Abstracts

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01. The value of [18F]FDG-PET-CT in patients with carcinoma of cervix in comparison with cross-sectional imaging and against Royal College of Radiologists (RCR) and Royal College of Physicians (RCP) 2022 PET-CT guidelines

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Aims: To assess the value of [18F]FDG PET-CT (PET-CT) in evaluation of carcinoma of cervix and to audit clinical indications against the Royal College of Radiologists and Royal College of Physicians 2022 PET-CT guidelines.

Method: A retrospective cohort study of 55 consecutive cervical cancer patients who underwent 67 PET-CT (46 had 1, 6 had 2, 3 had 3) scans and MRI +/- CT (within 4 months) over 2 years.

Clinical indications for each scan were compared with the 2022 guidelines, namely a) staging locally advanced cancer prior to chemoradiotherapy; b) response assessment; c) recurrence; d) prior to exenterative surgery.

Results: Sixty five of 67 (97%) scans were in accordance with the guidelines; 1/67 (1.5%) was a problem solving in synchronous cervical carcinoma and myeloma and 1/67 (1.5%) identified cervical carcinoma in a patient with oesophageal carcinoma.

PET-CT identified new metastatic sites (pelvic/extrapelvic nodal and distant metastases) in 18/67 (26.9%) of scans. In groups (a) and (c), PET-CT identified new metastatic sites [14/43 (32.5%) and 4/13 (30.8%), respectively], while remaining scans were concordant with MRI.

Allowing for limited number of scans, in (b) 5/5 and (d) 4/4, all scans (100%) were concordant with MRI.

Conclusion: In our cancer network, we have demonstrated the compliance with PET-CT 2022 guidelines' indications. Whole body PET-CT imaging has identified additional metastatic sites in approximately 1/3 of scans for staging and treatment response. However, further studies are planned to assess if PET-CT is fully utilised in clinical practice and its impact on the management.

References:

02. Prognostic value of [18F]FDG-PET-CT in patients with breast cancer

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Aim: To assess the prognostic value of [18F]FDG-PET-CT in patients with breast cancer in one cancer network.

Method: Retrospective cohort study of 159 consecutive patients with breast cancer who underwent an [18F]FDG-PET-CT between 01 January 2019 and 31 December 2020 were followed-up for 2 years. Positive (FDG avid malignant disease), indeterminate (non-specific possibly inflammatory uptake) and negative (no FDG avid malignancy) scan results were assessed versus overall survival (OS). OS was defined as the time from the first [18F]FDG-PET-CT scan to the date of death, regardless of cause.

Results: Eighty one of 159 (50.9%) scans were positive, 16/159 (10.1%) indeterminate and 62/159 (39%) negative. Twenty-four of 159 (15.1%) patients were deceased within 2 years. Of these 21/24 (87.5%) had a positive [18F]FDG-PET-CT and 3/24 (12.5%) with a negative scan. Kaplan-Meier analysis showed a statistically significant
03. Assessment of healthy tissue metabolism in patients with Advanced Hodgkin Lymphoma with [18F] FDG PET-CT

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Purpose: To assess changes in healthy tissue metabolism (HTM) using [18F]-fluorodeoxyglucose (FDG) positron emission tomography/computed tomography (PET-CT) during chemotherapy in newly diagnosed Hodgkin lymphoma (HL) and determine whether HTM is associated with pre-treatment metabolic tumour volume (MTV), haematological parameters, adverse events, early response and progression-free survival (PFS).

Methods: 200 patients with advanced HL who had PET-CT before (PET0) and after 2 cycles of chemotherapy (PET2) were retrospectively identified from the RATHL trial. [18F]FDG-HTM was measured in bone marrow (BM), spleen and liver. Patients were classified as responders (Deauville scores 1-3, PET2-) and non-responders (DS 4-5, PET2+). PFS was measured from registration until progression or death.

Results: Overall, HTM decreased significantly from PET0 to PET2 in BM and spleen but increased in liver. There was no association between HTM and baseline MTV. At PET0, BM uptake was negatively associated with haemoglobin (Hb) and positively associated with absolute neutrophil count (ANC), white blood cell (WBC) and platelets. Higher HTM at PET0 was significantly associated with neutropenia at cycles 1-2. Patients with higher BM HTM at PET0 were more likely to be PET2+ (p = 0.025; odds ratio = 1.64) and PET2+ patients with high BM uptake had significantly worse PFS (p = 0.006; hazard ratio = 2.31).

Conclusion: Significant changes in HTM occurred during treatment, which may not merely relate to changes in MTV but also suggest a possible effect of treatment. [18F] FDG-HTM may be a marker of myelosuppression in BM and a potential marker for insufficient early response and inferior PFS.

04. Imaging ghosts: developing the applications of [18F]FDG PET-CT in the diagnosis of secondary Hemophagocytic lymphohistiocytosis (HLH) in adults

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Purpose of study: Hemophagocytic lymphohistiocytosis (HLH) is a disorder of uncontrolled immune response due to a wide variety of stimuli, commonly underlying malignancy. Unrecognized, it has a mortality of up to 100% in some case series. The current diagnostic criteria is complex, as is ascertainment of the underlying HLH ‘trigger’. FDG is taken up by macrophages, and so theoretically the degree of macrophage activation could correspond with FDG uptake pattern.

This study aims to 1) look at the utility of [18F]FDG PET-CT in diagnosing the underlying cause of secondary HLH, and 2) identify [18F] FDG PET-CT imaging characteristics that are seen in HLH itself.

Methods: Retrospective review of HLH population at UCLH over a 5-year period, with analysis of [18F] FDG PET-CT to ascertain the underlying cause and to ascertain the characteristic FDG distribution in this pathology, with an aim to derive reporting criteria for both diagnosis and prognostication.

Results: A total of 13 patients received [18F] FDG-PET-CT at initial diagnosis. All patient had at least 3 organ involvement, predominantly lymph nodes, spleen, and bone marrow uptake in various degrees. In most cases (10/13) there was an underlying pathology identified, such as Adult-onset Still’s disease (5/13), lymphoproliferative disorder (4/13) and infection (1/13).

Conclusion: The rarity of HLH, as well as its complex diagnostic criteria, make diagnosis difficult; [18F] FDG PET-CT allows both diagnosis of the underlying cause as well as the pathology itself. Future work will allow development of FDG-based diagnostic and prognostic scoring systems.
05. PET-CT response assessment to Chimeric Antigen Receptor (CAR)-T cell therapy in refractory/relapsed aggressive B-cell lymphoma: single centre experience.

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**Aims:** Chimeric antigen receptor (CAR)-T cell therapy is a novel treatment for patients with refractory/relapsed aggressive B-cell lymphoma. The aim of this single centre study was to evaluate our experience of early (Day-28) and late (Day-100) response assessment FDG-PET-CT after CAR-T infusion.

**Methods:** PET-CT scans of patients undergoing CAR-T therapy were reviewed up to last clinico-radiological follow-up or death. Our standard imaging schedule was baseline PET-CT (pre-infusion) followed by Day-28 and Day-100 (post-infusion) response assessment PET-CT with further scans as clinically appropriate. Clinical and imaging data was extracted from clinical and radiology information systems.

**Results:** 31 patients were followed-up for a median of 100 days (range 15-514). Pre-infusion PET showed 4 (13%) in complete metabolic remission (CMR) following bridging therapy and 27 (87%) with suspected active metabolic disease (Deauville score 4-5). Early response assessment (Day-28) PET in 29 patients showed 2/4 maintained CMR and 21/27 achieved CMR (DS 1-3) whereas 1 relapsed and 5/27 had residual disease (DS 4-5). 3 patients with DS 4 response on Day-28 PET were found to have chronic inflammatory FDG uptake at follow-up. Late response assessment (Day-100) PET in 20 patients showed 13 maintained CMR, 3 relapsed and 4 with residual disease. Overall mortality at 3-months was 4/31 (13%).

**Conclusion:** Whilst a high proportion of patients achieve early metabolic remission following CAR-T therapy, there is an increasing rate of relapse and mortality at follow-up. Clinical and/or imaging parameters may be important for patient selection to identify those most likely to have durable responses to CAR-T therapy.


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**Purpose:** [68Ga] PSMA PET-CT is highly sensitive for the detection of disease in prostate cancer biochemical relapse (BCR). The purpose of this study was to determine whether delayed pelvic imaging adds value in terms of detection rates and diagnostic confidence.

**Methods:** Institutional approval was obtained for this retrospective study. All [68Ga] PSMA PET-CT for BCR in a 2-year period were included. Images were analysed with a two-reader consensus. A 5 point scale was used to document the presence or absence of disease (1 benign; 2 probably benign; 3 equivocal; 4 probably prostate cancer; 5 definitely prostate cancer). If a suspicious lesion was seen, then an additional 5-point confidence score was given (1 not confident at all; 2 low-level confidence; 3 intermediate; 4 fairly confident; 5 highly confident). Initially the half-body study (mean = 59.8 mins ± 5.10 post injection) was reviewed, followed by delayed pelvic imaging (mean 89.8 ± 6.13 post injection).

**Results:** 82/130 BCR patients had radiological evidence of disease recurrence. Qualitatively, pelvic imaging was found to increase the reporting confidence in 27/130 (21%) cases. Quantitatively, the average confidence score on the early whole-body imaging was 4.3 and on the 4.8 delayed pelvic imaging (p = 1.25). In 2/82 cases, pelvic disease was only present on the delayed pelvic imaging and not convincingly seen on the early whole-body imaging.

**Conclusion:** Delayed pelvic imaging qualitatively improves diagnostic confidence but appears to have less value in improving detection rate.

07. Determining real-world thresholds for [18F] PSMA PET-CT positivity in biochemical recurrence post prostatectomy

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**Aim:** To appraise factors determining [18F] PSMA PET-CT positivity for biochemical recurrence (BCR) after radical prostatectomy and determine meaningful, real-world clinical thresholds to help develop local practice guidelines.

**Method:** A retrospective analysis of 80 consecutive patients undergoing [18F] PSMA PET-CT between November 2020-22 at a single tertiary centre was performed. All patients had BCR after radical prostatectomy. Outcomes were collected via electronic records. Regression analysis was applied to test association with PSMA positivity and receiver-operating curve (ROC) analysis defined optimal threshold.

**Results:** Binary logistic regression showed significant associated between PSA level at time of scan and positivity rate (P<0.002). An optimal PSA threshold of 0.23 (AUC 0.813, SE 0.036, CI 0.744-0.883) was identified using ROC
analysis. If applied to our cohort this gives a sensitivity of 89% (48/54). There was no association between PSMA positivity and disease stage, PSA at diagnosis/post prostatectomy, PSA doubling time or time to biochemical recurrence.

All patient data was entered into the Evidencio Nomogram and average probability of a positive test was 49% for the patients with positive PSMA scan compared with 34% for patients with a negative scan.

Conclusion: The European Association of Urology prostate cancer guidelines panel recommends PSMA PET-CT for BCR after prostatectomy with level of 0.2 and our threshold is consistent with this. There remains heterogeneity in the literature for the optimal timing for PSMA PET-CT and the factors determining positivity rate.

References:

08. Can Artificial Intelligence predict survival from pre-treatment PET images for patients with Oesophageal cancer?

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Background: Oesophageal cancer is one of the leading causes of cancer death in the UK with 10-year survival rates as low as 12%. It is potentially curable with surgery however, the post-surgical recurrence rate has historically been over 50% and carries a significant risk of mortality. The decision to treat is important for patients and clinicians.

Aim: We propose an artificial intelligence method to predict disease-free survival (DFS) from PET imaging for patients with upper gastro-intestinal (GI) adenocarcinoma using a larger patient cohort than has previously been described in the UK.

Methods: We retrospectively analysed the staging PET-CT images of 92 patients with oesophageal and oesophagogastric junctional adenocarcinomas who underwent surgical treatment with curative intent. We analysed 58 radiomic features, 3 clinical features and 2 image reconstruction methods (OSEM and BRSEM). We performed 144 experiments to compare the predictive performance of 6 machine learning (ML) algorithms for predicting DFS up to 2 years post treatment.

Results: We found that most ML algorithms tested did not produce sufficient accuracy for use clinically however, BRSEM images with a logistic regression algorithm, provided the most clinically relevant results: an overall 75% accuracy predicting 70% of successful, and crucially, 83% of failed treatments.

Conclusion: BRSEM images with a logistic regression algorithm showed initial promise for predicting 2-year DFS from the radiomic signature from pre-treatment PET images of the primary tumour however further work with larger, standardised cohorts is required to validate this.

09. Predictors of metastatic disease in 18F PSMA-1007 PET-CT scans for staging in high-risk prostate cancer

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PSMA PET-CT has superior diagnostic accuracy over conventional imaging in staging patients with high-risk prostate cancer due to its ability to detect occult extra-prostatic disease. High-risk is defined as per the National Comprehensive Cancer Network: PSA ≥ 20 ng/ml, Gleason score ≥ 8, or a clinical stage of ≥T3.

We sought to explore the predictors of metastatic nodal and bony disease in our cohort of high-risk patients. A total of 194 consecutive patients who underwent a staging PSMA PET-CT scan for high-risk disease over an 18-month period were retrospectively reviewed. All patients were considered suitable for radical treatment and had prior negative or equivocal conventional imaging. Of the 194 patients, 73 (38%) had evidence of metastatic spread to nodes and/or bones. The remainder (121) showed no evidence of metastatic disease. A total of 96 out of 194 patients had a PSA ≥ 20 ng/ml, and of those, 46 had metastatic disease (48%). A Gleason sum score of ≥ 8 was seen in 89 of the 194 patients, and 44 of these 89 (49%) had metastatic disease. There was a positive correlation of metastatic disease with higher Gleason scores and PSA levels. Of 43 high-risk patients based on clinical stage of ≥T3, only 6 (14%) had metastatic disease on PSMA imaging.

Gleason grading and PSA levels are the dominant factors in predicting metastatic disease in patients with high-risk prostate cancer.

References:
1. Awenat, Salam et al. “Diagnostic Role of 18F-PSMA-1007 PET/CT in Prostate Cancer Staging: A Systematic Review.” Diagnostics (Basel,
10. Professional Identity and Role Perception of Nuclear Medicine Technologists working in a multi-disciplinary workforce - An exploratory qualitative study

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Introduction: This research aimed to explore and gain an understanding of the professional identity (PI) and role perception (RP) of Nuclear Medicine Technologists (NMT’s). An awareness of PI (an individual’s identity in relation to their professional group) and RP (an individual’s view of their specific role) is thought to enable safe and effective practice by providing an understanding of professional boundaries, behaviours and activities.

Methodology and Methods: 10 NMT’s were recruited from a large NHS Trust. Utilising the established methodology of Qualitative Description, data was obtained using semi-structured interviews and analysed using inductive thematic analysis.

Findings: 4 themes were identified: “Becoming the Unexpected” which detailed various training pathways; “Caring with Science” which described the NMT’s role and defined their PI; “Same View, Different Lens” which portrayed how Radiographers and Clinical Technologists practice as team of NMT’s; and “Confirmation of Professional Self” which presented how individuals view their professional status.

Conclusions: The study showed that the NMT role is highly specialised, multi-faceted and patient-centered. Professional status is based on the nature of the role and NMT’s University-Level education. NMT’s have a dual PI of “provider of care” and “user of science and technology”, and an individual identity of Radiographer or Clinical Technologist as determined by their training pathway. However, as Radiographers are statutorily regulated but Clinical Technologists are governed via a voluntary system, this may influence the future of the NMT workforce.

11. Nuclear Medicine Advanced Clinical Practice – A pathway to accreditation

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Purpose: This poster will discuss pathways for Nuclear Medicine (NM) Radiographers/Technologists to become nationally accredited advanced clinical practitioners (ACP). Many working within NM may not realise that they do in fact meet the 4 ACP pillars (defined by the Health Education England (HEE) multi-professional framework) (1) and may wish to become accredited ACP’s.

Methods: There are two routes for HEE accreditation, one through the completion of an accredited ACP MSc and the other through the HEE equivalence e-portfolio route. This is a personal account of three local NM Radiographers/Technologists who are pursing accreditation; two through the first cohort of the HEE e-portfolio route and one via an accredited ACP MSc.

Summary of the results: Application requirements and the process in entirety thus far will be presented.

Examples of gap analysis, job planning and suitable evidence for each of the four pillars (Clinical Expertise, Research, Education, Leadership) will be presented. The benefits of developing and engaging with ACP networks and stakeholders within the workplace will also be discussed alongside any hurdles and difficulties that have been encountered.

Conclusion: Identifying the existence of ACP’s within the Nuclear Medicine community and matching against the national framework not only standardises skill level between job roles but also matched against other professions. There is no reason why Nuclear Medicine expert practice should not meet the criteria to become nationally accredited ACP’s and subsequently receive the credit it so rightly deserves.

References:

12. Establishing the UK’s first D-SPECT Coronary Flow Reserve Service: A Technologist’s Perspective

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Background: Coronary Flow Reserve (CFR) assessment can aid the diagnosis of balanced multi-vessel disease and microvascular angina and has increased prognostic power over standard perfusion imaging. The department previously established the UK’s first routine SPECT CFR service on the GE Discovery 530Nmc CZT Gamma Camera. The aim was to establish a new CFR service on the Spectrum Dynamic D-SPECT CZT system.
13. Optimisation of parathyroid MIBI SPECT reconstruction parameters

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Statement on the purpose of the study: our institutions perform parathyroid MIBI washout for parathyroid localisation prior to surgical removal. The purpose of this study was to optimise the SPECT reconstruction algorithm.

Methods Used: SPECT-CT from 9 patients were retrospectively reconstructed using three different algorithms: algorithm 1 (OSEM (4 iterations, 10 subsets) + Butterworth (CF=0.60 and P=10.0)), algorithm 2 (OSEM (6 iterations, 10 subsets) + Hann (CF=1.8)) and algorithm 3 (OSEM (2 iterations, 10 subsets) + Butterworth (CF=0.40 + P=10.0) - original algorithm). The 9 selected studies have been reported as positive (3), negative (3) and inconclusive (3) to ensure a range of appearances. Signal-to-noise ratio (SNR), contrast (C) and contrast-to-noise ratio (CNR) were measured as quantitative assessments; qualitatively, the images were analysed by three consultants and two registrars.

Results: The analysed scans were performed between January 2022 and December 2022 - 6 females (66.7%) and 3 males (33.3%) were included with the mean age (±SD), 63.05±5.18 years.

Quantitatively, the SNR and CNR were statistically different between the three algorithms (p<0.05 and p<0.001, respectively with df=25), according to a pairwise t-test. Algorithm 1 had highest SNR (35.47) and algorithm 3 had highest CNR (17.77). Qualitatively, algorithm 1 was the preferred algorithm, p<0.05, using chi-squared test, df=8).

