ANZSNM – POSTERS PRESENTATIONS

Poster Award Entries

P01
UNSUSPECTED MULTIFOCAL MYOSITIS ON SKELETAL SCINTIGRAPHY
K Denneade, Q Chiam, H Dixon, K Lee, Department of Nuclear Medicine & Ultrasound, Bankstown Lidcombe Hospital

Skeletal scintigraphy is one of the most commonly requested nuclear medicine tests. Extraosseous conditions including myositis have been described with this imaging modality. A 75-year-old female gentleman was initially suspected to have right lower leg cellulitis. A lower limb Doppler ultrasound revealed findings suggestive of deep vein thrombosis without focal abscess or collection in the right pretilial region. Subsequently, SPECT/CT bone scintigraphy demonstrated abnormal uptake in the pretilial soft tissue as well as in the left piriformis muscle, consistent with multifocal myositis. Clinically, the underlying aetiology was felt to be infectious and the patient improved with antibiotics. This case helps illustrate the usefulness of SPECT/CT bone scintigraphy in demonstrating extraosseous lesions and in excluding common conditions, such as fractures and osteomyelitis.

P02
HEPATOBILIARY SCINTIGRAPHY WITH SPECT/CT IN MANAGEMENT OF BILE LEAKS
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Background: 72 year old man who has hepatobiliary Klatskins tumour Bismuth type 4 with increasing jaundice. He had a recent laparotomy and had replacement of left biliary external drain and a stent into the right hepatic duct ending in the duodenum. Patient presented with ascites and a suspected bile leak.

Aims: Biliary leakage after surgery or trauma can be a life-threatening complication. It can be difficult to diagnosis by clinical examination or other imaging modalities. The SPECT/CT technique is a non invasive and precise method for detecting the bile leak.

Methods: A Tc-99m HIDA scan with SPECT/CT technique demonstrated high sensitivity and specificity in detecting a bile leak.

Result: There was significant hepatocellular dysfunction with poor transit of tracer from the hepatic parenchyma to the biliary tree. Activity was seen within the left percutaneous drain indicating patency of the drain. The delayed image at 4 hours also showed activity within the small bowel loops in keeping with patency of the right biliary stent. No tracer activity was seen within the ascetic fluid to suggest an intra-abdominal bile leak.

Conclusion: Tc-99m HIDA scan has been routinely used to evaluate sphincter of Oddi dysfunction post cholecystectomy, determine presence of chronic cholecystitis and calculate gall bladder ejection fraction. In contrast, it is less common and underutilised on the evaluation of bile leaks. In this case study, hepatobiliary scan with SPECT/CT technique demonstrated high sensitive, high specificity, non invasive and precise diagnosis for detecting the bile leak. Indicating that this technique should be more widely used.

P03
LUNG PERFUSION ALTERATION DUE TO GLOSSOPHARYNGEAL BREATHING IN EXTREME BREATH HOLD DIVERS
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Background: Glossopharyngeal insufflation is a specialised technique used by competition Breath Hold (Free) divers. The intent of the manoeuvre is to increase their lung gas volume significantly above baseline total lung capacity in order to enhance their performance based on a single breath. The current world record for static apnoea is 11.5 minutes. While recognised side effects such as hypotension and pneumomediastinum have been documented, little is known about lung perfusion under these conditions.

Aim: Using lung perfusion scintigraphy and CT for attenuation correction (CTAC) protocols the aim of the study was to investigate any alterations in blood flow, quantify sub-segmental deposition of the injected radiopharmaceutical and demonstrate any structural changes within the thoracic cavity when these athletes undertake glossopharyngeal insufflation.

Method: With ethics approval, six young, healthy breath hold divers were recruited. All compete routinely with varying levels of experience. Over two separate days, each subject was injected supine with a bolus of 150 MBq of 99mTc-MAA whilst under the gamma camera. This was followed immediately by dynamic imaging and CTAC at baseline total lung capacity (TLC). One and at maximum glossopharyngeal insufflation (TLCmax) and twoStatic and SPECT imaging was also performed but with normal tidal breathing. Time activity curves were generated for each dynamic image and two nuclear physicians blindly graded each lung sub-segment (based on a published lung model) as being either normal, having mild perfusion reduction or absent perfusion.

Results: Time activity curves for dynamic imaging were not significant although for one diver the radiopharmaceutical bolus remained static in the region of the brachiocephalic and jugular veins junction at maximum insufflation. Activity did not pass this point until he exhaled on command. There was good agreement between the physicians in the assessment of alteration in perfusion intensity between TLC and TLCmax (p < 0.72). Imaging performed with baseline TLC was normal. Significant reduction in intensity for a number of anterior and inferior sub-segments was noted for the TLCmax images with little change noted in the posterior, upper and middle sub-segments. There was associated intercostal bulging of lung tissue whilst structurally the normally flat diaphragm became convex as the lungs increased in size, in some subjects forced it down to the level of L2. Cardiac anatomy was elongated and changed angle becoming near vertical with displacement of the mediastinum.

Conclusion: Glossopharyngeal insufflation significantly increased lung gas volume in the more experienced divers compared to baseline TLC. Compared to TLCmax protocol demonstrated that the increase in lung volume primarily occurred through expansion of the thoracic cavity and downward displacement of the diaphragm and abdominal organs. As these were all healthy volunteers with no history of lung abnormality or disease, reduced and altered perfusion at TLCmax was considered to be due to marked increase in alveolar pressure in either the entire or the newly expanded lung and/or an increase in pulmonary vasculature resistance in the expanded lung.

P04
DIAGNOSTIC IMAGING GUIDELINES IN FEBRILE URINARY TRACT INFECTION IN CHILDREN
E Thomas, H Hewitt, Princess Margaret Hospital

Urinary tract infections (UTIs) are common in children. Long term complications, including scarring, hypertension and end-stage renal failure are however rare. The aim of imaging is to identify those children at risk of long term sequelae so measures can be taken to modify this risk. Which imaging modality is most appropriate is subject to much discussion and protocols vary from centre to centre, both within Australia and internationally. Historically all children presenting with febrile UTI have been investigated with ultrason and micturating cysto-urography (MCUG). The evidence behind routine imaging is lacking. Current trends are towards less emphasis on the detection of vesicoureteric reflux, and a greater focus placed on the identification of renal injury. We have reviewed our own imaging practices at Princess Margaret Hospital for Children over the last 5 years. There has been a clear decline in the number of MCUG’s performed and an increase in DMSA scintigraphy performed at our institution, reflecting current trends
for an increasing role of DMSA scans both in acute management and long-term follow-up. After reviewing the current literature, we have proposed an imaging pathway to assist clinicians in the management of febrile UTI in children.

**Methods:** Defects as simulated by the phantom. Lung perfusion images using single segmental mismatch lung perfusion used as perfusion defect inserts in the phantom. Segmental embolism (PE) using planar and SPECT imaging. The solid segments represent lungs with segmental emboli. The phantom was designed to simulate PE using planar and SPECT imaging. The solid segments represent lungs with segmental emboli. The phantom is used to simulate PE using planar and SPECT imaging. The solid segments represent lungs with segmental emboli.

**Results:** As an example the planar and SPECT images show a lung perfusion deficiency in the left lung lingular superior segment. The whole atlas consists of 18 sets of planar and SPECT images, each set depicting a single segmental mismatch lung perfusion deficiency.

**Conclusion:** The limitation of this atlas is that it only provides absent perfusion instead of reduced perfusion. However it may be a useful reference for the teaching of anatomical segmentation and lung bronchopulmonary segmental anatomy in VQ scans. In addition, the atlas may be a useful teaching aid for developing experience in reading lung perfusion images of suspected PE patients. Nuclear Medicine Physicians may use also the atlas as a bronchopulmonary segment size reference for diagnosing lung perfusion images.

**POG**

**EXTRA THYMIC MALIGNANCY IN MYASTHENIA GRAVIS**

J Behn, Q Chiam, H Dixson, H Patapanian, K Lee, Bankstown/Lidcombe Hospital

Extra-thymic tumours have been reported as a common occurrence in patients with myasthenia gravis but only a small percentage of these patients have a concurrent thymoma. A 74-year-old osteoprotic female with myasthenia gravis and history of thymectomy without thymoma had bone scintigraphy to investigate her cervical, lumbar and left rib pain. SPECT-CT bone scintigraphy revealed cervical and lumbar spondylosis without fracture. On early imaging, there was hyperaemia in the left pelvis, which corresponded to a large, 8.5 cm soft tissue mass without increased delayed tracer uptake on SPECT-CT. This mass was subsequently proven to be a diffuse large B-cell lymphoma on core biopsy. The patient was on high dose steroids at the time of the bone scan to treat her polymyalgia rheumatica symptoms, including left flank pain that was also steroid responsive. Lymphoproliferative diseases are associated with several autoimmune diseases and the coexistence of myasthenia gravis and lymphoma has been reported. This case highlights the importance of early imaging and SPECT-CT in bone scans for the evaluation of patients with complex symptomatology, such as this patient with polymyalgia rheumatica and myasthenia gravis.

**PO6**

**PULMONARY EMBOLISM DIAGNOSIS – AN ATLAS OF PLANAR AND SPECT PERFUSION IMAGES**

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A Rosenfeld, Centre for Medical Radiation Physics, Faculty of Engineering, University of Wollongong, Wollongong, 2522 NSW, Australia

**Background:** An anthropomorphic lung phantom with 18 solid lung segments was manufactured in 2009 at the Centre for Medical Radiation Physics, University of Wollongong. The phantom was designed to simulate segmental lung perfusion deficiency in patients suspected of having pulmonary embolism (PE) using planar and SPECT imaging. The solid segments used as perfusion defect inserts in the phantom.

**Aim:** The purpose of the study was to produce an atlas of planar and SPECT lung perfusion images using single segmental masmatic lung perfusion defects as simulated by the phantom.

**Methods:** An appropriate activity (solution of approximately 40–50 MBq 99mTc) was added to the phantom prior to a planar or SPECT scan. The planar and SPECT scans were acquired using the ADAC Forte dual head gamma camera at the Department of Nuclear Medicine, Wollongong Hospital. Multiple planar images of the anterior, posterior, LAD, LPO, RAO and RPO views were acquired. SPECT imaging used 120 projections with 12 seconds per projection, reconstructed with a FBP ramp filter (Butterworth cut-off = 0.4).

**Results:** As an example the planar and SPECT images show a lung perfusion deficiency in the left lung lingular superior segment. The whole atlas consists of 18 sets of planar and SPECT images, each set depicting a single segmental mismatch lung perfusion deficiency.

**Conclusion:** The limitation of this atlas is that it only provides absent perfusion instead of reduced perfusion. However it may be a useful reference for the teaching of anatomical segmentation and lung bronchopulmonary segmental anatomy in VQ scans. In addition, the atlas may be a useful teaching aid for developing experience in reading lung perfusion images of suspected PE patients. Nuclear Medicine Physicians may use also the atlas as a bronchopulmonary segment size reference for diagnosing lung perfusion images.

**PO7**

**MULTIPLE INTRA-ABDOMINAL PURULENT COLLECTIONS DEMONSTRATED ON FDG PET/CT IN STAGING OF NON-HODGKIN’S LYMPHOMA**

T Cook, K Le, R Mansberg, C Bui, The Nuclear Medicine & PET Department, Nepean Hospital

Lymphoma is the most common type of blood cancer, more prevalent than both multiple myeloma and leukaemia. In Australia it ranks as the 5th most common cause of cancer. Over the last 20 years the number of cases in Australia has doubled creating a need for an accurate and non-invasive method of diagnosing and monitoring disease progression. The utility of FDG-PET/CT in the staging and management of patients with Lymphoma has been well documented. FDG-PET/CT has shown to be a particularly valuable diagnostic tool for pre-treatment staging, restaging, monitoring during therapy as well as post-therapy surveillance. A 56-year-old male presented with abdominal discomfort for investigation. An abdominal and pelvic CT revealed a large lobulated soft tissue mass with mesenteric lymphadenopathy involving the small bowel. A laparotomy was performed for tissue diagnosis, which confirmed non-Hodgkin’s lymphoma (NHL). Following this, an FDG PET/CT study was organised to stage disease. Circumscribed areas of increased FDG uptake with marked central photopenia were noted in the abdomen and pelvis, consistent with intra-abdominal collections. Multiple foci of FDG avid disease in the liver, representing either lymphomatous deposits or liver abscesses and intense FDG uptake was also demonstrated in widespread lymphadenopathy. Following diagnosis of the abdominal and pelvic collections, CT-guided drainage was urgently performed with aspiration of purulent material. A repeat FDG PET/CT scan 4 weeks later revealed resolution of the collections and extensive progression of the FDG avid lymphoma. The liver lesions became significantly larger and more confluent despite ongoing antibiotic treatment, consistent with lymphomatous deposits rather than abscesses. In view of the rapid progression urgent chemotherapy was instituted. Progress FDG PET/CT studies demonstrated virtual complete metabolic and anatomic response with near complete resolution of the underlying lymphoma.

**PO8**

**ATYPICAL GIANT CELL ARTERITIS INVOLVING THE LOWER LIMBS ON FDG PET/CT**

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Vasculitis is an inflammatory disorder which causes the destruction of blood vessels. It affects both arteries and veins and is caused primarily by leukocytic infiltration of these vessels. The diagnosis of vasculitis usually requires surgical biopsy. PET/CT scans are a non-invasive imaging technique utilizing FDG, a radiotracer which accumulates in areas of inflammation, infection and malignancies. FDG PET/CT studies have shown greater sensitivity compared to other diagnostic studies in the diagnosis of inflammatory vasculitis, primarily in the aorta and its main branches. Giant Cell Arteritis is a vasculitis that involves medium to large arteries usually in the head and neck. We present an unusual case of Giant Cell Arteritis involving the lower limb.
vessels exclusively demonstrated on FDG PET/CT. A 66 year old male with a history of polymyalgia rheumatica presented with lower limb pain and symptoms of claudication but no significant stenoses on CT angiography. He was referred for a FDG PET/CT scan, which demonstrated increased uptake in lower limb vasculature bilaterally, consistent with vasculitis. This confirmed a clinical diagnosis of Giant Cell Arteritis and the patient commenced steroid therapy with good clinical response and a progress FDG PET/CT will be performed to confirm the response to therapy.

P09

221-mIBG CARDIAC IMAGING: UTILISING SPECT/CT
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Background: Cardiac imaging using I-123 mIBG has been proven to be a useful tool in the differentiation of Parkinson’s disease from other movement disorders. Since the introduction of cardiac mIBG imaging for this purpose, planar imaging has been utilised to gain the heart to mediastinal ratio (H:M ratio) needed for diagnosis.

Aim: To demonstrate the effectiveness and clinical value of SPECT/CT in comparison to planar imaging when defining the H:M ratio of patients undergoing cardiac mIBG imaging.

Method: Planar anterior and SPECT/CT images planar images were collected at 15 minutes and 4 hours post injection. The heart (H) to mediastium (M) ratio was calculated for each time point. The change in the H/M ratio was measured to determine the amount of washout. The activity in aortic arch was found to be a more accurate measure of the blood pool activity. The CT was used to define the heart (H) and the aortic arch (M) regions of interest to calculate the SPECT H/M ratio.

Results: There was good correlation between SPECT/CT and planar methods.

In practice, the planar images are reprocessed multiple times because the operator often has difficulty producing accurate regions of interest on the low count, low resolution images. The segmentation of the CT was found to be more reliable than creating regions on planar images because of the greater anatomy. At the John Hunter and Calvary Mater Hospitals, Newcastle NSW, we have been performing the SPECT studies as a routine since March 2010. Planar studies are only performed if patient condition warrants or preferred by a physician.

Objectives: Between March 2010 and Jan 2011, 467 V/Q studies were performed. Since the data supporting a single mismatched perfusion defect as PE, was not sufficient, a single mismatched perfusion defect was considered to be intermediate/indeterminate for PE and further evaluation with CTPA was recommended. We identified eight studies (representing 1.7% of all V/Q studies performed) which, if EANM guidelines were strictly followed would have been reported as positive but were not related to this aetiology.

Conclusion: Single mismatched perfusion defects on SPECT are not always diagnostic for pulmonary embolism and caution is recommended. Value of further perfusion co-registered CT in these cases needs to be investigated.

P10

AN IODINE AVID RENAL CYST MIMICKING A THYROID METASTASIS
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Renal cysts are common but iodine avid renal cysts have very rarely been reported. We describe a case of an iodine avid renal cyst mimicking a thyroid metastasis in a 32 year-old male with a history of previous locoregional metastatic papillary thyroid carcinoma. This patient had detectable serum thyroglobulin on his surveillance blood tests and further radioiodine ablation was performed which revealed new intense tracer uptake in the upper pole of the left kidney and moderate uptake in the anterior mediastinum, possible involving lymph nodes or relating to physiological thymic uptake. Focal renal uptake is more commonly due to metastatic disease (20+ cases reported) though this is a rare pathology, while only a small number of renal cysts demonstrating iodine uptake have been reported. Previously described causes of false positive radioiodine scans can be categorised as relating to elimination of iodine in body fluids, inflammation or infection, transudates or cysts, or non-thyroidal tumours. The left renal cyst in this patient was 3.2 cm in size and minimally complicated as it contained some thin internal septations and possible early wall calcification on an ultrasound, which may relate to inflammatory change resulting in iodine uptake. Reassuringly, this cyst was seen on an abdominal CT 4 years ago and remains unchanged in size.

P11

FALSE POSITIVE VENTILATION/PERFUSION LUNG SPECT – A SINGLE CENTRE EXPERIENCE
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Context: V/Q Lung SPECT is very sensitive and specific for the diagnosis of pulmonary embolism (PE). In the revised EANM guidelines, PE is advised to be reported as present if ventilation/perfusion (V/P) mismatch is of at least one segment or two sub-segments that conform to the pulmonary vascular anatomy. At the John Hunter and Calvary Mater Hospitals, Newcastle NSW, we have been performing the SPECT studies as a routine since March 2010. Planar studies are only performed if patient condition warrants or preferred by a physician.

