

# **Asia Oceania Journal of Nuclear Medicine & Biology**

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**Abstracts of ARCCNM Annual Congress 2014**

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# Asia Oceania Journal of Nuclear Medicine & Biology

Official Journal of Asia Oceania Federation of Nuclear Medicine & Biology (AOFNMB)

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## Editorial Office

Asia Oceania Journal of Nuclear Medicine & Biology  
Nuclear Medicine Research Center  
Ghaem Hospital, Ahmabad Ave, Mashhad, Iran  
Postal Code: 91766-99199  
Tel: ++98-51-38400494  
Fax: ++98-51-38419521  
E-mail: [aojnmb@mums.ac.ir](mailto:aojnmb@mums.ac.ir)

## **The 13<sup>th</sup> Annual General Meeting of the Asian Regional Cooperative Council for Nuclear Medicine**

**November 5-6, 2014, Osaka, Japan**

Dear Colleagues

On behalf of the Scientific Program Committee of the 13<sup>th</sup> Annual General Meeting of Asian Regional Cooperative Council for Nuclear Medicine (ARCCNM), welcome to the 13<sup>th</sup> Annual General Meeting of the ARCCNM held in November 5<sup>th</sup> and 6<sup>th</sup>, 2014, in Osaka. This year, more than one hundred abstracts were registered from a number of regions of Europe, North America, Middle East, and Asia. Almost 150 scientific and educational abstracts will be presented during the Congress period. I am grateful to your great efforts to realize our dream.

Asia is now the hottest spot in the development and expansion of nuclear medicine and molecular imaging. I cordially invite you to the ARCCNM 2014 in Osaka and hope to meet new friends as well as old friends.

We go ahead together to the future of nuclear medicine.

Sincerely yours,

Jun Hatazawa, MD, PhD  
Congress Chairman  
The 13<sup>th</sup> AGM of ARCCNM

Department of Nuclear Medicine and Tracer Kinetics  
Osaka University Graduate School of Medicine



**Date:**  
**November 5-6, 2014**

**Venue:**  
**Osaka International Convention Center**

## **Time Table of ARCCNM 2014**

	<b>Nov. 4</b>	<b>Nov. 5</b>		<b>Nov. 6</b>
	Nakanoshima Center, Osaka University	Osaka International Convention Center (12F Conference Hall)		Osaka International Convention Center (12F and Main Hall)
9:00-10:00	ANMB Examination	Visiting PET Center Tour		CE 3 New Radionuclide Therapy and BNCT
10:00-11:00				Poster Session 2
11:00-12:00				
12:00-13:00		Luncheon Seminar Terry Jones		Luncheon Seminar Shanghai United Imaging Healthcare (12F)
13:00-14:00		Honorary Lecture Myung Chul Lee		Joint Ceremony (Main Hall)
14:00-15:00		CE 1 Immunology and Nuclear Medicine	Oral Session 1 Nuclear oncology (1)	
15:00-16:00		CE 2 New Imaging Modality and PET-MRI	Oral Session 2 Nuclear oncology (2)	National Delegates Meeting (12F, Room 1202)
16:00-17:00			Oral Session 3 Nuclear cardiology, neurology, and general nuclear medicine	Special Lecture by Honorary Fellow of ANMB (12F, Room 1202)
17:00-18:00		Poster Session 1		Global Collaboration in NM Education and Training (12F, Room 1202)
18:00-19:00				

## **Program**

### **ARCCNM Continuing Education Session**

This session is supported by the RCA Regional Office (Mr. Kun Mo Choi, Director).

**Wednesday, November 5, 2014**

**12F, Conference Hall**

14:00-15:30 Immunology and Nuclear Medicine

15:30-17:00 New Imaging Modality and PET/MR

**Thursday, November 6, 2014**

9:00-10:00 New Radionuclide Therapy and Boron Neutron Capture Therapy

### **ARCCNM Scientific Session**

**Wednesday, November 5, 2014**

**12F, Conference Hall**

13:00-14:00 Honorary Lecture Myung Chul Lee

Driving Forces for the Future of  
Nuclear Medicine Community

**12F, Room 1202**

14:00-15:00 Oral Presentation 1 Nuclear Oncology 1

15:00-16:00 Oral Presentation 2 Nuclear Oncology 2

16:00-17:00 Oral Presentation 3 Nuclear Cardiology, Neurology, and  
General Nuclear Medicine

17:00-18:30 Poster Presentation 1 Nuclear Oncology

**Thursday, November 6, 2014**

**12F, Conference Hall**

10:00-12:00 Poster Presentation 2 Nuclear Cardiology, Neurology, and  
General Nuclear Medicine

16:00-17:00 Special Lecture by Honorary FANMB **12F, Room 1202**

## **ARCCNM Symposium**

**Thursday, November 6, 2014**

**12F, Room 1202**

17:00-19:00 Global Collaboration of Education and Training of Nuclear Medicine

## **Luncheon Seminar**

**Wednesday, November 5, 2014**

**12F, Conference Hall**

12:00-13:00 Terry Jones

Future Development of PET Technology

**Thursday, November 6, 2014**

12:00-13:00 Huang Gang, Wai-Hoi, Gary, Wong

Visualizing the Dawn of Ultrahigh Resolution PET/CT in Nuclear Medicine

(Sponsored by Shanghai United Imaging Healthcare CO., Ltd.)

## **Contact to:**

### **ARCCNM/AOFNMB Secretariat**

Address: 6F Saehan Bldg.106, Nambusunhwan-ro 356-gil,

Seocho-gu, Seoul, 137-888, Korea

Tel : + 82 70 8867 7996

Fax : + 82 303 3441 7996

E-mail : [arccnm@arccnm.org](mailto:arccnm@arccnm.org)

### **ARCCNM 2014 Osaka Local Office**

Department of Nuclear Medicine and Tracer Kinetics

Osaka University Graduate School of Medicine

Address: 2-2 Yamadaoka, Suita, Osaka, 565-0871, Japan

Tel: +81-6-6879-3461

Fax: +81-6-6879-3469

Congre Co., Ltd.

Address: 3-6-13 Awaji, Chuo-ku, Osaka, 541-0047

Tel: +81-6-6229-2555

Fax: +81-6-6229-2556

[Nucl2014@congre.co.jp](mailto:Nucl2014@congre.co.jp)

## **Honorary Invited Lecture**

### **Driving Forces for the Future of Nuclear Medicine Community**

Myung-Chul Lee, M.D.

Korea Armed Forces Capital Hospital, Korea

Nuclear medicine is a complex Technology which is constituted by the integration of clinical practice, scientific research and strategic issues, supported by the inspiration, aspiration and perspiration of its dedicated professionals, and sustained by the consistent and systematic activities of various international and governmental organizations. Throughout the last 40 years, nuclear medicine has emerged dramatically as a truly promising field in Korea through the progress and proliferation of research, technology and practice which was stimulated by multiple driving forces as follows: foundation of the Korean Society of Nuclear Medicine, publishing related books and printed materials, host of the 3<sup>rd</sup> Asia and Oceania Congress of Nuclear Medicine and Biology, establishment of Korea Board of Nuclear Medicine, host country for World Federation and Congress of Nuclear Medicine and Biology, international cooperative activity through IAEA, JSNM, SNM, CJK, EANM and ARCCNM, contribution by national organizations such as Government, KAERI, Korea RI Association, etc, activated by the Korean Society of Nuclear Medicine Technologist, dedication by related industrial companies and introduction and expansion of PET/CT technology.

Now it is time to seriously consider the answer for two fundamental questions: 1. Is it essential health technology? 2. Is it self-survivable or self-sustainable? It is important to recognize and emphasize the new driving forces of our role in promoting and strengthening nuclear medicine community, based on vision, innovative changes and networks, which are most important essentiality for global leadership.

The leadership program should be held as a very important essential function to encourage all members to be real powerful leaders in nuclear medicine community. We need powerful leaders and experienced advisory groups to provide strategic directions and proper guidance. It is also essential to build multiple teams to expand and activate human network, institutional network, international network, industrial network and strategic or political partnership network.

The collaborative leadership through with national and international organizations will offer a scheme of global synergy to the overall growth and development of nuclear medicine. It can improve global communication will encourage constant progress, ultimately increasing harmony and success and strengthening nuclear medicine community.

## Invited Lecture

### Future development of PET methodology

Terry Jones

Visiting Professor at University of California Davis

A major opportunity for future development rests on making more use of the available signal emitted from the whole of the human body following the administration of a PET tracer. This is illustrated by the fact that with current PET scanners, less than 3% of the annihilation radiation emitted from the body is detected. Hence if a PET scanner could cover the total length of the body, 40 times more signal could be recorded making more efficient use of the cost of producing the tracer and the radiation dose incurred by the subject being scanned. Such an increase in efficiency would result in being able to reduce considerably the amount of radioactivity administered and hence radiation dose to the subject being scanned. This would allow more frequent scans to be undertaken in the same subject and the scanning of patients currently excluded for radiation dose reasons such as young children and pregnant women, see Jones and Budinger. Increased efficiency would make possible the measurement of low density disease such as micro-metastases see Price et al as well as infection and inflammation. The performance of such a total body PET scanner has been simulated as a 2metre long device now referred to as the Ultra PET. Simultaneously recording of data from the whole body offers an opportunity to undertake a “systems biology” range of studies which examine interactions and activations between organs such as brain-body as well as measuring the total body profile of the pharmacokinetics of a labelled drug to support drug development. There will be many challenges in implementing the Ultra-PET scanner including cost which although high would become affordable with volume production and further innovation in detector technology. One exciting challenge lies in undertaking data analysis of total body kinetic PET data. Even more exciting is the prospect of engaging clinician scientists across the spectrum of internal medicine which promises to realize the full potential of PET in clinical research and healthcare.



**CE-1-1****Cancer Control by Outpatient Thera-nostics: Radioimmunotherapy of Non-Hodgkin Lymphoma and Radiopeptide Therapy of Neuroendocrine Tumours as Paradigms for Asia and Oceania**

Professor J. Harvey Turner

The University of Western Australia, Fremantle Hospital

The prospect of controlling incurable cancer of high prevalence by novel outpatient nuclear medicine therapies of high efficacy and low toxicity, which are affordable and practical throughout Asia and Oceania is now achievable. Non-Hodgkin lymphoma is the 5<sup>th</sup> commonest cancer killer, and whilst incurable, it can be effectively controlled by a single outpatient administration of <sup>131</sup>I-Rituximab radioimmuno-therapy, with minimal toxicity and durable progression-free survival. First-line <sup>131</sup>I-Rituximab radioimmunotherapy of follicular non-Hodgkin lymphoma has achieved objective response rate (ORR) 99%, and complete remission (CR) 88%, with median time-to-next treatment (TTNT) not reached after up to 7 years follow-up. Iodine-131 Rituximab radio-immunotherapy of relapsed/refractory indolent NHL produces ORR 67%, CR 50%, median PFS 32 months in CR patients. Neither first-line, nor relapsed/refractory, nor repeat <sup>131</sup>I-Rituximab radioimmunotherapy has been accompanied by any episode of bleeding or infection and no hospital admission has been required. Radiation exposure to outpatient carers, family and members of the public is within international regulatory guidelines.

Neuroendocrine tumours (NETs), whilst relatively uncommon, are slowly progressive and thus have high prevalence. They do not respond to chemotherapy, but peptide receptor radionuclide therapy (PRRT) is effective for control of progression. Combination radiopeptide therapy with 4 cycles of <sup>177</sup>Lu-octreotate and radiosensitizing capecitabine/ temozolomide has achieved ORR 57%, CR 16%, PR 41 %, SD 37%, in GEP-NETS with median PFS 31 months. In pancreatic NETs treated as outpatients on this regimen, we observed ORR 83%, CR 13%, PR 70%, SD 20% and median PFS was not reached at 40 month follow-up. There is no long-term haematological toxicity and with amino acid nephroprotection there was no significant depression of renal function. Patients were all treated as day patients with no radiation exposure risk to carers or hospital personnel.

## CE-1-2

### Gallium-68 imaging in Neuroendocrine tumors

Prasanta Kumar Pradhan

Sanjay Gandhi Post Graduate Institute of medical sciences, Lucknow, India

Neuroendocrine tumors (NETs) constitute a heterogeneous group of neoplasms, arising from endocrine cells within glands (adrenal medulla, pituitary, parathyroid) or from endocrine islets in the thyroid, pancreas, respiratory and gastrointestinal tract. Majority of NETs express somatostatin (SST) receptors, so they can be effectively targeted and visualized with radiolabeled SST analogues in vivo. Scintigraphy with radiolabeled SST analogues, first with an I-123 label and subsequently with an  $^{111}\text{In}$  and  $^{99\text{m}}\text{Tc}$  label, has proven useful in diagnosing SST receptor positive tumours. The detection rate was reported to be between 80% and 100% in different studies. This method also shows the content of SST receptors which might indicate efficacy for treatment with Octreotide or other SST analogues or radiolabeled DOTA conjugate. Furthermore, there is evidence of a correlation between SST receptor expression and prognosis, since patients with NETs showing a positive profile on the scan have a better response to treatment with SST analogues.

Radioiodinated ( $^{123}\text{I}$ ,  $^{131}\text{I}$ ) MIBG is used to image and treat NETs, particularly those of the sympatho-adrenal system (pheochromocytomas, paragangliomas and neuroblastomas), although other NETs (e.g. carcinoids, medullary thyroid carcinoma (MTC), etc.) are also candidates for diagnosis and treatment with  $^{131}\text{I}$  MIBG. MIBG was shown to be less sensitive for detecting metastatic lesions of NET patients.

The recent introduction of PET imaging with Gallium-68 has major bearings in current and future clinical practice in neuroendocrine imaging. Its labeling with DOTA compounds has cleared the way for somatostatin receptor imaging with a viable PET agent, with all its inherent imaging advantages compared to single photon imaging (SPECT). The clinical application of this technique has been successful in a variety of tumours, for staging, restaging, monitoring response to treatment and planning of peptide receptor radionuclide therapy. The value of Ga-68 labeled peptide positron imaging will be demonstrated through representative cases.

## CE-1-3

### PET imaging of glial activation in neurological diseases using animal models

Miho Shukuri

Laboratory of Physical Chemistry, Showa Pharmaceutical University

In the central nervous system (CNS), glial cells, especially microglia, is known to be key players of the immune defense response against invading pathogens. On the other hand, abnormal inflammatory response induced by activated microglia may also lead to tissue injury and neurodegeneration. Recently, much attention has been paid to the role of activated microglia as a target for diagnosis and therapy of the various neurological diseases such as Alzheimer's disease, stroke, and multiple sclerosis. Positron emission tomography (PET) is one of the *in vivo* imaging modality which represents molecular alterations during immune response in neurological diseases. In this talk, we introduce our recent research on PET imaging studies for activated microglia in brains of animal models.

Carbon-11-labeled DAC is a PET probe with high affinity and selectivity to the translocator protein TSPO (18 kDa) which is expressed on activated glial cells during neuroinflammation. We investigated glial activation at different phases of experimental autoimmune encephalomyelitis (EAE) in rat brains by PET studies with  $^{11}\text{C}$ -DAC under *in vivo* condition and by postmortem histologic analysis. The increase of  $^{11}\text{C}$ -DAC uptake was shown in all CNS areas at the peak of EAE clinical episode and recovery stage, but not in preclinical stage. The time course of  $^{11}\text{C}$ -DAC uptake in the brain during EAE episode was closely corresponded to the expression pattern of activated microglia and infiltrated macrophages observed in immuno histochemical analysis. These results suggest that PET imaging with  $^{11}\text{C}$ -DAC could be a valuable diagnostic tool for monitoring neuroinflammation in pathological process of multiple sclerosis.

Purinergic receptor P2X7R is an initial regulator of microglial activation through the release of proinflammatory mediators such as IL-1 and TNF, and is regarded as a promising target for therapy of immune-related diseases including multiple sclerosis. The GSK group developed a series of pyroglutamic acid amide analogues (PGAA) as P2X7R antagonists. We synthesized  $^{11}\text{C}$ -labeled PGAA analogs to explore further microglial targets by PET. The PET images of  $^{11}\text{C}$ -PGAAs detected abnormal inflammatory microglial activation in the rat brains with hemispheric neuroinflammation induced by lipopolysaccharide.

We demonstrated the usefulness of PET imaging for glial activation in animal models of neurological diseases. The information described here indicates that PET is definitely helpful in shedding light on understanding the nature of disease processes and provides evidence for clinical applications.

## CE-1-4

### Clinical Translation of $^{99m}\text{Tc}$ -3PRGD2 SPECT/CT as a cost-effective method for diagnosis, lymph node staging, and response evaluation of non-small cell lung cancer

Zhaohui Zhu<sup>1</sup>, Xiaona Jin<sup>1</sup>, Shanqing Li<sup>1</sup>, Mengzhao Wang<sup>1</sup>, Bing Jia<sup>2</sup>, Quancai Cui<sup>1</sup>, Fang Li<sup>1</sup>, Ximin Shi<sup>1</sup>, Naixin Liang<sup>1</sup>, Jinmei Luo<sup>1</sup>, Yaping Luo<sup>1</sup>, Yunxiao Meng<sup>1</sup>, Kun Zheng<sup>1</sup>, Zhaofei Liu<sup>2</sup>, Jiyun Shi<sup>2</sup>, Fan Wang<sup>2</sup>

1 Peking Union Medical College Hospital, Chinese Academy of Medical Sciences and Peking Union Medical College, Beijing, China

2 Bing Jia, Zhaofei Liu, Jiyun Shi, Fan Wang, Medical Isotopes Research Center, Peking University, Beijing, China.

**Background:** A prospective translational study was designed to investigate a novel integrin receptor imaging approach based on the cost-effective single photon emission computed tomography/computed tomography (SPECT/CT) technology, using  $^{99m}\text{Tc}$ -3PRGD2 as the tracer, in diagnosis, lymph node staging, and response evaluation of non-small cell lung cancer (NSCLC), which was compared with  $^{18}\text{F}$ -fluorodeoxyglucose (FDG) positron emission tomography (PET)/CT in the same patients.

**Patients and Methods:** Sixty-five patients with suspicious lung lesions were prospectively recruited. All patients underwent  $^{99m}\text{Tc}$ -3PRGD2 SPECT/CT and  $^{18}\text{F}$ -FDG PET/CT within one week for initial evaluation. Among them, 21 patients with confirmed late-stage NSCLC repeated both  $^{99m}\text{Tc}$ -3PRGD2 SPECT/CT and  $^{18}\text{F}$ -FDG PET/CT to monitor the response after one cycle and three cycles of platinum-based chemotherapy. Twenty specimens from the removed lung lesions or lymph nodes were stained with  $\alpha_v\beta_3$ -integrin, CD34, and Ki-67 to correlate with the image findings.

**Results:** According to Receiver Operating Characteristic curve analysis and z statistics,  $^{99m}\text{Tc}$ -3PRGD2 SPECT/CT showed a significantly higher value than  $^{18}\text{F}$ -FDG PET/CT in assessing lymph node metastasis ( $z = 8.0$ ,  $P < 0.001$ ), which highlighted a significantly higher specificity (94.6% versus 75.0%,  $P = 0.004$ ), whereas in the diagnosis of lung lesions, no significant difference was found between the two methods ( $P = 0.410$ ). The late-stage NSCLC had significantly higher  $^{99m}\text{Tc}$ -3PRGD2 accumulation ( $P < 0.05$ ) but similar  $^{18}\text{F}$ -FDG uptake. In response evaluation, the  $^{99m}\text{Tc}$ -3PRGD2 assessment seemed relatively stable with less influence from the physiological uptake variation as commonly observed in  $^{18}\text{F}$ -FDG PET/CT. The  $^{99m}\text{Tc}$ -3PRGD2 accumulation was positively correlated with  $\alpha_v\beta_3$ -integrin receptor expression ( $r = 0.84$ ,  $P = 0.001$ ) and microvessel density ( $r = 0.63$ ,  $P = 0.011$ ).

**Conclusion:** An effective method for integrin receptor imaging of tumor is established based on the cost-effective SPECT/CT technology with  $^{99m}\text{Tc}$ -3PRGD2 as the tracer. The advantages of this method in lymph node staging, metastatic prognosis, and response evaluation merit it as an excellent technique with a promise to expand the clinical application of SPECT/CT in oncology in a broadly available, relatively low-cost manner than  $^{18}\text{F}$ -FDG PET/CT.

**CE-2-1****Development of integrated PET/MRI systems for molecular imaging**

Seiichi Yamamoto

Department of Radiological and Medical Laboratory Sciences, Nagoya University Graduate School of Medicine, Nagoya, Japan

Collaboration group of Nagoya university and Osaka university have developed two optical fiber based integrated PET/MRI systems for small animals and two Si-PM based PET systems that can be combined with MRI systems. There are some advantages and disadvantages in optical fiber based and Si-PM based PET/MRI systems. The main advantage of the optical fiber based PET system is less or no interferences between PET and MRI and the disadvantage is the light loss of the fiber which degrades the performance of the PET. The advantage of the Si-PM based PET system is no light loss and the disadvantages are the interferences between PET and MRI and the temperature dependent sensitivity changes. From our experiences, optical fiber PET systems are suitable for combined with low magnetic field MRI systems because the signal level of these MRI systems are small and sensitive to the noise from PET systems. Si-PM PET systems are suitable for higher magnetic field MRI systems probably because the signal level is higher enough to ignore the noise from the PET systems although some interferences from RF and gradient signals may decrease the performance of the Si-PM PET systems. One of our optical fiber based PET system employed 0.5mm diameter double clad fibers which have 24mm x 24mm rectangular output and dual 12mm x 24mm rectangular inputs. Two types LGSO scintillators were optically coupled in DOI direction, arranged in 11 x 13 matrix and optically coupled to the fiber bundle. The two inputs of the bundle are bent for 90 degrees, bound to one, and is optically coupled to a Hamamatsu 1-inch square PSPMT. Eight optical fiber based block detectors were arranged in a ring to form a PET system. A 0.3T open-MRI is combined with the optical fiber PET system. The spatial resolution of the integrated PET system was 1.2mm and sensitivity was 1.2%, better than one of the Si-PM PET systems we developed. So we still feel optical fiber based PET systems are promising for new hybrid systems in which the interference with other modality is critical. Si-PM PET systems are promising for combining with high field MRIs but we need to minimize the interference between PET and MRI for both modalities.

## CE-2-2

### Clinical experiences and Current status of PET/MR imaging system in Korea

Ihnho Cho

Department of nuclear medicine, Yeungnam University Hospital, Daegu, Korea

PET/MR imaging system has evolved slowly, but steadily over the last 20 years toward an integrated system that allows physicians to have more information about metabolic, functional and anatomic state of the pathologic lesions for the diagnosis, treatment and monitoring of various diseases. Since the idea to combine PET and MRI arose as early as the mid 1990s, three model types of commercial PET/MR was developed. In Korea, Philips whole body PET/MR imaging system was installed for the first time. Since 2 years ago, Siemens integrated whole body PET/MR system with simultaneous data acquisition has been operating in two hospitals. Also GE Healthcare system, which combines PET/CT and MRI by transporting patients from one modality to another, is running in one hospital.

PET/MR imaging may show the distribution of molecular tracers with picomolar sensitivity providing information about cell metabolism and receptor status by PET and MRI supports superb soft-tissue contrast and functional information on perfusion, diffusion and metabolism without radiation exposure on the patient. PET/MR has the potential to broaden our horizons in the emerging field of molecular imaging in the oncology, neurology and cardiology because complementary anatomic and biologic information is obtained and synergism of both modalities can be expected. But this novel imaging technology should prove the impact on diagnostic accuracy, the effect on therapy management and cost-efficiency to enter clinical routine study.

In Korea, F-18 FDG PET/MR imaging is applied for staging of head and neck cancer, breast cancer, hepatic malignancy or rectal cancer. Especially integrated whole body PET/MR imaging is routine tests for noninvasive pediatric diagnostics in my hospital. Also we are trying to find potential applications of cardiac PET/MR imaging in the field of cardiology.

Health care costs of the country is going up rapidly as other countries, so the government is trying to cut imaging costs in recent years. As a result, the reimbursement for new imaging tests is difficult and needs to get large randomized trials. Our insurance coverage is applied to PET or MRI, but not fusion PET/MR imaging. So now there are a few hospitals with PET/MR scanner due to low cost-effectiveness because it requires more expensive equipment and longer acquisition times than PET/CT.

In this section, I will present the clinical experiences of fully integrated whole body PET/MR imaging and the current status of Korea.

**CE-2-3****PET/MRI: Tumor Diagnosis and Other Applications**

Hiroshi Ito

Advanced Clinical Research Center, Fukushima Medical University, Japan

PET with [ $^{18}\text{F}$ ]-FDG can measure the glucose consumption rate of tumors in vivo, and it can indicate the product of tumor cell density and energy metabolic activity. The intrinsic spatial resolution of PET camera is about 5 mm which is not sufficient to obtain morphological information. PET/CT camera, which can obtain both the glucose consumption rate and morphological images of tumors, has been widely used for diagnosis and evaluation of treatment. MRI is superior in tissue contrast as compared with CT to obtain morphological information, especially in soft tissue tumors of orthopedic field.

Recently, PET/MRI camera, a PET camera with avalanche photodiode inserted into MRI gantry, has been developed. PET/MRI camera can simultaneously obtain both the glucose consumption rate and morphological images of tumors with high tissue contrast. In our institute, PET/MRI has been used for diagnosis of tumors in head and neck, pelvic organs, and orthopedic field. Due to a high tissue contrast, the glucose consumption rate for each component of tumor including solid and cystic components etc. can be evaluated using PET/MRI. PET/MRI might also be useful to evaluate effects of treatments.

Not only morphological images but also several kinds of functional images can be measured by MRI, e.g., blood flow, oxygen consumption rate, and diffusion of water molecule. Many kinds of functional images can also be measured by PET with various radiotracers, e.g., blood flow and energy metabolism, neurotransmission functions, and pathological changes. Thus, simultaneous measurement of several kinds of functional information by PET/MRI might introduce useful information for diagnosis and evaluation of treatment. In addition, simultaneous data acquisition by PET and MRI might allow real-time motion correction in neurology field.

The attenuation correction is important procedure in reconstruction of PET images to obtain quantitative measure. In PET/MRI system, an attenuation map is calculated from water and fat images obtained from in phase and opposed phase images of gradient echo T1-weighted images, and it is segmented into four components including fat, soft tissue, lung, and air. For head, ultra-short TE sequence is also applied to obtain skull images. The accuracy of calculation of attenuation map is important factor for quantitative PET study, however, the cases of failure in calculation of attenuation map from MR images were also reported. Such limitation should be considered in use of PET/MRI.

## CE-2-4

### To standardize the reconstruction parameters for Time of Flight and Non-Time of Flight PET images for predicting best clinical PET scan interpretation: A Comparative study using NEMA IQ-NU-2001 Body Phantom

Watts Ankit, Chitkara Ajay, Sarika Sharma, Singh Baljinder

Nuclear Medicine & PET Centre, PGIMER, Chandigarh, Chandigarh

**Background:** The aim of the present study was to standardize the reconstruction parameters for TOF and Non-TOF PET data using NEMA IQ NU-2001 body phantom for prediction of a better clinical image quality.

**Materials and Methods:** The NEMA IQ NU-2001 body phantom image acquisition was acquired on a Discovery PET/CT 710 and Discovery STE 16 PET systems. The typical background volume of phantom was 9830 cc and according to NEMA protocol amount of activity to be present at scan time was 1.5mCi that corresponds to activity concentration of 5.3kBq/cc. The hot Spheres volume was approximately 20 cc. We filled the phantom in 4:1 concentration ratio between the hot spheres and the background volume. PET data were acquired in 3-dimensional mode and were reconstructed with the baseline ordered-subsets expectation maximization (OSEM) algorithm, with the OSEM+NON-TOF (LYSO and BGO crystals) and OSEM+TOF (LYSO crystal) model. The default reconstruction parameter for the study were 3 iterations, 24 subsets and post-smoothing filter of 6mm was used in all reconstruction models. The image matrix was 128\*128, with 5.46mm pixels. The PET image slice thickness was 3.3mm. In a phantom study, we varied the number of iterations and number of subsets in both reconstruction models.

**Results:** Reconstruction parameters for acquired NEMA-IQ-Body Phantom PET images were standardized for LYSO and BGO based PET scanners by applying up to 10-iterations (OSEM-method). The image quality of reconstructed PET images was found to be best at 2<sup>nd</sup> iteration both for TOF (LYSO) and Non-TOF (BGO). The image quality of reconstructed PET images was found to be best at 3<sup>rd</sup> iteration for Non-TOF (LYSO). A qualitative image assessment by TOF – provided improved image resolution, definition of small lesions and image uniformity. PET images obtained by TOF were found to have higher signal to noise ratio as compared to both Non-TOF (LYSO & BGO). TOF- PET images showed higher CRC and lower BV (Noise) values for the smallest sphere (10mm) as compared to Non-TOF (LYSO & BGO).

**Conclusion:** The TOF reconstruction consistently resulted in improved image quality, resolution, image details, uniformity and definition of small lesions. A periodic performance checking of PET scanners using NEMA recommended -IQ PET Body phantom should be employed for predicting the best clinical image interpretation.



**CE-3-1****Current state and future perspectives for molecular imaging and therapy of prostate cancer; beyond the era of bone scans to theranostics**

Sumbul Zaheer, Winnie Lam, Wong Wai Yin, Anthony Goh, David Ng

Department of Nuclear Medicine and PET, Singapore General Hospital

**Background:** Prostate cancer causes significant morbidity in men over age 50 years and is one of the leading causes of cancer death in men worldwide, and it is imperative to keep pace with the recent rapid developments relating to prostate cancer imaging and therapy.

**Description and learning points:** The presentation is an educational exhibit providing a summary of the most recent developments in the field of Nuclear Medicine relating to molecular imaging and therapy of prostate cancer.

Included are brief description and interesting examples with images of the latest procedures for prostate cancer diagnosis, including

- F-18-Fluorocholine dual time point PET/CT imaging performed regularly in our institution and is becoming standard of care for detection of recurrence after initial therapy
- Prostate specific membrane antigen (PSMA) based imaging, with both Ga-68-labelled ligands and F-18 based compounds (e.g. DCFBC and e.g. the high affinity PSMA-avid small molecules I-123-MIP-1072 and I-123-MIP-1095)
- Role of the novel amino-acid PET/CT tracer F-18-FACBC (F-18-fluorocyclobutanecarboxylic acid)
- Exploration of renewed interest in use of F-18-NaF PET/CT for early detection of bone metastases

Also included are the recent exciting developments in therapy of prostate cancer with PSMA based therapeutic agents (e.g. Lu-177 labeled J591) and I-124/I-131 labeled small molecule (MIP-1095).

**CE-3-2****The experimental study on the labeling of antisense oligonucleotide from U87-EGFRvIII glioma cells with  $^{188}\text{Re}$** 

LI Guiping, QI Yongshuai, HUANG Baodan, DU Li, ZHANG Hui, HUANG Kai

Department of Nuclear Medicine, Nanfang Hospital, Southern Medical University, Guangzhou, China

**Background:** Gliomas, originating from glial cells, are the most common neoplasms affecting the central nervous system and glioblastoma multiforme is the most malignant subtype of glioma. The classical subtype of glioblastoma is defined by EGFR gene amplification, and glioblastomas bearing EGFR amplifications often express EGFRvIII. This suggests that EGFRvIII may operate as critical drivers in the genesis of glioblastoma, hence representing ideal targets for targeted anticancer therapies. The purpose of this study was to establish a radiolabeling method of antisense oligonucleotide ( $\text{U}_2$ ) from U87-EGFRvIII glioma cells with radionuclide rhenium ( $^{188}\text{Re}$ ) and to investigate the possibility of using  $^{188}\text{Re}\text{-U}_2$  as imaging agents for brain glioma.

**Materials and Methods:** A high affinity of antisense oligonucleotide sequences  $\text{U}_2$  from U87-EGFRvIII glioma cells was screened by the cell systematic evolution of ligands by exponential enrichment, and was directly labeled with  $^{188}\text{Re}$ . The optimal labeling condition and stability in vitro were investigated by an orthogonal experimental design method. Labeling rates was determined by paper chromatography. Blood radioactivity clearance of  $^{188}\text{Re}\text{-U}_2$  in rabbits was evaluated by determining blood radioactive concentrations at different time point after injection of  $^{188}\text{Re}\text{-U}_2$ , and its dynamic distribution was investigated by SPECT imaging.

