-phase bone scan. 4) Identify off-target distribution of Tc-99m MAA to the falciform artery on Y-90 microsphere planning SPECT/CT. 5) Recognize the imaging features of an obstructed ventriculoperitoneal shunt.

SPCT10

Best Clinical Trials @ RSNA 2019

Sunday, Dec. 1 10:45AM - 12:15PM Room: E352

BR GI HP MR NM

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 1.75

Participants
Udo Hoffmann, MD, Boston, MA (*Moderator*) Research Grant, Kowa Company, Ltd ; Research Grant, Abbott Laboratories; Research Grant, HeartFlow, Inc; Research Grant, AstraZeneca PLC;
David A. Mankoff, MD, PhD, Philadelphia, PA (*Moderator*) Speaker, Koninklijke Philips NV Consultant, General Electric Company Advisory Board, RefleXion Medical Inc Consultant, Blue Earth Diagnostics Ltd Research Funded, Siemens AG Advisory Board, ImaginAb, Inc Spouse, Owner, Trevarx
Ruth C. Carlos, MD, MS, Ann Arbor, MI (*Moderator*) Editor, Journal of the American College of Radiology; Support, Harvey L. Neiman Health Policy Institute; In-kind support, Reed Elsevier;

Sub-Events

SPCT10A MRI in Addition to Mammography Screening in Women with Extremely Dense Breasts: Primary Outcome of the Randomized DENSE Trial

Participants
Marije F. Bakker, PhD, Utrecht, Netherlands (*Abstract Co-Author*) Grant, Bayer AG; Software support, Volpara Health Technologies Limited
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Carla H. van Gils, PhD, Utrecht, Netherlands (*Abstract Co-Author*) Software support, Volpara Health Technologies Limited

ABSTRACT

PURPOSE To evaluate the effect of supplemental MRI for women with extremely dense breasts within a population-based screening program. METHOD AND MATERIALS Between 2011-2015, we randomized 40,373 screening participants (aged 50-75) with a negative screening mammography and extremely dense breasts (ACR category 4 by Volpara software) to (an invitation for) supplemental 3.0-T MRI at 8 sites (intervention arm; n=8,061) or mammography screening only (control arm; n=32,312). The difference in interval cancers after the first (prevalent) screening round, during the two-year screening interval, was investigated by intention-to-treat (ITT) analysis, and by complier-average causal effect (CACE) analysis to account for noncompliance. The performance of the incident screening rounds was investigated as well. RESULTS In the intervention arm, 4,783 (59%) underwent MRI examination. Cancer detection rate was 16.5/1000 screens [95%CI:13.3-20.5]. For this, 9.5% of women were recalled (6.3% with biopsy). Positive predictive values are 17.4% [95%CI:14.2%-21.2%] (recall) and 26.3% [95%CI:21.7%-31.6%] (biopsy). In the intervention arm, cancers were more frequently stage 0-I than in the control arm (82.8% vs 41.6%, p<0.001). With ITT analysis, the interval cancer rate was 4.98/1000 women in the control arm and 2.48/1000 women in the intervention arm, leading to a reduction of 2.50/1000 women [95%CI:0.98-3.71]; p<0.001. With CACE analysis, this reduction was 4.22/1000 women [95%CI:2.01-6.43]. Preliminary results of the incident screening rounds showed that 3,548 women had again undergone (at least one) mammographic screening with a negative result. Supplemental cancer detection rate was 5.3/1000 screens [95%CI:3.4-7.7]. For this, 2.8% [95%CI:2.4%-3.4%] of women were recalled for further diagnostic work-up. At the meeting, results on cost-effectiveness will be presented as well. CONCLUSION Supplemental MRI screening in women with extremely dense breasts results in statistically significantly fewer interval cancers. In subsequent rounds, both the cancer detection rate and the false-positive rate decrease. CLINICAL RELEVANCE/APPLICATION There is a heated debate on the value of supplemental screening in women with dense breasts. The DENSE trial is the first randomized trial on supplemental MRI screening that has been performed in women with dense breasts.

SPCT10B Disscussant for MRI In Addition to Mammography Screening

Participants
Christopher E. Comstock, MD, New York, NY (*Presenter*) Nothing to Disclose

SPCT10C 18F-FDG PET-MR Enterography in Predicting Histological Active Disease in Ulcerative Colitis: A Randomized Controlled Trial Using Nancy Index

Participants
Yan Li, Essen, Germany (*Presenter*) Nothing to Disclose
Benedikt M. Schaarschmidt, MD, Essen, Germany (*Abstract Co-Author*) Nothing to Disclose

Lale Umutlu, MD, Essen, Germany (*Abstract Co-Author*) Consultant, Bayer AG
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Ole Martin, Duesseldorf, Germany (*Abstract Co-Author*) Nothing to Disclose
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ABSTRACT

PURPOSE To evaluate the diagnostic performance of PET-MR enterography in detecting histological active inflammation in patients with ulcerative colitis and the impact of bowel purgation on diagnostic accuracies of PET-MR parameters. METHOD AND MATERIALS Fifty patients were enrolled in this randomized controlled trial (clinicaltrials.gov [NCT03781284]). 40 patients were randomized in two study arms, in which bowel purgation was performed either before or after PET-MR enterography. All patients underwent ileocolonoscopy with mucosal biopsies after PET-MR within 24h. Diagnostic performance of MR morphological parameters (MRmorph), diffusion-weighted imaging (DWI) and PET in detecting histological inflammation determined by Nancy index was compared with each other and between study arms. Correlation between PET and histological inflammatory severity was calculated. RESULTS In study arm without previous bowel purgation, SUVmax ratio of bowel segment (relative to SUVmax of the liver) facilitated the highest specificity and diagnostic accuracy compared to MRmorph and DWI. Bowel cleansing led to markedly increased metabolic activity of bowel segments, resulting in significantly reduced specificity of PET compared to study arm without purgation (0.808 vs. 0.966, p = 0.007, respectively). Inter-observer concordance for assessing MRmorph was clearly increased after bowel cleansing (Cohen's κ: 0.847 vs. 0.665, p = 0.013, respectively), though diagnostic performance of MRmorph was not significantly improved. Our findings suggested that the change of metabolic status was mainly associated with the grade of neutrophil infiltrate and less dependent on chronic infiltrate. CONCLUSION PET-MR enterography was an excellent non-invasive diagnostic method in the assessment of ulcerative colitis without the need of previous bowel purgation. CLINICAL RELEVANCE/APPLICATION SUVmaxRatio was a reliable parameter facilitating best diagnostic operating characteristics in predicting histological active disease in patients with ulcerative colitis and no previous bowel purgation was needed for PET-MR.

SPCT10D Discussant for 18F-FDG PET-MR Enterography

Participants
Joel G. Fletcher, MD, Rochester, MN (*Presenter*) Grant, Siemens AG; Consultant, Medtronic plc; Consultant, Takeda Pharmaceutical Company Limited; Grant, Takeda Pharmaceutical Company Limited; ;

SPCT10E Clinical and Cost-Effectiveness Implications of Utilizing Immediate Acute Magnetic Resonance Imaging (MRI) in the Management of Patients with Suspected Scaphoid Fracture and Negative Initial Radiographs: Results from a Randomized Clinical Trial

Participants
Tiago Rua, BSC,MSc, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Sanjay Vijayanathan, MBBS, Harrow, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Davina Mak, MBBS, BSC, Middlesex, United Kingdom (*Presenter*) Nothing to Disclose
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James Shearer, PhD, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Vicky J. Goh, MBBCh, Chalfont St Giles, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Paul McCrone, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Sam Gidwani, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose

ABSTRACT

PURPOSE Given the limited accuracy of radiographs on presentation to the Emergency Department (ED), the management of suspected scaphoid fractures remains clinically challenging and an economic burden to healthcare systems. This trial evaluated the clinical and cost-effectiveness implications of using immediate Magnetic Resonance Imaging (MRI) as an add-on test during the ED attendance for patients with negative findings on the initial radiographs. METHOD AND MATERIALS A pragmatic, randomized, single-center trial compared the use of immediate MRI for patients presenting to the ED with suspected scaphoid fractures against standard care with radiographs only. Participants' use of health services was estimated from primary care and secondary care databases and questionnaires at baseline, 3 and 6 months post-recruitment. Costs were compared using generalized linear models and combined with quality-adjusted life years (QALYs) to estimate cost-effectiveness. RESULTS A total of 136 participants were recruited based on 1:1 ratio, block randomization methods (mean age 37 years; 57% male; 79% full-time employed). 6.2% (4/65, control group) and 10% (7/67, intervention group) of participants sustained scaphoid fractures (p=0.37). 7.7% (5/65, control group) and 22% (15/67, intervention group) of participants had other fractures diagnosed (p=0.019). The use of MRI increased the diagnostic accuracy both in the diagnosis of scaphoid fracture (100.0% vs 93.8%) and any other fracture (98.5% vs 84.6%). Mean (SD) cost per participant up to 3 months post-recruitment was £542.4 (£855.2) for the control group and £368.4 (£338.6) for the intervention, leading to a cost difference of £174 (95% CI -£30 to £378, p=0.094). The cost difference per participant at 6 months increased to £266 (95% CI £3.3 to £528, p=0.047). The MRI intervention dominated standard care costing less and achieving more QALY gains, presenting a probability of 96% and 100% of being cost-effective at month 3 and 6 considering traditional willingness-to-pay thresholds. CONCLUSION The use of immediate MRI in the management of participants with suspected scaphoid fracture and negative radiographs led to significant cost-savings whilst improving and expediting the pathway's diagnostic accuracy. CLINICAL RELEVANCE/APPLICATION The immediate use of MRI in the management of suspected scaphoid fractures should be included as part of standard of care as an add-on test for patients with negative radiographs.

SPCT10F Discussant for Clinical and Cost-Effectiveness Implications

Participants
Garry E. Gold, MD, Stanford, CA (*Presenter*) Research support, General Electric Company

SPCT10G Imaging-guided Target Volume Reduction in Radiotherapy of Lung Cancer: The Prospective Randomized Multinational PET-Plan Trial

Participants
Tanja Schimek-Jasch, MD, Freiburg, Germany (*Abstract Co-Author*) Nothing to Disclose
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Stephanie Kremp, DIPLPHYS, Homburg, Germany (*Abstract Co-Author*) Nothing to Disclose
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Andreas Kusters, MD, Krefeld, Germany (*Abstract Co-Author*) Nothing to Disclose
Marco Tosch, MD, Wuppertal, Germany (*Abstract Co-Author*) Nothing to Disclose
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Anca-Ligia Grosu, Freiburg, Germany (*Abstract Co-Author*) Nothing to Disclose

ABSTRACT

PURPOSE Advanced medical imaging offers a chance for target volume reduction in modern radiotherapy, which may lead to more effective local treatments with reduced toxicity and offer the protection of draining lymph nodes and large vessels, possibly of importance for the upcoming combination of radiotherapy and immunotherapy. Locally advanced non-small cell lung cancer (NSCLC) with improvable local control and high toxicity is an excellent model to investigate this topic. METHOD AND MATERIALS In the prospective randomised controlled PET-Plan trial (NCT00697333), patients with inoperable stage II/III NSCLC and an indication for radiochemotherapy were randomized at a 1:1 ratio. In conventional arm A target volumes were informed by FDG-PET and CT plus elective nodal irradiation and in experimental arm B they were solely informed by FDG-PET. In both arms, quality assured isotoxically dose-escalated IMRT or 3D-CRT (60 - 74Gy, 2Gy per fraction) was planned and applied to the respective target volumes along with simultaneous platinum-based chemotherapy. The primary objective was time to locoregional progression (LRP) in terms of non-inferiority of experimental arm B. RESULTS 311 patients were recruited, 205 patients included in the intent to treat (ITT) (A: n=99, B: n=106) and 172 patients in the per protocol (PP) analysis (A: n=84, B: n=88). Median FU time in the PP set was 16 months. Non-inferiority of experimental arm B was confirmed for the pre-specified non-inferiority margin. The risk of LRP was lower in the experimental arm B (2y-LRP 0.20 vs. 0.39; HR=0·57; 95% CI: 0·30-1·06; p=0·039) with no difference between study arms concerning survival (2y-OS 0.57 vs. 0.54), out-field recurrence and toxicity. CONCLUSION In radiochemotherapy for locally advanced NSCLC, PET-Imaging based reduction of radiotherapy target volumes is feasible and may improve local control without increasing toxicity. CLINICAL RELEVANCE/APPLICATION The procedures established in this clinical trial provide a radiotherapy standard for future NSCLC trials including immunotherapy and may furthermore inspire trials on imaging based target volume reduction for other tumor types.

SPCT10H Discussant for Imaging-guided Target Volume Reduction

Participants
Daniel Pryma, MD, Philadelphia, PA (*Presenter*) Research Grant, Siemens AG; Research Grant, 511 Pharma; Research Grant, Progenics Pharmaceuticals, Inc; Research Consultant, Progenics Pharmaceuticals, Inc; Research Consultant, 511 Pharma; Research Consultant, Actinium Pharmaceuticals, Inc; Research Consultant, Nordic Nanovector ASA

SSA16

Nuclear Medicine (Genitourinary Oncology Nuclear Medicine and PET)

Sunday, Dec. 1 10:45AM - 12:15PM Room: S505AB

CT GU NM OI

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 1.75

FDA Discussions may include off-label uses.

Participants
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Sonya Y. Park, MD, Seoul, Korea, Republic Of (*Moderator*) Nothing to Disclose

Sub-Events

SSA16-01 AI Pipeline System for Detection of Bone Metastases on PET-CT

Sunday, Dec. 1 10:45AM - 10:55AM Room: S505AB

Participants
Saori Koshino, MD , Tokyo, Japan (*Presenter*) Nothing to Disclose
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PURPOSE

To develop a machine learning system for the detection of bone metastases from the data of CT based on ground truth generated from 18F-fluorodeoxyglucose (FDG) PET.

METHOD AND MATERIALS

In this study, 198 whole body PET-CT examinations (105 men and 93 women; mean age, 63.8 years ± 12.9 [standard deviation]) with one or more bone metastases were retrospectively evaluated. At first, an automated annotation generation tool for bone metastases was created to extract lesions from PET. A binary bone mask was obtained from CT and multiplied with the rescaled PET volume. This resulted in a PET volume with FDG uptake in bones only. A convolutional neural network (CNN), ResNet-50, was then used to discard high FDG uptake regions which did not correspond to bone metastases, such as brain or bladder. Each candidate of bone metastasis was assigned a unique lesion number before it was converted into slice-wise bounding boxes. Secondly, one of the authors labeled each automatically extracted lesion with osteoblastic metastasis, osteolytic metastasis, intertrabecular metastasis and other. The 198 examinations were split in 173 examinations for training and 25 examinations for validation. A Mask R-CNN model was trained on the training set using labeled bounding boxes as ground truth. Finally, prediction accuracy was measured on the validation set.

RESULTS

In a total of 198 examinations, 1263 lesions were detected with the annotation tool and composed of 364 osteoblastic metastases, 365 osteolytic metastases, 24 intertrabecular metastases, and 510 others such as normal lesions, postoperative lesions, degenerative changes, and inflammation. The sensitivity was 77.8% for osteoblastic metastases, 54.2% for osteolytic metastases, and 100% for penetrating metastases with a false positive per image of 0.701 in the validation datasets.

CONCLUSION

We successfully developed an AI pipeline system to detect bone metastases from the data of CT and FDG-PET. This is the first report on an AI-based automatic annotation system for PET-CT. Some limitations such as the low sensitivity for osteolytic metastases and too many false positives should be improved.

CLINICAL RELEVANCE/APPLICATION

Since the sensitivity for osteoblastic metastases was higher than that in the previous paper on human detection, our AI system can reduce the oversight of radiologists to detect bone metastases on CT.

SSA16-02 Detection of Seminal Vesicle Involvement and Extra-Prostatic Extension of Primary Prostate Cancer by Fluciclovine PET-CT

Sunday, Dec. 1 10:55AM - 11:05AM Room: S505AB

Participants
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Adeboye Osunkoya, MD, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose
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David M. Schuster, MD, Decatur, GA (*Abstract Co-Author*) Institutional Research Grant, Nihon Medi-Physics Co, Ltd; Institutional Research Grant, Blue Earth Diagnostics Ltd; Institutional Research Grant, Advanced Accelerator Applications SA; Institutional Research Grant, Telix Pharmaceuticals Inc; Consultant, Syncona Ltd; Consultant, AIM Specialty Health, Inc; ;

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PURPOSE

To evaluate the diagnostic performance of fluciclovine PET-CT in determining the extent of primary prostate cancer specifically seminal vesicle involvement (SVI) and extra-prostatic extension (EPE).

METHOD AND MATERIALS

51 patients with high risk primary prostate cancer, without conventional imaging findings of systemic metastasis, deemed eligible for potential curative surgery were recruited and underwent fluciclovine PET-CT after obtaining informed consent. Image interpretation was performed by a board-certified nuclear medicine physician blinded to other clinical and imaging data. Abnormal or absent uptake indicating the presence or absence of SVI and EPE was recorded. Histologic findings of SVI and EPE were compared with preoperative imaging results. Measures of diagnostic performance of fluciclovine PET-CT were assessed. Equivocal interpretations were analyzed as negative.

RESULTS

44/51 patients with a mean ± SD PSA of 25.8 ± 31.1 ng/ ml underwent radical prostatectomy and extended lymph node dissection within 11.8 ± 9.9 days of imaging. The remaining 7 were excluded from the final analysis as they were either still awaiting surgery or considered unsuitable for curative surgery. 28/44 and 20/44 patients were interpreted as positive for SVI and ECE respectively on fluciclovine PET-CT. On histology, 20/44 and 36/44 were positive for SVI and ECE respectively. Consequently, sensitivity, specificity and positive predictive value (PPV) of fluciclovine PET-CT for determination of SVI were: 80%, 50% and 57.1% respectively. For assessment of EPE, sensitivity, specificity and PPV of fluciclovine PET-CT were: 50%, 75% and 90% respectively.

CONCLUSION

Fluciclovine PET/CT showed high sensitivity and moderate PPV in the detection of SVI in primary prostate cancer. It also demonstrated high positive predictive value and moderate specificity in the detection of EPE.

CLINICAL RELEVANCE/APPLICATION

Fluciclovine PET/CT may be of use in preoperative determination of tumor extent in primary prostate cancer and consequently choice of therapy. Further studies with PET/MR with better anatomic definition may therefore be beneficial.

SSA16-03 Combined Hybrid Axumin (18F- Fluciclovine) PET/MRI Interpretation Compared to the Individual Interpretation of Axumin PET and Dedicated Prostate MRI in Evaluating for Prostate Cancer Local Recurrence

Sunday, Dec. 1 11:05AM - 11:15AM Room: S505AB

Participants
Sonam Jaglan, New York, NY (*Presenter*) Nothing to Disclose
Angela Tong, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
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PURPOSE

To determine if evaluation for prostate cancer local recurrence with a combined reading of hybrid Axumin PET/MRI leads to more confident interpretation with fewer indeterminate results when compared to separate reading of Axumin PET and multiparametric prostate MRI (mpMRI).

METHOD AND MATERIALS

This is a retrospective study of 60 patients with biopsy-proven prostate cancer who have had definitive therapy with concern for recurrence, who underwent a hybrid Axumin PET/MRI. PET and MRI images were reviewed separately by a nuclear medicine and an abdominal imaging specialist, respectively, each blinded to the other. Lesions were assigned a likelihood of local recurrence score. Axumin PET/MRI images were then jointly interpreted and a consensus likelihood of local recurrence score was assigned. The scores were based on qualitative 5-point scales outlined by each reader prior to the study. Scores were compared between individual PET or MRI and combined PET/MRI interpretations using Chi-Square and linear-by-linear association tests.

RESULTS

We evaluated 60 Axumin PET-MRI exams with a total of 68 lesions. 39 (65%) patients had radical prostatectomy while 21 (35%)

had local therapy only. The average patient age was 69 years old (range 45-85). There is a significant difference in the interpretation scores between individual mpMRI and combined Axumin PET/MRI interpretation (p=0.006). Of the 24 lesions with scores of 2-4 on MRI, 9 (38%) lesions were downgraded to a score of 1 and 10 (42%) lesions were upgraded to a score of 5 on combined interpretation. There is a trend toward a significant difference between individual PET and combined PET/MRI, with a linear-by-linear association of 1.1 (p = 0.139). Of the 17 lesions assigned scores of 2-4 on PET, 5 (29%) lesions were upgraded to a score of 5 and 4 out of 43 lesions (9%) with a PET score of 1 were upgraded to a score of 5 on combined interpretation.

CONCLUSION

The combined interpretation of Axumin PET/MRI showed significantly more confidence in assessing for locally recurrent prostate cancer over interpretation of MRI alone and a trend toward significance in confidence over interpretation of PET alone.

CLINICAL RELEVANCE/APPLICATION

Combined reading of Axumin PET/MRI increases confidence in local recurrence detection, facilitating management in prostate cancer patients with clinical concern for recurrent disease after treatment.

SSA16-04 Tumor Foci Size but Not Lymph Node Size Affects 18F-fluciclovine PET/CT Detection of Metastatic Lymph Nodes in Primary Prostate Cancer

Sunday, Dec. 1 11:15AM - 11:25AM Room: S505AB

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PURPOSE

To determine the effect of sizes of lymph node (LN) and metastatic foci (MF) on the diagnostic performance of preoperative fluciclovine PET/CT for identifying LN metastasis (LNM) in patients with primary prostate cancer.

METHOD AND MATERIALS

51 patients with intermediate to high-risk prostate cancer underwent fluciclovine PET/CT (Dose: 366.3±22.2 MBq) prior to radical robotic prostatectomy (RP) with extended pelvic lymph node dissection (EPLND). LNs were excised according to 12 predefined templates and correlated to PET findings. Metastatic LNs and MF in LNs were measured bidimensionally by a board certified urologic pathologist. Sizes of metastatic LNs and MF in templates with positive and negative PET findings were compared using t-test. For every LN packet (LNP), the greatest long axis diameter of LN and MF were utilized as the most conservative surrogate for the LNP.

RESULTS

EPLND was performed in 45/51 patients with median PSA 18.0 ng/ml (range 0.58-147.03 ng/ml) and Gleason score (Grade group) 8 (4) within 7 days (range 1-41 days) after fluciclovine PET. Of these, 24/45 (53.3%) patients had histologically confirmed LNM. 508 LNPs (mean 11 packets per patient) were analyzed. LNM were detected in 82/508 (16.1%) LNPs on histology. Fluciclovine PET detected LNM in 36/82 (43.9%) LNPs (true positives) while 46/82 (56.1%) LNPs were either benign or not seen (false negatives) on fluciclovine PET. Of the remaining 426/508 LNPs, 3/426 (0.7%) were read as equivocal on PET but were benign on histology (false positives). There was no significant difference in the mean long axis diameters of true positives (15.1 mm [range 3.0-40.0 mm]) and false negatives (13.1 mm [range 3.0-52.0 mm]; p=0.13) LNPs. In contrast, the mean long axis diameters of MF within true positive LNPs (11.4 mm [range 1.0-40.0 mm]) were significantly higher than false negative LNPs (3.9 mm [range 0.4-14.0 mm]; p<0.01). 13/52 (25.0%) LNPs with MF <=7 mm were detected on fluciclovine PET while 23/30 (76.7%) LNPs with MF >7 mm were detected on fluciclovine PET.

CONCLUSION

Fluciclovine PET detection rate of LNM was influenced by the size of metastatic foci but not lymph node size. Metastatic foci >7 mm were more likely to be detected on fluciclovine PET than MF <=7 mm.

CLINICAL RELEVANCE/APPLICATION

The ability of preoperative fluciclovine PET/CT to detect lymph node metastasis in patients with primary prostate cancer is influenced by the size of the metastatic focus within the lymph node.

SSA16-05 Difference in the Spectrum of Metastatic Disease on 68Ga PSMA PET/CT after Radical Prostatectomy and after Radical Radiotherapy in Patients of Carcinoma Prostate with Biochemical Recurrence

Sunday, Dec. 1 11:25AM - 11:35AM Room: S505AB

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PURPOSE

To determine the pattern of metastatic disease with 68Ga PSMA PET/CT in patients with biochemical recurrence after definitive treatment

METHOD AND MATERIALS

A retrospective analysis of subjects with carcinoma prostate, who had undergone definitive treatment (Radical prostatectomy or Radiotherapy) and presented with biochemical recurrence, was done by 68Ga PSMA PET/CT. The data collected was analysed to establish temporal occurrence and patterns of regional and distant metastatic disease in both the groups and correlated with serum PSA levels.

RESULTS

The study included 200 subjects with history of adenocarcinoma prostate. In the post radical prostatectomy group (n=144), median serum PSA was 1.8 ng/ml, the overall metastatic detection rate was 39.3% for PSA 0.2 to < 0.5 ng/ml, 47.3% for PSA 0.5 to < 1 ng/ml, 68.4% for PSA 1 to < 2 ng/ml and 93.1% for PSA >=2 ng/ml. In this group local recurrence was identified in 28.73 % and lymph nodal metastases in 65.1%, with the pelvic lymph nodal metastases being the most common site of metastasis followed by bone metastases. The mean time for serum PSA recurrence in the radical prostatectomy group was 49.77±44.44 months (range 2-184 months). In the post radiotherapy group, median serum PSA was 5.2 ng/ml, the detection rate was 88.8 % for PSA 2 to < 4 ng/ml and 100 % for PSA >= 4 ng/ ml. Local recurrence after radiotherapy was present in 79.5 % of the group and 63.6 % had lymph nodal metastases. The mean time for serum PSA recurrence following radiotherapy was 49.15± 24.32 months, (range 12-111 months).

CONCLUSION

Radical prostatectomy and Radical radiotherapy are the two standard treatment options for localized carcinoma prostate. Although the extent and patterns of recurrence differed in the two groups, the temporal occurrence of metastatic disease remained comparable.

CLINICAL RELEVANCE/APPLICATION

68Ga-PSMA has been suggested as a novel tracer for detection of prostate cancer relapse and metastases with high specificity and sensitivity.

SSA16-06 Correlation of Findings on 18F-Fluciclovine PET/CT with Failure-Free Survival of Salvage Radiotherapy in Post-Prostatectomy Patients with Biochemical Recurrence

Sunday, Dec. 1 11:35AM - 11:45AM Room: S505AB

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PURPOSE

To examine the impact of fluciclovine PET on failure-free survival (FFS) of radiotherapy (RT) ± androgen deprivation therapy (ADT) in recurrent prostate cancer patients post-prostatectomy.

METHOD AND MATERIALS

69 post-prostatectomy patients with biochemical recurrence in the experimental arm of a randomized controlled study (NCT01666808/NIH R01CA169188) underwent fluciclovine PET prior to RT±ADT. RT was based on PET and clinical findings: no

uptake/prostate bed only uptake - RT to prostate bed only, pelvic nodal uptake - RT to prostate bed+pelvis, extrapelvic nodal uptake - no RT. RT (median 66.6 Gy in 1.8 Gy fractions) was initiated 17±10 days after PET scan. 21 patients received RT+short course ADT. 8 patients at 12 months and 3 additional patients at 18 months post-RT were censored due to lack of follow-up. Treatment failure was defined as either serum prostate-specific antigen (PSA) >=0.2 ng/ml+post-RT nadir followed by another higher value, a continued rise in the serum PSA despite RT, initiation of systemic therapy after completion of RT, or clinical progression. FFS based on fluciclovine PET findings were compared using Fisher's exact test.

RESULTS

53/69 (76.8%) patients had positive fluciclovine PET findings. 4/69 patients were ineligible for RT due to systemic disease, hence, FFS was assessed in 65 patients (median PSA 0.32 [range 0.02-9.79] ng/ml). FFS at 6, 12 and 18 months was 63/65 (96.9%), 52/57 (91.2%), and 43/54 (79.6%), respectively. In patients with no uptake, FFS was 16/16 (100%), 15/15 (100%), 12/13 (92.3%) at 6, 12, and 18 months, respectively. In patients with uptake in the prostate bed only, FFS was 27/27 (100%), 21/22 (95.5%), 18/21 (85.7%) at 6, 12, and 18 months, respectively. In patients with pelvic±prostate bed uptake, FFS was 20/22 (90.9%), 16/20 (80.0%), 13/20 (65.0%) at 6, 12, and 18 months, respectively. FFS trends did not reach statistical significance at any timepoint.

CONCLUSION

Findings on fluciclovine PET/CT correlate with failure-free survival, potentially reflecting metabolic tumor burden and may have prognostic value. Longer follow-up duration and comparison to a control group not undergoing PET, are required to fully evaluate the value of fluciclovine PET based radiotherapy.

CLINICAL RELEVANCE/APPLICATION

Findings on fluciclovine PET/CT correlate with failure-free survival of salvage radiotherapy and may have prognostic value in post-prostatectomy patients with biochemical recurrence.

SSA16-08 Significant Interval Decrease in Bone Mineral Density in Osteopenic Patients: A Notable Limitation of FRAX Analysis in Dual-energy X-ray Absorptiometry

Sunday, Dec. 1 11:55AM - 12:05PM Room: S505AB

Participants
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PURPOSE

Bone mineral density (BMD) evaluation, considered to be the standard measure for the diagnosis of osteoporosis and fracture risk assessment, is most commonly measured by dual-energy x-ray absorptiometry (DXA). For patients diagnosed with osteopenia, the Fracture Risk Assessment Tool (FRAX) was developed, which incorporates clinical factors to aid the clinician in patient management. If the FRAX score in an osteopenic patient predicts a 10-year fracture risk of 20% or greater for a major osteoporotic fracture or 3% or greater for a hip fracture, therapy is warranted. However, any significant decline in BMD when compared to a prior DXA is not reflected in the FRAX analysis. Our goal was to determine the frequency with which there is a significant decline in BMD in patients diagnosed with osteopenia by DXA, but whose FRAX score predicts a fracture risk of less than 20% for a major osteoporotic fracture or less than 3% for a hip fracture.

METHOD AND MATERIALS

Over a period of 12 months, the number of patients diagnosed with osteopenia by DXA were counted, who (1) had a significant decrease in BMD when compared to a prior DXA and (2) the FRAX scores were both less than 20% for a major osteoporotic fracture and less than 3% for a hip fracture.

RESULTS

A total of 278 patients with osteopenia by DXA had a significant decrease in spine and/or hip BMD when compared to a previous DXA, yet the FRAX scores were both less than 20% for a major osteoporotic fracture and less than 3% for a hip fracture.

CONCLUSION

Fracture risk assessed by FRAX analysis is often underestimated in osteopenic patients whose BMD has significantly declined from a prior DXA. Therefore, in this clinical setting, a low FRAX score should not influence the therapeutic decision.

CLINICAL RELEVANCE/APPLICATION

The following sentence should be added to the DXA scan report in the above clinical scenario: "It should be noted that a significant decrease in BMD from a prior DXA is not reflected in FRAX analysis."

SSA16-09 Effect of Tumor Histology on Detection of Pelvic and Para-Aortic Nodal Metastasis with FDG-PET in Stage IB Cervical Cancer

Sunday, Dec. 1 12:05PM - 12:15PM Room: S505AB

Participants
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PURPOSE

To determine if the detection of FDG-avid pelvic and para-aortic lymph nodes in early stage cervical cancer patients is dependent on tumor histology.

METHOD AND MATERIALS

Patients with IB1-2 cervical cancer who underwent pre-surgical FDG-PET between 1997-2018 were identified in a tertiary academic center database. All patients had radical hysterectomy with pelvic and para-aortic lymph node dissection. The detection of pelvic and para-aortic lymph nodes by FDG-PET vs. surgical dissection was compared. FDG-PET sensitivity, specificity, positive predictive value (PPV) and negative predictive value (NPV) were determined and stratified by tumor histology. Freedom from relapse (FFR) was analyzed with Kaplan-Meier analysis and Cox proportional hazards models.

RESULTS

We identified 212 patients with early-stage cervical cancer (84% FIGO IB1, 16% IB2) who underwent pre-surgical FDG-PET; 137(65%) had squamous carcinoma and 75(35%) had adenocarcinoma. PET/CT was performed in 189(89%) patients and 23(11%) had PET only. Surgical dissection revealed positive pelvic and para-aortic lymph nodes in 25% and 3.3% of patients, respectively. For squamous carcinoma, the sensitivity, specificity, PPV and NPV of FDG-PET for pelvic nodal metastasis were 44%, 99%, 95% and 78%, respectively. For adenocarcinoma, the corresponding results for pelvic nodal metastasis were 25%, 99%, 67% and 92%, respectively. The overall sensitivity, specificity, PPV and NPV of FDG-PET for para-aortic nodal metastasis was 29%, 99%, 67%, and 98%, respectively. With a median follow up of 9.3 years, the 5-year FFR for squamous carcinoma and adenocarcinoma was 83% vs. 96% (p=0.008), respectively.

CONCLUSION

Pelvic nodal metastasis was less likely to be detected by FDG-PET in patients with early-stage adenocarcinoma than with squamous carcinoma. Patients with adenocarcinoma had a better prognosis than those with squamous carcinoma.

CLINICAL RELEVANCE/APPLICATION

FDG-PET was half as sensitive for detecting pelvic lymph nodes in adenocarcinoma vs. squamous carcinoma.

Printed on: 10/29/20

NMS-SUA

Nuclear Medicine Sunday Poster Discussions

Sunday, Dec. 1 12:30PM - 1:00PM Room: NM Community, Learning Center

NM OI

AMA PRA Category 1 Credit ™: .50

Participants
Amir H. Khandani, MD, Chapel Hill, NC (*Moderator*) Nothing to Disclose

Sub-Events

NM201-SD-SUA2 Clinical Follow-Up after Imaging and Dosimetry for Yttrium-90 (90Y) Liver Radioembolization Using a SiPM-Based PET/CT Scanner

Station #2

Participants
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PURPOSE

To evaluate the response rate and survival of patients treated with Yttrium-90 (90Y) radioembolization following personalized dosimetry and high-quality imaging using SiPM-based PET/CT.

METHOD AND MATERIALS

Thirty patients (19 males, 11 females; 47 - 88 years old) with hepatic malignancies were prospectively enrolled. According to their tumor, they were treated with resin or glass microspheres. Pre-therapy 99mTc MAA SPECT/CT and post-therapy 90Y PET/CT images were analyzed. Tumor and normal liver dose was calculated using SurePlan (MIM) software. 90Y PET/CT scans were obtained in a single bed position for 20 minutes using a SiPM-based PET/CT scanner and reconstructed as 10- and 15-min datasets. Image quality was evaluated using the 5-point Likert scale.

RESULTS

The mean administered activity was 2.3 GBq 90Y microspheres. Mean tumor dose estimated from 99mTc MAA SPECT/CT was 99.13 Gy vs. 111.53 Gy from 90Y PET/CT. For normal liver, a mean dose of 28.41 Gy was estimated from 99mTc MAA SPECT/CT and 21.04 Gy from 90Y PET/CT. 99mTc MAA SPECT/CT yielded great accuracy as there was no significant divergent tumor or normal liver dose between 99mTc MAA SPECT/CT and 90Y PET/CT (p=0.667 vs. 0.134). Image quality for 90Y PET/CT was similar at 10 min and 15 min scan time (Likert-scale 4.4 ± 0.6 vs. 4.6 ± 0.5).Our preliminary data show 12 (66.7%) patients had partial response, 1 (5.5 %) stable disease and 5 (27.8%) had progressive disease at 3 months follow up. Five patients passed away after a mean of 5 months. Median survival was 11.5 months.In a sub-analysis, patients treated with resin microspheres vs. glass microspheres had a mean survival of 12.6 vs. 10.3 months, respectively.

CONCLUSION

Our preliminary data show a high response rate and median survival of 11.5 months in this cohort. The administered activity may be adjusted to yield the desired 120 Gy in the tumor based on the estimated tumor dose from 99mTc MAA SPECT/CT. The SiPM-based PET/CT scanner showed excellent image quality even at a reduced scan time of 10 min, acquired with only one bed position. That may allow for inclusion of 90Y PET/CT in routine clinical workflow. However, more patients have to be evaluated to confirm these findings.

CLINICAL RELEVANCE/APPLICATION

Pre- and post-treatment imaging allow for a more accurate estimation of tumor and normal liver dose and are essential for personalized dosimetry.

NM202-SD-SUA3 Spectrum of Autoimmune Limbic Encephalitis on FDG PET/CT

Station #3

Participants
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PURPOSE

To evaluate the role of FDG PET CT in the diagnosis, treatment response evaluation and follow up of patients with suspected autoimmune limbic encephalitis and correlation with specific antibody sub-type.

METHOD AND MATERIALS

A retrospective analysis of 27 patients of clinically suspected and serologically proven cases of autoimmune encephalitis, who underwent FDG PET CT, was done. Whole body FDG PET CT scans were done in all the patients with separate special brain sequence. The patterns of FDG uptake in different antibody subtypes were recorded and comparison with normalized data was attempted. The areas of hypo/hypermetabolism that were two standard deviations from the mean were considered as abnormal. The patients were also analyzed based on the Z score surface maps of the 3D stereotactic surface projections (SSP) image and regional Z scores were evaluated. Post treatment follow-up scans were also acquired and analyzed.

RESULTS

Focal areas of hypermetabolism involving medial temporal regions, basal ganglia and thalami with relative global hypometabolism in rest of the cortical and subcortical structures was seen, both on visual inspection and on semiquantitative analysis. Serologically, 17 patients had antibodies against Voltage gated potassium channel (VGKC) complex /LGI1 receptors, 2 had antibodies against CRMP-5 (Anti-CV-2) and 1 had had antibodies against PCA-1/Anti-Yo receptor. We could not isolate the antibody in 7 patients. Suspicious mitotic lesions were identified in 10 patients on the whole body scan, which later were biopsied and characterized. No scan evidence of mitotic pathology was identified in 17 patients, thus were labeled as non-paraneoplastic.Depending on the temporal phase of the disease, focal hypermetabolism was found to be a feature of acute phase, whereas hypometabolic areas were seen in sub-acute and chronic phases of the disease. On follow-up, the post-treatment FDG PET CT scans obtained in some of these patients showed reversal to normal metabolism in the corresponding areas.

CONCLUSION

FDG PET/CT may have an important role both in the identification of Autoimmune encephalitis and in the detection of the unknown malignancy that might have caused it.

CLINICAL RELEVANCE/APPLICATION

FDG PET CT scan is a non-invasive diagnostic modality in the early diagnosis and management of patients with clinical suspicion of autoimmune encephalitis

NM234-SD-SUA4 Biochemical Recurrence with Low Values of PSA in Prostate Carcinoma after Radical Therapy: Sensibility of 68Ga-PSMA PET/CT

Station #4

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PURPOSE

The purpose of this study was to study the sensibility of 68Ga-PSMA PET/CT in patients with prostate cancer with biochemical recurrence with low values of PSA after radical therapy.

METHOD AND MATERIALS

A retrospective, cross-sectional and descriptive study was carried out with the aim of evaluate the sensibility of 68Ga-PSMA in patients with prostate cancer with biochemical recurrence following primary curative treatment. 53 patients with biochemical recurrence were scanned using 68Ga-PSMA during the period of October 2015 to February 2019. We selected 26 patients who had low values of PSA (<2.5ng/ml).

RESULTS

The mean age of the study population was 66 years (range 49-85) with a mean prostate-specific antigen (PSA) level of 1.06 ng/ml (range 0.09-2.23). SUVmax mean found was 12.03 (range 1.9-100). 20 patients (76%) were treated with radical prostatectomy, and 6 (23%) with radiotherapy. 20 scans were positive, 6 were negative with 68Ga-PSMA PET/CT. The disease sites at the moment of the study was locoregional in 17(65%), and distant metastasis 9 (34%),13(50%) had abnormal uptake in prostatic bed. The Sensibility in group one:0.01-0.5 (71%), group two: 0.5-1 (80%), group three:1.01-1.5 (75%), group four: 1.6-2.5(83%). 68Ga-PSMA PET/CT has a high sensibility with levels of PSA as low as <0.5ng/ml, and the sensibility increases with higher levels of PSA.

CONCLUSION

68Ga-PSMA PET/CT have a high sensitivity in patients with biochemical recurrence with values of PSA as low as <0.5ng/ml, to locate disease sites in prostate cancer.

CLINICAL RELEVANCE/APPLICATION

68GA-PSMA PET/CT can demonstrate sites of disease in patients with biochemical recurrence with low values of PSA therefore is recommended as part of the study workup in this patient's population.

NM121-ED-SUA5 Evaluation of Extrahepatic Shunting with 99mTc-MAA Hepatic Perfusion Before 90Y Radioembolization of HCC: A Concise Review

Station #5

Participants
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TEACHING POINTS

The aim of this work is to stress on the following: Evaluation of shunting before HCC radioembolization is imperative to enhance local treatment efficacy and to avoid its systemic toxicity. 99mTc-MAA particles imaging with SPECT-CT has a better sensitivity than planar imaging in detecting extrahepatic shunting. Portal hypertension and tumor-induced angiogenesis are the main mechanisms of extrahepatic shunting. Lungs are the commonest organs to show extrahepatic shunting. Other potential organs are bowel, gallbladder, veins, spleen, and lymph nodes. Elevated lung shunt fraction may be a sensitive prognostic indicator for local and metastatic HCC progression.

TABLE OF CONTENTS/OUTLINE

Significance of pre-radioembolization shunt mapping using 99mTc-MAA hepatic perfusion in HCC patients. Suggested mechanisms of 99mTc-MAA shunting. Role of SPECT-CT vs planar imaging in detecting extrahepatic shunting. Quantitative vs qualitative measurement of extrahepatic shunting using SPECT-CT. Prognostic values of elevated lung shunt fraction in local and metastatic HCC progression. Example cases of extrahepatic shunting to lungs, spleen, bowel, gallbladder, veins, and lymph nodes.

NM122-ED-SUA6 Targeted Imaging of Gastro-Entero-Pancreatic Neuroendocrine Tumors with 68Ga-DOTATATE PET/CT and Simultaneous 68Ga-DOTATATE Gadoxetate PET/MRI

Station #6

Participants
Ishan Garg, MBBS, Rochester, MN (*Presenter*) Nothing to Disclose
Chetan Saini, MBBS, Jaipur, India (*Abstract Co-Author*) Nothing to Disclose
Ananya Panda, MD,MBBS, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Geoffrey B. Johnson, MD,PhD, Rochester, MN (*Abstract Co-Author*) Research Grant, General Electric Company Research Grant, Pfizer Inc
Sudhakar K. Venkatesh, MD, FRCR, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Mark Truty, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Thorvardur Halfdanarson, Rochester, MN (*Abstract Co-Author*) Research Consultant, Curium; Research Consultant, Lexicon Pharmaceuticals, Inc; Research Consultant, Advanced Accelerator Applications SA; Research Grant, Ipsen SA; Research Grant, Thermo Fisher Scientific Inc
Ajit H. Goenka, MD, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

1. Review the concepts of somatostatin receptor imaging (SSRI) in gastro-entero-pancreatic (GEP) neuroendocrine tumors (NETs) with somatostatin analog 68Ga-DOTATATE 2. Compare utility of 68Ga-DOTATATE PET with 111In-pentetreotide (Octreoscan) and anatomic imaging (CT/MRI) 3. Highlight the complementary utility of 18F-FDG PET/CT for GEP NETs 4. Review pitfalls in 68Ga-DOTATATE PET imaging of GEP NETs 5. Review technical concepts underlying PET/MRI & highlight potential utility of simultaneous 68Ga- DOTATATE Gadoxetate PET/MRI in GEP NETs

TABLE OF CONTENTS/OUTLINE

1) Conceptual overview of Somatostatin Receptor Imaging (SSRI) with 68Ga DOTATATE 2) Image-based review of indications of 68Ga DOTATATE PET in GEP NETs such as o Diagnosis and Initial Staging o Detection of Recurrent Disease o Identification of unknown primary site o Theranostic applications in the context of peptide receptor radionuclide therapy (PPRT) 3) Combination of 68Ga-DOTATATE PET & 18F-FDG PET for characterizing the known intra-tumoral and intra-patient heterogeneity in GEP NETs 4) Physiologic and pathologic entities that can simulate GEP NETs on 68Ga DOTATATE PET 5) Technical concepts underlying PET/MRI: A Disruptive Imaging Modality 6) Rationale for simultaneous 68Ga- DOTATATE Gadoxetate PET/MRI in GEP NETs, imaging protocol considerations & case examples

NM123-ED-SUA7 Reassessing the Patterns of Response to Immunotherapy with PET Imaging: From Morphology to Metabolism

Station #7

Awards
Cum Laude
Identified for RadioGraphics

Participants
Larissa B. Costa, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose
Marcelo A. Queiroz, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Rafael F. Nunes, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose

Elaine C. Zaniboni, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Jose F. Marin, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Felipe d. Barbosa, MD, Sao Paulo , Brazil (*Abstract Co-Author*) Nothing to Disclose
Carlos A. Buchpiguel, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose

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TEACHING POINTS

1. Discuss the role of metabolic tumor assessment with 18F-FDG PET and review the status of the currently available response assessment criteria - anatomic and functional. 2. Recognize the standard patterns of response to immunotherapy (notably to immune checkpoint) and be aware of the unusual patterns, such as pseudoprogression and hyperprogression.3. Remember the major organs affected by side effects to immunotherapy and distinguish from metastatic disease or treatment failure.

TABLE OF CONTENTS/OUTLINE

1. 1. Why PET/CT for imaging evaluation of immunotherapy?2. 2. Therapy response assessment * A. The biology behind the therapeutic effect of immunotherapy * B. Overview of available immune chekpoint drugs with their mechanism of action * C. Review of the immunotherapy-adapted criteria of response assessment * I. iRECIST * II. irRECIST * III. PECRIT * IV. PERCIMT * D. Standard patterns of response * I. Complete response, partial response, stable disease and progressive disease * E. Unusual patterns of response * I. PseudoPD * II. HyperPD * 3. Immune-related adverse events * A. An organ-guided approach * I. Central nervous system (CNS) * II. Endocrine * III. Thorax * IV. Abdomen * V. MSK

Printed on: 10/29/20

NMS-SUB

Nuclear Medicine Sunday Poster Discussions

Sunday, Dec. 1 1:00PM - 1:30PM Room: NM Community, Learning Center

NM

AMA PRA Category 1 Credit ™: .50

FDA Discussions may include off-label uses.

Participants
Amir H. Khandani, MD, Chapel Hill, NC (*Moderator*) Nothing to Disclose

Sub-Events

NM203-SD-SUB1 The Utility of Positive 18F-FDG PET/CTs in Affecting Clinical Infectious Disease Management

Station #1

Participants
Anitha Menon, BS, Ann Arbor, MI (*Presenter*) Nothing to Disclose
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Daniel J. Wale, DO, Ann Arbor, MI (*Abstract Co-Author*) Nothing to Disclose
Michael Connolly, MD, Ann Arbor, MI (*Abstract Co-Author*) Nothing to Disclose
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PURPOSE

18F-FDG PET/CT is a promising technique for localizing foci of infection. However, few studies to date have determined how often PET scans performed for infection lead to clinical management changes.

METHOD AND MATERIALS

We identified all 18F-FDG PET/CT scans conducted on adult patients at Michigan Medicine from January 2016 to January 2018 for a comprehensive list of infectious indications (n=263). Scans that were read as positive for infection (n=162) were identified through systematic review of radiology reports. Four independent reviewers assessed whether the scans changed clinical management (work-up and/or therapy) through review of patient charts including all clinical notes and radiology reports. Unclear cases were resolved by the consensus between the first and last authors.

RESULTS

Of the 162 positive 18F-FDG PET/CT scans, 42 (25.9%) changed clinical management. Among the six most common primary indications, 18F-FDG PET/CT changed management in the following: 13/32 (40.6%) cases of 'Endocarditis/Cardiac Device Infection'; 3/8 (37.5%) cases of 'Graft Infection'; 4/12 (33.3%) cases of 'Non-Spinal Osteomyelitis'; 6/18 (33.3%) cases of 'Occult Infection'; 8/41 (19.5%) cases of 'Sepsis/Bacteremia'; and 4/27(14.8%) cases of 'Fever of Unknown Origin (FUO)'. The most common changes in clinical management were a change in antibiotic choice or course (25/42, 59.5%) and surgery (8/42, 19%).

CONCLUSION

In this study, positive 18F-FDG PET/CT scans had varying utility in altering clinical management based on the primary indication for which the scan was ordered. Scans done for endocarditis, cardiac device infections, graft infection, and identification of occult infection were most likely to change clinical management. While a significant proportion of scans done for osteomyelitis appeared to change management, most of these patients had perceived contraindications to MR (i.e. CIED, hardware), which is the preferred diagnostic test in this case. These results also suggest that, in the setting of sepsis, bacteremia, and FUO, positive 18F-FDG PET/CT scans are unlikely to change clinical management.

CLINICAL RELEVANCE/APPLICATION

18F-FDG PET/CT is most likely to lead to clinical management changes in cases of endocarditis, cardiac device infections, and graft infections and should be recommended for these specific indications when the initial work-up is indeterminate. More studies should investigate its utility in other infections.

NM204-SD-SUB2 18F-FDG PET/MRI of Patients with Chronic Pain Alters Management

Station #2

Participants
Peter Cipriano, BA, Stanford, CA (*Presenter*) Nothing to Disclose
Daehyun Yoon, PhD, Stanford , CA (*Abstract Co-Author*) Research support, General Electric Company
Ian Carroll, Redwood City, CA (*Abstract Co-Author*) Nothing to Disclose
Catherine Curtin, Stanford, CA (*Abstract Co-Author*) Nothing to Disclose
Vivianne Tawfik, MD, PhD, Stanford, CA (*Abstract Co-Author*) Nothing to Disclose
Yingding Xu, MD, Stanford, CA (*Abstract Co-Author*) Nothing to Disclose
Sandip Biswal, MD, Stanford, CA (*Abstract Co-Author*) Research Grant, General Electric Company

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PURPOSE

The goal of this work is to develop a clinical [18F]FDG PET/MRI method to accurately localize sites of increased inflammation related to sources of pain. The aims are to 1) determine whether imaging findings correlate with location of pain, and to 2) determine whether the imaging results affect management decisions.

METHOD AND MATERIALS

Patients with chronic pain were referred from pain physician specialists. 64 chronic pain patients have thus far been imaged with a GE SIGNA PET/MRI (time-of-flight PET; 3.0T bore; 4-8 min/bed position) from the head through the feet. Patients underwent imaging one hour after a 10mCi injection of [18F]FDG. MRI sequences included coronal DESS, coronal PSIF (isotropic), axial LAVA FLEX (with water/fat separation) and axial T2W FSE with fat-saturation. Two radiologists evaluated images (one blinded and the other unblinded to patient history). Maximum standardized uptake values (SUVmax) and target-to-background were measured using image analysis software (OsiriX v.8.0 64-bit). The radiologist unblinded to the patient exam and history determined if increased [18F]FDG uptake occurred in the site of symptoms and in other areas. Imaging results were discussed with the referring physician, who determined whether a change in management would follow.

RESULTS

Focal increased uptake of [18F]FDG in affected nerves and muscle (approx 2-4 times over background tissue) were identified in 57 of 64 patients at the site of pain and other areas of the body (SUVmax of lesions from 0.9 to 4.2 vs. SUVmax of background from 0.2 to 1.2). Modification suggested in the management plan based on imaging findings: 13/64 no change, 15/64 mild modification (e.g. diagnostic test) and 36/64 significant modification (e.g. new invasive procedure suggested). For example, PET/MR imaging helped to direct release of a fibrotic plantaris muscle that was causing foot pain and placement of blood patches to treat CSF leaks. New management plans have been implemented in 40 of 64 patients (63%).

CONCLUSION

[18F]FDG PET/MRI had lead to new management plans that had not been anticipated by the referring physician. Further following up with a large cohort of patients should be conducted to establish the effectiveness of [18F]FDG PET/MRI to guide interventions for relieving pain.

CLINICAL RELEVANCE/APPLICATION

Our data suggest that [18F]FDG PET/MRI can identify hypermetabolic or inflammatory abnormalities in patients suffering from neuropathic pain.

NM205-SD-SUB3 Clinical Impact of FDG PET-CT in the Management of Cancer Patients: Experience in 9000 Cases

Station #3

Participants
Antonio Maldonado, MD, Pozuelo de Alarcon, Spain (*Presenter*) Nothing to Disclose
Vicente Martinez de Vega, MD, Madrid , Spain (*Abstract Co-Author*) Nothing to Disclose
Manuel Recio Rodriguez, Majadahonda, Spain (*Abstract Co-Author*) Nothing to Disclose
Javier Carrascoso, Madrid, Spain (*Abstract Co-Author*) Nothing to Disclose
Mar Jimenez, Madrid, Spain (*Abstract Co-Author*) Nothing to Disclose
Raquel Cano, Madrid, Spain (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

The aim of this study was to establish the impact of whole body FDG PET-CT on global diagnostic and therapeutic management of cancer patients

METHOD AND MATERIALS

We retrospectively reviewed the clinical records from 7700 consecutive patients studied by PET-CT (5048 men and 3952 women; mean age 60.2 y). PET-CT studies were performed after injection of 10 mCi of FDG. For CT portion, oral and intravenous contrast were administered. All patients had their diagnosis of malignant neoplasm histologically confirmed. The primary sites were: lung (23.5%), lymphoma (17.5%), breast (14.7%) colorectal (9.4%), head and neck (5.3%), melanoma (2.6%) and others type of tumors (27%). PET-CT indications were: initial staging (23.2%), diagnosis (5.3%), restaging (40.9%), post-treatment changes vs recurrence (0.7%), suspected recurrence based on rising tumor marker levels (2.5%) and treatment response evaluation (27.3%). Changes in diagnostic and therapeutic management were evaluated based on information from PET-CT studies

RESULTS

Global patient management was modified by PET-CT results in 53% of the patients. Diagnostic management was modified by PET-CT in 63% of the patients. In 30% of cases a biopsy was avoided; in 15% was generated a new biopsy; imaging studies were avoided in 9%. Changes in the diagnostic process were more frequent when PET-CT indication was restaging (95%) or residual mass evaluation (87,5%). Therapeutic management was modified by PET results in 34% of cases. The most frequent type of treatment change was to administer chemotherapy (18%); in 16% patients surgical procedures were avoided; in 26% of cases PET-CT results supported previous treatment decision. Impact on treatment plans were more frequent when PET-CT indication were initial staging or residual mass evaluation

CONCLUSION

This retrospective study demonstrates that PET-CT shows an important impact in the diagnostic and therapeutic management of cancer patients and supports its introduction as a routine diagnostic tool in Oncology

CLINICAL RELEVANCE/APPLICATION

FDG PET-CT is an important tool in the management of cancer patients. Treatmente must be changed frecuently according to molecular imaging information

NM235-SD-SUB4 Whole Prostate Total Lesion Activity on 18F-Fluciclovine PET/CT and Prostate-Specific Antigen Level are Associated with the Presence of Metastasis at Primary Staging

Station #4

Participants
Olayinka A. Abiodun-Ojo, MD,MPH, Atlanta, GA (*Presenter*) Nothing to Disclose
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Martin J. Sanda, MD, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose
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David M. Schuster, MD, Decatur, GA (*Abstract Co-Author*) Institutional Research Grant, Nihon Medi-Physics Co, Ltd; Institutional Research Grant, Blue Earth Diagnostics Ltd; Institutional Research Grant, Advanced Accelerator Applications SA; Institutional Research Grant, Telix Pharmaceuticals Inc; Consultant, Syncona Ltd; Consultant, AIM Specialty Health, Inc; ;

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PURPOSE

To evaluate the role of preoperative 18F-fluciclovine PET/CT in predicting metastasis in patients with intermediate- or high-risk primary prostate cancer.

METHOD AND MATERIALS

Forty-five patients underwent fluciclovine PET/CT prior to radical prostatectomy (RP) with extended pelvic lymph node dissection (EPLND). Triple time-point PET acquisition {0-5 minutes (pelvis), 5-22.5 minutes (whole body) and 22.5-27.5 minutes (pelvis)} at 2.5 minutes/bed position was performed. Standardized uptake values (SUVmax, SUVmean, SUVpeak) and total lesion activity (TLA) of the whole prostate and hottest prostate lesion on PET were recorded. Clinical and fluciclovine uptake characteristics that correlated with the presence of regional nodal and non-regional metastasis were determined using t-test and Fisher's exact test.

RESULTS

4/45 patients were ineligible for RP due to systemic disease and therefore, pre-surgical biopsy Gleason scores of these patients were used. Histology (43/45), serial clinical follow-up and imaging (2/45) were reference standards for metastatic disease. Mean preoperative PSA was 27.9±31.8 ng/ml. Median time from imaging to surgery was 7 (range 1-42) days. All patients had multifocal disease on histology. Metastasis was detected in 26/45 (57.8%) patients. Of these, 15/26 (57.7%) patients had metastasis to regional lymph nodes only and an additional 11/26 (42.3%) patients also had non-regional metastasis. Mean PSA was significantly higher in patients with metastasis compared to those without metastasis (36.8±37.7 ng/ml vs 15.7±15.0 ng/ml; $p<0.01$). Of all the variables analyzed, whole prostate TLA (all time-points) was significantly higher in patients with metastasis than those without. Gleason score and SUVmean of the whole prostate (third time-point) were significantly higher in patients with non-regional metastasis versus regional metastasis (see table).

CONCLUSION

Prostate tumor burden as suggested by TLA of the whole prostate on fluciclovine PET may be useful in predicting the presence of distant metastasis in patients with primary prostate cancer.

CLINICAL RELEVANCE/APPLICATION

Total lesion activity of the whole prostate on fluciclovine PET may be predictive of presence of metastasis in patients with primary prostate cancer being evaluated for curative surgery.

NM124-ED-SUB5 Not For the Young at Heart: Cardiac TTR Amyloid Nuclear Imaging - Technique, Pathology, and Incidental Findings

Station #5

Participants
Anne-Olivia Raulli, MD, Boston, MA (*Presenter*) Nothing to Disclose
Nayer Nikpoor, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

1. Cardiac amyloid deposition is an under-diagnosed cause of restrictive cardiomyopathy which is traditionally diagnosed by myocardial biopsy. 2. The most common causes of amyloidosis are deposits of light chains (AL) and transthyretin (TTR). Two forms of the TTR amyloid disease are known: a senile form which accounts for the majority of patients and an inherited form caused by a mutation in the transthyretin gene. 3. There has been increasing interest in the use of 99m Tc-Pyrophosphate (PYP), a now outdated radionuclide for imaging of myocardial infarction for cardiac TTR amyloid imaging. 4. PYP localizes to TTR amyloid deposits with great sensitivity and specificity, thereby obviating the need for myocardial biopsy. 5. Focal PYP uptake may also be seen in various cardiac calcifications such as mitral, aortic, coronary and dystrophic calcifications as well as in rib fractures. 6. New medications recently approved by the FDA bring hope for the treatment of this fatal disease.

TABLE OF CONTENTS/OUTLINE

1. Background 2. Technique 3. Image interpretation: quantitative and semi-quantitative approaches 4. Correlation with cardiac MRI 5. Incidental findings 6. Implications for clinical practice and treatment

NM125-ED-SUB6 Differential Diagnosis of Atypical Parkinsonian Syndromes using 18F-FDG PET/CT

Station #6

Participants
Rosaura Suazo Aguero, MD, Mexico City, Mexico (*Presenter*) Nothing to Disclose
Rodrigo Hernandez Ramirez, Leon, Mexico (*Abstract Co-Author*) Nothing to Disclose

Eva A. Izquierdo Echavarri, MD, CD.MX. , Mexico (*Abstract Co-Author*) Nothing to Disclose
Juan P. Chavez Torres, MD, Mexico City, Mexico (*Abstract Co-Author*) Nothing to Disclose

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TEACHING POINTS

Movement disorders are frequent alterations among the elderly, being Parkinson disease the most common. Atypical Parkinsonian Syndromes (APS), also known as Parkinson-plus Syndromes, include corticobasal degeneration, multiple system atrophy and progressive supranuclear palsy and are considered part of the differential diagnosis. They all share similar clinical manifestations therefore radiologic features are essential for an accurate diagnosis. Over the last years, advances in metabolic imaging techniques have caused an impact for the diagnostic work up in neurodegenerative states. 18F-FDG is the most commonly used radiotracer for the assessment of regional cerebral glucose, where specific uptake patterns have been established for each disease.At the end of this review we will be able:1.To recognize the disease specific patterns of 18F-FDG uptake in APS and identifying the differential diagnosis.2.To acknowledge the utility of 18F-FDG in brain imaging.3.To evaluate the dopaminergic system by PET/CT.

TABLE OF CONTENTS/OUTLINE

Pathophysiology of Parkinsonian SyndromesClinical FindingsDescription of Radiotracers (presynaptic and postsynaptic)Establishing differential diagnosis of APS by analysing 18F-FDG uptake and PET/CT findings.Description of cases (Disease specific patterns)Conclusions

NM126-ED-SUB7 Bringing Light on the Era of Immunotherapy: The Role of CT and PET/CT-What Should We Know?

