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Predictors of Tolerability of Lu-PSMA-617 Therapy Based on a Single Hospital Experience. Rylen Stratford DO, Benjamin A. Gartrell, MD, Kenny Ye, PhD and Lionel S. Zuckier, MD. Montefiore Medical Center and the Albert Einstein College of Medicine, Bronx, NY 10461

Introduction: ^{177}Lu-PSMA-617 ("Pluvicto") is a new therapy introduced into the clinic for prostate cancer. Not all patients are able to tolerate the full course of 6 therapies due to toxicity or disease progression. As a QA initiative we wanted to better understand tolerability and predictive factors.

Methods: We retrospectively reviewed records of Pluvicto administration for patients initiated over 14 months between 2/20/2023 to 4/23/2024 including age, BMI, PSA levels, creatinine, HgB, WBC, platelets, bilirubin, albumin, Karnofsky score. Statistical significance was determined at a 0.05 level, 1- or 2-tailed.

Results: 33 prostate cancer pts consented for treatment however only 28 patients began receiving either the full (200 mCi) (n=26) or reduced (160 cmi) (n=2) dose of Pluvicto. Of these, 23 pts (82% of total) progressed to the second, 18 (78% of prior) progressed to the third, 13 (72% of prior) progressed to the fourth, 9 (69% of prior) progressed to the fifth, and 7 (78% of prior) progressed to sixth and final round of therapy, representing only 25% of original starters. Reasons for discontinuation included progression of disease, decline in renal function, and overwhelming morbidity. The factors at consult most predictive of number of treatments tolerated was Karnofsky score (p=.005) and HgB (p=.05). Age, BMI, creatinine, CBC, baseline PSA and others were not predictive. At each therapy, most predictive factors for reaching next treatment were Karnofsky score (p=.003) and HgB (p=0.002); other factors were not statistically significant.

On 26 pts who began receiving 200 mCi, 4 (15%) had dose reduced to 160 mCi during course of treatment, 3 of whom could not progress to the next therapy. Of 7 pts who completed therapy, 5 (71%) were receiving the full 200 mCi dose.

Conclusions: 15% of consented pts failed to initiate therapy and there was subsequent ~24% attrition following each treatment due to progression of disease or toxicity. Karnofsky score and Hgb were the only successful predictors of number of treatments tolerated.

POSTER # 6

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THE GREATER NEW YORK AND NEW ENGLAND CHAPTERS
SOCIETY OF NUCLEAR MEDICINE
AND
MOLECULAR IMAGING
HUSSEIN M. ABDEL-DAYEM, MD AWARD
NORTHEAST REGIONAL MEETING
SOCIETY OF NUCLEAR MEDICINE AND
MOLECULAR IMAGING

PSMA PET/CT Radiotracer Uptake in the Base of Prostate: Differential Considerations

Luis Octavio Tierradentro-Garcia, MD; Katerina Lee, MD; Sophia R. O'Brien, MD, MSEd; David Tischfield, MD, PhD; Austin Patel, MD, MSTR; Karthik Sundaram, MD, PhD.

Department of Radiology, Hospital of the University of Pennsylvania, Perelman School of Medicine, University of Pennsylvania.

Introduction

Prostate-specific membrane antigen (PSMA) PET/CT is an advanced imaging modality used for detection, staging, and monitoring of prostate cancer. PSMA-specific radiopharmaceuticals avidly bind to PSMA receptors expressed by malignant prostate cells and PSMA-expressing metastatic disease. However, increased PSMA radiotracer uptake can also occur in benign prostatic processes and distinguishing between benign and malignant uptake is crucial for appropriate patient management.

Objective

To highlight common situations in which benign prostatic processes may show increased PSMA radiotracer uptake.

Case presentation / Imaging findings:

Case 1

A 68-year-old male with elevated PSA levels underwent random biopsy of the bilateral prostate and found to have a focus of Gleason 4 + 3 = 7 in the right prostate. Subsequent MRI of the prostate (volume 54 mL) suggested three PIRADS 4 lesions in the left posterior base and right peripheral zone. A subsequent F-18 piflufolastat PSMA PET/CT showed mild radiotracer activity (SUV max 3.6) in the central zone bilaterally, as well as mild uptake in multiple left external iliac and inguinal nodes and bilateral axillary nodes, all favored to be reactive (**Fig. 1**) No dominant lesion in the prostate was noted by PET. The patient ultimately underwent radical prostatectomy that showed disease in only 1-5% of the prostate. The abnormal radiotracer uptake in the left prostate may have reflected an inflammatory response to a biopsy performed one month earlier. Another possible explanation is central zone compression, as referenced in the literature (**Fig 2-3**).

Case 2

A 67-year-old male with elevated PSA levels underwent dedicated prostate MRI (volume 79 mL). Findings demonstrated a PIRADS 4 lesion in the right posterolateral peripheral zone in the mid-gland. F-18 piflufolastat PSMA PET/CT showed avidity corresponding to the PI-RADS 4 lesion. Additional radiotracer avidity was found in the central transition zone, left peri-urethral transition zone from the mid-gland to the apex, and symmetrically in the bilateral prostate base. When correlated to the MRI, the central transition zone uptake correlated to urethra while the uptake in the prostate base correlated to the central zone. Patient underwent targeted and 12-core systematic biopsy. The results demonstrated Gleason 4+3=7 disease in the PI-RADS 4 lesion and mid-gland of the right peripheral zone. No additional sites of disease were noted. The radiotracer uptake, MRI findings, and biopsy were concordant. However, given discordance in the central transition zone, left peri-urethral transition zone, and central zone, we postulate uptake on the left may represent non-specific localization of radiotracer due to physiological reasons (**Fig. 4**). The patient subsequently underwent radiation therapy.

Case 3

A 66-year-old male with elevated PSA and prior systematic biopsy with a focus of Gleason 3+3=6 disease at the right prostate base. Patient underwent prostate MRI (volume 53 mL) which demonstrate no suspicious lesions. The patient underwent repeat systematic biopsy which demonstrate benign disease at the right prostate base but Gleason 3+3=6 disease at the left lateral mid prostate, right prostate mid-gland, and right apex. A focus of peri-neural invasion was noted from the disease in the right apex. Given concern for potentially extra-prostatic disease, the patient underwent dedicated PSMA PET/CT with piflufolastat F-18 within two months of the patient's prostate MRI, which showed intense radiotracer focal uptake at the right mid-gland to apex (SUV max 3.9), which may correspond to site of concern with Gleason 3+3=6 disease with perineural invasion , and faint diffuse uptake in the central zone **(Fig.5)**. Patient continues in active surveillance.

Discussion/Conclusion:

We present three cases demonstrating mild, symmetric increased PSMA radiotracer uptake in the prostate base corresponding to central zone of the prostate without evidence of a focal lesion on MRI or clinically significant prostate cancer. In these cases, focal uptake could represent chronic prostatitis as previously suggested, physiological

due to lower urinary tract symptoms and urinary reflux, or non-specific uptake due to a unknown mechanism.

Post-radiotherapy changes can also lead to false-positive PSMA PET/CT findings. Residual benign tissue or indolent tumor remnants expressing PSMA can be misinterpreted as malignant. Additionally, inflammatory processes or infection within the prostate can lead to increased radiotracer uptake, mimicking malignancy. Understanding potential false positives in PSMA uptake is crucial, particularly in patients who still have prostates in place post-radiation therapy.

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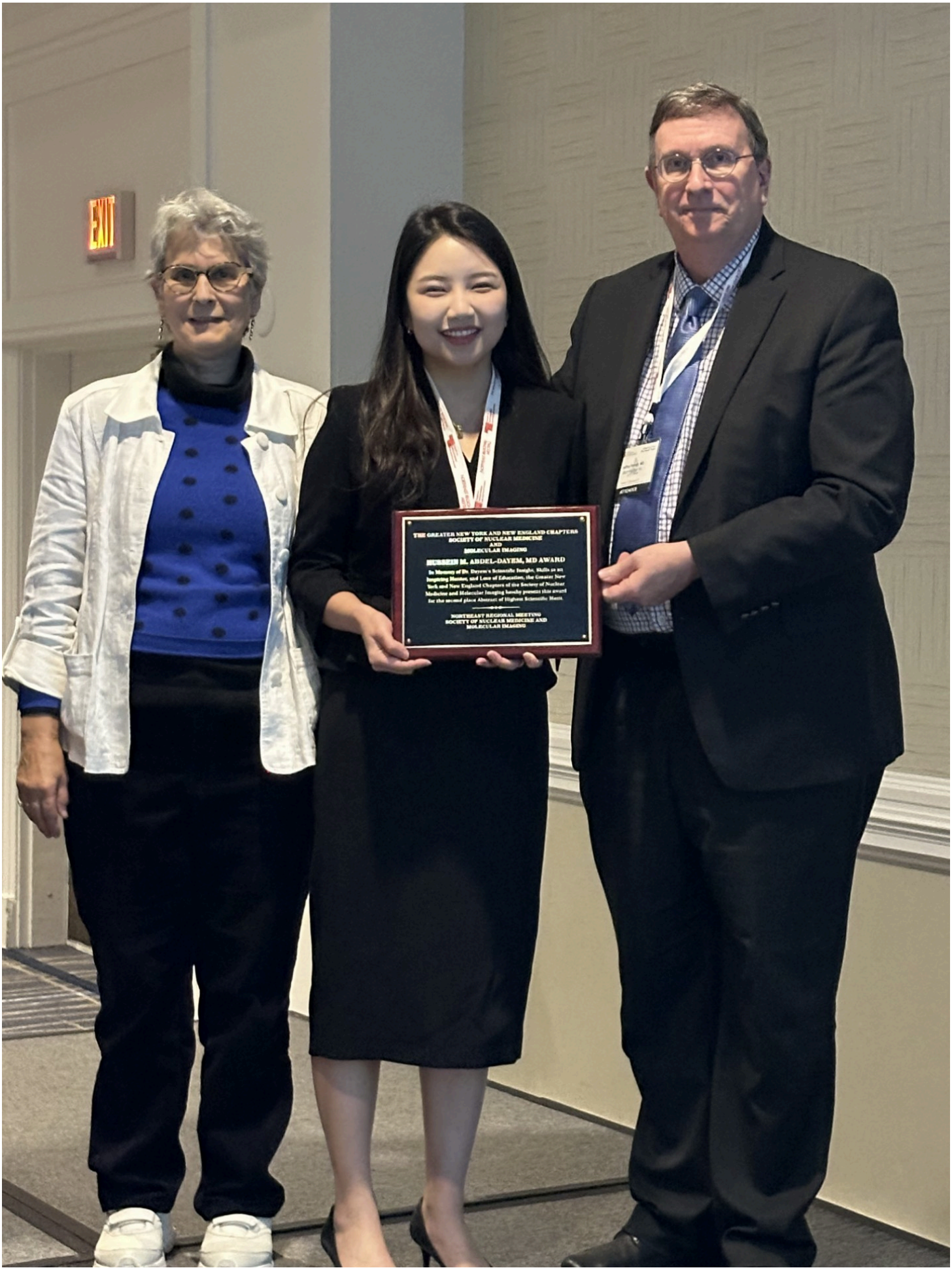
POSTER # 7


EXIT
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Technetium-99m Generator Elution and Quality Control: A Step-by-Step Simulation for Residents

Ryan C. Stoner MD, Kyle Stumetz DO, Robert Wulpern CNMT, Alan H. Siegel MD (faculty advisor)
Geisel School of Medicine at Dartmouth, Dartmouth-Hitchcock Medical Center, Lebanon, NH

Background
Per American Council of Graduate Medical Education (ACGME) and Nuclear Regulatory Commission (NRC) requirements for graduate medical education in diagnostic radiology, training programs must include hands-on work experience in the operational and quality control mechanisms involved in the day-to-day practice of nuclear medicine. Given the increased reliance on technetium-99m (Tc99m) produced by offsite commercial pharmacies, diagnostic radiology programs need alternative methods for providing instruction in the generation of this radiopharmaceutical and the quality control procedures needed prior to administration. This project provides step-by-step, pictorial simulation for the elution of Tc99m from a molybdenum99 (Mo99)/Tc99m generator and subsequent quality tests for Mo99 breakthrough (radionuclide purity) and alumina impurity (chemical purity).

Methods
Photographs were obtained of the simulated steps of Tc99m generator elution and quality control. First, a decommissioned generator (*previously used and which has since decayed to background radiation levels*) was eluted utilizing a saline charge and an evacuated vial to collect the elution. Second, the eluate was place into a dose calibrator to simulate measurement for potential Mo99 breakthrough. Third, testing for alumina was performed by comparing eluate placed on biochemical test strips to that of control solution placed on the same strips. Simulated control solution and test strips were created.

Results
A step-by-step, pictorial demonstration of elution and subsequent quality control tests for safe preparation of Tc99m was created. This exercise fulfills ACGME and NRC requirements for training in diagnostic radiology in the subspeciality of nuclear medicine.

Conclusions
Operational knowledge and experience in nuclear medicine are required for diagnostic radiology training and important for profession practice after residency. The simulated elution and quality control for the Tc99m presented here provides the necessary practical experience for residents to understand and replicate these skills in future practice.

POSTER # 1

Metastatic Renal Cell Carcinoma Incidentally Detected on PSMA PET/CT: Comparison With FDG PET/CT and Implications for Management

William Y. Raynor, MD[1], Stephen J. Sozio, DO, MBS[1], Anthony Yudd, MD, PhD, FACR[1], Tina Mayer, MD[2], Jeffrey S. Kempf, MD, FACR[1]

1. Department of Radiology, Rutgers Robert Wood Johnson Medical School, New Brunswick, NJ, USA.
2. Division of Medical Oncology, Rutgers Cancer Institute of New Jersey, New Brunswick, NJ, USA.

Background: Prostate-specific membrane antigen (PSMA) PET/CT employs radiotracers such as ^{68}Ga-PMSA-11, ^{18}F-DCFPyL, and ^{18}F-rhPSMA-7.3, which bind to the transmembrane protein PSMA and have entered clinical use in the staging and restaging of prostate cancer. However, additional tumors such as clear cell renal cell carcinoma (ccRCC) have also been found to overexpress the PSMA receptor, resulting in high PSMA uptake and potentially indicating a role for PSMA PET/CT in the evaluation of other solid tumors. We present a case of ccRCC which was incidentally detected on ^{18}F-DCFPyL PET/CT and also later imaged by ^{18}F-fluorodeoxyglucose (FDG) PET/CT, helping to direct the course of treatment.

Methods: ^{18}F-DCFPyL PET/CT was performed for assessment of biochemical recurrence of prostate cancer in a 77-year-old patient. At the time of initial prostate cancer diagnosis, his PSA was 6.2 ng/mL. He subsequently underwent radical prostatectomy, which revealed adenocarcinoma with Gleason score 7 (3 + 4) and peri-prostatic extension. The patient subsequently received radiation therapy to the pelvis, after which his PSA returned to undetectable levels. Approximately two decades later, he developed biochemical recurrence and underwent subsequent PSMA PET/CT with PSA of 1.0 ng/mL at the time of imaging. Abnormal PSMA uptake was present in the right iliac region, suspected to represent metastatic prostate cancer. There was additional PSMA localization to the region of the right renal vein and inferior vena cava (IVC), compatible with suspected tumor thrombus (SUVmax 8.8). There was a suspected right renal mass with only mild PSMA uptake, not detected on a recent outside contrast-enhanced CT of the abdomen and pelvis. PSMA-avid right paratracheal disease was also present (SUVmax 8.4), which was of indeterminate etiology. FDG-PET/CT was then performed for staging of the renal mass, which showed the right paratracheal nodal metastasis with only low level uptake (SUVmax 2.3), lesion in the upper pole of the right kidney, and tumor thrombus extending to the IVC (SUVmax 3.6).

Results: Right nephrectomy was performed which revealed ccRCC in the kidney extending to the renal vein and IVC, with fine needle aspiration of the right paratracheal mass confirming ccRCC metastasis. Restaging of metastatic ccRCC was performed with FDG PET/CT, which showed no evidence of local recurrence in the right nephrectomy bed as well as no significant change in the paratracheal metastasis. Several months later, partial response of the paratracheal ccRCC metastasis to stereotactic body radiation therapy (SBRT) was incidentally observed on repeat ^{18}F-DCFPyL PET/CT (SUVmax 4.8) performed for surveillance of metastatic prostate cancer. Continued imaging surveillance is planned with systemic therapy for ccRCC to be considered only if there is imaging evidence of disease progression.

Conclusions: While both the ccRCC primary tumor and mediastinal metastasis demonstrated PSMA and FDG uptake, PSMA uptake was higher at both sites. In addition, PSMA PET/CT was able to characterize the partial response of the paratracheal mass to radiotherapy. These observations further support the utility of PSMA PET/CT in identifying and monitoring ccRCC, suggesting evaluation of ccRCC as a possible future clinical indication for PSMA PET/CT.

POSTER # 2

Role of Nuclear Medicine Studies for Diagnosis and Monitoring Infections Associated with Left Ventricular Assist Devices (LVADs)

Ghazaleh Mehdipour, MD[1]; Rakan Al-Qaqa, MD[1] Kwang J. Chun, MD[1]

1 From the Division of Nuclear Medicine, Department of Radiology, Montefiore Medical Center, The University Hospital for Albert Einstein College of Medicine.

Background:

Left ventricular assist devices (LVADs) are increasingly used in the management of patients with heart failure as a bridge to cardiac transplantation. LVAD infection is a serious complication affecting 25% to 80% of patients, which may lead to death if left untreated. Infections can involve various LVAD components, and localization is crucial for treatment planning. LVAD infection may involve driveline entry point, subcutaneous driveline path, pump pocket, and outflow tract. Accurate localization can guide surgical intervention or conservative therapy. Diagnosis can be challenging as the symptoms might be nonspecific, and computed tomography (CT) is not always diagnostic due to device-related artifacts. We aim to present several examples where nuclear medicine studies were used for the diagnosis of infection and discuss the advantages and limitations of various nuclear medicine studies in diagnosis and localization of LVAD infections.

Methods:

We present imaging of patients with suspected LVAD driveline infections who underwent Gallium-67 studies, white blood cell (WBC) scans, and 18F-fluorodeoxyglucose positron emission tomography-computed tomography (FDG PET/CT) and discuss the advantages and limitations of each test in the clinical setting.

Results:

The Gallium-67 study employs one of the most commonly used radiopharmaceuticals for imaging inflammation and infection. Images are usually obtained 48-72 hours after injection. For patients with suspected driveline infection, images can be combined with single photon emission computed tomography (SPECT-CT) for higher diagnostic accuracy. As seen in cases 1-4, planar and SPECT-CT images showed focal increased radiotracer activity suggestive of driveline infection in the abdomen and subcutaneous skin infection at the driveline exit site. While Gallium-67 remains a valuable tool, WBC scans, though less commonly used, still play a role in identifying infection, especially in cases where other modalities are unavailable or for follow-up. Blood is drawn and labeled with either Indium-111 oxine or Technetium-99m hexamethylpropylene amine oxime, then re-injected into the patient, and images are obtained

after 24 hours. An example is seen in Case 5, where the infection site was first confirmed with Gallium-67 SPECT-CT. A subsequent Indium-111 WBC scan confirmed the patient's response to antibiotic treatment. 18F-FDG PET/CT is also useful due to its high sensitivity (approximately 95%) for detecting LVAD infection and localization (case 6). PET/CT result interpretation requires careful clinical correlation, as inflammatory and post-surgical changes might show some increased uptake. In addition, its use faces challenges in clinical practice, such as higher costs, interdepartmental coordination, and logistical challenges associated with outpatient settings, which can ultimately restrict access for inpatients, making it more difficult for both patients and clinicians to utilize this imaging modality.