**Result:** Antisense oligonucleotide ( $\text{U}_2$ ) was successfully radiolabeled with  $^{188}\text{Re}$  and the labeling rate of  $^{188}\text{Re}\text{-U}_2$  was  $70\%\pm 14\%$ . After purification of the labeled  $^{188}\text{Re}\text{-U}_2$  with Sep-PaK C18 reversed phase extraction cartridge, the radiochemical purity was 70.6% after placing in physiological saline for 24h and 95.55% after incubation at  $37^\circ\text{C}$  with human serum. SPECT imaging showed that  $^{188}\text{Re}\text{-U}_2$  could be quickly cleared from the blood in normal animals primarily through the kidneys, and the radioactivity in other tissues and organs remained low.

**Conclusion:** This method of directly labeling of antisense oligonucleotide ( $\text{U}_2$ ) with  $^{188}\text{Re}$  is simple with better labeling efficiency and stability both in vitro and in vivo, and so  $^{188}\text{Re}\text{-U}_2$  has more ideal biodistribution and biokinetics *in vivo*.

**CE-3-3****Tumor-selective particle radiation, boron neutron capture therapy**

Shin-Ichi Miyatake

Cancer Center and Department of Neurosurgery, Osaka Medical College

Boron neutron capture therapy (BNCT) in theory provides a way to selectively destroy malignant cells and spare normal cells. It is based on the nuclear capture and fission reactions that occur when boron-10, which is a nonradioactive constituent of natural elemental boron, is irradiated with low-energy thermal neutrons to yield high linear energy transfer (LET) alpha particles ( $^4\text{He}$ ) and recoiling lithium-7 ( $^7\text{Li}$ ) nuclei. In order for BNCT to be successful, a sufficient amount of  $^{10}\text{B}$  must be selectively delivered to the tumor ( $\sim 20 \mu\text{g/g}$  weight or  $\sim 10^9$  atoms/cell), and enough thermal neutrons must be absorbed by them to sustain lethal damage from the  $^{10}\text{B}(\text{n}, \alpha)^7\text{Li}$  capture reaction. Since the high LET particles have limited path lengths in tissue ( $5\text{--}9 \mu\text{m}$ ), the destructive effects of these high energy particles is limited to boron containing cells. After the accumulation of  $^{10}\text{B}$ -containing compounds into tumor cells, these cells should be irradiated by non-hazardous low-energy thermal neutrons as above. It is not necessary for us to aim only tumor cells with neutron irradiation. High LET particles destroy only  $^{10}\text{B}$ -containing cells and normal surrounding cells are preserved.

BNCT shows its potential, especially for the tumors infiltrating into normal tissues. Therefore most suitable targets of BNCT might be malignant gliomas. We applied BNCT more than 160 cases of malignant brain tumors, chiefly malignant gliomas and some high-grade meningiomas which have the infiltrating characteristics, using neutrons from atomic reactors. Prior to neutron irradiation, F-labeled boronophenylalanine (BPA) positron emission tomography has been applied to simulate the boron concentration in tumor and normal tissues. BPA is a boronated essential amino acid and selectively accumulates in tumor cells in comparison with normal cells. Also BPA is therapeutic compound itself in BNCT. Therefore the clinical effects can be anticipated just prior to neutron irradiation by this PET. Also F-BPA-PET gives us very reliable clinical effects after BNCT to discriminate tumor response and radiation necrosis. In my talk, let me introduce our clinical results of BNCT mainly in malignant brain tumors and some head and neck cancers.

Based on these reactor-based BNCT experiences and results for malignant brain tumors, now we and collaborators are applying accelerator-based BNCT for recurrent malignant gliomas, as a clinical trial to obtain on-label use from MHLW, since October 2012. This accelerator-based BNCT enables BNCT in hospital.

## Oral Sessions

### O-1-1

#### **Integrated $^{18}\text{F}$ -fluorodeoxyglucose positron emission tomography/contrast-enhanced computed tomography in the diagnosis of Primary Cardiac Tumors**

En-tao Liu, Dan Shao, Shu-xia Wang

Weilun PET Center, Department of Nuclear Medicine, Guangdong General Hospital, China

**Background:** Primary cardiac tumors are rare, and the imagine feature of positron emission tomography (PET) with  $^{18}\text{F}$ -fluorodeoxyglucose ( $^{18}\text{F}$ -FDG) is not clearly. The objective was to investigate the finding of  $^{18}\text{F}$ -FDG PET/contrast-enhanced CT (CE-CT) in the diagnosis of primary cardiac tumors.

**Materials and Methods:** 20 patients with primary cardiac tumors underwent a conventional  $^{18}\text{F}$ -FDG PET/CT scan with low-dose CT, and then had a full-dose dual-phase CT scan (arterial and venous phases) with contrast. The statistical difference between benign tumors and malignant tumors was tested by t-test to analyze maximum standardized uptake values ( $\text{SUV}_{\text{max}}$ ) and the tumor to non-tumor ratio (TNR). Paired t test was used to compare the  $\text{SUV}_{\text{max}}$  between the lessons and non-tumor region.

**Results:** All cases were single lesion and confirmed by histopathology. There was no significant difference for the average  $\text{SUV}_{\text{max}}$  of non-tumor region between benign and malignant cases ( $P=0.629$ ,  $t=0.492$ ), and between benign tumors and non-tumor region ( $P=0.281$ ,  $t=-1.146$ ). There was significant difference of average  $\text{SUV}_{\text{max}}$  between malignant tumors and non-tumor region ( $P=0.005$ ,  $t=3.892$ ). The average  $\text{SUV}_{\text{max}}$  in malignant tumors was  $6.3 \pm 3.1$  versus  $2.4 \pm 0.9$  in benign tumors ( $P<0.005$ ,  $t=-3.628$ ). The average TNR in malignant tumors was  $3.3 \pm 1.9$  versus  $1.1 \pm 0.3$  in benign tumors ( $P<0.009$ ,  $t=-3.351$ ). There was a statistically significant difference in  $\text{SUV}_{\text{max}}$  and TNR between benign tumors and malignant tumors.

**Conclusion:** Integrated  $^{18}\text{F}$ -FDG PET/CE-CT is an effective diagnostic imaging for primary cardiac tumors, especially in differentiating malignant from benign lesions in patients with primary cardiac tumors.

### O-1-2

#### **Differential Diagnosis of Diffuse Bone Marrow FDG Uptake**

Habusari Hapkido

Padjadjaran University

**Background:** Diffuse bone marrow uptake is frequently observed in  $^{18}\text{F}$ -FDG PET/CT scan, which

can caused by many conditions. The aim of this study was to describe the etiology of increasing diffuse bone marrow FDG uptake.

**Material and methods:** Sixteen patients with homogenously and diffusely increased FDG uptake on PET/CT whole body scan between January 2012 and December 2013 were evaluated to find out the etiology.

**Results:** Malignancy was observed in 14 patients and benign in 2 patients. Diffuse uptake due to hematology disorder, chemotherapy, GCSF and extra-nodal non-hodgkin lymphoma were observed in 7, 7, 1 and 1 patient respectively.

**Conclusion:** Diffuse homogenous bone marrow FDG uptake can be seen in malignant or benign disease and history of treatment.

### O-1-3

#### **FDG PET/CT total lesion glycolysis predicts prognosis in patients with operable extrahepatic biliary adenocarcinoma**

Withdrawn

### O-1-4

#### **$^{18}\text{F}$ -FDG PET-CT in restaging of patients with carcinoma of tongue and comparison with conventional imaging modalities: A single institutional experience**

Kunal Kumar

All India Institute of Medical Sciences

**Materials and Methods:** Data of 153 patients (M:125) with histopathologically confirmed carcinoma tongue who underwent FDG PET-CT for restaging after completion of treatment was analyzed. Result of PET-CT was compared with conventional imaging modalities (CT/MRI) whenever available.

**Results:** Sensitivity, specificity, positive and negative predictive values for PET-CT were 94.9%, 81.4%, 90.4% and 89.8% respectively and for CIM were 85.1%, 78.4%, 83.3% and 80.6% respectively. No significant difference was found between PET-CT and CIM for local ( $P=0.454$ ) and distant disease ( $p=0.218$ ), with superiority of PET-CT for nodal metastases ( $P=0.011$ ).

**Conclusion:** FDG PET-CT is highly sensitive and specific modality for restaging of patients with carcinoma of tongue. It performs better than CIM especially for the detection of nodal metastases.

**O-1-5****Value of  $^{18}\text{F}$ -FDG PET/CT in detecting recurrent and metastatic lesions in post-surgical differentiated thyroid carcinoma patients with high serum thyroglobulin and negative  $^{131}\text{I}$  whole - body scan**

Le Ngoc Ha, Bui Quang Bieu, Mai Hong Son

Tran Hung Dao Hospital

**Background:** In clinical practice, there were approximately 20 – 30 % of post-surgical differentiated thyroid carcinoma (DTC) patients treated with  $^{131}\text{I}$  therapy who had recurrent and metastatic lesions, that could not be detected by  $^{131}\text{I}$  whole-body scan. The purpose of our study was to evaluate value of  $^{18}\text{F}$ -FDG PET/CT in patients with high serum thyroglobulin (Tg) level and negative  $^{131}\text{I}$  whole-body scan.

**Materials and Methods:** We studied 69 post-surgical DTC patients with high serum Tg and negative  $^{131}\text{I}$  whole body scan after therapeutic doses in Department of Nuclear Medicine, Tran Hung Dao Hospital.

**Results:** 92 lesions detected in 62.3% patients with positive  $^{18}\text{F}$ -FDG PET/CT scan compared to only 39 lesions in 37.7% patients detected on CT scan. The sensitivity, accuracy and negative predictive value of  $^{18}\text{F}$ -FDG PET/CT were 87%, 88% and 76% respectively higher than those of CT (54.3%, 67.2% and 48.8%, respectively). Specificity and positive predictive value of  $^{18}\text{F}$ -FDG PET/CT (90.5% and 95.2% respectively) were similar to those of CT (95.2% and 96.2%, respectively).  $\text{SUV}_{\text{max}}$  threshold with good diagnostic value were 4.5 (sensitivity 92.3%, specificity 100%).  $^{18}\text{F}$ -FDG PET/CT had altered treatment plan in 47.8% of all patients.

**Conclusion:**  $^{18}\text{F}$ -FDG PET/CT plays an important role in detecting recurrent, metastatic lesions in post-surgical differentiated thyroid carcinoma patients with high serum Tg level and negative  $^{131}\text{I}$  whole body scan.

**O-1-6****The discrepancy between  $^{18}\text{F}$ -FDG PET/CT scan and ca 125 & anatomical imaging in ovarian cancer**

Patricia Marina

Padjadjaran University

**Background:** Several studies have shown the benefits of  $^{18}\text{F}$ -FDG PET/CT in the detection of ovarian cancer recurrence and residual compare to conventional methods. The objective was to show the discrepancies between  $^{18}\text{F}$ -FDG PET/CT scan and CA 125 &

anatomical imaging (AI) to detect suspected recurrence in ovarian cancer patients.

**Materials and Methods:** A retrospective study in patients with suspected recurrence of ovarian cancer who underwent  $^{18}\text{F}$ -FDG PET/CT scan in MRCCC-SH, between April 2011 to April 2014.

**Result:** A subject with FDG (-), but other modalities (+). In 4 subjects with FDG (+) while AI indeterminate & elevated CA 125 serum level. Two subjects with AI (+) & normal CA 125 serum level, the FDG (-). In 3 subjects, FDG (+) while AI (-) & normal CA 125 serum level.

**Conclusion:**  $^{18}\text{F}$ -FDG PET/CT scan was useful to detect recurrence in ovarian cancer, especially when conventional methods were indeterminate.

**O-1-7****Detection of recurrent STS with  $^{18}\text{F}$ -FDG PET/CT: a single institutional experience**

Ravi Kant Gupta, Ridhima B, Varun D

All India Institute of Medical Sciences

**Background:** To evaluate the utility of  $^{18}\text{F}$ -FDG PET/CT for detection of recurrent soft tissue sarcomas (STS) after successful treatment

**Materials and Methods:** PET/CT images of 45 patients (34 men) of histologically proven STS, who had been previously treated and apparently in clinical remission were included. A combination of clinico-radiological follow-up, repeat PET/CT and/or biopsy was taken as reference standard.

**Result:** Based on reference standard, 36/55 had recurrent disease. The sensitivity, specificity, positive predictive value and negative predictive value were 75%, 89.5%, 93.1%, and 65.3%, respectively. Second primary malignancy was diagnosed in 2 patients.

**Conclusion:** PET/CT can reliably detect recurrence in patients with STS who are apparently in clinical remission. Moreover, it has the utility to detect second primary malignancy.

**O-1-8**

Withdrawn

**O-1-9****Lungs on Fire: Acute Bleomycin induced pneumonitis on FDG PET-CT**

Vishal Agarwal

Medanta the Medicity hospital, India

**Background:** Bleomycin is a chemotherapeutic agent exerting its antitumor effect by inducing tumor cell

death and inhibition of tumor angiogenesis. Its most limiting factor is potentially fatal pulmonary toxicity, caused by induction of free radicals. Several distinct pulmonary syndromes are associated with it, most common being interstitial pneumonitis.

**Pathophysiology:** Due to lack of the bleomycin inactivating enzyme, Bleomycin Hydrolase in the lungs and skin, bleomycin-induced toxicity occurs predominantly in these organs. The central event in the development of BIP is endothelial damage of the lung vasculature due to bleomycin-induced cytokines and free radicals.

**Case:** 50 year-old man with Hodgkin's disease presented with shortness of breath, cough and chest pain after 4 cycles of chemotherapy, comprising doxorubicin, bleomycin, vinblastine, and dacarbazine. Interim PET-CT scan was performed which showed complete metabolic resolution of the previously noted FDG avid nodes, while diffuse FDG avid ground glass opacification and reticular pattern was seen in lower lobes of bilateral lungs, predominantly in subpleural areas.

**Conclusion:** Based on intense diffuse FDG uptake in B/L lung fields, along with clinical history and exclusion of infective etiology, diagnosis of BIP was made. FDG avidity is characteristic of acute inflammatory phase which can be treated by steroids vis-à-vis late fibrotic stage (residual lung damage) which doesn't respond. So, FDG PET is very useful in diagnosing acute phase of BIP and helping in deciding whether or not you are dealing with active disease.

## O-1-10

### Semiautomatic Internal Tumor Volume Segmentation for Positron Emission Tomography Based on Background - A Phantom Study

Yangchun Chen<sup>1,2</sup> Xiangrong Chen<sup>3</sup>, Fanyong Li<sup>2</sup>, Liu Ji-an<sup>4</sup>

1 Nuclear medicine department of Quanzhou First Hospital of Fujian Medical University, Licheng District, Quanzhou, China

2 The PET-CT Center of the first Affiliated Hospital of Guangzhou Medical University, Guangzhou, China

3 Radiology department of Quanzhou First Hospital of Fujian Medical University, Licheng District, Quanzhou, China

4 Guangdong Provincial Key Laboratory of Micro-nano Manufacturing Technology and Equipment, Guangdong University of Technology, Guangzhou, China

**Background:** A threshold value (ThV) to outline the internal tumor volume (ITV) of lung cancer computed by a SUV in the background was evaluated.

**Materials and Methods:** Three vacuous models filled with 55.0 kBq/mL [<sup>18</sup>F]-FDG representing a tumor and fixed in a barrel filled with 5.9 kBq/mL [<sup>18</sup>F]-FDG representing the background served as a phantom simulating breathing, while its PET/CT data were acquired. The SUV in the background was  $X \pm SD$ .

X+2SD and X+3SD were employed as ThVs to obtain ITVs. To evaluate our methods, the Dice similarity coefficient and volume recovery coefficient variables were used to evaluate the accuracy of the ITVs measured by eight methods using a nested analysis of variance and paired t-test.

**Results:** The analysis showed that these eight methods of ITV segmentation had significantly different results ( $P < 0.01$ ). Moreover, X+2SD and X+3SD and the method of Riegel et al. surpassed the results of the other five published methods.

**Conclusion:** The ThV of the SUV determined by the background has potential to delineate the ITV of lung cancer.

## O-2-1

### Primary brain tumor recurrence detection: comparative study between <sup>99m</sup>Tc-methionine and <sup>11</sup>C-methionine

Aashish Gambhir, Abhinav Jaimini, Amit Kumar, Sonia M Dinesh, Rajnish Sharma, Anupam Mondal

Molecular Imaging and Research Centre, Institute of Nuclear Medicine and Allied Sciences, New Delhi, India

**Background:** Uptake of C-11 methionine and Tc-99m methionine in brain tumor is still uncertain, but the most theories describe combination of passive diffusion through the damaged blood-brain-barrier and carrier mediated active tumor uptake due to an increased protein synthesis. We review our experience of <sup>11</sup>C methionine and <sup>99m</sup>Tc-methionine in detection of recurrent primary brain tumor.

**Materials and Methods:** 18 patients (10 males, 8 females) age 30-55 years' post therapy were sent for recurrence evaluation. All patients underwent C-11 Methionine PET/CT and Tc-99m Methionine SPECT/CT scans on two different days.

**Results:** C-11 methionine images were assessed visually and by SUV calculation. Tc-99m methionine images were visually assessed and tumor to background ratio calculated. Both were found to show tracer accumulation at sites of residual/recurrent tumor in all cases.

**Conclusion:** Our study reveals that Tc-99m methionine can be used as an alternative tracer to C-11 methionine in the evaluation of brain tumors suspected of residual or recurrence.



## O-2-2

### Imaging of gastroenteropancreatic neuroendocrine tumors (GEP-NETs) using $^{68}\text{Ga}$ -DOTA-NOC, $^{18}\text{F}$ -DOPA and $^{18}\text{F}$ -FDG PET/CT.

Abhishek Kumar

All India Institute of Medical Sciences

**Background:** To compare  $^{68}\text{Ga}$ -DOTA-NOC,  $^{18}\text{F}$ -DOPA and  $^{18}\text{F}$ -FDG PET/CT PET radiotracers in imaging of GEP-NETs.

**Materials and Methods:** 86 patients with definite histological diagnosis of GEP-NET who underwent both  $^{68}\text{Ga}$ -DOTA-NOC and  $^{18}\text{F}$ -DOPA PET-CT (group I, n=32) or  $^{68}\text{Ga}$ -DOTA-NOC and  $^{18}\text{F}$ -FDG PET-CT (group II, n=54) were selected for this retrospective study.

**Result:** In group I  $^{68}\text{Ga}$ -DOTA-NOC is superior to  $^{18}\text{F}$ -DOPA on patient wise and region wise analysis ( $P<0.0001$ ). In group II  $^{68}\text{Ga}$ -DOTA-NOC is superior to  $^{18}\text{F}$ -FDG on patient-wise analysis ( $P<0.0001$ ). Region wise,  $^{68}\text{Ga}$ -DOTA-NOC is superior to  $^{18}\text{F}$ -FDG only for lymph node metastases ( $P<0.003$ ).

**Conclusion:**  $^{68}\text{Ga}$ -DOTA-NOC seems to be superior to  $^{18}\text{F}$ -DOPA and  $^{18}\text{F}$ -FDG PET-CT for imaging GEP-NETs.

## O-2-3

### The Influence of P-glycoprotein and Ulcer to Tc-99m MIBI Retention Index In Locally Advanced Breast Cancer

Alvita Dewi Siswoyo

Department of Nuclear Medicine and Molecular Imaging RS. Hasan Sadikin / Padjajaran University Bandung

**Background:** Uptake of MIBI depends on tissue blood flow, electrical gradient, and cellularity; its retention was influenced by Pgp expression. Ulcer in fungating breast cancer can influence Tc-99m MIBI uptake. The objective was to analyze influence of ulcer and Pgp expression to Tc-99m MIBI uptake in LABC patients.

**Materials and Methods:** 28 inoperable LABC patients underwent Tc-99m MIBI dual phase scintigraphy. Early (10 min) and delayed (240 min) planar breast views were acquired after a 740-925 MBq Tc-99m MIBI intravenous injection. Expression of Pgp was assessed by IHC.

**Results:** There were significantly different of retention index Tc-99m MIBI in 4 groups (group 1: ulcer-high Pgp, group 2: ulcer-low Pgp, group 3: non ulcer-high Pgp, group 4: non ulcer-low Pgp; (-0.133±0.101, -0.112±0.115, -0.27±0.057, -0.225±0.087;  $p=0.011$ ). The difference between group subjects with ulcer as well as non-ulcer to subjects Pgp expression low and high were significant, conversely there were no significant difference of subjects with low as well as high Pgp expression to subject combination with ulcer and non-ulcer.

**Conclusion:** Retention index of Tc-99m MIBI in subjects with low Pgp expression were significantly higher than subject with high Pgp expression. Difference Tc-99m MIBI retention index was more influenced by Pgp expression than presence of ulcer.

## O-2-4

### Clinical characteristics and preliminary evaluation of empirical $^{131}\text{I}$ therapy in differentiated thyroid carcinoma patients with negative $^{131}\text{I}$ whole-body scan and elevated serum thyroglobulin

Le Ngoc Ha, Nguyen Thi Nhung, Mai Hong Son, Bui Quang Bieu

Tran Hung Dao Hospital

**Background:** Treatment and outcome of differentiated thyroid carcinoma (DTC) patients who had negative  $^{131}\text{I}$  whole body scan (WBS) and high serum thyroglobulin (Tg) concentrations take much debate on clinical practice. The aim of our study was to evaluate clinical characteristics and preliminary result of patients with negative diagnostic  $^{131}\text{I}$  WBS and increased serum Tg concentrations (during thyroid hormone withdrawal).

**Materials and Methods:** 140 DTC patients with negative diagnostic  $^{131}\text{I}$  WBS and Tg level >10 ng/ml were enrolled in the study.

**Results:** The presence of  $^{131}\text{I}$  uptake in post-therapy WBS was seen in thyroid beds 46.2 %, mediastinum 29.5 %, lungs 19.2 % and cervical lymph nodes 5.1%. There was no significant difference between the number of lesions detected in post-therapy  $^{131}\text{I}$  WBS and CT scan. However, cervical lymph nodes were detected more frequently in CT than that of the post-therapy WBS. On the contrary, post-therapy  $^{131}\text{I}$  WBS can detect more lesions in thyroid beds, lungs and mediastinum. After 12-month empirical  $^{131}\text{I}$  therapy, serum Tg levels were reduced significantly. 71% of patients were complete or partial remission.

**Conclusion:** Diagnostic multi-modalities should be used for detecting residual, recurrent and metastatic lesions in DTC patients with negative  $^{131}\text{I}$  WBS and elevated Tg. The empirical  $^{131}\text{I}$  therapy may be considered selected individuals of in these patients.

## O-2-5

### The Changes of Keloid Volume Post-Therapy Using P-32 Sodium Phosphate

Hapsari Indrawati

Padjajaran University

**Background:** P-32 has long been known for therapy and has characteristics that are suitable for keloid

therapy. So far there has been no record available of changes in keloid volume post-therapy with P-32. The objective was to observe post-treatment changes in keloid volume post P-32 treatment.

**Materials and Methods:** Participants were patients with keloids who received P-32 therapy. The number of lesions is determined by taking into account the estimated value of sensitivity so that the minimum total sample is 100 lesions.

**Results:** There is a significant reduction in keloids volume 2 and 3 months after treatment compared to pre-treatment volume ( $P < 0.05$ ).

**Conclusion:** Three months post-therapy is considered to be the best period to assess the response of keloid to P-32 therapy.

## O-2-6

### A Serum Predictor of Graves Disease Recurrence Following Radioactive Iodine Therapy

Kosik, Russell; Tom, Andrea; Tseng, Jeffrey

Santa Clara Valley Medical Center, Department of Nuclear Medicine, San Jose, California, USA

**Background:** Radioiodine therapy with  $^{131}\text{I}$  is the definitive treatment for Graves disease. Although success rates are relatively high, a subset of patients revert to a hyperthyroid state. In this study, we seek a serum marker that will predict the recurrence of Graves disease following radioiodine therapy.

**Materials and Methods:** All patients who underwent radioiodine therapy for Graves disease from 2005 to 2011 at our institution were examined. Multiple serum markers were collected. Recurrence of Graves disease was defined as a TSH  $< 0.01 \mu\text{IU/mL}$  following therapy. 140 patients were examined, including 104 patients who remained hypothyroid or euthyroid and 36 patients who experienced a recurrence of hyperthyroidism.

**Results:** Patients who experienced a recurrence were significantly more likely to have a greater than  $1.0 \mu\text{IU/mL}$  increase in serum T4 levels within two months post-therapy (36.1% versus 6.7%,  $P < 0.0001$ ).

**Conclusion:** Post-therapy serum T4 levels are good predictors of hyperthyroidism recurrence and should be obtained for all patients who have had radioactive iodine therapy.

## O-2-7

### $^{18}\text{F}$ -Labeled *trans*-Ferulic Acid and its evaluation as tumour imaging agent

Saikat Nandy; Avik Chakraborty; Yogita Pawar; S.H. Moghe; M.G.R. Rajan

Radiation Medicine Centre, Tata Memorial Centre Annexe, Bhabha Atomic Research Centre, Parel, Mumbai, India

**Background:** Ferulic Acid is one of the most common and well-known hydroxycinnamic acids (HCAs). Evidence that HCAs may have a potential inhibitory effect on cancer invasion and metastasis is increasingly being reported. Development of  $^{18}\text{F}$ -labeled derivative of *trans*-ferulic acid and exploring its potential as tumour imaging agent by PET.

**Materials and Methods:** *trans*-ferulic acid is successfully labeled with  $^{18}\text{F}$  by [ $^{18}\text{F}$ ] Fluoroalkylation method by a fully automated radiosynthesis procedure and Sep Pak® cartridge purification. PET/CT imaging in healthy and induced inflammation bearing rabbit were carried out for pharmacokinetic and tracer accumulation studies at inflammation sites. Bio-distribution was carried out in tumour (B16F10) bearing mice (C57BL6) for studying accumulation and retention of the tracer in tumour.

**Results:** The non-decay corrected radiochemical yield is  $\sim 25\%$  with  $>95\%$  radiochemical purity. PET/CT images showed complete blood, liver, gut clearance two hours post injection but showed high tracer accumulation in bone marrow, gall bladder, submandibular jaws etc. The images of two hours 45 min, showed complete clearance of the tracer from kidney and accumulation in bladder with high bone marrow uptake. The tracer does not accumulate at the inflammation sites. Bio-distribution study showed very high tracer accumulation in tumour [60 min post inj,  $5.53 \pm 0.65 \% \text{ID/g}$  ( $n = 3$ )] and retained upto two hours [ $5.68 \pm 0.29 \% \text{ID/g}$  ( $n = 3$ )].

**Conclusion:** The favourable pharmacokinetic as well as tumour localization and retention characteristics of the  $^{18}\text{F}$ -labeled *trans*-ferulic acid warrants further evaluation as a PET radiotracer for imaging tumour.

## O-2-8

### In vivo tracking of polycaprolacton micro-/nanoparticles using positron emission tomography imaging. Preparation, fractionation and surface modification

Stephan Maus

Department of Nuclear Medicine, University Medical Centre Mainz, Germany

**Background:** Particles are promising tools for imaging, targeting and delivery in tumor therapy. A rapid manufacturing of compact particles avoiding



the use of potentially toxic solvents is desirable. The preparation, fractionation, surface modification, radioactive labeling and biodistribution of solid polymeric microspheres based on biodegradable PCL was reported.

**Materials and Methods:** The production based on the emulsification of the molten polymer in an aqueous phase. Centrifugation was used to fractionate particles according to size. The surface was modified by aminolysis, conjugation of a chelator and labeling with  $^{68}\text{Ga}$ . Animal experiments were performed to visualize the biodistribution of the radiolabelled particles.

**Results:** Particles could manufacture using a melting method and the double- emulsion technique. Fractionation by centrifugation resulted in yields of 91 %. Only particles with less than 1  $\mu\text{m}$  were modified and labeled with  $^{68}\text{Ga}$  obtaining radiochemical yields of  $66 \pm 5$  %. The animal experiment showed that a negligible percentage of particles which were retained in the lung capillaries. Clearance of particles from the bloodstream occurred within 30-45 min.

**Conclusion:** The combination of size fractionation and chemical modification via surface aminolysis provides the opportunity for radio labeled particles and provides further potential in view of the conjugation of specific ligand's to the particles that enables the directed targeting of tumors.

## O-2-9

### Finger Dose measurement for Radiation worker at PET/ Cyclotron Center

Afshan Ashfaq<sup>1</sup>, Ahmad Qureshy, Numair Younis, Abubaker Shahid and Maqsood Ahmad<sup>2</sup>

1 Institute of Nuclear Medicine & Oncology (INMOL), Pakistan

2 Centre for High Energy Physics, University of the Punjab, Pakistan

**Background:** The US Pharmacopoeia and Good Manufacturing Practice describe a number of quality control tests that should be executed before release of FDG for human use. The key attention is to determine the finger dose of radiation worker during quality control of FDG and FDG administration to patients.

**Materials and Methods:** The finger doses received by eight workers were measured using TLD ring dosimeter on the right hand during routine quality control and patient injection. A total of two years data were obtained for the dispensing of the quality control samples for pH, gas chromatography, thin layer chromatography, endotoxin test, multi-channel analyzer test, Kryptofix test and high performance liquid chromatography.

**Results:** The average total dose for the completion of all tests was 19 mSv per month for quality control procedures and 6mSv per month in patient injection

respectively. The radiation workers involved in quality control of FDG received 3 times more doses as compared to radiation worker injecting patient. The radiation workers received 33% of the total dose during PH test.

**Conclusion:** Considering the finger dose these staff member should be rotated more frequently from duty place.

## O-2-10

### To optimize OSEM image reconstruction parameters (number of iterations and FWHM) for Whole body PET/CT

Akshima Sharma, A. K. Pandey, C. S. Bal, R. Kumar

Department of Nuclear Medicine, All India Institute of Medical Sciences, New Delhi, India

**Background:** The image quality of PET/CT is affected by various factors which include technical errors, Biological factors, and Physical factors. The errors due to physical factors can be reduced by using standardized image reconstruction parameters. The choice of reconstruction parameters is a trade-off between resolution and noise and has a major impact on the performance of clinically important tasks such as lesion detection. Moreover, these image reconstruction parameters are highly specific to manufacturer and scanner type thus making generalizations difficult.

**Materials and Methods:** PET/CT scan of Deluxe Jaszczak phantom filled with water having 74 MBq F-18 FDG was acquired on Biograph mCT (Siemens Healthcare) PET/CT scanner. PET scan was acquired in one bed for 5 minutes. Transverse slices were reconstructed using OSEM reconstruction method by varying FWHM from 1mm to 8 mm and for each FWHM, iterations (IT) varied from 1 to 10. The image quality of 240 mages was assessed by two nuclear medicine physicians based on 4 point scale.

**Results:** At constant iteration, increase in FWHM resulted in smooth images, but gradual decrease in image quality seen because of edge blurring. At constant FWHM, increase in number of iteration improved the contrast in the image but at the cost of inclusion of noise.

**Conclusion:** Optimized value of iteration and FWHM were found to be 4 and 2 mm respectively.

### 0-3-1

#### Cardiac mechanical dyssynchrony assessed by Equilibrium radionuclide angiography (ERNA) in patients with non-ischemic dilated cardiomyopathy (DCM) –Prediction of response to CRT

Anirban Mukherjee, ChetanD Patel, Nitish Naik, Gautam Sharma, Ambuj Roy

All India Institute of Medical Sciences India

**Background:** ERNA plays significant role in assessment of cardiac mechanical dyssynchrony (CMD) which may predict the response to Cardiac Resynchronisation therapy (CRT). The objective was to evaluate ERNA in prediction of response to CRT in patients with non-ischemic DCM.

**Materials and Methods:** ERNA and clinical evaluation was performed in 20 non-ischemic DCM patients (13 male,  $59.6 \pm 9.67$  year) before and 3 months after CRT implantation. SD of LV mean phase angle (SD LVmPA) and difference between LV and RV mPA (LV-RVmPA) were used to quantify left intraventricular synchrony and interventricular synchrony respectively. LVEF was also evaluated.

**Results:** At baseline: mean NYHA class  $3.55 \pm 0.51$  and mean LVEF  $26.95 \pm 7.2\%$ , SD LVmPA  $43.8^\circ \pm 20.6^\circ$ , LV-RVmPA  $23.9^\circ \pm 10.5^\circ$ . At 3 month follow-up 15 patients responded to CRT with improvement in NYHA class  $\geq 1$  or EF  $> 5\%$ . Responders had significantly higher SD LVmPA  $50.6^\circ \pm 19.1$  than nonresponders  $23.4^\circ \pm 7.4^\circ$  ( $P < 0.05$ ). ROC curve analysis showed 93.3% sensitivity and 80% specificity at a cut-off value of  $26^\circ$  for SD LVmPA for the prediction of response to CRT.