Conclusion: Algorithm 1 was the most preferred by the readers, which also had the highest SNR and C, but algorithm 3 has the highest CNR. Algorithm 1 outperformed the original reconstruction algorithm qualitatively and in most of the quantitative parameters. The improved reconstruction appearances could be used to offset reduction in patient dose or acquisition time.

References:

14. Assessment for potential improvement in image quality induced by Breath Hold During CT Acquisition of PET-CT

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For PET-CT acquisitions, the CT is acquired during ‘free-breathing’ and artefacts caused by respiratory motion such as blurring and misregistration of lesions are common. Breath hold during ‘relaxed expiration’ could reduce respiratory motion artefact whilst still allowing reasonable registration between CT and PET images.

Purpose: The aim of the pilot was to determine whether the effect of breath hold during ‘relaxed expiration’ for CT acquisition of PET-CT results in reduced motion artefact and improved image quality whilst achieving good or unchanged registration between CT and PET images.

Method: 10 patients with a previous PET-CT in the past 3-4 months were selected prior to scanning. They were instructed prior to the scan on the technique for ‘relaxed expiratory’ breath hold. Once positioned inside the PET-CT scanner, the patients were told to breathe out and hold then the CT scan commenced. After the CT had passed the liver the patient then was instructed to breathe as normal again. Following this, the routine PET scan was acquired.

CT images were visually assessed by a Consultant in Nuclear Medicine and the CT image quality and registration with PET was compared with patients previous PET-CT scans.

Summary of Results: Images for patients that adhered to instructions demonstrated reduced motion artefact and improved image registration. Reduced image quality was seen in patients that incorrectly performed ‘inspiratory’ breath hold due to worsening mis-registration.
Conclusion: ‘Relaxed expiratory’ breath hold can improve CT image quality and registration for PET-CT acquisition. It is important to ensure the patient does not perform full inspiratory breath hold.

15. Use of GATE Monte Carlo software for bespoke dosimetry of $^{18}$FFDG PET-CT studies

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The ARSAC Notes for Guidance (ARSAC 2022) currently estimates effective dose for typical sized patients undergoing examinations using 400 MBq $^{18}$FFDG as 7.6 mSv. However, currently there are no methods to determine how this value changes with patient size, which is particularly pertinent as more centres move to a weight-based administration scheme, as recommended by the EANM guidelines (Boellaard et al. 2015).

This project utilises GATE (GEANT4 Application for Emission Tomography, (Sarrut et al. 2014)) a Monte Carlo toolkit based on the well-established GEANT4 software, to determine patient specific S-factors for retrospective PET-CT data of patients of varying size and body habitus. To determine the S-factors, organs were outlined on the CT data using Limbus (Limbu.ai), an artificial intelligence-based radiotherapy organ segmentation tool. These outlines were used to mask PET data in order to produce source distributions for each organ of interest. Dose distributions within the CT data are calculated using GATE and the same outlines used to determine the dose to each organ from each source organ.

During this work, 103 $^{18}$FFDG patients who have received total body PET examinations will be simulated (47 females and 56 males, weight range 40kg-142kg, age range 18-86 years). At the current stage of the project, validation of the GATE code is being performed utilising DICOM versions of ICRP Reference Adult Male and Female phantoms and comparison to published S-values. Once validated, S-values for real patient data will be calculated using the above method and preliminary results will be available for the presentation.

References:

16. Foetal dose estimation following FDG PET scans for breast cancer

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Background and aim: $^{18}$FFDG PET imaging is indicated in the breast cancer pathway for staging and treatment stratification. However in cases where the patient is pregnant, they may be offered the scan due to the perceived risk to the foetus from ionising radiation by referring clinicians. The aim of this work was to quantify this dose to the foetus based on 3 cases scanned at UCLH.

Methods: 3 pregnant patients with diagnosed breast cancer, whose treatment could not be deferred until after delivery, were scanned using a half dose (2 MBq/kg) half speed protocol on a Siemens mMR PET-MR scanner. Estimated doses were calculated prior to administration based on literature dose per unit activity values, which could then be verified retrospectively on the patient images. Dose estimations were performed prior to injection, justified by the ARSAC practitioner and the patients were consented with full knowledge of the estimated risk.

Results: Estimated doses to the foetus ranged from 2.5-3.5 mGy, which is considered to be low risk. The dose was minimised by ensuring regular bladder voiding, a reduced dose protocol and using MR in lieu of CT for anatomical imaging. All images were considered to be of sufficient clinical image quality to determine the optimal treatment option.

Conclusions: $^{18}$FJDG PET scanning can be achieved with a low foetal dose provided that suitable provisions are made in the protocol. This information can help clinicians to make informed choices about whether to offer FDG PET scans to pregnant patients.

References:

17. The importance of testing trained neural networks for brain pseudo-CT generation in brain

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Purpose: Deep learning algorithms can predict pseudo-CT from MR for attenuation correction on simultaneous PET-MR scanners, but their performance robustness in out-of-sample datasets requires systematic study.

Methods: Here, we trained a residual 3D U-Net algorithm to create pseudo-CTs, with 106 adult brain T1-MPRAGE (TR/TE=1700/2.6 ms, no acceleration) images scanned on a Siemens mMR with their co-registered CT images used as ground truth. We then applied the algorithm to new datasets with the following characteristics relative to the training set:

- **Group A:** similar subjects and similar MR sequence (n=10 healthy adults, T1-MPRAGE, mMR)
- **Group B:** similar subjects, modified MR sequence (n=10 healthy adults, modified T1-MPRAGE (TR/TE=2300/3.0 ms, acceleration factor=2), mMR)
- **Group C:** similar subjects, modified MR sequence, different MR scanners (n=10 healthy adults, modified T1-MPRAGE (TR/TE=2300-6992/3.0 ms, acceleration factor=2))
- **Group D:** different subjects, MR scanner and sequence (n=10 paediatric dystonia patients, 3DT1 SENSE soft-tone)

All patients underwent CT scans which were used as reference.

Results: Mean absolute errors of less than 150 Hounsfield Units (HUs) were estimated for all subjects which is in line with the literature. However, biases of more than 2000% (changes of ~800 HUs) were observed in low-intensity structures in MRI such as the ventricles and large vessels for Groups B-D, which were misidentified as bone or air.

Conclusion: Deep learning is a promising technique for generating accurate pseudo-CT images. However, rigorous testing is required prior to application on domain-shifted data, with our results suggesting that even quite minor shifts may matter.

Acknowledgment: The DPUK PET-MR imaging network

References:

18. Can a neural network trained to generate pseudo-CT attenuation maps for PET-MR from an adult training dataset be used for paediatric patients? A pilot study

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Aim: Children often have two general anaesthesia sessions, one for PET-CT and one for MRI. Scanning on a PET-MR scanner would avoid one anaesthesia which is highly advantageous. The use of neural networks to generate a pseudo-CT for attenuation correction has great practical potential for attenuation correction in paediatric PET-MR. These methods require large amounts of training data which is difficult to obtain for many groups of patients. It is therefore necessary to examine any inaccuracies that arise when a network trained on one set of data is tested on data from another.

Methods: A residual 3D U-Net algorithm was trained to create pseudo-CTs, based on 106 healthy adult brain T1-MPRAGE images scanned on a Siemens mMR with co-registered ground truth CT images. A 3DT1 SENSE soft-tone MRI image acquired on a Philips scanner was then used to generate a pseudo-CT attenuation map for 3 paediatric dystonia patients also scanned on a GE discovery 710 PET-CT scanner. Reconstructed PET images were compared to CT attenuation corrected images.

Results: The global average error in PET uptake over the brain varied from 2 to 6%. Some structural differences were seen between CT and pseudo-CT in enlarged ventricles with misclassification of small areas of soft tissue as bone resulting in small local changes in PET uptake of <3%. One such area was misclassified as air resulting in a 20% difference.

Conclusion: The results are encouraging. Our method outperforms the UTE and 2-Point Dixon as evaluated in [1] and [2] from the mMR.

References:


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Purpose: [68Ga]Ga-PSMA imaging can be used for diagnosing recurrent prostate cancer, prostate cancer staging, and for assessing suitability for Lu-177 PSMA therapy. Ga-68 PSMA patients in GenesisCare Oxford are currently injected with 150 MBq and scanned for 4 minutes per bed. A fixed acquisition time can lead to a large
variation in image quality across the patient weight range. We explored the feasibility of adjusting the acquisition time based on patient weight with the aim of improving image quality consistency.

**Methods:** The liver standardised uptake value (SUV) signal to noise ratio (SNR) for 47 patients, acquired using the local standard acquisition parameters of 4 - 5 minutes/bed, were retrospectively analysed to establish an average SNR value for patients in different weight categories. This data was used to predict a weight-based scan time required to maintain an acceptable SNR, given a 150 MBq fixed injected activity.

An additional cohort of patients had their acquired scans Poisson resampled to either 2, 3, 4 or 5 minutes/bed based on this prediction based on patient weight. The resultant liver SUV SNR was used to establish if subsequent image quality was maintained as expected.

**Results and Conclusion:** The predicted updated scan times resulted in acceptable SNR for the additional cohort of patients where data resampling was used. These resampled patient images will undergo Clinician review to assess whether they are clinically acceptable to allow the centre to move to a weight-based acquisition protocol.

**20. Cycle-specific phase offsets for optimized data driven gating**

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Respiratory motion (RM) can affect PET image quality. One way to reduce motion effects is respiratory gating. The objective of this study, as we seek to further optimise Data Driven Gating (DDG) algorithms, is to compare two types of DDG phase-gating methodologies: Method-1 has fixed quiescent period offset while Method-2 has an optimised offset for each cycle based on the amplitude of the waveform.

Two phantoms (NEMA and anthropomorphic) and 9 patients were reconstructed using two DDG algorithms. The phantoms were placed on a RM platform. Algorithms were compared by measuring Contrast Recovery (CR) and Background Variability (BV). Additionally, volume and line profile analysis were carried out. For patients, healthy liver noise and SUVmax of 17 lesions were measured. T-testing was used to assess difference between means.

For NEMA’s spheres, the averaged ratio between the two gating algorithms was: CR1/CR2=1.00 and BV1/BV2=1.18. For the anthropomorphic phantom: 0.97 and 0.96 respectively. From line profile analysis, the averaged ratio of full width half maximum was FWHM1/FWHM2=1.02. The volume of sphere with diameter d=22mm, measured using a thresholding method was V1/V2=1.12. T-test results for each metric demonstrated no statistical difference between gated reconstructions (p>0.05).

For patients, the difference in healthy liver noise and SUVmax between gated reconstructions was always smaller than 10% with no statistical difference (p>0.05). The overlap of quiescent periods defined by the algorithms was between 65-95%. When the overlap was small, there was a trend towards reduced noise in the liver using Method-2 reconstructions.

**21. Welcome to CARL – a national research-dedicated facility for radionuclide production and radiopharmaceutical chemistry**

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The Cyclotron and Radiochemistry Laboratory (CARL) at King’s College London is the UK’s first nationally-accessible research-dedicated facility for radionuclide production and radiopharmaceutical chemistry.

Refurbished with a £1m EPSRC grant (June 2022) enabling the upgrade of equipment infrastructure and management of the facility, CARL internal activities have now started, with access for external users from August 2023.

CARL provides facilities for radionuclide production including target design and preparation, cyclotron irradiation (on site, or elsewhere e.g. via direct collaboration with the Birmingham Cyclotron Facility), target radionuclide purification, and radiochemistry development/radiopharmaceutical synthesis. Available radionuclides will include those in routine use (18F, 11C, 13N, 64Cu) and radionuclides of research interest, which are otherwise not produced in UK (currently 62Cu, 62Zn, 44Sc and 52Mn). In the next years 124I, 203Pb, and 211At will be available.
CARL offers the following support to users and collaborators:

- Access and use of equipment including an 11 MeV cyclotron, HPGe detector, ICP-OES, 6 hot cells/shielded fume hoods, radiosynthesis and radioanalytical modules, training and support from local staff
- A pipeline to on-site preclinical in vitro and in vivo research with tracers developed in CARL
- Support for writing joint grant proposals (in collaboration with Department of Imaging Chemistry and Biology) to sustainably fund CARL
- Supply and shipment of radionuclides and/or radiotracers
- Sample analysis e.g. trace metal analysis on ICP-OES
- Use of CARL space for teaching and training e.g. hosting hands-on equipment workshops

Interested users should contact the facility (carlfacility@kcl.ac.uk) to discuss research needs and project proposals, access, charges, training, or supply of radionuclides across the UK and overseas.

23. A UK survey of Medical Physics Expert support levels

James Scuffham¹, Glenn Flux², John Dickson³, Jonathan Price⁴, Graham Wright⁵, Emma O'Shaugnessy⁶, Heather Williams⁷, Anthony Murray⁸, Julian Macdonald⁹, David Towe⁴, Sandra Biggart¹⁰, Sofia Michopoulou¹¹, Richard Peace¹², Matthew Gray¹³, Aida Hallam¹⁴, Kat Dixon¹⁵, David Hall¹⁶, Katrina Cockburn¹⁷, Maria Burniston¹⁸, Chloe Trevail¹⁹, Sarah Heard²⁰, Lisa Rowley²¹, Matthew Aldridge²², Chloe Bowen²³, James Cullis²⁴, Daniel McCool²⁵, Mark Aplin²⁶, Mark Barnfield²⁷, Susan Manov²⁸, Lois Collins²⁹, Sue Douglas³⁰, Matthew Ward³¹, Mark Arthey³², Andrew Bradley³³

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²¹Cambridge University Hospitals NHS Foundation Trust, Cambridge, United Kingdom
²²University Hospitals Coventry & Warwickshire NHS Trust, Coventry, United Kingdom
²³Maidstone and Tunbridge Wells NHS Foundation Trust, Maidstone, United Kingdom
²⁴Imperial College Healthcare NHS Trust, London, United Kingdom
²⁵University Hospitals Birmingham NHS Foundation Trust, Birmingham, United Kingdom
²⁶Royal Free Hospital NHS Foundation Trust, London, United Kingdom
²⁷University Hospitals Sussex NHS Foundation Trust, Brighton, United Kingdom
²⁸Leeds Teaching Hospitals NHS Foundation Trust, Leeds, United Kingdom
²⁹Royal Devon and Exeter NHS Foundation Trust, Exeter, United Kingdom
³⁰University Hospitals of North Staffordshire NHS Foundation Trust, Stoke, United Kingdom
³¹East Kent Hospitals University NHS Foundation Trust, Canterbury, United Kingdom
³²East & North Hertfordshire NHS Trust, Northwood, United Kingdom
³³Clatterbridge Cancer Centre, Liverpool, United Kingdom
³⁴East Suffolk and North Essex NHS Foundation Trust, Colchester, United Kingdom
³⁵Manchester University NHS Foundation Trust, Manchester, United Kingdom

Medical Physics Experts (MPEs) must be appointed by Employers under IRMER and should be closely involved in optimisation, dosimetry and quality assurance in relation to medical exposures. In Nuclear Medicine, ARSAC Employer Licence applications require the level of MPE support to be specified. A recent Policy Statement developed by IPEM, BNMS, BIR and ARSAC provides recommendations on MPE support levels. This Policy Statement has now become the standard against which ARSAC Employer Licences are assessed.
We conducted a survey of UK Nuclear Medicine departments to determine current levels of MPE staffing, in comparison to the ranges specified in the Policy Statement. Utilising a new network for senior Nuclear Medicine Physicists established recently, a total of 55 departments across the UK were asked to participate in the survey. Departments were asked to provide their Whole Time Equivalent (WTE) MPE staffing levels, and the minimum and maximum levels of MPEs that would be required to support their local services according to the Policy Statement.

We had 33 responses to our survey. MPE coverage ranged from 26% of the minimum guidance level up to 130% (average 62%). 85% of departments had less than the minimum number of MPEs specified in the Policy Statement.

Our results indicate significant challenges in meeting current guidance on MPE staffing levels. A possible limitation is the interpretation of WTE, given the variety of job roles and other responsibilities of Nuclear Medicine Physicists. The contribution of Clinical Scientists and hub-and-spoke distributed models for MPE support should be further considered.

24. Improving the quality and efficiency of a large Nuclear Medicine service through automated image processing

Jonathan Taylor, Michael Sharkey, Peter Metherall
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Purpose: The Nuclear Medicine department in Sheffield is spread across 3 sites. In addition, support is provided to 4 external departments and to PETCT and PETMR installations. With an ever-increasing range of applications and site-specific protocols there is an increased risk of human error in processing scan data using traditional software, particularly with increasing workloads.

An automated image processing system was required in order to both reduce the risk of protocol deviations and to reduce time spent on routine scan processing tasks.

Methods: Tasks that were amenable to automation were first identified. A dicom server infrastructure was then built to provide a rule-based system for image processing. The design prioritised off-the-shelf software that was compliant with medical device legislation and was easy to maintain.

Summary of results: The processing infrastructure was largely based on MIM Assistant software but also utilised python. Incoming DICOM data (from scanners round the region) triggers specific rules according to the header information or the time of day. Current and historical activity can be monitored via web browser.

The following tasks have been successfully automated so far:

- SPECT image reconstruction (site and application specific)
- Patient details checks (comparison vs RIS)
- Triggering of AI auto-segmentation applications
- Scan QC checks
- Processing of gamma camera SeHCAT studies
- Collation of serial static scans into dynamic images with motion correction
- Transfer to site-specific archives and PACS

Conclusion: A system was built to facilitate automatic processing of Nuclear Medicine scans, increasing efficiency and reducing the risk of human error.

25. Assessing the impact of CT parameters on SPECT-CT imaging including relative quantitative measures

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Introduction: CT is commonly used for attenuation correction and localisation of lesions in SPECT imaging. There is no clear guidance on CT parameters for hybrid systems. Default manufacturer settings are often used.

Aim: Investigate the impact of CT parameters on quantitative relative measures in SPECT images and make recommendations for their clinical use on the GE Discovery NM/CT870 SPECT-CT.

Methods: A bespoke phantom with varying attenuation and tube insert containing $^{99m}$Tc was used to assess quantitative relative measures. A CT automatic exposure control (AEC) phantom was used to assess CT dose and image quality (IQ). Acquisitions were performed varying a range of CT parameters including the use of metal artefact reduction (MAR), AEC settings, reconstruction settings (Full/Plus mode), tube voltages (kV) and topogram acquisition order.

Results: The use of 10mm beam collimation to enable MAR, extending the tube current range or increasing the noise index did not affect CT dose. The relative quantitative measures were only altered in the largest sections of the phantom. Full mode resulted in an increase in CT dose with no improvement in CT IQ or relative quantitative measures. Higher kV resulted in similar CT doses but improved attenuation correction and relative quantitative measures. The topogram acquisition order impacts the CT dose and IQ.

Conclusion: CT optimisations can now be made with a better understanding of the consequences on the resultant SPECT-CT images and patient dose. These will include reducing the beam collimation, extending the range of AEC settings and increasing the kV.
26. Image Quality Optimisation and Dose Reduction using GE Clarity 2D

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Purpose: GE Clarity 2D is a post-processing image enhancer which promises to improve contrast whilst decreasing noise in planar acquisitions. Application of Clarity has the potential for reduction of patient dose and scanning time with preserved image quality.