Station #7

Participants
Emmanuel Alejandro Gamarra Aviles, MD, Ciudad de Mexico, Mexico (*Presenter*) Nothing to Disclose
Eva A. Izquierdo Echavarri, MD, CD.MX. , Mexico (*Abstract Co-Author*) Nothing to Disclose
Catalina Bravo Lopez I, DIPLPHYS, Mexico City, Mexico (*Abstract Co-Author*) Nothing to Disclose
Daniel A. Rodriguez Quintero, MD, Mexico City, Mexico (*Abstract Co-Author*) Nothing to Disclose
Mary C. Herrera-Zarza, MD, Mexico City, Mexico (*Abstract Co-Author*) Nothing to Disclose
Jorge Martin Schalch Ponce De Leon, Mexico City, Mexico (*Abstract Co-Author*) Nothing to Disclose
Jose Criales Cortes, Ciudad de Mexico , Mexico (*Abstract Co-Author*) Nothing to Disclose

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TEACHING POINTS

Describe the role of imaging in the evaluation of patients treated with immunotherapy.Comparison of RECIST, immune-related response criteria (irRC), immune-related RECIST(irRECIST) and immune RECIST (iRECIST). Limitations and key points.Review of the use of FDG PET in immunotherapy response assessment: immune PET Response Criteria in Solid Tumors (iPERCIST), PERCIST PET/CT Criteria for Early Prediction of Response to Immune Checkpoint Inhibitor Therapy (PERCRIT), PETResponse Evaluation Criteria for Immunotherapy (PERCIMT).Identify atypical patterns of response, the so-called pseudoprogression (PP) andhyperprogression (HP).Understanding the importance of the patient medical examination and be familiar withthe imaging manifestations of immune-related adverse events for a good PET interpretation.

TABLE OF CONTENTS/OUTLINE

1 Introduction2 Objectives3 Review of the current literature on Imaging methods for monitoring patients treatedwith immunotherapy.a Describe the traditional and newer imaging response criteria for evaluation of asolid tumor.b Use of the F-FDG PET/CT: the evolution of PERCIST.4 Recognize the immunotherapy action.5 Checklist for PET reporting. Step by step. From the medical examination to the PETreporting.6The other side: atypical patterns of response and immune-related adverse events.7 Conclusion.

RC111

Enhancing Your PET/CT Practice

Sunday, Dec. 1 2:00PM - 3:30PM Room: S505AB

CT NM

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 1.75

FDA Discussions may include off-label uses.

Sub-Events

RC111A Fluciclovine PET/CT: Interpretation and Case Examples

Participants
David M. Schuster, MD, Decatur, GA (*Presenter*) Institutional Research Grant, Nihon Medi-Physics Co, Ltd; Institutional Research Grant, Blue Earth Diagnostics Ltd; Institutional Research Grant, Advanced Accelerator Applications SA; Institutional Research Grant, Telix Pharmaceuticals Inc; Consultant, Syncona Ltd; Consultant, AIM Specialty Health, Inc; ;

LEARNING OBJECTIVES

1) Describe the mechanism of uptake of the PET radiotracer fluciclovine. 2) Identify normal biodistribution of fluciclovine. 3) Identify the FDA approved clinical indication of fluciclovine. 4) Discuss clinical interpretive criteria of fluciclovine PET.

RC111B DOTATATE PET/CT: Interpretation and Case Examples

Participants
Thomas A. Hope, MD, San Francisco, CA (*Presenter*) Research Grant, General Electric Company; Research Grant, Koninklijke Philips NV; Advisory Board, Ipsen SA; Researcher, Advanced Accelerator Applications SA

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LEARNING OBJECTIVES

1) Define somatostatin receptor PET. 2) Examine the circumstances where somatostatin receptor PET should be used in imaging neuroendocrine tumor patients. 3) Describe the false positives and other issues with interpretation somatostatin receptor PET imaging. 4) Explain the use of 177Lu-DOTATATE peptide receptor radionuclide therapy and how imaging is used to select patients.

RC111C Non-oncologic Applications for FDG-PET/CT

Participants
Don C. Yoo, MD, Lexington, MA (*Presenter*) Consultant, inviCRO, LLC

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LEARNING OBJECTIVES

1) Describe the role of PET/CT in evaluation of infection and inflammation. 2) Determine the role of PET/CT in evaluation of inpatients with fever without a source. 3) Describe the relative imaging costs of various radiopharmaceuticals that can be used for infection and inflammation.

RC111D Effective Reporting and Communication

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

RC117

Emerging Technology: Imaging of Dementias and Movement Disorders Update 2019

Sunday, Dec. 1 2:00PM - 3:30PM Room: S504CD

CT MR NR NM

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 1.75

Participants
Rathan M. Subramaniam, MD,PhD, Dunedin, New Zealand (*Moderator*) Nothing to Disclose

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LEARNING OBJECTIVES

1) To review the value of FDG and amyloid PET/CT in diagnosis of dementia. 2) To review the value of MR imaging in diagnosis of dementia. 3) To review the value of tau PET/CT in diagnosis of dementia.

ABSTRACT

This session will review the importance and value of FDG PET, Amyloid PET, MRI and Tau PET imaging in diagnosis of dementia.

Sub-Events

RC117A Imaging Dementias: FDG and Amyloid PET/CT

Participants
Rathan M. Subramaniam, MD,PhD, Dunedin, New Zealand (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Understand which FDA approved MR techniques are currently available for improving differential diagnosis in patients with dementia. 2) Improve basic knowledge of how MR results correspond to clinical dementia phenotypes. 3) Discuss recent technological advances including applications of dynamic susceptibility contrast (DSC) MR, arterial spin labelling (ASL) and resting state functional connectivity MRI (rs-fcMRI) in the setting of patients with dementia.

RC117B Imaging Dementias - Tau PET/CT: Update 2019

Participants
Val J. Lowe, MD, Rochester, MN (*Presenter*) Research Grant, General Electric Company; Research Grant, Siemens AG; Research Grant, Eli Lilly and Company; Advisory Board, Merck & Co, Inc

LEARNING OBJECTIVES

1) Describe the basic science principles behind tau PET/CT imaging. 2) Understand the utility of tau PET/CT imaging in neurodegenerative disease. 3) Identify the findings of a positive tau PET/CT scan.

RC117C Imaging of Movement Disorders: Update 2019

Participants
Kevin P. Banks, MD, Joint Base San Antonio , TX (*Presenter*) Nothing to Disclose

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LEARNING OBJECTIVES

1) Understand the Parkinsonian Syndrome entities and their clinical features. 2) Analyze the role and efficacy of I-123 Ioflupane Brain SPECT in the diagnosis and management of PS. 3) Learn the essential steps of proper exam preparation and acquisition. 4) Comprehend the interpretation criteria for I-123 Ioflupane Brain SPECT and potential pitfalls.

RC121

Innovations in Hybrid Imaging

Sunday, Dec. 1 2:00PM - 3:30PM Room: E351

CT MR NM PH

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 1.75

Participants
Osama R. Mawlawi, PhD, Houston, TX (*Coordinator*) Research Grant, General Electric Company Research Grant, Siemens AG

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LEARNING OBJECTIVES

1) Become more proficient with the latest innovations in PET/CT imaging and their impact of scanner performance. 2) Learn about the challenges and opportunities in PET/MR image quantification and potential clinical applications. 3) Understand the various corrections necessary to generate a quantifiable SPECT image.

ABSTRACT

This sesion will cover the latest innovations in hybrid immaging. The session will have three speakers covering 3 different topics. The first talk will cover the latest in PET/CT imaging including silicon photomultiplier tubes, larger axial fields of view and the effects these innovations have on scanner performance. The second talk will focus on PET/MR imaging and disuss the challenges and opportunities of PET/MR image quantification and potential clinical applications. Finally, the third talk will focus on SPECT/CT image quantification while discussing the various correction factors and processes needed to to generate a quantifiable SPECT image.

Sub-Events

RC121A Innovations in PET/CT

Participants
Osama R. Mawlawi, PhD, Houston, TX (*Presenter*) Research Grant, General Electric Company Research Grant, Siemens AG

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LEARNING OBJECTIVES

1) List the latest advances in PET/CT imaging. 2) Understand the impact of these innovations on scanner performance and image quality. 3) Recognize the differences between commercial PET/CT systems with respect to these innovations.

ABSTRACT

This talk will focus on the latest innovations in PET/CT imaging. Topics covered will include silicon photomultiplier (SiPM) tubes, large axial PET scanners, data driven gating, and the impact these innovations have on scanner performance and image quality.

RC121B Opportunities in PET/MR

Participants
Thomas Beyer, PhD, Vienna, Austria (*Presenter*) Co-founder cmi-experts GmbH; Co-founder Dedicaid GmbH

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LEARNING OBJECTIVES

1) Appreciate benefits and challenges of quantification in PET. 2) Be made aware of the basic principles of fully-integrated PET/MR imaging systems. 3) Understand the fundamental challenges and potential of MR-guided PET quantification. 4) Be pointed to potential applications of fully-integrated PET/MR in clinical research, and possibly routine.

ABSTRACT

PET is a non-invasive imaging technique that provides reproducible and fully-quantitative information on preselected metabolic/signaling pathways. PET is highly sensitive, thus, requiring only small amounts of biomarkers to be used for visualization and quantification purposes. By comparison to high-resolution anatomical images PET images appear blurred, which is attributed to the positron range effects and the limited detector size of the PET ring systems.Today, clinical PET imaging systems are offered almost exclusively in combination with CT and MR systems. Combined PET/MR, in particular, offers a number of intrinsic methodological advantages over PET only. These include, the use of MR imaging (e.g., by means of MR navigators) to estimate involuntary patient motion as a pre-requisite for motion compensation, and, thus, subsequent improvement of PET image quality and quantification. Following appropriate motion compensation, PET data can be improved in quality and accuracy through the use of MR-guided partial volume corrections and image reconstruction. In this presentation we will highlight the most important advances of PET instrumentation and data processing that help facilitate fully-integrated PET/MR in the first place, and draw a

benefit from this integration for the PET data. This includes a brief discussion of the effect of the static MR field on positron range effects, in particular for higher-energetic positron emitters. Overall, increase volume sensitivity helps reduce the amount of radiotracer injected into patients or shorten the emission scan time, in combination with increased signal-to-noise in the emission images (thanks to the use of time-of-flight, a concept different from TOF-MR) it helps increase sensitivity and reader accuracy of PET images. Lastly, advances in image reconstruction have brought the level of PET, and the appearance of the PET images, closer to the common understanding of radiologically useful images.

RC121C SPECT/CT Quantitation

Participants
Srinivas C. Kappadath, PhD, Houston, TX (*Presenter*) Research Grant, General Electric Company; Research Grant, BTG International Ltd; Consultant, BTG International Ltd; Consultant, ABK Biomedical Inc; Consultant, Terumo Corporation

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LEARNING OBJECTIVES

1) Identify the various correction factors applied to SPECT. 2) Understand the processes used for quantification of SPECT. 3) Describe the various approaches used commercially for SPECT quantitation.

Printed on: 10/29/20

PS12

Sunday Afternoon Plenary Session

Sunday, Dec. 1 4:00PM - 5:45PM Room: Arie Crown Theater

BR CH GI IR MK NR NM PD

AMA PRA Category 1 Credits ™: 1.75
ARRT Category A+ Credit: 1.75

Participants
Valerie P. Jackson, MD, Tucson, AZ (*Presenter*) Nothing to Disclose

Sub-Events

PS12A Report of the RSNA Research and Education Foundation

Participants
Thomas M. Grist, MD, Madison, WI (*Presenter*) Institutional research support, General Electric Company; Institutional research support, Bracco Group; Institutional research support, Siemens AG; Institutional research support, Hologic, Inc; Institutional research support, McKesson Corporation; Stockholder, Elucent; Stockholder, HistoSonics, Inc;

PS12B Image Interpretation Session

Participants
Neil M. Rofsky, MD, Dallas, TX (*Moderator*) Advisory Board, InSightec Ltd; CME & Education Steering Committee, Medscape, LLC
Laura W. Bancroft, MD, Venice, FL (*Presenter*) Nothing to Disclose
Yoshimi Anzai, MD, Salt Lake City, UT (*Presenter*) Nothing to Disclose
Robert D. Boutin, MD, Davis, CA (*Presenter*) Nothing to Disclose
Govind B. Chavhan, MD, Toronto, ON (*Presenter*) Speaker, Bayer AG
Philippe A. Grenier, MD, Saint Cloud, France (*Presenter*) Nothing to Disclose
S. Nahum Goldberg, MD, Efrat, Israel (*Presenter*) Consultant, AngioDynamics, Inc; Consultant, Cosman Medical, Inc; Consultant, XACT Robotics;
Nicole M. Hindman, MD, New York, NY (*Presenter*) Nothing to Disclose
Jessica W. Leung, MD, Houston, TX (*Presenter*) Scientific Advisory Board, Subtle Medical
Don C. Yoo, MD, Lexington, MA (*Presenter*) Consultant, inviCRO, LLC

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LEARNING OBJECTIVES

1) Identify key abnormal findings on radiologic studies that are critical to making a specific diagnosis. 2) Construct a logical list of differential diagnoses based on the radiologic findings, focusing on the most probable differential diagnoses. 3) Determine which, if any, additional radiologic studies or procedures are needed in order to make a specific final diagnosis. 4) Choose the most likely diagnosis based on the clinical and the radiologic information.

ED010-MO

Nuclear Medicine Monday Case of the Day

Monday, Dec. 2 7:00AM - 11:59PM Room: Case of Day, Learning Center

AMA PRA Category 1 Credit ™: .50

Participants
Ming Yang, MD, Scottsdale, AZ (*Presenter*) Nothing to Disclose
Michael C. Roarke, MD, Scottsdale, AZ (*Abstract Co-Author*) Nothing to Disclose
Ba D. Nguyen, MD, Scottsdale, AZ (*Abstract Co-Author*) Nothing to Disclose
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Matthew Kay, MBBS, Tucson, AZ (*Abstract Co-Author*) Nothing to Disclose
Gregory J. Woodhead, MD, PhD, Tucson, AZ (*Abstract Co-Author*) Nothing to Disclose
Phillip Kuo, MD,PhD, Tucson, AZ (*Abstract Co-Author*) Research Grant, Astellas Group; Research Grant, Blue Earth Diagnostics Ltd; Consultant, Novartis AG; Consultant and Speaker, General Electric Company; Consultant, Konica Minolta, Inc; Consultant, Imaging Endpoints

TEACHING POINTS

1) Recognize the association of lung malignancy and immune-mediated seizure activity. 2) Recognize incidental Thornwaldt cyst on FDG PET-CT. 3) Familiarize the scintigraphy feature of shin splint on three-phase bone scan. 4) Identify off-target distribution of Tc-99m MAA to the falciform artery on Y-90 microsphere planning SPECT/CT. 5) Recognize the imaging features of an obstructed ventriculoperitoneal shunt.

MSMI21

Molecular Imaging Symposium: Basics of Molecular Imaging

Monday, Dec. 2 8:30AM - 10:00AM Room: S405AB

BQ MR MI NM US

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 1.75

Participants
Zaver M. Bhujwalla, PhD, Baltimore, MD (*Moderator*) Nothing to Disclose
Jan Grimm, MD,PhD, New York, NY (*Moderator*) Nothing to Disclose

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Sub-Events

MSMI21A Molecular Imaging using Radioactive Tracers

Participants
Jan Grimm, MD,PhD, New York, NY (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Discuss the various radio tracers and their applications in Molecular Imaging studies. 2) Understand in which situations to use which radio tracers, what to consider when developing the imaging construct and what controls to obtain for nuclear imaging studies. 3) Examples will contain imaging with small molecules, with antibodies and nanoparticles as well as with cells in order to provide the participants with examples how o correctly perform their imaging studies. 4) Most of the examples will be from the oncology field but their underlying principles are universally applicable to other areas as well.

MSMI21B Molecular Imaging with MRI and MRS

Participants
Zaver M. Bhujwalla, PhD, Baltimore, MD (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To list the basic principles of magnetic resonance (MR) molecular imaging. 2) To describe the uses of noninvasive multi-nuclear MRI and magnetic resonance spectroscopic imaging (MRSI) for molecular imaging applications that provide spatial and temporal information on vasculature, metabolism and physiology. 3) To identify the applications of targeted MR contrast agents to detect receptor and gene expression. 4) To describe strategies that combine detection with therapy for theranostic imaging and for metabolotheranostics. 5) To provide examples of translational applications of molecular imaging and theranostics.

ABSTRACT

Noninvasive multi-nuclear magnetic resonance (MR) imaging and spectroscopic imaging (MRSI) provide a wealth of spatial and temporal information on vasculature, metabolism and physiology. Novel targeted contrast agents have widened the scope of MR techniques for molecular imaging applications to detect receptor and gene expression. In cancer, molecular imaging can be applied to identify targets specific to cancer with imaging, design agents against these targets to visualize their delivery, and monitor response to treatment, with the overall purpose of minimizing collateral damage. Genomic and proteomic profiling can provide an extensive 'fingerprint' of each tumor. With this cancer fingerprint, theranostic agents can be designed to personalize treatment for precision medicine of cancer, and minimize damage to normal tissue.

MSMI21C Molecular Imaging with Nanoparticles

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

LEARNING OBJECTIVES

1) To understand important safety aspects of ultrasmall superparamagnetic iron oxide nanoparticles (USPIO). 2) To understand the biodistribution of ferumoxytol nanoparticles and implications for imaging diagnoses. 3) To recognize the value of ferumoxytol nanoparticles for cancer MR imaging and PET/MR imaging.

ABSTRACT

Gadolinium chelates as contrast agents for MRI have been associated with mounting concerns about nephrogenic sclerosis and gadolinium deposition in the brain. Therefore, a search for safe alternatives is currently underway. In North America, the iron supplement ferumoxytol has gained considerable interest as an MR contrast agent. In Europe, ferumoxtran-10 is re-entering clinical trials. Both ferumoxytol and ferumoxtran-10 provide long-lasting blood pool enhancement, which can be used for MR imaging exams that require detailed and/or long-lasting vessel delineation for MR angiographies, tissue perfusion studies, and whole body tumor staging. Iron oxide nanoparticles are slowly phagocytosed by macrophages in the reticuloendothelial system, making them ideal for MR imaging detection of tumors in the liver, spleen, lymph nodes, and bone marrow. Similarly, iron oxide nanoparticles are slowly phagocytosed by tumor-associated macrophages in cancers; which can be used to grade tumor-associated inflammation and monitor the efficacy of new cancer immunotherapies. This presentation provides an introduction to the use of iron oxide

nanoparticles for clinical MR and PET/MR imaging, including safety data acquired in children thus far, recent insights and mechanisms of rare, but potentially severe adverse reactions, applications that impact patient care and comparisons with gadolinium chelates. New developments for image guided therapy and theranostics are under way.

MSMI21D Ultrasound Molecular Imaging with Targeted Bubbles

Participants
Alexander L. Klibanov, PhD, Charlottesville, VA (*Presenter*) Co-founder, Targeson, Inc, now dissolved; Shareholder, Targeson, Inc, now dissolved; Institutional research collaboration, AstraZeneca PLC; NIH Grant subcontract to UVA lab, SoundPipe Therapeutics;

LEARNING OBJECTIVES

1) Understand the principles of microbubble design-how to prepare fully biocompatible and safe ultrasound contrast agent particles that are clinically translatable, stable on storage, provide strong acoustic response and high sensitivity of detection by clinical ultrasound imaging systems, and could be targetable. 2) Understand the principles of selection of disease-specific targeting ligands usable for contrast ultrasound imaging, based on receptor levels in the vasculature in the disease issues, as well as vascular biomechanics. 3) Assess the results of early stage clinical trials performed with targeted microbubbles, and opportunities for clinical translation in diagnostic imaging and image-guided interventions.

ABSTRACT

Ultrasound is the most widespread clinical imaging modality. Therefore, enabling molecular imaging potential in an ultrasound setting will lead to the expanded and improved clinical diagnostic benefit. Ultrasound contrast microbubbles are already used in clinic as blood pool contrast agents, with excellent detection sensitivity: single particles with sub-picogram mass can be observed with clinical imaging systems in real time, at a depth of several cm. To achieve biomarker-selective molecular imaging, microbubble shell surface is decorated with targeting ligand molecules (antibodies, peptides, carbohydrates) that assure selective binding and retention in the areas of disease. Clinical microbubbles are typically 1-3 um in diameter; they do not extravasate, so target biomarker receptors should be located on the luminal surface of vessel wall, e.g., vascular endothelium. Microbubbles are targeted to the biomarkers in the areas of inflammation and ischemia-reperfusion injury (P- and E-selectin, VCAM-1, ICAM-1) or to tumor neovasculature (VEGFR2). The latter, a heterodimeric peptide-targeted contrast microbubble from industry, has successfully completed Phase 1-2 clinical trials for imaging of ovarian, breast and prostate cancer lesions. Overall, targeted microbubbles empower molecular ultrasound imaging; they could also be used in conjunction with image-guided interventions, such as targeted biopsy and therapy.

MSMI21E Quantitative Imaging Biomarkers and Radiogenomics

Participants
Lawrence H. Schwartz, MD, New York, NY (*Presenter*) Nothing to Disclose

RC211

Nuclear Medicine Series: New PET Tracers for Prostate Cancer

Monday, Dec. 2 8:30AM - 12:00PM Room: S505AB

GU NM

AMA PRA Category 1 Credits ™: 3.50
ARRT Category A+ Credits: 4.00

FDA Discussions may include off-label uses.

Participants
Terence Z. Wong, MD, PhD, Chapel Hill, NC (*Moderator*) Consultant, Lucerno Dynamics, LLC;
Phillip J. Koo, MD, Phoenix, AZ (*Moderator*) Advisory Board, Bayer AG; Advisory Board, Johnson & Johnson; Consultant, Blue Earth Diagnostics Ltd; Researcher, Progenics Pharmaceuticals, Inc; Speaker, Astellas Pharm Inc; Advisory Board, Pfizer Inc; Consultant, Merck & Co, Inc; Consultant, Advanced Accelerator Applications SA

Sub-Events

RC211-01 Logistics: Incorporating New PET Tracers into Practice

Monday, Dec. 2 8:30AM - 8:55AM Room: S505AB

Participants
Nancy M. Swanston, RT, Houston, TX (*Presenter*) Nothing to Disclose

RC211-02 Potential Use of Fluciclovine PET/CT as Follow-Up Modality in Patients with Biochemically Recurrent Prostate Cancer

Monday, Dec. 2 8:55AM - 9:05AM Room: S505AB

Participants
Yo Sup Kim, BS, Maywood, IL (*Presenter*) Nothing to Disclose
Petra Lovrec, MD, Wheaton, IL (*Abstract Co-Author*) Nothing to Disclose
Medhat S. Gabriel, MD, Maywood, IL (*Abstract Co-Author*) Nothing to Disclose
Robert H. Wagner, MD, Maywood, IL (*Abstract Co-Author*) Nothing to Disclose
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PURPOSE

The feasibility of fluciclovine PET/CT imaging as follow-up modality for biochemically recurrent prostate cancer patients undergoing treatment or surveillance.

METHOD AND MATERIALS

A retrospective chart review was conducted for biochemically recurrent prostate cancer patients (Pts) who underwent two fluciclovine PET/CT scans between August 2016 and March 2019. Outcomes of follow-up scans were recorded as: Progression (new and/or increased uptake), partial response (combination of decreased and persistent uptake), improved (decreased uptake), and resolved (complete resolution). The PSA changes (%) for each interval outcome were calculated. The maximum standardized uptake values (SUV max) of lesions suspicious for malignancy and their interval changes were collected. Differences in SUV max values in Pts who demonstrated progression of disease were evaluated using the Wilcoxon Rank Sum Test.

RESULTS

Among 260 Pts who underwent fluciclovine PET/CT, 12 Pts had 2 scans with average interval time (±SD) of 12 ±5.2 months. One patient was excluded due to poor management records. In total, 11 Pts with 22 scans were included in the analysis. Types of interval management were: 4 surveillance (S), 1 radiation therapy (RT) + selective lymph node dissection (sLND), 3 initiated androgen deprivation therapy (iADT), 2 continued previously initiated ADT (cADT), and 1 RT. Interval progression was noted in 6 Pts (55%): 4 S, 1 RT + sLND, 1 cADT. Partial response in 1 cADT Pt (9%). Improved outcome in 3 Pts (27%): 2 iADT, 1 RT. Resolution in 1 iADT Pt (9%). PSA level reduced by 86.9%, 86.7%, and 100% in partial response, improved, and resolved outcome scans, respectively. PSA level increased by 223.2% in the progressed outcome scan. Among the progressed outcome scans, average SUV max for positive lesions was 4.4 ±1.9 at baseline PET/CT (n=16) and 4.3 ±2.2 at follow-up (n=28). Although no statistical significance of uptake difference was noted ($p>0.05$), 12 new lesions were reported overall.

CONCLUSION

Fluciclovine PET/CT can potentially be used as follow-up for treatment management in Pts with biochemically recurrent prostate cancer.

CLINICAL RELEVANCE/APPLICATION

The usage of fluciclovine PET/CT scan as a modality to assess response to therapy is not known.

RC211-03 Preoperative 18F-fluciclovine PET/CT Findings are Predictive of Optimal Post-Operative Prostate-Specific Antigen (PSA) in Patients with Intermediate to High-Risk Prostate Cancer

Monday, Dec. 2 9:05AM - 9:15AM Room: S505AB

Awards
Trainee Research Prize - Fellow

Participants
Akinyemi A. Akintayo, MD, Atlanta, GA (*Presenter*) Nothing to Disclose
Olayinka A. Abiodun-Ojo, MD,MPH, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose
Mehrdad Alemozaffar, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose
Oladunni O. Akin-Akintayo, MD,MPH, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose
Dattatraya Patil, MBBS,MPH, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose
Adeboye Osunkoya, MD, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose
Martin J. Sanda, MD, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose
David M. Schuster, MD, Decatur, GA (*Abstract Co-Author*) Institutional Research Grant, Nihon Medi-Physics Co, Ltd; Institutional Research Grant, Blue Earth Diagnostics Ltd; Institutional Research Grant, Advanced Accelerator Applications SA; Institutional Research Grant, Telix Pharmaceuticals Inc; Consultant, Syncona Ltd; Consultant, AIM Specialty Health, Inc; ;

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PURPOSE

To evaluate factors associated with optimal post-operative PSA following fluciclovine PET/CT guided radical prostatectomy and extended pelvic lymph node dissection (RP+EPLND).

METHOD AND MATERIALS

35 patients with intermediate to high risk prostate cancer underwent 18F-fluciclovine PET/CT before robotic RP+EPLND. Image interpretation was performed by a board-certified nuclear medicine physician blinded to other clinical and imaging data. Fluciclovine uptake in the prostate and extraprostatic sites were reviewed with the surgeon preoperatively. Histologic assessment was completed and results correlated with the preoperative PET/CT. Post-operative PSA were obtained 52 (range 23-139) days after surgery. Undetectable PSA was considered optimal. Univariate analysis was performed to determine factors associated with optimal post-operative PSA. Patients ineligible for curative surgery were not included in this analysis. Statistical significance was set as $p<0.05$.

RESULTS

Local prostate disease was found in 23/35 (65.7%) patients and nodal disease was found in 12/35 (34.3%) patients [7 regional pelvic lymph nodes (N1), 5 non-regional lymph nodes (M1a)] on fluciclcovine PET. Optimal post-operative PSA was present in 14/35 (40%) patients. Absence of nodal disease on PET was significantly associated with optimal post-operative PSA (OR 1.64(95%CI 1.03-2.59, p=0.04). Also, histologic finding of localized prostatic disease (21/25 patients) was associated with optimal post-operative PSA (OR 2.79(95%CI 1.50-5.19, $p<0.01$). Though not statistically significant, pre-operative PSA in patients with optimal post-operative PSA was lower than the patients with those who has suboptimal post-operative PSA (16.68±17.13 vs 36.14±40.73 ng/ml, p=0.06). There was no significant difference in the Gleason scores, Grade groups or resection margins between patients who achieved optimal post-operative PSA and those who did not ($p>0.05$). All patients with non-regional LN metastasis (M1a) on PET (n=5) or histology (n=5) had sub-optimal post-operative PSA.

CONCLUSION

Findings on preoperative fluciclovine PET is predictive of achieving optimal post-operative PSA after RP+EPLND. Fluciclovine PET may have prognostic value in selecting patients that will benefit from surgery and those that may require adjuvant therapy.

CLINICAL RELEVANCE/APPLICATION

Findings on preoperative fluciclovine PET/CT is predictive of post-operative PSA. This may be of value in overall treatment planning for patients with high grade prostate cancer.

RC211-04 18F-Fluciclovine PET/CT for Response Assessment in Patients with Metastatic Castration Resistant Prostate Cancer Treated with Docetaxel

Monday, Dec. 2 9:15AM - 9:25AM Room: S505AB

Participants
Akinyemi A. Akintayo, MD, Atlanta, GA (*Presenter*) Nothing to Disclose
Mehmet Asim Bilen, MD, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose
Olayinka A. Abiodun-Ojo, MD,MPH, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose
Omer Kucuk, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose
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Ephraim E. Parent, MD,PhD, Ponta Vedra Beach, FL (*Abstract Co-Author*) Research support, Blue Earth Diagnostics Ltd Research support, Advanced Accelerator Applications SA
David M. Schuster, MD, Decatur, GA (*Abstract Co-Author*) Institutional Research Grant, Nihon Medi-Physics Co, Ltd; Institutional Research Grant, Blue Earth Diagnostics Ltd; Institutional Research Grant, Advanced Accelerator Applications SA; Institutional Research Grant, Telix Pharmaceuticals Inc; Consultant, Syncona Ltd; Consultant, AIM Specialty Health, Inc; ;

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PURPOSE

To determine the value of fluciclovine PET/CT in evaluation of response to docetaxel chemotherapy in patients with metastatic castration resistant prostate cancer (mCRPC).

METHOD AND MATERIALS

Seven patients with mCRPC were evaluated in this study. Each patient had fluciclovine PET/CT prior to commencement, after 1 and 6 cycles of docetaxel. Fluciclovine uptake parameters were recorded in the prostate/bed and up to 5 metastatic bone and soft tissue lesions. The same lesions were evaluated on subsequent scans. Therapy response was assessed using the summed changes in SUVmax between PET scans (PET response) on per patient basis. Decrease in summed SUVmax of >=30% was considered response, while appearance of new lesions or >30% increase in summed SUVmax was considered progressive disease. Prostate specific antigen (PSA) levels were assessed at baseline and before each dose of chemotherapy. Assessment of response was based on recommendations from Prostate Cancer Clinical Trial Working Group 3 for PSA, bone scan and RECIST 1.1. A decrease in PSA of >= 50% was considered response. Results on fluciclovine PET were compared to standard of care bone scan and CT and correlated with PSA response.

RESULTS

All patients in the study complete the 1st and 2nd fluciclovine PET/CT, while 4/7 patients completed all 3 PET/CT scans. PSA response was seen in 1/7 (14.3%), 4/7(42.9%) had stable PSA while 2/7 (28.6%) had PSA progression after 1 cycle of docetaxel. After 6 cycles of docetaxel, 3/4 (75%) patients had PSA response, while 1/4 (25%) patient had progression. PET response correlated with PSA response in 3/7 (42.9%) patients after 1 cycle of docetaxel. After 6 cycles of docetaxel, PET response was concordant with PSA response in 3/4 (75%) patients, while bone scan and CT correlated with PSA response in 1/4 (25%) patients. Fluciclovine PET correlated with CT and bone scan in 2/4(50%) patients.

CONCLUSION

Fluciclovine PET seems to better correlate with PSA response than CT or bone scan in the assessment of therapy response in patients with mCRPC on docetaxel. Larger studies are required to confirm the value of fluciclovine PET as an imaging biomarker for response assessment.

CLINICAL RELEVANCE/APPLICATION

Fluciclovine PET may be useful for assessment of treatment response in patients with metastatic castration resistant prostate cancer on docetaxel. Further investigation is warranted.

RC211-05 Q&A

Monday, Dec. 2 9:25AM - 9:35AM Room: S505AB

RC211-06 Landscape of New and Future PET Tracers for Prostate Cancer

Monday, Dec. 2 9:35AM - 10:00AM Room: S505AB

Participants
Andrei Iagaru, MD, Emerald Hills, CA (*Presenter*) Research Grant, General Electric Company Research Grant, Progenics Pharmaceuticals, Inc Research Grant, Advanced Accelerator Applications SA

LEARNING OBJECTIVES

1) List some of the molecular imaging targets that are used in prostate cancer. 2) Understand underlying biology and mechanism of action for some of the new PET radiopharmaceuticals in prostate cancer. 3) Discuss patterns of prostate cancer appearance when using some of the new PET radiopharmaceuticals.

ABSTRACT

Data from the American Cancer Society suggests that prostate cancer will continue to be the leading cancer diagnosis in men with 174,650 estimated new cases and will have the second highest mortality (after lung cancer) with 31,620 estimated deaths for 2019 in the United States. Initial and subsequent treatment of prostate cancer may involve surgery, radiation therapy, hormonal therapy, chemotherapy, or a combination of these. Additional molecular pathways in prostate cancer lead to the identification of new targets that may be amenable to diagnostic and therapeutic intervention with novel agents. Areas of interest for the Nuclear Medicine and Molecular Imaging community include mainly aminoacid analogues (Fluciclovine) and the prostate specific membrane antigen (PSMA), but also gastrin releasing peptide receptors (GRPR).

RC211-07 Clinical Impact of 68Ga-PSMA-11 PET on Patient Management for Staging Intermediate to High-Risk Prostate Cancer Patients

Monday, Dec. 2 10:00AM - 10:10AM Room: S505AB

Participants
Daniela A. Ferraro, MD, Zurich, Switzerland (*Presenter*) Nothing to Disclose
Helena I. Schuler, MD, Zurich , Switzerland (*Abstract Co-Author*) Nothing to Disclose
Urs J. Muhlematter, MD, Zurich, Switzerland (*Abstract Co-Author*) Nothing to Disclose
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PURPOSE

Accurate staging is of major importance for prognosis assessment and treatment approach for patients with prostate cancer. Positron emission tomography (PET) with prostate specific membrane antigen (PSMA) is a promising technique that already outperformed conventional imaging in the detection of nodal and distant metastasis in previous studies. However, it is still unclear whether this superior sensitivity and specificity of PSMA PET would translate into a significant impact on management. The aim of this study was to assess the detection rate of disease and impact on management of 68Ga-PSMA-11 PET in patients that underwent a 68Ga-PSMA-11 PET scan for staging prostate cancer.

METHOD AND MATERIALS

In this retrospective analysis, approved by the local ethics committee, from all 137 patients that underwent 68Ga-PSMA-11 PET/CT or 68Ga-PSMA-11 PET/MRI scans for staging intermediate and high-risk prostate cancer between April 2016 and May 2018, 116 patients gave written informed consent for retrospective analysis of their data and were included into the study. The potential 68Ga-PSMA-11 PET impact on patient management was assessed within a simulated multidisciplinary tumour board where clinical and conventional imaging information was used to define treatment option pre-68Ga-PSMA-11 PET and information from the 68Ga-PSMA-11 PET was added to define treatment post-68Ga-PSMA-11 PET.

RESULTS

The primary tumour was positive on 68Ga-PSMA-11 PET in 113 patients (97%). Nodal metastasis were detected in 27 (23%) and bone metastasis in 14 patients (12%). Compared to clinical staging and conventional imaging, 68Ga-PSMA-11 PET brought new information in 42 of 116 patients (36%), leading to a change in management in 32 (27%) of them. In 15 patients (13%) a new therapy modality was chosen and in 17 patients (14%) the therapy details would be adjusted based on 68Ga-PSMA-11 PET findings (e.g. modification of radiotherapeutic field).

CONCLUSION

68Ga-PSMA-11 PET changed the management in in more than a fourth of intermediate to high-risk prostate cancer patients. Whether tailor-made therapies based on 68Ga-PSMA-11 PET will improve patient outcome will need further investigation.

CLINICAL RELEVANCE/APPLICATION

68Ga-PSMA-11 PET have an impact on patient management in the staging setting for intermediate and high-risk prostate cancer patients.

RC211-08 The Impact of 18F-DCFPyL PET-CT Imaging on Staging and Clinical Management of Men with De Novo Prostate Cancer: A First Experience within Veterans Healthcare System

Monday, Dec. 2 10:10AM - 10:20AM Room: S505AB

Participants
Neil R. Parikh, MD,MBA, Los Angeles, CA (*Presenter*) Nothing to Disclose
Carol Bennett, MD, Los Angeles, CA (*Abstract Co-Author*) Nothing to Disclose
Michael Lewis, MD, Los Angeles, CA (*Abstract Co-Author*) Nothing to Disclose
Ahmad Sadeghi, MD, Santa Monica, CA (*Abstract Co-Author*) Nothing to Disclose
Isla Garraway, MD,PhD, Los Angeles, CA (*Abstract Co-Author*) Nothing to Disclose
William Aronson, MD, Los Angeles, CA (*Abstract Co-Author*) Nothing to Disclose
Amar U. Kishan, MD, Los Angeles, CA (*Abstract Co-Author*) Nothing to Disclose
Shadfar Bahri, MD, Los Angeles, CA (*Abstract Co-Author*) Nothing to Disclose
Sonny Tsai, Los Angeles, CA (*Abstract Co-Author*) Nothing to Disclose
Kiarash Vahidi, MD, Los Angeles, CA (*Abstract Co-Author*) Nothing to Disclose
David N. Ishimitsu, MD, Los Angeles, CA (*Abstract Co-Author*) Nothing to Disclose
Matthew Rettig, MD, Los Angeles, CA (*Abstract Co-Author*) Consultant, Johnson & Johnson; Speakers Bureau, Johnson & Johnson; Research funded, Novartis AG; Research support, Astellas Group
Nicholas Nickols, MD, Los Angeles, CA (*Abstract Co-Author*) Research Grant, Johnson & Johnson; Research Grant, Varian Medical Systems, Inc; Research Grant, Bayer AG; Consultant, Genes Sciences Inc; Consultant, Progenics Pharmaceuticals, Inc;
Lida Jafari Saraf, MD, Los Angeles, CA (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

Positron emission tomography with computed tomography (PET-CT) utilizing novel prostate-specific membrane antigen (PSMA) tracers has shown efficacy in detecting extraprostatic disease not otherwise seen on conventional imaging. Although most published studies with PSMA PET-CT were conducted in the recurrent/salvage setting and utilized a gallium-based probe, this study aimed to evaluate the effect of 18F-DCFPyL PET-CT on staging and clinical management of patients with newly-diagnosed, untreated prostate cancer.

METHOD AND MATERIALS

From 9/2018 to 3/2019, 39 Veterans with untreated prostate cancer were prospectively enrolled on a single-arm Phase II clinical trial to receive 18F-DCFPyL PET-CT, in addition to conventional imaging, for staging of prostate cancer. Enrollment criteria was defined as: prostate specific antigen greater than 10 ng/mL, Gleason Score 4+3 or higher, or clinical stage T2c or higher. Upon completion of 18F-DCFPyL PET-CT, management recommendations for each case were formulated by a multi-disciplinary physician team consisting of a urologic oncologist, medical oncologist, and radiation oncologist, based upon predetermined recommendations associated with clinic-pathologic criteria and imaging findings in accordance with current guidelines.

RESULTS

Of the 39 patients initially enrolled, clinic-pathologic features and conventional imaging enabled designation of 5 unfavorable-intermediate cases, 26 high-risk cases, 3 node-positive cases, and 5 metastatic cases. Following 18F-DCFPyL PET-CT, 12 patients were upstaged and 3 were downstaged. Modified treatment recommendations were made to initiate long-term abiraterone in 9 (23%) patients, extend abiraterone duration in 3 (8%) patients, extend ADT course in 12 (31%) patients, boost pelvic nodes in 4 (10%) patients, deliver metastasis-directed therapy (MDT) in 8 (21%) patients, and forgo RT to primary in 1 (3%) patient. Three patients (7.5%) initially thought to have M1 disease were downstaged and no longer recommended to receive abiraterone or MDT.

CONCLUSION

In conjunction with conventional imaging, 18F-DCFPyL PET-CT appears to significantly alter the staging and management of newly-diagnosed untreated prostate cancer patients.

CLINICAL RELEVANCE/APPLICATION

Patients with unfavorable-intermediate (or higher) prostate cancer may benefit from upfront 18F-DCFPyL PET-CT to improve

staging and designation of individuals for combination and/or systemic therapy.

RC211-09 Interim Analysis Results of a Prospective Study of 68Ga-RM2 PET/MRI in Patients with Biochemically Recurrent Prostate Cancer and Negative Conventional Imaging

Monday, Dec. 2 10:20AM - 10:30AM Room: S505AB

Participants
Lucia Baratto, MD, Stanford, CA (*Presenter*) Nothing to Disclose
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Farshad Moradi, MD, Stanford, CA (*Abstract Co-Author*) Nothing to Disclose
Andrei Iagaru, MD, Emerald Hills, CA (*Abstract Co-Author*) Research Grant, General Electric Company Research Grant, Progenics Pharmaceuticals, Inc Research Grant, Advanced Accelerator Applications SA

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PURPOSE

68Ga-RM2 is a synthetic bombesin receptor antagonist targeting gastrin-releasing peptide receptors (GRPr) that are overexpressed in several human tumors, including prostate cancer (PC). We present data from the use of 68Ga-RM2 in patients with biochemically recurrent (BCR) PC and negative conventional imaging (CI).

METHOD AND MATERIALS

We enrolled 91 men with BCR PC, 53-83-year-old (mean±SD: 68.8±6.3). Imaging started at 40-89 minutes (mean±SD: 53.6±8.8 after injection of 127.5-152.6 MBq (mean±SD: 141.8±5.3) of 68Ga-RM2 using a time-of-flight (TOF)-enabled simultaneous positron emission tomography (PET) / magnetic resonance imaging (MRI) scanner. T1-weighted (T1w), T2-weighted (T2w) and diffusion-weighted images (DWI) were acquired. Standardized uptake value (SUVmax) measurements in up to 6 lesions with highest uptake was collected in 35 patients for this analysis.

RESULTS

All patients had rising prostate specific antigen (PSA) (range: 0.2-124 ng/mL; mean±SD: 7.6±18.5) and negative CI (CT or MRI, and 99mTc MDP bone scan) prior to enrollment. 68Ga-RM2 PET identified recurrent PC in 64 of the 91 participants, while the simultaneous MRI scan identified findings compatible with recurrent PC in 25 of the 91 patients. PSA velocity (PSAv) values were 0.29±0.44 ng/ml/year (range: 0.03-1.9) in patients with negative PET scans and 2.29±2.01 ng/ml/year (range: 0.13-8.68) in patients with positive PET scans (P: 0.0042). We detected 73 lesions in 35 patients (45 lymph nodes, 9 prostate bed, 5 seminal vesicles, 9 bone, 2 liver and 2 lungs), mean±SD SUVmax was 9.19±11.23.

CONCLUSION

68Ga-RM2 PET identifies GRPr expression in BCR PC lesions despite negative CI, indicating it is a promising PET radiopharmaceutical in this clinical scenario. 68Ga-RM2 may identify higher risk patients given the highly statistically significant difference PSA velocity values between patients with negative and positive scans.

CLINICAL RELEVANCE/APPLICATION

68Ga-RM2 is a promising tracer for assessment of GRPr expression in patients with BCR PC.

RC211-10 Automatic Acquired 18F-Choline PET/CT Biomarkers Association with Prognostic Value in High-Risk Prostate Cancer Patients

Monday, Dec. 2 10:30AM - 10:40AM Room: S505AB

Participants
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Henrik Kjolhede, Goteborg, Sweden (*Abstract Co-Author*) Nothing to Disclose
Olof Enqvist, Malmo, Sweden (*Abstract Co-Author*) Nothing to Disclose
Eirini Polymeri, Gothenburg, Sweden (*Abstract Co-Author*) Nothing to Disclose
Mattias Ohlsson, Halmstad, Sweden (*Abstract Co-Author*) Nothing to Disclose
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Lars Edenbrandt, MD,PhD, Gothenburg, Sweden (*Abstract Co-Author*) Employee, EXINI Diagnostics

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CONCLUSION

Automated deep learning-based measurements of 18F-choline uptake in the prostate gland were significantly associated with prostate cancer specific survival in patients with hormone-naive prostate cancer. This type of deep learning-based methods could be applied to other prostate cancer PET tracers as well, for example PSMA.

Background

Biomarkers are not routinely used in PET/CT explorations, one of the motives could be that automated quantitative PET/CT assessments are often lacking. Although few research groups are incorporating deep learning in PET/CT management and have successfully used to delineate or identify gross tumoral volume in different malignancies, the use of biomarkers acquired with the aid of deep learning is almost unheard of in 18F-choline PET/CT in prostate cancer.

Evaluation

The core of the automated segmentation method is a fully convolutional neural network (CNN) taking both the PET and the CT image. The CNN works directly on the three-dimensional images and produces segmentations of the prostate as well as the urinary bladder (Figure 1). Based on these segmentation, prostate volume, lesion volume, SUVmax and total lesion uptake (TLU, defined as the product SUVmean x lesion volume) are calculated. The CNN was trained on a separate training set of manually segmented PET/CT scans. After the training, the method was applied to a separate validation group of patients with prostate cancer who had undergone 18F-choline PET/CT for primary metastasis staging before treatment. Associations between automated deep learning-based PET/CT measurements, age, PSA, Gleason score, T stage, and prostate cancer specific survival were studied using a univariate Cox proportional hazards regression model.

Discussion

A total of 77 patients were included in the validation group and twelve of them died from prostate cancer during follow-up. Median survival time was 4.9 years (range 1.7-7.0 years) compared to a median follow-up time of 6.6 years (range 1.8-8.5 years) in the remaining patients. TLU (p=0.01), prostate volume (p=0.02), lesion volume (p=0.001), and PSA (p=0.03) were significantly associated with prostate cancer specific survival, while SUVmax, age, T stage and Gleason score were not.

RC211-11 Q&A

Monday, Dec. 2 10:40AM - 10:50AM Room: S505AB

RC211-12 Clinician's Perspective: Impact and Applications

Monday, Dec. 2 10:50AM - 11:15AM Room: S505AB

Participants
Steve Cho, MD, Madison, WI (*Presenter*) Research Grant, General Electric Company; Consultant, Advanced Accelerator Applications SA;

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LEARNING OBJECTIVES

1) Review current and emerging PET radiotracers for prostate cancer. 2) Assess how these new PET imaging radiotracers can address unmet clinical needs in prostate cancer. 3) Address remaining clinical and research questions arising from new PET radiotracers in prostate cancer.

RC211-13 Prospective Comparison of 18F-DCFPyL PET/CT with 18F-NaF PET/CT for Detection of Skeletal Metastases in Biochemically Recurrent Prostate Cancer

Monday, Dec. 2 11:15AM - 11:25AM Room: S505AB

Participants
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PURPOSE

18F-DCFPyL is a promising 18F-labeled agent for PSMA PET imaging, available at our institution through a research access program. Here we compared 18F-DCFPyL PET/CT and 18F-NaF PET/CT for the detection of skeletal metastases in patients with biochemically recurrent prostate cancer (BCR PC).

METHOD AND MATERIALS

We prospectively enrolled 50 patients (52-91 years old, 71.2 ± 7.4 years) who had 18F- DCFPyL PET/CT at BCR PC after definitive treatment with prostatectomy (30 patients) and/or radiation therapy (20 patients). A total of 16 of the 50 patients (63-86 years old, 73.6 ± 5.9 years) also had 18F-NaF PET/CT for identification of bone metastases. Up to 7 bone lesions were recorded per patient for each tracer.

RESULTS

Three patients did not have bone metastases. A total of 41 skeletal lesions were found. 18F DCFPyL PET/CT identified 32 bone lesions (78%) and 18F NaF PET/CT identified 35 lesions (85.4%). Congruent findings between 18F-DCFPyL and 18F NaF were found in 26/41 (63.4%) lesions. 18F DCFPyL identified 1 lesion missed on 18F NaF in 4 participants (4/41, 9.8%). However, 18F DCFPyL was negative in 2 patients with lesions found on 18F NaF (4/41 lesions, 9.8%). CT alone identified 21 lesions (51.2%).

CONCLUSION

The performance of 18F DCFPyL PET/CT for detecting bone metastases is similar to that of 18F NaF PET/CT. Taken together with the accuracy of 18F-DCFPyL PET/CT in the detection of non-bone metastases and disease at low PSA presented separately, 18F DCFPyL PET/CT may be used as a "one stop shop" for evaluation of patients with BCR PC. However, more patients have to be evaluated to support these findings.

CLINICAL RELEVANCE/APPLICATION

18F DCFPyL PET/CT is a very promising diagnostic tool for evaluating patients with BCR PC.

RC211-14 Rapid High Definition Na18F Digital PET/CT for Whole-Body Osteoblastic Disease Assessment: A Phase I Intra-Individual Comparison Study

Monday, Dec. 2 11:25AM - 11:35AM Room: S505AB

Participants
Chadwick L. Wright, MD,PhD, Columbus, OH (*Presenter*) Nothing to Disclose
Katherine Binzel, PhD, Columbus, OH (*Abstract Co-Author*) Nothing to Disclose
Jun Zhang, PhD, Columbus, OH (*Abstract Co-Author*) Nothing to Disclose
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Dayssy A. Diaz-Pardo, Columbus, OH (*Abstract Co-Author*) Nothing to Disclose
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PURPOSE

In this Phase Ib intra-individual comparison study we assess the clinical feasibility of a substantially faster, high-definition whole-body Na18F PET approach using digital photon counting PET detector (dPET) technology in the evaluation of osteoblastic metastatic disease and compare to standard PET image acquisition times (60 - 120 s/bed).

METHOD AND MATERIALS

Whole-body Na18F dPET/CT imaging (Vereos, Philips) was performed in 29 male oncologic patients using a target Na18F dose of 185 MBq. At 70 min post injection, dPET acquisitions were performed using a substantially faster acquisition time of 30 s/bed. At 85 min post injection, dPET acquisitions were performed using standard 90 s/bed. All dPET image data sets were reconstructed using Time-of-Flight and high-definition approaches with voxel volume = 2x2x2 mm3. A blinded reader panel using an Intellispace Portal workstation to assess background quality, image quality and lesion detectability reviewed the data sets.

RESULTS

All patients had evaluable dPET data sets (n = 58) for qualitative assessment of 18F biodistribution and osteoblastic activity. Faster dPET acquisitions demonstrated comparable 18F-avidity in both normal bone and osteoblastic lesion conspicuity when compared to standard acquisitions with no discordant osteoblastic lesions. Average SUVmean were comparable for 30 s/bed and 90 s/bed acquisitions for background skeletal muscle (0.8 +/- 0.1 and 0.7 +/- 0.1, respectively) and normal vertebral bone (7.1 +/- 1.6 and 7.6 +/- 1.7, respectively). Average SUVmax of 48 osteoblastic lesions were also comparable for 30 s/bed and 90 s/bed acquisitions (32.4 +/- 27.9 and 35.9 +/- 30.8, respectively).

CONCLUSION

There is an unmet clinical need to reduce PET image acquisition time for patients with symptomatic bony disease. This Phase Ib study demonstrates the clinical feasibility of rapid whole-body high-definition PET imaging with dPET technology.

CLINICAL RELEVANCE/APPLICATION

Digital PET technology enables substantially faster (3x) whole-body Na18F PET imaging with no loss of lesion detectability, image quality or quantitative accuracy.

RC211-15 Ga-68-PSMA Activity Optimization Based on List-Mode Phantom and Patient Data

Monday, Dec. 2 11:35AM - 11:45AM Room: S505AB

Participants
Jette Wielaard, MSc, Nieuwegein, Netherlands (*Presenter*) Nothing to Disclose
Jan Habraken, Nieuwegein, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Peter Brinks, PhD, Nieuwegein, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Jules Lavalaye, MD, PhD, Nieuwegein, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Ronald Boellaard, PhD, Amsterdam, Netherlands (*Abstract Co-Author*) Researcher, Koninklijke Philips NV

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PURPOSE

A study on optimization of Gallium-68 (68Ga) activity for 68Ga-prostate specific membrane antigen positron emission tomography/computed tomography (68Ga PSMA PET/CT) studies is achieved by finding the highest coefficient of variation (COV) acceptable for reliable image interpretation and quantification.

METHOD AND MATERIALS

To obtain images with different COV, lower activities were mimicked by reconstructions with shorter acquisition times. A 20 min/bed (2 bed positions) scan of the NEMA Image Quality phantom is acquired in list mode PET (Philips Gemini PET/CT), of which sphere 1 (d=10mm) is analysed (activity ratio 9:1 for spheres compared to background). First, to evaluate impact on image interpretation, the relationship of COV and contrast-to-noise ratio (CNR) is studied and assuming that the CNR should remain greater than 5 (Rose criterion). Secondly, the effect of COV on the difference between quantification results of two equivalent studies is analysed. Pairs of equivalent images were obtained by reconstruction of two non overlapping parts of list-mode data. Comparison was done by calculating the percentage difference of the SUVmean. The maximum allowable percentage difference was set at 20%.

RESULTS

Results show that at a COVmax <= 25% image interpretation (CNR >= 5) as well as image quantification (percentage difference >= 20%) are within acceptable limits. The phantom scan with a COV of 25% was acquired with an acquisition time of 114 s and a background activity concentration of 0.71 MBq/kg. This is translated to the clinical protocol by taking into account decay between injection and acquisition time and urine clearance, resulting in a clinical activity regimen of 3.5 MBq/kg*min at injection. To verify this activity regimen, 16 patients (6 MBq/kg*min) with a total of 27 lesions are included. Additional reconstructions were made to mimic the proposed activity regimen. Based on the CNR criterion no lesions greater than 10 mm are missed with this proposed activity regimen.

CONCLUSION

A COVmax of 25% leads to a proposed activity regimen of 3.5 MBq/kg*min at injection, which indicates that activity can be reduced by almost 50% for diagnostic readings of scans. This is supported by clinical images: none of the included lesions were missed using the newly proposed activity regimen.

CLINICAL RELEVANCE/APPLICATION

The injected activity for 68Ga-PSMA imaging studies can be reduced for diagnostic readings of scans.

RC211-16 Panel Discussion

Monday, Dec. 2 11:45AM - 12:00PM Room: S505AB

Participants
Nancy M. Swanston, RT, Houston, TX (*Presenter*) Nothing to Disclose
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Steve Cho, MD, Madison, WI (*Presenter*) Research Grant, General Electric Company; Consultant, Advanced Accelerator Applications SA;

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LEARNING OBJECTIVES

1) Discuss questions and issues related to new and emerging PET imaging agents for prostate cancer.

RC222

Advanced PET Imaging for Radiotherapy Planning and Response Assessment

Monday, Dec. 2 8:30AM - 10:00AM Room: N229

BQ NM PH RO

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 1.75

Participants
Paul E. Kinahan, PhD, Seattle, WA (*Moderator*) Research Grant, General Electric Company Co-founder, PET/X LLC

Sub-Events

RC222A State of the Art in PET Imaging

Participants
Paul E. Kinahan, PhD, Seattle, WA (*Presenter*) Research Grant, General Electric Company Co-founder, PET/X LLC

LEARNING OBJECTIVES

1) Understand the connections between the capabilities of PET imaging and clinical and research uses. 2) Become familiar with recent technical advances in PET imaging and tradeoffs. 3) Gain awareness of initiative in quantitative imaging for clinical trials.

RC222B Technical Challenges in the Integration of PET Imaging into Radiotherapy Treatment Planning

Participants
Stephen R. Bowen, PhD, Seattle, WA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Understand the differences between diagnostic and treatment planning PET/CT imaging technical requirements. 2) Become familiar with the source and propagation of technical errors in PET/CT-guided radiation therapy. 3) Gain awareness of technical design elements in PET/CT-guided radiation therapy clinical trials.

NMS-MOA

Nuclear Medicine Monday Poster Discussions

Monday, Dec. 2 12:15PM - 12:45PM Room: NM Community, Learning Center

NM

AMA PRA Category 1 Credit ™: .50

Participants
Sonya Y. Park, MD, Seoul, Korea, Republic Of (*Moderator*) Nothing to Disclose

Sub-Events

NM206-SD-MOA1 Diagnostic Performance FDG PET/CT-Guided Metabolic Biopsies in Thoracic Lesions

Station #1

Participants
Rajender Kumar, MBBS, Chandigarh, India (*Presenter*) Nothing to Disclose
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Anish Bhattacharya, Chandigarh, India (*Abstract Co-Author*) Nothing to Disclose
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PURPOSE

Conventional image-guided sampling is subjected to sampling error. In this prospective study, we aimed to establish the diagnostic values of the automated robotic arm (ARA) assisted FDG PET/CT-guided biopsies in thoracic lesions.

METHOD AND MATERIALS

From December 2014 to January 2019, patients with thoracic cavity lesions were recruited for FDG PET/CT guided biopsy. All patients underwent diagnostic PET/CT scan prior to PET/CT-guided percutaneous biopsy. The biopsies were done using a dedicated automated-robotic-arm assisted PET/CT-guided biopsy device on the same day of diagnostic PET/CT scan. The real-time tissue sample was retrieved after confirming the needle tip to the target lesion. The procedure-related complications, radiation exposure to the interventionist were also recorded. The histopathology reports were reviewed for accuracy of the procedure. For confirmation of negative results, clinical or imaging follow-up was done.

RESULTS

The study included 392 patients of thoracic lesions for PET/CT guided biopsy. Of these 310/392 (79.1%) were lung lesions, 72/392 (18.4%) mediastinal lesions and 10/392 (2.5%) pleural-based lesions. The lesions were successfully targeted 384/392 (97.9%) and yielded a pathological diagnosis. In the remaining eight patient repeat biopsy confirmed the diagnosis. Of these 236/392(60.2%) patients had prior inconclusive CT guided biopsies and PET-guided biopsy confirmed the pathological diagnosis in 230/236 (97.4%) patients. Of the 384 lesions which were targeted successfully, 310 were malignant, 70 benign and four had no disease even on follow up. The results were true positive in 378 lesions, false-positive in none, true negative in four and false-negative in eight. The procedure showed sensitivity, specificity, PPV, NPV and accuracy of 98.9%, 100%, 100%, 66.7%, and 98.9%, respectively. No immediate complications or delayed life-threatening events were observed.

CONCLUSION

PET/CT guided percutaneous biopsy of metabolically active thoracic lesions with ARA assistance accurate method for pathological diagnosis and shown a high diagnostic performance. It is highly practical and useful approach in patients with a previous inconclusive biopsy.

CLINICAL RELEVANCE/APPLICATION

FDG PET-guided biopsy has shown high diagnostic values especially in the patients with prior inconclusive CT guided biopsy to establish a conclusive pathological diagnosis and helped in further treatment planning

NM207-SD-MOA2 The Role of FDG-PET/CT in the Staging and Restaging of Cholangiocarcinoma: Results of a 10-Year Analysis

Station #2

Participants
Charles M. Intenzo, MD, Philadelphia, PA (*Presenter*) Nothing to Disclose
Edith P. Mitchell, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
James Posey, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Paras Lakhani, MD, Media, PA (*Abstract Co-Author*) Nothing to Disclose
Sung M. Kim, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

To evaluate the accuracy of FDG-PET/CT in the initial staging and restaging of cholangiocarcinoma (CCA), as well as its utility in response to therapy.

METHOD AND MATERIALS

Over the last decade a total of 88 patients diagnosed with CCA underwent FDG-PET/CT for either initial staging prior to surgery, for follow-up after therapy (chemotherapy, immunotherapy, or radiofrequency ablation), and for suspicion of recurrence (on clinical grounds or elevation of tumor markers).

RESULTS

In 86 of the 88 patients, FDG accumulated in the primary tumor, yielding a sensitivity of 97.7%. The SUV max ranged from 2.9 to 19.8. Intrahepatic metastases were seen in 25 patients, abdominal metastatic lymphadenopathy was seen in 33 patients, and distant metastases were seen in 48 patients. The latter group included lung, bone, splenic, adrenal, and peritoneal metastases. In 8 patients, the hypermetabolic abdominal lymph nodes were not enlarged by CT or MRI criteria. The bone metastases in 4 patients were either not seen or were outside the field of view on MRI or diagnostic CT, and the splenic metastases of one patient were not well-defined on CT. For staging, follow-up PET/CT demonstrated either improvement or progression of disease.

CONCLUSION

CCA and its metastases are highly FDG avid. Therefore, FDG-PET/CT is a highly sensitive imaging modality for the detection of primary and metastatic CCA.

CLINICAL RELEVANCE/APPLICATION

FDG-PET/CT is invaluable in the staging and restaging of cholangiocarcinoma, as well as determining response to therapy, thereby impacting patient management.

NM208-SD-MOA3 Fluorine-18 Labeled Hydroxyphenethylguanidines: Prospective PET Imaging Agents for the Detection and Localization of Adrenergic Malignancies

Station #3

Participants
Jonathan Pham, Ann Arbor, MI (*Presenter*) Nothing to Disclose
Benjamin L. Viglianti, MD,PhD, Ann Arbor, MI (*Abstract Co-Author*) Nothing to Disclose
Allen F. Brooks, PhD, Ann Arbor, MI (*Abstract Co-Author*) Nothing to Disclose
David Raffel, Ann Arbor, MI (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

While metaiodobenzylguanidine (MIBG), labeled with I-123 or I-131, is frequently used for single photon imaging of adrenergic tumors, it suffers from poor spatial resolution and sensitivity due to reversible uptake and trapping. The PET radiotracers 3-[18F]fluoro-*p*-hydroxyphenethylguanidine ([18F]3F-PHPG) and 4-[18F]fluoro-*m*-hydroxyphenethylguanidine ([18F]4F-MHPG) undergo norepinephrine transporter-mediated uptake and irreversible vesicular trapping, presenting an opportunity to address the inherent limitations of MIBG scintigraphy scans and visualize neuroendocrine tumors not amenable to detection with radiolabeled somatostatin analogues.