Conclusions:

Nuclear medicine plays a key role in diagnosis and follow-up of LVAD infections, allowing for whole-body imaging to detect the extent of infections. SPECT/CT can help localize infection and guide patient-specific treatment plans, including surgical intervention, conservative therapy, and evaluation of treatment response.

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POSTER # 3

Calvarial Intraosseous Venous Malformation (Hemangioma) Diagnosed on Technetium-99m labeled RBC Scan: A Case Report

Stephen J. Sozio, DO, MBS[1], William Y. Raynor, MD[1], Murray C. Becker, MD, PhD[1], Dhruv Patel, MD[1], Jeffrey S. Kempf, MD, FACR[1]

1. Rutgers Robert Wood Johnson Medical School, Department of Radiology, New Brunswick, NJ

Background: Venous malformations, previously termed "hemangiomas," are commonly encountered, slow-growing, non-aggressive tumors consisting of small and large caliber vascular channels. These malformations can be encountered throughout the osseous structures of the body, most commonly within the vertebrae and skull. In cases where these masses do not present with the typical hallmark X-Ray, CT, or MRI findings, a Technetium-99m labeled Red Blood Cell (RBC) scan may be performed, in which delayed imaging reveals pooling of tagged RBCs within the venous malformation, without a corresponding initial increase in blood flow. While such examination has been historically associated with diagnosis of venous malformations of the liver (hepatic hemangiomas), the same fundamental principles can be applied to these venous malformations throughout the body, including within the musculoskeletal system.

Methods: A retrospective chart review was performed of a single patient suffering an indeterminate mass of the calvarium. Relevant clinical history and imaging findings were reviewed. Current literature regarding the use of technetium-99m labeled RBC scan in the diagnosis of intraosseous venous malformations will be reviewed.

Results: A 25-year-old woman initially presented to a neurologist in 2016 for new onset of seizures and intermittent panic attacks, at which time a non-contrast MRI Brain revealed a T2 hyperintense, mildly T1 hyperintense mass within the occipital calvarium, which was suspected to be a calvarial venous malformation (hemangioma). She was then lost to follow-up, but underwent a repeat non-contrast MRI Brain examination in 2024 for headaches, upon which the follow-up examination revealed an increase in size of the calvarial lesion from 1.6 cm to 2.4 cm, which was again felt to represent a probable hemangioma. As a confirmatory imaging examination, Technetium-99m labeled RBC scan was recommended, which revealed no abnormal increase in blood flow to the lesion, but internal pooling of tagged RBCs on delayed imaging, compatible with an occipital intraosseous venous malformation (hemangioma). In this exhibit, current literature and case reports on this topic will also be presented.

Conclusion: Technetium-99m labeled RBC scan may be an effective problem-solving tool in the diagnosis of intraosseous venous malformations (hemangiomas), and can be considered when results of conventional imaging techniques are indeterminate, as opposed to immediate histologic correlation.

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POSTER # 4

Effect of PSMA PET/CT on utilization of ^{18}F-fluciclovine PET/CT in patients with prostate carcinoma at a university-based imaging center

Paige Bennett, MD, Christopher Caravella, MHA, LNMT, RT(N)(CT), Kenneth J. Nichols, PhD, Christopher J. Palestro, MD
Donald and Barbara Zucker School of Medicine at Hofstra/Northwell, Hempstead NY; USA

Background: We observed at our university-based imaging centers that when prostate specific membrane antigen (PSMA) PET/CT became available, the volume of the synthetic amino acid radiotracer ^{18}F-fluciclovine (fluciclovine) PET/CT performed on patients with prostate cancer decreased significantly. The objective of this investigation was to study the effect of PSMA PET/CT on fluciclovine PET/CT during a five-year period around United States Food and Drug Administration (US FDA) approval of PSMA PET/CT in December 2020 and its implementation at our imaging centers. We tested the hypothesis that the rate of decline of fluciclovine PET/CT accelerated following approval of PSMA PET/CT, as physicians planned for use of PSMA PET/CT in patients with prostate carcinoma.

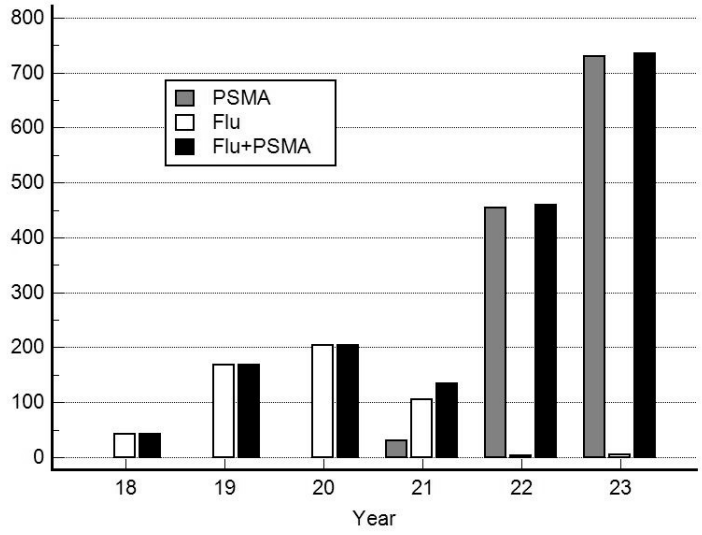
Methods: Our clinical report system was searched for fluciclovine PET/CT and PSMA PET/CT from January 2018 through December 2023. Clinical implementation of fluciclovine PET/CT at our centers occurred in Quarter 3 of 2018. Clinical implementation of PSMA PET/CT at our centers occurred in Quarter 3 of 2021. Fluciclovine PET/CT and PSMA PET/CT were performed using standard protocols and included imaging from skull base to thigh and skull vertex to knees, respectively. Quantitative and statistical analyses were performed.

Results: Annualized average fluciclovine PET/CT peaked at 51.0 cases/mo in 2020, and subsequently decreased over time. There were 42 fluciclovine PET/CTs performed in 2018, 168 in 2019, 204 in 2020, 105 in 2021, 4 in 2022 and 5 in 2023. There were 30 PSMA PET/CTs in 2021, 455 in 2022 and 731 in 2023. See Table 1. Fluciclovine PET/CT monthly averages declined by -49% from 2021 to 2022 and by -96% from 2022 to 2023, while PSMA PET/CT monthly averages increased by +1,416% from 2021 to 2022 and by +61% from 2022 to 2023. These dramatic changes occurred after US FDA approval of PSMA PET/CT in mid-2021. There was a significantly greater decline in fluciclovine PET/CT cases from 2022 to 2023 (-96%) compared to the decrease from 2021 to 2022 (-49%) ($p < .0001$). The steepest quarterly decline in fluciclovine PET/CT (-94%) coincided with the greatest quarterly increase in PSMA PET/CT (+400%), which occurred at the outset of PSMA PET/CT implementation in Q4 of 2021. The decline in fluciclovine PET/CT as PSMA PET/CT increased continued into Q4 2023, when the percentages of PSMA PET/CT and fluciclovine PET/CT were 99% and 1% ($p < 0.0001$) out of total cases, respectively.

Conclusions: At our imaging centers, the utilization of fluciclovine PET/CT for prostate carcinoma has virtually ceased and correlates with the implementation of

PSMA PET/CT. Various factors were likely related, including studies showing higher rate of lesion detection with PSMA PET/CT, implementation of new clinical practice indications, and factors influencing insurance reimbursement. These data illustrate changes in workflow that occur in the nuclear medicine clinic when new agents are introduced.

Table 1. Number of PSMA and fluciclovine PET/CTs performed each year, as well as total number of fluciclovine and PSMA PET/CTs performed per year.



POSTER # 5

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Introduction: ^{177}Lu-PSMA-617 ("Pluvicto") is a new therapy introduced into the clinic for prostate cancer. Not all patients are able to tolerate the full course of 6 therapies due to toxicity or disease progression. As a QA initiative we wanted to better understand tolerability and predictive factors.

Methods: We retrospectively reviewed records of Pluvicto administration for patients initiated over 14 months between 2/20/2023 to 4/23/2024 including age, BMI, PSA levels, creatinine, HgB, WBC, platelets, bilirubin, albumin, Karnofsky score. Statistical significance was determined at a 0.05 level, 1- or 2-tailed.

Results: 33 prostate cancer pts consented for treatment however only 28 patients began receiving either the full (200 mCi) (n=26) or reduced (160 cmi) (n=2) dose of Pluvicto. Of these, 23 pts (82% of total) progressed to the second, 18 (78% of prior) progressed to the third, 13 (72% of prior) progressed to the fourth, 9 (69% of prior) progressed to the fifth, and 7 (78% of prior) progressed to sixth and final round of therapy, representing only 25% of original starters. Reasons for discontinuation included progression of disease, decline in renal function, and overwhelming morbidity. The factors at consult most predictive of number of treatments tolerated was Karnofsky score (p=.005) and HgB (p=.05). Age, BMI, creatinine, CBC, baseline PSA and others were not predictive. At each therapy, most predictive factors for reaching next treatment were Karnofsky score (p=.003) and HgB (p=0.002); other factors were not statistically significant.

On 26 pts who began receiving 200 mCi, 4 (15%) had dose reduced to 160 mCi during course of treatment, 3 of whom could not progress to the next therapy. Of 7 pts who completed therapy, 5 (71%) were receiving the full 200 mCi dose.

Conclusions: 15% of consented pts failed to initiate therapy and there was subsequent ~24% attrition following each treatment due to progression of disease or toxicity. Karnofsky score and Hgb were the only successful predictors of number of treatments tolerated.

POSTER # 6

PSMA PET/CT Radiotracer Uptake in the Base of Prostate: Differential Considerations

Luis Octavio Tierradentro-Garcia, MD; Katerina Lee, MD; Sophia R. O'Brien, MD, MSEd; David Tischfield, MD, PhD; Austin Patel, MD, MSTR; Karthik Sundaram, MD, PhD.

Department of Radiology, Hospital of the University of Pennsylvania, Perelman School of Medicine, University of Pennsylvania.

Introduction

Prostate-specific membrane antigen (PSMA) PET/CT is an advanced imaging modality used for detection, staging, and monitoring of prostate cancer. PSMA-specific radiopharmaceuticals avidly bind to PSMA receptors expressed by malignant prostate cells and PSMA-expressing metastatic disease. However, increased PSMA radiotracer uptake can also occur in benign prostatic processes and distinguishing between benign and malignant uptake is crucial for appropriate patient management.

Objective

To highlight common situations in which benign prostatic processes may show increased PSMA radiotracer uptake.

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A 68-year-old male with elevated PSA levels underwent random biopsy of the bilateral prostate and found to have a focus of Gleason 4 + 3 = 7 in the right prostate. Subsequent MRI of the prostate (volume 54 mL) suggested three PIRADS 4 lesions in the left posterior base and right peripheral zone. A subsequent F-18 piflufolastat PSMA PET/CT showed mild radiotracer activity (SUV max 3.6) in the central zone bilaterally, as well as mild uptake in multiple left external iliac and inguinal nodes and bilateral axillary nodes, all favored to be reactive (**Fig. 1**) No dominant lesion in the prostate was noted by PET. The patient ultimately underwent radical prostatectomy that showed disease in only 1-5% of the prostate. The abnormal radiotracer uptake in the left prostate may have reflected an inflammatory response to a biopsy performed one month earlier. Another possible explanation is central zone compression, as referenced in the literature (**Fig 2-3**).

Case 2

A 67-year-old male with elevated PSA levels underwent dedicated prostate MRI (volume 79 mL). Findings demonstrated a PIRADS 4 lesion in the right posterolateral peripheral zone in the mid-gland. F-18 piflufolastat PSMA PET/CT showed avidity corresponding to the PI-RADS 4 lesion. Additional radiotracer avidity was found in the central transition zone, left peri-urethral transition zone from the mid-gland to the apex, and symmetrically in the bilateral prostate base. When correlated to the MRI, the central transition zone uptake correlated to urethra while the uptake in the prostate base correlated to the central zone. Patient underwent targeted and 12-core systematic biopsy. The results demonstrated Gleason 4+3=7 disease in the PI-RADS 4 lesion and mid-gland of the right peripheral zone. No additional sites of disease were noted. The radiotracer uptake, MRI findings, and biopsy were concordant. However, given discordance in the central transition zone, left peri-urethral transition zone, and central zone, we postulate uptake on the left may represent non-specific localization of radiotracer due to physiological reasons (**Fig. 4**). The patient subsequently underwent radiation therapy.

Case 3

A 66-year-old male with elevated PSA and prior systematic biopsy with a focus of Gleason 3+3=6 disease at the right prostate base. Patient underwent prostate MRI (volume 53 mL) which demonstrate no suspicious lesions. The patient underwent repeat systematic biopsy which demonstrate benign disease at the right prostate base but Gleason 3+3=6 disease at the left lateral mid prostate, right prostate mid-gland, and right apex. A focus of peri-neural invasion was noted from the disease in the right apex. Given concern for potentially extra-prostatic disease, the patient underwent dedicated PSMA PET/CT with piflufolastat F-18 within two months of the patient's prostate MRI, which showed intense radiotracer focal uptake at the right mid-gland to apex (SUV max 3.9), which may correspond to site of concern with Gleason 3+3=6 disease with perineural invasion , and faint diffuse uptake in the central zone **(Fig.5)**. Patient continues in active surveillance.

Discussion/Conclusion:

We present three cases demonstrating mild, symmetric increased PSMA radiotracer uptake in the prostate base corresponding to central zone of the prostate without evidence of a focal lesion on MRI or clinically significant prostate cancer. In these cases, focal uptake could represent chronic prostatitis as previously suggested, physiological

due to lower urinary tract symptoms and urinary reflux, or non-specific uptake due to a unknown mechanism.

Post-radiotherapy changes can also lead to false-positive PSMA PET/CT findings. Residual benign tissue or indolent tumor remnants expressing PSMA can be misinterpreted as malignant. Additionally, inflammatory processes or infection within the prostate can lead to increased radiotracer uptake, mimicking malignancy. Understanding potential false positives in PSMA uptake is crucial, particularly in patients who still have prostates in place post-radiation therapy.

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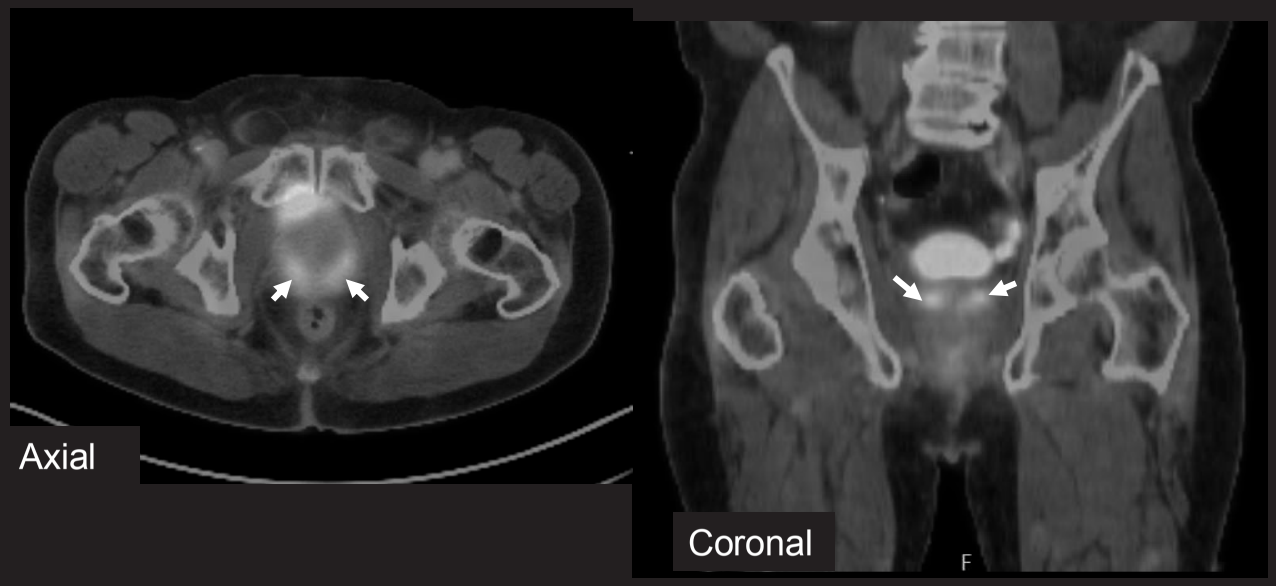
POSTER # 7

PSMA PET/CT Radiotracer Uptake in the Base of Prostate: Differential Considerations

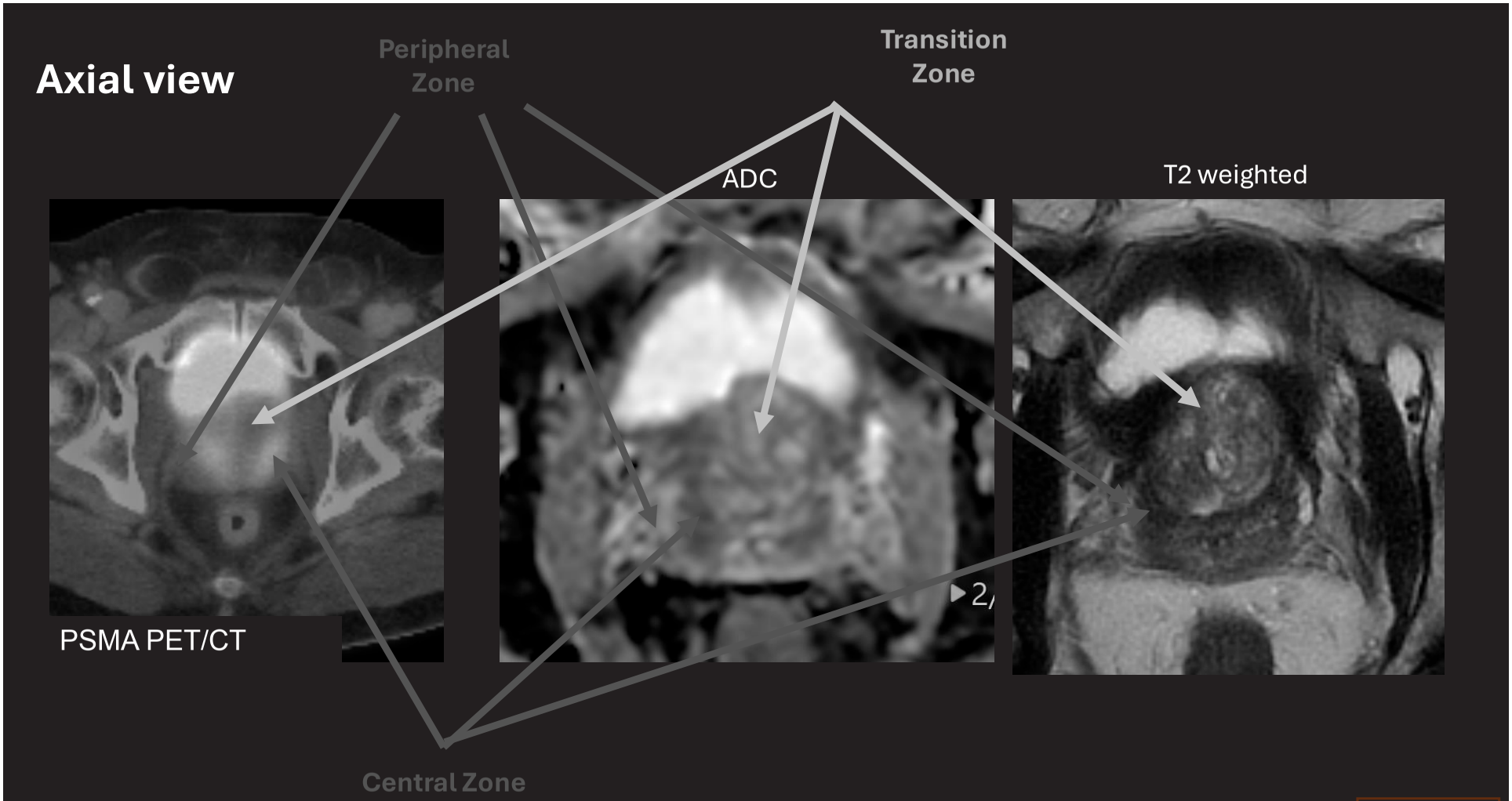
Luis O. Tierradentro-Garcia, MD; Katerina Lee, MD; Sophia R. O'Brien, MD, MSEd;
David Tischfield, MD, PhD; Austin Patel, MD, MSTR; Karthik Sundaram, MD, PhD

Department of Radiology, Hospital of the University of Pennsylvania
Perelman School of Medicine, University of Pennsylvania.



