1 Myocardial Perfusion Imaging (MPI) referral for patients with high coronary calcium score (CCS ≥ 1000) is safe and cost effective when compared to the current recommendation of direct angiography
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City Hospital, Birmingham, UK

**Aim:** NICE recommend an angiogram referral after a patient has a high CCS result. We have looked at the alternative pathway which includes initial MPI and assessed its safety and cost effectiveness.

**Method:** 2036 patients referred for MPI also had CCS during two year period (2013–2015). Angiographic findings, and 6-30 months clinical follow-up were collected for those with CCS > 999.

**Results:** 117 patients were included in the study. 59 (50%) had normal MPI (lesion ≤ 3%, 36 with no perfusion defects). Of these 13 had angiogram, (7 received stent or referred for CABG). There were no cardiac events during follow up period, 1 patient died from pneumonia.

58 patients (50%) had > 3% ischaemia in MPI. 31 had angio (53%), which resulted in stent (11) or CABG referral (9). 2 died with severe heart failure and 3 from non-cardiac causes.

**Discussion:** Following NICE guidelines all 117 patients with high CCS would have coronary angiography (£2125/angiogram, [http://www.privatehealth.co.uk/conditions-and-treatments/coronary-angiogram/costs/](http://www.privatehealth.co.uk/conditions-and-treatments/coronary-angiogram/costs/)), costing £248,625. When MPI was performed first (117 patients, £500/test, total cost £58,500), only 44 (38%) required angiograms (£93,500), with the total diagnostic cost of £15,200 with a 38% saving (£96,625).

**Conclusion:** MPI before angiography in patients with high calcium score is safe and cost effective and should be used whenever available.

2 Nuclear medicine software quality group (NMSQG) audit of thyroid uptake measurements
Sheffield Teaching Hospitals NHS Foundation Trust, Sheffield, South Yorkshire, Poole Hospital NHS Foundation Trust, Poole, Dorset, Barnsley Hospital NHS Foundation Trust, Barnsley, South Yorkshire, Royal United Hospital Bath NHS Trust, Bath, Somerset, UK, St Luke’s Hospital, Dublin, Ireland, University Hospitals Coventry and Warwickshire NHS Trust, Coventry, West Midlands, Northampton General Hospital NHS Trust, Northampton, Northamptonshire and Link Medical, Bramshill, Hampshire, UK

**Introduction:** An audit has been carried out into how UK hospitals perform thyroid uptake calculations. The results for different centres have been compared.

**Methods:** 2 × 10 planar thyroid images were available for participants. One set was acquired following administration of $^{123}$I and the other following administration of $^{99m}$Tc pertechnetate. To assess repeatability, each dataset included two identical images. Different methodologies for calculating uptake were considered. Participating centres were asked to measure the percentage uptake in the thyroid.

**Results:** 54 centres participated. 43 sites calculated uptake for the $^{99m}$Tc dataset. Results showed good agreement between centres, with a small inter-quartile range for each patient. Bland-Altman analysis of the repeated dataset showed a mean bias of 0.02% uptake across all sites (SD = 0.09%). 10 centres calculated uptake for the $^{123}$I dataset. Overall, $^{123}$I results were more variable. Bland-Altman analysis of the repeated dataset showed a mean bias of 0.18% uptake across all centres (SD = 0.31%).

**Conclusion:** There appears to be good intra and inter-site variability in calculated uptake for $^{99m}$Tc patients. Variability in the measurement of uptake for $^{123}$I patients appears to be greater. This may be related to the increased septal penetration associated with $^{123}$I imaging.

3 Plugging the hole in the NET with technetium
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**Purpose:** A clinical and practical comparison between conventional NET imaging using $^{111}$In Octreoscan and the more recently available $^{99m}$Tc Tektrotyd.

**Method:** In June 2014 Poole Hospital NHS Foundation Trust moved from using $^{111}$In Octreoscan as its routine
NET imaging radiopharmaceutical to using $^{99m}$Tc Tektrotyd. This study is a comparison of clinical data from the 25 $^{111}$In Octreoscan studies performed in the preceding 12 months and the 35 $^{99m}$Tc Tektrotyd performed in the subsequent 12 months. Data compared includes image protocol, activity administered and avidity of uptake in primary and secondary sites.

**Conclusion:** Imaging with $^{99m}$Tc Tektrotyd in preference to $^{111}$In Octreoscan has resulted in an improved signal to noise ratio and a subsequent significant increase in the number of lymph nodes reported as showing avid uptake. The change has resulted in a lower radiation dose and a more convenient imaging schedule for the patients. In addition the department has benefited as less camera time is required and costs have reduced.

4 Comparison of $^{68}$Ga-DOTATATE and $^{18}$F-FDG PET/CT in clinical impact and management plan in patients with neuroendocrine tumours

E. Panagiotidisa, A. Alshammaria, S. Michopouloua, E. Skoura, M. Mohmaduveshb, M. Al-Harbi, M. Berta, M.E. Caplin, C. Toumanakis and J. Bomanji

**Purpose:** To determine the clinical impact of $^{68}$Ga-DOTATATE and $^{18}$F-fluorodeoxyglucose (FDG) in the management of patients with Neuroendocrine tumours (NET) and to investigate the role of SUV max for both tracers as a prognostic indicator.

**Methods:** This is a retrospective study of 120 patients with histologically proven NET that underwent both $^{68}$Ga-DOTATATE and $^{18}$F-FDG PET/CT. PET/CT results and SUV values were compared with pathological grading (G1, G2, G3).

**Results:** The combination of both tracers had an impact in therapy modification in 41% of pts. In 7% the decision was made based on $^{18}$F-FDG findings, in 17% on both radiotracers and in 17% on $^{68}$Ga-DOTATATE alone. Only in one out of 34 pts with G1 tumours and in 4 out of 27 pts with G2 tumours, the management was based on $^{18}$F-FDG results. Using one-way ANOVA, there was significant differences only for $^{68}$Ga-DOTATATE SUV max values, being higher for G1 and lower for G3 tumours ($P = 0.036$). There was no association regarding SUV max values and patients' survival.

**Conclusion:** $^{68}$Ga SUV max values correlated with tumour grade, but could not predict patients' prognosis. There is no significant clinical impact of $^{18}$F-FDG PET/CT in G1 NET and G2 NET tumours.

5 SPECT/CT parathyroid imaging - why are we getting less accurate?

D. Little, R. Graham and S. Redman

**Purpose:** Our protocol for parathyroid adenoma localisation in primary hyperparathyroidism (PHPT) includes contrast enhanced $^{99m}$Tc- Sestamibi SPECT/CT. Local audit data and subjective feedback from surgical colleagues suggests we are becoming less accurate in detecting adenomas. The purpose of this study was to investigate the relationship between Sestamibi uptake and biochemical findings.

**Methods:** Radiological, biochemical and histopathological data was retrospectively collected from 60 patients with PHPT, referred for localisation of parathyroid adenoma using SPECT/CT in 2013, 2014 and 2015 (20 consecutive patients/year).

**Results:** Time taken to perform 20 scans in 2015, 2014 and 2013 was 49 days, 89 days and 122 days respectively. Mean age $= 68$ years, Female:Male $= 50:10$. Mean pre-operative Calcium was 2.71, 2.80 and 2.84 in 2015, 2014 and 2013 respectively. Mean pre-operative parathyroid hormone (PTH) was 8.5, 15.4 and 14.7 in 2015, 2014 and 2013 respectively. If PTH is $> 12$ there is a 74% likelihood of identifying increased Sestamibi uptake, if PTH $< 10$ this drops to 32%.

**Conclusion:** Our data shows that we are performing more scans to investigate PHPT at an earlier biochemical threshold. Sestamibi uptake and adenoma identification is more likely in patients with higher PTH. Imaging at a lower biochemical threshold may explain our reduced accuracy.

6 Left ventricular synchronicity relates with bone mineral density of the hands in rheumatoid arthritis


**Purpose:** The incidence of heart failure (HF) is increased in rheumatoid arthritis (RA). HF and osteoporosis share pathogenic mechanisms. We studied the correlations of left ventricular (LV) synchronicity and bone mineral density (BMD) in RA.

**Methods:** We evaluated 79 RA patients (normal LV perfusion and ejection fraction) who performed $^{99m}$Tc-tetrofosmin gated myocardial perfusion SPECT with adenosine. LV synchronicity was assessed by phase analysis. BMD was assessed by DXA in the lumbar spine, femur and both hands. Were evaluated the correlations of phase analysis parameters (standard deviation (SD) and
histogram bandwidth (HB) with clinical and analytical parameters and with the BMD.

Results: Sixty-one women, 54±12 years-old and 13±9 years of disease duration. We identified significant correlations of age of RA diagnosis with HB (r=0.316; P<0.01) and SD (r=0.254; P<0.05), of SD with the left hand (r=0.300; P<0.05) and the right hand (r=0.256; P<0.05) BMD, and of HB with the left hand (r=0.299; P<0.05) BMD.

Conclusion: Bone mineral density of the hands is related with left ventricular mechanical synchronicity in rheumatoid arthritis. This association may be explained with left ventricular mechanical synchronicity in rheumatoid arthritis.

7 18F-fluoromethylcholine PET/CT and proton magnetic resonance spectroscopy; imaging and tissue biomarkers of cell membrane turnover in primary brain gliomas - a pilot study

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aImperial College London and bImperial College Healthcare NHS Trust, London, UK

Background: Choline phosphorylation is required for cell membrane turnover; and reflected in choline kinase (CK) α over-expression in proliferating tumours. The relationship between choline metabolism detected by PET and MRS, CKα and aggressive glioma phenotype is unclear.

Purpose: To investigate the association of in vivo 18F-FMC uptake and choline-containing metabolites measured with proton MRS in brain gliomas with CKα expression.

Method: 13 patients with suspected primary glioma underwent multimodal 3T MRI (including multi-voxel MRS) and PET/CT (285MBq 18F-FMC; 45min dynamic list mode acquisition). Co-registered PET and MRI data were used to target biopsy to defined regions of high and low choline metabolism using real-time neuronavigation, prior to surgical resection. Immunohistochemistry for expression of CKα is being performed.

Results: All gliomas show increased tracer uptake relative to contralateral white matter, with greater uptake in high grade compared with low grade gliomas. Significant differences were found between grade II and III lesions in both 18F-FMC uptake (t-test, P<0.05) and Cho/Cr ratios on MRS (t-test, P<0.05). CKα expression assays are pending.

Conclusion: 18F-FMC uptake and Cho/Cr ratio on MRS can distinguish between high and low grade glioma. Correlation between CKα and imaging markers will probe the molecular basis of this uptake/signal.

8 The effect of a new bayesian penalised likelihood reconstruction algorithm (QClear) on image quality with count reduction in PET/CT studies

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University Hospital Coventry and Warwickshire, Coventry, UK

Purpose: To investigate the improvement of a new proprietary reconstruction algorithm (QClear) on PET/CT image quality when compared to standard OSEM reconstruction with reduced counts.

Method: Experiments were performed on a GE DISCOVERY 710 PET/CT system. The NEMA IEC phantom was used with standard clinical protocol and 3D List Mode. 20-100% time reductions were simulated and reconstructed using QClear. Contrast-noise-ratio (CNR) for each sphere was compared to OSEM reconstruction (2 iterations 24 subsets). Whole-body PET/CT was performed on 20 patients after injection of 350 MBq (range 269-411 MBq) 18F-FDG using List Mode. OSEM and QClear reconstructions were performed with the reduced-count data, (75% and 50% time). CNR differences were analysed. Images were also visually assessed as good, satisfactory or suboptimal.