Objectives: Between March 2010 and Jan 2011, 467 V/Q studies were performed. Since the data supporting a single mismatched perfusion defect as PE, was not sufficient, a single mismatched perfusion defect was considered to be intermediate/indeterminate for PE and further evaluation with CTPA was recommended. We identified eight studies (representing 1.7% of all V/Q studies performed) which, if EANM guidelines were strictly followed would have been reported as positive but were not related to this aetiology.

Conclusion: Single mismatched perfusion defects on SPECT are not always diagnostic for pulmonary embolism and caution is recommended. Value of further perfusion co-registered CT in these cases needs to be investigated.

P12

A STANDARDISED TECHNIQUE FOR GASTRO-INTESTINAL TRANSIT IN PAEDIATRIC POPULATIONS
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Background: Chronic constipation is a common problem in childhood. Since 1998 we have undertaken more than 800 individual paediatric Gastro-Intestinal Transit (GIT) studies employing standardised radio-labelled meals. Gastric Emptying, Small Bowel Transit and Colonic Transit can be readily characterised, with information provided to the referring clinician(s) in an easily understood format.

Objectives: The technique relies on the quantification of radioactivity in separate compartments of the GIT – stomach, small bowel, ascending colon, transverse colon, descending colon, recto-sigmoid colon and evacuated activity. ‘Geometric Centres (GC) of activity’ are calculated at various times over

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normalised GFR was calculated at 63 mls/min/1.73 m

The GFR was measured using a standard two-sample Brochner-Mortensen

therapy for sacro-coccygeal teratoma. The patient was adequately hydrated.

Case Study:

affected by concurrent Total Parenteral Nutrition (TPN).

binding. We describe a case of a patient whose GFR measurement was

formed to assess the patient's renal function. In oncology patients, these

Introduction:

GLOMERULAR FILTRATION RATE (GFR) MEASUREMENT

THE EFFECT OF TOTAL PARENTERAL NUTRITION (TPN) ON

P14

A Adams, E Wegner, The Prince of Wales Hospital; and Sydney Chil-

of the importance of skeletal scintigraphy in the pre-purchase evaluation of per-

Results: Skeletal scintigraphy is of great potential value to the horse racing industry as it provides early detection of bone pathologies in performance horses. This therefore minimises prolonged absence from racing and thus minimising financial loss. Skeletal scintigraphy can effectively detect bone pathologies such as; trauma injury (fractures and avulsion injuries), infection injury (osteomyelitis and discitis), tumours (neoplasia and sclerotic lesions) and degenerative changes (osteoarthrits and spondylous). The relative spec-

Conclusion: Although radiography and ultrasound are more commonly utilised greater awareness of skeletal scintigraphy would aid in the early detection of bone pathologies as it is a more sensitive procedure. The superior sensitivity of skeletal scintigraphy has significant potential to identify previ-

ment may be required to ensure accuracy.

P15

INTERESTING CASE: A FUNGATING BREAST MASS

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After denying the presence of a mass for 18 months a 64 year old female presented with a right fungating breast mass, right axillary lymphadenopathy and tenderness. A core biopsy was performed in which invasive ductal car-

Conclusion: In the case of our patient, a markedly different GFR measure-

ment was obtained following cessation of TPN. Concurrent administration of Total Parenteral Nutrition may cause reduced plasma clearance of Tc-99m DTPA. The resulting falsely low GFR measurement could lead to underes-

Discussion: The GFR measurements using Tc-99m DTPA may be affected by a number of factors including the patient’s hydration status, the radiopharmaceutical kit preparation and plasma protein binding (although this is thought to be negligible under normal circumstances). The effect of TPN on GFR measurements has not been previously described and in the case of our patient the GFR increased after cessation of TPN. The mechanism of reduced plasma clearance of Tc-99m DTPA in the presence of concurrent TPN is not clear. It possibly can be attributed to increased tracer binding to the high levels of circulating amino-acids and protein, and potentially other nutrients and unknown additive components of the TPN solution. Cessation of TPN may be required prior to GFR measurement to ensure accuracy. The length of cessation is at present indeterminate.

Conclusion: Although radiography and ultrasound are more commonly utilised greater awareness of skeletal scintigraphy would aid in the early detection of bone pathologies as it is a more sensitive procedure. The superior sensitivity of skeletal scintigraphy has significant potential to identify previ-

A two-month old male patient undergoing TPN, presented for a GFR measurement prior to commencement of cisplatin-based chemo-

therapy for sacro-coccygeal teratoma. The patient was adequately hydrated.

The GFR was measured using a standard two-sample Brochner-Mortensen method, with venous sampling at one hour and three hours following intra-

venous administration of 55 MBq of Tc-99m DTPA. The body surface normalised GFR was calculated at 63 mlis/min/1.73 m². The serum appeared unusually ‘milky’. As the patient was on continuous TPN at the time of blood sampling, concern arose that the obtained GFR measurement may be affected. TPN was ceased for 4 days and repeat GFR measurements were performed. Following intravenous administration of 55 MBq of Tc-99m DTPA, the GFR was measured at 80 mlis/min/1.73 m². The serum collected on this occasion appeared markedly less ‘milky’, however not entirely normal.
THE UNUSUAL SUSPECT: A NEW CULPRIT OF A FALSE-POSITIVE PULMONARY FDG PET/CT CASE

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W Varkat, Department of Tissue Pathology, ICPMR, Westmead Hospital, Australia

Context: A 58 year old male ex-smoker with a right upper lobe pulmonary mass was referred for an 18F FDG PET/CT scan. His clinical history included asbestos exposure, night sweats, fever, cough and weight loss. Initial FNA demonstrated no diagnostic malignant cells. In March 2009 a whole body 18F FDG PET, low dose non contrast CT scan was performed on our Siemens Biograph 16 PET/CT scanner. A 7 cm FDG avid spiculated mass (SUVMax 10.5) was observed in the right lung mid zone posteriorly with avid mediastinal and abdominal lymphadenopathy. A high grade neoplasm was the favoured diagnosis due to high pre-test probability, CT appearance of the mass and metabolism. Focal FDG uptake in the left adrenal gland also raised suspicion of metastatic involvement. FNA of a mediastinal node, right pleural biopsy and an open right lung biopsy were all non-diagnostic of malignancy. Steroid therapy resulted in partial improvement in the patient's clinical condition. A progress PET scan was performed in October 2009 as the patient continued to lose weight and experience chest pain. The second FDG PET/CT scan showed a reduction in FDG avidity and size of the lung lesion with resolution of the metabolically active lymph nodes and left adrenal uptake, suggestive of an underlying benign infective or inflammatory aetiology. Other conditions were considered in the differential diagnosis. Kamisawa and Okumoto (2008) proposed Immunoglobulin G4 (IgG4) related sclerosing disease as a new distinct clinicopathological systemic disease. The disease is characterised by extensive IgG4 positive plasma cells and T-lymphocyte infiltration of various organs with clinical manifestations apparent in the organs which responds to steroid therapy (Kamisawa et al 2008). IgG4 related sclerosing disease is also frequently associated with lymphadenopathy. In June 2010, a review of the initial open lung biopsy pathology was requested by the respiratory specialist and further immunoperoxidase staining demonstrated plasma cells expressing IgG and IgG4. IgG4 positive cells were >50 high power field and the percentage of IgG4+IgG+ cells were >40%. Clinical and pathological features were those of a chronic inflammatory and fibrotic process with positive IgG4 staining. Baseline serum IgG4 was not measured. A diagnosis of IgG4 associated disease was made and the patient was referred to a clinical immunologist for management. Eighteen months after the commencement of corticosteroids and oral methotrexate as a steroid sparing agent, an improvement in his inflammatory syndrome was evident.

Discussions: IgG4 related sclerosing disease is an emerging condition which can mimic neoplastic pathologies clinically and on CT and PET imaging. Two presentations of IgG4 related sclerosing disease with pulmonary manifestations have been observed in our department but this was the first case of IgG4 lung disease experienced.

Conclusion: Extensive pathological testing was performed which were not diagnostic of malignancy. FDG PET/CT is a sensitive imaging modality however it is not specific in detecting disease. IgG4 related sclerosing disease should be considered in the differential diagnosis of pulmonary and pancreatic masses referred for FDG PET/CT imaging. Reports of lung manifestations of IgG4 related sclerosing disease in FDG PET/CT imaging are few. FDG PET/CT may be of benefit in monitoring of IgG4 related disease activity when serum IgG4 levels are not elevated. 

CORRELATION OF FLEX NECK PLANAR IMAGING AND SPECT/CT IN THE IDENTIFICATION OF CLINICALLY SIGNIFICANT FACET JOINT ARTHROPATHY

N Droquet-Fuhrer, L Emmett, R Mansberg, M Magee, G Yung, R Russo, Concord Hospital

Study Aim: To correlate planar flex neck imaging with SPECT/CT in the identification of active facet joint arthropathy in patients with neck pain. Inter and intra-rater reliability with respect to these imaging modalities will be calculated.

Methods: Sixteen consecutive patients, thus far, who have presented for a bone scan in the context of neck pain, were interviewed regarding the severity and location of their symptoms. The patient subsequently underwent a technetium-99m MDP delayed flex neck planar imaging, acquired for six minutes on a high resolution single head MPR gamma camera, and a cervical spine SPECT/CT was also acquired on a Philips Precedence 16 Slice SPECT/CT camera. The de-identified image data sets were analysed by two Nuclear Medicine Physicians in a blinded manner. A semi-quantitative analysis of scintigraphic activity localising to the facet joints; whereby no increase in activity was assigned a score of 0, mild 1, moderate 2, and marked 3 for each level within the cervical spine. The results will be tabulated using a Kappa Score to determine the intra and inter-rater reliability between Planar Flex Neck Imaging and SPECT/CT in the evaluation of facet joint arthropathy within the cervical spine.

Results: These will follow at the meeting if selected. Interim results can be provided if requested.

Conclusion: Cervical spine pain is a common disorder affecting a significant proportion of the population, which is most commonly the result of degenerative disease involving the ligamentous (facet) joints. Scintigraphy has demonstrated a role in the evaluation of active facet joint arthropathy, which may guide treatment options. SPECT/CT is becoming increasingly popular, whereby the traditional use of flexed neck imaging is decreasing. This study will provide further information regarding these two imaging approaches in the evaluation of neck pain and in justifying the modern practice of nuclear medicine.
P19
COMPARISON OF TRUE AND SPECT-DERIVED PLANAR VENTILATION AND PERFUSION IMAGE ANALYSIS OF RELATIVE LUNG FUNCTION
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Aim: Relative lung function has traditionally been assessed using planar images. However, with the increasing use of SPECT V/Q replacing planar imaging, the use of SPECT-derived planar images has been suggested. The aim of this study was to compare true and SPECT-derived planar ventilation and perfusion images to assess relative lung function.

Method: This was a retrospective study using clinical V/Q scans acquired with both planar and SPECT. The SPECT data were used to generate both angular summed and reprojected planar images in the anterior and posterior projections. Geometric mean (GM) images for all planar images of ventilation and perfusion were generated. A rectangular region was placed over each lung on the GM perfusion image. Each region was split equally into upper, mid and lower zones and duplicated to the ventilation data. The percentage of total ventilation and perfusion for each segment was calculated for each lung. The same lung regions were also applied to the angular summed and reprojected planar images. Data were recorded in an excel spreadsheet and tested for agreement with linear regression.

Results: 61 patient V/Q studies were included in the analysis. Good agreement was found between the true planar images and both the angular summed and reprojected planar images, with slopes of 0.98 and 0.97 and R = 0.95 and 0.92 respectively.

Conclusion: This study has shown that SPECT-derived planar ventilation and perfusion images can be used to assess relative lung function and can replace traditional planar images.


P20
SINGLE-CENTRE, RETROSPECTIVE 5 YEAR REVIEW OF SCINTIGRAPHIC IMAGING OF NEONATAL HYPOTHYROIDISM
A De Silva, Austin Health
D Nandurkar, P Bergman, J Jong, Southern Health, Melbourne

Background: Congenital hypothyroidism has an incidence of 1 in 3600 and is commonly detected by Guthrie test performed at birth. The main mode of investigation is thyroid scintigraphy using Tc-99. Early diagnosis and treatment are imperative to avoid complications of severe physical and mental retardation.

Aims: The aim of the study was to retrospectively determine the scintigraphic appearance of congenital hypothyroidism, assess the relative prevalence of the different sub-categories and to determine the correlation with thyroid stimulating hormone (TSH) levels using Technetium thyroid scan in 92 consecutive patients presenting in a single tertiary hospital over a 5 year period.

Methods: A total of 89 consecutive patients (51 females, age 5 days–12 months, average 32 days) were identified to have had technetium thyroid scans for the clinical indication of congenital hypothyroidism between 2005 and 2009. Two Nuclear medicine physicians blinded to the clinical details interpreted the scans in consensus. The results were then tabulated and categorised into 5 groups – 1) normal site-normal uptake; 2) normal site-increased uptake; 3) normal site-decreased uptake; 4) ectopic site (which was further subdivided into lingual and sublingual); 5) no uptake. TSH results for each patient was also tabulated and a median calculated for each category.

Results: Based on the technetium scan appearance, 14/89 were categorised as normal site-normal uptake, 13/89 as normal site-increased uptake, 25/89 were categorised as normal site-decreased uptake, 22/92 were categorised as no uptake, and 15/89 were categorised as ectopic uptake. The median TSH levels for these groups were 28.4, 49.6, 7.7, 474, 213 mU/L respectively. Female predominance was seen in all subcategories except in the normal site-decreased uptake group where a strong male was demonstrated.

Conclusion: The scintigraphic appearance of congenital hypothyroidism falls in to five major categories, with no clear dominance of a particular subgroup. The need to assess the particular subgroup is important due to the potential therapeutic implications with regards to lifelong thyroid therapy in agenesis versus trial of stopping thyroxine in the other subgroups. We found that there is a clear female predominance (51/89) in congenital hypothyroidism. Scintigraphic appearance of agenesis has a high correlation with a very high TSH level, whereas TSH levels are only mildly elevated in patients with a normally sited gland with decreased uptake.


P21
99mTc-MAGIII DIURETIC RENOGRAPHIC FINDINGS IN SULFADIAZINE INDUCED CRYSTALLURIA
A Wilmott, A McCombie, M Rossleigh, Prince of Wales Hospital

Case Report: A 10 year old boy presented with central abdominal pain and microscopic haematuria three weeks after commencing 100 mg/kg sulfadiazine and 1 mg/kg pyrimethamine daily for the treatment of recurrent toxoplasmosis retinitis. Initial ultrasound assessment revealed mild left hydronephrosis but no renal calculi was identified. A diuretic 99mTc-Mag III study was performed to further evaluate the kidneys.

Background: Sulfadiazine is an antimicrobial used in the treatment of toxoplasmosis. The principle metabolite of sulfadiazine, acetylsulfadiazine, precipitates in acid urine resulting in crystalluria, urolithiasis, obstruction and acute renal failure. Sulfadiazine crystals and calculi are difficult to visualise and have variable presentation on ultrasound.

Methods: A total of 89 consecutive patients (51 females, age 5 days–12 months, average 32 days) were identified to have had technetium thyroid scans for the clinical indication of congenital hypothyroidism between 2005 and 2009. Two Nuclear medicine physicians blinded to the clinical details interpreted the scans in consensus. The results were then tabulated and categorised into 5 groups – 1) normal site-normal uptake; 2) normal site-increased uptake; 3) normal site-decreased uptake; 4) ectopic site (which was further subdivided into lingual and sublingual); 5) no uptake. TSH results for each patient was also tabulated and a median calculated for each category.

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Conclusion: The scintigraphic appearance of congenital hypothyroidism falls in to five major categories, with no clear dominance of a particular subgroup. The need to assess the particular subgroup is important due to the potential therapeutic implications with regards to lifelong thyroid therapy in agenesis versus trial of stopping thyroxine in the other subgroups. We found that there is a clear female predominance (51/89) in congenital hypothyroidism. Scintigraphic appearance of agenesis has a high correlation with a very high TSH level, whereas TSH levels are only mildly elevated in patients with a normally sited gland with decreased uptake.

Conclusion: Sulfadiazine induced crystalluria and urolithiasis is an uncom-
mon cause of ureteric obstruction and is difficult to diagnose with any single
imaging modality. This case demonstrates how the combination of ultra-
soundography, a structural imaging modality, and dieresis renography, a func-
tional imaging modality, ensured an accurate diagnosis and assessment of the
patient’s condition enabling the appropriate therapy to be implemented.

P22
THE ROLE OF BONE SCAN IMAGING IN CHILDREN WHO PRESENT WITH OSTEOMYELITIS
M Triantafilou, I Jong, G Soo, Department of Nuclear Medicine, Southern-
ern Health, Victoria, Australia

Early detection of osteomyelitis in children is important to enable prompt
treatment and minimize the risk for long term complication. Clinical diag-
nosis is often difficult as presenting symptoms in children can sometimes be
 occult and of insidious onset. Initial investigative work up for these patients
includes pathology (i.e. Raised white cell count and inflammatory markers)
and plain x-ray. X-ray abnormalities related to early osteomyelitic infection
are initially not present. Nuclear Medicine Bone Scan and MRI can visualize
abnormalities within the first few days of change. Whilst MRI does not use
ionizing radiation, there are practical difficulties in terms of creating MRI
scanner time and organizing sedation/anaesthesia at short notice in order for
young children to tolerate scanning, making bone scan a more practical
option for early imaging at our institution. Changes on a bone scan typically
are seen as increased perfusion with correlated delayed phase abnormality,
which is dependent on the degree of reactive bone turnover. In more severe
cases leading to vascular insufficiency from localized intra-osseous pressure,
osteomyelitis may also present as a photopenic focus. The whole body bone
scan may also delineate further occult sites of infection which may not neces-
sarily have otherwise being imaged by other modalities. We present this
collection of interesting cases collected are institution to highlight the varied
clinical and nuclear medicine imaging presentations of osteomyelitis in the
paediatric population.