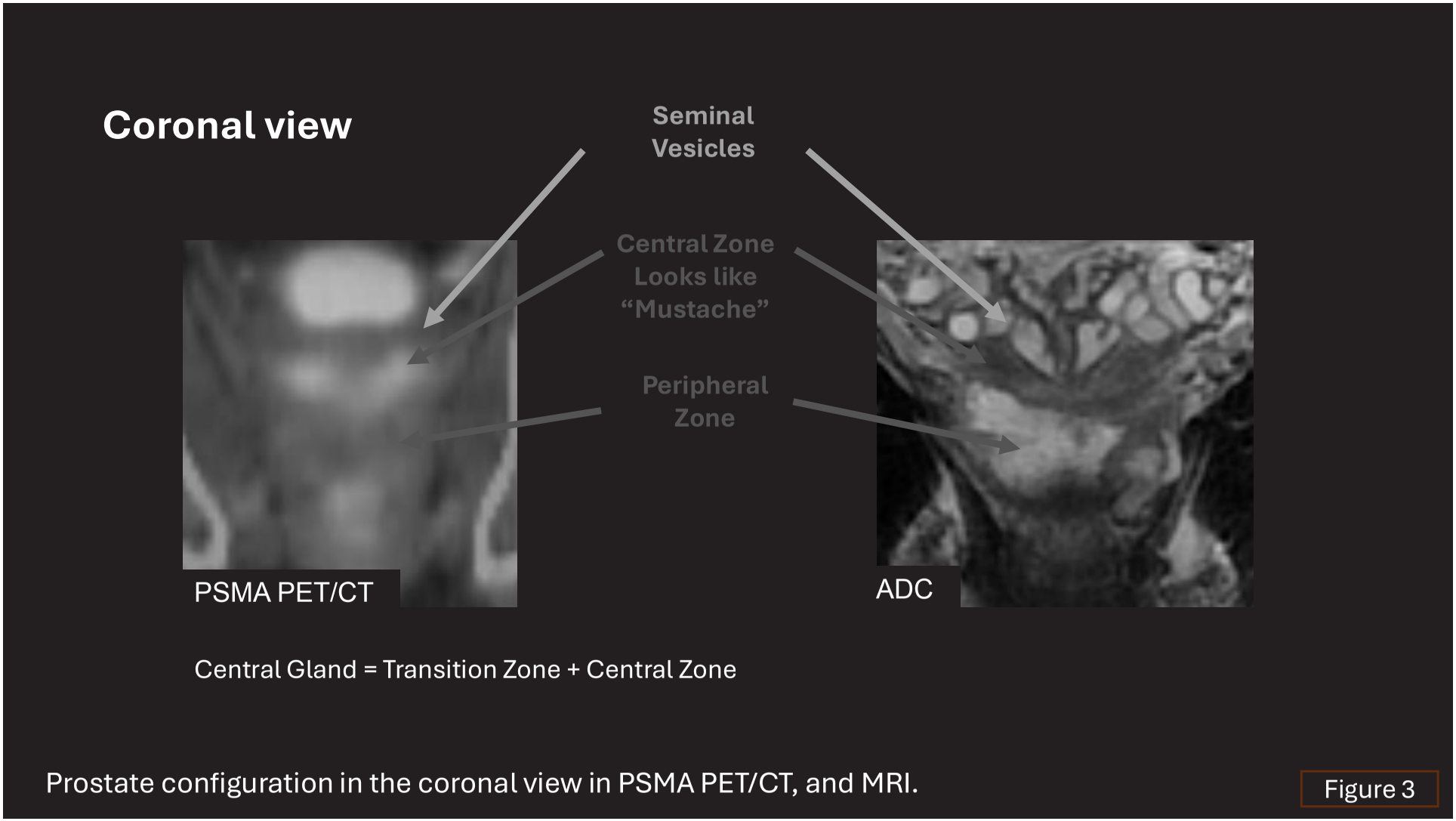
68-year-old with elevated PSA. Axial (A) and coronal (B) PSMA PET/CT images show bilateral uptake in the central zone (arrows).

Figure 1



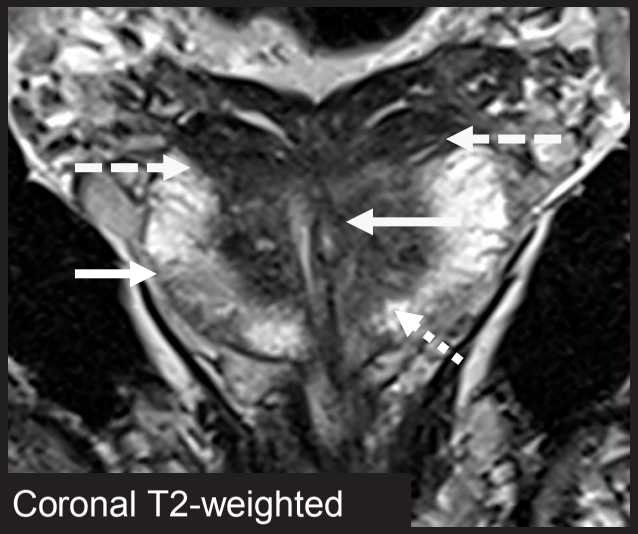
Prostate configuration in the axial view in PSMA PET/CT and MRI.

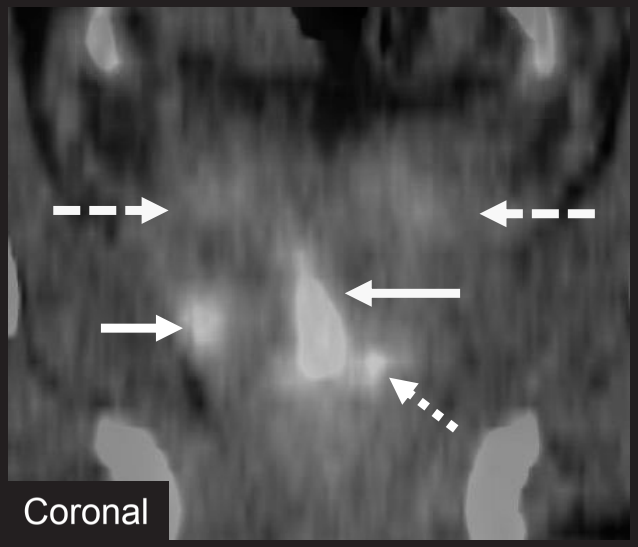
Figure 2

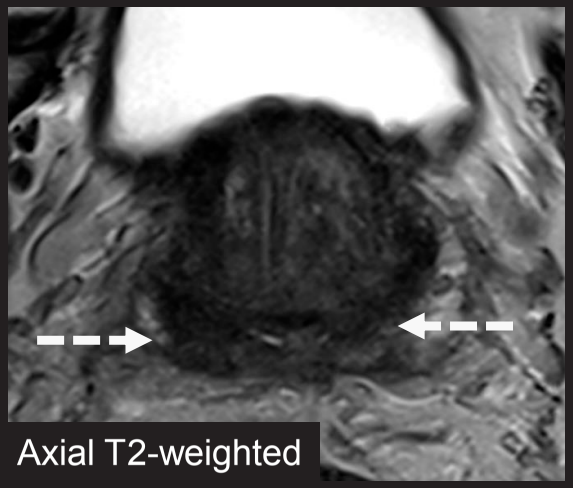


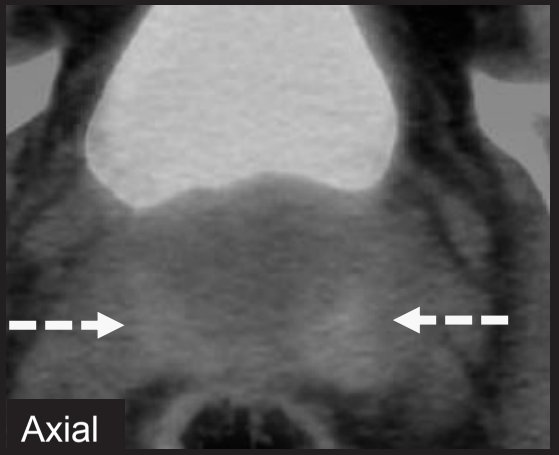
Prostate configuration in the coronal view in PSMA PET/CT, and MRI.

Figure 3



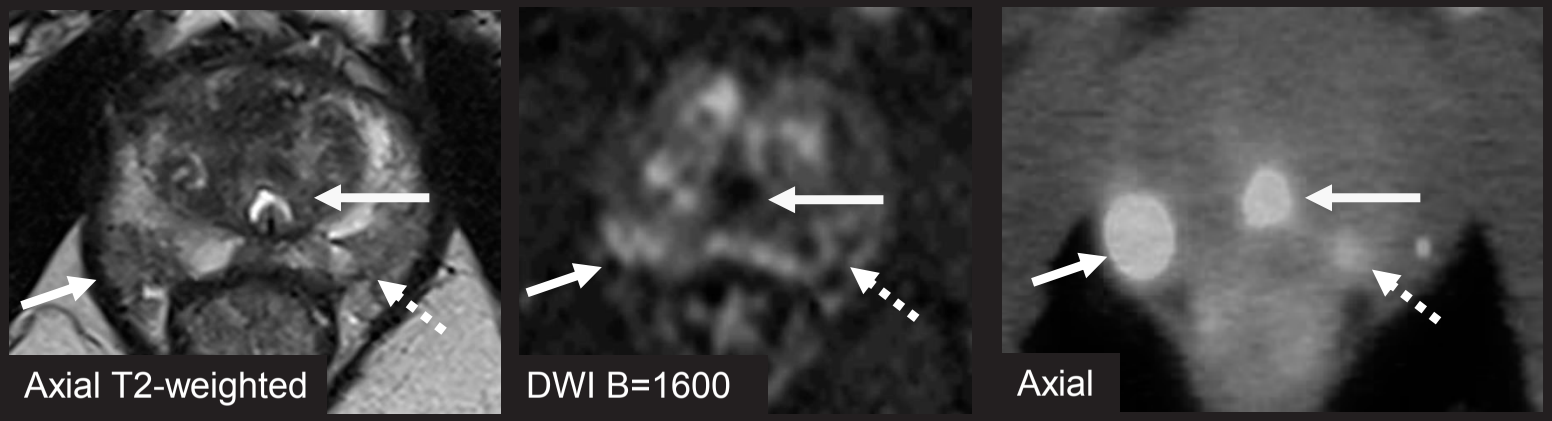






67-year-old man with elevated PSA. T2-weighted, DWI and PET/CT fusion images demonstrate foci of avidity in the right mid prostate (white solid arrow) and left peri-urethral prostate at the mid-gland to apex (dashed arrows). Systematic and targeted MR fusion biopsy demonstrated Gleason 3+4=7 disease in the right mid-gland peripheral zone and PI-RADS 4 lesion. Increase radiotracer activity in the urethra (yellow arrow) and central zone of the prostate (dashed yellow arrows).

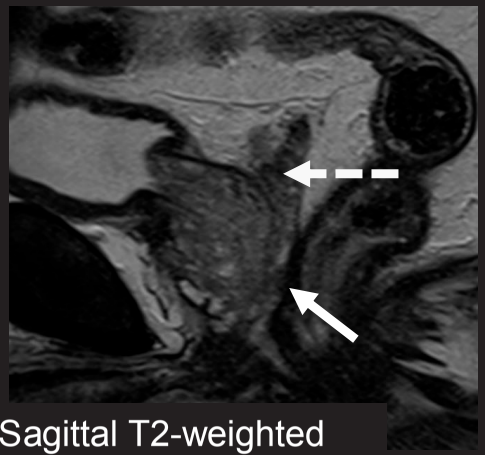
Figure 4



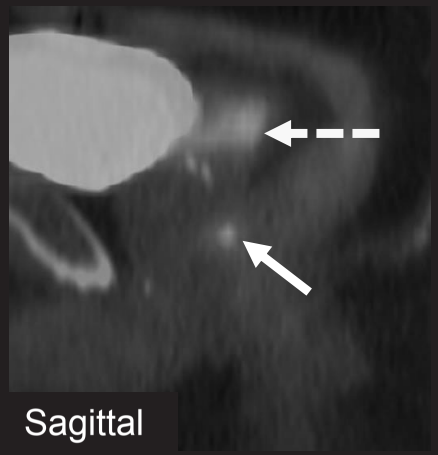
67-year-old man with elevated PSA. T2-weighted, DWI and PET/CT fusion images demonstrate foci of avidity in the mid prostate posterior bilateral peripheral zones (white solid and dashed arrows). Systematic MR fusion biopsy demonstrated Gleason 3+4=7 disease on the right only. Increase radiotracer activity in the urethra (yellow arrow) and central zone of the prostate (dashed yellow arrows).

Dashed yellow arrow – central zone uptake (faint)
Yellow arrow – Urethra
White arrow – clinically significant prostate cancer
Dashed white arrow – increased uptake but no cancer confirmed on biopsy

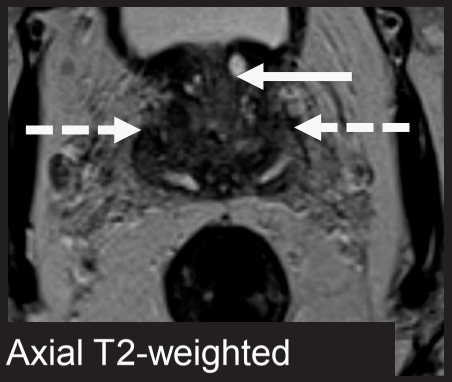
Figure 4



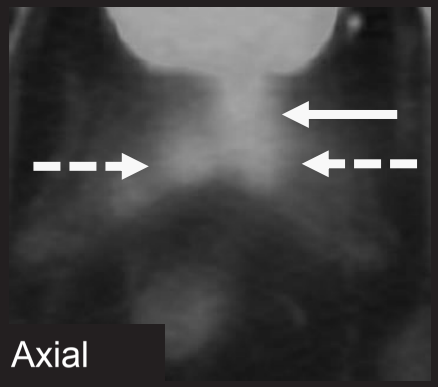
Sagittal T2-weighted



Sagittal



Axial T2-weighted



Axial

66-year-old man with elevated PSA.

Left column. Sagittal and axial T2-weighted image with central zone and T2-hypointense focus at the right mid-gland to apex.

Right column.
Corresponding PSMA-PET with radiotracer uptake and diffuse uptake in the central zone.

Dashed yellow – central zone uptake (faint)
Yellow arrow – Urethra
White arrows – questionable focus of disease

Figure 5

[^{18}F]Fluoroestradiol PET/CT to clarify an equivocal bone lesion seen on MRI and bone scan

Katerina Lee MD, Luis Tierradentro MD, Peter Park MD, Daniel Levine MD, Ryan McClintock MD, Sophia R. O'Brien MD MSEd, Austin R. Pantel MD MSTR

Patient presentation:

A 52-year-old female with estrogen receptor 100% (ER+), progesterone receptor 50%, human epidermal growth factor receptor 2 (HER2) negative multicentric invasive ductal carcinoma of the left breast presented for magnetic resonance (MR)-guided biopsy of a third left breast mass with no lymphadenopathy. On breast MRI (Figure 1), a 6-mm enhancing sternal lesion was discovered adjacent to the sternomanubrial joint, suspicious for metastasis. For further investigation, a [^{99m}Tc]-hydroxydiphosphonate (HDP) whole-body bone scan was performed (Figure 2), which revealed mild uptake in the area of concern at the sternomanubrial joint. Given that this region not uncommonly demonstrates degenerative uptake, this uptake was deemed nonspecific. Subsequently, an [^{18}F]Fluoroestradiol (FES) PET/CT scan was performed for diagnostic clarification. Leveraging FES PET/CT to evaluate an "equivocal or suspicious" finding on other imaging tests is one of the 4 SNNMI appropriate uses of FES PET/CT[1].

Imaging Findings:

Figure 1. Initial post-contrast MRI showed a 6-mm focus of enhancement within the sternum, concerning for metastatic disease. Subsequent whole-body bone scan was recommended.

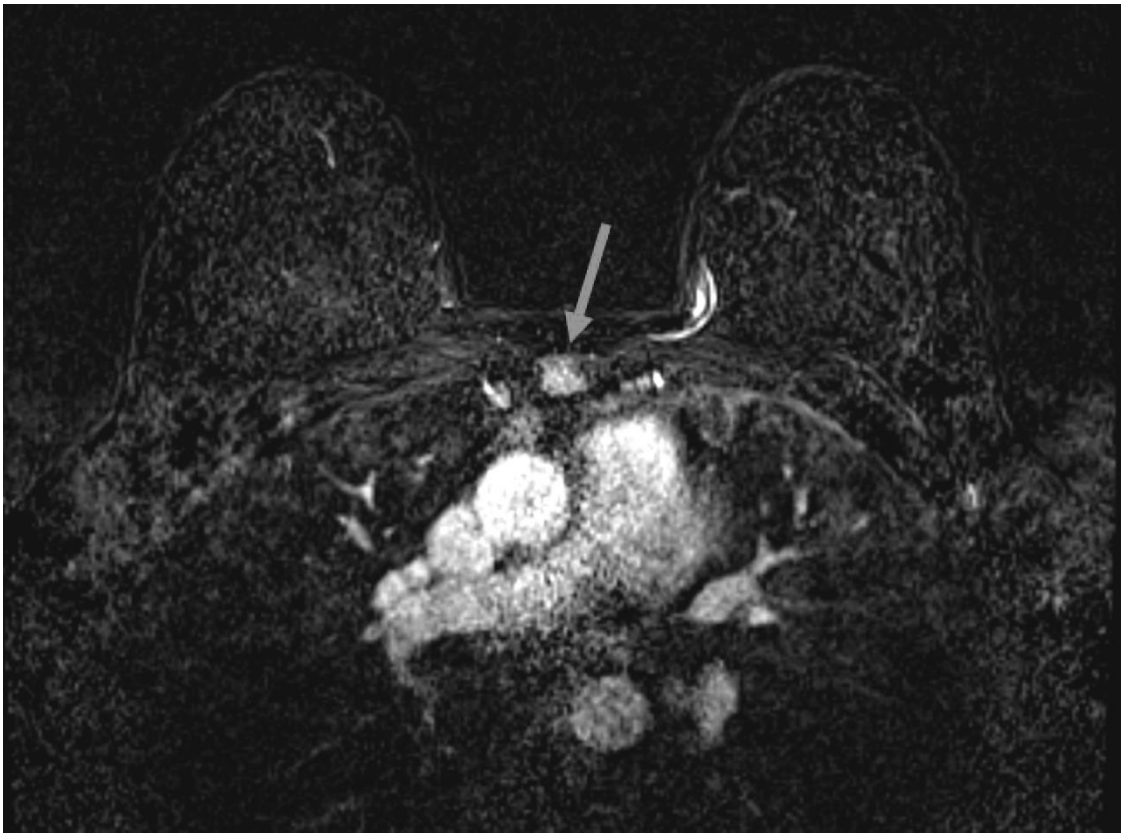


Figure 2. [^{99m}Tc]-HDP whole-body bone scan was obtained (with a frontal spot image of the thorax shown with the arms raised) demonstrated a focus of mild uptake seen at the sternomanubrial joint. Given that degenerative uptake is often seen in this region, this was deemed nonspecific and an [^{18}F]FES PET/CT was recommended for further evaluation due to the initial suspicion raised by the MRI in combination with the multicentric nature of the patient's disease.