METHOD AND MATERIALS

Retrospective analysis was conducted in subjects previously imaged with [18F]3F-PHPG and [18F]4F-MHPG (4 whole body scans in healthy controls, 7-8 scans in heart failure patients for each tracer). For scans with one or both adrenals in the field of view, volumetric regions of interest (VOI) were drawn around the glands, with localization confirmed by corresponding CT when available. Tracer accumulation was quantified as maximum standardized uptake value (SUVmax) by PMOD (version 3.8).

RESULTS

Two adrenal glands were clearly visualized in 6/10 cases for [18F]3F-PHPG and 7/9 cases for [18F]4F-MHPG in images acquired approximately 60 minutes post-injection. SUVmax values were modest, averaging 6.44 ± 3.14 for [18F]3F-PHPG and 2.94 ± 0.78 for [18F]4F-MHPG (mean ± SD). The SUVmax ranges are comparable to those of 18F-fluorodopamine in normal control subjects (Timmers et al., 2007). In healthy control subjects, who underwent whole body imaging, background uptake in the abdominal region was lower for [18F]3F-PHPG compared to [18F]4F-MHPG. The time-activity profile of both tracers suggests specific uptake and trapping in the adrenal gland.

CONCLUSION

[18F]3F-PHPG and [18F]4F-MHPG localize in the human adrenal gland, supporting further characterization of their ability to detect malignancies characterized by overexpression of the norepinephrine transporter, including neuroendocrine tumors (e.g. pheochromocytoma, paraganglioma) and neuroblastoma.

CLINICAL RELEVANCE/APPLICATION

[18F]3F-PHPG and [18F]4F-MHPG localize in the human adrenal gland, supporting further characterization of their ability to detect malignancies characterized by overexpression of the norepinephrine transporter, including neuroendocrine tumors (e.g. pheochromocytoma, paraganglioma) and neuroblastoma.

NM232-SD-MOA4 18F-Fluciclovine PET/CT in Primary Staging of Prostate Cancer

Station #4

Participants
Erik M. Velez, MD, San Francisco, CA (*Presenter*) Nothing to Disclose
Jeremy Paluch, BS, Los Angeles, CA (*Abstract Co-Author*) Nothing to Disclose

Redmond-Craig Anderson, MD, Los Angeles, CA (*Abstract Co-Author*) Nothing to Disclose
Bhushan Desai, MBBS, MS, Los Angeles, CA (*Abstract Co-Author*) Nothing to Disclose
Hossein Jadvar, MD, PhD, Pasadena, CA (*Abstract Co-Author*) Investigator, SubtleMed; Investigator, ImaginAb, Inc

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PURPOSE

18F-fluciclovine positron emission tomography (PET) has been approved for imaging evaluation of patients with biochemical recurrence of prostate cancer, yet data is limited for its potential utility in primary staging. We present our early experience with 18F-fluciclovine PET/CT for primary staging of prostate cancer.

METHOD AND MATERIALS

Patients with biopsy proven prostate cancer underwent 18F-fluciclovine PET/CT at the discretion of the urologist between 2018-2019. All studies were interpreted by a board-certified nuclear radiologist according to established criteria and the ordering clinician was made aware of the results. Findings were compared to conventional imaging and a review of the clinical notes was performed to assess changes in clinical management. Based on extent of disease, patients were categorized into local disease - confined to the prostate, regional- metastases to pelvic lymph nodes, and distant- metastases to lymph nodes outside the pelvis or other organs.

RESULTS

7 patients underwent 18F-fluciclovine PET/CT at the time of primary staging of prostate cancer. The median age was 72 (interquartile range [IQR]: 14) years and the median serum PSA level was 12.0 (IQR 29.4) ng/mL. Based on conventional imaging 3 patients (43%) had local disease, 2 patients (29%) had regional disease, and 2 patients (29%) had distant disease. 18F-fluciclovine PET/CT and conventional imaging results were discordant in 5 patients (71%), with the detection of regional disease in 2 patients thought to have only local disease and detection of distant disease in 1 patient with regional disease on conventional imaging. In addition, 1 patient with presumed distant disease (sclerotic bone lesion with increased uptake on bone scintigraphy) was downstaged to local disease after negative 18F-fluciclovine PET/CT and 1 patient was downstaged from regional disease to local disease. Discordant 18F-fluciclovine PET/CT findings resulted in change of management in all 5 patients.

CONCLUSION

18F-fluciclovine PET/CT is contributory to primary staging of prostate cancer, which may lead to management change. Additional investigations are needed to assess the impact of 18F-fluciclovine PET/CT in primary staging of prostate cancer.

CLINICAL RELEVANCE/APPLICATION

18F-fluciclovine PET/CT may offer a more accurate means of staging prostate cancer compared to conventional imaging, ensuring patients receive appropriate upfront therapy.

NM230-SD-MOA5 Inflammation in Acute Aortic Intramural Hematoma: CTA and PET/CT Correlation

Station #5

Participants
Jose Miguel Escudero-Fernandez, MD, Barcelona, Spain (*Presenter*) Nothing to Disclose
Miguel A. Rios-Vives, MD , Barcelona, Spain (*Abstract Co-Author*) Nothing to Disclose
Gemma Burcet Rodriguez, MD, Barcelona, Spain (*Abstract Co-Author*) Nothing to Disclose
Alberto Roque, MD, Rubi, Spain (*Abstract Co-Author*) Nothing to Disclose
Maria Nazarena Pizzi, Barcelona, Spain (*Abstract Co-Author*) Nothing to Disclose
Santiago Aguade, MD, Barcelona, Spain (*Abstract Co-Author*) Nothing to Disclose
Marina Conangla-Planes, MD, Barcelona, Spain (*Abstract Co-Author*) Nothing to Disclose
Marta Gonzalo Carballes, BMBCh, Barcelona, Spain (*Abstract Co-Author*) Nothing to Disclose
Hug Cuellar Calabria, MD, Barcelona, Spain (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

CT angiography (CTA) is the first-line test in the diagnosis of acute aortic syndrome. The pathogenesis and natural history of aortic intramural hematoma (IMH) remains unclear. The presence of intimal lesions in the acute phase and a high metabolic activity in PET/CT have been described as predictors of adverse events. Our objectives are: To describe the presence of contrast enhancement in the aortic wall of acute IMH in the diagnostic CTA. To evaluate the intensity and heterogeneity of 18FDG uptake in PET/TC and its evolution during follow-up. To correlate the intensity and heterogeneity of contrast enhancement with the 18FDG uptake.

METHOD AND MATERIALS

12 patients were diagnosed with an acute type B IMH in a CTA performed for acute aortic syndrome at a median of 2.5 days from symptoms onset and were managed conservatively. A 18FDG PET/TC was performed in the subacute phase. The target to blood ratio (TBR) was defined as the relation between the SUVmax of IMH and the SUVmean of the blood pool, and regional heterogeneity as the SUVmax difference between the most and the least metabolically active aortic regions. Aortic wall enhancement was defined as the corrected HU difference between late and unenhanced CT acquisitions in the diagnostic CTA. Morphological characteristics of the IMH were also recorded (aortic diameter, IMH thickness and presence of ulcers)

RESULTS

In the diagnostic CTA, IMH thickness and aortic diameter were 10.1±5 mm and 41±7.3 mm, respectively, while 75% of patients presented ulcers. Aortic wall enhancement was 82%. SUVmax and TBR of IMH at the most active aortic region were 5.4±1.3 and 3.1±0.7. Regional heterogeneity was 31. There was no correlation between TBR and the thickness of IMH or the number of ulcers at the diagnostic CTA. TBR and aortic wall enhancement at the most active aortic region were correlated (Pearson r=0.72, p=0.008). Aortic wall enhancement was lower in the least metabolically active regions in comparison to the most active regions.

CONCLUSION

Aortic wall enhancement in the diagnostic CTA of IMH was correlated to 18FDG uptake in PET/CT and may be an inflammatory marker. Furthermore, contrast enhancement mirrored the regional variations in metabolic activity.

CLINICAL RELEVANCE/APPLICATION

Diagnostic CTA in patients with type B IMH can demostrate inflammatory activity in aortic wall and correlated to 18FDG uptake in PET/CT

NM127-ED-MOA6 Emergent Findings on PET/CT

Station #6

Participants
Daniel I. Warren, MD, Saint Louis, MO (*Presenter*) Nothing to Disclose
Malak Itani, MD, Clayton, MO (*Abstract Co-Author*) Nothing to Disclose
Vincent M. Mellnick, MD, Saint Louis, MO (*Abstract Co-Author*) Nothing to Disclose
Joyce C. Mhlanga, MBBCh, Saint Louis, MO (*Abstract Co-Author*) Nothing to Disclose

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TEACHING POINTS

Review incidental emergent findings on clinical PET/CT (F18-FDG, Ga68-Dotatae, C11-Choline, F18-Fluciclovine [FACBC]). Illustrative imaging examples showcasing the PET and CT findings of a variety of emergent findings. Review the clinical relevance of emergent findings on PET/CT in light of the molecular basis and mechanism of action of the tracer used. Highlight the importance of carefully evaluating the cross sectional imaging on the CT obtained for attenuation correction (CTAC).

TABLE OF CONTENTS/OUTLINE

1. Present a brief overview of normal distribution and physiologic uptake of commonly used clinical PET agents (F18-FDG, Ga68-Dotatae, C11-Choline, F18-Fluciclovine PET/CT). 2. Demonstrate emergent and important incidental findings unrelated to the underlying malignancy, with case examples including acute cholecystitis, complicated appendicitis, discitis, hydronephrosis, fractures, hemorrhagic brain metastases, pneumoperitoneum, etc. 3. Highlight the importance of careful and systematic review of the cross sectional imaging on the CT obtained for attenuation correction (CTAC) in addition to the PET findings. 4. Review the importance of early communication and appropriate follow-up of emergent findings which may impact patient outcome based on ACR guidelines.

NM128-ED-MOA7 Finding the Target for Therapy by Imaging: A Comprehensive Review of the Theranostics (Re)Emerging in Nuclear Medicine

Station #7

Awards
Magna Cum Laude
Identified for RadioGraphics

Participants
Jose F. Marin, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Felipe d. Barbosa, MD, Sao Paulo , Brazil (*Presenter*) Nothing to Disclose
Rafael F. Nunes, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Larissa B. Costa, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Marcelo A. Queiroz, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Carlos A. Buchpiguel, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose

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TEACHING POINTS

I. Understand the concept of theranostic, emphasizing the nuclear medicine perspective. II. Discuss the main theranostic procedures in nuclear medicine practice and the role of diagnostic imaging in selecting patients. III. Theranostic thinking is important to push imaging to a new level in nuclear medicine, since additional molecular features, prognostic and quantitative information will be required to better select appropriated treatments.

TABLE OF CONTENTS/OUTLINE

1. The rational of theranostics 2. Bringing theranostics to nuclear medicine context 3. Classical theranostic procedures in nuclear medicine a. 131I for Thyroid Differentiated Carcinoma b. 131I-mIBG for neural crest derived neoplasia c. Bone-seeking radiopharmaceuticals for bone pain palliation 4. Newer theranostic procedures in nuclear medicine a. SSTR PET/CT and PRRT: starting a new era in nuclear medicine theranostic b. PSMA-ligand radiopharmaceuticals c. Newer bone- seeking agents: new results to an old need d. Hepatic radioembolization under the theranostic point of view e. Other less frequent theranostic procedures 5. Perspectives: think each new diagnostic radiopharmaceutical as a theranostic

NMS-MOB

Nuclear Medicine Monday Poster Discussions

Monday, Dec. 2 12:45PM - 1:15PM Room: NM Community, Learning Center

BR NM

AMA PRA Category 1 Credit ™: .50

FDA Discussions may include off-label uses.

Participants
Sonya Y. Park, MD, Seoul, Korea, Republic Of (*Moderator*) Nothing to Disclose

Sub-Events

NM209-SD-MOB1 18F-FDG PET/CT Predicts the Expression of PD-1/PD-L1 Before Immunotherapy in Multiple Cancer Types

Station #1

Participants
Huimin Shan, Guangzhou, China (*Presenter*) Nothing to Disclose
Wei Fan, Guangzhou, China (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

18F-fluorodeoxyglucose positron emission tomography/computed tomography (18F-FDG PET/CT) is a molecular imaging technique that can provide metabolic information on malignant tumors. PD-L1 is widely expressed in tumor cells and PD-L1 antibodies produce efficacious clinical responses in diverse cancers. The purpose of this study is to evaluate the ability of quantitative 18F-FDG PET/CT parameters to predict the PD-1/PD-L1 status of cancer.

METHOD AND MATERIALS

251 patients with newly diagnosed or refractory recurrent malignant tumors who underwent 18F-FDG PET/CT scans before immunotherapy from January 2015 to December 2018 were retrospectively enrolled(malignant lymphoma, n=164; bronchial carcinoma, n=21; malignant melanoma, n=15; nasopharyngeal carcinoma, n=11; other, n=40).Maximum standardized uptake values(SUVmax), metabolic tumor volume(MTV) and total lesion glycolysis(TLG), were measured for the most active tumor site from PET/CT images. The expression of tumor cell PD-L1/ T cell PD-1 in fresh or archived pathologic specimens was analyzed by immunohistochemistry.

RESULTS

SUVmax in PD-1/PD-L1 positive was clearly higher than that in PD-1/PD-L1 negative(14.16 ± 6.87 vs. 10.21 ± 3.76, p=0.0004;16.31 ± 8.65 vs. 7.26 ± 3.34, p<0.0001), moreover, there was a positive correlation between SUVmax and PD-1/PD-L1 expression(Kendall's tau-b=0.153, p=0.073; Kendall's tau-b=0.248, p=0.010). Both TLG and MTV was obviously higher in PD-L1 positive than that in PD-L1 negative (1158.95 ± 2577.07 vs. 275.24 ± 472.69, p=0.001; 152.67 ± 280.35 vs. 60.73 ± 103.32, p=0.004), however, TLG and MTV seem to be no statistical significance with the PD-1 status. ROC curves analysis revealed that using an SUVmax cut-off value of 10.94, PD-L1 status could be predicted with the sensibility of 70.7% and specificity of 96.6%, and AUC is 0.861. Further Chi-Square analysis showed that the positive expression rate of PD-L1 differed significantly (2.8% vs. 97.2%, p<0.001) between the groups with the low and high frequency of SUVmax(cutoff>=10.94).

CONCLUSION

Superior 18F-FDG uptake is significantly associated with higher PD-1/PD-L1 expression in the malignant tumor, and SUVmax could be used to infer the PD-L1 status.

CLINICAL RELEVANCE/APPLICATION

18F-FDG PET/CT has the potential to become a useful complement to assist in making the clinical decision as to whether to use an anti-PD-1/PD-L1 antibody therapy.

NM210-SD-MOB2 18F-FTC-146 PET/MR in Women with Chronic Pelvic Pain: Early Results

Station #2

Participants
Angela M. Fast, MD, Stanford, CA (*Presenter*) Consultant, Arterys Inc
Mary Ellen I. Koran, MD, PhD, Stanford, CA (*Abstract Co-Author*) Nothing to Disclose
Peter Cipriano, BA, Stanford, CA (*Abstract Co-Author*) Nothing to Disclose
Daehyun Yoon, PhD, Stanford , CA (*Abstract Co-Author*) Research support, General Electric Company
Deirdre Lum, Palo Alto, CA (*Abstract Co-Author*) Nothing to Disclose
Sandip Biswal, MD, Stanford, CA (*Abstract Co-Author*) Research Grant, General Electric Company

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PURPOSE

Chronic pelvic pain affects 15% of women and has multiple etiologies, including gynecologic, gastrointestinal, musculoskeletal, urologic, and psychosocial conditions. Studies have shown up to half of these patients lack a clear diagnosis. Additionally, half of patients have more than one potential cause of pain, and targeting the pain generator can be challenging. 18F-FTC-146 is a highly specific radioligand that targets the sigma-1 receptor, which is upregulated in inflamed tissues. Prior studies have shown promising results in targeting neuropathic pain. This study investigates the use of this radiotracer in diagnosing the etiology of chronic pelvic pain in women.

METHOD AND MATERIALS

This IRB approved prospective observational study identified 5 women (ages 25-69) with pelvic pain for greater than 6 months. Patients underwent full body 18F-FTC-146 PET/MR with diagnostic MR imaging of the pelvis and completed surveys describing their pain at the time of the study. SUV values were compared to a preexisting database of asymptomatic female control patients.

RESULTS

All patients had increased radiotracer uptake compared to asymptomatic controls. A patient with history of stage 4 endometriosis and another patient with prior lysis of adhesions showed intense uptake along the bowel with SUV max of 4.1 (Figure 1), compared to SUV average max of 1.5 (SD 0.12), which may reflect underlying adhesions, distant endometrial implants, or bowel pathology. Another patient showed intense vaginal uptake with an SUV max of 5.5 (Figure 2), compared to SUV average max of 2.1 (SD 0.46), and the patient was clinically suspected to have vaginismus. Two patients showed intense uterine uptake with an SUV max of 7.0 (Figure 3), compared to SUV max average of 3.2 (SD 0.70).

CONCLUSION

Early results demonstrate the potential use of 18F-FTC-146 PET/MR in diagnosing pain generators outside the established use in neuropathic pain. This radiotracer may be helpful in identifying conditions that are currently challenging to diagnose with imaging, such as adhesive disease or distant endometrial implants, which could potentially both help diagnose and guide treatment for chronic pelvic pain.

CLINICAL RELEVANCE/APPLICATION

Chronic pelvic pain in women is a complex, multidisciplinary problem that is challenging to diagnose and treat. 18F-FTC-146 PET/MR may be a novel approach to targeting the pain generator in these patients to guide diagnosis and treatment.

NM211-SD-MOB3 Non-blood Sampling Assessment for Quantitative Cerebral Blood Flow in PET with 15O-labeled Oxygen Gas: Comparison with an Invasive Arterial Blood Sampling Method

Station #3

Participants
Yusuke Terakawa, Suita, Japan (*Presenter*) Nothing to Disclose
Atsushi K. Kono, MD, PhD, Suita, Japan (*Abstract Co-Author*) Nothing to Disclose
Akira Imoto, Suita, Japan (*Abstract Co-Author*) Nothing to Disclose
Akihide Shimizu, Suita, Japan (*Abstract Co-Author*) Nothing to Disclose
Yoshifumi Nouno, Suita, Japan (*Abstract Co-Author*) Nothing to Disclose
Keisuke Matsunaga, Suita, Japan (*Abstract Co-Author*) Nothing to Disclose
Masaji Fukumoto, Suita, Japan (*Abstract Co-Author*) Nothing to Disclose
Kazuto Harumoto, Suita, Japan (*Abstract Co-Author*) Nothing to Disclose
Emi Tateishi, Suita, Japan (*Abstract Co-Author*) Nothing to Disclose
Keisuke Kiso, MD, Suita, Japan (*Abstract Co-Author*) Nothing to Disclose
Satoshi Iguchi, Chiba, Japan (*Abstract Co-Author*) Nothing to Disclose
Hidehiro Iida, DSc,PhD, Suita City, Japan (*Abstract Co-Author*) Nothing to Disclose
Jun C Takahashi, Suita, Japan (*Abstract Co-Author*) Nothing to Disclose
Tetsuya Fukuda, Suita, Japan (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Evaluation of cerebral blood flow (CBF) is necessary for the monitoring or preoperative assessment of cerebral arterial stenotic disease. Positron emission tomography with 15O-labeled oxygen gas (O-PET) provides a precise quantification of CBF; however, the current method (DARG; dual-autoradiography) requires arterial blood sampling. Therefore, we proposed a novel CBF measurement method that does not need blood sampling (NBS; non-blood sampling). The aim of this study was to compare the values obtained with NBS-CBF to those obtained with DARG-CBF.

METHOD AND MATERIALS

We retrospectively reviewed a total of 12 patients with significant stenosis in the cervical intracarotid artery who underwent both DARG and NBS O-PET examinations. Regional CBF values were measured in the basal ganglia and cortex of the cerebral hemisphere for the diseased and non-diseased sites, respectively. The right-to-left ratio (RLR) was also evaluated. The variability between the two methods was assessed by measuring the intraclass coefficient (ICC). The inter-observer reproducibility was also tested.

RESULTS

In total, 144 regions of interest showed a good overall correlation between DARG and NBS (ICC=0.80, P<0.01), where ICC=0.83 for the diseased site and ICC=0.78 for the non-diseased sites. The RLR also showed an excellent correlation (ICC=0.89, P<0.01). Inter-observer reproducibility was very high (ICC=0.93, P<0.01).

CONCLUSION

Non-blood sampling could be an alternative to the invasive blood sampling method used in 15O-labeled oxygen gas PET scans.

CLINICAL RELEVANCE/APPLICATION

Oxygen gas PET provides an accurate and high quality image of the brain; however, the current method requires blood sampling. Our proposed non-blood-sampling method is less invasive, more time efficient, and more reliable. This new method could therefore

be an alternative to the current method.

NM233-SD-MOB4 Comparison of 18F-Fluciclovine PET/CT with Conventional Imaging in Prostate Cancer Patients with Biochemical Recurrence

Station #4

Participants
Hong Song, MD, Sunnyvale, CA (*Presenter*) Nothing to Disclose
Caitlyn Harrison, MD, Stanford, CA (*Abstract Co-Author*) Nothing to Disclose
Kip E. Guja, MD,PhD, Stanford, CA (*Abstract Co-Author*) Nothing to Disclose
Benjamin L. Franc, MD, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose
Farshad Moradi, MD, Stanford, CA (*Abstract Co-Author*) Nothing to Disclose
Guido A. Davidzon, MD, Stanford, CA (*Abstract Co-Author*) Nothing to Disclose
Carina Mari Aparici, MD, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose
Andrei Iagaru, MD, Emerald Hills, CA (*Abstract Co-Author*) Research Grant, General Electric Company Research Grant, Progenics Pharmaceuticals, Inc Research Grant, Advanced Accelerator Applications SA

PURPOSE

18F-Fluciclovine (Axumin®) PET/CT was approved by the FDA for diagnostic workup and disease localization in prostate cancer patients with biochemical recurrent (BCR). Here we present our experience with 18F-Fluciclovine PET/CT and compare it to other available conventional imaging modalities for disease detection and impact on patient management.

METHOD AND MATERIALS

We retrospectively reviewed 114 prostate cancer patients with BCR (50 to 86 year old, 71.9 ± 9.1) (from 12/2017 to 12/2018) who had 18F-Fluciclovine PET/CT after definitive treatment with prostatectomy (69 patients) and/or radiation therapy (45 patients). A total of 84 out of 114 patients had concurrent scans by at least one of the other imaging modalities available at our institution: CT (21 patients), MR (33 patients), 99mTc MDP bone scan (39 patients), 18F-NaF PET/CT (10 patients), 68Ga-PSMA-11 PET/CT (11 patients) and 18F-DCFPyL PET/CT (7 patients). Changes in management after 18F Fluciclovine PET/CT were also recorded.

RESULTS

For anatomic imaging, 33/48 (69%) CT or MRI have congruent findings of BCR with Fluciclovine PET, while Fluciclovine PET was positive in 15/48 (31%) cases with negative CT or MRI. For detection of bone metastases, 35/47 (74 %) of dedicated bone imaging (30 bone scan and 5 NaF PET) were congruent with Fluciclovine PET findings, while 10/47 (21%) of positive dedicated bone imaging (6 bone scan and 4 NaF PET) had no corresponding uptake on Fluciclovine PET. When compared to PSMA based PET/CT, 10/18 (56%) PSMA PET (6 PSMA11 and 4 DCFPyL) were congruent with Fluciclovine PET positivity, while 4/18 PSMA PET (2 PSMA11 and 2 DCFPyL) detected different lesions from Fluciclovine PET. In addition, another 4/18 (22 %) patients with negative Fluciclovine PET had disease localization on PSMA PET (3 PSMA11 and 1 DCFPyL). The clinical management was changed by starting radiation therapy or androgen deprivation therapy based on Fluciclovine PET findings in 41/114 patients (36 %) who had negative conventional imaging.

CONCLUSION

18F Fluciclovine PET/CT is a useful diagnostic tool in the work-up of prostate cancer patients with BCR as it changed clinical management in 36 % of participants who had negative conventional images in our cohort.

CLINICAL RELEVANCE/APPLICATION

18F Fluciclovine PET/CT alters clinical management of prostate cancer patients with biochemical recurrence.

NM231-SD-MOB5 Trends in Brain Death Scintigraphy at a Tertiary Care Trauma Center

Station #5

Participants
Reza Assadsangabi, MD, Philadelphia, PA (*Presenter*) Nothing to Disclose
Ilya M. Nasrallah, MD, PhD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Jacob G. Dubroff, MD, PhD, Philadelphia, PA (*Abstract Co-Author*) Speaker, Ion Beam Applications SA; Research Grant, Voyager Therapeutics

PURPOSE

Nuclear medicine brain perfusion imaging is used as an ancillary test for determining the brain death per 2010 American Academy of Neurology guidelines (Neurology, 2010; 74(23) 1911-18.). The purpose of this study is to examine differences in demographics, precipitating events, and decision for organ donation of patients who underwent brain death scintigraphy.

METHOD AND MATERIALS

Nuclear medicine brain death perfusion studies conducted per standard of care within the University of Pennsylvania Health System from 2006 through 2018 were identified. Utilization was compared to historical studies performed from 1991-2005. These studies were analyzed for result (+/-), contributing event to clinical brain death status, patient demographics, and whether to proceed to organ donation.

RESULTS

126 studies were identified that were performed on 124 patients. 66% of patients were male with a mean age of 42.9 years (SD+/-19 years). Over the study period, a mean of 0.9 studies were performed per month and 93.5% of studies were positive for brain death, compared to 1 study per month with 74% positive from 1991-2005 representing a significant increase in the rate of positive studies (chi square, $p<0.0001$). Contributing causes included trauma (n=51, 41%), cardiopulmonary arrest (n=36, 29%), CVA (n=29, 23%), and toxin/other (n=8, 6%) who differed significantly in mean age (33.6, 50.1, 54, and 31.1, respectively, single factor ANOVA $p<0.0001$). Trauma cases were further subcategorized into gunshot wounds (n=29, 57%), motor vehicle accidents (n=15, 29%), and falls (n=7, 14%). These trauma subgroups also significantly differed in mean age (27.4, 37.3, and 50.9, respectively, single factor ANOVA $p<0.001$) and there were significantly (chi square, $p=0.03$) higher percentage of males relative the overall cohort ($p=0.03$). 60% (70/116) patients with positive studies went on to organ donation.

CONCLUSION

The rate of positive brain death scans has significantly increased while the utilization scintigraphy has mildly decreased relative to an internal historical comparison perhaps due to more stringent patient selection. The rate of organ donation has been stable (JAMA, 2002; 288(17): 2121-2.). Significant demographic differences exist based on precipitating event.

CLINICAL RELEVANCE/APPLICATION

Despite changes in utilization and results, brain death scintigraphy remains an important clinical tool as a bridge to organ donation.

NM129-ED-MOB6 Prostate Cancer Imaging with 18F-Fluciclovine PET/CT: Physiologic Distribution, Clinical Applications, Interpretation Criteria and Pitfalls

Station #6

Participants
Daniella F. Pinho, MD, Dallas, TX (*Presenter*) Nothing to Disclose
Asha Kandathil, MD, North Richland Hills, TX (*Abstract Co-Author*) Nothing to Disclose
Orhan K. Oz, MD,PhD, Dallas, TX (*Abstract Co-Author*) Nothing to Disclose

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TEACHING POINTS

1. Discuss the indications of 18F-Fluciclovine PET/CT and its utility in prostate cancer 2. Overview of study interpretation, patters of uptake, pitfalls 3. Review of overall performance of the tracer based on current literature

TABLE OF CONTENTS/OUTLINE

1- Overview of prostate cancer 2- Biochemical recurrence - definition 3- Limitations of conventional imaging for recurrence evaluation (CT, bone scan, MRI) 4- Properties and kinetics 5- Imaging protocol 6- Physiologic distribution a. Bladder activity, muscular uptake 7- Interpretation criteria a. Prostate, prostatic bed, typical lymph nodes b. Atypical lymph nodes c. Bones 8- Pitfalls 9- Atypical presentations 10- Overall performance a. Compared to CT b. Compared to other prostate specific PET agents c. Performance in bone lesions 11- Fluciclovine PET/CT at initial staging 12- Impact on therapy management

NM130-ED-MOB7 What is That Bright Spot? Mimics and Pitfalls in PET CT Scans in Oncological Imaging

Station #7

Participants
Srujana Ganti, MBChB, Manchester, United Kingdom (*Presenter*) Nothing to Disclose
Joe Mercer, BMBCh, BMedSc, Bolton, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Rohit Kochhar, MD, Manchester, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Yatin Jain, MBBS,FRCR, Manchester , United Kingdom (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

PET CT scans are becoming integral in the diagnosis and treatment surveillance in oncological imaging. The purpose of this exhibit is to present a comprehensive pictorial review of mimics and pitfalls to aid pattern recognition when evaluating these cases. The learner should aim to have a greater undertanding of the topic and be equipped with a framework to evaluate these cases in clinical practice.

TABLE OF CONTENTS/OUTLINE

The exhibit will include an overview of the pathophysiology of FDG uptake and showcase anatomical, physiological and pathological processes which may mimic malignancy. Tips and tricks to help with pattern recognition will also be provided. Pitfalls of poorly FDG avid/inavid malignancies are highlighted with examples of sites of metastases as well as incidentally identified tumours. Additionally, an interesting series of cases will be presented as a self assessment based on a similar theme to reinforce the learner's knowledge.

SPSP21

Contrastes y Trazadores: Estado del Art-Sesion del Colegio Interamaricano de Radiologia (CIR) en Espanol/Contrast Agents and Radiopharmaceuticals: State of the Art-Session of Interamerican College of Radiology (CIR) in Spanish

Monday, Dec. 2 1:30PM - 3:30PM Room: E353C

CT GI MR NM SQ US

AMA PRA Category 1 Credits ™: 2.00
ARRT Category A+ Credits: 2.25

FDA Discussions may include off-label uses.

Participants
Jose L. Criales, MD, Huixquilucan, Mexico (*Moderator*) Nothing to Disclose
Jorge A. Soto, MD, Boston, MA (*Moderator*) Royalties, Reed Elsevier

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LEARNING OBJECTIVES

1) Conocer el uso actual, ventajas y desventajas de los medios de contraste en diferentes modalidades y en diversas situaciones clinicas. 2) Conocer los diversos trazadores, ademas de FDG, analizando su metabolismo normal y las indicaciones mas frecuentes. 1) Understand the current indications, benefits and limitations of the use of contrast agents for various imaging modalities. 2) Review the various types of radiotracers available today for PET Imaging, along with their normal metabolism and common indications for their use.

Sub-Events

SPSP21A Bienvenida/Welcome

Participants
Jose L. Criales, MD, Huixquilucan, Mexico (*Presenter*) Nothing to Disclose
Jorge A. Soto, MD, Boston, MA (*Presenter*) Royalties, Reed Elsevier

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SPSP21B Aplicaciones de Contraste en Ultrasonido/Use of Contrast Agents in Ultrasonography

Participants
Alison C. Harris, MBChB, Vancouver, BC (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Review the general principles and technique of using CEUS in the abdomen. 2) Discuss the role of CEUS in the diagnosis and characterization of masses in the liver and kidney. 3) Briefly discuss other applications of CEUS including guiding interventional procedures and monitoring of therapy.

ABSTRACT

Contrast-enhanced ultrasound (CEUS) continues to gain traction as a technique that complements traditional B-mode and Doppler ultrasound in the evaluation of the liver and other organs. Because the micro-vasculature can be visualized with CEUS and real-time imaging of tissue perfusion can be performed, imaging with this technique yields supplementary information, including flow and perfusion kinetics.The contrast agent used in CEUS is comprised of microbubbles, which are injected into a peripheral vein. The microbubble composition varies depending on the agent used, but the agent typically consists of an inert gas encased by a stabilizing shell composed of phospholipid, galactose, or albumin. The microbubbles circulate in the bloodstream and oscillate irregularly at low mechanical index settings within the acoustic field, creating nonlinear reflections that resonate at diagnostic ultrasound frequencies (3-5 MHz) and increase the signal produced.Proper technique and optimization of contrast-enhanced ultrasound require a balance between maintaining the integrity of the microbubble contrast agent and preserving the ultrasound signal. Established and emerging applications in the liver include diagnosis and characterization of focal lesions, aiding ultrasound-guided intervention, monitoring of therapy, and aiding surgical management.Read More: https://www.ajronline.org/doi/10.2214/AJR.17.17843Read More: https://www.ajronline.org/doi/10.2214/AJR.17.17843Read More: https://www.ajronline.org/doi/10.2214/AJR.17.17843

SPSP21C Uso de Agentes Organoespecificos en RM de Higado/Use of Organ-specific Agents in MR of the Liver

Participants
Claudio Bonini, MD, Rosario, Argentina (*Presenter*) Speaker, Bayer AG

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LEARNING OBJECTIVES

1) Medios de contraste hepatoespecíficos por MR. 2) Estructura molecular y su interacción a nivel celular. 3) Indicaciones actuales. 4) Ventajas y desventajas en comparación con los contrastes convencionales. 5) Contraindicaciones / 1) Hepatospecific contrast by MR. 2) Molecular structure and interaction at the cellular level. 3) Current indications. 4) Advantages and disadvantages compared to conventional contrasts. 5) Contraindications.

SPSP21D PET-CT: Radiotrazadores Mas Alla de FDG/PET-CT: Beyond FDG

Participants
Belen Rivera Bravo, MD, Mexico City, Mexico (*Presenter*) Nothing to Disclose

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LEARNING OBJECTIVES

1) Identify PET/CT radiopharmaceuticals other than FDG, used in clinical practice. 2) Describe the uptake mechanism of each radiopharmaceutical. 3) Differentiate the normal biodistribution of each radiopharmaceutical by reading the images of the study. 4) Recognize the clinical indication of each radiopharmaceutical based in the uptake mechanism. / 1) Al final de esta actividad, los participantes deberán ser capaces de. 2) Identificar radiofármacos de PET/CT diferentes al FDG utilizados en la práctica clínica. 3) Describir el mecanismo de concentración de cada radiofármaco. 4) Diferenciar la biodistribución habitual de cada radiofármaco al observar las imágenes del estudio. 5) Reconocer la indicación clínica de cada radiofármaco basado en su mecanismo concentración.

SPSP21E Preguntas/Q&A

SPSP21F Presentacion del CIR/CIR Update

Participants
Henrique Carrete Jr, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Present the Inter-American College of Radiology and its main educational activities. 2) Address the activities of the CIR throughout the year 2019. 3) Outline future directions of CIR.

SPSP21G Contraste Oral en TC: Nunca, Siempre O Algunas Veces?/Oral Contrast for Abdominal CT: Never, Always or Sometimes?

Participants
Antonio Jose B. Madureira, MD, Porto, Portugal (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To understand the rationale for the use of oral contrast agents in CT examinations.2) To become familiar with the major indications of oral contrast use.3) To discuss the benefits and drawbacks of their use.

ABSTRACT

There has been a gradual decline in the last years in the use of oral contrast agents in CT examinations. In spite of these there are some clinical scenarios in which their use is of great benefit as it can clearly establish a diagnosis.In the emergency setting and in patients suspected of high-grade bowel obstruction their use is not warranted and may even be contraindicated.Oral contrast agents administration still has a role in CT imaging and every radiologist should be familiar with their indications and benefits in specific clinical situations.

SPSP21H Daño Renal Agudo por Contraste Iodado: Conceptos Actuales/Iodine Contrast Induced Acute Kidney Injury: Current Concepts

Participants
Cristian Varela, MD, Santiago, Chile (*Presenter*) Nothing to Disclose

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LEARNING OBJECTIVES

1) Revisar la definición actual de daño renal agudo inducido por medio de contraste iodado/Review the current definition of contrast induced acute renal injury. 2) Conocer las características de los pacientes en riesgo/To know the characteristics of the high risk patients. 3) Definir las medidas de prevención basadas en la evidencia que el radiologo debe conocer y practicar/Define the evidence based prevention that the radiology need to know and apply.

SPSP21I Retencion de Gadolinio/Gadolinium Retention

Participants
Juan E. Gutierrez, MD, Medellin, Colombia (*Presenter*) Speakers Bureau, Bayer AG

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LEARNING OBJECTIVES

1) Define the classification of GBCAs based on molecular structure and other physicochemical properties. 2) Discuss current

literature regarding deposition of gadolinium in the brain (Clinical - Pre Clinical). 3) Describe the relationship between the type of contrast agents and gadolinium deposition in brain Describe FDA, ACR, and European Medicines Agency (EMA) guidelines for GBCA usage.

ABSTRACT

Gadolinium Based Contrast Agents (GCBA) had been part of MRI environment for three decades with great benefits on the development of imaging as well as helping radiologists to achieve a better knowledge of the human body and its diseases. So far more than 500 million injections of GCBA's have been applied Worldwide, initially and for many years GBBA's were believed to be a harmless solution, to the point of being used as contrast for DSA and also in double or triple dose for MRI, however, in 2006 evidence of Gadolinium retention in tissues was published proving its link with Nefrogenic Systemic Fibrosis (NSF) in renal impaired patients. This situation triggered multiple academic and regulatory evaluations, involving the pharma industry to define the risk benefit of using GBCA's depending on its safety profile, plus new warning regulations and classification for this agents issued by the FDA, EMA and ACR. New evidence of Gadolinium deposition in the brain, specifically locate at Dentate Nucleus and Globus Pallidus, after multiple GCBA's injections in patients with normal kidney function was recently published (2014), and gives again new evidence of the potential harmful effect of Gadolinium in tissues. This situation brought a new regulatory environment with different approach by the FDA and EMA, as well as a new challenge for the MRI practice worldwide.

SPSP21J **Preguntas/Q&A**

SPSP21K **Clausura/Closing**

Participants
Jose L. Criales, MD, Huixquilucan, Mexico (*Presenter*) Nothing to Disclose
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Printed on: 10/29/20

SPAI23

RSNA AI Deep Learning Lab: Generative Adversarial Networks (GANs)

Monday, Dec. 2 3:00PM - 4:30PM Room: AI Showcase, North Building, Level 2, Booth 10342

AI CT MR NM

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 1.75

Participants
Bradley J. Erickson, MD, PhD, Rochester, MN (*Presenter*) Board of Directors, VoiceIt Technologies, LLC; Stockholder, VoiceIt Technologies, LLC; Board of Directors, FlowSigma, LLC; Officer, FlowSigma, LLC ; Stockholder, FlowSigma, LLC

Special Information

In order to get the best experience for this session, it is highly recommended that attendees bring a laptop with a keyboard, a decent-sized screen, and the latest version of Google Chrome. Additionally, it is recommended that attendees have a basic knowledge of deep learning programming and some experience running a Google CoLab notebook. Having a Gmail account is also helpful. Here are instructions for creating and deleting a Gmail account.

ABSTRACT

This course describes a more recent advance in deep learning known as Generative Adversarial Networks (GANs). GANs are a deep learning technology in which a computer is trained to create images that look very 'real' even though they are completely synthetic. Getting 'large enough' data sets is a problem for most deep learning applications, and this is particularly true in medical imaging. This may be one way to address the 'data shortage' problem in medicine. GANs have also been created that can convert MRIs to CTs (e.g. for attenuation correction with MR/PET).

Printed on: 10/29/20

SSE17

Nuclear Medicine (Cardiovascular PET)

Monday, Dec. 2 3:00PM - 4:00PM Room: S403A

CA NM VA

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

FDA Discussions may include off-label uses.

Participants
Peter S. Conti, MD, PhD, Los Angeles, CA (*Moderator*) Consultant, Canon Medical Systems Corporation; Consultant, Bayer AG; Consultant, Lantheus Medical Imaging, Inc;
Don C. Yoo, MD, Lexington, MA (*Moderator*) Consultant, inviCRO, LLC

Sub-Events

SSE17-01 To Evaluate the Role of 18F-FDG PET/CT in Prosthetic Vascular Graft Infection

Monday, Dec. 2 3:00PM - 3:10PM Room: S403A

Participants
Sikandar M. Shaikh, DMRD, Hyderabad, India (*Presenter*) Nothing to Disclose

PURPOSE

Graft infection after prosthetic vascular reconstruction is an uncommon nowadays due to utmost psot surgical care however severe complication. The clinical presentation is often subtle and nonspecific and may occur long after surgery. Although defining a prosthetic vascular graft infection can be difficult, early diagnosis and treatment are important because of the relatively high rates of amputation and death. The present study assessed the role of PET/CT using 18F-FDG for the diagnosis of vascular graft infections

METHOD AND MATERIALS

Nineteen patients (15 men and 4 women; age range, 44-71 y) with suspected vascular graft infection underwent 18F-FDG PET/CT. The performance of PET/CT for the diagnosis of an infectious process and its localization to the graft or soft tissues was assessed. The final diagnosis was based on histopathologic findings and microbiologic assays obtained at surgery or on clinical and imaging follow-up.

RESULTS

PET/CT detected foci of increased 18F-FDG uptake suspected as infection in 14 patients and localized these findings to the graft in 8 patients. Vascular graft infection was confirmed in 7 of these patients (88%). PET/CT excluded graft involvement in 5 patients, and in 5 (91%) of these 5, long-term follow-up further confirmed that the infectious process was limited to surrounding soft tissues only. No abnormal 18F-FDG uptake was found in any of the 6 patients with no further evidence of infection. PET/CT had a sensitivity of 93%, specificity of 91%, positive predictive value of 88%, and negative predictive value of 96% for the diagnosis of vascular graft infection.

CONCLUSION

18F-FDG PET/CT is a reliable noninvasive imaging modality for the diagnosis of vascular graft-related infection. The precise anatomic localization of increased 18F-FDG uptake provided by PET/CT enables accurate differentiation between graft and soft-tissue infection.

CLINICAL RELEVANCE/APPLICATION

Thus 18F-FDG PET/CT is a reliable noninvasive imaging modality for the diagnosis of vascular graft-related infection

SSE17-02 Usefulness of ^{11}C-PiB PET/CT for Diagnosing Cardiac Amyloidosis

Monday, Dec. 2 3:10PM - 3:20PM Room: S403A

Participants
Takashi Norikane, Kita-gun, Japan (*Presenter*) Nothing to Disclose
Yuka Yamamoto, MD, PhD, Kita-Gun, Japan (*Abstract Co-Author*) Nothing to Disclose
Yasukage Takami, Mikicho, Japan (*Abstract Co-Author*) Nothing to Disclose
Katsuya Mitamura, Kita, Japan (*Abstract Co-Author*) Nothing to Disclose
Yukito Maeda, Kita-gun, Japan (*Abstract Co-Author*) Nothing to Disclose
Nobuyuki Kudomi, Kagawa, Japan (*Abstract Co-Author*) Nothing to Disclose
Takahisa Noma, Kita, Japan (*Abstract Co-Author*) Nothing to Disclose
Yoshihiro Nishiyama, MD, Kagawa, Japan (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

11C-Pittsburgh compound B (PiB) has been promising PET tracer for evaluating amyloid deposition in myocardium. The purpose of this study was to investigate the usefulness of PiB PET/CT for the detection of cardiac amyloidosis using retention index (RI)

images and standardized uptake value (SUV) images.

METHOD AND MATERIALS

PiB PET/CT studies were performed in 12 patients with cardiac amyloidosis (ATTR: 5, AL: 5, AA: 1 and unknown: 1) and 6 patients without cardiac amyloidosis. A 30-min dynamic emission scan of the heart was obtained immediately after bolus injection of PiB. The RI was calculated as the mean PiB radioactivity concentration between 15 and 25 min after injection divided by the integral of the arterial time-activity curve between 0 and 20 min after injection. The SUV images (at 10-20 min and 20-30 min) were reconstructed. RI and SUV images were visually evaluated. SUV images were also semiquantitatively evaluated using myocardium-to-blood pool ratio (MBR).

RESULTS

PiB uptake was visually evident in all 12 patients with cardiac amyloidosis on RI image, in 11/12 patients on 10-20min SUV image and in 7/12 patients on 20-30min SUV image. Myocardial PiB uptake was not observed in all 6 patients without cardiac amyloidosis on both SUV and RI images. The mean (±SD) value of MBR in cardiac amyloidosis on SUV images at 10-20 min and 20-30 min was significantly higher (2.01±0.78 and 1.70±0.75, respectively) than that of patients without cardiac amyloidosis (1.07±0.13 and 0.92±0.14, respectively) (p=0.010 and 0.024). With a cutoff MBR of 1.5 on 10-20min SUV image, the sensitivity and specificity were 100% and 92%, respectively. The mean (±SD) value of MBR in AL type cardiac amyloidosis patients on SUV images at 10-20 min and 20-30 min was higher (2.36±1.12 and 1.98±1.10, respectively) than that of ATTR type cardiac amyloidosis patients (1.88±0.18 and 1.65±0.20, respectively), however, there were no significant differences between two types of cardiac amyloidosis.

CONCLUSION

These preliminary results indicate that PiB PET/CT using RI images and SUV images were likely to be a useful imaging modality for cardiac amyloidosis.

CLINICAL RELEVANCE/APPLICATION

PiB PET/CT using RI images and SUV images were likely to be a useful imaging modality for diagnosing cardiac amyloidosis.

SSE17-03 Varying Correlation between Inflammation and Microvascularization in Carotid Atherosclerotic Plaques with Hybrid 18^F-FDG PET/MR

Monday, Dec. 2 3:20PM - 3:30PM Room: S403A

Participants
Yue Zhang, MD, Beijing, China (*Presenter*) Nothing to Disclose
Jie Lu, MD, PhD, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Hongwei Yang, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Jie Ma, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Haiqing Song, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Qingfeng Ma, Beijing, China (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

Hallmarks of vulnerable atherosclerotic plaques are inflammation that can be quantitatively assessed with 18F-fluorodeoxyglucose positron emission tomography (18F-FDG-PET), and increased neovascularization that can be evaluated by dynamic contrast-enhanced magnetic resonance imaging (DCE-MRI). It remains unclear whether these parameters are correlated or represent independent imaging parameters. This study determines to investigate the correlation between inflammation and neovascularization in atherosclerotic carotid plaques by performing hybrid 18F-FDG PET/MR.

METHOD AND MATERIALS

Twenty-five patients with transient ischemic attack or minor stroke in the carotid territory and ipsilateral carotid artery stenosis of 30% to 69% were included. All patients underwent hybrid PET/MR a median of 180 min after injection of 18F-FDG. 18F-FDG standard uptake values with target/background ratio (TBR) were determined. Neovascularization was quantified by transfer constant (Ktrans). Spearman rank correlation coefficients between TBR and Ktrans were calculated.

RESULTS

Results: The correlation between TBR and Ktrans was only marginal in the whole study sample (r=0.25, p=0.043). The two variables correlated with each other in the symptomatic plaques (r=0.71, p=0.013), but were independent in the asymptomatic plaques (r=0.03, p=0.473). Neither TBR nor Ktrans was significantly higher in the symptomatic plaques, but both showed inverse relationships with time since last cerebrovascular ischemic event (r=-0.92 and -0.74 for TBR and Ktrans, respectively).

CONCLUSION

The correlation between inflammation and microvascularization in carotid atherosclerotic plaques with hybrid 18F-FDG PET/MR varied with clinical conditions, pointing to a complex interplay between macrophages and neovessels under different pathophysiological conditions. The moderate correlation shown only in symptomatic plaques indicates the presence of acute plaque inflammation with increased metabolic activity and cytokine production by inflammatory cells. Hybrid 18F-FDG PET/MR systems can help to evaluate the correlation between inflammation and microvascularization in carotid atherosclerotic plaques.

CLINICAL RELEVANCE/APPLICATION

Hybrid 18F-FDG PET/MR systems can help to evaluate the correlation between inflammation and microvascularization in carotid atherosclerotic plaques and this exam is recommended when the underlying cause of such a lesion is unclear.

SSE17-04 Brown Fat Activation Demonstrated on FDG PET/CT Predicts Favorable Lipid Profile and Reduced Risk of Diabetes

Monday, Dec. 2 3:30PM - 3:40PM Room: S403A

Participants
Sonya Y. Park, MD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose

PURPOSE

Brown adipose tissue (BAT) plays a key role in energy homeostasis, conferring protection against diet-induced obesity, and has even been suggested as a potential target for the treatment of obesity and metabolic syndrome. The purpose of this study was to compare the metabolic outcomes (lipid profile and diabetes) of patients with and without BAT activity on FDG PET/CT.

METHOD AND MATERIALS

PET/CT exams from 1834 breast cancer patients were retrospectively reviewed for bilateral symmetric elongated FDG activity in the neck and chest, typical of BAT activation. To account for temperature changes in the environment, patients with BAT activity and those who underwent PET/CT exams on the same day (but without BAT activity) were included in the study. Blood glucose, lipid profile and presence of diabetes at baseline and last clinical follow-up (mean follow-up of 57 months) were recorded. Comparison of the groups with and without BAT activity was done using Mann Wwhithney U-test. Development of diabetes was analyzed with respect to the other clinical variables using Cox proportional hazard model.

RESULTS

1.1% (20/1834) of the patients who underwent PET/CT demonstrated BAT activation, and 119 patients were analyzed for comparison as the group without BAT activity. The group with BAT activity showed significantly lower age (mean 41.8 vs. 53.7, p<0.001), BMI (mean 22.0 vs. 23.6, p=0.049), blood glucose (mean 90.3 vs. 109.3, p=0.029) and total cholesterol (mean 169.4 vs. 190.4, p=0.029) than the group without. At last clinical follow-up, the group with BAT activity showed little change in terms of triglyceride and total cholesterol levels, but increased HDL (mean 45.5 to 60.8) and decreased LDL (mean 115.5 to 85.6). Presence of BAT activity was the only statistically significant predictor for diabetes on Cox regression (p=0.014), with a hazard ratio of -9.007.

CONCLUSION

Patients with BAT activity demonstrated the characteristic traits of lower age, BMI, blood glucose and total cholesterol at baseline, and showed a favorable change in lipid profiled on follow-up. The hazard for this group was also lower than for the group without BAT activity in terms of diabetes, further suggesting the role of brown fat in lipoprotein metabolism.

CLINICAL RELEVANCE/APPLICATION

Mention of brown adipose tissue activity is recommended when visualized on FDG PET/CT, due to the added information it offers regarding lipoprotein metabolism.

SSE17-05 Assessment of Aortic Involvement in Takayasu Arteritis with FDG PET during the Immunosuppressive Therapy

Monday, Dec. 2 3:40PM - 3:50PM Room: S403A

Participants
Emi Tateishi, Suita, Japan (*Presenter*) Nothing to Disclose
Keisuke Kiso, MD, Suita, Japan (*Abstract Co-Author*) Nothing to Disclose
Yoshifumi Nouno, Suita, Japan (*Abstract Co-Author*) Nothing to Disclose
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Yusuke Terakawa, Suita, Japan (*Abstract Co-Author*) Nothing to Disclose
Akira Imoto, Suita, Japan (*Abstract Co-Author*) Nothing to Disclose
Yasutoshi Ohta, MD, Suita, Japan (*Abstract Co-Author*) Nothing to Disclose
Atsushi K. Kono, MD, PhD, Suita, Japan (*Abstract Co-Author*) Nothing to Disclose
Tetsuya Fukuda, Suita, Japan (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

F-18 fluorodeoxyglucose (FDG) positron emission tomography (PET) is a promising technique for the diagnosis of Takayasu arteritis (TAK). The severity of FDG uptake in the aortic wall is often evaluated by the comparison with liver uptake; whereas, the FDG uptake in the liver has been discussed to be affected by prednisone (PSL) and tocilizumab (TCZ), which are the common treatment of TAK. Moreover, the optimal evaluation of aortic involvement with FDG PET in TAK during the immunosuppressive therapy (IST) has not been established enough. The aim of this study was to elucidate the influence of PSL and TCZ on liver FDG uptake and to find out the appropriate assessment of FDG uptake in the aortic wall in TAK patients during IST.

METHOD AND MATERIALS

Twenty-five consecutive TAK patients during IST were examined with FDG PET. We excluded 6 patients with a history of total arch replacement. Of 19 patients, 11 patients were treated with only PSL (PSL group) and 8 patients received TCZ with/without PSL (TCZ group). First, the maximum standardized uptake value (SUVmax) of the aortic wall, liver, and lumen blood pool was calculated. Next, the aortic wall to liver FDG uptake ratio [target-to-liver uptake ratio (TLR)] and the aortic wall to lumen ratio [target-to-background ratio (TBR)] were determined. Furthermore, TLR and TBR were compared between the patients remaining symptoms (Active, n=12) and the patients with no clinical complaint (Inactive, n=7).

RESULTS

First, SUVmax in the liver was significantly lower in TCZ group than PSL group (2.36±0.15 vs. 3.08±0.13, p<0.01). Secondly, there was no significant difference in TLR between Active and Inactive; on the other hand, TBR was significantly higher in Active than Inactive (1.45±0.07 vs. 1.14±0.09, p=0.01). Based on ROC curve analysis, the optimal TBR cut-off value for detecting active inflammation in the aortic wall was 1.35 with the sensitivity of 72% and specificity of 100%.

CONCLUSION

Since liver FDG uptake was susceptible to IST, the comparison with the liver uptake might not be recommended for the assessment of persistence or recurrence of aortic involvement with FDG PET. TBR is more appropriate to evaluate the aortic involvement in TAK during IST.

CLINICAL RELEVANCE/APPLICATION

IST for TAK affects the FDG distribution in the liver. For the assessment of aortic involvement in TAK during IST, it is more appropriate to compare the FDG uptake in the aortic wall with the lumen blood pool.

SSE17-06 Vulnerable Plaque Features Can Be Detected in Carotid Plaques with Hybrid 18^F-FDG PET/MR Imaging

Monday, Dec. 2 3:50PM - 4:00PM Room: S403A

Participants
Yue Zhang, MD, Beijing, China (*Presenter*) Nothing to Disclose
Jie Lu, MD, PhD, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Hongwei Yang, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Jie Ma, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Haiqing Song, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Qingfeng Ma, Beijing, China (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

To investigate morphological and biological features of vulnerable carotid atherosclerotic plaques in patients with known increased risk of atherosclerosis with hybrid 18F-FDG PET/MR imaging.

METHOD AND MATERIALS

Sixteen patients with known increased risk of atherosclerosis underwent hybrid PET/MR of the carotid arteries after injection of 18F-FDG. PET/MR was performed a median of 180 min after injection. American Heart Association (AHA) lesion type and plaque composition were determined on consecutive MRI axial sections in both carotid arteries. 18F-FDG uptake in carotid arteries was quantified using maximum standardized uptake values (SUVmax) and tissue to background ratio (TBR) on corresponding PET sections.

RESULTS

The prevalence of complicated atherosclerotic plaques (AHA lesion type VI) detected with high-resolution MRI was significantly higher in the carotid artery ipsilateral to the ischemic stroke as compared to the contralateral side (31 vs 0 %; p=0.006). Atherosclerotic plaques classified as vulnerable with MRI (AHA lesion type VI) were associated with higher 18F-FDG uptake in comparison with other AHA lesions (SUVmax=3.31±1.13 vs 1.61±0.68 and 0.91±0.37; TBR=3.21±1.04 vs 1.56±0.53 and 0.88±0.26, respectively; p<0.001).

CONCLUSION

Morphological and biological features of vulnerable plaques can be detected with 18F-FDG PET/MR in patients with known increased risk of atherosclerosis. Hybrid 18F-FDG PET/MR systems might help in the evaluation of patients with vulnerable carotid atherosclerotic plaques.

CLINICAL RELEVANCE/APPLICATION

Hybrid 18F-FDG PET/MRI systems can help in the evaluation of patients with vulnerable carotid atherosclerotic plaques.

SSE23

Physics (Nuclear Medicine)

Monday, Dec. 2 3:00PM - 4:00PM Room: E351

NM PH

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

Participants
Chin-Tu Chen, PhD, Chicago, IL (*Moderator*) Board Member, BioMed Global Board Member, EVO Worldwide, Inc Board Member, AEPX Board Member, EnDepth Vision Systems, LLC Research Grant, DxRay, Inc Advisor, RefleXion Medical Inc Shareholder, EDDA Technology, Inc
Srinivas C. Kappadath, PhD, Houston, TX (*Moderator*) Research Grant, General Electric Company; Research Grant, BTG International Ltd; Consultant, BTG International Ltd; Consultant, ABK Biomedical Inc; Consultant, Terumo Corporation

Sub-Events

SSE23-01 Comparison of Post-Therapy Y-90 PET/CT Dosimetry Methods in Liver Therapy with Y-90 Microspheres

Monday, Dec. 2 3:00PM - 3:10PM Room: E351

Participants
Karin Knesaurek, PhD, New York, NY (*Presenter*) Nothing to Disclose
Sherif Heiba, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Renata Pyzik, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Sara D. Pasik, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Lale Kostakoglu, MD, MPH, New York, NY (*Abstract Co-Author*) Research Consultant, F. Hoffmann-La Roche Ltd

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CONCLUSION

The MIM and Planet Dose DPK dosimetry values were practically interchangeable. Y-90 disimetry values obtained by all methods were similar, but LDMwS tended to produce slightly higher values.

Background

The aim of our study was to compare dosimetry methods for Y-90 PET/CT, using commercially available software packages.

Evaluation

As a part of continuing study, 25 patients were taken to a PET/CT suite (mCT, Siemens Medical) following therapy with Y-90 microspheres. The low mA, non-diagnostic CT images were used for attenuation correction and localization of the Y-90 microspheres in PET/CT studies. The acquisition time was 15 min, the reconstruction matrix size was 200x200x75 mm and voxel size 4.07x4.07x3.00 mm. Two commercially available software packages, MIM 6.8 (MIM software Inc., Cleveland, Ohio) and Planet Dose (DOSIsoft SA, Cachan, France) were utilized to calculate Y-90 dosimetry from PET images. Three methods were used for voxel-based dosimetry calcualtions; the Local Deposition Method (LDM), LDM with scaling (LDMwS) for known injected activity, and a Dose Point Kernel (DPK) method using the MIRD kernel. Only the DPK approach was applied to the Planet Dose software and these walues were comapred with MIM DPK dosimetry values. LDM and LDMwS were only applied to the MIM software. The average total liver dosimetry values (mean±SD) were 53.59±23.47 Gy, 60.93±28.62 Gy, 55.33±24.80 Gy and 54.25±23.70 Gy, for LDM, LDMwS, DPK with MIM and DPK with Planet Dose (DOSI), respectively. In most cases the LDMwS method produsd slightly higher values than the other methods. The MIM and Planet Dose DPK dosimetry values (i.e., DPK vs. DOSI) were higly comparable. Bland-Altman analysis calculated a mean difference of 1.1 ± 1.6 Gy. The repeatability coefficient was 3.1(5.7% of the mean).

Discussion

The slightly higher values produced by LDMwS compared to the other methods is due to the difference between dose calibrator scaling, and the quantitative accuracy of the Y-90 PET imaging. Although, the differences are not great, they should be diminished by better quantifiable Y-90 PET imaging and improved dose calibrator quality control.

SSE23-02 Accuracy Dose Evaluation in Radioembolization Procedures Using 99mTc-SPECT/CT and 90Y-PET/CT

Monday, Dec. 2 3:10PM - 3:20PM Room: E351

Participants
Luca Indovina, PhD, Roma , Italy (*Presenter*) Nothing to Disclose
Amedeo Capotosti, Roma , Italy (*Abstract Co-Author*) Nothing to Disclose
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Luigi Azario, Roma , Italy (*Abstract Co-Author*) Nothing to Disclose
Alessia Milano, Roma , Italy (*Abstract Co-Author*) Nothing to Disclose
Roberto Iezzi, MD, Chieti, Italy (*Abstract Co-Author*) Nothing to Disclose
Germano Perotti, Roma , Italy (*Abstract Co-Author*) Nothing to Disclose

Luca Zagaria, Roma , Italy (*Abstract Co-Author*) Nothing to Disclose
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CONCLUSION

In this paper it is emphasized that, in radioembolization procedures, 99mTc-SPECT/CT images can be used to predict directly the final dose distribution for 90Y microspheres with accuracy. In particular, pixel's intensity uniformity, noise and sensitivity in 99mTc-SPECT/CT images are obviously much better than those observed in 90Y-PET/CT scans. The 90Y-PET/CT dosimetric accuracy, in comparison to 99mTc-SPECT/CT dosimetric accuracy, is still acceptable for dosimetric purpose and it remains a necessary tool for theranostic analysis with therapeutic and diagnostic capabilities.

Background

Radioembolization with 90Y-microspheres is increasingly used in HCC treatment. In terms of the impact of tumoral dose, many studies confirmed a tumor dose response relationship. For pre-therapeutic dosimetry, 99mTc-MAA is used as a surrogate of microsphere distribution to assess tumoral targeting and dosimetry. In the same way, 90Y-PET/CT following radioembolization has been established as a viable diagnostic tool for tumoral targeting and dosimetry. The aim of this study is to evaluate dosimetry accuracy both in 99mTc-SPECT/CT and in 90Y-PET/CT.