Methods: Static images of a Williams phantom filled with 150 MBq of 99mTc were acquired using a GE DR 870 gamma camera. Acquisitions had 6 million, 3 million and 1.5 million counts, and Clarity was incremented in strength between 0% and 70%. Regions of interest (ROIs) were drawn using Hermes encapsulating 80% of the cross-sectional area of the 4, 2 and 1 cm hot and cold circular regions. Using the count statistics from these and a background ROI, the contrast to noise ratio (CNR) and uniformity were calculated.

Results: A linear relationship was found between the strength of Clarity applied and the CNR and uniformity. Scans with 3 million counts and 30% Clarity, and scans with 1.5 million counts and 70% Clarity had an equivalent or better CNR than 6 million count scans without Clarity. At higher levels of Clarity, artefacts were identified which may reduce its usefulness in the clinical setting.

Conclusion: Use of Clarity 2D in planar phantom studies has shown that some clinical protocols could have the potential for their acquisition times or administered doses to be drastically reduced, perhaps by up to 50%. This will be investigated further, with Clarity being applied to patient scans post-acquisition and the resulting changes in image quality quantified and reviewed by radiologists.

References:
GE Healthcare 2019, Clarity 2D Technical Description and Demonstration

27. GE Swiftscan SPECT – effect on standardised uptake values when imaging patients administered with [99mTc]Tc-HYNIC-TOC

Katrina Cockburn, Alison Mackie
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Introduction: GE Swiftscan SPECT increases the number of counts in an image dataset through use of the novel low-energy high-resolution and sensitivity collimators in conjunction with Step-and-Shoot-Continuous (S&SC) mode data acquisition, whereby the gamma camera continues to acquire data between planar projections. Whilst increased counts improves image quality, we wished to investigate whether S&SC acquisitions changed the standardised uptake values (SUVs) compared to traditional step-and-shoot (S&S) acquisitions.

Methods: After ethical approval, three patients (two male) were administered with 740MBq +/- 10% of [99mTc] Tc-HYNIC-TOC. SPECT-CT images were acquired with a GE Discovery 850 gamma camera acquiring simultaneously in both S&S and S&SC modes. Separate S&S and S&SC images were reconstructed with GE Q.Volumetrix MI, and maximum and minimum SUVs (SUVmax and SUVmean) were calculated for tumours and a range of normal tissues.

Results: Due to the increased counts in the reconstructed datasets, use of S&SC resulted in higher SUV values than for S&S, (2,2 times higher for SUVmax and 1.7 times for SUVmean). Use of automatic thresholding resulted in delineation of similar but not identical volumes, with larger volumes on average from S&SC acquisitions, and this is more pronounced when higher thresholds are applied (Ratio of S&S:S&SC volumes for 42% threshold is 1.01, 50% is 1.02, 70% is 1.09).

Conclusions: SUVs are higher in datasets acquired with S&SC, despite increased volumes delineated by automatic thresholding.

28. Evaluation of motion detection software for myocardial perfusion imaging on a cardiac gamma camera

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2Newcastle University, Newcastle, United Kingdom

There are multiple options available to assess patient motion on the cardiac camera. In this study, the GE Alycone Motion Detection (MD) and the GE Alcyone Motion Detection and Correction (MDC) software were evaluated for their usability, manual intervention and ease of interpretation. A user-friendly interface is desired to reduce the additional workload on the users.

A dataset of 44 myocardial perfusion images (30 stress, 14 rest) from a GE430C Cardiac Camera, were processed using the two programs, to visually assess for significant motion (>10mm) on each interface. The usability of each software was measured by its crash rate, degree of manual intervention required and an objective appraisal of the interface.

There were no studies with significant motion identified using the MD software and three studies identified with significant motion on the MDC software. The three cases where the MDC software identified motion all included gut uptake in the ROI and were subsequently classified as false positives. The MD software did not crash.
during its use and the MDC software crashed once every six times it was opened. The objective appraisal of the interfaces found that the MD assessment screen was simpler, relied less on manual intervention and was therefore likely to be interpreted with less inter- and intra-operator variability.

The 3 false counts of significant motion on the MDC software indicate that it is less reliable for motion detection, and combined with its less user-friendly interface, it was recommended that the MD software be used for routine motion detection.

29. IPEM Technologist Training scheme – A tool for staff training and retention for NHS Scotland

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3University of Glasgow, Glasgow, United Kingdom

Introduction: For the past decade, NHS Greater Glasgow and Clyde (NHSGGC) has made good use of the IPEM Clinical Technologist training scheme to grow our own trained clinical technologist workforce.

Methods: NHSGGC hosts the IPEM West of Scotland Training Centre, offering a number of clinical technology specialisms notably Medical Engineering and Nuclear Medicine, as well as Radiation Engineering and Radiation Physics. Other NHS boards in NHS Scotland also offer training under our accredited scheme with local supervisors. Oversight and review are provided using a hub and spoke model.

Results: The training scheme has attracted radiographic and physics graduates. Nineteen clinical technologists have successfully qualified in Nuclear Medicine with DipIPEM allowing entry to the Register of Clinical Technologists. All have subsequently worked within an NHS Nuclear Medicine role.

We currently have ten trainees in various stages of preparation. Most training posts had to be funded from existing posts and staff are brought in at Band 5 level. Five, one-off training posts have been funded directly by NHS Education Scotland.

Only one candidate has chosen not to complete the scheme and chosen a different path within healthcare.

Conclusions: The use of this training scheme has proved highly successful in training and retaining excellent clinical technology staff in Nuclear Medicine within NHS Scotland. We are seeking further NHS funding to offer additional recurrent supernumerary training posts, with an annual graduate intake. We have demonstrated that use of the IPEM Training Scheme is excellent value for money and effective at filling the skills shortage.

30. Do patient positioning errors in the SeHCAT test scan impact the clinical diagnosis of Bile acid malabsorption?

Jennifer Williamson, James Scuffham, Alexander Smout
Royal Surrey County Hospital, Guildford, United Kingdom

Purpose of the study: The aim of the study was to correct patient positioning errors in SeHCAT test scans using uncollimated gamma cameras, to analyse the impact these have on the diagnosis of Bile Acid malabsorption (BAM).

Methods: The analysis was carried out using a MATLAB script that loops through pseudoanomysed patient files to apply positioning corrections to the image data. The counts in the posterior and anterior views were modelled as 2D Gaussians that were corrected to the centre of the FOV. From this, the corrected count data went through further processing to output the corrected SeHCAT retention values.

Summary of the results: Patient positioning errors from a 50 patient dataset have produced changes in the SeHCAT retention value that ranged between 0% and 1.2% for the whole retention range (0-100%). In the BAM range (0-15%), the change in SeHCAT retention value was lower, ranging between 0% and 0.4%.

Conclusion: The 2D Gaussian correction model improved the accuracy of diagnosis by removing positioning errors caused by challenges in maintaining consistent patient positioning in the scans. Patient positioning errors have less of an impact on low SeHCAT retention values, where the BAM range is found. Therefore, a change in diagnosis would only likely occur at borderline retention levels if relatively large positioning errors are observed in the count data.

31. Audit of Sentinel Lymph Node localisation in breast cancer surgery following administration of radioactive nanocolloids

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Sentinel lymph node biopsy (SLNB) in breast cancer aids staging without side-effects caused by axillary node clearance. SLNB best practice is a combination technique guided by radioactive nanocolloids (RN) and blue
dye (BD) with published success rates of 94-97% for RN alone and 99% for combination. An audit was performed to determine localisation rates of breast SLN at two hospitals in our trust.

Nuclear Medicine (NM) and surgical records were retrieved for patients who had breast SLNB. The data was analysed to identify: the SLN localisation rate; whether more SLN were identified on imaging than in theatre; whether localisation rates changed over time; whether failure to locate SLN was linked to a specific operator or site.

Using RN, 93% of SLN were identified at Hospital 1 and 82% at Hospital 2. Addition of BD improved localisation to 95% and 98% respectively. For imaged patients, more SLN were located using the gamma probe than were found on images. The poorer localisation rate using RN at Hospital 2 could not be linked to any individual operator, but decreased after a temporary closure of the NM department and gamma probe replacement.

Hospital 1 located more SLN by RN than Hospital 2 but there was little performance difference when RN and BD were combined. The poorer localisation rate at Hospital 2 may have been related to temporary closure of the Hospital 2 NM department and replacement of the gamma probe during the period audited. Then audit will be repeated in 12 months.

**32. Liquid gastric emptying studies: should we be doing them?**

**Abigail Redwood, Deepak Subedi**

*NHSLothian, Edinburgh, United Kingdom*

**Aims:** To determine the necessity of performing a liquid gastric emptying study following the completion of a prolonged solid gastric emptying study.

**Methods:** 100 solid gastric emptying studies were reviewed retrospectively. Data was collected and analysed regarding whether these patients went on to undergo a liquid gastric emptying study, whether this was prolonged, and whether or not this changed the outcome of the overall study report.

**Results:** Almost half (44%) of patients went on to undergo liquid gastric emptying studies following an abnormal or borderline solid gastric emptying result. Only 12 (27%) of these were abnormal, and these were all in patients with convincingly prolonged gastric emptying to solids. Of the 31 liquid studies that were normal or borderline, 24 (77%) were reported as having abnormal gastric emptying on the basis of delayed solid emptying. Only 7 (23%) patients with prolonged solid emptying and normal liquid emptying were reported as demonstrating normal gastric emptying, and all of these had only mildly prolonged solid emptying.

**Summary:** Liquid phase gastric emptying studies represent a significant burden of time, resources and cost to nuclear medicine departments, yet these results suggest that they rarely add useful information to patients’ investigations. In most cases, the presence or absence of delayed gastric emptying can be assessed using solid emptying studies only.

**33. Incidental Findings on PSMA PET-CT**

**Asma Nisar, Siraj Yusuf, Iain Murray, Carla Abreu**

*The Royal Marsden Hospital, London, United Kingdom*

**Objective:** To review our experience of PSMA PET-CT imaging and highlight normal and abnormal tracer biodistribution of [68Ga]PSMA and [18F]PSMA PET-CT scans as well as significant incidental findings.

**Methods:** Patients who underwent [68Ga]PSMA or [18F]PSMA PET-CT scans at the Royal Marsden Hospital from October 2022 to January 2023 were reviewed retrospectively.

**Results:** Our review resulted in this poster demonstrating similar [68Ga]PSMA and [18F]PSMA uptake in lacrimal glands, parotid and submandibular salivary glands, liver, spleen, kidneys and bladder but the differences in hepatobiliary and urinary excretion. Examples of incidental findings unrelated to the prostate cancer are also demonstrated.

**Conclusion:** A version of this educational poster will be displayed in our PET-CT control rooms. We will audit its effectiveness as a tool in increasing the detection of unusual or incidental findings by PET technologists and highlighting these to reporting clinicians.

**References:**

**34. [18F]FDG PET-CT: interesting cases review**

**Suzannah Patel1, Ruth McCloy1, Bruno Ferreira1, Chun Lap Pang1,2, Anthony Chambers1,2,**

**Subhadip Ghosh-Ray1**

1*Paul Strickland Scanner Centre, Northwood, United Kingdom*

2*London North West University Healthcare NHS Trust, Harrow, United Kingdom*

**Purpose of case studies:** The reviewing of patients’ scans is common practice to assess image quality and identify any underlying life-threatening conditions. This presentation aims to present four individual case studies of incidental findings discovered on [18F]FDG PET-CT scans. This presentation will provide pictorial resources to aid operators in detecting pathologies that are infrequently seen on PET-CT scans.
Method: Patient 1: history of gastric cancer; had previous CT scan which detected a malignant obstruction in the transverse colon. The PET-CT scan was requested to determine the cause of the obstruction.

Patient 2: TxN2M0 small cell lung cancer and mucinous adenocarcinoma. Differentiation of avid sites.

Patient 3: left upper lobe lung mass, recent biopsy. For possible surgical resection.

Patient 4: patient with renal transplant. Referred for PET-CT scan for myeloma staging.

Summary of results

Prior to a patient leaving the department, the image registration is checked, and images are reviewed for any gross abnormalities or artefacts.

Patient 1: a perforation of the caecum, resulting in a gas-fluid collection in the peritoneal cavity was identified.

Patient 2: diffuse metastatic skeletal involvement with structural compromise at C1 and skull base. Other fractures noted in mandible and scapulae.

Patient 3: near complete left lung collapse, post biopsy.

Patient 4: new haemorrhage in transplanted kidney and from collecting system extending into the bladder.

Conclusion: Training and Radiographer-led education sessions are essential in maintaining good image quality and the ability to identify life-threatening conditions.

35. The First National NM Teaching programme for trainees in the UK: set-up, challenges, and future prospects

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4Royal Marsden Hospital NHS Foundation Trust, London, United Kingdom
5Cambridge University Hospitals NHS Foundation Trust, Cambridge, United Kingdom

Background/ Aims: The delivery of structured teaching for Nuclear Medicine trainees has been an organizational challenge before the COVID-19 pandemic due to the geographically dispersed, small number of trainees in the UK Nuclear Medicine Training Programme. The rapid adoption of new online teaching methods during and after the COVID-19 pandemic created the conditions for establishing a UK-wide National Teaching Programme aimed at increasing regular practice-based interactive learning opportunities for Nuclear Medicine trainees (mapped to the requirements of the 2021 Nuclear Medicine curriculum). We present our initial experience with establishing this programme.

Methods: The programme has been set up as a series of monthly Microsoft Teams-mediated teaching afternoons. Although the main target audience is UK Nuclear Medicine trainees, the programme has been opened to Radionuclide Radiology trainees, Consultants, Clinical Scientists and Allied Health Professionals. The programme is organized by two teaching programme coordinators, the Nuclear Medicine Specialty Trainee Committee representative and the National Training Programme Director.

Results: Invited speakers delivered 7 teaching sessions since May 2022 and formal feedback on presentation quality, content and relevance was gathered from the attendees. Feedback has been overwhelmingly positive, with sessions being attended by at least 10 participants (maximum 24).

Most attendees have been satisfied with the format, frequency and length of the teaching sessions, and several complimentary comments on the usefulness of teaching also having been made.

Progress/ Future Directions: Future plans include strengthening the case-based discussion format of teaching, involving international speakers, increasing collaboration with BNMS and engaging more teaching sites.

References:

36. Improved management of clinical trials in nuclear medicine: A Royal Free Perspective

Sean Baker, Joanne Page
Royal Free Hospital, London, United Kingdom

Background/ Purpose: The Nuclear Medicine department at the Royal Free Hospital provides nuclear medicine tests for clinical trials run by other departments. Ensuring thorough compliance with the trial protocol and nuclear medicine specific legislation requires effective communication and co-ordination across different professional groups within the department. We developed a systematic departmental approach to effectively manage incoming research.

Methods: To better facilitate the department’s contribution to clinical trials, we established a research committee (RC), composed of a member from each of the
professional groups (physicists, technologists, radiopharmacists and consultants). The systems developed and implemented by the RC are to ensure we are compliant with all aspects of study protocols, including IRMER, radiopharmacy, activity administration specifics, QC, scan protocols, image reconstruction and data storage/transfer.

**Results:** The research committee and their methodical approach to approaching research trials has vastly improved our department’s management of trials, allowing for a more timely and efficient process. Through their well-documented systems and checklists, we can ensure all staff involved with each stage of the trial process are confident to perform their role and satisfy all aspects of the study protocols and necessary legislation.

**Conclusion:** Effective communication between all professional groups has guided the creation of the necessary framework which has been implemented in the Royal Free Hospital’s Nuclear Medicine department. A structured and holistic approach to managing research has proved significantly beneficial in the overall management of clinical trials.

**37. The value of semiquantitative analysis to increase the diagnostic yield of lymphoscintigraphy for lower limb lymphoedema.**

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**Purpose:** Lymphoscintigraphy is an essential imaging modality for diagnosing lymphoedema. Protocol variability, poor image resolution and variety of findings in qualitative analysis makes the interpretation challenging. We aim to assess if semi-quantitation adds value to the qualitative assessment.

**Methods:** Patients referred for lymphoscintigraphy with suspicion of lower limb lymphoedema, between 2020-2022, were assessed. Visual assessment for all the limbs was done based on Taiwan lymphoscintigraphy staging\(^1\) and classified as normal, partial obstruction and severe obstruction. Semi-quantitative analysis was given as percentage uptake in ilio-inguinal nodes on 2-hour post injection images (normal range > 10%). The ilio-inguinal node uptake values were assessed against the visual staging.

**Results:** 30 patients (15 females, median age 58 years) were included in the study (60 limbs analysed). On visual assessment, 26 limbs were normal and 4 had partial obstruction. On semi-quantitative analysis, the median, 1st and 3rd quartiles of lymph node uptake for normal limbs and those with partial obstruction were 14.2(9.2-23.6) and 5.5(3.3-9.1) respectively. In 13/60 (21.7%) patients’ discordance was observed between visual and quantitative findings. In 11.7% limbs there were features of partial obstruction visually with normal quantitation. In 11.6%, visual assessment showed normal limbs but delayed drainage on quantitation. Quantitation helped in changing the lymphoedema staging in 4/60 (6%) patients.

**Conclusion:** Lymphoscintigraphy quantitation is useful in visually equivocal cases with mild/early lymphatic abnormality, helps in changing the stage of lymphoedema and increases the confidence in reporting.

**References:**

**38. Quantitative lymphoscintigraphy of the lower limbs for the diagnosis of phlebolymphoedema**

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\(^3\)King’s College Hospital NHS Foundation Trust, London, United Kingdom

**Introduction:** Quantitative lymphoscintigraphy measures lymphatic function: we hypothesise that in phlebolymphoedema, where chronic venous insufficiency causes increased lymph production, we could measure unusually high lymphatic drainage while the lymph system is still fully functional.

The presence of scintigraphic features of increased lymph production were noted for each limb: visualisation of ilioinguinal nodes in the immediate image; obvious prominence of ilio-inguinal nodes at 2 or 2.5 hours; lymphatic vessel collaterals; lymph diversion into the skin or deep system.

**Method:** Patients referred for lymphoscintigraphic investigation of swollen legs between April 2021 and December 2022 were reviewed. The quantitative lymphoscintigraphy technique described by Keramida et al. (2017) was followed to calculate ilio-inguinal nodal uptake (IIQ%).

**Results:** A total of 39 patients were reviewed (78 limbs, 29F, 10M). Taking IIQ>30% as the upper limit of normal, seven limbs were identified with supranormal lymphatic function (IIQ=51.0%, 50.0%, 44.8%, 41.3%, 39.3%, 36.7%, 35.6%) plus three borderline (IIQ=29.4%, 29.2%, 28.9%). Of these 10 limbs, all had at least two scintigraphic features of increased lymph production. Five out of the 10 limbs were swollen, and in those patients both limbs were swollen.