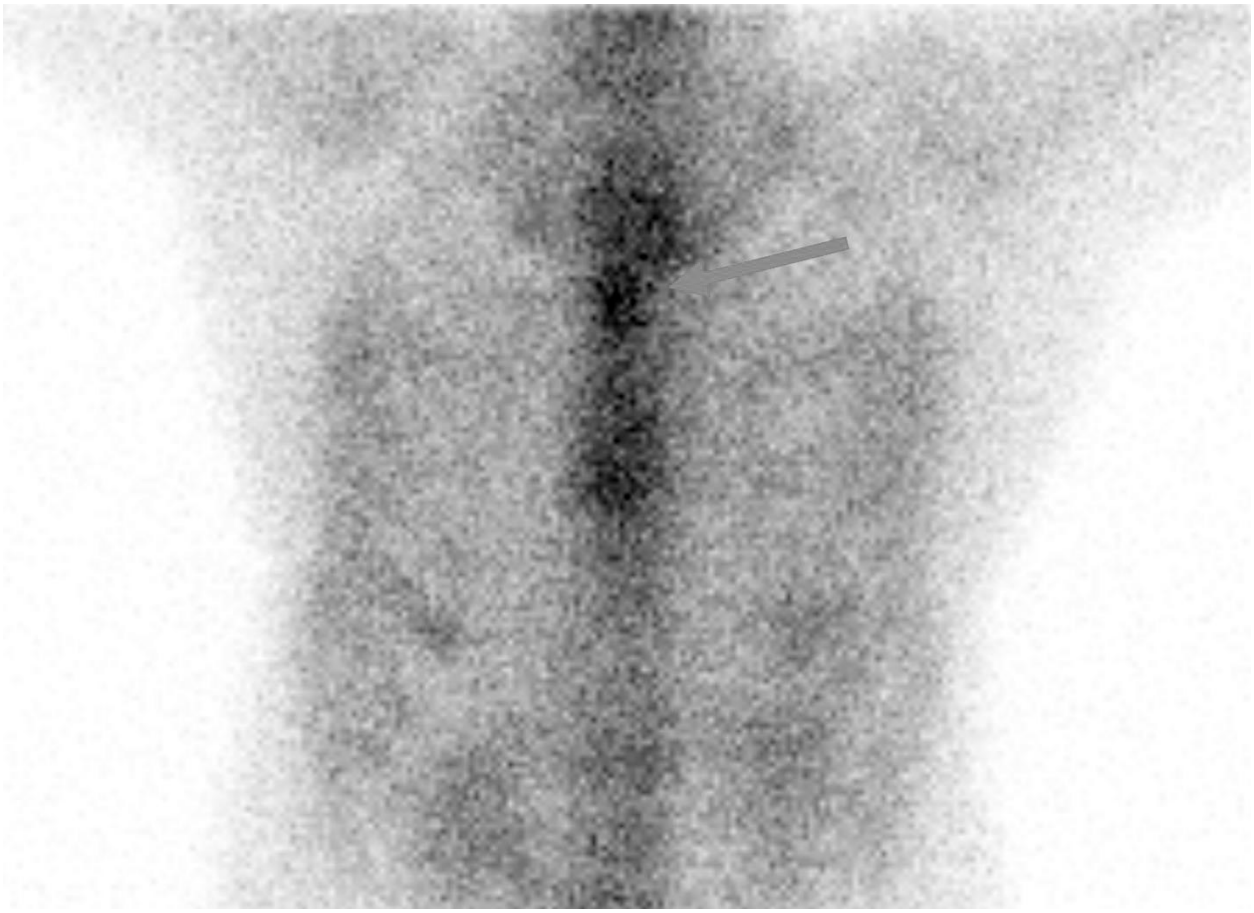
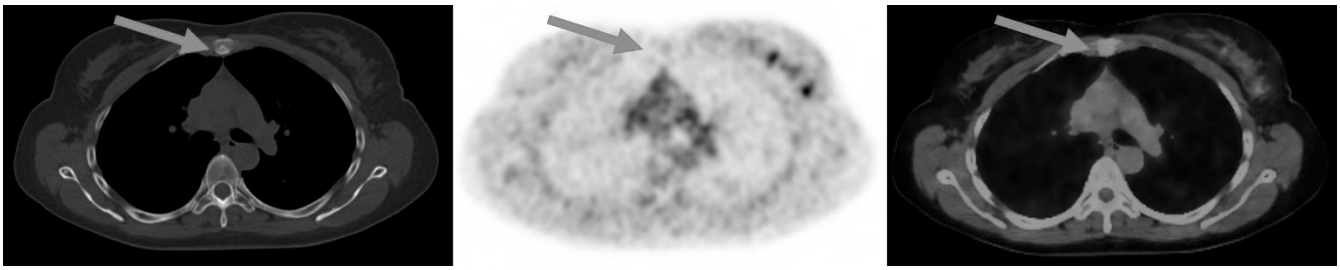


Figure 3. [^{18}F]FES PET/CT showed no abnormal radiotracer uptake above background in the area of concern to suggest an ER+ osseous metastasis. Absence of [^{18}F]FES uptake does not exclude an ER-negative osseous metastasis; however, this possibility was felt to be unlikely given the patient has a recent diagnosis of ER+ breast cancer which was not previously treated. Additionally, further analysis of the MRI images by MSK radiology colleagues suggested degenerative change. This patient was also discussed at multidisciplinary tumor board.



Discussion with Literature Review:

Diagnosing metastases in joints and articular surfaces can be a challenging to due to interference from common degenerative features, such as subchondral sclerosis, erosive changes, and synovitis[2]. In our patient, the 6-mm enhancing lesion on MRI and mild focus of radiotracer uptake on the whole-body bone scan were both inconclusive because they were at the sternomanubrial joint, a common site of degenerative changes. Because our patient was not taking any ER blocking therapy, an FES PET/CT was performed, which showed no uptake, confirming that this was not ER+ breast cancer.

For a multidisciplinary tumor board, nuclear medicine and MSK radiologists reviewed this patient's imaging including MR, CT, whole-body bone scan, and FES PET/CT and concluded that this initial suspicious lesion was degenerative rather than a metastatic lesion. The enhancement on initial MR may have been due to synovitis or fibro-cartilaginous disc. Similar to our MR findings, a recent retrospective analysis of sternal lesions noted that 80% of presumed benign lesions had contrast enhancement[3].

Conclusions:

[^{18}F]FES PET/CT has diagnostic utility in patients who have ER+ breast cancer and are not taking ER blocking therapy. As in our case, in patients with newly diagnosed ER+ breast cancer and low suspicion for metastatic disease, FES PET/CT can aid in differentiating metastatic lesions from benign findings, thereby guiding treatment planning appropriately. It should be noted, however, that for patients with recurrent breast cancer or previously treated ER+ breast cancer, the possibility of an FES-negative lesion representing an ER-negative metastasis should be more strongly considered.

For a poster presentation, we will present this case with relevant images and include this discussion. In addition, we will provide a brief overview of clinical scenarios where [^{18}F]FES PET/CT may be appropriate, referencing the recently published SNMMI Appropriate Use Criteria[1]. In particular, we will discuss *Scenario #14: Detecting ER status when other imaging tests are equivocal or suggestive*, apropos to this case and with ample supporting literature.

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POSTER # 8

Is Definitive External Beam Radiation Therapy Effective in Treatment of Prostate Cancer as Determined by serum PSA and PSMA PET-CT imaging?

Safah Majid[3], BS, Yi Li[1,2] , MD, Simin Dadparvar[1], MD;
Division of Nuclear Medicine and Molecular Imaging**,** Department of Radiology, Temple University Hospital[1], Fox Chase Cancer Center[2] and Lewis Katz School of Medicine at Temple University [3], Philadelphia, PA 19140

Background: External beam radiation therapy stands as a cornerstone in the management of localized disease in prostate cancer. However, despite advancements in radiation techniques and delivery, a considerable proportion of patients with prostate cancer experience disease recurrence, noted by an increase in prostate-specific antigen (PSA) levels following initial response to therapy detected by PET/ CT imaging with prostate-specific membrane antigen (PSMA).
Methods: We retrospectively reviewed 76 recurrent prostate cancer patients (age range 59-92, mean age 73.8 years) between February 4, 2022- June 14, 2024, with suspicion for metastasis (showed evidence of biochemical recurrence) and had known metastasis who underwent PSMA PET/CT scans post-radiation therapy. The patients' initial PSA and Gleason scores were reviewed. Patients' response to radiation with PSA was measured. Following recurrence with elevation of PSA level the PET/CT study was performed with 8-10 mCi of F-18 DCFPyL, 3-7 mCi of Ga-68 LOCAMETZ or 3–7 mCi Ga-68 PSMA-11 (ILLUCCIX) intravenously. Studies were compared with bone scintigraphy as well as anatomical imaging of CT/ MRI.
Results: The median PSA level at initial diagnosis was 9.42 ng/ml (range, 2.20 to 2000), while the median PSA level at the time of biochemical recurrence was 2.05 ng/ml (IQR, 4.16). The median Gleason score among patients was 7 (range (2+1) to (5+5). Notably, 75 of 76 (98.7%) patients showed evidence of local recurrence, regional metastasis, and distant metastasis. 63 of the 76 patients (82.9%) exhibited local recurrence in the prostate, as identified by PSMA PET/CT imaging. Of these patients, the range of the highest SUV max at the positive PET was 1.9 to 77.5. Additionally, 29 patients (38.16%) had nodal metastasis, 5 patients (6.6%) presented with visceral metastasis, and 25 patients (32.9%) showed bone metastasis. Of the 62 patients with local recurrence, 38 (61.3%) had a higher Gleason grade (3-5).
Conclusion: PSMA PET/CT study is a very sensitive test in detection of recurrent prostate cancer, as it can detect PSA levels as low as 0.14 ng/ml. Despite definitive external beam radiation treatment to the prostate gland, this study demonstrated that as high as 98.7% of our patient population showed persistent or recurrence in the prostate gland, as well as regional and distant metastasis. In patients with rising PSA and higher Gleason scores, especially those at a higher risk, we recommend PSMA PET/CT to evaluate the extent of the disease for a better treatment strategy.

Supplemental Data

Characteristics	**Positivity Rate**
PSA 0-0.49 ng/mL	6/76 (7.9%)
PSA 0.5-0.99 ng/mL	8/76 (10.5%)

PSA 1-1.99 ng/mL	23/76 (30.3%)
PSA > 1.99 ng/mL	39/76 (51.3%)
Gleason grade 1	5/72* (6.9%)
Gleason grade 2	24/72 (33.3%)
Gleason grade 3	8/72 (11.1%)
Gleason grade 4	15/72 (20.8%)
Gleason grade 5	20/72 (27.8%)

**Of 76 patients, 4 patients did not have documented Gleason grades.*

POSTER # 9

Title: Diagnosis of Post-Renal Transplant Urinary Leak Using Renal Scintigraphy with SPECT/CT Correlation

Zahra Karimi, MD, Justin Zhang, MD, Arleen Li, MD, Surita Banerjee, MD, Kwang J. Chun, MD.

Department of Radiology, Division of Nuclear Medicine, Montefiore Medical Center/ The university Hospital for Albert Einstein College of Medicine

Background: A common early complication following kidney transplantation is fluid collection, which can arise from various causes, including lymphoceles, urine leaks, hematomas, and seromas. While these fluid collections may be asymptomatic, they can also present with symptoms such as swelling and pain around the allograft, wound drainage, lower limb swelling, and hidden blood loss. (1,2)

To facilitate early and accurate diagnosis, several imaging techniques are employed. Ultrasound is particularly useful for detecting postoperative complications; however, it often struggles to differentiate the specific nature of these collections, which is essential for effective management. The limitation of IV contrast use in the early post-transplant phase also restricts the utility of CT for evaluating leaks (3). In this context, renal scintigraphy emerges as a promising modality for detecting urinary leaks in these patients.

Methods/Results: We present three cases of post-renal transplant urinary leaks identified through renal scans with corresponding SPECT/CT correlation in two of them.

Case 1) A 48-year-old male with a kidney transplant presented 3 weeks post-operation with scrotal swelling and pain. CT and ultrasound showed multiple fluid collections. The renal scan revealed urinary activity below the transplanted kidney, corresponding to a well-defined collection lateral to the urinary bladder on SPECT/CT. A significant amount of urine was noted to extend inferiorly through the inguinal canal into the scrotum. The patient underwent interventional radiology-guided drainage with catheter placement.

Case 2) A 68-year-old male presented 3 weeks after renal transplant with new abdominal pain, rising creatinine levels, and new ascites observed on ultrasound. Due to the unavailability of Tc99m MAG3 in the afternoon, Tc99m DTPA was administered. Radiotracer activity was detected within the abdominal ascites in bilateral flanks on SPECT/CT, indicating a urinary leak. The patient underwent ureteral reimplantation.

Case 3) A 60-year-old male with double renal transplants presented with abdominal pain. Ultrasound revealed multiple fluid collections surrounding the transplant. A CT scan with contrast identified a 19-cm hematoma surrounding the renal transplants, with a few foci of air in the posterior aspect of the collection. The renal scan demonstrated satisfactory perfusion to both

transplanted kidneys, along with a small urinary leak from the lower portion of the medially located transplanted kidney. Due to high clinical suspicion for a urinary leak, the patient was taken immediately to the operating room for open repair of the UPJ leak, without further confirmatory imaging. The patient had another renal scan a few years later, which raised concerns for a urinary leak. Due to the unavailability of SPECT/CT, correlation was made with a KUB, which showed intestinal radiotracer activity due to hepatobiliary excretion of Tc99m MAG3, ruling out a urinary leak.

Conclusion: Renal scintigraphy can be a valuable tool for evaluating post-transplant urine leaks and distinguishing them from other causes of fluid collection, such as hematomas, in the early post-transplant phase. Additionally, SPECT/CT correlation can accurately assess both the location and extent of a urine leak in positive cases. When SPECT/CT is unavailable, correlations can be made with other imaging modalities, such as KUB.

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POSTER # 10

Title: Evaluating the Role of Bone Scintigraphy with SPECT/CT correlation in the Diagnosis of Calciphylaxis

Zahra Karimi, MD, Justin Zhang, MD, Millie Yu, MD, Eduardo Sanchez Perez, MD, Kwang J. Chun, MD.

Department of Radiology, Division of Nuclear Medicine, Montefiore Medical Center/ The university Hospital for Albert Einstein College of Medicine

Background: Calciphylaxis is a rare but severe vascular condition characterized by calcification of small blood vessels in the subcutaneous fat and dermis, leading to painful ischemic skin lesions with a poor prognosis (1). Calciphylaxis can be classified into uremic and non-uremic forms. The uremic type is typically seen in patients with end-stage renal disease (ESRD), while the non-uremic type is associated with conditions such as obesity and diabetes. Lesions can develop in both central and peripheral areas. Diagnosis is typically confirmed via skin biopsy, which reveals arteriolar calcifications. However, non-invasive imaging techniques including X-Ray, CT and bone scintigraphy, offer alternative diagnostic tools (2,3). Bone scintigraphy using technetium-99m methyl diphosphonate (Tc-99m MDP) has shown high sensitivity and specificity in early studies for detecting calciphylaxis (4). Tc-99m MDP targets hydroxyapatite crystals found in dermal and subcutaneous calcifications, making it a valuable tool in identifying systemic calciphylaxis before skin lesions appear. It holds potential as a screening method for high-risk patients.

Method/Results: We present three cases where bone scintigraphy aided in the diagnosis of calciphylaxis.
Case 1)
A 56-year-old female with stage III chronic kidney disease and obesity presented with persistent plaques and eschar on her left calf that had not responded to antibiotics. Bone scan showed normal blood flow and pooling. However, delayed imaging showed increased radiotracer uptake in the soft tissues of the left lower extremity below the knee, corresponding to intense radiotracer activity in the anteromedial pretibial soft tissue on SPECT-CT, consistent with calciphylaxis. There were also other areas of less intense radiotracer activity in the soft tissues of both lower extremities, with the left side being more affected, consistent with early phase of disease progression in these regions. Notably, no calcifications were observed on low-dose CT.

Case 2)
A 40-year-old female with ESRD on hemodialysis presented with painful, ulcerated wounds on her hips and thighs after a prolonged period of immobilization with clinical suspicion for calciphylaxis. X-Ray and CT were negative for soft tissue calcifications. A Tc-99m MDP bone

scintigraphy with SPECT-CT demonstrated abnormal radiotracer uptake in the soft tissues of the bilateral buttocks and lateral pelvis. SPECT-CT confirmed subcutaneous radiotracer deposits, compatible with calciphylaxis.

Case 3)
A 55-year-old male with Hodgkin's lymphoma and normal renal function presented with painful bilateral thigh ulcers that had persisted for two months. The bone scan revealed mild radiotracer activity in the thigh ulcers on both early and 24-hour delayed images, with corresponding mild activity noted on SPECT-CT. Unexpectedly, more significant radiotracer uptake was observed in the bilateral calves on 24-hour delayed images with corresponding uptake on SPECT/CT and subcutaneous calcifications on low dose CT. The findings suggested early calciphylaxis in the calves, while the thigh changes were likely reactive.

Conclusion: Bone scintigraphy has the potential to play a crucial role in evaluating calciphylaxis by identifying active disease, determining its extent, guiding biopsy locations, and monitoring treatment response. This imaging modality is especially valuable for diagnosing calciphylaxis in its early stages, which could lead to significant improvements in patient outcomes.

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POSTER # 11

Dual Tracer Imaging with FDG and FES PET of Breast Cancer Brain Metastasis

Joshua Lim MD[1], Josephine Rini MD[1], Mehdi Djekidel MD[1]

1. Northwell Health. New York.

Background: Molecular Imaging of primary and metastatic brain tumors has been successfully done over the past twenty years using a variety of PET probes. FDG PET currently still plays an important role in the evaluation of post radiation necrosis and recurrence. On the other hand, amino acid PET imaging is becoming the standard of care when available and approved for clinical use. FES PET has been FDA approved in 2020 for the evaluation of estrogen receptor (ER) positive lesions and hence used for whole body in vivo molecular phenotyping of disease in several clinical instances.

Methods: We propose to showcase the use of FDG and FES PET imaging in the assessment of suspicious brain lesions in a stage IV breast cancer patient. We will illustrate images from whole-body FDG and FES PET scans as well fusion brain PET-MR images.