**Conclusion:** Baseline for SD LVmPA assessed by ERNA can predict the response to CRT.

### 0-3-2

#### Association of Coronary Flow Reserve (CFR) by Dipyridamole SPECT Mibi with Perfusion Findings and Risk factors for CAD

Deverly Tumapon, MD, Jerry Obaldo, MD

Philippine Heart Center

**Background:** Blunting of CFR may precede overt ischemia. The study aimed to correlate CFR with perfusion findings and risk factors for CAD.

**Materials and Methods:** Fifty-four consecutive patients underwent dipyridamole-rest Mibi SPECT on two separate days. CFR was computed as the quotient of myocardial blood flow (MBF= global tissue perfusion divided by arterial input function) at stress and at rest.

**Results:** CFR was significantly lower in patients with abnormal perfusion vs normals ( $p = 0.005$ ). Reduced

CFR noted in 83% of patients with normal SPECT. Lower CFR seen in hypertensive patients with LVH compared to those without LVH ( $p = 0.029$ ); likewise in DM vs no DM ( $p = 0.121$ ). Independent predictors of reduced CFR were age and extent of ischemia.

**Conclusion:** Abnormal perfusion is associated with reduced CFR. In those with normal perfusion, there is a high prevalence of reduced CFR, which may be attributed to the presence of risk factors for CAD and LVH.

### 0-3-3

#### Correlation of Perfusion and Wall Motion Abnormalities on Gated Myocardial Perfusion Scan In Patients of Coronary Artery Disease

Jaweria Gillani

Suraya Azeem Hospital, Pakistan

**Background:** Purpose of study was to find correlation between segmental perfusion defects (SPD) and wall motion defects (WMD) on Gated Myocardial Perfusion SPECT (G-MPS) in patients of coronary artery disease (CAD).

**Material and Methods:** Consenting adult patients referred for G-MPS for CAD assessment were enrolled in the study belonging both genders. Patients underwent Two days rest-stress study using 20-25mCi Tc-99m MIBI injected intravenously. Imaging was performed at Siemens E-cam gamma camera. Data was analyzed using software SPSS version 17.0.

**Results:** Of 28 patients, male to female ratio was 65% and 35%, with 21% above 50 years. 42% had single risk factor, hypertension being highest and 48% with two or more risk factors. Mean LVEF on stress and rest was 59% and 55% respectively. 20 segment analysis was used to analyze 560 segments. Stress showed 17%, 23%, 18.3%, 30%, 9.6% SPD and 17.9%, 24.3%, 19%, 29.6%, 10% WMD in the anterior, inferior, septal, lateral and apical part respectively with lateral wall showing higher number of abnormalities. Rest study showed 7.8%, 35.9%, 20.2%, 20.2%, 13.4% SPD and 13%, 33%, 18%, 24%, 12% WMD in anterior, inferior, septal, lateral and apical part respectively with inferior wall showing higher number of abnormalities.

**Conclusion:** The study shows that Chi-square correlative index was calculated to be as 0.05 at the confidence interval of 95% which is significant. CAD producing significant SPD on stress shows similar extent of WMD indicating a good correlation between perfusion and wall motion. The discordance of SPD and WMD was observed in less than 5%, probably due to cardiomyopathy, stunning and attenuation artifacts. Thus we may conclude that G-MPS can be used reliably for evaluation of LV perfusion and wall motion.

### O-3-4

#### Diagnostic value of FDG-PET/CT in thoracic aortic graft, aortic root and pulmonary stent infection

Karina Del Mundo, MD

University of Santo Tomas Hospital

Three case reports are presented to emphasize the importance of 18FDG PET-CT as part of the initial workup of patients presenting with suspicious stent graft infection. In these cases, the diagnosis of infected stents-grafts were diagnosed initially based on the abnormal uptake in the 18FDG PETCT scan.

The first patient is a case of thoracic aortic graft infection detected by 18FDG PETCT scan. Her CT angiography was negative for infection. The second patient had an aortic root abscess and prosthetic valve endocarditis as seen by abnormal uptake in the 18FDG PETCT. Her previous echocardiography was negative for any signs of infection. The third patient had pulmonary artery stent infection as suggested by the abnormal 18FDG PETCT findings. Both her trans esophageal echocardiography and trans thoracic echocardiogram were negative for any site of infection.

These cases highlight the importance of FDG PET CT in diagnosing stent graft infection in the background of negative findings in other imaging modalities. In some cases, FDG PET CT could be the most sensitive and specific test in detecting this condition. It may be used as an initial and follow up test in selected patients with stent-graft infection.

### O-3-5

#### Comparison of biventricular ejection fractions with cadmium-zinc-telluride SPECT and planar equilibrium radionuclide angiography

Yi-Chieh Chen, Mei-Fang Lo, Chi-Lun Ko, Mei-Fang Cheng

Department of Nuclear Medicine, National Taiwan University Hospital and National Taiwan University College of Medicine, Taipei, Taiwan

**Background:** Radionuclide angiography provides a simple and noninvasive method to assess ventricular function. Gated blood-pool SPECT (GBPS) on solid state cadmium-zinc-telluride (CZT) detectors has the potential to replace planar equilibrium radionuclide angiography (ERNA). The Objective was to compare the CZT SPECT with traditional planar camera for biventricular ejection fractions (LVEF and RVEF) and to assess the inter-operator variation among three different analyses.

**Materials and Methods:** 34 patients underwent 24-

frame gated ERNA with traditional gamma camera and GBPS with CZT detectors. The GBPS datasets were reframed at an LAO orientation. Both traditional and reframed planar images were analyzed to measure ejection fractions. Additionally, the GBPS studies were also processed using Cedars-Sinai Blood-Pool Gated SPECT software that automatically calculates LVEF and RVEF. Each of the three datasets was analyzed individually by two technologists.

**Results:** Comparison of LVEF from ERNA and CZT-reframe yielded excellent correlation coefficient of 0.984 and 0.959 by two operators. RVEF showed poorer correlation among three analyses. The inter-operator reproducibility of LVEF in ERNA, CZT-reframe and GBPS were good ( $r = 0.958, 0.941$  and  $0.92$  respectively) but poorer in the RVEF measurements ( $r = 0.799, 0.668$  and  $0.797$  respectively).

**Conclusion:** GBPS and CZT-reframe provided high inter-operator reproducibility and correlated well with planar ERNA in the assessment of left ventricular function.

### O-3-6

#### A preliminary study on Guinea Pig by Positron Emission Tomography with Dopamine Transporter imaging agent $^{18}\text{F}$ -FECNT

Miao Liu<sup>1</sup>, Zhengping Chen<sup>2</sup>, Xingdang Liu<sup>1\*</sup>

1 Department of Nuclear Medicine, Huashan Hospital, Fudan University, Shanghai, 200040, China

2 The Key Laboratory of Nuclear Medicine, Ministry of Health PRC, Jiangsu Institute of Nuclear Medicine, Wuxi, 214063, PR China

**Background:**  $^{18}\text{F}$ -FECNT is a potential dopamine transporters (DAT) imaging agent for its high affinity and selectivity to DAT. The aim of this study was to investigate  $^{18}\text{F}$ -FECNT distributions in guinea pig eyes, striatum, cortex and cerebellum.

**Materials and Methods:** Dynamic imaging with microPET of five tricolor guinea pigs was performed immediately after Intravenous injection of  $^{18}\text{F}$ -FECNT for 120mins, and two were extended to  $^{180}\text{min}$ . To sketch and draw ROI and time activity curve of eyes, striatum and cerebellum by software ASIPro VMTM.

**Results:** All subjects, aged 11 weeks, average weighted 256.7g, received 12.0MBq ( $323.7\mu\text{Ci}$ )  $^{18}\text{F}$ -FECNT. Drugs gathered quickly after iv in cortex, cerebellum and striatum, declined rapidly and remained stable at last. That in eyes continued to increase, peaked at about 60 min, and remained stable at a relatively high level. The drug ratio of striatum / brain at 5,15,30,60,90,120,180 min were respectively 1.31,2.04,2.27,2.10,1.94,1.56,1.22. And the retina / brain ratio were respectively 0.48,1.06,1.61,2.30,2.53,2.62,2.54.

**Conclusion:** This study demonstrated good affinity of  $^{18}\text{F}$ -FECNT to DAT in guinea pig's retina and striatum.

### O-3-7

#### FDG-PET Scan in Dementia

Ryan Yudistiro, Ivana Dewi Mulyanto, Rocksy Fransisca VS, Anyeliria Sutanto, Feliana,

Nuclear Medicine Department, MRCCC Siloam Hospital Semanggi, Universitas Pelita Harapan

**Background:** Nowadays, diagnosis of dementia is made through several clinical criteria, as in DSM IV and Petersen criteria (specificity 75% and sensitivity 31%). Thereby, a reliable and more accurate diagnostic tool is needed. One of the promising examinations is FDG-PET Scan, which have sensitivity as high as 78-97% along with specificity of 74-86%. Purpose is to describe the characteristic of FDG PET scan images in dementia patients.

**Case Report:** Ten cases of cognitive impairment was reported with 4 cases suggestive of Alzheimer dementia, 2 cases of frontotemporal dementia, 2 cases of mild cognitive impairment, 1 normal aging, and 1 cases of cognitive impairment in young adult with depression. FDG-PET Scan examination in Alzheimer dementia cases reveals significant hypometabolism particularly in frontotemporal and posterior cingulate cortex. Contrast with frontotemporal dementia results in hypometabolism of frontal, temporal, and parietotemporal area. In mild cognitive impairment examination, mild hypometabolism was found in cingulate posterior and parietotemporal cortex. In normal aging case, normal level of metabolism was discovered in most of the brain area. In the other hand, the result of cognitive impairment in young adult with depression case was hypometabolism in cingulate posterior and inferior parietal cortex.

**Conclusion:** FDG-PET Scan could be used as diagnostic tool to support the diagnosis of cognitive impairment in various levels by discovering the specific hypometabolism area in brain.

### O-3-8

#### Tc-99m DTPA UPTAKE IN PATIENT WITH GRAVES' OPTHALMOPATHY

Erwin Affandi Soeriadi

Universitas Padjadjaran, Indonesia

**Background:** Differentiation active from inactive Graves' ophthalmopathy is very important in the management of Graves' ophthalmopathy. The aim of this study is to determine the differences between Tc-99m DTPA uptake in active and inactive Graves' ophthalmopathy based on Clinical Activity Score (CAS).

**Material and Methods:** Evaluation of CAS was

conducted by an ophthalmologist on twenty seven proptosis patients (54 orbits). The patients then underwent Tc-99m DTPA orbital scan. Statistical analysis was done using the Mann-Whitney method.

**Results:** In this study showed a very significant difference in Tc-99m DTPA orbital uptake between active and inactive Graves' ophthalmopathy ( $P < 0,002$ ). Tc-99m DTPA uptake was higher in the active group compared to the inactive group.

**Conclusion:** Tc-99m DTPA orbital scan can be used to differentiated active and inactive Graves' ophthalmopathy.

### O-3-9

#### Value of $^{18}\text{F}$ -FDG PET/CT in assessing prosthetic cardiac and vascular device infections

Karina Del Mundo, Neha Kwatra, Chun K. Kim

University of Santo Tomas Hospital

Brigham Women's Hospital, Boston Children's Hospital

**Background:** Three cases are presented to emphasize the importance of  $^{18}\text{F}$ -FDG PET/CT in suspected cardiac or vascular device infections. A literature review will also be presented.

**Case Series:** The 1st patient is a case of thoracic aortic graft infection with a negative initial CT angiogram. Her  $^{18}\text{F}$ -FDG PET/CT scan showed intense focal uptake in the graft consistent with infection that was confirmed intra-operatively. The 2nd patient is a case of prosthetic valve endocarditis/abscess diagnosed by  $^{18}\text{F}$ -FDG PET/CT, who had a negative initial echocardiogram. The 3rd patient is a case of pulmonary artery stent infection diagnosed by abnormal focal FDG uptake in the stent that improved on follow-up PET after antibiotic therapy.

**Conclusion:**  $^{18}\text{F}$ -FDG PET/CT may be useful in patients with cardiac or vascular devices, particularly with negative or equivocal findings on other imaging modalities and with a high clinical suspicion.

### O-3-10

#### Diagnostic Accuracy of Tc-99m Ceftizoxime in Diagnosis of Bone Infection

Mona Abid Jafri

Rawalpindi Institute of Cardiology, Pakistan

**Background:** Ceftizoxime is a broad spectrum third generation cephalosporin. It has been successfully labeled with Tc-99m and could be utilized as an infection imaging agent. The study was conducted to evaluate the potential as a bone infection imaging agent in humans and to do comparison of  $^{99\text{m}}\text{Tc}$ -



Ceftizoxime ( $^{99m}\text{Tc}$ -CFT) with Magnetic Resonance Imaging (MRI) in the diagnosis of Osteomyelitis.

**Materials and Methods:** We studied 40 patients (14 females, 26 males, mean age: 25.4 yrs range; 2-59 yrs) suspected of having bone infections. All patients underwent 3 phase MDP bone scan and  $^{99m}\text{Tc}$ -Ceftizoxime scan.

**Results:** Out of 40 patients, who underwent  $^{99m}\text{Tc}$ -Ceftizoxime scan, 29 were positive for Osteomyelitis and 11 were negative for Osteomyelitis. Sensitivity, Specificity, Positive predictive value, Negative predictive value and Accuracy of  $^{99m}\text{Tc}$ -Ceftizoxime was 100%, 84.6%, 93%, 100% and 95% respectively and that of MRI was 100%, 50%, 91.6%, 100% and 92% respectively. Semi-quantitative analysis revealed mean T/NT ratio of ( $2.49 \pm 0.98$ ) at 60 minutes and ( $2.48 \pm 0.97$ ) at 180 minutes. No significant difference was found between the mean values of T/NT ratios.

**Conclusion:**  $^{99m}\text{Tc}$ -Ceftizoxime is highly sensitive and specific agent for the imaging bone infections.  $^{99m}\text{Tc}$ -Ceftizoxime is more specific than MRI in the diagnosis of osteomyelitis.

### O-3-11

#### Comparison Tc-99m RBC Venography with Contrast Phlebography in detecting DVT

Ryna Z Martiana, Chafied Varuna

Department of Nuclear Medicine, Pertamina Central Hospital

**Background:** The diagnosis of Deep Venous Thrombosis (DVT) in the lower limb is based on clinical signs-symptoms in conjugation with imaging studies. Contrast phlebography is accepted gold standard for detecting DVT; but it is invasive and often painful, compared with  $^{99m}\text{Tc}$ -RBC Venography. The objective was to compare  $^{99m}\text{Tc}$ -RBC Venography with contrast phlebography, in detecting DVT.

**Materials and Methods:** A retrospective study on 13 patients (6 males/7 females, aged 51-68) with suspected to have DVT. We conducted imaging with  $^{99m}\text{Tc}$ -RBC Venography and contrast phlebography on all patients.

**Results:**  $^{99m}\text{Tc}$ -RBC Venography: all of the 26 lower limbs diagnosed DVT were confirmed. Contrast phlebography: 4 lower limbs had DVT, 20 lower limbs had varicose veins, and 2 lower limbs were normal. All patients received DVT therapy.

**Conclusion:**  $^{99m}\text{Tc}$ -RBC Venography has the capability to detect DVT better than contrast phlebography.

### O-3-12

#### Comparison of Methods to Measure GFR in South Asian Population

Muhammad Sohaib

Pakistan Institute of Engineering and Applied Sciences

Scintigraphic determination of glomerular filtration rate (GFR) using  $^{99m}\text{Tc}$ -DTPA is frequently ordered by urologists. Method by Gates is most commonly used despite that its inaccuracies has been reported in several occasions. In this study we compared Gates method (GFRGates) with a Japanese formula by Inoue et al (GFRInoue) in healthy Pakistani population. In phase-I of the study GFR values by Gates and Inoue methods in 94 healthy potential kidney donors (25 females and 69 males) were compared with Russell's two plasma sample clearance method (2-PSC). In phase-II 616 healthy adults were studied for GFR using Gates and Inoue formulae, 24-hour creatinine clearance (GFRCrCl), and Cockcroft-Gault (GFRCG) methods. In phase-I Inoue's method had no statistical significant difference (p value 0.22), good correlation ( $R=0.69$ ) and least bias ( $-1.91 \text{ ml/min/1.73m}^2$ , RMSE =  $11.85 \text{ ml/min/1.73m}^2$ ) with 2-PSC. Gates method on the other hand tended to underestimate GFR by 20.90% with bias of  $25.07 \text{ ml/min/1.73m}^2$  and RMSE of 29.97. In phase II GFRInoue had better correlation with GFRGates ( $r=0.67$ ) compared with GFRCrCl ( $r=0.13$ ) and GFRCG ( $r=0.08$ ). GFRCrCl and GFRCG had wider scatters (RMSD=  $21.27$  and  $21.59 \text{ ml/min/1.73m}^2$  respectively) compared with GFRGates (RMSD= $14.53 \text{ ml/min/1.73m}^2$ ). All values of GFR tended to underestimate when compared with Inoue's method. Method by Inoue to measure GFR is more accurate in normal South Asian population.

## Poster Presentations

### P-1-1

#### FDG PET/CT in Staging, Restaging and Response Assessment of Ewing Sarcoma Family of Tumors

Amrita Tiwary

Artemis, India

**Background:** To determine the role of FDG PET/CT in staging, restaging and response assessment of Ewing's Sarcoma Family of Tumors (ESFT).

**Materials and Methods:** 37 patients of histopathologically proven ESFT were subjected to FDG PET/CT. Patient age ranged between 5-45 years with mean age of 21 yrs; male to female ratio was 4.2:1. Response was assessed as per PERCIST criteria by follow up PET/CT in 26 cases.

**Results:** Out of 37 cases, 29 cases of skeletal Ewing's sarcoma (ES)-17 spinal & 12 extra-spinal, 4 Extraskelatal Ewings (ESE), 2 Askin's tumor of chest wall & 2 PNET. There were 43.2% cases of stage IIa, 2% IIb, 2% III, 21% IVa & 29.7% IVb. SUVmax of primary lesion ranges from 2.5 to 19.3 (mean 6.1). Regional lymphnodes (57%) were most common site of metastases. Distant metastases were found in 37%, lung (21.6%) was most common site, followed by bone (18.9%). Out of 26 patients there was CMR in 9 (34.6%), PMR in 7 (26.9%), SD in 1 (3%) & PD in 9 (34.6%) cases respectively.

**Conclusion:** FDG PET/CT may be helpful tool for staging, restaging & response assessment of ESFT as well as for localization of distant metastases.

### P-1-2

#### <sup>18</sup>F-FDG PET/CT imaging in patients with cutaneous lymphoma

A. Mukherjee, P. Sharma, H. Singh, S. Suman KC, R. Kumar, C.S. Bal

A.I.I.M.S, India

**Background:** <sup>18</sup>F-FDG PET/CT can play significant role in evaluation of patients with cutaneous lymphoma. The Objective was to evaluate role of <sup>18</sup>F-FDG PET/CT in patients of cutaneous lymphoma.

**Materials and Methods:** 32 patients (52±20.5 years; M/F- 22/10) underwent 50 <sup>18</sup>F-FDG PET/CT studies were evaluated qualitatively and semiquantitatively (SUVmax). Histopathology was taken as gold standard.

**Results:** 31 PET/CT studies were positive with 93.5% Sensitivity, 89% specificity and 92% accuracy. 27 Cutaneous lesions, 17 nodal lesions, 3 splenic lesions & 1 liver lesion were noted. Sensitivity, specificity and accuracy of PET/CT for cutaneous lesions were 90%, 100% and 94%, and for nodal lesions were 100%, 94%, and 96%. Mean SUVmax of cutaneous lesions

(5.1±2.8) & nodal lesions (4.4±2.7).

**Conclusion:** FDG PET/CT has high sensitivity, specificity and accuracy in patients of cutaneous lymphoma.

### P-1-3

#### Diagnostic Performance of <sup>18</sup>F FDG PET CT in Patients Presenting With Secondary Neck Nodes From an Unknown Primary Malignancy - an institutional experience

Manjit Sarma, Shagos G. S, S. Satish, Padma S, Shanmuga Sundaram P

Department of Nuclear Medicine & PET CT, Amrita Institute of Medical Sciences and Research Centre (Amrita Vishwa Vidyapeetham), Cochin, Kerala, India

**Background:** In many patients presenting with neck nodal metastases from an unknown primary the primary tumor remains occult even after thorough imaging investigations. We aimed to evaluate the diagnostic performance of FDG PET CT in patients with recently detected neck nodal metastases from unknown primary.

**Materials and Method:** Study included 38 patients (male: female=30:8, age range=32-80 years, mean age=57.9 ± 13.39 years) with one or more palpable cytologically /histopathologically confirmed malignant neck node(s). A standard protocol for whole body FDG PET CT was followed.

**Results:** Distribution of primary tumor sites identified by PET CT included nasopharynx in 3 patients (27.2%), tonsils in 2 (18.6%), esophagus in 2 (18.6%), pancreas in 2 (18.6%), base of the tongue in 1 (9.0%) and breast in 1 patient (9.0%). Detection rate, sensitivity, specificity, PPV, NPV and false positivity rates were respectively 28.9 %, 100%, 77.7 %, 64.7%, 100% and 22.2%. FDG PET CT study also detected other lymphnodal and organ metastases in 42% patients (16/38 patients).

**Conclusion:** <sup>18</sup>F-FDG PET CT is an useful modality for detecting unknown primary with lymph nodal metastases in neck from an unknown primary malignancy.

## P-1-4

### Isolated skeletal muscle metastatic deposit in a patient with micropapillary carcinoma thyroid identified on $^{18}\text{F}$ FDG PET CT – A Case Report

Manjit Sarma, Shagos G. S, S. Satish, Padma S, Shanmuga Sundaram P

Department of Nuclear Medicine & PET CT, Amrita Institute of Medical Sciences and Research Centre (Amrita Vishwa Vidyapeetham), Cochin, Kerala, India

Micropapillary carcinoma of thyroid are said to be low risk differentiated thyroid malignancy with excellent prognosis. We report the identification of an isolated FDG avid muscle deposit in a treated case of micropapillary carcinoma of right lobe and widely invasive follicular carcinoma of left lobe thyroid gland. Patient was found to have an elevated thyroglobulin level with negative iodine scan (TENIS syndrome) on follow up at 6 months. An  $^{18}\text{F}$  FDG PET CT (18 fluorine-fluorodeoxyglucose positron emission computed tomography) whole body study was suggested. PET CT study revealed a solitary FDG avid deltoid muscle deposit which was histopathologically confirmed to be metastatic papillary carcinoma. While Follicular carcinoma is known to have distant metastases, this is may be the first reported case of solitary skeletal metastases from micropapillary carcinoma of thyroid and probably the second reported skeletal muscle deposit from DTC detected on  $^{18}\text{F}$  FDG PET CT done following elevated thyroglobulin level and negative  $^{131}\text{I}$  iodine WB scan (TENIS). This case also assumes importance because it demonstrates possibility of metastases even from a micropapillary carcinoma in contrast to American Thyroid Association guidelines (2009) which suggests that micropapillary carcinoma of thyroid does not merit further treatment after a Total Thyroidectomy.

## P-1-5

### F-18 FDG PET/CT imaging in Identifying Primary Cancer in Patients with Cancer of Unknown Primary (CUP)

S Meutia, B Darmawan and H Budiawan

Padjadjaran University

**Background:** PET is a functional imaging that shows biodistribution of F-18 FDG in cancer cells. The aim of this study was to find out the value of F-18 FDG PET/CT in identifying the primary tumors in patients suffering from cancer of unknown primary.

**Materials and Methods:** 73 patients (40 men and 33 women; mean age 53 years) with CUP were referred to MRCCC-SH for F-18 FDG PET/CT scan. Quantitative SUV max  $\geq 2.5$  of suggested primary tumor and

qualitative analysis using pattern metastatic sites of lymph node consider to be primary tumor site.

**Results:** 7 of 73 patients was in negative, 7 in equivocal and 59 in primary tumor suggested malignancy. F-18 FDG PET/CT imaging showed positive findings for possible location of primary tumor; 3 in nasopharynx, 2 in oropharynx, 3 in thyroid nodule, 2 in breast, 24 in lung, 3 in gastric, 4 in liver, 4 in pancreas, 1 in kidney, 3 in colon, 2 in ovary, 1 in rectum, 4 in lymph node and 3 in bone

**Conclusion:** F-18 FDG PET/CT can be used as a biopsy guidance to detect the primary tumor in CUP.

## P-1-6

### Can FDG PET/CT predict I-131 therapy outcome in patients with differentiated thyroid cancer?

Sachin Jain, Ajiv Mishra, Aftab Hasan Nazar, Chandrasekhar Bal

Nuclear Medicine, AIIMS, New Delhi, India

**Background:** To find any association between  $^{18}\text{F}$  FDG avidity and radioiodine ablation/treatment outcome in patients having differentiated thyroid cancer

**Materials and methods:** We prospectively recruited 45 patients of DTC, who were referred for RIA after either total thyroidectomy or hemithyroidectomy followed by completion thyroidectomy. All 45 patients underwent both DxWBS and  $^{18}\text{F}$  FDG PET/CT scan before radioiodine therapy. RAI treatment was done based on the result of I-131 WBS.

**Results:** 40 patients had significant radioiodine uptake in DxWBS and 5 were negative.  $^{18}\text{F}$  FDG PET/CT scan was positive in 26 (57.8%) and negative in 19 patients. Twenty-nine (64.4%) patients showed concordant scan finding; both scans were positive in 25 and both scans were negative in 4 patients. Regarding discordant scan findings- 15 patients had positive DxWBS but negative  $^{18}\text{F}$  FDG PET/CT scan and only 1 patient was DxWBS negative but  $^{18}\text{F}$  FDG positive. In 15  $^{18}\text{F}$  FDG PET/CT negative patients, all 15 patients achieved remission in one dose. In 25  $^{18}\text{F}$  FDG PET/CT positive patients, only 9 patients achieved remission in one dose while remission in 8 patients required more than one dose where as other 8 patients still had persistent disease. Patients with positive FDG PET/CT scans who required more than one dose for remission or still had persistent disease had  $\text{SUV}_{\text{max}} > 4.6$  ( $p=0.001$ ). 7 out of 9 (77.8%) patients with positive  $^{18}\text{F}$  FDG PET/CT who got remission in one dose had  $\text{SUV}_{\text{max}} < 4.6$ .

**Conclusion:** FDG PET/CT could be a prognostic marker in the initial evaluation of patients with DTC.

**P-1-7****Management impact of <sup>18</sup>F FDG PET/CT in Carcinoma of Unknown Primary**

Withdrawn

**P-1-8****Can we predict microvascular invasion in HCC on FDG PET-CT?**

Vishal Agarwal

Medanta the Medicity hospital, India

**Background:** The purpose of this study is to correlate clinicopathologic and PET-CT parameters with the presence of microvascular invasion (MVI) at histopathologic examination (HPE) in patients with hepatocellular carcinoma (HCC) who underwent liver transplantation.

**Materials and Methods:** We assessed 224 patients with HCC undergoing liver transplantation and a pre-transplant PET-CT. Three physicians (two nuclear physicians and one radiologist) analyzed the following tumor parameters in consensus: size, multi-focality, pattern of uptake, quantitative FDG uptake (SUV), pattern of enhancement and distance to closest vessel. The size and number of lesions, tumor differentiation and the presence or absence of microvascular invasion were determined at HPE and these findings were analysed vis-a-vis to the imaging parameters on PET-CT.

**Results:** None of the clinical parameters was predictive of MVI; however on uni-variate analysis, MVI was significantly associated with multi-focality, uptake pattern and distance to the closest vessel on FDG PET-CT. By applying multiple logistic regression analysis, uptake pattern (heterogeneous and peripheral FDG uptake) was found to be the only independent risk factor for MVI.

**Conclusion:** Heterogeneous and peripheral FDG uptake on PET-CT was the only parameter that correlated significantly with MVI.

**P-1-9****Coexistence of hepatocellular carcinoma (HCC) and c-Kit positive gastrointestinal stromal tumor (GIST): a case report.**

Vishal Agarwal

Medanta the Medicity hospital, India

**Background:** A past history of sporadic solid cancers is disclosed in 10% of gastrointestinal stromal tumor (GIST) patients. Simultaneous occurrence with other malignancies is encountered in 14 to 16%, but the

synchronous occurrence of GIST and hepatocellular carcinoma (HCC) has been reported only once in the English literature.

**Case:** A 62-year-old male patient presented for evaluation of cirrhosis and suspected HCC in view of raised AFP. On the FDG PET-triphasic CT, done for staging workup, a non-FDG avid area was noted in segment 4 which was hypervascular on the arterial phase with a corresponding wash out. Abutting the lesser curvature of stomach, another non-FDG avid exophytic polypoidal mass with heterogeneous hypervascular enhancement was noted.

**Results:** A non FDG avid exophytic hypervascular enhancing mass arising from the lesser curvature of stomach was suggested to be GIST with possible diagnostic considerations for the non FDG avid arterial phase enhancing focal lesion in segment IV of liver included hypervascular metastatic deposit / De novo HCC. Endoscopic/ histopathological correlation was advised which confirmed the omental lesion to be GIST and liver lesion to be HCC.

**Conclusion:** Patient coming for HCC staging in whom a synchronous exophytic hypervascular omental GIST, adjacent to the lesser curvature of the stomach was incidentally discovered, is a rare case of simultaneous two primaries involving the GIST and HCC.

**P-1-10****Primary Malignant Melanoma of Vagina on FDG PET-CT: A rare entity**

Vishal Agarwal

Medanta the Medicity hospital, India

**Background:** Melanoma is the most serious form of skin cancer. Some melanomas may also arise from the mucosal epithelium lining the respiratory, alimentary and genitourinary tracts; all of which contain melanocytes besides the skin. These melanomas are called mucosal melanomas and they are rare, account for approximately 1 percent of all melanomas. An estimated 20% of mucosal melanomas are multifocal, compared with less than 5% of those arising in the skin, and approximately 40% of mucosal melanomas are amelanotic, compared with less than 10% of cutaneous melanomas. Melanomas arising from the female urogenital tract occur primarily in the vulva and vagina.

**Case:** A 65-year-old woman presented with vaginal discharge for past 1 year and vaginal bleeding for past 1 month. On examination, a cauliflower like growth was noted arising from the lateral wall. Patient was referred for local MR and whole body PET-CT scanning.

**Results:** WB FDG PET-CT examination revealed FDG avid localized growth arising from the anterior wall in the upper vagina, with defined fat planes with adjacent structures. On biopsy and IHC staining,



malignant melanoma was confirmed as it was negative for cytokeratin and positive for S-100 and HMB-45.

**Conclusion:** Primary malignant melanoma of the vagina is an aggressive and extremely rare malignancy with worse prognosis than those arising from cutaneous sites. This is probably the first reported case of primary vaginal malignant melanoma on FDG PET-CT imaging.

## P-1-11

### Solitary metastatic focus in parotid on FDG PET-CT in treated patient of urinary bladder cancer

Vishal Agarwal

Medanta the Medicity hospital, India

**Background:** Bladder cancer usually spreads via the lymphatic and hematogenous routes, the most common sites of metastases being the regional lymph nodes, liver, lung, bone, peritoneum, pleura, kidney, adrenal gland and intestines.

**Materials and Methods:** The lymph node drainage from the superior part of the bladder passes to the external iliac lymph nodes, and those from the inferior part of the bladder pass to the internal iliac nodes. Some lymphatic vessels from the neck region of the bladder drain into the sacral or common iliac lymph nodes. In a report of 107 patients, the most common site of metastasis of UBC was the regional lymph nodes (78%) followed by liver (38%), lung (36%), bone (27%), adrenal gland (21%), and intestine (13%). Metastases to the head and neck area occur in very low rate, according to a retrospective autopsy study. Hesson et al. retrospectively reviewed 845 cases of urogenital tract tumors for metastases to the head and neck area and only 3 cases had metastasis with UBC in origin.

**Conclusions:** To the best of author's knowledge, this is the first reported case of UBC with parotid gland metastases, that too solitary.

## P-1-12

### Cholangiocarcinoma with metastases to breast: Rarer than the rare entity

Vishal Agarwal

Medanta the Medicity hospital, India

**Background:** With over 1 million new cases in the world each year, breast cancer is the most common malignancy in women, and accounts for 18% of all female cancers. However, metastatic involvement of the breast is relatively rare, most common causes being contralateral breast cancer, malignant

melanoma, lymphoma and lung cancer. Autopsy reports indicate an incidence of 1.7% to 6.6% for non-primary breast malignancy.