Evaluation

iDVH and dDVH obtained from 99mTc SPECT-CT and 90Y PET-CT were evaluated to analyze mean and voxel dose accuracy in tumor and liver dose evaluation, as implemented in MIM software vs. 6.8, with three different dosimetric approach both in a torso phantom and patients. Images were acquired in a Siemens Biograph mCT PET/CT and in a Siemens Intevo 2 SPECT/CT. Figure 1 shows dose distribution in the phantom liver compartment for 99mTc SPECT-CT and 90Y PET-CT. iDVH and dDVH for all the dose calculation methods, both for 99mTc and 90Y, are reported in Figure 2 and 3, respectively. Figure 4, 5 and 6 show same results in patient study with 99mTc SPECT-CT.

Discussion

Mean doses, standard deviation and coefficient of variation obtained from iDVH, for 99mTc SPECT-CT and 90Y PET-CT, shows deviations from MIRD dose between -9% and -4% while deviations between -27% and -9% are reported for 90Y PET-CT. Finally, the CoV dispersion index 1 confirm the better dose distribution estimation obtained in the 3D dosimetry for 99mTc SPECT-CT with respect to those obtained for 90Y PET-CT.

SSE23-03 Development of Wearable Technology to Enable Therapy Personalization of 177Lu DOTATATE for Neuroendocrine Tumors

Monday, Dec. 2 3:20PM - 3:30PM Room: E351

Participants
Robert Miyaoka, Seattle, WA (*Presenter*) Co-founder, Precision Sensing, LLC; Research Consultant, MIM Software Inc; Research Grant, General Electric Company;
Larry Pierce, PhD, Seattle, WA (*Abstract Co-Author*) Co-founder, Precision Sensing LLC
Hubert J. Vesselle, MD, PhD, Seattle, WA (*Abstract Co-Author*) Consultant, MIM Software Inc

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PURPOSE

The goal of this work is to enable patient specific 177Lu-DOTATATE organ dosimetry without requiring serial imaging sessions at a medical facility. This will be accomplished by developing wearable monitoring technology to allow quantitative measurements to be made through at home usage. This will support accurate estimation of the washout from individual organs at risk (OAR) enabling physicians to tailor the number of treatments based upon personalized organ dosimetry information .

METHOD AND MATERIALS

The enabling technologies are the development of a precision sensing belt (PSB) and software methods that can determine the optimal placement of a sparse set (e.g., 8-15) of small radiation detectors around the mid-section of the patient. A CT image will be used to register the PSB with a patient's internal organs. Based upon the patient specific CT image, Monte Carlo simulations and optimization methods are used to select the optimum positioning of a small set of detectors around the patient. Measurements from the PSB are then correlated with a quantitative SPECT/CT image acquired 24 hours after dose administration. After being sent home, the patient will wear the PSB for 2 minutes per day for 7-21 days. The basic methodology was tested using Monte Carlo simulation. The testing phantom consisted of anthropomorphic objects representing the liver, spleen, right and left kidneys and two tumors. Activity ratios for the liver, spleen, right and left kidneys, 2.5 cm and 1.5 cm tumors to background were 2, 10, 10, 8, 48 and 60. The washout half-lives were 74, 66, 40, 46, 92, 96, and 95 hours, respectively. One hundred simulations were run and the root mean squared error (RSME) was determined for the estimated and actual decay constants for the OAR, background and tumors .

RESULTS

Using only 4 PSB measurements at 4 hrs and 1, 3 and 7 days, the RSME between the estimated and actual washout constants for the OAR and background were all <5%. The 2.5 cm tumor had the worst RMSE of ~12%. However, when 21 daily PSB measurements were made all OAR, background and tumors had a RSME of <4% .

CONCLUSION

The initial results based upon simulation studies indicate that the precision sensing belt is able to estimate washout from OAR and tumors to within ±5%. Use of the PSB could significantly lower the cost of any clinical trial to investigate personalized 177Lu DOTATATE therapy and lead to FDA approval for personalized therapy.

CLINICAL RELEVANCE/APPLICATION

The goal of the precision sensing belt is to enable low cost, patient friendly methods for the personalization of 177Lu DOTATATE therapy.

SSE23-04 Quantitative Impact of Iterative Reconstruction Settings for Next-Generation Digital Photon Counting PET/CT

Monday, Dec. 2 3:30PM - 3:40PM Room: E351

Participants
Katherine Binzel, PhD, Columbus, OH (*Abstract Co-Author*) Nothing to Disclose
Taylor Porter, Columbus, OH (*Abstract Co-Author*) Nothing to Disclose
Richard Moore, Columbus, OH (*Abstract Co-Author*) Nothing to Disclose
Michael T. Friel, BS, Columbus, OH (*Abstract Co-Author*) Nothing to Disclose
Yu-lung Hsieh, PhD, Columbus , OH (*Abstract Co-Author*) Nothing to Disclose
Jun Zhang, PhD, Columbus, OH (*Abstract Co-Author*) Nothing to Disclose
Michael V. Knopp, MD, PhD, Columbus, OH (*Presenter*) Nothing to Disclose

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PURPOSE

The introduction of next generation, digital PET/CT enables high definition reconstruction with decreased voxel volumes, improving image quality, lesion detectability, and quantitative accuracy. However, using a larger reconstruction matrix without changing reconstruction parameters leads to increases in image noise. We assessed the impact of iterative reconstruction settings on PET quantification in order to overcome the perceived limitations of image noise.

METHOD AND MATERIALS

80 patients injected with 13 mCi 18F-FDG were imaged 90sec/bed on a digital photon counting PET/CT system (Philips Vereos, dPET). PET listmode data were reconstructed with 4 and 2mm3 isometric voxel volumes, initially using 3 iterations with 29 subsets. Secondary reconstructions then completed using 13, 15, and 17 subsets for the 4mm standard definition (SD) images, and 11, 13, and 15 for the 2mm high definition (HD) images. We evaluated visual quality and quantitative precision in target tumors and background tissues, using the 29 subset images as a reference.

RESULTS

Visual review revealed that the lower subset images were more preferable than the reference 29 subset images, particularly for the HD reconstructions where image noise is more apparent. Quantitative evaluation was revealed to be quite stable over a range of reconstruction settings. On average, quantification of physiologic uptake varied less than 2% and 3% for SD and HD reconstructions. In target lesions, the SUVmax decreased on average 4.4%, 4.1%, and 4.2% for SD images with 13, 15, and 17 subsets. In the HD images, the average decrease was 8.7%, 7.2%, and 6.4% for 11, 13, and 15 subsets.

CONCLUSION

The improved sensitivity and time of flight timing resolution of the dPET system allow for more accurate lesion detection and quantification, enhanced by the use of HD reconstructions. Here we have shown that when modifying the reconstruction settings to optimize visual quality of the images, quantitative parameters remain stable. Thus the optimization can be tailored to chosen voxel volumes and expected count densities in order to best leverage the capabilities of new digital photon counting PET.

CLINICAL RELEVANCE/APPLICATION

Higher definition PET imaging is readily achieved after optimization of iterative reconstruction parameters to account for increased noise in the now more count sparse voxels.

SSE23-05 A Study of Pseudo CT Generation for PET/MR Attenuation Correction Using Deep Learning

Monday, Dec. 2 3:40PM - 3:50PM Room: E351

Participants
Guobing Liu, Shanghai, China (*Presenter*) Nothing to Disclose
Shuangyue Zhang, Shanghai, China (*Abstract Co-Author*) Employee, Medical Imaging System Manufactor
Tuoyu Cao, PhD, Houston, TX (*Abstract Co-Author*) Employee, Medical Device Manufactor
Hui Liu, Shanghai, China (*Abstract Co-Author*) Nothing to Disclose
Hongcheng Shi, Shanghai, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Accurate attenuation correction (AC) remains a challenging problem in today's PET/MR systems. Specialized UTE MR images have been used for generating AC map in conventional scanners. However, the UTE acquisitions are time-consuming and provide little information for clinical diagnostic purpose. In this study, we investigated the feasibility of a deep learning approach using conditional generative adversarial network (cGAN) (Isola et. al., arXiv:1611.07004) to synthesize pseudo CT images from T1-weighted MR images for AC map generation in brain PET/MRI imaging.

METHOD AND MATERIALS

The cGAN network was trained to provide continuously valued CT images. The network structure was adopted from the original paper, which consists of a U-Net generator and a PatchGAN discriminator. Both MR and CT images were acquired at the head position for 100 patients. The T1-GRE-FSP-ISO images, which were included in the clinical scanning protocol, were chosen as the input MR images. The MR and CT images were registered and transformed into 2D axial images with 1mm*1mm pixel size and 2mm slice thickness. Images of 80 patients were used in the training procedure and those of

the other 20 patients were used for validation. The performance of the trained model was evaluated by comparing the generated pseudo-CT to the acquired CT images using structural similarity index (SSIM). Dice coefficients were also calculated via segmenting the images into air (<-500 HU), bone (>500 HU), and soft tissue regions.

RESULTS

For the validation image set of 20 patients, the SSIM between the pseudo-CT images generated by the trained model and acquired CT images is 0.894±0.049. The Dice coefficients are 0.987±0.008 for air, 0.736±0.094 for bone, and 0.938±0.028 for soft tissues.

CONCLUSION

The initial results show that this deep learning approach based on cGAN technique has the potential to synthesize continuously-valued pseudo-CT images from T1-weighted MR brain images, which can then be further used to generate AC map for PET/MR imaging. Future work may include training of 2.5D or fully 3D models as well as employing additional MR sequences as the model input.

CLINICAL RELEVANCE/APPLICATION

This study provides an alternative approach for attenuation correction in PET/MR systems, which may potentially improve the current PER/MR imaging procedure and quality.

SSE23-06 Total-body Parametric Imaging on EXPLORER

Monday, Dec. 2 3:50PM - 4:00PM Room: E351

Participants
Xuezhu Zhang, PhD, Davis, CA (*Presenter*) Nothing to Disclose
Zhaoheng Xie, PhD, Davis, CA (*Abstract Co-Author*) Nothing to Disclose
Tianyi Xu, PhD, Shanghai, China (*Abstract Co-Author*) Employee, Shanghai United Imaging Healthcare Co, Ltd
Weiping Liu, Shanghai, China (*Abstract Co-Author*) Employee, Shanghai United Imaging Healthcare Co, Ltd
Yu Ding, Shanghai, China (*Abstract Co-Author*) Researcher, Shanghai United Imaging Healthcare Co, Ltd
Yang Lv, PhD, Shanghai, China (*Abstract Co-Author*) Researcher, Shanghai United Imaging Healthcare Co, Ltd
Yun Dong, Shanghai, China (*Abstract Co-Author*) Employee, Shanghai United Imaging Healthcare Co, Ltd
Hongcheng Shi, Shanghai, China (*Abstract Co-Author*) Nothing to Disclose
Pengcheng Hu, Shanghai, China (*Abstract Co-Author*) Nothing to Disclose
Shuguang Chen, MD, Shanghai, China (*Abstract Co-Author*) Nothing to Disclose
Eric Berg, Davis, CA (*Abstract Co-Author*) Nothing to Disclose
Edwin Leung, Davis , CA (*Abstract Co-Author*) Nothing to Disclose
Benjamin A. Spencer, BEng, Sacramento, CA (*Abstract Co-Author*) Nothing to Disclose
Guobao Wang, PhD, Sacramento, CA (*Abstract Co-Author*) Nothing to Disclose
Jun Bao, Shanghai, China (*Abstract Co-Author*) Employee, Shanghai United Imaging Healthcare Co, Ltd
Hongdi Li, PhD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Simon R. Cherry, PhD, Davis, CA (*Abstract Co-Author*) Research Collaboration, Shanghai United Imaging Healthcare Co, Ltd
Ramsey Badawi, PhD, Sacramento, CA (*Abstract Co-Author*) Investigator, Koninklijke Philips NV; Investigator, Shanghai United Imaging Healthcare Co, Ltd;
Jinyi Qi, PhD, Davis, CA (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

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PURPOSE

Dynamic PET can estimate physiologically relevant parameters. Current PET scanners offer whole-body dynamic imaging but require a multi-pass scan protocol, which results in low signal-to-noise and misses temporal information at each bed position. To overcome these limitations, a 2-meter long PET/CT (EXPLORER) has been developed. In this work, we perform total-body parametric imaging and demonstrate its potential benefit for clinical imaging.

METHOD AND MATERIALS

We conducted the first human dynamic total-body PET study using the EXPLORER scanner in a healthy female subject. A 60min dynamic scan was performed immediately after an intravenous injection of 256 MBq of 18F-FDG. We divided the one-hour dynamic dataset into 187 frames and reconstructed it using a 3D TOF list-mode OSEM algorithm with all quantitative corrections (normalization, attenuation, scatter and random corrections) incorporated in the forward model. The linear Patlak model was implemented to analyze total-body FDG metabolism. The Patlak slope Ki image was estimated from the reconstructed 30-60min frames and was compared with the standard uptake value of the static scans at different times post-injection. The input function was obtained from the aorta time activity curve.

RESULTS

First, the reconstructed dynamic images show good image quality with low noise and demonstrate the high sensitivity of the EXPLORER and the benefit of total-body coverage. Second, the Patlak Ki image show good contrast and high signal-to-noise ratio for detecting abnormally high FDG uptake which may potentially increase lesion detectability using FDG PET. In this volunteer study, a hot spot in the right collarbone, possibly representing bone healing processes, can be clearly seen in the Patlak Ki image using the 30-60min data. The hot spot is confirmed in the delayed scan acquired at 4-hr post injection. This result suggests that we may be able to use dynamic scans to obtain improved lesion conspicuity without the inconvenience of late time-point scanning.

CONCLUSION

In this study we performed a total-body parametric imaging study using the EXPLORER and demonstrated its high image quality for clinical imaging.

CLINICAL RELEVANCE/APPLICATION

FDG PET images glucose metabolism and has been widely used in cancer detection and staging. Total-body parametric imaging can potentially improve lesion detection over existing static scans.

Printed on: 10/29/20

ED010-TU

Nuclear Medicine Tuesday Case of the Day

Tuesday, Dec. 3 7:00AM - 11:59PM Room: Case of Day, Learning Center

AMA PRA Category 1 Credit ™: .50

Participants
Ming Yang, MD, Scottsdale, AZ (*Presenter*) Nothing to Disclose
Michael C. Roarke, MD, Scottsdale, AZ (*Abstract Co-Author*) Nothing to Disclose
Ba D. Nguyen, MD, Scottsdale, AZ (*Abstract Co-Author*) Nothing to Disclose
Molly Carnahan, MD, Phoenix, AZ (*Abstract Co-Author*) Nothing to Disclose
Akash Sharma, MD, Ponte Vedra Beach, FL (*Abstract Co-Author*) Nothing to Disclose
Geoffrey B. Johnson, MD,PhD, Rochester, MN (*Abstract Co-Author*) Research Grant, General Electric Company Research Grant, Pfizer Inc
Manoj K. Jain, MD, Jacksonville, FL (*Abstract Co-Author*) Nothing to Disclose
Ephraim E. Parent, MD,PhD, Ponta Vedra Beach, FL (*Abstract Co-Author*) Research support, Blue Earth Diagnostics Ltd Research support, Advanced Accelerator Applications SA
Derek R. Johnson, MD, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Jess A. Graham, MD, Albuquerque, NM (*Abstract Co-Author*) Nothing to Disclose
Nandan Keshav, MD, Albuquerque, NM (*Abstract Co-Author*) Nothing to Disclose
Lisa C. Blacklock, MD, Albuquerque, NM (*Abstract Co-Author*) Nothing to Disclose
JoAnna R. Fair, MD, PhD, Albuquerque, NM (*Abstract Co-Author*) Nothing to Disclose
Shana Elman, MD, Albuquerque, NM (*Abstract Co-Author*) Nothing to Disclose
Saeed Elojeimy, MD, PhD, Albuquerque, NM (*Abstract Co-Author*) Nothing to Disclose
Matthew Kay, MBBS, Tucson, AZ (*Abstract Co-Author*) Nothing to Disclose
Gregory J. Woodhead, MD, PhD, Tucson, AZ (*Abstract Co-Author*) Nothing to Disclose
Phillip Kuo, MD,PhD, Tucson, AZ (*Abstract Co-Author*) Research Grant, Astellas Group; Research Grant, Blue Earth Diagnostics Ltd; Consultant, Novartis AG; Consultant and Speaker, General Electric Company; Consultant, Konica Minolta, Inc; Consultant, Imaging Endpoints

TEACHING POINTS

1) Recognize the association of lung malignancy and immune-mediated seizure activity. 2) Recognize incidental Thornwaldt cyst on FDG PET-CT. 3) Familiarize the scintigraphy feature of shin splint on three-phase bone scan. 4) Identify off-target distribution of Tc-99m MAA to the falciform artery on Y-90 microsphere planning SPECT/CT. 5) Recognize the imaging features of an obstructed ventriculoperitoneal shunt.

SPSH30

Hot Topic Session: Patient-facing Nuclear Medicine Clinics for Prostate Cancer

Tuesday, Dec. 3 7:15AM - 8:15AM Room: E450B

GU NM

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

Participants
Phillip J. Koo, MD, Phoenix, AZ (*Moderator*) Advisory Board, Bayer AG; Advisory Board, Johnson & Johnson; Consultant, Blue Earth Diagnostics Ltd; Researcher, Progenics Pharmaceuticals, Inc; Speaker, Astellas Pharm Inc; Advisory Board, Pfizer Inc; Consultant, Merck & Co, Inc; Consultant, Advanced Accelerator Applications SA

Sub-Events

SPSH30A The Value and Challenges of Creating Patient Facing Clinics

Participants
Phillip J. Koo, MD, Phoenix, AZ (*Presenter*) Advisory Board, Bayer AG; Advisory Board, Johnson & Johnson; Consultant, Blue Earth Diagnostics Ltd; Researcher, Progenics Pharmaceuticals, Inc; Speaker, Astellas Pharm Inc; Advisory Board, Pfizer Inc; Consultant, Merck & Co, Inc; Consultant, Advanced Accelerator Applications SA

LEARNING OBJECTIVES

1) Describe the importance of patient facing clinics as radiopharmaceutical based therapies become approved for the treatment of prostate cancer. 2) Identify challenges for creating patient facing clinics.

SPSH30B The Nuclear Medicine Therapy Care Coordination Service: A Model for Radiologist-driven Patient-centered Care

Participants
David M. Schuster, MD, Decatur, GA (*Presenter*) Institutional Research Grant, Nihon Medi-Physics Co, Ltd; Institutional Research Grant, Blue Earth Diagnostics Ltd; Institutional Research Grant, Advanced Accelerator Applications SA; Institutional Research Grant, Telix Pharmaceuticals Inc; Consultant, Syncona Ltd; Consultant, AIM Specialty Health, Inc; ;

LEARNING OBJECTIVES

1) Understand the importance of a creating a patient-centric Nuclear Medicine Therapy Care Coordination Service. 2) Learn key components of operationalizing a nurse navigator within a traditional radiology/nuclear medicine practice. 3) Gain a better understanding of the potential for theranostic approaches for prostate and other cancer, and how radiologists/nuclear medicine physicians can increase their impact in multi-disciplinary care.

SPSH30C Co-Managing Patients with Castration Resistant Prostate Cancer: A GU Oncologist's Perspective

Participants
Alicia K. Morgans, MD,MPH, Chicago, IL (*Presenter*) Speaker, Astellas Group; Speaker, AstraZeneca PLC; Speaker, sanofi-aventis Group; Speaker, Johnson & Johnson; Speaker, Bayer AG

LEARNING OBJECTIVES

1) To understand the treatment decision implications of use of novel PET imaging approaches in prostate cancer from a medical oncology perspective. 2) To understand the oncologic outcome implications of use of novel PET therapeutics in prostate cancer from a medical oncology perspective.

MSCC31

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

Tuesday, Dec. 3 8:30AM - 10:00AM Room: E450B

CT HN NR NM

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 1.75

FDA Discussions may include off-label uses.

Participants
Katherine A. Zukotynski, MD, PhD, Ancaster, ON (*Moderator*) Nothing to Disclose

Sub-Events

MSCC31A Brain FDG and Amyloid PET/DAT Scans

Participants
Phillip Kuo, MD,PhD, Tucson, AZ (*Presenter*) Research Grant, Astellas Group; Research Grant, Blue Earth Diagnostics Ltd; Consultant, Novartis AG; Consultant and Speaker, General Electric Company; Consultant, Konica Minolta, Inc; Consultant, Imaging Endpoints

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pkuo@email.arizona.edu

LEARNING OBJECTIVES

1) Apply a systematic approach to interpretation of PET imaging in dementia. 2) Explain the optimal performance and interpretation of dopamine transporter imaging. 3) Describe the complementary roles of amyloid, FDG and dopamine transporter imaging in the assessment of neurodegenerative diseases.

MSCC31B Neck

Participants
Rathan M. Subramaniam, MD,PhD, Dunedin, New Zealand (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

rathan.subramaniam@utsouthwestern.edu

LEARNING OBJECTIVES

1) To review best clinical practices in Head and Neck PET/CT and case review.

RC311

Review of Pediatric Nuclear Medicine

Tuesday, Dec. 3 8:30AM - 10:00AM Room: S504CD

GI GU MK NM PD

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 1.75

LEARNING OBJECTIVES

1) Review of Pediatric Nuclear medicine, particularly for radiologists and nuclear medicine physicians who may not specialize in pediatric patients, and for resident and fellow trainees.

Sub-Events

RC311A Pediatric Gastrointestinal

Participants
Helen R. Nadel, MD, Palo Alto, CA (*Presenter*) Consultant, ICON plc

For information about this presentation, contact:

hnadel@stanford.edu

LEARNING OBJECTIVES

1) Be able to list indications for GI scintigraphy in children. 2) Be able to describe scintigraphic patterns of disease on GI examinations in children.

RC311B Pediatric Genitourinary

Participants
Neha S. Kwatra, MBBS, MD, Boston, MA (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

neha.kwatra@childrens.harvard.edu

LEARNING OBJECTIVES

1) Describe pediatric renal diseases and understand the complementary role of scintigraphy and other imaging modalities. 2) Apply pediatric-specific imaging considerations. 3) Identify important normal variants/pitfalls in interpretation.

RC311C Pediatric Musculoskeletal

Participants
Susan E. Sharp, MD, Cincinnati, OH (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Be able to describe the utilization and performance of nuclear medicine imaging for musculoskeletal indications in pediatric patients. 2) Be able to identify musculoskeletal findings on Tc-99m-MDP and F-18-FDG scans.

RC311D Case Presentation/Panel Discussion

Participants
Stephan D. Voss, MD,PhD, Boston, MA (*Presenter*) Nothing to Disclose

RC317

Emerging Technologies: Prostate Cancer Imaging & Management - Update 2019

Tuesday, Dec. 3 8:30AM - 10:00AM Room: S505AB

GU MI MR NM

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 1.75

FDA Discussions may include off-label uses.

Participants
Peter L. Choyke, MD, Rockville, MD (*Moderator*) License agreement, Koninklijke Philips NV; Researcher, Koninklijke Philips NV; License agreement, ScanMed; License agreement, Rakuten Medical; Researcher, Rakuten Medical; Researcher, General Electric Company; Researcher, Progenics Pharmaceuticals, Inc; Researcher, Novartis AG; ; ; ; ;

For information about this presentation, contact:

pchoyke@mail.nih.gov

LEARNING OBJECTIVES

1) Understand current issues in prostate cancer relevant to imaging. 2) Understand the role of emerging technologies in the imaging and management of prostate cancer.

ABSTRACT

Prostate cancer is a major health issue. Imaging has made great strides in the last decade including the use of multiparametric MRI, MR-ultrasound fusion biopsies and most recently PET scanning. This refresher course explores emerging technolgies in prostate cancer imaging and management.

Sub-Events

RC317A Introduction to Imaging in Prostate Cancer

Participants
Peter L. Choyke, MD, Rockville, MD (*Presenter*) License agreement, Koninklijke Philips NV; Researcher, Koninklijke Philips NV; License agreement, ScanMed; License agreement, Rakuten Medical; Researcher, Rakuten Medical; Researcher, General Electric Company; Researcher, Progenics Pharmaceuticals, Inc; Researcher, Novartis AG; ; ; ; ;

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pchoyke@mail.nih.gov

LEARNING OBJECTIVES

1) Understand the impact of new screening guidelines on imaging of prostate cancer. 2) Understand the issues facing clinicians treating prostate cancer.

ABSTRACT

This talk will provide an overview regarding the major issues of imaging in prostate cancer including screening and detection, initial staging, biochemical recurrence and metastatic disease. Recent trends in the management of prostate cancer from active surveillance to first and second line androgen deprivation, radium and chemotherapy/immunotherapy will be briefly discussed. The role of imaging in prostate cancer is becoming much more central than it was a decade ago and this talk will set the stage for other talks in the session that will provide new details regarding novel imaging methods.

RC317B Next Generation Prostate MRI

Participants
Baris Turkbey, MD, Bethesda, MD (*Presenter*) Research support, Koninklijke Philips NV; Royalties, Invivo Corporation; Investigator, NVIDIA Corporation

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turkbeyi@mail.nih.gov

LEARNING OBJECTIVES

1) Understand current status and uses of multi-parametric MRI. 2) Understand role of MRI in assessment of prostate cancer aggressiveness and tumor heterogeneity. 3) Understand role of computer aided diagnosis systems in evaluation of prostate cancer aggressiveness and tumor heterogeneity.

RC317C Molecular Prostate Imaging: Chemistry to Clinic

Participants
Martin G. Pomper, MD, PhD, Baltimore, MD (*Presenter*) Research Grant, Progenics Pharmaceuticals, Inc; Royalties, Progenics Pharmaceuticals, Inc

For information about this presentation, contact:

mpomper@jhmi.edu

LEARNING OBJECTIVES

1) To compare and contrast the imaging characteristics of present and emerging molecular imaging agents for prostate cancer. 2) To describe how emerging molecular imaging agents for prostate cancer are being integrated into clinical practice. 3) To focus on PET agents targeting the prostate-specific membrane antigen (PSMA) with respect to a new structured reporting system proposed to enhance clinical management.

ABSTRACT

n/a

RC317D Hyperpolarized C-13 MR Molecular Imaging of Prostate Cancer

Participants
Daniel B. Vigneron, PhD, San Francisco, CA (*Presenter*) Research Grant, General Electric Company;

LEARNING OBJECTIVES

1) To describe the basic principles and techniques used in hyperpolarized carbon-13 MRI. 2) Understand the cellular metabolic reprogramming that occurs in prostate cancer. 3) Demonstrate the changes in pyruvate to lactate conversion that are observed in prostate cancer and differences with cancer aggressiveness and response to therapy.

RC317E Radionuclide Therapy for Prostate Cancer

Participants
Frank I. Lin, MD, Bethesda, MD (*Presenter*) Nothing to Disclose

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Printed on: 10/29/20

MSCC32

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

Tuesday, Dec. 3 10:30AM - 12:00PM Room: E450B

CH CT NM

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 1.75

Participants
Samuel E. Almodovar-Reteguis, MD, Orlando, FL (*Moderator*) Nothing to Disclose

Sub-Events

MSCC32A Lung Diseases

Participants
David M. Naeger, MD, Aurora, CO (*Presenter*) Consultant, Ebix Inc; Consultant, Oakstone Publishing, LLC

For information about this presentation, contact:

david.naeger@dhha.org

LEARNING OBJECTIVES

1) List the various guidelines used to determine follow up recommendations for pulmonary nodules. 2) Analyze clinical scenarios as to which nodule follow up guideline is most appropriate. 3) Describe how FDG PET can be used to guide pulmonary nodule management.

ABSTRACT

This review course lecture will guide radiologists in the imaging management of pulmonary nodules. We will review the various guidelines used to determine pulmonary nodule follow up and the clinical scenarios for when each is appropriate. Finally, we will review how FDG PET can be used to guide pulmonary nodule management

MSCC32B PET/CT for Breast Cancer: Where is the Clinical Impact?

Participants
Gary A. Ulaner, MD,PhD, New York, NY (*Presenter*) Research support, General Electric Company; Research support, F. Hoffmann-La Roche Ltd; Research support, Novartis AG; Research support and Consultant, sanofi-aventis Group; Research support, sanofi-aventis Group

For information about this presentation, contact:

ulanerg@mskcc.org

LEARNING OBJECTIVES

1) Review the strengths and weaknesses of FDG PET/CT for evaluation of a primary breast malignancy, axillary and extra-axillary nodal metastases, and distant metastases. 2) Review the utility of FDG PET/CT for measuring breast cancer treatment response. 3) Understand that not all breast cancers are the same; there is recent data that breast histology may influence imaging interpretation.

ABSTRACT

FDG PET/CT impacts the management of patients with breast cancer in multiple settings, including initial staging, treatment response, and evaluation of suspected recurrence. This lecture reviews the strengths and weaknesses of FDG PET/CT for staging of the primary breast malignancy, axillary and extra-axillary nodal metastases, and distant metastases. The utility of FDG PET/CT for measuring breast cancer treatment response is appraised. The role tumor histology may have on PET/CT interpretation is discussed. National Comprehensive Cancer Network (NCCN) guidelines for patients with breast cnacer are reviewed. Emphasis is given where FDG PET/CT has demonstrated clinical impact.

SPAI31

RSNA AI Deep Learning Lab: Generative Adversarial Networks (GANs)

Tuesday, Dec. 3 10:30AM - 12:00PM Room: AI Showcase, North Building, Level 2, Booth 10342

AI CT MR NM

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 1.75

Participants
Bradley J. Erickson, MD, PhD, Rochester, MN (*Presenter*) Board of Directors, VoiceIt Technologies, LLC; Stockholder, VoiceIt Technologies, LLC; Board of Directors, FlowSigma, LLC; Officer, FlowSigma, LLC ; Stockholder, FlowSigma, LLC

Special Information

In order to get the best experience for this session, it is highly recommended that attendees bring a laptop with a keyboard, a decent-sized screen, and the latest version of Google Chrome. Additionally, it is recommended that attendees have a basic knowledge of deep learning programming and some experience running a Google CoLab notebook. Having a Gmail account is also helpful. Here are instructions for creating and deleting a Gmail account.

ABSTRACT

This course describes a more recent advance in deep learning known as Generative Adversarial Networks (GANs). GANs are a deep learning technology in which a computer is trained to create images that look very 'real' even though they are completely synthetic. Getting 'large enough' data sets is a problem for most deep learning applications, and this is particularly true in medical imaging. This may be one way to address the 'data shortage' problem in medicine. GANs have also been created that can convert MRIs to CTs (e.g. for attenuation correction with MR/PET).

Printed on: 10/29/20

SSG02

Cardiac (CT, MRI, and Nuclear Medicine: General Topics)

Tuesday, Dec. 3 10:30AM - 12:00PM Room: S104A

CA CT MR NM

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 1.75

Participants
Tarun Pandey, MD, FRCR, Little Rock, AR (*Moderator*) Nothing to Disclose
Scott R. Akers, MD,PhD, Philadelphia, PA (*Moderator*) Nothing to Disclose

Sub-Events

SSG02-02 Imaging Findings after Aortic Valve Implantation on 18F-Fluorodeoxyglucose Positron Emission Tomography with Computed Tomography

Tuesday, Dec. 3 10:40AM - 10:50AM Room: S104A

Participants
Ali R. Wahadat, MD,MSc, Rotterdam, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Wilco Tanis, The Hague, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Asbjorn Scholtens, MD, Utrecht, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Margreet Bekker, Rotterdam, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Laura H. Graven, MD, Rotterdam, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Laurens E. Swart, MD, Rotterdam, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Annemarie M. Den Harder, MD, Utrecht , Netherlands (*Abstract Co-Author*) Nothing to Disclose
Marnix G. Lam, MD, Utrecht, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Linda M. de Heer, MD, Utrecht , Netherlands (*Abstract Co-Author*) Nothing to Disclose
Jolien Roos - Hesselink, Rotterdam, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Ricardo P. Budde, MD,PhD, Rotterdam, Netherlands (*Presenter*) Nothing to Disclose

PURPOSE

Although 18F-Fluorodeoxyglucose (18F-FDG) Positron Emission Tomography (PET) with computed tomography (CT) is an essential tool in diagnosing prosthetic heart valve (PHV) endocarditis, the normal uptake patterns after PHV implantation have not been studied prospectively. We prospectively assessed perivalvular FDG uptake at different time points after aortic PHV implantation.

METHOD AND MATERIALS

Patients who had undergone uncomplicated aortic PHV implantation were included and underwent 18F-FDG PET/CT at 5(±1) weeks (group 1), 12(±2) weeks (group 2) or 52(±8) weeks (group 3) after implantation. After a preparatory diet to suppress normal myocardial glucose uptake, FDG uptake in the myocardium as well as around the PHV was scored using the Qualification Visual Score for Hypermetabolism (QVSH) as 'none' (< mediastinum), 'mild' (> mediastinum but < liver), 'moderate' (> liver), or 'severe' (intense uptake) and quantitative analysis was performed with maximum Standardized Uptake Value (SUVmax) and target to background ratio (SUVratio) on standardized European Association of Nuclear Medicine Research Ltd. (EARL) reconstructions by an experienced nuclear medicine physician.

RESULTS

In total 37 patients (group 1: n=12, group 2: n=12, group 3: n=13) (age 66±8 years) were included. Myocardial FDG uptake was moderate or less in 29/37 scans (78%). QVSH around the PHV was in 8/12 (67%) mild and 4/12 (33%) moderate in group 1, 7/12 (58%) mild and 5/12 (42%) moderate in group 2 and 8/13 (62%) mild and 5/13 (38%) moderate in group 3 (p=0.91). No scan was scored as 'none' or 'severe'. EARL SUVmax was 3.48±0.57, 3.50±0.59 and 3.34±0.55 (mean±SD, p=0.77) and EARL SUVratio was 2.00±0.29, 1.96±0.41 and 1.71±0.26 (mean±SD, p=0.07) for groups 1, 2 and 3, respectively.

CONCLUSION

Baseline FDG uptake around aortic PHV at 5, 12 and 52 weeks after implantation is similar and mild in the majority of cases with an overall mean SUVmax and SUVratio of 3.44±0.56 and 1.89±0.34 respectively.

CLINICAL RELEVANCE/APPLICATION

Knowing the normal baseline FDG uptake around prosthetic heart valves on 18F-FDG-PET-CT is essential to discriminate between normal and infected valves in patients suspected of endocarditis.

SSG02-03 Accuracy of Absolute Myocardial Blood Flow Quantification with Dual-Source CT: Validation in Human Using 15O-Water PET

Tuesday, Dec. 3 10:50AM - 11:00AM Room: S104A

Participants
Masafumi Takafuji, Tsu, Japan (*Presenter*) Nothing to Disclose
Kakuya Kitagawa, MD, PhD, Tsu, Japan (*Abstract Co-Author*) Nothing to Disclose
Masaki Ishida, MD, PhD, Tsu, Japan (*Abstract Co-Author*) Nothing to Disclose

Yasutaka Ichikawa, MD, Tsu, Japan (*Abstract Co-Author*) Nothing to Disclose
Satoshi Nakamura, MD, Tsu, Japan (*Abstract Co-Author*) Nothing to Disclose
Yoshitaka Goto, MD, Tsu-city , Japan (*Abstract Co-Author*) Nothing to Disclose
Hajime Sakuma, MD, Tsu, Japan (*Abstract Co-Author*) Research Grant, EIZAI; Research Grant, DAIICHI SANKYO Group; Research Grant, FUJIFILM Holdings Corporation; Research Grant, Guerbet SA; Research Grant, Nihon Medi-Physics Co, Ltd;

PURPOSE

15O-water PET is the most accurate method in quantifying myocardial blood flow (MBF). Model-based analysis of perfusion CT with correction of flow-dependent alteration in extraction fraction(E) of iodine contrast medium may permit quantification of absolute MBF. The purpose of this study was to determine the accuracy of CT measurements of stress MBF by CT using 15O-water PET as a reference.

METHOD AND MATERIALS

Thirty-four patients (70±8 years, 27 male) with known or suspected coronary artery disease(CAD) underwent dynamic stress CT perfusion and stress 15O-water PET. Perfusion index (PI) was quantified in 16 myocardial segments with a dual-source CT and its dedicated software (Force/VPCT body, Siemens) based on maximal upslope method. Since PI is mathematically equivalent to unidirectional influx constant in compartment model analysis, PI can be expressed as a product of MBF and E. For the quantification of stress MBF using 15O-water PET, non-commercial software (Carimas) was used. The E of iopamidol was determined using CT-derived PI and PET-derived MBF (PET-MBF) in 17 subjects (pilot group). For validation, CT-derived MBF (CT-MBF) was calculated using the relation between E and CT-derived PI for the remaining 17 patients (validation group) and compared with PET-MBF. The segments with myocardial infarction were excluded from the analysis.

RESULTS

In the pilot group, CT-derived PI was 1.33±0.27ml/min/g and PET-MBF value was 2.80±0.84 ml/min/g, respectively. From these data, the relationship between E and MBF was $E = 1-\exp[-(0.11\times MBF+1.58)/MBF]$. In the validation group, CT-MBF was 2.40±2.03ml/min/g, while PET-MBF was 2.54±2.03ml/min/g. CT-MBF showed a good linear correlation with PET-MBF (r= 0.93, P<000.1). The measurement bias in measuring MBF between CT and PET was 0.14±0.73ml/min/g.

CONCLUSION

The relationship between E of iodine contrast medium and MBF was determined in this study. By using the relationship, stress MBF can be accurately quantified from the perfusion index obtained from dual-source CT and its dedicated analysis software.

CLINICAL RELEVANCE/APPLICATION

CT-MBF quantification has potential to provide detection of perfusion abnormality and risk stratification in patients with known or suspected CAD with high accuracy comparable to 15O-water PET.

SSG02-04 Development of an Automated Software for 3D Quantification of Extracellular Volume in Cardiac CT: Comparison with Cardiac MRI

Tuesday, Dec. 3 11:00AM - 11:10AM Room: S104A

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PURPOSE

The objective of our study is to develop and validate a software for automatic three-dimensional (3D) measurement of myocardial extracellular volume (ECV) in cardiac CT compared to CMR in patients with cardiac amyloidosis (CA)

METHOD AND MATERIALS

Twenty patients with a proven diagnosis of CA and 20 control patients free of cardiac pathology were included. Unenhanced and late enhanced (5 minutes) cardiac CT images were analyzed automatically by the software. Duration of processing was recorded. Manual measurements of myocardial attenuation were performed on both sets of images by one operator within the interventricular septum (IVS) as usually performed in clinical practice. Automatic and manual values of ECV were calculated using biological hematocrit and synthetic hematocrit (derived from blood pool attenuation values). Measurements were correlated together and with MR measurements for all patients.

RESULTS

3D automatic segmentation of unenhanced and late enhanced cardiac CT images was successfully performed by the software for all patients. The duration of myocardial segmentation was 20 +/- 5 seconds. The software was able to provide 3D ECV values for all patients. Automated (30+/-20%) and manual (32+/-18%) measurements of ECV were well correlated each other (r2=0.8; p<0.005), and significantly correlated (r2>0.7; p<0.05) with the ECV measured by CMR (34+/-21%). Automatic and manual ECV values calculated with synthetic hematocrit did not significantly differ from biological ones.

CONCLUSION

Automated 3D measurement of ECV in cardiac CT is feasible and well correlated with manual measurements and CMR values. These

results have to be confirmed on a wider range of patients (work in progress)

CLINICAL RELEVANCE/APPLICATION

Myocardial extracellular volume (ECV) is a good diagnostic and prognostic marker in cardiac diseases. ECV measurement is traditionally performed with cardiac magnetic resonance (CMR). Assessment of ECV in cardiac CT may help to use it more often in clinical practice.

SSG02-05 Assessment of Myocardial Extracellular Volume on Routine Body Computed Tomography in Breast Cancer Patients Treated with Anthracyclines

Tuesday, Dec. 3 11:10AM - 11:20AM Room: S104A

Participants
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PURPOSE

To evaluate the feasibility of estimating myocardial extracellular volume (ECV) on routine thoracic contrast-enhanced CT in breast cancer patients, and, if feasible, to assess if a rise in ECV is associated with anthracyclines administration even in absence of clinical symptoms or echocardiographic changes.

METHOD AND MATERIALS

After Ethics Committee approval, female patients with breast cancer who had undergone routine CT examinations at our institution before and shortly after the end of chemotherapy including anthracyclines were retrospectively evaluated. Patients without available haematocrit, with CT images with artefacts, or who had undergone radiation therapy of the left breast were excluded. Follow-up CT examinations were also analysed, when available. ECV was calculated on scans obtained at about 1, 3, and 7 min after contrast injection.

RESULTS

Thirty-two female patients (aged 57±13 years, mean±standard deviation) with pre-treatment haematocrit 38±4%, and ejection fraction 64±6% were analysed. Pre-treatment ECV was 27.0±2.9% at 1 min, 27.4±3.8% at 3 min, and 26.4±3.8% at 7 min, similar to normal values reported for normal subjects in the literature. Post-treatment ECV (median interval: 89 days after treatment) was 31.1±4.9%, 32.5±5.0%, and 30.0±5.1%, respectively, values significantly higher than pre-treatment values at all times ($p < 0.005$). *ECV at follow-up (median interval: 135 days after post-treatment CT) was 31.0±4.5%, 30.0±3.4%, and 27.7±3.7%, respectively, without significant differences ($p > 0.548$) when compared to post-treatment values.*

CONCLUSION

After anthracyclines treatment, ECV was significantly higher than pre-treatment values. In the follow-up ECV remains higher than pre-treatment values.

CLINICAL RELEVANCE/APPLICATION

Myocardial ECV values from routine contrast-enhanced CT scans could play a role in the assessment of myocardial condition in breast cancer patients undergoing anthracycline-based chemotherapy.

SSG02-06 *Cardiac Energetics Alteration in Chronic Hypoxia Rat Model: A Non-Invasive In Vivo 31P Magnetic Resonance Spectroscopy Experimental Study*

Tuesday, Dec. 3 11:20AM - 11:30AM Room: S104A

Participants
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PURPOSE

Energetics alteration plays a key role in the process of myocardial injury in chronic hypoxic diseases (CHD).31P magnetic resonance spectroscopy (MRS) can investigate alterations in cardiac energetic in vivo. This study was aimed to characterize the potential of 31P MRS in evaluating cardiac energetics alteration of chronic hypoxia rats (CHR).

METHOD AND MATERIALS

Thirty CHR were induced by SU5416 combined with hypoxia. 31P MRS (Bruker BioSpec 7.0T) was performed weekly (0-5 week) to follow-up the ratio of concentrations of phosphocreatine (PCr) to adenosine triphosphate (ATP) (PCr/ATP). The index of myocardial structure and systolic function, including the left ventricular function (LVEF) and the right ventricular function (RVEF), were also measured by magnetic resonance imaging (MRI) in each rat. The myocardial injury was shown based on hematoxylin and eosin (H&E) staining and Masson's trichrome staining.

RESULTS

Along weeks, the resting cardiac PCr/ATP ratio decreased from 0 to 5 weeks of modeling. The ratio dropped more markedly after injection of isoproterenol and recovered slowly thereafter. The declension of resting cardiac PCr/ATP ratio in CHR can be observed at the first week, compared with the healthy ones((3.92±0.43vs.4.48±0.56, P<0.05). While the LVEF and RVEF in CHR was similar to healthy rats. Also, the myocardial injury cannot be observed in the first week.

CONCLUSION

31P MRS can sensitivily reveal the cardiac energetics alteration in CHD before the onset of myocardial injury and ventricular dysfunction.

CLINICAL RELEVANCE/APPLICATION

31P MRS at 7.0 T can investigate cardiac energetics alteration in chronic hypoxia rat. Of note, defects in energy regulation were present before detectable myocardial injury and ventricular dysfunction.

SSG02-07 Complete Free-Breathing Adenosine Stress Cardiac MRI Using Compressed Sensing and Motion Correction: Comparison of Functional Parameters, Perfusion and Late Enhancement with the Standard Examination in Breathhold

Tuesday, Dec. 3 11:30AM - 11:40AM Room: S104A

Participants
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PURPOSE

Stress cardiac MRI (CMR) is a demanding examination with multiple breathholds (BH) and long scan times. Aim of this study was to compare free breathing (FB) examinations with the gold standard acquired in BH.

METHOD AND MATERIALS

40 consecutive patients were enrolled prospectively and examined on a 3T MRI. Functional imaging, perfusion and late gadolinium enhancement (LGE) were performed in BH and in FB using compressed sensing and inline motion correction. Left (LV) and right ventricle (RV) functional parameters in BH and FB were compared using Bland-Altman plots and subjective image quality was assessed on a 5-point scale (1=non diagnostic to 5=very good). For perfusion and LGE imaging diagnostic confidence was rated on a 3-point scale (1=low up to 3=high) and image quality on a 5-point scale (1=non diagnostic to 5=very good). Wilcoxon test was used to compare image quality and diagnostic confidence.

RESULTS

Bland-Altman plots showed good agreement for LV and RV functional parameters in BH and FB. Subjective image quality was significantly better with BH for LV (p<0.01) but comparable for RV (p=1.0). Scan time for cine BH was 218s (range 130s-385s), for cine FB 16s (range 11-27s). Extent of perfusion defects, LGE and diagnostic confidence was comparable between both groups. Scan time for LGE BH was 371s (range 239-502s), for LGE FB 189s (range 122-286s).

CONCLUSION

FB adenosine stress CMR examination delivers diagnostic image quality and could represent an alternative for patients who are unable to meet the demands of multiple BH and long examination times.

CLINICAL RELEVANCE/APPLICATION

Free breathing stress cardiac MRI can be performed in significantly shorter time than the gold standard in breathhold.

SSG02-08 Image Quality and Reliability of a Novel Dark Blood Late Gadolinium Enhancement Sequence in Ischemic Cardiomyopathy

Tuesday, Dec. 3 11:40AM - 11:50AM Room: S104A

Participants
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PURPOSE

To assess the reliability of a novel dark-blood LGE (DBLGE) technique compared to standard bright-blood LGE (SBBLGE) sequence in patients with ischemic cardiomyopathy

METHOD AND MATERIALS

This prospective study included 78 patients (63.1 ± 12.6 years, 62 males) with clinical history of ischemic cardiomyopathy who underwent CMR at 1.5T (Discovery MR450w, GE Healthcare, Waukesha, WI) with postcontrast SBBLGE and DBLGE acquisition. Two observers performed the imaging analysis in a double blinded fashion. The endpoints were: a) qualitative and quantitative analysis of signal intensity ratio (SIR) b) n° segments involved; c) transmurality index (i.e. 0-25%;25-50%,50-75%and75-100%) d) papillary muscle enhancement e) microvascular occlusion (MVO). Statistical analysis was performed with non-parametric test.

RESULTS

There were no interobserver variability (all p >0.05). Subjective image quality in DBLGE compared to SBBLGE was higher for the discrimination between LGE and blood signal (p<0.001), inferior (p<0.001) between LGE and myocardium and similar between blood and myocardium (p=0.56). DBLGE provided higher SIR between LGE and blood signal (1.18±1.15vs0.18±0.42;p<0.001), lower SIR between LGE and myocardium (0.91±4.95vs1.96±1.64;p<0.001) and between blood and myocardium (-0.26±0.71vs1.57±1.26;p<0.001). The n° segments involved was similar (p = 0.08). The transmurality index was inferior for DBLGE (3.09±1.02vs3.30±1.11;p=0.007). DBLGE was superior in identifying papillary muscle hyperenhancement (25vs17 cases;p<0.001) and inferior in MVO detection (7vs12 cases;p<0.001).

CONCLUSION

The DBLGE sequences when compared to SBBLGE provided better contrast between LGE and blood-pool, seemed to be superior in identifying papillary muscle hyperenancement, whereas underestimated the trasmurality extension of LGE and the presence of MVO.

CLINICAL RELEVANCE/APPLICATION

Black blood LGE can be extremely useful for evaluation of patients with ischemic cardiomyopathy, however it would be carefully evaluated in patients with acute myocardial infarction.

SSG02-09 Transfer Learning has Potential to Produce Better Reconstruction of Highly-Accelerated, Single-Shot LGE Images than Conventional Deep Learning

Tuesday, Dec. 3 11:50AM - 12:00PM Room: S104A

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PURPOSE

Compressed sensing (CS) is capable of highly accelerating single-shot late gadolinium enhanced (LGE) MRI for achieving relatively high spatial resolution (1.6mmx1.6mm), but the lengthy image reconstruction time (~50s per image) and inconsistent performance hinder its clinical translation. Given limited training data, we propose a transfer learning (TL) approach to leverage our access to a large database of real-time cine images having similar image content as single-shot LGE, for developing a rapid image reconstruction framework for single-shot LGE.

METHOD AND MATERIALS

Image reconstruction was performed on a GPU workstation equipped with Pytorch. As shown in Figure 1, we pre-trained two deep learning (DL) networks (one for real and another for imaginary data, layer depth = 3, 64 features on the first layer) using existing 5811 (42 rays per frame) zero-filled and the corresponding CS reconstructed (total variation as constraint) real-time cine images from 19 patients (mean age = 66.1 ± 12.0 years; 8 females) as input/output pairs. For TL, we prospectively obtained 2-shot (42 radial spokes per shot), breath-held LGE data sets from 12 patients (mean age = 51.1 ± 20.3 years; 6 females) on 1.5T scanners (Aera and Avanto, Siemens), retrospectively undersampled the 2-shot data (101 images) by a factor of 2 (42 rays per image), and trained the U-Nets using single-shot, zero-filled (input) and the corresponding 2-shot, CS reconstructed images (output). For validation, we obtained 1-shot LGE (42 rays per image) data sets from 10 other patients (mean age = 56.5 ± 16.2 years; 6 females) and compared TL to CS and DL reconstructed images.

RESULTS

As shown in Figure 1, TL produced sharper images and fewer residual artifacts than DL and CS. Both edge sharpness (1.8 ±0.4mm) and CNR for TL (33.5 ± 18.8) were significantly (p<0.05) different from DL (2.3 ±0.4 mm and 27.0 ± 15.7) and CS (1.9 ± 0.4mm and 15.9 ± 7.6). The reconstruction time for DL and TL (0.7 ± 0.0s) was significantly (p <0.05) lower than CS (49.6 ± 1.1s).

CONCLUSION

This study demonstrates a TL approach to rapidly reconstruct 1-shot LGE with better image quality than a conventional DL approach.

CLINICAL RELEVANCE/APPLICATION

While CS is capable of highly accelerating data acquisition, the lengthy image reconstruction hinders its clinical translation.

While CS is capable of highly accelerating data acquisition, the lengthy image reconstruction hinders its clinical translation. Transfer learning enables rapid image reconstruction without requiring a large database of training data.

Printed on: 10/29/20

SSG09

Nuclear Medicine (Lymphoma PET)

Tuesday, Dec. 3 10:30AM - 12:00PM Room: S504CD

NM OI

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 1.75

Participants
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Don C. Yoo, MD, Lexington, MA (*Moderator*) Consultant, inviCRO, LLC

Sub-Events

SSG09-01 Impact of PET/CT on Clinical Management in Patients with Cancer of Unknown Primary

Tuesday, Dec. 3 10:30AM - 10:40AM Room: S504CD

Participants
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PURPOSE

To evaluate the impact of PET/CT on clinical management decisions in patients with Cancer of Unknown Primary (CUP).

METHOD AND MATERIALS

A cohort of patients with CUP undergoing clinically indicated PET/CT was prospectively enrolled in a local PET/CT registry study between 01/2013 to 06/2018. Questionnaire data from referring physicians on intended patient management before and after PET/CT were recorded. The questionnaire included items on PET/CT indication (primary staging, re-staging, lesion characterization), intended diagnostic procedures (biopsy, additional imaging), and intended treatment concept (no treatment plan, curative treatment, palliative treatment, watchful waiting). Changes in management before and after PET/CT were analyzed. Patient outcome was measured as overall survival from initial diagnosis and drawn from available patient records.

RESULTS

155 patients (53 female; 63.4±12.1y) with CUP were included. PET/CT detected the primary in 36 patients (23.7%). Intended treatment concepts were changed in 74 patients (47.7%) on the basis of PET/CT results. The treatment plan changed from 'curative' or 'no treatment plan' before PET/CT to 'palliative' in 28 patients (18.1%) and from 'no treatment plan' to a 'curative' concept in 15 patients (9.7%). Minor therapy adjustments without change of treatment goal were documented in 30 patients (19.4%). Additional invasive procedures and imaging (CT, MRI) were intended in 40 (25.8%) and 98 (63.2%) patients before PET/CT and in 21 (13.5%) and 10 (6.5%) patients after PET/CT. Overall patient survival was significantly longer in patients with one CUP manifestation (4.6±0.4y) compared to patients with 2-3 (2.8±0.4y) or more than 3 manifestations (2.4±.4y)(p=.001). Patients with cervical CUP manifestations showed a significantly longer survival (4.3±0.3y) than patients with extracervical manifestations (3.5±0.5y)(p=.01), as well as patients with intended curative (4.0±3.6y) compared to palliative treatment (2.7±0.6y) after PET/CT (p=.001).

CONCLUSION

PET/CT significantly influences clinical management in patients with CUP. It helps referring physicians to select a more appropriate and individualized treatment and to avoid unnecessary additional diagnostics.

CLINICAL RELEVANCE/APPLICATION

PET/CT has a high impact on clinical management of CUP patients due to its potential as a method for detection of the primary and distant metastases that directly influences overall patient survival.

SSG09-03 Characterization of Interim Residual Lymphoma Masses Using Diffusion-Weighted MRI with Apparent Diffusion Coefficient Mapping: FDG-PET as the Reference Standard

Tuesday, Dec. 3 10:50AM - 11:00AM Room: S504CD

Participants
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PURPOSE

To assess the value of diffusion-weighted MRI in characterizing residual lymphoma masses early during first-line chemotherapy, compared with FDG-PET as the reference standard.

METHOD AND MATERIALS

Our two-nation and two-institutional prospective study included 133 patients with bulky disease (at least one mass >7cm in diameter) at diagnosis. Whole-body diffusion-weighted MRI at 3.0-T (b = 50, 400, 800 sec/mm2) and FDG-PET/CT were performed within a week from each other, or simultaneously using FDG-PET/MRI in the later patients, before initiation in all and after 2 chemotherapy cycles (interim) in 126 patients. Volume-of-interest encompassing the entire bulky mass before and after treatment was drawn semi-automatically to obtain the mean apparent diffusion coefficient values (ADCmean). The 2014 Lugano classification was used for PET response interpretation and a Deauville score of 4 or 5 was considered positive.

RESULTS

There were 64 diffuse large B-cell (DLBCL), 45 Hodgkin (HL) and 24 follicular (FL) lymphoma patients with a total 157 bulky masses at diagnosis. Before treatment, ADCmean of these masses was 1.071 ± 0.352 x10-3 mm2/sec (range, 0.415-2.400). They were all FDG-avid with a maximum SUV of 17.0 ± 8.1 (range, 4.0-43.3). ADCmean values were comparable between two institutions for each histology subtype (P = .621-.769). Among three lymphoma subtypes, HL (52 masses) had significantly higher ADCmean values than either DLBCL (75 masses) or FL (30 masses), 1.321 v. 0.976 or 0.873 x10-3 mm2/sec, respectively (P < .0001), while only marginal difference was found between DLBCL and FL (P = .048). At interim, ADCmean values were lower in PET-positive (poor response, 50 masses) than in PET-negative (good response, 100 masses) residual masses, 1.442 ± 0.486 v. 1.865 ± 0.559 x10-3 mm2/sec (P < .0001).

CONCLUSION

Diffusion-weighted MRI with ADC mapping demonstrated in lymphoma patients with bulky disease at diagnosis different features between HL and the other two major histology subtypes. In addition, interim residual masses with good response on FDG-PET showed higher ADCmean values than those with poor response (NCT02300402).

CLINICAL RELEVANCE/APPLICATION

Diffusion-weighted MRI with ADC mapping seems useful in characterizing residual masses in lymphomas, by providing quantitative information of lesion cellularity.

SSG09-04 Comparison of FDG PET/CT-Guided Percutaneous Metabolic Bone Marrow Biopsy and Conventional Trephine Bone Marrow Biopsy for the Assessment of Lymphomatous Bone Marrow Infiltration in Newly Diagnosed Lymphoma

Tuesday, Dec. 3 11:00AM - 11:10AM Room: S504CD

Participants
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PURPOSE

To compare the diagnostic-values of PET/CT-guided targeted metabolic bone marrow (BM) biopsy and trephine bone marrow-biopsy (TBMB) to assess lymphomatous infiltration in newly diagnosed lymphoma.

METHOD AND MATERIALS

Newly diagnosed patients of lymphoma were recruited for FDG PET/CT. FDG uptake in the marrow was classified as focal, multifocal, diffuse and negative and PET/CT guided BM biopsy was done from focal or multifocal marrow lesion. The PET-guided biopsies were done using a dedicated automated-robotic-arm assisted device on the same day of diagnostic PET/CT. The real-time tissue sample was retrieved after confirming the needle tip to the target lesion. All the patients underwent TBMB from bilateral posterior superior iliac spine as a routine staging work-up. The reference standard was histopathology results of the biopsies. The diagnostic values of PET/CT-guided BM-biopsy with TBMB was compared for assessment of BM infiltration. The PET/CT-guided procedure related complications and radiation exposure to the interventionist were also recorded.

RESULTS

From January 2017 to December 2018, 167 patients of lymphoma were recruited for baseline FDG PET/CT staging. The FDG uptake in bone marrow was classified as focal (n=8), multifocal (n=25), diffuse (n=32) and negative (n=102). Of these 33/167 patients underwent both, PET/CT guided targeted BM biopsies and TBMB. Of these 33 patients, PET-guided-biopsy revealed 30 true-positive (TP), no false-positive (FP), two true-negative (TN), and one false-negative (FN). The sensitivity, specificity, positive predictive

values, NPV and accuracy of 96.7%, 100%, 100%, 66.7%, 96.9 % respectively. TBMB revealed TP-18, FN-12, FP-0 and TN-3 with sensitivity, specificity, positive predictive values, NPV and accuracy of 60.0%, 100%, 100%, 20%, 63.6% respectively. No procedure related complications were encountered in the present study. The estimated absorbed radiation dose was 566.7 µSv/year for the interventionist.

CONCLUSION

PET/CT-guided targeted BM biopsy has shown a higher diagnostic performance as compared to routine TBMB from iliac spine. It is highly practical and useful in characterization of focal FDG avid lesion and negates the false negative results.

CLINICAL RELEVANCE/APPLICATION

TBMB is established method for evaluation of BM involvement in lymphoma but only a fraction of the BM is sampled leading to a FN results. PET-guided targeted BM biopsy may reduce these FN findings.

SSG09-05 Radiomic Features of Glucose Metabolism Enable Prediction of Outcome in Mantle Cell Lymphoma

Tuesday, Dec. 3 11:10AM - 11:20AM Room: S504CD

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PURPOSE

To determine whether, in mantle cell lymphoma (MCL), [18F]FDG-PET/CT-derived radiomic features are predictive of 2-year progression-free survival (PFS), alone or in combination with clinical, laboratory and biologic data, and whether they enable outcome prognostication.

METHOD AND MATERIALS

107 treatment-naïve MCL patients scheduled to receive CD20-antibody-based immuno(chemo)therapy were retrospectively included. Standardized uptake values (SUV), total lesion glycolysis, and 16 co-occurrence matrix radiomic texture features were extracted from metabolic tumor volumes on pre-therapeutic [18F]FDG-PET/CT. A multi-layer perceptron neural network in combination with logistic regression analyses for feature selection was used for 2-year PFS prediction. Outcome prediction was first performed for radiomic features alone, and then and in combination with ECOG, WBC, LDH, and Ki67 index. International prognostic indices (MIPI and MIPI-b) were calculated, and combined with radiomic data (MIPI-m, MIPI-bm). Kaplan-Meier estimates with log-rank tests were used for PFS prognostication.

RESULTS

SUVmean (odds ratio OR, 1.272; P=0.013) and Entropy (heterogeneity of glucose metabolism; OR, 1.131; P=0.027) were significantly predictive of 2-year PFS: median areas-under-the-curve were 0.72 based on the two radiomic features alone, and 0.82 with addition of ECOG, WBC, LDH, and Ki67. Higher SUVmean in combination with higher Entropy, reflecting high 'metabolic risk', was associated with a poorer prognosis (median PFS, 20.3 vs. 39.4 months; hazard ratio HR, 2.285; P=0.005). Best PFS prognostication was achieved with the MIPI-bm (i.e., combination of MIPI-b and metabolic risk): median PFS was 43.2 months in the low risk group; 38.2 months in the intermediate risk group; and 20.3 months in the high risk group (P=0.005).

CONCLUSION

In MCL, [18F]FDG-PET/CT-derived radiomic features SUVmean and Entropy may improve 2-year PFS prediction and PFS prognostication. Best results may be achieved by a combination of metabolic, clinical, laboratory and biologic data.

CLINICAL RELEVANCE/APPLICATION

Radiomic features extracted from pre-therapeutic [18F]FDG-PET/CT may improve outcome prognistication in mantle cell lymphoma patients, and may therefore be useful for risk stratification and treatment decisions. Radiomic features could be easily integrated into an artificial intelligence-based outcome prediction model together with clinical, laboratory and biological data.