**Conclusion:** Quantitative lymphoscintigraphy, although developed for diagnosing abnormally low lymphatic function, may also have utility at the upper end of the spectrum for identifying chronic venous disease. An IIQ% upper normal limit of 30% could be used to diagnose underlying venous disease as the cause for limb swelling.
in cases where venous ultrasound results are erroneous, missing or inconclusive.

References:

Stephanie Doherty, William Murphy, Karen Mullin
Royal Victoria Hospital, Belfast, United Kingdom

Purpose: [123I]MIBG is a valuable tool in the diagnosis of Parkinson’s disease and differentiating Parkinson’s disease from atypical Parkinsonian syndromes. The purpose of our study was to review [123I]MIBG and assess radiology reporting using visual analysis, quantitative assessment using heart to mediastinum ratios (H/M ratio) and comparing scan findings with clinical diagnosis.

Method: A ten-year (2012-2022) retrospective review was performed in a tertiary referral centre which yielded 50 studies. First, three radionucleotide radiologists independently re-reported studies using visual analysis. Second, a clinical scientist calculated the H/M ratios. Lastly, correlation of scan findings with clinical diagnosis by reviewing patients’ Electronic Care Records.

Results: Visual assessment is non binary and radiologists coherently highlighted ambiguity of interpretation on visual analysis. Quantitative assessment showed average H/M ratio with preserved cardiac uptake (22 cases) was 1.52 (1.23-1.90) and 1.10 (1.02-1.28) when cardiac uptake was absent (28 cases). There was an overlap of the ratios. Scan interpretation was not fitting with clinical diagnosis in 7 cases (14%).

Conclusions: [123I]MIBG scintigraphy is an aid in diagnosing Parkinson’s disease but the test has limitations. In particular we have highlighted weaknesses regarding the non-binary nature of visual assessment, the lack of a diagnostic reference range for H/M ratios and variation between scan findings and clinical diagnosis. Our department are no longer routinely calculating H/M ratios and the limitations of [123I]MIBG have been highlighted to our clinical colleagues.

40. Small sample study of Siemens Striatal analysis to improve decision making for patients imaged with [123I] Ioflupane
Emily Fittock, Davina Pawaroo, Ramona-Rita Barbara, Matthew Gray
Norfolk and Norwich University Hospital NHS Foundation Trust, Norwich, United Kingdom

Aims:
- Validate the imaging protocol required to use Siemens “Striatal analysis”
- Determine whether Striatal analysis changes reports of [123I]Ioflupane studies.

Our local imaging protocol did not match the FPCIT2A Siemens Striatal analysis norms database thus we modified the number of projections, added Chang attenuation correction [AC] and modified the Butterworth filter.

Validating parameters: 15 patients (normal=5, abnormal=10) were reconstructed per-protocol and with AC (µ=0.11cm-1). For AC reconstructions the Butterworth filter was harmonized with the normals database. Images were anonymised, randomised and two radiologists reviewed them qualitatively, evaluating images as “normal”, “abnormal” or “indeterminate”.

The striatal phantom filled with a 7:1 striata:brain ratio was imaged using 120 (database) and 128 (per-protocol) projections, the images were reconstructed using AC.

Results: A weighted kappa test determined complete agreement between the diagnosis of per-protocol and AC reconstructions (κ=1). Image analysis tests indicated image quality was not impacted by fewer projections. Signal in the striata decreased by 10%, however the signal to background ratio and signal uniformity both improved by 2%. There was no difference in background uniformity and no significant difference in average striatal length, considering the measurement error (0.1±0.26cm).

Striatal analysis: 10 patient images acquired using the verified parameters were anonymised and randomised into two identical datasets; one reported qualitatively and one using Striatal analysis.

Results: Change of management was observed for one patient (10%) when using Striatal analysis, the diagnosis changed from indeterminate/abnormal to normal.

Conclusions: The database imaging protocol was adopted so [123I]Ioflupane images may be reported qualitatively using Striatal analysis.

41. The role of Ventilation/Perfusion (V/Q) Single-Photon Emission Computed Tomography (SPECT)- CT lung lobar quantification (LLQ) in surgical decision-making in lung cancer patients
Safia Rehman1, Julia Charlotte Fowler2,
Lawrence Okiror1, Jeessoo Choi2
1University Hospitals Birmingham NHS Foundation Trust, Birmingham, United Kingdom
2Guy’s and St Thomas’ NHS Foundation Trust, London, United Kingdom
Introduction: Lung Lobar Quantification (LLQ) derived from V/Q SPECT-CT quantifies the percentage of perfusion and ventilatory function contributed by the individual lung lobes, using CT to accurately define the lobar volumes. This technique is increasingly useful in preoperative assessment of patients undergoing lung resection.

Objective: This study aimed to assess the impact of LLQ studies on surgical decision-making in lung cancer patients.

Methods: This is a retrospective study of lung cancer patients having preoperative LLQ scans to prior to surgery at a single centre. Scans were performed in patients with borderline lung function (based on spirometry), borderline surgical fitness due to comorbid conditions, or those undergoing major resection. Patient notes were reviewed for preoperative fitness, lung function tests results, surgical plan including extent of planned lung resection before and after results of lung LLQ tests. Any change in management plan was noted following LLQ (change of surgical approach, extent of lung resection or change to non-surgical management).

Results: The use of LLQ studies led to change in surgical management plan in 17 patients (34%), with a change of surgical resection extent in 8 (16%) and a shift from surgical to non-surgical management in 9 (18%) cases.

Conclusion: In this single centre retrospective study, the inclusion of LLQ appears to facilitate personalised tailoring of the surgical management plan. Larger prospective studies are required to confirm this impression. It is considered likely that including LLQ will improve patient outcomes and may reduce costs, particularly in patients with borderline respiratory reserve.

42. A review of the Northern 99mTc-Tc-MIBI SPECT-CT pathway for Parathyroid Adenoma investigation following addition of contrast enhanced CT.

Amy Verrinder, George Petrides, Tamir Ali
Newcastle University Hospitals Trust, Newcastle, United Kingdom

Purpose: In our institution parathyroid adenomas have historically been localised with 99mTc-Tc-MIBI (Sestamibi) SPECT-CT without contrast. Recently the protocol has been adapted to add CT contrast with the aim to improve anatomical localisation. We aimed to assess the additional benefit derived from contrast enhanced CT in localisation and to compare the degree of reporter confidence when using enhanced and unenhanced Sestamibi SPECT-CT.

Methods: Retrospective review of all patients who underwent SPECT-CT between 17/6/2021 and 20/06/21. Inclusion criteria were all patients with a biochemical diagnosis of primary hyperparathyroidism imaged with Sestamibi SPECT-CT with iodinated contrast. We developed a standardised scoring system for the degree of avidity and enhancement to delineate which features added value. Reporter confidence was documented and compared to reporter confidence from an earlier audit cycle of patients undergoing unenhanced SPECT-CT for adenoma localisation.

Results: 78 patients met the inclusion criteria. An adenoma was radiologically located in 61% (n=48). Of these 48 patients, 4 patients had adenomas only seen on contrast enhanced CT and 13 patients had adenomas with low Sestamibi uptake. 11 of these 13 cases demonstrated enhancing adenomas which increased conspicuity. In addition 81% of surgically proven radiologically located adenomas were reported confidently compared to the previous confidence level of 50% from unenhanced SPECT-CT.

Conclusion: Contrast enhanced Sestamibi SPECT-CT increases reporter confidence and adds diagnostic value in the pre-operative localisation of parathyroid adenomas in turn shortening both imaging and hospital care pathways.

43. Comparison of standardised uptake values in malignant and degenerative bone lesions on bone scintigraphy.

Rob Foley, Richard Graham, Stewart Redman, David Little
Royal United Hospital, Bath, United Kingdom

Introduction: Bone scintigraphy is a commonly utilised imaging modality in the investigation of patients with potential bone metastasis. Bone metastasis may demonstrate increased radiotracer uptake, however other non-malignant conditions may also lead to increased uptake. The purpose of this study was to assess and compare maximum standardised uptake values (SUVmax) in malignancy, degenerative joints and normal bone.

Methods: Whole body bone scintigraphy studies using a 360° CZT scanner were analysed in 27 patients with bone metastases (prostate n=15, breast n=10, lung n=2). SUVmax was recorded and compared in 76 bone metastases, 95 degenerative joints and 40 regions of normal bone. Statistical comparison was undertaken using the student’s t-test for 2 groups and ANOVA for comparison of 3 groups.

Results: Quantitative uptake values were significantly higher in metastatic lesions, mean SUVmax 40.1 ± 26.9, compared to degenerative uptake, mean SUVmax 12.4 ± 5.6 (p<0.05) and normal bone, mean SUV max 4.3 ± 2.7 (p<0.05). There was no significant difference in SUVmax values between mild, moderate and severe degenerative joints, with values of 11.8 ± 4.4, 14.3 ± 8.1 and 13.1 ± 6.1 respectively (F-ratio = 0.28, p=0.53), although degenerative uptake was significantly higher than normal bone (p<0.05).

Conclusion: There are significant differences in the SUVs in malignant and non-malignant bone and quantification of the
uptake associated with these entities has the potential to lead to improved bone scintigraphy reporting.

44. Lessons from a 3-year review of \(^{18}\text{F}\) F-PSMA PET-CT in a tertiary setting.

Vincent Pant, Ahmed Zaid Zanial, Faisal Naeem, Sobhan Vinjamuri
Royal Liverpool University Hospital, Liverpool, United Kingdom

Purpose of the study: To draw inferences from a retrospective evaluation of PSMA PET-CT scans performed for biochemical recurrence (BCR) of prostate cancer.

Methodology and Results: Of 295 PET-CT scans in 229 patients; 179 were positive (PSA 0.18-99.7), 66 were negative (PSA 0.08-3.5) and 50 had indeterminate findings (PSA 0.14-6.5).

In 179 positive scans; 67 had radical prostatectomy (PSA 0.18-7.4) and most commonly the avid lesions were seen in pelvic lymph nodes. In the remaining 112 positive scans (non-radical prostatectomy group, PSA range (0.71-99.7), in 75% (84/112), prostate gland harbored an avid lesion.

Indeterminate findings (PSA 0.14-6.5) were mostly (41/50 scans) in small pelvic/retroperitoneal lymph nodes or bones.

Follow up scans (61) were useful in 24/30 previously indeterminate and 24/31 with further rise in PSA levels.

Conclusion: While evaluating for BCR, PSMA scans can be stratified for acceptance on the basis of PSA levels.

- In the prostatectomy group, the scans are rarely positive if PSA <0.08 (can be normal up to 3.5) and in the patients with intact prostate, PSA can be slightly higher at <0.7.

- A follow up scan for indeterminate findings is more useful with a PSA rise of >0.7 in 6 months.

- In non-radical Prostatectomy group, positive focus in prostate gland either alone or in various combinations was seen very frequently (75%). This raises a fundamental question of whether prostatectomy should be offered more proactively?

45. Design and manufacture of a 3D printed phantom for PET quality control

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\(^1\)Royal Marsden NHS Foundation Trust, Sutton, United Kingdom

Aim/Introduction: Long-lived PET phantoms are typically limited to uniform activity distributions, restricting analysis to verification of SUV and uniformity. It has been proposed to incorporate radioisotopes into the resin material of 3D printers, facilitating the production of complex designs for more sophisticated analysis.

This project aimed to demonstrate this possibility by producing a lesion detection phantom with associated software for PET QC and system benchmarking.

Methods: 72MBq \(^{89}\text{Zr}\) was added to the support resin of an Objet30-Pro 3D-printer and printed alongside the build resin to create the desired activity geometry. The phantom (110mm length, 140mm diameter) contained 40 radioactive cylinders ranging from 1.3 to 13.9mm in diameter.

Imaging was performed using a list mode acquisition on a Siemens Biograph-mCT 128-slice PET-CT scanner. Reconstructions were performed for acquisition durations ranging from 5s to 1h, with and without partial-volume correction. ROC analysis was conducted and AUCs calculated to quantify image quality.

Results: The phantom took 94h to print with suitable print quality and matching the original design specification. \(^{89}\text{Zr}\) remained uniformly distributed within the resin. Significant differences were observed for the different image reconstructions in both visual and quantitative analysis. AUC measured in the software were shown to increase with acquisition duration, reaching a plateau at 18 minutes.

Conclusion: Radioactive 3D printing is a promising tool and could be utilised for the manufacture of PET QC phantoms.

46. Investigation of a SPECT-CT Imaging Artefact and its Impact on Quantification

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Aim/Introduction: Truncation artefacts can occur during nuclear medicine SPECT-CTs of patients with large body habitus - if part of the patient lies out with the imaging field-of-view (FOV). This results in artificial radiopharmaceutical uptake at the FOV edge, introduced during reconstruction. This artefact could impact SPECT quantification, therefore, this work will:

- Assess truncation artefacts within parathyroid SPECT-CTs.
• Establish the impact truncation artefacts have on quantification.
• Determine differences between camera configurations and radioisotopes.

Materials & Methods: Three phantom studies were performed for configurations: L-mode and H-mode, with and without background activity - images without background do not have the artefact. A parathyroid phantom was filled with $^{99m}$TcPertechnetate and $^{123}$I Sodium-Iodide and a torso phantom with saline bags provided background activity. Clinical parathyroid protocols were used on Siemens Symbia Intevo Bold. Reconstructions were performed using Hermes Medical software with calibration factors for $^{99m}$Tc and $^{123}$I.

Standard 1cm-diameter spherical volumes-of-interest (VOIs) were placed in the thyroid within all images using Hermia software, Affinity. Maximum standard uptake values (SUVmax) were recorded for $^{99m}$Tc and $^{123}$I. Statistical analysis determined if differences were significant, using Wilcoxon-signed-rank (WSR) tests and box-plots for comparison.

Key Results & Discussion: WSR results indicate differences for $^{99m}$Tc are not significant, however, differences are significant for $^{123}$I. The differences between $^{123}$I acquisitions are caused by different configurations and presence of the artefact. There is greater spread of quantification results for L-mode as compared to H-mode.

Conclusion: Literature suggests SPECT quantification gives errors of 10%, therefore, supplementary work will assess clinical significance.

References:

47. What is your True Skin Dose in Radiopharmacy? Evaluating the Effectiveness of Extremity Dose Monitoring Mechanisms within UK Units

Harry Thomas, Bill Thomson, Shaun Johns, Jilly Croasdale
Sandwell and West Birmingham NHS Trust, Birmingham, United Kingdom

Purpose: Radiopharmacy operators generally monitor their extremity dose using ring or, less commonly, finger stall dosemeters. Recommendations suggest various multiplying factors for the ring dose to represent the fingertip dose. Our unit routinely uses finger stalls, so we could also wear rings for comparison without affecting performance. Additionally we surveyed other UK Radiopharmacies for their dosemeter practices.

Methods: Three operators in our Radiopharmacy wore ring dosemeters in addition to their finger stall dosemeters for 5 months during $^{99m}$TcPertechnetate radiopharmaceutical manufacturing. UK Radiopharmacies (n=18) responded to our survey of monitoring practices and supplied doses for n=109 operators. Our departmental and literature derived correction factors were applied to survey doses and analysed in relation to legislative limits.

Results: The index fingertip of the non-dominant hand displayed the highest dose. The worst-case multiplying factors for the ring dose were x1.4 and x1.3 for the dominant and non-dominant hand respectively. Doses on the non-dominant hand were significantly increased (P<0.05) compared to the dominant.
The survey showed large variations in monitoring techniques although most (67%) used ring dosimeters, on the non-dominant hand. Upon applying worst-case literature factors, it was estimated that 46.6% and 8.2% of individuals may unknowingly exceed the 150mSv and 500mSv limit respectively. However when applying internally derived factors 1.4% exceeded 150mSv.

**Conclusion:** Current recommendations are that ring dosimeters should have a multiplying factor applied for correct dosimetry. Departments may apply literature derived factors; however this could lead to over-estimation. Departments need to determine their own internal correction factor for appropriate dose assessment.


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**Introduction:** After radiotherapy, PSMA PET-CT is increasingly used for whole-body restaging, but its ability to identify intra-prostatic lesions is unclear. Using a histopathological reference, we compared the performance of [68Ga]Ga-PSMA-11 PET-CT to multiparametric MRI (mpMRI) for identifying intra-prostatic radiorecurrent cancer.

**Methods:** In this single-centre retrospective series (2016-2022), men were included with a rising PSA post-radiotherapy. mpMRI was performed at the hemi-gland level using cluster bootstrapping. Samples were independently viewed anonymized reconstructions in a randomised order.

**Results:** 70 hemi-glands (35 men) were included, with median PSA 3.80ng/mL (IQR 2.60-5.53) at PET/CT. 43 (61%) had cancer on biopsy. PET-CT sensitivity was good (0.86, 95%CI 0.76-0.95), but not significantly different to MRI (0.70, 95%CI 0.58-0.91; p=0.1). The specificity of PET-CT and MRI combined was 0.93 (95%CI 0.85-1.00), significantly higher than MRI alone (p=0.004). The specificity of PET-CT (0.71, 95%CI 0.52-0.88) was not significantly different to MRI (0.59, 95%CI 0.40-0.79; p=0.6). The specificity of both modalities combined was 0.44 (95%CI 0.25-0.65), not significantly different to MRI alone (p=0.13).

**Conclusions:** [68Ga]Ga-PSMA-11 PET-CT had good sensitivity for detecting intra-prostatic radiorecurrent cancer. Furthermore, the sensitivity of PET-CT and MRI combined was significantly higher than MRI alone, and could therefore improve ruling-in of localised radiorecurrence.

### 49. Impact of [18F] Fluorocholine (FCH) PET-CT reconstruction technique on detection rate, reader confidence and agreement in localisation of parathyroid adenomas in persistent/ recurrent primary hyperparathyroidism

Craig Ferguson, Sairah Khan, Mitesh Naik, Amy Eccles, Sam Khan, Kate Houghton, Tara Barwick

**Introduction:** Reoperative parathyroidectomy is the only cure for recurrent/persistent pHPT but is associated with a higher rate of complication which makes accurate pre-operative localization imaging essential. Recent studies of [18F] Fluorocholine (FCH) PET-CT in this cohort have reported promising detection rates, mostly using older analogue PET scanners.1,2

Modern digital PET scanners offer improved image quality. Smoothing filters applied to PET data have been shown to reduce lesion conspicuity in phantoms for small lesions.3

**Aim:**
1. Assess detection rates of parathyroid adenoma candidates on FCH PET-CT in persistent/recurrent pHPT using each reconstruction, Gaussian 4.5, Gaussian 6.0 and All-Pass Filter.
2. Compare diagnostic confidence using each reconstruction.
3. Compare inter-observer agreement of reviewers using each reconstruction.

**Method:** Two expert consultant readers, (>5 years’ experience) and two inexperienced readers (NM trainees) independently viewed anonymized reconstructions in a randomised order.