**Case:** We present a young female of age 35 years with a liver mass and altered liver function tests. On FDG PET-CT examination, FDG avid heterogeneously enhancing irregular lesion was noted in the right breast with another FDG avid peripherally enhancing rounded lesion in the left breast. Liver showed a peripherally enhancing FDG avid SOL in segment V, VIII and IV, with ill-defined margins and irregular peripheral enhancement & lobular outline.

**Results:** In view of hypermetabolic heterogeneously enhancing lesions in B/L breasts and FDG avid peripherally enhancing SOL in liver, diagnoses of metastatic Ca. breast was suggested and pathologic correlation was advised. However, HPE of right breast lesion confirmed it to be metastatic carcinoma rather than the primary of breast.

**Conclusion:** Cholangiocarcinoma is a slow growing rare, malignant tumor of the bile duct, accounting for less than 1% of all cancers. Mostly, it spreads locally via the lymphatics to regional lymphnodes. Metastatic focus in the breast is a very rare presentation, this being probably the first reported case.

## P-1-13

### <sup>18</sup>F FDG Kinetics In Tuberculosis And Lung Carcinoma And Dual Time Point Imaging: A Prospective Analysis

V. Vijayant

Department of Nuclear Medicine, Rajiv Gandhi Cancer Institute & Research Centre, Delhi, India

**Background:** It is hypothesized that various cell types exhibit varying rates of glucose uptake and metabolism and its measurement at any two time points may prove to be helpful in differentiating between infective and malignant lesions. The objective was to evaluate the kinetics of <sup>18</sup>F FDG PET/CT in pulmonary tuberculosis and malignant lung lesions with an aim for characterization in this prospective study, utilizing whole body PET CT with dual time point imaging.

**Materials and Methods:** Sixty nine patients with primary neoplastic or infective pulmonary and extra pulmonary pathologies were included in the study. 37 were proved case of tuberculosis, whereas 32 were of proved case of carcinoma lung. Standard whole body PET acquisition and delayed regional imaging (at 3 hours) protocols were used. The percentage (%) change in SUV<sub>max</sub> and mean  $\pm$  SD were calculated in both groups of patients.

**Results:** Evaluation of initial scans: There is statistically significant difference between SUV<sub>max</sub> of benign and malignant lesions. For pulmonary lesions  $P=0.00025$  and for extra pulmonary lesions  $P=0.04$ . Evaluation of delayed scans: There is

statistically significant difference between  $SUV_{max}$  of benign and malignant lesions for delayed scans also. For pulmonary lesions  $P=0.00027$  and for extra pulmonary lesions  $P=0.03$ . It was seen that infective and malignant pulmonary lesions have statistically significant difference in  $SUV_{max}$  irrespective of the time point as compared to extrapulmonary lesions which did not show statistically significant difference.

**Conclusion:** The malignant pulmonary lesions have higher metabolism with different CT imaging patterns as compared to the pulmonary tuberculosis. However extra pulmonary lesions do not show such statistically significant difference. There is no clinically significant additional information in the dual time point images either in pulmonary or extra pulmonary lesions and can thus be avoided.

### P-1-14

#### Delineation of gross tumor volume based on PET images by a numerical approximation scheme

Yangchun Chen<sup>1,2</sup> Xiangrong Chen<sup>3</sup> Fanyong Li<sup>2</sup>, Liu Ji-an<sup>4</sup>

1. Nuclear medicine department of Quanzhou First Hospital of Fujian Medical University, Quanzhou, China
2. The PET-CT Center of the first Affiliated Hospital of Guangzhou Medical University, Guangzhou, China
3. Radiology department of Quanzhou First Hospital of Fujian Medical University, Quanzhou, China
4. Guangdong Provincial Key Laboratory of Micro-nano Manufacturing Technology and Equipment, Guangdong University of Technology, Guangzhou, China

**Background:** A scheme, named SUV\_Shape, for the tumor delineation was evaluated in this study.

**Materials and Methods:** Seven vacuous plastic balls filled with [ $^{18}F$ ]-FDG solution as tumor were acquired by a PET/CT. The volume of each ball was measured by SUV\_Shape and a balance, labeled as GTVs and GTVt. Five rabbits implanted VX2 tumors were acquired by [ $^{18}F$ ]-FDG PET/CT. These rabbits were mercy killed within 24h after acquisition. VX2 tumors' volumes were measured by SUV\_Shape, and caliper, labeled as GTVs and GTVt. The correlation coefficient between GTVs and GTVt were done.

**Results:** The volume of each ball confirmed by the balance was 0.56, 1.26, 5.88, 11.74, 21.30, 64.56, 179.50 mL. Twelve VX2 tumors were measured; their GTVt ranged from 0.11mL to 29.26mL. The Spearman's rho between GTVt and GTVs were 0.96 and 0.89 for phantom and animal tumor models, respectively.

**Conclusions:** The SUV\_Shape could delineate tumors based on their radiopharmaceutical-avid PET images.

### P-1-15

#### Analysis of Standardized Uptake Values of $^{18}F$ -FDG PET in relation to histology tumor differentiation in esophageal carcinoma

Yasir Majeed, A. Hassan, A. A. Syed, A. Murtaza, Q. Khan, A. Kazmi, A. Loya

Shaukat Khanum Memorial Cancer Hospital and Research Center Lahore, Pakistan

**Background:** Quantitative measurement of glucose metabolism using standardized uptake value (SUV) has prognostic relevance in several tumors. The objective was to evaluate for correlation between esophageal cancer histopathology and the F-18 FDG SUV on PET/CT scan.

**Materials and Methods:** Retrospective analysis of 284 baseline scans over 55 months (September 2009 – July 2014). (59% males and 41% females, mean age 52.6 years).

**Results:** 214 were squamous cell carcinomas (SCCa) and 70 adenocarcinomas. Of SCCa, 16% were poorly, 71% moderately and 14% were well differentiated. Of adenocarcinomas, 21% were poorly, 49% moderately, and 31% were well differentiated. Mean  $SUV_{max}$  for SCCa was  $12.6 \pm 5.14$  and  $10.5 \pm 6.2$  for adenocarcinomas. Mean  $SUV_{max}$  of SCCa was  $12.6 \pm 5.14$  and  $10.5 \pm 6.2$  for adenocarcinomas.

In bivariate analysis, being a female was associated with a higher primary lesion SUV by 1.66 units ( $p=0.011$ ) compared to male. Adenocarcinomas showed a lower SUV by 2.14 units ( $p=0.004$ ) compared to SCCa. There was no significant correlation between the T stage and primary tumor  $SUV_{max}$  ( $p=0.339$ ). Multivariate analyses showed no association of the primary tumor SUV with age, gender, histopathology or degree of differentiation. Also no correlation existed between the esophageal lesion  $SUV_{max}$  and activity level of metastatic foci.

**Conclusion:** We found no association between the  $SUV_{max}$  and histopathology or degree of differentiation of the primary esophageal cancer.

### P-1-16

#### Post Radiation Tumor Recurrence Comparative Evaluation in Gliomas on Mr And $^{11}C$ -Methionine PET/CT

Abhinav Jaimini, Maria M D'Souza, Aashish Gambhir, Vivek M James, Rajnish Sharma, Anupam Mondal

Institute Of Nuclear Medicine and Allied Sciences (INMAS) Brig. SK Majumdar Road, Delhi, India

**Background:** Radiation necrosis creates significant diagnostic dilemma in brain tumor recurrence. We compared the diagnostic performance of novel MR

techniques and  $^{11}\text{C}$ -methionine PET/CT to differentiate tumor recurrence from post-radiation changes.

**Materials and Methods:** 20 patients (age 37-80 yrs) suspected to have recurrent tumor or radiation-induced necrosis were evaluated over 24 months. All patients underwent conventional sequences (T1, T2, Flair), MRS and T2 MR Perfusion study.  $^{11}\text{C}$ -Methionine PET/CT was performed. Histopathology and follow-up were used as indicators to establish lesion identity.

**Results:** 12 patients had recurrent/residual disease and 8 had post-treatment change. The overall sensitivity and specificity on MR was 90.6% and 86.2% respectively. The sensitivity and specificity on PET/CT was 100% and 72.1%.

**Conclusion:**  $^{11}\text{C}$ -methionine PET/CT has a higher sensitivity; however MRI appears to be more specific.

### P-1-17

#### Can Ultrasound Predict Malignancy in Patient With Thyroid Cold Nodule?

J Wiyanto, AHS Kartamihardja and T Nugrahadi

Padjadjaran University

**Background:** Thyroid cold nodule with malignant lesions can be discovered using ultrasound parameters. The aim of this study was to assess ultrasound as supporting modality for thyroid scintigraphy to predict malignancy in patient with thyroid cold nodules.

**Materials and Methods:** A retrospective study was done with 19 patients with thyroid cold nodule. Ultrasound and histopathology were performed in all subjects.

**Results:** Papillary thyroid carcinoma was observed in all 19 subjects with thyroid cold nodules based on histopathology. Ultrasound showed malignancy only in 8 (42.11%), while the rest 11 (57.89%) subjects were benign.

**Conclusions:** Ultrasound has no role in predicting malignancy in patient with thyroid cold nodules, since the typical appearance of malignancy on ultrasound does not always show up on a malignancy.

### P-1-18

#### Most solitary orbital lesions on Tc-99m MDP bone scan are benign

Le Song, Weifang Zhang, Yanyan Zhang

Peking University Third Hospital

**Background:** Solitary orbital lesion on bone scan is not uncommon but difficult to diagnosis. The objective was to characterize the solitary orbital

lesion demonstrated on bone scan.

**Materials and Methods:** Ten orbital lesions on bone scan were followed up, evaluated and compared with CT.

**Results:** Compared with bone scans taken 6-49 months later, 6 lesions remained stable, 3 had decreased uptake and 1 progressed. So, 9 lesions were considered benign, 6 of which showed ground-glass density on CT indicating benign fibro-osseous lesions, 3 was normal on CT.

**Conclusion:** Most solitary orbital lesions detected on bone scan are benign and fibro-osseous lesions might be the cause of uptake.

### P-1-19

#### Detection of occult lesions and avoidance of unnecessary $^{131}\text{I}$ therapy using $^{131}\text{I}$ SPECT/CT along with planar $^{131}\text{I}$ whole-body scans in the management of post-thyroidectomy differentiated thyroid cancer patients

Manas Kumar Sahoo, Varun singh Dhull, Chandra Sekhar Bal

All India Institute of Medical Sciences, New Delhi, India

**Background:** Role of  $^{131}\text{I}$  Whole body scan in thyroid cancer management is well documented. The limitation and false positive detection in this modality can be overcome with the advanced technology of SPECT/CT. The objective was to evaluate the role of  $^{131}\text{I}$  Single photon emission computed tomography/computed tomography (SPECT /CT) in differentiated thyroid cancer (DTC) patients and to evaluate the additional contribution of SPECT/CT in patient management.

**Materials and methods:** 625 consecutive DTC patients referred for  $^{131}\text{I}$  therapy were studied.  $^{131}\text{I}$  WBS was performed approximately 24 hours after 1.5-2 mCi  $^{131}\text{I}$  administration in all patients.  $^{131}\text{I}$  SPECT/CT was performed in 218 (80 males, 138 females) of DTC (185 papillary and 33 follicular) with median age 37 years (11-72).

**Results:** Planar  $^{131}\text{I}$  WBS showed 245 lesions of abnormal increased radioiodine uptake in those 218 patients who underwent SPECT/CT. SPECT/CT revealed 320 lesions, (out of total 352 lesions from all modalities). All lesions seen on planar imaging are also noted on SPECT/CT along with 85 (24.1%) additional occult lesions in 72(33%) patients. SPECT/CT over the planar WBS could restage in 36 (16.5%) patients, determined for higher dose administration in 69 (31.6%), prevented from higher dose administration in 105 (48.2%) and same treatment in 44(20.2%) patients.

**Conclusion:**  $^{131}\text{I}$  SPECT/CT was found to be superior in detecting occult lesions and preventing needless  $^{131}\text{I}$  therapy thus suggesting it to be the most appropriate imaging modality in management of DTC.

## P-1-20

### Insular Cell Carcinoma of the Thyroid: A Retrospective Analysis of 42 Cases

Sreekumar.A. V.M.Pradeep. Paul Sebastian.

Regional Cancer Centre. Trivandrum, India

**Background:** Insular cell carcinoma or poorly differentiated carcinoma of the thyroid is a new subtype of thyroid carcinomas. The classification of insular cell carcinoma comes in between well differentiated thyroid carcinoma and anaplastic carcinoma thyroid, with respect to both cell differentiation and clinical behavior. The objective was to retrospectively analyze the clinical presentation, treatment and outcome of insular cell carcinoma of the thyroid, registered in our center.

**Materials and Methods:** All cases of insular cell carcinoma thyroid were retrospectively analyzed for the following parameters: -age, sex, tumor size, presence or absence of distant metastases, treatment given and outcome.

**Results:** A total number of 42 cases were retrospectively analyzed from 1997. There were 33 females and 9 males. At presentation, 13 patients had tumor restricted only to the thyroid, 20 had lymph node metastases and 9 had distant metastases. 34 patients were eligible for surgery. Post operatively I-131 scan showed uptake in the neck in 28 cases and neck and metastatic sites in 3 cases. The dose of I-131 varied from 100 to 250mCi. Follow up varied from 6 months to 10 years. 12 patients had recurrence. 7 patients had local recurrence and 5 patients had recurrence at distant sites.

**Conclusion:** Insular cell carcinoma thyroid is an aggressive tumor that is classified in between well-differentiated and anaplastic tumors. In our series majority [33/42] of the patients were females. Unlike anaplastic carcinoma majority of the patients [28/42] showed I-131 concentration. The minimum dose of I-131 given in our center was 100mCi for residual thyroid ablation and maximum dose given was 250mCi [for bone metastases]. These tumors are also TSH dependent, so thyroxine should be given to suppress TSH < 0.01 microIU/ml. Those patients who developed recurrence invariably had poor prognosis.

## P-1-21

### <sup>68</sup>Ga-DOTANOC PET/CT in patients with pancreatic neuroendocrine tumors: single institutional experience

Sumeet Suresh Malapure

All India Institute of Medical Sciences, New Delhi, India

**Background:** To evaluate the diagnostic accuracy of <sup>68</sup>Ga-DOTANOC PET/CT imaging in a large exclusive

population of pancreatic neuroendocrine tumors (NETs).

**Materials and Methods:** 141 (Mean age: 46.2±15.2 years) patients who underwent 178 PET/CT studies for diagnosis and staging (n=30), staging (n=58) and restaging (n=90) of pancreatic NET were retrospectively analyzed. PET/CT results were compared to conventional imaging (CIM) when available (n=86). HPE and/or clinical/imaging follow up (min-6 months) were used as reference standard.

**Results:** Overall sensitivity, specificity and accuracy of PET/CT were 85.7%, 79.1% and 84.8%. The corresponding values were 73%, 50% and 70.4% for diagnosis/staging groups and 98.6%, 100% and 98.8% for restaging groups. The accuracy was significantly higher for restaging as compared to diagnosis/staging ( $P<0.0001$ ) and in non-insulinoma tumors than insulinomas ( $P<0.0001$ ). The SUV<sub>max</sub> of primary tumors was significantly higher than metastatic lesions overall ( $P=0.001$ ), as well as in diagnosis/staging ( $P=0.041$ ) and restaging ( $P=0.0003$ ) sub-groups. When available, CIM was less specific than PET/CT ( $P<0.001$ ) and showed fewer lesions.

**Conclusions:** <sup>68</sup>Ga-DOTANOC PET/CT is useful for diagnosis/staging and restaging of patients with pancreatic NET. It demonstrates more lesions compared to CIM and is more specific.

## P-1-22

### <sup>68</sup>Ga-DOTANOC PET-CT for restaging gastrointestinal neuroendocrine tumors after primary treatment

Varun Singh Dhull

All India Institute of Medical Sciences

**Background:** To evaluate the utility of <sup>68</sup>Ga-DOTANOC PET-CT for restaging in patients of gastrointestinal neuroendocrine tumors after treatment.

**Materials and Methods:** 89 patients with histopathological diagnosis of gastrointestinal neuroendocrine tumors (foregut-23, midgut-56, hindgut-10) who underwent treatment were included. To validate the results, histopathological correlation/conventional radiologic imaging and clinical follow up were considered as the reference standard.

**Results:** Based on reference standard 63 patients had disease and 26 patients were disease free. PET-CT was positive in 62 patients (TP-58, FP-4) and negative in 27 patients (TN-22, FN-5). Sensitivity, specificity, positive and negative predictive values were 92.06%, 84.62%, 93.55%, and 81.48% respectively. The accuracy of the study was 89.88%.

**Conclusion:** <sup>68</sup>Ga-DOTANOC PET-CT is highly efficacious in restaging patients with gastrointestinal



neuroendocrine tumors. It appears to be promising for assessing the disease burden in this group of patients.

### P-1-23

#### **<sup>99m</sup>Tc MAA SPECT/CT Quantification of Lung Mass and Liver-to-Lung Shunting Prior to <sup>90</sup>Y Radioembolization**

Butch Maulion Magsombol

Singapore General Hospital

**Background:** Applying the MIRD assumption of a 1000g lung mass it is estimated that 3.0 GBq of <sup>90</sup>Y SIR-spheres in a patient with 20% mean liver-to-lung shunt ratio will receive a mean lung dose of approximately 30 Gy. The objective was to assess the variability in the patient-specific lung mass of our patients going for <sup>90</sup>Y radioembolization. To assess the differences between the liver-to-lung ratios (LLR) estimated by planar scintigraphy and SPECT/CT.

**Material and Methods:** Seventy five patients underwent hepatic angiogram and <sup>99m</sup>Tc MAA injection for assessment of hepatic vasculature and dosimetry. Planar and SPECT/CT images were obtained to derive the LLR. Specific lung masses were derived from CT morphometry.

**Results:** Planar scintigraphy slightly overestimated the SPECT/CT LLR by an average of 2.09%. The mean lung mass in our patient population is 690g (726.3g for males, 564.9g for females) therefore the MIRD lung mass overestimates the mean lung mass by 310g.

**Conclusion:** Lung morphometry derived from SPECT/CT data achieves patient-specific dosimetry for safer radioembolization.

### P-1-24

#### **Therapy Dose Calculation in Graves Disease Using 4-Hour I-131 Uptake Measurements: A Retrospective Study**

Carla Mari M. Macaia

University of Santo Tomas Hospital, Manila, PH

**Background:** Twenty-four-hour RAIU is commonly used to compute for therapy dose in Graves disease (GD). The objective was to determine the feasibility of using 4-hr RAIU in calculating the dose by correlating 4-hr with 24-hr RAIU and comparing the actual therapy dose using 24-hr RAIU with the computed dose using 4-hr RAIU.

**Materials and Methods:** A total of 103 GD patients (67% F, 33% M; 18-60 y/o), who underwent RAI therapy at USTH (Jan 2011 to Jul 2013) were included. Dose using 4-hr RAIU was calculated.

**Results:** There was a strong correlation between 4-hr and 24-hr RAIU values ( $r=0.736$ ). Paired t-test showed no statistical difference between the actual therapy dose based on 24-hr RAIU and the computed dose using 4-hr RAIU in 140-160  $\mu$ Ci/g.

**Conclusion:** Therapy dose calculation using 4-hr RAIU in 140-160  $\mu$ Ci/g can be achieved in Filipino patients with Graves disease.

### P-1-25

#### **Effectiveness dose of I-131 Fixed Dose for Hypertthyroidism (Bandung Experience)**

KP Kusumahstuti, AHS Kartamihardja, T Nugrahadi

Padjajaran University

**Background:** Dose of <sup>131</sup>I for hyperthyroidism treatment is still controversy. The dose of <sup>131</sup>I can be given fixed dose based on empirical experience or use calculated dose. The objective was to compare the effective of fixed dose with calculated dose.

**Material and Methods:** Retrospective study was done to 46 patients with hyperthyroidism. Fixed dose of <sup>131</sup>I is 8 mCi, and < 8 mCi and > 8 mCi consider as calculated dose. Following up was done in 3 and 6 months.

**Results:** Euthyroid was observed in 3 months on 72% of patient using 8 mCi, 4% with < 8 mCi, and 9% with > 8 mCi. Euthyroid observed in 83% using 8 mCi in 6 months and 13% using calculated dose.

**Conclusion:** Fixed dose of <sup>131</sup>I more effective for hyperthyroidism treatment compare to calculated dose.

### P-1-26

#### **Which form of I-131 is precious for thyroid carcinoma patient, either liquid or capsule. Mathematical evaluation**

Om Prakash\*, R. Tiwari, S.rach, N.patel, V.patel, N.Sakhia, V.bhatt, R.K.vyas.

Gujrat cancer & research institute, new civil , ahmedabad , Gujrat, India

**Background:** Capsule & liquid radioiodine (I-131) is routinely used in treatment of differentiated thyroid carcinoma. In thyroid tissue it accumulates 17-25 times more than the other parts of the body. It exerts cyto toxic effect on thyroid tissue by beta emission. I-131 is an isotope of I-127 which is a beta and gamma emitter. Its maximum beta energy is 0.61 Mev and average energy is 0.192 Mev. It is a byproduct of uranium and plutonium fission.

The objective of this study was to compare the

ablation rate and side effect with high dose radioiodine (I-131) capsule & liquid formulation.

**Materials and Methods:** All the capsules and liquid radio iodine procured from BRIT, bhabha atomic research centre, Mumbai. All the patients fasted for at least 8hrs or overnight before the dose and 1 hr after. More than 300 patients included in this study. Before large dose therapy diagnostic imaging of all patient done, then therapeutic dose administered and sharply put under observation. what type of complain they are making were noted.

**Results:** The liquid form of I-131 absorbed from stomach within 15-30 min, but capsules dissolve slowly and shape maintained upto 2 hrs. due to slow absorption rate mucosal lining of stomach get very high radiation dose from 100 mCi, the dose to stomach wall was approx 448 rad or 4.48 Gy per hour. On the other side liquid I-131 delivered very less dose to stomach. Common complaint from both type (liquid & capsule) was nausea, vomiting, neck pain and abdominal pain. But in our observation we found that those pts. Who have got capsule were complaining more abdominal pain. So I have calculated the dose to stomach from capsule which was approx. 6-10 Gy to stomach. Due to radiation injury mucosa lining damage occurs. This was the reason for capsule patient's abdominal pain.

**Conclusion:** This quantification & dosimetric evaluation is pointing that liquid I-131 is better for patients. Quick absorption and less dose to abdomen. So less gastralgia complain. But liquid handling needs extra care and more radiation exposure to occupational worker. On other side capsule is safe to handle, less occupation worker exposure.

## P-1-27

### Super absorber; New approaches in $^{177}\text{Lu}$ hospital waste management

Stephan Maus

Department of Nuclear Medicine, University Medical Centre Mainz, Germany

**Background:** Treatments with  $^{177}\text{Lu}$ -DOTATATE could result, depending on the production route of the used  $^{177}\text{Lu}$ , in impurities of  $^{177\text{m}}\text{Lu}$  ( $t_{1/2} = 160$  d) which prevents the timely release of the waste. The aim of our study was the development a conversion method of the liquid wastes into gel resulting in the possibility of disposal over the national collection point.

**Materials and Methods:** We studied 3 patients regarding their excreta and the absorption behavior of the super-absorbers for water, NaCl and urine as well as the storage behavior for a period of 3 months.

**Results:** The precipitated volume of  $2.42 \pm 0.18$  L contained  $74 \pm 2.2$  % ( $5602 \pm 166$  MBq) of the administered activity. An accumulation of 10 GBq  $^{177}\text{Lu}$  and 12 MBq  $^{177\text{m}}\text{Lu}$  at after 40 days was calculated. The absorber-volume ratio for water of 0.013 and for NaCl / urine of 0.02 was estimated. No

changes in the properties or release of activity could be observed.

**Conclusion:** The conversion from liquid to solid form using a superabsorber guaranteed an easier handling, storing at smaller space, uncomplicated collecting, shipping and deposition for decay and financial savings > 30.000 € per year.

## P-1-28

### Fully automated Radiosynthesis of novel [ $^{18}\text{F}$ ]-Fluoro ethylated Juglone derivative and its feasibility study as tumour imaging agent

Nandy, Saikat<sup>1</sup>; Chakarborthy, Avik<sup>1</sup>; Pawar, Yogita<sup>1</sup>; Moghe, S.H.<sup>1</sup>; Ghosh, Sandipto<sup>2</sup>; Chaudhary, P.R.<sup>2</sup>; Rajan, M.G.R.<sup>1</sup>

1 Radiation Medicine Centre, Tata Memorial Centre Annexe, Bhabha Atomic Research Centre, Parel, Mumbai, India

2 Advanced Centre for Treatment, Research and Education in Cancer (ACTREC), Tata Memorial Centre, Kharghar, Navi Mumbai, India

**Background:** Quinones have been extensively investigated for their potential as anticancer compounds. Juglone (5-hydroxy-1, 4-naphthoquinone) is one such naphthoquinone which has exhibited the potential of inhibition of growth of various types of carcinomas. The objective was to develop  $^{18}\text{F}$ -labeled derivative of Juglone and exploring its potential as tumour imaging agent by PET.

**Materials and Methods:** [ $^{18}\text{F}$ ]-Fluoroethylated derivative of Juglone is developed by [ $^{18}\text{F}$ ]-Fluoroalkylation method by a fully automated radiosynthesis procedure and Sep Pak® purification. Pharmacokinetic as well as tracer uptake study at the inflammation sites were carried out by PET/CT imaging in healthy and induced inflammation bearing rabbit model. Bio-distribution as well as micro-PET/CT imaging study were carried out in tumour (B16F10) bearing mice (C57BL6).

**Results:** The non-decay corrected radiochemical yield is ~ 15% with >95% radiochemical and chemical purity. PET/CT images of rabbit showed very fast blood as well as liver clearance but tracer accumulation in highly proliferating regions like bone marrow, guts, submandibular glands without any brain uptake. The tracer does not accumulate at the inflammation sites. The tracer showed high accumulation in tumours (60 min post inj) and retained upto two hours as confirmed by bio-distribution as well as micro-PET imaging studies.

**Conclusion:** Juglone is successfully labelled with F-18 by [ $^{18}\text{F}$ ]-Fluoroalkylation method. The favourable pharmacokinetics as well as the localization and retention of [ $^{18}\text{F}$ ]-Fluoroethylated Juglone derivative in tumours suggests further evaluation as a promising PET imaging agent for detecting tumours.

## P-1-29

### Validation of the EZAG Modular-Lab Pharm Tracer module processed preparation of Ga-68 DOTA peptides for routine clinical application using the iThemba LABS Ge-68/Ga-68 generator

Stephan Maus

Department of Nuclear Medicine, University Medical Centre Mainz, Germany

**Background:** With a view for the production of radiopharmaceutical existing GMP requirements and the reduction of the radiation exposure for the employees, radiolabeling of somatostatin analogues with  $^{68}\text{Ga}$  or  $^{177}\text{Lu}$  using robotically cassette systems are object of intense investigations. We describe the Modular-Lab Pharm Tracer module processed preparation of  $^{68}\text{Ga}$ -DOTATOC using the  $\text{SnO}_2$ -based iThemba LABS  $^{68}\text{Ge}/^{68}\text{Ga}$  generator.

**Materials and Methods:** The generator (50 mCi) was eluted with 0.6 mol/L HCl. Elution efficiency was expressed as the  $^{68}\text{Ga}$  activity at time of elution, expressed as percentage of the  $^{68}\text{Ge}$  activity on the generator column.  $^{68}\text{Ge}$  content was measured using gamma spectrometry. Endotoxin testing was performed using the Endosafe PTS.

**Results:** The synthesis of  $^{68}\text{Ga}$ -DOTATOC resulted in radiochemical yields of 80% (d.c) and purities of >98% by heating 33.3mg (23, 42  $\mu\text{mol}$ ) peptide at pH 3.5–4.0 for 5 min at  $95^\circ\text{C}$  in 1.5 ml 0.6 mol/L HCl. The Sep-Pak C18 cartridge was implemented as a "safety net system". This eliminates the need for pre-purification of eluate.

**Conclusion:** Produced under GMP conditions and in combination with the evaluated Modular-Lab Pharm Tracer synthesis device this combination provides the opportunity for a full functional GMP production.

## P-1-30

### Initial experience of Ga-68 DOTANOC imaging in NET in a tertiary care medical center

Arya A

Sanjay Gandhi Post Graduate Institute of Medical Sciences

**Background:** Role of molecular imaging by PET-CT using Ga-68 DOTANOC in neuroendocrine tumors. The objective was to analyze retrospectively the utility of Ga-68 DOTANOC in PET-CT imaging in the management of neuroendocrine tumors.

**Materials and Methods:** PET-CT study was done in 21 patients of neuroendocrine tumors [NET's], which included 14 males & 10 females, aged 7 to 62 yrs. They underwent PET- CT study after IV injection of 74-148 MBq of Ga- 68 DOTANOC. Pt. was given oral contrast .Images were acquired 1 hr. later on PET-CT scanner

[Biograph 64 slice scanner, Siemens, Germany].

**Results:** The NET's included 4 cases of pheochromocytoma, 4 cases of MTC, 4 cases of carcinoid, 1 case of MEN-1, 3 cases of paraganglioma, 1 case of neuroblastoma, 4 cases of gastroenteropancreatic NET's which included duodenal, retroperitoneal, esophageal & pancreatic tumors.

Each case was analysed with respect to the clinical context which revealed Ga-68 DOTANOC avid in 3 cases of pheochromocytoma, 1 case of neuroblastoma, 3 cases of medullary carcinoma of thyroid, 1 case of MEN I, 3 cases of carcinoid, 3 cases of gastroenteropancreatic tumors i.e. duodenal, pancreas, esophagus, 2 cases of paraganglioma. There was no radiopharmaceutical concentration in 1 case of pheochromocytoma, one case of medullary carcinoma of thyroid and one case of carcinoid and one case of paraganglioma. The interesting aspects of this molecular imaging will be demonstrated in form of clinical case.

**Conclusion:** This early experience of PET-CT using Ga-68 DOTANOC in diverse patients of neuroendocrine tumors provide further insight into Ga-68 labeled positron imaging and for radionuclide therapy in metastatic neuroendocrine tumors.

## P-1-31

### Development and evaluation of software for Hepatopulmonary Shunt estimation for Transarterial Radioembolization therapy planning

Ashish Kumar Jha, Arun C. Gandhi, Sneha Shah, Archi Agrawal, Nilendu C. Purandare, V. Rangarajan

Tata Memorial Hospital, Parel, Mumbai, India

**Background:** Transarterial radioembolisation (TARE) is an established treatment for inoperable hepatocellular carcinoma and liver metastases. Radiation induced toxicity to the lung parenchyma is the dose limiting factor in TARE. Pre treatment Hepatopulmonary Shunt (HPS) is estimated by gamma camera method.

**Materials and Methods:** We have developed HPS software on XELERIS-1.123 workstation, GE medical systems, Milwaukee, USA for accurate calculation of HPS.

HPS is estimated by this software post transarterial administration of 5 mCi  $^{99\text{m}}\text{Tc}$ -MAA. Two sets of static images - one with a Co-57 flood phantom -SET 1 and another without the phantom -SET 2 were acquired on gamma camera in anterior and posterior projection in 256x256 matrix including lung and liver in the same field of view in identical position.

**Results:** Accurate HPS calculation is mandatory, as the radiation dose of > 30 Gy to the lungs may cause irreversible damage and is the limiting factor for TARE. Drawing liver and lung ROI is difficult without anatomical demarcations and may cause erroneous

HPS calculations. A precisely drawn ROI and proper background correction technique is mandatory to calculate accurate HPS. In our HPS Software the Co-57 flood phantom image is used for accurate organ delineation and also helps to draw precise ROI around lung, liver and background. Pixel normalized background correction and geometric mean techniques are used to obtain accurate counts from the ROI for precise calculation of HPS.

**Conclusion:** The HPS software incorporates anatomical information for ROI generation and pixel normalization technique to calculate precise HPS value. HPS Software is also user friendly.

### P-1-32

#### Comparison of Tc-99m sulfur colloid and Tc-99m phytate efficacy on sentinel lymph node (SLN) identification in patients with early breast cancer

Kuan-Yin Ko<sup>1</sup>, Ruoh-Fang Yen<sup>1</sup>, Chiun-Sheng Huang<sup>2</sup>

Departments of <sup>1</sup>Nuclear Medicine and <sup>2</sup>Surgery, National Taiwan University Hospital, Taipei, Taiwan

**Background:** SLN biopsy is now the standard of care for early breast cancer. However, what the ideal radiopharmaceutical is remain an question. The objective is to compare effectiveness of filtered <sup>99m</sup>Tc sulfur colloid and <sup>99m</sup>Tc phytate on SLN procedure and prognosis in a closely followed-up early breast cancer patients.