SSG09-06 The Potential Value and Pitfalls of Radiomics for Clinical Positron Emission Tomography (PET) in DLBCL: Results from the Phase 3 GOYA Study

Tuesday, Dec. 3 11:20AM - 11:30AM Room: S504CD

Participants
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Paul E. Kinahan, PhD, Seattle, WA (*Presenter*) Research Grant, General Electric Company Co-founder, PET/X LLC

PURPOSE

We are using the large multi-center (207 sites) phase 3 GOYA study to investigate using quantitative image texture features (ITFs, i.e. 'radiomics') to improve the prognostic value of the FDG-PET baseline exams in patients with previously untreated diffuse large

B-cell lymphoma (DLBCL). Here we evaluate the robustness of ITFs in clinical practice.

METHOD AND MATERIALS

Images with regions of interest (ROIs) defined by qualified physicians were transferred to the imaging core laboratory. Analysis was performed on the original images and after interpolation to common voxel sizes of 2, 4, 5, 10mm. ITFs were computed using the open-source 'PET oncology radiomics test suite (PORTS). The stability of standard metrics (SUV-mean, SUV-max, MTV, TLG), SUV histogram metrics (variance, skewness and kurtosis), and ITFs were analyzed as a function of image voxel size. Supervised machine learning models (SVM, LDA, KNN, GBRM, RF) were applied to a training set (80% of patients) to differentiate the lesion from an ROI in liver. Diagnostic accuracy was calculated on the test set (20% of patients).

RESULTS

FDG-PET images came from a variety of PET/CT scanners; thus, a unified image reconstruction protocol was not possible. Using a threshold of > 5ml, a total of 1085 radiomics-evaluable patients with 9307 lesions were analyzed. Standard SUV and histogram metrics were stable w.r.t. to image voxel size. There was a substantial variation in the distribution of many of the ITFs w.r.t. to image voxel size. Eight of the ITFs were stable w.r.t. to image voxel size, in particular GTSDM Autocorrelation, and GLZSM High Gray-Level Zone Emphasis. While the rest of the ITFs were not stable, several were stable except for the 2 or 10 mm voxels (e.g. GTSDM Sum Entropy). The stable metrics were able to differentiate liver from lesions with a diagnostic accuracy for all ML models ranging from 0.995 to 0.999.

CONCLUSION

While radiomics signatures can potentially increase the prognostic value of risk prediction of DLBCL patients at baseline, the impact of variable voxel size inherent to clinical imaging, and the distributed nature DLBCL disease visualized by PET, imply caution in interpretation by image texture analysis.

CLINICAL RELEVANCE/APPLICATION

The impact of variable voxel size inherent due to variations inherent in clinical imaging, and the distributed nature DLBCL disease visualized by PET, imply caution in interpretation by image texture analysis.

SSG09-07 Is Inappropriate Imaging Really the Culprit? An Analysis and Comparison of Published PET/CT Guidelines

Tuesday, Dec. 3 11:30AM - 11:40AM Room: S504CD

Participants
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PURPOSE

Inappropriate imaging strains patients and the health system. Several Positron Emission Tomography/Computed Tomography (PET/CT) imaging guidelines have been proposed with varying formats. Our purpose was to examine the current rates of inappropriate imaging and guideline coverage using several national guidelines to evaluate PET/CT imaging in Canada.

METHOD AND MATERIALS

Academic PET/CT centers across Canada were surveyed and asked to provide exam requests from a consecutive 7-day period. Four sets of guidelines were used to analyze the appropriateness of the exam requisitions by the author and verified by a senior radiologist: the Canadian Association of Radiologists (CAR) Referral Guidelines, the American College of Radiologists (ACR) Appropriateness Criteria, the National Cancer Care Network (NCCN) Practice Guidelines and the Institut National d'Excellence en Santé et Services Sociaux (INESSS) Interactive Tool.

RESULTS

In total, 521 exam requisitions were received from 8 PET/CT centers across Canada with most (435, representing 83%) submitted for oncological investigations, 36 (7%) for neurological conditions, 26 (5%) to investigate infectious/inflammatory processes, and the remaining 24 (5%) for various reasons. The guidelines indicated that 14-31 (3-7%) of the oncological cases were inappropriate, 123-301 (29-69%) were appropriate, and the remaining 118-299 (27-69%) were indeterminate. Among neurological exams, 0-1 (0-3%) were inappropriate, 0-29 (0-81%) were appropriate and 0-36 (0-100%) were deemed indeterminate. Of the infection/Inflammation requests, 0-1 (0-4%) were inappropriate, 0-14 (0-56%) were appropriate, and 11-25 (44-100%) were indeterminate.

CONCLUSION

While the rate of inappropriateness was similar across guidelines, the proportions deemed appropriate and indeterminate varied substantially. These results demonstrate that in addition to the existence of guidelines, further education for referring physicians, as well as development of consensus, integrated guideline assistance and override justification could prove useful.

CLINICAL RELEVANCE/APPLICATION

Insufficient information on requests and lack of guidelines are much more prevalent than inappropriate imaging, further review of PET/CT guideline utility is required.

SSG09-08 Is it Time to Reduce FDG PET Dose to 5 mCi? Findings from an NCI Quick Trial NCT03519659

Tuesday, Dec. 3 11:40AM - 11:50AM Room: S504CD

Participants
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PURPOSE

FDG PET imaging dosing in the US is based on two recommendations, the NCI workshop guidance (10 to 20 mCi FDG (Shankar et al.)) and the FDA packaging label for the production of FDG which allows dosing above 5 mCi. These recommendations have remained unchanged in spite of major PET technology developments. We performed a prospective clinical quick trial aimed to validate equivalency of 5 mCi, low dose FDG PET/CT compared to current standard of care (SOC) FDG PET/CT based on both true low dose and simulated low dose imaging.

METHOD AND MATERIALS

Low dose PET/CT imaging was assessed in 228 whole body PET studies exams, 50% true 5 mCi dosing, 50% simulated by reduced frame time of the SOC. As intraindividual comparison with two dose and scan sessions was not feasible, a matched pair distribution in BMI, gender, and age was accomplished within the desired time frame. All PET acquisitions were performed using time of flight 75 minutes post-injection using 90 seconds per bed position. A subpopulation of 97 patients were imaged on two TOF PET systems in direct succession. The low dose group had a dose of 4.9 mCi +/- 0.4, the matched SOC group 13.0 mCi +/- 0.8. Target lesion SUVmax and visual image quality evaluation were the primary assessment points. Secondary assessments include qualitative and quantitative image quality, uptake in other tissues, diagnostic confidence, and presence/visibility of artifacts. As established in prior studies, optimized image reconstruction was BMI adapted for the low dose data sets.

RESULTS

Assessment of image quality, diagnostic confidence, and image artifacts demonstrates equivalency ($p<.01$) for the dose reduced 5 mCi FDG for whole-body oncologic PET imaging. There was no loss of diagnostic capabilities, even when maintaining an acquisition time consistent with standard of care examinations. We have found that the key is the re-optimization of TOF reconstruction parameters to account for the reduced relative count density.

CONCLUSION

This trial demonstrates the ability to perform oncologic whole-body imaging at the low dose of 5 mCi with high quality and quantitatively equivalent by using TOF optimized, BMI adapted reconstruction at the lower count density without any negative diagnostic impact.

CLINICAL RELEVANCE/APPLICATION

We demonstrate that FDG dose reduction to 5 mCi is feasible in oncologic whole body TOF PET provided that an optimized, BMI adapted reconstruction approach is implemented.

SSG09-09 Accelerating Whole-Body PET Acquisitions Using Deep Learning: External Validation on Foreign Country Data

Tuesday, Dec. 3 11:50AM - 12:00PM Room: S504CD

Participants
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PURPOSE

The goal of this study was to evaluate the use of deep learning to enhance the image quality of 2-fold, 3-fold, and 4-fold accelerated whole-body PET acquisitions.

METHOD AND MATERIALS

Seven subjects (5 males, age: 57±14 years, weight: 81±10Kgs) referred for a whole-body FDG-18 PET/CT scan on a GE Discovery 710 scanner (GE Healthcare, Waukesha, WI) were recruited for this study following IRB approval and informed consent. The standard of care was a 2 min/bed PET acquisition acquired in list-mode. 2-fold, 3-fold, and 4-fold accelerated acquisitions were

synthesized using the first 30s, 40s, and 60s list-mode PET counts of the original 2min acquisition. All accelerated PET acquisitions were enhanced using a FDA-cleared commercially available deep learning software: SubtlePET (Subtle Medical, Menlo Park, CA). Quantitative image quality metrics such as normalized root-mean-squared-error (NRMSE), peak signal to noise ratio (PSNR), and structural similarity (SSIM) were calculated for all enhanced and non-enhanced accelerated PET scans, with the standard 2min acquisition as the ground-truth. Image slices in regions of elevated PET uptake (bladder and brain) were excluded from the analysis. Paired 2-tailed t-tests were computed to evaluate whether the quantitative metrics were superior for the deep-learning enhanced accelerated acquisitions compared to the non-enhanced acquisitions.

RESULTS

NRMSE, PSNR, and SSIM were significantly better ($p<0.001$) for all deep learning enhanced PET scans for all acceleration factors compared to the non-enhanced images (except 2-fold accelerated SSIM, $p<0.05$). All the deep learning enhanced images (2 to 4-fold) demonstrated similar perceptual image quality and lesion conspicuity when compared to standard of care scans. Representative PET images and quantitative metrics are seen in Figure 1.

CONCLUSION

Up to 4-fold faster PET scans can be enhanced using deep learning while maintaining similar image quality and diagnostic accuracy as the standard of care acquisition.

CLINICAL RELEVANCE/APPLICATION

Deep learning can enhance the speed of PET acquisitions for enhancing patient comfort and increasing efficiency and throughput of PET imaging, especially in resource constrained countries.

Printed on: 10/29/20

NMS-TUA

Nuclear Medicine Tuesday Poster Discussions

Tuesday, Dec. 3 12:15PM - 12:45PM Room: NM Community, Learning Center

NM

AMA PRA Category 1 Credit ™: .50

Participants

Andrew C. Homb, MD, Rochester, MN (*Moderator*) Nothing to Disclose

Sub-Events

NM212-SD-TUA1 Relationship between Decreased Cerebral Blood Flow in 123I-IMP SPECT and the Severity of Postoperative Memory Impairment of Anterior Communicating Artery Aneurysm: A Pilot Study

Station #1

Participants

Shunji Mugikura, MD, PhD, Sendai, Japan (*Presenter*) Nothing to Disclose
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PURPOSE

Recent MR imaging studies have suggested that the occlusion of the subcallosal artery, a largest unpaired artery from the anterior communicating artery (ACoA) could cause memory impairment following ACoA aneurysmal surgery. The purpose of this study is to examine whether decreased regional cerebral blood flow (rCBF) in the territory of subcallosal artery related to the severity of postoperative memory impairment.

METHOD AND MATERIALS

10 consecutive patients diagnosed with postoperative memory impairment by the formal neuropsychological tests underwent 123I-IMP-SPECT in a median of 4 months after the ACoA aneurysmal surgery. The rCBF map was imaged and regional voxel data analyzed by three-dimensional stereotactic surface projection were compared between the 10 patients and 13 age-matched normal subjects. The severity of decreased rCBF was calculated as average Z-value of the coordinates with a Z-value exceeding the threshold (Z-value=2). The cerebral lobes with rCBF representing Z value >2 in all patients were identified. Then in such lobes, the Z-values of the detailed gyri were compared with the memory quotients (MQs) by Wechsler Memory Scale -Revised. $P<0.01$ was considered significant.

RESULTS

In the right subcallosal gyrus, there was a significant negative correlation between the Z-value and visual MQ ($\rho=-0.88$, $p=0.0007$) or general MQ ($\rho=-0.85$, $p=0.0017$). In the right anterior cingulate gyrus, there was a significant negative correlation between the Z-value and verbal MQ ($\rho=-0.76$, $p=0.0092$) . In the right rectal gyrus, there was a significant negative correlation between the Z-value and general MQ ($\rho=-0.81$, $p=0.0044$). No significant correlation was found between Z-value in other brain region and verbal, visual or general MQ.

CONCLUSION

Our preliminary results showed that the severity of decreased rCBF in the subcallosal gyrus and anterior cingulate gyrus perfused by the subcallosal artery and that in the rectal gyrus in the right hemisphere are related to the severity of postoperative memory impairment of ACoA aneurysmal surgery.

CLINICAL RELEVANCE/APPLICATION

The decreased rCBF in the subcallosal gyrus, anterior cingulate gyrus and rectal gyrus in the right by 123I-IMP-SPECT suggested severe memory impairment following ACoA aneurysmal surgery

NM213-SD-TUA2 The Utility of FDG-PET/CT in the Staging and Restaging of Orbital Malignancies

Station #2

Participants

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PURPOSE

Over the past decade, we have performed FDG-PET/CT imaging on patients referred by the Ocular Oncology Department of our associated Ophthalmology Hospital. Our goal was to evaluate the role of FDG-PET/CT in the initial staging and restaging of the various ocular/orbital neoplasms, as well as its role in the response to therapy.

METHOD AND MATERIALS

Our study is the both retrospective and prospective. From 2008 through 2018, a total of 56 patients with varying orbital malignancies underwent FDG-PET/CT imaging for either initial staging prior to surgery, or for follow-up after excision and treatment. Follow-up was obtained in all but one patient (who was lost to follow-up) via review of medical records and attendance at tumor boards.

RESULTS

In all 55 patients, FDG accumulated in the primary tumor, with a sensitivity of 100%. These included lacrimal duct cancers, invasive squamous cell tumors, lymphoma, uveal melanoma, basal cell cancers, uveal schwannoma, high-grade sebaceous gland tumors, plasmacytoma, ethesioneuroblastoma, poorly-differentiated adenocarcinoma, undifferentiated adenocarcinoma, and neuroendocrine tumors. PET/CT was requested for initial staging, restaging of recurrent disease, and response to therapy. In 5 patients, PET/CT detected metastases that were not identified or unappreciated on CT. In addition, in 3 patients, PET/CT localized additional metastases outside of the field of view of CT and MRI, thereby upstaging the tumors.

CONCLUSION

In our series of 55 patients, FDG-PET/CT is 100% sensitive in detection of orbital malignancies, and is an excellent tool for the detection of metastases. Moreover, PET/CT can be potentially more sensitive than anatomical cross-sectional imaging in disease staging.

CLINICAL RELEVANCE/APPLICATION

FDG-PET/CT is a highly reliable imaging modality in the staging and restaging of orbital neoplasms, and plays a key role in monitoring treatment response, all of which impacts patient management.

NM214-SD-TUA3 Correlation between 99m Tc-PYP Cardiac Accumulation Using SPECT/CT PYP Cardiac Accumulation and Cardiac Disturbance in Familial Amyloid Polyneuropathy Patients with Cardiac Amyloidosis

Station #3

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PURPOSE

The usefulness of 99m Tc-PYP for the diagnosis of ATTR-type cardiac amyloidosis is widely recognized. In cases with advanced amyloidosis, it is reported the degree of 99m Tc-PYP accumulation to the myocardium does not accurately reflect the disease state. However, in familial amyloid polyneuropathy (FAP) patients, there is no report evaluating the correlation between 99m Tc-PYP accumulation and cardiac disturbance. The purpose of this study is to clarify the association between the degree of correlation between 99m Tc-PYP cardiac accumulation using SPECT/CT PYP cardiac accumulation and cardiac disturbance in FAP patients with cardiac amyloidosis.

METHOD AND MATERIALS

The subjects consisted of 63 FAP patients who underwent 99mTc-PYP scintigraphy and SPECT/CT. We assessed the degree of 99mTc-PYP myocardial accumulation in both planar and SPECT / CT images using visual and quantitative indicators. Quantitative indicators for planar images used the heart-to-contralateral chest ratio (H / CL ratio), and the indicators for the SPECT / CT, images were the maximum LV wall thickness-to- LV lumen ratio (LVW / LVL ratio). The left ventricular ejection fraction, left ventricular septum thickness, left ventricular posterior wall thickness, and age were used as indicators of the degree of cardiac dysfunction.

RESULTS

The indices of each 99mTc-PYP scintigraphy were correlated with the left ventricular ejection fraction, left ventricular septum thickness, left ventricular posterior wall thickness and age. (in visual analyses using planar images: LVEF, correlation coefficient (r)=-0.353, p=0.004; IVST, r=0.710, p<0.001; PLVW, r=0.675, p<0.001, age, r=0.550, p<0.001, in quantitative analyses using planar images: LVEF, r=-0.271, p=0.032; IVST, r=0.656, p<0.001; PLVW, r=0.637, p<0.001; age, r=0.503, p<;0.001; in visual analyses using SPECT/CT images: LVEF, r=-0.366, p=0.003; IVST, r=0.689, p<0.001; PLVW, r=0.716, p<0.001; age, r=0.535, p<0.001; in quantitative analyses using SPECT/CT images: LVEF, r=-0.323, IVST, r=0.723, p<0.001; PLVW, r=0.742, p<0.001; age, r=0.504, p<0.001)

CONCLUSION

Our findings suggested that 99mTc-PYP cardiac accumulation is related to the cardiac dysfunction in FAP patients with cardiac amyloidosis. Also, the SPECT / CT indices were more sensitive than the planar image indexes.

CLINICAL RELEVANCE/APPLICATION

99m Tc-PYP may de noticed ATTR cardiac amyloidosis before developing heart failure. This would have clinical relevance.

NM240-SD-TUA4 Impact of PET/CT on Clinical Management in Patients with Cancer of Unknown Primary

Station #4

Participants
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PURPOSE

To evaluate the impact of PET/CT on clinical management decisions in patients with Cancer of Unknown Primary (CUP).

METHOD AND MATERIALS

A cohort of patients with CUP undergoing clinically indicated PET/CT was prospectively enrolled in a local PET/CT registry study between 01/2013 to 06/2018. Questionnaire data from referring physicians on intended patient management before and after PET/CT were recorded. The questionnaire included items on PET/CT indication (primary staging, re-staging, lesion characterization), intended diagnostic procedures (biopsy, additional imaging), and intended treatment concept (no treatment plan, curative treatment, palliative treatment, watchful waiting). Changes in management before and after PET/CT were analyzed. Patient outcome was measured as overall survival from initial diagnosis and drawn from available patient records.

RESULTS

155 patients (53 female; 63.4±12.1y) with CUP were included. PET/CT detected the primary in 36 patients (23.7%). Intended treatment concepts were changed in 74 patients (47.7%) on the basis of PET/CT results. The treatment plan changed from 'curative' or 'no treatment plan' before PET/CT to 'palliative' in 28 patients (18.1%) and from 'no treatment plan' to a 'curative' concept in 15 patients (9.7%). Minor therapy adjustments without change of treatment goal were documented in 30 patients (19.4%). Additional invasive procedures and imaging (CT, MRI) were intended in 40 (25.8%) and 98 (63.2%) patients before PET/CT and in 21 (13.5%) and 10 (6.5%) patients after PET/CT. Overall patient survival was significantly longer in patients with one CUP manifestation (4.6±0.4y) compared to patients with 2-3 (2.8±0.4y) or more than 3 manifestations (2.4±.4y)(p=.001). Patients with cervical CUP manifestations showed a significantly longer survival (4.3±0.3y) than patients with extracervical manifestations (3.5±0.5y)(p=.01), as well as patients with intended curative (4.0±3.6y) compared to palliative treatment (2.7±0.6y) after PET/CT (p=.001).

CONCLUSION

PET/CT significantly influences clinical management in patients with CUP. It helps referring physicians to select a more appropriate and individualized treatment and to avoid unnecessary additional diagnostics.

CLINICAL RELEVANCE/APPLICATION

PET/CT has a high impact on clinical management of CUP patients due to its potential as a method for detection of the primary and distant metastases that directly influences overall patient survival.

NM241-SD-TUA5 FDG PET/MRI Analysis in Neurodegenerative Disorders: How Strong is the Correlation between Volumetric Analysis and Hypometabolism?

Station #5

Participants
Kiyon Naser-Tavakolian, MD, Nesconset, NY (*Presenter*) Nothing to Disclose
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PURPOSE

Neurodegenerative disorders demonstrate typical lobar and regional patterns of volume loss with corresponding decreased glucose metabolism. In this retrospective study, we aim to correlate volumetric changes utilizing Neuroquant morphometric analysis with decreased FDG uptake as per age-matched calculated Z-scores utilizing [F18] FDG PET-MR neuroimaging.

METHOD AND MATERIALS

70 patients (mean age 70) with neurodegenerative disorders underwent PET-MR brain imaging. Patients were categorized by dementia subtype as follows: Alzheimer's disease (AD), Frontotemporal dementia (FTD), Lewy Body Dementia (LBD). NeuroQuant software was used for assessment of intracranial volumetric information compared to normal age-matched controls. MIM software was utilized to provide semi-quantitative Z-score analysis of abnormal areas of hypometabolism. Volumetric data was graded by severity into none/mild volume loss (MVL) (>=1 standard deviation below the mean) and severe volume loss (SVL) (2 standard deviations or more below the mean). A two-tailed T-test was used for analysis.

RESULTS

In the 26 patients with suspected AD (mean age 70), parietal lobe SVL had an average Z score of -2.74 compared to -1.31 in MVL ($p = 0.08$). Patients with temporal lobe SVL had an average Z score of -1.55 compared to -0.26 in MVL ($p = 0.08$). In 31 patients with FTD (mean age 72), patients with SVL had a frontal lobe Z score of -1.15 compared to -0.66 in MVL ($p = 0.07$). Patients with temporal lobe SVL had an average Z score of -0.39 compared to -0.59 in MVL ($p = 0.63$). In the 13 patients with LBD (mean age 66), SVL patients had an average occipital lobe Z score of -2.5 compared to -2.98 in MVL ($p = 0.26$). Patients with parietal lobe SVL had an average Z score of -3.8 compared to -1.7 in MVL ($p < 0.05$).

CONCLUSION

Our semi-quantitative approach to lobar specific volume loss and brain hypometabolism on PET-MRI imaging demonstrate a strong trend towards statistical significance in several regions including the parietal/temporal lobe with AD, frontal lobe in FTD and statistical significance within the parietal lobe in suspected LBD. Increasing sample size may provide further clarification of the strength of this correlation.

CLINICAL RELEVANCE/APPLICATION

Correlating lobar-specific volumetric percentiles with FDG Z-score values may add diagnostic confidence in the differential diagnosis of neurodegenerative disease in clinical practice.

NM131-ED-TUA6 Histiocytoses and Neoplasms of the Macrophage-Dendritic Cell Lineages: Multimodality Imaging with PET/CT Emphasis

Station #6

Awards
Certificate of Merit
Identified for RadioGraphics

Participants
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TEACHING POINTS

1.To present the revised classification of histiocytoses and neoplasms of macrophage-dendritic cell lineage with five main groups: Group L: Langerhans cell histiocytosis (LCH) and Erdheim-Chester disease, Group C: Non-LCH of skin and mucosa, Group R: Rosai-Dorfman disease, Group M: Malignant histiocytoses, and Group H: hemophagocytic lymphohistiocytosis. 2.To review the anatomic and functional imaging of these five groups with emphasis on PET/CT impact of staging and post-therapeutic surveillance.

TABLE OF CONTENTS/OUTLINE

The histiocytoses are rare disorders characterized by the accumulation of cells thought to be derived from dendritic cells or macrophages. The first classification of histiocytosis consisted of 3 categories: Langerhans cell (LC) or non-LC-related groups, and malignant histiocytoses. The revised classification has 5 groups mentioned above. The educational exhibit has two components: (1) introduction and discussion of the revised classification with the related physiopathology of the 5 main groups, and (2) the multi-imaging of each of these five categories of lesions on cross-sectional imaging and PET/CT. All the common and unusual sites of the lesions are reviewed and discussed.

NM132-ED-TUA7 Spectrum of Incidental Vascular Findings on 18F-FDG PET/CT Imaging

Station #7

Awards
Identified for RadioGraphics

Participants
Gaurav V. Watane, MBBS, MD, Boston, MA (*Presenter*) Nothing to Disclose
Hyewon Hyun, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Matthew S. Robertson, MD, Cambridge, MA (*Abstract Co-Author*) Stockholder, CRISPR Therapeutics; Stockholder, Gossamer Bio, Inc

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TEACHING POINTS

1. To become familiar with various emergent and non-emergent vascular findings observed on oncologic and non-oncologic PET/CT scans 2. To gain awareness of the current role and limitations of PET/CT in vascular imaging.

TABLE OF CONTENTS/OUTLINE

1. Case based review of the spectrum of clinically relevant incidental vascular findings detected on PET/CT; including drug induced vasculitis, large vessel vasculitis, pulmonary infarction, thrombophlebitis, post-surgical complications related to graft repair and inadvertent vascular injury. 2. Current status of the PET/CT in vascular imaging with emphasis on inflammatory vasculitis 3. Limitations of the PET/CT in vascular imaging.

NMS-TUB

Nuclear Medicine Tuesday Poster Discussions

Tuesday, Dec. 3 12:45PM - 1:15PM Room: NM Community, Learning Center

NM

AMA PRA Category 1 Credit ™: .50

Participants
Andrew C. Homb, MD, Rochester, MN (*Moderator*) Nothing to Disclose

Sub-Events

NM221-SD-TUB1 Clinical Significance of FDG Uptake by Bone Marrow on the Prognosis of Head and Neck Squamous Cell Carcinoma

Station #1

Participants
Sang Mi Lee, Cheonan, Korea, Republic Of (*Presenter*) Nothing to Disclose
Jeong Won Lee, MD,PhD, Incheon, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

FDG uptake of bone marrow (BM) on PET/CT is known to be a biomarker that reflects systemic inflammatory response. In patients with various malignant diseases, FDG uptake of BM is known to be associated with clinical outcomes, but, in patients with head and neck squamous cell carcinoma (HNSCC), the clinical significance of FDG uptake of BM has not been evaluated thoroughly. The purpose of this study was to assess the relationship between FDG uptake in the BM on PET/CT and serum inflammatory markers, tumor factors, and survival in patients with HNSCC.

METHOD AND MATERIALS

We retrospectively enrolled 157 HNSCC patients who underwent staging FDG PET/CT and subsequent treatment. On FDG PET/CT, the maximum standardized uptake value (SUV), metabolic tumor volume (MTV), and total lesion glycolysis (TLG) of the primary tumor, the mean FDG uptake of BM (BM SUV) and BM-to-liver uptake ratio (BLR) were measured. The correlations between FDG uptake of BM, serum inflammatory markers and tumor factors were evaluated. The prognostic values of BM SUV and BLR for predicting disease progression-free survival and distant failure-free survival were assessed by using Cox proportional hazards regression model.

RESULTS

The mean follow-up period of the patients was 25.4 months, During follow-up, 48 patients (30.6%) experienced disease progression, including 17 (10.8%) with distant failure. The BM SUV and BLR showed positive correlations with serum C-reactive protein level, neutrophil-to-lymphocyte ratio, tumor size, tumor stage, and maximum SUV, MTV, and TLG of the primary tumor. In multivariate analysis, BLR was significantly associated with disease progression-free survival along with TNM stage and maximum SUV of the primary tumor. For distant failure-free survival, TNM stage, tumor size, maximum SUV, MTV, and TLG of the primary tumor, and BLR showed prognostic significance on univariate analysis. However, all of the variables failed to show significance on multivariate analysis.

CONCLUSION

FDG uptake of BM in HNSCC patients was an independent predictor for disease progression-free survival and had significant association with stage and metabolic parameters of the tumor.

CLINICAL RELEVANCE/APPLICATION

In patients with HNSCC, FDG uptake of BM on PET/CT can be used as an imaging biomarker that reflects the degree of systemic inflammatory response and the risk of disease progression.

NM216-SD-TUB2 Variable Scintigraphic Presentations of Parathyroid Gland Hyperplasia on Parathyroid Scintigraphy: Results of a Multi-Year Analysis

Station #2

Participants
Charles M. Intenzo, MD, Philadelphia, PA (*Presenter*) Nothing to Disclose
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John Kairys, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Alliric Willis, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
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Serge Jabbour, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Jeffrey Miller, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Sung M. Kim, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

Scintigraphic imaging using Tc-99m sestamibi is often a routine diagnostic procedure for the preoperative localization of parathyroid adenomas. While the latter appears as an area of focal tracer uptake and retention, parathyroid gland hyperplasia (PGH) often presents as a negative study (i.e., no discrete focal tracer uptake). However, upon follow-up of our scan results, most cases of PGH were not normal scans, with a varying number of tracer foci. Our goal was to determine the various scan findings on all patients referred for parathyroid scintigraphy, who had histologically-proven PGH.

METHOD AND MATERIALS

Our study is both retrospective and prospective. Over a period of 12 years, we reviewed the sestamibi scans of all patients whose pathology report from surgical neck exploration indicated parathyroid gland hyperplasia, as the final histopathological result.

RESULTS

A total of 108 patients were diagnosed as having PGH. Of these, 29 (28.6%) patients had normal scans, 37 patients (34.2%) had one focus of tracer activity (27 of these had persistent tracer retention on the 3-hour delayed images, while 10 showed uptake on the initial images only). 39 patients (36.1%) demonstrated 2 foci of tracer retention. Two patients (1.8%) showed 3 areas of tracer retention, and there was one patient (less than 1%) with 4 foci of tracer retention. The histopathological description of those with 1, 2, and 3 focal areas was 'asymmetric hyperplasia.'

CONCLUSION

On sestamibi parathyroid scintigraphy, PGH has variable scan patterns, depending on the number of hyperplastic glands observed histiologically.

CLINICAL RELEVANCE/APPLICATION

1. A negative sestamibi scan is not the most common scan presentation of parathyroid gland hyperplasia. 2. In our series, 2 areas of sestamibi concentration was the most common scan appearance of parathyroid gland hyperplasia. 3. Two foci of sestamibi uptake on parathyroid scintigraphy does not necessarily indicate a double parathyroid adenoma; 39 patients in our series with this finding had parathyroid hyperplasia.

NM217-SD-TUB3 Role of a Portable Gammacamera for the Assessment of Margins Involvement after Radioguided Surgery of Pulmonary Nodules

Station #3

Participants
Pilar Paredes, MD, Barcelona, Spain (*Presenter*) Nothing to Disclose
David Sanchez-Lorente, Barcelona, Spain (*Abstract Co-Author*) Nothing to Disclose
Nuria S. Sanchez-Izquierdo, Barcelona, Spain (*Abstract Co-Author*) Nothing to Disclose
Sergi Vidal-Sicart, MD, Barcelona, Spain (*Abstract Co-Author*) Nothing to Disclose
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PURPOSE

To evaluate the role of an intraoperative portable gammacamera (PGC) to assess the resection margins of pulmonary nodules.

METHOD AND MATERIALS

We included 29 patients (16 men, 13 women), mean age 65±12 years, referred to Nuclear Medicine Department for the surgical biopsy of a pulmonary nodule with ROLL technique (radioguided occult lesion localization), with a total of 38 nodules. In 30 cases, radioguided surgery was helped with a PGC fitted with an optical view. A radiotracer was injected inside the nodule 2-23 h before surgery. Pulmonary nodules were removed by means of a gamma-probe and a Video-Assisted-Thoracoscopy (VATS) approach. Once removed, the specimen was imaged by a PGC to confirm the presence of the tracer inside the specimen and to assess if the margins were free of involvement. When the activity was in contact with the stitches, it was considered as an involved margin.

RESULTS

The PGC detected 22 lesions centered inside the nodule. In 8 cases the radiotracer was in contact with margins. Pathologic exam revealed free margins in 22/22 cases where the tracer was centered, that means a negative predictive value of 100%. Margins were involved in 1/8 cases in which the tracer was in contact with margins.

CONCLUSION

The assessment of margins with an PGC inside the surgical room could replace the intraoperative pathologic exam and shorten the length of surgery.

CLINICAL RELEVANCE/APPLICATION

The use of a portable gammacamera allows to shorten the length of surgery due to its high negative predictive value (100%) in detecting margins free of involvement.

NM242-SD-TUB4 Effects of New Block Sequential Regularized Expectation Maximization (BSREM) Reconstruction Algorithm on Visualization and Quantification of Small Abdominal Malignant Tumors in FDG PET-CT Examinations

Station #4

Participants

Mitsuaki Tatsumi, MD, PhD, Suita, Japan (*Presenter*) Nothing to Disclose
Takashi Kamiya, Suita, Japan (*Abstract Co-Author*) Nothing to Disclose
Tadashi Watabe, Suita, Japan (*Abstract Co-Author*) Nothing to Disclose
Hiroki Kato, Suita, Japan (*Abstract Co-Author*) Nothing to Disclose
Jun Hatazawa, MD, PhD, Suita, Japan (*Abstract Co-Author*) Nothing to Disclose
Noriyuki Tomiyama, MD,PhD, Suita, Japan (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

BSREM reconstruction algorithm, or so called 'Q. Clear', was recently introduced to improve image quality and quantification in PET examinations. The purpose of this study was to evaluate the effects of this new algorithm on visualization and quantification of small abdominal malignant tumors in FDG PET-CT examinations, comparing the results to those by an ordered subset expectation maximization (OSEM) reconstruction algorithm.

METHOD AND MATERIALS

This study included 60 abdominal malignant (36 liver metastatic and 24 pancreatic cancer) lesions <1.5 cm in greatest diameter. FDG PET-CT images were acquired with a GE Discovery 710 scanner equipped with a time-of-flight system. Images were reconstructed using BSREM beta 700 and OSEM (subset 8, iteration 3, and Gaussian filter 4mm; regular setting in our hospital) algorithms. Visual image quality of each lesion was evaluated with a 4-point scale (1=poor, 2=fair, 3=good, and 4=excellent). SUVmax was obtained for quantitative metrics. Visual score and quantitative metrics were compared between BSREM and OSEM images. Tumor margin was delineated with SUVmax 2.5 threshold. Statistical analysis was performed with a Wilcoxon signed-rank test and a Spearman's correlation method.

RESULTS

Visual scores were 2.7+/-0.98 and 3.1+/-0.87 (mean+/-SD) in OSEM and BSREM, respectively. The score in BSREM was significantly higher than that in OSEM ($p < 0.001$). Increase in visual score was observed in 20 (33%) of all 60 lesions (11: 2 in OSEM to 3 in BSREM, 1: 2 to 4, 5: 3 to 4). SUVmax were 4.3+/-2.4 and 4.5+/-2.4 in OSEM and BSREM, respectively. SUVmax in BSREM was significantly higher than that in OSEM ($p < 0.05$) (5.7% increase with BSREM). Increase in visual score was negatively correlated with [score in OSEM] or [SUVmax in OSEM] ($|Rho| = 0.44$-0.48, $p < 0.001$), and was positively with [%increase of SUVmax with BSREM] ($Rho = 0.51$, $p < 0.001$).

CONCLUSION

This study demonstrated that BSREM improved visual image quality and SUVmax in small abdominal malignant tumors. The effect of BSREM was more prominent in lesions with low image quality or low SUVmax in OSEM.

CLINICAL RELEVANCE/APPLICATION

BSREM improved visual image quality and SUVmax in small abdominal malignant tumors, especially when the lesions represented low image quality or low SUVmax in OSEM.

NM243-SD-TUB5 Qualitative [18F] FDG PET/MRI Assessment of Hypometabolism Patterns in Suspected Corticobasal Degeneration Syndromes

Station #5

Participants
Osama Ahmed, MD, Stony Brook, NY (*Presenter*) Nothing to Disclose
Kiyon Naser-Tavakolian, MD, Nesconset, NY (*Abstract Co-Author*) Nothing to Disclose
Michael Clifton, MD, Stony Brook, NY (*Abstract Co-Author*) Nothing to Disclose
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Lev Bangiyev, DO, Stony Brook, NY (*Abstract Co-Author*) Nothing to Disclose
Dinko Franceschi, MD, Stony Brook, NY (*Abstract Co-Author*) Nothing to Disclose
Ana M. Franceschi, MD, Manhasset, NY (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

Corticobasal degeneration (CBD) is a rare neurodegenerative dementia that classically involves the parietofrontal cortex, basal ganglia, and thalami in addition to the primary sensorimotor cortex, typically in an asymmetric pattern. We aim to demonstrate lobar-specific patterns of CBD and their respective metabolic and volumetric abnormalities.

METHOD AND MATERIALS

74 patients (41 female, 33 male, mean age 70) with suspected neurodegenerative disease underwent hybrid FDG PET/MR brain imaging. Patients were categorized by dementia subtype into Alzheimer's, Frontotemporal, Lewy Body and CBD. NeuroQuant software was used for assessment of intracranial volumetric information compared to normal age-matched controls. MIM software provided semi-quantitative Z-score analysis of abnormal areas of hypometabolism compared to age-matched controls. Metabolic and volumetric data of each hemisphere was then compared to assess for symmetric or asymmetric involvement of regions of interest.

RESULTS

7 of 74 patients had cognitive impairment with clinical signs and symptoms as well as imaging patterns suggestive of CBD. 6 out of 7 had asymmetric FDG uptake. Most subjects with asymmetric patterns (83%) had sensorimotor cortex volumes in the <5th percentile for age. Regions involved include the pre/postcentral gyri, ipsilateral thalami, and basal ganglia. In patients with asymmetry, precentral gyrus mean Z scores in the affected and unaffected sides were -2.7 and 0.18, respectively ($p = .002$). The postcentral gyrus had mean Z scores of -2.2 and 0.150 in the affected and unaffected sides, respectively. One patient demonstrated symmetrically decreased metabolism within the precentral gyrus (Z-scores of -1.88 and -1.69 on the left and right, respectively) and postcentral gyrus (Z-scores of -1.66 and -1.90 on the left and right, respectively).

CONCLUSION

CBD demonstrates decreased volume and metabolism in one of two patterns. The first being marked asymmetric hypometabolism and volume loss of the parietofrontal cortex, sensorimotor cortex, ipsilateral subcortical structures, and the thalamus and basal ganglia. The second more atypical pattern is bilateral hypometabolism most pronounced in the sensorimotor cortex.

CLINICAL RELEVANCE/APPLICATION

This study addresses the knowledge gap in assessment of metabolic/volumetric abnormalities in cognitively impaired patients with movement disorders and suspected CBD syndrome undergoing FDG PET/MRI imaging.

NM134-ED-TUB6 Tumor and Tumor-Like Diffuse Peritoneal Diseases on CT and FDG-PET/CT: A Correlation with Pathologic Findings

Station #6

Participants
Satoshi Makise, Shinjuku, Japan (*Presenter*) Nothing to Disclose
Masatoshi Hotta, Shinjuku, Japan (*Abstract Co-Author*) Nothing to Disclose
Ryotaro Kamei, MD, Fukuoka, Japan (*Abstract Co-Author*) Nothing to Disclose
Takashi Okafuji, MD, Fukuoka, Japan (*Abstract Co-Author*) Nothing to Disclose
Yoshitaka Shida, MD, Tokyo, Japan (*Abstract Co-Author*) Nothing to Disclose
Ryogo Minamimoto, MD, PhD, Tokyo, Japan (*Abstract Co-Author*) Nothing to Disclose
Tsuyoshi Tajima, MD, PhD, Tokyo, Japan (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

Imaging features of peritoneal diseases including primary and secondary tumor and tumor-like lesions frequently overlap, and the radiological diagnosis is thus often difficult. The combination of CT and FDG-PET/CT can provide clues enabling a differential diagnosis in peritoneal diseases. The purpose of this exhibit is to: (1) Review the clinical and pathologic features of peritoneal tumors and tumor-like lesions (2) Demonstrate CT and FDG-PET/CT images of diffuse peritoneal diseases, in a comparison with pathologic findings (3) Describe key features of CT and FDG-PET/CT, which can narrow the differential diagnosis of peritoneal deceases

TABLE OF CONTENTS/OUTLINE

(1) Introduction (2) Overview of peritoneal diseases (3) Primary peritoneal diseases: (a)mesothelioma, (b)peritoneal serous carcinoma (4) Secondary peritoneal diseases: (a) carcinomatosis, (b) pseudomyxoma peritonei (PMP), (c) lymphomatosis, (d) sarcomatosis (gastrointestinal stromal tumor [GIST], leiomyosarcoma) (5) Tumor-like peritoneal diseases: (a) granulomatous peritonitis (tuberculosis, mycobacterium avium complex, histoplasmosis), (b) miscellaneous diseases (splenosis, endometriosis)

NM133-ED-TUB7 Radioisotope Safety Exam: What Every Radiology Resident Needs to Know to Pass the Exam

Station #7

Participants
Dmitry Trifanov, MD, Darby, PA (*Presenter*) Nothing to Disclose
Hanna Tomsan, MD, Darby, PA (*Abstract Co-Author*) Nothing to Disclose
Gerard T. Berry Jr, MD, Wayne, PA (*Abstract Co-Author*) Nothing to Disclose
Michael K. McGarry JR, MD, Drexel Hill, PA (*Abstract Co-Author*) Nothing to Disclose
Oleg Teytelboym, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose

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TEACHING POINTS

-Regulations (training requirements, radiation safety program)-Radiobiology (measurements, radiation effects)-Dose limits (occupational, public, pregnancy)-Radiopharmaceuticals (regulations, transport, written directive, patient release)-Adverse Events (reporting, medical events, spills)-Common real-life challenges

TABLE OF CONTENTS/OUTLINE

-Radiation Physics-Radiation measurement instruments -Radiopharmaceutical administration -Management of radioactive sources-Administrative/practice controls and responsibilities -Radiation safety and protection -Radiation accidents/incidents

MSCC33

Case-based Review of Nuclear Medicine: PET/CT Workshop-Abdomen/Pelvis & Pediatrics (In Conjunction with SNMMI) (Interactive Session)

Tuesday, Dec. 3 1:30PM - 3:00PM Room: E450B

CT GI GU NM PD

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 1.75

Participants
Medhat M. Osman, MD, Saint Louis, MO (*Moderator*) Speakers Bureau, Advanced Accelerator Applications SA

Sub-Events

MSCC33A Adult Abdomen/Pelvis

Participants
Don C. Yoo, MD, Lexington, MA (*Presenter*) Consultant, inviCRO, LLC
Terence Z. Wong, MD, PhD, Chapel Hill, NC (*Presenter*) Consultant, Lucerno Dynamics, LLC;

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LEARNING OBJECTIVES

1) Review challenging and instructive cases PET/CT scans in the abdomen and pelvis which will help with interpretation of PET/CT scans.

ABSTRACT

For oncologic studies, F18-FDG is an outstanding tracer with wide applications. However, there are many pitfalls which can make interpretation challenging. The purpose of this educational activity is to familiarize the audience with the normal biodistribution of FDG in the body and learn various pitfalls in the abdomen and pelvis that can occur when interpreting oncologic PET/CT scans.

MSCC33B Pediatrics

Participants
Helen R. Nadel, MD, Palo Alto, CA (*Presenter*) Consultant, ICON plc

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LEARNING OBJECTIVES

1) Be able to identify indications for pediatric PET /CT or PET/MRI imaging. 2) Be familiar with protocols used for pediatric PET/MRI.

SSJ17

Nuclear Medicine (CNS Nuclear Medicine and PET)

Tuesday, Dec. 3 3:00PM - 4:00PM Room: S505AB

NM NR

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

Participants
Hossein Jadvar, MD, PhD, Pasadena, CA (*Moderator*) Investigator, SubtleMed; Investigator, ImaginAb, Inc
Phillip Kuo, MD,PhD, Tucson, AZ (*Moderator*) Research Grant, Astellas Group; Research Grant, Blue Earth Diagnostics Ltd; Consultant, Novartis AG; Consultant and Speaker, General Electric Company; Consultant, Konica Minolta, Inc; Consultant, Imaging Endpoints

Sub-Events

SSJ17-01 Image-Based Deep-Learning Prediction of Amyloid Deposition Patterns Using Early Phase Imaging of Amyloid PET

Tuesday, Dec. 3 3:00PM - 3:10PM Room: S505AB

Participants
Seisaku Komori, Salt Lake City, UT (*Presenter*) Employee, Hamamatsu Photonics KK
Donna J. Cross, PhD, Salt Lake City, UT (*Abstract Co-Author*) Nothing to Disclose
Megan K. Mills, MD, Salt Lake City, UT (*Abstract Co-Author*) Nothing to Disclose
Takashi Norikane, Kita-gun, Japan (*Abstract Co-Author*) Nothing to Disclose
Tanyaluck Thientunyakit, MD, Bangkok, Thailand (*Abstract Co-Author*) Nothing to Disclose
Yasuomi Ouchi, Hamamatsu, Japan (*Abstract Co-Author*) Nothing to Disclose
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Satoshi Minoshima, MD, PhD, Salt Lake City, UT (*Abstract Co-Author*) Consultant, Hamamatsu Photonics KK; Research Grant, Hitachi, Ltd; Research Grant, Nihon Medi-Physics Co, Ltd;

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PURPOSE

This study is to develop an image-based deep-learning technique that generates predicted delay uptake patterns of amyloid PET using only early-phase images obtained after radiotracer injection.

METHOD AND MATERIALS

Deep-learning architecture was developed in a seven layer U-net convolutional neural network, units normalized by batch normalization, and activated by a rectified liner unit. [11C]PiB PET image sets were obtained from 259 subjects (age 67.3±8.0 yrs, 151 female) who underwent imaging at early (0-20 min) and delayed (50-70 min) time points. Additionally, an independent data set (20 subjects, age 67.4±8.7 yrs, 10 female) was used for testing the accuracy of future image prediction. The subjects included normal subjects, as well as Alzheimer's, Lewy body, and fronto-temporal dementias and mild cognitive impairment patients. Both volumetric PET images and NEUROSTAT/3D-SSP images were used for the analysis. By learning the relationship between the image at the early time point and the image at the delayed time point, the system performed the interpolation considering the relation and generated delayed images. In order to compensate for the small amount of data, a generative adversarial network (GAN) was used for learning.

RESULTS

The proposed technique achieved a root mean square percentage error (RMSPE) of 6.3%, peak signal-to-noise ratio (PSNR) of 21.8 dB, structural similarity index (SSIM) of 0.45 using NEUROSTAT/3D-SSP images to predict the delayed image based on the early image. These results shows that the predicted images are very similar to the real images.

CONCLUSION

This study has demonstrated the feasibility of an image-based deep-learning technique to predict delayed patterns of [11C]PiB PET uptake based on the early uptake. Such image-based prediction has not been well established in the past.

CLINICAL RELEVANCE/APPLICATION

This technique can predict delayed images from early images measured in a short time; hence it would contribute to saving measurement time and will benefit the patients, technicians and facilities.

SSJ17-02 Concordance between 18F-PI-2620 tau PET/MRI Imaging and Clinical Outcomes in Alzheimer Disease and Other Tauopathies

Tuesday, Dec. 3 3:10PM - 3:20PM Room: S505AB

Awards
Trainee Research Prize - Resident

Participants
Mary Ellen I. Koran, MD, PhD, Stanford, CA (*Presenter*) Nothing to Disclose
Patrick L. Adams, MD, Stanford, CA (*Abstract Co-Author*) Nothing to Disclose
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Sharon Sha, Stanford, CA (*Abstract Co-Author*) Nothing to Disclose
Carolyn A. Fredericks, Stanford, CA (*Abstract Co-Author*) Nothing to Disclose
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Anthony Wagner, Stanford, CA (*Abstract Co-Author*) Nothing to Disclose
Greg Zaharchuk, MD, PhD, Stanford, CA (*Abstract Co-Author*) Research Grant, General Electric Company; Research Grant, Bayer AG; Stockholder, Subtle Medical
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Elizabeth Mormino, Stanford, CA (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

Primary pathology of Alzheimer disease (AD) includes both ß-amyloid and neurofibrillary tangles (NFT) of misfolded tau. Diagnosing tau pathology in vivo, and correlating pathology burden with clinical status, is crucial in diagnosing disease and in development of anti-tau therapy. The goal of this study was to 1) create a clinical protocol for evaluating a novel Tau PET ligand 18F-PI-2620 and 2) evaluate the concordance rate between radiologists and in comparison to clinical status.

METHOD AND MATERIALS

Per Braak staging, NFTs start in the entorhinal cortex in early stages (Braak 1-2), progress to the hippocampus (Braak 3-4) and lastly impact neocortex (Braak 5-6). Criteria for tau positivity was based on modified Braak staging, where Braak stages 1 & 2, 3 & 4, and 5 & 6 were collapsed into stage A, B, and C, respectively. Patients with no uptake were staged as 0. Tau positivity was determined based on visual uptake greater than off target regions. Two physicians were blinded to patient status, and independently evaluated the fused PET/MRI for 16 healthy older controls and 12 patients with mild cognitive impairment or dementia.

RESULTS

19, 2, 1, and 6 participants were classified as 0, A, B, and C, respectively. Using this staging, there was 89.2% agreement rate between readers (Cohen's kappa coefficient of 0.78, standard error=0.12). The greatest disagreement was for intermediate levels corresponding to Braak 3-4. Off target uptake included the substantia nigra, venous sinuses, the nasal sinuses, and choroid plexuses.

CONCLUSION

Overall, tau imaging with PI2620 is promising clinically, using modified Braak staging. Longitudinal imaging and confirmation with histopathology is needed to fully validate this tracer and understand whether Tau PET will be useful to track disease progression.

CLINICAL RELEVANCE/APPLICATION

As anti-tau therapy is developed for Alzheimer's and other tauopathies, 18F-PI-2620 PET/MRI seems a promising candidate for quantifying disease burden in vivo.

SSJ17-03 Hybrid PET-MR Imaging in Neurodegenerative Disorders: Are Age-Matched Controls Needed to Evaluate FDG Hypometabolism Patterns?

Tuesday, Dec. 3 3:20PM - 3:30PM Room: S505AB

Participants
Kiyon Naser-Tavakolian, MD, Nesconset, NY (*Presenter*) Nothing to Disclose
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PURPOSE

Neurodegenerative disorders demonstrate lobar patterns of parenchymal volume loss with associated decreased glucose metabolism. Limited data exists comparing semi-quantitative metabolic fluorodeoxyglucose (FDG) uptake on PET/MR imaging in patients with suspected dementia using an age-matched or non-age matched control brain atlas. This retrospective study compares semi-quantitative Z-scores provided by MIM Software in PET/MRI imaging of suspected dementia patients utilizing an age-matched versus non-age matched brain atlas.

METHOD AND MATERIALS

70 patients (37 female, 33 male, mean age 70) with suspected neurodegenerative disorder underwent hybrid FDG PET/MRI brain imaging. Patients were categorized by dementia subtype into Alzheimer's disease (AD), Frontotemporal dementia (FTD), and Lewy

Body Dementia (LBD). A Z score subset was obtained both in comparison with age-matched controls (minimum of 5 controls +/- 5 years of age) and a non-age matched control brain atlas which included a total of 43 individuals (19 female, 24 male; mean age 63.8 +/- 10 years). A two-tailed paired T-test was performed to compare the corresponding average Z scores.

RESULTS

26 patients with suspected AD (mean age 70) had mean parietal lobe Z-score values of -1.82 and -1.68, when compared to age-matched (AMC) and non-age matched controls (NAMC), respectively (p = 0.82); temporal lobe Z scores when compared to AMC and NAMC were -1.15 and -1.35, respectively (p = 0.69). 31 patients with suspected FTD (mean age 72) had mean Z-score values in the frontal lobes of -1.09 and -1.21 when compared to AMC and NAMC, respectively (p = .78); temporal lobe Z scores were -0.55 and -0.74 when compared to AMC and NAMC (p = 0.55). 13 patients with suspected LBD (mean age 66) had mean occipital, parietal, and temporal lobe Z scores of -2.61, -1.85, and -0.77 for AMC and -2.46, -1.98, and -0.943 for NAMC, respectively [p-values for AMC versus NAMC in the occipital, parietal, and temporal lobe were 0.54, 0.92, and 0.67 respectively].

CONCLUSION

Our semi-quantitative PET/MRI approach to recognize lobar patterns of brain hypometabolism in patients with neurodegenerative disorders demonstrates no significant difference when comparing patients to AMC or NAMC.

CLINICAL RELEVANCE/APPLICATION

Without the need for age-matched controls, a semi-quantitative approach to dementia can be more easily applied in the routine assessment of patients with underlying neurodegenerative disease.

SSJ17-04 18F-FDG PET/CT in Immunocompetent Patients with Primary Central Nervous System Lymphoma: Differentiation from Glioblastoma and Correlation with DWI

Tuesday, Dec. 3 3:30PM - 3:40PM Room: S505AB

Participants
Wen Jianbo, Shanghai , China (*Presenter*) Nothing to Disclose
Geng Daoying, Shanghai, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

18F-fluorodeoxyglucose (FDG) positron emission tomography (PET)/computed tomography (CT) is useful for the detection of cancerous lesions, and FDG uptake is related to the apparent diffusion coefficient (ADC) derived from diffusion-weighted imaging (DWI) of extracranial tumors. The purpose of our study was to investigate the ability of FDG PET/CT in distinguishing primary central nervous system lymphoma (PCNSL) from glioblastoma multiforme (GBM) and to explore the relationship between 18F-FDG uptake and the ADC in patients with PCNSL.

METHOD AND MATERIALS

We reviewed 92 patients (40 with PCNSL and 52 with GBM) who underwent FDG PET/CT scans at disease onset. The maximum standardized uptake value (SUVmax), tumor to normal contralateral cortex activity (T/N) ratio, SUVmean, metabolic tumor volume (MTV), and total lesion glycolysis (TLG) of tumor lesions were calculated. Receiver operating characteristic (ROC) curves were generated to determine the diagnostic performance for FDG PET-related parameters to differentiate PCNSL from GBM. Twenty-eight patients with PCNSL (with 34 lesions) also underwent diffusion-weighted imaging. Pearson's correlation analysis was used to assess the relation between SUV- and ADC-derived parameters.

RESULTS

The SUVmax, T/N ratio, SUVmean, and TLG values were significantly higher in PCNSL than in GBM. Comparative ROC analysis indicated that the SUVmax had a greater area under the curve (AUC) of 0.910 than the T/N ratio (0.905, P=.85), SUVmean (0.836, P=.0006), or TLG (0.641, P < 0.0001). The T/N ratio had the highest specificity (94.23%) for differentiating PCNSL from GBM, while the SUVmax had the most optimal sensitivity (92.31%). Further combined analysis of the indices did not significantly improve the AUC. Moderate inverse correlations between the SUVmax, SUVmean, TLG, and the ADC ratio (rADC) were found in PCNSLs (r=-0.526, P=.002; r=-0.504, P=.004; and r=-0.483, P=.006; respectively)

CONCLUSION

The SUVmax and T/N ratio may be reliable measures for differentiating PCNSLs from GBMs. Additionally, FDG metabolism indices were inversely proportional to the rADCs of PCNSL lesions.

CLINICAL RELEVANCE/APPLICATION

(dealing with PET CT) we found a potential benefit for combining PET and MRI scans for PCNSL lesions, as the ADC values on MRI and the intensity of 18F FDG uptake on PET may provide synergistic information on tumor aggressiveness and progno

SSJ17-05 Evaluation of 18F-trifluoromethylated D-cysteine as a Promising PET Tracer in Orthotopic C6 Glioma

Tuesday, Dec. 3 3:40PM - 3:50PM Room: S505AB

Participants
Hui Ma, Guangzhou, China (*Presenter*) Nothing to Disclose
Jing Zhao Jr, MD, PhD, Guangzhou, China (*Abstract Co-Author*) Nothing to Disclose
Shao Y. Liu, Guangzhou , China (*Abstract Co-Author*) Nothing to Disclose
Dingxiang Xie, Guangzhou , China (*Abstract Co-Author*) Nothing to Disclose
Hua G. Tang, Guangzhou , China (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

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PURPOSE

To explore the potential application of 18F-trifluoromethylated D-cysteine (S-[18F]CF3-D-CYS), a new sulfur-containing amino acid

PET tracer in evaluating glioma in terms of tumor heterogeneity and boundaries.Further, compared its value with multiparametic MRI and 18F-FDG PET imaging.

METHOD AND MATERIALS

S-[18F]CF3-D-CYS was prepared from multi-step reactions. Small-animal PET imaging with S-[18F]CF3-D-CYS was performed on the same rats bearing orthotopic C6 glioma with 60-min dynamic scan and compared with 2-deoxy-2-[18F]fluoro-D-glucose ([18F]-FDG) and multiparametic MRI. The regions of interest were drawn on tumors and normal brain parenchyma. Further, we compared the imaging with histopathological examinations

RESULTS

Dynamic S-[18F]CF3-D-CYS PET imaging showed tumor uptake was at peak rapidly and then maintained plateau after 10 min p.i.. And there was an avid uptake in tumors and a much low uptake in normal brains in PET images with S-[18F]CF3-D-CYS, thus causing a high uptake ratio of tumor to control brain, which was higher than that in PET images with 18F-FDG (3.15 ± 0.37 vs 1.22 ± 0.05, $P < 0.0001$). S-[18F]CF3-D-CYS PET imaging also depicted clearer boundaries in glioma tumors than those 18F-FDG PET imaging depicted. The uptake extent of S-[18F]CF3-D-CYS was consistent with tumor cell density. Compared with multiparametic MRI, S-[18F]CF3-D-CYS PET imaging can give better differentiation between infiltrating tumor tissue and brain edema.

CONCLUSION

Compared with [18F]-FDG and MRI, S-[18F]CF3-D-CYS PET has an even clear tumor boundary and reflect the tumor heterogeneity. S-[18F]CF3-D-CYS PET might serve as a potential PET tracer with a good performance in diagnosis of glioma

CLINICAL RELEVANCE/APPLICATION

S-[18F]CF3-D-CYS PET is superior than [18F]-FDG and MRI in defining the glioma boundary and tumor heterogeneity and S-[18F]CF3-D-CYS might serve as a potential PET tracer for evaluating glioma.

SSJ17-06 Evaluation of the Potential Role of F-18 FDG PET as a Biomarker in Diagnosing Patients with Anti-Glutamic Acid Decarboxylase 65 (anti-GAD65) Associated Neurologic Disorders Including Stiff-Person Syndrome and Cerebellar Ataxia

Tuesday, Dec. 3 3:50PM - 4:00PM Room: S505AB

Participants
Mohammad S. Sadaghiani, MD, Baltimore, MD (*Presenter*) Nothing to Disclose
Yujie Wang, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Michael Comisac, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Scott Newsome, Baltimore, MD (*Abstract Co-Author*) Scientific Advisory Board, Biogen Idec Inc; Scientific Advisory Board, F. Hoffmann-La Roche Ltd; Scientific Advisory Board, Celgene Corporation; Scientific Advisory Board, Merck KGaA; Advisor, Gerson Lehrman Group, Inc; Institutional Research Grant, Biogen Idec Inc; Institutional Research Grant, F. Hoffmann-La Roche Ltd
Lilja B. Solnes, MD, Baltimore, MD (*Abstract Co-Author*) Advisory Board, Progenics Pharmaceuticals, Inc

PURPOSE

To evaluate the role of F-18 FDG PET as a biomarker in anti-glutamic acid decarboxylase 65 (anti-GAD65) associated neurologic disorders including Stiff-person syndrome (SPS) and cerebellar ataxia (CA).

METHOD AND MATERIALS

30 patients with brain F-18 FDG PET who were diagnosed with Anti-GAD65 associated neurologic disorder were analyzed for brain uptake in 47 different clusters compared to 50 asymptomatic controls using NeuroQ™. Among the 30 patients, 19 had isolated SPS, 8 had isolated CA and 3 had co-existing SPS and CA. The whole-body F-18 FDG PET scans were used to subjectively evaluate muscular uptake for 50 patients with antiGAD65 neurologic disorders. ±1.65 was considered as the threshold for abnormal Z scores.

RESULTS

The Z scores calculated based on the average of the first scan of patients with FBP/RAMP-FBP protocol showed hypermetabolic activity in areas including brain stem, right medial temporal cortex, right lentiform nucleus, right caudate nucleus, bilateral superior lateral temporal cortices, bilateral associative visual cortices, and left superior parietal cortex, while areas including bilateral inferior lateral posterior temporal cortices, left lateral anterior temporal cortex, bilateral middle frontal cortices, bilateral primary visual cortex, bilateral inferior frontal cortices, showed hypometabolic activity. Patients with SPS phenotype showed lower uptake in cerebellum and thalamus and higher uptake in left parietal cortex, while those with CA revealed hypermetabolism in cerebellum and thalamus and hypometabolism in the bilateral parietal cortices. 62% of the patients showed increased muscular uptake. The most common pattern was symmetric shoulder girdle involvement.

CONCLUSION

Anti-GAD65 neurologic disorders comprise rare disorders with evolving diagnostic criteria. Our results showed that thalamus, as well as parietal and cerebellar cortices, are able to distinguish patients with CA vs. those with SPS phenotype. According to literature, normal musculature shows 12.5% increase in FDG PET uptake while our study showed 62% abnormal muscle uptake among these patients. FDG PET has the potential to become a diagnostic biomarker for patients with anti-GAD associated neurologic disorders.

CLINICAL RELEVANCE/APPLICATION

Anti-GAD65 neurologic disorders do not have definitive diagnostic criteria. F-18 FDG PET has the potential to become a diagnostic biomarker for these disorders based on the brain and muscle uptake.

MSCC34

Case-based Review of Nuclear Medicine: PET/CT Workshop-Advances in PET (In Conjunction with SNMMI) (Interactive Session)

Tuesday, Dec. 3 3:30PM - 5:00PM Room: E450B

BQ CT NM

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 1.75

FDA Discussions may include off-label uses.