Combined expert consensus following joint review ultimately determined whether each reconstruction was considered positive, equivocal or negative.

**Results:** The reconstruction without smoothing Gaussian filtering applied (‘All-Pass Filter’) produced the highest detection rate (83%) and highest diagnostic confidence.
for positive lesions for all readers. Inter-observer agreement was high for expert readers across all three reconstructions (84%) and highest for inexperienced readers for the APF reconstruction.

**Conclusion:** Highest detection rate and diagnostic confidence were observed in the APF reconstruction, suggesting Gaussian smoothing filtering may decrease lesion conspicuity.

**References:**

50. To assess the accuracy of [111In] labelled leucocyte scintigraphy and [99mTc] Sulphur-colloid bone marrow imaging in detecting infection in prosthetic joints or internal fixations.

Wee Ping Ngu, Amanda Isherwood, Gerard Avery, Najeeb Ahmed
Hull University Teaching Hospital NHS Trust, Hull, United Kingdom

**Method:** At our centre, 97 combined [111In] labelled leucocyte scintigraphy/ [99mTc] Sulphur-colloid bone marrow studies were performed to investigate potential prosthesis infection between January 2019 - December 2020. The scintigraphic results were compared to the gold standard for infection: evidence of infection at surgery (microbiological or clinical) or in the absence of surgery, clinical follow-up for a minimum of 6 months. Data collection was obtained via the Trust’s patient information system.

**Summary of Results:** 9.3% (9/97) of patients had positive studies:
- 56% (5/9) demonstrated infection intra-operatively
- 44% (4/9) did not undergo surgery but were treated clinically as infected
  - 100% positive predictive value
90.7% (88/97) of patients had normal WBC studies:
- 11/88 awaiting surgery delayed by the pandemic, and therefore excluded from the analysis.
- 45/88 managed clinically as non-infected
- 32/88 underwent surgery,
- 1 patient showed infection intra-operatively
  - 98% negative predictive value

**Conclusion:** The assessment for infection in prosthetic joints or internal fixations is imperative as the surgical treatment can be complex and the consequence of missed infection is potentially devastating for the patient. Our study has demonstrated an accuracy of 98% which is above the levels quoted in the literature.

Given the infrequency of positive results and surgeries delayed by the pandemic, a larger study would be beneficial. On the current evidence, the combination of [111In] labelled leucocyte scintigraphy and [99mTc] Sulphur-colloid bone marrow studies have demonstrated high accuracy for the evaluation of infection.

**References:**

51. Thallium-201 (201Tl) - labelled Prussian blue nanoparticles for Auger electron-emitter radionuclide therapy.

Katarzyna Wulfmeier, Juan Pellico, Philip Blower, Samantha Terry, Vincenzo Abbate
King’s College London, London, United Kingdom

**Aim:** Auger electron-emitters have potential for targeted treatment of small tumours due to their high linear energy transfer (LET) and short-range emissions. 201Tl, previously used in myocardial perfusion scintigraphy, releases around 37 Auger electrons per decay (1) and shows significant radiotoxic effect in breast and prostate cancer cells when internalised (2). However, targeted therapy with 201Tl is currently hindered by the lack of efficient chelators to incorporate 201Tl into bioconjugates. Prussian blue particles can efficiently bind thallium and are recognised antidotes for thallium poisoning. In this study, we synthesised chitosan-coated Prussian blue nanoparticles (PNBs) for 201Tl delivery and assessed their radiotoxicity in vitro.

**Method:** PBNPs were synthesised based on a previously published method (3) and radiolabelled with [201Tl]TlCl at room temperature under aqueous conditions. 201Tl-PBNPs radiolabelling yield was measured by thin-layer chromatography and stability was tested under various conditions. Specific cellular uptake, clonogenic survival and nuclear DNA damage were determined in A549 lung cancer cells incubated for 3 h with 201Tl-PBNPs.

**Results:** Physicochemical characterisation of PBNPs revealed highly positive zeta-potential and size below
100 nm. The average radiolabelling yield with $^{201}$Tl was 90.4±6.2% with high radiochemical stability for at least 48 h. $^{201}$Tl-PBNPs cellular uptake ranged between 10.0-26.6% for 250,000 cells. Toxicity assays showed significant reduction in clonogenic survival (0.5 Bq/cell to achieve 90% reduction in clonogenicity) and 4- to 10-fold increase in the number of DNA damage foci per nucleus compared to non-treated cells.

**Conclusions:** $[^{201}\text{Tl}]-$PBNPs were able to enter cells and showed considerable radiotoxicity, offering a method for future $^{201}$Tl targeted delivery.

**References:**

### 52. Metrology for Alpha Emitting Radiopharmaceuticals

**Andrew Fenwick**, **Andre Robinson**, **Ana Denis Bacela**, **Daniel Deidda**, **Kelley Ferreira**, **Warda Heetun**, **James Scuffham**

**1National Physical Laboratory, Teddington, United Kingdom**
**2Royal Surrey NHS Foundation Trust, Guildford, United Kingdom**

**Aims:** The efficacy of alpha-emitter based radiopharmaceuticals has been established over recent years due to the success of products such as $[^{223}]$RaCl$_2$ (Xofigo). This has led to rapid developments in the field and interest has been shown in developing pharmaceutical products based on other alpha emitting radiopharmaceuticals such as $^{224}$Ra, $^{225}$Ac, $^{212}$Pb and $^{227}$Th. The starting point for accurate activity measurement of these pharmaceutical products is development of primary standards and measurement of nuclear data and this study aims to provide background on progress in these areas to underpin developments.

**Methodology:** Measurements undertaken at NPL have been combined with evaluated literature studies to present the ‘state-of-the-art’ in this area and expose areas where more focussed research is required. Half-life data, primary standardisation work and measured radionuclide calibrator dial for $^{227}$Th, $^{223}$Ra and $^{224}$Ra are presented alongside a summary of results from other published work. Evaluation of Nuclear data for the same radionuclides is also presented. A literature study of imaging protocols. The use of CZT based gamma cameras shows potential for improved imaging and unleashes the potential for tracking of decay progeny which can be used to refine dosimetry calculations.

**Conclusions:** There has been significant progress in developing standards of radioactivity for alpha emitting radiopharmaceuticals. As these approach the market, clinical sites have a wealth of knowledge available to help prepare measurement and administration processes. Care should be taken in identifying accurate nuclear data and imaging protocols. The use of CZT based gamma cameras shows potential for improved imaging and unleashes the potential for tracking of decay progeny which can be used to refine dosimetry calculations.

### 53. The value of regular auditing and feedback of personal monitoring data from a hand and foot monitor in a Nuclear Medicine department


**Sandwell and West Birmingham NHS Trust, Birmingham, United Kingdom**

**Purpose:** A hand-and-foot monitor was networked in our department for the compliance with IRR17 in the control of contamination. The aim of our study was to examine the impact of regular audits and feedback on improved monitoring compliance.

**Method:** Over a 9-month period, data was downloaded from the monitor (Berthold LB147) and reviewed monthly. Trends in monitoring and contamination frequency were analysed and the improvement quarterly is presented here. This audit included review of a logbook which was kept with the monitor to document actions taken to control any contamination following a positive reading.

**Results:** When monthly auditing and feedback was introduced, the frequency of monitoring in the department increased by 26% from Q1 to Q2. Documentation of contamination events improved with 71% of high readings in Q2 having written comments compared to 42% in Q1. Documentation quality also improved considerably, with 62% of incidents in Q2 showing details of the action taken to remove contamination compared to 23% in Q1. However, it was found that only 17% of incidents clearly indicated the source of contamination, or the action taken to locate it.

**Conclusion:** By regularly audit and feedback of the monitoring data from a hand-and-foot monitor, we can demonstrate control of radioactive contamination to satisfy IRR17. In addition, we have influenced and demonstrated an improvement in monitoring data and the quality of incident investigation and documentation. The data shows areas for future improvement such as focusing on improvement of documentation of positive readings to include the source of contamination.

### 54. Development, implementation, and impact of a system for automated recording of hand contamination monitoring

**Andrew Bussey**, **Tony Alton**

**South Tees Hospitals NHS FT, Middlesbrough, United Kingdom**

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54. Analytical approach to skin dosimetry of alpha emitting radionuclides

Iain Murray1,2, Jan Taprogge1,2, Allison Craig1,2, Glenn Flux1,2
1Royal Marsden NHS FT, Sutton, United Kingdom
2Institute of Cancer Research, Sutton, United Kingdom

Aim: An audit of UK centres revealed a wide discrepancy in the estimation of 223Ra skin dosimetry arising from contamination [1]. The aim of this work was to extend an analytical approach to alpha skin dosimetry previously developed for radon progeny [2] to 223Ra and to validate the results using available Monte Carlo derived estimates in the literature [3,4].

Method: Equations derived by Eatough [2] to calculate the dose at skin depth as a function of alpha particle energy and range were applied to each particle emitted by 223Ra and its progeny. Account was taken of relative abundance to calculate absorbed dose as a function of skin depth.

Variations in the depth of the basal layer were accounted for and mean absorbed doses caused by 223Ra contamination on different areas of skin were also calculated.

55. Analytical approach to skin dosimetry of alpha emitting radionuclides

Iain Murray1,2, Jan Taprogge1,2, Allison Craig1,2, Glenn Flux1,2
1Royal Marsden NHS FT, Sutton, United Kingdom
2Institute of Cancer Research, Sutton, United Kingdom

Aim: Contamination monitoring of the hands is essential after the manipulation of unsealed radioactive sources to reduce the radiation dose to individuals by prompt identification and removal of contaminants. Retaining records of this monitoring is important in demonstrating regulatory compliance but often involves time consuming completion and retention of hardcopy records.

Methods: A system was developed to facilitate the digital recording of hand monitoring using a commercial contamination monitor combined with a microcomputer unit and RFID reader.

Users monitor their hands by placing them in the system’s aperture and observing the reading on the monitor display. The user then taps their RFID card on the surface of the monitor which records the time of the monitoring event and displays an audio & visual acknowledgment.

Two systems were installed outside the nuclear medicine department and radiopharmacy.

Results: 701 hand monitoring events were logged in the first month of system usage, representing approximately 2.4 events per staff member per day.

Post installation, the rate at which known contamination of the hands was recorded in the department’s spill log increased from ~0.04/month to ~0.5 per month, showing the new monitors promote more regular monitoring and facilitate greater detection of hand contamination. Furthermore, the rate of hand contamination detected on unannounced hand monitoring also dropped significantly from 5% (n=142) to 0% (n=35) post installation.

Conclusion: A system for automated recording of hand monitoring by was developed in-house using simple components. Following their introduction, the rate of unknown hand contamination in the department significantly decreased.

56. Using Geant4 to risk assess skin doses from potential [223Ra]RaCl2 contamination

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Aim: Skin doses from alpha emitting radionuclides can vary by several orders of magnitude depending on geometry due to the short range of alpha particles. The aim of this study is to independently assess the risk of skin contamination from [223Ra]RaCl2.

Method: Geant4 Monte Carlo code was used to simulate skin contamination scenarios from [223Ra]RaCl2. Droplet models and disk (uniform deposit) models were considered. Doses were recorded to basal layers defined by a cylindrical volume of area = 1cm² and thickness = 10µm. The basal layers were positioned at various depths, d, in a cuboid volume of skin in increments of 5µm up to a basal depth of 70µm (ICRP, 2007).

Results: Instantaneous dose rates from 223Ra and it’s daughters are given in the table below for a disk model and droplet model.
Conclusion: Skin doses from $^{223}$Ra are very high and indeed vary by several orders of magnitude depending on the specific geometry. The results show that the alpha particles do not contribute dose at a basal depth of 70µm however instantaneous dose rates are still high due to the beta emissions from $^{211}$Pb and $^{207}$Tl. The daughter radionuclides must therefore be considered in any risk assessment of $^{223}$RaCl₂.

57. Varskin equivalent convolution kernels for image-based contamination exposure estimations

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The commonly used skin dosimetry software Varskin implements simplified geometries for exposure calculations. In practice, this is not generally applicable and heterogenous distributions are often encountered. This work aimed to derive convolution-based kernels to allow rapid and pragmatic skin dose assessments in the image domain.

The methods and references from the Varskin software (version Varskin+ 1.1) [1] were interpreted into an in-house developed Python based implementation for calculation of photon and electron doses to a point. These methods were used to generate high-resolution two-dimensional kernels for square pixels of width 1-4mm, which were resampled to give the mean dose to each surrounding pixel to distances containing 99% and 100% of the delivered dose for photons and beta particles respectively.

The kernels were verified by convolving with an image containing pixelated representations of discs from 2-50mm in diameter, followed by a convolution with a pixelated disc of diameter 1cm² to represent the regulatory required values. These results were compared to those from Varskin+ v1.1 under the same geometry. For accessibility, these kernels have also been incorporated into a Xeleris (GE Healthcare) processing application for routine use.

For all isotopes and pixel sizes considered the total dose was determined to be within 4% for source diameters greater than the size of the regulatory required averaging disc. For the 4mm pixel results alone, the errors increased to within 20% at source disc diameters within the averaging disc diameter.

References:

58. Radionuclide penetration through surgical gowns from scratching with contaminated hands

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We present an incident and subsequent investigation after significant skin contamination was found after a $^{90}$Y therapy where we believe scratching with contaminated gloves pushed activity through the fabric of a surgical gown.

Full body PPE is already in use due to alarming potential doses from $^{90}$Y. Operators double glove and wear surgical gowns with no exposed skin. After therapy, the outer gloves are doffed safely and contamination monitoring is performed by an experienced physicist. Hands, bloodied areas and any touch points are routinely monitored.

In this case, no contamination whilst wearing PPE was found. We later identified an additional touch point as the operator was scratching their forearm. Significant contamination was then found (1000cps, Mini-900 type 44A). The skin was fully decontaminated, and was confirmed to be $^{99m}$TcMAA from a previous case. The skin dose was estimated as 0.5mSv. Had this been $^{90}$Y, the dose may have been 1500mSv.

We designed an experiment to test whether radioactivity could be ‘pushed’ through four different surgical gowns (unbranded thin plastic aprons, Tyvek lab suit PL309, 365Healthcare standard and zone reinforced surgical gowns), each tested in duplicate. The challenge was 1MBq $^{99m}$TcPertechnetate in a 0.1ml drop, scratched in using individual gloved pens for 3s.

$^{99m}$Tc penetration was confirmed for both 365Healthcare standard surgical gown samples, but not for the reinforced...
gown or plastic aprons. $[^{99m}Tc]$ was detected under one of two Tyvek PL309 samples so was inconclusive. We have now changed practice to use reinforced gowns for all $[^{90}Y]$ procedures.

59. Our Experience of Carers and Comforters in Nuclear Medicine

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A review of our department’s carers and comforters procedures was performed to ensure compliance with the Ionising Radiation (Medical Exposures) Regulations 2017 and the Royal College of Radiologists’ ‘Implications for Clinical Practice in Diagnostic Imaging, Interventional Radiology and Diagnostic Nuclear Medicine’ guidance [1]. A radiation risk assessment was performed to calculate the effective radiation doses that carers and comforters might expect to receive from patients undergoing different diagnostic studies and radionuclide therapies, for a range of different contact patterns. A policy, standard operating procedure, consent form and a range of information leaflets for carers and comforters were written, covering diagnostic studies, therapies, paediatric patients and CT exposures.

Carers and comforters include persons entering a controlled area to provide care, comfort or support for patients undergoing a nuclear medicine study or therapy. They may also include those providing ongoing care if they can be knowingly and willingly consented. In addition, for patients undergoing nuclear medicine therapies, carers and comforters include persons at home who cannot adhere to the radiation safety restrictions whilst providing care to the patient and/or who will be actively involved in dealing with the patient’s bodily fluids.

Our new carers and comforters procedures were implemented in July 2022, with 63 diagnostic and 1 therapeutic carers and comforters having been consented as of February 2023. The new procedures have been adopted successfully and this work aims to showcase our procedures, the methodology behind them and the learning points from this process.

References:
[1] The Royal College of Radiologists. 2020, IR(ME)R Implications for clinical practice in diagnostic imaging, interventional radiology and diagnostic nuclear medicine

60. Use of a closed-system drug transfer device to eliminate risk of needle stick injury and radioactive contamination in $[^{223}Ra]$ therapy

Isabella Nicolaides$^1$, James Scuffham$^1$

$[^{223}Ra]$Radium dichloride (Xofigo®) is an alpha-emitting radiopharmaceutical used in bone palliation therapy for patients with metastatic castrate-resistant prostate cancer. Due to potentially high skin doses, operating procedures for handling $^{223}$Ra must minimise the risk of personal contamination, and needle stick injury should be considered a “never event”. Preparation of $^{223}$Ra injections conventionally requires transfer from vial to syringe using needles, and further manipulations to connect to an intravenous cannula. Despite the use of protective equipment and staff training, with this method there is still potential for needle stick injury and radioactive contamination. The Nuclear Medicine department at the Royal Surrey County Hospital have trialled a closed-system drug transfer device (CSDTD) which creates a needleless, sealed, drip-free workflow from vial manipulation through to administration. This eliminates the risk of needle stick injury, prevents inadvertent contamination of staff and patients and also reduces the number of manual manipulations in the workflow, thus decreasing the overall radiation exposure time to the operators. A retrospective study was conducted to compare residual syringe activity and administered activity for 130 conventional administrations and 70 administrations using the CSDTD. The results showed that while using the CSDTD, there was no significant increase in the residual syringe activity, and all patients were successfully administered within 5% of their prescribed activities, in compliance with local standards. Since the implementation of the CSDTD has been successful for $^{223}$Ra therapy, our department intends to investigate the use of the CSDTD across other therapies including $[^{177}Lu]Lu$-PSMA and $[^{177}Lu]Lu$-DOTA-TATE.

61. Introduction of flat table top in a busy PET-CT department

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Purpose: Flat table top was introduced to improve image fusion of PET-CT scans with CT planning scans for patients who will ultimately be treated with radiotherapy (up to 30% of our patients) to allow more accurate delivery of radiotherapy.

Methods: In February 2022, further to a pilot study done for the introduction of flat table top, we scanned a total of 652 patients on the flat bed in 2 of our 3 scanners, to allow for patients with more difficulties such as inpatients, low mobility patients and children to be scanned on the third scanner with normal couch. An audit was carried out to
evaluate the introduction of flat table top with the main focus on if patients were able to tolerate the flat table top.

**Summary of Results:** From the audit, although 80% of patients complained of some discomfort, all patients scanned were able to tolerate the procedure. 100% of scans were completed fully with no need to terminate the scan early. This audit also identified that 10% additional time was needed to position patients comfortably but was mitigated as the audit also identified further subset of patients not suitable for flat table top.

**Conclusion:** Further to this audit, flat table top was implemented into our daily practice on 2 scanners at 2 sites in our Centre. The use of the flat table top has improved image quality and has allowed our radiotherapy colleagues to better fuse PET-CT images with radiotherapy planning CT, thus reducing tumour margins and uncertainty when contouring tumours.