**Materials and Methods:** We studied 554 female patients with T1 or T2 breast cancer but without neoadjuvent chemotherapy and palpable axillary lymph node. The first 292 patients underwent SLNB using sulfur colloid and the next 262 using phytate. Radiotracers were administered by periareolar intradermal injection using 2-day or 1-day protocol. All patients underwent lymphoscintigraphy (LSG) and SLN identification was performed by hand-held gamma probe during surgery.

**Results:** The number of SLNs identified by LSG and gamma probe was  $1.6 \pm 0.9$ ,  $4.2 \pm 3.0$  in colloid group and  $1.3 \pm 0.6$ ,  $3.1 \pm 2.0$  in phytate group, respectively ( $P < .05$ ). Metastatic SLN was found 71 of 292 patients in colloid group and 48 of 262 in phytate group. Median follow-up in colloid and phytate group was 60 and 55 months. Axillary recurrence was seen in 5 colloid patients, and 2 phytate patients; distant metastasis in 8 colloid patients and 5 phytate patients (all  $P = n.s.$ ).

**Conclusion:** Mean SLN number detected by intraoperative gamma probe was significantly higher in colloid group. We didn't find significant difference in loco-regional/axillary recurrence, distant metastasis and mortality between two groups. The results of our study suggest these two radiopharmaceuticals have different performance on

the number of SLNs detection but without significant influence on positive SLN frequency.

### P-1-33

Withdrawn

### P-1-34

#### Evaluation of Thyroid Stimulating Hormone (TSH) Suppression (Lagging Behind) State after Radioiodine Therapy in Hyperthyroid Patients

Mohshi Um Mokaddema, Fatima Begum, Sadia Sultana, Simoon Salekin, Nurun Nahar

National Institute of Nuclear Medicine and Allied Sciences, Dhaka, Bangladesh

**Background:** A few numbers of hyperthyroid patients may show delayed recovery of thyroid stimulating hormone (TSH) level in clinically evident euthyroid condition after radioiodine (<sup>131</sup>I) therapy. The purpose of the study was to evaluate the duration of lag in TSH recovery after <sup>131</sup>I therapy and stable thyroid function status in hyperthyroid patients in a tertiary hospital.

**Materials and Method:** Total 145 hyperthyroid patients treated with <sup>131</sup>I therapy were included. These patients were followed up clinically and biochemically at three months interval. Patients having suppressed TSH with normal FT3 level and clinically euthyroid condition were followed up without giving antithyroid drug.

**Results:** At three months follow up, 25/130 (19%) had suppressed TSH with normal FT3 level. Duration of lagging behind state of TSH was three months for 19 (76%) patients, six months for four patients (16%) and one year in two patients (8%). Among these patients, 18 (72%) became hypothyroid, five (20%) became euthyroid and two (8%) became hyperthyroid during subsequent follow up to 15 months. 15/145 patients were lost from follow up.

**Conclusion:** Lagging state of TSH may be unexpectedly prolonged in some hyperthyroid patients treated with <sup>131</sup>I. These patients should be followed up with both TSH and thyroid hormone levels. Most of them do not require further therapy.



## P-2-1

### Assessment of Agreement between Gated SPECT Myocardial Perfusion Imaging and Gated SPECT Blood Pool Imaging for measurement of Left Ventricular Ejection Fraction in Coronary Artery Disease

Azmal Kabir SARKER, Raihan HUSSAIN, Khokon NATH, Shamim MOMTAZ, Faria NASREEN and Lutfun NISA

National Institute of Nuclear Medicine and Allied Sciences, Bangladesh

**Background:** Left ventricular ejection fraction (LVEF) is an important diagnostic and prognostic parameter in coronary artery disease (CAD). Gated SPECT myocardial perfusion imaging (GSMPI) is a popularly used for non invasive quantitative assessment of LVEF. Gated SPECT blood pool imaging (GSBPI) being a radionuclide ventriculography technique is gold standard as well as technically comparable to GSMPI. Good correlation of these two methods for measurement of LVEF is reported by using correlation coefficients. Bland and Altman show the inappropriateness of correlation coefficient for comparison analysis of measurement methods. The objective was to assess agreement between GSMPI and GSBPI for measurement of LVEF in CAD.

**Materials and Methods:** Study was done in 27 patients (24 men/ 3 women) with CAD. The mean age was  $54.2 \pm 6.2$  years ranging from 32 to 68 years. All patients underwent GSMPI and GSBPI with a gap of three to seven days. LVEF measured in rest phase of one day stress-rest GSMPI was compared with LVEF measured by GSBPI performed at rest. Agreement analysis was done using Bland Altman plot.

**Results:** Differences between GSMPI and GSBPI for measurement of LVEF at rest in same patient fell within two standard deviation of the mean difference. Thus the apparent overall slight underestimation of LVEF by GSBPI ( $54.8 \pm 25.3$ ) in comparison to GSMPI ( $56.9 \pm 25$ ) was statistically insignificant.

**Conclusion:** There was significant overall agreement between GSMPI and GSBPI for measurement of LVEF in CAD.

## P-2-2

### Prediction of response to CRT in patients with non-ischemic dilated cardiomyopathy using gated myocardial perfusion SPECT (GMPS).

Chetan. D Patel, Anirban Mukherjee, Nitish Naik, Gautam Sharma, Ambuj Roy

All India Institute of Medical Sciences, India

**Background:** GMPS plays significant role in

assessment of cardiac mechanical dyssynchrony (CMD) which may predict the response to Cardiac Resynchronisation therapy (CRT). The objective was to predict response to CRT in non-ischemic DCM patients using GMPS.

**Materials and Methods:** GMPS and clinical evaluation was performed in 22 patients (15 male,  $60.18 \pm 9.4$  year), before and 3 months after CRT implantation. In MPS, Phase SD (PSD) and Phase histogram bandwidth (PHB) were used to quantify CMD. LVEF was also evaluated.

**Results:** At baseline, mean NYHA class  $3.5 \pm 0.5$  and mean LVEF  $27.1 \pm 6.9$  %, PSD  $49.7 \pm 14.7^\circ$ , PHB  $151.7 \pm 57^\circ$ . At 3 month follow-up 17 patients responded to CRT with improvement in NYHA class  $\geq 1$  or EF  $> 5\%$ . Responders had significantly higher PSD ( $53.4 \pm 13.2$  vs  $36.9 \pm 13.3$ ,  $p < 0.05$ ) & PHB ( $165.8 \pm 54.3$  vs  $103.6 \pm 39.0$ ,  $p < 0.05$ ) than nonresponders. ROC curve analysis showed 70.6% sensitivity and 80% specificity at cutoff value of  $43^\circ$  for PSD and  $126^\circ$  for PHB for prediction of response to CRT.

**Conclusion:** Baseline PSD & PHB assessed by GMPS can predict the response to CRT.

## P-2-3

### Future Cardiac Events in Normally Diagnosed Gated Myocardial Perfusion SPECT (GSPECT)

Hamid Amer, K.Niaz, A.Jelani, M.Alqaseer, M.Saleem

King Abdulaziz Hospital, National Guard Health Affairs (NGHA), Al Ahsa, Kingdom of Saudi Arabia (K.S.A.)

**Background:** Coronary heart disease (CHD) is a major cause of mortality and morbidity and its management consumes a large proportion of national healthcare budgets. A normal myocardial perfusion scintigraphy (MPS) study is associated with a very low rate of future cardiac events. The objective was to determine the risk of future cardiac events after a normal myocardial perfusion scan (MPS), and whether clinical risk factors alter the risk of future cardiac events after normal MPS in our local population.

**Materials and Methods:** The data were collected from the nuclear medicine database identifying all the reported normal myocardial perfusion scans between January 2008 and December 2011. There were 290 patients identified with normal cardiac nuclear scans in the pre-specified time frame. 103 of these patients were male accounting for 35% of the total population. Average age at the time of examination was  $60.6 \pm 11.8$  years and the highest age group were between 66 and 70 years.

**Results:** There were 2 patients that were admitted with NSTEMI and went on to have diagnostic angiograms. One of those two patients underwent

percutaneous coronary intervention with stenting. The other patient had non-obstructive CAD and was advised for medical management only. These findings are consistent with a 0.7% risk of cardiac events after a negative scan

**Conclusion:** The above findings demonstrate that the risk of major cardiac events after a negative nuclear cardiac scan is low irrespective of the clinical risk factors and is in keeping with the international statistics available.

## P-2-4

### In the Detection of Coronary Artery disease – A Head to Head Comparison Regarding the Diagnostic Accuracy of the Dobutamine stress Myocardial Perfusion Imaging and Dobutamine Stress Echocardiography

Sultana N<sup>1,\*</sup>, Ibrahim Md<sup>2</sup>, Nisa L, CA Meshkat<sup>2</sup>, Banerjee S<sup>2</sup>

<sup>1</sup>Scintigraphy division, <sup>2</sup> Cardiology departments, National Institute of Nuclear Medicine and Allied Sciences (NINMAS), Dhaka, Bangladesh

**Background:** For the evaluation of coronary artery disease simultaneous Dobutamine stress myocardial perfusion imaging and dobutamine stress echocardiography (DSE) assessed for a head to head comparison regarding the diagnostic accuracy of the two tests. The objective was to investigate the sensitivity, specificity, diagnostic accuracy of DSE and dobutamine stress SPECT-MPI with Tc-99m tetrofosmin in the detection of coronary artery disease (CAD).

**Materials and Methods:** A total 80 patients with mean age 55.0±1.02 years were included in this study. All patients underwent simultaneous DSE followed by Dobutamine stress myocardial perfusion imaging in a single day stress-rest protocol with Tc-99m Tetrofosmin. Coronary angiogram was performed within one month of the perfusion scan.

**Results:** The overall sensitivity, specificity, diagnostic accuracy of dobutamine stress perfusion imaging for the detection of CAD were 96.9%, 62.5% and 90% respectively. Positive predictive value was 91% and negative predictive value was 83.3% for dobutamine stress myocardial perfusion. For the detection of CAD the sensitivity of MPI and DSE were 96.9 and 92.2% ( $p>0.05$ ), while the specificity was 62.5 and 75% respectively ( $p>0.05$ ). The negative predictive value of MPI was somewhat higher (83.3%) than that of DSE (70.6%), although the difference between the two did not reach the level of significance ( $p = 0.064$ ). The predictive accuracies of MPI (90%) and DSE (88.7%) were also fairly comparable ( $p > 0.05$ ).

**Conclusion:** Compare to DSE dobutamine stress myocardial perfusion demonstrated higher sensitivity but was low in specificity.

## P-2-5

### Effect of Exercise-Induced Maximum Heart Rate on Liver Activity in Technetium-99m Sestamibi Myocardial Perfusion Scintigraphy

Oliver R. Lubiano, RMT

University of Santo Tomas Hospital, Manila, Philippines

**Background:** Superimposed visceral activity is a potential cause of artifacts in Tc-99m Sestamibi cardiac scintigraphy. The objective was to compare liver activity between patients achieving 85-100% of predicted maximum heart rate (PMHR) during treadmill stress test and those who achieved >100% of PMHR.

**Materials and Methods:** A retrospective study (Jan 2010 to Dec 2013) was conducted at USTH, comparing 53 patients who achieved 85-100% of PMHR on exercise (Group I) with 16 who exceeded 100% (Group II). Liver-to-heart uptake ratios were computed. Statistical significance was assessed by t-test.

**Result:** The mean planar liver-to-heart ratio for Group I was 0.79±0.18 while the mean ratio for Group II was 0.69±0.14 ( $P = 0.041$ ).

**Conclusion:** Patients who achieve >100% of PMHR have significantly lower liver activity.

## P-2-6

### The impact of Attenuation Correction on Myocardial Blood Flow Quantitation (MBFQ) with <sup>99m</sup>Tc-sestamibi Dynamic SPECT (dSPECT) for Detection of Coronary Artery Disease

Song-Han Yang

Chang Bing Show Chwan Memorial Hospital, Changhua, Taiwan

**Background:** No-AC dSPECT can be relatively simple in clinical setting, but its adequateness for MBFQ is still unclear.

**Materials and Methods:** Twenty-five patients who received both dSPECT and coronary angiography were included (CAD=14). Vvalues and heterogeneity (SD/mean\*100%) of flow and coronary flow reserve (CFR) obtained from no-AC and AC images were analyzed and compared.

**Results:** MBFQ with no-AC dSPECT had significantly higher values of stress K1 (21%), stress flow (49%), CFR (243%) with 2.0 times (1.6-2.4) heterogeneity of rest/stress flow and CFR than AC dSPECT. For detecting CAD, the areas under ROC curve of no-AC dSPECT was significantly smaller than that of AC dSPECT.

**Conclusion:** Attenuation artifact in dSPECT can

overestimate flow values and amplify flow heterogeneity in myocardium. Attenuation correction is mandatory to ensure the diagnostic performance of MBFQ with dSPECT for CAD detection.

## P-2-7

### Incremental value of myocardial blood flow quantitation with Tc-99m Sestamibi dynamic SPECT/CT in the diagnosis of coronary artery disease

Tien Tien Jhang

Show Chwan Memorial Hospital, Changhua, Taiwan

**Background:** This study evaluated the diagnostic performance of myocardial blood flow (MBF) and flow reserve (MFR) obtained by a dual-head SPECT/CT in detecting coronary artery disease (CAD) compared with traditional perfusion images.

**Materials and Methods:** This study included 21 patients who had received dynamic SPECT/CT and invasive coronary angiography. Stress MBF (SMBF), rest MBF (RMBF) and MFR were quantified by one-tissue compartment flow model. Summed stress score (SSS) and summed difference score (SDS) were also generated.

**Results:** Using  $\geq 50\%$  stenosis as positive CAD, areas under ROC curve (AUCs) of MFR, SMBF, SSS and SDS were  $0.91 \pm 0.07$ ,  $0.86 \pm 0.09$ ,  $0.64 \pm 0.12$  and  $0.59 \pm 0.13$ , for patient-based analysis. For vessel-based analysis, AUCs of MFR, SMBF, SSS and SDS were  $0.81 \pm 0.05$ ,  $0.76 \pm 0.06$ ,  $0.62 \pm 0.07$  and  $0.56 \pm 0.08$ , respectively.

**Conclusions:** Myocardial blood flow quantitation with a conventional SPECT/CT system is clinically simple and effective to enhance CAD detection.

## P-2-8

### Does the Thallium defect pattern in Myocardial Perfusion Scintigraphy depict the level of stenoses in SVD involving the LAD?

Vishal Agarwal

Medanta the Medicity hospital, India

**Background:** Apart from being invasive, coronary angiography does not show the real effect of the stenoses on the myocardial blood flow. However, the myocardial perfusion scintigraphy shows the real ischemic burden on the myocardium. To correlate this reversible defect pattern and deduce some relationship with the level of stenoses at least in single vessel disease patients.

**Materials and Methods:** We carried out this study in 326 patients out of 1200 patients, in the study period of 7 months, who had SVD involving the left anterior

descending artery. Of these, 154 patients had proximal stenoses (proximal to and including first major septal branch - as per SYNTAX scoring for coronary stenoses), 68 patients had mid stenoses (after S1 origin to  $\frac{1}{2}$  of distance up to apex) and 104 had distal stenoses (terminal portion of LAD). The MPI was done with dual isotope protocol in our department.

**Results:** Five patterns of reversible perfusion defects were identified: type I (apex, anterior wall and septum), type II (apex and septum), type III (anteroseptal wall), type IV (apex and anterior wall) and type V (apex).

**Conclusions:** On correlating with the CAG findings available, proximal stenoses was most commonly related to type I, II and III (in 138 of 154), mid stenoses with type IV (in 54 of 68) whereas distal stenoses was related with type V (in 90 of 104).

## P-2-9

### $^{99m}\text{Tc}$ -methionine (MET) Brain SPECT for the detection of recurrent/remnant gliomas- Comparison with ceMRI and $^{18}\text{F}$ -FLT- PET imaging: Initial Results

Singh, Baljinder <sup>1</sup>; Kumar, Narendra, Sharma, Sarika<sup>1</sup>; Watts, Ankit<sup>1</sup>; Hazari, Puja P.<sup>2</sup>; Abrar, ML; Singh, Harpreet<sup>1</sup>; Chuttani, Krishna<sup>2</sup>; Ghai, Anchal; Sharma, Rajnish<sup>2</sup>; Mittal, Bhagwant R.<sup>2</sup>; Mishra, Anil K.<sup>2</sup>

<sup>1</sup>Nuclear Medicine & PET Centre, PGIMER, Chandigarh, Chandigarh, India

<sup>2</sup>Division of Radiopharmacy and PET/Cyclotron Centre, INMAS, DRDO, Delhi, India

<sup>3</sup>Radiation Oncology, PGIMER, Chandigarh, India

**Background:** To evaluate the diagnostic utility of an indigenously developed single vial ready to label (with  $^{99m}\text{Tc}$ ) kit preparation of DTPA-bis-methionine ( $^{99m}\text{Tc}$ -MET-SPECT) for the detection of gliomas. The objective was to compare the  $^{99m}\text{Tc}$ -MET-SPECT imaging results with  $^{18}\text{F}$ -FLT-PET and ceMRI data in patients with recurrent/residual gliomas.

**Materials and Methods:** The conjugate (DTPA-bis-MET) was synthesized and formulated (in-house) in to lyophilized single vial ready to label (with  $^{99m}\text{Tc}$ ) kit preparations and were used in the present study. Thirty-two (22M: 10F, mean age= $43.0 \pm 16.0$  yrs; range=8-72 yrs.) post operative gliomas cases (21- Glioblastoma Multiforme-G-IV; 04 Astrocytoma/Oligodendroglioma-G-I/G-II); 04- Anaplastic Oligodendroglioma/Oligoastrocytoma-G-III; 03- Pilocytic astrocytoma -GI) were recruited in the present prospective study. All the study subjects underwent brain  $^{99m}\text{Tc}$ -MET-SPECT and ceMRI. Brain  $^{99m}\text{Tc}$ -MET-SPECT was acquired at 2h after administration of 555-740 MBq activity of the radiotracer. Additionally, sixteen (16/32) patients underwent  $^{18}\text{F}$ -FLT-PET (mean administered activity

=239.0 ±15.5 MBq; mean uptake time=56.0 min) and 2 patients underwent  $^{11}\text{C}$ -MET-PET (555.0 MBq, uptake time 20-min) imaging in addition to  $^{99\text{m}}\text{Tc}$ -MET-SPECT and ceMRI.

**Results:** Concordant  $^{99\text{m}}\text{Tc}$ -MET-SPECT and ceMRI findings were observed in 28 scans (15-positive & 13 negative). Discordant findings were observed in the remaining 5 scans with positive MRI & negative SPECT in 2-scans and negative MRI & positive SPECT in 3-scans respectively. All the three investigations i.e.  $^{18}\text{F}$ -FLT-PET,  $^{99\text{m}}\text{Tc}$ -MET-SPECT and ceMRI were positive in 9/16 and negative in 5/16 patients respectively. In the remaining 2-patients both  $^{18}\text{F}$ -FLT-PET and  $^{99\text{m}}\text{Tc}$ -MET-SPECT were positive but MRI was negative.  $^{11}\text{C}$ -MET-PET was positive and negative in one patient each and the findings were in consonance with the  $^{99\text{m}}\text{Tc}$ -MET-SPECT and ceMRI findings. There was no discordance in the findings on  $^{99\text{m}}\text{Tc}$ -MET-SPECT,  $^{18}\text{F}$ -FLT-PET and  $^{11}\text{C}$ -MET-PET. The overall sensitivity, specificity, PPV, NPV and DA of  $^{99\text{m}}\text{Tc}$ -MET-SPECT technique was estimated to be 88.24%, 81.25%, 83.3%, 86.7% & 84.8 %.

**Conclusion:**  $^{99\text{m}}\text{Tc}$ -MET preferentially localized in the sites of recurrent/residual gliomas and the technique showed very good agreement with ceMRI and  $^{18}\text{F}$ -FLT-PET findings.  $^{99\text{m}}\text{Tc}$ -Methionine SPECT imaging thus could be a cost-effective substitute both for  $^{18}\text{F}$ -FLT and  $^{11}\text{C}$ -MET-PET imaging.

## P-2-10

### Studying the Cerebral blood flow (CBF) in the inter-ictal period in patients suffering from migraine.

SrivastavaMK<sup>1</sup>, KiranGP<sup>2</sup>, WadhwaJ<sup>2</sup>, PanditN<sup>1</sup>

<sup>1</sup>Department of Nuclear Medicine & <sup>2</sup>Internal Medicine, JIPMER, Puducherry

**Background:** Migraine is a common disabling primary headache disorder. Modern imaging defies vascular theory by showing that vascular and diameter changes are not linked with pain. Migraine is associated with disturbances of neuronal function and reduced cerebral perfusion. We aimed to study the CBF in the interictal period in migraineurs using technetium-99m ethyl cysteinate dimer (Tc-99m-ECD).

**Material and Methods:** 43 Migraine patients with mean age of 27 ± 7.5 years were studied. A detailed history was taken with Migraine Disability Assessment (MIDAS) grade and score and Visual analog score (VAS). The patients underwent Tc-99m-ECD brain study within one week of diagnosis. The images were interpreted for areas of reduced perfusion and scored accordingly.

**Results:** The most consistent hypoperfused region was thalamus (81.4%) with nine patients showing bilateral thalamic hypoperfusion, followed by temporal cortex (51.2%), basal ganglion (34.9%) (lentiform nucleus - 32.6% & Caudate lobe - 25.6%).

The other hypoperfused regions were basi-frontal cortex in 2 patients and parietal cortex in 1 patient. There was no significant correlation between number of hypoperfused regions and MIDAS grade ( $r = 0.13$ ) or MIDAS score ( $r = 0.01$ ) or VAS ( $r = -0.08$ ). However, the number of area hypoperfused increased with duration of disease ( $r = 0.55$ ).

**Conclusion:** Thalamus, temporal lobe and basal ganglion were most consistent hypoperfused regions in migraine patients. The hypoperfused area increased with duration of disease.

## P-2-11

### Brain atlas-based mean cortical SUVR for evaluation of positive/negative scan of PiB PET

Takashi Kato, Ken Fujiwara, Kaori Iwata, Yoshitaka Inui, Kengo Ito, Akinori Nakamura, and MULNIAD Study Group

National Center for Geriatrics and Gerontology

**Background:** The purpose of this study was to evaluate mean cortical standard uptake value ratio (mcSUVR) on the automated regions of interest for the positive/negative scan of PiB PET.

**Materials and Methods:** The subjects were 62 cognitively normal subjects (69.8±5.3yo), 25 patients with mild cognitive impairment (74.5±6.6 y.o.), and 16 patients with Alzheimer's disease (74.9±6.1 y.o.). The mcSUVR was calculated from spatially normalized PET of 50-70 min after injection of PiB using the Automated Anatomical Labeling Atlas. The PiB PET scans were visually rated as PiB-positive or PiB-negative. Diagnostic performance of mcSUVR for positive/negative scan was evaluated using a ROC analysis in all the subjects.

**Result:** When cut off of the mcSUVR was 1.26, diagnostic sensitivity, specificity, and accuracy were 0.974, 0.969, and 0.971, respectively.

**Conclusion:** The brain atlas-based mcSUVR was useful to discriminate between positive and negative scan of PiB PET.

## P-2-12

### Impact of right-ventricular apical pacing on the optimal left-ventricular lead positions measured by phase analysis of SPECT myocardial perfusion imaging

Ji Chen

Emory University School of Medicine, Atlanta, GA, USA

**Background:** The use of SPECT phase analysis to optimize LV lead positions for cardiac resynchronization therapy (CRT) was performed at



baseline, but CRT works as simultaneous right ventricular (RV) and LV pacing. The aim of this study was to assess the impact of RV apical pacing on optimal LV lead positions measured by SPECT phase analysis.

**Materials and Methods:** Forty-six patients received 2 SPECT scans after single injection of Tc-99m sestamibi under sinus rhythm and RV apical pacing. LV dyssynchrony parameters and optimal LV lead positions were measured by the phase analysis technique and then compared between the two scans.

**Results:** The LV dyssynchrony parameters were significantly larger with RV apical pacing than with sinus rhythm ( $P \sim 0.01$ ). In 39 of the 46 patients, the optimal LV lead positions were the same between RV apical pacing and sinus rhythm ( $\kappa = 0.861$ ). In 6 of the remaining 7 patients, the optimal LV lead positions were along the same radial direction, but RV apical pacing shifted the optimal LV lead positions toward the base.

**Conclusion:** The optimal LV lead positions measured by SPECT phase analysis were consistent, no matter whether the SPECT images were acquired under sinus rhythm or RV apical pacing. This study supports the use of baseline SPECT myocardial perfusion imaging to optimize LV lead positions for increasing CRT efficacy.

## P-2-13

### Performance Characteristics and Evaluation of Recently Installed PET/CT Scanner at INMOL

Afshan Ashfaq, Ahmad Qureshy, Areesha Zaman, Munir Ahmed, Nouroze Gul Abubaker Shahid and Maqsood Ahmad

Institute of Nuclear Medicine & Oncology (INMOL), Pakistan

**Background:** Evaluation of performance is essential prior to human studies. The objective was to evaluate the physical performance of the new integrated PET/CT system according to NEMA and IAEA standards.

**Materials and Methods:** A series of Quality control procedures was performed on GE Discovery™ STE<sup>16</sup> Whole Body PET-CT system.

**Results:** (1). 2 cold and 4 hot spheres were visible in 3D mode with contrast values of 28.5%, 35.7%, 50.8%, 69.2% from smallest to largest hot sphere for cold spheres from 53.4% and 61.6%. In 2D mode 2 cold and 3 hot spheres were visible.

(2). The average transverse and axial spatial resolution (FWHM) at 1 cm off center was 5.03 (5.05) mm and 10 cm off axis was 5.2 (6.1) mm in 2D, and 5.4 (6.9) mm and 6.1 (6.6) mm in 3D.

(3). The average sensitivity for two radial positions ( $r=0$  cm and  $r=10$  cm) was 1.7 cps/kBq in 2D and 8.4 cps/kBq in 3D.

CT:

(1). All slice thicknesses (5, 3.75, 2.5, 1.25) mm are acceptable except 0.625 mm.

(2). Standard deviation in the image noise uniformity, for center and 2 radial positions, was 3.27, 3.2 and 3.21 respectively.

**Conclusion:** The system has excellent overall performance in 2D and 3D modes in particular high sensitivity. Hence, CT alone is good enough for diagnostic use.

## P-2-14

### Striatal Tc-99m Uptake Measurements Using Visual and P-Mode Analyses

Chia-Chi Chang, Wen-Sheng Huang

Changhua Christian Hospital

**Background:** <sup>99m</sup>Tc-TRODAT-1 SPECT has been clinically used to measure activity of striatal (ST) dopamine transporter. Problems remain in its semi-quantitation. The objective was to compare differences between preset-ROI and co-registered PMOD analyses using a phantom method.

**Materials and Methods:** A dual-headed camera was used for phantom imaging. <sup>99m</sup>Tc radioactivity was adjusted to simulate clinical settings with ST/background ratios ranged from 3:1 to 9:1, yielding specific uptake ratios (SURs) ranged from 1 to 6. The actual radioactivity was measured by a gamma counter.

**Results:** Good correlations were found between the gamma counter and the gamma camera ( $r^2 = 0.96$  for preset-ROI). Good parallelism was also noted between preset-ROI and PMOD methods ( $r^2 = 0.96$ ). The SUR reproducibility in ST and its sub-regions ranged 0-9.4% (averaged < 5%).

**Conclusion:** Using visual inspection and preset-ROI method to evaluate activity of ST and its sub-regions might be a clinically reliable means.

## P-2-15

### Self Shielded Medical Cyclotron- Initial experience in developing country

Dhananjay K Singh

DR.RMLIMS

**Background:** At present 18 cyclotrons are in operation and few are in process and will get commissioned in next 1-2 year time in India. In a Medical Cyclotron, radiation safety aspects are more stringent due to neutron, high energy gamma radiation and because of this the occupational workers of facility are very sceptical about radiation exposure. The objective was to access the production capability of cyclotron under different circumstances,

radiation safety of facility and occupational workers.

**Materials and Methods:** Our Medical Cyclotron (RDS Eclipse-RD, Siemens Medical Solution having 11 MeV fixed energy) are capable to produce F-18, F18-F2 gas, N-13, C11 and O-15 radioisotopes. The radiation monitoring of facility were doing routinely and every time before beam initialization, during production and post production around the self shield and outside of secondary wall of cyclotron room and radiochemistry room.

**Results:** The mean duration of bombardment in there run on the F-18 target was  $40 \pm 10.57$  Min, while for N-13 target was  $15 \pm 5.21$  min and for F-18-F2 gas target was  $90 \pm 20.53$  min. Radiation levels in the cyclotron vault are varies from 0.03 to 65 ( $\mu\text{Sv/hr}$ ) micro Sievert per hour. The neutron dose rate was not in the detectable range just before and after the production run in the cyclotron vault.

**Conclusion:** The radiation (gamma and neutron) levels were well with the permissible limit except during the leakage of F-18 F-2 gas target or C-11 gas target.

## P-2-16

### The application of different scatter correction function settings in Siemens SPECT

Yuankai Wang, Zhuang Liu, Yu Sun

Huashan Hospital, Fudan University

**Background:** Tomography can be corrected by scatter correction (SC) to improve image quality. Siemens SPECT has several function of optional marked SC in the tomographic image reconstruction. The aim of this research is to distinguish the difference between the different function settings.

**Materials and Methods:** "SC-Tc-99m-NMG" energy peak of Brain model tomographic data were used. Dual Isotopes loaded in "Tomo Reconstruction" activity primary and secondary energy peak to analyze separately in 2 groups. Single Isotopes loaded in "Tomo Reconstruction" activity divided into SC and NSC to analyze separately in 2 groups. Dual Isotopes loaded in "AutoRecon" activity divided into SC and NSC to analyze separately in 2 groups. Limited by "AutoRecon" activity, we use Flash 3D (8,8) gaussian 8.00 function to reconstruct and analyze the range of image to the largest extent.

**Results:** With all 128 layers summed in axial section, the average radioactive counts of the 6 groups respectively were  $10092.30 \pm 24.20$ ,  $4199.40 \pm 13.41$ ,  $10092.60 \pm 24.95$ ,  $10084.30 \pm 16.05$ ,  $8151.60 \pm 20.64$  and  $10238.80 \pm 20.64$ , and the maximum counts were 10328, 3621, 10370, 10338, 8546 and 10445. Except secondary energy peak data, others met the clinical requirements through visual assessment brain SPECT. There was no statistically significant differences between a, c, d groups after paired T test.

**Conclusions:** SC could only be done with Flash 3D

function in "AutoRecon" activity using Siemens syngo V60B.

## P-2-17

### Using Bone Tomo Imaging to obtain the volume of bone mineral density values with SPECT/CT

Yuankai Wang, Zhuang Liu

Huashan Hospital, Fudan University

**Background:** In order to better define the nature of local bone lesions, we often perform bone tomo with CT imaging. In previous study (Eur J Nucl Med Mol Imaging (2013) 40 (Suppl 2):S521), we have established low radiation dose CT scanner scheme. Since the CT acquisition parameters are relatively fixed, so this is a method of obtaining stable CT values. CT values can be analyzed to seek to obtain the method of volume bone mineral density.

**Materials and Methods:** We used SIEMENS Symbia T16. Using three kinds of uniform liquid of known density contrast agents (350mg/ml, 300mg/ml, 282mg/ml), diluted to (225 mg/ml, 200mg/ml, 191 mg/ml, 150mg/ml, 140mg/ml). All of the 8 kinds of reagents were filled with 5ml ampoules. CT scanner acquisition to ampoules in accordance with bone tomo condition and the liquid volume CT value (HU) is analyzed according to the previous plan after CT image reconstruction.

**Results:** The relation between the volume of bone mineral density values(y) and CT value (x):  $y = 0.034x + 93.84$   $R^2 = 0.983$ . Since the upper limit of CT (normal) device is 3071, the liquid density higher than 225mg/ml cannot get the correct CT values.

**Conclusion:** Since the SPECT / CT rack cannot be rotated and cannot measure QCT accurately. However, CT data can be used to obtain the results of volume bone mineral density of bone, it can not only to give a clinical reference, but can also be used as means for semi-quantitative analysis.