P23
SEPARATION AND PURIFICATION OF THE PET ISOTOPE 89Zr FOR RADIOPHARMACEUTICAL APPLICATIONS
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S Chan, D Cryer, C Jeffery, A Asad, L Morandeau, Medical Technology
& Physics, Sir Charles Gairdner Hospital
L Morandeau, Medical Technology & Physics, Sir Charles Gairdner Hospital
R Price, Medical Technology & Physics, Sir Charles Gairdner Hospital;
and Surgery, University of Western Australia

Aim: To determine the optimal operating conditions of an hydroxamate
ion-exchange resin column method to separate 89Zr from the ‘cold’ 89Y target
material, post proton-bombardment, using the deliberately co-produced
radioisotopic contaminant 89Y as a tracer.

Methods: A custom beam-line produced 89Zr by cyclotron-derived 17.3 MeV
proton-bombardment of 89Y foil (thickness = 127 µm). When beam energy
is deliberately set above 11.7 MeV, 89Zr & 89Y are co-produced, as well as
88Y. 88Zr was separated using hydroxamate ion-exchange column chemistry,
where target is dissolved in conc. HCl and separation achieved by successive
washes of HCl & water (clicting ‘Waste’ fractions, see Table below) and
finally oxalic acid to elute Zr (‘Product’ fractions) (Holland, 2009). Addition-
ally, there is the small ‘lost’ fraction bound to the separation equipment
(‘Apparatus’). Ideally, all the 89Zr and none of the 89Y should appear in the
Product fractions. Effects on separation efficiency of different steps & vari-
ables were examined. Experiment (Exp) A tracked the 89Y through the separa-
tion process, using aged (5 mo; shelf-life = 12 mo) hydroxamate resin. Exp
B used fresh resin. Exp C doubled waste wash volumes, putatively to remove
more 88Y (and thus ‘cold’ Y) from the resin, into ‘Waste’ fractions. Exp D
added washes and oxalate eluent directly to the column, bypassing the
holding vessel used for target dissolution. Exp E increased the molarity of
the HCl wash by 50%, aiming to remove more 88Y from the resin, but with
potentially more 89Zr lost to waste.

Results: For each Exp, Table shows 89Zr and 89Y relative abundances (%),
normalised to the total EOB number of nuclei, appearing in the different

<table>
<thead>
<tr>
<th>Sequential separation fraction</th>
<th>Experiment</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>B</td>
</tr>
<tr>
<td>88Zr</td>
<td>89Y</td>
</tr>
<tr>
<td>Waste A</td>
<td>0</td>
</tr>
<tr>
<td>Waste B</td>
<td>1</td>
</tr>
<tr>
<td>Apparatus</td>
<td>2</td>
</tr>
<tr>
<td>Tot. Waste</td>
<td>3</td>
</tr>
<tr>
<td>Product A</td>
<td>18</td>
</tr>
<tr>
<td>Product B</td>
<td>55</td>
</tr>
<tr>
<td>Product C</td>
<td>24</td>
</tr>
<tr>
<td>Tot. Prod.</td>
<td>97</td>
</tr>
</tbody>
</table>

Conclusions: Between 92–97% of 88Zr was usefully recovered, illustrating
efficient separation, satisfying the required extraction efficiency of ~95%.
However, the product was contaminated with 89Y and therefore ‘cold’ 89Y,
falling the required purity of <1%. The final experiment indicated that the
problem lay with the concentration of the HCl washes. Indeed, in Exp ‘E’
the first product (‘A’) fraction contained nearly half the identifiable 89Zr, with
negligible 89Y. Waste ‘A’ contained nearly half the 89Y, without 88Zr. Therefore,
radioisotopic tracer analysis indicates that the hydroxamate ion-exchange
method is suitable for yielding a usable fraction of 88Zr, with acceptably low
contaminating target material. These results require corroboration using
‘cold’ separations analysed with ICP-MS.

P24
BILATERAL APICAL CAVITATING LESIONS DUE TO MYCOBACTERIUM AVIUM INTRACELLULAR COMPLEX (MAC)
INFECTION ON FDG PET/CT
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Department, Nepean Hospital, Australia

Mycobacterium Avium Intracellular Complex (MAC) is an atypical myco-
bacterial infection comprising of two types of bacteria; Mycobacterium Avium
and Mycobacterium Intracellularure. These opportunistic mycobacte-
ria commonly cause respiratory infections in immuno-compromised
patients. A 64 year old male presented with progressive weight loss and a
history of heavy smoking was suspected of lung cancer after chest CT
revealed multiple bilateral upper lobe lesions. A FDG PET/CT study was
performed for further investigation. Scan findings demonstrated intense
FDG accumulation in fibrotic/cavitating parenchymal areas of both lungs
suggestive of an inflammatory/infecitive process; however, isolated neoplasm
could not be excluded. Bronchoscopy with broncho-alveolar lavage (BAL)
and sputum cultures were subsequently obtained. Mycobacterium Intracel-
lulare was isolated on both BAL and sputum cultures achieving a
good clinical response. FDG PET/CT is known for its ability to effectively
diagnose and stage a number of malignancies, and recently it has been
studied to evaluate chronic inflammatory processes/infection. As increased
FDG uptake occurs in both malignancy and infection and standardised
uptake values (SUV’s) are not definitive, differentiation still remains difficult
and requires further investigation.

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DOES WARM UP PERIOD MATTER FOR RADIONUCLIDE DOSE CALIBRATOR MEASUREMENTS?

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Aim: The radionuclide dose calibrator is one of the most essential instruments in nuclear medicine for measuring the radioactivity of radiopharmaceuticals. The manufacturer recommendations should be strictly followed for the operation of this equipment to reach the required efficiency and accuracy for the measurement of radiopharmaceutical vials and patient doses. A new Capintec (CRC-15R) dose calibrator is recently installed in our laboratory. The operation manual suggests an approximately 30 minutes warm up period allowing the system to be stabilized. The purpose of this work is to investigate the suitable warm up period and to verify whether the warm up period would influence the accuracy of measurements. The constancy tests were performed for the dose calibrator using the standard sources ($^{137}$Co, $^{133}$Ba and $^{157}$Cs) for two different warm up periods before measurements; 8 hours warm up and continuous plug in running.

Results: The constancy test results of dose calibrator for two different warming up periods were shown in Table 1.

Table 1. Comparison of the dose calibrator constancy tests between 8 hours warm up and running continuously before measurements

<table>
<thead>
<tr>
<th>Standard source</th>
<th>Turned on 8 hours</th>
<th>Continuous running</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Calculated act.</td>
<td>Measured act.</td>
</tr>
<tr>
<td>$^{137}$Co</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Day 1</td>
<td>130</td>
<td>108</td>
</tr>
<tr>
<td>Day 2</td>
<td>130</td>
<td>109</td>
</tr>
<tr>
<td>Day 3</td>
<td>129</td>
<td>117</td>
</tr>
<tr>
<td>Day 4</td>
<td>129</td>
<td>109</td>
</tr>
<tr>
<td>Day 5</td>
<td>128</td>
<td>106</td>
</tr>
<tr>
<td>$^{133}$Ba</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Day 1</td>
<td>197</td>
<td>191</td>
</tr>
<tr>
<td>Day 2</td>
<td>197</td>
<td>193</td>
</tr>
<tr>
<td>Day 3</td>
<td>197</td>
<td>192</td>
</tr>
<tr>
<td>Day 4</td>
<td>196</td>
<td>193</td>
</tr>
<tr>
<td>Day 5</td>
<td>196</td>
<td>192</td>
</tr>
<tr>
<td>$^{157}$Cs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Day 1</td>
<td>185</td>
<td>159</td>
</tr>
<tr>
<td>Day 2</td>
<td>185</td>
<td>161</td>
</tr>
<tr>
<td>Day 3</td>
<td>185</td>
<td>160</td>
</tr>
<tr>
<td>Day 4</td>
<td>185</td>
<td>157</td>
</tr>
<tr>
<td>Day 5</td>
<td>185</td>
<td>158</td>
</tr>
</tbody>
</table>

Conclusion: Despite the factory recommended warm up period being approximately 30 minutes, our results indicated that warming up for 8 hours might be insufficient to stabilize the dose calibrator. This causes significantly inaccurate measurements resulting in out of limit constancy tests for $^{137}$Co and $^{157}$Cs standard sources. Therefore our findings suggest that continuous plug in is recommended for newly installed and routinely used dose calibrators. In addition, we conclude that warm up period is one of the factors that can influence the accuracy of radioactivity measurements in dose calibrators.

P26

PARTIAL VOLUME CORRECTION IN SMALL ANIMAL POSITRON EMISSION TOMOGRAPHY

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W Lehner, University of Sydney/BMRI, Sydney, Australia

Background: In Positron Emission Tomography (PET), the activity quantification in small structures is hampered by the Partial Volume Effects (PVEs), a well known consequence of the limited spatial resolution offered by the current PET scanners (~5 mm). PVEs typically result in overestimation of the activity in ‘cold’ regions and underestimation of the activity in ‘hot’ regions. In the context of dynamic PET imaging, PVEs induce important distortions in the shape and magnitude of the measured Time Activity Curves (TACs), resulting in biased kinetic parameters estimates. Whereas, microPET scanners offer better resolutions (~2 mm) – they are specifically designed for imaging small animals, the effects are still present due to the smaller size of the investigated regions. Various approaches have been proposed for the correction of human PET data, including the incorporation of the system response function in the reconstruction process, the iterative deconvolution of the reconstructed PET images by the system resolution and the use of the anatomical data to correct the measured regional TACs. So far, little efforts have been done for implementing and assessing these methods for the correction of microPET data.

Aim: In this work we adapted 2 post-reconstruction methods for the correction of microPET data in the context of the dynamic PET imaging of the cannabinoid type I receptors in rat brains using 18F-MK-9470 and assessed the impact of the correction on the derived kinetic parameters.

Method: We adapted the following correction methods:
1) The Geometric Transfer Matrix method which allows estimating the true mean signal in homogeneous tissues provided that their spatial definition is known and
2) The Richardson-Lucy deconvolution method allowing the estimation of the true activity image of the anatomical data.

Both methods were applied on 12 dynamic PET volumes of rat brains obtained with the Inveon microPET scanner using the 18F-MK-9470 compound. Each volume consisted in 17 frames for a total duration scan of 60 mins.

Results/Conclusion: Both PVE correction methods were successfully implemented and applied on the set of 12 rats imaged with 18F-MK-9470, allowing a better activity recovery at the cost of an increased variability. Corrected images obtained with the iterative approach exhibited improved contrasts when compared to the original images. The iterative deconvolution approach has the advantages over the GTM method of generating corrected images instead of corrected TACs only and without requiring the a priori delineation of the tissues.

P27

INVESTIGATING THE ACCURACY OF PARTIAL SATURATION IN ATYPICAL CONDITIONS

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M Gregoire, Australian Nuclear Science and Technology Organisation

Aim: The aim of the study was to investigate the accuracy of the partial saturation method depending on conditions and assumptions made. The investigation was conducted by looking at the impact of the time window, the residual term (see method), and the injected mass (or receptor occupancy) on the accuracy of the estimated parameters.

Method: (1) A series of partial saturation experiments using a 2-tissue compartmental model and human parameters from the Delorge et al paper (K1, k2, k3 = (l/mVp)*(B’max-B), k4) were simulated with a partial saturation dose that gave range of receptor occupancies from 20%-90% in 10% increments.
(2) The equilibrium relation was used to estimate the parameters B’max and Kd for each % occupancy. The relation includes a residual term which is related to the equilibrium state of the system being studied: B’F = (B’max-B)/KdVr – DB’D’T*(1/kod*F). (3) To study the effect of the time window and the residual term, a constant window of average 36 minutes was slid up and down the whole time span of the experiment starting at 2 minutes and ending at 54 minutes. This was done for all receptor occupancy doses. The B’max and Kdapp bias values were estimated and along with that the mean residual value for each time window was recorded. (4) To look at the effect of the receptor occupancy, the B’max and Kdapp bias values for each receptor occupancy level

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(20–90%) were estimated using a single time window of 6 minutes to 49 minutes, which was overall the best time window.

**Results:** (1) The residual profile for the total partial saturation experiment, the whole time window shows that the residual term reaches a large peak of about 370% at about 3 minutes, but after 5 minutes reduces to around 2%. It then slowly decreases for the rest of the time period and reaches a minimum of about −6% at the end.

1. The residual profile for the total partial saturation experiment, the whole time window shows that the residual term reaches a large peak of about 370% at about 3 minutes, but after 5 minutes reduces to around 2%. It then slowly decreases for the rest of the time period and reaches a minimum of about −6% at the end.

2. The overall best time window for the accuracy of Bmax and Kd was found to be 6–49 minutes. This single window was taken to look at the accuracy of B'max and Kdup over the whole range of receptor occupancies. The figure below shows that there is close to 0 bias for a wide range of receptor occupancy values, and the bias does not increase past about 13%.

**Figure legend (Fig. 2):** Y-90 PET/CT depicts hepatic Y-90 microsphere biodistribution in high resolution. Peri-ablation cavity Y-90 activity (arrow) is well-delineated, and focal Y-90 activity in the caudate lobe is well-defined (Fig. 2A transaxial; Fig. 2B coronal).

**Conclusions:** This study has shown that it is possible to use the residual term as an indicator of the accuracy of the parameter (B'max and Kd) estimates. This is due to the very high correlation between the amplitude of the residual term and the accuracy of the parameter estimates. Also, it was shown that using a single time window, even at a low receptor occupancy level of ~30%, the inaccuracy of B'max and Kdapp are only at ~6% thus the method used will work for a wide range of receptor occupancy levels. Therefore, the partial saturation method will be useful in clinical and atypical situations where there can be a wide range of receptor occupancies. Further work will be to add noise to the system and then use a reference region (simulated pons) instead of the free compartment in the parameter estimation.

**Discussion:** Imaging Y-90 microsphere biodistribution using first generation PET/CT technology is feasible. Its high resolution images are useful for qualitative diagnostic purposes. Post-SIRT Y-90 PET/CT permits accurate prognostication and effective planning of adjuvant modalities (e.g. radiofrequency ablation) by targeting poorly implanted tumour regions.

**P29**

**DETERMINATION OF THE DOSIMETRIC CHARACTERISTICS OF IrSeed **

**125**

**I BRACHYTHERAPY SOURCE**

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S Sheibani, Nuclear Science Research School, Nuclear Science and Technology Research Institute, Tehran, Iran

**Background:** Low dose rate brachytherapy sources have been used widely for interstitial implants in tumour sites, particularly the prostate. Dosimetric characteristics of IrSeed **125**

**I** (4.7 mm length) brachytherapy source have been determined using the LiF TLD chips.

**Materials and Methods:** Dose distributions around the IrSeed **125**

**I** source were measured in a Plexiglass phantom using TLD-100 LiF thermoluminescent dosimeters (LiF : Mg,Ti, TLD-100, Harshaw). In this work a PMMA slab phantom of dimensions 30 cm × 30 cm × 7.3 cm was used to measure the dose distribution around the sources.

**Results:** The dose rate constant, Λ, was measured to be 0.965 ± 0.06 cGyh⁻¹ U⁻¹ using LiF TLDs in Plexiglass phantom. And the radial dose function, g(r), of the IrSeed **125**

**I** source was measured at 0.5 cm increments from 0.5 to 1 cm and 1 cm increments for distance between 1 cm to 7 cm using the LiF TLDs chips.

**Conclusion:** Basically, the dosimetric parameters that have presented for this new source, have many clinical and treatment planning applications.
**P30**

**PRINCIPLES OF ‘HUMAN FACTORS ENGINEERING’ NEED TO BE APPLIED TO RADIOLOGICAL SCIENCES TO DECREASE MEDICAL ERRORS AND IMPROVE PATIENT SAFETY**

S Vijayakumar, V Vijayakumar, J Caudell, S Packianathan, C Yang, R Jennelle, University of Mississippi

**Context:** Medical Errors are recognized as a major issue in the current high-tech clinical practice.

Radiation Safety is also drawing increased attention. Human Factors Engineering [HFE] has helped improve safety in non-medical and medical specialties. Applying HFE principles to radiological sciences will help improve patient and radiation safety.

**Objectives:** Describe principles of HFE. Discuss how HFE’s application in radiological sciences could help improve patient and radiation safety. One in five American or his/her family member has experienced a medical error, a minimum of 44,000 deaths – eight cause of deaths – in the USA; the cost of medical errors are 17 to 29 billion dollars per year in the USA. Radiation dose errors top the hospital technology errors. After a recent radiation error incident in the USA, the radiological sciences are under added scrutiny. As a discipline we need to take proactive steps to decrease errors and improve patient safety.

Human Factors Engineering is a new concept and an outgrowth of previous work on process engineering. Specifically, it addresses the integration of uniquely human characteristics and how these impact and influence the human/organizational process, human/organization, and human/machine interface. Diagnosis and Radiology and Radiation Oncology are unique in their highly integrated interaction between machines and humans. This presentation addresses lessons from the past and proposes paradigms for the future that will assist in optimizing the human interface with the primary goal of decreasing medical errors. We review the lessons learned from the Therac 25 incident and certain case studies from the recent past that highlight the unique difficulties of the human/machine interface. We demonstrate that applying principles of human factors engineering, specifically data acquisition and target projection, which have been used by the military and aviation are equally well suited to the radiological sciences. Using these principles in a structured manner can reduce the chance of medical error and result in measurable increase in the quality of care. We will show a process by which a complex task can be broken down into standardized sub-units that can be organized into a structured system. Once organized, the system can be ‘trained to standard’ and provides continuous feedback that builds upon a quality-minded foundation. This system can be measured and analyzed. This process becomes a self-correcting mechanism designed to objectively obtain a targeted goal.

Radiopharmaceutical Sciences Poster Abstracts

**P31**

**THE PROPOSED AUSTRALASIAN BIOMEDICAL CYCLOTRON NETWORK: CONSIDERATION OF ITS JUSTIFICATION, REMIT, STRUCTURE & GOVERNANCE**

R Price, Medical Technology & Physics, Sir Charles Gairdner Hospital; and Schools of Physics & Surgery, University of Western Australia

**Outline:** Currently in Australasia there are 13 existing or imminent biomedical cyclotrons with associated laboratories, including 2 commercial operators and some with V-1 accelerator.