Results: Phantom studies showed increased CNR for all QClear reconstructions (Wilcoxon signed rank test, P<0.05) for 40-100% time, as did the clinical studies for all QClear reconstructions (P<0.001). Observers, on average scored half-time Q-Clear images equivalent or better when compared to full-time standard OSEM reconstruction.

Conclusion: QClear reconstruction achieves a significant increase in CNR even at 50% of the acquired time (counts). This new reconstruction algorithm has the potential to significantly reduce patient radiation dose.

9 Use of autologous radiolabelled neutrophils to quantify lung neutrophil retention in healthy volunteers, experimental LPS-induced neutrophilic inflammation and COPD

University of Cambridge, Nuclear Medicine, Addenbrookes’ Hospital, GSK, Clinical Unit, Cambridge, Refractory Respiratory Inflammation DPU GSK, Clinical Pharmacology Experimental Medicine & Technologies GSK, GlaxoSmithKline and Clinical Sciences Imaging Centre, Brighton and Sussex Medical School, Brighton, UK

Aim: Using single photon emission tomography plus integrated CT (SPECT/CT) we aimed to quantify...
lung neutrophil retention in: (i) healthy non-smoking volunteers (HVs) following either saline or LPS (lipopolysaccharide) inhalation and (ii) patients with stable COPD.

Methods: Neutrophils were isolated using hetastarch red cell sedimentation and discontinuous percoll-plasma gradients. Labelling was achieved using $^{99m}$Tc-Technetium-hexamethylpropyleneameine oxime. HVs received either saline ($n=6$) or LPS (50 μg) challenge ($n=11$) 90 or 180 min prior to injection of labelled neutrophils. SPECT was performed over the thorax/upper abdomen at 45 min, 2, 4 and 6 h post injection of labelled cells. Neutrophil clearance was determined using Patlak-Rutland analysis.

Results: We observed an increased rate of accumulation of labelled neutrophils into the lungs of COPD patients (mean 0.0025 ml/min/ml lung-blood-volume ($n=7$)) and LPS-challenged subjects (mean 0.0024 ml/min/ml lung-blood-volume) compared to saline-challenged subjects (mean 0.00055 ml/min/ml lung-blood-volume ($P=0.0002$ and $P<0.001$ respectfully)). Neutrophil clearance was elevated to a similar extent in the HV-LPS and COPD groups.

Conclusion: These data support the utility of using non-invasive imaging to quantify ‘whole’ lung neutrophil retention in HVs and patients with COPD. This non-invasive imaging platform could be used to assess the efficacy of drugs that target lung neutrophil retention in patients with COPD or following LPS-challenge.

10 The clinical impact of $^{18}$F-fluorodeoxyglucose (FDG) positron emission tomography/computed tomography (PET/CT) in patients with cognitive impairment


University of Leeds, Leeds, UK

Purpose: This study evaluated the clinical impact of brain FDG PET/CT in patients with cognitive impairment at a tertiary referral centre in the UK. It also assessed the accuracy of FDG brain imaging to correctly diagnose Alzheimer’s Dementia (AD).

Methods and materials: A total of 136 patients were included in the study. FDG scans were performed using a consistent methodology and interpreted by radiologists. Standardised questionnaires were sent to the referring clinicians to establish the final clinical diagnosis and to obtain information about subsequent management.

Results: There was a 72% questionnaire return rate (98/136). FDG PET/CT had an impact on patient management in 81%, adding confidence to the pre-test diagnosis in 43%, changing the pre-test diagnosis in 35%, reducing the need for further investigations in 42%, and resulting in a change in therapy in 32%. There was a correlation of 0.78 ($P<0.0001$) between the PET diagnosis and final clinical diagnosis. The accuracy of FDG imaging to diagnose AD was 94%, with a sensitivity of 87% (CI 69.2–95.8) and a specificity of 97% (CI 88.7–99.5).

Conclusion: FDG PET/CT has a significant clinical impact when performed selectively in patients with unexplained cognitive impairment and shows high accuracy in the diagnosis of AD.

11 A multicentre survey of DaTSCAN quantification in Birmingham using phantom data acquired on different camera systems


aCity Hospital, Birmingham, West Midlands, bHeart of England NHS Foundation Trust, Birmingham, West Midlands and cGE Healthcare Ltd, Amersham, Buckinghamshire, UK

Introduction: Quantification is helpful in reporting DaTSCAN images, especially in difficult cases. We report cases from local hospitals for second opinion. Their systems and protocols differ therefore we have assessed potential effects of these differences on quantification results.

Method: The Alderson DaTSCAN phantom was used. Striata were filled to mimic normal (right) and abnormal (left) uptake, then scanned same day at three different hospitals using local protocols (four different cameras). Time-per-projection was adjusted to account for decay. Data was processed centrally by two operators on a GE-Xeleris(v3) and results analysed using GE-Datquant™ and EXINI-Dat™ software. Specific Binding Ratios (SBR) were recorded.

Results: Four quantification methods were compared. Least variation was obtained with one operator re-processing raw-data and using the Transverse-Oblique files:

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<th>Bham-GoodHope</th>
<th>BHam-Heartlands</th>
<th>BHam-City GE D630</th>
<th>BHam-City GE INFINA</th>
<th>Std-Dev</th>
<th>Max/Min/ (Range)</th>
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<tr>
<td>DaTQUANT</td>
<td>1.77</td>
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<td>1.89</td>
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<td>0.05</td>
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<td>0.71</td>
<td>0.83</td>
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<td>EXINI</td>
<td>3.30</td>
<td>3.12</td>
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<td>3.32/3.12/0.20</td>
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<td>1.15</td>
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<td>0.05</td>
<td>1.29/1.15/0.14</td>
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Discussion and conclusion: Variability between systems was minimal using this approach, and is now used for second opinions. Other quantification methods highlighted
variation caused by use of trans-axial files, processing software and operators, which will be presented.

12 MIMvista for DaT vs. southampton method. an inter-operator variability comparison
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University Hospital Southampton, Southampton, UK

Purpose: Quantification of DaTSCAN images is a proven adjunct to visual assessment. The aim of this project is to evaluate the inter-operator variability in the quantification of specific binding ratios (SBRs) comparing a recently launched commercial software (MIMvista for DaT) with the Southampton method implemented on a Link Medical workstation.

Methods: Three operators processed reconstructed images from 28 DaTSCAN patients (20 male, age range 42-87 years) using MIMvista for DaT and the Southampton method. The input for both methods consisted of images reconstructed with OSEM and attenuation correction. MIMvista applies registration of the image to a DaT template and requires operator intervention to fit anatomical VOIs to the caudate and putamen. The Southampton method requires manual positioning of a larger geometric VOI encompassing the whole striatum.

Results: The coefficient of variation (COV) for the whole striatum was 11.93% with MIMvista and 4.80% with the Southampton method. With MIMvista inter-operator variability increases further when quantifying sub-regions. The COVs for caudate and putamen separately were 13.15% and 14.42% respectively.

Discussion/Conclusion: Geometrical VOIs are more robust than anatomical regions in the quantification of SBRs in DaTSCANs, despite the larger size. This is likely to be due to their resilience to partial volume losses.

13 Balanced dopamine transporter loss on 123I-Ioflupane (DaTSCAN) may correlate to presence of hallucinations in patients with suspected dementia with lewy bodies (DLB)
Royal Sussex County Hospital, Brighton, UK

Aim: To correlate the presence of hallucinations with 123I-Ioflupane (DaTSCAN) scan qualitative and semi-quantitative analysis in abnormal, 13/20 (Group 1a, DLB) and normal scans, 7/20 (Group 1b; presumed psychiatric). Group 1a was compared with Group 2a (20 patients with no hallucinations and abnormal scans, predominantly PD), using the unpaired t-test and Mann-Whitney test.

Results: Visually, 10/13 (77%) patients from Group 1a demonstrated symmetrical reduction in the basal ganglia, but high background vs. 6/20 (30%) in Group 2a. Semi-quantitative analysis (symmetric definition < 0.10) demonstrated symmetrical reduction in 9/13 (69%) versus 10/20 (50%) in Group 1a and 2a, respectively. The putamen asymmetry showed a trend (P = 0.07) with the median Putamen/Background ratio of 0.05 (IQR 0.02-0.11) for Group 1a vs. 0.11 (IQR 0.05-0.15) for Group 2a. However, the Putamen/Caudate ratios were significantly different between the groups (P = 0.01), for both sides.

Conclusion: Our preliminary data suggests that dopamine transporter loss is more balanced with high background in patients with abnormal scan presenting with hallucinations than in those without.

14 Florbetapir imaging in clinical practice: a retrospective study of 100 patients at a tertiary referral centre
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“Department of Neurology, Imperial College Healthcare NHS Trust, Department of Neuroradiology and ‘Department of Nuclear Medicine, Imperial College Healthcare NHS Trust, London, UK

Amyloid-PET imaging detects amyloid-beta pathology early in the course of Alzheimer’s disease (AD) with high sensitivity and specificity and can classify the underlying disease process in patients with cognitive impairment. Florbetapir (Amyvid) is an amyloid-binding PET ligand with a long half-life, suitable for clinical use outside of the trial setting. How Amyvid imaging affects patient investigation and management in the ‘real-world’ arena is unknown.

We retrospectively reviewed the clinical details, investigations and management of 100 consecutive patients imaged with Amyvid as part of their routine clinical investigation at the Imperial Cognitive Clinic (ICC) since 2014. Amyvid was employed in patients with young onset dementia (42%), mild or subjective cognitive impairment (33%), or AD patients with an atypical course or equivocal investigations (26%). Amyvid confirmed clinical suspicion in 68% of patients but caused a change in diagnosis in 32% and induced a change in management in 47%. Patients had significantly fewer investigations post-Amyvid and patients who presented to ICC at a time when Amyvid was available had significantly fewer investigations pre-Amyvid also.
Amyvid imaging commonly confirms diagnostic suspicion when investigating dementia, but also directly influences management and enables clear pathological segregation whilst reducing the overall burden of investigations performed.

15 The added benefit of quantification on PET $^{18}$F-florbetapir reporting; first experience in one dementia network
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$^a$Brighton and Sussex University Hospitals NHS Trust, $^b$Clinical Imaging Sciences Centre, Brighton and $^c$Sussex Partnership NHS Foundation Trust, Worthing, UK

**Purpose:** To assess whether quantification influenced confidence of reporting clinicians in the evaluation of $^{18}$F-Florbetapir studies.

**Methods:** A retrospective review of 13 consecutive clinically indicated Florbetapir studies was conducted between July 2014 and December 2015. All scans were reported visually and assessed by semi-quantitative analysis using Hermes BRASS$^\text{TM}$ with a SUVratio cut-off of 1.10, normalised to the cerebellum. Clinical conclusions and confidence (using a scale of 1-5, where 1 was no confidence and 5 was complete confidence) were assessed by three independent reporting clinicians, before and after consideration of quantification.

**Results:** Quantification agreed with visual assessment in all but one case, where the patient exhibited hydrocephalus. Clinician confidence was increased in 16/39 (41%) of cases, and did not decrease confidence for any cases. The mean change ($\pm$standard deviation) in confidence score was 0.67$\pm$0.96. The least experienced reporter benefitted most from quantification; increasing their score by an average of 1.00. The mean usefulness of the quantification was scored at 3.56$\pm$1.21, with a maximum score of 5/5 given in 12/39 (31%) of cases.