## P-2-18

### Optimization of FDG PET/CT scanning for Obese oncology Patient

Afshan Ashfaq<sup>1</sup>, Ahmad Qureshy, Numair Younis, Areesha Zaman, Khalid Masood, Munir Ahmed, Abubaker Shahid and Maqsood Ahmad<sup>2</sup>

1 Institute of Nuclear Medicine & Oncology (INMOL), Pakistan

2 Centre for High Energy Physics, University of the Punjab, Pakistan

**Background:** Positron Emission Tomography/Computed Tomography (PET/CT) with  $^{18}\text{F}$ -FDG is an

essential modality for cancer imaging and provides accurate lesion detection and improved image quality than PET and CT alone. During treatment of Oncology patient repeated essential PET/CT scans includes, pre-therapy for determination of staging, post-therapy for monitoring of chemotherapy response and follow up scan. These repeated PET/CT scan increases radiation exposure especially in obese patients. The aim of the study is to optimize the PET/CT scanning toward radiation dose reduction.

**Material and Method:** In this study, a group of 83 patients with weight of (75-120 kg) were acquired on GE Discovery STE PET/CT scanner. Acquisition parameters kV, mA and noise index were adjusted. From each scan volume CT dose index (CTDI<sub>vol</sub>) and dose length product (DLP) were recorded. For quantitative analysis of image quality, percentage Coefficient of variance (COV) was calculated from specific liver slice.

**Results:** The CTDI<sub>vol</sub> and DLP radiation doses were reduced by 23% and 57% respectively by adjusting CT acquisition parameters. The entire studies were considered diagnostically sufficient.

**Conclusion:** Significant radiation dose reduction can be obtained by the modification of acquisition parameters for CT in preference to PET without degradation in image quality for obese patients.

## P-2-19

### Semiquantification of Captopril Renal Scintigraphy in detection of Renal Artery Stenosis and its Prognostic Value

Ching-Chu Lu, Vin-Cent Wu, Kwan-Dun Wu, Kai-Yuan Tzen, Ruoh-Fang Yen

National Taiwan University Hospital, Taipei, Taiwan

**Background:** Renovascular hypertension caused by renal artery stenosis can be accurately diagnosed by Captopril renal scintigraphy. It provides evidence of the necessity performing renal revascularization and subsequent renal function improvement. Traditionally changes in patterns of renographic curves after Captopril is used to give probabilities of renal artery stenosis. Some semiquantification parameters such as changes of 20-min to maximum ratio, split renal function or peak time are helpful to increase the accuracy. In this study, five semiquantification parameters generated from Captopril renal scintigraphy, changes of peak time ( $\Delta$ peak), half-time from peak value ( $\Delta$ T1/2), 20-min to maximum ratio ( $\Delta$ 20), estimated glomerular filtration rate ( $\Delta$ GFR), and split renal function ( $\Delta$ split), are evaluated to decide their ability to detect renal artery stenosis and predictive value of prognosis after renal artery revascularization. The objective was to identify the ability of detecting renal artery stenosis and predictive value of prognosis after renal artery revascularization by semiquantification parameters

derived from Captopril renal scintigraphy.

**Materials and Methods:** From August 2004 to August 2012, 39 renal arteries in 21 patients were included in this study. All these patients were clinically manifested as hypertension and receiving renal artery angiography within three months after Captopril renal scintigraphy. Significant Renal artery stenosis was defined as greater than 50% stenosis in diameter. Changes of five semiquantification parameters before and after Captopril were expressed in percentage. Vessel-based analysis was performed with dividing into two groups, significant stenosis and non-significant stenosis and five semiquantification parameters were compared between two groups. Patients receiving renal artery revascularization were divided into two groups, with positive outcome (normotensive blood pressure without antihypertensive medication) and with negative outcome (no improvement in hypertension and/or requiring antihypertensive medication), and five semiquantification parameters were analyzed to decide their ability of predicting outcome after revascularization.

**Results:** Among 39 renal arteries, 9 were with significant stenosis and 30 were patent or with non-significant stenosis. Average changes of five semiquantification parameters ( $\Delta$ peak,  $\Delta$ T1/2,  $\Delta$ 20,  $\Delta$ GFR and  $\Delta$ split, expressed as mean  $\pm$  SD) in significant stenosis group were  $0.0426 \pm 0.6002$ ,  $0.8613 \pm 1.9208$ ,  $-0.5303 \pm 0.2883$ ,  $-0.2266 \pm 0.3597$  and  $-0.1149 \pm 0.1637$ , separately. Average changes in non-significant stenosis group were  $0.6041 \pm 0.9898$ ,  $1.8133 \pm 5.7426$ ,  $0.1831 \pm 0.3594$ ,  $0.1516 \pm 0.3668$  and  $0.0055 \pm 0.0781$ , separately.  $\Delta$ peak and  $\Delta$ T1/2 were failed to differentiating renal artery stenosis (p value = 0.06 and 0.32, separately), while  $\Delta$ 20,  $\Delta$ GFR and  $\Delta$ split can effectively detect renal artery stenosis (p value = 0.04, 0.005 and 0.004, separately). Among 30 patent or non-significant stenotic vessels, according to renographic curve changes, 6 were in high probability, 18 were in intermediate probability and 6 were in low probability. To distinguish high probability from intermediate probability,  $\Delta$ peak,  $\Delta$ T1/2 and  $\Delta$ 20 showed statistical significance with p value of <0.0001, 0.0479 and 0.0170, separately. For differentiating high probability from low probability,  $\Delta$ peak and  $\Delta$ 20 showed statistical significance with p value of 0.0063 and 0.0172, separately.  $\Delta$ GFR is the only one parameter showed ability to distinguish intermediate probability from low probability, with p value of 0.0337. Furthermore, there were 6 patients with significant renal artery stenosis receiving revascularization. Two of them showed improvement of hypertension, and the other four showed no improvement of hypertension.  $\Delta$ split is the only parameter that correctly predict clinical outcome after revascularization, with average changes of  $-0.3912 \pm 0.0352$  in positive outcome group and  $-0.0183 \pm 0.4182$  in negative outcome group (p value = 0.0005).

**Conclusion:** Captopril renal scintigraphy is a useful tool to diagnosis renal artery stenosis. Numerous semiquantification parameters generated from

renogram with their changes before and after captopril were helpful to decide whether renal artery is with significant stenosis or not.  $\Delta 20$ ,  $\Delta GFR$  and  $\Delta split$  can effectively achieved this goal. With additional information provided by semiquantification parameters, it is possible to show more evidence to determine significant renal artery stenosis than using traditional three probabilities. Finally, by the changes of split renal function, physicians will be more confidence to perform renal artery revascularization due to its excellent ability to predict clinical outcome.

## P-2-20

### Cisplatin Induced Severe Renal Injury-Scintigraphic Evaluation Using Tc-99m DTPA

Muhammad Nouman

Armed Forces Institute of Pathology, Rawalpindi, Pakistan

**Background:** The purpose of this study was to evaluate cisplatin induced severe renal injury by using tc-99m DTPA in patients undergoing chemotherapy with cisplatin based regimens in a Cross-sectional study with a sample size of 62 patients

**Materials and Methods:** Patients who were candidates for cisplatin based chemotherapy regimen with normal renal function as evidenced by normal RFTs and a normal value of age adjusted GFR on Tc-99m-DTPA renal scintigraphy as per guidelines of National kidney foundation were subjected to a post chemotherapy Tc-99m-DTPA renal scintigraphy within 02 weeks of completion of 06 cycles cisplatin based chemotherapy. Post chemotherapy GFR was calculated.

**Results:** Out of 62 patients, 48 were males and 14 were females. The severe renal injury was determined as 2/62(3.2%)

**Conclusion:** This significantly low prevalence of severe renal injury does not warrant any restriction on the common use of cisplatin.

## P-2-21

Withdrawn

## P-2-22

### Association of Ultrasound and DMSA Findings among Pediatric Patients (Ages 2 – 12 Years) with Urinary Tract Infection (UTI) Admitted at University of Santo Tomas Hospital (USTH)

Nilo C. Lopez, Jr M.D.

University of Santo Tomas Hospital, Manila, Philippines

**Background:** Performing both ultrasound and DMSA renal scan in young children with UTI, given our local set-up, is neither realistic nor practical. DMSA is considered the gold standard in detecting renal scarring. Ultrasound's non-invasive nature and its lack of ionizing radiation are advantages of this method. However, the sensitivity of ultrasound in detecting renal cortical scarring is not high. The objective was to determine ultrasound findings associated with renal scarring as seen in DMSA renal scan.

**Materials and Methods:** We conducted a retrospective review of records of pediatric patients (30 boys/52 girls, mean age= 6 years old) with UTI who were admitted to USTH. Imaging reports were retrieved and compared the ultrasound findings with reports of DMSA study.

**Results:** There is a significantly higher proportion of children with sonographically enlarged kidney, diagnosed with renal scarring [ $P < 0.001$ ]. Similarly, there is a significantly higher severity of hydronephrosis in children diagnosed with renal scarring [ $Z = 4.128$ ,  $P = 0.042$ ]. There is however, no relationship exists between renal scarring and pelvocaliectasia ( $P = 1.000$ ) across different age groups.

**Conclusion:** Our results indicate that ultrasound findings of enlarged kidneys and increasing severity of hydronephrosis are associated with a high incidence of renal scarring.

## P-2-23

### Normal Functioning Fused Pelvic Kidneys: Case Series from Nuclear Medicine Perspective

Parvez Ahmed, Kabiruzzaman Shah, Nasrin Begum, Mosharruf Hossain, Tasnim Ahmed, Shariful Islam Chowdhury, Rafiqul Islam

Institute of Nuclear Medicine and Allied Sciences, Rajshahi, Bangladesh

This study describes two cases having fused pelvic kidneys who were first detected by ultrasonographic examination. One case was 24-year-old female and the other case was 21-year-old male. Both cases were referred to our institute for diuretic renal scintigraphy. Their urinary drainage system was assessed and the renal scintigraphy showed that



their fused pelvic kidneys were functioning normally. The authors also present the diuresis renography findings of these cases to depict the fusion and position related anomalies of the kidneys which are very rare congenital situation of the urinary tract.

## P-2-24

### Radionuclide Lymphoscintigraphy in the Evaluation of Lower Extremity Lymphedema – Single Hospital Experience

Perveen R, Sultana N, Jabin Z

National Institute of Nuclear Medicine & Allied Sciences

**Background:** Lymphoscintigraphy (also known as isotope or radionuclide lymphangiography) is the main investigation to establish the diagnosis of lymphedema and visualize peripheral lymphatic channel. Lymphedema (oedema that results from chronic lymphatic insufficiency) is a chronic disease due to accumulation of tissue fluid in the interstitial spaces, resulting from obstruction or defective lymphatic drainage. Lymphoscintigraphy has become the standard investigation in the evaluation of lymphedema and ensure the therapies that can properly diagnosed and characterized with lymphoscintigraphy. The objective was to review our hospital experience in the use of lymphoscintigraphy to evaluate lymphedema of lower extremities.

**Materials and Methods:** We retrospectively identified all the cases with lower limb lymphedema referred for lymphoscintigraphy from January 2014 to June 2014. The scans were performed after subcutaneous injection of 99mTc-nanocolloid in the first inter-digital space in both feet.

**Results:** Total 28 patients (F= 11 and M=17 (ratio of 1:1.7; age range 10 -55 years)) had undergone lymphoscintigraphy. Seven patients (25%) revealed normal flow in both limbs, twenty-one patients (75%) consistent with secondary lymphedema, where six patients (21.4%) revealed bilateral partial obstruction and twelve patients (42.8%) had unilateral partial obstruction and unilateral total occlusion is found about 3 patients (10.7%).

**Conclusion:** Lymphoscintigraphy is frequently misdiagnosed, treated too late or not treated. Lymphatic flow and sites of lymphatic drainage can readily be evaluated with lymphoscintigraphy, and this imaging can play a pivotal role in defining the etiology of lower extremity swelling and ensure the effective therapies. It is safe and effective for the evaluation of lymphedema in lower extremity.

## P-2-25

### Frequency of Delayed Gastric Emptying in Type - 2 Diabetic Patients with Suspected Gastroparesis

Saima Seher

Nuclear Medical Centre, Armed Forces Institute of Pathology, Rawalpindi, Pakistan

**Background:** Diagnosis of gastroparesis requires quantitation of gastric emptying time. Scintigraphy provides a cost effective solution. The objective was to determine the frequency of delayed gastric emptying in type - 2 diabetic patients with suspected gastroparesis, through scintigraphic evaluation of gastric retention.

**Materials and Methods:** This descriptive, cross-sectional study conducted from Jan to Apr 2014 included type - 2 diabetics with suspected gastroparesis. Percentage gastric retention was determined at 1, 2, 3 and 4 hours after ingestion of radiolabelled meal. Percentage gastric retention of >10% at 4 hours was considered abnormal.

**Results:** 85 patients (56 females, 29 males) were included. Delayed gastric emptying was observed in 28/85 (32.9%) patients.

**Conclusion:** Frequency of delayed gastric emptying was 32.9%.

## P-2-26

### Evaluation of GFR in Indian Population: Comparison of Serum Creatinine based estimating equations and gamma camera based GFR by Gates protocol with GFR measured by plasma clearance of Tc-99m DTPA

Shefali M. Gokhale , A.V. Mulay

Inlaks and Budhrani Hospital, Pune

**Background:** In clinical practice, GFR assessment by plasma clearance of Tc-99m DTPA is considered standard. The objective was to compare GFR estimation by gamma camera based Gates protocol and S. Creatinine based predicting equations with GFR measured by plasma clearance of Tc-99m DTPA.

**Materials and Methods:** Eighty four patients (50 male and 34 female) underwent Tc-99m DTPA renal scan followed by withdrawal of venous blood samples as per predefined protocol. Gates method GFR (GFR<sub>G</sub>) was generated. GFR by plasma sampling (GFR<sub>p</sub>) was calculated by the slope-intercept method with provision for corrections. Cockcroft-Gault, 4 variable MDRD and CKD-EPI equations based on serum creatinine were used to generate GFR<sub>CG</sub>, GFR<sub>MDRD</sub>, GFR<sub>CKD-EPI</sub> respectively.

**Results:** GFR estimated by all three estimating equations correlated better than GFR<sub>s</sub> with GFR<sub>p</sub>. For

estimating GFR<sub>p</sub>, GFR<sub>CKD-EPI</sub> had least bias and also was the most precise. GFR<sub>s</sub> was the least precise method.

**Conclusion:** Three estimating equations based on serum creatinine are superior to Tc-99m DTPA scintigraphy for estimating GFR; CKD-EPI equation being the most accurate and precise.

## P-2-27

### Ultrasound Correlation of Renal Cortical Thickness and Renal Scintigraphy Using Technetium-99m Diethylenetriamine Pentaacetic Acid (DTPA) In Patients with Decreased Renal Function: A Retrospective Study

Trisha Noelle DJ. Reyes

University of Santo Tomas Hospital, Philippines

**Background:** Renal cortical thickness (RCT) and decreased renal function on renal scintigraphy are possible indicators of renal disease. The objective was to compare RCT measured through ultrasound with split renal function based on DTPA scan.

**Materials and Methods:** The study included a total of 44 adults (26 male, 18 female; mean age 55.86 ± 16.86) with renal ultrasound and DTPA scan from 2011 to 2013.

**Results:** The pathologic kidney with decreased split renal function shows a decreasing trend on the mean RCT compared to the normal side of the kidney, although not statistically significant. RCT may also predict an abnormal split renal function.

**Conclusion:** RCT of the pathologic kidney may be directly related to split renal function.

## P-2-28

### Association Between The Presence of Active Brown Adipose Tissue and Blood Lipid Profile, Liver Function Tests and Non Alcoholic Fatty Liver Disease in Adult Humans

S.Ozguven<sup>1</sup>, T.Ones<sup>1</sup>, Y.Yilmaz<sup>2</sup>, F.Dede<sup>1</sup>, T.Y. Erdil<sup>1</sup>, S. Inanir<sup>1</sup>, N.Imeryuz<sup>2</sup>, H.T. Turoglu<sup>1</sup>

<sup>1</sup>Marmara University Pendik Training and Research Hospital, Department of Nuclear Medicine, Istanbul, Turkey

<sup>2</sup>Marmara University Pendik Training and Research Hospital, Department of Gastroenterology, Istanbul, Turkey

**Background:** The aim of this study is to investigate whether the presence of activated brown adipose tissue (ABAT) in patients undergoing FDG PET-CT examinations for suspected malignancy or staging purposes is related to blood lipid profile, liver function tests and non-alcoholic fatty liver disease (NAFLD).

**Materials and Methods:** We analysed 11820

consecutive PET-CT whole-body scans performed on a total of 5907 patients who were referred for suspected malignancies or staging purposes retrospectively and prospectively. In the light of regional outdoor temperature (C°) and by taking into consideration of age, gender and body mass index (BMI) each ABAT(+) patient was enrolled one to one with three BAT(-) subjects.

**Results:** 25 out of the 5907 screened individuals fulfilling the criteria for study (9 men, 16 women) demonstrated brown fat tissue uptake [ABAT(+) subjects]. After adjustment for potential confounders, ABAT(+) group had lower total cholesterol, low density lipoprotein cholesterol (LDL), alanin aminotransferase (ALT) and aspartate transaminase (AST) levels ( $p < 0.05$ ). The levels of serum triglyceride and high density lipoprotein (HDL) were not significantly different between ABAT(+) and BAT-negative subjects. In addition, the prevalence of NAFLD in cases with ABAT(+) was lower compared to BAT(-) ( $P < 0.01$ ).

**Conclusion:** In conclusion, our study showed that the presence of ABAT in adults has positive impact on blood lipid profile, liver function tests and also reduces the prevalence of NAFLD suggesting that active BAT may be a potential target for preventing and treating dyslipidemia and NAFLD.

## P-2-29

### How to reduce radiation Dose in sentinel scintigraphy? Comparison of two versus four injection site technique in breast carcinoma

Withdrawn

## P-2-30

### Oatmeal labeled with <sup>99m</sup>Tc-DTPA as a stable semisolid alternative test meal for gastric emptying scintigraphy

Chia-Ju Liu,<sup>1</sup> Ping-Huei Tseng,<sup>2</sup> Mei-Fang Cheng,<sup>1</sup> Yih-Hwen Huang,<sup>1</sup> Ruoh-Fang Yen,<sup>1</sup> Kai-Yuan Tzen,<sup>1</sup> and Yen-Wen Wu<sup>1,2,3,4,5\*</sup>

<sup>1</sup> Departments of Nuclear Medicine and <sup>2</sup> Internal Medicine, National Taiwan University Hospital, National Taiwan University College of Medicine, Taipei, Taiwan

<sup>3</sup> Department of Nuclear Medicine and <sup>4</sup> Cardiology Division of Cardiovascular Medical Center, Far-Eastern Memorial Hospital, New Taipei City, Taiwan

<sup>5</sup> National Yang-Ming University School of Medicine, Taipei, Taiwan

**Background:** The use of radiolabeled test meals with scintigraphy is considered the gold standard for measurement of gastric emptying (GE). Instant oatmeal has been proposed as a good alternative to

the standardized low-fat egg-white test meal. The objective was to evaluate the stability and labeling efficiency of instant oatmeal using technetium-99m ( $^{99m}\text{Tc}$ )-DTPA, in comparison with other commonly test meals used in GE scintigraphy.

**Materials and Methods:**  $^{99m}\text{Tc}$ -DTPA (4.6 MBq) was mixed with each meal including scramble egg, cheese, oatmeal and ensure, and placed in a glass tube containing fresh human gastric juice. Samples of each meal were separated to solid meal from the liquid elute, and the activity before and after filtering was assayed in a dose calibrator. The percentage of initial radioactivity remaining with the meal of admixture was measured and compared.

**Results:** Scramble eggs and cheese had least breakdown with radioactivity of solid parts (> 98% and 96%, respectively). The oatmeal meal also had high binding stability more than 90%, as good as scramble eggs and cheese ( $P=NS$ ) within 2 hours. Although slightly lower stability after 2 hours (85.7%, 85.1% and 86.3% for 2, 3 and 4 hrs respectively, all  $P<0.05$ ), it remained in semisolid appearance with acceptable binding stability. On the other hand, Ensure presented mainly as liquid with lowest radioactivity (77.3%) after 30 minutes.

**Conclusion:** Oatmeal could be served as an alternative test meal for GE scintigraphy due to good stability and labeling efficiency in semisolid form in gastric juice.

## P-2-31

### Noninvasive rest and acetazolamide brain perfusion one - day protocol using SPECT/CT

Dang An Binh<sup>1</sup>, Bui Dieu Hang<sup>1</sup>, Tran Song Toan<sup>1</sup>, Tran Minh Tri<sup>1</sup>, Tran Vu Quynh Vy<sup>1</sup>, Massanobu Ishiguro<sup>2</sup>, Hiroshi Toyama<sup>2</sup>

Cooperate project between <sup>1</sup>Cho Ray Hospital, Ho Chi Minh, Viet Nam & <sup>2</sup>Fujita Health University Hospital, Toyoake, Japan

**Background:** Brain perfusion SPECT imaging has been a useful way to evaluate cerebro-vascular diseases and other neuro diseases. Two-day protocol brain perfusion SPECT is more accurate but not convenient for most patients. This is the reason why a one - day protocol using SPECT/CT was designed.

**Materials and Methods:** Both rest and acetazolamide was done by SPECT/CT system. A 2 minute - dynamic acquisition was carried out immediately after injection of  $^{99m}\text{Tc}$  - HMPAO. Then, the 1<sup>st</sup> rest SPECT study was done for 30 min after 3 min post injection of 370 MBq (10 mCi) of  $^{99m}\text{Tc}$  - HMPAO. Immediately after the 1<sup>st</sup> SPECT, 1g of acetazolamide was given intravenously. Ten minutes later, 740 MBq (20 mCi) of  $^{99m}\text{Tc}$  - HMPAO was additionally injected. Three minutes later the 2<sup>nd</sup> SPECT study was carried out for 30 min. To measure regional cerebral blood flow (rCBF) non-invasively, the

Patlak plot analysis was applied to time-activity data on radionuclide angiography. Then reconstructed images from 1<sup>st</sup> SPECT were converted to 1<sup>st</sup> rCBF map. Base on the increased count ratio in cerebellum between decay corrected 1<sup>st</sup> and 2<sup>nd</sup> SPECT images, acetazolamide increasing ratio was calculated, and then 2<sup>nd</sup> rCBF map was generated. Region of interest (ROI) in 1<sup>st</sup> and 2<sup>nd</sup> images were set, then %increase values were calculated.

**Results:** Thirty-three patients were performed. The rest cortices showed rCBF values by  $49.3 \pm 3.3$  ml/100g brain/min, acetazolamide enhanced cortices show rCBF values by  $53.8 \pm 4.0$  ml/100g brain/min and % increase value by  $8.9 \pm 3.7$  on average.

**Conclusion:** This method of imaging would be significant for evaluating cerebral perfusion reserve in the routine cerebro-vascular disease for a comfortable method to patient because they do not have to come to hospital in 2 days for scanning.

## P-2-32

### Effect of CarekV on image quality & R.D in PET/CT examination

Ridhima Bhayana, Ravi Kant Gupta, Varun Dhull

All India Institute of Medical Sciences

**Background:** To find the effect of CarekV on image quality & effective radiation dose(R.D) in PET/CT examination.

**Materials and Methods:** This study included 37 patient who had another PET/CT scan done on the same machine (Seimens Biograph mCT, without CarekV) with the same CT parameters except CarekV. R.D in CT was calculated. Both scans of these pt were analysed for image quality grading score (G.S) on scale of 1-4 (1-Non diagnostic to 4-excellent). Images were compared for noise, contrast resolution, edge definition, overall quality & 4 organs. G.S was calculated & compared.

**Result:** Using CkV, mean R.D significantly reduced from 11.7 to 11.0 mSv (p value-0.002) & mean G.S significantly increased from 20.24 to 22.36 (p value-0.0117).

**Conclusion:** Using CkV in PET/CT examination, CT R.D to the patient can be reduced significantly without compromising the image quality.

## P-2-33

### Comparison of SPECT study performances between 6 months and 3 years after the Fukushima Daiichi nuclear power plant disaster questionnaire survey

Shigeru Kosuda

National Defense Medical College, Japan

**Background:** To assess the disaster effect on SPECT

study performances obtained by sending a questionnaire sheet to the institutes in Saitama 6 months and 3 years after the Fukushima Daiichi nuclear power plant disaster.

**Materials and Methods:** A questionnaire sheet was sent to the departments of NM in 33 hospitals of Saitama Prefecture where is located 80 to 100 km south of the Fukushima Daiichi nuclear power plant as of September 15th, 2011 and June 15th, 2014. All of the hospitals except 3 answered the questionnaire.

**Results:** 50% (15/30) of the hospitals described continued decrease in the number of NM studies (NMS) 6 months after the disaster. However, all but 3 showed return to the number of NMS before the disaster in the survey 3 years after the disaster. Approval rate of domestic supply of Mo-99/Tc-99m generator was 54% 6 months after the disaster and increased to 60% 3 years after that. Eight patents (16%) expressed exposure uneasy or fear before NMS 6 months after disaster. One of them showed a feeling like cancellation of NMS. However, two patients (4%) expressed exposure uneasiness 3 years after that.

**Conclusion:** The Fukushima Daiichi disaster resulted in reduction of the number of NMS and ill affected the patients' feeling regarding exposure. The situation has been improving but to some extent remains to be solved.

## P-2-34

### A combination of different scintigraphy techniques in hyperparathyroidism assessment

Tran Song Toan, MD\*; Dang An Binh; Tran Vu Quynh Vy; Bui Dieu Hang, MD

Department of Nuclear Medicine, Cho Ray Hospital, Ho Chi Minh, Viet Nam

**Background:** Because of the small size and location of normal parathyroid glands, diagnostic imaging with most modalities is difficult. Hyper-functioning glands, however, can be imaged by using nuclear medicine techniques. The objective was to confirm the role of  $^{99m}\text{Tc}$ -sestamibi imaging in diagnosis of hyperparathyroidism.

**Materials and Methods:** All patients, who had clinical suggestion of hyperthyroidism, underwent a neck ultrasound (US),  $^{99m}\text{TcO}_4^-$  (sodium pertechnetate) and  $^{99m}\text{Tc}$ -sestamibi planar images and SPECT/CT study. Dual-phase  $^{99m}\text{Tc}$ -sestamibi procedure was used. Then a 20-minute SPECT/CT study was done immediately after finished the delayed phase.  $^{99m}\text{TcO}_4^-$  imaging would be done on the next day. All processed images were visually compared together, then the results of these preoperative localization studies were compared to surgical and pathological data of patients.

**Results:** From May 2010 to September 2013, 48 consecutive patients are enclosed in this research.

Thirteen men and 35 women were studied with median PTH value was 277 pg/mL (normal < 70). Twenty two patients had thyroid nodules. Sensitivity and specificity of SPECT/CT observed in our patients were 88.8% and 93.3%.

The overall correlation between the diameter of nodules with PTH value was highly significant ( $r=0.72$ ).

**Conclusion:** A combination of planar imaging of  $^{99m}\text{Tc}$ -MIBI,  $^{99m}\text{TcO}_4^-$  and SPECT/CT scan showed the highest sensitivity (88.8%) and specificity (93.3%), appeared to be a highly accurate preoperative imaging procedure in primary hyperparathyroidism.

## P-2-35

### Haemodynamically significant Coronary Artery Disease detected by Myocardial Perfusion Imaging can be predicted by Carotid Intima Media Thickness

Tapati Mandal, Lutfun Nisa, Nasreen Sultana, Faria Nasreen

Department of Nuclear Medicine, National Institute of Nuclear Medicine and Allied Sciences, Dhaka, Bangladesh

**Background:** Increased Carotid Intima Media Thickness (CMT) has been used as a surrogate marker of atherosclerosis and can predict cardiovascular risk. The objective was to assess the diagnostic performance of CMT for prediction of haemodynamically significant CAD detected by MPI.

**Materials and Methods:** We studied 40 patients (40-50 years of age) with cardiovascular risk factors. MPI was done with  $^{99m}\text{Tc}$  Sestamibi. CMT was measured with B mode high resolution (7 MHz) ultrasound scanner.

**Results:** Summed stress score (SSS) of SPECT MPI images were used for optimum correlation with the CMT. Patients with normal MPI (n=23) had either normal (<1 mm in 11 patients) and/ or mildly increased (1-1.3 mm in 12 patients) CMT and 16 of the 17 patients with myocardial perfusion defect showed consistently high CMT. A direct relationship was observed between the degree of CMT and the extent and severity of perfusion defect as analyzed by the Pearson's correlation coefficient (positive correlation of  $r=0.055$ , statistically highly significant  $P<0.001$ ). The CMT value of  $\geq 1.25$  mm was found to be a predictor of abnormal perfusion detected by MPI (sensitivity - 70.6%, specificity - 87%, PPV - 80% and accuracy - 80%).

**Conclusion:** A CMT of  $\geq 1.25$  mm can significantly predict the haemodynamic effect of atherosclerotic lesions on myocardial perfusion in patients with risks of CAD with an accuracy of about 80%.



## P-2-36

### Degree of myocardial perfusion & fatty acid metabolism mismatch and its correlation with LV remodeling following successfully reperfused ST segment elevated myocardial infarction (STEMI)

Shankar Kumar Biswas<sup>1</sup>, Masayoshi Sarai<sup>2</sup>, Hiroshi Toyama<sup>2</sup>, Masatsugu Iwase<sup>2</sup>, Yukio Ozaki<sup>2</sup>

<sup>1</sup> Institute of Nuclear Medicine & Allied Sciences, Dhaka

<sup>2</sup> Fujita Health University, Japan

**Background:** Discordant <sup>123</sup>I-β-methyl-iodophenyl pentadecanoic acid (BMIPP) and <sup>99m</sup>Tc-tetrofosmin (TF) uptake is designated as viable dysfunctional myocardium. A little is known about its relation with left ventricular (LV) remodeling. The objective was to unravel the impact of the degree of BMIPP-TF mismatch and its correlation with change of LV volume following successfully reperfused STEMI.

**Materials and Methods:** Twenty five patients with STEMI underwent emergency percutaneous coronary intervention. BMIPP and TF cardiac scintigraphy were performed around 7 days of admission. A difference of BMIPP and TF defect score by  $\geq 4$  were considered as mismatched defect. Echocardiography was performed within 24 hrs of admission and at 3 months interval. End diastolic volume index (EDVI) and end systolic volume index (ESVI) were recorded accordingly.

**Results:** Twenty one patients showed BMIPP-TF mismatched defect and rest 4 showed matched defect. Twelve patients (48%) showed reduction of EDVI and 14(56%) patients showed reduction of ESVI over 3 months. Mismatched defect score showed significant correlation with the relative change of EDVI ( $P=0.002$ ,  $r=0.58$ ) and ESVI ( $P=0.043$ ,  $r=0.40$ ).

**Conclusion:** The degree of dysfunctional viable myocardium showed nice correlation with the reduction of LV volumes following successfully reperfused STEMI.

## P-2-37

### Incremental value of stress-induced dyssynchrony on early post-stress Tl-201 gated SPECT in the diagnosis of coronary artery disease

Guang-Uei Hung

Chang Bing Show Chwan Memorial Hospital

**Background:** Previous studies showed different dyssynchrony patterns between ischemic and normal myocardium at early post-stress using Tl-201 gated SPECT. The aim of this study was to assess the relation of stress-induced dyssynchrony and the extent of coronary artery disease (CAD).

**Materials and Methods:** 144 patients were

retrospectively analyzed. With  $\geq 70\%$  stenosis as the criteria of CAD, 57 had no CAD, 32 had 1-vessel disease, 36 had 2-vessel disease, and 19 had 3-vessel disease, respectively. LV global and territorial dyssynchrony parameters were measured by the phase analysis from stress/rest Tl-201 SPECT and compared between stress and rest among the patient groups.

**Results:** The patients with multi-vessel CAD had significantly more global dyssynchrony than the patients without  $\geq 70\%$  stenosis at stress. In the patients with multi-vessel CAD, stress images showed significantly more global and territorial dyssynchrony than the rest images. More patients with 3-vessel CAD were correctly classified as multi-vessel disease, when combining both visual interpretation and dyssynchrony assessment.

**Conclusion:** The patients with multi-vessel CAD had significantly more global and territorial dyssynchrony at early post-stress than at rest. Such quantitative measures of myocardial stunning may assist in the diagnosis of multi-vessel CAD.

