IRANIAN JOURNAL OF NUCLEAR MEDICINE

Iranian Journal of Nuclear Medicine is a peer-reviewed biannually journal of the Research Institute for Nuclear Medicine, Tehran University of Medical Sciences, covering basic and clinical nuclear medicine sciences and relevant application. The journal has been published in Persian (Farsi) from 1993 to 1994, in English and Persian with English abstract from 1994 to 2008 and only in English language form the early of 2008 two times a year. The journal has an international editorial board and accepts manuscripts from scholars working in different countries.

Editorial Office
Iranian Journal of Nuclear Medicine,
Research Institute for Nuclear Medicine,
Shariati Hospital, North Kargar Ave. 14114, Tehran, Iran

Tel: ++98 21 88633333, 4
Fax: ++98 21 88026905
E-mail: irjnm@tums.ac.ir
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INSTRUCTION TO AUTHORS

Aims and Scope

Iranian Journal of Nuclear Medicine is a peer-reviewed biannually journal of the Research Institute for Nuclear Medicine, Tehran University of Medical Sciences, covering basic and clinical nuclear medicine sciences and relevant application. The journal has been published in Persian (Farsi) from 1993 to 1994, in English and Persian with English abstract from 1994 to 2008 and only in English language form the early of 2008 two times a year. The "Iran J Nucl Med" is indexed and abstracted in the world-known bibliographical databases including EMBASE, Scopus, Index Copernicus, IMEMR, SID, IranMedex and Magiran. The journal has an international editorial board and accepts manuscripts from scholars working in different countries.

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These include controlled trials, interventional studies, studies of screening and diagnostic tests, outcome studies, cost-effectiveness analyses, and large-scale epidemiological studies. Each manuscript should clearly state an objective; the design and methodology; the essential features of any interventions; the main outcome measures; the main results of the study; a discussion placing the results in the context of published literature; and the conclusions which can be drawn based on the study. The text should not exceed 4000 words, the number of tables, figures, or both should not be more than six, and references not more than 40.

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Use System International (SI) measurements only, except when "Dual report" is indicated in the SI unit conversion table. Use generic names of drugs, unless the specific trade name of a drug used is directly relevant to the discussion. When generic names are not available, brand names which take an initial capital can be used. In Original articles, the maker of the study drug must be given. Do not use ***abbreviations and symbols*** in the title or abstract and limit their use in the text. Standard abbreviations may be used and should be defined on first mention in the text unless they are the standard units of measurement. In general, terms should not be abbreviated unless they are used repeatedly and the abbreviation is helpful to the reader.

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Abstract-The abstract should not exceed 250 words for structured (Original articles, Review articles) unstructured abstracts (Case reports). The abstract should be concise, summarizing the purpose, basic procedures, main findings (giving specific data and their statistical significance, if possible), and principal conclusions of the investigation. Abstract headings should be as follows: Objective, Design, Setting, Patients (or Participants), Interventions (if any), Main outcome measures, Results, and Conclusions (for Original articles); Objective, Data sources, Study selection, Data extraction, Data synthesis, and Conclusions (for Review articles); or Objective, Participants, Evidence, Consensus Process, and Conclusions (for Consensus statements).

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Discussion-Data given in the Results section should not be repeated here. This section should consider the results in relation to any hypothesis/es advanced in the Introduction. This may include an evaluation of methodology and of the relationship of new information to the existing body of knowledge in that field. Conclusions should be incorporated into the final paragraph and should be commensurate with-and completely supported by-data in the text.

Acknowledgement-All contributors who do not meet the criteria for authorship should be covered in the acknowledgement section. It should include persons who provided technical help, writing assistance and departmental head who only provided general support. Financial and material support should be acknowledged.

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Chapter in a book:
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Book, personal author(s):
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Conference proceedings:
Kimura J, Shibasaki H, editors. Recent advances in clinical neurophysiology. Proceedings of the 10th International Congress of EMG and Clinical Neurophysiology; 1995 Oct 15-19; Kyoto, Japan. Amsterdam: Elsevier; 1996.

Conference paper :
Bengtsson S, Solheim BG. Enforcement of data protection, privacy and security in medical informatics. In: Lun KC, Degoulet P, Piemme TE, Rienhoff O, editors. MEDINFO 92. Proceedings of the 7th World Congress on Medical Informatics; 1992 Sep 6-10; Geneva, Switzerland.

Tables and figures

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Abstracts

International Congress of Nuclear Medicine
&
14th Iranian Annual Congress of Nuclear Medicine

4-6 November 2010

Organized and Hosted by

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Welcome Message

Nuclear Medicine Research Center (NMRC) of Mashhad University of medical Sciences is honored to host the "International Nuclear Medicine Meeting" accompanied with "14th Annual Meeting of Iranian Society of Nuclear Medicine" on 4th-6th of Nov 2010. This is my great honor to welcome all physicians and scientists in this event.

The meeting which is under auspices of EANM, AOFNMB and Mashhad University of Medical Sciences attracted hundreds of scientific abstracts from the region and all around the world.

This multidisciplinary meeting will discuss new findings in different fields of nuclear medicine from clinical experiments to radiopharmacy and physics. We tried to provide a scientific environment for sharing the research findings with other colleagues.

Nuclear Medicine and related specialties will enjoy 14 CME credits for participation in this meeting. Also we organized a "Regional Training Course on Radiation Protection" especially designed for nuclear medicine staff.

The holy city of Mashhad, is one of the most visited spiritual cities in the world. In your free time you will have the opportunity to discover many interesting places in Khorasan, the land of great Poets of Iran.

I thank you all for your scientific contribution to this meeting and I appreciate our sponsors for supporting this scientific meeting.

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Oral Presentations

Thursday
S1.Room1

Evolving applications of PET in assessing cardiovascular disease

Simin Dadparvar

Division of Nuclear Medicine, Department of Radiology, University of Pennsylvania School of Medicine, Hospital of the University of Pennsylvania, Philadelphia, PA, USA.

[No abstract available]

Thursday
S1.Room1

Perfusion appraisal in resting Technetium-99m-Sestamibi SPECT in recovery of myocardial function after thrombolytic therapy in patients with acute myocardial infarction

Isa Neshandar Asli[1], Hamid Javadi[1], Sara Jallalat[1], Parvin Yavari[1], Majid Assadi[2]

[1] Nuclear Medicine Department -Taleghani Hospital-Yaman Street, Chamran Highway, Tehran, Iran.
[2] Bushehr Research Center of Nuclear Medicine.

Presenter Address: Isa Neshandar Asli, Professor of Nuclear Medicine, Nuclear Medicine Department,Taleghani Hospital-Yaman street, Chamran Highway,Tehran, Iran, E-mail: isa_neshandar@yahoo.com

Introduction: This study was performed to determine the clinical application of rest ^{99m}Tc-sestamibi in the assessment of viability and functional improvement of the left ventricle (LV) myocardium in the post-thrombolytic therapy of acute myocardial infarction (AMI).
Methods: In 37 patients with AMI who received thrombolytic therapy, 2-dimensional (2D) echocardiography, as well as the resting redistribution of ^{99m}Tc-sestamibi, was investigated both within 1 week and 3–5 months after AMI. The predictive capacity of the perfusion percent for myocardial function recovery was evaluated. Also, the capacities of the possible variables in the prediction of recovery of myocardial function resulting from a change in LV ejection fraction (EF) were evaluated using stepwise multiple regression analysis.
Results: Thirty-seven patients (30 men and 7 women; mean age: 58±14 years) with AMI were enrolled in the study. Redistribution was observed in 35 and 50 segments of the initial and follow-up scan, respectively. In addition, 146 segments with reverse redistribution (RR), both in the initial scan (118 segments) and the follow-up scan (86 segments), were also observed. An apparent difference in wall motion scores was seen between the initial and follow-up echocardiograph ($p<0.001$). Furthermore, using the optimal cutoff point of perfusion percent in each image set, sensitivity as well as specificity and likelihood ratio (LR) for the improvement of regional wall motion after 3–5 months were defined.
Conclusion: This data showed that redistribution and reverse redistribution of ^{99m}Tc-sestamibi post thrombolytic therapy can be used as a marker of viability to predict the recovery of segmental wall motion abnormality (stunning), as well as the improvement of segmental perfusion uptake. This study also demonstrates that the resting Tc-sestamibi SPECT perfusion percent can be used for an approximate assessment of LV function status and can predict the recovery of jeopardized myocardium function after thrombolytic therapy.

Keywords: Perfusion, Technetium-99m-Sestamibi SPECT, Myocardial Infarction.

Thursday
S1.Room1

Effects of enhanced external counterpulsation on myocardial perfusion in patients unsuitable for invasive interventions

Fariba Eslamian[1], Babak Mahmoudian[2], Naser Aslanabadi[3], Ahmad AhmadzadehPurnaki[3].

[1] Department of Physical Medicine and Rehabilitation, Tabriz, Iran.
[2] Tabriz Gamma Scan Nuclear Medicine Center, Tabriz, Iran.
[3] Department of Cardiology.

Presenter Address: Fariba Eslamian, Department of Physical Medicine and Rehabilitation, Tabriz, Iran.

Introduction: Enhanced external counter-pulsation (EECP) is a non-invasive outpatient treatment used for angina pectoris. In patients with intractable angina who were symptomatic after medical and invasive strategies, several novel techniques are considered including EECP. EECP produces an acute hemodynamic effect that is presumed to be similar to that produced by the invasive intra-aortic balloon pump. By applying a series of compressive cuffs sequentially from the calves to the thigh muscles upon diastole and rapidly deflating the cuffs in early systole, an increase in diastolic and decrease in systolic pressure is created. Objectives: The purpose of this study was finding effects of EECP on status of myocardial perfusion in patients, unsuitable for invasive interventions.

Methods: In this study, 50 consecutive patients (34 male, 16 female) with known coronary artery disease, which was found on coronary angiography, were treated with EECP and followed for one month post treatment. For all patients ECG Gated Myocardial Perfusion Single Photon Emission Computerized Tomography (SPECT) with 99mTc - MIBI in rest and stress was carried out before and one month after completion of treatment with 30 session EECP. Any differences in myocardial perfusion before and after EECP were compared qualitatively and semi-quantitatively and analyzed statistically.

Results: The mean age was 62.18±8.67 years. A significant difference was found in Summed Rest Score (SRS) before and after EECP treatment ($p=0.010$). Differences between pre and post treatment Summed Stress Score were not significant ($p=0.058$). Before and after EECP treatment Summed Difference Score (SDS) were significant ($p<0.001$). End Diastolic Volume Index (EDVI), End Systolic Volume Index (ESVI) and Left Ventricle Ejection Fraction (LVEF) were not changed after treatment ($p=0.67$). Severity of ischemia is diminished significantly after EECP compared to before that ($p=0.044$), however, extent of ischemia showed no significant changes ($p=0.105$). Difference of fixed defects extension was also not significant before and after treatment ($p=0.051$).

Conclusion: This study demonstrated that EECP is a useful method in improvement of myocardial perfusion in patients who are not suitable for intervention such as PCI and CABG, which is more prominent at rest status. So could be assumed that EECP augments angiogenesis in diseased myocardium after cardiovascular incidence.

Keywords: EECP, Gated SPECT, Myocardial perfusion, CAD

Thursday
S1.Room1

Comparison of technetium-99m IgG with in vitro technetium-99m RBC labeling in cardiac blood-pool scintigraphy: a preliminary study

Hamid Javadi[1], Sara Jallalat[1], Majid Assadi[2]

[1] Department of Nuclear Medicine,Taleghani Hospital.
[2] Bushehr Research Center for Nuclear Medicine, The Persian Gulf Biomedical Sciences Institute, Bushehr University of Medical Sciences.

Presenter Address: Hamid Javadi, Department of Nuclear Medicine, Taleghani Hospital, Yaman Street, Chamran Highway, Tehran, Iran.

Introduction: This article as the first clinical prospective study was conducted to use of Tc-IgG as compared with autologous Tc-RBC in gated blood pool ventriculography. Moreover, two objectives were followed: (a) assess the feasibility of this radiotracer in routine practice; (b) appraise its in vivo steadiness over time by measurement of organs activity ratios and the image quality.
Methods: the study population included 12 patients who referred for evaluation of liver hemangioma or infection process. Six patients underwent gated planar blood pool (GPBP) acquisition using Tc-RBC and remaining 6 cases underwent GPBP with Tc-IgG. Additionally, to evaluate the activity ratios in different organs, ROIs were manually drawn over the LV, RV, right lung, left lung, aorta, liver and spleen on the static anterior datasets in 20 minute (early) and also delayed (180 minutes) post injection of Tc-RBC and Tc-IgG. Ratios of activity between the early and delayed images were compared for each ROI.
Results: The mean time of acquisition following injection of each radiotracer (RBC; 75.83±11.75 minute Vs IgG; 80.00±7.09 minute) was not different [p value > 0.05]. Observer 1 and 2 were classified good quality for both radiotracers in all participants. The mean ejection fraction (EF) of patients with Tc-RBC and Tc-IgG wan not significantly different (59.00±7.64 % vs. 58.33±16.03 %) [P value > 0.05]. The ratio of LV to crescent background in GBP was not statistically difference between two agents (RBC; 2.55±0.99 Vs IgG; 2.11±0.78) The mean activity of LV and RV to backgrounds ratios in patients with Tc-IgG was more (although nonsignificant) relative to cases radiolabeled with in vitro Tc-RBC on early and delayed views (P>0.05). In addition, the relevant constancy of biodistribution of both radiotracers over time was also compared in the organs activities between the early and delayed studies.
Conclusion: This data showed that the use of Tc-IgG in cardiac blood pool studies might led to comparable images as Tc-RBC. Therefore, 99mTc-IgG, readily accessible and needing a single injection, might be an attractive alternative to Tc-RBC for the estimation of LV function, especially in subjects with poor vein quality or busy departments.

Keywords: Gated planar blood pool, IgG, RBC

Thursday
S1.Room1

Clinical value and severity of myocardiardial perfusion defects in asymptomatic diabetic patients with negative or weakly positive exercise treadmill test

S.R.Zakavi[1], M.Taherpour[2], Z.Mousavi[3], H.Rokni[3], V.R Dabbagh Kakhki[1] and R.Rajabian[3], R.Sadeghi[1]

[1]Nuclear Medicine Research Center, Mashhad University of Medical Sciences, Mashhad, Iran
[2]Cardiology Department, Razavi Hospital, Mashhad, Iran
[3]Endocrinology and Metabolism Research Center, Mashhad University of Medical Sciences, Mashhad, Iran.

Presenter Address: Seyed Rasoul Zakavi, MD, Nuclear Medicine Research Center, Mashhad University of Medical Sciences, Mashhad, Iran, Email :zakavir@mums.ac.ir

Introduction: Although coronary artery disease (CAD) is the leading cause of death in type 2 diabetic patients, it is frequently asymptomatic. Myocardial perfusion imaging (MPI) is reported to show ischemia in a significant number of asymptomatic diabetic patients. We studied the prevalence and severity of myocardial perfusion defects in asymptomatic diabetic patients and its clinical impact.
Methods: One hundred thirty consecutive asymptomatic patients (81 female, 49 male), aged 35-65 years with type 2 diabetes mellitus and with no history of CAD and no cardiac symptoms were recruited in the study. Echocardiography, ECG, routine laboratory tests and exercise treadmill test (ETT) were performed and patients with weakly positive or negative ETT underwent Dipyridamole MPI. Patients with positive ETT were referred to coronary angiography. All patients were followed for at least 17 months (mean 21.7 months) and any cardiac event was recorded.
Results: We studied 81 female and 49 male patients with mean age of 51.8 years. Negative and positive ETT result was noted in 74.3% and 10.7% respectively. One third of patients with positive ETT agreed to undergo coronary angiography which showed CAD in 75% of these patients. Gated myocardial perfusion SPECT showed reversible defect in 26.9% of the patients with mean summed stress score of 3.3±1.8. About 87% of the patients completed follow up and only one patient with abnormal MPI underwent coronary angiography followed by PTCA. No cardiac death, MI, UA or cardiac admission occurred among our patients during follow up.
Conclusion: Reversible defects are commonly seen in myocardial perfusion SPECT in asymptomatic diabetic patients and are mild in severity and not associated with adverse cardiac events. Routine approach beginning with ETT seems to be appropriate in these patients.