Participants
Chadwick L. Wright, MD,PhD, Columbus, OH (*Moderator*) Nothing to Disclose

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Sub-Events

MSCC34A Fluciclovine/PSMA PET Cases

Participants
Andrei Iagaru, MD, Emerald Hills, CA (*Presenter*) Research Grant, General Electric Company Research Grant, Progenics Pharmaceuticals, Inc Research Grant, Advanced Accelerator Applications SA

LEARNING OBJECTIVES

1) List some of the molecular imaging targets that are used in prostate cancer. 2) Understand underlying biology and mechanism of action for some of the new PET radiopharmaceuticals in prostate cancer. 3) Discuss patterns of prostate cancer appearance when using some of the new PET radiopharmaceuticals.

ABSTRACT

Data from the American Cancer Society suggests that prostate cancer will continue to be the leading cancer diagnosis in men with 164,690 estimated new cases and will have the second highest mortality (after lung cancer) with 29,430 estimated deaths for 2018 in the United States. Initial and subsequent treatment of prostate cancer may involve surgery, radiation therapy, hormonal therapy, chemotherapy, or a combination of these. Additional molecular pathways in prostate cancer lead to the identification of new targets that may be amenable to diagnostic and therapeutic intervention with novel agents. Areas of interest for the Nuclear Medicine and Molecular Imaging community include mainly aminoacid analogues (Fluciclovine) and the prostate specific membrane antigen (PSMA), but also gastrin releasing peptide receptors (GRPR).

MSCC34B Somatostatin Receptor PET Cases

Participants
Corina Millo, MD, Bethesda, MD (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

millocm@nih.gov

LEARNING OBJECTIVES

1) Understand the rational and complexity of imaging neuroendocrine tumors. 2) Describe different categories of SSTR-2 positive tumors and their molecular characteristics relevant to the imaging algorithm. 3) Discuss the impact of molecular imaging on management of neuroendocrine tumors.

ABSTRACT

Neuroendocrine tumors (NET) are unique in that they overexposes the somatostatin receptor (SSTR). This can be leveraged in imaging by labelling somatostatin analogs with radiation to image the location of tumors. DOTATATE is a SSTR analog, that when labeled with Gallium-68 can be used to image neuroendocrine tumors with very high sensitivity and specificity. It is important to remember that although SSTR PET using Ga68 DOTATATE is very effective, conventional imaging using either CT or MRI will remain the most common imaging modality for NET patients over time. Beyond imaging, SSTR analogs can be labeled with beta emitters than can be used therapeutically. During this case review session we will discuss a wide range of cases demonstrating both common and esoteric imaging and clinical aspects encountered in patients with SSTR-2 positive tumors.

MSCC34C Response Assessment

Participants
David A. Mankoff, MD, PhD, Philadelphia, PA (*Presenter*) Speaker, Koninklijke Philips NV Consultant, General Electric Company Advisory Board, RefleXion Medical Inc Consultant, Blue Earth Diagnostics Ltd Research Funded, Siemens AG Advisory Board, ImaginAb, Inc Spouse, Owner, Trevarx

For information about this presentation, contact:

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[redacted]

LEARNING OBJECTIVES

1) List applications of molecular imaging as a cancer biomarker. 2) Describe clinical setting for which molecular imaging response approaches are applicable. 3) Discuss investigational agents being investigated for response assessment and early results.

ABSTRACT

This talk will review molecular imaigng approaches for cancer, considering molecular imaging as a cancer biomarker to guide treatment decisions and evaluate therpaeutic repsonse. Examples form recent or ongoing multi-center trials will be presented as exmaples of possible future clinical role for molecular imaigng cancer biomarkers.

Printed on: 10/29/20

RC411

Advances in Cardiac Nuclear Imaging: SPECT/CT and PET/CT

Tuesday, Dec. 3 4:30PM - 6:00PM Room: S504CD

CA CT NM

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 1.75

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

RC411A Advances in Cardiac SPECT

Participants
E. Gordon Depuey, MD, New York, NY (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Implement protocols that facilitate patient-centered imaging and that reduce patient radiation exposure. 2) 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. 3) Understand instrumentation advances that allow new cameras to perform SPECT with markedly reduced acquisition times and/or less radiopharmaceutical activity and their clinical impact. 4) Review myocardial perfusion SPECT scans systematically to avoid artifacts and maximize diagnostic accuracy.

ABSTRACT

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 following technical advancements described facilitate implementation of patient-centered imaging. 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. 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.

RC411B Advances in Cardiac PET

Participants
Sharmila Dorbala, MD,MPH, Boston, MA (*Presenter*) Research Grant, Pfizer Inc; Speaker, General Electric Company; Speaker, AAA; Speaker, Pfizer Inc; Advisory Board, Proclara; ; ; ;

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 coronary artery disease. 3) Discuss novel clinical applications of cardiovascular PET imaging in systemic diseases. 4) Review Case Examples of Cardiac PETs.

ABSTRACT

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. Robust clinical evidence coupled with 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. A growing body of recent literature supports the role of targeted molecular PET to image inflammatory, infectious and infiltrative heart diseases. 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 current advanced clinical tool. 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.

RC411C Imaging Cardiac Sarcoid

Participants
Sharmila Dorbala, MD,MPH, Boston, MA (*Presenter*) Research Grant, Pfizer Inc; Speaker, General Electric Company; Speaker, AAA; Speaker, Pfizer Inc; Advisory Board, Proclara; ; ; ;

LEARNING OBJECTIVES

1) Interpret cardiac SPECT and PET scans with optimal sensitivity and specificity. 2) Recognize technical and patient-related artifacts. 3) Characterize myocardial perfusion defects whereby patients can be risk stratified with regard to risk of future cardiac events. 4) Formulate reports in a clinically relevant manner.

ED010-WE

Nuclear Medicine Wednesday Case of the Day

Wednesday, Dec. 4 7:00AM - 11:59PM Room: Case of Day, Learning Center

AMA PRA Category 1 Credit ™: .50

Participants
Ming Yang, MD, Scottsdale, AZ (*Presenter*) Nothing to Disclose
Michael C. Roarke, MD, Scottsdale, AZ (*Abstract Co-Author*) Nothing to Disclose
Ba D. Nguyen, MD, Scottsdale, AZ (*Abstract Co-Author*) Nothing to Disclose
Molly Carnahan, MD, Phoenix, AZ (*Abstract Co-Author*) Nothing to Disclose
Akash Sharma, MD, Ponte Vedra Beach, FL (*Abstract Co-Author*) Nothing to Disclose
Geoffrey B. Johnson, MD,PhD, Rochester, MN (*Abstract Co-Author*) Research Grant, General Electric Company Research Grant, Pfizer Inc
Manoj K. Jain, MD, Jacksonville, FL (*Abstract Co-Author*) Nothing to Disclose
Ephraim E. Parent, MD,PhD, Ponta Vedra Beach, FL (*Abstract Co-Author*) Research support, Blue Earth Diagnostics Ltd Research support, Advanced Accelerator Applications SA
Derek R. Johnson, MD, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Jess A. Graham, MD, Albuquerque, NM (*Abstract Co-Author*) Nothing to Disclose
Nandan Keshav, MD, Albuquerque, NM (*Abstract Co-Author*) Nothing to Disclose
Lisa C. Blacklock, MD, Albuquerque, NM (*Abstract Co-Author*) Nothing to Disclose
JoAnna R. Fair, MD, PhD, Albuquerque, NM (*Abstract Co-Author*) Nothing to Disclose
Shana Elman, MD, Albuquerque, NM (*Abstract Co-Author*) Nothing to Disclose
Saeed Elojeimy, MD, PhD, Albuquerque, NM (*Abstract Co-Author*) Nothing to Disclose
Matthew Kay, MBBS, Tucson, AZ (*Abstract Co-Author*) Nothing to Disclose
Gregory J. Woodhead, MD, PhD, Tucson, AZ (*Abstract Co-Author*) Nothing to Disclose
Phillip Kuo, MD,PhD, Tucson, AZ (*Abstract Co-Author*) Research Grant, Astellas Group; Research Grant, Blue Earth Diagnostics Ltd; Consultant, Novartis AG; Consultant and Speaker, General Electric Company; Consultant, Konica Minolta, Inc; Consultant, Imaging Endpoints

TEACHING POINTS

1) Recognize the association of lung malignancy and immune-mediated seizure activity. 2) Recognize incidental Thornwaldt cyst on FDG PET-CT. 3) Familiarize the scintigraphy feature of shin splint on three-phase bone scan. 4) Identify off-target distribution of Tc-99m MAA to the falciform artery on Y-90 microsphere planning SPECT/CT. 5) Recognize the imaging features of an obstructed ventriculoperitoneal shunt.

RC511

Update on Radionuclide Therapies

Wednesday, Dec. 4 8:30AM - 10:00AM Room: S504CD

IR NM OI

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 1.75

FDA Discussions may include off-label uses.

Sub-Events

RC511A New Guidelines for I-131 Therapy of Thyroid Cancer

Participants
Don C. Yoo, MD, Lexington, MA (*Presenter*) Consultant, inviCRO, LLC

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donyoo@brown.edu

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.

RC511B Lu177-DOTATATE Therapy for Neuroendocrine Tumors

Participants
Erik S. Mittra, MD, PhD, Portland, OR (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Understand the background and role of Peptide Receptor Radionuclide Therapy (PRRT) for neuroendocrine tumors (NETs). 2) Review the latest publications on the subject. 3) Understand how to perform this therapy and future directions.

RC511C Hepatic Artery Infusion Therapy with Y90 Microspheres

Participants
Charles Y. Kim, MD, Raleigh, NC (*Presenter*) Consultant, Medtronic plc; Consultant, Humacyte; Consultant, Galvani

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.

RC518

Metabolic Tumor Imaging: Current and Beyond

Wednesday, Dec. 4 8:30AM - 10:00AM Room: S501ABC

MR NM OI

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 1.75

FDA Discussions may include off-label uses.

Participants
Marius E. Mayerhoefer, MD,PhD, Vienna, Austria (*Moderator*) Speaker, Siemens AG; Research support, Siemens AG

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LEARNING OBJECTIVES

1) Learn about he new PET tracers and they new potential clinical applications. 2) Review the added value of PET/MRI in oncology. 3) Learn about the current and future applications of hyperpolarised MRI.

Sub-Events

RC518A PET Tracers: Which Ones Will Be Next to Make it to Clinical Practice?

Participants
Jan Grimm, MD,PhD, New York, NY (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To have an appreciation for some of the latest PET tracers in clinical research in oncology. 2) Understand the PET and radiotherapy agents currently FDA approved and those undergoing the approval process. 3) Understand the next generation of PET tracers and molecular imaging agents that could be the next standard-of-care imaging probes.

RC518B PET/MRI: The Added Value in Oncology

Participants
Hebert Alberto Vargas, MD, Cambridge, United Kingdom (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To understand the concept of value in imaging and how it relates to PET/MR technology. 2) To discuss the need for research specifically geared toward assessing the value of PET/MRI in oncology.

RC518C Hyperpolarized MRI: Current and Future Applications

Participants
Ferdia A. Gallagher, PhD, FRCR, Cambridge, United Kingdom (*Presenter*) Research support, General Electric Company; Research support, GlaxoSmithKline plc

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LEARNING OBJECTIVES

1) To explore the role of metabolism in cancer development. 2) To understand how these changes in metabolism can be exploited using hyperpolarized 13C-pyruvate. 3) To review the current evidence for hyperpolarized carbon-13 imaging in oncology. 4) To understand potential clinical applications for hyperpolarized carbon-13 imaging. 5) To consider the role of new hyperpolarized molecules in oncology.

ABSTRACT

There is increasing evidence to support a role for metabolism in tumor development; for example, deregulation of cellular energetics is now considered to be one of the key hallmarks of cancer. Changes in tumor metabolism over time are now known to be early biomarkers of successful response to chemotherapy and radiotherapy. There are a number of imaging methods that have been used to probe cancer metabolism: the most widely available is 18F-fluorodeoxyglucose (FDG), an analogue of glucose, used in PET. Hyperpolarized carbon-13 MRI (13C-MRI) is an emerging molecular imaging technique for studying cellular metabolism, particularly in the field of oncology. This method allows non-invasive measurements of tissue metabolism in real-time. To date, the most promising probe used in conjunction with hyperpolarized MRI has been 13C-labelled pyruvate: pyruvate is metabolized into lactate in normal tissue in the absence of oxygen, but in tumors this occurs very rapidly even in the presence of oxygen. Results from many animal models have shown that there is a reduction in the metabolism of pyruvate following successful treatment with chemotherapy. Tumor lactate labelling has also been shown to correlate with the grade of some tumor types. There are now a small number of sites performing human hyperpolarized carbon-13 MRI imaging. This talk will discuss the progress that has been made in this field within the area of oncology and potential clinical applications.

MSRO42

BOOST: Lymphoma-Case-based Multidisciplinary Review (Interactive Session)

Wednesday, Dec. 4 10:30AM - 12:00PM Room: S103CD

CT MR NM OI RO

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 1.75

Participants
Chelsea C. Pinnix, MD,PhD, Houston, TX (*Moderator*) Research Grant, Merck & Co, Inc; Consultant, Global One Inc; Speaker, International Journal of Radiation Oncology, Biology & Physics
Jurgen Rademaker, MD, New York, NY (*Presenter*) Nothing to Disclose
Yolanda D. Tseng, MD, Seattle, WA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Case-based review of staging and treatment response in lymphoma. 2) Discuss imaging findings in lymphoma and their clinical significance (PET, CT, MRI). 3) Describe the management of patients with lymphoma, including the role of imaging and radiation treatment options.

ABSTRACT

Management of lymphoma continues to evolve in the setting of improved imaging, pathologic understanding of this heterogeneous disease, systemic therapy, and radiotherapy techniques. This interactive, multi-disciplinary session is geared to general radiologists and radiation oncologists with the goal to provide clinically relevant, up-to-date knowledge and skills in evaluating and treating these patients. Through cases, we will review common manifestations of Hodgkin and non-Hodgkin lymphoma and imaging features of these lymphomas that are important for workup, staging, and assessment of treatment response. Cases will be used to walk participants through the management of common lymphomas with a focus on the role of radiotherapy.

SSK15

Nuclear Medicine (Gastrointestinal Oncology Nuclear Medicine and PET)

Wednesday, Dec. 4 10:30AM - 12:00PM Room: E451A

GI NM

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 1.75

Participants
Amy M. Fowler, MD,PhD, Madison, WI (*Moderator*) Institutional research support, General Electric Company; Author with royalties, Reed Elsevier
Steve Cho, MD, Madison, WI (*Moderator*) Research Grant, General Electric Company; Consultant, Advanced Accelerator Applications SA;

Sub-Events

SSK15-01 Integrated Time-Of-Flight 18F-FDG PET/MRI For Assessment of Pathologic Response to Neo-Adjuvant Chemo-Radiotherapy in Borderline Resectable Pancreatic Ductal Adenocarcinoma

Wednesday, Dec. 4 10:30AM - 10:40AM Room: E451A

Awards
Trainee Research Prize - Fellow

Participants
Ishan Garg, MBBS, Rochester, MN (*Presenter*) Nothing to Disclose
Ananya Panda, MD,MBBS, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
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PURPOSE

To determine if parameters derived from integrated time-of-flight 18F-FDG PET/MRI correlate with pathologic response after neoadjuvant chemo-radiotherapy (CRT) in patients with borderline resectable pancreatic ductal adenocarcinoma (PDAC).

METHOD AND MATERIALS

Patients with FDG-avid (SUVmax>=4) borderline resectable PDAC on baseline PET/MRI who also underwent a post-CRT PET/MRI prior to surgical resection were included. Primary tumor SUVmax, glucose-corrected SUVmax (SUVgluc), SUVmean and volumetric PET parameters (total lesion glycolysis and metabolic tumor volume) were measured using anatomic guidance from simultaneously acquired contrast-enhanced MRI. Metabolic response on PET/MRI was correlated to histologic treatment response using College of American Pathologists grading system (path grade). Complete metabolic response (CMR) defined as FDG uptake indistinguishable from surrounding background and normalization of post-CRT CA 19-9 were evaluated as surrogates of path grade 1/0 (marked or complete response).

RESULTS

34 patients (52.9% males; mean age: 62-years, range 23-80) were included. Follow-up duration was 17.6±5.7 months (mean ± SD). Pathologic response grades were either 1/0 (n=13) or 2/3 (n=21). Complete metabolic response on post-CRT PET/MRI was observed in 20 patients - 12 with path grades 1/0, and 8 with path grade 2. CMR was superior to normalization of post-CRT CA 19-9 as a surrogate for path grade 1/0 (sensitivity 92.3 v/s 66.7%; specificity 61.9 v/s 18.2%; PPV 60 v/s 40%; NPV 92.9 v/s 40%; AUC 0.77 v/s 0.42; P <0.05). Using ROC analysis, a relative change of >=50% in SUVgluc had 100% sensitivity, 61.9% specificity, 61.9% PPV and 100% NPV for path grade 1/0.

CONCLUSION

Qualitative and quantitative parameters derived from FDG PET/MRI correlate with pathologic response after neoadjuvant CRT and had better performance than normalization of post-CRT CA 19-9 as a surrogate for path grade 1/0.

CLINICAL RELEVANCE/APPLICATION

Qualitative and quantitative parameters derived from 18F-FDG PET/MRI show promise for assessment of pathologic response to CRT in patients with borderline resectable PDAC and merit evaluation in larger studies.

SSK15-02 18F-FDG PET-MR Enterography in Predicting Histological Active Disease in Ulcerative Colitis: A Randomized Controlled Trial Using Nancy Index

Wednesday, Dec. 4 10:40AM - 10:50AM Room: E451A

Participants

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PURPOSE

To evaluate the diagnostic performance of PET-MR enterography in detecting histological active inflammation in patients with ulcerative colitis and the impact of bowel purgation on diagnostic accuracies of PET-MR parameters.

METHOD AND MATERIALS

Fifty patients were enrolled in this randomized controlled trial (clinicaltrials.gov [NCT03781284]). 40 patients were randomized in two study arms, in which bowel purgation was performed either before or after PET-MR enterography. All patients underwent ileocolonoscopy with mucosal biopsies after PET-MR within 24h. Diagnostic performance of MR morphological parameters (MRmorph), diffusion-weighted imaging (DWI) and PET in detecting histological inflammation determined by Nancy index was compared with each other and between study arms. Correlation between PET and histological inflammatory severity was calculated.

RESULTS

In study arm without previous bowel purgation, SUVmax ratio of bowel segment (relative to SUVmax of the liver) facilitated the highest specificity and diagnostic accuracy compared to MRmorph and DWI. Bowel cleansing led to markedly increased metabolic activity of bowel segments, resulting in significantly reduced specificity of PET compared to study arm without purgation (0.808 vs. 0.966, p = 0.007, respectively). Inter-observer concordance for assessing MRmorph was clearly increased after bowel cleansing (Cohen's κ: 0.847 vs. 0.665, p = 0.013, respectively), though diagnostic performance of MRmorph was not significantly improved. Our findings suggested that the change of metabolic status was mainly associated with the grade of neutrophil infiltrate and less dependent on chronic infiltrate.

CONCLUSION

PET-MR enterography was an excellent non-invasive diagnostic method in the assessment of ulcerative colitis without the need of previous bowel purgation.

CLINICAL RELEVANCE/APPLICATION

SUVmaxRatio was a reliable parameter facilitating best diagnostic operating characteristics in predicting histological active disease in patients with ulcerative colitis and no previous bowel purgation was needed for PET-MR.

SSK15-03 CT-Attenuation and FDG Uptake of Visceral Adipose Tissue Can Predict the Risk of Peritoneal Recurrence in Gastric Cancer Patients after Curative Surgical Resection

Wednesday, Dec. 4 10:50AM - 11:00AM Room: E451A

Participants
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PURPOSE

CT-attenuation and FDG uptake of adipose tissue have been used as imaging parameters that reflect qualitative characteristics of adipose tissue. Given that gastric cancer grows in an adipose tissue-dominated environment, gastric cancer might have interaction with visceral adipose tissue (VAT). The purpose of this study was to investigate the prognostic significance of CT-attenuation and FDG uptake of VAT to predict recurrence-free survival (RFS), peritoneal RFS and overall survival (OS) in patients with advanced gastric cancer (AGC).

METHOD AND MATERIALS

We retrospectively enrolled 117 patients with AGC who underwent staging FDG PET/CT and subsequent curative surgical resection. CT-attenuation and FDG uptake (SUV) of VAT and maximum FDG uptake of primary tumor (SUVmaxT) were measured from PET/CT images. The relationship of VAT attenuation and SUV with clinico-histopathologic factors and survival was assessed.

RESULTS

There was a significant positive correlation between VAT attenuation and SUV ($p<0.001$, $r=0.799$). In correlation analyses, both VAT attenuation and SUV showed significant positive correlations with T stage, tumor size, and platelet-to-lymphocyte ratio ($p<0.05$), and patients who died during follow-up had significantly higher VAT attenuation and SUV than those who survived ($p<0.05$). Patients with high VAT attenuation and SUV showed significantly worse RFS, peritoneal RFS, and OS than those with low values ($p<0.05$). On multivariate survival analysis, VAT attenuation and SUV were remained as significant predictors for peritoneal RFS and OS after adjusting age, sex, tumor stage, and SUVmaxT ($p<0.05$).

CONCLUSION

CT-attenuation and FDG uptake of VAT on staging FDG PET/CT were correlated with tumor characteristics and were significant independent predictive factors for peritoneal RFS and OS in patients with AGC.

CLINICAL RELEVANCE/APPLICATION

The qualitative characteristics of visceral adipose tissue measured on FDG PET/CT could be used to predict the risk of periteoneal recurrence in patients with advanced gastric cancer after surgical resection.

SSK15-04 Standardized Uptake Values on 68Ga-DOTATATE PET/CT Predict Response to Somatostatin Analog Therapy in Gastroenteropancreatic Neuroendocrine Tumors

Wednesday, Dec. 4 11:00AM - 11:10AM Room: E451A

Participants
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PURPOSE

68Ga-DOTATATE PET/CT provides a quantitative measure of tumor somatostatin receptor status in gastroenteropancreatic neuroendocrine tumors (GEP-NETs). We examined the ability of standardized uptake values (SUVs) on 68Ga-DOTATATE PET/CT to predict response to somatostatin analog (SSA) therapy.

METHOD AND MATERIALS

The medical records of 108 consecutive patients with grade 1-2 GEP-NETs on SSA monotherapy who received 68Ga-DOTATATE PET/CT scans at a single institution were reviewed to obtain baseline characteristics, 68Ga-DOTATATE SUVmax, and progression-free survival (PFS) data. A receiver operating characteristic curve was constructed to determine the optimal SUVmax cutoff for stratification. PFS in the high vs. low SUVmax groups was compared with Kaplan-Meier survival analysis. The effects of baseline characteristics and SUVmax on PFS were examined with univariate and multivariate Cox regression.

RESULTS

SUVmax was significantly higher ($p<0.001$) in pancreatic compared to gastrointestinal NETs, but did not vary with other baseline clinical, pathologic, and laboratory characteristics. Median clinical follow-up was 16 months, and PFS at 6, 12, and 18 months was 91 ± 3%, 80 ± 4%, and 61 ± 6%, respectively. The best SUVmax cutoff of 18.35 from ROC analysis yielded sensitivity and specificity of 39% and 98%, respectively, for disease progression by 12 months (area under the curve=0.66). The low SUVmax group showed significantly shorter PFS compared to the high SUVmax group ($p<0.0001$) with median of 6.6 months vs. >24 months, which was reproduced in a subgroup analysis of 30 SSA naïve patients ($p<0.05$). On univariate analysis, high tumor grade, Ki-67, and mitotic index, as well as low SUVmax and no prior SSA therapy, were identified as predictors of early treatment failure. Only low SUVmax remained statistically significant on multivariate analysis with hazard ratio of 6.85. (95% CI: 2.10-22.34). In a subgroup analysis of 46 grade 2 patients, short PFS on SSA was again predicted by SUVmax<18.35 ($p<0.01$), but not with the Ki-67 cutoff value of 10% ($p=0.38$).

CONCLUSION

Low SUVmax on 68Ga-DOTATATE PET/CT independently predicts early failure on SSA monotherapy in grade 1-2 GEP-NET patients with high specificity.

CLINICAL RELEVANCE/APPLICATION

Based on 68Ga-DOTATATE PET/CT, clinicians can better inform patients on the expected benefit of SSA therapy, especially when access to SSA is difficult, and offer proactive discussion on alternatives.

SSK15-05 68Ga-DOTATATE PET/CT Parameters for the Early Prediction of Response to Peptide Receptor-Mediated Radionuclide Therapy (PRRT) for Metastatic Neuroendocrine Tumors (NET)

Wednesday, Dec. 4 11:10AM - 11:20AM Room: E451A

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PURPOSE

To determine whether change in 68Ga-DOTATATE (DT) uptake at tumor sites is predictive of early response to PRRT. A secondary aim was to determine whether DT uptake in reference tissues changes after first cycle of PRRT (C1).

METHOD AND MATERIALS

There were 36 patients (20 men, 16 women; mean age, 60 yrs) with metastatic well-differentiated NETs (Ki67<30%, median Ki67, 6.6) being considered for PRRT who underwent baseline & follow-up DT PET after C1. SUVmax in reference tissues (mediastinal blood pool, liver & spleen) were recorded at baseline and after C1. Response to therapy at 4 months post 4th cycle of PRRT, assessed by RECIST 1.1, was available for 28 patients (mean time to response assessment, 10.9 mo; range 6-16). SUVmax & SULpeak were recorded in <=5 marker lesions per patient (<= 2 per organ). Response to therapy was compared to SUVmax & SULpeak at baseline, change in SUVmax and SULpeak after C1, and change in ratio of average SUVmax/ SULpeak of tumor to liver and spleen.

RESULTS

At baseline and after C1, mean SUVmax in blood pool, liver and spleen were 1.45 and 1.42 (-0.7%); 5.2 and 5.8 (+13%); and 16 and 19.4 (+28.4%), respectively. There were 15/28 (53.6%) patients with stable disease (SD), 10/28 (35.7%) with partial response (PR) and 3/28 (10.7%) with progressive disease (PD). The most predictive parameters for response were baseline SUVmax & change in SUVmax/SULpeak ratio of tumor/spleen. Baseline SUVmax for SD, PR and PD was 43.8 (range: 13.5-111.2), 43.3 (range: 11-137.7) & 26.2 (range: 16.5 - 40.2), respectively. Change in SUVmax ratio of tumor/spleen for SD, PR and PD was -24.2% (range: 11.2 [-77.1]), -33.5% (range: 7.8-[-70.8]) & -13.3% (range: 0.8-[-39.6]), respectively. Change in SULpeak ratio of tumor/spleen for SD, PR and PD was -24.4% (range: 19.9-[-76.9]), -36% (range: 0.7-[-84.8]) & -7.8% (range: 19.2-[39.3]), respectively.

CONCLUSION

There is generally an SUV increase in liver & spleen after C1, with little change in blood pool activity. Although there is significant overlap in measured parameters, likely limiting utility of early prediction of response on an individual basis, lower SUVmax at baseline and smaller decrease in SUVmax/ SULpeak tumor to spleen ratio were the most predictive parameters for early disease progression.

CLINICAL RELEVANCE/APPLICATION

There is significant overlap in measured DT-PET parameters, likely limiting utility of early prediction of response on an individual basis.

SSK15-06 Diffusion-weighted MRI (DWI) and 68Ga-DOTATATE PET/CT: Comparison of Both Modalities in Assessment of Tumor Response of Hepatic Metastases of Primary Neuroendocrine Tumor (NET) Undergoing Selective Internal Radiotherapy with 90Yttrium-microspheres

Wednesday, Dec. 4 11:20AM - 11:30AM Room: E451A

Participants
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PURPOSE

To compare ADC values of DWI and SUV of 68Ga-DOTATATE PET/CT in assessing treatment response in patients with liver metastases of primary NET following SIRT.

METHOD AND MATERIALS

30 patients with 80 target liver metastases of primary NET who underwent abdominal MRI with DWI and 68Ga-DOTATATE PET/CT before and after SIRT were included. Tumor size, mean ADC values of the lesions and normal liver, intralesional SUVmax and SUV mean, tumor to spleen ratio (T/S ratio), and tumor to liver ratio (T/L ratio) were measured. Tumor response to radioembolization was categorized with respect to Response Evaluation Criteria in Solid Tumors v1.1 (RECIST) on follow-up examination.

RESULTS

67/80 metastases were categorized as stable disease (SD) and 13/80 metastases as partial remission (PR). Intralesional ADCmin and ADC mean increased significantly ($p < 0.006$) in the group of PR and SD with a significant higher increase of ADCmin values in the PR group (54,1 ± 14,6 % vs. 24 ± 4,9 %, $p = 0,02$) before and after SIRT. Currently used SUV measurements showed significant decrease in the PR group (SUV max, SUVmean, T/S ratio and T/L ratio), whereas only SUV max, SUVmean, T/S ratio (max/max) decrease significantly in the SD group. Using ROC curves, SUVmean was found the best metric (AUC 0.75), however similar results were found for ADCmin (AUC 0.7).

CONCLUSION

SUV measurements of 68Ga-DOTATATE PET/CT but also ADC values on DW-MRI seem to represent a valuable, functional maker for evaluation of response to SIRT treatment of hepatic metastases in patients with primary NET and may help in assessing further therapeutic strategies.

CLINICAL RELEVANCE/APPLICATION

DW-MRI appears similar to 68Ga-DOTATATE PET/CT for quantitative response assessment in patients with hepatic metastases of NET and may be used to guide further management of patients who undergo SIRT.

SSK15-07 Tumor Volume Remains the Most Important Variable When Considering Radiomic Feature Analysis in Anal Cancer

Wednesday, Dec. 4 11:30AM - 11:40AM Room: E451A

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PURPOSE

Anal squamous cell carcinoma is a rare disease and most cases can be effectively with chemoradiotherapy. However if locoregional relapse occurs, outcomes following surgical salvage are often poor. Novel biomarkers have the potential to help predict response to treatment and select patients for appropriate follow up pathways based on risk of relapse. We aimed to explore the potential of pre-treatment PET-CT radiomic features in predicting locoregional failure and survival in these patients.

METHOD AND MATERIALS

257 consecutive patients between Jan 2012 and Jan 2018 underwent staging PET-CT. Clinical outcomes were overall survival (OS) and locoregional relapse. Radiomic features (RFs) comprising conventional PET and CTparameters, texture and shape features were extracted using LifeX software. Unsupervised learning, usingPrinicipal Components Analysis, on those parameters was then performed to generate clusters of patients. Clinical variables and endpoints were then assessed across the clusters generated. In addition, supervised learning, using elastic net regularisation, was also performed. Multivariable clinical risk prediction models, built using standard clinical parameters, with/without RFs were assessed using concordance probability estimate (CPE), adjusted R-squared (R2) and likelihood ratio-test statistic (LRT).

RESULTS

Unsupervised learning highlighted that: (1)many of the RFs correlated to tumour size; (2) patient clusters using RFs correlated with T-Stage and MRI size thus tumour volume. The final multivariable risk prediction model with RFs contained one textural and one volume-based PET parameter (CPE = 0.76, R2= 0.17, LRT = 36.7), which performed marginally better than a clinical model using tumour volume (CPE = 0.75, R2=0.14, LRT = 30.0).

CONCLUSION

Survival prediction models were enhanced by a textural feature and a volume-specific parameter identified using supervised learning. Primary tumour size remains the most important factor in predicting outcome. Challenges in accurate assessment of lesion size are well known on MRI, tumour volume can be easily assessed with appropriate PET-CT reporting software and this information should be considered in routine reporting and prediction modelling.

CLINICAL RELEVANCE/APPLICATION

Improvements in risk stratification may avoid excessively intense follow up protocols while ensuring early diagnosis of locoregional failure and the best chance of successful salvage.

SSK15-08 Intratumoral Metabolic Heterogeneity and Other Quantitative 18F-FDG PET/CT Parameters for Prognosis Prediction in Esophageal Cancer

Wednesday, Dec. 4 11:40AM - 11:50AM Room: E451A

Participants
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PURPOSE

To evaluate the impact of intratumoral metabolic heterogeneity and other quantitative FDG PET/CT parameters for predicting patient outcomes in esophageal cancer.

METHOD AND MATERIALS

This IRB and HIPPA complaint retrospective study included a total of 71 patients with biopsy proven adenocarcinoma or squamous cell carcinoma of the esophagus who had a FDG PET/CT for initial staging. Automated gradient-based segmentation method was used to assess the primary tumor standardized uptake value maximum and peak (SUV max and SUV peak), metabolic tumor volume (MTV) and metabolic intratumoral heterogeneity index, calculated as the area under cumulative SUV-volume histograms (AUC-CSH), with lower AUC-CSH indexes corresponding to higher degrees of tumor heterogeneity. Patient's demographics and tumor staging were also collected. Median follow up time was 28.2±30.3 months. Overall survival (OS) and progression free survival (PFS) were calculated using univariate cox regression with the adjustment of age, gender, staging, treatment and histological grade. All pet measurements were normalized and the hazard ratios change was equivalent to one standard deviation.

RESULTS

The patients' mean age was 64±10.3 years and there were 6 patients with stage I, 11 with stage II, 31 with stage III, 21 with stage IV disease, and 2 with unknown staging. Median survival was 16.1 months. Forty-six patients died and 15 were alive as of the end of the study (for 10 patients no recent information on survival was available). Eighteen patients had recurrence as of the end of the study. Higher MTV was significantly associated with reduced PFS for every standard deviation increase (HR=0.193, 95% CI=0.052-0.711, p=0.0134). Higher AUC-CSH (lower tumor heterogeneity, homogeneous tumor) was significantly associated with increased PFS for every standard deviation increase in the area under the curve (HR=10.779, 95% CI=1.306-88.957, p=0.0272).

CONCLUSION

There was a significant association of MTV and tumor heterogeneity with progression free survival for patients with esophageal cancer.

CLINICAL RELEVANCE/APPLICATION

FDG PET/CT quantitative parameters, particularly intramural metabolic heterogeneity, can provide prognostic information on initial staging scan, potentially leading to a more personalized approach for patient's treatment.

SSK15-09 Early Utilization of SPECT/CT to Improve Localization and Reduce Time to Diagnosis and Intervention in Acute Gastrointestinal Bleeding

Wednesday, Dec. 4 11:50AM - 12:00PM Room: E451A

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PURPOSE

Approximately 2% of the admissions to the emergency department are for acute GIB, with 1 in 4 requiring immediate attention. Planar scintigraphy using Tc-99m tagged red blood cells (Tc-99m RBCs) is used as an ideal first line diagnostic option in suspected GIB due to being non-invasive and having a very high sensitivity. However, due to this high sensitivity, it is often the case that patients with positive or equivocal Tc-99m RBC scans have negative findings on CT angiography and/or catheter based angiography. These patients that continue to bleed ultimately require provocative angiograms or invasive procedures like surgery, which are risky and often also negative. This is due to a combination of low confidence of interpretation and poor localization of planar scintigraphy. We hypothesized that by utilizing hybrid SPECT/CT in cases of suspected GIB, we would be able to improve confidence of interpretation and localization of the bleed, and this was tested and proven in our institution. Yet, while we found a high negative predictive value of adding SPECT/CT, positive predictive value was still low. As it is well known that the sooner a bleed is identified, the higher chances are of successful treatment, we proposed a new protocol in which SPECT/CT is utilized earlier. Thus, the purpose of this report is to evaluate if a change in imaging protocol with early utilization of SPECT/CT can improve localization of acute GIB and decrease time to intervention, and/or eliminate unnecessary procedures.

RESULTS

In our retrospective analysis, 49 patients who underwent planar scintigraphy and hybrid SPECT/CT for suspected acute non-variceal GIB were included. 28 of them had positive studies on nuclear imaging (planar and SPECT/CT), while 21 were negative. For confidence of interpretation, of the 20 patients that were deemed "equivocal" on planar imaging, 13 were found to be negative and 7 positive on hybrid SPECT/CT. For localization, only 6 of the 28 positive patients had a bleed that was accurately localized on planar imaging, while all 28 were accurately localized on SPECT/CT. Finally in terms of outcomes, of the 28 patients with positive studies on nuclear medicine imaging, only 6 were found to be positive on angiography or endoscopy (PPV: 21.4%). However, all 21 patients who were negative on SPECT/CT were also negative on angiography or endoscopy (NPV: 100%). In our limited experience with the new protocol in 4 cases, time to diagnosis and/or intervention has been reduced by 50%.

CONCLUSION

Our retrospective analysis previously showed that SPECT/CT improves confidence of interpretation, localization, and ultimately outcomes in the diagnosis of GIB. While the PPV of 21.4% is low, it is still higher than planar scintigraphy alone, and likely is mostly due to slow or intermittent GI bleeding that is detected by SPECT/CT but not brisk enough to be seen on subsequent testing. On the other hand, our analysis demonstrated a 100% NPV, which can be utilized to avoid further unnecessary and possibly invasive or risky tests. Furthermore, SPECT/CT eliminated "equivocal" findings which are often reported on planar scintigraphy alone, and allowed for more accurate localization in all positive cases. Due to these findings and the fact that the initial flow phase of planar scintigraphy (first minute) is comparable to the first order angiographic arterial phase, we proposed that any tests that were positive or equivocal in that first minute should have their planar imaging stopped and go directly to SPECT/CT. Thus, as opposed to 60 minutes of planar testing, these higher risk cases would have SPECT/CT imaging completed within 30 minutes of tagged RBC injection. Any that were negative on SPECT/CT would not need further provocative or invasive testing, while those that were positive would proceed directly to angiography. In our limited experience of our first 4 patients in which we have implemented this protocol, definite diagnosis (in negative cases) or intervention (in positive cases) was achieved at least 50% faster (30 minutes vs. 60+ minutes for planar plus additional SPECT/CT). Based on our findings, we propose a similar protocol be implemented in centers where GIB are evaluated and treated to improve time to diagnosis or intervention, and eliminate any unnecessary testing.

METHODS

Retrospective analysis from 2001-2014 of patients with suspected non-variceal GIB who underwent planar tagged RBC scintigraphy and hybrid SPECT/CT prior to angiogram or endoscopy/colonoscopy. Data on confidence of interpretation, localization, and outcomes were collected and analyzed. Based on the results, a new protocol was implemented at our institution as follows: all patients in whom GIB is suspected, the planar scintigraphic images are watched in the flow phase (first minute), and if there is a definite positive, probable positive, or equivocal finding, the study is stopped and a SPECT/CT is performed.

NMS-WEA

Nuclear Medicine Wednesday Poster Discussions

Wednesday, Dec. 4 12:15PM - 12:45PM Room: NM Community, Learning Center

NM

AMA PRA Category 1 Credit ™: .50

Participants
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Sub-Events

NM218-SD-WEA1 Malignancy Probabilistic Model in Mediastinal and Hilar Lymph Nodes in Lung Cancer Based on PET/CT and EBUS

Station #1

Participants
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PURPOSE

Mediastinal lymph node (LN) staging of non-small cell lung cancer (NSCLC) is routinely performed by PET/CT, and EBUS-TBNA if histological confirmation is required. Among the variability of the SUVmax cut-off points for PET/CT staging, other variables such as metabolic parameters and different ratios have been proposed. Ultrasonographically, different variables associated with the probability of malignancy of a lymph node such as diameter of its short axis (DSA) and the morphology have been described. However, there are no studies exploring the diagnostic capacity of both techniques together. Our aim was to find an algorithm based on combined PET/CT and EBUS variables together with clinical criteria that provide the most accurate probability of malignancy for each LN explored.

METHOD AND MATERIALS

We performed a retrospective study of mediastinal staging of NSCLC (51.4% adenocarcinoma; 34.9% squamous cell carcinoma; 13.7% other), based on PET/CT and EBUS-TBNA. LNs were identified according to the clinically approved staging level (IASCLC) (N1, N2 and N3) and by anatomical region (AR) (subcarinal, not subcarinal, and hilar). Metabolic parameters (MTV, TLG, SUVmax, SUVmean and SUVpeak) were determined for each sampled LN as well as for pulmonary mass. Also liver and blood pool SUV were registered as reference. The ultrasound features collected were: DSA, morphology, border, echogenicity and presence of the vascular hilium. For the construction of the predictive algorithm a mixed model of logistic regression of Firth was used.

RESULTS

116 consecutive patients were included and a total of 358 LN were evaluated. The set of variables that presented the best discrimination were: age, DSA, SUVmax and AR. The model determines the probability for malignancy for each LN, using the following formula = (-9.26) constant + (-0.21) Age + (4.29) SUVmax + (0.52) DSA + AR. The discrimination power of the model measured by the Area Under the Roc curve was =0.95.

CONCLUSION

The model including age, DSA, SUVmax and AR provide the probability of malignancy for each LN with the highest accuracy. All other variables can be discarded when combining PET/CT and EBUS image features. A further analysis is warranted.

CLINICAL RELEVANCE/APPLICATION

Mediastinal lymph node staging is routinely performed by PET-CT and EBUS-TBNA. However, there are no studies the diagnostic capacity of both techniques together.

NM219-SD-WEA2 Convolution Neural Network in Grading of Parkinson Syndrome on Dopamine Transporter Single Photon Emission CT (DaT-SPECT) with (123I) Ioflupane

Station #2

Participants
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PURPOSE

DaT-SPECT with 123I ioflupane (DaTscan) assists practitioners more accurately in their clinical evaluation diagnosis of suspected Parkinson's syndromes, based upon the appearance of the striata which reflects loss of DaT receptors. The normal DaTscan image appears as two symmetric comma or crescent shape accumulation. The abnormal appears as dot shape or none with asymmetric or symmetric deplete in putamen and caudate nucleus. The grading is made visually by the shape. We demonstrated the accuracy of grading DaTscan image by using Convolution Neural Network (CNN) on patients with Parkinson's symptoms and examined the possibility of contribution in the clinical diagnosis.

METHOD AND MATERIALS

Image of 171 (Male 86, Female 85, mean age 73.4) patients with Parkinson's symptoms who underwent for DaTscan were retrospectively reviewed. All patients had a SPECT/CT scan with the collimator of low energy high resolution and the matrix size of 128×128. Four-point grading system was obtained prescribed in the FDA information for DaTscan. Images were evaluated by two experienced radiologists (one with 13 and the other with 9 years) as ground truth (grade 0/1/2/3 : 74/28/38/37). The evaluation was made independently and the differences in grading between the evaluators were resolved by consensus. The degree of the association between the ground truth and the two evaluators, CNN were analyzed by using Kappa coefficient (K). The architecture of 6 layers CNN (2 convolution, and 4 affine layers) was automatically designed and obtained as machine learning. Hyper parameters were learning rate : Adam, epoch : 500, batch size : 25, activation function : ReLU(rectified linear unit)/PReLU(parametric ReLU)/SELU(scaled exponential linear unit). The accuracy was evaluated by using 5-fold cross validation method. The process time was also measured.

RESULTS

The processs time for a case was 0.84sec. CNN achieved a high performance with an accuracy of overall/average : 0.83/0.79, a F-measure of macro/micro : 0.83/0.79. K showed in high order as 13 years/CNN/9 years : 0.86/0.73/0.59.

CONCLUSION

CNN may support young radiologist in grading of DaTscan image and may reduce time in grading for more experienced radiologist.

CLINICAL RELEVANCE/APPLICATION

Using Convolution Neural Network as machine learning for SPECT image to support young radiologist with diagnosis and to save time for experienced.

NM220-SD-WEA3 Whole-Body [18F]FDG-PET/MRI versus [18F]FDG-PET/CT in Melanoma Patients

Station #3

Participants
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Gundula Berzaczy, MD, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose
Marius E. Mayerhoefer, MD,PhD, Vienna, Austria (*Abstract Co-Author*) Speaker, Siemens AG; Research support, Siemens AG

PURPOSE

To assess the diagnostic performance of simultaneous whole-body [18F]FDG-PET/MRI compared to [18F]FDG-PET/CT for detection of distant metastatic disease in patients with malignant melanoma.

METHOD AND MATERIALS

Patients with histologically proven, malignant melanoma were included in this prospective, IRB-approved study. Patients underwent [18F]FDG-PET/MRI and subsequent [18F]FDG-PET/CT after a single tracer injection on the same day for staging or restaging purposes. Images were evaluated for the presence of metastatic lesions by two rater teams, each consisting of a nuclear medicine physician and a radiologist, in an observer-blinded fashion. Overall agreement, accuracy, sensitivity, and specificity, relative to a composite reference standard (consensus review including follow-up data), were calculated.

RESULTS

Between July 2014 and December 2018, 22 patients were enrolled. Overall agreement and accuracy between the two rater teams were 87.8% (71-84.9) and 93.2% (95%CI 90.2-95.3) for PET/MRI and 78% (70.2-84.3) and 94.9% (95%CI 93.2-97.4) for PET/CT, respectively (P=1.00). Overall, PET/MRI reached 83% Se (95%CI 76.4-88.1) and 100% Sp (95%CI, 98.1-100), PET/CT showed 87.4% Se (95%CI 81.3-91.8) and 100% Sp (95%CI, 98.1-100) for the detection of metastatic disease in malignant melanoma.

CONCLUSION

Whole-body [18F]FDG-PET/MRI appears to be comparable to [18F]FDG-PET/CT for lesion detection in patients with malignant melanoma.

CLINICAL RELEVANCE/APPLICATION

The diagnostic performance of Whole-body [18F]FDG-PET/MRI seems to be equally well compared to [18F]FDG-PET/CT in patients with metastatic malignant melanoma.

NM244-SD-WEA4 MUO-Metastasis of Unknown Origin in Head and Neck-Role of FDG PET CT in Finding the Culprit

Station #4

Participants
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PURPOSE

To assess the role of FDG PET CT in searching for primary in cases with histology/cytology proven malignancy in neck lymphnodes where primary has not been found on clinical , and endoscopic evaluation.

METHOD AND MATERIALS

We performed a retrospective review of PET CT scans of cases with MUO head and neck over a period of two years from 1-01-2017 to 01-01-2019. 40 cases were included in the study. All these cases had cytology/biopsy proven metastasis in neck lymphnodes and no primary was identified on clinical, endoscopic examination. Some of these patients had prior CT/MRI study done prior to PET CT.

RESULTS

Out of 40 cases, 7 cases (17.5%) had no identifiable primary on FDG PET CT. Amongst the 33 positive cases (82.5%) most commonly identified primary was in order - Tonsils(6/33 -18.1%), Valleculae (5/33-15.1%), Pyriform fossa(5/33-15.1%),Tongue base(4/33-12%), nasopharynx(3/33-9%), carcinoma lung (2/33-6%),carcinoma thyroid (2/33-6%). Other rare sites of primary seen were supraglottis, parotid gland, posterior pharyngeal wall, esophagus, gingivobuccal sulcus and breast.

CONCLUSION

Most common sites for primary in MUO in our study were tonsils, valleculae, pyriform sinus and posterior tongue base which are blind spots and can be missed on routine endoscopy. PET CT helped in identifying distal primaries which were associated with metastatic cervical lymphnodes.

CLINICAL RELEVANCE/APPLICATION

FDG PET CT plays a valuable role in identifying rare sites of primary which can be missed on clinical evaluation and conventional radiological examinations.

NM245-SD-WEA5 Comparison of 68Ga-DOTATOC PET-MRI and MR-DWI for Whole-Body Staging of Patients with Neuroendocrine Tumors

Station #5

Participants
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Lale Umutlu, MD, Essen, Germany (*Abstract Co-Author*) Consultant, Bayer AG

PURPOSE

To compare the diagnostic potential of integrated 68Ga-DOTATOC Positron emission tomography-magnetic resonance imaging (PET-MRI) and diffusion weighted imaging-MRI (DWI-MRI) for whole-body staging of patients with neuroendocrine tumours (NET).

METHOD AND MATERIALS

A total of 43 patients with a histopathologically proven NET (50% G1, 30% G2 and 5% G3) underwent a whole-body 68Ga-DOTATOC PET-MRI examination 60 minutes after the injection of a mean activity of 60,2 MBq. The MR study protocol comprised the acquisition of a T1w 3D VIBE sequence (pre- and post-contrast), a T2w HASTE and a diffusion-weighted EPI sequence. Two readers evaluated the following datasets 1. whole-body MRI including DWI, 2. 68Ga-DOTATOC PET-MRI without DWI regarding (1) lesion detection, (2) lesion conspicuity (4-point ordinal scale) and (3) diagnostic confidence (5-point ordinal scale). Wilcoxon's signed-rank test was used to determine the significance of differences between the ratings.

RESULTS

68Ga-DOTATOC PET-MRI correctly detected 70 malignant lesions. Among them, MRI-DWI enabled correct identification of 59 malignat lesions. Additionally, 68Ga-DOTATOC PET-MRI exhibited a significant higher conspicuity (PET-MRI: 2.93 ± 0.75; MRI+DWI: 2.27 ± 0.99) and diagnostic confidence (PET-MRI: 4.59 ± 0.60; MRI+DWI: 4.09 ± 0.88) in the detection of malignant lesions ($p<0.01$). Furthermore, 68Ga-DOTATOC PET-MRI and MRI-DWI showed an equivalent performance in the detection of benign lesions.

CONCLUSION

Our results demonstrate the superiority of 68Ga-DOTATOC PET-MRI in detecting malignant lesions when compared to MR-DWI alone, underlining its superior potential for whole-body staging of patients with NETs when compared to MR-DWI.

CLINICAL RELEVANCE/APPLICATION

68Ga-DOTATOC PET-MRI superior in detecting malignant lesions of neuroendocrine tumours when compared to MR-DWI alone.

NM135-ED-WEA6 "Virtual Planar Image" Reconstructed from SPECT Data: How to Process and Its Clinical Feasibility

Station #6

Awards
Certificate of Merit

Participants

Akira Imoto, Suita, Japan (*Presenter*) Nothing to Disclose
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TEACHING POINTS

Planar image (PI) of scintigraphy is one of the useful modalities for diagnosis of cardiovascular diseases in addition to SPECT image. In most cases, PI is evaluated by count ratio of contralateral regions or target/control regions. For example, 'Right/Left ratio' in lung perfusion scintigraphy in pediatric patients, 'Lung/Heart ratio' in stress myocardial perfusion scintigraphy, 'Heart/Mediastinum ratio' in myocardial MIBG scintigraphy, 'Heart/Contralateral ratio' in 99mTc-PYP scintigraphy, etc. are often evaluated in clinical practice. However, since these scintigraphic examinations require mainly SPECT image, rather than PI, additional acquisition of PI is sometimes omitted to save the examination time in many institutions. Therefore, we developed the novel algorithm to generate PI from SPECT data (hereafter 'virtual planar image: VPI'). The purpose of this exhibit is to present how to process VPI and its clinical feasibility. Learning this technique will bring you more efficient performance of scintigraphy in terms of the saving time of PI acquisition without losing its information.

TABLE OF CONTENTS/OUTLINE

1.Explanation of how to process VPI. 2.Presentation of the clinical examples of cardiovascular diseases which show the feasibility of VPI compared with conventional planar image. 3.Verification of accuracy of measurement by VPI: phantom study.

NM136-ED-WEA7 Imaging in Chronic ThromboEmbolic Pulmonary Hypertension

Station #7

Participants
Hina Shah, MD, Boston, MA (*Presenter*) Nothing to Disclose
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TEACHING POINTS

After reviewing the exhibit, the learner is expected to: Understand what Chronic Thromboembolic Pulmonary Hypertension (CTEPH) is, including WHO groupings Know the pathophysiology of CTEPH Discuss the advantage and disadvantages of various imaging modalities in the evaluation of CTEPH

TABLE OF CONTENTS/OUTLINE

Outline of proposed presentation: CTEPH Definition and WHO groupings Pathophysiology of CTEPH Advantages and Disadvantages of various imaging modalities Each example illustrated with nuclear medicine, CT and angiographic image where appropriate with management and outcome

NMS-WEB

Nuclear Medicine Wednesday Poster Discussions

Wednesday, Dec. 4 12:45PM - 1:15PM Room: NM Community, Learning Center

NM

AMA PRA Category 1 Credit ™: .50

Participants
Robert R. Flavell, MD, PhD, San Francisco, CA (*Moderator*) Nothing to Disclose

Sub-Events

NM215-SD-WEB1 Correlation of Wall Shear Stress on MR Angiography with 18F-FDG and 18F-NaF Uptake on PET/CT in Patients with Carotid Artery Stenosis

Station #1

Participants
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PURPOSE

Arterial stenosis and vulnerable plaque in carotid artery are the important causes of stroke. The purpose of this study was to evaluate the correlation of wall shear stress by computational fluid dynamics on MR angiography with 18F-FDG and 18F-NaF uptake on PET/CT in patients with carotid artery stenosis.

METHOD AND MATERIALS

A total of 30 carotid arteries in 15 patients with carotid artery stenosis were examined with MR angiography, 18F-FDG PET/CT and 18F-NaF PET/CT. In one patient, only one carotid artery was analyzed because the stenosis was too narrow to analyze. The maximum wall shear stress (WSS) of the carotid artery was quantitatively assessed by computational fluid dynamics analysis on MR angiography. 18F-FDG and 18F-NaF uptake in carotid arteries were semiquantitatively assessed using maximum standardized uptake value (SUVmax).

RESULTS

The mean (±SD) maximum WSS was 25.14±18.16 Pa. On 18F-FDG PET/CT, the mean (±SD) SUVmax was 2.76±1.40. On 18F-NaF PET/CT, the mean (±SD) SUVmax was 2.53±0.97. A significant correlation was observed between the maximum WSS and the 18F-FDG SUVmax ($r = 0.77$, $p < 0.001$). There was no significant correlation between the 18F-NaF SUVmax and the maximum WSS or between the 18F-NaF SUVmax and the 18F-FDG SUVmax.

CONCLUSION

Based on the results of this preliminary study, it was found that WSS on MR angiography was associated with the 18F-FDG uptake on PET/CT in carotid artery stenosis patients.

CLINICAL RELEVANCE/APPLICATION

Wall shear stress on MR angiography was associated with the 18F-FDG uptake on PET/CT in carotid artery stenosis patients.

NM222-SD-WEB2 FDG Uptake of Bone Marrow on PET Has Prognostic Potential for Predicting Distant Recurrence in Breast Cancer Patients After Surgical Resection

Station #2

Participants
Sang Mi Lee, Cheonan, Korea, Republic Of (*Presenter*) Nothing to Disclose
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PURPOSE

FDG uptake of bone marrow (BM) on PET/CT is known to be related with systemic inflammatory response to cancer. Considering the significant association of host inflammatory response to tumor progression and metastasis, parameter that reflects the degree of systemic inflammatory response could be used to predict the risk of distant recurrence. The aim of this study was to assess the prognostic value of FDG uptake of BM as well as metabolic parameters of primary tumor on PET/CT for predicting distant recurrence in patients with breast cancer.

METHOD AND MATERIALS

FDG PET/CT images of 345 breast cancer patients without distant metastases were retrospectively evaluated. Maximum standardized uptake value (SUV), metabolic tumor volume (MTV), and total lesion glycolysis (TLG) of primary breast cancer and

bone marrow-to-liver uptake ratio (BLR) on PET/CT were measured. A cox proportional hazard regression model was used to evaluate prognostic potential of parameters for predicting recurrence-free survival (RFS) and distant RFS.

RESULTS

BLR was significantly correlated with T stage, serum inflammatory markers, and recurrence pattern ($p<0.05$). Patients with high BLR and TLG showed worse RFS and distant RFS than those with low BLR and TLG. On multivariate analysis, BLR and TLG were significantly associated with both RFS ($p=0.002$ and hazard ratio 3.19 for BLR; $p=0.010$ hazard ratio 3.30 for TLG) and distant RFS ($p=0.009$ and hazard ratio 5.38 for BLR; $p=0.015$ and hazard ratio 8.42 for TLG) along with T stage and estrogen receptor status. None (0%) of the patients with TLG <9.00 g and BLR <0.81 experienced distant recurrence, but, the distant recurrence rate of patients with TLG >=9.00 g and BLR >= 0.81 was high at 21.0%.

CONCLUSION

BLR on pretreatment FDG PET/CT were significant predictors for RFS and distant RFS in patients with breast cancer.

CLINICAL RELEVANCE/APPLICATION

By combining FDG uptake of BM and volumetric PET/CT index of primary cancer, the risk of distant recurrence could be stratified in patients with breast cancer after curative resection.

NM223-SD-WEB3 Early-Phase F-18 Florbetaben PET as an Alternative Modality for Diagnosis of Dementia

Station #3

Participants
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Sang-Woo Lee, Daegu, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Uicheul Yoon, Gyeongbuk, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Early-phase FBB (E-FBB) brain PET has recently been identified as a surrogate for brain perfusion and can provide complementary 18F-fluorodeoxyglucose (FDG)-like information by semi-quantification analysis. To prove the competitiveness of FBB, we investigated the diagnostic performance between E-FBB PET and FDG brain PET with visual scoring system and uptake pattern analysis.

METHOD AND MATERIALS

This prospective study included 40 patients with clinical suspicion of dementia due to neurodegenerative disease. The amyloid brain PET was acquired in dual time-point with FBB; E-FBB PET was acquired for the initial 5 minutes after injection, and late-phase (L-FBB) at 90 minutes after injection. FDG PET was also acquired in all subjects. E-FBB and FDG PET data were reviewed by 3 expert nuclear medicine physicians, and were analyzed with visual scoring system from the segmented cerebral regions. The uptake patterns were analyzed to specify the disease and the determined diseases by both PET scans were statistically compared with using concordance correlation coefficient. Furthermore, regional standardized uptake value ratio (SUVR) with whole brain mean normalization were calculated for E-FBB and FDG PET, and analyzed the relationship between E-FBB and FDG PET scans.

RESULTS

Among the 40 patients (mean age 68.5 ± 9.8 years), 19 were amyloid-positive, and 21 were amyloid-negative on L-FBB PET. The rated scores from E-FBB and FDG PET were significantly correlated ($r=0.664$, $p < 0.0001$). According to the sub-analysis in each cerebral region, the best correlation between two PET scans was achieved in frontal lobe (0.752, $p < 0.0001$), followed by occipital and parietal lobes (0.730 and 0.696, respectively). The rated scores from both E-FBB and FDG PET were statistically correlated with R2 value of 0.4464 ($p < 0.0001$). The rated score values were relatively higher in FDG PET. Disease types, specified by E-FBB and FDG PET, were statistically correlated (concordance correlation coefficient=0.9035). On the analysis about VOI-based comparison of E-FBB and FDG PET, all brain regions showed significant correlations ($p < 0.0001$).

CONCLUSION

E-FBB PET images were well correlated with FDG PET images. The results of differential diagnosis of dementia were similar with both PET scans. E-FBB PET could potentially be a useful biomarker for diagnosis of dementia in place of FDG PET.

CLINICAL RELEVANCE/APPLICATION

Diagnosis of Dementia

NM246-SD-WEB4 18 F-PET/MRI versus Contrast-Enhanced MRI in Detecting Loco-Regional HNSCC Nodal Metastases

Station #4

Participants
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PURPOSE

To evaluate the accuracy of established dimensional and morphological criteria for MRI vs integrated 18 F-PET/MRI for the identification of loco-regional lymph node metastases in patients affected by newly diagnosed head and neck squamous cell carcinoma (HNSCC).

METHOD AND MATERIALS

we retrospectively reviewed 26 patients affected by histologically proven HNSCC who underwent gadolinium-enhanced 18F-FDG PET/MRI as part of their staging. All neck lymph nodes were classified using dimensional, morphological and dimensional/morphological criteria based on contrast- enhanced MR images. Then, lymph nodes were evaluated using integrated 18F-PET/MRI images by a nuclear medicine physician and a radiologist in consensus. ROC curves were drawn to compare the different techniques. Lymph node histopathology was considered the reference standard.

RESULTS

35/865 lymph nodes were malignant at histopathology (3 with micro-metastases). Sensitivity and specificity were 48.6% and 99.5% for MRI using dimensional criteria, 60.0% and 99.6% for MRI using morphological criteria, 60.0% and 99.4% for MRI using dimensional or morphological criteria and 74.3% and 97.6% for integrated PET/MR respectively. AUC for PET/MRI (0.859) was higher than for dimensional (0.740; $p<0.05$), for morphological (0.798; $p<0.05$) and dimensional/morphological criteria (0.797; $p<0.05$). SUVmean of the 26 true positive lymph nodes identified by PET/MRI was significantly higher than SUVmean of the 20 false positive lymph nodes (5.69 +−3.50 vs 2.64 +− 0.62; $p=0.0001$).

CONCLUSION

Integrated PET/MR improved diagnostic accuracy in detection of metastatic lymph nodes in patients affected by HNSCC compared to traditional contrast-enhanced MR.

CLINICAL RELEVANCE/APPLICATION

18F-FDG PET/MRI can improve regional nodal metastases detection in HNSCC patients

NM247-SD-WEB5 Using Artificial Intelligence to Quantify Simultaneous FDG and [68Ga]DOTATATE Neuroendocrine Tumor PET Imaging

Station #5

Participants
Wenxiang Ding, St. Louis, MO (*Abstract Co-Author*) Nothing to Disclose
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Richard L. Wahl, MD, Saint Louis, MO (*Abstract Co-Author*) Research Consultant, Nihon Medi-Physics Co, Ltd Contract, WhiteRabbit.AI Inc

PURPOSE

Both FDG and [68Ga]DOTATATE PET-CT are routinely used in clinical for quantitative imaging neuroendocrine tumors (NET) glucose metabolism and somatostatin receptor subtype 2 (SSTR2) density, respectively. The objective of this study is to investigate the feasibility of quantification of simultaneous FDG and [68Ga]dotatate neuroendocrine tumor PET imaging using machine learning approach.