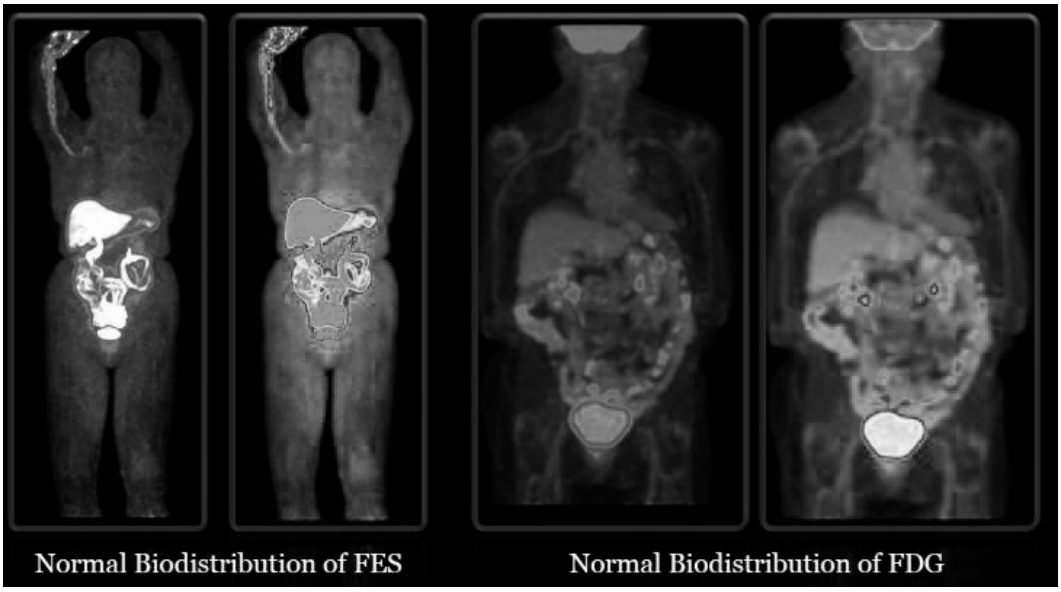
Results: We present the case of a 56-year-old woman with a 10-year history of ER+/PR-, HER-2/neu-right breast cancer status post radical mastectomy and axillary lymph node dissection and adjuvant chemoradiation. She presented with seizures and was found to have brain metastasis in the right frontal lobe, right pons, and left cerebellum. These were treated with stereotactic radiosurgery and adjuvant hormonal therapy with Exemestane. Over two years the right frontal lesion decreased in size with resolution of the cerebellar and pontine lesions. However, on subsequent follow-up the right frontal lesion grew, raising the suspicion for progression of disease versus treatment related effects/radiation necrosis. Hence an FDG PET/CT was performed showing viable tumor on fused PET/MR images. A few months later and in the context of brain lesion growth while on Exemestane an FES PET/CT scan was performed. This showed FES positivity in the entire volume of the brain lesion and confirmed the positive ER status and viability of the lesion, both elements crucial in choice of therapy and further management. Additional stereotactic radiosurgery was then performed.

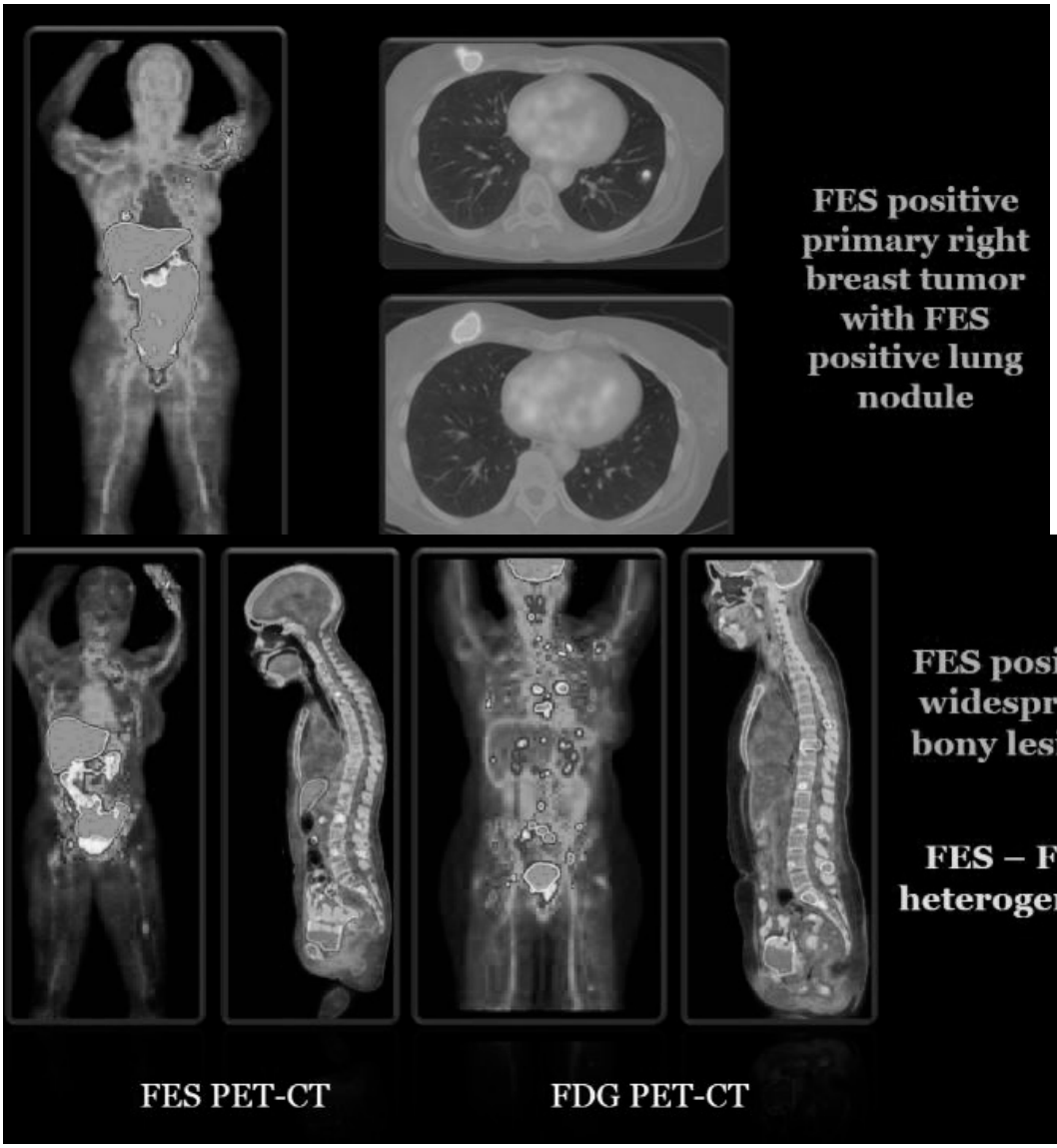
Discussion**:** Post-treatment MR imaging can yield ambiguous findings complicating differentiating treatment-related effects from persistent or recurrent tumor. FDG PET/CT is very helpful in assessing residual/recurrent disease versus posttreatment radiation necrosis. However, it's sensitivity and accuracy are limited by tumor grade and kinetics and normal background brain activity. FES PET maps in-vivo ER status. In patients with ER-positive breast cancer, FES PET imaging can be utilized as a problem-solving tool to stage disease and assess metastatic burden. Assessing ER status in brain lesions with FES PET is a novel interesting idea and depending on avidity may guide treatment strategies.

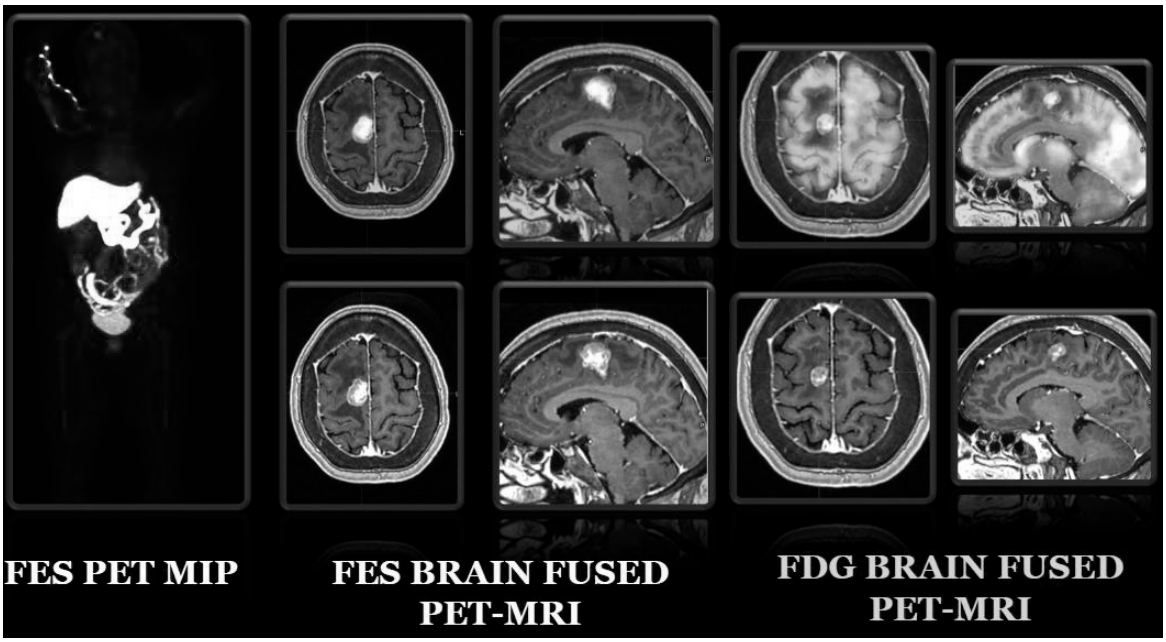
Conclusion: Brain cancer metastasis can be effectively characterized with a variety of PET probes. FES PET can help determine estrogen receptor status of brain lesions in select cases.

Jorianne Boers, Naila Loudini, Celina L. Brunsch, Sylvia A. Koza, Erik F.J. de Vries, Andor W.J.M. Glaudemans, Geke A.P. Hospers, Carolina P. Schröder. Value of 18F-FES PET in Solving Clinical Dilemmas in Breast Cancer Patients: A Retrospective Journal of Nuclear Medicine Sep 2021, 62 (9) 1214-1220; DOI: 10.2967/jnumed.120.256826. PMID: 33990400

Appendix Summary Figures.







POSTER # 12

Nuclear Medicine Theranostics. A Valuable Clinical Paradigm. An Overview.

Mehdi Djekidel[1], Charito Love[1], Christopher Palestro[1]

1. Northwell Health. New York. USA

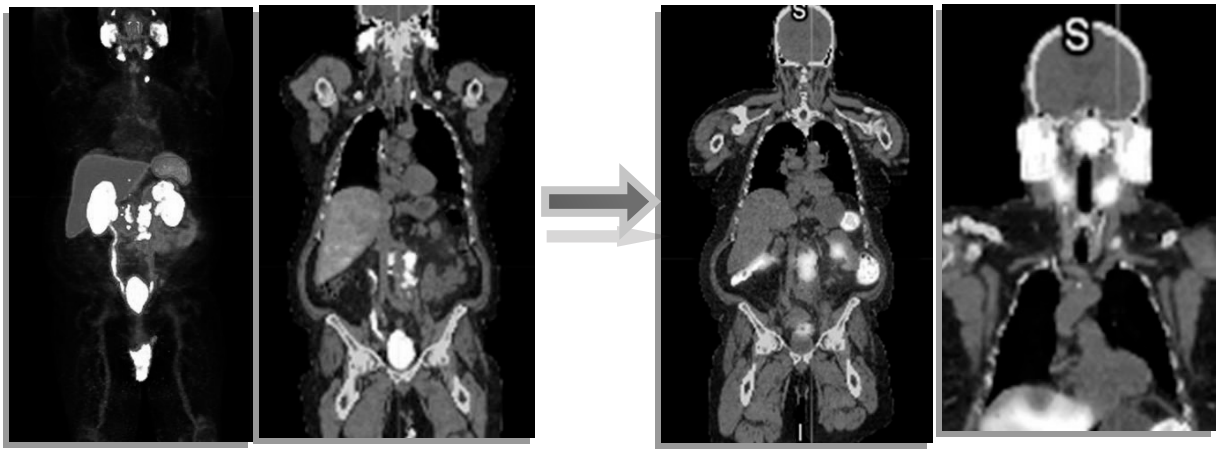
Background: Theranostics is a state-of-the-art paradigm in the personalized medicine approach. Nuclear medicine Theranostics or the combination of a pair of diagnostic and therapeutic radiopharmaceuticals provides a framework to map the patient's disease with similar pretreatment targets to predict the homing of the therapeutic radiopharmaceutical. In essence you see what you treat, and you treat what you see. Nuclear medicine Theranostics has gained wide clinical acceptance over the past several years because of positive data from large clinical trials and recent FDA approvals of newer targeted therapeutic agents. Numerous clinical trials are also underway evaluating novel Theranostics pairs.

Methods: We present illustrative cases with discussion of currently available Theranostics agents and review of physiologic and technical aspects of their use. Readers will get an overview of clinical paradigms for Theranostics in nuclear medicine practice.

Results: Nowadays, nuclear medicine plays an important therapeutic role by offering theranostics radiopharmaceuticals. This includes radioactive iodine -an established treatment for both patients with hyperthyroidism and well differentiated thyroid cancer-. Selecting the appropriate amount of activity to be administered, requires an in-depth review of pre and post treatment molecular imaging. Additionally, Lutetium DOTATATE is another clinical theranostics agent that requires careful evaluation with pre and posttherapy imaging to choose the appropriate candidate for treatment and optimal safe activity. Pre and post treatment mapping of somatostatin receptors guide the therapy, use of adjuvant treatments (if any), benefit, progression, and dosage selection. Furthermore, Lutetium PSMA is a widely used theranostics radiopharmaceutical and requires the evaluation of multiple parameters pre and post treatment. Lutetium DOTATATE and Lutetium PSMA initially approved as second- and third-line treatment options, based on up-to-date data may become useful in the future as first line agents. In addition, Iodine 131 MIBG is also a useful theranostics agent used primarily in children with neuroblastoma and in adults with pheochromocytoma. Yttrium 90 liver directed microsphere therapy is a well-established theranostics treatment option that also benefits from pre and posttreatment molecular imaging with ^{99m}Tc MAA used for pretreatment mapping. Moreover, Samarium and Strontium are also available therapeutic radiopharmaceuticals in the Theranostics space used rarely for bone palliation with pretreatment MDP, HDP or fluoride mapping scans. Radium 223 is an FDA approved theranostics radiopharmaceutical used in select advanced bone predominant metastatic prostate cancer patients with pretreatment mapping assessed also with MDP, HDP or fluoride scans. Lastly, dosimetry techniques are set to play an important role in a variety of future theranostics applications as they demonstrate improved benefit in safety and outcomes.

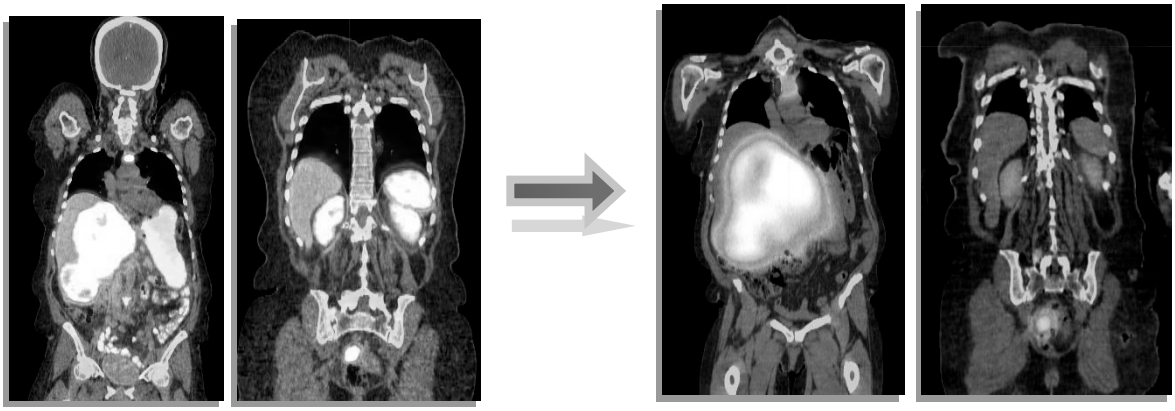
Conclusion: Theranostics is rapidly becoming an essential tool in the treatment of a variety of conditions and professionals in the field require greater expertise and knowledge to provide best clinical patient care.

Appendix:



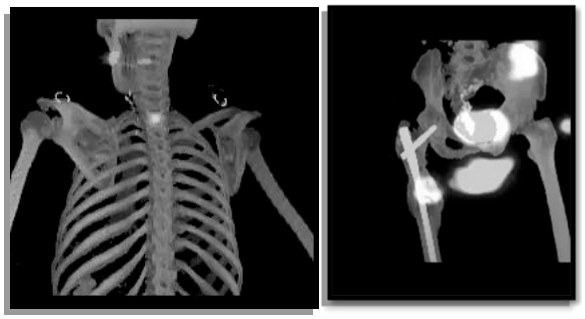
PSMA based Pretreatment Mapping PET/CT **scan** showing retroperitoneal and left supraclavicular lymph nodes

PSMA based radiopharmaceutical **therapy** (PLUVICTO®) SPECT/CT scan demonstrating uptake in these lesions

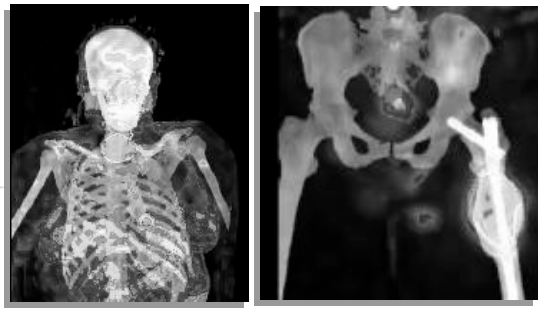


DOTATATE based Pretreatment Mapping PET/CT **scan** showing lesions in the liver, mediastinal and pelvis lymph nodes

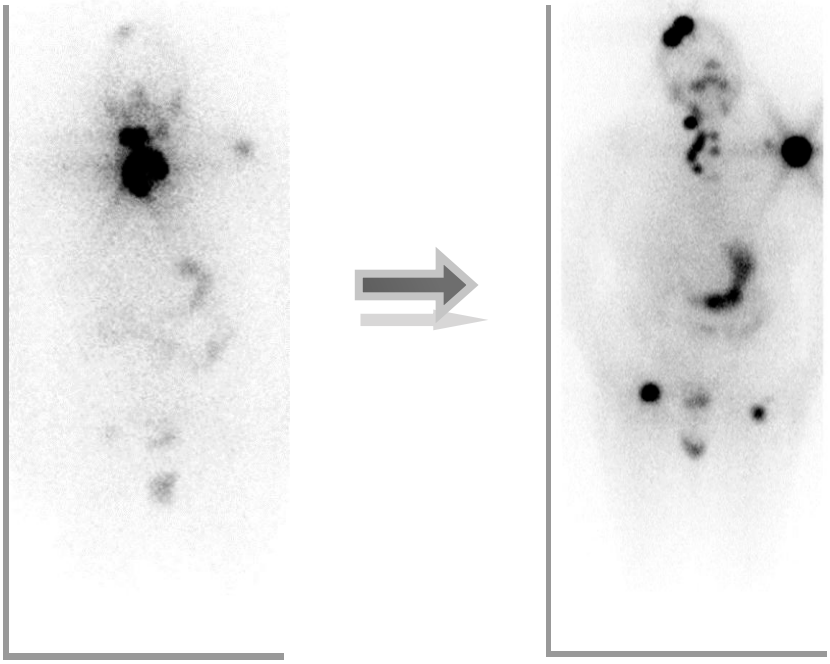
DOTATATE based radiopharmaceutical **therapy** (LUTATHERA®) SPECT/CT scan confirming uptake in these lesions