Keywords: Diabetes mellitus, Myocardial perfusion scan, Perfusion defect.

Thursday
S1.Room1

Dosimetric evaluation of Ho-166 radioisotope in intravascular brachytherapy to reduce vascular restenosis

Motahareh Sufi[1], Seyed Mahmoud Reza Aghamiri[1], Shahab Sheybani[2] , Hosseyn Pourbeygi[1]

[1]Department of Radiation Medicine Engineering, Shahid Beheshti University, Tehran, Iran
[2]Atomic Energy Organization of Iran [AEOI]

Presenter Address: Motahareh Sufi, Department Of Radiation Medicine Engineering Shahid Beheshti University, 19, Golestan2 Street, Shahid nam Street, 17Shahrivar Blv, Langrood, Iran, Email: motahare.soufi@gmail.com

Introduction: Restenosis is a major drawback of percutaneous transluminal coronary angioplasty (PTCA). About 35–40% of patients have vascular restenosis within 6 months after PTCA. Results of pre-clinical and clinical studies have shown that application of ionization radiation brachytherapy at the proper dose level (15–30Gy) to the affected area inside the artery reduces the occurrence of intravascular restenosis to below 10%. The purpose of this study was to estimate the absorbed dose distribution of ^{166}Ho as intravascular brachytherapy source using radiochromic film dosimetry.
Methods: The liquid form of 166Ho was produced at the Tehran Research Reactor. GafChromic film was used for the estimation of the absorbed dose from beta particles. A 60Co teletherapy unit was used to generate dose-intensity calibration curves. Tissue-equivalent plexiglass phantom was constructed for dosimetery of liquid filled balloon angioplasty. After positioning of radiochromic films in the phantom, angioplasty balloon containing radioactive solution positioned in the phantom. Balloon activity was measured by a PTW dose calibrator, and activity of 166Ho balloon was 0.55mCi. EBT radiochromic film was used and 90 min exposure time was selected. The exposed films were read using transmission and reflective scanner and the image processing software (OSIRIS) was applied for determination of intensity at milimetric distance to gain radial dose distribution from balloon surface.
Results: results shown that dose at the 1mm distance from balloon surface for 166Ho liquid filled balloon was 1.45 Gy. The calculated dose distribution using MCNP4C for Ho-166 at 1mm distance from balloon surface was 1.75Gy. The results showed good agreement between measurment and calculation data.
Conclusion: Absorbed dose distribution showed that for intravascular brachytherapy with 166Ho liquid source, the minimum required activity is 80 mCi/cc. By the way, the results of film dosimetery shown that using transmission scanner with image processing softeware as reader, for energetic beta particle, is a simple and applicable method with enough precision (10% error) for milimeteric distances from beta sources.

Keywords: Holmium-166, Angioplasty, Film dosimetry.

Thursday
S1.Room3

Evaluation of [^{99m}Tc]-Neuropeptide Y as a specific breast tumor imaging agents

Mostafa Gandomkar[1], Mohammad Mazidi[1] , Mostafa Godarzi[1], Seyed Pejman Shirmardi[1]

[1] Nuclear Science Research School, Nuclear Science & Technology Research Institute (NSTRI), Atomic Energy Organization of Iran, Tehran, Iran

Presenter Address: Mostafa Gandomkar , PHD , Nuclear Science Research School, Nuclear Science & Technology Research Institute (NSTRI), Atomic Energy Organization of Iran, Tehran, Iran , Email: msgandomkar@yahoo.com

Introduction: Over expression of selected peptide receptors in human tumors has been shown to represent clinically relevant targets for cancer diagnosis and therapy. The aim of this work was to investigate Neuropeptide Y (NPY) as a new radiopharmaceutical for diagnosis of breast cancer.
Methods: A neuropeptide Y analogues with Y1 receptor preference and agonistic properties was synthesized by solid phase method. Labeling with 99mTc was performed and yield of labeling, stability in human serum, receptor binding in cell surface with internalization in SK-N-MC cells, and biodistribution in normal rat were determined.
Results: Peptide was synthesized and labeled with more than 95% purity. Radiolabeled peptide was stable in human serum and specifically binds and internalized in the cells with Y1 receptor (4h = 12%). A rapid clearance from blood pool and urinary excretion were observed.
Conclusion: Our results showed that this peptide can be considerate as a candidate for diagnosis of breast tumors.

Keywords: Neuropeptide Y, Tc-99m, Tumor.

Thursday
S1.Room3

Preparation and primary evaluation of ^{66}Ga-DTPA-chitosan in fibrosarcoma bearing mice via intra-tumor injection technique

Mehdi Akhlaghi[1,2], Ali Pourjavadi[2], Amir Reza Jalilian[2]

[1]Polymer Research Laboratory, Sharif University of Technology, Tehran, Iran
[2] Nuclear Sciences and Technology Research Institute, Tehran, Iran

Presenter Address: Mehdi Akhlaghi, PHD student, Polymer Research Laboratory, Department of Chemistry, Sharif University of Technology, Email: akhlaghi.mehdi@gmail.com.

Chitosan was chemically modified by DTPA in different degrees of modification (DM= 6.1%, 10.3%, 15.7% and 20.9%). DTPA-chitosans were radiolabeled by gallium-66 radionuclide. The effect of several factors on labeling yield such as degree of modification, acidity and concentration of DTPA-chitosan solution, contact time and radioactivity was investigated. Radiolabeled DTPA chitosans were intratumorally injected to fibrosarcoma bearing mice and the leakage of radioactivity form the injection site was evaluated. In comparison with chitosan, all DTPA chitosans showed better efficiency in preventing the leakage of radioactivity from tumor lesion and DTPA-chitosan (DM=10.3%) was the best which led to remaining 97% of injected dose in the injection site after 54 hours of injection. the highest leaked radioactivity from the injection site was in the lungs, liver, spleen and the kidneys. Our results indicated that DTPA modified chitosan can be an effective carrier for therapeutic radionuclides for tumor treatment by the intra-tumoral injection technique.

Keywords: DTPA-chitosan, Gallium-66, Intratumor injection

Thursday
S1.Room3

Preparation and biological evaluation of ^{177}Lu-labeled rituximab for B-lymphoma treatment

Edalat Radfar, Azim Arbabi, Dariush Sardari

Islamic Azad University

Presenter Address: Edalat Radfar, Email: edalatradfar@gmail.com

Introduction: 177Lu is a beta emitter with suitable decay mode [T1/2=6.7 d, Eβmax=497 keV, EY=112keV (6.4%) & 208 keV (11%)] for using in radio therapy. Various radiolabeled monoclonal antibodies have been developed in treatment. Rituximab is a chimeric mouse-human monoclonal antibody. Rituximab binds with human B-lymphocate-restricted differentiation antigen: CD20. Rituxsimab was used successfully as an anti-CD20 radiolabeled antibody before.
Methods: 177Lu was produced by thermal neutron irradiation of 1 mg of natural Lu2O3 with 4*10^13 n cm-2 s-1 neutron flux at Tehran Research Reactor. The irradiation target was dissolved in 200 µL of 1.0 M HCl, to prepare 177LuCl3. The radionuclide purity of product was measured by using ITLC and gamma spectroscopy by HPGe detector. The macrocyclic bifunctional chelating agent, N-succinimidyl-1,4,7, 10-tetraazacyclododecane-1,4,7,10-tetraacetic acid (DOTA-NHS) was prepared at 25 C using DOTA, N-hydroxy succinimide (NHS) in CH2Cl2. DOTA-Rituximab was obtained by the adding 0.5 mL of a rituximab pharmaceutical solution (10 mg/mL, in phosphate buffer, pH 7.8) to a glass tube pre-coated with DOTA-NHS (0.01–0.1 mg) at 25C with continuous mild stirring for 15 h. The stability of radiolabeled was studied in human serum. The biodistributions of 177Lu-DOTA-Rituximab and 177LuCl3 were determined for normal rats. The tissue uptakes of each injection were measured.
Results: Radiolabeling was performed at 37C in 24 h. Radio-thin layer chromatography showed an overall radiochemical purity of >98% at optimized conditions. The percents of Injected Dose per gram of tissue were compared in different selected times (2-168 h). The peak of uptakes for 177LuCl3 was observed in bone, liver and kidney. High uptakes of 177Lu-DOTA-Rituximab were in spleen, liver and lungs.
Conclusion: The radiolabeled complex was stable in human serum at 37C for 24 h. The biodistribution of the radiolabeled antibody is in agreement with other radiolabeled antiCD20 species already reported. 177Lu-DOTA-Rituximab is potential radioimmunotherapeutic agent for B-lymphoma treatment.

Keywords: 177Lu Rituximab, Radioimmunotherapy, Biodistribution

Thursday
S1.Room3

Preparation and quality control of ^{166}Ho-DTPA-antiCD20 for radioimmunotherapy

Samaneh Zolghadri, Amir Reza Jalilian, Hassan Yousefnia, Simindokht Shirvani-Arani, Ali Bahrami-Samani, Mohammad Ghannadi-Maragheh.

Radiopharmaceutical Research & Development Laboratory (RRDL), Nuclear Science & Technology Reaserch Institute (NSTRI), Tehran, Iran.

Presenter Address: Samaneh Zolghadri, Radiopharmaceutical Research & Development Laboratory (RRDL), Nuclear Science & Technology Reaserch Institute (NSTRI),Tehran, Iran. P.O.Box: 14155-775, Email: s_zolghadri63@yahoo.com.

Introduction: The importance of existence and application of radiolabeled anti-CD20 monoclonal antibodies at nonmyeloablative doses in treating B-cell NHL is well recognized throughout the world. In this work, anti-CD20 was successively labeled with beta-particle emitting radionuclide, Ho-166, for ultimate radioimmunotherapy applications.
Methods: Ho-166 chloride was obtained by thermal neutron flux (1 × 1013 n.cm-2.s-1) of natural Ho2(NO3)3 sample, dissolved in acidic media. 166Ho-holmium chloride (185 MBq) was added to the conjugated antibody after ccDTPA residulation at room temperature. Radiochemical purity was determined using HPLC and ITLC. The final isotonic 166Ho-rituximab complex was checked by gel electrophoresis for protein integrity retention. Biodistribution studies of Ho-166 chloride and radioimmunoconjugate were performed in wild-type rats to determine the biodistribution.
Results: The radioimmunoconjugate was prepared with a radiochemical purityof 95% (ITLC) and 98% (HPLC) (Specific activity = 3-3.5 GBq/mg). The final compound was stable in presence of human serum at 37°C and at room temperature. The samples were showed to have similar pattern of migration in the gel electrophoresis. The accumulation of the radiolabeled antibody in lungs, liver and spleen demonstrates a similar pattern to the other radiolabeled anti-CD20 immunoconjugates.
Conclusion: 166Ho-rituximab is a potential compound for therapy of lymphoma B patients. The experiments on lymphoma animal models should be performed for this radioimmunoconjugate before human use.

Keywords: Holmium-166, Anti-CD20, Targetted therapy, Biodistribution.

Thursday
S1.Room3

Optimization of ^{90}Y-antiCD20 preparation for radioimmunotherapy

Ariandokht Vakili[1], Amirreza Jalilian[2], Edalat Radfar[1], Ali Bahrami-Samani[2], Simindokht Shirvani-Arani[2], Bahram Salimi[2], Mohammad Ghannadi-Maragheh[2].

[1] Islamic Azad University
[2] Radiopharmaceutical Research & Development Laboratory (RRDL), Nuclear Science & Technology Reaserch Institute (NSTRI), Tehran, Iran.

Presenter Address: Ariandokht Vakili, Master of science, Email: arian_v84@hotmail.com

Introduction: The importance of existence and application of radiolabeled anti-CD20 monoclonal antibodies at nonmyeloablative doses in treating B-cell NHL is well recognized throughout the world. In this work, Rituximab was successively labeled with yttrium-90**.**
Methods: The antibody was labeled with 90Y-yttrium chloride (185 MBq) after conjugation with freshly prepared ccDTPA. Y-90 chloride was obtained by thermal neutron flux (4 × 1013 n.cm-2.s-1) of a natural Y2O3 sample, dissolved in acidic media. Radiolabeling was completed in 24 hours by the addition of DTPA-rituximab conjugate at room temperature**.**
Results: Radiochemical purity of 96% (using ITLC) was obtained for final radioimmunoconjugate (Specific activity = 440-480 MBq/mg). The final isotonic 90Y-rituximab complex was checked by gel electrophoresis for protein integrity retention. Biodistribution studies in normal rats were carried out performed to determine the radioimmunoconjugate distribution up to 72 h.
Conclusion: Due to the importance of developing anti lymphoma B agents in nuclear medicine for country use, the optimization of 90Y-antiCD20 radioimmunoconjugate production and quality control methods for future clinical studies in the country was targeted in this work.

Keywords: Radiopharmaceutical, Yttrium-90, Rituximab, Targetted therapy

Thursday
S1.Room3

Formulation and quality control of single dose ^{99m}Tc-sestamibi as a myocardial perfusion imaging agent

G.A. Shabani, F.H. Abbasi, M. Farahani, M. Godarzi, H.R. Khosrounejad.

Radioisotope research group, NSTRI, Atomic Energy org. of Iran, North Kargar Ave., Tehran, Iran

Presenter Address: G.A. Shabani, Radioisotope research group, NSTRI, Atomic Energy org. of Iran, North Kargar Ave., Tehran, Iran, Email: gashabani@yahoo.com

Introduction: 99mTc-sestamibi is a cationic 99mTc complex which has been found to accumulate in viable myocardial tissue in a manner analogous to that of thallous chloride Tl-201.Scintigraphic images obtained in humans after the intravenous administration of the drug have been comparable to those obtained with thallous chloride Tl-201 in normal and abnormal myocardial tissue.It was subsequently used as a tumor imaging agent for lung, mammary, thyroid, parathyroid, brain tumors and lymphoma because it accumulates in tumor cells. 99mTc-sestamibi is a number of a chemical family referred to as isonitril. This radiopharmaceutical is a monovalent cation in which 99mTc is surrounded by six isonitril ligands.
Methods: In this new formulation, we changed the formulation of multi-dose MIBI kit to single dose for one patient and then we reduced the amount of the main ligand (MIBI). After getting a new formulation, the MIBI-SD produced as lyophilized, following quality control has been done: radiochemical purity, stability at room temperature, biodistribution in mice, determination of shelf life and sterility, pyrogenicity test.
Results: Radiolabelling efficiency was more than 95 percent with up to 30.0 mCi of pertechnetate (99mTcO4-). The 99mTc-MIBI-SD complex was stable at 6 hrs at room temperature. Biodistribution in mice showed that the percent of injected dose accumulation in heart after 30.0 min was the same amount of MIBI multi-dose kit.
Conclusion: The study demonstrates that our formulation of 99mTc-MIBI-SD as a 99mTc-radiopharmaceutical for myocardial imaging agent is stable after one year of shelf-life. Besides, we sent it to the nuclear medicine centers for clinical evaluation.