**62. Inter-rater variability of visual Krenning Score & comparison with quantitative metrics for [99mTc]EDDA/HYNIC-TOC SPECT-CT**

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**Aim:** The Krenning Score is used in Somatostatin Receptor Imaging to identify patients suitable for Peptide Receptor Radionuclide Therapy (PRRT). As a visual metric it may be subject to inter-rater variability. This study will compare visual Krenning Score determined by an Expert Consensus (ECS) to scoring by less-experienced reporters. Quantitative metrics will be compared to the ECS, to consider if variability is reduced by using quantification.

**Methods:** 88 lesions from [99mTc]EDDA/HYNIC-TOC whole-body SPECT-CT scans were rated on the Krenning Scale by two experts with >12 years’ experience, giving the ECS. Three radiologists each with <6 years’ experience also scored the lesions. Agreement with ECS and inter-rater variability was assessed using Kappa statistics.

Lesions were segmented by three physicists using 40% of maximum threshold, and quantitative metrics extracted. Intra- and Inter-observer variability of the quantitative metrics was tested. Quantitative versions of the Krenning Score (qK) were calculated and compared to ECS.

**Results:** Agreement of visual raters with ECS varied from $\kappa =0.573$ to $\kappa =0.914$ (“moderate” to “almost perfect”). Visual inter-rater variability was “moderate” at $\kappa =0.52$. Best-performing SUV metric (SUVmax) had “substantial” agreement with ECS at $\kappa =0.796$. The best-performing qK metric had “almost perfect” agreement with ECS of $\kappa =0.877$, with no inter-observer variability ($\kappa =1$).

**Conclusion:** Whilst agreement on a visual Krenning Score may be high for individual reporters compared to experts, there can exist variability between reporters. A quantitative Krenning Score can improve consistency in scoring, providing similar levels of agreement to the expert consensus with reduced inter-observer variability.

**63. Quantitative Patient Imaging of [99mTc]Tc-HYNIC-TOC in Neuroendocrine Tumours – SUV values of normal and diseased tissues.**

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SPECT-CT imaging of patients with [99mTc] Tc-HYNIC-TOC (Tektrotyd) allows for diagnosis and staging of neuroendocrine tumours (NETs). The standardised uptake value (SUV) in PET-CT imaging of NETs is established to aid in tumour differentiation, prognostication and monitoring treatment response. We looked at whether SPECT SUVs from patients imaged with Tektrotyd are comparable to those published for PET-CT and for SPECT from other centres.

After ethical approval, three patients (two male) were administered with 740MBq of Tektrotyd. SPECT-CT images were acquired at two and four hours on a GE Discovery 850 gamma camera in step-and-shoot mode, and reconstructed with GE QVolumetrix MI. Maximum and minimum SUVs (SUVmax and SUVmean) at both time points were calculated for spleen, kidney, liver, bone, mesentery, and blood pool. SUVmax was calculated for tumours.

Normal tissue SUVs were highest in spleen, followed by kidney and liver. SUVs in bone and gut/mesentery were broadly similar. SUVs in most normal tissues decreased over time.

Tumour SUVmax ranged from 17.7-31.1 at two hours, and 21.7-39.8 at four hours. Tracer uptake in most tumours was higher at four hours, suggesting tumour to background contrast improves with time. All SUVs were similar to PET SUVs found in the literature and similar to previously published SPECT SUVs.
Four hours (hydroxyurea (HU)) at 37 °C/5% CO₂. Following chemotherapy, cultures were allowed to recover for 4 hours prior to a) harvesting for assessing SSTR2A expression by flow cytometry, or b) 24 hour exposure to 0.7-0.9 MBq [177Lu]Lu-PSMA treatment, >30% had their treatment discontinued following their reassessment PET-CT scans with the aim of quantifying treatment response and may also facilitate prediction of treatment response on an individual patient basis.

**Conclusion:** Targeting DNA-synthesis increased SSTR2A expression with all chemotherapies, inducing increased [177Lu]Lu-DOTA-TATE uptake and further reducing cell viability in U2OS+SSTR2A compared to [177Lu]Lu-DOTA-TATE monotherapy. Non-SSTR2A expressing U2OS cells largely remained unaffected.

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**64. Combining chemotherapy pre-treatment with [177Lu] Lu-DOTA-TATE enhances radiopharmaceutical uptake and reduces cancer cell survival in vitro**

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**Purpose:** Investigate the effects of combining [177Lu] Lu-DOTA-TATE with DNA synthesis-disrupting chemotherapies in vitro as candidates for combined chemo-molecular radionuclide therapy (CMRT).

**Methods:** Cultures of wildtype and transfected (U2OS/U2OS+SSTR2A) human bone osteosarcoma cells were subjected to chemotherapy for 24 hours (5-fluorouracil (5FU), triapine (TRI) or gemcitabine (GEM)) or 17 hours (hydroxyurea (HU)) at 37°C/5% CO₂. Following chemotherapy, cultures were allowed to recover for 4 hours prior to a) harvesting for assessing SSTR2A expression by flow cytometry, or b) 24 hour exposure to 0.7-0.9 MBq [177Lu]Lu-DOTA-TATE (approximately 25 nM DOTA-TATE) for uptake/viability studies. Cell viability was assessed after 7 days [177Lu]Lu-DOTA-TATE exposure.

**Results:** All four chemotherapies increased SSTR2A expression (percentage increase compared to untreated; HU 62.7±16.8%, 5FU 71.6±28.7%, TRI 45.0±31.6%, GEM 61.9±6.9%). Increased [177Lu]Lu-DOTA-TATE uptake in U2OS+SSTR2A cells was also observed following chemotherapy (untreated 0.26±0.05 Bq/cell, HU 0.39±0.06 Bq/cell, 5FU 0.41±0.18 Bq/cell, TRI 0.99±0.17 Bq/cell, GEM 1.06±0.29 Bq/cell). U2OS cells, not expressing SSTR2A, showed insignificant uptake.

Correspondingly, CMRT induced further reductions in U2OS+SSTR2A viability compared to [177Lu] Lu-DOTA-TATE monotherapy. 5FU data was unanalysable due to culture cytostasis. Remaining viable cells (percentage to untreated controls): [177Lu] Lu-DOTA-TATE alone 59.5±22.3%, HU 18.8±5.2%, TRI 27.7±2.5%, Gem 25.9 ± 6.7%. Contrarily, U2OS viability did not decrease below 90.3% regardless of monotherapy or CMRT regimens.

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**65. The role of PSMA PET-CT in the management of patients undergoing [177Lu] Lu-PSMA therapy**

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**Aims:** All patients treated with [177Lu]Lu-PSMA for metastatic castration-resistant prostate cancer must undergo a PSMA PET-CT scan to determine their suitability for treatment. At GenesisCare, [68Ga] Ga-PSMA PET-CT scans are also carried out every two cycles of treatment in order to visually assess individual patient response, and subsequently determine if the patient should continue with further cycles. The aim of this work was to explore the impact of [68Ga]Ga-PSMA PET-CT on patient management, and determine whether quantitative image metrics could be used as a tool to quantify treatment response.

**Methods:** Several patients treated with [177Lu]Lu-PSMA had their [68Ga]Ga-PSMA PET-CT scans retrospectively analysed, using a semi-automated segmentation process, to assess their volume of baseline disease prior to treatment. A metric known as “total lesion PSMA” was also calculated by multiplying the total disease volume by the SUV mean. These same metrics were calculated from their reassessment PET-CT scans with the aim of quantifying treatment response.

**Results:** Of the 130 patients who had completed their [177Lu]Lu-PSMA treatment, >30% had their treatment discontinued following their reassessment [68Ga] Ga-PSMA PET-CT scan after 2 cycles of treatment. Quantitative metrics of total tumour volume and total lesion PSMA were successfully able to quantify individual patient response and correlated well with biochemical response.

**Conclusions:** PSMA PET-CT plays a crucial role in determining patient response to [177Lu]Lu-PSMA treatment and can prevent unnecessary treatment continuation. Quantitative whole-body metrics show great promise for quantifying treatment response and may also facilitate prediction of treatment response on an individual patient basis.
66. ALP Response Following A Single Cycle of \( ^{223}\text{Ra}[\text{RaCl}_2] \)

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**Aim:** Whilst comparing local data to results from the National \( ^{223}\text{RaCl}_2 \) Audit (NRDA) Group, all patients treated with \( ^{223}\text{Ra}[\text{RaCl}_2] \) at BHRUT from 2015-2022 were assessed for Alkaline Phosphatase (ALP) response. High ALP values can be indicative of high metastatic burden, and ALP is a recognized biomarker for effective \( ^{223}\text{Ra}[\text{RaCl}_2] \) therapy [1].

**Methods:** 63 patients were assessed, having undergone \( ^{223}\text{Ra}[\text{RaCl}_2] \) therapy as a third line treatment option. Patient’s ALP values were considered prior to treatment, after a single cycle of treatment and at the end of treatment.

**Results:** When considering response over the entire course of treatment, 58/62 (94%) of patients experienced a drop in ALP which is indicative of biochemical response. 67% of patients had a drop of ≥30% in ALP following a full course of treatment. Between pre-treatment and first cycle, 90% of patients experienced a drop in ALP. In 57% of patients, this drop was ≥30% after just one cycle of treatment. In 22% of these patients, there was ≥100% drop in ALP levels after just one cycle and in 6% of patients there was >250% drop in ALP levels following a full course of treatment. Between pre-treatment and first cycle, 90% of patients experienced a drop in ALP. In 57% of patients, this drop was ≥30% after just one cycle of treatment. In 22% of these patients, there was ≥100% drop in ALP levels after just one cycle and in 6% of patients there was >250% drop in ALP levels following one cycle of treatment.

**Conclusions:** Treatment with a single cycle of \( ^{223}\text{Ra}[\text{RaCl}_2] \) can induce a substantial drop in ALP for metastatic castrate resistant prostate cancer patients. This may impact patients who were previously considered unsuitable for treatment with \( ^{223}\text{Ra}[\text{RaCl}_2] \) due to poor survival prognosis.


67. Promoting Molecular Radiotherapy Research in the UK - the CTRad MRT Working Group

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**Purpose:** With rapidly expanding indications for molecular radiotherapy (MRT) and potential for the use of novel radionuclides, but inadequate understanding of how radiobiology and dosimetry can be used to personalise treatment, there is an urgent need for more clinical research in this field.

There are however significant challenges: access to radionuclides, access to imaging and therapy infrastructure, workforce, current trial regulations and access to research funding which need to be overcome.

The National Cancer Research Institute (NCRI) Clinical and Translational Radiotherapy Research Working Group (CTRad) has established a working group to address these issues.

**Methods:** CTRad refreshed its strategic priorities in July 2022. As a result, a multidisciplinary working group was established to work on MRT. Applications for group membership were sought from the NCRI Radiotherapy Group and other professional bodies, including BNMS, RCR and IPEM.

**Results:** A group of 24 healthcare professionals held its inaugural meeting on 8th December 2022.

The group has the following goals:

1. Produce and publish a roadmap/position paper on the barriers and challenges in MRT research with proposed solutions
2. Organise a meeting with funders and industry to develop a joint understanding of the UK MRT funding landscape, to inform and support collaborative trial development and delivery
3. Organise a workshop or sandpit to explore new ideas for MRT trials to encourage multidisciplinary collaboration
4. Develop and seek funding for two academic UK MRT trials

**Conclusions:** The group hopes to generate clinical trials which will improve the outcomes of patients receiving MRT.

68. Radiation protection considerations for \( ^{188}\text{Re} \) skin cancer treatments – experiences from the first UK treatment centre

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The recent emergence of \( ^{188}\text{Re} \) therapy has provided an alternative treatment option for skin cancer patients with several advantages over conventional methods. \( ^{188}\text{Re} \) is a beta-emitter with main decay energies of maximum 2120keV and 1965keV. It also emits gamma photons with a photopeak energy of 155keV. The product is applied in close contact with the skin, where it remains for minutes to hours until a dose of 50Gy to the deepest part of the lesion is achieved. The external application of this beta-emitter presents challenges in ensuring the safety of patients and staff, including limiting staff doses,
Managing high-levels of radioactive waste and minimising the risk of contamination.

In 2022/23, King’s College Hospital participated in the EPIC-Skin study, treating 37 lesions across 23 patients. The average activity applied to each lesion was 288 MBq (85-755) with an average treatment time of 107 minutes (34-233). Radiation safety guidance was provided by the radiopharmaceutical supplier, but was not tailored to the specific legislative requirements of each country participating in the study. As well as the radiation protection measures that were implemented prospectively when starting out in this study, such as lead aprons and visors for the consultant applying the radiopharmaceutical, several additional controls were added as risks were identified throughout the initial treatment sessions.

By implementing rigorous control measures with regards to the handling and disposal of radioactive material, we have shown that it is possible to complete these treatments safely, with minimal risk to staff, patients and the environment.

**69. Assessing Updated Guidelines for Thyroid Cancer Patients**

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Patients are routinely administered radioiodine for the treatment of thyroid cancer after thyroidectomy. These patients present an external and contamination hazard to the people they encounter. New radiation protection guidance for patients undergoing radioiodine therapy for thyroid cancer was published this year [1]. The restrictions suggested were evaluated using modern contact patterns and the dose constraints in IRR17 [2].

Six patients administered with 3700-5500 MBq [131I]NaI to treat thyroid cancer wore an EPD on their waistband for 9-14 days following treatment. The EPD measured the slow phase and fast phase effective half-life of radioiodine for each patient. This data was used alongside an initial external dose rate measurement at 1.5 m and updated contact patterns to calculate the dose to their close contacts. Furthermore, the contamination hazard was assessed using published voiding volumes [3].

The fast phase and slow phase effective half-life’s of [131I]NaI were measured to be 0.55±0.03 and 2.7±0.4 days respectively. The doses to contacts complied with the 1mSv whole body dose limit for adults in their household and 0.3mSv dose constraint for other close contacts for five out of six patients. We calculated that patients present a contamination hazard for up to eight days following treatment.

The new method of calculating restrictions is effective at keeping the whole-body dose to close contacts within the legal dose limit. Additional advice on reducing the contamination risk and avoiding the use of public toilets should be provided to patients following their treatment to ensure that skin dose limits are also complied with.

**References:**

**70. The combination of post-operative thyroglobulin and absorbed dose to the thyroid predicts radioiodine therapy outcome in differentiated thyroid cancer patients**

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**Aim/Introduction:** Post-operative serum thyroglobulin (Tg) measurements have been shown to predict therapy outcome after radioiodine ablation in differentiated thyroid cancer (DTC) patients. The hypothesis underlying the present work is that Tg measurements can be used as a surrogate for thyroid remnant volume to allow for thyroid remnant dosimetry calculations.

**Materials and Methods:** Patients were included in the multi-centre multi-national study (MEDIRAD) if they had histologically proven DTC and total thyroidectomy. Thyroid remnant dosimetry was performed taking into account a volume estimate from post-operative Tg. Treatment failure was defined by an unstimulated or stimulated Tg level of >1.0 or >10.0 ng/ml, respectively, 6-12 months post therapy. ROC curve analysis was performed to evaluate the diagnostic ability of post-operative Tg and absorbed dose to identify patients early on who respond to therapy.

**Results:** Four of the 83 patients were classed as non-responders. Absorbed dose, corrected for post-operative stimulated Tg, a proposed surrogate of thyroid remnant volume, was found to have an ROC area-under-curve (AUC) of 0.94±0.05. Post-operative Tg was found to have an ROC AUC of 0.95±0.04. Non-responders and responders could best be distinguished when considering both the post-operative Tg and the absorbed dose corrected for post-operative stimulated Tg.

**Conclusion:** Absorbed dose calculations of thyroid remnants are often considered impracticable. Post-operative stimulated Tg could be a promising surrogate for volume to obtain relationships between absorbed dose and outcome and to allow for patient-specific treatment planning.
71. Are published radiation restrictions appropriate for hyperthyroid patients?

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Aims: The aim of the study was to determine whether the radiation protection instructions (“restrictions”) provided to hyperthyroidism patients treated with \(^{131}I\)NaI at the Royal Surrey County Hospital, and elsewhere in the UK, are still appropriate. The restrictions currently used are those from the Medical and Dental Guidance Notes (MDGN) [1].

Methods: The total whole-body effective dose received by young children (aged 5 and under) and adults in close contact with these patients was estimated using the MDGN restrictions, conservative contact patterns and published \(^{131}I\)NaI effective half-lives for hyperthyroidism patients. Contact patterns used were based on assumed social behaviour around young children and adults. The results were compared to the member of the public’s whole-body effective dose constraint of 0.3 mSv.

Results: The estimated total whole-body effective doses for young children (5.5 mSv) and adults (6.9 mSv) vastly exceeded the 0.3 mSv dose constraint.

Comparison was made to the study referenced by the MDGN [2]. Family members of patients following the above restrictions received maximum whole-body effective doses of 7.2 mSv (children aged up to 16 years) and 5.8 mSv (adults). These doses exceeded the dose limit that the study authors were aiming to adhere to: 5 mSv in 5 years as per the Basic Safety Standards [3].

Conclusion: Using the MDGN restrictions can easily lead to the 0.3 mSv dose constraint being exceeded, hence the restrictions used for hyperthyroidism patients treated with \(^{131}I\)NaI should be revised. Proposed alternative restrictions based on our assumptions will be presented.


72. \(^{177}Lu\) PSMA restrictions: “But when is it safe to...?”

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\(^{177}Lu\) prostate-specific membrane antigen (PSMA) is expanding as a theranostic option for metastatic castrate resistant prostate cancer. The therapy is carried out over 6 cycles, 6 weeks apart and can be performed as a day-case treatment. Following discharge, the Royal Surrey Country Hospital (RSCH) gives radiation protection restrictions to patients to keep doses received by close contacts below a dose constraint of 300uSv over 6 cycles. Standard restrictions can have a significant impact on quality of life over the total course of therapy. Furthermore, the last few days of restrictions offer minimal dose saving for close contacts.

Prior to therapy, a detailed patient risk assessment can ascertain the patient’s expected contact pattern following treatment. From this information a contact “K” factor can be derived for each close contact, which is the fraction of time spent at a distance equivalent to 1m. The dose rate from the patient can be measured in the hours following therapy with the dose rate after patient discharge modelled using published data [1]. The cumulative dose received by a close contact is then estimated by integrating the dose rate curve between the time points of interest and multiplying by K.

RSCH has developed a tool to allow simple visualisation of this data, with the period and severity of contact restrictions customisable to the circumstances of each patient. This work aims to showcase this tool; this approach can allow us to personalise the radiation protection restrictions for each patient, improving quality of life following each treatment.

References:

73. 30-minute whole-body \(^{177}Lu\)PSMA SPECT-CT: evaluating quantitative accuracy of reduced time xSPECT scans

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Aim: As part of setting up a new service for \(^{177}Lu\) Lu-PSMA, we evaluated the use of Acquire During Step (ADS) SPECT mode and reduced frame-time on image quality and quantification accuracy.