Iodine based Pretreatment Mapping SPECT-CT **scan** of thyroid cancer lesions in the neck and skeleton (posterior imaging)

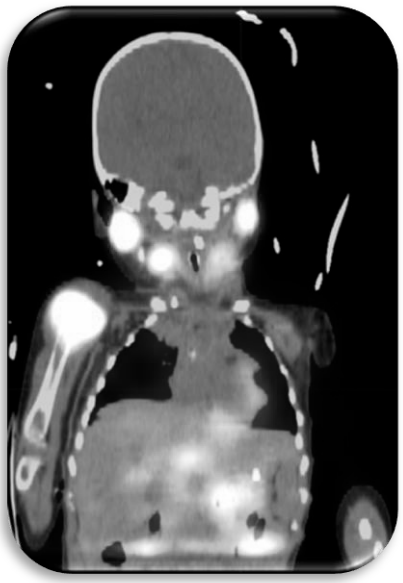


Iodine based radiopharmaceutical **therapy** confirming uptake in these lesions (anterior imaging)

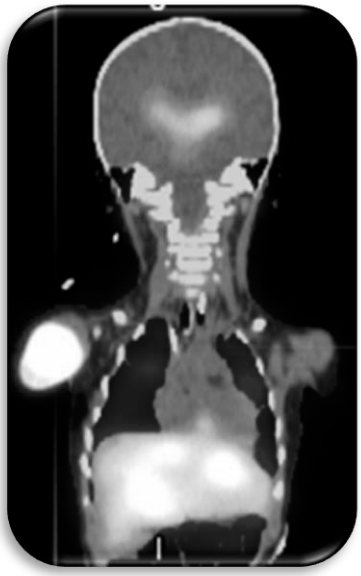


Iodine based Pretreatment Mapping **scan** of Thyroid cancer lesions in the neck, nervous system and skeleton

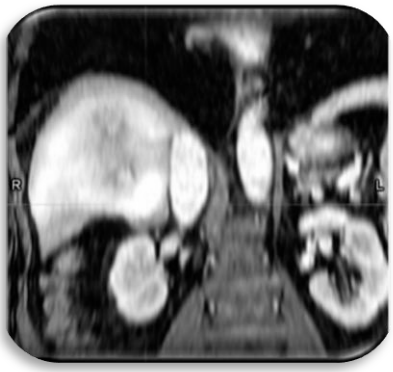
Iodine based radiopharmaceutical **therapy** confirming uptake in these lesions



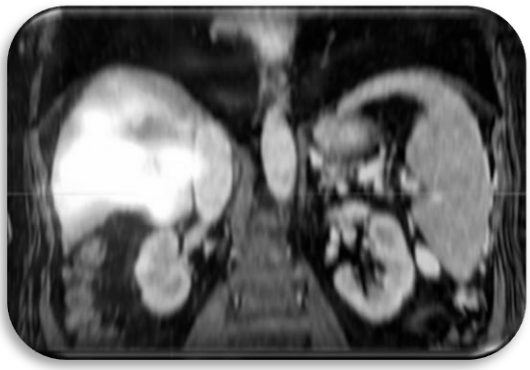
MIBG mapping SPECT-CT **pre** radiopharmaceutical **therapy**



MIBG mapping SPECT-CT **post** radiopharmaceutical **therapy**



MAA mapping SPECT-MRI **pre** Y90 microsphere radiopharmaceutical **therapy**



Y90 mapping SPECT-MRI **post** microsphere radiopharmaceutical **therapy**

POSTER # 13

Tongue Hyperpigmentation Following Radioactive Iodine Treatment in Thyroid Cancer.

A Rare and Alarming, but Self-Limiting Side Effect.

Diana Hammer[1], Charito Love[1], Christopher Palestro[1], Mehdi Djekidel[1]

1. Northwell Health. New York. USA.

Background: Radioactive iodine (RAI) is the main therapeutic radiopharmaceutical agent used in nuclear medicine. It has been used for almost 80 years with great efficacy and safety to treat thyroid cancer patients. RAI has been essentially characterized by a good clinical effectiveness coupled with a high safety profile and low clinical and biochemical toxicity. Most patients do not experience any tangible side effects. However, a low incidence of clinically tolerable and manageable side effects may occur such as dysgeusia, metallic taste, nausea, vomiting, dry mouth, dry eyes, and occasionally mouth sores. We describe the occurrence of a very rare side effect of RAI treatment: tongue hyperpigmentation. Although it is self-limiting and not harmful, tongue hyperpigmentation can be alarming to both the patient and treating physician.

Discussion: We describe four patients who developed tongue hyperpigmentation within 10 days after RAI treatment **Figure 1.** Patient 1 was an ATA high risk 61 yo stage IVB female. Patient 2 was an ATA intermediate risk stage II 73 yo female. Patient 3 was an ATA intermediate risk stage II 58 yo female. Patient 4 was a young ATA high risk stage I 31 yo femaie. Hyperpigmentation was not accompanied by pain, tongue swelling, or paresthesia. Loss of taste was an accompanying symptom as well as salivary gland tenderness and swelling in 3 patients all of whom received 150 mCi of RAI. Patient 4 received 122.4 mCi I-131 but did not experience salivary gland swelling or tenderness. Scans are illustrated in **Figure 2, 3 and 4**. The hyperpigmentation was self-limiting and resolved over the course of several weeks.

Tongue hyperpigmentation is felt to be a relatively rare complication of RAI treatment. Very few reports exist[1-3]. The etiology is unknown. Considering patient reporting may be low the exact incidence is also unknown.

Conclusion: Although tongue discoloration and hyperpigmentation is a very rare complication of RAI treatment, it can be very disconcerting to the patient and treating physician. It is self-limiting and resolves within a few weeks. Supportive measures may be needed during the initial acute phase mostly related to accompanying symptoms of pain, salivary gland swelling, mouth sores. Treating physicians should be familiar with this complication for proper management and counseling.

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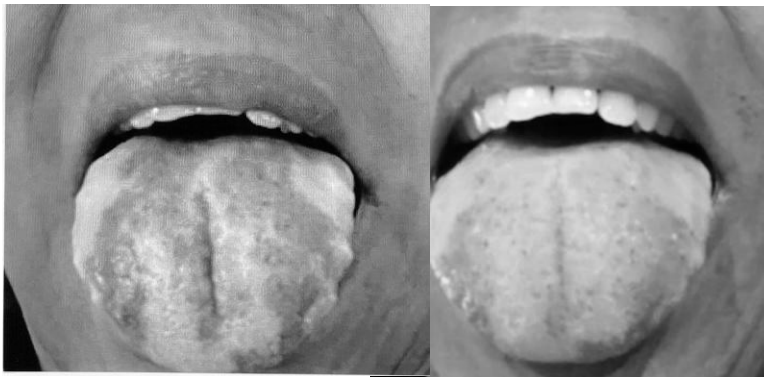

FIGURE 1a. Showing tongue discoloration from left to right in patient 1 appearing 10 days and improving 4 weeks post RAI and Patient 2 seven days post RAI treatment.

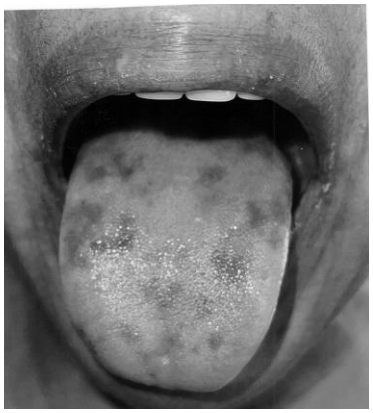

FIGURE 1b. Showing tongue discoloration in patient 2 seven days post RAI treatment.

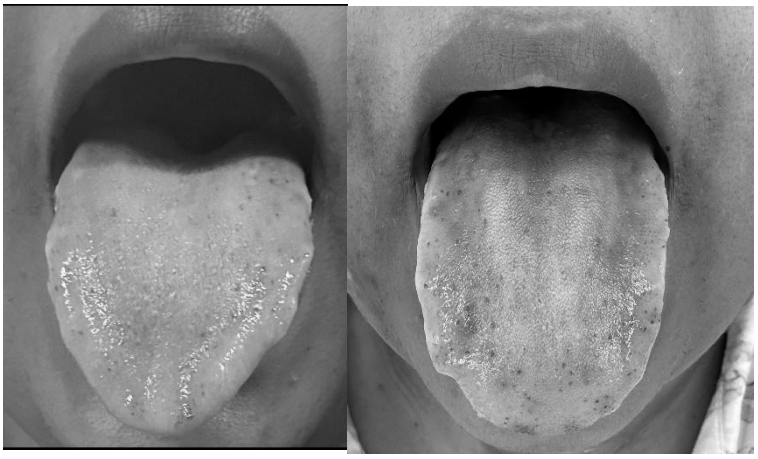

FIGURE 1c. Showing tongue discoloration from left to right in patient 4 appearing 10 days and worsening 13 days post RAI treatment.

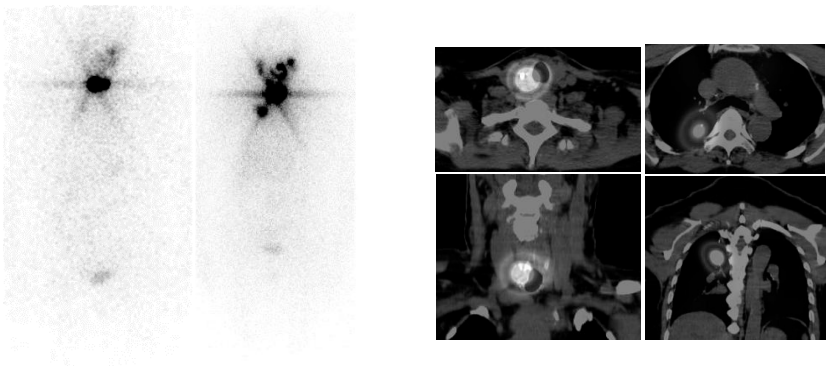

Figure 2. Patient 1 with pre and post treatment whole body and post treatment SPECT-CT scans

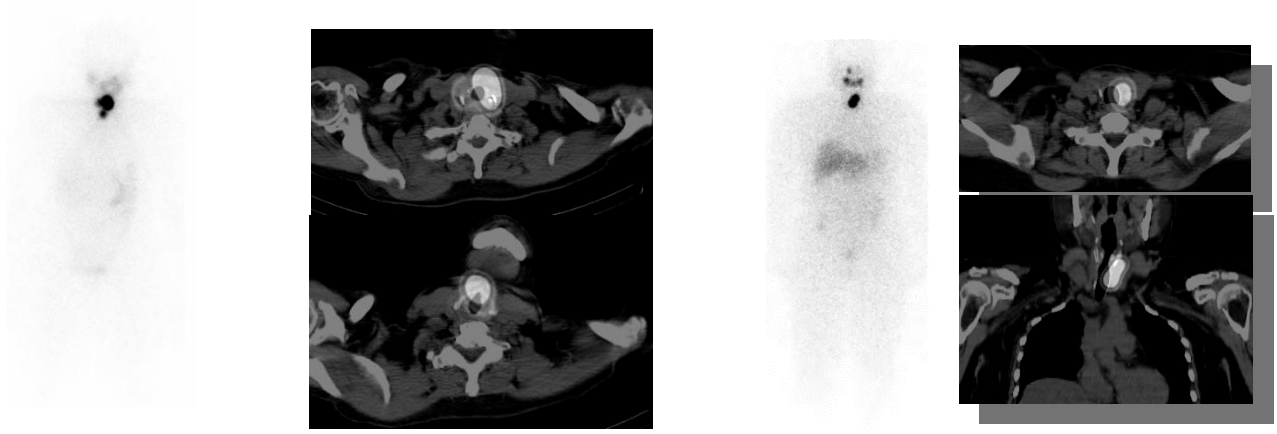

Figure 3. Patient 2 (left) and patient 3 (right) post treatment whole body and SPECT-CT scans

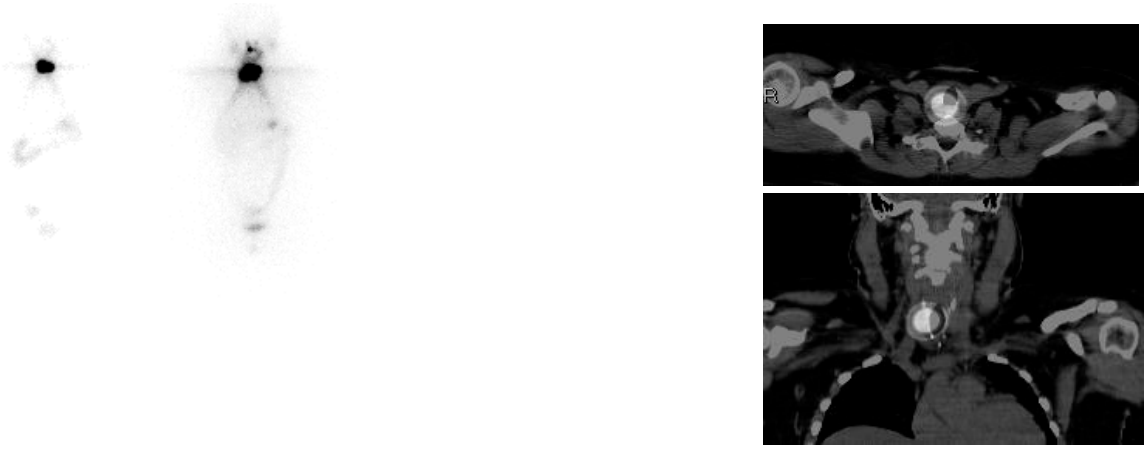

Figure 4. Patient 4 with pre and post treatment whole body and post treatment SPECT-CT scans

POSTER # 14

Emergency Findings on Outpatient PET: A Case Series Highlighting the Need for Vigilance in Routine Oncologic Surveillance

Authors: Surita Banerjee MD; Rylen Stratford DO, Renee Moadel, MD.
Department of Diagnostic Radiology,
Division of Nuclear Medicine
Montefiore Medical Center and the Albert Einstein College of Medicine
111 East 210th Street, Bronx, NY, USA

Introduction:
Positron emission tomography/computed tomography (PET/CT) is an essential imaging modality used in oncologic, neurologic, and cardiac applications, with most findings contributing to long-term disease management. However, emergent findings during outpatient PET/CT scans, though rare, can reveal life-threatening conditions requiring immediate medical intervention. This case series highlights four instances where routine PET/CT scans identified urgent medical conditions, emphasizing the critical need for swift recognition and action.

Methods:
We retrospectively reviewed PET/CT scans from four outpatient cases, each referred for routine oncologic follow-up. The cases included patients whose scans unexpectedly revealed significant findings requiring emergency intervention. PET/CT imaging was performed using 18F-FDG as the radiotracer on a standard clinical PET/CT scanner.

Results:

1. **Case 1**: A 69-year-old male with a history of aggressive B-cell lymphoma presented for routine surveillance post six cycles of R-CHOP chemotherapy. The PET/CT revealed an intensely FDG-avid lesion in the left frontal lobe with surrounding edema and mass effect, raising concerns for metastasis versus CNS lymphoma (Deauville 5). Emergency MRI and biopsy confirmed CNS lymphoma, and the patient was promptly hospitalized for treatment.

2. **Case 2**: A 78-year-old female with metastatic small-cell lung cancer underwent PET/CT for staging. The scan identified a large, FDG-avid gallbladder with pneumobilia, indicative of acute cholecystitis. The patient was immediately referred to the emergency department (ED), where emergent cholecystectomy tube placement was performed.

3. **Case 3**: A 54-year-old male with a 20-pack-year smoking history and stage IV lung adenocarcinoma presented for staging PET/CT, which incidentally revealed a large pericardial effusion. This was a new finding compared to his prior exam. The patient was clinically correlated for cardiac tamponade and referred to the ED. A transthoracic

echocardiogram confirmed tamponade, and pericardiocentesis drained 1250 cc of sanguineous fluid.

4. **Case 4**: A 59-year-old male with cutaneous T-cell lymphoma and mycosis fungoides presented for follow-up post-chemotherapy and radiotherapy. The PET/CT scan demonstrated an interval increase in the size of a right-sided pleural effusion occupying more than 50% of the thoracic volume. The oncology team was immediately notified, and the patient was advised to seek emergency care if dyspnea worsened.

In each instance, the emergent PET/CT findings led to timely hospitalization and life-saving interventions, underscoring the crucial role of PET/CT in detecting unexpected but clinically significant conditions in outpatient settings.

Conclusion:
Outpatient PET/CT can occasionally reveal unexpected life-threatening conditions, necessitating prompt medical intervention. This case series underscores the importance of vigilance in interpreting PET/CT scans, even in an outpatient setting, as early detection of emergency findings can significantly impact patient outcomes. Clinicians should be aware of such potential findings to ensure timely diagnosis and intervention.

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POSTER # 15

The Role of ^{18}F-FDOPA in the Pediatric Nuclear Medicine Clinic

Mehdi Djekidel MD[1], Christopher Palestro MD[1]

1. Northwell Health New York USA

Background: ^{18}F-FDOPA has been used successfully in the evaluation of a variety of conditions in pediatric and adult cohorts. ^{18}F-FDOPA is now FDA approved in the management of adults with movement disorders. However, it is also a safe and valuable radiopharmaceutical to investigate numerous pediatric diseases. It is successfully used around the world where available. ^{18}F-FDOPA is an aminoacid. ^{18}F-FDOPA enters the cell through large neutral aminoacid transporters (LAT). It is converted to fluorodopamine by a dopa decarboxylase enzyme. Upregulation of LAT transporters and dopadecarboxylase activity results in increased FDOPA uptake.

Methods: We present a few relevant cases for this radiopharmaceutical in the pediatric nuclear medicine clinic.

Results:

We present two cases of *congenital hyperinsulinism.* Diagnosis and management of this condition can be challenging. ^{18}F-FDOPA is more accurate than conventional anatomical imaging techniques and can detect focal congenital hyperinsulinism which is associated with better outcomes. It guides surgical and medical management and guides towards differentiation between focal, multifocal, and diffuse forms of the disease.

We also present two cases of *diffuse intrinsic pontine glioma* with ^{18}F-FDOPA PET imaging.

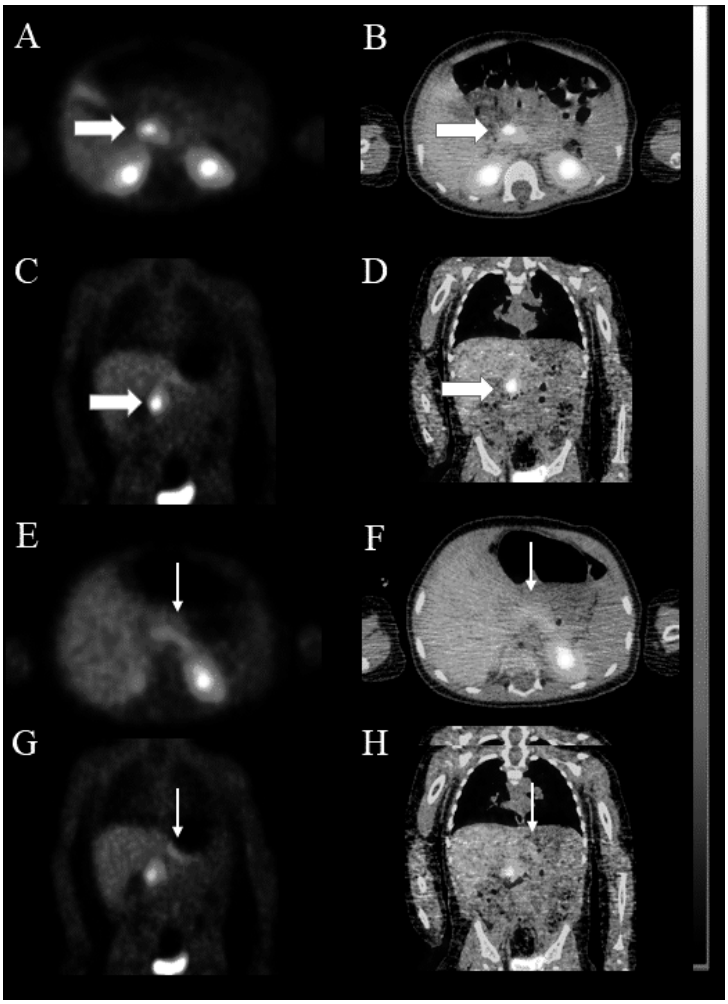
We also present a case of a suspected *neuroblastoma* with elevated biochemical biomarkers.