Keywords: Tc-99m, Scintigraphic Imaging, MIBI-SD, Myocardial perfusion

Thursday
S1.Room3

Production, quality control and biodistribiotion studies of ^{170}Tm-DOTA-NHS-Cetuximab

Simindokht Shirvani-Arani, Ali Bahrami-Samani , Amir Reza Jalilian, Mohammad Ghannadi-Maragheh

Radiopharmaceutical Research and Development Laboratory (RRDL), Nuclear Science and Technology Research Institute (NSTRI),

Presenter Address: Simin Dokht Shirvani-Arani, PHD, Radiopharmaceutical Research and Development Laboratory (RRDL), Nuclear Science and Technology Research Institute (NSTRI),
Email:smshirvani@aeoi.org.ir

Introduction: Antibodies with specificity towards tumour antigens can be labelled with radionuclides to enable diagnostic imaging (e.g. SPECT or PET) or to improve therapeutic efficiency. Combining beta-particle and gamma emission effect with therapeutic properties of C225 monoclonal antibody, Cetuximab (Erbitux, Merck Pharmaceuticals) was targeted in this study.
Methods: The C225 antibody was labeled with 170Tm-Thulium chloride (100 MBq) after conjugation with in-house freshly prepared 1,4,7,10-tetraazacyclododecane-N,N,N,N-tetraacetic acid mono-(N-hydroxysuccinimidyl) ester (DOTA-NHS). Conjugated-cetuximab was obtained by the addition of 0.5 ml of a cetuximab pharmaceutical solution (1 mg, in phosphate buffer, pH = 8) to a glass tube precoated with freshly prepared DOTA-NHS (~5 mg) at 25°C. 170Tm-Thulium chloride was obtained by a thermal neutron flux (3-4 × 1013 n•cm–2•s–1) of a natural thulium nitrate sample, dissolved in acidic media. Radiolabeling was performed in 2-3 hours by the addition of DOTA-NHS-Cetuximab conjugate at room temperature.
Results: Radiochemical purity of 92% (ITLC, DTPA 1mM) was obtained for the final radioimmunoconjugate (specific activity = 72 TBq/mmol). Biodistribution studies in normal rats were performed to determine radioimmunoconjugate distribution up to 24 h. Stability of radiolabeled protein in presence of human serum was tested at 37˚C for up to 72h and it was observed that the botained formulation is stable even up to one month after preparation.
Conclusion: For [170Tm]-DOTA-NHS-Cetuximab, the radiochemical purity was 92% and the labeling and quality control took less than 1 h. The radiolabeled complex was stable in human serum for at least 72 h and no significant amount of free 170Tm as well as 170Tm-DOTA-NHS was observed. The final preparation was administered to normal rats and biodistribution of the radiopharmaceutical was checked 2-168 h later. The prepared radio-labeled cetuximab using 170Tm can be applied to improve the therapeutic potential of (epidermal growth factor receptor) EGFR -targeted drugs. The use of these selective labeled agents in nuclear medicine applications may facilitate in vivo EGFR-targeted drug efficacy.

Keywords: Thulium-170, DOTA-NHS Cetuximab, Biodistribution studies

Thursday
S2.Room1

PET/CT in esophageal cancer and other GI malignancies

Simin Dadparvar

Division of Nuclear Medicine, Department of Radiology, University of Pennsylvania School of Medicine, Hospital of the University of Pennsylvania, Philadelphia, PA, USA.

[No abstract available]

Comparison between early and delayed images of ^{67}Gallium Citrate scintigraphy for evaluation of recurrent lymphoma

Thursday
S2.Room1

Ramin Sadeghi, Toktam Mohammadi Rana, Mohammad Mahdi Koushyar, Abbas Shirdel, Vahid Reza Dabbagh Kakhki, Mehdi Momennezhad, Seyed Rasoul Zakavi, Mehdi Momennezhad, Kamran Aryana

Nuclear Medicine Research Center, Emam Reza Hospital, Mashhad, Iran,

Presenter Address: Toktam Mohammadi Rana, Nuclear Medicine Research Center, Mashhad University of Medical Sciences, E.mail: MohammadiT1@mums.ac.ir

Introduction: Despite widespread use of Gallium-67 (67Ga) for lymphoma evaluation, timing of imaging after injection is a matter of controversy and to the extent of our knowledge no direct comparison has been made between early and delayed gallium imaging in this regard. We aimed to compare 24 and 48h post injection planar gallium imaging in patients referred to our department for evaluation of lymphoma recurrence.

Methods: 255 patients suspicious of recurrent lymphoma were included in the study. Twenty four and 48h post injection (370MBq) whole body 67Ga imaging was performed for the patients. Semi-quantitative evaluation (background corrected) was also performed in positive whole body 67Ga scans.

Results: Results showed that the whole body gallium scintigraphy was positive in 115 out of 150 patients with recurrence (sensitivity of 76%). Comparison of the 24h and 48h image sets didn't show any new lesion on the 48h images. However, delayed 48h images were required for definite detection of the gallium avid lesions in the abdominal and pelvic areas in 40 patients. Semi-quantitative evaluation of the lesions showed higher lesion to background ratio for 24h compared to the 48h images ($P<0.001$).

Conclusion: We conclude that 24h whole body 67Ga imaging is sufficient for the detection of lymphomas while 48h imaging can be reserved for suspicious lesions in the abdominal area.

Keywords: ^{67}Gallium, SPECT, Plannar imaging, Lymphoma, Time of imaging

Thursday
S2.Room1

Radioprotective effect of Vitamin E against radiation-induced injuries to the salivary glands in radioiodine-treated patients with thyroid cancer

Mohsen Saghari, Babak Fallahi, Davood Beiki, Seyed Mohammad Abedi, Armaghan Fard-Esfahani, Mohammad Eftekhari

Research Institute for Nuclear Medicine, Shariati Hospital, Tehran University of Medical Sciences, Tehran, Iran

Presenter Address: Mohsen Saghari, Professor, Research Institute for Nuclear Medicine, Shariati Hospital, Tehran University of Medical Sciences, Tehran, Iran , Email: sagharim@sina.tums.ac.ir

Introduction: Salivary gland impairment is a known complication after high-dose radioiodine treatment in patients with differentiated thyroid carcinoma (DTC). The goal of our study was to evaluate the protective effect of vitamin-E against radiation-induced injuries of the salivary glands subsequent to I-131 therapy.
Methods: After enrolling 36 patients to the study, the cases were randomly allocated in Vitamin E (19 patients) and placebo (17 patients) groups. All patients were candidates of I-131 therapy with a dose of about 100 - 150 mCi for ablation of thyroid remnant. Patients of vitamin E group received 800 Iu/day vitamin E for 5 weeks (from one week before to 4 weeks after of radioiodine therapy). The quantitative parameters of salivary gland function [first uptake ratio (FUR), maximum uptake ratio (MUR), maximum secretion percentage (MSP) and excretion fraction (EF)] were measured using a dose of about 10 mCi 99mTcO4- for sialoscintigraphy in two occasions, one before and the second, 6 months after ablation. The changes in the corresponding parameters were compared between two groups.
Results: Comparing with baseline values, the averages of EF and MSP of the right submandibular as well as EF of the left parotid gland were significantly decreased following radioiodine treatment in placebo group while no significant change in functional parameters was noted in vitamin E group. About 8% of salivary glands in vitamin E group and 18% of salivary glands in placebo group revealed a 10% decrease in MSP after radioiodine therapy.
Conclusion: The rate of functional deterioration in salivary glands may be decreased by using vitamin E as a protective agent against radiation-induced salivary gland dysfunction following radioiodine therapy. However further studies with larger series of patients are suggested to confirm the effect of vitamin E as a radioprotective agent for prevention of salivary gland injuries following high dose radioiodine therapy.

Keywords: Vitamine E, Salivary gland scintigraphy, I-131

Thursday
S2.Room1

PET/CT in radiation therapy & treatment planning

Amin Zonoozi

Medical Physics and Applied Radiation Sciences, McMaster University.

Presenter Address: Amin Zonoozi, PHD Student of Medical Physics, McMaster University, 206 Brigadoon Drive, Hamilton, ONL9C 0B5, Ex: 32746,E-mail: amin_zonoozi@yahoo.com

Radiation therapy (RT), staging, treatment planning, monitoring and evaluation of response are traditionally based on Computed Tomography (CT) and Magnetic Resonance Imaging (MRI). These radiological investigations have the significant advantage to show the anatomy with a high resolution, being also called anatomical imaging. In recent years, so called biological imaging methods which visualize metabolic pathways have been developed. To date, the most prominent biological imaging system in use is Positron Emission Tomography (PET), whose diagnostic properties have clinically been evaluated for years. The combination of PET and CT in a single system (PET/CT) to form an inherently fused anatomical and functional dataset has provided an imaging modality which could be used as the prime tool in the delineation of tumor volumes and the preparation of patient treatment plans, especially when integrated with virtual simulation. This powerful method offer complementary imaging of various aspects of tumor biology. The aim of this review is to discuss the valences and implications of PET/CT in RT. The focus will be on evaluation of the following topics: the role of biological imaging for tumor tissue detection/delineation of the gross tumor volume (GTV) and for the visualization of heterogeneous tumor biology. The role of fluorodeoxyglucose-PET in lung will be discussed. There was also evidence for utility of PET in head and neck cancers, lymphoma and in esophageal cancers, with promising preliminary data in many other cancers. The best available approach employs integrated PET/CT images, acquired on a dual scanner in the radiotherapy treatment position after administration of tracer according to a standardized protocol, with careful optimization of images within the RT planning system and carefully considered rules for contouring tumor volumes. The impact of amino acids (AA)-PET in target volume delineation of brain gliomas was discussed. Furthermore, it is summarized the data of the literature about tumor hypoxia and proliferation visualized by PET. It concluded that regarding treatment planning in radiotherapy, PET offers advantages in terms of tumor delineation and the description of biological processes. PET/CT will play an increasing valuable role in RT planning for a wide range of cancers.

Keywords: PET, PET/CT, Radiotherapy planning, FDG

Thursday
S2.Room1

The role of PET and PET/CT in radiation therapy planning process

Mehdi Seilanian Toussi, Sudabeh Shahid Sales.

Department of Radiation Oncology, Mashhad University of Medical Sciences, Mashhad, Iran.

Presenter Address: Mehdi Seilanian Toussi, Department of radiation oncology, Mashhad University of Medical Sciences.

Radiation therapy has a major role in treatment of malignant tumor not only as an adjuvant treatment for surgery but also as a primary modality in treatment of inoperable tumors or as an alternative to surgery in order to preserve organ function and/or avoiding surgical complications.
Treatment planning has evolved from simple conventional planning to conformal techniques such as Three-Dimentional conformal radiation therapy and intensity Modulated Radiation Therapy (IMRT). These techniques which are based on anatomical information from CT scan or MRI allow us to confirm radiation dose distribution to the target volume with a minimum possible dose to normal tissues. A major step in planning process is delineating tumor bearing tissues (target volume). The most important limitation is that the extent of target volume is not always discernible based on CT scan or MRI information.
Positron emission tomography (PET) using radioactive fluorine-18 labelled FDG as a tracer enables biological imaging of tumors and highlights its proliferating areas. This imaging technique which has an important role in diagnosis, staging and restaging of tumors has been introduced in radiation planning to facilitate tumor delineation. By using the same table and positioning for a PET / CT scan it is possible to fuse both images and combine the physiologic information from PET and superior images of anatomy and localization from CT scan. Using PET / CT scan in radiotherapy planning has the following potential advantages: 1- Differentiating between tumor and normal tissue. Take for an example; in lung cancer a distal atelectasis could be mixed up with a central tumor in CT scan. 2- Including the tumor spread such as metastatic lymph nodes into the target volume which could be missed in CT information. 3- Assessing the tumor response after terminating the planned treatment and prescribing additional boost dose to the remaining functional area. 4- In some organs such as lung which lesions move considerably during respiration and radiotherapy, acquiring gated 4-D PET scan and hybrid PET / CT make it possible to assess the tumor motion precisely and allowing tighten tumor margins.
In non-small cell lung cancer using FDG-PET has resulted in safe decrease in radiotherapy volume in a considerable number of patients and allowed dose escalation in tumor. In esophageal and Head and neck carcinoma it is possible to detect unrecognized lymph node metastasis and to delineate the tumor volume more precisely. In Hodgkin's lymphoma, PET may be essential in involved field radiotherapy after chemotherapy to safely decrease the treatment volume while avoiding geographic miss. In cervical carcinoma PET can help a clinician to decide whether to encompass the para-aortic lymph nodes in treatment volume or not. PET has also an emerging role in radiotherapy of primary brain tumors.
Multiple studies suggest an increasingly important role for PET in radiotherapy planning. However, using PET should follow strict standardized protocols. Further investigations are needed to reveal its exact role in radiation planning for different malignancies and to define safe recommendations.

Key words: PET scan, CT scan, Radiotherapy, Radiotherapy planning.

Thursday
S2.Room1

Application of ursodeoxycolic acid in hepatobiliary scintigraphy for neonatal hyperbilirubinemia: comparison with phenobarbital

Enayatollah Nemat Khorasani

Kermanshah Medical University of Science, Kermanshah, Iran.

Presenter Address**:** Enayatollah Nemat Khorasani**,** Associated Prof, Kermanshah Medical University of Science, Kermanshah, Emam Reza Hospital, Email: KHORASANI@DR.COM

Introduction: Early differentiation of biliary atresia from neonatal hepatitis is of utmost importance, since on time surgery of biliary atresia significantly 7 h ad neonatal hepatitis. The specificity improves the outcome. Hepatobiliary scintigraphy is an integral part of diagnosis work-up of these patients; however its specificity for diagnosis of biliary atresia is suboptimal. In this study we evaluated the value of ursodeoxycholic acid pre-treatment for improvement of hepatobiliary scintigraphy specificity.
Methods: 30 consecutive infants with direct heperbilirubinemia were included into the study. All infants underwent hepatobiliary scintigraphy with 99mTc-BrIDA twice (first after pre-treatment with Phenobarbital and the other time after pre-treatment with ursodeoxycholic acid.
Results: Of 30 patients included into our study 13 had final diagnosis of extrahepatic biliary atresia and 1of hepatobiliary scintigraphy for diagnosis of biliary atresia was 80 % and 96.6 % for diagnosis of biliary atresia with phenobarbital and ursodeoxycholic acid respectively. All patients had complications of Phenobarbital administration (lethargy, poor feeding, irritability, hypotonia, etc) to some extent. These findings decreased significantly after discontinuation of Phenobarbital and were not present with ursodeoxycholic acid.
Conclusion: Ursodeoxycholic acid is a safe and efficient drug for pre-treatment of patients with neonatal cholestasis syndrome who are going to undergo hepatobiliary scintigraphy. Compared to Phenobarbital, this drug has fewer complications and is more efficient. Keywords: Ursodeoxycholic acid, Hepatobiliary scintigraphy, Tc-99m BrIDA, Infantile jaundice, Neonatal Hyperbilirubinemia.

Keywords: Ursodexycholic Acid, Infantile jaundice, Hepatobiliary scintigraphy.

Thursday
S2.Room3

Synthesis and evaluation of a new bombesin analogue for imaging of gastrin-releasing peptide receptors

Seyed Pezhman Shirmardi[1], Mostafa Gandomkar[2], Mojtaba Shamsaei[1], Mohammad Ghannadi Maragheh[2].

[1]Nuclear Engineering and Physics Faculty.
[2]Nuclear Sciences and Technology Research Institute, Tehran, Iran.

Presenter Address: Seyed Pezhman Shirmardi, PHD, Amirkabir University of Technology, Email: p_shirmardi@aut.ac.ir

Introduction: Bombesin is a 14-amino acid peptide indicating high affinity for the gastrin releasing peptide receptor (GRPr). Tumors such as, prostate, small cell lung cancer, breast, gastric, and colon cancer are known to over express receptors to bombesin (BBN) and gastrin releasing peptide (GRP). The goal of this study was to evaluate a new 67Ga radiolabeled BBN analogue based upon the bifunctional chelating ligand DOTA (1, 4, 7, 10-tetraazacyclododecane-1, 4, 7, 10-tetraacetic acid) that can be used as a tool for diagnosis of GRP receptor-positive tumors.
Methods: DOTA-Bombesin (7-14) NH2 was synthesized using a standard Fmoc strategy. Labeling with 67Ga was performed at 95°C for 30 min in ammonium acetate buffer (pH=4.8). Radiochemical analysis involved ITLC and HPLC methods. The stability of radiopeptide was checked in the presence of humane serum at 37 °C up to 24 h. The receptor bound internalization and externalization rates were studied in GRP receptor expressing PC-3 cells. Biodistribution of radiopeptide was studied in nude mice bearing PC-3 tumor.
Results: labeling yield of >90% was obtained. Peptide conjugate showed good stability in the presence of human serum. The radioligand showed a good and specific internalization into PC-3 cells. In animal biodistribution studies, a receptor-specific uptake of radioactivity was observed in GRP-receptor-positive organs
Conclusion: These data show that 67Ga-DOTA-Bombesin (7-14) NH2 is a specific radioligand for gastrin-releasing peptide receptor positive tumors and is a suitable candidate for clinical studies.

Keywords: Bombesin, ^{67}Ga, DOTA, Tumor, PC-3 cells.