Methods: A Jaszczak phantom with rod and sphere inserts was filled with ~1.6MBq/ml Lu in the spheres and 0.19MBq/ml in the background (8:1 ratio).

It was scanned on a Siemens Intevo 6 gamma camera using medium-energy-low-penetration collimators. Frame duration was set to clinically relevant counts and the phantom was scanned in Step-and-Shoot (S&S) and ADS modes. Scans were repeated using half-counts and quarter-counts.

SPECT data was reconstructed using the Siemens xSPECT Best and Flash3D algorithms.
Quantification of activity in the hot spheres was performed by delineating their volume on CT and calculating the SUVmean for each scan and mode.

Image quality between modes, reconstructions and scan times was assessed independently by two experienced nuclear medicine consultants.

**Results:** There was no significant difference in quantification between any of the scans (CoV = 2%).

Image quality was found to be consistent with regards to visibility of spheres (hot lesions), rods (resolution) and uniformity between S&S and ADS modes, full- and half-time scans with degradation becoming apparent in quarter-time scans.

**Conclusion:** The ‘half-time’ ADS scan was found to be comparable in image quality and quantification to that of the standard full-time S&S scan. We have now updated our scan parameters for 24h [177Lu]Lu-PSMA to 10s per view, ADS mode, 3-bed SPECT-CT (vertex to thighs, FOV ~111cm), total scan time approximately 30-mins.

### 74. Improving accuracy of significant underestimation of dose estimates in [177Lu]Lu-PSMA therapy

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²Department of Nuclear Medicine, University Hospital Southampton, Southampton, United Kingdom

**Introduction:** Dosimetry in molecular radiotherapy is a resource-intensive, time-consuming, and cumbersome procedure. The underestimation of measurement activity due to partial volume effects (PVE) is one of the most significant factors of uncertainty. The aim was to evaluate the impact of PVE-correction for single-time point dosimetry in [177Lu]Lu-PSMA therapy.

**Methodology:** Four patients (age: 80±10.13) treated with a total of 13 cycles [177Lu]Lu-PSMA (7.34±0.18 GBq) during 2022 were retrospectively analysed. Following treatment, a quantitative eyes-to-thighs SPECT-CT was acquired at approximately 24h (23.5±2h) and reconstructed with the built-in xSPECT reconstruction. Mirada software was used for segmentation and activity measurements of the kidneys, salivary glands and tumours. Predefined time and organ-specific scaling factors were used to directly estimate the absorbed dose. A Jaszczak phantom containing different hot spheres with cold background was used to generate the recovery curve (RC) for PVE correction. Organ doses were recalculated using recovery-corrected activity concentrations. A paired t-test was used to compare the differences between measurements.

**Results:** For kidneys, salivary glands and tumours, the mean estimated doses with and without corrections were 5.61 and 4.65; 1.99 and 1.44; 11.2 and 8.27 Gy, respectively. Dosimetry without PVE correction underestimated doses by 18% in the kidneys, 32% in the salivary glands, and 29% in the tumour lesions and these differences were statistically significant (p<0.05).

**Conclusion:** PVE causes a large underestimation in dose to the parotids and even the kidneys, meaning radio-toxicity could occur earlier than expected if PVEs are not accounted for. Dosimetry reliability is significantly improved by integrating recovery coefficients in [177Lu] Lu-PSMA therapy.

### 75. Three-year review of clinical utility of [99mTc] Tc-DPD scans in the evaluation of cardiac amyloidosis and optimisation of protocols

Faisal Nacem, Vincent Pant, Sobhan Vinjamuri
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We performed a retrospective review of [99mTc] Tc-DPD scans acquired for 55 patients with suspected cardiac amyloidosis between February 2019 and August 2022.

Images and reports were blinded and reviewed visually as well as semi-quantitatively.

Out of 55 patients, 29 were positive for cardiac amyloidosis and 26 were negative. Perugini score was three in 27, two in 2, one in 7 and zero in 19 patients.

We looked at the clinical utility of SPECT-CT as per EANM and ASNC guidelines which favours its use to: avoid overlap of bone uptake, distinguish blood pool activity from myocardial activity, assess regional distribution of myocardial tracer uptake and in interventricular septum and quantify the myocardial uptake by comparison to rib uptake.

In our visual and semi-quantitative analysis, diffuse myocardial uptake was seen on SPECT images in all the positive patients hence ruling out any blood pool activity. No overlap of uptake between bone and myocardium was observed. In addition, Perugini score only differed by one score in only one patient (Score of 3 on whole-body imaging versus score of 2 on SPECT-CT imaging for anonymised patients).

Therefore, we conclude that only whole-body imaging with [99mTc] Tc-DPD scan is sufficient for non-invasive labelling of patients with cardiac amyloidosis and SPECT acquisition is not necessary as a routine but can be reserved as an ad hoc procedure only if required.
76. Increasing the diagnostic yield from PET-CT in Giant Cell Arteritis by reporting Cardiovascular Parameters.

Rob Foley, Ben Mulhearn, Jessica Ellis, Shannon Gunawardana, Rajika Wickramarachchi, Jonathan Rodrigues, Oliver Watkinson, Sarah Tansley, Sarah Skeoch, Richard Graham

Royal United Hospital, Bath, United Kingdom

Introduction: Cardiovascular disease (CVD) is well-recognised in giant cell arteritis (GCA) and thoracic aortic aneurysms are a late complication. Positron Emission Tomography - Computed Tomography (PET-CT) is commonly used for evaluation of large vessel vasculitis in GCA. Although not routinely reported, additional measurements including aortic calibre and presence of coronary and aortic calcification can be assessed. The purpose of this study was to estimate the prevalence of these cardiovascular abnormalities on PET-CT scans in GCA patients.

Methods: A retrospective review of PET-CT scans in GCA patients between 2016-2022 was undertaken. We determined the prevalence of CV abnormalities; namely, the maximum diameter of the thoracic aorta, as well as the presence and burden of coronary and aortic calcification.

Results: Fifty-two consecutive patients with GCA who had undergone PET-CT were identified. Original PET-CT scans reported coronary artery and/or aortic calcification in 6/51 (12%) of GCA patients and there was no thoracic aortic dilatation reported. Re-examination of PET-CT scans found coronary artery calcification in 38/51 (74%) and aortic calcification in 14/51 (27%) of all GCA patients. Dilatation of the thoracic aorta was noted on review in 3/51 (6%) of patients.

Conclusion: We observed a significant burden of cardiovascular abnormalities on PET-CT in GCA patients and therefore PET-CT can be used in the opportunistic screening for cardiovascular disease in this high-risk population. We suggest that coronary calcification, aortic valve calcification and thoracic aorta diameter should be sought for and reported in this patient cohort.

77. Serial quantitative evaluation of [18F]FDG uptake in PET-CT in patients with cardiac sarcoidosis

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2Imperial College Healthcare NHS Trust, London, United Kingdom
3Hermes Medical Solutions, London, United Kingdom

Aim/Introduction: [18F]FDG positron emission tomography (FDG PET) shows good sensitivity and specificity for diagnosis of cardiac sarcoidosis (CS), but has a less clear role in follow-up imaging of CS, with no well-established quantitation method. Changes in FDG PET myocardial inflammation were explored and correlated with changes in left ventricular ejection fraction (LVEF) and arrhythmia detection.

Methods: A retrospective study of our institution database was performed to identify all repeat FDG PET imaging for CS.

Mean Standardised Uptake Value (SUV) and SUVpeak were measured for spherical volumes of interest (VOIs) of various diameters centred around the heart. Total lesion glycolysis (TLG) was examined for VOIs with SUVs over several thresholds. A 17-segmental score was also performed.

The values obtained were plotted against the clinical parameters for each patient over successive scans.

Results: There were total of 16 patients and 37 scans. The most visually representative quantitation methods were SUVpeak in a spherical VOI of 6cm diameter centred around the heart and TLG in a VOI of SUV over the threshold described by (Ahmadian, et al., 2017). The measurements had a weak correlation with LVEF and stored arrhythmias.

Conclusion: Quantitative interpretation of FDG PET in CS can detect changes in uptake, but with no clear relationship to LVEF or arrhythmia detection. Further studies are needed to conclude whether quantitative changes in FDG uptake are associated with other biomarkers, imaging parameters (e.g. from cardiac magnetic resonance) or clinical outcomes.


78. Establishing a normal range for dyssynchrony parameters from RNVG phase analysis

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Introduction: Novel dyssynchrony parameters including synchrony, entropy, approximate entropy (ApEn), and sample entropy (SampEn), can be calculated from RNVG phase images to provide a quantitative measure of cardiac dyssynchrony [1,2]. Their potential has been demonstrated [3,4] but there is currently no normal range published. The aim of this study was to establish a normal range for each parameter.
Methods: 187 (51 male and 136 female) patients were retrospectively analysed using MAPS Link Medical 10000 software. Patients were selected based on the following criteria: normal myocardial perfusion, normal LV EF, normal wall motion and no previous cardiac history. Dyssynchrony parameters were calculated using in-house software written in R. Previously optimised input parameters m and r (m = sequence length, r = tolerance) were used for ApEn and SampEn [5].

Results: A normal cut off is suggested for each parameter in the Table below, defined using two standard deviations.

<table>
<thead>
<tr>
<th></th>
<th>Mean ± SD</th>
<th>Normal cut-off</th>
</tr>
</thead>
<tbody>
<tr>
<td>Synchrony</td>
<td>0.99 ± 0.01</td>
<td>&gt; 0.97</td>
</tr>
<tr>
<td>Entropy</td>
<td>0.58 ± 0.04</td>
<td>&lt; 0.64</td>
</tr>
<tr>
<td>ApEn (m=2, r=7)</td>
<td>0.42 ± 0.14</td>
<td>&lt; 0.70</td>
</tr>
<tr>
<td>SampEn (m=2, m=4)</td>
<td>0.66 ± 0.19</td>
<td>&lt; 0.84</td>
</tr>
</tbody>
</table>

Conclusion: The study has defined a normal range for synchrony, approximate entropy, and sample entropy based on a sample of 187 patients. Ideally, to further validate the data, the normal range would be confirmed using healthy normal volunteers. It is important to keep in mind that the phase image pixel values are not standardised across different software packages. Therefore, it is recommended to test the normal range when using different software.

References:
4. Jones KA et al. 2022, J Nucl Cardiol. (in print)

79. 7-year review of FDG PET-CT for possible Cardiac Sarcoidosis in a teaching hospital: Diagnostic yield and evaluation of the role of PET-CT for treatment monitoring.

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Aims: To retrospectively compare the agreement of Left Ventricular Ejection Fraction (LVEF) by echocardiography (echo), and cardiovascular magnetic resonance (CMR) with \(^{82}\)Rb PET in patients with known or suspected ischaemic heart disease. It is important to know whether results of each modality are interchangeable. Cross modality comparisons with myocardial perfusion scintigraphy have been made before, but none with Rubidium PET.

Materials and Methods: The radiology information system database was queried to identify patients who had Rb PET imaging and who had also undergone CMR.
or echo within Barts Health NHS Trust. Patients were included if they had Rb imaging and either CMR or echo within 180 days. LVEFs were extracted from the imaging reports. Correlations, paired sample t-tests, Bland Altman plots and coverages were used to compare Rb PET LVEF values with those from CMR and echo.

**Results:** Correlations between the Rb PET and CMR LVEF were strong (n=58, R²=0.78) though the Rb PET values were lower (p<0.001), on average by 5.2% and with a Bland Altman range of 32.6%. 41.4% of CMR and Rb studies agreed within 5%. The correlation between Rb PET and echo (biplane) LVEF values was slightly lower (n=82, R²=0.64), with no statistically significant difference and a slightly larger Bland Altman range of 36.1%. 45.1% of echo and Rb studies agreed within 5%.

**Conclusion:** LVEF measurements from [82Rb]RbCl MPI agree well with those from CMR or echo, though there appears to be a small negative offset compared with CMR.

### 81. Inter-operator variability in reversible ischemia when using Cedars Sinai QPS for myocardial perfusion scans

**Purpose:** Myocardial perfusion scans (MPS) are used to diagnose and measure reversible ischemia extent qualitatively and semi-quantitatively when using a package such as Cedars Sinai QPS.

If a patient has greater than 8% reversibility as measured by QPS, which is agreed qualitatively by the reporting clinician, this would be considered clinically significant. QPS requires the operator to set contours around the LV myocardium of the processed images. The contour position can influence the value of percentage reversibility. We have investigated the variability of reversibility between 6 experienced operators.

**Method:** 10 MPS patients (5M, 5F) were randomly selected. Data was processed by 6 experienced operators using standard protocol with a GE Xeleris (v4DR) and QPS 2009. Inter-operator variation for reversibility results on attenuation corrected images was examined and range of reversibility was assessed.

**Results:** Percentage reversibility (>8% is highlighted).

**Analysis:** 7/10 patients showed small variability (<=5% range). For 2/7, the reversibility value straddled the 8% cut-off for clinically significant reversibility.

2/10 patients gave reversibility values that straddled the 8% cut-off for significant reversibility and had a range >=5%. 1 patient had a range >=5% but did not straddle the 8% clinically significant value.

**Discussion:** Even with 6 trained and experienced operators, 3/10 patients showed significant variability of QPS reversibility figures.

**Conclusion:** QPS 2009 software exhibits variation between operators. Results warrant a further check before or during reporting.

Reporting clinicians need to be aware of this variation and should ensure their qualitative assessment matches that of the semi-quantitative results.
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Jessica Johnson, Kathryn Adamson, Sarah Allen
Guy’s and St Thomas’ Hospitals NHS Foundation Trust, London, United Kingdom

P02. Couldn’t you have just posted this $^{75}$SeSeHCAT capsule to me?

Alexander Smout
Royal Surrey County Hospital, Guildford, United Kingdom

P03. Hold the gin, mine’s a tech and tonic

Alexander Smout
Royal Surrey County Hospital, Guildford, United Kingdom

P04. Evaluation of a water vacuum for large volume spills

Alexander Smout, Isabella Nicholaides
Royal Surrey County Hospital, Guildford, United Kingdom

P05. Does a UV torch have a place in a nuclear medicine spills kit...for urine?

Alexander Smout
Royal Surrey County Hospital, Guildford, United Kingdom

P06. Using a contamination monitor to count GFR plasma samples as part of a business continuity plan

Alexander Smout
Royal Surrey County Hospital, Guildford, United Kingdom

P07. Comparison of finger doses to the dominant and non-dominant hands for imaging and radiopharmacy staff

Christine Turner, Simon Evans
Singleton Hospital, Swansea, United Kingdom

P08. Experiences of supervising the drainage of ascitic fluid in $^{177}$Lu-Lu-DOTA-TATE therapy patients

Neil Davis, Tamar Willson, Richard Meades, Danny McCool
Royal Free London NHS Foundation Trust, London, United Kingdom

P09. Patient dose-rates from $^{18}$FPSMA-1007 administration: impact on public and staff doses

Alastair Gemmell$^{1,2}$, Gavin Orchin$^{1,2}$, Shannon Higgins$^4$
Mary-Frances Dempsey$^{1,2}$, Sandy Small$^{1,2}$
$^1$West of Scotland PET Centre, Gartnavel General Hospital, Glasgow, United Kingdom
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$^3$Radiotherapy Physics, Beatson West of Scotland Cancer Centre, Glasgow, United Kingdom
$^4$Philips Electronics UK, Farnborough, United Kingdom

P10. Longitudinal stability of quantitative SPECT accuracy with Siemens BroadQuant for multiple radionuclides

Alastair J. Gemmell$^{1,2,3}$, Colin Brown$^{1,2}$, Surajit Ray$^3$
Sandy Small$^{1,2}$
$^1$Nuclear Medicine & PET, Gartnavel General Hospital, Glasgow, United Kingdom
$^2$Department of Clinical Physics & Bioengineering, NHS Greater Glasgow & Clyde, Glasgow, United Kingdom
$^3$School of Mathematics & Statistics, University of Glasgow, Glasgow, United Kingdom

P11. Management of radioactive pipework – A Royal Free Perspective

Jo Page, Richard Meades, Daniel McCool
Royal Free London NHS Foundation Trust, London, United Kingdom

P12. Evaluation of restrictions for thyrotoxicosis patients using EPD’s

Rachael Clitheroe$^1$, Daniel R McGowan$^{1,2}$, Aida Hallam$^1$
$^1$Oxford University Hospitals NHS Foundation Trust, Oxford, United Kingdom
$^2$University of Oxford, Oxford, United Kingdom

P13. An EXCEL calculator for the radiation dose to Carers and Comforters

Bill Thomson, Joe O’Brien, Joseph Burmiston, Amelia Perry
Sandwell and W Birmingham Hospitals NHS Trust, Birmingham, United Kingdom

P14. Testing the radioactive transport emergency arrangements with the Health Courier Service (HCS): A South West Wales perspective

Simon McPhee, Rachel Bidder
Swansea Bay University Health Board, Swansea, United Kingdom

P15. How protective is our PPE? Evaluating the Permeability of PPE with Common Radioisotopes used in Nuclear Medicine
Katherine Aktemel1,2, Carolyn Paterson1,2, Frances Hogg1,2, Alison Bolster1,3,4
1Department of Clinical Physics and Bioengineering, Glasgow, United Kingdom
2Department of Nuclear Medicine, North East Sector, Glasgow, United Kingdom
3Department of Nuclear Medicine, North East, Glasgow, United Kingdom
4College of Medical, Veterinary and Life Sciences, University of Glasgow, Glasgow, United Kingdom

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Jonnessa Cribello, Kate Pacunayen, Theeksita Selvakumar, Arum Parthipun
Trinity Medical Imaging, London, United Kingdom

P17. Review of fingertip radiation dose monitoring for staff working with unsealed radionuclides at Oxford University Hospitals NHS Foundation Trust.
Lara Bonney, Jill Bradley, Katherine Morelli-Batters, Isabelle Tabb, Mark Cox, Aida Hallam, Helen Amatiello
Oxford University Hospitals NHS Foundation Trust, Oxford, United Kingdom

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Zoe McAlpine1,2, Helen Davison1,2, Peter PhillipsDr 3
1County Durham and Darlington NHS Foundation Trust, Durham, United Kingdom
2Newcastle Upon Tyne Hospitals NHS Foundation Trust, Newcastle, United Kingdom
3Medical Imaging Sciences Institute of Health, University of Cumbria, Lancaster, United Kingdom

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Vanessa Woodhouse1,2, David McCulloch1
1Newcastle-upon-Tyne Hospitals NHS Foundation Trust, Newcastle-upon-Tyne, United Kingdom
2Newcastle University, Newcastle-upon-Tyne, United Kingdom