**Conclusion:** Quantification is a useful adjuvant tool for $^{18}$F-Florbetapir image reporting, improving confidence particularly for less experienced reporters.

16 $^{18}$F-Fluorocholine uptake in adrenal glands: an analysis of 104 consecutive cases of normal and benign adrenal lesions
K. Singh, S. Dizdarevic and J.C. Fowler
Brighton and Sussex University Hospitals, Brighton, UK

**Purpose:** To establish the range of adrenal uptake of $^{18}$F-Fluorocholine within normal glands and benign lesions in patients with prostate cancer.

**Methods:** 104 consecutive $^{18}$F-Fluorocholine PET/CT studies were retrospectively reviewed. Tracer uptake within the adrenal glands was measured by the maximum Standard Uptake Value (SUVmax) to compare to a previously published range of 3.42–7.42 (IranJNuclMed 2016;24 (1):65–68). All adrenals were assessed on the CT component of the study and classified as normal or abnormal. If abnormal, lesions were measured in diameter, characterized by attenuation density assessment and compared to previous imaging to distinguish between metastatic lesions and adrenal adenomas.

**Results:** Normal adrenals had a wide range of activity: SUVmax 2.5–9.1, mean 4.6. Four right adrenals were excluded from the analysis, being too close to the liver. There were 5 adrenal lesions, all had typical features of adrenal adenomas, being low density and stable in size/appearance on serial imaging. These varied in size from 13–40 mm, with tracer uptake ranging from 3.4 to 17, with activity increasing with size.

**Conclusion:** Our series shows highly variable tracer uptake within normal adrenals, with a wider range of uptake (2.5 to 9.1) than described from previous study and variable uptake within adrenal adenoma.

17 Evidence based management of focal incidental uptake detected on FDG PET/CT in the thyroid, colon and prostate gland
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Royal Free Hospital, London, UK

**Introduction:** Focal incidental uptake within various organs is detected in 6–8% of FDG PET/CT scans. Focal uptake can represent malignancy however guidelines on how to report and manage this uptake is lacking. We aimed to devise evidence based guidelines for management of the commonest sites of incidental uptake within the thyroid, colon and prostate.

**Method:** Literature review of the aetiology of incidental, focal uptake in the thyroid, colon and prostate was performed. The results from selected studies were used to devise evidence based guidelines on the management of this uptake.

**Results:** Multiple papers have been published on the aetiology of incidental uptake in the thyroid, colon and prostate. None have sufficient follow up to determine the true incidence of malignancy however estimates can be made. SUVmax is not sufficient to accurately distinguish between benign and malignant causes of uptake however other factors can be helpful.

**Conclusion:** 28–40% of focal colonic, 17–35% of focal thyroid and 6–19% of focal prostatic uptake represents malignancy. All focal uptake should be further investigated in these organs. SUV max is helpful in stratifying...
the urgency of investigation in colonic uptake and the HU of the CT in thyroidal uptake might be helpful.

18 Effect of bayesian penalized likelihood reconstruction on [13N]-NH3 perfusion imaging in suspected cardiac sarcoidosis
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aKing’s College London, London, bUniversity of Oxford and cOxford University Hospitals, Oxford, UK

Background: Detection of cardiac involvement in patients with suspected extra-pulmonary sarcoidosis is of paramount importance in their clinical management. We evaluate the use of a new Bayesian penalized likelihood (BPL) reconstruction algorithm on dynamic [13N]-NH3 quantified perfusion data.

Methods: We retrospectively analysed data from 10 patients who had undergone rest perfusion imaging with dynamic [13N]-NH3 in combination with [18F]-FDG for viability imaging. We reconstructed [13N]-NH3 datasets with a range of BPL penalization coefficients from 1-500 and calculated K1 perfusion values for all [13N]-NH3 data using commercially available software utilizing a 2-compartment kinetic model. All segmentations and calculations were automatically generated by the software.

Results: Reconstruction of the [13N]-NH3 dynamic data using the BPL or standard FBP showed no quantitative difference on the calculation of rest MBF in terms of territorial or global perfusion (P = 0.98). BPL images generated less noisy time activity curves and images appeared smoother with higher penalization factor.

Conclusion: Quantification of perfusion via kinetic modeling of cardiac rest perfusion by [13N]-NH3 is unaffected by the use of a BPL reconstruction technique, yet subjectively the images present with less noise and appear smoother with BPL.

19 68Ga-PSMA PET/CT in radically treated prostate cancer patients with biochemical recurrence: first experience in UK
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University College Hospital, London, UK

Aim: Assess the value of 68Ga-PSMA PET/CT in early detection of metastases/recurrence in patients with radically treated prostate cancer with biochemical recurrence (BCR).

Methods: 25 patients with BCR were referred for 68Ga-PSMA PET/CT scan. Patient’s age, indication for scan, tracer dose (MBq), SUVmax of lesions, Gleason score (GSC), recent PSA level, PSA doubling time (PSADT), previous imaging and initial therapy (prostatectomy/radiotherapy/HIFU) were recorded. Patients underwent scan 1 h post injection of 68Ga-PSMA [dose 104–185 MBq (mean 145 MBq)]. Any non-physiological tracer activity was considered abnormal.

Results: The patient’s age was 56–82 years (median 68 years). Of the 25 patients 13 had radical prostatectomy, 11 RT and 1 HIFU. PSA level was available for 22 patients [range of 0.03–5.36 ug/l (mean 1.82 ug/l)]. PSADT range 1.4–27.3 months (mean 9.5 months). 76% had GSC between 7–9. 68Ga-PSMA PET/CT scans were negative in 10 patients & positive in 15 patients [local recurrence (n = 6), LN metastases (n = 7) & bone metastases (n = 2)]. SUVmax of lesions ranged between 1.2–21.8 (mean 6). There was significant correlation of positive scans with PSA levels (P < 0.05).

Conclusion: 68Ga-PSMA is a novel new tracer and can detect disease in 60% of prostate cancer patients with BCR.

20 SUV reproducibility on different reporting platforms
aImperial College Healthcare NHS Trust, London, bNorthampton General Hospital NHS Trust, Northampton, cSheffield Teaching Hospitals NHS Trust, Sheffield, dUniversity Hospitals Coventry and Warwickshire NHS Trust, Coventry, eLeeds Teaching Hospitals NHS Trust, Leeds, fRoyal United Hospitals Bath NHS Trust, Bath, UK, gSt Luke’s Hospital, Dublin, Dublin, Ireland, hBristol Royal Infirmary, Bristol, iLink Medical Limited, Bramshill, jPoole Hospital NHS Foundation Trust, Poole, UK and kBarnsley Hospital, Barnsley, UK

The standardised Uptake Value (SUV) is a commonly used semiquantitative measure in PET reporting. This audit examined reproducibility of SUV-max as reported on PET reporting software platforms.

Methods: Twelve PET/CT scans were acquired from phantoms using three clinical PET/CT scanners. The phantoms contained one obvious hot spot in the main phantom body and external PET sources to allow orientation to be checked. The datasets were exported and then distributed to PET centres for analysis using clinical reporting software.

Results: The datasets were analysed on 20 workstations running 13 software programs. The orientation tags were correctly interpreted by all 13 programs. 8 of the 13...
21 Role of serial 18-Fluoride PET/CT scans in the management of alkaptonuria
P.S. Chuaha, M. Baker, V. Militano, L.R. Ranganath and S. Vinjamuri
Nuclear Medicine Department and Department of Clinical Biochemistry and Metabolic Medicine, Royal Liverpool University Hospital, Liverpool, UK

Introduction: Alkaptonuria (AKU) is a rare autosomal recessive disorder caused by deficiency of homogentisate1,2-dioxygenase (HGD) enzyme. This leads to excessive accumulation of homogentisic acid (HGA) in joints, resulting in progressive osteoarthritis. As more research is being conducted to identify treatment for AKU, our emphasis is to generate confidence in a method of objectively assessing changes in arthropathic activity on serial 18-Fluoride scans.

Methods: Thirty-two patients were imaged with \(^{18}\text{F}\)-PET/CT scans (baseline and at one year follow-up) to assess disease progression and/or treatment response. Each image has been independently reviewed and scored on a 4 point scale for each joint by 3 nuclear medicine physicians. Change was assessed on a 3 point scale (positive, no and negative change).

Results: There was good agreement between the 3 readers. In the vast majority of patients, no significant change in uptake is noted in most joints imaged. A few patients showed some deterioration, and there were a very small number where there was perceived improvement. This will be correlated with MRI and clinical assessment in the next phase of the study.

Conclusion: \(^{18}\text{F}\) PET/CT is a useful tool to measure disease progression and/or monitor treatment response in patients with alkaptonuria-related osteoarthritis.

22 Iodine-125 (\(^{125}\text{I}\)) seeds in the localisation and excision of breast tumours
The Newcastle upon Tyne Hospitals NHS Trust, Newcastle upon Tyne, UK

Aim: Around 17 000 impalpable breast tumours per annum are detected in the UK. Many patients will undergo safe and effective surgical excision of the tumour guided by a wire with the tip localised to the tumour. Resection can be challenging resulting in re-resection or poorer cosmesis. Wires can also migrate or become dislodged peri-operatively. There is time pressure on staff inserting the wire, often on the morning of surgery, and additional anxiety for the patient. Our aim is to describe the UK's first service development and audit.

Method: An Iodine-125 seed is inserted 7–14 days prior to surgery under radiological guidance. Excision is achieved using a hand held gamma probe, similar to the method for sentinel node localisation. Therefore surgery is technically simpler than wires. We describe a cohort study of seeds versus wires (100 patients each) with full pathology results.

Results: The specimen positive margin rate was 13/100 for seeds compared with 15/100 for wires. The mean specimen weight was 31 g for seeds compared with 37 g for wires.

Conclusion: We have found that seeds allow for comparable positive margin rates and lower excised volumes. In addition scheduling in Radiology and Theatres is significantly improved along with the patient experience.

23 What are the best FDG-PET/CT positivity cut-offs for the assessment of nodal involvement in non-small cell lung cancer?
A. Mallorie and T. Wagner
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Background: Nodal involvement in non-small cell lung cancer (NSCLC) is a major factor in determining management and prognosis. We aim to evaluate the accuracy of FDG-PET/CT for assessment of nodal involvement in patients worked up for radical treatment.

Methods: In this retrospective study we included 61 patients with suspected or confirmed resectable NSCLC from 4/2013 to 4/2015 at Royal Free Hospital. 221 nodes with pathological staging from surgery or EBUS (endobronchial ultrasound) were assessed using nodal station based analysis with original clinical reports and three different cut-offs: mediastinal blood pool (MBP), liver background and tumour SUVmax/2.

Results: Using nodal station based analysis for activity > tumour SUVmax/2: sensitivity 45%, specificity 89%, NPV 87%. For activity > MBP: sensitivity 93%, specificity 72%, NPV 98%. For activity > liver background: sensitivity 83%, specificity 84%, NPV 96%. ROC analysis showed the optimal nodal SUVmax to be > 6.4 with sensitivity of 45% and specificity 95% with area under curve of 0.85.
Conclusion: Activity > MBP was the most sensitive cut-off with highest sensitivity and NPV. Activity > primary tumour SUVmax/2 was the most specific cut-off. Nodal SUVmax > 6.4 has a high specificity of 95%.