Thursday
S2.Room3

Radiolabeling of ciprofloxacin with Tc-99m and evaluation of its biological activity for infectious foci scintigraphy

Seyedeh Fatemeh Mirshojaei, Mostafa Gandomkar, Reza Najafi, Mohamad Mazidi, Mohamad Hosein Talebi, Seyed Esmaeil Sadat Ebrahimi

Nuclear Science & Technology Research Institute, Tehran, Iran.

Presenter Address: Seyedeh Fatemeh Mirshojaei, PHD Student, Nuclear Science & Technology Research Institute, Tehran, Iran Email: fmirshojaei@aeoi.org.ir

Introduction: Radiolabeled antibiotics are being used for the specific diagnosis of infection by exploiting their specific binding properties to the bacterial components, thereby making it possible to differentiate infection from sterile lesions. Ciprofloxacin is a fluoroquinolone antibiotic which is active against both gram-positive and gram-negative bacteria. It inhibits the DNA gyrase enzyme and thus interferes with the strand cutting and releasing function during DNA replication. 99mTc-ciprofloxacin is the most widely used infection imaging agent. The aim of this work was radiolabeling of 99mTc-ciprofloxacin and evaluation of its stability and biological activity, which make it able to identify a septic focus (E-coli) in the experimental infection model in mice.
Methods: Antibiotic was reconstituted with 99mTc at room temperature and incubation time of 15 min. The kit stability and affinity to human serum was challenged for 24 hours and its in vitro binding to bacteria was assessed. Biodistribution and accumulation of labeled compound in staphylococcus aureus infected mice were studied using Scintigraphic methods and ex vivo counting.
Results: Radiolabeling was performed at high specific activities, and radiochemical purity was >90±4 %. The stability of radiolabeled peptide in human serum was excellent. In-vitro studies showed 75 % of radioactivity was bound to bacteria. After injection into mice with a bacterial infection, removing from the circulation occurred mainly by biliary-renal clearance and site of infection was rapidly detected within 30 min. The ratio of infected muscle to non-infected muscle is 3.2 and 1.8, 1h and 4 hours post injection.
Conclusion: 99mTc-ciprofloxacin is a stable, reproducible and safe preparation with high labeling efficiency having specific accumulation in bacteria. It showed favorable radiochemical and biological characteristics which permitted detection of the infection with optimal visualization.

Keywords: Ciprofloxacin, Radiolabeling, Infection imaging

Thursday
S2.Room3

Development of ^{177}Lu-chitosan for radio-synovectomy

Hassan Yousefnia, Amir Reza Jalilian, Samaneh Zolghadri, Ali Bahrami-Samani, Simindokht Shirvani-Arani, Mohammad Mazidi, Mohammad Ghannadi-Maragheh

Radiopharmaceutical Research & Development Laboratory (RRDL), Nuclear Science & Technology Reaserch Institute (NSTRI), Tehran, Iran.

Presenter Address: Hassan Yousefnia, Nuclear Science & Technology Reaserch Institute (NSTRI), Tehran, Iran. P.O. Box: 14155-775, Email: hasan_usefnia@yahoo.com

Introduction Chitosan (CHITO), is a natural, non-allergic and biodegradable polysaccharide with wide range applications in biopharmaceutics, agriculture and water treatment purposes and also RSV. In tis research the 177Lu-chitosan complex (177Lu-CHITO) was prepared successfully with high radiochemical purity (>99%) in diluted acetic acid solution**.**

Methods: Lu-177 chloride was obtained by thermal neutron flux. 177Lu-CHITO complex was prepared and Radiochemical purity was determined using ITLC. Stability of 177Lu-CHITO was determined in presence of freshly prepared human serum (300 µl) and kept at 37˚C for 2 days. The prepared complex solution (300 µCi/100 µl) was injected intra-articularly to rabbit knee joint. Leakage of injected dose from injection site and its distribution in the rabbit organs was investigated using SPECT imaging up to 2 days**.**

Results: The 177Lu-CHITO complex was prepared with high radiochemical yield (>95 %) in the optimized condition; 35mg/3ml of chitosan concentration in diluted acetic acid solution (pH=3). The prepared complex was stable in the final solution at room temperature, 37ºC and presence of human serum, and can be used even 24 hours after preparation. The retention in the injected rabbit knee joint was observed even after 48 hours post injection.

Conclusion: A kit formulation was developed for the in-situ preparation of the radiopharmaceutical in remote clinical centers.

Keywords: Chitosan, Radiosynovectomy, Lu-177, Biodistribution

Thursday
S2.Room3

Synthesis and ^{99m}Tc labeling of a new radiopharmaceutical for imaging of $5HT_{1A}$ receptors in brain diseases

Leila Hassanzadeh[1], Mostafa Gandomkar[2], Reza Najafi[2], Seyed Esmaeil Sadat Ebrahimi[1]

[1] Department of Medicinal Chemistry, Faculty of Pharmacy, Tehran University of Medical Science, Tehran, Iran.
[2] Nuclear Science and Technology Research Institute, Tehran, Iran.

Presenter Address: Leila Hassanzadeh, PH.D Student, Department of Medicinal Chemistry, Faculty of Pharmacy, Tehran University of Medical Science, Tehran, Iran, Email: l_analytic@yahoo.com

Introduction: The 5-HT1A receptor has been studied extensively due to its role in a number of neuropsychiatry disorders such as schizophrenia, depression, hallucinogenic behavior, eating disorders and anxiety. The aim of this work was to evaluate preparation and labeling of a new WAY 100635 analogous for diagnosis of brain diseases.
Methods: A WAY 100635 analogues with 5-HT1A receptor preference was synthesized. The structure of synthesized derivative was confirmed by NMR, IR and Mass spectroscopy. For labeling technetium tricarbonyl precursor prepared from an IsoLink kit was added to 0.5 ml of a solution of the produced final substance (1 mg/ml) adjusted to pH 11 by addition of 0.5 ml of a 0.5M phosphate buffer pH 11 and the mixture was heated in a water bath at 100˚C for 15 min. For labeled compound radiochemical yield was evaluated by ITLC and HPLC methods.
Results: WAY derivative was synthesized in overall yield of %56 and its structure confirmed by H-NMR. Synthesized final substance was labeled in high yields with a Tc(CO)3 core to form cationic complexes. Labeling yield of >90% was obtained corresponding to a high specific activity. Labeled compound was stable for more than 6 h.
Conclusion: These data show that our WAY derivative is a suitable candidate for further evaluation as a new brain imaging radiopharmaceutical.

Keywords: WAYderivative, Technetium Tricarbonyl, Brain imaging

Thursday
S2.Room3

Technetium-99m-Labeled Quercetin as a potential radical scavenging agent

Seyed Jalal Hosseinimehr, Amirhossein Ahmadi, Reza Taghvai

Department of Radiopahrmacy, Faculty of Pharmacy, Mazandaran University of Medical Sciences, Sari, Iran.

Presenter Address: Seyed Jalal Hosseinimehr, Department of Radiopahrmacy, Faculty of Pharmacy, Mazandaran University of Medical Sciences, Sari, Iran , Email: sjhosseinim@yahoo.com.

Quercetin as a natural product scavenges superoxide anion radicals and hydroxyl radicals with potent antioxidant activity, these properties are mainly due to polyphenolic and several hydroxyl groups of quercetin. In this study, we have prepared and evaluated technetium-99m (99mTc)-labeled quercetin as a potential radical scavenging radiotracer. A 99mTc-quercetin complex was prepared using quercetin, SnCl2 and Na99mTcO4 in a buffered solution over 30 minutes. The participation coefficient was measured in octanol and queues solutions. The stability was determined in phosphate buffered saline and serum. The biodistribution in normal mice was evaluated at 0.5, 2, 6 and 24 h post-injection. The radiochemical purity (>99%) was determined by thin layer chromatography (TLC) in normal saline solution as the mobile phase. It has a log P of 0.204. It was mainly cleared by the kidneys and showed negligible brain uptake at four time points measured post-injection. The pharmacological properties of quercetin, mainly its free radical scavenging, may potentially cat as a radiopharmaceutical agent for radical-targeted imaging of tissue with high levels of reactive oxygen species.

Keywords: Radiopharmaceutical, Quercetin, Free Radical, Tc-99m .

Development of [^{201}Tl](III)Oxinate complex for cell labeling

Thursday
S2.Room3

Amir Hakimi[1], Amir Reza Jalilian[2], Javad Garousi[3], Mehdi Kamali Dehghan[3], Gholamreza Aslani[3].

[1] Islamic Azad University, Science and research Unit, Tehran, Iran
[2] Radiopharmaceutical Research and Development Lab (RRDL), Tehran, Iran
[3] Nuclear Medicine Research Group (NMRG), Tehran, Iran

Presenter Address: Amir Hakimi, Master of Science, Islamic Azad University, Science and research Unit, Tehran, Iran, E-mail: amir_1985us@yahoo.com

Introduction: Due to interesting physical properties and wide availability of thallium-201 as a SPECT radionuclide, the incorporation of this nuclide into 8-hydroxyquinoline for cell labeling was targeted.
Methods: Thallium-201 (T1/2=3.04 d) in Tl+ form was converted to Tl3+ cation in presence of O3/6M HCl and di-isopropyl ether, controlled by RTLC/gel electrophoresis
The final evaporated activity reacted with ethanolic 8-hydroxy-quinoline (oxine) solution in normal saline to yield [201Tl](III)oxinate at room temperature after 0.5 h, followed by solid phase extraction/purification using C18 Sep-Pak column
Results: A radiochemical yield of more than 95% was obtained. Radiochemical purity of 92% was obtained using RTLC (>90% using HPLC) with specific activity of about 820 GBq/mmol. The tracer was stable in the final product and in presence of human serum at 37°C up to 6h. The partition coefficient of lopP=5.5 was obtained. The labeled compound was used in red blood cell (RBC) labeling. The cell uptake ratio was determined at 37°C up to 3 hours.
Conclusion: The radiolabeled compound used in this study is a very inexpensive agent for use in cell labeling studies in biology, medicine and various research areas.

Keywords: 201Tl (III)-Complex, Oxinate, Cell labeling, SPECT.

Thursday
S2.Room3

Optimization of ^{67}Ga-Oxine preparation and labeling of white blood cells

Ariandokht Vakili[1], Amir Reza Jalilian[2], Sona Nazari[1], Maryam Ghazi Zahedi[3], Saeed Rajabifar[4], Fatemeh Bolourinovin[4]

[1] University of Medical Sciences of Birjand, Birjand, South Khorasan Province, Iran
[2] Radiopharmaceutical Research and Development Lab (RRDL), Tehran, Iran.
[3] K.N.Toosi University of Technology
[4] Nuclear Medicine Research Group (NMRG)

Presenter Address:, Ariandokht Vakili, University of Medical Sciences of Birjand, No 30, Corner of 44th Pasdaran Ave, Down to Janbazan Sq, Birjand, South Khorasan Province, Iran, Email: morteza_bi@yahoo.com

Introduction: The aim of this work is Optimization of 67Ga-Oxine preparation in order to diagnostic purposes and cell labeling.The incorporation of Gallium-67 into 8-hydroxyquinoline was targeted for cell labeling due to interesting physical properties and wide availability of this nuclide as a single photon emission computed tomography (SPECT) radionuclide.
Methods: Gallium-67 is a bioisoester of ferric iron with physical half-life of 3.3 days (78 hr) and biological half-life of 2-3 weeks .In this study, 67Ga was produced at a 30 MeV cyclotron (IBA-Cyclone 30) via the 68Zn(p,n)67Ga reaction.Oxine has been labeled with this radionuclide in the form of [67Ga]gallium chloride for its possible diagnostic properties and the reaction conditions were optimized for time, temperature and reactant concentrations. In vitro white blood cell (WBC) labeling was also performed.
Results: The [67Ga]oxine complex was obtained at pH = 5.5 in acetate buffer medium at 25°C in 2 hours. Radio-TLC showed a radiochemical purity of more than 95 ± 2%. The chemical stability of the complex was checked in vitro with a specific activity of 1432 GBq/mmol. The labeled compound was used in WBC labeling. The cell uptake ratio was 0.12 after 120 min.
Conclusion: [67Ga](III) oxinate used in this study is a widely available agent for use in WBC labeling studies in biology, medicine and various other research areas.

Keywords: Gallium-67, Oxinate Cell, Labeling, SPECT.

Thursday
S2.Room3

Synthesis and biodistribution of ^{99m}Tc-Ceftazidime and its application in infection imaging

Seyedeh Fatemeh Mirshojaei, Mostafa Gandomkar, Reza Najafi, Mohamad Mazidi, Seyed Esmaeil Sadat Ebrahimi

Nuclear Science & Technology Research Institute, Atomic Energy Organization of Iran, Tehran, Iran.

Present address: Seyedeh Fatemeh Mirshojaei, PHD Student, AEOI, Email: fmirshojaei@aeoi.org.ir

Introduction: Contrary to conventional imaging techniques like CT and MRI, scintigraphic imaging is based on physiological and biochemical alterations resulting from inflammatory and infectious processes. A new proposal is based on the use of radiolabeled antibiotics. They are used as specific infection imaging because of their affinity to bind with bacteria. Antibiotics localize in the infectious focus, where they are frequently taken up and metabolized by microorganisms. The majority of the various antibiotics studied so far are those of the quinolones group. Recently, a new radiopharmaceutical, 99mTc-ciprofloxacin (Infecton), has been developed. Ceftazidime a third-generation cephalosporin antibiotic used to treat bacterial infections was investigated to label with 99mTc.
Methods: labeling of Ceftazidime with 99mTc was performed by using sodium dithionite as reducing agent. Labeling was performed at 100 ºC for 10 min and radiochemical analysis involved ITLC and HPLC methods. The stability of labeled antibiotic was checked in the presence of human serum at 37 ºC up to 24 h.
Results: The maximum radiolabeling yield was 95.5±1.5 %. Bacterial binding assay was performed with S. aureus and the in vivo distribution was studied in mice. Images showed minimal accumulation in non-target tissues, with an average target/non-target ratio of 1.97±0.28.
Conclusion: Reaction was easygoing within a very short time which makes it a good radiopharmaceutical for clinical usage in nuclear medicine laboratories. The radiotracer demonstrated excellent radiochemical stability even up to 24 h post labeling. This antibiotic showed an improvement in excretion pathway from liver to kidney followed by an accumulation of radioactivity in infected areas.

Keywords: Ceftazidime, Radiolabeling, Infection detection, Biodistribution.

Thursday
S3. Room1

Read with expert session for skeletal scintigraphy

A.H. Elgazzar

Department of Nuclear Medicine, Faculty of Medicine, Kuwait University PO Box 24923, Safat, Kuwait, Email: aelgazzar49@hotmail.com.

[No abstract available]

Therapeutic effects of radiosynovectomy, effectiveness of P-32 in treatment of chronic hemophilic synovitis

Mohammad Eftekhari[1], Saeed Farzanefar[2]

[1] Research Institute for Nuclear Medicine, Shariati Hospital, Tehran University of Medical Sciences, Tehran, Iran
[2] Vali Asr Hospital, Tehran, Iran

Presenter Address: Mohammad Eftekhari, Shariaty Hospital, Email: Meftekhari@yahoo.com

Radiation synovectomy using different types of radioisotopes is becoming an appropriate cost-effective option in treatment of different inflammatory joint diseases especially when standard treatment methods fail. This approach is applied for treatment of rheumatoid arthritis, psoriatic joint disease, pigmented villonodular synovitis and hemophiliac arthropathy. Several beta emitters are used depending on underlying pathology and joint size. P-32 has been one of the first radioisotopes used but because of radiation concerns other agents namely yttrium Y 90, dysprosium Dy 165, erbium Er 169, strontium Sr 153 hydroxyapatite, holmium Ho 166, and rhenium Re 186 has been used experimentally and in clinical practice. P-32 chromic phosphate however still remains one of the choices for treatment of haemophilic arthropathies. In this presentation, different options of radiation synovectomy and effectiveness of P32 in treatment of chronic haemophilic synovitis are discussed.

Keywords: Radiosynovectomy, P-32, Haemophlia, Arthritis.