## P-2-38

### <sup>99m</sup>Tc-HMPAO nano liposomes, an excellent RBC substitute for blood pool imaging

Sadri K<sup>1,\*</sup>, Momenypoor S<sup>2</sup>, Dabbagh Kakhki VR<sup>1</sup>, Sadeghi R<sup>1</sup>, Aryana K<sup>1</sup>, Johari Doha F<sup>3</sup>, Zakavi SR<sup>1</sup>, Jaafari MR<sup>2</sup>

1 Nuclear Medicine Research Center, Mashhad University of Medical Sciences (MUMS), Mashhad, Iran

2 Biotechnology Research Center, Nanotechnology Research Center, School of Pharmacy, MUMS, Mashhad, Iran

3 Nuclear Science and Technology Research Institute, Tehran, Iran

**Background:** *In vitro* labeling of RBC with <sup>99m</sup>Tc is an intricate procedure and there is always a need for an alternate blood pool imaging agent. The aim of this study was to prepare an effective nano sized liposome (NLs) similar to human red blood cell for blood pool scintigraphy.

**Materials and Methods:** PEG-NLs and none PEG-NLs were prepared using film method plus high pressure homogenization technique. Planar images were acquired using a 256 × 256 matrix 0, 1, 2 and 24 h after <sup>99m</sup>Tc-HMPAO-NLs injection. SPECT images were obtained 15 min after injection (64 slices, 30 second/projection).

**Results:** <sup>99m</sup>Tc-HMPAO-PEG-NLs showed a significant circulation tracer activity ( $7.74 \pm 1.63\%$  ID/g at 1 h and  $4.9 \pm 0.77\%$  ID/g at 4 h), with low tracer accumulation in the liver ( $12.07 \pm 3.66\%$  ID/g at 1 h and  $14.85 \pm 1.3\%$  ID/g at 4 h). Heart to liver, spleen and background ratios (ROIs) for <sup>99m</sup>Tc-HMPAO-PEG-NLs was 1.25, 4 and 4.28 respectively at 2 h which changed to 1.06, 1.75 and 2.51 respectively at 24 h.

**Conclusion:** The <sup>99m</sup>Tc-HMPAO-PEG-NLs with a prolonged blood circulation time could be an excellent RBC alternative for scintigraphy.

## S-1

### Initial experience of Ga-68 DOTANOC imaging in NET in a tertiary care medical center

Arya A, Singh D, Gambhir S, Agarwal G\*, Agarwal A\*, Pradhan PK

Department of Nuclear Medicine, Department of Endosurgery\*, Sanjay Gandhi Post Graduate Institute of Medical Sciences, Lucknow, India

**Background:** The aim of this study was to analyze retrospectively the utility of Ga-68 DOTANOC in PET-CT imaging in the management of neuroendocrine tumors.

**Materials and Methods:** PET-CT study was done in 21 patients of neuroendocrine tumors [NET's], which included 14 males & 10 females, aged 7 to 62 yrs. They underwent PET-CT study after IV injection of 74-148 MBq of Ga-68 DOTANOC. Pt. was given oral contrast. Images were acquired 1 hr. later on PET-CT scanner [Biograph 64 slice scanner, Siemens, Germany].

**Results:** The NET's included 4 cases of pheochromocytoma, 4 cases of MTC, 4 cases of carcinoid, 1 case of MEN-1, 3 cases of paraganglioma, 1 case of neuroblastoma, 4 cases of gastroenteropancreatic NET's which included duodenal, retroperitoneal, esophageal & pancreatic tumors. Each case was analysed with respect to the clinical context which revealed Ga-68 DOTANOC avid in 3 cases of pheochromocytoma, 1 case of neuroblastoma, 3 cases of medullary carcinoma of thyroid, 1 case of MEN I, 3 cases of carcinoid, 3 cases of gastroenteropancreatic tumors i.e. duodenal, pancreas, esophagus, 2 cases of paraganglioma. There was no radiopharmaceutical concentration in 1 case of pheochromocytoma, one case of medullary carcinoma of thyroid and one case of carcinoid and one case of paraganglioma. The interesting aspects of this molecular imaging will be demonstrated in form of clinical case.

**Conclusion:** This early experience of PET-CT using Ga-68 DOTANOC in diverse patients of neuroendocrine tumors provide further insight into Ga-68 labeled positron imaging and for radionuclide therapy in metastatic neuroendocrine tumors.

## S-2

### Evaluation the Clinical Efficacy of Knee Radiosynovectomy in Kuwait Population

Anwar Al.Banna

Ministry of Health, Kuwait

Radiosynoviorthesis (RSO) or radiosynovectomy is a local form of radiotherapy for treatment of resistant synovitis of individual joints resulting in a restoration of the inflamed synovium. This study

designed to assess the overall efficacy of RSO in different synovial pathologies among Kuwait population. The study conducted in Farwania Nuclear Medicine Department in Farwania Hospital, Kuwait. We did knee joints RSO using Yttrium-90 intra-articular injection in 34 patients ranged from 19 to 69-year-old. A comprehensive pain evaluation questionnaire were performed by patients and recorded before and after the treatment for assess the efficacy of the therapy in individual patient. Also, pre and post imaging evaluation with two phase bone scan and knee ultrasonography were obtained to assess the response rate objectively. Seventy one percent of patients showed significant therapeutic relief; 20% partially relieved and 9 % had no response. Our result data are keeping with international publications. Also, a new approach of Bremstrahlung SPECT-CT images of the knee following intra-articular injection of Yttrium-90 was adopted to delineate intra or extra-articular distribution of the injected radiotracer. This novel approach is not to date being reported for RSO and appears to be promising.

## S-3

### FDG-PET Brain Imaging Patterns in Patients with X-linked Dystonia Parkinsonism

Eduardo Erasto S. Ongkeko

St. Luke's Medical Center, Philippines

**Background:** X-linked dystonia-parkinsonism (XDP) or Lubag is a rare movement disorder that afflicts mostly Filipino men. Diagnosis is based on the clinical presentation and the establishment of an x-linked recessive pattern of inheritance or by genetic confirmation. Objectives for this study are to describe the brain FDG distribution using PET imaging in Filipino patients with Lubag including asymptomatic carriers and to determine differences in striatal FDG utilization in those presenting with predominant parkinsonism and those with predominant dystonia.

**Materials and Methods:** Eleven male patients having clinical manifestations of XDP and diagnosed by movement disorder specialists underwent an FDG-PET scan. Four genetically-proven asymptomatic carriers and seven normal controls were also recruited for FDG-PET studies. Qualitative and semi-quantitative assessment using SUV and % FDG uptake of striatal structures were obtained and compared for each group.

**Results:** Visual assessment revealed five of the 11 symptomatic patients having both caudate and putaminal hypometabolism while the remaining six symptomatic patients having putaminal hypometabolism alone. All four asymptomatic carriers had normal FDG PET studies. In comparison



with data obtained from normal control subjects, there was significantly reduced FDG metabolism in the caudate nuclei and more so in the putamen in the symptomatic lubag group ( $P < 0.05$ ) but no differences were observed between the asymptomatic carriers and normal controls ( $P > 0.05$ ). XDP patients having hypometabolism in both the putamen and caudate nuclei appear to have longer duration of clinical disease than those with putaminal hypometabolism alone ( $P < 0.05$ ). No significant difference in striatal FDG metabolism was documented between those having predominant dystonia and those having predominant parkinsonism ( $P > 0.05$ ).

**Conclusions:** This small series of patients demonstrate that patients with the phenotypic characteristics of X-linked Dystonia Parkinsonism have consistently poor glucose metabolism in the putamen and various degrees of decreased glucose metabolism in the caudate nuclei. Patients having both caudate and putaminal hypometabolism suggest that they have been symptomatic for a longer period of time. FDG-PET cannot discriminate between lubag patients presenting predominantly with dystonic symptoms and those presenting predominantly with parkinsonism. Lastly, FDG-PET did not show striatal abnormalities in the carriers of XDP mutation that would suggest preclinical disease activity.

## S-4

### Our experience use the concentration of thyroglobulin and anti-thyroglobulin antibodies in patient with differentiated thyroid cancer after Radioiodine 131 treatment

Erdenechimeg S, Enkhuya B, Enkh-Amar T, Enkhbat G

Department of Nuclear Medicine, First State Central Hospital of Mongolia

**Background:** The measurement of serum thyroglobulin (Tg) is the primary biochemical marker used for disease surveillance, creating challenges in monitoring patients with differentiated thyroid cancer (DTC) for residual or recurrent disease. Anti-thyroglobulin antibodies (anti-TgAbs) elevated in some patients as well. The persistence of anti-TgAbs, especially if levels are rising, may indicate persistent, recurrent or progressive thyroid cancer. The aim of this study was to evaluate the concentration of Tg and anti-TgAbs in patients with DTC 3 and 6 months after radioiodine therapy to analyze whether the raise and course of anti-TgAbs is related to the clinical status of DTC patients or Tg levels before and after radioiodine therapy.

**Materials and Methods:** Pre-treatment measurements made in conditions of stimulation of

Tg secretion endogenous thyroid stimulating hormone (TSH) ( $TSH \geq 30$  mIU/L), while the measurement after treatment were obtained in conditions of suppression of Tg secretion ( $TSH \leq 0.1$  mIU/L).

**Results:** Concentration of Tg were decreased in the serum of all patients with DTC 6 months after radioiodine therapy, as well as mean concentration of anti-TgAbs. Individual values of anti-TgAbs in patients with DTC after the radioiodine treatment were diverse (decreased, increased or unchanged).

**Conclusion:** The development and course of anti-TgAbs in DTC patients cannot be predicted by Tg levels before and after radioiodine therapy.

## S-5

### Future cardiac events in normally diagnosed Gated myocardial perfusion SPECT (GSPECT)

Hamid Amer

King Abdulaziz Hospital for national Guards Alahsa - Kingdom of Saudi Arabia

**Background:** Coronary heart disease (CHD) is a major cause of mortality and morbidity in Europe and USA and its management consumes a large proportion of national healthcare budgets. Many studies had tested the prognostic value of a normal myocardial perfusion scintigraphy; they concluded that a normal MPI study is associated with a very low rate of future cardiac events. In view of the above this study is designed to determine the risk of future cardiac events after normal MPS in local population and the influence of clinical risk factors over the rate of future cardiac events.

**Materials and Methods:** This was a retrospective observational registry performed in a single center in the Kingdom of Saudi Arabia. The data were collected from the nuclear medicine database identifying all the reported normal myocardial perfusion scans between January 2008 and December 2011. There were 290 patients identified with normal

cardiac nuclear scans in the pre-specified time frame. Basic patient demographics were outlined and the patients' charts were reviewed looking for any major cardiac events such as MI or sudden death. Mean follow up was 14.8 months.

**Results:**

**Demographic Data of the Patients:** There were 290 patients identified with normal cardiac nuclear scans in the pre-specified time frame. 103 of these patients were male accounting for 35% of the total population. Average age at the time of examination was  $60.6 \pm 11.8$  years and the highest age group were between 66 and 70 years. **Risk factors for CAD:** The patients were presented with one or more risk factors. Out of the 290 patients, 61% were diabetic,

75.2% were hypertensive, 65.5% were dyslipidemic, 2.8% had a significant positive family history of IHD, 7.2% were smokers, and 24.1% had history of CAD. 2.1% of the total patient populations had prior CABG. 2.4% of the patients had prior percutaneous coronary intervention (PCI). Most of the cases presented with more than a single risk factor and the highest group were carrying three risk factor.

**Follow up Data:** There were 2 patients that were admitted with NSTEMI and went on to have diagnostic angiograms. One of those two patients underwent percutaneous coronary intervention with stenting. The other patient had non-obstructive CAD and was advised for medical management only. These findings are consistent with a 0.7% risk of cardiac events after a negative scan.

**Conclusion:** It is concluded that a normal MPI study is associated with a very low rate of future cardiac events. Women with multiple risk factors including family history of CAD are more likely to sustain events and require close surveillance for the development of coronary disease. However the above findings demonstrate that the risk of major cardiac events after a negative nuclear cardiac scan is low and is in keeping with the international statistics available.

## S-6

### Heterogeneity analysis in differentiating between malignant and benign FDG-avid thyroid nodules

Hendra Budiawan<sup>1,2</sup>, Gi Jeong Cheon<sup>1,3</sup>, Jin Chul Paeng<sup>1</sup>, KeonWook Kang<sup>1,3</sup>, June-Key Chung<sup>1,3</sup>, Dong Soo Lee<sup>1</sup>

<sup>1</sup>Department of Nuclear Medicine, Seoul National University Hospital, Seoul, Korea

<sup>2</sup>Department of Nuclear Medicine, Mochtar Riady Comprehensive Cancer Centre – Siloam Hospitals Semanggi, Jakarta, Indonesia

<sup>3</sup>Cancer Research Institute, Seoul National University, Seoul Korea

**Background:** Differentiating between malignant and benign FDG-avid nodules is still challenging. The purpose of this study was to assess if heterogeneity of FDG uptake could be useful.

**Materials and Methods:** There were 27 malignant nodules and 17 benign nodules. SUV<sub>max</sub>, longest diameter, HU, and coefficient of variation (CV) were compared between the 2 groups. CV was obtained by dividing standard deviation of SUV by mean of SUV. The volume of interest was made without using any threshold, but by drawing manually.

**Results:** Malignant thyroid nodules tended to have higher SUV<sub>max</sub> and CV compared to benign nodules. Longest diameter and HU were not significantly different.

**Conclusion:** Malignant thyroid nodules showed more heterogeneous FDG uptake than benign nodules.

Heterogeneity, represented by CV derived from manual VOI, can be helpful in characterizing thyroid nodules.

## S-7

### Efficacy of <sup>99m</sup>Tc-sestamibi SPECT/CT for minimally invasive parathyroidectomy: Comparative study with <sup>99m</sup>Tc-sestamibi scintigraphy, SPECT, US and CT

HY Lee

Snubh

**Background:** We evaluated the efficacy of <sup>99m</sup>Tc-sestamibi SPECT/CT for planning minimally invasive parathyroidectomy (MIP), comparing with dual phase <sup>99m</sup>Tc-sestamibi scintigraphy, <sup>99m</sup>Tc-sestamibi SPECT and conventional imaging (US and CT).

**Materials and Methods:** Thirty-one patients (M:F = 10:21, range 35–78 years old) who showed high serum parathyroid hormone (intact PTH) level were included. <sup>99m</sup>Tc-sestamibi scintigraphy was performed 15 and 150 min after injection of <sup>99m</sup>Tc-sestamibi (555 MBq), and <sup>99m</sup>Tc-sestamibi SPECT/CT was obtained just after the delayed scan. Comparison study between imaging modalities was done by patient-based and lesion location-based analysis.

The location of the lesion was confirmed by the operative finding. An operation was performed in 24 patients. Seven patients had normal <sup>99m</sup>Tc-sestamibi SPECT/CT, and followed for more than 6 months after SPECT/CT.

**Results:** Among 24 patients, parathyroid adenoma was detected in 19 patients and the other 5 had parathyroid hyperplasia (total 35 lesions). <sup>99m</sup>Tc-sestamibi scintigraphy detected abnormal uptake in 15 patients with 24 lesions. Conventional imaging identified abnormal findings in 17 patients with 27 lesions. SPECT detected abnormal findings in 18 patients with 27 lesions. SPECT/CT identified abnormal findings in 24 patients with 35 lesions. SPECT/CT demonstrated 100 % sensitivity in a patient-based analysis. SPECT/CT exhibited significantly better sensitivity than <sup>99m</sup>Tc-sestamibi scintigraphy, SPECT and conventional imaging (p<0.05). All lesion location was correctly identified to perform MIP. The final clinical diagnosis of 7 normal SPECT/CT patients was secondary hyperparathyroidism on 6 months follow-up.

**Conclusion:** We correctly identified the precise location of parathyroid adenomas or hyperplasia by <sup>99m</sup>Tc-sestamibi SPECT/CT which was helpful to perform MIP.

## S-8

**Breast cancer and autoimmune thyroiditis: Does the sodium iodide symporter play a role?**

Jefferson R. Pagsisihan, Hyun-Yeol Nam, Jae Seon Eo, June-Key Chung and Dong Soo Lee

Department of Nuclear Medicine, Seoul National University Hospital, Seoul, South Korea

**Background:** Breast cancer is the most common malignancy in women. Thyroid disease is likewise prevalent in the female population. On whole body PET/CT, increased thyroid gland uptake of F-18 Fluorodeoxyglucose (FDG) is sometimes encountered. It may appear diffusely or focally increased. Sodium iodide symporter is found in both the thyroid gland and breast. This study aims to determine the incidence and evaluate the clinical significance of diffusely increased thyroidal uptake of F-18 FDG in breast cancer patients. This also aims to determine the possible role of NIS in thyroid disease among breast cancer patients.

**Materials and Methods:** The study population was comprised of 440 adult female cancer patients. Those who were diagnosed with thyroid and ovarian malignancy, as well as those with previous thyroid surgery, were excluded. Whole body PET/CT images and medical records were reviewed. The presence of NIS mRNA in the serum was determined using nested RT-PCR.

**Results:** One hundred thirty-three (30.2%) patients had breast cancer while 307 (69.8%) had malignancies other than breast cancer. Diffusely increased thyroidal uptake was demonstrated in 18.8% and 10.4% patients in the breast cancer group and non-breast cancer group, respectively. There was significant difference between these incidence rates. Diffusely increased thyroid uptake was more frequently noted in women 50 years old and above. The average SUV<sub>max</sub> of the thyroid gland in breast cancer patients with diffusely increased thyroid uptake (3.33) was significantly higher than in those who did not exhibit increased thyroid uptake (1.25) ( $P < 0.0001$ ). In the patients with diffusely increased thyroid uptake, the average SUV<sub>max</sub> of the thyroid gland of the non-breast cancer group (4.80) was significantly higher than that of breast cancer group (3.33) ( $P = 0.021$ ). There was no statistical significance in the incidence of diffusely increased thyroid uptake with regards to cancer stage and hormone receptor status. On further thyroid gland evaluation, autoimmune thyroiditis was noted in the breast cancer patients with diffusely increased uptake. NIS mRNA was detected in serum of the breast cancer patients and was negative in all the normal controls.

**Conclusions:** Diffusely increased thyroidal F-18 FDG uptake was more frequently exhibited in patients with breast cancer. Further thyroid gland evaluation revealed autoimmune thyroiditis. NIS mRNA was detected in serum of the breast cancer patients. These

are suggestive of an association between breast cancer and autoimmune thyroiditis and the possible role of NIS in the causation of this milder form of autoimmune thyroiditis.

## S-9

**Prediction of hepatocellular carcinoma recurrence after liver transplantation by <sup>18</sup>F-FDG PET/CT using metabolic and volumetric parameters**

Jin Chul Paeng

Seoul Nat'l University Hospital

**Background:** Our aim is to compare the various parameters of <sup>18</sup>F-FDG PET/CT for prediction of hepatocellular carcinoma (HCC) recurrence after liver transplantation (LT).

**Materials and Methods:** Total 110 HCC patients (M:F = 89: 21 age =  $54.4 \pm 8.6$  yr) who underwent <sup>18</sup>F-FDG PET/CT and following LT (93 from living donor, 17 from deceased donor) were retrospectively enrolled. Patients were followed up for more than 1 yr (mean =  $27.4 \pm 13.4$  mo) by ultrasonography, enhanced-CT, and/or <sup>18</sup>F-FDG PET/CT. On preoperative <sup>18</sup>F-FDG PET/CT, peak, maximum and mean standardized uptake values (SUV) and tumor-to-background [inferior vena cava (IVC) or liver] ratio of SUV (TBR, SUV<sub>max</sub> divided by background) were measured as metabolic parameters. Metabolic tumor volume (MTV), total lesion glycolysis (TLG, SUV<sub>mean</sub> multiplied by MTV) and uptake volume portion (UVP, TBR multiplied by MTV) were also measured as volumetric parameters and compared for prediction of HCC recurrence.

**Results:** Thirty patients (27.3%) exhibited HCC recurrence after  $11.5 \pm 9.0$  mo. On receiver operating characteristic (ROC) curve analyses, various PET parameters had significant area under curve (AUC: TBR by IVC = 0.913, UVP by liver = 0.896). On log-rank test, TBR by IVC, UVP by liver, Milan criteria, tumor largest diameter, tumor number, vascular invasion, T stage and tumor grade showed significant predictive values for recurrence. Multivariate analysis by Cox-regression revealed that TBR by IVC, UVP by liver and vascular invasion were significant predictors, with highest odds ratio (OR) on UVP by liver [OR = 12.0 (3.0 - 47.1)].

**Conclusion:** Among several metabolic and volumetric parameters of <sup>18</sup>F-FDG PET/CT, TBR and UVP by IVC exhibited the highest predictive value for prediction of HCC recurrence after LT. <sup>18</sup>F-FDG PET/CT is an effective imaging method for prediction of tumor recurrence after LT for HCC.

## S-10

### Role of 11C-Methionine PET/CT for amygdala enlargement

Kimiteru Ito

Tokyo Metropolitan Geriatric Hospital and Institute of Gerontology

The aim of this study is to explore amygdalar enlargement (AE) pathogenesis as one of the potential epileptogenic lesions by using 11C-methionine (Met) positron emission tomography (PET)/computed tomography (CT). Forty-four patients with temporal lobe epilepsy (TLE) including twenty-six AE underwent Met PET/CT. Met uptake was visually assessed. AE were diagnosed with MRI findings by neuroradiologists. Seven of twenty-six AE cases showed Met positive. All TLE without AE cases showed Met negative. Lesion/normal ratio of Met uptake was significantly higher in the AE with Met positive group than in the AE with Met negative or TLE without AE groups. Finally, twelve patients underwent surgical treatment. Pathological evidence revealed 1 low grade glioma, 1 ganglioglioma, and 1 focal cortical dysplasia (FCD) in the AE with Met positive group, 2 FCD and 1 hamartoma in the AE with Met negative group, and 6 non-tumor lesions in the TLE without AE group. Met PET/CT can detect hidden brain tumors in TLE patients with AE.

## S-11

### Ga-68 labelled PSMA in the evaluation of biochemical relapse in prostate cancer: Preliminary results

Madhavi Tripathi, Rajeev Kumar, Partha Sarathi Chakroborty, \*Amlesh Seth, Shambo Guha Roy, Parul Thukral, Sanjana Ballal, Chandrasekhar Bal

Department of Nuclear Medicine and PET and \*Department of Urology, All India Institute of Medical Sciences, New Delhi, India

**Background:** Till date, the detection of lesions in the context of biochemical recurrence of prostate cancer (PC) is a major challenge for all imaging modalities and one of the key issues in management. The aim of the present study was to evaluate the role novel generator based PET radiotracer Ga-68 labeled PSMA in PC with biochemical relapse.

**Materials and Methods:** Eight patients with biochemical relapse of prostate cancer mean PSA= 9.9 ng/ml (range=1.14 to 31.0 ng/ml) underwent Ga-68 PSMA and conventional imaging for evaluation of relapse. Plain and fused Ga-68 PSMA PET/CT images were viewed for visual interpretation. Radiotracer uptake that was visually considered as PC was semi-quantitatively analysed by measuring SUV<sub>max</sub>.

**Results:** Lesions characteristic of prostate cancer were detected in five (62.5%) patients using Ga-68 PSMA, this included two patients with PSA levels < 2.8 ng/ml. All cases with recurrence in the prostatic bed (two) and one case with prostatic and lymph node metastasis were proven on MRI. In one case with marrow metastasis on Ga-68 PSMA, bone scan was normal but MRI proved the marrow lesion. One case with pleural and lung metastasis was proven on CT.

**Conclusion:** Thus Ga-68 PSMA correctly localized disease in 62.5 % of patients with biochemical relapse of PC. Further evaluation in a larger number of patients is planned to establish its true influence on patient management.

## S-12

### Diagnostic performance of <sup>18</sup>F FDG PET CT in patients presenting with secondary neck nodes from an unknown primary malignancy; An Institutional Experience

Manjit Sarma, Shagos G. S, S. Satish, Padma S, Shanmuga Sundaram P

Department of Nuclear Medicine and PET CT, Amrita institute of Medical Sciences and research centre (Amrita Vishwa Vidyapeetham), Cochin, Kerala, India

**Background:** In many patients presenting with neck nodal metastases from an unknown primary the primary tumor remains occult even after thorough clinical and anatomical imaging investigations. Whole body FDG PET CT is being increasingly used for evaluation of these patients. We aimed to evaluate the diagnostic performance of FDG PET CT in patients with recently detected neck nodal metastases from unknown primary.

**Materials and Methods:** Study included 38 patients (male: female=30:8, age range=32-80 years, mean age= 57.9 ± 13.39 years) with one or more palpable cytologically /histopathologically confirmed malignant neck node(s). All the patients had been subjected to thorough physical examination, endoscopies and anatomical imaging, but no primary malignancy had been identified. A standard protocol for whole body FDG PET CT was followed. PET CT findings, FNAC or endoscopic findings from PET guided/ directed biopsies of suggested occult primaries (when applicable), and finally histopathologies of the specimen (when applicable) were correlated. Any FNA or biopsy finding from suggested metastatic sites was also correlated.

**Results:** Distribution of primary tumor sites identified by PET CT included nasopharynx in 3 patients (27.2%), tonsils in 2 (18.6%), esophagus in 2 (18.6%), pancreas in 2 (18.6%), base of the tongue in 1(9.0%) and breast in 1 patient (9.0%). Detection rate of occult primary by FDG PET CT in our series is 28.9% (11 out of 38 patients). Assessment of validity parameters for FDG-PET CT showed a



sensitivity and specificity of 100% and 77.7 %, respectively. The positive predictive value (PPV) was 64.7% and the negative predictive value (NPV) was 100%. False positivity rate was found to be 22.2%. FDG PET CT study also detected other lymphnodal and organ metastases. (a). In patients with cervical nodal metastases (N staged patients, total 26 patients): Extracervical lymphnodal or contralateral cervical metastatic disease was detected in 2 patients. Altogether distant skeletal and soft tissue metastases were detected in 5 patients. (b). In patients with supraclavicular nodal (SCN) presentation (total 12 patients): Extra SCN lymphnodal metastatic lymphnodes in 5 patients and overall skeletal and soft tissue metastases were detected in 8 patients in this group. Overall PET CT detected other lymphnodal or organ metastases in 42% patients (16/38 patients).

**Conclusion:** 18F-FDG PET CT is an useful modality for detecting unknown primary as well as other sites of metastasis in patients presenting with lymph nodal metastases in neck from an unknown primary malignancy.

## S-13

### Relationships between F-18 FDG Uptake and the Status of BRAF V600E Mutation and Glucose Transporter-1 Expression in the Papillary Thyroid Carcinomas

Minki Yoon

Department of Nuclear Medicine, Good Samaritan Hospital, Republic of Korea

**Background:** The purpose of this study was to find out the utility of F-18 FDG PET/CT in PTCs, the association of the maximum standardized uptake value (SUV<sub>max</sub>) of F-18 FDG PET/CT and the status of BRAF V600E mutation and the glucose transporter-1 (GLUT1) expression was evaluated.

**Materials and Methods:** Retrospective analysis was performed in 33 patients with PTCs. F-18 FDG PET/CT was performed preoperatively and the SUV<sub>max</sub> was calculated in the region of interest. The BRAF V600E mutation was detected by DNA sequencing. Immunohistochemical study for GLUT1 expression was done.

**Results:** The BRAF V600E mutation was detected in 63.6% (21/33) patients with PTCs and the GLUT1 expression was 72.7% (24/33). The SUV<sub>max</sub> of PTCs was significantly higher in the mutated BRAF group than in the wild-type BRAF group (8.6±6.7 vs. 4.1±2.6,  $P<0.05$ ). The SUV<sub>max</sub> was not significantly associated with the levels of GLUT1 expression in all patients with PTCs ( $P=0.326$ ). The BRAF V600E mutation was significantly correlated with GLUT1 expression (Spearman's rho=0.380,  $P<0.05$ ).

**Conclusion:** The BRAF V600E mutation is significantly associated with increased SUV<sub>max</sub> of F-18

FDG PET/CT and GLUT1 overexpression in PTCs. Preoperative F-18 FDG PET/CT, which reflects the glucose metabolism, can be an adjunctive method to predict the BRAF V600E mutation in PTCs.

## S-14

### Efficacy of radiosynovectomy in the treatment of chronic knee synovitis: systematic review and meta-analysis

Nasim Norouzebeigi

Nuclear Medicine Research Center, Mashhad, Iran

**Background:** Knee joints are commonly involved with various inflammatory and non-inflammatory rheumatic diseases. Radiosynovectomy is being used as a local therapeutic option to alleviate pain and swelling in involved joints. The present study evaluated the effectiveness of radiosynovectomy for treatment of chronic knee synovitis.

**Materials and Methods:** Through a search of Medline and SCOPUS with (Radiosynovectomy OR radiosynovectomy OR "radio synovectomy" OR "radiation synovectomy" OR radiosynoviorthesis OR radiosynoviorthesis OR synoviorthesis OR "radiochemical synovectomy" OR "radioisotope synovectomy") AND (Re-188 OR Y-90 OR SM-153 OR P-32) as key words, 9 RCTs were enrolled in the analysis.

**Results:** The outcomes of interest were odds ratio and risk difference of improvement in the radiosynovectomy group compared to the control group. Odds ratio and risk difference for SM-153 plus corticosteroid subgroup was 1.959[0.571-6.725,  $P=0.285$ ] and 14.9% [-17.1%-47%,  $P=0.362$ ] respectively. The subgroup of Y-90 plus corticosteroids showed pooled odds ratio and risk difference of 2.366[0.779-7.188,  $P=0.129$ ] and 23.9% [-1.7%-49.4%,  $P=0.67$ ] and in the subgroup Y-90 alone were 0.851[0.356-2.036,  $P=0.717$ ] and -2.3% [-23.3%-18.7%,  $P=0.829$ ] respectively.

**Conclusion:** Combination of Y-90 colloid or Sm-153 with corticosteroids in radiosynovectomy have higher response rate compared to each of radioisotope or corticosteroid therapy alone.

## S-15

### Comparison of $^{18}\text{F}$ -Fluoride PET/CT, $^{18}\text{F}$ -FDG PET/CT and bone scintigraphy for detection of bone metastasis in renal cell carcinoma: A pilot study

Punit Sharma<sup>1,2</sup>, Sellam Karunanithi<sup>2</sup>, Partha Sarathi Chakraborty<sup>2</sup>, Rajeev Kumar<sup>2</sup>, Chandrasekhar Bal<sup>2</sup>, Rakesh Kumar<sup>2</sup>

<sup>1</sup>Department of Nuclear Medicine & PET/CT, Eastern Diagnostics India Ltd., Kolkata, India

<sup>2</sup>Department of Nuclear Medicine, All India Institute of Medical Sciences, New Delhi, India

**Background:** To evaluate the role of  $^{18}\text{F}$ -Fluoride PET/CT for detection of bone metastasis in patients with renal cell carcinoma (RCC) and compare the same with  $^{18}\text{F}$ -FDG PET/CT and  $^{99\text{m}}\text{Tc}$ -MDP bone scintigraphy (BS), when available.

**Materials and Methods:** Total 36 patients (Mean age:  $52.5 \pm 14.1$  years; Male/female: 27/9) with RCC underwent  $^{18}\text{F}$ -Fluoride PET/CT and there data were analyzed. PET/CT images were analyzed by two nuclear medicine physicians in consensus, visually and semiquantitatively ( $\text{SUV}_{\text{max}}$ ). Results of  $^{18}\text{F}$ -Fluoride PET/CT were compared to  $^{18}\text{F}$ -FDG PET/CT (n=16) and BS (n=22). Histopathology/clinical/imaging follow up (minimum-6 months) was used as reference standard.

**Results:** Overall  $^{18}\text{F}$ -Fluoride PET/CT showed sensitivity of 100%, specificity of 94.4%, PPV of 94.7%, NPV of 100% and accuracy of 97.2%. It demonstrated total 134 skeletal lesions of which 101 were characterized as metastasis and 33 as benign. Corresponding CT changes were seen for 129/134 lesions. The mean  $\text{SUV}_{\text{max}}$  of the lesions was  $30.3 \pm 48.4$ .  $^{18}\text{F}$ -Fluoride PET/CT and  $^{18}\text{F}$ -FDG PET/CT showed similar accuracy for visualization of bone metastasis (93.7% vs. 100%;  $P=0.993$ ). However,  $^{18}\text{F}$ -FDG PET/CT also demonstrated extraskelatal metastasis in 6/16 patients. No significant difference was seen between accuracies of BS and  $^{18}\text{F}$ -Fluoride PET/CT for visualization of bone metastasis (93.7% vs. 100%;  $P=0.115$ ), but the former showed more skeletal lesions (91 vs. 44;  $P<0.0001$ ). In 4/22 patients (18%) with negative BS,  $^{18}\text{F}$ -Fluoride PET/CT demonstrated skeletal metastasis.

**Conclusions:**  $^{18}\text{F}$ -Fluoride PET/CT shows high diagnostic accuracy for detection of bone metastasis in patients with RCC. It shows comparable results to  $^{18}\text{F}$ -FDG PET/CT and detects more skeletal lesions as compared to BS.