24 The effect of post-injection image acquisition time on measurement of texture parameters for tumour heterogeneity analysis
E. Lovatª, M. Siddiqueª, V. Gohª, R. Fernerb, G.J.R. Cookª and V. Warbeya
ªKing’s College London and 1Guy’s and St Thomas’ NHS Foundation Trust, London, UK

Purpose: Texture analysis of 18F-FDG PET provides predictive and prognostic biomarkers but it is unknown if the post-injection time interval before image acquisition influences measurement of texture parameters (TPs). We aimed to compare TPs from 18F-FDG PET of benign and malignant neurofibromas that had undergone dual time-point imaging.

Methods: 56 18F-FDG PET/CT scans, from 54 patients (30M, 24F, mean age 34.7 years) with neurofibromatosis-1 and suspected malignant transformation with a histological reference standard were performed at 90 and 240 min post-injection. All PET-image TPs (1st, 2nd, high-order and model-based) were measured using in-house software implemented under MATLAB at both time-points and compared using Wilcoxon signed-rank test.

Results: For the 35 benign and 21 malignant lesions combined 7/12 1st-order, 7/22 2nd-order, 13/31 high-order and 3/6 model-based TPs changed significantly between 90 and 240 min post-injection. All PET-image TPs (1st, 2nd, high-order and model-based) were measured using in-house software implemented under MATLAB at both time-points and compared using Wilcoxon signed-rank test.

Conclusion: Several TPs vary with time post-injection although for 1st-order TPs this is less common in malignant tumours. Imaging should be performed at a consistent time post-injection for reliable inter- and intra-patient comparisons when measuring tumour heterogeneity with texture analysis.

25 Does texture analysis of 18F-FDG PET improve characterisation of malignant peripheral nerve sheath tumours in neurofibromatosis-1 patients?
G.J.R. Cookª,ª, E. Lovatª, M. Siddiqueª, V. Gohª,ª, R. Fernerb,ª and V.S. Warbeyaª
ªKing’s College London and 1Guy’s and St Thomas’ NHS Foundation Trust, London, UK

Purpose: 18F-FDG PET texture analysis (TA) provides a measure of tumour heterogeneity but it is unknown if it can differentiate benign and malignant peripheral nerve sheath tumours (PNSTs) in patients with neurofibromatosis-1, a frequent diagnostic dilemma. We aimed to compare TA with SUVmax in 18F -FDG PET for this purpose.

Methods: 18F-FDG PET was performed at 90 and 240 min post-injection in 55 patients with neurofibromatosis-1 and suspected malignant transformation (M:F 30:25, mean age 34.9 years). TA was performed at both time-points measuring 1st, 2nd, high-order and model-based texture parameters. Statistical comparisons were made using the Mann-Whitney U-test and ROC analysis.

Results: 31 benign and 24 malignant lesions were confirmed histopathologically, AUROC was greatest for SUVmax at 90 and 240 min time-points (0.991, 3 false-positives and 0.996, 2 false-positives, respectively). SD, entropy, fractal dimension (FD) and coarseness performed well (0.965, 0.991; 0.942, 0.952; 0.804, 0.81; 0.890, 0.891). The greatest AUROC resulted from the combined parameter SUVmax/FD (0.997, 0.996) with only one false positive result and no false negatives.

Conclusion: TA does not improve discrimination of benign and malignant PNSTs compared to SUVmax. However, a number of texture features measuring tumour heterogeneity show good discrimination and using a combined parameter (SUVmax/FD) maximises diagnostic accuracy.

26 Sentinel node biopsy for primary salivary gland tumours, feasibility study of a new technique
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Introduction/Aims: Sentinel node biopsy (SNB) is an accurate staging tool but has not been widely described in primary salivary gland malignancy. We show that lymphatic drainage from can be accurately mapped using a combination of SPECT/CT and navigational surgery.

Materials/Methods: Ethical permission was obtained for patients with rN0 primary salivary malignancy to undergo SNB. Patients underwent USS guided injection of tracer (99mTc-Nanocolloid± ICG) followed by lymphoscintigraphy (LSG) and SPECT/CT. At surgery sentinel nodes were identified by 3D navigation SNB ± fluorescence imaging and sent for serial sectioning. Resection of the tumour and nodal basins was completed as per MDT.

Results/Statistics: Eight patients (6 parotid, 2 sublingual) underwent SNB. Sentinel nodes were found in all patients, (by LSG (5/8), SPECT/CT (6/8), and navigation (8/8)). Nodes were located in level I, IIa & III and superficial intraparotid, but none in the deep lobe. Metastasis in two patients (25%), resection of the remaining nodal basins did not reveal positive non-sentinel nodes.
Conclusions/Clinical Relevance: This proof of concept study shows sentinel nodes draining salivary tumours can be identified, offering the prospect of patient specific management of the N0 neck. Further work is necessary to determine which patients will benefit from this procedure.

27 Clinical implications of combining pre-operative axillary ultrasonography and fine needle aspiration cytology with radionuclide guided sentinel lymph node biopsy in breast cancer patients with palpable axillary lymph nodes after ACOSOG Z0011 trial

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Kuwait Cancer Control Center, Kuwait and Hull and East Yorkshire Hospital’s NHS Trust, Hull, UK

Purpose: The ACOSOG Z0011 trial results have significantly impacted practice by decreasing rates of axillary lymph node dissection (ALND). Clinically palpable lymph nodes (CPLN) are considered a contraindication to sentinel lymph node biopsy (SLNB) but one third of these are not malignant.

Materials and methods: Fifty three patients with primary breast cancer and CPLN were included in the study. All patients underwent preoperative axillary ultrasonography (AUS) and FNAC followed by SLNB in FNAC negative patients (Group A). Patients with proven metastasis subsequently had ALND (Group B).

Results: Nodal metastases were documented at FNAC in 26 (49%) of the 53 patients with subsequent axillary clearance (Group B). All 27 patients (51%) with negative FNAC results (Group A) underwent sentinel lymph node biopsy (SLNB), which revealed metastasis in 6 (11%) patients. The remaining 21 (40%) patients were tumour negative with NPV of 100% (follow-up period of 12–36 months).

Conclusion: The inaccuracy of clinical assessment allows widening of indication for SLNB. Preoperative ultrasonography and guided-FNAC can help in selecting the patients suitable for ALND or SLNB. Patients who are FNAC positive can proceed to ALND whilst FNAC negative samples can undergo SLNB. This combination strategy may be helpful in avoiding unnecessary ALND.

29 The value of SPECT/CT in polycystic kidney disease. A case study

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Background: A 55 year old male presented with polycystic kidney disease (PKD) involving a large complex cyst suspicious of malignancy. The physiological nature of the cyst could not be determined on previous radiological examinations so the patient was referred for a Nuclear Medicine 99mTc-DMSA scan.

Aim: To determine if a large complex cyst on the lower right renal pole was an area of renal parenchyma.

Method: A routine 99mTc-DMSA scan was performed with standard planar imaging. Review of the images left the diagnosis still unclear so additional Single Photon Emission Computed Tomography/Computed Tomography (SPECT/CT) imaging was performed.

Results: The SPECT/CT confirmed absence of tracer uptake in the enhancing solid component of the complex renal cyst, indicating it is not an area of renal parenchyma and most likely to be a malignant lesion.

Conclusion: Cross-sectional hybrid imaging was essential in assessing the physiological properties and anatomical localisation of the renal tissue under investigation. This
case study highlights the value of SPECT/CT’s ability to provide unique information in patients with PKD that may impact the patient’s treatment plan resulting in the best possible clinical outcome.

30 An investigation into reporting in nuclear medicine by non-medical clinical practitioners, current status and potential requirements for future provision

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A pilot study of the level and practice of non-medical reporting within NM, gaining an understanding of the education and support required for the future provision. A mixed methodology was used of literature review and a two-stage interrogation of a prospective sample of the workforce by semi-structured interview and an internet questionnaire.

The initial literature review of selected databases revealed a paucity of evidence directly related to non-medical reporting in NM so a secondary investigation was undertaken which looked at key concepts contained within this literature.

The existence of non-medical reporting support, which included the 2005 draft BNMS guidelines on gave a good starting point for investigating the criteria and competencies. Data from both the interviews and questionnaire results demonstrated a surprisingly wide range of studies being reported by staff ranging from Clinical Scientists to Technologists and Radiographers. The majority of these practitioners had completed a course in reporting skills including a portfolio of evidence to support this.

Conclusion: That a number of suitably senior and experienced non-medical staff are undertaking clinical reporting. However there appears to be some lack of contingency planning for future provision when these move on in their careers.

31 Reviewing CT images: A useful guide for PET/CT technologists

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Purpose: PET/CT departments are commonly staffed by Nuclear Medicine technologists who may not necessarily have a background in Radiology. The purpose of this work is to share our radiological experience with technologists in order to increase their confidence in reading CT images that may be acquired during PET/CT and distinguish the difference between normal variants and pathologies.

Methods: CT images with a variety of pathologies have been collected with patients’ consent and anonymised. Radiological reports were read for verification of the abnormalities.

Results: We describe a number of CT cases demonstrating normal variants and pathology that could occur as part of a PET/CT examination and need to be recognised by radiographers and technologists.

Conclusion: A working knowledge and confidence in reviewing CT images is important for radiographers and technologists performing PET/CT and may contribute to improvements in patient management as non-urgent findings can be distinguished from those that need to be more urgently escalated to a clinician.

32 Personal dosimeters: Where to wear them for maximum reliability

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Purpose: This study aims to investigate the differences in measurements of whole body ionising radiation dose, measured at four different locations on an operator within a PET/CT department.

Methods: Personal radiation dose was measured over five days for a single operator in normal work conditions. In order to monitor and measure the personal dose equivalent Hp (10), Electronic Personal Dosimeters (Polimaster® PM1610) were placed on the right hip (current standard position for EPDs), left neck (as a control for radiosensitive organs), chest and lower body. The last two were chosen to analyse how the whole-body lead shield affects the Hp (10), as the chest dosimeter is not protected by it.

Results: The preliminary results show that despite considerable variation between positions, the mean dose was at least 9% higher of that received on the hip with the neck position being the highest Hp (10). The chest dose is approximately 17% higher when compared with the lower body dose.

Conclusion: As an ongoing study, the reliability of these preliminary results is not yet established. However, the higher doses in all the other tested locations, when compared to the current standard position, suggests a need for a review of the standard EPD dosimeter’s position.
33 Multigated acquisitions and the role they play in current clinical practice
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University College London Hospital, UK

Multigated acquisitions (Muga) have been proven to be more reliable than echocardiography and remains the gold standard for evaluating left ventricular ejection fraction (LVEF) in the context of toxicity associated with chemotherapy and drug trials. Mugas are the bread and butter of Nuclear Medicine departments and is a relatively cheap and simple test to perform. Several advances in modalities and new tracers have seen the introduction of novel methods to investigate LVEF. As competitors we discuss the relevance of Mugas in the era of multimodality imaging and the role it plays in current clinical practice, as well as the technical factors to optimise image acquisition and processing.

34 Continuing professional development of UK nuclear medicine staff - national survey
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Introduction: Continuing professional development (CPD) is part of professional practice in nuclear medicine (NM). Uniquely NM technologists do not require statutory registration or have a clear community of practice for CPD, compared to clinical scientists and radiographers. Last year technologists on the RCT voluntary register were required to formally start undertaking CPD. This research explores the CPD experiences of UK NM staff, also with a focus on technologists.