**Context:** This broad remit of most centres, with its multiple objectives; (i) reliable (>98.5%) daily supply of [18F]FDG; (ii) regular supply of other [18F] as well as [11C] labels; (iii) collaboration in preclinical studies, including operation of external beam-line; (iv) hosting generators for synthesising [68Ga] compounds places significant & diverse demands on the skills & training of staff, scientific & managerial, plus the engineering, chemistry & physics capabilities of the site. Centres have evolved into multi-skilling of staff; however much knowledge remains local and there is surprisingly little knowledge of how these impact and influence the human/machine interface. We demonstrate that applying principles of human factors engineering, specifically data acquisition and target projection, which have been used by the military and aviation are equally well suited to the radiological sciences. Using these principles in a structured manner can reduce the chance of medical error and result in measurable increase in the quality of care. We will show a process by which a complex task can be broken down into standardized sub-units that can be organized into a structured system. Once organized, the system can be ‘trained to standard’ and provides continuous feedback that builds upon a quality-minded foundation. This system can be measured and analyzed. This process becomes a self-correcting mechanism designed to objectively obtain a targeted goal.

**Conclusion:** The challenge for the Cyclotron Network exploratory group is to mobilise the outcomes of the Dec. ANSTO meeting, consolidated by the reports of the task forces due at the July ANZSNM satellite meeting, to agree on a justification, mission, structure and governance. Agreement in other critical areas would follow. A major aim will be to convince participants that the operational scope, autonomy and flexibility that they currently experience will be ‘valued added’. The prospect of presenting the Network to the Federal Government as an inclusion in its National Characterisation initiative (and related funding) may be worthwhile and feasible.
P33 IMPLEMENTATION OF AN IN VITRO ASSAY FOR PHASE 1 METABOLISM OF PET RADIOTRACERS

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S Yeoh, J Sachinidis, Centre for PET, Austin Health, Melbourne, Australia
A Scott, Centre for PET, Austin Health, Melbourne, Australia; University of Melbourne, Melbourne, Australia; and Ludwig Institute for Cancer Research, Melbourne Australia

Background: Determination of radiotracer metabolism is an important part of the evaluation process for new radiopharmaceuticals. Radioactive metabolites can negatively impact on the signal to noise ratio if they show non-specific binding in vivo. Even worse, radioactive metabolites that have affinity for the target can make kinetic modelling difficult and may require extensive blood sampling in order to correct for metabolites. Since the smooth endoplasmic reticulum of the liver is the principal organ of drug metabolism, in vitro tests using S9 liver fractions or liver microsomes are frequently used in the development of pharmaceuticals. The majority of xenobiotic compounds undergo phase 1 metabolism in the liver, a process that is catalysed by the cytochrome P450 family of enzymes. Phase 1 metabolism is an oxidative process that results in the conversion of a C-H bond into a C-OH bond. It is usually followed by phase 2 metabolism, where conjugation reactions are catalysed by a variety of enzymes such as the uridine diphosphate glucuronosyltransferases (UGT). The glucuronidated metabolites can be excreted easily since they are highly polar molecules. Unlike the phase 1 metabolites, they normally do not show any affinity for the target.

Aim: The aim of this project was to establish a cytochrome P450 phase 1 metabolism assay in our laboratory and to determine the metabolic profiles and biological half-lives of our novel hypoxia and tumour cell proliferation tracers.

Methods: The radiotracers were incubated with rat S9 liver fractions, phosphate buffer and either NADPH or an NADPH generating system at 37°C using the CAT Thermo Shaker SH26. At the designated time points (30, 60, 90, 120 and 240 minutes) an aliquot was removed and the reaction terminated by the addition of methanol. The reaction mixture was centrifuged and analysed by radio-HPLC. The HPLC system consists of a Shimadzu HPLC controller CBM 20A equipped with a 20 µL injection loop, a SPD-20A UV-Vis detector and two LC-20AD solvent pumps for high pressure mixing of mobile phases. For the detection of radioactive compounds, the Bioscan dual BGO coincidence detector was used.

Results: All novel hypoxia tracers underwent phase 1 metabolism in this assay. The quinone F-18 DS9 had a biological half-life of 22.8 min and at least 8 metabolites could be identified in the metabolic profile. The nitrophenyl sulfonate F-18 SO402 had a biological half-life of 43.5 min with only 2 metabolites present. The click chemistry derivative F-18 SO402c had a biological half-life of 32.1 min and only 2 metabolites could be detected. F-18 FMISO did not show any metabolites in this assay. The proliferation tracers F-18 FLT and F-18 FLETT also showed no phase 1 metabolism. It is known from the literature that FLT only undergoes phase 2 metabolism and this result is therefore consistent with previous observations.

Conclusion: We have successfully used a cytochrome P450 assay to model radiotracer metabolism in vitro. The assay allows us to measure the biological half-life of a radiopharmaceutical and we can also determine the metabolic profile. Furthermore, we have access to LCMS and LCMS/MS technology to elucidate the chemical structure of metabolites. We are now aiming to implement a phase 2 metabolism assay in order to investigate further the biological half-lives of our hypoxia and proliferation tracers. Due to the structural similarities between FLETT and FLT, we believe that FLETT most likely does undergo phase 2 metabolism.

P34 STUDY OF CREATION OF SPECT IMAGING POSSIBILITY IN 90Y GLASS MICROSPHERE USING ADDING A GAMMA EMITTER IMPURITY

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In this work the effect of doping a gamma emitter such as 177Lu to 90Y was considered 10% in time of hepatic prescription. This product is prepared by sol-gel technique comprising alumina-silicate glass, Y2O3, and 90Y03 with high purity of 99Lu and in this method, sol droplets directly were formed to gel microspheres using oil gelation chamber. The microsphere quality and density were evaluated using light microscopy and gas pycnometry. The specific activity of 177Lu and the radio-nuclide purity after thermal neutron activation were evaluated using gamma spectrometry. The level of the long-lived impurity was very low and this product safe for patient prescription. The resulting spectrum using gamma camera with medium energy collimator identified two photo-peaks (113 keV and 208 keV) with capable of SPECT imaging.

P35 MODIFIED AND SIMPLIFIED 3 STEP LABELLING OF 99mTc-TRODAT-1 WITH NORMAL BIODISTRIBUTION AND OPTIMISED SPECT IMAGING PROTOCOL

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Background: Differential diagnosis of Parkinsons disease, due to overlapping symptoms, is challenging. CT and MRI brain scans of people with PD usually appear normal. 99mTc-TRODAT-1 based on molecular imaging can be used for diagnosis of Parkinsons disease. However, labelling of 99mTc-TRODAT-1 is tedious.

Aim: We developed a simple 3 step labelling procedure of 99mTc-TRODAT-1 and optimised the imaging time for better diagnostic accuracy.

Materials and Methods: 1. 99mTc-Sodium Pertechnetate (2.9–3.7GBq, 1–2 ml) is added to a reaction vial containing Sodium Glucoséchonate: SnCl2.2H2O (16 mg-40 µg). Wait for ten minutes. 2. Add 50 µl of Na-EDTA (0.05 M, freshly prepared) and 200 µg of TRODAT-1 in ethanol HCl [ethanol:HCl(1:1) = (20:1 v/v)]. 3. Boil for 30 min and cool. Quality control was done by ITLC. The preparation can be used for 2–3 patients (25–30 mCi/patient). Brain SPECT images were acquired using a LEHR collimator on a Siemens dual head Symbia T6 camera at 1 hr, 2 hr, 3 hr, 4 hr, 5 hr and 6 hr post injection, to determine optimum imaging time with best T/B ratio and good sensitivity and resolution. Whole body images were also acquired to determine the biodistribution. Images were acquired in both normal subjects as well as in Parkinsonism suspected patients.

Results: The final product is a clear colourless solution at pH 6–7 with radiochemical purity >98%. Brain SPECT Images, acquired at 4 hr post administration and minimum 3000K counts, showed best T/B ratio with good sensitivity and resolution. Whole body images showed physiological uptake in lungs, liver, gall bladder and intestinal gut. In normal subjects a high uptake was seen in basal ganglia whereas patients with Parkinsons syndrome demonstrated a reduced uptake in basal ganglia.

Conclusion: This method of 99mTc-TRODAT-1 labelling is simple and less time consuming. The product is suitable for human administration and provides good images for better diagnostic efficacy.
P36 HYDROXOMATE COLUMN CONSTRUCTION FOR PRELIMINARY ASSESSMENT OF VIABILITY FOR \(^{99m}Zr\) FUSION: THE \(^{99m}Ga\) TEST

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Introduction: In the development of a viable Zirconium 89 labelled monoclonal antibody, the construction of a Hydroxomate column will enable isotopes to be passed through and bind to the column’s resin. This will enable a bifunctional chelating agent, containing the monoclonal antibody, to extract the isotope into elution. However, the availability of Zirconium for column construction is limited in Australia due to its cost and lack of cyclotrons producing it. As a result, Gallium 68 is the isotope of choice following the design of the column. With a half-life of 1.13 hr, Gallium 68 decays from Germanium 68, with a half life of 271 d, via electron capture. Gallium 68’s radiochemistry consists of 3 available valence electrons. Zirconium 89, the final isotope to be tested in a future study, has a half life of 78 h and a valency of 4+. The Germanium 68/Gallium 68 (Ge68/Ga68) generator is easily accessible within a PET centre and makes an easy alternative as Zirconium 89 is not currently available. The ultimate aim is to develop a novel procedure for production of Zirconium 89 labelled monoclonal antibodies and to improve the specificity of detecting cancer cells via PET imaging. However, in order to be achieved a viable Hydroxamate exchange column that will bind Gallium 68 was constructed to prove to have a yield of Zirconium 89.

Method: The construction of the Hydroxomate column consisted of three main stages to ensure viability of a strong anion exchange-1. STEP 1: Accel CM material was washed three times with tetrafluorophenol in acetonitrile and 3 M hydrochloric acid. This prepared the column for Hydroxomate ion introduction. STEP 2: 700 mg of hydroxyamine hydrochloride was added to a mixture of 1 mL of 1 mol/L NaOH and 2 mL of MeOH and introduced into the column. STEP 3: The column was dried and 25 MBq Gallium 68 added to the column immediately following generator elution. Step 3 was repeated twice alternating the order of the water and acid elution with the activities of both vials and the column counted in a calibrator set for Gallium 68 (trial 1 and 2, respectively).

Results: For both elution profiles, approximately 100% of the Gallium 68 was retained in the hydrochloric acid. In trial 1 and 2 there was 24.8 MBq present in each sample with the remaining 0.2 MBq in the column. The distilled water elution had no activity present when eluted before and after hydrochloric acid in the two separate trials. The pH of the sample was also recorded at 5.8 as a result of adding the 3 M hydrochloric acid elution.

Discussion: The hydrochloric acid elution was initially intended to only act as a wash and not extract the Gallium 68. However, due to the 3+ valence state and Gallium 68’s affinity for Cl ions at a low pH, this result was expected. However, this result does not effect the potential for Zirconium to be retained in the column as it differs in its valence chemistry which has previously been demonstrated by Verel et al to not be extracted by the hydrochloric acid wash. Finally, the Hydroxamate resin was successfully constructed and demonstrated the ability to bind Gallium and allow extraction by a stronger chelating agent. Therefore, a viable column for Zirconium purification has been established for further investigation to ultimately allow an easy, efficient and safe way to label Zirconium 89 to monoclonal antibodies.

Conclusions: This study will provide details of radiotherapy applications of purifying radioisotopes for use in further research. For example, the use in heavy PET radiosotopes that have been avoided due to inherent impurities from cyclotron production. Finally, the increased specificity this study has brought to PET will complement the outstanding sensitivity of the modality. This will continue to make PET the gold standard in diagnostic imaging and promote its use within Australia.

References
Conclusion: This research has improved the education and awareness by nuclear medicine technologists of the factors that impact on FDG PET/CT studies and the importance of ensuring that image quality is maintained.

P39 THE PREGNANT NMT AND RADIATION SAFETY
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Introduction: Once a nuclear medicine technologist’s (NMT) pregnancy is acknowledged the code of practice from the Australian Radiation Protection and Nuclear Safety Agency (ARPANSA) states that the Responsible Person must, if necessary, ensure that the external skin exposure of the pregnant worker will not exceed 1 mSv during the entire gestation or 0.1 mSv per month. The dose limit applied to the foetus is equivalent to the level of protection as to a member of the public. That is, 1/20th of the effective dose limit that a radiation worker receives per year. Possible side effects can occur if the foetus is over exposed to radiation. These may include cancer, reduction in IQ, growth retardation and possible major malformations. In order to avoid these health risks to the embryo, the radiation exposure principle of ALARA and the three over-riding safety tenants of time, distance and appropriate shielding, must be applied at all times. The aim of our study was to evaluate the effectiveness of the changes in work practice for a pregnant NMT in reducing radiation dose.

Method: Research was performed in conjunction with a 28 year old pregnant NMT from the Royal Melbourne Hospital. Measurements were taken weekly using a RADOS RAD-60 electronic personal dosimeter during the 1st trimester, and monthly TLD measurements from the month pregnancy was known until maternity leave. After each stage, the activities, duration and the cumulated dose were recorded. An interview was also conducted with the NMT.

Results: Results from this study indicate the highest levels of exposure to the NMT whilst in the 1st month of pregnancy. It was noted that during this time, the NMT was unsure of which duties to change. In the 1st trimester, the highest dose received was whilst setting up an exercise GRPS. The lowest was whilst having assistance from a student. Arrangements in work duty observation 9 months prior and during pregnancy showed significant reduction in average whole-body dose.

Discussion: The high dose during the 1st month of pregnancy and the uncertainty of appropriate work duties raised concern to the NMT. Thus, she was not entirely satisfied with her working arrangements, especially at the beginning of pregnancy. Perhaps the fact that there had not been a pregnancy link to the profession for the radiation exposure principle of ALARA and the three over-riding safety tenants of time, distance and appropriate shielding, must be applied at all times. The aim of our study was to evaluate the effectiveness of the changes in work practice for a pregnant NMT in reducing radiation dose.

Conclusion: This highlighted the importance of reducing radiation exposure to the pregnant NMT. It was found that the highest exposure levels were received during the 1st trimester, a stage of embryonic development recognized to be the most radiosensitive. Strategies need to be implemented in NM departments to help minimize radiation exposure to staff members who can potentially be pregnant and also reduce the levels of anxiety during gestation.

P40 THE EVALUATION OF PATIENT SATISFACTION AT THE WESTERN HOSPITAL NUCLEAR MEDICINE DEPARTMENT
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Introduction: Patient satisfaction has always been and will continue to be an essential component in the success of any health care facility. As stated by Press, ‘the new definition of patient satisfaction is really the existing meaning of quality’. A patient’s perception of quality is determined by everything that occurs during their visit to the hospital, including the interaction between the health care provider and the patient and the interaction with the clinical environment as a whole. In recent years, greater emphasis has been placed upon the evaluation of patient satisfaction. This emphasis has been driven by the need to improve the quality of medical care and reduce disparities within the health care organisation. Evaluating patient satisfaction through the eyes of the patient often reveals vital information about the quality of care delivered by the staff during the patient’s visit to the department. The patient’s experiences often relate to how satisfactorily a health care facility is operating highlighting strengths and weaknesses of the department. It is therefore imperative to evaluate patient satisfaction. This can best be attained through a well directed survey that gauges the patient’s hospital experience and identifies areas of the service to the patient that could be improved to help the service delivered to future patients.

Method: Research was performed in conjunction with the Western Health Nuclear Medicine staff members. The number of participants involved in this survey was limited only by the five week data collection time frame. Any patient booked for a nuclear medicine scan over the age of eighteen and who could understand (read and write) English was able to participate in this survey. The level of patient satisfaction was evaluated through a questionnaire survey examining the three aspects of patient satisfaction. These three aspects were: service provided by nuclear medicine staff, environment of the department and communication between patients and staff members. The patients were asked to complete the survey after the completion of the procedure. The survey used the Likert scale for the question responses, with 4 indicating ‘excellent’, 3 ‘good’, 2 ‘Fair’ and 1 ‘poor’. One open ended question was also included in the survey for suggestions.

Results: A total of twenty-seven surveys were obtained, 74% of those surveyed being women. The mean age was forty-five. The data revealed that patient satisfaction in relation to service provided by the staff and the communication between the staff and the patient was rated as either ‘excellent’ or ‘good’ with no response of ‘poor’. However, 3% of responses were rated as ‘poor’ for the environmental aspect of the department. Out of the twenty-seven surveys collected, three patients added comments on their experience which were all positive in nature.

Discussion: High levels of patient satisfaction are imperative to any Nuclear Medicine Department. The most poorly patient rated aspects of the department are found to be vital information for strategies to be implemented to assist in improvement of the service delivered to the future patients. From this study it was found that the communication aspect and the service provided by the staff was highly rated, whereas the environmental aspect was rated poorly by the patients.

Conclusion: The study aimed to evaluate the level of patient satisfaction with a focus on service delivery by the Nuclear Medicine staff at the Western Hospital. This provided the department with an indication of its strengths and weaknesses and also identified ways to enhance patient satisfaction. The results from the survey clearly indicate that the level of patient satisfaction in the department is very high, however some environmental aspects can be improved to strengthen this perception. Suggestions from patients can be reviewed to further enhance patient satisfaction for future patients.

P41 A METHOD FOR ASSESSING LYMPHOEDEMA USING LYMHOGRAPHY IN PATIENTS FOLLOWING AXILLARY CLEARANCE AS TREATMENT FOR BREAST CANCER
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Aim: Lymphoedema is a debilitating side effect that occurs in approximately two thirds of women following axillary clearance as treatment for breast cancer. This can result in significant swelling and pain in the affected arm. The ability to quantitatively assess and predict the severity of swelling may help in improving treatments for this condition. A study was undertaken to assess lymphoedema using lymphoscintigraphy to compare the clearance rates between the affected and unaffected arm.