METHOD AND MATERIALS

Twenty-seven NET patients were recruited in the study. All patients had 45-min [68Ga]DOTATATE single-bed dynamic PET-CT scans, and eight of them have both FDG and [68Ga]DOTATATE and FDG dynamic PET-CT scans. Aorta TACs were used blood input function for kinetic modeling and computer simulation. An irreversible 2-tissue compartmental model with blood input function was used for simulation. The weighted average of simulated tracer activity curves is used to mimic simultaneous FDG and [68Ga]DOTATATE PET study. Random Forests Regression Models (RFM) was proposed to separate the mixed TACs in blood and tissue by computer simulation. In addition, tracer uptake rate constants Ki and initial distribution volume (Vid) are estimated from tissue-TACs by the RFM for parametric imaging.

RESULTS

For the aorta-TACs, the prediction errors of FDG and Ga68dotatate are 2.71% and 9.31%, respectively. And for the tissue-TACs, the prediction errors of FDG and Ga68dotatate are 7.69% and 11.41%, respectively. The parametric images generated by the Patlak plot from last 10 min are not reliable and too noise to be used in clinical, while the parametric images generated by the RFM from the last 10 min scan are comparable to the ones from last 35 min scan. In addition, the variance of estimates of Ki and Vid from RFM are almost constant at different noise level. But for the Patlak, the variance of Ki and Vid at high noise level are larger than the ones at low noise level.

CONCLUSION

It is feasible to reliably separate the mixed FDG and [68Ga]DOTATATE time activity using RFM algorithm. The parametric images of Ki and Vid by RFM is robust for clinical evaluation. The evaluation by human NET dynamic PET study with simultaneous FDG and [68Ga]DOTATATE injection will be investigated by the ongoing project.

CLINICAL RELEVANCE/APPLICATION

The simultaneous FDG and [68Ga]DOTATATE PET imaging on NET patient will reduce the time and cost of diagnosis, and improve the accuracy in NET detection, grading, staging, and monitoring the responses to treatments.

NM137-ED-WEB6 A Pictorial Review of Positron Emission Tomography with 18F-FDG in Rheumatoid Arthritis

Station #6

Participants
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TEACHING POINTS

Rheumatoid arthritis (RA) is a chronic autoimmune multi-systemic inflammatory disease which predominantly affects the synovial tissues and joints. Positron emission tomography (PET) is a potential technique for the detection and quantification of inflammation in vivo. This exhibit describes the role of 18F-fluorodeoxyglucose (18F-FDG) PET on the assessment of RA in clinical practice This exhibit also describes some other PET tracers for imaging RA

TABLE OF CONTENTS/OUTLINE

1. Introduction Rheumatoid arthritis Diagnosis of RA Imaging modalities in RA 2. Present role of FDG PET in RA Diagnostics (Differential Diagnosis) Assessment of disease activity Evaluation of treatment response Prediction of joint destruction Detection of RA-associated disease 3. Other PET imaging tracer in RA 4. Summary

NM138-ED-WEB7 Nuclear Scintigraphy in Adult Congenital Cardiovascular Diseases

Station #7

Participants
Shaimaa A. Fadl, MD, Seattle, WA (*Presenter*) Nothing to Disclose
Gensuke Akaike, MD, Seattle, WA (*Abstract Co-Author*) Nothing to Disclose
Malak Itani, MD, Clayton, MO (*Abstract Co-Author*) Nothing to Disclose
Stan Sukhtoski, Seattle, WA (*Abstract Co-Author*) Nothing to Disclose
Manuela C. Matesan, MD, PhD, Seattle, WA (*Abstract Co-Author*) Nothing to Disclose

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TEACHING POINTS

To describe the role of nuclear scintigraphy in the diagnosis and management of adult congenital heart and vascular diseases (ACHD).To review the different scintigraphy imaging features in patient with ACHD, with focus on ventilation/ perfusion (V/Q) and myocardial perfusion scans.To illustrate the different technical consideration in nuclear imaging in patients with ACHD

TABLE OF CONTENTS/OUTLINE

Role of pulmonary and myocardial nuclear scintigraphic imaging in the diagnosis and management if patients with ACHD.An overview of scintigraphic imaging appearances in patients with ACHD.Specific scintigraphic imaging appearances in postoperative adult patients with congenital heart diseases.Technical challenges and consideration in scintigraphy imaging of patients with ACHD.Differential diagnosis and imaging pitfalls.

SPAI42

RSNA AI Deep Learning Lab: Generative Adversarial Networks (GANs)

Wednesday, Dec. 4 1:00PM - 2:30PM Room: AI Showcase, North Building, Level 2, Booth 10342

AI CT MR NM

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 1.75

Participants
Bradley J. Erickson, MD, PhD, Rochester, MN (*Presenter*) Board of Directors, VoiceIt Technologies, LLC; Stockholder, VoiceIt Technologies, LLC; Board of Directors, FlowSigma, LLC; Officer, FlowSigma, LLC ; Stockholder, FlowSigma, LLC

Special Information

In order to get the best experience for this session, it is highly recommended that attendees bring a laptop with a keyboard, a decent-sized screen, and the latest version of Google Chrome. Additionally, it is recommended that attendees have a basic knowledge of deep learning programming and some experience running a Google CoLab notebook. Having a Gmail account is also helpful. Here are instructions for creating and deleting a Gmail account.

ABSTRACT

This course describes a more recent advance in deep learning known as Generative Adversarial Networks (GANs). GANs are a deep learning technology in which a computer is trained to create images that look very 'real' even though they are completely synthetic. Getting 'large enough' data sets is a problem for most deep learning applications, and this is particularly true in medical imaging. This may be one way to address the 'data shortage' problem in medicine. GANs have also been created that can convert MRIs to CTs (e.g. for attenuation correction with MR/PET).

Printed on: 10/29/20

MSRO44

BOOST: Advanced Techniques in Image-guided Therapy (Interactive Session)

Wednesday, Dec. 4 3:00PM - 4:15PM Room: S103CD

CT MR NM OI RO

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

Participants
Florence K. Keane, MD, Boston, MA (*Presenter*) Advisory Board, AstraZeneca PLC
Susanna I. Lee, MD,PhD, Boston, MA (*Presenter*) Royalties, Wolters Kluwer nv; Royalties, Springer Nature
Homer A. Macapinlac, MD, Houston , TX (*Presenter*) Nothing to Disclose
Peter Balter, PhD, Houston, TX (*Presenter*) Research Grant, Varian Medical Systems, Inc; Research Grant, RaySearch Laboratories AB

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LEARNING OBJECTIVES

1) Explain and apply modern CT, MR, and PET technologies for treatment planning of solid malignancies in the chest, abdomen and pelvis. 2) Explain and apply the modern techniques in radiotherapy safely and effectively in the chest, abdomen and pelvis.

ABSTRACT

The last decade has seen emergence of important advances in locoregional cancer therapy. Use of functional imaging and advanced radiotherapy often integrated with targeted chemotherapy have improved patient outcomes. This course will present the underlying principles in diffusion MRI, novel MR contrast agents, ultrasound contrast agents and dual energy CT. PET tracers to be discussed are F-18 FDG, widely used for most solid tumors, C-11 choline/F-18 Fluciclovine for prostate cancer and Ga-68-DOTATATE for neuroendocrine tumors. Advances in PET detector instrumentation will be presented. Advanced radiotherapy techniques such as Image Guided Radiotherapy (IGRT), Intensity Modulated Radiation Therapy (IMRT), and Stereotactic Body Radiation Therapy (SBRT) using image guidance with X-ray, CT, MRI and PET will be described.

Printed on: 10/29/20

SSM18

Nuclear Medicine (Head and Neck/Thyroid Nuclear Medicine and PET)

Wednesday, Dec. 4 3:00PM - 4:00PM Room: S504CD

HN NR NM

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

Participants
Robert R. Flavell, MD, PhD, San Francisco, CA (*Moderator*) Nothing to Disclose
Amy M. Fowler, MD,PhD, Madison, WI (*Moderator*) Institutional research support, General Electric Company; Author with royalties, Reed Elsevier

Sub-Events

SSM18-01 What is the Incidence of Malignancy in Small Hypermetabolic Pulmonary Nodules?

Wednesday, Dec. 4 3:00PM - 3:10PM Room: S504CD

Participants
Charles M. Intenzo, MD, Philadelphia, PA (*Presenter*) Nothing to Disclose
Paras Lakhani, MD, Media, PA (*Abstract Co-Author*) Nothing to Disclose
Michael Unger, MD, Philadelphia , PA (*Abstract Co-Author*) Nothing to Disclose
Achala Donuru, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Boyd Hehn, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Gregory Kane, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Nathaniel Evans, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Maansi R. Parekh, MBBS, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Scott Cowan, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Sung M. Kim, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Julie Barta, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

FDG-PET/CT is often utilized to differentiate between benign and malignant indeterminate lung nodules. Throughout the literature, the sensitivity of FDG-PET/CT in this setting is quite high, however, the vast majority of studies focused on nodules generally larger than 1 to 2 cm in diameter. Our study focuses on the potential role of PET/CT imaging in small FDG-avid lung nodules. We define "small" nodules as those measuring 1 cm or smaller in greatest dimension.

METHOD AND MATERIALS

Our study is both prospective and retrospective. Over a four-year interval, we obtained histopathological follow-up of those patients whose PET/CT scans demonstrated a clearly visible FDG-avid lung nodule measuring up to 1 cm in greatest diameter, in whom there were final pathology results from wedge resection.

RESULTS

A total of 39 patients met the above criteria, 24 men and 15 women. One of these patients was proven to have a benign lung nodule, namely a granuloma measuring 9mm in greatest diameter with an SUV max of 0.94. Of the remaining 38 patients with proven malignant nodules, 23 had adenocarcinoma, 14 had squamous cell tumors, and one patient had Non-Hodgkins lymphoma. The least metabolically-active lung nodule, a squamous cell tumor, measured 5 mm in greatest diameter with an SUV max of 0.73 (background SUV max=0.38). The most active lung nodule, an adenocarcinoma, measured 1 cm with an SUV max of 2.60.

CONCLUSION

Thirty-eight of the 39 patients in our series had small FDG-avid lung nodules measuring up to 1 cm, that were subsequently proven to be malignant. This yields a positive-predictive value of 97.4%, despite the limitations imposed by the so-called partial volume effect, which potentially underestimates the SUV max. FDG-PET/CT is therefore highly sensitive and specific in diagnosing malignancy in such small lung nodules; perhaps this modality's potential has been overlooked in this subgroup of hypermetabolic lung nodules.

CLINICAL RELEVANCE/APPLICATION

Any lung nodule measuring up to 1 cm in greatest dimensions that is FDG-avid on PET/CT should be highly concerning for malignancy.

SSM18-02 FDG PET/CT May Predict Clinical Course in Radioiodine-Negative Lung Metastases from Differentiated Thyroid Cancer

Wednesday, Dec. 4 3:10PM - 3:20PM Room: S504CD

Participants

Kunihiro Nakada, Sapporo, Japan (*Presenter*) Nothing to Disclose
Yasushi Furuta, 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
Hiroki Sugie, MD, Sapporo, Japan (*Abstract Co-Author*) Nothing to Disclose
Noriyoshi Kato, MD,PhD, Sapporo, Japan (*Abstract Co-Author*) Nothing to Disclose
Ichiro Sakuma, MD, PhD, Sapporo, Japan (*Abstract Co-Author*) Nothing to Disclose
Masayuki Sakurai, Sapporo, Japan (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

There is a considerable variety in the clinical course of radioiodine negative lmetastasis from differentiated thyroid cancer (DTC). The aim of this study was to determine whether PET/CT with F-18 FDG was valuable in predicting prognosis of radioiodine-negative lung metastasis from DTC.

METHOD AND MATERIALS

This study included 39 patients who had lung metastases from DTC (PCA/FCA 35/4. age 33-86yrs.) that did not avid I-131 on the post therapy whole body scan and SPECT/CT after high-dose radioactive iodine therapy (RAI). Two out of 34 patients had bone metastasis and another 19 patients had lymph node metastasis in addition to lung metastasis. PET/CT imaging was performed 5-16 mos after the latest RAI using a dedicated scanner .Uptake of FDG in the metastatic tumor was visually evaluated by 2 independent radiologists. When a tumor showed FDG activity stronger than that in the mediastinum on the whole body MIP images, FDG uptake was defined as positive. Based upon FDG uptake, patients were classified into 2 subgroups: Positive FDG uptake (n=21), and negative FDG uptake (n=18) .Follow up period ranged from 45 to 147 mos(median:92mos.). Patents did not receive additional treatment for lung metastases except for TSH suppression, pleurodesis, or radiotherapy. Anatomical imaging and Tg measurement were performed at a regular interval to evaluate Tg-doubling time (TgDT) and longitudinal changes in tumor diameter (as a rule, based on RECIST1.1) during the follow- up period. Additionally, progression-free survival (PFS) was determined using Kaplan-Meier plot.

RESULTS

Short TgDT (< 1 yr) was more frequently seen in positive FDG uptake group than in negative FDG uptake group (67% vs 17%,p<0.005). The median PFS (mos.) in the positive FDG uptake group vs. the negative FDG uptake group was 40 vs. NA (p<0.001), respectively.

CONCLUSION

FDG positive lung metastases had a increased risk for shorter TgDT or shorter PFS than those with FDG negative ones , while FDG negative lung tumor were associated with stable clinical course. FDG uptake may be predictive of clinical core and prognosis of radioiodine negative lung metastasis from DTC.

CLINICAL RELEVANCE/APPLICATION

Early differentiation of patients with possible unfavorable prognosis from those with favorable prognosis should be helpful in planning an adjunctive treatment to RAI. FDG-PET/CT may be valuable in optimizing the management of radioiodine- negative lung metastases from DTC.

SSM18-03 Is 30mCi of I-131 Inadequate for Adjuvant Therapy for Postsurgical Thyroid Cancer?

Wednesday, Dec. 4 3:20PM - 3:30PM Room: S504CD

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

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PURPOSE

2015 ATA management guidelines recommend 100-150 mCi of I-131 for adjuvant therapy (AT) for postsurgical differentiated thyroid cancer. However, so far, number of patients in our country had been given 30mCi of I-131 for the purpose of AT. The aim of this study was to determine whether 30mCi of I-131 was inadequate for AT in patients with increased risk for recurrence.

METHOD AND MATERIALS

This study was retrospective analysis of 58 patients with thyroid cancer (M/F 19/39, PCA54/FCA4, age:59.8 ±13.7 yrs.), who underwent total thyroidectomy and were followed by rhTSH-aided RAI with 30mCi. Inclusion criteria were: a) clinicopathological finding by TNM 8th edition was either stage II of pT3 and pN positive (n=25), stage III (n= 24),or stage IVA (n=9), and b) there was no lymph node suspicious for metastasis on neck ultrasound (US) after surgery. Patients followed a low iodine diet (< 100μg/day) from 7 days before to 3 days after RAI. I.m. injection of rhTSH(0.9mg) was done for 2 consecutive days. Patients were given 30 mCi of I-131 on the day after 2nd rhTSH injection. Post therapy I-131 SPECT/CT was imaged 72- 96 hrs. after RAI. Response assessment was done 6-12 mos. after RAI by combination of diagnostic dose I-131 SPECT/CT, neck US, and stimulated Tg. Eleven patients with positive TgAb values were additionally underwent FDG-PET/CT. Fulfillment of negative I-131 uptake, no suspicious mass on anatomical imaging, and stimulated Tg value < 1.0 (ng/ml) was considered as complete response (CR). Patients were further followed up for 19-82mos. (median 44).

RESULTS

Seven patients were excluded from analysis because structural disease was depicted by post therapy imaging. In the remaining 51, CR was achieved in 35 (75%), while 16 showed incomplete response. Thirteen out of those 16 pts. underwent 2nd RAI with 30mCi. CR was additionally achieved in 7 (54%). Among 42 pts who attained CR, structural disease developed in 6 (14%) during the follow up period.

CONCLUSION

CR was achieved in more than 80% of patients after rhTSH-aided RAI with 30 mCi of I-131. Once CR was attained, prevalence for new structural disease was less than 15%. Although the impact on the long-term prognosis remains uncertain, 30 mCi of I-131 is not inadequate for AT in post-surgical thyroid cancer patients with increased risk for recurrence.

CLINICAL RELEVANCE/APPLICATION

30mCi of I-131 seems feasible for adjuvant therapy and thus, can be considered for selected patients.

SSM18-04 Defining Metabolic Heterogeneity Thresholds with FDG PET/CT for Head and Neck Tumors Can Help Predict Patient Risk of Death

Wednesday, Dec. 4 3:30PM - 3:40PM Room: S504CD

Participants
James Cassuto, MD,PhD, Miami, FL (*Presenter*) Nothing to Disclose
Juan Hinestroza, Medellin, Colombia (*Abstract Co-Author*) Nothing to Disclose
Russ A. Kuker, MD, Miami, FL (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

Disease risk stratification is a corner stone of precision oncology, with radiomic feature analysis being recognized as an important determinant of tumor behavior and overall prognosis. Accordingly, this study sought to quantify and define tumor metabolic heterogeneity thresholds predictive of patient mortality in the setting of head and neck cancer.

METHOD AND MATERIALS

This is a retrospective study examining 298 histologically proven head and neck cancer FDG PET/CT's (and associated clinical data) within the Cancer Imaging Archive data base from April 2006 to November 2014. Segmentation analysis of the most FDG avid lesion from each pre-treatment PET scan was performed. Tumor heterogeneity was defined by the standard deviation and skewness of the tumor pixel intensity distribution. These values were then segregated into ten equal groups (deciles) for further analysis. COX regression was used to model the relative risk (RR) of patient mortality with respect to tumor metabolic heterogeneity as defined by the standard deviation and skewness deciles. Patient age was also included in the regression model as a covariate - the only clinical variable independently associated with risk of death in univariate analysis.

RESULTS

Larger standard deviation and negative skewness define greater degrees of heterogeneity. Serial time dependent multivariable models identified head and neck tumors with PET data demonstrating pixel standard deviation above the eighth decile (27.39) and pixel skewness below the third decile (0.00) to be associated with increased risk of death (RR 2.4, P=0.022) compared to patients with tumor PET data not meeting any or only meeting one of these heterogeneity thresholds.

CONCLUSION

By defining standard deviation and skewness thresholds for head and neck cancer we have been able to identify a sub-set of patients with an increased risk of death based on analysis of pre-treatment FDG PET/CT scans. Inclusion of radiomic data in risk stratifying head and neck tumor patients may have important clinical implications, such as altering time to follow-up and the aggressiveness of treatment strategy.

CLINICAL RELEVANCE/APPLICATION

Quantitative analysis of pre-treatment head and neck cancer heterogeneity with FDG PET data (Radiomics) can be used to identify patients with increased risk of death.

SSM18-05 Interpretation of Response Assessment PET-CT in Head and Neck Carcinoma: Comparative Analysis of 4 Qualitative Interpretative Criteria in a Large Patient Cohort

Wednesday, Dec. 4 3:40PM - 3:50PM Room: S504CD

Participants
Jim Zhong, Leeds, United Kingdom (*Presenter*) Nothing to Disclose
Moses Sundersingh, Leeds, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Peter Brown, MBChB, BSc, Leeds, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Karen Dyker, Leeds, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Robin Prestwich, PhD, FRCR, Leeds, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Stuart Currie, MBCHB, MRCS, Leeds, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Sriram Vaidyanathan, MBBS, FRCR, Leeds, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Andrew F. Scarsbrook, FRCR, York, United Kingdom (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

There is no clear consensus regarding the optimal interpretive criteria (IC) for Fluorine-18 fluorodeoxyglucose (FDG) Positron

There is no clear consensus regarding the optimal interpretive criteria (IC) for Fluorine-18 fluorodeoxyglucose (FDG) Positron Emission Tomography - Computed Tomography (PET-CT) response assessment following (chemo)radiotherapy (CRT) for head and neck squamous cell carcinoma (HNSCC). The aim of this study was to compare the accuracy of 4 IC (NI-RADS, Porceddu, Hopkins, Deauville) for predicting local control, regional control and progression free survival (PFS) in a large patient cohort.

METHOD AND MATERIALS

All patients with histologically-confirmed HNSCC treated at a specialist cancer center between August 2008 and May 2017 who underwent baseline and response assessment FDG PET-CT 4 months post CRT were included. Metabolic response was assessed using 4 different IC harmonised into 4-point scales (complete response, indeterminate, partial response, progressive disease). IC performance metrics (sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), accuracy) were compared. The Kaplan-Meier method and Cox proportional hazards regression analyses were used for survival analysis.

RESULTS

562 patients were included (397 oropharynx, 53 hypopharynx, 48 larynx, 64 other/unknown primary). 420 patients (75%) received CRT and 142 (25%) had radiotherapy alone. Median follow-up was 26 months (range 3-148). 156 patients (28%) progressed during follow-up. All IC were accurate for prediction of local (primary tumor) outcome (mean NPV 85.0% (84.6-85.3), PPV 85.0% (82.5-92.3), Accuracy 84.9% (84.2-86.0)) and regional (nodal) outcome (mean NPV range 85.6% (84.1-86.6), PPV 94.7% (93.8-95.1), Accuracy 86.8% (85.6-88.0)). Number of indeterminate cases for NI-RADS, Porceddu, Deauville and Hopkins were 91, 25, 20 and 13. PPV was significantly reduced for indeterminate uptake across all IC (mean PPV primary tumor 36%, nodes 48%). Survival analyses showed significant differences in PFS and OS between response categories classified by each of the four IC ($p < 0.001$).

CONCLUSION

All four analysed IC had similar diagnostic performance characteristics although Porceddu and Deauville provided the best trade off minimising indeterminate scores whilst maintaining a high NPV.

CLINICAL RELEVANCE/APPLICATION

FDG PET-CT accurately predicts complete response or disease progression post-CRT in HNSCC. Porceddu and Deauville IC offer the best combination of high NPV and low indeterminate scores.

SSM18-06 Comparison Between 18F-FDG PET and DWI Data for Prediction of Therapy Response of Soft Tissues Sarcoma Under Neoadjuvant ILP

Wednesday, Dec. 4 3:50PM - 4:00PM Room: S504CD

Participants
Johannes Grueneisen, Essen, Germany (*Presenter*) Nothing to Disclose
Benedikt M. Schaarschmidt, MD, Essen, Germany (*Abstract Co-Author*) Nothing to Disclose
Michal Chodyla, Essen, Germany (*Abstract Co-Author*) Nothing to Disclose
Ole Martin, Duesseldorf, Germany (*Abstract Co-Author*) Nothing to Disclose
Aydin Demircioglu, Essen, Germany (*Abstract Co-Author*) Nothing to Disclose
Axel Wetter, Essen, Germany (*Abstract Co-Author*) Nothing to Disclose
Lars Podleska, MD, Essen, Germany (*Abstract Co-Author*) Nothing to Disclose
Ken Herrmann, Essen, Germany (*Abstract Co-Author*) Co-founder, SurgicEye GmbH Stockholder, SurgicEye GmbH Consultant, Sofie Biosciences Consultant, Ipsen SA Consultant, Siemens AG Research Grant, Advanced Accelerator Applications SA Research Grant, Ipsen SA
Michael Forsting, MD, Essen, Germany (*Abstract Co-Author*) Nothing to Disclose
Lale Umutlu, MD, Essen, Germany (*Abstract Co-Author*) Consultant, Bayer AG

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PURPOSE

To evaluate and compare the clinical utility of simultaneously obtained quantitative 18F-FDG PET and DWI datasets for the prediction of therapy response of soft tissue sarcomas (STS) under neoadjuvant isolated limb perfusion (ILP).

METHOD AND MATERIALS

A total of 39 patients with confirmation of a STS of the extremities underwent a 18F-FDG PET/MR examination before (1st scan) and after (2nd scan) ILP with melphalan and alpha-TNF. For each patient, the maximum tumor size, metabolic activity (SUVs) and diffusion-restriction (ADC-values) were measured in pre- and posttherapeutic examinations and percentage changes during treatment were calculated. A Mann-Whitney-U test was used and ROC analysis was performed to compare the results of the different quantitative parameters to predict therapy response. Histopathological results after subsequent tumor resection served as reference standard and patients were categorized as responders/non-responders based on the grading scale by Salzer-Kuntschik.

RESULTS

Histopathological analysis categorized 25 (64%) patients as therapy responders (Grade I-III) and 14 (36%) patients as non-responders (Grade IV-VI). Tumors in the responder group showed a reduction in size of -8.6% and metabolic activity (SUVmax: -51.1%; SUVpeak: -56.3%) as well as an increase of the ADC values (ADCmin: +30.3% and ADCmean: +23.7%) under treatment. Percentage changes in the non-responder group amounted to: maximum tumor size -3.9%; SUVmax: -12.7%; SUVpeak: 13.3%; ADCmin: +11.8% and ADCmean: +10.5%. Differences of SUVs between histopathological responder and non-responders were significantly different (< 0.05), whereas differences in tumor size and the ADC values did not reach significance level (>0.01). The corresponding AUCs were 0.63 (tumor size), 0.83 (SUVmax), 0.81 (SUVpeak), 0.65 (ADCmin) and 0.68 (ADCmean), respectively.

CONCLUSION

Our study demonstrates the superiority of 18F-FDG PET data over MR-derived quantitative imaging parameters for response assessment of STS under neoadjuvant ILP.

CLINICAL RELEVANCE/APPLICATION

18F-FDG PET data may be highly valuable when implemented into diagnostic algorithms for monitoring neoadjuvant treatment

18F-FDG PET data may be highly valuable when implemented into diagnostic algorithms for monitoring neoadjuvant treatment strategies of STS. However, considering the importance of MRI data for presurgical evaluation, integrated PET/MRI could serve as a valuable tool for therapy planning and monitoring of neoadjuvant treatment strategies of STS.

Printed on: 10/29/20

ED010-TH

Nuclear Medicine Thursday Case of the Day

Thursday, Dec. 5 7:00AM - 11:59PM Room: Case of Day, Learning Center

AMA PRA Category 1 Credit ™: .50

Participants
Ming Yang, MD, Scottsdale, AZ (*Presenter*) Nothing to Disclose
Michael C. Roarke, MD, Scottsdale, AZ (*Abstract Co-Author*) Nothing to Disclose
Ba D. Nguyen, MD, Scottsdale, AZ (*Abstract Co-Author*) Nothing to Disclose
Molly Carnahan, MD, Phoenix, AZ (*Abstract Co-Author*) Nothing to Disclose
Akash Sharma, MD, Ponte Vedra Beach, FL (*Abstract Co-Author*) Nothing to Disclose
Geoffrey B. Johnson, MD,PhD, Rochester, MN (*Abstract Co-Author*) Research Grant, General Electric Company Research Grant, Pfizer Inc
Manoj K. Jain, MD, Jacksonville, FL (*Abstract Co-Author*) Nothing to Disclose
Ephraim E. Parent, MD,PhD, Ponta Vedra Beach, FL (*Abstract Co-Author*) Research support, Blue Earth Diagnostics Ltd Research support, Advanced Accelerator Applications SA
Derek R. Johnson, MD, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Jess A. Graham, MD, Albuquerque, NM (*Abstract Co-Author*) Nothing to Disclose
Nandan Keshav, MD, Albuquerque, NM (*Abstract Co-Author*) Nothing to Disclose
Lisa C. Blacklock, MD, Albuquerque, NM (*Abstract Co-Author*) Nothing to Disclose
JoAnna R. Fair, MD, PhD, Albuquerque, NM (*Abstract Co-Author*) Nothing to Disclose
Shana Elman, MD, Albuquerque, NM (*Abstract Co-Author*) Nothing to Disclose
Saeed Elojeimy, MD, PhD, Albuquerque, NM (*Abstract Co-Author*) Nothing to Disclose
Matthew Kay, MBBS, Tucson, AZ (*Abstract Co-Author*) Nothing to Disclose
Gregory J. Woodhead, MD, PhD, Tucson, AZ (*Abstract Co-Author*) Nothing to Disclose
Phillip Kuo, MD,PhD, Tucson, AZ (*Abstract Co-Author*) Research Grant, Astellas Group; Research Grant, Blue Earth Diagnostics Ltd; Consultant, Novartis AG; Consultant and Speaker, General Electric Company; Consultant, Konica Minolta, Inc; Consultant, Imaging Endpoints

TEACHING POINTS

1) Recognize the association of lung malignancy and immune-mediated seizure activity. 2) Recognize incidental Thornwaldt cyst on FDG PET-CT. 3) Familiarize the scintigraphy feature of shin splint on three-phase bone scan. 4) Identify off-target distribution of Tc-99m MAA to the falciform artery on Y-90 microsphere planning SPECT/CT. 5) Recognize the imaging features of an obstructed ventriculoperitoneal shunt.

SPDL50

Keeping Radiology Weird: Spot Diagnoses from the Pacific Northwest (Case-based Competition)

Thursday, Dec. 5 7:15AM - 8:15AM Room: E451B

GI MI MK NM

AMA PRA Category 1 Credit ™: 1.00
ARRT Category A+ Credit: 0

Participants
Barry G. Hansford, MD, Chicago, IL (*Presenter*) Nothing to Disclose
Elena K. Korngold, MD, Portland, OR (*Presenter*) Nothing to Disclose
Nadine Mallak, MD, Portland, OR (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

Hansford@ohsu.edu

korngold@ohsu.edu

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Special Information

This interactive session will use RSNA Diagnosis Live™. Please bring your charged mobile wireless device (phone, tablet or laptop) to participate.

LEARNING OBJECTIVES

1) Be introduced to a series of musculoskeletal, abdominal radiology and nuclear medicine case studies via an interactive game approach designed to encourage "active" consumption of education material. 2) Be able to use their mobile wireless device (tablet, phone, laptop) to electronically respond to various imaging case challenges; participants will be able to monitor their individual and team performance in real time. 3) Receive a personalized self-assessment report via email that will review the case material presented during the session, along with individual and team performance.

RC611

Head and Neck PET/CT: Clinical Approach

Thursday, Dec. 5 8:30AM - 10:00AM Room: S504CD

CT HN MR NR NM

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 1.75

Sub-Events

RC611A Oropharyngeal Cancer: Evolving Challenges-Clinician's Perspective

Participants
Colette J. Shen, MD,PhD, Chapel Hill, NC (*Presenter*) Speaker, Nanobiotix

LEARNING OBJECTIVES

1) To understand how radiological interpretation of pre-treatment and post-treatment imaging studies influences the management of patients with head and neck cancer. 2) Using PET to delineate the radiation target. 3) Can we OMIT treatment of the PET negative neck? 4) 3 month Post-Treatment PET/CT response assessment.

RC611B CT and MRI Anatomy and Interpretation

Participants
Valerie L. Jewells, DO, Chapel Hill, NC (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Provide radiologists with the tools to access CT and MRI imaging for head and neck cancer. 2) Teach attendees how to address the images in a manner that will assist the ENT surgeon for staging and surgical planning. 3) Address the principles for critical thinking and analysis as well as preparation and skill development for a head and neck tumor board.

ABSTRACT

A successful multidisciplinary head and neck tumor board requires coordination and imaging review on the part of radiology to assist the surgeon, radiation oncolcogist and medical oncologist. The goal is to reach the best option for each individual patient depending upon tumor type, staging and underlying medical conditions. Appropriate imaging and interpretation is key to this endeavor. These topics will be addressed through discussion of selective CT and MRI cases from our weekly tumor board. References: 1. Heineman T, St John MA, Wein RO and Weber RS. It takes a village: The importance of multidisicplinary care. Otoloaryngol Clin North Am 2017 Aug;50(4):679-687. 2. Liao CT, Kang CJ, Lee LY et al. Association between multidisciplinary team care approach and survival rates in patients with oral cavity squamous cell carcinoma. Head Neck 2016 Apr;38 Suppl 1:E5444-53. 3. Shah BA, Qureshi MM, Jalisi et al. Analysis of decision making at a multidisciplinary head and neck tumor board incorporating evidence-based National Cancer Comprehensive Network (NCCN) guidelines. Pract Radiat Oncol 2016 Jul-Aug;6(4):248-54.

RC611C FDG-PET/CT: Applications and Interpretation

Participants
Terence Z. Wong, MD, PhD, Chapel Hill, NC (*Presenter*) Consultant, Lucerno Dynamics, LLC;

LEARNING OBJECTIVES

1) Describe applications for FDG-PET/CT for initial evaluation and follow up of patients with head and neck cancer. 2) Learn the value of combining metabolic findings on FDG-PET findings with morphology on CT and endoscopic appearance. 3) Understand potential etiologies of false positive and false negative studies.

ABSTRACT

Optimal evaluation of patients with head and neck malignancies requires a multidisciplinary approach. Correlation of FDG-PET, CT, direct visualization, and clinical examination is important to provide the best management of these patients.

RC611D Panel Discussion: Q&A

Participants
Terence Z. Wong, MD, PhD, Chapel Hill, NC (*Presenter*) Consultant, Lucerno Dynamics, LLC;
Valerie L. Jewells, DO, Chapel Hill, NC (*Presenter*) Nothing to Disclose
Colette J. Shen, MD,PhD, Chapel Hill, NC (*Presenter*) Speaker, Nanobiotix

LEARNING OBJECTIVES

1) To discuss case examples which highlight the value of multidisciplinary approaches for managing patients with head and neck cancer.

SSQ14

Nuclear Medicine (Breast/General Oncology Nuclear Medicine and PET)

Thursday, Dec. 5 10:30AM - 12:00PM Room: S402AB

BR MR NM OI

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 1.75

Participants
Amy M. Fowler, MD,PhD, Madison, WI (*Moderator*) Institutional research support, General Electric Company; Author with royalties, Reed Elsevier
Bital Savir-Baruch, MD, Atlanta, GA (*Moderator*) Research Grant, Blue Earth Diagnostics Ltd; Consultant, Blue Earth Diagnostics Ltd

Sub-Events

SSQ14-01 Can We Replace Sentinel Lymph Node Resection in Breast Cancer Patients by Breast MRI, Axillary MRI, Axillary 18F-FDG PET/MRI or Axillary Sonography?

Thursday, Dec. 5 10:30AM - 10:40AM Room: S402AB

Participants
Ole Martin, Duesseldorf, Germany (*Abstract Co-Author*) Nothing to Disclose
Julian Kirchner, Dusseldorf, Germany (*Abstract Co-Author*) Nothing to Disclose
Nils M. Bruckmann, MD, Duesseldorf, Germany (*Abstract Co-Author*) Nothing to Disclose
Benedikt M. Schaarschmidt, MD, Essen, Germany (*Abstract Co-Author*) Nothing to Disclose
Johannes Grueneisen, Essen, Germany (*Abstract Co-Author*) Nothing to Disclose
Lale Umutlu, MD, Essen, Germany (*Abstract Co-Author*) Consultant, Bayer AG
Gerald Antoch, MD, Dusseldorf, Germany (*Abstract Co-Author*) Nothing to Disclose
Lino Sawicki, MD, Dusseldorf, Germany (*Presenter*) Nothing to Disclose

PURPOSE

To compare the diagnostic performance of Mamma-MRI, axillary MRI, axillary 18F-FDG PET/MRI and axillary sonography in the detection of lymph node metastases in patients suffering from breast cancer.

METHOD AND MATERIALS

56 female patients with breast cancer (mean age 53.5±12.2 years) with newly diagnosed, histopathologically proven breast cancer were prospectively enrolled in this two-center trial. All patients underwent dedicated prone 18F-FDG breast PET/MRI and supine whole-body 18F-FDG PET/MRI as well as axillary sonography. Sentinel lymph node biopsy (SLNB) and/or axillary lymph node dissection were performed in all patients and histopathology served as reference standard. Sensitivity, specificity, PPV, NPV and accuracy regarding axillary lymph node assessment were calculated for dedicated breast MRI, axillary MRI, axillary 18F-FDG PET/MRI and axillary sonography.

RESULTS

According to the reference standard, lymph node metastases were present in 25 patients with a total of 78 metastases. On a patient based analysis, dedicated breast MRI identified 14/25 (56%), axillary MRI 15/25 (60%), axillary PET/MRI 19/25 (76%) and axillary sonography 18/25 (72%) of the patients with a positive nodal status. On a lesion-based analysis, sensitivity, specificity, PPV, NPV and accuracy were 54.5%, 88.9%, 88.9%, 54.5% and 67.6% for breast MRI; 55.1%, 90%, 89.3%, 53.2% and 57,5% for axillary MRI; 71.4%, 92.1%, 65.0%, 89.7% and 78.2% for axillary PET/MRI and 60.0%, 86.2%, 84.0%, 61.1% and 71.9% for axillary sonography.

CONCLUSION

18F-FDG PET/MRI and sonography serve equally acceptable diagnostic accuracy for nodal staging in breast cancer patients and are both superior to dedicated breast MRI or supine whole-body MRI. Although PET/MRI provides important information for staging workup breast cancer patients, neither PET/MRI nor axillary sonography do reliably differentiate N-positive from N-negative breast cancer patients.

CLINICAL RELEVANCE/APPLICATION

Sentinel lymph node biopsy cannot be replaced by imaging procedures alone and is still mandatory for staging breast cancer patients.

SSQ14-02 Simultaneous PET/MRI in the Early Prediction of Response to Neoadjuvant Chemotherapy in Patients with Locally-Advanced Breast Cancer

Thursday, Dec. 5 10:40AM - 10:50AM Room: S402AB

Participants
Valeria Romeo, Naples, Italy (*Presenter*) Nothing to Disclose
Carlo Cavaliere, Naples, Italy (*Abstract Co-Author*) Nothing to Disclose
Luca Basso, Naples, Italy (*Abstract Co-Author*) Nothing to Disclose
Nunzia Garbino, Naples, Italy (*Abstract Co-Author*) Nothing to Disclose

Mario Petretta, 80125, Italy (*Abstract Co-Author*) Nothing to Disclose
Emanuele Nicolai, Napoli, Italy (*Abstract Co-Author*) Nothing to Disclose
Massimo Imbriaco, MD, Napoli, Italy (*Abstract Co-Author*) Nothing to Disclose
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PURPOSE

Aim of the study was to assess whether simultaneous PET/MRI could be helpful in the early prediction of the response to neoadjuvant chemotherapy (NAC) in patients with locally advanced breast cancer (LABC).

METHOD AND MATERIALS

Between January 2017 and July 2018, 20 consecutive patients (mean age 45 yrs) with LABC who underwent anthracycline- and taxane-based neoadjuvant chemotherapy (NAC) followed by surgical resection were prospectively enrolled. Simultaneous breast PET/MRI examination was performed twice in each patient, one week before NAC and early after the second anthracycline cycle. PET/MRI images were analyzed to extract quantitative diffusion (ADCmin, ADCmean), perfusion (Ktrans, Kep, Ve, IAUC) and metabolic (SUV2d, SUV3d, MTV) parameters. The variation of each parameter (delta, D) after the second anthracycline cycle was then calculated. The normality of the data was tested using the Shapiro-Wilk test. Differences in terms of pre-treatment and D parameters between patients histologically classified as complete response (CR) and partial response (PR) were compared using of the nonparametric Mann-Whitney U test. Logistic regression analysis was performed to identify imaging parameters predictive of the response.

RESULTS

D-Size, D-Ktrans, Kep, D-Kep, MTV and D-MTV resulted significantly different ($p<0.03$) between patients who showed CR and PR. In detail, pre-treatment Kep and MTV were significantly lower in patients with CR while the variation of each parameter was significantly higher in patients with CR as compared to patients with PR. A cut-off value of 5.09 D-MTV perfectly predicted the response to treatment (Figure 1). MRI parameters significantly associated to the response to treatment were D-Ktrans ($p=0.05$), Kep (0.04), and D-Kep (0.05).

CONCLUSION

Simultaneous breast PET/MRI could be useful to early predict the response to NAC in patients with LABC. Our preliminary observations show that functional (i.e. perfusion and metabolic) rather than morphological parameters may identify patients who will respond completely, particularly using both pre-treatment and the variation of quantitative parameters early after the second cycle of NAC.

CLINICAL RELEVANCE/APPLICATION

Simultaneous breast PET/MRI may be useful for early identification of LABC patients who would benefit from continuing NAC or for whom surgical excision could be optionally considered.

SSQ14-03 Quantitative 18F-FDG Uptake of Invasive Breast Cancer Using Harmonized Prone PET/CT and Simultaneous Breast PET/MRI with 10 Minute PET Acquisition Time

Thursday, Dec. 5 10:50AM - 11:00AM Room: S402AB

Participants
Amy M. Fowler, MD,PhD, Madison, WI (*Presenter*) Institutional research support, General Electric Company; Author with royalties, Reed Elsevier
Manoj Kumar, MS, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
Leah Henze Bancroft, PhD, Madison, WI (*Abstract Co-Author*) Institutional research support, General Electric Company
Jacob Johnson, Madison, WI (*Abstract Co-Author*) Institutional research support, General Electric Company
Jillian A. Karow, MD, Minneapolis, MN (*Abstract Co-Author*) Nothing to Disclose
Kelley Salem, PhD, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
Tyler Bradshaw, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
Alan B. McMillan, PhD, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
Roberta M. Strigel, MD, Madison, WI (*Abstract Co-Author*) Research support, General Electric Company

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PURPOSE

To compare tumor 18F-FDG uptake measured with 10 min PET acquisition using breast PET/MRI harmonized with prone PET/CT in patients with newly diagnosed invasive breast cancer.

METHOD AND MATERIALS

This HIPAA-compliant, IRB-approved single-institution, prospective study was performed from 2016 to 2018. Patients with biopsy-proven invasive breast cancer undergoing preoperative breast MRI were included. Patients who were pregnant, lactating, had implants, or underwent neoadjuvant therapy were not eligible. Fasting subjects underwent PET/CT (Discovery 710) of the breasts 60 min after injection of 10 mCi 18F-FDG. Patients were scanned at one bed position for 10 min in the prone position using the breast MRI coil housing with metal components removed. A low dose CT scan was obtained for attenuation correction. Subjects then underwent simultaneous breast PET/MRI (Signa 3.0T PET/MR) using an 8-channel breast coil 85 min after 18F-FDG injection. Standard clinical breast MRI sequences and Dixon-based sequences for attenuation correction were obtained simultaneously with the PET acquisition for 30 min. PET reconstruction was harmonized between scanners based on phantom scans. For analysis, the first 10 min of PET/MRI acquisition was compared to PET/CT. Standardized uptake value (SUV) measurements were performed for the tumor and contralateral normal (nl) fibroglandular tissue. Bland-Altman analysis was performed to determine measurement bias and 95% limits of agreement.

RESULTS

23 women (mean 49.6 yrs; 33-70) with 24 biopsy-proven sites of invasive breast carcinoma participated. Mean lesion size was 3.8 cm (1.1-8.8 cm) on MRI. Mean±SEM for tumor SUVmax, tumor SUVmean, and nl breast SUVmean for PET/MRI vs PET/CT, respectively, were 8.6±1.3 vs 7.3±1.1, 4.9±0.76 vs 3.7±0.57, and 1.4±0.083 vs 1.3±0.090. Measurement bias for PET/MRI vs PET/CT was 15.6% [-15.1,46.2] for tumor SUVmax, 28.7% [-7.21,64.6] for tumor SUVmean, 3.74% [-29.3,36.7] for tumor SUVmax/nl breast SUVmean, and 17.1% [-18.2,52.5] for tumor SUVmean/nl breast SUVmean.

CONCLUSION

Quantitative assessment of 18F-FDG uptake of invasive breast cancer is feasible using simultaneous breast PET/MRI with acceptable agreement between PET/MRI and PET/CT.

CLINICAL RELEVANCE/APPLICATION

Establishing the agreement between PET/CT and simultaneous breast PET/MRI for tumor 18F-FDG uptake is important for potential clinical applications such as neoadjuvant therapy response assessment.

SSQ14-04 Comparison of Whole-Body 18F-FDG-PET/MRI and PET/CT in Terms of Lesion Detection in Asymptomatic Subjects: A Retrospective Study

Thursday, Dec. 5 11:00AM - 11:10AM Room: S402AB

Participants
Mingxiang Sun, Shanghai, China (*Abstract Co-Author*) Nothing to Disclose
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Liling Peng, Shanghai, China (*Abstract Co-Author*) Nothing to Disclose
Xin Gao, MD, Shanghai , China (*Presenter*) Nothing to Disclose
Holger Schmidt, Erlangen, Germany (*Abstract Co-Author*) Employee, Siemens AG

PURPOSE

To compare fluorine fluorodeoxyglucose (18F-FDG) combined positron emission tomography and magnetic resonance imaging (PET/MRI) with 18F-FDG combined positron emission tomography and computed tomography (PET/CT) in terms of organ-specific lesion detection in asymptomatic subjects for cancer screening.

METHOD AND MATERIALS

2794 individuals undergoing PET/MRI (Biograph mMR, Siemens Healthcare, Erlangen, Germany) and 4283 individuals undergoing PET/CT examinations (Biograph mCT, Siemens Healthcare, Knoxville, USA), from January 2016 to December 2017 in our center, were enrolled for this retrospective study. The local ethics committee approved this study. Written, informed consent was obtained from all subjects. Besides PET/MRI and PET/CT examinations, the screening methods included ultrasound, CT (for PET/MRI), MRI (for PET/CT) and tumor marker tests of CEA, CA19-9, PSA (for male) and CA125 (for female), dependent on the cancer type. Subjects who had no positive findings in the following 12 months were considered as 'cancer negative'.

RESULTS

In the 2794 subjects, PET/MRI detected 66 suspicious lesions, 54 of them were diagnosed as malignant tumors (true positive) and 12 of them were benign (false positive). 12 malignant tumors were missed but detected by other modalities (false negative). The detection rate, sensitivity, specificity, PPV and NPV of PET/MRI screening were 1.93% (54/2794), 81.8% (54/66), 99.5% (2715/2728), 81.8% (54/66) and 99.5% (2715/2728) respectively. In the 4283 subjects, PET/CT detected 55 suspicious lesions and 48 of them were malignant tumors (true positive) and 7 of them were benign (false positive). 7 malignant tumors were missed but detected by other modalities (false negative). The detection rate, sensitivity, specificity, PPV and NPV of PET/CT screening were 1.12% (48/4283), 87.3% (48/55), 99.8% (4228/4283), 87.3% (48/55) and 99.8% (4228/4283) respectively. The detailed distribution of cancer types is shown in Figure.

CONCLUSION

To our best knowledge, this is the first work to compare the diagnostic values of PET/MRI and PET/CT for cancer screening in asymptomatic subjects. Both methods can detect a wide variety of cancer at early stage.

CLINICAL RELEVANCE/APPLICATION

Compared to PET/CT, PET/MRI has a higher detection rate and a higher sensitivity in solid organs except lung. Considering also the reduced radiation dose, PET/MRI is recommended as part of a cancer screening program for asymptomatic subjects.

SSQ14-05 Whole-Body MRI and 18F-FDG PET/MRI for N and M Staging in Primary Breast Cancer: A Multicenter Trial

Thursday, Dec. 5 11:10AM - 11:20AM Room: S402AB

Participants
Nils M. Bruckmann, MD, Duesseldorf, Germany (*Presenter*) Nothing to Disclose
Julian Kirchner, Dusseldorf, Germany (*Abstract Co-Author*) Nothing to Disclose
Ole Martin, Duesseldorf, Germany (*Abstract Co-Author*) Nothing to Disclose
Benedikt M. Schaarschmidt, MD, Essen, Germany (*Abstract Co-Author*) Nothing to Disclose
Lale Umutlu, MD, Essen, Germany (*Abstract Co-Author*) Consultant, Bayer AG
Gerald Antoch, MD, Dusseldorf, Germany (*Abstract Co-Author*) Nothing to Disclose
Lino Sawicki, MD, Dusseldorf, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate and compare the diagnostic potential of whole-body MRI and 18F-FDG PET/MRI for N and M staging in newly diagnosed, histopathological proven breast cancer.

METHOD AND MATERIALS

A total of 77 patients with newly diagnosed, histopathological proven breast cancer were enrolled in this study prospectively. All patient underwent a whole-body 18F-FDG PET/MRI in supine position. The MRI protocol included a transverse T2-weighted, a T1-weighted and a DWI sequence of the whole body from head to the thigh. The N and M staging was assessed according to the eighth edition of the American Joint Committee on Cancer staging manual in MRI datasets alone and in 18F-FDG PET/MRI datasets, respectively. Histopathology or follow up examination as reference standard were available in all 77 patients for N and M staging. A McNemar chi2 test was performed to investigate whether differences in the evaluation of the correct N and M stage between 18F-FDG PET/MRI and MRI were statistically significant.

RESULTS

MRI and PET/MRI were concordant for N and M staging in 74 of 77 (96.1%) patients. Compared to the reference standard, PET/MRI as well as MRI determined a correct N and M stage in 57/77 (74%) of the patients, respectively. A positive nodal status was present in 33/77 patients (43%). PET/MRI determined the N stage correctly in 62 of 77 (80.5%) patients with a sensitivity of 78.8% and a specificity of 93.2%. MRI determined the N stage correctly in 61 of 77 (79%) with a sensitivity of 75.8% and a specificity of 93.2%. Distant metastases were present in 4/77 patients (5%). PET/MRI detected all of the histopathological proven metastases (100% identification), while one metastasis was missed in MRI (75% identification). Additionally, PET/MRI leads to false-positive findings in 6 patients (8%) and MRI in 5 patients (7%). No statistically significant differences between the modalities were seen.

CONCLUSION

18F-FDG PET/MRI was shown to be slightly superior to MRI in the N and M staging in primary breast cancer patients. However, both modalities bear the risk to overestimate the M-stage.

CLINICAL RELEVANCE/APPLICATION

A whole-body 18F-FDG PET/MRI and MRI are highly accurate for evaluating the M stage in breast cancer patients and therefore could be considered in combination with a dedicated breast 18F-FDG PET/MRI as staging method of choice at time of diagnosis.

SSQ14-06 Correlation of 18F-FDG PET/MRI Imaging Information with Relevant Immunohistochemical Markers in Breast Cancer Patients: Could PET/MRI Identify High-Risk Patients?

Thursday, Dec. 5 11:20AM - 11:30AM Room: S402AB

Participants
Ole Martin, Duesseldorf, Germany (*Abstract Co-Author*) Nothing to Disclose
Julian Kirchner, Dusseldorf, Germany (*Abstract Co-Author*) Nothing to Disclose
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Johannes Grueneisen, Essen, Germany (*Abstract Co-Author*) Nothing to Disclose
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Lale Umutlu, MD, Essen, Germany (*Abstract Co-Author*) Consultant, Bayer AG
Gerald Antoch, MD, Dusseldorf, Germany (*Abstract Co-Author*) Nothing to Disclose
Lino Sawicki, MD, Dusseldorf, Germany (*Presenter*) Nothing to Disclose

PURPOSE

To correlate prognostically relevant immunohistochemical parameters of breast cancer with simultaneously acquired standardized uptake values (SUV) and apparent diffusion coefficient (ADC) derived from hybrid PET/MRI.

METHOD AND MATERIALS

56 female patients with therapy naive, histologically proven breast cancer (mean age 54.1±12.0 years) underwent dedicated prone 18F-FDG breast PET/MRI and supine whole-body 18F-FDG PET/MRI. As part of the diagnostic imaging protocol, diffusion-weighted imaging (DWI, b values: 0, 500, 1000 s/mm²) was performed simultaneously with PET acquisition. A region of interest (ROI) encompassing the entire primary tumor was drawn into each patient's breast and prone PET/MR images to determine the glucose metabolism represented by maximum and mean SUV and into ADC maps to assess tumor cellularity represented by mean and minimum ADC values. Histopathological tumor grading as well as additional prognostically relevant immunohistochemical markers, i.e. Ki-67, progesterone, estrogen receptor, and human epidermal growth factor receptor 2 (HER2/neu) were determined.

RESULTS

We found a significant inverse correlation between both SUV- and ADC-values derived from breast PET/MRI ($r=-0.49$ for SUVmean vs. ADCmean and $r=-0.43$ for SUVmax vs. ADCmin, both $p<0.001$). Tumor grading as well as Ki67 showed a significant positive correlation with SUVmean from both whole-body PET/MRI ($r=0.42$ and $r=0.37$, $p<0.001$) and breast PET/MRI ($r=0.37$ and $r=0.32$, $p<0.01$). For immunohistochemical markers, HER2/neu significantly correlates inverse with ADC-values from breast PET/MRI ($r=-0.35$, $p<0.01$). In addition, estrogen receptor expression showed significant inverse correlation with SUV-values from whole-body PET/MRI ($r=-0.47$, $p<0.001$) and breast PET/MRI ($r=-0.45$, $p<0.001$).

CONCLUSION

The present data show a correlation between increased glucose-metabolism, cellularity, degree of differentiation as well as Ki67 and HER2/neu expression of breast cancer primaries. 18F-FDG-PET and DWI from hybrid PET/MRI may offer complementary information for evaluation of breast cancer aggressiveness in initial staging and treatment response.

CLINICAL RELEVANCE/APPLICATION

Easily applicable information from PET/MRI leads to complementary knowledge in breast cancer staging workup. This could help to identify high-risk patients efficiently.

SSQ14-07 Impact of 18FDG PET/MRI on Therapeutic Management in Breast Cancer Patients - A Prospective Multicenter Comparison Trial to the Guideline Staging Algorithm

Thursday, Dec. 5 11:30AM - 11:40AM Room: S402AB

Participants
Julian Kirchner, Dusseldorf, Germany (*Presenter*) Nothing to Disclose
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Gerald Antoch, MD, Dusseldorf, Germany (*Abstract Co-Author*) Nothing to Disclose
Christian Buchbender, Dusseldorf, Germany (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

To investigate whether the differences between the traditional staging imaging algorithm and 18F-FDG PET/MR lead to different therapeutic decisions in patients with breast carcinoma

METHOD AND MATERIALS

A total of 57 female patients with newly diagnosed breast cancer and elevated pre-test probability for distant metastases (initial tumor stage, immunohistochemical receptor expression) from two centers were prospectively included in this study. The traditional staging imaging algorithm was performed in clinical routine at the home institution of the patient. Additionally, each patient underwent a PET/MRI including dedicated diagnostic breast imaging and a whole-body MRI. Tumor stage was determined according to AJCC Staging Manual separately for both, 18F-FDG PET/MR and traditional staging algorithm. To determine the different treatment strategies each patient was discussed two times in separate DMT sessions. In one, the determination of the treatment strategy was based exclusively on the results of the traditional algorithm and in the other on the PET/MR. The primary endpoint was the incidence of differences between the therapy recommendations. The secondary endpoint was the comparison of diagnostic accuracy between the traditional staging algorithm and PET/MR for the TNM classification.

RESULTS

PET/MR and the traditional staging algorithm agreed on TNM-stages in 45 of 57 (78.9%) patients. All deviations between were due to a higher stage in PET/MR. Compared with the reference standard, PET/MR determined correct stage in 53/57 (93.0%) and the traditional staging algorithm in 43/57 (75.4%), respectively and resulting in a significant higher diagnostic accuracy in PET/MR. Different therapeutic decisions between PET/MR and the traditional staging algorithm occurred in 7/57 (12.3%) of the patients.

CONCLUSION

For breast cancer patients with elevated pre-test probability for distant metastases a change of the therapy regime occurs in 12.3% compared to the traditional staging algorithm when staged by 18F-FDG PET/MR. Furthermore the study revealed the diagnostic superiority for determining the exact TNM stage of 18F-FDG PET/MR over the traditional staging algorithm

CLINICAL RELEVANCE/APPLICATION

Current guidelines should consider systemic staging with 18F-FDG-PET/MRI in breast cancer patients with elevated pre-test probability for distant metastases at the time of initial diagnosis.

SSQ14-08 CT-Less Direct Correction of Attenuation and Scatter in Image Space Using Deep Learning for Total-Body PET: A Feasibility Study

Thursday, Dec. 5 11:40AM - 11:50AM Room: S402AB

Participants
Jaewon Yang, San Francisco, CA (*Presenter*) Nothing to Disclose
Dookun Park, PhD,DPhil, Seattle, WA (*Abstract Co-Author*) Nothing to Disclose
Grant Gullberg, PhD, Berkeley, CA (*Abstract Co-Author*) Nothing to Disclose
Youngho Seo, PhD, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

A total-body PET scanner like EXPLORER provides a substantial sensitivity gain of a factor of approximately 40 over current clinical PET scanners. The 40-fold increase in the effective sensitivity can reduce total radiation dose by 1/40th; however, the extra radiation dose of CT for PET attenuation and scatter correction (ASC) will mitigate the merit of the ultralow-dose PET. Therefore, we propose CT-less direct ASC without any intermediate step using deep learning (DL) potentially for total-body PET.

METHOD AND MATERIALS

In an IRB-approved study, we obtained images from 59 whole-body 18F-FDG PET/CT studies that were acquired from March 2016 through August 2017. A deep convolutional neural network (DCNN) was implemented with the 59 pairs of uncorrected PET (without ASC; PETUC) and corrected PET (with ASC; PETASC) as inputs to predict attenuation-scatter corrected PET (PETDCNN) directly from uncorrected PET (50/9 split for training and test data). Quality of the predicted images (PETDCNN) was evaluated using standardized uptake values (SUV) by the normalized root mean square error (NRMSE), peak signal to noise ratio (PSNR), and structural similarity index (SSIM). Statistical analyses were performed using joint and error histograms.

RESULTS

The overall performance of PETDCNN is quantitatively comparable to CT-based ASC (PETASC). Across the test set of 9 subjects, the NRMSE was 0.26 ± 0.05; the average PSNR was 14.75 ± 3.22; the average SSIM was 0.94 ± 0.03, demonstrating high image similarity between PETDCNN and reference PETASC. The joint histogram shows the voxel-wise similarity between PETDCNN and

reference PETASC with the slope of 1.05 and R2 of 0.90 which was consistent with the result of the error histogram where most of errors (~ 90%) stay within ±0.5 SUV differences.

CONCLUSION

We demonstrated the feasibility of CT-less direct ASC using deep learning potentially for total-body PET. The clinical translation of our approach will remove the need of CT scans for PET ASC, which results in significant reduction of radiation dose particularly for pediatric patients or treatment follow-ups.

CLINICAL RELEVANCE/APPLICATION

Our proposed DL method can remove the need of CT for PET ASC, which reduces the radiation dose from a whole-body CT scan, preserving the merit of ultra-low dose imaging in total-body PET.

SSQ14-09 Quantitative Standardized Uptake Value Evaluation of 4x Faster PET Scans Enhanced Using Deep Learning

Thursday, Dec. 5 11:50AM - 12:00PM Room: S402AB

Participants
Akshay Chaudhari, PhD, Menlo Park, CA (*Abstract Co-Author*) Research Consultant and Stockholder, Subtle Medical; Research Consultant, Skope MR; Scientific Advisory Board and Stockholder, Brain Key; Scientific Advisory Board, Chondrometrics GmbH; Stockholder, LVIS Corporation; ;
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Tao Zhang, Menlo Park, CA (*Abstract Co-Author*) Employee, Subtle Medical
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Greg Zaharchuk, MD, PhD, Stanford, CA (*Abstract Co-Author*) Research Grant, General Electric Company; Research Grant, Bayer AG; Stockholder, Subtle Medical
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PURPOSE

The goal of this study was to evaluate the accuracy of quantitative standardized uptake values (SUV) for noisy PET scans acquired 4x faster and subsequently enhanced using deep learning.

METHOD AND MATERIALS

15 subjects (7 male, 8 female; mean age: 67 years, range: 45;85 yrs, average BMI: 30, range: 19-48) referred for clinical whole-body PET/CT exams underwent two separate PET scans - one with the standard acquisition duration followed by one acquired 4 times faster, following IRB approval and informed consent. The 4x faster PET images were enhanced using a deep learning (DL) software (SubtlePET, Subtle Medical, Menlo Park, CA). One nuclear medicine physician reviewed the standard acquisition PET images, identified possible lesions and some normal regions, and drew regions of interest (ROIs) in OsiriX. The same lesions were reviewed on the DL-enhanced 4x faster scan images and the ROIs from the standard acquisition were propagated to the DL-enhanced 4x faster scan. Quantitative mean and maximum SUV values per ROI between the standard and DL-enhanced 4x faster acquisitions were visualized using Bland-Altman tests and compared using concordance correlation coefficients (CCC), linear regressions, and Mann-Whitney U-Tests.

RESULTS

A total of 63 ROIs were identified in the standard acquisition PET images. The Bland-Altman plot in Fig.1a-b (dotted line indicating mean, and dashed line indicating 95% limits of agreement) showed minimal differences between SUVs obtained from the two sets of scans, with almost all values contained within the 95% limits of agreement interval. CCC and linear Pearson coefficient values of 0.99 for both SUV-max and SUV-mean indicated very strong agreement between the SUV values from standard acquisition and DL-enhanced scan (Fig.1c-d, where the dotted line indicates the unity line). This was further indicated by the lack of statistical significance of p=0.68 for SUV-max and p=0.77 for SUV-mean values using the Mann-Whitney U-Test. Sample images can also be seen in Fig.1.