Methodology: A focus group (n = 2) and national online survey (n = 150) were performed. The survey was advertised on the UK medical physics JISC Mailbase and also on the BNMS, IPEM and COR websites. The results were qualitatively analysed and the resultant themes were extracted.

Results: Staff resoundingly desire protected CPD time/activities (lectures, workshops, conferences) and funding. Online CPD resources (access to guidelines/journals, educational material, etc) were also preferred. Technologists are disadvantaged through lacking a CPD culture and having an ill-defined community of practice.

Conclusion: While the value of CPD is widely accepted, the time and resources provided by NM departments are scarce, especially in the current climate of austerity cutbacks. Inexpensive structured online CPD activities should be supported. More research is required to support the maturing CPD cultures amongst technologists.

35 Validation of caffeine measurements in blood for patients undergoing Rb-82 adenosine myocardial perfusion scintigraphy (MPS) PET studies
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“Central Manchester University Hospitals and University of Manchester, Manchester, UK

Introduction: Caffeine ingestion within 12 h of adenosine perfusion imaging may reduce vasodilation and myocardial perfusion reserve (MPR) masking ischemia at plasma levels above 2.9 μg/ml.

Aims: To validate caffeine measurements in patients undergoing MPS and correlate effects of blood caffeine concentration on MPR measurement.

Methods: The study included 14 patients with low pre-test likelihood of coronary artery disease. Caffeine was extracted from 20ml of blood and quantified by reverse phase HPLC using 85:15 (v/v) methanol/water mobile phase. Method performance was assessed with standard validation parameters. Results were split into two groups based on caffeine plasma concentration (< 2.9 μg/ml and > 2.9 μg/ml) and MPR was compared between the two groups.

Results: The mean caffeine level was 2.52 μg/ml (range 0.16–7.49 μg/ml). 43% of patients had caffeine levels above a threshold of 2.9 μg/ml. A trend of decreasing MPR was observed at higher caffeine levels, with reduction of 8.34% in the higher caffeine plasma concentration patient cohort. Method quantification and detection limits were 0.0224 μg/ml and 0.0056 μg/ml; mean caffeine recovery was 103.4% (90.4–114%).

Conclusion: The method detects caffeine plasma levels in patients even after apparent abstention from caffeine for 12 h. We plan to study more patients to analyse the effects of adenosine-caffeine interaction on MPR.

36 Development and validation of 68Ga-HBED-CC-PSMA to GMP standards for routine clinical use
C.E. Monaghan, M. Trabelsi and M.S. Cooper
Royal Liverpool Hospital, Liverpool, Merseyside, UK

Introduction: 68Ga-HBED-CC-PSMA is novel PET tracer for detecting recurrent prostate cancer and metastasis. We sought to develop a suitable method for radiolabelling using an iG 68Ge/68Ga generator and iQS® Ga-68 Fluidic Labelling Module to GMP standards for clinical use which could incorporate a filter integrity test as part of the quality control.

Methods: Radiolabelling was carried out using a similar protocol to that used for 68Ga-DOTA-NOC. HBED-CC-PSMA was dissolved in 0.25M sodium acetate, heated for 5 min before elution of the 68Ge/68Ga generator in 4 ml 0.05M HCl, reacted at 110°C for 10 min and purified over
a C18 Sep-Pak eluted with 30% ethanol. We also investigated the use of a suitable filter where the bubble point could be conveniently tested. However, radiolytic impurities were seen in the quality control tests so the protocol was adapted to include addition of ethanol (100 μl) in the reaction, reduced heating time and modified purification process.

Results: $^{68}$Ga-HBED-CC-PSMA was produced with an acceptable yield with high radiochemical purity (mean = 98.9% (n = 3) by HPLC). A Millex GV Durapore PVDF membrane 0.22 μm filter was found to be most suitable for terminal filtration of the product.

Conclusion: A method for radiolabelling $^{68}$Ga-HBED-CC-PSMA in full compliance with GMP was successfully validated.

37 Evaluation of syringe retention after administration of Yttrium-90 citrate and optimisation of syringe sizes and brand


City Hospital, Birmingham, UK

Purpose: An ongoing audit of the residual activity within syringes post injection of 185 MBq Yttrium-90 synovectomy suggest that the patient may be receiving an activity lower than required. We evaluated the use of different syringe manufacturers and sizes to assess activity retention. As syringe size has a consequence on finger dose, this was also recorded.

Method: A practical experiment was conducted investigating three different syringe manufacturers and two different syringe sizes.

Approximately 200 MBq Yttrium-90 Citrate, was drawn into each type of syringe (Table 1) then measured. After 1 h the contents were expelled from the syringe and the residual measured.

The dose received to the operator’s fingers for 2 ml and 5 ml syringes was compared by TLD worn on the end of the index finger.

Results: Table 1

<table>
<thead>
<tr>
<th>Syringe</th>
<th>% Retention</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 ml Terumo</td>
<td>7</td>
</tr>
<tr>
<td>2 ml Omnifix</td>
<td>12.1</td>
</tr>
<tr>
<td>5 ml BD (standard)</td>
<td>20</td>
</tr>
<tr>
<td>5 ml Terumo</td>
<td>11.9</td>
</tr>
<tr>
<td>5 ml Omnifix</td>
<td>10</td>
</tr>
</tbody>
</table>

TLD’s:

2 ml: 1.1 mSvhr$^{-1}$.
5 ml: 0.6 mSvhr$^{-1}$.

Conclusion: Results indicate that 2 ml Terumo syringes provide less retention of activity but give higher finger doses when compared to the 5 ml syringe. This increase in dose is worrying as a 5 ml Omnifix syringe would be preferable which is shown to have less retention than the equivalent BD.

38 Investigating the effectiveness of thyroid blockade in DaTSCANTM studies

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Aim: To investigate efficacy of potassium iodate in blocking uptake of free radioiodine in the thyroid for patients undergoing DaTSCAN™ imaging.

Method: Six patients received 170 mg potassium iodate one hour before administration of DaTSCAN™ (Ioflupane $^{123}$I). Residual activity retained in the syringe was used to calculate the net activity administered. Count rate was acquired at the region of interest to calculate the percentage retention in the thyroid.

Results:

<table>
<thead>
<tr>
<th>Patient</th>
<th>Net activity administered (MBq)</th>
<th>Activity in thyroid (MBq)</th>
<th>Uptake in thyroid (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>126.7</td>
<td>0.08</td>
<td>0.04%</td>
</tr>
<tr>
<td>2</td>
<td>135.7</td>
<td>0.05</td>
<td>0.03%</td>
</tr>
<tr>
<td>3</td>
<td>126.4</td>
<td>0.04</td>
<td>0.03%</td>
</tr>
<tr>
<td>4</td>
<td>138.4</td>
<td>0.07</td>
<td>0.05%</td>
</tr>
<tr>
<td>5</td>
<td>124.8</td>
<td>0.04</td>
<td>0.03%</td>
</tr>
<tr>
<td>6</td>
<td>133.0</td>
<td>−0.01</td>
<td>−0.01%</td>
</tr>
</tbody>
</table>

Conclusion: As DaTSCAN™ injection may contain up to 6% free iodine, thyroid blockade agents are required. Although the ARSAC notes for Guidance recommend commencing thyroid blockade the day before, this study found that administration of potassium iodate one hour prior to injection of DaTSCAN™ is effective in blocking the thyroid and thus reduces the long term risk for thyroid neoplasia.

39 Can we use a phantom to apply a centre-specific radionuclide ventriculography (RNVG) normal range for left ventricle ejection fraction (LVEF) to other centres?

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Purpose: A normal LVEF is often taken to be the >55% quoted in NICE guidance TA107 regarding Herceptin.
There are large systematic differences between RNVG processing methods so normalisation is needed to apply a common normal range (Skrypniuk J.V. et al. 2005; 26:205–215. Nuc Med Comm, Hiscock S.C. et al. 2008; 29:103–109. Nuc Med Comm) We investigated whether it was feasible to use phantom data for normalisation.

Methods: Sixteen normal clinical datasets were processed three times with six different programs. We also acquired data using a Vanderbilt phantom for 30%, 51% and 75% LVEFs. These datasets were processed with the same programs. Linear fits were applied and the results used to normalise the clinical data.

<table>
<thead>
<tr>
<th></th>
<th>Mean without normalisation (%)</th>
<th>Mean with normalisation (%)</th>
<th>Mean-2SD without normalisation (%)</th>
<th>Mean-2SD with normalisation (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>GE (manual)</td>
<td>65</td>
<td>68</td>
<td>53</td>
<td>55</td>
</tr>
<tr>
<td>GE (automatic)</td>
<td>67</td>
<td>70</td>
<td>52</td>
<td>54</td>
</tr>
<tr>
<td>Phillips (manual)</td>
<td>66</td>
<td>67</td>
<td>54</td>
<td>55</td>
</tr>
<tr>
<td>Phillips (automatic)</td>
<td>71</td>
<td>71</td>
<td>57</td>
<td>58</td>
</tr>
<tr>
<td>FU2Ga4.6</td>
<td>67</td>
<td>59</td>
<td>52</td>
<td>47</td>
</tr>
<tr>
<td>FU2Ga2.5</td>
<td>66</td>
<td>68</td>
<td>49</td>
<td>50</td>
</tr>
<tr>
<td>Link Medical wlm_lvef</td>
<td>67</td>
<td>63</td>
<td>50</td>
<td>48</td>
</tr>
<tr>
<td>In-house program</td>
<td>45</td>
<td>60</td>
<td>35</td>
<td>48</td>
</tr>
</tbody>
</table>

Conclusion: Phantom calibration reduced the variation in normal range between systems from 22 to 10 percentage points, but ANOVA testing showed the limits remained significantly different. Using clinical data to harmonise normal ranges is likely to be more successful.

40 Evaluating image quality gains with TOF in cardiac imaging
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Unlike oncology, quantitation of image noise in cardiac imaging is challenging due to the lack of homogeneous uptake. This preliminary work aims to establish a technique and evaluate image noise and gains with TOF in PET imaging for cardiac data.

A 5-minute, 10-frame dynamic image was reconstructed with and without TOF from FDG cardiac viability scans in 5 patients. Parametric mean and coefficient of variation (COV) images were generated from the 10 frames. A myocardial threshold mask was derived on the mean image and transposed onto the COV image, exploiting the situation of image voxel variance scaling with voxel value in iterative reconstruction. The mean counts within the mask on the COV images were obtained

The mean of the COV was 18–20 % lower with TOF compared with non-TOF in all patients irrespective of patient size. This reflects findings seen in oncology patients in our department.

This work suggests that image quality gains with TOF in cardiac PET are similar to those seen in oncology and hence similar reductions in administered activity and/or scan time can be applied. The work proposes a technique of assessing image quality gains in cardiac PET.

41 Investigation into the improvement of a new bayesian penalised likelihood PET reconstruction algorithm on obese patients
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Oxford University Hospitals NHS FT, Oxford, Royal Surrey County Hospital NHS FT, Guildford and University of Oxford, Oxford, UK

Purpose: To investigate the impact of a PET Bayesian penalised likelihood (BPL) reconstruction on signal-to-noise ratio (SNR) over a range of patient weights.