Thursday
S3. Room1

Diagnostic value of ^{99m}Tc- labaled-Ubiquicidin 29-41 (^{99m}Tc-UBI) scan in differentiating prosthesis infection from loosening in patients with complicated hip prosthesis

Kamran Aryana, Alireza Hootkani, Yasamin Davoodi, Ramin Sadeghi, Seyed Rasoul Zakavi, Mahboobeh Naderinasab, Mostafa Gandomkar, Narjess-Khatoon Ayati.

Nuclear Medicine Research Center, Mashhad University of Medical Sciences, Faculty of Medicine, Imam Reza Hospital, Mashhad, Iran.

Presenter Address: Kamran Aryana, Nuclear Medicine Research Center, Mashhad University of Medical Sciences, Faculty of Medicine, Imam Reza Hospital, Ebn Sina Ave, Mashhad, Iran, Email: aryanak@mums.ac.ir

Introduction: Hip prostheses implantation has been increased significantly through the recent years. Despite the importance of this surgery in pain relief and increasing the life quality, it has some complications. Loosening is the most frequent complication and prosthetic infection is the most serious one. As the management of these two complications is very different, it is very necessary to find the best way to distinguish between these two problems. Inevitably nuclear medicine imaging is the modality of choice for diagnosis of infected joint prosthesis, but which radiopharmaceutical is the best, have been always questionable. Ubiquicidin 29-41(UBI) is an antimicrobial peptide fragment with the ability to point to the bacterial colony directly. This study was conducted to investigate the feasibility of 99mTc-UBI scintigraphy for detection of infection foci in painful hip prostheses.

Methods: 33 consecutive patients (19 male and 14 female) aged 19-83 years, with painful hip prosthesis have been included. All patients signed written informed consent before enrollment. 99mTc-UBI scan and three phase bone scan was performed and two expertise nuclear medicine specialists after discussion, interpreted the UBI scintigraphy first lonely and then in combination with bone scan. Both qualitative and semi-quantitative methods were done on 30, 45 and 60 min post injection images. The patients were actively followed up. 19 cases out of 33 patients underwent surgery. According to surgical findings, microbiological culture and clinical, radiological and biochemical follow up (more than 8 months) final diagnosis was obtained.

Results: 23 negative and 10 positive UBI scan have been recorded. One patient passed away due to myocardial infarction before surgery that had positive UBI scan. No false positive or negative result was obtained in other patients. However the sensitivity, specificity, negative and positive predictive value and accuracy of the study were all 100%. Bone scan did not influence on UBI interpretation. 30, 45 and 60 min images showed no significant difference. No adverse effect has been noticed following UBI scan.

Conclusion: 99mTc-UBI scintigraphy could be the gold standard method for evaluation of hip prosthesis infection. 30 min post administration images have strongly the ability to be used for final impression. More investigation for predictive value of UBI scan for knee prosthesis is recommended.

Keywords: Scintigraphy, Ubiquicidin, Prosthesis infection, UBI

Thursday
S3.Room1

Investigation of pain relief and side effects of ^{186}Re-HEDP in patients with widespread bone metastasis

Elahe Pirayesh, Mahasti Amouie, Hamid Reza Mirzaie, Isa Neshandar Asli, Faraj Tabeie, Mostafa Gandomkar, Bagher Kalantari, Afshin Rakhsha, Babak Shafiei, Behzad Davarpanah.

Nuclear Medicine Department, Taleghani Hospital, Yaman Street, Chamran Highway, Tehran, Iran.

Presenter Address: Elahe Pirayesh, Email: elahe_pirayesh@yahoo.com

Introduction: Rhenium-186-HEDP (186Re-HEDP), a new and attractive radiopharmaceutical for the treatment of bone pain due to metastases, is produced recently by Iranian Atomic Energy organization (IAEO, IR .Iran). The aim of this study is to investigate palliative and side effect of 186 Re- HEDP in patients with different types of cancers.
Methods: Nineteen (8 male, 11 female) patients with various cancers (breast, prostate, RCC, colon, NET) and bone metastases were included in the study and 40-100 mci 186 Re-HEDP was administered slowly. The patients with bone marrow suppression, pathologic fracture or cord compression were excluded from the study. The pain relief was assessed by Visual Analogue Scale (VAS), for 8 weeks after treatment. Blood sample were taken weekly in this period.
Results: no side effect was reported by the patients during injection and 4-6 hours after administration. Flare reaction was seen in 63.2% of patients. Palliation effect is seen in 48-72 hr after treatment in responders. The maximal palliation was observed between 1-3 weeks. Overall response rate was 89.5%. Mean pain score (VAS) was decreased from 9.1 to 5.3 after 1 week and 6.63 after 8th week. (P< effects side minimal shows and pain bone metastatic of treatment palliative the in used radiopharmaceutical effective an is Re-HEDP 186.
Conclusion: hemoglobin. serum seen change significant No toxicity. marrow 4 grade revealed patient treatment. after weeks Th 6 ml 5941 to 11270 from count lymphocyte mean.

Keywords: 186Re-HEDP, Bone metastasis, Pain palliation

Thursday
S3.Room1

Evaluation of treatment efficacy of metastatic bone pain with ^{153}Sm-EDTMP

Narjess-Khatoon Ayati, Kamran Aryana, Fatemeh Homaei, Ramin Sadeghi, Vahid Reza Dabbagh Kakhki, Mahdi Momennezhad, Mahdi Seilanian Tousi, Ali Samani, Amirreza Jalilian, Rasoul Zakavi.

Nuclear Medicine Research Center, Emam Reza Hospital, Ebn sina street, Mashad, Iran.

Presenter Address: Narjess-Khatoon Ayati, MD, Nuclear Medicine Research Center, Emam Reza Hospital, Ebne Sina Street, Mashad, Iran, Email: ayatin871@mums.ac.ir.

Introduction: Involvement of the skeleton can cause excruciating pain in two-third of terminal patients with the history of malignancy. According to several limitations of other therapies, such as analgesics, bisphosphonates, chemotherapy, hormonal therapy and external beam radiotherapy, bone-seeking radiopharmaceuticals have an important role in palliation of pain from bone metastases. Although these kind of therapies have many advantages including the ability to treat multiple sites of tumoral involvement simultaneously, no significant confliction with other treatments, ease of administration and the potential to be used repetitively; in Iran using of this modality is not widely practiced. In this study we evaluated the clinical usefulness of Sm-153 lexidronate for pain management of bone metastases.

Methods: 14 patients with the history of painful bone metastases caused by different cancers (5 prostate, 5 breast, 1 lung and 4 nasopharynx), not responding to conventional treatments were included in the study. All patients had recent whole body bone scan indicating multiple bone metastases. 1 mCi/Kg Sm-153 lexidronate was injected intravenously to the patients. Whole body Sm scintigraphy was done 3 and 18 hours post injection. Pain relief and quality of life have been evaluated by analog pain scale and Karnofsky index every week respectively. Also all patients were evaluated for hematological toxicity every two weeks. Active follow up was performed.

Results: 64% of patients showed presence of flare phenomen between 24 to 72 hours after Sm injection with mean duration of 3.7 days. Three patients (21%) showed complete relief of pain and 9 (64%) achieved partial response to therapy. (Over all response to therapy was 85%). Karnofsky index significantly increased in 57% of study patients. 71% and 50% of patients showed decreased in platelets and leukocytes respectively after two weeks which was backed to primary range between 4 to 8 weeks post injection. No one experienced hematological toxicity induced problem. No significant difference has been noted between 3 and 18 hours post injection images quality.

Conclusion: Sm-153 lexidronate is an effective treatment for painful bone metastases. The complication rate is low and the quality of life of the patients after treatment would be significantly improved.

Keywords: Bone metastasis, Bone pain, Samarium.

Thursday
S3.Room1

Is bone densitometry helpful in detection of osteomalacia?

Masoud Saghafi[1], Azita Azarian[2], Maryam Sahebari[2], Zahra Rezaieyazdi[1]

[1] Rheumatic Diseases Research Center, Ghaem Medical Center, Mashhad University of Medical Sciences, Mashhad, Iran.
[2]Radiology Department , Ghaem Medical Center, Mashhad University of Medical Sciences, Mashhad, Iran.

Presenter Address: Masoud Saghafi , Associate professor of medicine, Rheumatic Diseases Research Center ,Ghaem Medical Center, Mashhad University of Medical Sciences, Mashhad, Iran ,Email: Saghafim@mums.ac.ir

Introduction: Osteomalacia, particularly in its mild and early stages, may be misdiagnosed as only osteopenia or osteoporosis. Our purpose was to determine the amount of bone mineral density (BMD) in patients with osteomalacia and to evaluate the efficiency of bone densitometry in suspicion of osteomalacia.
Methods: BMD (gm/cm2) at the lumbar vertebrae (L2-L4) and femoral neck were measured by dual X-ray absorptiometry (LUNAR-DPXIQ machine) in 20 patients with osteomalacia (16 females and 4 males, age range 20 to 60 years, mean 39.4 year), and their T scores were evaluated according to WHO criteria.
Results: Mean T score at lumbar vertebrae was -3.005±1.28, with 70% osteoporosis (T≤ -2.5). Mean T score at femoral neck was -3.009±1.34, with 60% osteoporosis.50% of patients had T≤-3.
Conclusions: Osteoporosis may be detected in 70% of patients with Osteomalacia. Middle aged individuals with significant osteoporosis (T≤-3) should be evaluated for osteomalacia, beside other causes of secondary osteoporosis.

Keywords: Osteomalacia, Osteoporosis, Bone densitometry, BMD

Thursday
S3.Room1

Comparing the bone scan and CA15-3 titer in patients with breast cancer for evaluation of bone metastasis

Shahram Dabiri Oskouei [1], Esmaeil Gharepapagh[1], Babak Mahmoudian[2]

[1] Nuclear Medicine, Tabriz University of Medical Sciences, Tabriz, Iran.
[2]Tabriz Gamma Scan Nuclear Medicine Center, Tabriz, Iran.

Presenter Adress: Shahram Dabiri Oskouei, Professor of Nuclear Medicine, Tabriz University of Medical Sciences, Tabriz, Iran.

Introduction: Despite prominent progress in the treatment and prevention of cancer in the last decades, breast cancer still ranks among the most prevalent and deadly cancers in women. Thus, research on potential causes, risk factors, symptoms and treatments is in abundance. One of the most common and painful consequences of breast cancer is bone metastasis. Bone scan is currently used for detecting the asymptomatic bone metastasis; however, researches are continuing for simpler and accurate new methods for detection of early bone metastasis. CA 15-3 is a newly proposed tumor marker which has been shown to be efficient in detection of remote metastasis in breast cancer. This study aimed at comparing the bone scan and CA 15-3 titer in patients with breast cancer for evaluation of bone metastasis.
Methods: In an analytic-descriptive setting, 35 patients with definite diagnosis of breast cancer were evaluated in Tabriz Imam Khomeini Hospital during one-year period. Bone scan with ^{99m}Tc-MDP, considered as reference method, was carried out in all patients. The serum level of CA 15-3 was measured by ECLIA method. The increased level was considered as >30 U.ml. The serum level of CA 15-3 was compared between the patients with and without bone metastasis, as well as its correlation with the extent of bone involvement.
Results: Thirty five patients with the mean age of 51.69±10.77 (34-81) years were enrolled in the study. According to bone scan results, 24 (68.8%) patients revealed bone metastasis. The mean level of serum CA 15-3 was significantly higher in pat with bone metastasis in comparison with patients without metastasis (26.37±4.74 U/ml vs. 19.09±1.99 U/ml; $p<0.001$); however, the rate of increase CA15-3 antigen was comparable between the two groups (12.5% of the patients with bone metastasis vs. 0 in other group; $p=0.536$). There was no considerable and significant correlation between the serum level of CA15-3 and the extent of bone metastasis (rho=-0.063, $p=0.769$). Coordinates of the curve study yielded a cut-off point>21.8 U/ml for the serum level of CA 15-3 in our patients, with a sensitivity and specificity of 91.7%, respectively.
Conclusion: This study showed that the serum level of CA15-3 antigen is higher in the patients with bone-metastatic breast cancer; however, the recommended cut-off point might not be suitable for Iranian patients. Further studies with large sample sizes are recommended.

Keywords: Breast cancer, CA-15-3 antigen, Bone Scan, Metastasis.

Thursday
S3.Room3

Quantitative assessment of inter-crystal scatter and penetration in the PET subsystem of the FLEX triumph preclinical multi-modality scanner

Hosein Arabi[1], Navid Zeraatkar [2], Mohammad Reza Ay[3], Habib Zaidi[4]

[1] Department of Radiation Medicine Engineering, Shahid Beheshti University Tehran Iran
[2] Research Center for Science and Technology in Medicine, Tehran University of Medical Sciences, Tehran Iran
[3] Department of Medical Physics and Biomedical Engineering, Tehran University of Medical Sciences ,Tehran Iran
[4] Division of Nuclear Medicine, Geneva University Hospital, 1211 Geneva, Switzerland

Presenter Address: Hosein Arabi, University of Shahid Beheshti, Tehran, Iran, Email: H.arabi@mail.sbu.ac.ir

Introduction: The amount of events undergo inter-crystal scatter (ICS) and penetration increases as the dimensions of the crystal elements and the gantry diameter get smaller for reaching higher resolution in small animal PET systems. As a consequence, spatial resolution is deteriorated due to mispositioning of the events undergone ICS or penetration. In this study, we aimed to quantify the fraction of such events in XPET, the PET subsystem of FLEX Triumph scanner.
Methods: To the best of our knowledge, up to now the few studies performed on ICS and penetration quantification, except our previous studies on some GE PET scanners, have primarily concentrated on single 511-keV photons. Conversely, we analyzed the events in the form of coincidences. Also, we discriminated between penetrated events versus ICS ones. For this, we applied the GATE (Geant4 Application for Tomographic Emission) Monte Carlo toolkit and used modified version of our previously validated model of XPET. XPET is a recently-developed small-animal PET scanner with several innovations for performance improvement. It has been incorporated as PET subsystem in FLEX Triumph preclinical scanner. Numerous points in different positions were analyzed inside the field of view (FOV) of the XPET. Using geometrical symmetries of the XPET and interpolation, the fraction of ICS and penetration can be determined for all possible positions inside the FOV.
Results: The results revealed that the notable variations in quantitative behavior of ICS and penetration occurred with varying radial positions; the fraction of ICS/penetration-induced mispositioned coincidences out of true coincidences ranged from 37.0% at the radial center to 78.0% at the edge of the transaxial FOV, while its minimum occurred at around 3mm radial offset with the value of 31.5%.
Conclusion: The current quantitative assessment of ICS and penetration in XPET not only provides a deeper understanding of their respective contributions, but is also aimed to be utilized in refining the system matrix in the image reconstruction task to achieve resolution modeling in the scanner. In addition, our team is going to investigate the qualitative impact of ICS and penetration in image domain in XPET.

Keywords: Inter-Crystal Scatter, Penetration, PET, FLEX Triumph.

Thursday
S3.Room3

Scatter compensation in SPECT images using 3D Klein-Nishina formula in MLEM reconstruction method

Mohsen Hajizadeh, Shabnam Oloomi

Mashad University of Medical Science, Medical Physics Department

Presenter Address: Mohsen Hajizadeh, PHD, Mashad University of Medical Science, Medical Physics Department, Email: hajizadeh@mums.ac.ir.

Introduction: In SPECT, usually a large number of scattered photons are detected .Therefore the reconstructed image without scatter compensation has degraded image quality and biased quantization. While the efforts made to compensate the scatter effect, none of them can perform fast and accurate scatter compensation in non-uniform scattering objects.

Methods: and materials: A class of scatter compensation methods, called reconstruction-based scatter compensation method, RBSC, is based on modeling scatter effects in the transition matrix used in iterative reconstruction methods. The accuracy of this method is dependent upon the accuracy of scatter model used. Beekman et al 1997 have shown that RBSC methods results in images with less variance when compared with subtraction-based scatter compensation methods. The main disadvantage of RBSC methods is that the scatter models tend to be very computationally intensive. In this paper we would present a mathematical approach for further reducing the calculations and time of reconstructions using subtraction in the iterative reconstruction methods. In this algorithm scattering contributions of each pixel, from activity of 27 neighbor pixels in 3 slices, which are along the detector is estimated for all detector bins, using Klein-Nishina formula. These data are stored in a certain file and can be used in all iterations in RBSC process. The iterations start with an uncorrected image which is estimated using MLEM formula and then it is corrected subsequently for scattering using: Where fj represents one pixel in the image space, gi is the measured SPECT emission data with detector, and ai j is the coefficient that represents contribution of image pixel j to detector i. Index l denotes pixels number j in projection bin i, so that summation over l makes the projector, and the summation over i the backprojector. SCl is the scattering contributions of pixel j from neighbors\' pixels on slice s to detector i, which is calculated from K-N formula as below:

Results: The result on heart phantom and patient images showed that the proposed algorithm significantly improves the contrast and resolution of images. The RAM of the computer and time of reconstruction is dependent to the image size.