## S-16

### Delayed Presentation in Hospital in DTC with Bone Metastasis; Patient's Point of View

Sadaf Butt

Nuclear Medicine, Oncology and Radiotherapy Institute (NORI), Pakistan

Bone is the second most frequent target of distant metastases in patients with differentiated thyroid cancer (DTC). Prognosis and outcome of these patients is unfavorable.

We retrospectively reviewed Medical records of Patients with DTC having bone, who registered in our hospital between 2000 and 2005. We found 57 patients having bone metastasis.

All 57 patients had bone metastasis at the time of presentation in hospital, and none developed it during the course of their treatment. It was found that 52% patients presented to the hospital due to some complication of their bone metastasis, while 48% patients were found to have bone metastasis during baseline investigations. Patients who presented to the hospital with complication of bone metastasis when enquired about their neck disease- 59% had long standing MNG and they did not want any treatment because it was not causing any problems. Patients who didn't know about their neck disease were 22%, while 19% patients had previous thyroidectomy, and were not properly guided or had misplaced histopathology report.

Although majority of patients of DTC present late with bone metastasis due to patient related factors but a large percentage are being missed due to hospital related factors. We suggest Patient education as well as strict hospital policy for post-operative patient guidance to reduce patient presentation at this late stage.

## S-17

### Unreported Normal Variant of Renography Study

Safdar Raza Kamal Babar

Nuclear Medicine Department, Aseer Central Hospital, Abha, Saudi Arabia

Normal variants are commonly seen in Diagnostic Studies across all modalities. One novel variant is reported in this study that has not been described before in the literature---Focal Bladder Hot Spot. A focal spot is noted in the bladder during the excretory phase of Diuretic Renal Scintigraphy, that was then correlated with Ultrasonography for any pathology. All the cases show normal outline, thickness of the urinary bladder wall suggesting an anatomical cause rather than pathological cause.



## S-18

### Role of $^{18}\text{F}$ -FDG PET/CT in the diagnosis and staging of Rosai Dorfman Disease

Sellam Karunanithi

Department of Nuclear Medicine, All India Institute of Medical Sciences, New Delhi, India

**Materials and Methods:** Twenty patients (mean age-30.5 years, median-32 years, range: 3-45) with clinically suspected and/or histopathologically proven Rosai Dorfman Disease (RDD) underwent  $^{18}\text{F}$ -FDG PET/CT imaging for staging and/or localisation of the disease.  $\text{SUV}_{\text{max}}$  of nodal and extranodal lesions were measured. Results were verified with clinical follow up and histopathology.

**Results:** Of the 20 patients with RDD, PET/CT demonstrated pure lymph nodes (LN) involvement in 12 (generalised LN in 10; bilateral cervical LN in 2), extranodal (retro-orbital mass) in 2 and both nodal & extranodal (skeletal & soft tissue) lesions in 6 patients. The mean  $\text{SUV}_{\text{max}}$  of nodal and extranodal lesions were 6.5 and 5.8 respectively. PET/CT emerged as excellent imaging modality for assessment the disease burden with 100% sensitivity and PPV for detecting nodal and extranodal lesions.

**Conclusion:**  $^{18}\text{F}$ -FDG PET/CT is a very useful imaging investigation for diagnosing and staging in RDD.

## S-19

### Metastatic central lymph node ratio can characterize FDG-avid lymph nodes in papillary thyroid cancer patients

Seong Young Kwon

Chonnam National University Hwasun Hospital, South Korea

**Background:** We investigated the role of metastatic central lymph node ratio (CLNR) for characterizing FDG-avid cervical lymph nodes (LNs).

**Materials and Methods:** Enrolled patients underwent total thyroidectomy and had FDG-avid LNs incidentally detected on postoperative PET/CT. CLNR (%) was calculated as follows: (number of metastatic LNs/number of removed central LNs) x 100. We investigated clinicopathologic factors significant for predicting metastasis.

**Results:** Of the 59 patients, 23 had metastatic LNs. The frequency of pN1b stage and LN location were significant factors for predicting metastases. Among 29 patients with FDG-avid LNs located in mid to lower neck compartments, high CLNR (>40%) was the only significant factor on multivariate analyses (OR, 9.89; 95% CI, 1.54-63.65;  $P = 0.016$ ).

**Conclusion:** CLNR was a significant factor for characterizing FDG-avid LNs especially located in mid to lower neck compartments.

## S-20

### Degree of myocardial perfusion & fatty acid metabolism mismatch and its correlation with the LV remodeling following successfully reperfused ST segment elevated myocardial infarction

Shankar Kumar Biswas, Masayoshi Sarai, Hiroshi Toyama, Masatsugu Iwase, Yukio Ozaki

Bangladesh Atomic Energy Commission, Fujita Health University Hospital, Japan

**Background:** Discordant  $^{123}\text{I}$ - $\beta$ -methyl-iodophenyl pentadecanoic acid (BMIPP) and  $^{99\text{m}}\text{Tc}$ -tetrofosmin (TF) uptake is designated as viable dysfunctional myocardium. But a little is known about its relation with the left ventricular (LV) volume change / remodeling. This study was designed to unravel the impact of the degree of BMIPP-TF mismatch and its correlation with change of LV volume following successfully reperfused ST-segment elevation myocardial infarction (STEMI).

**Materials and Methods:** Twenty five patients (Age:  $60 \pm 11$  yrs) with recent STEMI were enrolled, and all of them underwent emergency successful percutaneous coronary intervention (PCI). BMIPP and TF cardiac scintigraphy was performed on  $7 \pm 3$  days of admission. On 17 segment model, a difference of BMIPP and TF defect score by  $\geq 4$  were considered as mismatched defect. Conventional echocardiography was performed within 24 hrs of admission, and at 3 months interval. Left ventricular end diastolic volume index (EDVI), and end systolic volume index (ESVI) were recorded accordingly.

**Results:** Out of 25 patients, 21 showed BMIPP-TF mismatched defect and rest 4 showed matched defect. Twelve patients (48%) showed reduction of left ventricular EDVI, and 14 (56%) patients showed reduction of ESVI over 3 months. Mismatched defect score showed a significant correlation with the relative change of EDVI ( $P = 0.002$ ,  $r = 0.58$ ) and ESVI ( $P = 0.043$ ,  $r = 0.40$ ).

**Conclusion:** The degree of dysfunctional viable myocardium showed nice correlation with the reduction of LV volumes following successfully reperfused STEMI, and emergency PCI could prevent the upcoming ventricular remodeling.

## S-21

### Risk Stratification in Patients with Newly Diagnosed Stage III or IV Breast Cancer by Volume-based Metabolic Parameters in 18F-FDG PET/CT

Su Yun Chen, Nuhad Ibrahim, Stephen T. Wong, Hui Wang and Franklin C. Wong

Shanghai Jiaotong University School of Medicine Xinhua Hospital, China; The University of Texas, MD Anderson Cancer Center, US

**Background:** The goal of this study was to determine if the pretreatment  $^{18}\text{F}$ -FDG PET/CT derived metabolic tumor volume (MTV) and total lesion glycolysis (TLG) in patients with newly diagnosed stage III or IV breast cancer (BC) may have added prognostic values.

**Materials and Methods:** A total of 129 consecutive patients with stage III (54) or IV (75) BC underwent  $^{18}\text{F}$ -FDG PET/CT scans were retrospectively studied. MTV and TLG were estimated with fixed and relative thresholds. MTVs and TLGs were evaluated for association with progression free survival (PFS) and BC-specific overall survival (OS). They were compared with maximum standard uptake value ( $\text{SUV}_{\text{max}}$ ) and clinicopathological factors using univariate and multivariate analysis to identify independent prognostic factors.

**Results:** Independent prognostic factors, MTV with fixed SUV threshold of 3.0 and TLG with fixed threshold of 2.5, were found to outperform  $\text{SUV}_{\text{max}}$  and other volume-based parameters to predict disease progression and BC-related death. After stratified with volume-based parameters, stage III BC patients with high MTV or TLG had a similar OS with stage IV patients with low MTV or TLG ( $P=0.294$  or  $0.381$ ). Stage IV BC patients with high MTV or TLG had worse PFS and OS than same stage patients with low MTV or TLG ( $P<0.001$  or  $P=0.002$ ).

**Conclusion:** Both MTV and TLG have independent prognostic value on survival in stage III or IV BC patients. They may provide powerful prognostic information in patient risk stratification and lead to better management of these advanced stage patients who account for the largest mortality rate from BC.

## S-22

### Prognostic prediction in patients with glioblastoma: intratumoral distribution analysis on 11C-methionine PET study

Tadashi Watabe

Osaka University Graduate School of Medicine, Japan

**Background:** To evaluate the prognostic value of pretreatment 11C-methionine (Met) PET in

glioblastoma (GBM) patients focusing on the intratumoral distribution.

**Materials and Methods:** Study population consisted of 14 patients with histologically confirmed GBM. Met PET was performed before surgery followed by chemotherapy and radiotherapy. Metabolic core volume (MCV) was defined as total voxel volume above the percent threshold of  $\text{SUV}_{\text{max}}$ . Intratumoral distribution was evaluated by percent metabolic core volume ratio.

**Results:** Univariate analysis showed that %MCVR50, %MCVR60, and %MCVR70 were significant factors associated with overall survival. Multivariate analysis demonstrated that MCV50 ( $p=0.021$ ) and %MCVR60 ( $p=0.045$ ) were the significant predictors for overall survival.

**Conclusion:** This study demonstrated the prognostic value of intratumoral distribution analysis of metabolic core in GBM patients.

## S-23

### Comparison of Glomerular Function by Tc-99m Renal DTPA Scan with Conventional Methods in Health and Chronic Kidney Disease Amongst Sub-Population of South Asia

Tahira Ejaz

Nescom Hospital, Pakistan

The glomerular filtration rate (GFR) is traditionally considered the best overall index of renal function in health and disease (1). Because GFR is difficult to measure in clinical practice, most clinicians estimate the GFR from serum creatinine concentration being the conventional method. This study compares GFR by Tc-99m renal DTPA, Gamma camera scan ( $\gamma\text{GFR}$ ) with various conventional methods amongst Pakistani population of different age groups.

The GFR was estimated with conventional creatinine clearance methods (Cockcroft-Gault (CG) and Modification of Diet in Renal Disease (MDRD)) and then compared with calculated GFR by Gamma camera method ( $\gamma\text{GFR}$ ). The  $\gamma\text{GFR}$  was considered as a reference. The  $\gamma\text{GFR}$  correlates well with CG formula in subjects with normal and mildly reduced kidney function ( $\text{GFR}>60\text{ ml/min/1.73m}^2$ ), ( $P=0.0140$ ).

For patients with moderately reduced renal function ( $\text{GFR } 30\text{--}60\text{ ml/min/1.73m}^2$ ),  $\gamma\text{GFR}$  correlates well with MDRD equation ( $P=0.0005$ ). For significantly reduced functioning kidneys ( $\text{GFR}<30\text{ ml/min/1.73m}^2$ ), no correlation was found between  $\gamma\text{GFR}$  and conventional methods. This study further augments the results of R. Kumaresan and Giri in "A Comparison of Modification of Diet in Renal Disease and Cockcroft-Gault Equations for estimating Glomerular Filtration Rate in Chronic Kidney Disease Patients".

Therefore  $\gamma$ GFR can be considered as an acceptable method of assessing renal function in health and chronic kidney disease.

## S-24

### Haemodynamically significant Coronary Artery Disease detected by Myocardial Perfusion Imaging can be predicted by Carotid Intima Media Thickness

Tapati Mandal, Lutfun Nisa, Nasreen Sultana, Faria Nasreen

Department of Nuclear Medicine, National Institute of Nuclear Medicine and Allied Sciences, Dhaka, Bangladesh

**Background:** The leading cause of myocardial ischemia and / or infarction is coronary artery disease (CAD). It is often the sequel of atherosclerosis which may involve the entire vasculature as well as coronary arteries. The change in the coronary arteries due to atherosclerosis have variable haemodynamic effect on myocardial perfusion, which can be assessed by SPECT Myocardial perfusion imaging (MPI). Increased Carotid Intima Media Thickness (CIMT) has been used as a surrogate marker of atherosclerosis and can predict cardiovascular risk. The aim of this study was to assess the diagnostic performance of CIMT for prediction of haemodynamically significant CAD detected by MPI.

**Materials and Methods:** This study was carried out in the National Institute of Nuclear Medicine and Allied Sciences, Dhaka Bangladesh from January 2010 to December 2010. The study subject consisted of 40 patients with age ranging from 40 to 50 years with cardiovascular risk factors. Myocardial Perfusion Imaging was done with Tc-99m Sestamibi using one day stress and rest protocol. Carotid Intima Media Thickness was measured with B mode high resolution ultrasound scanner equipped with 7 MHz linear array transducer.

**Results:** The SPECT myocardial perfusion images were semi quantitatively analysed to obtain summed stress score (SSS) which was used for optimum correlation with the CIMT measurement in each patient. According to the result of SPECT- MPI patients were divided into two groups. There were 23 patients with normal MPI in Group A and 17 patients with myocardial perfusion defect in Group B.

In Group A with normal MPI, the corresponding CIMT was either normal ( $<1$  mm in 11 patients) and/ or mildly increased ( $1-1.3$  mm in 12 patients).

In Group B with perfusion defects, 16 of the 17 patients showed consistently high CIMT. The degree of CIMT was compared with the extent and severity of perfusion defects obtained by SSS and showed a direct relationship between two parameters. This relationship was further analyzed by the Pearson's correlation coefficient showing a positive

correlation of  $r=0.055$  which was statistically highly significant ( $P<0.001$ ). The accuracy of mean maximum CIMT to predict haemodynamically significant CAD measured from the area under the receiver operation curve (ROC) was 0.824 which was quite good. The sensitivity specificity, positive predictive value, negative predictive value and accuracy of different cut off values of CIMT were measured. The CIMT value of  $\geq 1.25$  mm was found to be a predictor of abnormal perfusion detected by MPI. There was a sensitivity of 70.6%, specificity of 87%, positive predictive value of 80% and an accuracy of 80% at this CIMT cut off value to predict haemodynamically significant CAD, detected by MPI. The implication is that, a CIMT of  $\geq 1.25$  mm can significantly predict the haemodynamic effect of atherosclerotic lesions on myocardial perfusion in patients with risks of CAD with an accuracy of about 80%.

**Conclusion:** A significant association is observed between CIMT and MPI in patients with risk factors for CAD. a cut off CIMT value of  $\geq 1.25$  mm correlated most with the haemodynamic effect of coronary artery stenosis on perfusion. Findings from this small sample of patients, though insufficient, suggest that CIMT can be used as predictor of haemodynamically significant CAD, detected by MPI and thus improve patient outcome.

## S-25

### Differentiation of Anterior Mediastinal Lymphoma from Thymic Epithelial Tumors by FDG-PET

Tomohiko Yamane, Akira Seto and Ichiei Kuji

Saitama International Medical Center, Saitama Medical University, Hidaka, Japan

**Background:** The aim of this study is to evaluate the ability of FDG-PET for differentiating mediastinal malignant lymphoma from thymic epithelial tumors.

**Materials and Methods:** We retrospectively analyzed 112 patients with mediastinal tumors. Each maximum standardized uptake value ( $SUV_{max}$ ) of the tumor was measured.

**Results:** Average  $SUV_{max}$  was 4.9 in thymoma ( $n=27$ ), 10.1 in thymic cancer ( $n=12$ ), and 17.4 in lymphoma ( $n=12$ ). There were significant differences among all groups ( $P<0.01$ ). When  $SUV_{max}>11.2$  was considered to be malignant lymphoma, sensitivity was 100% and specificity was 88%.

**Conclusion:** Anterior mediastinal lymphoma has significantly higher FDG uptake than thymoma and thymic cancer. FDG-PET can be an important modality to distinguish these tumors.

## S-26

### Effect of $^{131}\text{I}$ Therapy for Differentiated Thyroid Carcinoma on Parathyroid Function

Shumin Yang

First Affiliated Hospital of Kunming Medical University, China

**Background:** To investigate the effect of radioactive iodine ( $^{131}\text{I}$ ) for differentiated thyroid carcinoma (DTC) on parathyroid function.

**Materials and Methods:** Serum parathyroid hormone (PTH) and calcium (Ca) levels were determined in 30 patients with DTC pre-treatment (baseline group) and at the 6th and 12th months of  $^{131}\text{I}$  administration for thyroid remnant ablation.

**Results:** Compared with the baseline group respectively, serum PTH and Ca levels of the 6th month group and 12th month group were on the uptrend with no statistical significance ( $P>0.05$ ). The difference of serum PTH and Ca levels between the 6th month group and the 12th month group was not significant ( $P>0.05$ ).

**Conclusion:** There was no significant effect of  $^{131}\text{I}$  therapy for DTC on parathyroid function

## S-27

### $^{68}\text{Ga}$ -exendin-4 PET/CT is highly effective in localizing insulinomas

Yaping Luo, Qingqing Pan, Zhaohui Zhu, Fangli

Department of Nuclear Medicine, Peking Union Medical College Hospital, P.R. China

**Background:** The Surgical removal of insulinomas is hampered by difficulties to localize insulinomas using conventional imaging procedures (CT, MR, EUS). Recent studies showed  $^{111}\text{In}$ - and  $^{99\text{m}}\text{Tc}$ -labelled exendin-4, targeting GLP-1R, revealed high accuracy in localizing insulinomas. However, because of different advantages and disadvantages of all GLP-1R targeting tracers (labelled with  $^{99\text{m}}\text{Tc}$ ,  $^{111}\text{In}$ ,  $^{68}\text{Ga}$ ,  $^{18}\text{F}$ ), it is a matter of argument if positron nuclide labelled exendin-4 is better for detecting insulinomas. The objective of this study is to present a new method for the diagnosis of insulinoma with the use of  $^{68}\text{Ga}$ -NOTA-exendin-4 using PET/CT.

**Materials and Methods:** A prospective study was performed in 11 consecutive patients with proven clinical and biochemical endogenous hyperinsulinemic hypoglycemia. All patients underwent contrast-enhanced CT and  $^{99\text{m}}\text{Tc}$ -HTOC SPECT/CT.  $^{68}\text{Ga}$ -NOTA-exendin-4 was administered intravenously. Whole-body PET/CT images were performed at 30-60 min, and abdomen images at 2-3 h if late scan is necessary. Surgical removal of the insulinomas was performed subsequently.

**Results:** In 10 cases,  $^{68}\text{Ga}$ -NOTA-exendin-4 PET/CT successfully detected the insulinomas showing significant intensity of radioactivity. Among these 10 cases, 5 cases were identified using contrast-enhanced CT, and only 1 case was positive in  $^{99\text{m}}\text{Tc}$ -HTOC SPECT/CT.  $^{68}\text{Ga}$ -NOTA-exendin-4 PET/CT was negative in a G2 insulinoma, which showed high uptake of  $^{99\text{m}}\text{Tc}$ -HTOC, and was also identified by CT.

**Conclusion:**  $^{68}\text{Ga}$ -NOTA-exendin-4 PET/CT is highly effective in localization of insulinomas, and shows great superiority to CT.  $^{99\text{m}}\text{Tc}$ -HTOC is a good complementation to  $^{68}\text{Ga}$ -NOTA-exendin-4 in detecting insulinoma with malignant potential.

## S-28

### Evaluation of the predictive value for the conversion of mild cognitive impairment to Alzheimer's disease by $^{18}\text{F}$ -FDG PET and MRI: A multicenter study

Yoshitaka Inui

National Center for Geriatrics and Gerontology

**Background:** The aim of this study was to examine the predictive value for the conversion of mild cognitive impairment (MCI) to Alzheimer's disease (AD) by  $^{18}\text{F}$ -FDG PET and MRI.

**Materials and Methods:** In total, 114 patients with amnesic MCI were enrolled in this study and followed periodically for 5 years. They underwent  $^{18}\text{F}$ -FDG PET and MRI at baseline. An automated analysis for  $^{18}\text{F}$ -FDG PET was performed to calculate the PET score and the cases were visually classified into the predefined dementia patterns. Z-scores in the medial temporal structure were calculated using automated VBM method.

**Results:** Forty-nine MCI patients progressed to AD. The diagnostic accuracy of PET score, the image interpretation, and the VBM analysis was 57%, 82%, and 76%, respectively.

**Conclusion:** The diagnostic accuracy of PET image interpretation showed the highest to predict conversion to AD in patients with MCI.

## S-29

### Establishment and Clinical verification of a mathematical model for diagnosing SPN with $^{18}\text{F}$ FDG PET/CT

Yumei Chen

Ren Ji Hospital, School of Medicine, Shanghai Jiao Tong University, China

**Backgrounds:** To establish a mathematical model for diagnosing the solitary pulmonary nodules (SPN)



with  $^{18}\text{F}$ FDG PET/CT and to verify the established mathematical model.

**Materials and Methods:** In the first part, 182 patients with SPN (115 malignance, 67 benign) from Jan 2005 to Feb 2010 were collected in the study. Clinical data including 12 items (age, gender, maximum diameter, site, density, border of tumor and parenchyma, lobulation, spiculation, pleural retraction sign, vascular convergence, FDG uptake) were analyzed by univariate and multi-variate statistical method. The mathematical model was obtained from binary Logistic regression. In the second part, A prospective study included 109 patients with SPN (67 malignance, 42 benign) from Jan 2011 to Jun 2012. Clinical data including 7 items (age, density, border of tumor and parenchyma, lobulation, pleural retraction sign, vascular convergence sign, FDG uptake) were incorporated into the mathematical model. The diagnostic results were compared between the model and 2 senior doctors with rich experience in reading PET/CT imaging.

**Results:** The mathematical model established by binary Logistic regression was:  $P = e^X / (1 + e^X)$ ,  $X = -4.146 + 0.041 \times \text{age} + 2.226 \times \text{density} - 1.053 \times \text{border of tumor and parenchyma} + 1.211 \times \text{lobulation} + 2.579 \times \text{vascular convergence} + 1.954 \times \text{pleural retraction sign} + 0.286 \times \text{SUV}_{\text{max}}$ . The AUCs of mathematical model was  $0.889 \pm 0.025$  which was better than the AUCs of  $\text{SUV}_{\text{max}}$  ( $\text{AUC} = 0.729 \pm 0.038$ ,  $P < 0.05$ ). The clinical value for diagnosing the SPN with mathematical model was verified with sensitivity of 95.52%, specificity of 69.05%, positive predictive value of 83.12%, negative predictive value of 90.63%, accuracy of 85.32%. The diagnostic efficiency from doctors was also obtained with sensitivity of 97.01%, specificity of 52.38%, positive predictive value of 76.47%, negative predictive value of 91.67%, accuracy of 79.82%. The AUCs of mathematical model were  $0.887 \pm 0.034$ , while the AUCs of the diagnostic results from the doctors were  $0.747 \pm 0.053$  ( $P < 0.05$ ).

**Conclusion:** The mathematical model established by binary Logistic regression has high diagnostic value for estimating the character of SPN and will be used in clinical practice well.

group, it is observed that RAI therapy is becoming a common option for definitive therapy as persistent remission is expected in 1/3rd of cases. The objective was to evaluate the outcome of I-131 therapy in thyrotoxicosis in childhood and adolescence.

**Materials and Methods:** This was a retrospective study of 32 thyrotoxic patients (10-17.9 years) who received I-131 therapy during January 2001 to December 2012 in the thyroid division of National Institute of Nuclear Medicine & Allied Sciences (NINMAS). ATDs were given before RAI therapy and therapy doses were calculated based on the size of the thyroid and its percentage uptake at 24 h. Gender, duration of antithyroid drug (ATD) treatment, hormonal status, RAIU, ultrasound, thyroid scan, dosage and number of therapies and post therapy thyroid status at 6 months were recorded.

**Results:** 32 patients (87.5 % F, 12.5 % M) treated with I-131 were analyzed to assess the effectiveness of therapy as related to dose and gland size. The patients were classified into 2 groups according to treatment success (euthyroid and hypothyroid) and treatment failure (hyperthyroid). There were no significant differences in age, gender, duration of ATD treatment, 2 and 24 h I-131 uptake, thyroid weight, and total I-131 dose between these two groups. The average age at diagnosis was  $14.9 \pm 3.4$  years. All children and adolescents received single or multiple I-131 doses between 6 to 14mCi. Six months after treatment, 31.25% of the patients were hyperthyroid, 25% euthyroid and 43.75% were hypothyroid. Of the 10 cases with hyperthyroidism, 8 needed a second dose and finally reached a hypothyroid state.

**Conclusion:** I-131 therapy is safe and effective for thyrotoxicosis in childhood and adolescence. It is suitable as a good second-line therapy for patients with severe complications, those who show poor compliance, and those who fail to respond to ATD treatment.

## S-30

### Outcome of 131-radioactive iodine therapy in the treatment of childhood and adolescent thyrotoxicosis

Zeenat Jabin, Nurun Nahar, Raihan Hussain

National Institute of Nuclear Medicine and Allied Sciences (NINMAS), Bangladesh

**Background:** Treatments for thyrotoxicosis in children and adolescents are not always simple and easy. Though a clinical trial with oral antithyroid drugs (ATDs) remain the preferred choice in this age

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Asia Oceania Journal of Nuclear Medicine & Biology, Nuclear Medicine Research Center, Ghaem Hospital, Ahmabad Ave, Mashhad, Iran. Post Code: 91766-99199

Tel: +98-51-38400494 (Saturday-Wednesday: 8:00-14:00, Thursday: 8:00-12:00, Local time, GMT+3:30) Fax: +98-51-38419521

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It should contain a Maximum of 350 words divided in 4 sections preceded by headings: Objective, Methods, Results and conclusion. For review articles and case reports an unstructured abstract with a maximum of 200 words is required. Three to five keywords are necessary for all abstracts. **Word count** should be written at the bottom of abstract page.

### **7-3: Main document**

**7-3-1:** The abstract must be the first page of Main document. For original articles, the following sections should be included: Introduction, Methods, Results, Discussion and Conclusion. For reporting Clinical Trials, please follow reporting requirements published by CONSORT: <http://www.consort-statement.org/consort-statement> (There is no maximum word limit, but it is preferable to keep Maximum word count at 6000 and Maximum references at 40).

**7-3-2:** For short communications and technical notes, the following sections should be included: Introduction, Methods, Results, Discussion and Conclusion. (Maximum word count 3000 and Maximum references 20)

**7-3-3:** For case reports, three sections of Introduction, Case report and Discussion are required. (Maximum word count 3000 and Maximum references 20)

**7-3-4:** For Meta-analyses, Introduction, Methods, Results, Discussion and Conclusion should be included. Please use PRISMA statement for reporting your work: <http://www.prisma-statement.org/statement.htm> (There is no maximum word limit, but it is preferable to keep Maximum word count at 6000 and Maximum references at 40)

**7-3-5:** For review articles; (There is no maximum word limit, but it is preferable to keep Maximum word count at 6000 and Maximum references at 40)

### **7-4: Formatting**

- Use MS Word 97 or later versions.
- Use plain normal fonts (12 Times New Roman) with double space formatting

throughout the document including abstract, manuscript and references.

- Leave 3 cm margin on each side of the page.
- Number pages consecutively, beginning from the Abstract and put it in right upper corner of the page.
- Do not use field function, do not use the space bar, instead use tab stops.
- Cite every reference in the text in parenthesis using Vancouver style in the order they appear in the text. Using Endnote for citation is encouraged.
- Paragraphs should begin with an indentation (One tab of at least five-spaces length).
- Use the equation editor or MathType for inserting equations.
- The abbreviations should be used according to Système Internationale (SI) nomenclature and units and they should be explained the first time they are used in the manuscript. All units of radioactivity should be based on the SI system *i.e.*, Bq, Gy, Sv, *etc.* Chemical formulae should be written according to the recommendations of the American Chemical Society.

#### **7-5: Acknowledgement**

Acknowledgements, sponsorship or grants should be written after the main text and before the references.

#### **7-6: References**

The references should be listed consecutively in order of citation in the manuscript. All references must be cited either in text, table or figures. Unpublished data and personal communications cannot be cited. The AOJNMB uses Vancouver style for references. For citation of journals, all authors should be listed if the number of authors were 6 or less. If not, please list the first 6 authors followed by *et al.* A paper published online but not in print can be cited using the Digital Object Identifier (DOI). A web document can be cited using the URL address. Using ENDNOTE or similar soft ware and selecting the Vancouver style (parenthesis) in Bibliographic Output Style will facilitate correct reference citation.

Here are samples of citation styles:

- a) Journal article (With 6 or less authors)  
Palestro CJ. In vivo leukocyte labeling: The quest continues. *Journal of Nuclear Medicine*. 2007; 48(3):332-4.
- b) Journal article (With more than 6 authors)  
Intenzo C, Jabbour S, Miller JL, Ahmed I, Furlong K, Kushen M, et al. Subclinical hyperthyroidism: Current concepts and scintigraphic imaging. *Clinical Nuclear Medicine*. 2011; 36(9):e107-e113.
- c) Book  
Walsh G. *Proteins: biochemistry and*

*biotechnology*. 2nd ed. Chichester: John Wiley & Sons; 2002.

- d) Book chapter  
Moallem SA, Balali Mood K. Opioids and opiates. In: Mozayani A, Raymon LP, editors. *Handbook of drug interactions: A clinical and forensic guide*. 1st ed. Totowa: Humana Press Inc; 2004. p. 123-149.
- e) Epub; Article by DOI:  
Daliri M, Shafiei S, Zakavi SR, Dabbagh Kakhki VR, Sadeghi R. Application of (99m)Tc-denatured red blood cells scintigraphy in the evaluation of post-traumatic spleen auto-transplantation. *Rev Esp Med Nucl Imagen Mol*. 2012 Nov 12. doi:pii: S2253-654X(12)00212-0. 10.1016/j.remnm.2012.09.004.
- f) Online document:  
RCT critical appraisal sheet In: *Critical Appraisal Sheets, Center for Evidence Based Medicine* 2012.  
<http://www.cebm.net/index.aspx?o=1157>. Accessed 3 Dec 2012.

#### **7-7: Figure legends**

Figure legends should be written after references, each in a separate sheet preceding with figure number (Figure 1). The figure legends will be published below the figure. The legend should not be included in the figure file. All figures must be cited in the manuscript and numbered consecutively using Arabic numerals.

#### **7-8: Tables**

Tables should not be sent as figures or as separate file, they should be inserted at the end of the manuscript, each in a separate sheet. Tables are expected to be self explanatory, should supplement and not duplicate the text and numbered consecutively in order of appearance in the text and using Arabic numerals. Put horizontal line at the top of the table, below column headings and at the bottom of it. Do not use vertical line in the tables.

#### **8- Figures and artworks**

Figures and artwork should be submitted as separate files in JPG or TIFF format. Figures should be utilized only if they augment understandability of the text. Drawings and graphs should be professionally prepared in deep black and white with no shading. Professionally designed computer generated graphs with a minimum of 300 DPI laser printer output is preferable. Color photographs are welcomed. Vector graphics containing fonts must have the fonts embedded in the files. For lettering the figures, use 8-12 point (only one size) Helvetica fonts. Name each figure with the word "Fig" followed by figure number without punctuation: "Fig1". If you include a figure from previous



publication, you must provide permission from the copyright owner(s) for both the print and online format.

### **9- Supplementary materials**

Video clips, sound records, excel or SPSS files and other supplementary materials could be sent for electronic linking to the manuscript in the website. MPEG-1 format (.mpg) should be used for video clips. Supplementary documents are encouraged to be sent as .PDF files if possible. Please name each supplementary file beginning with the name of first author (eg. Bom-video.mpg, Sadeghi-data.xls, etc). In text files you should enter the full name of the article and the authors as a header.

### **10- Cover letter**

All manuscripts should be accompanied by a cover letter. In the cover letter signed by corresponding author on behalf of all authors, it must be mentioned that the article is not submitted to any other journal. A sample of cover letter could be found in: <http://aojnmb.mums.ac.ir/journal/authors.note>

### **11- Peer review process**

All manuscripts will be peer reviewed prior to publication. Authors are encouraged to suggest names of three expert reviewers, but selection remains a prerogative of the Editor. The whole review process depends on receiving referees' comments and revising the manuscripts based on these comments to the author and may take few months. AOJNMB will try to make the time between submission and final decision as short as possible. On receipt of the revised article from the author, and after final approving by the referees, the letter of acceptance is issued to the author.

### **12- Acceptance/Rejection**

You will be notified regarding acceptance or rejection of the article by e-mail. Upon acceptance and after editorial amendments, galley proof will be sent to the corresponding author for final correction. No major change in content or title is accepted at this stage without editor's approval. Any addition or removal of an author from the list of authors must be accompanied with a written and signed agreement of the author(s) to be added or deleted.