Methods: Patients were injected with 4 MBq/kg18F-FDG and scanned on a GE Discovery 690/710 with data reconstructed using OSEM (2 iterations, 24 subsets) and BPL (beta = 400). Patients were randomly selected over 40–200 kg (BMI 13–58), n = 111. For each patient a 3 cm diameter sphere in the background liver was used to calculate SNR = SUVmean/SUVdeviation. Each image was blind scored by a consultant radiologist on a scale 0–5.

Results: For BMI < 25 (normal) BPL SNR is significantly higher than OSEM (P = 0.03), for BMI > 25 (overweight) BPL SNR is very significantly higher (P < 1x10-5). As BMI increases the OSEM SNR decreases (gradient 95% confidence interval (CI) – 0.1 to – 0.05) whereas the BPL-SNR remains constant (gradient CI – 0.01 to 0.1). This was validated with clinical scoring where OSEM scores decreased with increasing BMI whilst BPL scores remained constant as BMI changed. Across all BMI groups (normal, overweight, obese, very obese) there was no significant difference between BPL SNR values whilst significant differences were seen for OSEM SNRs.

Conclusion: BPL gives a significantly higher SNR than OSEM with a greater significance for heavier patients; BPL SNR is consistent across patient BMI.

42 Collimator optimisation for high activity 131I imaging
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Quantitative imaging for 131I dosimetry is affected by several factors including scatter, septal-penetration, system resolution and camera dead-time. Most commercial high-energy collimators are designed for diagnostic imaging and optimised for detection efficiency. High activity
administrations of therapeutic $^{131}$I do not suffer from a lack of counts and collimator efficiency could be reduced in favour of improved resolution.

Lead, tungsten and uranium parallel-hole collimators were designed by iteratively solving analytical formulae for penetration, efficiency and resolution. Optimised collimator geometries were then used as input into the Monte Carlo program SIMIND to demonstrate the improvement in $^{131}$I image quality that could be achieved. Simulated images for each collimator were used to generate NEMA system characteristics. Comparisons with physical measurements for commercial collimators were also made.

A good agreement between physical and simulated measurements was observed for commercial lead collimators. For optimised uranium collimators NEMA system-sensitivity was reduced by a factor of 5 compared to commercial alternatives. However, sensitivity also includes scattered and penetrating photons which were reduced from 18% to 3%. Spatial resolution improved from 14 mm to 6 mm FWHM. A simulation of a thyroid remnant demonstrated clearer foci with the optimised collimator with peak counts only 50% less than commercial lead HEGP.

43 Optimisation and standardisation of quantitative radioiodine SPECT/CT imaging for dosimetry in the multicentre SEL-I-METRY trial

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The aim of this study was to optimise and standardise quantitative imaging for a multicentre phase II clinical trial of the MEK inhibitor Selumetinib, in iodine refractory thyroid cancer (SEL-I-METRY). This trial will evaluate the ability of Selumetinib to stimulate radioiodine uptake and the subsequent benefit from radioiodine therapy. The tumour absorbed dose will be measured on pre-therapy $^{123}$I and post-therapy $^{131}$I NaI SPECT/CT images.

The trial SPECT imaging protocol was developed to use 20% wide energy windows and 72 views, providing high-count projections for quantitative accuracy. A partial volume effect (PVE) and $^{131}$I dead-time calibration protocol was also developed to set up 8 sites for participation in the trial. The $^{131}$I PVE factors varied between systems by up to a factor of 10. Some systems did not reach a peak $^{131}$I count rate, whilst others peaked at 2.2 GBq making dead-time correction challenging above that activity. Therefore optimisation and standardisation of quantitative imaging will enable multicentre dosimetry-based clinical trials.

44 Modelling the effect of fractionation in radionuclide therapy

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Purpose: To develop the methodology to enable the comparison of treatment effects from different fractionation schemes in molecular radiotherapy based on patient-specific dosimetry and radiobiological modelling.

Materials and methods: Clinical dosimetry results from $^{223}$Ra-dichloride and $^{186}$Re-HEDP treatments of bone metastases from prostate cancer were used. The biological effective dose (BED) was determined taking into account the repair of sub-lethal damage between administered fractions. The maximum administered activity that could be administered was determined from absorbed dose limits to the bone marrow and the BED to the bone metastases was calculated a combination of number and time between fractions. A uniform uptake distribution of the radiopharmaceuticals across the metastases and a relative biological effectiveness of 1 for $^{223}$Ra were assumed.

Results: An administered activity constrained by the absorbed dose limit to the bone marrow and a low $\alpha/\beta$ ratio typical of prostate cancer cells, produced a maximum BED to the bone metastases for a low number and a short time between fractions.

Conclusion: The methodology presented here can be used to compare the radiobiological effect of different fractionation schemes and repeated treatments.

45 Calculating local CT diagnostic reference levels (DRLs), for SPECT/CT studies

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Aim: Data was collected to establish local Diagnostic Reference Levels (DRLs) for the CT component of our most common SPECT/CT studies.

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Methods: 432 SPECT/CT scans were analysed from Dec 2014–Dec 2015. CT dose values of CTDIVol (mGy) and DLP (mGycm) were recorded as well as patient's weight and the anatomical area, for different scan procedures. Octreoctide, MIBG and Lutetium scans, were grouped together as neuro-endocrine tumour (NET) studies.

DRLs for CTDIVol and DLP were calculated as the 75th percentile, from patients weighing 50–90 kg following IPEM Report 88.

Results: CTDIVol and DLP DRLs are given below for:

1. Hepato-Biliary scans: 2.2 mGy and 93 mGycm
2. 131I post-ablative scans: 2.4 mGy and 98 mGycm
3. Parathyroid scans: 2.6 mGy and 107 mGycm (with 2 SPECT/CT scans giving a total study DLP of 215 mGycm)
4. NET studies: 2.2 mGy and 171 mGycm (ranging from 2.0 mGy and 84 mGycm for an Abdo, Pelvis to 2.43 mGy and 279 mGycm for Head, Chest, Abdo, Pelvis)
5. All Bone scans: 11.8 mGy and 461 mGycm (ranging from 2.2 mGy and 91 mGycm for low-dose localisation CT of the torso to 16.0 mGy and 574 mGycm for diagnostic non-contrast CT of the lumbar spine)

Conclusion: Local DRLs were created and can be compared with initial data released by the IPEM working party on Hybrid CT DRLs.

46 The impact of motion on automatic quantitation in BRASS for florbetapir [18F] (Amyvid) PET/CT scans
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Purpose: BRASS (Hermes Medical Solutions) is available for quantification of Amyvid PET/CT brain studies. The impact of patient motion on the results was investigated to determine the need for motion analysis prior to quantification.

Methods: 20×1 min non attenuation corrected (NAC) reconstructions were coregistered to the first minute for 8 patients using SPM (v12) and Matlab (R2015b). Each minute's registration matrix was applied to a reference point to calculate displacement between frames. The 10 consecutive frames with minimum summed displacement represent the most stable 10 min. The stable 10 and the manufacturer recommended first 10 min were reconstructed using our clinical protocol and evaluated in BRASS.

Results: A paired T-test, significance P<0.05, was used to investigate the change in SUVr between reconstructions. The best 10 min show consistently higher SUVr than the first 10 min, this is significant in 2/8 patients (P = 8.6E-04 and 5.3E-04). The parietal ROI in negative scans shows the largest average change for a single region (2.99%, P = 0.049).

Conclusion: Patient motion does appear to impact the results from BRASS in some cases. A larger sample size is needed to confirm this. These results suggest that Amyvid scans should be checked for motion before analysis in BRASS.

47 Single sample GFR: Reliable alternative to three sample slope-intercept method for use at UHS?
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GFR tests are carried out at UHS using the three sample slope-intercept (SI) method, with patient samples taken at 2, 3, and 4 h post administration. Single sample (SS) GFR results are calculated for each time point, using the Christensen-Groth (CG) method, for quality control purposes. An audit was carried out to determine whether a SS technique could be used in place of the three sample SI method.

Two SS GFR techniques (CG and Fleming[1]) were compared to the three sample SI technique for 450 adult patients and 187 paediatric patients at UHS. Two sample SI techniques were also investigated.

Poor correlation was found between the three sample SI method and the CG SS method, particularly for paediatric patients. The Fleming SS method matched the three sample SI method more closely. The two sample SI method produced results which were closest to those of the three sample SI method.

CG SS method cannot be used to calculate GFR results for the UHS patient population. The Fleming SS method or the two sample SI method could potentially be used, but risk-benefit analysis must be carried out.

References

48 Renography following renal transplant: experience from a specialist transplant centre
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Aim: Review of the role of renal scintigraphy (99m-Tc MAG3) in follow-up of renal transplant surgery.
Methods: 166 kidney transplants performed at our centre from 01/01/15 to 31/08/15 were reviewed. Imaging of the transplanted kidney occurred if the transplant team had any concerns about the surgery, or graft function.

Complications are divided into immediate (72 h), early (3 – 60 days) and late (after two months).

Results: A normal transplant renogram was reported in 89 of 121 patients that had renography within 72 h post-op. A total of 79 out of the 166 kidney transplant patients developed complications. Of those 79 patients, 32 had immediate complications. Renography was instrumental in the diagnosis of ATN in 26 out of those 32 patients. Finally, only 15 of the 89 patients with a normal renogram in the first 72 h post-op, subsequently developed complications affecting function.

Conclusion: Renal Scintigraphy is a readily accessible investigation, which assesses both function and perfusion of the transplanted kidney. It is instrumental in the non-invasive confirmation of the diagnosis and the monitoring of ATN, which is the most common complication. A normal renogram in the immediate post-operative period is a good predictor of a satisfactory outcome.

50 A comparative review of potassium iodate and potassium perchlorate regimes in thyroidal blockade within paediatric I123metaiodobenzylguanidine scans

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Purpose: To compare the protective effect of potassium perchlorate and potassium iodate to determine which provides greater thyroidal protection in paediatric I123metaiodobenzylguanidine scans.

Methods: A total cohort of 136 patients underwent I123MBG scintigraphy during a period of 2 years at GOSH. 100 of these patients were retrospectively sampled, 50 receiving the potassium perchlorate and 50 receiving the potassium iodate within separate defined time periods. The data was saved in JPEG format and scored for radiiodine uptake by a nuclear medicine physician blinded to the intervention received using a 5-point Likert scale question to obtain ordinal data for statistical analysis.

Results: The Mann-Whitney's U test was used to evaluate the difference within the Likert scale responses. A statistically significant difference was found in thyroidal uptake between KClO4 and KIO3 exists, with the uptake of KClO4 being significantly higher than that of KIO3. (U=806, Z=-3.518, P=0.002 < 0.05). The effect size was also calculated, (r=0.3), medium effect.

Conclusion: The study concluded that potassium iodate provided a greater level of thyroidal protection from unbound radiiodine compared to potassium perchlorate in I123metaiodobenzylguanidine scans within the cohort observed.

49 Impact of SPECT/MR fusion on scoring of 123I-mIBG scintigraphy in neuroblastoma

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Purpose: To audit the impact of routine SPECT/MR fusion on reporting and semi-quantitative scoring of 123I-metaiodobenzylguanidine scintigraphy in neuroblastoma.

Methods: Clinical reports and image data for 123I-MIBG scintigraphy appointments over a 2 year period were reviewed retrospectively. This corresponded to 51 image sets with both planar and SPECT/MR imaging. Numerical analysis was performed on the image data from the earliest time-point available for each of the 19 represented patients. Each wholebody scan was scored using the SIOPEN and Modified Curie scoring systems. Each image set was then re-scored with the addition of SPECT/MR fusion. The difference in two scores was calculated for each case.