Conclusions: The proposed algorithm effectively compensates scattering effects in SPECT images and is capable to modify clinical images using a pc in routine clinical activity.

Keywords: Scatter compensation, SPECT, Klein-Nishina MLEM

The precise methods for the measurement of collimator hole angulations and Center of rotation of SPECT with adaptive quality control phantom

Thursday
S3.Room3

Hossein Zamani Zeinali , Moradkhani, Anita Alipour , Abass Majdabadi

Atomic Energy Organization of Iran, Tehran, Iran.

Presenter Address: Hossein Zamani Zeinali, PHD, Atomic Energy Organization of Iran, Email: hzeinali@nrcam.org

Introduction: The Adaptive Quality Control Phantom (AQCP) is the computer-controlled phantom which positions and moves a radioactive source in the Field of View (FOV) of an imaging nuclear medicine device on a definite path to produce any spatial distribution of gamma rays to perform the QC Tests such as the Collimator Hole Angulation (CHA) and the Center OF Rotation (COR) of Single Photon Emission Computer Tomography (SPECT).

Methods: The collimator hole angulation for three collimators were measured with the method by using a point source and computer-controlled cylindrical positioning. In this method the displacement of the image of a point source examined as the AQCP move point source vertically away from the collimator face. A new method for center of rotation assessment by AQCP is introduced and the results of this proposed method as compared with the routine QC test (IAEA-TECDOC-602 method) and their differences are discussed in detail.

Results: The results of the high-accuracy measurement method of CHA show that the measurement accuracy for absolute angulation errors is better than ±0.024˚. The Root Mean Square (RMS) of CHA for LEHR, LEHS and LEUHR collimators were measured to be 0.290°, 0.292° and 0.208° respectively. In addition, it has been proved and established that the precise measurement of the distance of the point source movement vertically away from the collimator face has had a great effect on the CHA measurement. It is to be added in this connection that the measured RMS of CHA for LEHR collimator with the distance variation from the collimator's surface +/-1 mm has been varied +/-0.04 degree.

Conclusion: Based on such comparison between the two afore-described methods, it proofs the mechanical problems of detector rotation should be considered as the main cause of the difference between the two methods under consideration. We defined and measured a new parameter called Dynamic Mechanical Error (DME) for applying the gantry motion correction.

Keywords: Quality control, Nuclear Medicine, Phantom.

Thursday
S3.Room3

Determination of human absorbed dose of ^{67}Ga-DTPA-HCG based on distribution data in Rats

Mohamad Reza Khoshdel[1], Amir Reza Jalilian[2], Saeid Shanesaz Zadeh[2]

[1]Islamic Azad University
[2] Nuclear Medicine Research Group, Agricultural, Medical and Industrial Research School (AMIRS), Karaj, Iran.

Presenter Address: Mohamad Reza Khoshdel, MS, Nuclear Medicine Research Group, Agricultural, Medical and Industrial Research School (AMIRS), Karaj, Iran, E-mail: M.R.KHOSHDEL@GMAIL.COM

Introduction: Radiation dosimetry assessment often commences with measuring pharmaceutical biodistribution in rodents. In our investigation, we used a robust description of organ biodistribution (source organs in dosimetry calculations) and whole body activity. In this investigation, we attempted to estimate the radiation absorbed dose to normal organs following i.v. administration of 67Ga-labeled hCG by using biodistribution data in normal rats.
Methods: Four animals each were sacrificed at 15, 30, 60, 120, 240 min and 24 hours after injection of 1.2 MBq of radiotracer and exsanguinated, and the percentage of injected dose per gram of each organ were calculated. The Medical Internal Radiation Dose (MIRD) formulation was applied to calculate the absorbed radiation dose for various organs.
Results: The results show that most of the activity is accumulated in the testes. Nearly all excretion of activity occurred by the renal system, and hepatobiliary excretion was negligible. The testis to blood activity concentration ratio were 5.1 and 15.2 after 3 and 24 hours respectively, while target (testis):muscle ratios were 35 and 40 after 3 and 24 hours. A 185-MBq (5-mCi) injection of 67Ga-DTPA-hCG into the human body caused an estimated absorbed dose of 3.52mGy for the total body and the highest absorbed dose was in the testis with 42.5 (mGy) and second to the testis were spleen, liver and LLI wall which received 31.4 (mGy), 19.9 (mGy) and 8.26 (mGy), respectively.
Conclusion: Radiation dosimetry for 67Ga-DTPA-hCG was estimated for humans based on distribution data of 67Ga-DTPA-hCG in normal rats. Previous studies have demonstrated the usefulness of using animal distribution as a model for absorbed dose estimations in humans.The biodistribution of 67Ga-DTPA-hCG showed significant gonadal uptake of the tracer after 240 minutes and high target:muscle and target:blood ratios, allowing for early imaging of the testes anomalies and hCG receptors malignancies.Although further dosimetry work should be performed on humans as 67Ga-DTPA-hCG becomes useful in the clinic, these estimates can be used to predict potential absorbed doses in humans and for planning human studies.

Keywords: Radiolabeled, MIRD, Internal dosimetry, Absorbed dose, Radiopharmaceutical, HCG.

Thursday
S3.Room3

A new method for activity estimation in dosimetry of radiopharmaceuticals based on MRI imaging and magnetic nano particles

Samira Rasaneh[1], Hossein Rajabi[2], Mohammad Hossein Babaei[1], Fariba Johari[1], Shahab Sheybani[1]

[1] Nuclear Science and Technology Research Institute, Tehran, Iran.
[2] Tarbiat Modares University, Tehran, Iran

Presenter Address: Samira Rasaneh, PHD, Nuclear Science and Technology Research Institute, Email: samira_rasaneh@hotmail.com

Introduction: Estimation of activity accumulated in tumor and organs is very important in predicting the response of radiopharmaceuticals treatment. In this study, we synthesized 177Lu-trastuzumab-iron oxide nanoparticles as a double radiopharmaceutical agent for treatment and better estimation of organs activity in a new way by MRI imaging.
Methods: 177Lu-trastuzumab-iron oxide nanoparticles was synthesized and all the quality control tests such as labeling yield, nanoparticle size determination, stability in buffer and blood serum up to 4 days, immunoreactivity and biodistribution in normal mice was determined. In mice bearing tumor, liver and tumor activities were calculated in three methods: SPECT, MRI imaging and organs extraction were compared with each other**.**
Results: The good results of quality control tests (labeling yield: 61±2%, mean nanoparticle hydrodynamic size ~ 41±15, stability in buffer: 86±5%, stability in blood serum: 80±3%, immunoreactivity: 80±2%) indicated that 177Lu-trastuzumab-iron oxide nanoparticles could be used as a double radiopharmaceutical agent in mice bearing tumor. Results showed that 177Lu-trastuzumab-iron oxide nanoparticles with MRI imaging had the ability to measure organs activities more accurate than SPECT imaging.
Conclusion: Co-conjugating radiopharmaceutical to MRI contrast agents such as iron oxide nanoparticles may be a good way for better dosimetry in nuclear medicine treatment.

Keywords: Iron Oxide, Nanoparticles, Trastuzumab, HER2 Antigen.

Thursday
S3.Room3

Analysis of absorbed dose in vital organs of radiation workers at industrial radioisotope department and radio-pharmaceutical production line (Tc-99m) with the use of RANDO Phantom and TLD method

Elham Shahhoseini, Navideh Aghaei Amirkhizi, Javad Soleimani, Mehrdad Ghandehari

Nuclear Science Research School ,Nuclear Science & Technology Research Institute (NSTRI),Atomic Energy Organization of Iran, North Karegar Ave, Tehran , Iran

Presenter Address: Elham Shahhoseini , B.Sc, Nuclear Science Research School ,Nuclear Science & Technology Research Institute (NSTRI),Atomic Energy Organization of Iran, North Karegar Ave. , Tehran , Iran ,P.O. Box: 11365-3486 , Email: eshahhoseini@aeoi.org.ir

Introduction: Analysis of absorbed dose in vital organs of radiation workers at Industrial Radioisotope Dept. and Radio-pharmaceutical production line (Tc-99m) with the use of RANDO phantom and TLD method. Materials and

Methods: This article examines the experimental simulation method of Gamma-rays'- absorbed dose in µSv in the eye cornea, thyroid and testicles measured with the use of a RANDO phantom and the employment of TLD100H (Li:Mg:P:Cu) dosimeters and a model 4500 reader, made by Harshaw, an American manufacture. The simulation method was performed on pre-determined parts in both normal and emergency conditions.

Results and Conclusion: The result of this research indicates that the level of absorbed dose in various body parts of radiation workers in ordinary work conditions in controlled areas is less than the allowable absorbed dose. Moreover, despite the fact that the irradiation level for the whole body and different body parts are being 10 times more in restricted and prohibited areas, the absorbed dose is also measured to be less than the allowable dose. However, number of incidences such as human error in charging the gamma cameras in Industrial radio isotope department can cause the whole body irradiation of a radiation worker to exceed the allowable dose of 20 msv per year.

Keywords: TLD, Radiation protection, Organ absorbed dose.

Thursday
S3.Room3

Designing of a liver phantom to quantify ^{32}p radionuclide using gamma camera

Maryam Khazaee Moghadam, Seyed Mahmoud Reza Aghamiri, Hosseyn Pourbeygi

Department of Radiation Medicine Engineering, Shahid Beheshti University, Tehran, Iran

Presenter Address: Maryam Khazaee Moghadam, PHD, Department Of Radiation Medicine Engineering, Shahid Beheshti University, 71, 16th Street, Kargar Blv, Tehran, Iran ,Email: maryam.khazaee63@gmail.com

Introduction: 32P is a promising radionuclide for liver cancer because of its energetic beta emissions. The radionuclide microspheres are injected to liver artery. The injected particles must block the capillaries so radionuclide remain close to the tumor and give high dose to the target. The aim of this study was to determine how effective this method is, so we should quantify activity within organs such as liver and lung. So we provided a liver phantom and took planar images with gamma camera from injection of 32P to the liver phantom and assess the validity of static images for quantification of activity in liver.
Methods: In order to design the phantom, ICRU was our reference. The phantom consists of a plastic hollow closure with trapezoidal cross section, which contains radionuclide, pure water and Agaroz powder. In this study, ORBITER7500 is used for counting and imaging. The energy windows and system sensitivity for 32P and LEGP collimator were investigated to determine optimum conditions for quantitative imaging. The phantom containing radionuclide was placed in front of camera head then two-dimensional static image and counting was taken. Experiment was designed in three stages: point source in air, cylindrical phantom and liver volumetric phantom in water. Furthermore Monte Carlo simulation with MCNP4C was done in order to calculate sensitivity.
Results: In tentative results static imaging for 15%, 20%, 25% and 30% energy windows with energy level of 80 keV, yield the sensitivity value 1.44×10-6, 2.27×10-6, 2.92×10-6 and 3.54×10-6 respectively; measurement errors were 17%. Moreover, comparison between tentative and simulation results for 15%, 20%, 25% and 30% energy windows with 80 keV energy level signified that relative errors were 3%, 7%, 19% and 43% respectively.
Conclusion: The best selections were found LEAP collimator and an energy window of 80 keV±20%. When we used these optimal conditions for image acquisition, the estimation of 32P activity in organs and tumors was within 17% of the true activities. These results are acceptable and illustrated that two dimensional static imaging are beneficial for quantification of activity. Furthermore in this method with the use of two dimensional static imaging we can specify value of activity in any desirable ROI

Keywords: Bremsstrahlung imaging, Radioembolisation, Liver.

Molecular imaging: new PET/CT technologies and trends in tracers' production

Walter Capece

Presenter Address: Walter Capece, GE health technologies, Email: walter.capece@med.ge.com

Molecular imaging has great potential to image molecular changes that are currently defined as pre-disease states. Disease's early detection leads changes from Reactive (Symptom based Medicine) to Predictive (Preventive Medicine) and consequently a greater chance of cure with less side effects so better quality of life. PET/CT is world wide recognized as the best diagnostic tool for early diagnosis of many metabolic diseases but, recently, capability of assessing therapy effectiveness is giving additional value to PET/CT in Radiation Therapy as well as drug therapy. It is not only about overall patient's outcome benefit t is mainly about cost reduction in managing diseases. It is very well known that the main source of artifacts in PET are related to patient's breathing thorax movements in addition to heartbeats. Motion creates blurring of image and lost of accuracy. PET/CT is all about early lesions detectability: novel techniques to ensure high accuracy in quantitative analysis and artifacts' free imaging are discussed.

About tracers, growth of PET/CT examinations still continues to rely on a single tracer for most applications. The introduction of more specific biological probes can further steps clinical applications up.

Novel PET/CT techniques in combination with more specific tracers are discussed. New GE solutions for PET tracers productions are presented too.

Friday
S1.Room1

PET / CT based novel quantitive techniques in measuring disease activity

Simin Dadparvar

Division of Nuclear Medicine, Department of Radiology, University of Pennsylvania School of Medicine, Hospital of the University of Pennsylvania, Philadelphia, PA, USA.

[No abstract available]

Friday
S1.Room1

Peptide based Radiopharmaceuticals in Tumor Diagnosis and Therapy

Mostafa Gandomkar

Nuclear Science Research School, Nuclear Science & Technology Research Institute (NSTRI), Atomic Energy Organization of Iran, Tehran, Iran

Presenter Address: Mostafa Gandomkar, PHD, Nuclear Science Research School, Nuclear Science & Technology Research Institute (NSTRI), Atomic Energy Organization of Iran, Tehran, Iran , Email: msgandomkar@yahoo.com

Peptides are necessary elements in more fundamental biological processes than any other class of molecules. They regulate many body functions acting as chemical messengers, neurotransmitters and highly active stimulators or inhibitors. The term “peptide” is conventionally used to refer to peptides of less than 100 amino acids, or about 10000 Daltons in molecular weight. Peptides primarily synthesized in the brain, especially in neurons, are called neuropeptides. However, since most of them are also found in the gut, lymphatic tissue, endocrine system etc., the expression “regulatory peptide” is often used. They bind to their specific receptors, which mostly belong to the super family of G-protein coupled receptors. Tumor tissues expressing receptors for a peptide can be addressed specifically by the peptide or differently labelled analogues. Depending on the label, the tumor can be visualized or therapeutically treated. The use of an 111In peptide was first explored for the use in nuclear medicine in 1981; it was not until a decade later that a 123I labelled peptide was injected to tumor bearing animals. To date, radiolabeled receptor-binding peptides have appeared as a new class of radiopharmaceuticals. Development in peptide analogues and radiolabeling methods, and latest results from in vitro, in vivo and clinical studies will be presented.

Keywords: Peptide, Tumor, Radiopharmaceutical

Friday
S1.Room1

PET Imaging of EGFR expression in nude mice bearing MDA-MB-468, human breast cancer using ^{64}Cu-DOTA-Cetuximab

Kayvan Sadri, Kaijun Zhang, Deva Kumar, Qing Ren, Urich Rodeck, Mathew Thakur

Department of Radiology, Thomas Jefferson University, USA.

Presenter Address: Kayvan Sadri , PHD of Radio Pharmacy , Thomas Jefferson University, Email: kayvan.sadri@jefferson.edu

Introduction: EGFR is a transmembrane protein related to the tyrosine kinase receptor family. An increased expression of EGFR is the hallmark of many human tumors, such as breast cancer, squamous-cell carcinoma of the head and neck, and prostate cancer. Cetuximab (C225, ErbituxR, an IgG1 class) targeting the EGFR is the first mAb targeted against EGFR receptors approved by the FDA for metastatic colorectal carcinoma. The overall goal of this study was to evaluate 64Cu labeled DOTA-Cetuximab to image EGFR positive breast cancer in athymic nude mice bearing MDA-MB-468.