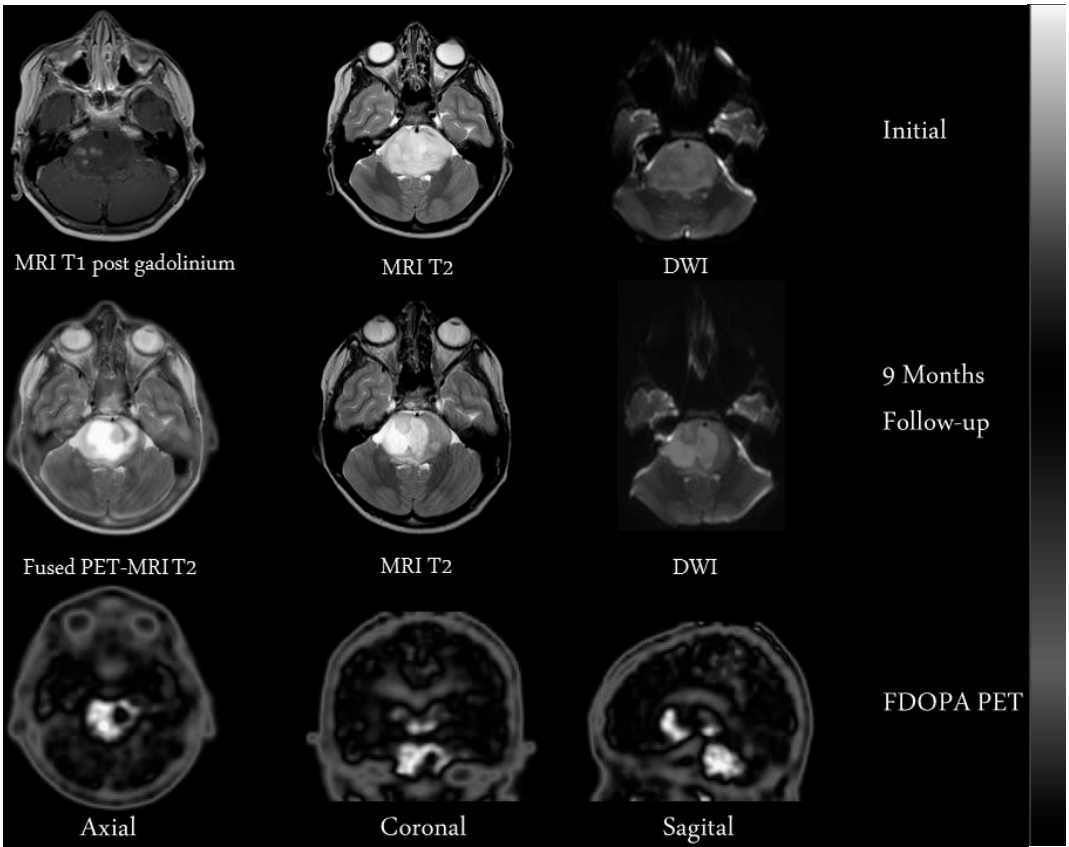
Discussion:

Evaluation of brain tumors in children can be challenging at various moments of the patient course. Although MRI is the workhorse of imaging brain tumors, ^{18}F-FDOPA is useful for evaluating suspicious areas of residual or recurrent tumor when MRI is equivocal. It can also be used to evaluate areas of highest uptake for biopsy as well as assessing treatment response and external beam radiation dose painting.
^{18}F-FDOPA has been reported to have a high sensitivity in evaluating *neuroendocrine tumors*, such as *neuroblastomas*, *pheochromocytomas* and *paragangliomas*.

An additional role can be contemplated for the evaluation of *insulinomas* and *medullary thyroid cancer* patients with a calcitonin level > 100 pg/ml.

Conclusion: ^{18}F-FDOPA is a valuable radiopharmaceutical that can have high impact on clinical care in the pediatric population and further consideration for clinical use should be contemplated.





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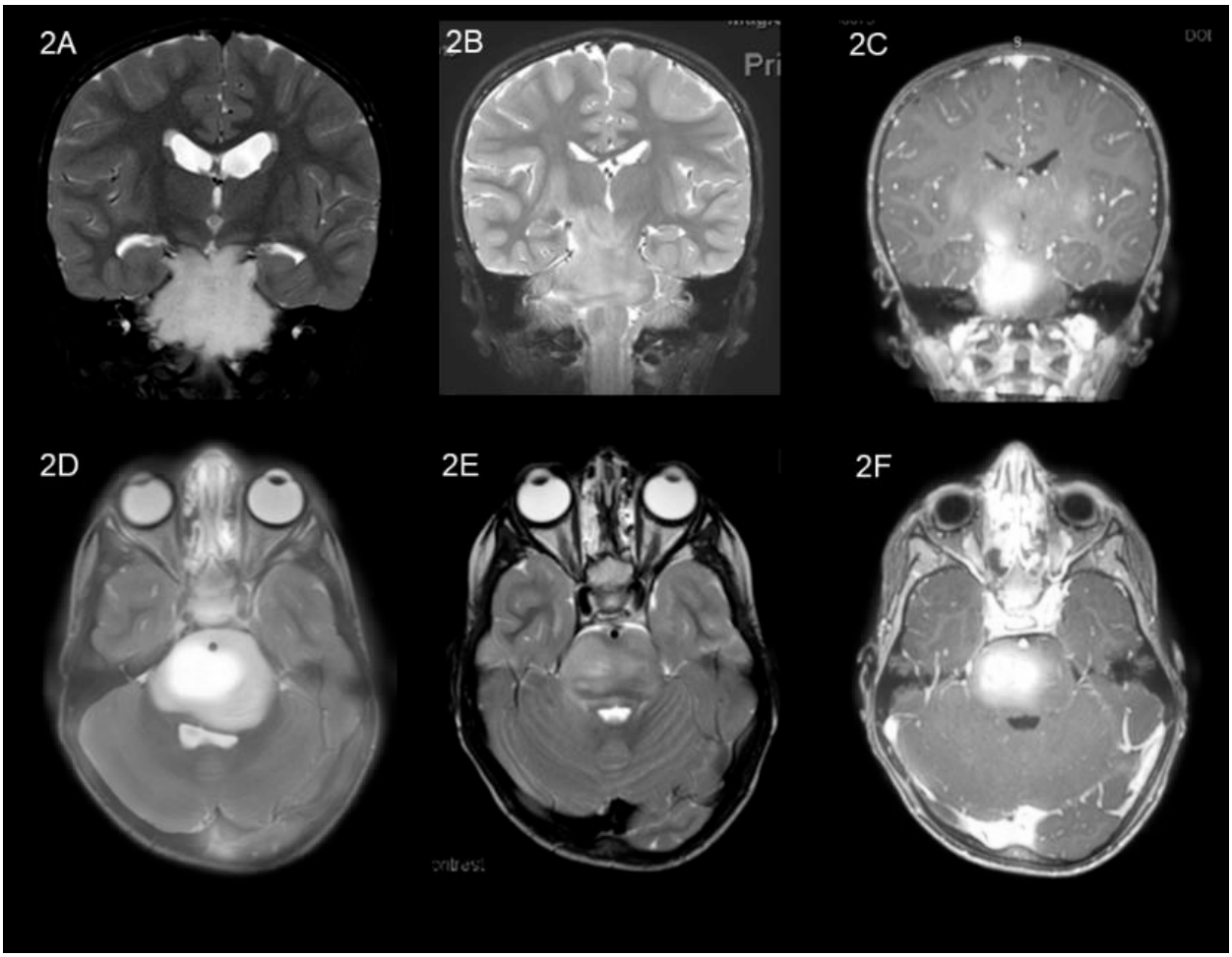
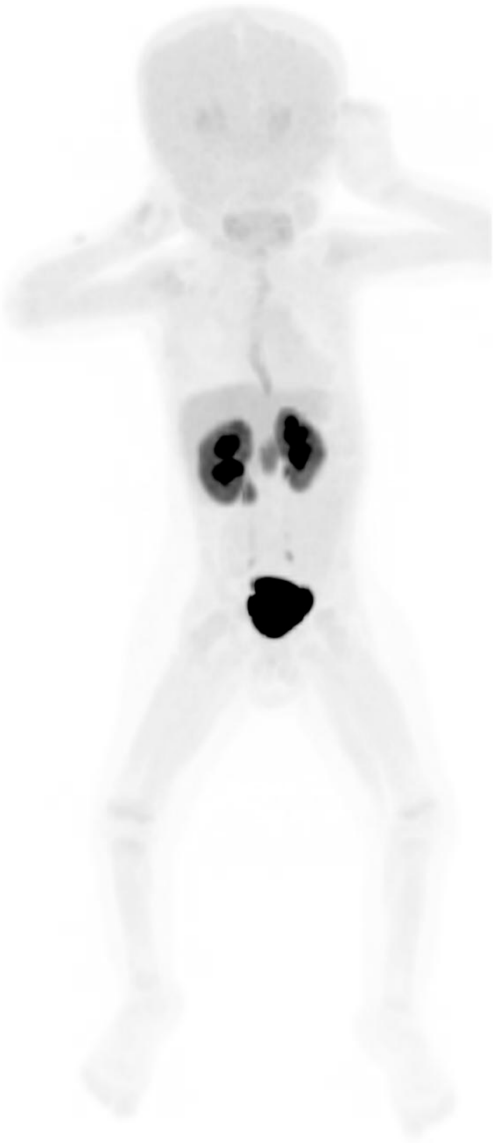
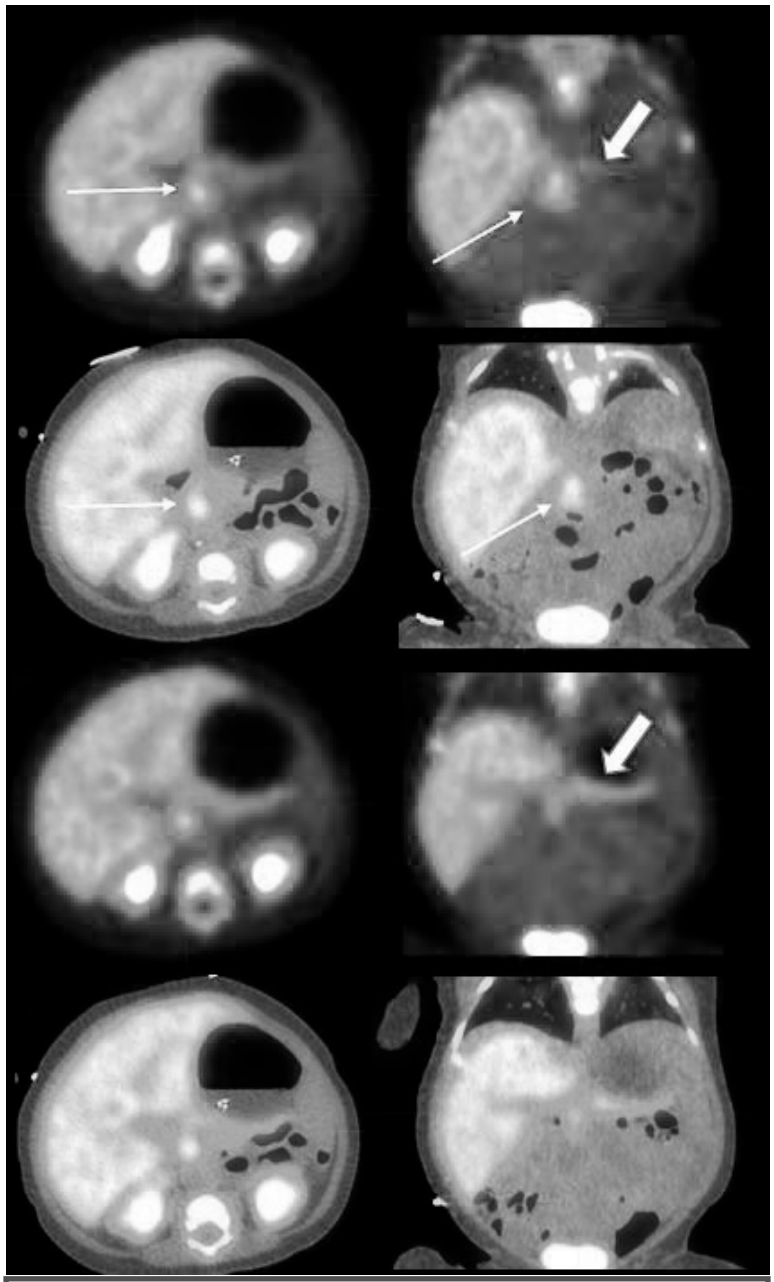
6 YEAR OLD BOY WITH NO CLEAR CHANGE IN THE SIZE OF THE INITIAL DIPG TUMOR 9 MONTHS AFTER THE INITIAL MRI. CHANGES IN APPEARANCE ON DIFFERENT SEQUENCES SHOWED T2 AND DWI SIGNAL DISTRIBUTION CHANGES. FDOPA SCAN FUSED WITH FOLLOW UP MRI CLEARLY DELINEATES TUMOR VIABILITY AND RECURRENCE.



INTENSE FDOPA UPTAKE IN A RECURRENT DIPG SHOWING BETTER TUMOR DELINEATION OF TRUE TUMOR BOUNDARIES AND INTENSITY OF UPTAKE LIKELY A PROGNOSTIC PARAMETER. 2A. CORONAL T2 FS INITIAL 2B. CORONAL T2 FS 9 M F/U 2C. CORONAL FUSED FDOPA PET/MR 9 M F/U 2D. AXIAL FDOPA FUSED TO INITIAL MR 2E. AXIAL T2 FS 9 M F/U 2F. AXIAL FUSED FDOPA PET/MR 9 M F/U



MIP IMAGE OF A NORMAL FDOPA SCAN IN A 2 YEAR OLD BOY WITH SUSPICION FOR NEUROBLASTOMA WITH HIGH VMA AND HVA MARKERS AND NORMAL ANATOMICAL IMAGING



2 MONTH OLD BABY GIRL WITH CHI. PANCREATIC HEAD (THIN SMALL ARROW) AND TAIL UPTAKE (THICK WHITE ARROW) NOTED ON ^{18}F-FDOPA PET SCAN DOES NOT MEET QUANTITATIVE CRITERIA FOR FOCAL CHI: SUVMAX RATIO OF 1.2

POSTER # 16

PYP Cardiac Polar Plot Evaluation. A Novel Approach in the Assessment of Cardiac Amyloidosis

Mehdi Djekidel MD[1], Kenneth J Nichols PhD[1], Christopher J Palestro MD[1]

1. Northwell Health. New York. USA

The value of ^{99m}Tc-pyrophosphate (PYP) imaging for the diagnosis of cardiac transthyretin amyloidosis (ATTR) is well established (1). The high sensitivity and specificity of the test has led to widespread use (2,3). The current paradigm offers interpretation criteria based on heart-to-contralateral lung ratios for planar imaging and a 4-grade visual scale, comparing myocardial to rib uptake for SPECT/SPECT-CT. These interpretive criteria focus on detecting the presence or absence of amyloid; however, the extent and degree of myocardial involvement could be important for prognosis, therapy, and genetic counseling. We propose a novel evaluation approach involving polar plot assessment of PYP myocardial uptake, which may potentially be more informative and provide additional information that may be important for patient management.

Methods: One experienced individual reviewed 25 positive PYP SPECT/CT studies. Myocardial polar plots were reconstructed from 3-hour SPECT-CT acquisitions. Parameters evaluated were the distribution of amyloid uptake in different myocardial walls, as well as in a 17 myocardial segment model. Myocardial wall involvement and segments with the highest uptake were assessed visually and with semiquantitative parameters. Type of myocardial uptake (homogeneous or heterogenous), and extent of myocardial involvement also were assessed (Figures).

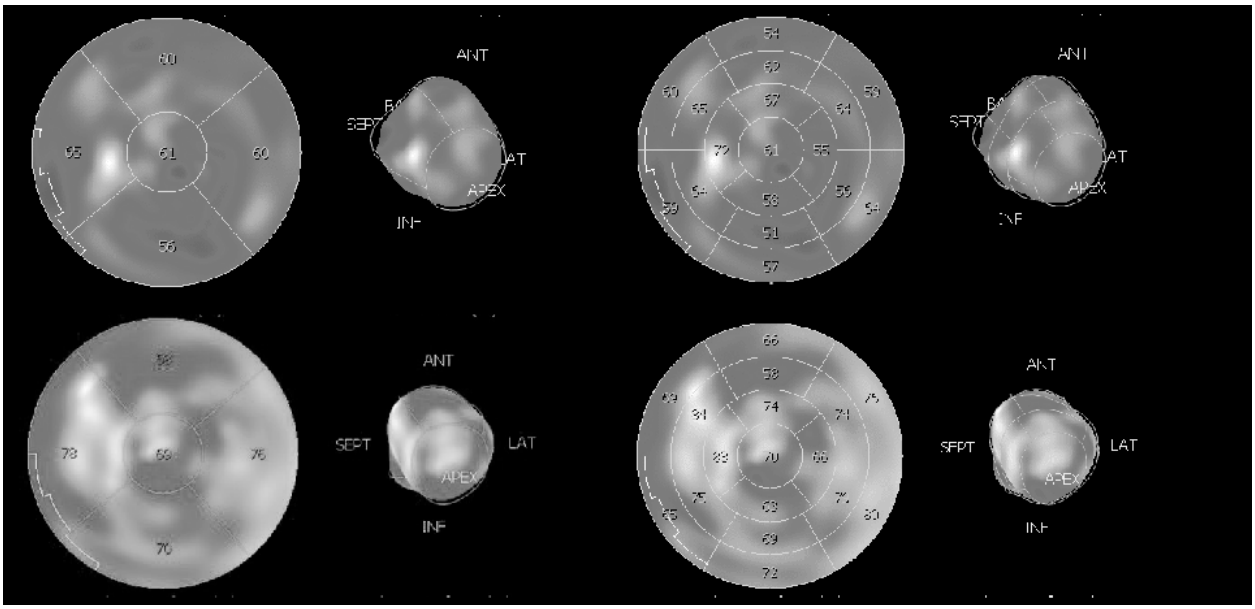
Results: Mean age of the cohort was 78±5 years (8 females, 17 males). The most prevalent territory to have the highest uptake judged by 17-segment inspection of PYP deposition on the polar maps was the apical-septum, significantly more often than the apical-lateral wall (79% versus 4%, $p < .0001$); the least common location was the mid-antero-lateral wall (0%). This was consistent with the visual impression of highest PYP deposition observed most frequently in the septum and least frequently in the lateral walls (88% versus 16%, $p < .0001$), which was also more common than anterior walls (22%, $p < .0001$) and similar to inferior walls (74%, $p = .21$). The extent of wall involvement was greater for the septum than lateral walls (89% versus 47%, $p = .002$), and similar to anterior and inferior walls (70%, $p = .10$ and 80%, $p = .38$). PYP uptake was perceived as homogenous more frequently in the septum than in the lateral, anterior or inferior walls (44% versus 4%, 4% and 4%; $p = .004$).