Method: Study included patients with secondary lymphoedema and varying degrees of swelling graded from 0 (none) to 3 (most severe). Two 20 MBq subdermal injections of 99mTc-Anitomycolloid were given into the web space between the 2nd and 3rd, and the 4th and 5th fingers on each hand with the patient sitting upright in front of the gamma camera, palmar side toward the detector. To ensure accurate re-positioning at each imaging time-point, outlines of the hands were traced on absorbent paper secured to the collimator. Dynamic images were acquired continuously for 30 minutes, then repeated for 5 minutes at 60, 120 and 180 minutes after injection. Anterior chest images were acquired at 45 and 100 minutes following a SPECT/
P42 IMPROVING THE CLINICAL PRACTICE EXPERIENCE IN NUCLEAR MEDICINE
M Tempest, K Allen, Western Health

Clinical teaching is a major component in the education of undergraduate Nuclear Medicine Technologists. The clinical practice experience can have a great impact on learning outcomes and development of practical skills. There is however, little published literature on the factors that contribute to a positive clinical practice experience in Nuclear Medicine.

Aim: The aim of this study was to determine the key factors which have an important impact on the clinical practice experience in order to provide insight into improving the experience.

Method: A survey was conducted by mail, sent to 2nd and 3rd year Nuclear Medicine students from the Royal Melbourne Institute of Technology and interns and PDY’s participating in the Victorian 2010 program. The survey listed 14 possible factors impacting on the clinical practice experience. Survey recipients were asked to rate level of importance of each factor and list the top 5 contributing factors.

Results: 30 completed surveys were returned, 21 surveys from undergraduates and 9 from interns/PDY’s. Results showed that physical factors such as location, availability of resources, age of equipment and the physical environment of a department are not important to student and intern technologists. The most important factors are those that the qualified technologists can control, and include providing adequate opportunity to participate in clinical work, interpersonal skills of supervisor and attitude of technologists.

Conclusion: Survey responses provide valuable information to centres participating in clinical teaching, showing overwhelmingly that it is the technologists and their behaviour that have the most important role in providing a positive learning environment.

P43 THE DEVELOPMENT AND IMPLEMENTATION OF AN IN-HOUSE APPROACH TO PROVISION OF WEB BASED REFERRER ACCESS TO IMAGES AND REPORTS
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M Pesi, MicroEImark Pty Ltd

Background: This presentation overviewed the conception, development and implementation of an in-house approach to the provision of Web based access to images and reports. This project was launched as a result of a desire from a number of our referrers to ‘go filmless’. It was further motivated by the potential to save on the significant costs involved in the provision of hard-copy (film and laminated colour paper print-outs). Another catalyst was to gain maximum benefits from the installation of a centralised server and multi-site integration of a network within our organisation. One part of the Southern Nuclear Imaging Group (SNIG) decision to provide an integrated network between sites, was the potential for the provision of referrer access through a Picture Archiving and Communications System (PACS). We overviewed some of the many potential PACS solutions and trialled some of the products which were claimed to be suitable for Nuclear Medicine. We then undertook a cost analysis of suitable products. These analyses led to our conclusion that significant capital outlay and on-going costs would be involved in purchasing the available commercial products.

Aims: We set out to develop a simple, cost effective, safe and secure method for image access provision.

Methods: We chose In-house development of a workable solution by SNIG staff and provision of software development and integration by our software engineer who created our network. The access was tested, by participants in the project, on all browsers and operating systems. Implementation was initially through the recruitment of trial sites. This was followed by access provision to all referrers with internet access and a desire to view Web based images.

Results: This initially involved the development of a user interface which provided our referrers with secure links to images stored on our server in individual folders. This initial approach was somewhat cumbersome and proved labour intensive for our technologist staff. It was also unlikely to be accepted by our referrers. Another solution was sought using our available resources. We had all clinical workstations integrated as part of our network. The key to the system integration of our clinical workstations was the simplicity and ease of use of the General Electric (GE) Xeleris workstations. We decided to incorporate a program, featuring an already developed user interface. The output from the program contained all of the essentials for image, movie, audio and pdf output from a single folder annotated with the patient’s name and patient ID. The output distributed from the program; Multimedia Creator (MMC) (a GE product purchased as an option with the Xeleris workstations) can be used for CD, network or email to provide an electronic record of the patient’s procedure. Further development led to the removal of the MMC, instead of ‘dropping’ the ‘ Patient List’ by signing in securely from our LOGIN page, with a Username and Password. Then, on selecting the link to the required patient, it launches the MMC user interface providing a simple method to view images, review AVIs, listen to added audio and view the patient’s report. Implementation involved recruiting trial sites where referrers had shown interest in becoming ‘filmless’. This trial proved successful and the access has now been extended to hundreds of SNIG referrers. The approach has proven robust and has been well accepted by our referral base. Although a number of larger referrer sites have chosen to no longer receive hard-copy, we have yet to fully withdraw hard-copy availability. This is the next phase of our project. A major unexpected benefit which has come from Web availability is the simplicity for image review and remote and collaborative reporting by our physicians.

Conclusion: SNIG have developed a cost effective, simple and secure method for remote viewing of images, reports, patient information and other multi-media data through Web based access. This is a works in progress which is already providing a ‘live’ environment that is flexible to meet the demands of various referrers. Our eventual goal is to become filmless.

P44 CAPACITY BUILDING FOR NUCLEAR MEDICINE CONTINUING PROFESSIONAL DEVELOPMENT
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To meet the needs and requirements for evolving nuclear medicine hybrid technology and molecular imaging requires a shift in responsibilities and adaptation to new specialized skills with understanding, to ensure safe and efficient practice. There is a growing need to tailor professional development programs to suit nuclear medicine specialties pertaining to the competencies and capabilities of individuals and groups. With the advancement of internet technologies, so traditional e-Learning evolves towards e-Training supporting integration with e-Knowledge as well as the forming of virtual communities and networking which can provide real “continuous lifelong learning and working”. The provision of an on-line integrated web-based educational platform permits complimentary visual and interactive teaching aids to assist the understanding of difficult concepts, questions/answers with automatic feedback and ease of monitoring course progress and management. Creating a community for users, developers, researchers, and organizations to improve the exchange of expertise, knowledge and practices also encourages the development and distribution of additional educational materials. In essence, a capacity building process will lead to sustained and self-generating improvements in education and work performance.

Objective: To utilize the Distance Assisted Training on-line programme for Nuclear Medicine Professionals (DAT-OL) http://www.datnten.org and support a national, regional and global sharing of knowledge, assessment, training and further develop the facility to offer continuing education to all...
sections of the nuclear medicine community. Sustainability is an essentially important objective and flexibility is needed to enable the capacity-building approach for modifications, as required.

Discussions:
- Job-training and continuing professional development under an effective e-learning environment can improve and harmonize professional skills and competencies in nuclear medicine technologies.
- On-line cooperative learning such as forum discussions and emails may reduce the potential of isolation for the distance learner, however workshops and human interaction are a vital ingredient to collaborative learning, sharing of knowledge and refinement of practical skills.
- Capacity building stresses the significance of continuous learning and with the DAT-OL facility as a platform for providing the fundamentals, additional programs can be easily adapted to accommodate specialized individuals.
- Online learning provides flexibility in Module delivery accommodating specialty preferences and needs – it is student-centred. The technologies used give online instructional designers the ability to build in tools that may never be seen in a traditional classroom.

Conclusion: DAT-OL can provide a common basic assessed standard providing a benchmark of assumed knowledge prior to specialized workshops thus maximizing the time available and lecturers’ delivery. This cost-effective approach to capacity building in continuing professional development for nuclear medicine is being adopted for a growing number of specialties in the industry within Australia-New Zealand and globally.

P45
KEEP YOUR EYES OPEN
N Farnham, Lyell McEwin Hospital

An educational presentation that covers several cases and uses incidental findings to highlight the importance of reviewing raw, processed and displayed data. It reinforces that the target organ is not what we should solely target our vision. Some of these findings have lead to significant changes in patient management with suitable additional imaging confirming incidental findings from Nuclear Medicine Studies.

P46
‘YOU MUST POUR ITS BLOOD OUT AND COVER IT WITH DUST’
K O’Donnell, Hunter Imaging Group
D Lynall, The University of Newcastle

Introduction: Invitro blood labelling provides the highest RBC labelling efficiency and is considered the labelling method of choice to measure an accurate left ventricular ejection fraction. However, if a patient’s religious belief prevents them from having blood taken for invitro labelling, what alternative methods are suitable?

Discussion: A patient presented to department for a baseline Gated Heart Pool Scan, pre Herceptin. The patient’s blood was taken for invitro blood labelling using Ultratag. Whilst the blood was being labelled the patient revealed that they were a Jehovah’s Witness and they were not able to receive their blood back. Jehovah’s Witnesses do not believe in receiving stored blood products. Unfortunately, the blood that was being labelled in the Ultratag vial fell into this category. If the syringe that we used to take the blood was left in their arm and not removed, this would have been deemed adequate. However, invitro labelling is not performed in this manner so it was not an appropriate method. Jehovah’s Witnesses believe that blood that has been removed from their body must be disposed of in accordance with their belief, “he must pour its blood out and cover it with dust” (Leviticus 17:13–14). In this case the patient’s blood was radioactive and it would not be keeping with radiation safety practices if we were to smash the Ultratag vial on the ground and cover it with dust.

Conclusion: We were not able to continue with the Gated Heart Pool Scan using invitro labelling. To achieve the desired outcome of a baseline ejection fraction other methods needed to be considered. The methods to be considered include invitro, invitro, echo, gated rest 99mTc-MIBI. Which method would achieve an accurate ejection fraction? Godkar et al. (2007)*, found there is high correlation between labelled RBC MUGA scans and angiography, with echocardiography also demonstrating a good correlation where gated SPECT may over estimate LVEF.

Student Poster Abstracts

P47
HOLY MOLY THERE IS A SHORTAGE! THE GLOBAL 99Mo CRISIS AND SHORT TERM SOLUTIONS
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Background: Nuclear Medicine services rely heavily upon the availability of 99mTc as it is the parent isotope of 99mTc which is used in the majority of modern day scintigraphy. In the past, issues with servicing, repairs and other unforeseen circumstances has caused supply issues for this isotope. This has caused the nuclear medicine world to find effective alternatives. The most recent shortage arose due to the closure of the world’s two main reactors, National Research Universal (NRU) in Canada and High Flux Reactor (HFR) in the Netherlands. As a result of the closures there was an increased need for the manufacture of alternate radiopharmaceuticals to allow the nuclear medicine world to function. In a response to the shortage most departments reverted back to using older radiopharmaceuticals. Before it was superseded by 99mTc-MIBI, 201TI was used to conduct myocardial perfusion imaging. 201TI is unique as it provides extra information on the viability of the patient heart. Another solution to the global shortage was the expansion of the use of the PET radiopharmaceutical 18F-FDG. Recently there has been an increase in the research and use of FDG, especially in the field of skeletal scintigraphy. This has shown an immense improvement in the visibility of metastatic lesions as well as more suitable imaging characteristics when compared with 99mTc-diphosphonates. In the past cyclotron produced pertechnetate was very expensive and not a viable option of most imaging centres. However, in recent times the retail price has been lowered which has made it more accessible.

Conclusion: Short term alternatives are necessary to allow the Nuclear Medicine world to be able to provide the public with the health care services they require. Due to the Molybdenum shortages there has been an increase in research of alternatives for 99mTc and in the future this may alleviate the high dependence on this one radiopharmaceutical.

P48
IMPROVING PATIENT SAFETY IN 131I THERAPY
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Background: Radioiodine therapy of the thyroid gland has been utilised successfully since the 1930’s in the treatment of hyperthyroidism and thyroid carcinomas. However, there are significant risks involved, with both negative short and long-term effects being documented. Importantly, there are steps that can be taken to reduce the chance of these negative side-effects occurring. Side effects and methods of minimising them have been proven to be imperative in patient safety and management.

Aims: To explore the side effects of 131I post-therapy and assess the means of minimising these effects.

Results: The risks of negative effects increase linearly with the administered dose of 131I and range from minor taste disturbances, to infertility, and second primary cancers. Accordingly, methods to minimise the risk of developing these effects focus on reducing the extrathyroidal radiation dose. Techniques include the stimulation of the salivary glands with a lemon sialogue; radioprotection by amifostine; increasing fluid intake; sperm banking; pre-treatment of the patient with recombinant human thyroid-stimulating hormone (rhTSH); and laxatives to increase bowel motility.

Conclusion: Organ-specific side effects are mostly dose-dependent and are typically mild; however with repeated doses, these negative side effects may become more permanent. Nuclear medicine scientists should teach and encourage patients to perform safe practice during RAI treatment, which will better balance the risk of side effects with the benefits.
**P49**

**PHANTOM EVALUATION OF PET ATTENUATION CORRECTION USING COMPUTED TOMOGRAPHY IN PRESENCE OF CONTRAST AGENT**

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**Introduction:** Positron Emission Tomography (PET) is an increasingly popular imaging modality that demonstrates the physiological functions in the human body. The dual imaging modality PET/CT provides fast and accurate transmission attenuation correction (TAC) for the emission data. This phantom study aimed to assess whether the presence of CT oral or intravenous contrast medium in a PET/CT AC scan has any significant impact on the PET AC in emission images.

**Method and Material:** All PET/CT scans of 50 ml syringe phantoms were performed using a Philips Gemini scanner. One phantom contained water and 10 MBq of 18F-FDG without contrast agent. Another syringe contained the IV CT contrast OMNIPAQUE in 50 ml. The others contained 0.25 ml, 0.5 ml and 1 ml of oral IOSCAN CT contrast agent, respectively. Both CT and 123I Cs transmission scans of individual phantoms were performed followed by a 5 minute PET emission scan. The images obtained from the scans were reconstructed using 3D RAMLA algorithm. The averaged SUVs of volumes of interest drawn over 5 continuous transverse slices were measured for all phantom images.

**Results:** With the radioactivity properly distributed throughout the syringe phantoms, the results are of acceptable values and can be accurately used in the study. Both IOSCAN and OMNIPAQUE studies show that the SUVs in both the OsCaC (1.023 ± 0.031) and the CTAC (1.040 ± 0.038) are similar. This indicates that there is no significant impact on the presence of IOSCAN nor OMNIPAQUE in relation to attenuation correction.

**Conclusion:** The results suggest that when performing a CTAC scan in the presence of contrast medium, the PET images are of the same image quality to that of a CTAC scan without contrast. To utilise this data in the clinical PET/CT setting there will need to be further research in both torso phantoms and even humans to rectify its use in clinical settings.

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**P50**

**THE IMPERFECT SCIENCE OF NON-ACCIDENTAL INJURY DIAGNOSIS**

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In 2007/08 317,526 (7% of children) suspected child abuse reports were made in Australia. Of those 55120 were substantiated. It is the pattern and types of injuries that may suggest NAI. Single long bone fractures, multiple unexplained rib fractures, classic metaphyseal lesions and complex skull fractures all have a high specificity for abuse. However, when evaluating a child who is suspected of being physically abused, it is very important to remember that findings that may appear inflicted may be a result of other causes. Imaging plays a vital role in making the correct diagnosis. A quick and definitive diagnosis is required to put in place the correct management plan for both the child and family. This case study looks at a seven week old male child who presented with Left femoral shaft fracture and right arm pain. Initial diagnosis was non accidental injury. The infant underwent our standard protocol for NAI, skeletal survey, bone scan and CT all of which are complementary in making an accurate diagnosis. Bone scan imaging plays a vital role in identifying skeletal injury particularly where x-ray may be negative, and in this case played an important role in the overall diagnosis of Osteogenesis imperfecta (OI) and not NAI. OI is a group of congenital bone disorders, responsible for varying degrees of skeletal fragility. It is also known as ‘brittle bone disease’. Our patient had treatment with bisphosphonate therapy (Pamidronate infusion). As at the 12/07/2010 the patient had no evidence of further fractures and is a ‘happy and interactive infant’ and is developing normally and will continue therapy monthly. So in conclusion, bone scan imaging plays an important role in the differential diagnosis of non accidental injury. It is both a sensitive and comprehensive method of assessing skeletal injury.
**Case 1:** A 6-year-old boy with a history of neonatal Sweet syndrome and idiopathic hyper-eosinophilic syndrome receiving long-standing immunosuppressive therapy presented with ongoing fevers for several months. A 18F-FDG-PET scan was requested to determine sites of active infection and direct biopsy. We present 2 case studies of children with CGD, looking for the cause of ongoing fevers and localisation of sites which may direct biopsy and identification of the infective organism.

**Conclusion:** 18F-FDG-PET scans are an important diagnostic tool in the identification of active infective/inflammatory disease in CGD patients. They can provide additional information to conventional imaging and histology and can help in directing biopsy. Thus, the PET/CT scan was described as pivotal in pointing to the eventual diagnosis.

**Case 2:** An 8-year-old boy with known CGD on intravenous prophylaxis presented with fever and chest pain. A right chest wall abscess was drained. A bone scan performed elsewhere reported multiple sites of increased activity (2, 3, 4 left ribs; T3 vertebral body; right olecranon; left knee). CT images with IV contrast were obtained through the chest, and showed a right-sided mediastinal mass and right upper lobe. Immediately adjacent to the right thoracic mass, the right 3rd and 4th ribs were expanded with irregular cortical margins, but no increased FDG metabolic activity. Another area of mild increased uptake was seen in the posterior left lower lobe with thickening of the left pleura. A diagnostic CT confirmed the lesions seen in the PET/CT. Biopsy showed Aspergillus fumigatus and appropriate anti-fungal medication was started. The patient rapidly responded to Voriconazole treatment. The FDG PET/CT scan described above was performed in the event of the patient’s condition deteriorating.

**Conclusion:** 18F-FDG-PET scans are an important diagnostic tool in the investigation of patients with CGD and has been shown to be more specific in identification of active infective/inflammatory sites than conventional imaging. As these patients are highly susceptible to infections particularly if immunosuppressed, early diagnosis and identification of the organisms is required to improve treatment and outcomes for these patients. There has been a significant clinical impact in management decisions for these patients. 18F-FDG-PET has replaced 99mTc imaging in our institution for the evaluation of PUO and infections except suspected myocarditis or focal infections in the brain.