Methods: Cetuximab was conjugated with DOTA, purified by molecular filtration and concentration was determined spectrophotometrically. DOTA-Cetuximab was labeled with 64Cu and radiochemical yield was determined by HPLC. The binding affinity of 64Cu - DOTA-Cetuximab to MDA-MB-468 was determined in the presence of 0.05-10 nM of unlabeled Cetuximab. The athymic nude mice bearing MDA-MB-468 (~5×106) xenografts were given, 64Cu - DOTA-Cetuximab i.v., (50 ± 6.1 μCi, 4 hr group, n=5, 200 ± 22.7 μCi, 24 hr group, n=5). Animals were then imaged, sacrificed and quantitative tissue distribution was performed. In order to assess tumor uptake is mediated by EGFR-receptors expression, biodistribution study was done with blocking unlabeled Cetuximab.

Results: The radiochemical yield was 97.1 ± 1.1% with the specific activity of 923 Ci/mM Cetuximab. 64Cu - DOTA-Cetuximab showed high affinity to EGFR-positive MB-468 cells (KD of 0.4 nM). Both biodistribution and microPET imaging studies with 64Cu - DOTA-Cetuximab demonstrated higher tumor uptake at 24 hr (21.91% ± 0.86% ID/g) as compare to at 4 hr (12.33% ± 0.41% ID/g). Excellent PET images were obtained.

Conclusion: 64Cu - DOTA-Cetuximab is worthy of further investigation to target EGFR for imaging breast cancer

Keywords: EGFR, Cetuximab, Copper, PET

Friday
S1.Room1

Development of microparticles based on biocompatible, biodegradable polymers as possible surrogates for Y-90 labelled SIR-Spheres

Stephan Maus, Hans Georg Buchholz, Mathias Schreckenberger
Clinic and Polyclinic of Nuclear Medicine, University Medical Centre, Mainz

Presenter Address: Stephan Maus, Clinic and Polyclinic of Nuclear Medicine, University Medical Centre Mainz, Mainstrasse 365203 Wiesbaden Deutschland, E-mail: Stephan.Maus@freenet.de

Introduction: SIRT is a non-surgical therapy that uses microscopic radioactive spheres, called SIR-Spheres®, to deliver radiation directly to liver tumors. Currently only two types of available micro spheres are FDA approved. Therasphere from Nordion which based on glass microspheres and SIRT-Spheres from SIRTEX contain resin based microspheres. The intention of our work was the synthesis of novel Y-90-labelled therapy spheres based on biodegradable polymeric microparticles.
Methods: We use the double emulsion methode for hollow spheres which allows the encapsulation of various drugs and the hot melt technique, which allows the production of solid spheres. The drug, dissolved in an aqueous solution, was added to a mixture of poly (ε-caprolactone) in dichloromethane and stirred for 20 min. Contemporaneously an aqueous mixture of polyvinylalcohole was prepared. Both formations were combined and continuously stirred to evaporate the organic solvent leading to the formation of the microspheres. The hot melt technique was only used to prepare carrier spheres. Herby poly(ε-caprolactone) was added directly to the aqueous solution of polyvinylalcohole. The mixture was heated up to 80°C for 20 min and cooled down at room temperature under continuous stirring. The generated spheres hardened within 2 h. The surface modification was carried out by amination using an aliphatic diamine. The second amine group allowed the coupling with 1,4,7,10-tetraazacyclododecane-N, N`,N``,N```-tetra acetic acid (DOTA) chelator and subsequently the labelling with Ga-68,Y-90,In-111.
Results: We obtained microspheres in size ranges between 10 ~ 200 µm. The successful implementation of the cross linker ethylendiamine was confirmed by coupling of FITC and measuring with fluorescence microscopy. After coupling of 1,4,7,10-tetraazacyclododecane-N, N`,N``,N```-tetra acetic acid and radioactive labelling with Ga-68 yields of 60 ± 5% were achieved. Y-90 was used for the preparation of therapy spheres. Here we obtained yields of 45 ± 5%. For in vivo stability and biodistribution of Ga-68-DOTA labelled spheres were i.v. injected through a tail vein of Sprague dawdle rats. As a dimension of the stability of microspheres the radioactivity recovery in the lungs was used.
Conclusions: We could show successfully the use of surface modificated spheres based on biological degradable polymers for the estimation of the biodistribution, the exclusion of lung-shunt's and as possible therapy surrogates for 90Y labelled SIR-Spheres.

Keywords: Microspheres, Surrogate marker, Biodegradable, DOTA, MicroPET, Ga-68

Friday
S1.Room1

Modification of elution efficiency of ^{99m}Tc from ^{99}Mo/^{99m}Tc gel generators using ascorbic acid

Mohammad Reza Davarpanah, Sima Attar Nosrati, Hosseinali Khoshhosn

Nuclear Science and Technology Research Institute, Tehran, Iran

Presenter address: Sima Attar Nosrati, Nuclear Science and Technology Research Institute, Tehran, Email:simanosrati@gmail.com.

Introduction: Newer applications of radiopharmaceuticals in nuclear medicine require pertechnetate of moderate to high radioactive concentration. Hence there is a need to develop simple procedures for the concentration of pertechnetate. In this paper the influence of the addition of ascorbic acid to the eluent saline solution on the 99mTc elution yield is examined.

Methods: Molybdenum-99 produced by neutron activation of molybdenum [98Mo(n,γ)99Mo] in the research reactor of Tehran was converted to zirconium molybdate gel under controlled conditions. The resulting Zr99Mo granules were load in two glass columns (internal diameter of 15.3 mm and length of 70 mm). Initially the 99Mo activity of each column was measured in a dose calibrator and then calculated for the subsequent days using decay corrections. In order to study the influence of ascorbic acid in the elution efficiency of the generators following solvents used for the elutions: 8 ml of normal saline solution (0.9%) and 8 ml of saline containing 20-120 µg ascorbic acid per ml. Eluted 99mTc activity in each column was measured in a dose calibrator and the elution efficiency was calculated. The elution profile of 99mTc was determined by collecting 2 ml volume fractions of eluates.

Results: 99mTc activity was measured for each column and the 99mTc (measured)/ 99mTc (theoretical) ratio is determined as a yield. The elution yield for the column eluted with saline solution was 70% but elution of the generator columns with saline solution containing ascorbic acid increase in radioactive concentration of 99mTc and its elution efficiency was obtained about 78%. 99Mo breakthrough percentage, the proportion of the total radioactivity in the eluate that is present as 99Mo, molybdenum-99 activity is measured by dose calibrator was about <0.015% for both columns.

Conclusion: We have evaluated the influence of addition of ascorbic acid to the saline solution in an attempt to minimize the reduced yields observed after storage of 99Mo/99mTc generators. The results demonstrate that addition of ascorbic acid at low concentrations in the saline eluant was found to be an effective method of maintaining good 99mTc yields. However, for a possible routine use of this procedure further investigations are needed.

Keywords: Pertechnetate, Elution efficiency, Ascorbic acid

Friday
S1.Room1

Radioimmunotherapy of the mice bearing breast tumor with Herceptin labeled ^{177}Lu

Samira Rasaneh [1], Hossein Rajabi[2], Mohammad Hossein Babaei [1], Fariba Johari [1], Shahab Sheybani[1], Seyed Hasan Mirfallah[1], Mohamad Mazidi[1], Sepideh Khoshbakht[1], Yaser Tavakoli[1]

[1] Nuclear science and Technology Institute, Tehran, Iran
[2] Tarbiat Modares University, Tehran, Iran

Presenter Address: Samira Rasaneh, PHD, Nuclear Science and Technology Research Institute, Email: samira_rasaneh@hotmail.com

Introduction: Trastuzumab (trade name Herceptin) is a humanized IgG1 monoclonal antibody directed against the extracellular domain of the Human Epidermal growth factor Receptor 2 (HER2). HER2 receptor is overexpressed in 20-30% of the early-stage breast cancers and these patients may be candidates for Herceptin treatment. However, due to the cardiotoxicity of Herceptin, some patients cannot tolerate the treatment due to pre-existing heart conditions. Radioimmunotherapy (RIT) is a targeted treatment that has potential to augment the efficacy of conventional monoclonal antibodies. In radioimmunotherapy, a radioisotope is coupled to a monoclonal antibody to form a tumor-specific target agent. In the present study, we have labeled trastuzumab with lutetium-177 (a beta emitter suitable for therapy), preformed the biodistribution study and investigated its therapeutic efficacy in mice bearing tumor.
Methods: Herceptin was labeled with Lutetium-177 via DOTA as chelator. Radiochemical purity, immunoreactivity and stability of 177Lu-Herceptin were determined. The biodistribution and imaging studies were performed in mice bearing breast tumor. Radioimmunotherapy(5.5 and 7.4 MBq/mouse) and dosimetry was performed in mice bearing tumor.
Results: Number of chelates per antibody: 6; incorporated activity: 81%; immunoreactivity: 87%; buffer stability: 86%; serum stability: 81% after 4 days suggested that 177Lu-Herceptin could be used as a radioimmunotherapy agent. The good tumor uptake in biodistribution studies was agreed with gamma camera images after 7 days. Reductions of 81% and 98% in the mean tumor volume for the group that received 177Lu-Herceptin [7.4 MBq] were observed at 42 and 45 days after treatment respectively.
Conclusion: The results showed that 177Lu-Herceptin could be considered possibly in humans as a new radiopharmaceutical agent for using in radioimmunotherapy of breast cancer.

Keywords: Radioimmunotherapy, Lutetium-177, Herceptin, Trastuzumab

Friday
S1.Room1

A freeze-dried kit for Bombesin receptor expressing tumors scintigraphy

Mostafa Gandomkar[1], Seyed Pejman Shirmardi [1], Mostafa Godarzi[1], Nourollah Sadeghzadeh[2], Mohammad Mazidi [1], Seyed Hassan Mirfallah[1]

[1] Nuclear Science Research School, Science Research School, Nuclear Science & Technology Research Institute (NSTRI), Atomic Energy Organization of Iran, Tehran, Iran
[2] Faculty of pharmacy, Tehran University of Medical Sciences, Tehran, Iran

Presenter Address: Mostafa Gandomkar , PHD, Nuclear Science Research School, Nuclear Science & Technology Research Institute (NSTRI), Atomic Energy Organization of Iran, Tehran, Iran , E-mail: msgandomkar@yahoo.com

Introduction: It has been shown that some primary human tumors and their metastases, including prostate and breast tumors, over express gastrin-releasing peptide (GRP) receptors. Bombesin is a neuropeptide with a high affinity for these GRP receptors. The purpose of this study was to prepare and evaluate characteristics of a Freeze-dried Kit, designed for the labeling with 99mTc using tricine and EDDA as coligand.
Methods: Synthesis was preformed on a solid phase using a standard Fmoc strategy and HYNIC precursor coupled at the N-terminus. Purified peptide conjugate was labeled with 99mTc at 100°C for 10 min. Radiochemical analysis involved ITLC and high-performance liquid chromatography methods. Peptide conjugate stability and affinity to human serum was challenged for 24 hours. The internalization rate was studied in GRP receptor expressing PC-3 cells. Biodistribution of radiopeptide was studied in rats.
Results: Radiolabeling was performed at high specific activities, and radiochemical purity was >98%. The stability of radiolabeled peptide in human serum was excellent. In vitro studies showed >14% of activity was specific internalized into PC-3 cells up to 4 h. After injection into rat biodistribution data showed a rapid blood clearance, with renal excretion and specific binding towards GRP receptor-positive tissues such as pancreas (1.15±0.19% ID/g after 4 h).
Conclusion: this new kit showed favorable radiochemical and biological characteristics which make our new designed labeled peptide conjugate as a very suitable candidate for diagnostic of malignant tumors.

Keywords: Bombesin, Kit, 99mTc, Tumor.

Friday
S2.Room1

Review of quantitative kidney analysis

Peter Knoll, Siroos Mirzaei and Adolf Mostbeck

Dept. of Nuclear Medicine and PET Center, Wilhekminenspital, Vienna, Austria

Quantification of nuclear medicine renal studies is required in order to allow the comparison results of patients. The guidelines presented here are based on a survey carried out amongst nuclear medicine laboratories in Austria and have been edited and harmonized in a workshop organized by the Austrian Nuclear Medicine Society. In this work a software package for quantitative renal analysis is shown, which allows the analysis of renal clearance from the renogram and mean transit time calculation. Furthermore we present methods how to separate parenchyma from pyelon. Also, captopril renography for the diagnosis of unilateral renal artery stenosis and of the frusemide renogram for the diagnosis of hydronephrosis is presented. Improved analysis is achieved by comparing the results with a normal database.

Friday
S2.Room1

Sentinel node biopsy in medical practice: more than 6 years of practice in Mashhad

Ramin Sadeghi

Nuclear Medicine Research Center of Mashhad University of Medical Sciences, Faculty of Medicine, Imam Reza Hospital, Mashhad, Iran.

Presenter Address: Ramin Sadeghi, Nuclear Medicine Research Center, Mashhad University of Medical Sciences, Mashhad, Iran, E-Mail: sadeghir@mums.ac.ir

The concept of sentinel node biopsy has become the cornerstone of cancer management in several malignancies. This concept is used for less invasive and more accurate staging of the malignancies and is the matter of significant debate and investigation nowadays. In this review, we have presented our experience in sentinel node biopsy in Mashhad for several malignancies including: breast cancer, melanoma, endometrial cancer, cervical cancer, marjolin ulcer, colon cancer, etc.

Key words: Sentinel node biopsy, Lymphoscintigraphy, Breast cancer, Melanoma, Genito-Urinary malignancies

Friday
S2.Room1

The study of validation of sentinel lymph node biopsy with radio nuclide scans in stomach cancer surgery

Fereshte Kamani[1], Shapoor Azizi[1], Elena Saremi[2]

[1] Shahid Beheshti Medical University, Taleghani Hospital, Tehran, Iran.
[2] Surgical Oncology Research Center, Imam Reza Hospital, Mashhad, Iran

Presenter Address: Elena Saremi, Surgical Oncology Research Center, Mashhad University of Medical Sciences, SaremiE871@mums.ac.ir

Introduction: Goal: The study of using the sentinel lymph node biopsy with radio nucleoid scan and concordance of the pathological evidences of the sentinel lymph node and other lymph nodes in stomach cancer surgery.
Methods: There are 10 patients, which they had stomach cancer involved in the study. As a result of this study before and during the cancer surgery, they had resectable cancer and they did not involve any lymph node clinically. In all patients the sentinel lymph node or lymph nodes marked with radio nucleoid scan and the biopsy of the sentinel lymph nodeand lymphatic dissection done in standard way, then the patient put under the gastrectomy. At last, the pathology result of the sentinel lymph node and other lymph nodes have been compared and the concordance of them have been analysed.
Results: Tumor location in 7 cases was in lesser curvature, one in greater curvature, one in antrum and one in EG junction. In 9 cases the sentinel lymph node was against to the tumor in pregastric area, in one case of GE junction tumor, the sentinel lymph node was in the hilum of spleen, and only in one case there was skip metastasis. As a result of pathology report, in 8 cases the sentinel lymph node was involved with cancer which in final pathologic report there was involvement of the lymph node. In other 2 cases the sentinel lymph nodes was clean which in final pathology report there was no involvement in lymph nodes.
Conclusion: In this study there was a concordance between the pathology report of sentinel lymph node and lymph node involvement. According to this study we can find out that when the sentinel lymph node is not involved with the cancer we can refuse from wide lymph node dissection.

Keywords: Sentinel lymph node biopsy, stomach cancer, Radiopharmaceutical

Friday
S2.Room1

Comparing the rate of sentinel node detection by using a peri-areolar blue dye injection to a peri-incisional injection of radio colloid in patients with the history of excisional biopsy of breast cancer

Ali Jangjoo[1], Ramin Sadeghi[2], Shahriar Azizi[1], Elena Saremi[3]

[1] Surgery Department , Emam Reza Hospital, Mashhad
[2] Nuclear Medicine Research Center of Mashhad University of Medical Sciences, Faculty of Medicine, Imam Reza Hospital, Mashhad, Iran.
[3] Surgical Oncology Research Center, Mashhad University of Medical Sciences, Mashhad, Iran.