Results: Differences due to SPECT/MR fusion were observed in 47% and 33% of cases respectively for SIOPEN and Curie scores. However, in all such cases the maximum observed difference was ±1 score unit. Statistical analysis (Student’s t-test) demonstrated a small but significant difference in SIOPEN score of 0.2 score units on average. Analysis of the Cure score revealed no statistically significant difference with the addition of SPECT/MR fusion.

Conclusion: SPECT/MR fusion provides a small but statistically significant difference to the SIOPEN score. The Modified Curie score is statistically unchanged with the addition of SPECT/MR fusion.

51 The role of thyroid scintigraphy in infants with congenital hypothyroidism

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Purpose: The early diagnosis and treatment of congenital hypothyroidism is critical, to avoid detrimental outcomes such as mental retardation. TSH level is the usual diagnostic screening test; however, thyroid scintigraphy helps
identify etiologies of the disease thereby determining different management plans. Our primary objective is to evaluate thyroid scintigraphy findings in hypothyroid infants. The secondary objective is to assess the outcomes of those who underwent a scan in terms of final diagnosis.

Methods: Retrospectively we reviewed 101 congenital hypothyroid infants, initially diagnosed biochemically then underwent thyroid scintigraphy between 2010–2015 at a tertiary hospital in Oman. Patients’ data was collected from the hospital’s database and then analyzed using SPSS.

Results: The performed scans revealed five different findings which included dyshormonogenesis, ectopia, agenesis, reduced uptake and normal thyroid glands in 25% of the patients. 57.1% of those with normal thyroid glands were discontinued on the prescribed treatment. There was a statistical significance (P-value = 0.000) between scan findings and the need to change the treatment plan following the scan.

Conclusion: Thyroid scintigraphy is useful in differentiating the causes of congenital hypothyroidism thus initiating proper management plans. We therefore, highly advise to supplement it to the usual screening tests.

52 A method of comparing PET/CT viewing software for multicentre trials
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Software from several manufacturers is currently used for review of PET/CT scans in multicentre trials, many of which involve quantitative measurements. The aim of this project was to develop a method of comparing the software packages and establish how well they reproduce measured results, in order to ensure reproducibility across sites.

Six PET/CT datasets comprising scans of the NEMA IQ phantom were acquired following the procedures for the NCRI PET Core Lab on scanners from the last and current generations from three different manufacturers. A virtual ‘digital phantom’ created by the University of Washington was also analysed. Using 5 different viewing program versions from 4 manufacturers, the maximum, mean and peak activity concentrations for each of the 6 hot spheres in each phantom were measured, and the mean from a large ROI drawn in the background compartment. Any artefacts or anomalies were noted.

The measurements for maximum sphere concentrations, and the background mean measurements, were consistent across all software packages and versions. However, mean sphere measurements varied by as much as 17%, and peak measurements varied by as much as 40%.

This method shows SUVmax is measured consistently across all software packages, but measurements differ significantly for SUVmean and SUVpeak.

53 Does combining 18F -choline PET data with multiparametric MRI improve accuracy in detecting clinically significant prostate cancer?
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Background: Multiparametric MRI (mpMRI) is routine in patients with suspected prostate cancer (PCa) but accuracy is <80%. 18F -choline PET/CT in high-risk PCa is becoming established for N and M but not T-staging. We hypothesise that combining 18F -choline PET with mpMRI improves non-invasive detection of significant PCa within the prostate compared to mpMRI alone.

Methods: Retrospective study of 15 men with 18F-choline PET/CT prior to prostatectomy. Each prostate gland was divided into 16 segments and, scored for presence of increased choline uptake by two readers by consensus and combined with mpMRI PI-RADS in each segment, (PI-RADS score >3 classed tumour-positive). The Gleason score in prostatectomy specimens was assessed in each segment by a histopathologist blinded to the imaging results (reference standard).

Results: Evaluation of 240 prostate segments showed a mpMRI PI-RADS sensitivity 64%, specificity 85%, NPV 67%, PPV 84% and accuracy 74%. For PET combined with mpMRI respective results were 90%, 68%, 85%, 77% and 80%. Significant correlation was found between index lesion SUVmax and Gleason score (r = 0.89, P = 0.019).

Conclusion: Combining 18F -choline PET data with mpMRI improves sensitivity and accuracy for detection of clinically significant PCa. However, 18F -choline increases the false positive rate and more specific tracers (e.g. PSMA) may offer better specificity.
54 Determining the best method for measuring the metabolic tumour volume (MTV) in diffuse large B cell lymphoma (DLBCL)
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Purpose: To review added value of SPECT/CT in radioiodine whole body scan [131I WBS] for differentiated thyroid cancer.

Methods: Retrospective review of SPECT/CT scans acquired as an adjunct to planar 131I WBS between January 2014 and December 2015.

Results: A total of 745 131I WBS acquired with SPECT/CT performed in 87 cases [52 females and 35 males; Age range: 16–80 years]. Thyroid carcinoma variants included 76 papillary, 8 follicular, 2 insular and 1 oncocytic variant.

Of 87 patients, 15 had diagnostic and 72 post-therapeutic WBS.

SPECT/CT showed matching findings to planar imaging in 41 (47%) patients with determination of thyroid remnant [n = 31]. However, SPECT/CT led to better characterization of 131I foci in 33 (38%) patients; thyroid remnant/neck nodes [n = 39], pulmonary nodules [n = 7], bone [n = 1].

In 13 (15%) patients, SPECT/CT upstaged the disease determining cervical mediastinal nodes [n = 11], pulmonary nodules [n = 2], bone [n = 1] and non-avid pulmonary nodules [n = 1].

Eighteen foci on planar WBS were benign or physiological variants; hyoid bone [n = 6], oesophagus [n = 4], vocal cord [n = 1], thyroid cartilage [n = 2], breast [n = 1], rib [n = 2] and contamination [n = 2].

Conclusion: SPECT/CT improves the diagnostic yield and specificity of 131I WBS and impacts patient management with regard to staging and frequency of follow-up.

55 Diagnostic value of 131I spect/CT imaging in the management of differentiated thyroid cancer
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Aim: To determine the common uptake patterns seen in patients with ongoing back pain post spinal fusion surgery on SPECT/CT.

Methods: 44 patients who had previously undergone spinal fusion were included. Patients were divided into early (within 2 years), intermediate (within 2–4 years) and late fusion (>4 years). The findings were classified into osteoblastic activity within the fused and/or peri-fusion segments and further categorized according to anatomic location.

Results: 33 patients had positive uptake [12 (36%) within the fused segment, 16 (49%) within peri-fusion segments and 5 (15%) in both]. Of the 17 patients with positive uptake in the fused segment, most had uptake in facet joints (7 pts). The majority of positive findings were in patients with fusion within 2 years (59%). Of the 20 patient with positive uptake in the peri-fused segments, 14 had uptake in the facet joints.

Conclusion: In patients with ongoing pain post spinal fusion, abnormal osteoblastic activity is commonly noted within the fused segment in the first two years' post-

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surgery. The commonest site in both fused and perfusion segments is seen in the facet joints (43%).

57 A new model to predict the decrease in metastatic tumour burden in patients with bone metastases from prostate cancer treated with molecular radiotherapy


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Aim: The aim of this study was to develop a model to predict the decrease in metastatic tumour burden as a function of the absorbed doses delivered to individual bone lesions.

Materials and methods: The standard metastatic control probability model was used to calculate the probability of complete cure by eradicating all the lesions in a patient. A more realistic measure of disease control would however consider tumour burden control and prevention of metastatic spread. Therefore we propose a new model to calculate the decrease in metastatic tumour burden as a function of the absorbed dose delivered to multiple lesions. Clinical data from 22 patients treated with fixed administered activities of $^{186}$Re-HEDP were used.

Results: A strong correlation between metastatic control and degree of absorbed dose heterogeneity was observed. A median absorbed dose of 110 Gy (53–343 Gy) was found necessary to eradicate all metastases in this patient cohort, whilst a median of only 54 Gy (18–285 Gy) was predicted to reduce the metastatic tumour burden by 50%.

Conclusion: The steep tumour burden response curves observed in 91% of patients showed that a large benefit in metastatic could be achieved for a small increase in the absorbed doses delivered.

58 Combined three phase bone scintigraphy (TPBS) and Gallium-67 ($^{67}$Ga) imaging of prosthetic and non-prosthetic osseous infection (OI); our local experience

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Purpose: TPBS is highly sensitive examination for OI. However, it lacks specificity. We evaluate the accuracy of TPBS in detecting prosthetic infection when combined with $^{67}$Ga at our institution

Methods: The study was approved by institutional review board. We did retrospective analysis of reports from TPBS during Dec 1st 2010 till November 30th 2012 performed for OI. Images were reviewed when required

Results: 143 TPBS, mostly with SPECT/CT were performed for prosthetic and non-prosthetic OI. Ages were 4–91 years for 80 females and 63 males. 84/143 patients (59%) were evaluated for non-prosthetic OI while 59/143 (41%) for prostheses OI. For non-prosthetic, 11 patients had negative TPBS. However, 73 patients had positive TPBS which further warranted $^{67}$Ga imaging. Out of these, 28 $^{67}$Ga were positive (38%). For prosthetic evaluation, 13 TPBS were negative while 46 TPBS were positive. Out of 46 TPBS, 18 were positive (39%) on $^{67}$Ga

Conclusion: We conclude that in our patients there is no significant difference in the overall accuracy of combined TPBS and $^{67}$Ga for the evaluation of non-prosthetic and prosthetic infection evaluation. However, the percentage of positive $^{67}$Ga in our patient population was relatively lower than known published data, where it ranges from 60–85%.

59 Role of $^{18}$F-FDG PET/CT in tuberculosis

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Aim: To assess the role of FDG PET/CT in tuberculosis (TB) in different clinical settings.

Methods: From the beginning of 2014 to the end of 2015 we analyzed 73 patients (51 male, 22 female) who performed 89 PET/CT (Gemini, Big Bore TOF, Philips) for probable TB (40), for a past history of TB (22), to taste the response to therapy (11). The maximum standardized uptake value (SUVmax) of the most FDG avid lesions was recorded.

Results: Using a cut-off value of SUVmax of 1.3, PET/CT identified 10 (14%) true negative patients and 44 (60%) cases of true TB (SUVmax range 1.6 to 20.1). In 19 positive (26%) patients TB were ruled out after biopsies and microbiological cultures (4 tumors and 15 inflammation/infection). PET/TC identified active pulmonary TB in 12 cases (27%), extra-pulmonary TB in 10 (23%) and both sites in 22 (50%) patients.

Conclusion: FDG PET/CT was useful to distinguish active from inactive TB in patients with a positive history of this infection, it was a valid tool in the evaluation of therapeutic response. It could not distinguish between TB and malignancies but it guided biopsy, providing detailed information to clinicians in the overall evaluation of these patients.
60 The impact of SPECT/CT in the clinical diagnostic confidence of foot and ankle problems by anatomical site
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Purpose: To evaluate the clinical impact of SPECT/CT of the foot and ankle on local practice.