Conclusion: A novel technique using polar plots analysis enabled evaluation of PYP distribution in the LV myocardium and provided semi-quantitative measurements of PYP deposition.

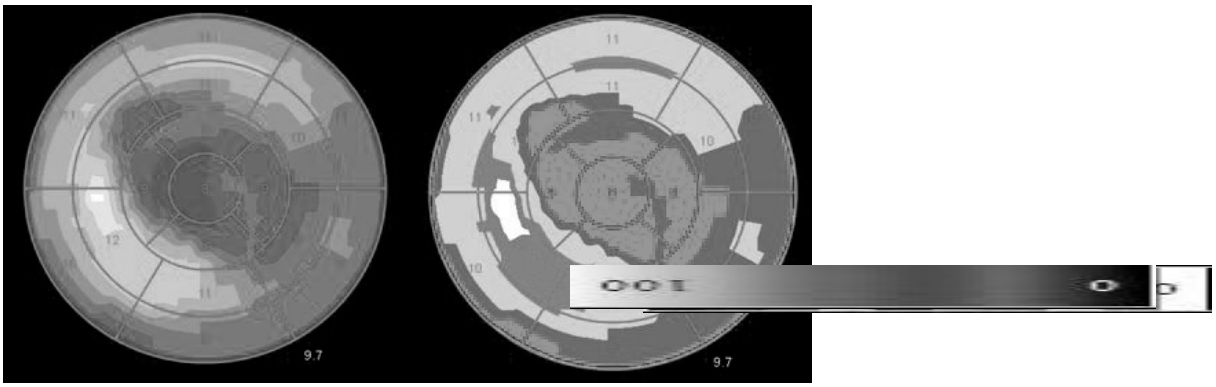
Clinical Implications: Analyzing patterns and distribution of myocardial PYP uptake potentially could have prognostic implications, and guide therapy in patients with cardiac ATTR.

1. Falk RH, Quarta CC, Dorbala S. How to image cardiac amyloidosis. Circ Cardiovasc Imaging 2014;7:552-62.
2. Perugini E, Guidalotti PL, Salvi F, Cooke RM, Pettinato C, Riva L et al. Noninvasive etiologic diagnosis of cardiac amyloidosis using 99mTc-3,3-diphosphono-1,2-propanodicarboxylic acid scintigraphy. J Am Coll Cardiol 2005;46:1076-84.
3. Gertz MA, Brown ML, Hauser MF, Kyle RA. Utility of technetium Tc 99m pyrophosphate bone scanning in cardiac amyloidosis. Arch Intern Med 1987;147:1039-44.

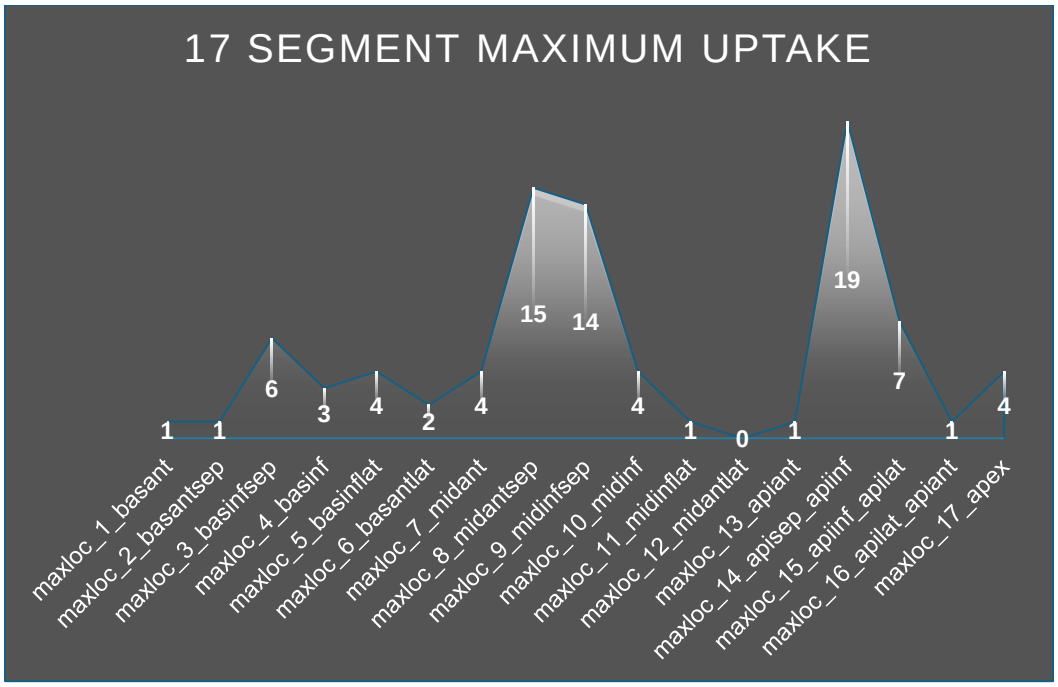
Figures:

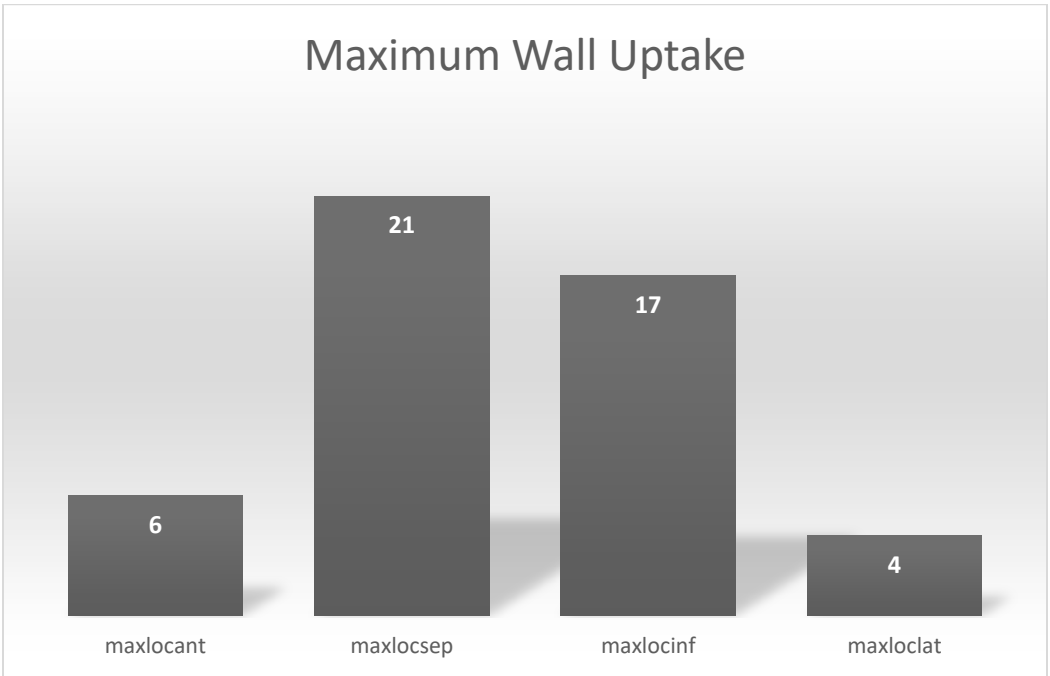


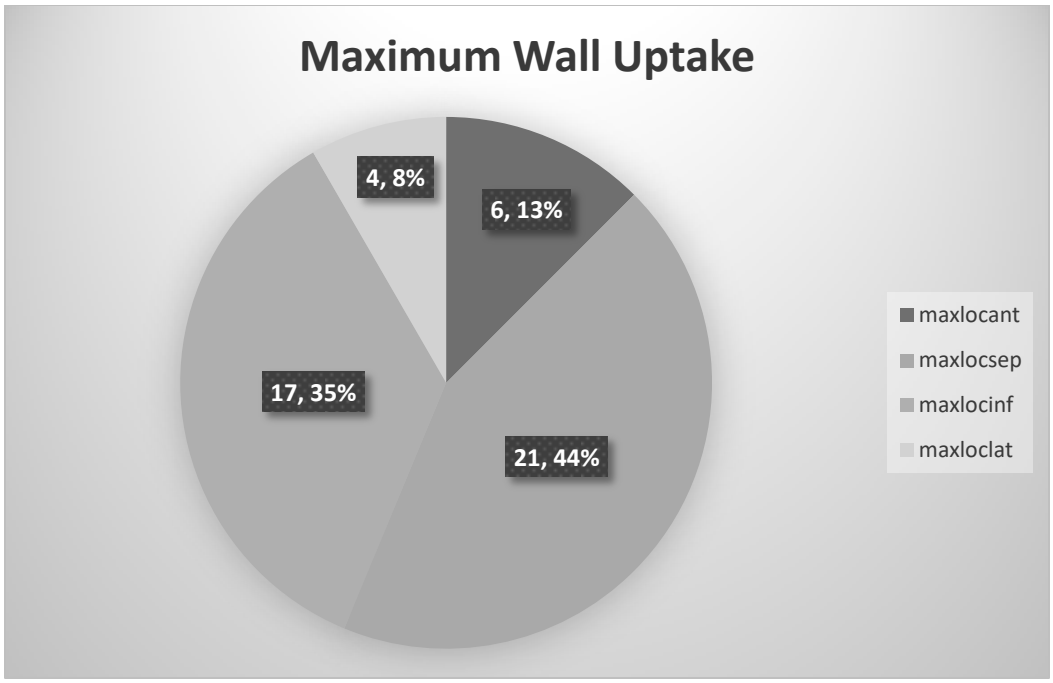
Myocardial PYP Polar plot in two patients (top and bottom) showing heterogeneous distribution of PYP uptake in anterior, lateral, inferior walls, septum and apex (LEFT) as well as in a 17-segment model (RIGHT). With adjacent 3D myocardial SSP plots.

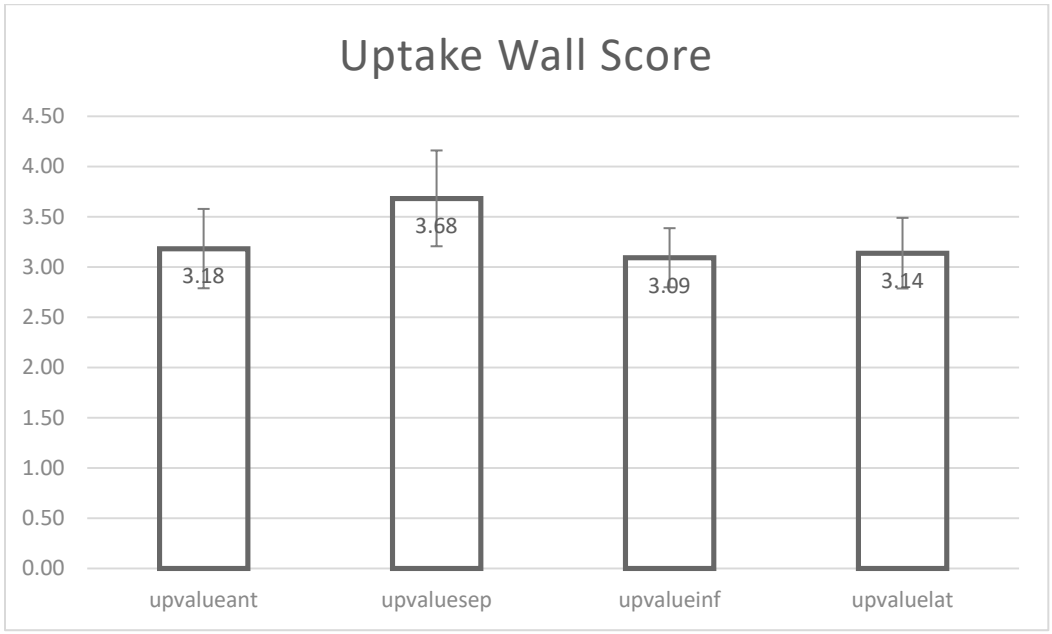


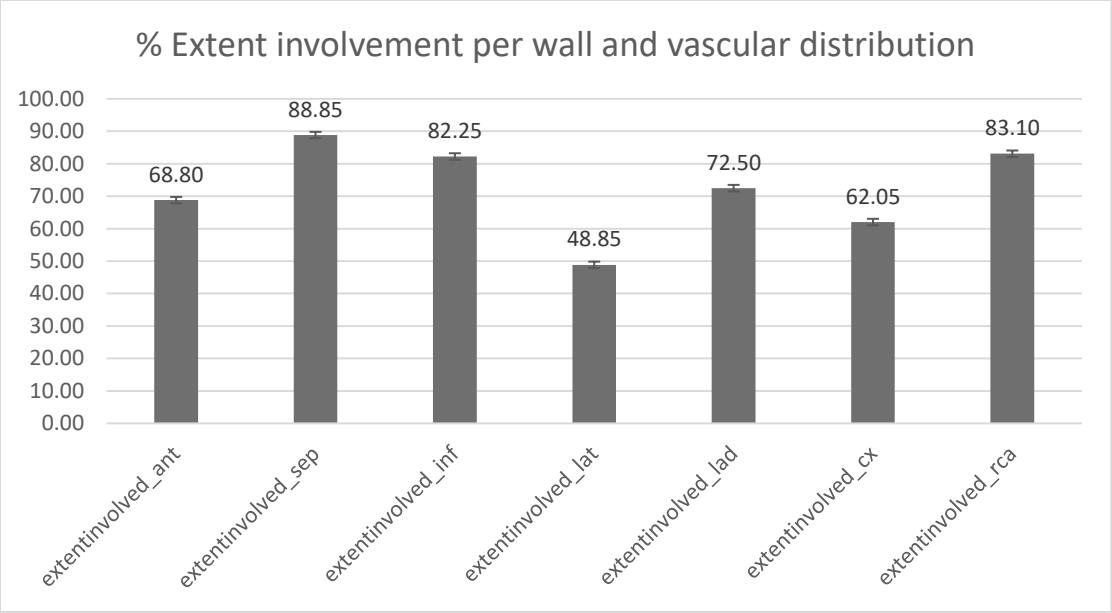
Myocardial PYP Polar plot in a patient with two different linear and nonlinear color scales used for qualitative assessment of PYP uptake in a 17-segment model showing area of maximal uptake in the septum and inferoseptal wall


17 SEGMENT MAXIMUM UPTAKE
1
1
6
3
4
2
4
15
14
4
1
0
1
19
7
1
4
maxloc_1_basant
maxloc_2_basantsep
maxloc_3_basinfsep
maxloc_4_basinf
maxloc_5_basinflat
maxloc_6_basantlat
maxloc_7_midant
maxloc_8_midantsep
maxloc_9_midinfsep
maxloc_10_midinf
maxloc_11_midinflat
maxloc_12_midantlat
maxloc_13_apiant
maxloc_14_apisep_apiinf
maxloc_15_apiinf_apilat
maxloc_16_apilat_apiant
maxloc_17_apex


Maximum Wall Uptake
6
21
17
4
maxlocant
maxlocsep
maxlocinf
maxloclat


Maximum Wall Uptake
4, 8%
6, 13%
17, 35%
21, 44%
maxlocant
maxlocsep
maxlocinf
maxloclat


Uptake Wall Score
4.50
4.00
3.50
3.00
2.50
2.00
1.50
1.00
0.50
0.00
3.18
3.68
3.09
3.14
upvalueant
upvaluesep
upvalueinf
upvaluelat


% Extent involvement per wall and vascular distribution
100.00
90.00
80.00
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
68.80
88.85
82.25
48.85
72.50
62.05
83.10
extentinvolved_ant
extentinvolved_sep
extentinvolved_inf
extentinvolved_lat
extentinvolved_lad
extentinvolved_cx
extentinvolved_rca

POSTER # 17

A Case of Immunotherapy Induced Hypophysitis on FDG PET

Joshua Lim[1]MD, Mehdi Djekidel[1]MD

1. Northwell Health. New York. USA

Background: Hypophysitis is a rare condition characterized by the acute, subacute or chronic inflammation of the pituitary gland. It can be in some cases life threatening. Early diagnosis and management is crucial. There are two main forms of hypophysitis, primary and secondary, with the latter being more common. Incidence has been increasing due to increased use of immunotherapy agents. FDG PET has been reported to be a valuable tool in the early detection of immunotherapy induced hypophysitis with a sensitivity of about 73% and a high specificity of 91 %.

Methods: We illustrate a case of hypophysitis detected on a routine FDG PET restaging scan.

Results: We present the case of a 69-year-old woman who initially presented with right axillary lymphadenopathy confirmed by CT. Pathology revealed HMB45, SOX10, S100-positive tumor cells consistent with metastatic melanoma. The patient underwent axillary lymph node dissection and began monthly treatment with an immune checkpoint PD-1 inhibitor called nivolumab (brand name Opdivo) for one year. Follow-up re-staging PET/CT study 8 months later showed incidental new focal uptake in the region of the sella **Figure**. Given the patient's history of treatment with an immunotherapy agent, drug-induced hypophysitis was suspected.

Discussion: With the increasing use of immunotherapy agents, drug induced changes/adverse events including hypophysitis can be detected on staging FDP PET scans. Characteristic imaging findings include thickening of the infundibular stalk and an enlarged pituitary gland, although involvement of the infundibular stalk can be variable in drug-induced hypophysitis. Clinically, patients can present silently as in this case or more frequently display symptoms related to some degree of pituitary dysfunction and adrenal insufficiency. Considering the confounding nature of some symptoms with traditional treatment related symptoms such as fatigue, nausea, vomiting, weight loss, sexual dysfunction diagnosis can be initially challenging. Subclinical cases as well as instances with imaging changes and relatively preserved biochemical indices can be seen. Keeping a high clinical suspicion is required when noting abnormally increased uptake in the pituitary gland on FDG PET scans to address clinical management as necessary.

Conclusion: Hypophysitis is a rare condition with an increasing incidence due to immunotherapy induced hypophysitis. FDG PET can be useful in its detection. A high clinical suspicion and awareness should be maintained for proper detection.

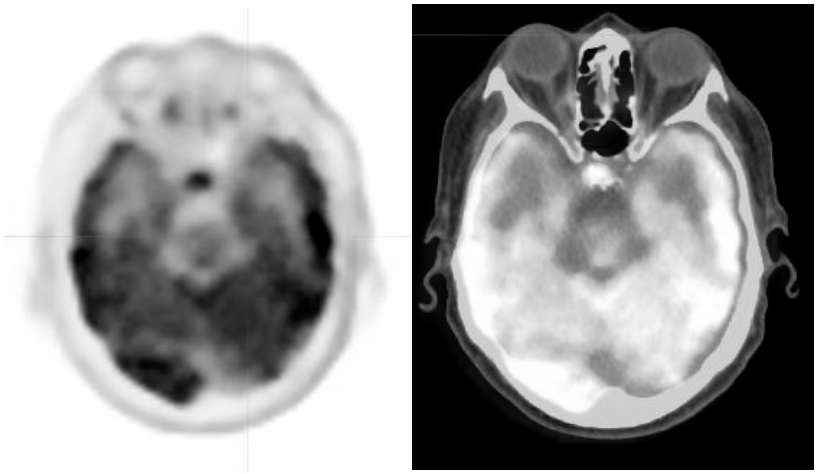


Figure. Increased focal uptake in the pituitary on axial FDG PET and fused PET-CT images.

POSTER # 18