**Oncology Poster Abstracts**

**P52**

**CHRONIC GRANULOMATOUS DISEASE AND THE IMPACT OF 18F-FDG PET IN PATIENT MANAGEMENT**

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**Introduction:** Chronic Granulomatous Disease (CGD) is a genetic disorder with an X-linked variant or autosomal inheritance, in which the phagocytes are unable to produce bacterial superoxide anions (O2·−) leading to recurrent life-threatening bacterial and fungal infections. Despite prophylaxis with antifungal medications or interferon, CGD patients are at risk of contracting aspergillosis. Effective treatment of infection in CGD requires accurate identification of the organisms often by biopsy and discriminating between active and chronic or inactive infections can be difficult with many imaging modalities including CT and MRI. We have found whole body 18F-FDG-PET scans to be more specific and have significant clinical impact in the care of these patients by identifying sites of active infection and directing biopsy. We present 2 case studies of children with CGD, looking for the cause of ongoing fevers and localisation of sites which may direct biopsy and identification of the infective organisms.

**Case 1:** A 6-year-old boy with a history of neonatal Sweet syndrome and idiopathic hyper-eosinophilic syndrome receiving long-standing immunosuppressive therapy presented with ongoing fevers for several months. A 18F-FDG-PET scan was requested to determine sites of active infection and direct biopsy. It showed intense FDG accumulation in a large anterior mediastinal mass and right upper lobe. Immediately adjacent to the right thoracic mass, the right 3rd and 4th ribs were expanded with irregular cortical margins, but no increased FDG metabolic activity. Another area of mild increased uptake was seen in the posterior left lower lobe with thickening of the left pleura. A diagnostic CT confirmed the lesions seen in the PET/CT. Biopsy showed Aspergillus fumigatus and appropriate anti-fungal medication was started. The patient rapidly responded to Voriconazole treatment. The FDG PET/CT scan described above was performed in the event of the patient’s condition deteriorating.

**Conclusion:** 18F-FDG-PET scans are an important diagnostic tool in the investigation of patients with CGD and has been shown to be more specific in identification of active infective/inflammatory sites than conventional imaging. As these patients are highly susceptible to infections particularly if immunosuppressed, early diagnosis and identification of the organisms is required to improve treatment and outcomes for these patients. There has been a significant clinical impact in management decisions for these patients. 18F-FDG-PET has replaced 99mTc imaging in our institution for the evaluation of PUO and infections except suspected myocarditis or focal infections in the brain.

**P53**

**UTILITY OF PET/CT IN DIAGNOSIS GRAFT-VERSUS-HOST DISEASE (GVHD)**

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**Graft-versus-host disease (GVHD) is a common complication following allogeneic hematopoietic stem-cell transplantation (HSCT). It is an immunological condition where the transplanted donor cells attack the patient receiving the transplant. The disease affects many internal organs and is associated with an increased risk of death particularly in patients with gut involvement. The gold standard for diagnosis of intestinal GVHD is biopsy using endoscopy which can itself lead to undesirable complications in patients with GVHD. PET/CT has recently proven to be an effective non-invasive diagnostic tool for GVHD. This is a similar case of a 9-year-old girl with a background of B-cell ALL treated with external radiotherapy, chemotherapy and finally with allogeneic HSCT. Within 30 days of HSCT she developed a skin rash, abdominal pain and raised LFTs which are common symptoms of GVHD. A PET/CT was arranged to determine the aetiology of the patient’s symptoms. The PET/CT revealed post-therapy changes in the activity of marrow, liver and spleen. There was increased glucose metabolism in the bowel, predominantly in small intestine. There was also an area of mild increased uptake in the rectosigmoid region. The pattern of uptake was suggestive of GVHD. The patient subsequently went on to have an endoscopy and biopsy. There was obvious oesophagitis, gastritis and duodenitis. The duodenal and rectal biopsies showed changes consistent with GVHD and there appeared to be significant oesophageal ulceration. A follow-up PET/CT demonstrated progression of the GVHD. She was started on corticosteroid treatment and a PET scan 5 weeks later showed no evidence of GVHD. The patient remained well until she developed blood in her stools 2 months after resolution of her GVHD. Another PET/CT scan was organised which confirmed the possibility of a recalcitrant GVHD. Prompt detection of GVHD is important as early treatment will be more effective at preventing disease progression. Monitoring with PET/CT can refine treatment duration as prolonged corticosteroid use can lead to other complications such as avascular necrosis. Experience in our centre thus far shows a good correlation between positive PET/CT scans and biopsy proven GVHD. PET/CT has become an invaluable tool for the diagnosis, staging and monitoring response to treatment of GVHD.
with mean ages of 58.2 and 57.4 in each group respectively. The proportion of SLN detection was 96.8% (0.968 (95% CI: 0.931–1.01)) in group 1 and 90.6% (0.906 (95% CI: 0.844–0.968)) in group 2. There was no statistically significant difference between the groups with a calculated proportional difference of 0.065 (95% CI: 0.009–0.139). The median time to detection was 5 minutes in both groups.

Conclusion: The use of topical anaesthetic EMLA in breast SLN mapping does not impact on the rate or timing of SLN detection.

P55 LIPOMATOUS HYPERTROPHY OF THE INTER-ATRIAL SEPTUM (LHIS) – ANOTHER CAUSE OF FOCAL BENIGN FDG UPTAKE

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Introduction: FDG PET scans are a sensitive technique for the detection of metastatic disease in a variety of malignancies. However, recognition of other causes of FDG uptake is important to improve specificity. We present the PET and MRI appearances of Lipomatous Hypertrophy of the Interatrial Septum (LHIS), which may be confused with a cardiac metastatic deposit.

Case History: A 72 year old lady had a total thyroidectomy for papillary thyroid cancer in late 2009, followed by an ablative dose of radioiodine. Follow-up 8 months later revealed a Tg (on Thyroxine) of 6 and two small nodules in the right neck. The Tg rose to 94 off Thyroxine. A post-therapy Iodine scan in September 2010 did not reveal any Iodine-avid pathology and biopsy of the thyroid nodules was negative for thyroid cancer. Therefore a PET scan was performed, followed by a MRI study.

Findings: The PET study showed moderate focal FDG uptake in the interatrial septum, without an obvious mass lesion on the low-dose CT images. Only low-grade FDG activity was seen in the right side of the neck. Extensive cystic liver changes were also noted. The MRI scan showed focal thickening of the inter-atrial septum, with minor enhancement. The signal was not consistent with simple fat. However, on review of all imaging, the appearances were considered to represent LHIS.

Discussion: LHIS is characterised by benign fatty infiltration of the interatrial septum. Its incidence is between 1–8%. Although benign, it has been associated with supra-ventricular arrhythmias, syncope and sudden death. It may also mimic fat containing neoplasms including rhabdomyomas, myxomas and liposarcomas. The FDG uptake is related to the presence of variable amounts of brown fat.

Conclusion: Cardiac uptake of FDG is variable and with focal uptake it is important to distinguish benign variations such as LHIS from more serious conditions such as primary or metastatic tumours and cardiac sarcoid. The site of FDG activity and the absence of an obvious mass lesion on the low-dose CT images is an important characteristic to allow the diagnosis of Lipomatosus Hypertrophy of the Inter-atrial Septum.

P56 AN INTERESTING CASE OF MYOEPITHELIAL CARCINOMA OF THE PAROTID

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Context: Myoepithelial carcinoma is a rare, malignant tumour of the salivary glands, usually the parotid. It has been previously described as intensely avid on F-18 FDG PET-CT.

Objectives: To demonstrate an unusual scintigraphic appearance of myoepithelial carcinoma on F-18 FDG PET-CT which has not been previously reported.

Discussion: We report a case of metastatic myoepithelial carcinoma of the parotid in a 44 year old male. Primary tumour was 9.5 cm in size. Pathology showed high grade, widely invasive myoepithelial carcinoma with tumour necrosis and negative level 2 neck nodes. Patient was treated with radiotherapy to neck. One year later underwent pleurodesis for malignant effusion and later chemotherapy for bilateral lung metastases, ongoing at the time of imaging with F-18 FDG PET-CT, which was performed to evaluate treatment response and extent of residual disease. This demonstrated unusual finding of non-avid and only faintly FDG-avid metastases in the lung and pleura contrasting with intense FDG avidity in adjacent inflammatory calci-
P59 INVESTIGATION OF DOSES TO NON-TARGET ORGANS IN 131I THYROID CANCER TREATMENT AND THEIR POTENTIAL SIDE EFFECTS
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Introduction: Radioactive iodine (RAI) therapy was first introduced into the medical field in the 1940s for the treatment of thyroid cancer and hyperthyroidism. The basis of the success of RAI therapy is due to the active uptake of iodine in the thyroid gland. Radioiodine is selectively trapped and organified in the thyroid allowing visualisation of the thyroid and other iodine avid organs, such as the salivary glands, during pre- and post-thyroid therapy imaging. In relation RAI therapy potentially has short-term and long-term side effects; common short-term side effects include change in taste, nausea, sialadenitis, and neck swelling. While long-term side effects of RAI therapy are normally organ specific: dysfunction of the salivary gland and/or lacrimal gland, and bone marrow suppression. A study conducted by Pauwels et al. concluded that the stomach and the bladder received the highest radiation doses, second to the thyroid, which may increase the risk of secondary damage. This study aimed to establish whether a patient would be at increased risk of developing certain cancers or other potential side effects as a result of their RAI treatment.

Method: Patient data from St Vincent’s Hospital was reviewed between January and December 2009. Patients suitable for the study had to fit within the selection criteria, which included aged over 18, raw post-therapy images available for analysis, treatment with I-131 and high retention in non-target organs. For this study non-target organs included salivary glands, stomach, gastrointestinal tract (GIT) and bladder. Uptake was considered high when altering the intensity to the full width at half maximum (FWHM) of the highest pixel and the organ was still observed. The second part of the methodology involved determining the camera sensitivity used to calculate the fractional uptake within the non-target organ. The camera sensitivity was determined using a 20 cm Perspex phantom and two I-131 reference sources. The sources were placed at 0 cm, 5 cm, 10 cm and 15 cm intervals from the anterior projection. WB images of the phantom were acquired in anterior and posterior projections and sensitivity factors were established.

Results: Once the data was collected, calculations were made and the values obtained were compared to the publication by Mettler & Upton. Results from this study showed that there are variable ranges of absorbed doses for non-target organs. The absorbed dose of a non-target organ was observed to be highest when there were only anterior or posterior counts in the post-therapy image. The highest dose was to the GIT, with 24.289 mGy at 48 hours post-therapy. However this patient was one who had anterior counts only. The lowest dose was to the stomach, which received 3.668 mGy at 48 hours.

Conclusion: While there are many previous studies on RAI therapy that emphasise the limits of absorbed dose when deterministic radiation effects will be observed few studies that have been published that contain observations from RAI therapy imaging.

P60 COMPARISON OF PHILIPS JETSTREAM, PHILIPS EBW AND SIEMENS SYMBA T-2008 CAMERA BASED GLOMULAR FILTRATION RATE (GFR) VALUES VERSUS 51Cr-EDTA BLOOD GFRs
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Objective: The use of differing GFR Renal analysis software has shown to produce a significant range of computer based GFR values. This study was designed to compare software implemented by the Philips Jetstream, Philips EBW and Siemens Symbia computer generated GFR analysis against Chromium 51 EDTA blood GFR results. This study will also take into consideration that each of the software utilize different formulae.

Methods: Patients undergoing both 51Cr Blood GFR and 99mTc-DTPA renal scan were selected. The data collected from renal DTPA scans was processed with all three software systems, by the same Technologist, to generate a GFR.

Results: Data obtained is being analysed. The manufacturers differing processing methods, used to calculate the GFR values, will be taken into consideration.

Conclusion: It is feasible to assess different software used to generate GFR values against Chromium 51 EDTA blood GFRs. Results awaiting completion of analysis.
P63

Aβ ACCUMULATION CORRELATES WITH COGNITIVE DECLINE: RESULTS FROM THE AIBL LONGITUDINAL STUDY

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Aims: Longitudinal evaluation of ageing individuals is providing insight into the relations between the different factors leading to Alzheimer’s disease (AD). In this study, we used longitudinal data from the AIBL cohort, to provide a better understanding of the cognitive and imaging changes that occur in the development of AD.

Methods: Eighty-one participants – 50 elderly healthy controls (HC); 18 amnestic Mild Cognitive Impairment (MCI) subjects; and 13 mild Alzheimer’s disease (AD) patients – were evaluated at enrolment and 18 and 36 months later. On each visit, participants underwent neuropsychological examination, MRI and 11C-PiB PET. Rates of change for Aβ accumulation and cognitive decline were derived from the slope of the regression plots over 3 years and used in the correlational analysis.

Results: Aβ accumulation (0.05 ± 0.03 vs 0.01 ± 0.03 SUVR/yr, p = 0.0003) and memory decline (−0.20 ± 0.21 vs 0.001 ± 0.22 SD/yr, p = 0.004) were significantly faster in PiB+ vs PiB− HC. While Aβ accumulation was also faster in PiB+ vs PiB− MCI (0.05 ± 0.02 vs 0.01 ± 0.03 SUVR/yr, p = 0.02), the faster memory decline (−0.11 ± 0.14 vs −0.04 ± 0.15 SD/yr) was not significantly different. Aβ accumulation was slightly slower in AD (0.03 ± 0.03 SUVR/yr) than in MCI and HC. There was a trend towards an inverse correlation between Aβ accumulation and cognition in MCI (r = −0.40, p = 0.1) and AD (r = −0.40, p = 0.18). In HC, cognitive performance was inversely associated with Aβ accumulation (r = −0.32, p = 0.03).

Conclusion: Aβ deposition is associated with cognitive decline even in asymptomatic healthy controls. This supports the theory that Aβ accumulation plays a fundamental role in the development of AD and suggests that to be effective, anti-amyloid therapy may need to be given early in the course of the disease, perhaps even before symptoms appear.

P64

THE CONSEQUENCES OF Aβ DEPOSITION IN AGEING AND ALZHEIMER’S DISEASE: RESULTS FROM 366 ELDERLY SUBJECTS

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Aims: To study the development of Alzheimer’s disease (AD) in an elderly population by periodical assessment of a spectrum of biochemical and neuroimaging biomarkers.

Methods: 366 participants – 195 elderly healthy controls (HC) (age 72.2 ± 7.2 years); 92 Mild Cognitive Impairment (MCI) subjects; and 79 mild AD patients, were evaluated at enrolment and 20 and 36 months later, with 5% of participants already reaching the 54-month follow-up mark. On each visit, participants underwent a comprehensive clinical and neuropsychological examination, 3D MRI, and 11C-PiB PET imaging.

Results: At baseline, AD and MCI had significantly lower hippocampal volumes than HC, while 98% of AD, 63% of MCI and 34% of HC had high PiB (PiB+). By the latest follow-up of the MCI subjects, 42 met criteria for dementia, (38 AD, 2 dementia with Lewy bodies, 1 frontotemporal dementia, 1 vascular dementia) and 3 were re-classified as HC. Progression to AD occurred in 54% of PiB+ MCI vs. 14% of PiB− MCI, while 13% of PiB− MCI progressed to other dementias. Of the PiB+ HC, 10% developed MCI and 5% AD by 3 years. Three (2%) PiB+ HC developed MCI.

Conclusions: Extensive Aβ deposition precedes cognitive impairment and is associated with a higher risk of cognitive decline, denoting the non-benign nature of Aβ deposition. Based on our results, there is a > 98% (95% CI, 93–99%) chance that an asymptomatic PiB+ elderly HC will remain cognitively stable over 3 years in contrast to the 15% risk of developing MCI or AD in PiB+ HC.

P65

CONVERSION FROM MILD COGNITIVE IMPAIRMENT TO ALZHEIMER’S DISEASE OVER 12 MONTHS: PREDICTIVE VALUE OF Aβ IMAGING WITH 18F-FLORBETaben

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Aims: In-vivo amyloid imaging studies enable researchers to more clearly define the role of Aβ deposition in the development of dementias where Aβ may play a role.

Methods: 45 subjects (72.7 ± 6.6 yo, MMSE 27.2 ± 1.8) with Mild Cognitive Impairment (MCI) underwent neuropsychological examination, MRI and 18F-Florbetaben PET at baseline and 12 months later. MCI was classified by a history of cognitive decline but largely intact normal activities and performance more than 1.5 standard deviation below normal on neuropsychological assessment. 41 were amnestic. Subjects were classified Aβ-positive when Florbetaben cortical SUVR was greater than 1.4.

Results: At baseline, 24 MCI subjects (53%) showed high Aβ deposition, while 29/42 (69%) had hippocampal atrophy. By the 12-month follow-up 13 met criteria for dementia, 9 (20%) for probable AD, 3 for frontotemporal dementia and 1 for dementia with Lewy bodies. In a year, 33% of the Aβ-positive MCI and one Aβ-negative converted to AD, and 19% of Aβ-negative subjects progressed to other dementias. While Aβ-positive MCI were 7 times more likely to convert to AD in a year than Aβ-negative, MCI with hippocampal atrophy were 1.3 times more likely to convert to AD.

Conclusion: The presence of brain Aβ deposits as measured by 18F-Florbetaben PET is a very strong predictor of progression from MCI to AD at one year. Follow-up is continuing to determine the longer-term predictive accuracy of 18F-Florbetaben PET for development of Alzheimer’s disease.
normalized to cerebellar cortex (SUVR). MH were manually counted by normative data, and consensus between two readers.

**Results:** Lobar MH were present in 31% of AD, 36% of MCI and 19% of HC. Subjects with lobar MH had significantly higher mean SUVR (1.9 ± 0.5) than those without (1.6 ± 0.6), p < 0.01. Seventy-four percent of HC with single lobar MH and 86% with multiple lobar MH were 11C-PiB-positive.

Prevalence of lobar MH in 11C-PiB-positive subjects was similar in AD (31%), MCI (39%) and HC (41%). Lobar MH were present in 4/55 (7.3%) of 11C-PiB-negative HC.