Materials and methods: The first 25 patients referred for SPECT/CT foot/ankle from our centre were imaged on a Siemens Symbia 16T. Attenuation corrected SPECT bone scan images were fused with 0.625 mm CT images and reported using proprietary software. For each patient, the managing consultant orthopaedic surgeon assigned a clinical diagnostic confidence score (CDCS) before and following consideration of the SPECT/CT report/images, where 1 = no diagnostic confidence and 5 = complete diagnostic confidence. The impact and frequency of SPECT/CT positive contribution to diagnostic confidence was assessed and ranked by anatomical site.

Results: A wide range of pathologies was demonstrated; many were unexpected clinically and following conventional imaging. The CDCS increased in 24 cases (96%) following SPECT/CT, the mean score increasing from 2.52 to 4.36 (P = 0.0001). The sites which contributed the most to diagnostic confidence was the subtalar joint (60%), ankle joint (46%) and sesamoids (45%). The sites most frequently involved were Chopart’s joint (24%), TMTJ (20%), sesamoids (16%) and the ankle joint (12%).

Conclusion: Employing a CDCS, this pilot study demonstrated the positive contribution of SPECT/CT in the diagnosis of patients with ankle and foot pain.

61 To discharge or not to discharge! A prospective study of radioiodine clearance in patients treated with radioiodine for thyroid carcinoma (DTC)
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Aims: To assess the impact of radioiodine clearance on discharge planning of patients receiving radioiodine ablation therapy for DTC.

Materials and methods: 22 consecutive patients admitted for radioiodine ablation therapy between 8/2014 and 11/2015 were included. After $^{131}$I treatment, dose rates were measured at 0, 1, 2, 4, 6, 24, 28, 32 and 48 h hours at 1, 2 and 4 meters. Five patients were excluded because of incomplete data.

Results: 1.1 Gbq group: (n = 11).
There were 3 males and 8 females. Mean age 52 years (range 27–79). Median time to reach 800 MBq for N = 10 patients was 8.4 h with mean time of 8.02 h with SD of 4.2 h. 75% reached 800 MBq by 10.9 h.

3.7 Gbq group: (n = 11).
They included 4 males and 7 females with mean age 53 (range of 30–82). The median time to reach 800 MBq discharge level for N = 7 patients was 32.3 h, mean time of 29 h with SD of 9.5 h. 75% of patients reached 800 MBq by 37.1 h.

Conclusion: Most patients treated with 1.1 GBq activity could be discharged on the day of treatment with appropriate discharge planning and most patients treated with 3.7 GBq could be discharged following day.

62 An effective yet underused procedure: $^{90}$Y radiosynovectomy of the knees
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Aim: Radiosynovectomy is underused in the UK (100 procedures per annum vs. 60 000 in Germany), surprising given the reported response rates of 60–80% in rheumatoid and poly-arthritis and 90% in haemophilic arthritis. We reviewed the outcome of radiosynovectomy in a group of patients to raise awareness of its potential value.

Methods: Over 45 months, we performed radiosynovectomy in 13 knee joints (8 patients, 4 males, average age 63 years, range 53–77). All had recurrent effusions poorly responsive to NSAIDs with repeated aspirations and intra-articular corticosteroid injections during the preceding 12 months. The procedure was performed according to published guidelines using 185 MBq 90Y-citrate.

Results: Average follow-up was 23 months (range 15–45 months). Five patients showed pain control and no recurrence of effusion for the follow-up period. One patient required aspiration of the knee 10 months later, with no further recurrence after 26 months. Another patient required second radiosynovectomy for the left knee with good response. Only one patient relapsed within 3 months.

Conclusion: Despite the small number of patients, our good results prompt us to raise awareness of the potential benefit of this procedure. There is less referral from the new generation of rheumatologists leading to less experience and interest in the nuclear medicine community.
63 Review and outcomes of the first 30 months of the wessexF peptide receptor radionuclide therapy (PRRT) service
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Background and Aims: The Wessex PRRT service commenced in July 2013, using Yttrium-90. Patients have increased local access to this now evidence based therapy. We reviewed our experience during the first 30 months of service.

Method: All patients treated between Jul 13 - Jan 16 (30 month period) were identified from the Wessex NET MDT database and UHS electronic patient records.

Results: 41 treatments were administered in 23 patients referred for PRRT (age range 48 - 74 yr).

(1) 9 had the 3 planned treatments.
(2) 2 stopped after 1 cycle due to toxicity.
(3) 2 stopped after 2 cycles due to progressive disease.
(4) 6 currently undergoing treatment.

4 awaiting treatment.

Of 9 who completed treatment, 2 had partial response, 4 stable disease and 3 disease progression, 4 have passed away. 15% experienced grade 3 toxicity, most serious being myelodysplasia and renal impairment. Primary was in small bowel (11), pancreas (6), lung (1) and unknown (1).

Conclusion: In most patients, PRRT achieves therapeutic efficacy with minimal toxicity. The Wessex PRRT service provides improved patient access and experience. We introduced Lutetium-177 PRRT in 2016 and will continue monitoring patient outcomes.

6567Ga: an in vitro assessment as a therapeutic Auger electron emitting radionuclide
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Introduction: 67Ga therapy has been neglected due to lack of suitable chelators and targeting molecules. Improved radiochemistry now allows re-evaluation of therapy with 67Ga. Here, 67Ga is compared with Auger electron 111In as a therapeutic radionuclide.

Methods: Plasmid pBR322 studies allowed direct comparison between 67Ga and 111In (1 MBq) in causing DNA damage. Non-targeted studies were also carried out in DU145 prostate cancer cells and MDA-MB-231 and HCC1954 breast cancer cells with oxine, tropolone and MPO. Cellular uptake, retention, cell viability and clonogenic capacity of 67Ga- and 111In-oxine after one-hour incubation were then determined.

Results: DNA damage caused by 67Ga was comparable to 111In and was partially protected by chelators. 111In acted more through indirect methods than 67Ga. External irradiation caused minimal DNA damage. Cellular uptake was 8-13% for 67Ga-oxine and 73–78% for 111In-oxine in all cell lines. Retention at 72 h was 43% for 67Ga and 50% for 111In. Cells incubated with 67Ga (IC50 0.5–1 Bq/cell) showed less viability than for 111In (IC50 0.5–2.5 Bq/cell) and decreased clonogenic capacity (67Ga: IC50 0.1–0.3 Bq/cell; 111In: IC50 0.2–0.7 Bq/cell). Controls, i.e. 67Ga-citrate or 111In-chloride did not affect viability nor clonogenicity.

Conclusion: 67Ga deserves further evaluation for radio-nuclide therapy.

64177Lu -DOTATATE Therapy in paediatric patients: Sharing our experience
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Purpose: To share our experience, difficulties and possible side effects during 177Lu- DOTATATE administration and the peri-infusion period.

Materials and methods: Between 2005–2015, 31 patients (16 male, 15 female); age range 4-17 years (median 9 years) underwent a total of 79 177Lu-DOTATATE therapies with pre-therapy administration of amino acid infusion, pre-hydration and antimetatic. Patients were admitted 24 h prior to therapy in lead-lined side rooms.

Results: Of the 31 children, 60% received 1–2 cycles with a target of 4 cycles. 58% tolerated therapy well. 42% of children experienced side effects. Ten children (32%) had immediate minor side effects (nausea, flushing, tachycardia, skin rash, stomach pain) managed by decreasing the infusion rate. Three children developed bone marrow suppression after the first cycle. All three had previous chemotherapy and history of reduced bone marrow reserve. One child experienced diarrhoea. No nephrotoxicity was observed.

Logistic problems: Keeping children still during the therapy session was an issue. Most children wanted their parents present during infusion, increasing radiation burden on parents. Patient boredom was a factor and in-house entertainment needed to be planned.

Conclusion: 177Lu -DOTATATE therapy is a promising option for children with refractory/refractory neuroblastoma and metastatic neuroendocrine tumours, with a good safety profile.
Radioembolisation of liver metastases using Theraspheres: Comparison of MAA SPECT/CT vs CT based pre-therapy liver volume assessment for dosimetry
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Background: Radioembolisation of liver metastases using Theraspheres was introduced at our centre in July 2015. The therapeutic activity is determined by calculating the perfused liver volume on CT. A pre-therapy MAA SPECT/CT scan is used to assess liver perfusion and extra-hepatic flow/shunting.

Aim: To compare MAA SPECT/CT liver volume calculation against the current standard using CT volume calculation for Theraspheres treatment planning.

Methods: Retrospective analysis of 8 treatment volumes was performed. CT treatment volumes were delineated using Syngo freehand volume segmentation based on segmental liver anatomy. MAA liver perfusion volumes were delineated on fused SPECT/CT data using automated 3D segmentation on MIRADA-XD. The threshold was set to match the MAA isocontour to the liver/tumour contour.

Results: There was good overall agreement between CT and MAA based volumes and treatment activities in 7/8 volumes ($r^2 = 0.99$, average difference =10%). In one case there was paradoxically limited MAA perfusion to the left lobe, requiring treatment plan modification. For this case the MAA volume was 81% lower than the CT volume.

Conclusion: In Theraspheres treatment planning, MAA SPECT/CT liver perfusion volumes can be a helpful adjunct to CT volume and treatment activity calculations, especially in cases of atypical liver perfusion.

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\textsuperscript{a}Glasgow Royal Infirmary and \textsuperscript{b}Strathclyde University, Glasgow, UK

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K.C. Cockburn\textsuperscript{a}, A. Baker\textsuperscript{c} and E. Jefferson\textsuperscript{a,b}
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P96 Optimisation of computed tomography (CT) based attenuation correction for positron emission tomography (PET) on a Siemens Biograph mCT flow PET/CT scanner
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P97 Assessment of Q.clear reconstruction on FDG brain imaging using a Hoffman phantom
Z. Chalampalakis, J. MacKewn and J. O’Doherty
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**P98 Estimation of bladder voiding factor from patients undergoing PET/CT imaging with $^{18}$F-FDG using external radiation dose rate measurements**

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**P99 Five year experience with staff dose for PET/CT at PSMMC in Saudi Arabia**

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**P100 PET explained using only the ten-hundred most commonly used words**

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**P101 Investigation of the radionuclide impurities in an I-123 radiopharmaceutical**

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**P102 Use of a new CT reconstruction algorithm for ultra low dose attenuation correction CT doses in myocardial perfusion imaging with and without GE's Q.AC reconstruction algorithm**

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**Introduction:** A CT scan is commonly performed for the stress and rest parts of myocardial perfusion imaging (MPI) studies for attenuation correction (AC).

The GE Discovery 670 uses a new CT reconstruction algorithm, ‘Quantitation achieved consistently’ (Q.AC), which enables the use of an ultra-low dose CT specifically for AC purposes. The algorithm convolves the CT projection data with a noise reduction function in order to reduce image artefacts from a low detected signal.

The aim was to compare the CT dose of MPI AC scans performed with (GE Discovery 670) and without (GE Hawkeye 1.0) the Q.AC software.

**Method:** A retrospective study was performed of 50 patients who were scanned with Q.AC (Discovery 670) for the stress study and the rest study without (Hawkeye 1.0). Images were assessed for the presence of artefacts.

**Results:** Average DLP with Q.AC was 7.9($\pm$0.7) mGy.cm compared to 99.4($\pm$13.2) mGy.cm without. This results in a dose reduction factor of 12.5. Only 2 datasets exhibited artefacts relating to photon starvation.

**Conclusion:** Q.AC offers the ability to perform ultra-low dose CT scans for AC purposes. As a result it may be possible to perform CT AC on scans where it was potentially avoided due to the dose.