CONCLUSION

Deep learning can enhance 4x faster PET acquisitions without compromising quantitative SUV values compared a standard duration acquisition.

CLINICAL RELEVANCE/APPLICATION

Deep learning can enhance image quality of noisy 4x faster PET acquisitions thereby enabling higher comfort for patients, higher throughput of PET scans for hospitals, or reduced radiotracer dosages.

NMS-THA

Nuclear Medicine Thursday Poster Discussions

Thursday, Dec. 5 12:15PM - 12:45PM Room: NM Community, Learning Center

NM

AMA PRA Category 1 Credit ™: .50

Participants

Bital Savir-Baruch, MD, Atlanta, GA (*Moderator*) Research Grant, Blue Earth Diagnostics Ltd; Consultant, Blue Earth Diagnostics Ltd

Sub-Events

NM224-SD-THA1 Association between 18F-fluoromisonidazole Uptake Heterogeneity and Isocitrate Dehydrogenase 1 Mutation in Patients with Newly Diagnosed High-Grade Gliomas

Station #1

Participants

Yuka Yamamoto, MD, PhD, Kita-Gun, Japan (*Presenter*) Nothing to Disclose
Kengo Fujimoto, Kitagun, Japan (*Abstract Co-Author*) Nothing to Disclose
Katsuya Mitamura, Kita, Japan (*Abstract Co-Author*) Nothing to Disclose
Takashi Norikane, Kita-gun, Japan (*Abstract Co-Author*) Nothing to Disclose
Yoshihiro Nishiyama, MD, Kagawa, Japan (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Beyond tumor histology, molecular alterations, such as isocitrate dehydrogenase enzyme isoforms 1 (IDH1) and 2 (IDH2) mutation as part of the 2016 world health organization classification of tumors of the central nervous system have been found to provide additional prognostic value in gliomas. The purpose of this study was to evaluate association between 18F-fluoromisonidazole (FMISO) uptake heterogeneity using texture indices and IDH1 mutation status in patients with newly diagnosed high-grade gliomas.

METHOD AND MATERIALS

FMISO PET/CT was investigated in 38 patients with newly diagnosed high-grade gliomas. Tumor lesions were identified as areas of focally increased uptake, exceeding that of background uptake. For semi-quantitative analysis, the maximal standardized uptake value (SUVmax) and 6 texture indices (homogeneity, entropy, short-run emphasis, long-run emphasis, high-gray-level-zone emphasis, and low-gray-level-zone emphasis) were measured. The presence of IDH1 mutation in tumor specimens was examined by immunohistochemistry and compared with PET parameters.

RESULTS

All high-grade gliomas showed hypoxia on FMISO PET/CT. The value of SUVmax ($p<0.02$) and 5 of 6 texture indices [homogeneity ($p<0.02$), short-run emphasis ($p<0.003$), long-run emphasis ($p<0.002$), high-gray-level-zone emphasis ($p<0.03$), and low-gray-level-zone emphasis ($p<0.02$)] significantly differed between IDH1-mutated tumors and IDH1-nonmutated tumors.

CONCLUSION

These preliminary results indicate that FMISO PET parameters including texture indices seem to be useful for assessment of IDH1 mutation status in patients with newly diagnosed high-grade gliomas.

CLINICAL RELEVANCE/APPLICATION

FMISO PET parameters including texture indices seem to be useful for assessment of IDH1 mutation status in patients with newly diagnosed high-grade gliomas.

NM225-SD-THA2 The New Perspective of PET/CT for Axillary Node Staging in Breast Cancer Patients According to ACOSOG Z0011 Trial

Station #2

Participants

Eun-Jung Kong, MD, Daegu, Korea, Republic Of (*Presenter*) Nothing to Disclose
Jungeun Choi, Daegu, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

According to the results of the ACOSOG Z0011 trial, the use of sentinel lymph node (SLN) dissection alone did not result in inferior survival compared with axillary lymph node dissection (ALND) in patients with limited SLN disease treated with breast-conserving surgery (BCS). We investigated the diagnostic performance of FDG PET/CT with respect to negative or 1-2 ALN metastasis from 3 or more.

METHOD AND MATERIALS

We retrospectively analyzed preoperative contrast enhanced PET/CT images taken from Jan 2010 to June 2012. The patients had cT1-2 primary invasive breast cancer without palpable adenopathy and underwent BCS with ALND within 2 weeks from the scan. We excluded the patients with neoadjuvant chemotherapy or distant metastasis. We counted the number of suspicious LN, considering FDG avidity with morphologic change; Image analysis was as follows: FDG PET evaluation for any focal hypermetabolism, then a morphologic evaluation was done. Images were considered positive if areas in the axillary basin took up

more FDG than background. The criteria for abnormal LN on CT included a round/ovoid, or cortical thickening with enhancement. The sizes of the LNs did not enter the PET/CT finding criteria. We compared our PET/CT results with histology reports.

RESULTS

222 women (26-75 y-o) with 225 axilla (3 bilateral) were enrolled and their tumor size was 1.66 ± 0.72 cm. 214 cases had limited metastasis (0 - 2), and 11 had extended metastasis (3 or more). 23 women had recurrence during follow up period. The mean tumor size was 1.64 cm in limited (L)group and 2.19 cm in extended (E)group (p = 0.056). The mean SUVmax for tumor was 5.16 in L group and 7.16 in E group (p = 0.073). The sensitivity, specificity, NPV and PPV of PET/CT for extended metastasis was 72.7%, 100 %, 100% and 98.6% respectively. Regarding 3 false negative patients, 7.2 in tumor SUVmax and 2.4 cm in tumor size. Regarding 23 recurred patients, 7.56 in tumor SUVmax and 1.95 cm in tumor size, they had higher SUVmax and larger tumor size than those who did not (p=0.005 and p=0.046).

CONCLUSION

Preoperative PET/CT scan predict 3 or more positive ALN metastasis with high specificity and have evolving role to treat plan in patients with clinical T1-2 IDC and no palpable adenopathy.

CLINICAL RELEVANCE/APPLICATION

FDG PET/CT in detecting 3 or more positive axillary LN metastasis has high specificity and is recommended in the initial evaluation to surgical plan.

NM226-SD-THA3 Multi-Molecular Probe-Based Micro PET Imaging Combined with Tumor Markers in Predicting Colorectal Cancer Liver Metastasis

Station #3

Participants
Mingyu Zhang, PhD, harbin, China (*Presenter*) Nothing to Disclose
Huijie Jiang, PhD, MS, Harbin, China (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

This study aimed to explore the application of 3′-deoxy-3′-18F-fiuorothymidine (FLT) and 18F-fluoromisonidazole (FMISO) union imaging combined with tumor metastasis-related biomarkers to predict a liver metastasis for colorectal cancer (CRC).

METHOD AND MATERIALS

Radiotracer-based cellular uptake in vitro were performed anterior to Micro-PET imaging. Mouse models of CRC hepatic metastases were established by implantation of human CRC cell lines LoVo and HT29 via intrasplenic injection. Tumor-bearing mouse models were established by subcutaneously injecting LoVo and HT29 cells. Radiotracer-based micro-positron emission tomography imaging of liver metastasis and tumor-bearing mice was performed and the cellular levels of each tracer in the tumor tissues were quantified as tumor to liver maximum standardized uptake ratio values (T/L SUVmax ratio). Pearson correlation coefficient were used to analyze the relationship between tumor markers (hypoxia inducible factor 1 alpha (HIF-1a) and proliferating cell nuclear antigen (Ki67) and radioactive parameters.

RESULTS

The incidence of liver metastases in LoVo-xenografted mice was significantly higher than that in HT29-xenografted ones. Both the SUVmax ratio values of 18F-FMISO and 18F-FLT in LoVo xenografts were significantly greater than those in HT29 ones. The areas of tumor hypoxia and reproductive can be reflected in tumor-bearing models. For in vitro study, LoVo cells exhibited a stronger metastatic potential and a higher radiotracer uptake ability than HT29 cells. Mechanistically, the expression of Ki67 and HIF-1a in LoVo cells and LoVo tumor tissues was remarkably higher than those in HT29 cells and tissues. Pearson correlation coefficient demonstrated significant correlations between cellular 18F-FLT/18F-FMISO uptake and Ki67/ HIF-1a expression in vitro, as well as between 18F-FMISO SUVmax ratio and HIF-1a expression in vivo.

CONCLUSION

The union imaging of 18F-FLT and 18F-FMISO PET can better reflect the different biological behavior of CRC. 18F-FLT and 18F-FMISO union SUVmax ratio parameter may be used as a promising predictive biomarker for CRC hepatic metastases.

CLINICAL RELEVANCE/APPLICATION

18F-FLT and 18F-FMISO union SUVmax ratio parameter may be used as a promising predictive biomarker for CRC hepatic metastases.

NM236-SD-THA4 Prediction of Therapy Response in Soft Tissue Sarcoma Based on Multi-Dimensional PET/MRI

Station #4

Participants
Johannes Grueneisen, Essen, Germany (*Abstract Co-Author*) Nothing to Disclose
Benedikt M. Schaarschmidt, MD, Essen, Germany (*Abstract Co-Author*) Nothing to Disclose
Ole Martin, Duesseldorf, Germany (*Abstract Co-Author*) Nothing to Disclose
Michal Chodyla, Essen, Germany (*Abstract Co-Author*) Nothing to Disclose
Aydin Demircioglu, Essen, Germany (*Abstract Co-Author*) Nothing to Disclose
Axel Wetter, Essen, Germany (*Abstract Co-Author*) Nothing to Disclose
Lars Podleska, MD, Essen, Germany (*Abstract Co-Author*) Nothing to Disclose
Ken Herrmann, Essen, Germany (*Abstract Co-Author*) Co-founder, SurgicEye GmbH Stockholder, SurgicEye GmbH Consultant, Sofie Biosciences Consultant, Ipsen SA Consultant, Siemens AG Research Grant, Advanced Accelerator Applications SA Research Grant, Ipsen SA
Michael Forsting, MD, Essen, Germany (*Abstract Co-Author*) Nothing to Disclose
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PURPOSE

To assess the clinical applicability of simultaneously acquired PET- and MR-derived quantitative imaging parameters for response assessment of patients with soft tissue sarcomas (STS) under neoadjuvant isolated limb perfusion (ILP).

METHOD AND MATERIALS

A total of 45 patients with confirmation of an STS manifestation underwent a 18F-FDG PET/MR examination before and after ILP, followed by tumor resection. For each patient, the maximum tumor size, contrast-enhancement of solid tumor parts and the SUVpeak in pre- and posttherapeutic examinations were measured and changes during treatment were calculated. ROC analysis was performed and the AUC values as well as the optimal threshold for percentage changes were calculated to predict treatment response under ILP. A combined score was used and relative changes as well as all interactions were computed by a LASSO regression. Histopathological results served as the reference standard and patients were classified as responder/non-responder according to the grading scale by Salzer-Kuntschik.

RESULTS

A total of 27 patients were categorized as histopathological responder and revealed a mean reduction in tumor size of -8.4%, contrast-enhancing solid tumor parts of -33.2% and the SUVpeak of -58.7%, respectively. Patients classified as non-responder (n=18) showed a lower decrease of the quantitative parameters (mean reduction: -6.9%, -23.3% and -20.1%). ROC analysis revealed an optimal threshold for percentage changes of the quantitative variables under ILP of -7.2% (AUC: 0.59) for the maximal tumor diameter, -26.0% (AUC: 0.60) for contrast-enhancement of the tumors and -34.3% (AUC: 0.82) for the SUVpeak. The combined regression model showed a significantly higher AUC value (0.90) than for tumor diameter and contrast-enhancement (p-values: <0.001), whereas, differences to the results of SUVpeak did not reach the significance level (p-value: 0.067).

CONCLUSION

Our study demonstrates the superiority of 18F-FDG PET over MR-datasets for response assessment of STS under neoadjuvant ILP. However, combining the information of 18F-FDG PET/ MR-derived imaging parameters shows a tendency to enable a more accurate prediction of histopathological tumor response.

CLINICAL RELEVANCE/APPLICATION

Considering the valuable information of MRI for presurgical assessment, integrated PET/MRI could serve as a valuable tool for pretherapeutic evaluation as well as monitoring of neoadjuvant treatment strategies of STS.

NM139-ED-THA6 How We Do It: A Multidisciplinary Approach to Lu- 177 Dotatate PRRT (Peptide Receptor Radionuclide Therapy)

Station #6

Participants

Brian J. Burkett, MD , Rochester, MN (*Presenter*) Nothing to Disclose
Ayca Dundar, MD, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Jason Young, MD, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Ann Packard, MD, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Geoffrey B. Johnson, MD,PhD, Rochester, MN (*Abstract Co-Author*) Research Grant, General Electric Company Research Grant, Pfizer Inc
Thorvardur Halfdanarson, Rochester, MN (*Abstract Co-Author*) Research Consultant, Curium; Research Consultant, Lexicon Pharmaceuticals, Inc; Research Consultant, Advanced Accelerator Applications SA; Research Grant, Ipsen SA; Research Grant, Thermo Fisher Scientific Inc
Ayse T. Karagulle Kendi, MD, Rochester, MN (*Abstract Co-Author*) Investigator, Endocyte, Inc

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TEACHING POINTS

1. Introduce strategies to implement a formal, multidisciplinary approach to successfully and safely administering lutetium Lu-177 dotatate peptide receptor radionuclide therapy (PRRT) 2. Evaluate how to select appropriate patients for Lu-177 dotatate including evaluating prior imaging, prior therapies, hepatic and renal function, along with involving additional medical specialties such as nephrologists, as needed 3. Illustrate several examples of how to approach challenging scenarios while selecting patients for PRRT 4. Gain familiarity with typical and unusual imaging presentations related to PRRT

TABLE OF CONTENTS/OUTLINE

A. Introduction to Lu-177 dotatate: • Mechanism of action • NETTER-1 trial • FDA approval B. Workflow and approval for Lu-177 dotatate therapy: • Role of our Advanced Practice Provider • Initial ordering, approval, and patient selection for multidisciplinary discussion • Description of our multidisciplinary nuclear therapy tumor board, emphasizing factors of the neuroendocrine tumor histopathology, imaging features, patient prognosis, functional status, and systemic medical conditions C. Implementing therapy: • Preparing patients for treatment (paperwork provided to patients) • Nuclear Medicine Consultation • Review of Imaging • Day of therapy D. Challenging cases, presented in the format of a multidisciplinary conference discussion

NM140-ED-THA7 Tc-99m MAG3 Renogram is a Useful Non-Invasive Diagnostic Tool to Evaluate Renal Function After Carbon-Ion Radiotherapy (CIRT) in Patients with Renal Cell Carcinoma

Station #7

Participants

Ryuichi Nishii, MD, PhD, Chiba-pref. , Japan (*Presenter*) Nothing to Disclose
Kana Yamazaki, Nakano, Japan (*Abstract Co-Author*) Nothing to Disclose
Goro Kasuya, MD,PhD, Chiba, Japan (*Abstract Co-Author*) Nothing to Disclose
Hirokazu Makishima, MD,PhD, Chiba, Japan (*Abstract Co-Author*) Nothing to Disclose

Tachen Chang, MD,PhD, Chiba, Japan (*Abstract Co-Author*) Nothing to Disclose
Hiroshi Tsuji, MD,PhD, Chiba, Japan (*Abstract Co-Author*) Nothing to Disclose
Tatsuya Higashi, MD, Kyoto, Japan (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

1) 99mTc-MAG3 renogram is a useful non-invasive diagnostic tool to evaluate renal function after CIRT in patients with renal cell carcinoma, especially for the assessment of split renal function.2) With 99mTc-MAG3 renogram, it is possible to detect renal function deterioration of non-irradiated renal parenchyma.3) Serial assessment of renal function by measuring tubular extraction with 99mTc-MAG3 might permit earlier and more sensitive detection of renal damage after CIRT.

TABLE OF CONTENTS/OUTLINE

Background# Contents- Renogram before and after CIRT for RCC.- Renogram; Pre-, 3-6 months and 12-18 months after CIRT with comparison National Cancer Institute's Common Terminology Criteria for Adverse Events (CTCAE) version 4.0 as adverse event evaluation.- Relationship between total cERPF and eGFR# Case presentation, - Case: T1aN0M0, 66Gy/12Fr., Comorbidity: none- Case: T1bN0M0, 66Gy/12Fr., Comorbidity: none- Case: T1bN0M0, 66Gy/12Fr., Cerebrovascular disease- Case: T1aN0M0, 72Gy/12Fr., Cerebrovascular disease- Case: T1aN0M0, 72Gy/12Fr., Diabetic nephropathy- Case: T3aN0M0, 72Gy/12Fr., Diabetic nephropathy# Summary

Printed on: 10/29/20

NMS-THB

Nuclear Medicine Thursday Poster Discussions

Thursday, Dec. 5 12:45PM - 1:15PM Room: NM Community, Learning Center

NM

AMA PRA Category 1 Credit ™: .50

FDA Discussions may include off-label uses.

Participants

Bital Savir-Baruch, MD, Atlanta, GA (*Moderator*) Research Grant, Blue Earth Diagnostics Ltd; Consultant, Blue Earth Diagnostics Ltd

Sub-Events

NM227-SD-THB1 Correlation of the Prognostic Value between Deauville and RECIL Therapy Response Scales in Hodgkin's Lymphoma

Station #1

Participants
Erika S. Fajardo, MD, Mexico City, Mexico (*Presenter*) Nothing to Disclose
Estuardo Paredes I, MD, Lima 51, Peru (*Abstract Co-Author*) Nothing to Disclose
Luis Felipe Alva Lopez, MD, Mexico City, Mexico (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

To evaluate the Correlation of the prognostic value between Deauville and RECIL therapy response scales in Hodgkin lymphoma.

METHOD AND MATERIALS

A cross-sectional, analytical, retrospective study was carried out to evaluate the Correlation of the prognostic value between Deauville and RECIL therapy response scales, in patients diagnosed with Hodgkin's lymphoma, treated between 2009 and 2015; who had been evaluated with 18F-FDG PET/CT at baseline, interim and end-of-treatment. 206 patients, with qualitative information on response to treatment were selected. Information was processed with the SPSS Statistics v.22 program, displaying Pearson's Chi square test and Cohen's Kappa index, to determine the proportion of the concordance observed among the qualitative variants with significance of 95% and p <0.05.

RESULTS

The complete response assessment of Deauville / RECIL scales at the end of treatment were similar (X2 = 432.6 and p = 0.0000); with a final concordance between studies was 94.65%. Additionally it was found that, the relationship RECIL Interim / final was (X2 = 0.35 and p = 0.000) and Deauville Interim / final was (X2 = 263 and p = 0.000).

CONCLUSION

The scale of RECIL is as reliable as the DEUVILLE scale for assessment of the response during and at the end of treatment in patients with Hodgkin lymphoma.

CLINICAL RELEVANCE/APPLICATION

18FDG-PET/CT has become a valuable tool in the staging and monitoring of patients with lymphoma, providing a continuous scale to refine the threshold of adequate / inadequate response in specific clinical situations and the optimization of treatment in the patient with Hodgkin´s Lymphoma.

NM228-SD-THB2 Association between 18F-FDG Uptake Heterogeneity and p16-Expression in Patients with Oropharyngeal Squamous Cell Carcinoma

Station #2

Participants
Katsuya Mitamura, Kita, Japan (*Presenter*) Nothing to Disclose
Yuka Yamamoto, MD, PhD, Kita-Gun, Japan (*Abstract Co-Author*) Nothing to Disclose
Hanae A. Okuda, MD, Kita-Gun, Japan (*Abstract Co-Author*) Nothing to Disclose
Takashi Norikane, Kita-gun, Japan (*Abstract Co-Author*) Nothing to Disclose
Yoshihiro Nishiyama, MD, Kagawa, Japan (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The new classification provides guidelines for p16 testing in oropharyngeal squamous cell carcinoma (OPSCC) and moderate staining intensity is classified as p16 positivity and plausible human papillomavirus (HPV) related etiology. The purpose of this study was to evaluate association between 18F-FDG (FDG) uptake heterogeneity using texture indices and p16-expression in patients with OPSCC, in comparison with the conventional PET parameters.

METHOD AND MATERIALS

FDG PET/CT was performed in 25 patients with newly diagnosed OPSCC. The 4 conventional parameters [SUVmax, SUVpeak, metabolic tumor volume (MTV) and total legion glycolysis (TLG)] and 4 texture parameters [skewness, kurtosis, entropy, and uniformity] were measured. The presence of p16-expression in tumor specimens was examined by immunohistochemistry and compared with PET parameters.

RESULTS

All tumors showed focally increased FDG uptake. No significant differences in all 4 conventional parameters were noted between p16-positve tumors and p16-negative tumors. Two of 4 texture indices [entropy ($p<0.03$) and uniformity ($p<0.05$)] significantly differed between p16-positve tumors and p16-negative tumors.

CONCLUSION

These preliminary results indicate that texture indices reflecting heterogeneity on FDG PET/CT images seem to be useful for assessment of p16-expression in patients with OPSCC.

CLINICAL RELEVANCE/APPLICATION

Texture indices reflecting heterogeneity on FDG PET/CT images seem to be useful for assessment of p16-expression in patients with OPSCC.

NM229-SD-THB3 Usefulness of Combined Analysis Using Both FDG-PET and Diffusion MRI in Predicting Overall Survival in Invasive Ductal Pancreatic Cancer

Station #3

Participants
Shigeki Nagamachi, MD, PhD, Fukuoka , Japan (*Presenter*) Nothing to Disclose
Masanari Nonokuma, Fukuoka , Japan (*Abstract Co-Author*) Nothing to Disclose
Youichi Mizutani, Miyazaki, Japan (*Abstract Co-Author*) Nothing to Disclose
Tamasa Terada, Miyazaki, Japan (*Abstract Co-Author*) Nothing to Disclose
Toshinori Hirai, MD, PhD, Miyazaki, Japan (*Abstract Co-Author*) Research Grant, Bayer AG
Kengo Yoshimitsu, MD, Fukuoka, Japan (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Both Total lesion glycolysis (TLG) calculated by FDG-PET and apparent diffusion coefficient (ADC) calculated by diffusion MRI are useful for predicting overall survival (OS) in invasive ductal pancreas cancer. However, few researches predicting OS of invasive ductal pancreas cancer using combined analysis FDG-PET and diffusion MRI have been reported. We investigated whether combined analysis using both FDG-PET and diffusion MRI can predict OS of invasive ductal pancreas cancer in this study.

METHOD AND MATERIALS

Fifty-two pancreatic cancer patients (27 females and 25 males, mean age 67.7) were enrolled in the retrospective analyses. Although the stages were various (III 18, IV 34), all cases were undertaken surgical treatment and post-operative chemo-therapy. Both pre-operative FDG-PET and MRI images were analyzed retrospectively. The values of TLG were calculated by multiplication of the SUV mean value and total volumes more than 40% of SUVmax using FDG-PET/CT. The values of ADC mean were measured on ADC map under the condition b value 1000 on the 3T MRI. We divided all patients into the three groups according to the value of TLG and ADCmean obtained in pre-therapy examinations. The cut-off values of each examinations were 50g and 1200 s/mm2 respectively. We compared the OS among three group, namely the patient group with both high TLG and low ADC mean (Both index severe) (n=9), the patients group with either high TLG or low ADCmean (One index severe)(n=25) and the patient group with both moderate value TLG and ADCmean (Both index moderate) (n=18).

RESULTS

The mean value of OS was significantly shorter in the both index severe group compared with that in the one index severe group (595.0 vs. 1342.4 days). However, the mean value of OS in the both index moderate group was 1240.7 days and it did not show any statistical significance compared with other two groups. Regarding other clinical parameters including pathological stages, there was no statistical significance.

CONCLUSION

Although single image abnormality did not influence on the OS, severe abnormalities of both TLG and ADCmean in the pre-operative PET and MRI significantly shortened OS of invasive ductal pancreas cancer.

CLINICAL RELEVANCE/APPLICATION

In planning treatment of invasive ductal pancreas cancer, both TLG by FDG-PET and ADCmean by MRI should be analyzed before pre-therapy in order to predict OS.

NM238-SD-THB4 Clinical Utility of 18FDG-PET/CT in Treatment Response Assessment and Follow-Up of Lung Tumors Treated with Stereotactic Body Radiotherapy

Station #4

Participants
Jose Luis Vercher Conejero, Lhospitalet de Llobregat (Barcelona) , Spain (*Presenter*) Nothing to Disclose
Paula C. Notta, Lhospitalet de Llobregat , Spain (*Abstract Co-Author*) Nothing to Disclose
Arturo Navarro Martin, Lhospitalet de Llobregat , Spain (*Abstract Co-Author*) Nothing to Disclose
Eduardo Andia Navarro, MD, L'Hospitalet De Llobregat, Spain (*Abstract Co-Author*) Nothing to Disclose
Susana Padrones, MD, Barcelona, Spain (*Abstract Co-Author*) Nothing to Disclose
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Azahara Palomar Munoz, Lhospitalet de Llobregat , Spain (*Abstract Co-Author*) Nothing to Disclose
Belen del Rio Carrero, MD, LL'Hospitalet de Llobregat, Spain (*Abstract Co-Author*) Nothing to Disclose
Maria D. Arnaiz, MD, Barcelona, Spain (*Abstract Co-Author*) Nothing to Disclose

Cristina Gamez-Cenzano, Lhospitalet de Llobregat , Spain (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

Stereotactic body radiation therapy (SBRT) is a relatively new treatment modality whose main indications are inoperable non-small-cell lung cancer and oligometastases to liver and lung. The aim of this study was to evaluate the usefulness of 18FDG-PET/CT in monitoring treatment response and in the follow-up of patients with pulmonary lesions treated with stereotactic body radiotherapy (SBRT).

METHOD AND MATERIALS

We retrospectively studied 91 patients who received SBRT for stage I lung cancer or isolated pulmonary metastases from other tumors. The final analysis excluded 52/91 patients because an initial follow-up PET was not available or additional therapies were administered. We included 39 patients with pulmonary tumor lesions: 32/39 lung cancer and 7/39 colorectal metastases. PET/CT was performed <1 month prior SBRT, and after SBRT at 3 timepoints: <6, 6-18 and> 18 months. The clinical evaluation of the response was classified as stable disease (SD), including partial or complete metabolic response or progression (PD).

RESULTS

Primary lung tumors were adenocarcinomas (22) and squamous carcinoma (10), and adenocarcinomas (7) for colorectal cancer, presenting a baseline-SUVmax average of 6.9, 10.8 and 6.5 g/ml, respectively. SBRT dose ranged 34-60 Gy.The majority of patients (76%) with SD already had a decrease in metabolic activity within the early evaluation without a significant reduction in size. Low diffuse metabolic uptake was observed in most patients due to inflammatory changes. 6 patients had PD by PET and CT, 3 in early evaluation, 2 in intermediate and 1 >18 months.

CONCLUSION

The response evaluation with PET/CT is more reliable than that observed only with CT in the follow-up of lung lesions treated with SBRT. The morphological changes induced by SBRT can show a consolidation or a mass-like appearance making the diagnosis complicated. However, it is important to keep in mind that diffuse hypermetabolism after SBRT may persist beyond 18 months after treatment without definitive evidence of recurrence. In our study, PET correlated with the clinical response and may be useful in predicting the response to SBRT and further research to determine optimal management is needed.

CLINICAL RELEVANCE/APPLICATION

Considering the increasing use of SBRT for the treatment of pulmonary lesions, tools for the early detection of local failure are needed to allow the timely rescue of surgery.

NM239-SD-THB5 18F FDG as a Prognostic Imaging Biomarker in the Rra of LIRADS Diagnosis of Hepatocellular Carcinoma (HCC)

Station #5

Participants
Munazza Anis, MD, Richmond, VA (*Presenter*) Nothing to Disclose
James L. Tatum, MD, Midlothian, VA (*Abstract Co-Author*) Nothing to Disclose
Jennifer M. Hubert, MD, Mechanicsvlle, VA (*Abstract Co-Author*) Nothing to Disclose
Binu John, MD, MPH, Cleveland, OH (*Abstract Co-Author*) Nothing to Disclose
Sean Aubuchonsm@Mymail.Vcu.Edu, Richmond , VA (*Abstract Co-Author*) Nothing to Disclose

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TEACHING POINTS

1. Understand status of 18F FDG PET/CT imaging in the diagnosis of hepatocellular carcinoma (HCC) in the era of LIRADS 2. Understand the bio;logy of 18F FDG uptake in the diagnosis of HCC 3, Review data supporting the role of 18F FDG as a prosgnostic imaging biomarker following cross sectional imaging LIRADS diagnosis of HCC

TABLE OF CONTENTS/OUTLINE

1. Introduction: Role of 18 F FDG in the diagnosis of HCC in comparison with LIRADS vs the biological phenotype information 2. 18F FDG uptake quantification in HCC to predict microvascular metastases and distant metastases 3. Cases 4. Role of 18 F FDG in evaluating recurrence after ablative therapies 5. Cases 6. Conclusion

NM141-ED-THB6 Beyond Pulmonary Embolism (PE): A Pictorial Review of the Mimickers of PE and Incidental Findings on Ventilation/Perfusion (V/Q) Scintigraphy

Station #6

Awards
Identified for RadioGraphics

Participants
Ryan T. Downey, MD, Omaha, NE (*Presenter*) Nothing to Disclose
Neil J. Hansen, MD, Bennington, NE (*Abstract Co-Author*) Nothing to Disclose
Craig M. Johnson, MD, Omaha, NE (*Abstract Co-Author*) Nothing to Disclose
Jorge D. Oldan, MD, Chapel Hill, NC (*Abstract Co-Author*) Nothing to Disclose

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TEACHING POINTS

The purpose of the this exhibit is: 1. To review potential mimickers of PE on VQ scintigraphy 2. To review common and uncommon incidental findings on VQ scintigraphy

TABLE OF CONTENTS/OUTLINE

Principles of VQ scintigraphy Mimickers of PE on VQ scintigraphy -Parenchymal disease -Mediastinal mass/lymphadenopathy -Congenital abnormalities Incidental findings -Parenchymal disease -Cardiovascular disease -Extrathoracic abnormalities Representative examples with CT correlation Summary

Printed on: 10/29/20

RC711

Advances and Updates in SPECT/CT

Thursday, Dec. 5 4:30PM - 6:00PM Room: S504CD

CT NM

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 1.75

FDA Discussions may include off-label uses.

Sub-Events

RC711A SPECT/CT in Infection and Inflammation

Participants
Christopher J. Palestro, MD, New Hyde Park, NY (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Interpret SPECT/CT performed for suspected inflammation/infection to determine their precise location and extent. 2) Compare available radiopharmaceuticals and imaging modalities for specific clinical indications in the assessment of inflammation and infection. 3) Recognize and avoid pitfalls in interpretation of SPECT/CT studies performed for inflammation and infection.

RC711B SPECT/CT Oncology and Endocrinology

Participants
Esma A. Akin, MD, Washington, DC (*Presenter*) Nothing to Disclose

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LEARNING OBJECTIVES

1) To describe indications of using SPECT-CT imaging in endocrine and neuroendocrine tumors. 2) Observe case examples of common and uncommon presentations of these disease entities in daily clinical practice.

RC711C SPECT/CT Technology: State of the Art

Participants
Timothy Turkington, PhD, Durham, NC (*Presenter*) Consultant, Data Spectrum Corporation

LEARNING OBJECTIVES

1) To be able to provide a basic description of SPECT imaging. 2) To be able to describe at least two factors that limit SPECT imaging and how new technologies are helping to mitigate those factors.

RC717

Emerging Technology: PET/MRI Update 2019

Thursday, Dec. 5 4:30PM - 6:00PM Room: S505AB

MR NM

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 1.75

FDA Discussions may include off-label uses.

Participants
Rathan M. Subramaniam, MD,PhD, Dunedin, New Zealand (*Moderator*) Nothing to Disclose

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LEARNING OBJECTIVES

1) To discuss opportunities of PET/MRI in clinical practice and research. 2) To discuss challenges of PET/MRI in clinical practice and research.

Sub-Events

RC717A PET/MRI Update 2019: Clinical Practice Implementation - Pearls

Participants
Geoffrey B. Johnson, MD,PhD, Rochester, MN (*Presenter*) Research Grant, General Electric Company Research Grant, Pfizer Inc

RC717B PET/MRI Update 2019: Clinical Applications - Brain and Head and Neck

Participants
Alexander Drzezga, MD, Cologne, Germany (*Presenter*) Research support, Siemens AG; Speakers Bureau, Siemens AG; Stockholder, Siemens AG; Research support, General Electric Company; Consultant, General Electric Company; Research support, Life Molecular Imaging; Speakers Bureau, sanofi-aventis Group; Speakers Bureau, General Electric Company; Research support, Eli Lilly and Company;

LEARNING OBJECTIVES

1) Review relevant clinical applications for PET/MR in the diagnostic work-up of disorders of the brain. 2) Review strengths of PET/MR for disorders of the head and neck. 3) Understand the value of different currently available tracers for neuroimaging and oncological applications. 4) Review challenges and limitations of PET/MR in brain/head & neck and expected future developments.

RC717C PET/MRI Update 2019: Clinical Applications - Body

Participants
Spencer C. Behr, MD, San Francisco, CA (*Presenter*) Research Grant, General Electric Company; Consultant, Navidea Biopharmaceuticals, Inc; Grant, Navidea Biopharmaceuticals, Inc

LEARNING OBJECTIVES

1) Review common current applications for abdominopelvic oncologic PET/MRI, including hepatic malignancies, rectal cancer, and cervical cancer. 2) Understand the role of novel tracers in prostate cancer (PSMA PET) and neuroendocrine tumors (somatostatin receptor PET). The presentation will focus on prostate cancer as an application. 3) Present the current limitations and future advances in PET/MRI that will help increase the clinical acceptance and applicability of body PET/MRI.

RC717D PET/MRI Update 2019: Clinical Applications - Cardiac

Participants
Pamela K. Woodard, MD, Saint Louis, MO (*Presenter*) Researcher, Siemens AG; Research Grant, F. Hoffmann-La Roche Ltd; Consultant, Medtronic plc; ; ; ; ; ;

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LEARNING OBJECTIVES

1) Individuals attending this session will understand clinical cardiac PET/MR imaging applications; applications will include a) myocardial perfusion and viability, b) inflammation, c) nonischemic cardiomyopathy, and d) tumor assessment.

RC717E PET/MRI Update 2019: Clinical Applications - Pediatrics

Participants
Lisa J. States, MD, Plymouth Mtng, PA (*Presenter*) Nothing to Disclose

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LEARNING OBJECTIVES

1) Suggest optimal protocols for pediatric PET/MRI. 2) List indications for pediatric PET/MRI in oncologic and non-oncologic applications. 3) Understand the challenges of these studies in children.

RC717F PET/MRI Update 2019: Physics

Participants
Georges El Fakhri, PhD, Boston, MA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Understand the challenges and opportunities afforded by simultaneous PET/MR. 2) Understand the role of PET/MR in imaging myocardial membrane potential.

Printed on: 10/29/20

RC817

Emerging Technology: Theranosis-Molecularly Targeted Therapies 2019

Friday, Dec. 6 8:30AM - 10:00AM Room: E260

MI NM

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 1.75

FDA Discussions may include off-label uses.

Participants
Rathan M. Subramaniam, MD,PhD, Dunedin, New Zealand (*Moderator*) Nothing to Disclose

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LEARNING OBJECTIVES

1) To review the established and emerging molecularly targeted radionuclide therapies for human solid tumors.

Sub-Events

RC817A Thyroid Cancer: 131-I Na Therapy

Participants
Arif Sheikh, MD, New York, NY (*Presenter*) Nothing to Disclose

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LEARNING OBJECTIVES

1. To review the basic approaches of radioiodine therapy in thyroid cancer management 2. To evaluate the integration of radioiodine imaging and therapy in thyroid cancer 3. Understanding radioiodine therapy as the general model for theranostics

RC817B Phaeochromocytomas and Paragangliomas: 131-I MIBG Therapy

Participants
Lilja B. Solnes, MD, Baltimore, MD (*Presenter*) Advisory Board, Progenics Pharmaceuticals, Inc

RC817C Neuroendocrine Tumors: 177Lu-DOTATATE Therapy

Participants
Rathan M. Subramaniam, MD,PhD, Dunedin, New Zealand (*Presenter*) Nothing to Disclose

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LEARNING OBJECTIVES

1) To learn the indications and patient selections for 177Lu DOTATATE therapy. 2) To review the 177Lu DOTATATE therapy procedures, toxicity monitoring and patient care follow-up. 3) To review therapy response methods for 177Lu DOTATATE treatments.

RC817D Prostate Cancer: 177Lu-PSMA Therapy

Participants
Ayse T. Karagulle Kendi, MD, Rochester, MN (*Presenter*) Investigator, Endocyte, Inc

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LEARNING OBJECTIVES

1) Brief review of clinical background. 2) Discuss basic principles of Lu-PSMA therapy. 3) Describe therapy methods. 4) Explain side effects. 5) Review clinical impact/outcomes of Lu-PSMA therapy.

SST06

Nuclear Medicine (Thoracic Oncology Nuclear Medicine and PET)

Friday, Dec. 6 10:30AM - 12:00PM Room: E353B

CH NM OI

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 1.75

Participants
Robert R. Flavell, MD, PhD, San Francisco, CA (*Moderator*) Nothing to Disclose
Andrew C. Homb, MD, Rochester, MN (*Moderator*) Nothing to Disclose

Sub-Events

SST06-01 TNM Sub-Stage Does Not Predict Survival in Surgical Patients with Both Clinical and Pathological Stage I Non-Small Cell Lung Cancer

Friday, Dec. 6 10:30AM - 10:40AM Room: E353B

Participants
Jingmian Zhang, MD, Shijiazhuang, China (*Abstract Co-Author*) Nothing to Disclose
Bill C. Penney, PhD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Daniel E. Appelbaum, MD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Yonglin Pu, MD, PhD, Chicago, IL (*Presenter*) Nothing to Disclose

PURPOSE

To determine if TNM sub-stage (IA1-IB) and PET tumor measurements are predictive of survival in surgical patients with both clinical and pathological stage I non-small cell lung cancer (NSCLC).

METHOD AND MATERIALS

This study reviewed surgical patients with clinical and pathological stage I NSCLC and a baseline FDG PET/CT between Feb 2004 and Dec 2014. The pathological staging was based on the prevailing staging system at the time of the surgery. The clinical stage (8th edition) was determined retrospectively by radiologists based on FDG PET/CT and contrast CT. The metabolic tumor volume (MTV), total lesion glycolysis (TLG), and SUVmax from PET/CT were measured. The primary endpoint was overall survival (OS). Kaplan-Meier and Cox survival analyses were performed.

RESULTS

172 surgical patients with pathological stage I also had clinical stage I (9 with IA1, 63 with IA2, 63 with IA3 and 37 with IB) (111 females and 61 males), with 44.8% who expired during follow-up, median OS was 69.1 months; and the 1-year, 2-year, and 5-year OS rates were 96.0%, 88.3% and 71.7 %, respectively. The median follow-up among survivors was 79.2 months. Univariate analysis showed that age [hazard ratio (HR) of age for every year= 1.04, p=0.001] and ECOG performance status (p=0.027) were associated with OS. Clinical TNM sub-stage (p=0.702), gender (p=0.405), smoking status (0.171), histology (p=0.111), ln(MTV) (p=0.120), ln(TLG) (p=0.147) and ln(SUVmax) (p=0.316) were not significantly associated with OS. The statistically significant association of age (HR= 1.04, p=0.002) and ECOG performance status (p=0.027) with OS persisted in multivariate Cox regression analyses after adjusting for clinical TNM sub-stage and ln(MTV). However, there was no significant association of clinical TNM sub-stage (p=0.451) and ln(MTV) (p=0.08) with OS. Kaplan-Meier survival analysis showed statistically significant association of MTV (>=3.5 ml vs <3.5ml, p=0.049), age (p=0.001) and ECOG performance status (p=0.02) with OS.

CONCLUSION

Clinical TNM sub-stage is not associated with OS in the surgical patients with both clinical and pathological stage I NSCLC. Age, MTV (>=3.5 ml vs <3.5ml) and ECOG performance status are significantly associated with OS in such patients.

CLINICAL RELEVANCE/APPLICATION

Patients with clinical stage 1 as determined with CT and PET, and pathologic stage 1 do well after surgery. Clinical TNM sub-stages add little prognostic information in this group.

SST06-02 Mediastinal Lymph Nodal Staging by 18 F FDG PET CT in Patients with Co-Existent Carcinoma Lung and Tuberculosis: A Tertiary Care Centre Experience

Friday, Dec. 6 10:40AM - 10:50AM Room: E353B

Participants
Ritu Verma, New Delhi, India (*Abstract Co-Author*) Nothing to Disclose
Ram K. E, New Delhi, India (*Abstract Co-Author*) Nothing to Disclose
Amit Dhamija, New Delhi, India (*Abstract Co-Author*) Nothing to Disclose
Ankur Pruthi, New Delhi, India (*Abstract Co-Author*) Nothing to Disclose
Ethel S. Belho, New Delhi, India (*Abstract Co-Author*) Nothing to Disclose
Dharmender Malik, New Delhi, India (*Abstract Co-Author*) Nothing to Disclose
Nikhil Seniaray, New Delhi, India (*Abstract Co-Author*) Nothing to Disclose
Vanshika Gupta, New Delhi, India (*Abstract Co-Author*) Nothing to Disclose

Nitin Gupta, New Delhi, India (*Abstract Co-Author*) Nothing to Disclose
Harsh Mahajan, MD,MBBS, New Delhi, India (*Presenter*) Director, Mahajan Imaging Pvt Ltd; Research collaboration, General Electric Company; Research collaboration, Koninklijke Philips NV; Research collaboration, Qure.ai; Research collaboration, Predible Health
Vidur Mahajan, MBBS, New Delhi, India (*Abstract Co-Author*) Researcher, CARING; Associate Director, Mahajan Imaging; Research collaboration, General Electric Company ; Research collaboration, Koninklijke Philips NV; Research collaboration, Qure.ai; Research collaboration, Predible Health; Research collaboration, Oxipit.ai; Research collaboration, Synapsica; Research collaboration, Quibim

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PURPOSE

The aim of this study is to evaluate the imaging characteristics of metastatic and benign (Tubercular) lymph nodes on 18 F FDG PET/CT, in patients with co-existent Carcinoma lung and Tuberculosis, and correlation with histopathological analysis.

METHOD AND MATERIALS

A retrospective analysis of 25 patients (19 males, 6 females; mean age 62.4+/- 10.08 years) with co-existent Carcinoma lung and Tuberculosis was done. All the subjects underwent F-18 FDG PET/CT scanning and subsequently the mediastinal lymph nodes were biopsied. SUV Max-Tumour, SUV Max-Lymph node and SUV Max-Ratio (SUV Max Lymph node / SUV Max Tumour) for each lymph node station on 18F-FDG PET/CT was determined and then each station was classified into one of the three groups based on SUV Max -Tumour (low, medium and high SUV Max -Tumour groups). Diagnostic performance was assessed based on receiver operating characteristic (ROC) curve analysis, and the optimal cut-off values that would best discriminate metastatic from benign lymph nodes were determined for each method.

RESULTS

A total of 115 lymph node stations with a mean of 4.6 lymph node station per patient and total of 540 lymph nodes with a mean of 21.6 lymph nodes per patient were resected and biopsied. 79 nodes were reported positive for metastasis and 27 nodes were reported as granulomatous. On pre-treatment 18F-FDG PET/CT scan, the mean SUV Max-Tumour of squamous cell carcinoma was significantly higher than that of adenocarcinoma (9.9±3.97 vs. 5.76±3.48, P<0.001). The mean SUVmax of malignant lymph nodes was significantly higher than that of tubercular lymph nodes (6.7±0.94 vs. 2.7± 0.84 P<0.001). The mean SUV Max -Ratio in patients with malignant lymph nodes was significantly higher than in those with tubercular lymph nodes (0.91±0.36 vs. 0.41±0.28, P<0.001).

CONCLUSION

The overall diagnostic accuracy of 18 F FDG PET CT in mediastinal lymph nodal staging in patients with co-existent Tuberculosis and Carcinoma lung carcinoma is 67.4 %, if SUV Max of 2.5 is taken as the cut off criteria, however if SUV Max-Ratio is taken into consideration, the overall diagnostic accuracy increases to 74.8%, thus helping in the accurate staging of patients

CLINICAL RELEVANCE/APPLICATION

Carcinoma lung with co-existing Tuberculosis results in false positive mediastinal lymph nodes and fallacies in pre-operative staging.

SST06-03 Improving Accuracy of FDG PET/CT to Diagnose Mediastinal Nodal Involvement in Non Small Cell Lung Cancer (NSCLC): Utility of Using various Predictive Models

Friday, Dec. 6 10:50AM - 11:00AM Room: E353B

Participants
Boon Mathew, MD, Mumbai, India (*Presenter*) Nothing to Disclose
Nilendu C. Purandare, DMRD, Mumbai, India (*Abstract Co-Author*) Nothing to Disclose
Ameya D. Puranik, MBBS, Mumbai, India (*Abstract Co-Author*) Nothing to Disclose
Sneha A. Shah, Mumbai, India (*Abstract Co-Author*) Nothing to Disclose
Archi Agrawal, MBBS, Mumbai, India (*Abstract Co-Author*) Nothing to Disclose
C S Pramesh, Mumbai, India (*Abstract Co-Author*) Nothing to Disclose
Venkatesh Rangarajan, MBBS, Mumbai, India (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

Accurate nodal staging is crucial in deciding the therapy for NSCLC patients. PET using FDG as well as CECT scan have not been proven to be sufficiently accurate in predicting mediastinal nodal disease, particular in infection endemic regions of the world. The purpose of the study was to determine a predictive model that could improve the accuracy for identifying mediastinal (N2) nodal metastases based on both PET and CT findings seen on baseline FDG PET/CT.

METHOD AND MATERIALS

This retrospective study includes 339 patients with NSCLC who underwent FDG PET/CT within 6 weeks prior to surgery. PET parameters obtained were 1) number of visual PET positive N2 nodes (FDG uptake more than mediastinal blood pool), 2) maximum standardized uptake value (SUVmax) of nodes and 3) ratio of node to aorta (N/A) SUVmax. CT parameters obtained were 1) short axis diameter and 2) Hounsfield units (HU) of PET positive nodes. Cutoff value of N/A ratio and HU for predicting metastases were obtained from ROC curve analysis. PET and CT parameters were correlated with nodal histopathology alone and in combination to find out the sensitivity, specificity, PPV and NPV. 3 different predictive models (PM) were devised and the incremental improvement in accuracy was determined.

RESULTS

PET positive N2 nodes were seen in 139 patients. Pathologically proven N2 disease was seen in 54 patients. 285 patients were negative for N2 nodal metastases. Predictive model (PM1) based on visual PET positivity showed sensitivity, specificity, PPV, NPV and accuracy of 70.3, 64.6, 27.3, 92 and 65.5 respectively. Predictive model (PM2) which combined visual PET positivity and N/A ratio >= 2 showed sensitivity, specificity, PPV, NPV and accuracy of 57.4, 92.2, 55.4, 91.9 and 85.8 respectively. Predictive model

(PM3) which combined visual PET positivity, N/A ratio >= 2 and HU < 75 showed sensitivity, specificity, PPV, NPV and accuracy of 55.5, 96.5, 75, 92 and 90 respectively.

CONCLUSION

Predictive model (PM3) which combined visual PET positivity, N/A ratio >= 2 and HU < 75 showed much improved accuracy in the preoperative diagnosis of mediastinal nodal metastases.

CLINICAL RELEVANCE/APPLICATION

Predictive model combining PET and CT parameters can identify N2 nodal involvement with high accuracy than either alone. The specificity and NPV appears excellent. However the sensitivity and PPV is only modest, demanding invasive nodal sampling especially in infectious endemic areas

SST06-05 FDG-PET/MRI versus Whole-Body MRI versus FDG-PET/CT versus Conventional Radiological Examination: Diagnostic and Prediction Capabilities for Postoperative Recurrence in Non-Small Cell Lung Cancer Patients

Friday, Dec. 6 11:10AM - 11:20AM Room: E353B

Participants
Yoshiharu Ohno, MD,PhD, Toyoake, Japan (*Presenter*) Research Grant, Canon Medical Systems Corporation; Research Grant, DAIICHI SANKYO Group; ;
Shinichiro Seki, Kobe, Japan (*Abstract Co-Author*) Research Grant, Canon Medical Systems Corporation
Yuji Kishida, MD,PhD, Kobe, Japan (*Abstract Co-Author*) Nothing to Disclose
Kota Aoyagi, Otawara, Japan (*Abstract Co-Author*) Employee, Canon Medical Systems Corporation
Masao Yui, Otawara, Japan (*Abstract Co-Author*) Employee, Canon Medical Systems Corporation
Takeshi Yoshikawa, MD, Kobe, Japan (*Abstract Co-Author*) Research Grant, Canon Medical Systems Corporation

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PURPOSE

To compare the utilities of diagnostis and prediction for postoperative recurrence among FDG-PET/MRI, whole-body MRI, FDG-PET/CT and conventional radiological method in non-small lung cancer (NSCLC) patients.

METHOD AND MATERIALS

484 consecutive postoperative NSCLC patients (289 men, 195 women; mean age 69 years) prospectively underwent whole-body MRI, integrated PET/CTs and conventional radiological method as well as follow-up and pathological examinations. Then, all patients were divided into recurrence (n=42) and non-recurrence (n=484) groups based on pathological and follow-up examination results. 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. Then, diagnostic accuracy of postoperative recurrence was statistically compared each other by using McNemar's test. Finally, multivariate analysis was performed to determine predictors for postoperative recurrence.

RESULTS

Area under the curves (Azs) of PET/MRI (Az=0.99) was significantly larger than that of MRI (Az=0.97, $p<0.05$), PET/CT (Az=0.97, $p<0.05$) and conventional radiological examination (Az=0.94, $p<0.05$). When applied feasible threshold values, accuracy of PET/MRI (97.7%) was significantly higher than that of others (MRI: 96.3%, p=0.004; PET/CT: 94.8%, p=0.0001; conventional radiological method: 90.0%, $p<0.0001$). Accuracy of MRI was also significantly higher than that of PET/CT (p=0.02) and conventional radiological method ($p<0.0001$). Moreover, accuracy of PET/CT was significantly higher than that of conventional radiological method ($p<0.0001$). As the results of multivariate analysis for prediction of postoperative recurrence, histological subtype (p=0.005), tumor marker ($p<0.0001$), PET/MRI result (p=0.001) and conventional radiological method result (p=0.002) were determined as significant predictors.

CONCLUSION

FDG-PET/MRI has better potential for diagnosis of postoperative recurrence than others and considered as one of the predictors in postoperative NSCLC patients.

CLINICAL RELEVANCE/APPLICATION

FDG-PET/MRI has better potential for diagnosis of postoperative recurrence than others and considered as one of the predictors in postoperative NSCLC patients.

SST06-06 Radiomics Features of Lung Adenocarcinoma Based on 18F-FDG PET/CT for Predicting the Mutation Status of EGFR and Its Correlation Analysis with Prognosis

Friday, Dec. 6 11:20AM - 11:30AM Room: E353B

Participants
Bin Yang, MD, Dali, China (*Presenter*) Nothing to Disclose
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Ying Qian Ge, Philomont, China (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

To investigate whether the radiomics features of 18F-FDG PET-CT in lung adenocarcinoma combining with relevant clinical

characteristics can predict the EGFR mutation status, and to explore the association with the prognosis of patients with different mutation status.

METHOD AND MATERIALS

A total of 174 patients with lung adenocarcinoma who received PET/CT scan and EGFR gene test were retrospectively analyzed. 1672 Radiomics features were extracted from PET/CT images using a Radiomics prototype (Frontier, VB10, Siemens Healthineers). The clinical and pathological datas were retrospectively analyzed and a combination of radiomics signature with clinical factors model was constructed using the Randon Forest (RF) method to identify EGFR mutants from wild types. The mutant/wild model was trained on a set of 149 patients and validated on an independent test group (n=35) using the AUC. A subset of 99 patients with EGFR mutation were further analyzed. The second model was built with RF classifier to predict 19/21 mutation site. The performance of training group (n=79) and test group (n=20) were evaluated by AUC. And then, and the COX proportional hazard model of multivariate analysis was established.

RESULTS

56.9% (99/174) of patients showed EGFR mutation. EGFR mutation of exon 21wa the most common mutation type (57/99) . We identified a combined radiomics signature and clinical factor model to discrimated between EGFR mutant and wild type in the training group (AUC=0.77) and the validation group (AUC=0.71). (Figure1)The performance of the second model for the identification of 19/21 mutation site reached an AUC of 0.82 and 0.73 in the training group and validation group, respectively. (Figure2) The average survival time of the mutant and wild-type patients was 54.653 months (95% CI:44.940 - 64.366) and 35.993 months (95% CI: 29.377 -42.608)respectively; the median survival time was 46 months (95% CI: 39.216-52.784) and 28 months (95% CI : 18.842-37.158) respectively. (Table1,2)(Figure3)

CONCLUSION

Radiomics features based on the 18F-FDG PET/CT combining with clinical pathological data could have the potential to predict EGFR mutation type, moreover, associated with patients' prognosis, thus providing reference for individualized molecular targeted therapy.

CLINICAL RELEVANCE/APPLICATION

Radiomics features based on the 18F-FDG PET/CT could have the potential to predict EGFR mutation type.

SST06-07 18F-FDG PET-CT Can Predict the Major Pathologic Response to the Neo-Adjuvant PD-1 Blockade in Resectable Non-Small Cell Lung Cancer

Friday, Dec. 6 11:30AM - 11:40AM Room: E353B

Participants
Xiuli Tao, Beijing, China (*Presenter*) Nothing to Disclose
Ning Wu, MD, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Jie He, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Shugeng Gao, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
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Jianming Ying, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Yun Ling, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Wei Tang, Beijing, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To investigate if 18F-FDG PET-CT has the potential to predict the major pathologic response to the neoadjuvant PD-1 blockade in resectable NSCLC patients.

METHOD AND MATERIALS

From March 2018 to March 2019, 35 patients with resectable NSCLC (the largest diameter of the pulmonary mass was 2.0 cm or larger) who were eligible to the open-label, single-center, single-arm phase Ib clinical trial with PD-1 blockade (IBI308) as neoadjuvant therapy treatment were enrolled. All patients received two doses of intravenous PD-1 blockade (at a dose of 200mg) every 2 weeks. PET-CT scan was performed before neoadjuvant therapy (baseline) and 4 weeks after the first dose (before surgery). PET responses were classified using PET response criteria in solid tumors (PERCIST). Peak standardized uptake values normalized by lean body mass (SULpeak) were measured, and post-treatment percentage changes in SULpeak (ΔSULpeak%) were calculated. The above metabolic information on FDG-PET was correlated with the surgical pathology.

RESULTS

After 4 weeks of neoadjuvant PD-1 blockade treatment, all 35 patients were under surgery, and the major pathological response (MPR, defined as 10% or less residual viable tumor) occurred in 13 of 35 resected tumors (37%). 13 patients (37%) showed partial metabolic response (PMR), 21 (60%) had stable metabolic disease (SMD), and 1 (3%) had progressive metabolic disease (PMD). There was a significant correlation between the pathological response and the PET responses which were classified using PET response criteria in solid tumors (PERCIST). All (100%) the partial metabolic response (PMR, ΔSULpeak% < -30%) tumors showed the major pathological response (MPR, defined as 10% or less residual viable tumor). The patient who had progressive metabolic disease (PMD, ΔSULpeak% > 30%) was progressive confirmed by the biopsy of the pleural metastasis.

CONCLUSION

18F-FDG PET-CT can predict the major pathologic response to the neoadjuvant PD-1 blockade in resectable non-small cell lung cancer.

CLINICAL RELEVANCE/APPLICATION

Metabolic responses by 18F-FDG uptake which were classified using PET response criteria in solid tumors (PERCIST) are significant associated with therapeutic response at 4 weeks after PD-1 blockade treatment. Even if morphological changes on CT scans are investigated to evaluate the response to PD-1 blockade at an early phase, it is difficult to distinguish between responders and non-

responders. Thus, the uptake of 18F-FDG PET-CT appears to be a promising biomarker for sift patients who probably benefit form immunotherapy.

SST06-08 Relationship between the Expression of PD-L1 and F-FDG Uptake in Advanced Non-Small Cell Lung Cancer (NSCLC)

Friday, Dec. 6 11:40AM - 11:50AM Room: E353B

Participants
Wang Huoqiang, MD, Shanghai, China (*Presenter*) Nothing to Disclose
Zhao Long, MD, Shanghai, China (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

Programmed cell death-ligand 1 (PD-L1) have been identified as novel targets of immunotherapy of lung cancer. To our knowledge, all published studies of the relationship between the 18F-FDG uptake of lung cancer and PD-L1 expression were performed in patients undergoing surgical resection. However, majority of reports have demonstrated the superiority of PD-L1 inhibitors as a therapy for patients with advanced lung cancer. The purpose of this study is to investigate the predictive value of 18F-fluorodoxyglucose positron emission tomography/computed tomography (18F-FDG PET/CT) in evaluating PD-L1 expression in advanced non-small cell lung cancer (NSCLC).

METHOD AND MATERIALS

From January 2017 to December 2018, advanced NSCLCs were retrospectively identified in 154 consecutive patients who underwent 18F-FDG PET/CT scan and PD-L1 expression test. The histopathological results were confirmed by aspirated or biopsied samples. The maximum standardized uptake value (SUVmax) of 18F-FDG uptake were calculated for the primary lesion. Associations between quantitative continuous variables and PD-L1 expression were investigated by using the Mann-Whitney U test. This study was approved by the institutional review board of our hospital.

RESULTS

PD-L1 expression were identified in 77 patients (50%). PD-L1 expression of NSCLC occurred more frequently in larger lesions ($p = 0.039$), higher SUVmax value ($p = 0.019$), KRAS mutation-positive ($p = 0.048$). PD-L1 expression of adenocarcinoma (ADC) occurred more frequently in larger lesions ($p = 0.022$), higher SUVmax value ($p = 0.043$). The receiver operating characteristic (ROC) curve yielded area under the curve (AUC) values of 0.596 (95%CI, 0.506-0.686, $p = 0.039$) and 0.633 (95%CI, 0.509-0.756, $p = 0.043$) for NSCLC and ADC, respectively.

CONCLUSION

We demonstrated that higher 18F-FDG uptake may be helpful in predicting PD-L1 expression of advanced NSCLC, especially advanced ADC.

CLINICAL RELEVANCE/APPLICATION

For the first time, we demonstrated that PD-L1 expression were more frequent in advanced NSCLC with higher 18F-FDG uptake.

SST06-09 The Role of 18F-FDG SPECT/CT in Predicting Expression of PD-1/PD-L1 in Surgically Resected Non-Small Cell Lung Cancer (NSCLC)

Friday, Dec. 6 11:50AM - 12:00PM Room: E353B

Participants
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Zhao Long, MD, Shanghai, China (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

Although 18F-fluorodoxyglucose positron emission tomography/computed tomography (18F-FDG PET/CT) has been widely used, there are still many hospitals performing 18F-FDG single photon emission computed tomography/computed tomography (18F-FDG SPECT/CT) scan. In previous studies, 18F-FDG SPECT/CT was a reliable tool in evaluation of malignant tumours, which were concordant with 18F-FDG PET/CT. At present, some studies have demonstrated a correlation between PD-1/PD-L1 expression and SUVmax in NSCLC, but the relationship between PD-1/PD-L1 expression and T/NT value are not clear. The purpose of this study is to investigate the value of 18F-FDG SPECT/CT predicting expression of PD-1/PD-L1 in NSCLC.

METHOD AND MATERIALS

From July 2014 to May 2016, NSCLCs were retrospectively identified in 229 consecutive patients who underwent 18F-FDG SPECT/CT scan and PD-1/PD-L1 expression test. The histopathological results were confirmed by resected samples. Tumor-to-normal tissue (T/NT) uptake ratios of 18F-FDG were calculated for the primary lesion.

RESULTS

PD-1 and PD-L1 expression were identified in 120 patients (52.4%) and 81 patients (35.4%), respectively. PD-L1 expression occurred more frequently in males ($p = 0.013$), larger lesions ($p < 0.001$), higher T/NT value ($p < 0.001$), T3/4 stage ($p = 0.002$), III stage ($p = 0.002$). In multivariate analysis, T/NT was significantly associated with PD-L1 expression. PD-1 expression occurred more frequently only in patients with higher T/NT value ($p = 0.028$). The receiver operating characteristic (ROC) curve yielded area under the curve (AUC) values of 0.685 (95%CI, 0.615-0.756, $p < 0.001$) and 0.568 (95%CI, 0.512-0.659, $p = 0.025$) for PD-L1 and PD-1 expression, respectively.

CONCLUSION

We demonstrated that T/NT value of FDG uptake may be helpful in predicting PD-1/PD-L1 expression, which is consistent with results of 18F-FDG PET/CT. In some countries, 18F-FDG SPECT/CT scan is covered by medical insurance, while 18F-FDG PET/CT is not, which enhances the clinical value of 18F-FDG SPECT/CT scan for cost reasons.

CLINICAL RELEVANCE/APPLICATION

For the first time, we demonstrated that PD-1/PD-L1 expression were more frequent in NSCLC with higher T/NT value.

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