Lobar MH correlated with age and 11C-PiB uptake in HC, but not AD or MCI. Aβ-burden (OR 4.8, 95% CI 1.7–13.8, p = 0.003), but not age OR 1.1, 95% CI 1.0–1.1, p = 0.09, was an independent predictor of presence of lobar MH.

**Conclusion:** Lobar microhaemorrhages in the elderly, even in asymptomatic individuals, are strongly associated with Aβ deposition.

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**P67**

**THE ROLE OF ACETAZOLAMIDE (DIAMOX) ENHANCED CEREBRAL PERFUSION SPECT IMAGING IN CORONARY ARTERY STENOSIS**

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**Background:** A 57 year old male presented to the Wyllie McKee Hospital with right arm and leg weakness. A CT of the brain was performed demonstrating ischaemic changes in the left frontal region. An ultrasound of the carotid arteries revealed high-grade bilateral carotid artery stenosis (CAS). The patient was referred to nuclear medicine for an Acetazolamide cerebral perfusion scan to confirm that the left carotid artery stenosis was symptomatic.

**Method:** The patient firstly underwent a baseline 99mTc-HMPAO cerebral perfusion SPECT scan. The patient returned the following week for a repeat scan, this time administered with an IV injection of 1000 mg of acetazolamide, slowly infused over 4 minutes. Twenty minutes post acetazolamide administration he was injected with 99mTc-HMPAO under resting conditions.

**Findings:** The acetazolamide images revealed a relative reduction in blood flow to the left posterior and frontal parietal lobe to a lesser extent the left temporal lobe when compared to the baseline study.

**Discussion:** Acetazolamide is a carbonic anhydrase inhibitor and anti-hypertensive agent. When administered to patients it causes vasodilatation, increasing the blood supply and hence tracer activity to the brain. However patients with carotid artery stenosis have vessels which are already performing at maximum dilatation and therefore cannot dilate further after Acetazolamide administration. This causes a scan appearance of relatively reduced perfusion in the areas of abnormal vasculature when compared to the surrounding healthy vessels that have dilated and subsequently perfuse a greater amount of tracer.

**Conclusion:** Acetazolamide enhanced cerebral perfusion SPECT imaging is a useful tool to demonstrate deficits in cerebral vascular reserve. Common indications include patients with high-grade bilateral carotid artery stenosis, arterial venous malformations and Moyamoya disease.

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**P68**

**MULTIFOCAL BONE INFARCTS IN A PATIENT WITH APLASTIC ANAEMIA AND INFECTIVE ENDOCARDITIS**

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Osteonecrosis or bone infarction refers to the ischaemic death of the cellular elements of the bone and bone marrow. We present a case study of a young patient with a recent diagnosis of aplastic anaemia and incidental imaging findings of multifocal bone infarcts in the setting of infective endocarditis. Case Presentation: A 35 year old previously well male presented with fever, exertional dyspnoea and epistaxis. His peripheral blood counts demonstrated a pancytopenia and a bone marrow biopsy confirmed aplastic anaemia. His admission was complicated by MRSA sepsis and infective endocarditis with embolic phenomena including a vesiculopurpuric rash. An initial 99mTc-HDP wholebody bone scan demonstrated mild diffuse reactive skeletal uptake with no infective foci. He was treated with 6 weeks of intravenous antibiotics with clinical improvement and negative blood cultures. A subsequent 99mTc-HDP wholebody bone scan, two months following the initial study, performed for the investigation of hypercalcaemia demonstrated progressive changes with focal areas of increased vascularity and delayed tracer uptake in the left pro;ximal and distal tibiae suspicious for sites of osteomyelitis superimposed on non-specific diffuse increased uptake in the bilateral distal femora and proximal tibiae. AT2-weighted MRI revealed symmetric multifocal serpiginous areas of signal abnormality within the diaphyseal regions of the distal femora, proximal and distal ends of the tibiae bilaterally corresponding to the bone scan abnormalities typical for multifocal bone infarcts. The cause of his hypercalcaemia was unknown and resolved after intravenous bisphosphate therapy and he remained well following completion of antibiotic treatment with no development of significant clinical symptoms in the lower limbs.

**Conclusion:** Osteonecrosis may be clinically silent particularly if it involves the metaphysis and diaphysis, is more commonly multifocal in atraumatic forms, and in this case presumably as a result of septic emboli causing arterial occlusion. Radionuclide bone scintigraphy has good sensitivity but poor specificity in the detection of osteonecrosis and is dependent on the stage of the disease possibly accounting for the differences in the bone scan and MRI appearances. MRI has both high sensitivity and specificity and plays a complementary role especially in the differential diagnosis of multifocal infarction and should be utilised when the diagnosis is uncertain.

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**P69**

**ASSESSMENT OF MYOCARDIAL SALVAGE USING SPECT MYOCARDIAL PERFUSION IMAGING IN STEMl PATIENTS UNDERGOING PRIMARY PCI ± ADJUVANT GTN AND VERAPAMIL THERAPY**

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**Background:** The use of myocardial perfusion imaging (MPI) using Tc-99m Sestamibi in the assessment of both ‘potential’ myocardial infarct size and ‘actual’ infarct size (and hence myocardial ‘salvage’) following primary percutaneous coronary intervention (PCI) in patients presenting with acute ST-elevation myocardial infarction (STEMI) has been previously reported.

**Aim:** To use this technique in a subset of patients enrolled in the multi-centre IVANA (Intravenous Verapamil And Nitrites in Acute myocardial infarction) trial, and compare extent of myocardial salvage in patients randomised to either combined intravenous Verapamil and nitroglycerine (GTN) therapy (Group A) or placebo infusions (Group B) administered immediately prior to PCI.

**Methods:** A subset of 14 patients who presented during Nuclear Medicine working hours were enrolled in the imaging substudy of the IVANA trial. They were injected with 400 MBq Tc-99m Sestamibi IV immediately prior to PCI and imaged 1–3 hours post intervention, when stable, utilising a Picker IRIX triple head gamma camera. Subsequently, rest images were obtained to 9 days post STEMI utilising the same imaging technique. The two sets of SPECT MPI images were analysed with the 4D-MSPECT programme, to PCI and imaged 1–3 hours post intervention, when stable, utilising a Picker IRIX triple head gamma camera. Subsequently, rest images were obtained to 9 days post STEMI utilising the same imaging technique. The two sets of SPECT MPI images were analysed with the 4D-MSPECT programme, utilising a standard 17 segment model of the left ventricle. Perfusion in each segment was scored 0–4 (0 = normal, 1 = equivocal, 2 = moderately reduced, 3 = severely reduced, 4 = absent perfusion). Summed scores were obtained at presentation (potential infarct size), 5–9 days post intervention (actual infarct size) and the difference was used to estimate myocardial salvage. A comparison between the two groups was performed using Mann Whitney U test for myocardial salvage (difference in MI size between pre and post intervention as ranked data) and a within group comparison for the effect of the salvage procedure (PCI + verapamil) on MI size was also performed.

**Results:** Although there was an overall reduction in infarct size in both patient groups, a comparison between the two groups for myocardial salvage did not show a statistically significant effect (p = 0.20).

**Conclusion:** MPI can be used to accurately quantify the extent of myocardial salvage following intervention for acute NSTEMI. In this small group, no additional effect of IV Verapamil and GTN prior to PCI on myocardial salvage was demonstrated. Due to the small sample size, however, a small beneficial effect is not ruled out.
P70
A RETROSPECTIVE REVIEW OF LUNG VENTILATION AND PERFUSION (V/Q) SCANNING IN PREGNANT WOMEN
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Background: Pulmonary Emboli (PE) is a recognised complication and potential cause of significant morbidity in pregnant women. The risks associated with Computed Tomography Pulmonary Angiogram (CTPA) include radiation exposure to foetus (dependant on pregnancy stage), radiation dose to breast tissue (with associated increased incidence of breast cancer) and transfer of potentially detrimental iodine from the CT contrast media to the developing embryo's thyroid. This led to the Nuclear Medicine lung ventilation and perfusion (V/Q) study to being the preferred test for PE within our network if there is no co-existent significant lung pathology.

Aim: To determine the prevalence of PE in pregnant women presenting to Nuclear Medicine with a suspicion of PE over a two year period.

Method: A retrospective review of lung V/Q scans on pregnant patients presenting to SouthernHealth Nuclear Medicine over a 25 month period. The patient's history was obtained and reviewed by Dr Hofman to determine the patient's clinical presentation, history and where possible the final diagnosis. Other investigative results such as Chest XRay, D-Dimer and CTPA were also recorded.

Results: Two of the 82 patients had a positive lungV/Q study. Final diagnosis was obtained for the other patients where possible – these included pneumonia, upper and lower respiratory tract infections, urinary tract infections, muscular skeletal, anxiety cholecystitis as well as no cause identified. These results are tabled. Discussion on the method of imaging (reduced dose and increased scanning time) and the estimated patient/foetus radiation exposure is included.

P71
THE EFFECT OF MATRIX SIZE AND FILTERING ON THE ACCURACY AND REPRODUCIBILITY OF LVEF CALCULATION USING PLANAR GATED HEART POOL SCANS
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Aim: Gated heart pool planar studies have traditionally been acquired using a 64 matrix. The software analysis packages have been developed to allow semi-automatic tracking of the LV using this matrix size. The aim of this study is to compare the effect of acquisition matrix size on (i) image quality, (ii) the accuracy of LVEF calculation and (iii) the reproducibility of the result between patients using a validated dataset of planar gated blood pool studies.

Methods: A set of 12 validated planar gated heart pool studies acquired with a 64 matrix were converted to a 128 matrix through standard rebinning with Gaussian, followed by smoothing in the temporal domain. The LVEF was calculated for each dataset using the Hermes (Nuclear Diagnostics) gated blood pool analysis package. Data were recorded in an excel spreadsheet and tested for agreement using linear regression.

Results: 48 studies were included for analysis. Good agreement was found between the 64 matrix and 128 matrix for both the 9-point temporal and 9-point temporal with Gaussian filter with slopes of 0.93 and 0.91 and R = 0.93 and 0.96 respectively. Operator input to manually adjust the ED and ES regions increased with the 128 matrix 9-point smooth with Gaussian.
PET/CT IN Q FEVER ENDOCARDITIS: A CASE STUDY

A Evans, P Maton, N Lenzo, Oceanic Medical Imaging

A 60 year old male truck driver with a 6 month history of intermittent fevers, sweats and general malaise was referred for a PET/CT scan by his cardiologist. Clinically he had a cardiac murmur of aortic incompetence and his blood cultures grew Q fever. Transthoracic and transoesophageal echo showed an incompetent valve but could not confirm endocarditis. The PET/CT study showed focal intense activity at the aortic valve in keeping with endocarditis. The patient was treated with the appropriate antibiotics with resolution of symptoms. PET was definitive in confirming endocarditis and helped direct management in this patient. Q fever is a rickettsial family disease caused by inhalation of particles infected with the bacterium Coxiella burnetii, which is extremely virulent. The respiratory system is the main organ infected though in chronic Q fever there are often findings consistent with endocarditis. Treatment involves the long term (up to 2 years) administration of antibiotics. This case exemplifies the potential benefit of FDG PET in assessing pyrexia of unknown significance. We believe it is the first published case of PET-CT in Q fever.

PET/CT IN Q FEVER ENDOCARDITIS - WHAT DO THE TECHNICAL ASPECTS OF THE SCANS TELL US?

S Stephenson, Royal Brisbane and Women's Hospital, Brisbane, Australia

Myocardial perfusion imaging makes up a large part of the daily workload at The Royal Brisbane and Women's Hospital. Our department will perform up to 10 myocardial perfusion scans a day. Scans were historically performed on a standard gamma camera. The rest pictures were performed approximately forty five minuets post rest injection with anterior/left lateral statics performed followed by a gated SPECT at twenty five seconds/step (approximately twenty minutes total scanning time). Forty five minutes to sixty minutes post exercise or pharmacological stress test, stress images were performed that included an anterior/left lateral static followed by a gated SPECT at twenty five seconds/step (approximately twenty minutes total scanning time). This is a substantial amount of time to keep still, with both arms above their head, for any patient; especially those with shoulder problems, claustrophobia and any other conditions that make it difficult to keep still for lengthy periods of time. Attempts to cut acquisition times are limited with current SPECT technology. In June 2010 a GE Discovery NM 530c was installed in our department. As quoted from the GE website 'this camera uses Alcyone Technology and combines Cadmium Zinc Telluride (CZT) detectors, focused pin-hole collimation, 3D reconstruction, and stationary data acquisition, to improve workflow, dose management, patient care and overall image quality.' The introduction of this camera has been a huge change for our department. Often we focus on how new technologies make things better from our (the healthcare provider’s) perspective but we should also be focusing on the impact these new technologies have on the patient.

In this presentation I will solely be focusing on the impact the introduction of the GE Discovery NM 530c has had from the perspective of a patient. For a period of six months we scanned patients on both our conventional SPECT camera and then on the GE Discovery NM 530c. This was for the technologists to get used to how the camera performed and for the doctors to gain confidence in this relatively new technology. We were performing a five minute rest image on the 530c and a four minutes stress image. (Static images are not possible on this system.) When patients had been scanned on both systems we verbally asked which system they preferred. Every single patient preferred the 530c system. This was mainly due to the decreased scan time, the image quality and the design of the knee rest and arm support. Patients that had been scanned first on the standard gamma camera and then on the 530c had to be clearly told that the 530c scan was starting as they were expecting moving parts! As part of the information letter sent out to patients booked in for myocardial perfusion scans they are told that the test can take anywhere from four to six hours. With the introduction of the GE Discovery NM 530c we are finding that the patients are in the department nowhere need that amount of time and are currently working out a revised time for our information letters. We are also finding that we can schedule all our patients for an early arrival rather than spread their arrival time throughout the day. This allows patients the flexibility to make plans for the afternoon rather than book off a whole day for this procedure. We are yet to investigate decreasing the injection dose given to patients but ideally this will be the next step. This is an important step, as we as health professionals are always conscious about the radiation dose we are giving a patient. In summary patients prefer being scanned on the GE Discovery NM 530c scans compared to standard SPECT cameras for a variety of reasons. They are in the department for a much shorter time and are more comfortable when they are being scanned and the introduction of the GE Discovery NM 530c has made a positive difference to their visit to our department.

HEPATOBILIARY IMAGING IN THE DIAGNOSIS OF HEPATIC ADENOMA

G Pandos, S Unger, The Queen Elizabeth Hospital

Case Study: A 30 year old female on the oral contraceptive pill (OCP) presented with sudden onset of colicky right upper abdominal pain. Ultrasound, and subsequently CT, were performed and revealed a large heterogeneous mass in the left hepatic lobe with multiple smaller lesions in the right hepatic lobe. A total of 6 lesions were identified, with a differential diagnosis of multifocal hepatic adenoma (HA), focal nodular hyperplasia (FNH), or less likely, hepatocellular carcinoma (HCC). She was referred for nuclear medicine imaging and a 3-phase biliary scan with Tc-99m HIDA was performed.

Results: Early blood pool and 30 minute planar images of the abdomen were obtained. SPECT images and SPECT/CT were performed with low dose CT for anatomical localisation. The large lesion in the left liver, and the smaller lesions in the right, showed very poor uptake on the blood pool and 30 minute images, but eventual accumulation and retention of tracer, becoming brighter than surrounding normal liver tissue on the 3 hour images.

Follow-up: The day after the HIDA scan, the patient went into shock, due to rupture of the large left hepatic lobe lesion, and was operated on. Histology confirmed HA.

Conclusion: FNH and HA are the most common nonvascular benign neoplasms of the liver, and both are more common in young women. While FNH is benign and usually found incidentally, HA may rupture with serious consequences. The hepatobiliary scan in this case was not typical of FNH (which usually demonstrates immediate uptake with delayed washout), HA, which is strongly associated with the OCP, can show no uptake, or occasionally, as in this case, very delayed uptake with increased retention.

VASCULAR ANOMALIES VISUALISED USING GI BLEED STUDIES

J Lawrie, M Kitchener, Lyell McEwin Hospital

GI bleeding has the potential to be fatal, in severe cases, without localisation of the site of haemorrhage and treatment to prevent bleeding. The cause of GI bleeding cannot be pinpointed in approximately 20% of cases. A Nuclear Medicine GI Bleed study is a useful tool in localising active bleeding and has a greater sensitivity than other imaging modalities. There are many common causes of GI bleeding including ulcers, anal fissures, carcinoma, polyps, diverticular disease and inflammatory bowel diseases. Vascular anomalies are not among the more common causes of GI bleeding. This presentation includes three case studies where regions of abnormal vasculature were identified using nuclear medicine GI Bleed Studies. They highlight the importance of an awareness of abnormal vasculature, such as an aorto-enteric fistula or aneurysm, as a possible cause of haemorrhage. Vascular anomalies visualised via a GI bleed scan may be incidental pathologies unrelated to the source of bleeding. SPECT/CT is extremely useful in improving accuracy in identifying the source of GI bleeding especially those involving vascular anomalies. In the absence of SPECT/CT, diagnostic CT can be used to visualise areas of abnormal activity and confirm the presence of an aneurysm or other vascular abnormality. Nuclear Medicine GI Bleed studies are very useful and highly sensitive in detecting active gastro-intestinal haemorrhage. GI bleed studies can also identify regions of abnormal vasculature which may possibly be an unusual source of gastro-intestinal bleeding. An awareness of vascular anomalies and attention to the scan appearance with this in mind is important in identification of these causes of bleeding. The use of SPECT/CT enhances diagnostic confidence when reviewing these cases and aids in avoiding false positives.

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P77 SPECT/CT: MAKING SENSE OF $^{68}$Ga SCINTIGRAPHY
E Lambert, Q Chiam, H Dixson, K Lee, Department of Nuclear Medicine and Ultrasound, Bankstown/Lidcombe Hospital

Diagnosing the source of infection on gallium scintigraphy can prove difficult due to the normal biodistribution of the tracer. This can potentially lead to misinterpretation of a scan. We report a case of gallium-avid prostatitis in a septiic elderly gentleman who presented with lower urinary tract symptoms, negative blood cultures, and an unhelpful urine culture. Without the aid of SPECT/CT, the gallium scan would have been interpreted as physiological excreted tracer in the rectum and may have limited effective patient management.