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Corey Lyth1,2, Sarah Bell1, Emma O'Shaughnessy1, Asha Omar1
1University Hospitals Plymouth NHS Trust, Plymouth, United Kingdom
2University of Liverpool, Liverpool, United Kingdom

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Will Foster, Gemma Roberts
Newcastle upon Tyne NHS Foundations Trust, Newcastle upon Tyne, United Kingdom

P22. Misregistration of wholebody SPECT-CT acquisitions
Jonathan Dixon, Caitlin Reilly, Alice Nicol
Nuclear Medicine Department, Queen Elizabeth University Hospital, Department of Clinical Physics and Bioengineering, NHS Greater Glasgow and Clyde, Glasgow, United Kingdom

P23. SPECT SUVs – QC requirements and clinical implementation for Tektrotyd imaging
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Royal Surrey County Hospital, Guildford, United Kingdom

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Laura McKinley, Rebecca Hammond
Royal Surrey County Hospital, Guildford, United Kingdom

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Alp Notghi1, Gregory James2, Joseph O’Brien1
1Sandwell & West Birmingham Hospitals NHS trust, Birmingham, United Kingdom
2University Hospitals of North Midlands NHS Trust, Stoke on Trent, United Kingdom

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Helen Davison, Robyn Cooke
County Durham and Darlington NHS Foundation Trust, Durham, United Kingdom

P27. Use of LEHRS collimators for DAT imaging – a note of caution
Emma Birch1, John Cain2
1The Christie NHS Foundation Trust, Manchester, United Kingdom
2Lancashire Teaching Hospitals NHS Foundation Trust, Preston, United Kingdom

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William Morton, Nicholas Vennart, Peter Bartholomew
South Tyneside and Sunderland NHS FT, Sunderland, United Kingdom
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Lucy McAreavey, James Hubber, Anton Paramithas
St George’s University Hospitals NHS Foundation Trust, London, United Kingdom

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Nathaniel Scott
GenesisCare, Windsor, United Kingdom

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Jan Walukiewicz, Elisabeth Arrowsmith, Heather Williams
The Christie NHS Foundation Trust, Manchester, United Kingdom

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Jan Walukiewicz, Peter Julyan, Jose Anton-Rodriguez, Michael Gornall
The Christie NHS Foundation Trust, Manchester, United Kingdom

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Jan Walukiewicz, Dave Ashworth
The Christie NHS Foundation Trust, Manchester, United Kingdom

P34. Challenges in testing the performance of a large area pixelated cadmium zinc telluride gamma camera
Amie Roberts1,2, Christopher Marshall1,2, William Evan1,2, Daniel McGowan3,4
1Cardiff and Vale University Health Board, Cardiff, United Kingdom
2Cardiff University, Cardiff, United Kingdom
3Oxford University Hospitals NHS Foundation Trust, Oxford, United Kingdom
4University of Oxford, Oxford, United Kingdom

P35. Initial characterization of the Seracam: a small-footprint gamma-optical camera, with fully automated collimator changing capabilities
Andrew Farnworth, Alasdair Ruff, Glyn Spencer, Andrew Edwards, Sarah Bugby
Loughborough University, Loughborough, United Kingdom

P36. [18F]-FDG PET brain: Validation of new quantification programme
Karen Mullin, WP Murphy, Stephanie Doherty
Belfast Health and Social Care Trust, Belfast, United Kingdom

P37. Development of a method to assess automated PET injection systems
Lewis Davies1, Alyss Harman1, Joel Dunn1, Armidita Jacob1, Ana Sofia Percira1, Giorgio Testanera1, Nesin Guler2, Jane Mackewn1
1King’s College London, London, United Kingdom
2Bayer Inc., Reading, United Kingdom

P38. Accuracy of the KARL100 automated dispensing cart and Rad-Inject portable automated injectors
Rebecca Gregory1, Oliver Berry1, Fiona Barrack1, James Scuffham1, Vincet Prakash1,2, Claudia Bastos2, Claire Fitzgerald2, Angela Meadows2, Peter Strouhal2
1Royal Surrey County Hospital, Guilford, United Kingdom
2Alliance Medical Ltd, Guilford, United Kingdom

P39. Predicting monthly PET-CT referral rate using machine learning time-series forecasting
Richard Meades, Daniel McCool
The Royal Free London NHS Foundation Trust, London, United Kingdom

P40. Review of current PET-CT scanner technology in the UK and use of available features in [18F]FDG scanning.
Alyss Harman, Georgios Krokos, Jane MacKewn, Paul Marsden, Sally Barrington
King’s College London & Guy’s and St Thomas’ PET Centre, Division of Biomedical Engineering and Imaging Sciences, King’s College London, London, United Kingdom

P41. Harmonisation of digital to analogue PET-CT systems for continued recruitment into ongoing clinical trials
Anton Paramithas1, Stephen Carter2, J.T. O’Brien2, Peter Strouhal3, Nathalie Trinidad4, Philip Webster3
1St. George’s University Hospitals NHS Foundation Trust, London, United Kingdom
2Department of Psychiatry, University of Cambridge, Cambridge, United Kingdom
3Alliance Medical Ltd, Warwick, United Kingdom

P42. Physiological uptake pattern of [18F] choline in the myocardium may have potential to provide better target to background ratio than [18F]FDG.
Natasha Gardiner, Barbara Ribeiro, Ewa Nowosinska, Ade-Oju Busola Adebusola, Athar Haroon
Barts Health NHS Trust, London, United Kingdom

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Courteney Kelly
Glasgow Royal Infirmary, Glasgow, United Kingdom

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Richard Lee
Royal Marsden/ICR, Sutton, Surrey, United Kingdom

P45. Refining referral pathways for gastric emptying studies on the basis of a 3 year retrospective review.

Faisal Naeem, Ian Hufton, Vincent Pant, Sobhan Vinjamuri
Royal Liverpool University Hospital, Liverpool, United Kingdom

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Anthony Murray
Bradford Teaching Hospitals NHS Foundation Trust, Bradford, United Kingdom

P47. Atypical and rare presentation of genitourinary sarcoidosis with incidental synchronous nasopharyngeal carcinoma. [18F] FDG PET-CT: case report and literature review

Sarah Algodayan1,2, Francesco Fraioli2, Jamsed Bomanji2
1Imam Abdulrahman Bin Faisal University, Dammam, Saudi Arabia
2University College London Hospital, London, United Kingdom

P48. Using Brain SUV as reference for lymphoma

Adrien Peters, Job Daniel Livingstone, Marko Berovic, Nicola Mulholland
King’s College Hospital NHS Foundation Trust, London, United Kingdom

P49. Case review of breast SNB: Diffuse [99mTc] nano-colloid uptake

Gillian Ainslie-McLaren1,2,3, Alison Bolster1,2,3, Sai Han1,3
1Departments of Nuclear Medicine Glasgow Royal Infirmary & Stobhill ACH, NHS Greater Glasgow & Clyde, Glasgow, United Kingdom
2Department of Clinical Physics and Bioengineering, NHS Greater Glasgow & Clyde, Glasgow, United Kingdom
3University of Glasgow, Glasgow, United Kingdom

P50. Caveats of PET-CT interpretation in pancreatic carcinoma - How can we improve?

Randeep Kulshrestha, Hedvig Kartesz, Malcolm Gill, Keir Ovington, Aaron Mortjaria
University Hospitals Bristol & Weston NHS Foundation Trust, Bristol, United Kingdom

P51. Dual tracer [18F] PSMA and [123I] NaI positive in recurrent differentiated thyroid cancer - a case report and literature review

Chamani Punchihewa1, Maged Elsewafy3, Nitasha Singh1, Joanna Simpson1, Elle Lambert1, Sabina Dizdarovic1,2
1University Hospitals Sussex NHS Foundation Trust, Brighton, United Kingdom
2Brighton and Sussex Medical School, Brighton, United Kingdom

P52. Development of low-volume mouse-scale [82Sr]/[82Rb] generator for preclinical PET imaging

Zilin Yu, Aidan Michaels, George Firth, Thomas R Eykyn, Philip J Blower
King’s College London, School of Biomedical Engineering & Imaging Sciences, St Thomas’ Hospital, London, United Kingdom

P53. The value of a baseline study in morphine HIDA studies for assessment of sphincter of Oddi dysfunction in patients with cholecystectomy

Amelia Perry, Alp Notghi, Bill Thomson
Sandwell and West Birmingham NHS Trust, Birmingham, United Kingdom

P54. Gastric Emptying Studies: Importance of applying the correct normal range

Joseph O’Brien, Joseph Burmiston, Alp Notghi, Bill Thomson
Sandwell & West Birmingham Hospitals NHS Trust, Birmingham, United Kingdom

P55. Is there a role for SUVmax in predicting histological outcomes of incidental focal [18F]FDG uptake within the parotid glands?
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Abigail Ezekiel1, Stewart Redman2, David Little2
1University of Bristol, Bristol, United Kingdom
2RUH Bath, Bath, United Kingdom

P56. Rare Presentation of Primary Pulmonary Sarcoma in young male.

Amrita Tiwary VyasDr 1, Ajay VyasDr 2
1Janakpuri Superspeciality Hospital, New Delhi, India
2Max Superspeciality Hospital, Vaishali, Ghaziabad, India

P57. The Efficacy of [18F] PSMA PET-CT to diagnose biochemically recurrent adenocarcinoma prostate: An Indian Perspective

Amrita Tiwary VyasDr 1, Ajay VyasDr 2, Abhishek Gupta Dr 3
1Janakpuri Superspeciality Hospital, New Delhi, India
2Max Superspeciality Hospital, Vaishali, New Delhi, India
3Max Superspeciality Hospital Vaishali, New Delhi, India

P58. A rare case of primary synovial sarcoma of prostate with no distant metastases, staging by [18F]F-18 PSMA Scan - Case Report

Ajay VyasDr 1, Amrita Tiwary VyasDr 2, Abhishek Gupta Dr 3
1Max Superspeciality Hospital, Vaishali, New Delhi, India
2Janakpuri Superspeciality Hospital, New Delhi, India
3Max Superspeciality Hospital Vaishali, New Delhi, India

P59. Clinical significance and management of Incidental [18F]FDG uptake in the prostate

Basil Raju1, Stewart Redman2, David Little2, Will Loughborough3
1University of Bristol, Bristol, United Kingdom
2Royal United Hospital, Bath, United Kingdom

P60. Setting up a new PMSA PET service: a retrospective review of lessons learned from the first 20 patients

Amanda Isherwood1, Ged Avery1,2
1Hull Universities Teaching Hospitals NHS Trust, Hull, United Kingdom
2Hull York Medical School, Hull, United Kingdom

P61. A Pictorial Review demonstrating the potential benefits of combining of [111In] In- labelled leucocyte scintigraphy with [99mTc]Tc sulphur-colloid bone marrow imaging in the diagnosis of peri-prosthetic joint infection.

Amanda Isherwood1, Sandra Ngu1, Najeeb Ahmed1, Ged Avery1,2
1Hull Universities Teaching Hospital NHS Trust, Hull, United Kingdom
2Hull York Medical School, Hull, United Kingdom

P62. Role of [68Ga]-DOTA-NOC PET-CT in the assessment of Thymic Neuroendocrine Tumours (NETs)

Shamim Ahmed Shamim, Rashi Goel, Naresh Kumar, Sameer Rastogi, Rakesh Kumar, C S Bal
All India Institute of Medical Sciences, New Delhi, India

P63. Clinical impact of the reconstruction method selected in interpretation of [18F]FDG PET-CT for lymphoma response assessment

Ruth Brown, Mark Baker, Kate Van Elteren
Clatterbridge Cancer Centre, Liverpool, United Kingdom

P64. The performance of three-month post-treatment PET-CT quantitative metrics in the detection of residual Head and Neck lesions following chemoradiotherapy

Reem Althubaiti1, Ridhi Agarwal2, Bal Sanghera3, Paul Nankivel1, Hisham Mehanna1
1The Institute of Head and Neck Studies and Education, University of Birmingham, Birmingham, United Kingdom
2The Institute of Applied Health Research, University of Birmingham, Birmingham, United Kingdom
3Paul Strickland Scanner Centre, Mount Vernon Hospital, Northwood, United Kingdom

P65. Characterisation of [68Ga]-PSMA PET negative, biopsy proven primary prostate cancer.

Noora Bin Essa1,2, Alaa Alderaibi1,3, Dimitrios Priftakis1, Asim Afaq1, Jamshed Bomanji1
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P66. Optimisation of [18F] FDG whole-body scanning on a GE Discovery MI Gen2 Digital PET-CT system

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P67. Incidental [18F] PSMA tracer uptake in synchronous primary high-grade glioma in a patient with prostate carcinoma

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P68. [18F] PSMA and [18F] F-choline positive benign adrenal adenoma and differential diagnoses
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P69. How Useful Is Imaging of the Legs for Prostate Cancer Staging in Whole Body SPECT-CT?
Kate Pacunayen, Jonnese Cribello, Aram Parthipun, Theeksita Selvakumar
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P70. Performing Fast Whole Body SPECT-CT – Are solid state detectors really necessary?
Theeksita Selvakumar, James Hubber, Kate Pacunayen, Jonnese Cribello, Arum Parthipun
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P71. Reducing scan time for post-therapy [131I] NaI SPECT-CT scans
Thomas Ball, Helena McMeckin, Arhar Haroon, Manuela Vadrucci, John Buscombe, Ewa Nowosinska, Mohan Krishnamurthy
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P72. SPECT-CT protocol vs planar bone scan with targeted SPECT-CT in cancer staging – a single centre audit
Sweni Shah, Adeola Omotade, Charlotte Munday, Cindy Leung
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P73. Is it time to review the national guidelines on [99mTc]Tc-tetrofosmin uptake in breastmilk?
Glenn Guthrie, Mark Gannon
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P74. Impact of dental fillings on head CT doses for [18F] FDG PET-CT brain scans when using dose modulation
Stuart Bartley, Ian Armstrong
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P75. Changing standard operating procedure (SOP) to reduce tracer extravasation in PET-CT
Charlotte Shepherd, Sugama Chicklore, Giorgio Testanera
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P76. Lateral bed transfer techniques to reduce body dose and exposure time in PET-CT
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P78. Simulating gamma camera uniformity…in Excel!
Alexander Smout
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P79. Revolutionizing Nuclear Medicine: The Power of ChatGPT
Alexander Smout
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P80. Tektrotyd imaging in Ectopic Cushing’s Syndrome: a case report
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P81. Incidence of persistence and recurrence of differentiated thyroid cancer in post-surgical cases from a Tertiary Care Hospital in Dubai, United Arab Emirates.
Malek Othman1, Mohammed Al-Haidery1, Mazin Al-Janabi1,2
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P82. Do Primary Care radionuclide bone scan referrals improve patient pathway?
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P83. Bayesian penalized likelihood reconstruction algorithm for [18F]sodium fluoride PET-CT in evaluation of metastatic bone disease
Maya Trybala, Caroline Findlay
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P84. Bone mineral density in adult thalassemia, a retrospective longitudinal study with a serial assessment over decades.
Sarah Algodayan, Ramya Balachandar, Bomanji Jamshed
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P85. Quantification of SPECT-CT Imaging in unilateral condylar hyperplasia
Luke Collett, Ayah Nawwar, Aline Demmery, Hannah Marsh, Nirav Kaneria
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P86. Incidence of myocardial uptake on [99m Tc] Tc-HDP Bone Scan in patients referred for non-cardiac indications
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P87. Audit evaluating patient understanding and satisfaction of diagnostic imaging for venous thromboembolism (VTE) in the pregnant population
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P88. HMPAO SPECT scanning: An assessment of image quality
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P89. Using a Hoffman phantom to validate use of digital PET [18F]FDG brain images with a legacy normal database
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P90. Brain SPECT and PET Imaging and Quantification: a UK wide survey
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P91. Value of combined functional brain imaging (DaT scan and HMPAO brain SPECT) in the evaluation of cognitive impairment.
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P92. Representation of [18F] FDG brain PET-CT scan findings in three cases of dementia with not so common underlying pathologies.
Anuj Jain
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P93. Optimisation of clinical reporting of [123I]Ioflupane (DaTSCAN) SPECT studies: A clinical review of two commercially available automated quantification applications
Jessica Patel1, Harriet Pack1,2, Richard Fernandez1, Chris Sibley-Allen1, Dhruba Dasgupta1, Nicolas Efrychiou1, Fahim-Ul Hassan1
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P94. The value of multi-tracer multimodality imaging in the differential diagnosis of...
Parkinsonian syndrome and other neurodegenerative disorders

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P95. Idiopathic primary bilateral brain basal ganglia calcifications (Fahr's syndrome), as a potential differential diagnosis of parkinsonism identified by [123I] Ioflupane dopamine transporter (DaT) scan (DaTSCAN) SPECT-CT

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P96. Use of eGFR to predict mGFR for selection of optimum sampling time point in single-sample 99mTc-DTPA GFR studies.

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P97. Cortical transit time observer variability and normal ranges in paediatric [99mTc] MAG3 renograms prior to pyeloplasty

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P98. Evaluation of lobar lung quantitation at University Hospital of Hartlepool

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P100. Effect of low dose CT-based attenuation correction for SPECT on Lung Lobar Perfusion Quantification

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P101. An investigation into [99mTc]Tc-Macroaggregated Albumin Liver-Lung Shunt studies and their correlation with pulmonary function

Andrew Martin, William Murphy, Dorota Ferguson, Karen Mullin
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P102. Assessment of indeterminate rate in ventilation-perfusion (V/Q) lung scintigraphy in the diagnosis of pulmonary embolism in a tertiary care centre

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P103. Imaging in pulmonary embolism – are we following revised trust guidance?

Keir Ovington, Aaron Morjaria, Priyankar Singhal, John Spillane, Ayah Nawwar, Iara Sequeiros, Randeep Kulshrestha
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P104. Current use of Gallium - a case review

Kirsty MacKay, Muhammad Ayub, Shahid Rasul, Saif Khan, Jim McGarvie, Sam Allen
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P105. Comparison to the National [223Ra]Radium Dichloride audit results 2019

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P106. Reduction in rates of nausea in Peptide Receptor Radiotherapy patients following optimisation of radiopharmaceutical infusion rate

Neil Heraghty, Danielle Levart, Sarah Wicks, Eleni Kalogianni, Benjamin Corcoran
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P107. Scratch that! Redesigning and developing a new Nuclear Medicine department.

Anna Hallam, Steven Hill, Mark Singleton, Shelley Redgate, Tracy Soanes
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P108. Real world data – using blood indicators to assess [177Lu]Lu-PSMA treatment response

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P110. Validating a simple model of the [177Lu]Lu-DOTA-TATE gravity-assisted administration method.

Frederick Varley, Mitesh Naik, Chloe Bowen
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P111. [177Lu]Lu-PSMA therapy in metastatic castration-resistant prostate cancer patients: initial experience at University College London Hospital

Stefan Voo, Saima Riaz, Catherine Scott, Belinda Stiles, Cameron Anderson, Dimitris Priftakis, Jamshed Bomanji