P78 CLINICALLY UNSUSPECTED RETROPERITONEAL HAEMATOMAS FOLLOWING FALLS MAY BE REVEALED BY SPECT/CT BONE SCINTIGRAPHY
A Woodcock, Q Chiam, H Dixson, C Bui, K Lee, Department of Nuclear Medicine & Ultrasound, Bankstown Lidcombe Hospital

Bone scintigraphy is commonly performed in our department to investigate hip and pelvic pain in elderly patients who have had a recent fall and a suspected fracture. We report four cases where bone SPECT/CT has diagnosed a retroperitoneal haematoma. Bone scintigraphy ruled out recent hip or pelvic fractures in three of these patients and demonstrated recent fractures in the fourth patient along with the finding of a retroperitoneal hematoma. Retroperitoneal haematoma is a known complication of pelvic fracture and highlights the importance of looking for other causes of hip and pelvic pain on both the bone scan and the co-registered CT after falls in the elderly. The finding of a retroperitoneal haematoma is important in altering patient management, including cessation of anticoagulant therapy.

P79 CLINICALLY IMPORTANT, INCIDENTAL FINDINGS FROM CARDIAC SPECT/CT
C Eastance1,2, N Lenzo1,2, J Crouch1,2, Oceanic Medical Imaging, 1Envisian Medical Imaging

SPECT/CT provides more accurate attenuation correction than previous methods in myocardial perfusion imaging. The CT also allows for basic anatomical assessment of the thorax and upper abdomen. Our practice carries out around 750 myocardial perfusion studies a year using a Siemens Symbia SPECT/CT system. In a number of cases we have found unexpected additional diagnostic information, with visualisation of other medical conditions unrelated to the patient's cardiac condition. We present four cases of incidental, clinically important findings detected by CT intended for attenuation correction on a myocardial perfusion scan.

P80 UPDATE ON THE ROLE OF NUCLEAR MEDICINE IN THE DIAGNOSIS AND THERAPY OF PATIENTS WITH PHEOCHROMOCYTOMA
V Vijayakumar, C Koch, University of Mississippi Medical Centre

Objectives: Describe current and future nuclear medicine imaging modalities for diagnosing pheochromocytoma.

Review the current status of Somatostatin analogue, 123I-MIBG, DOTATOC therapies.

Discussion: 123I-MIBG scintigraphy is selectively used for pheochromocytoma patients with a high risk of recurrent, multifocal, or malignant disease and for patients with a positive biochemical diagnosis that who fail to demonstrate a lesion on CT or magnetic resonance imaging (MRI).

Conclusion: Sensitivity and specificity of functional imaging modalities including 123I-MIBG, 18F-DOPA, 18F-FDA, and 18F-FDG for diagnosing pheochromocytoma vary and can be as high as 97% depending on whether pheochromocytoma is located in the adrenal gland, extra-adrenal, or metastatic. After conventional imaging including CT and MRI scanning, a scintigraphic imaging study cannot only be helpful in localizing pheochromocytoma but also in assessing its potential for radioreceptor therapy. Therefore, utilizing 123I-MIBG scanning remains valuable in the diagnosis of selective patients with pheochromocytoma such as those with multifocal, malignant, and/or high risk of recurrent disease. For diagnosing head and neck paragangliomas, 111In-octreotide may be preferred over using 123I-MIBG. Selected patients including those with malignant pheochromocytoma may benefit from somatostatin analogue, DOTATOC, and 131I-MIBG therapy combined with compounds such as arsenic trioxide.

P81 RAPID SPECT/CT PROTOCOL FOR GASTROINTESTINAL BLEEDING
A Culverson, T Siew, S White, Sir Charles Gardiner Hospital & W.A P.E.T Service

Context: SPECT/CT has been shown to increase diagnostic accuracy in localising gastro-intestinal bleeding with 99mTc RBC scintigraphy. One pitfall however is that peristaltic bowel movement can push blood away from the source of the bleed as SPECT is acquiring, reducing its accuracy.

Objectives: To improve localisation accuracy and reduce imaging time, a Rapid SPECT/CT protocol was implemented at Sir Charles Gardiner Hospital. Using a LEAP collimator a 5 minute SPECT is acquired at first sight of a bleed at 6 sec/view for 96 views, followed by low dose CT. This yields between 30–160 Kcounts per view, providing adequate image quality.

Discussion: Rapid SPECT/CT can improve accuracy of localisation of gastrointestinal bleeding. Reduced imaging time also means a bleed can be localised within 5 minutes of initiation of the bleed so the patient can proceed straight to embolisation while the bleed is still active, or to theatre if a more radical approach is required.

Radionuclide Therapy Poster Abstracts

P82 EVALUATION OF DOSIMETRIC PARAMETERS FROM PATIENTS BASED ON WHOLE BODY $^{131}$I BIO-KINETIC CLEARANCE IN THYROID CANCER THERAPY
W Changmuang, N Anongpornjossakul, K Thongklam, K Poonak, R Toengkhuot, Department of Nuclear Medicine, Faculty of Medicine Ramathibodi Hospital, Mahidol University

Aim: Retention and clearance of $^{131}$I from radioidine patients are the most important parameters in the absorbed dose calculation and radiation protection in nuclear medicine. The aims of this study were to evaluate the biokinetic clearance of $^{131}$I in the thyroid cancer patients treated with 30 mCi and to calculate whole body absorbed dose with MIRD schema by using the published $S$ factor. The whole body retention of $^{131}$I in all patients was determined individually by using gamma camera with high-energy general all purpose (HEGP) at 4, 24, 48, 72 and 144 hours after administration. The dose-rate measurements were performed immediately at 1 meter from external surface of the patients.

Results: The effective half-life ($T_{1/2}$) and the residence time ($T$) were estimated from the generated time-activity curves. The mean for effective half-life from whole body clearance curve was 26.8 ± 9.4 hours. The estimated residence time was 40.8 ± 15.0 hours. The retained activity of $^{131}$I at 24, 48 and 72 hours was 54%, 24%, and 7%, respectively. The mean for whole body absorbed dose for these patients was 136.3 ± 52.0 mGy. In addition, our study showed 48.8 ± 14.8 µSv/hr for the mean dose-rate determined immediately from the patients after administration. The actual time spent in strict order with each patient for technologists was calculated from the dose-rate according to the limitation of occupational exposure. The mean time in which technologists used for contact with a radioidine patient was 12 minutes per day.

Conclusion: Retention and clearance rates of $^{131}$I can be obtained by in vivo measurements in individual patient. These parameters are essential for management in thyroid cancer therapy, for both in-patients and out-patients. This method is improved whole body absorbed dose estimates by using more realistic parameters in the clinical practice. Additionally, our parameters could be a useful parameter to develop the guideline for occupational and public radiation protection.
P83 192Y TIME-OF-FLIGHT PET/CT IS SUPERIOR TO BREMSSTRAHLUNG SPECT/CT FOR POST-RADIOEMBOLIZATION IMAGING OF MICROSPHERE BIODISTRIBUTION
Y Kao, E Tan, K Lim, C Ng, S Goh, Singapore General Hospital

Context: Yttrium-90 (Y-90) has internal pair production which can be imaged by PET/CT. Y-90 PET/CT has better spatial resolution than bremsstrahlung SPECT/CT for post-radioembolization imaging of microsphere biodistribution. Y-90 time-of-flight (TOF) PET/CT produces higher quality images than non-TOF PET/CT.

Objective: We present a case of Y-90 TOF PET/CT after Y-90 selective internal radiation therapy, depicting hepatic microsphere biodistribution in high resolution. Our Y-90 TOF PET/CT protocol is provided.

Discussion: Y-90 TOF PET/CT represents the current state-of-the-art in post-radioembolization imaging of hepatic microsphere biodistribution. This facilitates reliable patient prognostication, effective planning of adjuvant modalities (e.g., radiofrequency ablation), retrospective calculation of radiation dose estimates and improved patient stratification for data analyses.

Figure legend: Fig. 1A: Delayed phase of triphasic CT in transaxial plane shows recurrent hepatocellular carcinoma (arrow) at the surgical margin of previous segment IV resection. Fig. 1B: Bremsstrahlung SPECT/CT in transaxial plane acquired 15 hours after hepatic intra-arterial injection of 0.9 GBq of Y-90 resin microspheres show grossly satisfactory bremsstrahlung activity in the target region. Fig. 1C: Maximum Intensity Projection of Y-90 TOF PET/CT in anterior view depicts overall hepatic microsphere biodistribution in high resolution. Fig. 1D: Y-90 TOF PET/CT in transaxial plane demonstrates preferential microsphere implantation tumour periphery with good spatial resolution. Y-90 TOF PET/CT was able to detect a small area of sub-optimal microsphere implantation (arrow) which was not detectable by bremsstrahlung SPECT/CT.

P84 192Y SELECTIVE INTERNAL RADIATION THERAPY: SUCCESSFUL DOWNSTAGE TO LIVER RESECTION
Y Kao, P Chow, S Goh, Singapore General Hospital

Context: Yttrium-90 (Y-90) selective internal radiation therapy (SIRT) is an emerging therapeutic modality for advanced primary and secondary liver tumors, which may downstage inoperable liver tumors to surgery.

Objective: We present a case of successful Yttrium-90 resin microsphere implantation with excellent therapeutic response, downstaging to liver resection. A 62 year old Chinese man with inoperable hepatocellular carcinoma in a background of chronic hepatitis B underwent Y-90 SIRT with hepatic intra-arterial injection of 2.0 GBq of Y-90 resin microspheres. This delivered an estimated uniform radiation dose of 134 Gy to the tumor, 70 Gy to the non-tumorous liver and 9 Gy to the lungs. Three months later, triphasic liver CT showed significant reduction in tumor size. Serum alphafetoprotein decreased from 14598 ng/ml to 188 ng/ml. Liver function tests remained normal. The patient was successfully downstaged and underwent liver resection with curative intent.

Discussion: Y-90 SIRT may downstage inoperable liver tumors to surgery.

Figure legend: Figure 1: Bremsstrahlung SPECT/CT performed 24 hours after Y-90 SIRT confirmed excellent implantation of Y-90 resin microspheres, depicted here in transaxial (Fig. 1A) and coronal (Fig. 1B) planes. Figure 2: Pre-SIRT triphasic liver CT depicting the targeted large solitary liver segment IV tumor in transaxial (Fig. 2A) and coronal (Fig. 2B) planes. Figure 3: Three month post-SIRT triphasic liver CT depicting significant reduction of tumor size in transaxial (Fig. 3A) and coronal (Fig. 3B) planes. The patient was successfully downstaged to liver resection. Figure 4: Histopathological slide of resected liver tissue depicting the typical distribution of implanted Y-90 resin microspheres in heterogeneous clusters, preferentially in the tumor periphery (Fig. 4A; red dashed lines delineate liver-tumor boundary). High-power view of the Y-90 resin microspheres is shown (Fig. 4B).

P85 THE MOST EFFECTIVE WAY TO ESTABLISH DOSIMETRY FOR THE TREATMENT OF LYMPHOMA WITH 177Lu MABTHERA
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P Eu, Peter MacCallum Cancer Centre, Melbourne, Australia

Introduction: There are two main groups of lymphoma, Hodgkin’s and Non-Hodgkin’s lymphoma (NHL). NHL is characterised by neoplastic proliferation of the B or T lymphocytes, and in rare cases histiocytic cells, with various responses from treatment. There are several ways to treat NHL, including, external beam therapy, chemotherapy, immunotherapy and most recently radioimmunotherapy. Usually a multimodality approach is the best treatment regime and outcome for the patient. Radioimmunotherapy is a unique treatment, in that each patient must be individually assessed as to how much activity should be given based on the nature of the antibody, mechanism of action, radionuclide properties, the tumour (size, location, degree of vascularisation) and each individual patients pharmacokinetics. The limiting factor of this form of therapy is the maximum tolerated dose of the patient’s bone marrow. The aim of this research project was to perform a meta analysis on the possible methods for establishing the dosimetry for patients with Non-Hodgkin’s Lymphoma who undergo radioimmunotherapy with the radioactive monoclonal antibody Lutetium177 Mabthera as part of their treatment regime.
Method: The meta analysis involved an online database search of articles related to the current methods of dosimetry for Zevalin and Bexxar (radioimmunotherapy agents currently available for NHL treatment) and Lu-177 Mabthera as well as other radioimmunotherapies that use Mabthera or Rituximab.

Results: The study found Lu$^{177}$ Mabthera that an uptake study can be performed to check the biodistribution and uptake levels of tumour cells. However, the easiest and most effective way to calculate the dose was based on the patient surface area which can be calculated by $\left(\text{Height (cm)} \times \text{Weight (kg)}\right)/36000$ $^1$. Once this is calculated a tolerable dose of 740 MBq/m$^2$ can be given.

Discussion: As Mabthera is a chimeric antibody there is less chance of the body recognising it as foreign body allowing repeat administrations. That repeat administrations are possible presents the potential for effective serial radioimmunotherapy administrations. The S value is the amount of radiation in $10^{-6}$ Gy/(Bq s) for the irradiation of the nucleus. The higher the S value the more effective the beta emitter is as a therapeutic agent. The following values where obtained:

- Lu$^{177}$ – Cell Surface = 1.32 and Cytoplasm = 2.03
- I$^{131}$ – Cell Surface = 1.06 and Cytoplasm = 1.54
- Y$^{90}$ – Cell Surface = 0.48 and Cytoplasm = 0.68

This study showed that Lu$^{177}$ is potentially a very effective therapeutic agent due to; cost, Beta Negative emissions, energy, distance travelled by each particular emission and that patient surface area is a prime predictor of radiation dosage.

P86 TLD DOSIMETRY OF A NEW $^{131}$I PULSED DOSE RATE BRACHYTHERAPY SOURCE

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Aim: The PDR brachytherapy source with 140 mCi activity is used for therapeutic purposes. According to AAPM Reference determination of dosimetric parameters for a new source by at least one group are necessary. In this research functions related to dosimetry of brachytherapy PDR IR-192 source with the active part of 3 mm length by measuring the dose in water equivalent phantom is investigated. Dose measured by TLD which placed in gaps produced plexiglass phantom.

Results: With increasing distance from the source, anisotropy function values tends to 1 (ideal case) which shows anisotropy is decreased (with increasing distance, source size tends to the point source approximation). As the angles close to the axis of the source due to self absorption in the active part of the structure and metallic coating of the encapsulation, higher anisotropy is observed. Maximum at 1 cm and zero degree equal to 20% compared to the ideal case is achieved. As from the theoretical calculation could be predicted, the anisotropy function is independent of phantom dimensions. In the same way, at angles $30^\circ < \theta < 150^\circ$ anisotropy changes are negligible. The dose rate constant values are also independent of the dimensions and design of the source and phantom dimensions.

Conclusion: The results of the anisotropy function, radial dose function and dose rate constant of less than 5% margin indicates that this new source is applicable in medical centres.

P87 MRVOXEL: A CROSS-PLATFORM SOFTWARE FOR RADIONUCLIDE THERAPY DOSIMETRY

E McKay, St. George Hospital

Background: The MrVoxel software tool developed at St. George Hospital has been used for calculating individual internal dosimetry for radionuclide therapy since 1998. The tool was originally written in C++ for the Macintosh architecture, using a proprietary software framework (Metrowerks PowerPlant) that is now obsolete. It has become increasingly difficult to add new features to the package and the licence conditions placed on the framework make it impossible to distribute the source code.

Aim: A new version of the MrVoxel software will be developed from scratch using a multi-platform language and open source libraries. Like the original, the new software will be extensible, via a plug-in module mechanism. It will also provide a scripting language for automating repetitive analyses. In addition, the new tool will include some data charting and curve fitting functionality that can be used for time-series analysis.

Methods: The core functionality of the original MrVoxel package was re-written using the Java language (version 1.5 Sun Microsystems). This allowed a single executable to be run on any platform providing an appropriate Java Runtime Engine. Java’s application frameworks and image processing libraries made this porting task relatively straightforward. Java also provides excellent built-in support for dynamic loading of code modules so plug-in support was trivial to add. The JIDL library (v1.4.1) provides a Tcl interpreter, written in Java, which was used both as a script interpreter and as a data file parser for certain plug-ins that load external data files. The JFreeChart library (v1.0.13) was incorporated to provide graphical display of time series data and fitted functions. Most of the original MrVoxel plug-in modules were converted to pure Java dynamic modules. Modules depending on the high-performance FFTW library for fast Fourier transforms were re-written to link to a platform-specific binary using the Java Native Interface facility. In addition to the original plug-in interfaces for file import/export and image processing, new interfaces were added to the package for time series manipulation and curve fitting, this latter using a Java implementation of the Levenberg-Marquardt algorithm. A Java jar file, essentially a zip archive with a text-based manifest, was used as a native file format, with images stored in PNG format, tables as columns of text and charts in JFreeChart’s own serialised object format.

Results: The implementation is complete and the new version of MrVoxel is now in service at St. George Hospital. The package is installed on a mixture of Macintosh, Windows and Solaris (Hermes) hosts and is used for various ad-hoc image processing tasks as well as for internal dosimetry calculations for radionuclide therapy. Like the original, the new package provides tools for image registration and segmentation, multi-channel image support and regions of interest based on a painting metaphor. It includes plug-ins for common quantitative image analysis tasks such as geometric mean, transmission-based attenuation correction, voxel dose kernel convolution and volume-of-interest statistics. It provides standard cut/copy/paste facilities, undo/redo for image processing operations and a native file format that can save an entire workspace with images, tables and curves for later display or reprocessing. In addition, several new plug-ins have been written that allow voxel models created with MrVoxel to be converted to input files for the Monte Carlo radiation transport codes MCNPX and GRNT. These packages provide a means to calculate radiation absorbed dose at the voxel level in a non-homogeneous target and their output can be imported back into MrVoxel and fused with a subject’s other medical images, yielding dose maps and dose volume histograms.

Conclusion: A new version of the MrVoxel image processing software has been developed. This new code is fully open-source (GPL 3 licence) and runs on Macintosh, Windows and Solaris architectures. It is available from the author on request.