Presenter Address: Elena Saremi, Surgical Oncology Research Center, Mashhad University of Medical Sciences, E-Mail: SaremiE871@mums.ac.ir

Introduction: Sentinel lymph node biopsy is the standard procedure for axillary staging in early breast cancer patients. Many aspects of this important procedure are still controversial and need to be addressed in details. One of these controversial issues is the history of previous excisional biopsy of the breast lesions and its implication in the injection site of the radiotracer. In the study, we evaluated the concordance between peri-incisional injection of the tracer and peri-areolar injection of the blue dye regarding sentinel node detection.
Methods: Sixty breast cancer patients with the history of previous excisional biopsy of the breast lesion were included in the study. The patients received 2 injections of 99m-Tc-antimony sulfide colloid in both ends of the incision line. During surgery 2 mL patent blue V was also injected in the peri-areolar region of the indexed quadrant. The sentinel nodes were harvested using a hand-held gamma probe and the concordance between blue and hot nodes were recorded**.**
Results: In 59 patients at least one sentinel node could be harvested during surgery. Totally 79 sentinel node were harvested. Nodes blued while not hot were detected. 72 lymph nodes were both blue and hot (91.1%). The indexed quadrant in those patients (3 patients) with only hot (not blue) nodes was the upper outer one.
Conclusion: The high concordance rate between two procedures shows that the injection site of the radiotracer may also be in the peri-areolar region for patients with the history of previous excisional biopsy. This can decrease the received dose of patients and surgeons twice as well as the injection site's pain. Another important advantage of peri-areolar injection is less interference of the injection site with the axillary lymph nodes during imaging.

Keywords: Sentinel lymph node biopsy, Excisional biopsy, Core needle biopsy

Friday
S2.Room1

Preoperative ^{99m}Tc-Sestamibi scintigraphy in patients with primary hyperparathyroidism: Comparison of SPECT-CT, SPECT, and planar imaging.

Babak Shafiei

Presenter Address: Babak Shafiei, Assistant Professor, Erfan Hospital, Email: babak_shafiei@yahoo.com

Introduction: Primary hyperparathyroidism is the most common cause of hyperparathyroidism and hypercalcemia , and the treatment is mainly surgical. Planning for focused surgical parathyroidectomy or minimally invasive parathyroidectomy requires precise preoperative localization of parathyroid lesions in patients with hyperparathyroidism. The purpose of this study is to evaluate reliability in correctly detecting parathyroid lesions by SPECT-CT, SPECT and planar 99mTc-Sestamibi imaging.

Methods: 65 patients with primary hyperparathyroidism were enrolled in this study. All patients underwent planar and SPECT-CT before surgery. Planar imaging was performed at 20 minutes and 2 hours after injection. SPECT as well as combined non-contrast-enhanced low dose CT scan using a hybrid SPECT-CT instrument were also obtained immediately after early phase planar scintigraphy. Three image sets (early and delayed planar images, SPECT, and SPECT-CT) were reviewed for parathyroid lesion localization separately. Surgical location and histopathologic findings were used as the standard. Sensitivity and positive predictive value were determined for each method.

Results: In all patients (5 cases with multiple endocrine neoplasia), surgery was done successfully. Totally, 72 parathyroid lesions (70 adenomas and 2 hyperplasia) were dissected. Solitary parathyroid adenoma, double parathyroid adenomas, and double hyperplastic parathyroid glands were found in 60, 5, and 1 patients, respectively. Planar images showed correct localization of lesions only in 36 cases, with low sensitivity (63%) and positive predictive value (69%) in comparison with other image sets. Sensitivity of SPECT-CT (88%) was significantly greater than SPECT (72%) ($p>0.001$). Positive predictive value of SPECT-CT (92%) was also greater than SPECT (80%) ($p>0.001$). SPECT-CT was markedly superior to planar images and SPECT in patients with ectopic adenomas.

Conclusion: In patients with primary hyperparathyroidism preoperative SPECT-CT is a reliable method for parathyroid lesion localization, and is also helpful in surgical planning for parathyroidectomy.

Keywords: primary hyperparathyroidism; 99mTc-Sestamibi scintigraphy; SPECT-CT

Friday
S2.Room1

Effects of routine and intermittent protocols, on rising TSH level and clinical manifestations of hypothyroidism in 60 patients with differentiated thyroid carcinoma, preparing for whole body scan with ^{131}I

Parvin Layegh[1], Zohreh Mousavi[2], Seyed Rasoul Zakavi[2]

[1]Research Center for Skin Diseases and cutaneous Leishmaniasis of Mashhad University of Medical Sciences, Mashhad, Iran.
[2] Endocrinology Research Center, Mashhad University of Medical Sciences, Mashhad, Iran.
[2]Nuclear Medicine Research Center of Mashhad University of Medical Sciences, Faculty of Medicine, Imam Reza Hospital, Mashhad, Iran.

Presenter Address: Parvin Layegh, Research Center for Skin Diseases and cutaneous Leishmaniasis of Mashhad University of Medical Sciences, Department of Dermatology, Ghaem Hospital, Faculty of Medical Sciences,Mashhad, Iran , E-mail: layeghpa@mums.ac.ir

Introduction: it is favorable to obtain an optimal level of TSH with a minimum of clinical manifestations of hypothyroidism in patients with differentiated thyroid carcinoma, preparing for whole body scan with I131.
Methods: We compared two protocol: routine and intermittent. .In routine protocol , 4-6 weeks after surgery , levothyroxin discontinued and liothyronin (50 µg/day) prescribed for two weeks , then liothyronin discontinued for 2 weeks and TSH measured at the end of this time.In intermittent protocol , levothyroxin prescribed 100 µg every other day and after 30 days levothyroxin discontinued and TSH was measured. If TSH was 30 µu/ml or more scan performed and if TSH was lower than 30 µu/ml, we asked for patients to comeback one week later and TSH was measured again.
Results:. Mean of age was 40.5 years. Fifty patients were female and 10 cases were male. Fifty-three patients (88.3%) had papillary and 7 cases(11.7%) had follicular carcinoma. Twenty-two patients performed intermittent protocol and 38 patients were on routine protocol.There was no significant difference in mean of age (p=0.145) ,female to male ratio (p=0.9) and type of carcinoma between two groups. (p=0.95)There was no significant difference in pulse rate per minute(p=0.128), skin dryness (p=0.7),constipation(p=0.73),paresthesia(p=0.2) ,puffiness(p=0.15),change in weight(p=0.157), systolic (p=0.05) and diasolic(p=0.119)blood pressures. Abnormal reflexes were not seen in any patients in two groups.In routine protocol 14 days after discontinuation of levothyroxin TSH reached to 53.7 µu/ml . In intermittent protocol mean of TSH 30 days after every other day use of levothyroxine was 16.2 µu/ml and 10.5 days after complete discontinuation of levothyroxine was 46.8 µu/ml . there was no significant difference in TSH level between two groups at the end of two protocol. (p=0.08)
Conclusion: Severity of hypothyroid manifestations in intermittent protocol was not different with routine protocol.Exposure to high levels of TSH and its outcomes is less in intermittent protocol . It is reasonable to check TSH level before whole body scan in any of two methods to be sure of reaching to optimal level of TSH.

Keywords: Thyroid carcinoma, Differentiated, Scan, Hypothyroidism.

Friday
S2.Room1

Development of second primary cancer in radioiodine treated patients with differentiated thyroid carcinoma

Babak Fallahi[1], Armaghan Fard-Esfahani[1], Ramin Heshmat[2], Bagher Larijani[2], Vahid Haghpanah[2], Davood Beiki[1], Mohsen Saghari[1]

[1] Research Institute for Nuclear Medicine, Tehran University of Medical Sciences, Tehran, Iran
[2] Endocrinology and Metabolism Research Center (EMRC), Tehran University of Medical Sciences, Tehran, Iran

Presenter Address: Babak Fallahi, Associate professor, Research Institute Nuclear Medicine, Tehran University of Medical Sciences, Tehran, Iran, Dr. Sahariati Hospital, North Kargar Ave. Tehran Iran ,Email: bfallahi@sina.tums.ac.ir

Introduction: Development of second primary cancers (SPC) is a matter of concern in patients with differentiated thyroid carcinoma (DTC) especially after treatment with I-131. As many factors may interfere with the development of a second malignancy in DTC patients, the actual risk of SPC in treated patients with different doses of I-131 is under question. A retrospective cohort study was conducted to estimate the standardized rate of SPC and the associated factors after treatment with I-131 in patients with DTC.
Methods: 973 DTC patients with history of radioiodine treatment were included in this study to calculate the age-standardized rate (ASR) of SPC using a direct method. In order to allow a minimum latency period for a radiation-induced cancer to occur after radioiodine therapy, the cases with a follow-up duration less than 3 years following initial I-131 treatment were not included in analysis. ASR of SPC and its 95% confidence interval (CI) during a median of 6 (from 3 to 26) years follow-up in the studied patients was compared with the data of general population. The ratio of ASR in the studied population to the ASR of cancers in the general population was defined as standardized rate ratio (SRR). A logistic multivariable regression analysis was applied to evaluate the effect of other potential covariates interfering with the risk of SPC after DTC treatment.
Results: Eleven patients in 7370 patients-years at risk involved with SPC. The SRR of non-thyroid malignancies in the studied patients relative to the general population was 0.81 (95% CI: 0.57-1.04). In a multivariate model, the cumulative dose of I-131, age, follow-up duration, histology of DTC, presence/absence of metastasis and external radiotherapy were considered as potential covariate factors that may change the risk of SPC. In this model, the odds of SPC was significantly increased only when the cumulative dose of I-131 exceeded 40GBq (Odds ratio: 113; 95% CI: 8.6-1495.6; $p<0.0001$).
Conclusion: The overall incidence of SPC following a minimum interval of 3 years from the first I-131 treatment may not be significantly increased on the whole population of patients with DTC; however, the chance of SPC may be increased in especial cases received a cumulative dose of I-131 exceeding 40GBq during repeated courses of treatments.

Keywords: Second primary malignancy, Radioiodine therapy

Friday
S2.Room1

Predicting factors of successful post-surgical remnant ablation in radioiodine-treated patients with differentiated thyroid carcinoma

Babak Fallahi, Davood Beiki, Mohammad Eftekhari, Armaghan Fard-Esfahani, Mohsen Saghari.

Research Institute for Nuclear Medicine, Tehran University of Medical Sciences, Tehran, Iran.

Presenter Address: Babak Fallahi, Research Institute Nuclear Medicine, Tehran University of Medical Sciences, Tehran, Iran, Email: bfallahi@sina.tums.ac.ir

Introduction: A successful ablation of remnant tissue with I-131 after total or near-total thyroidectomy (TT or NTT) is necessary to enhance disease-free survival and facilitate long-term follow up of patients with differentiated thyroid carcinoma (DTC). The stage of the disease, optimal surgical treatment and the extent of post-surgical residual mass are known as critical factors influencing the success rate of radioiodine ablation therapy; however the effects of many other independent factors on the outcome of this treatment is still unclear. This study was conducted to analyze the factors affecting the successful ablation rate at the first post-ablative evaluation.

Methods: 341 patients (286 female, 55 male) with age range between 12 and 78 years (39.41±12.10 yrs) and different histologic types of DTC (326 papillary and 15 follicular type) were entered in the study. The cases with suboptimal surgical treatment (any surgery other than TT or NTT), significant post-surgical palpable mass, capsular or vascular invasion, lymph node involvement or distant metastasis were not included in this study. A binary logistic regression analysis using a model of multiple covariates including the dose of I-131, age, gender, type of surgery, histopathology of tumor, the degree of functioning remnant on baseline whole body scintigraphy, baseline serum TSH and Tg values and subsequent TSH values on levothyroxine suppressive therapy was applied to calculate the odds ratio (OR) of different factors and to determine the significant predictors of successful ablation.

Results: The dose of I-131 (3700 vs. 1110 MBq, OR=3.39, $p<0.0001$), baseline serum Tg ($\leq$4.5 vs. >4.5 ng/ml, OR=2.86, $p<0.0001$), baseline serum TSH in off-levothyroxine state (>25 vs. $\leq$25 mIU/L, OR=2.36, $p=0.006$), gender (female vs. male, OR=2.15, $p=0.032$) and efficiency of TSH suppressive therapy during follow up phase (<0.3 vs. $\geq$0.3 mIU/L, OR= 1.72, $p=0.033$) were the significant factors affecting the chance of successful ablation. The pathologic type of tumor, age, the extent of post-surgical functioning remnant and type of thyroidectomy (TT vs. NTT) were not significant predictors of successful ablation.

Conclusion: The best factors for predicting successful ablation are the radioiodine dose, baseline Tg and TSH values, gender and effective suppressive therapy.

Keywords: Ablation, I-131, Differentiated thyroid carcinoma

Friday
S3.Room1

PET/CT in lung diseases especially in the SPN and lung cancer

Simin Dadparvar

Division of Nuclear Medicine, Department of Radiology, University of Pennsylvania School of Medicine, Hospital of the University of Pennsylvania, Philadelphia, PA, USA.

[No abstract available]

Colon transit scintigraphy in the idiopathic constipated patients by ^{67}Ga-citrate

Friday
S3.Room1

Isa Neshandar Asli[1], Mohammad Javad Ehsani, Hamid Javadi[1], Sara Jallalat[1], Majid Assadi[2]

[1] Nuclear Medicine Department, Taleghani Hospital, Yaman Street, Chamran Highway, Tehran, Iran.
[2] Bushehr Research Center for Nuclear Medicine, The Persian Gulf Biomedical Sciences Institute, Bushehr University of Medical Sciences.

Presenter Address: Isa Neshandar Asli, Professor, Nuclear Medicine Department, Taleghani Hospital, Yaman Street, Chamran Highway, Tehran, Iran , Email: isa_neshandar@yahoo.com

Introduction: Measurement of segmental colonic transit is important in the assessment of patients with severe constipation.67Ga_citrate is an readily available in Iran and is an expensive tracer and have low burden exposure dose relative to radio-opaque markers, And when given orally is not absorbed from the bowel. No previous study was performed in Iran. It is investigate different pattern of colonic transit scintigraphy in the patients with idiopathic constipated patients.
Methods: 13 idiopathic constipated patients were underwent colon transit scintigraphy. study was performed after oral administration of 6-7 MBq 67Ga_citrate .Serial abdominal images were performed up to 72h and computer data were generated from geometric mean center (GMC) of segmental retention of tracer, mean activity profiles and colonic tracer half-clearance time.
Results: we have found three patterns of colonic transit scintigraphy.9 patients with normal pattern, that propagation of activity was acceptable during study.3 patients with colonic inertia pattern with mark retention of activity in the transverse colon, splenic flexure and rectosigmoid regions in 48h and 72h. 1 patient has significant retention of activity in the rectosigmoid in 72h and defined as functional rectosigmoid obstruction (FRSO).No significant difference was seen in GMC24h between normal pattern and colonic inertia (p=0.053), but significant difference in GMC48h and GMC72h were seen between two groups (p=0.016 and p=0.025 respectively), There is also significant difference in the mean half clearance time (MCT) between two groups (p=0.017).
Conclusion: Oral 67Ga_citrate colon transit scintigraphy is safe method and can perform in idiopathic constipated patients.

Keywords: Colon transit Scintigraphy, Constipation, 67Ga-Citrate

Friday
S3.Room1

MIBG imaging in heart disease

Mehrossadat Alavi

Nuclear medicine ward, Namazee Hospital, Shiraz, Iran

Presenter Address: Mehrossadat Alavi, Associate professor, Nuclear medicine ward, Namazee Hospital, Shiraz, Iran, E-mail: alavimh@sums.ac.ir

MIBG is the first widely available tracer that allows the direct, non invasive study of the cardiac sympathetic nervous system in vivo. MIBG is taken up and stored in sympathetic neurons in a manner similar to norepinephrine. Multiple studies have validated the use of MIBG as a marker of sympathetic nervous function. They showed that MIBG uptake is decreased in situations in which there is damage to sympathetic neurons such as myocardial infarction and transplantation .It is also seems to be useful to predict of mortality in idiopathic and ischemic heart failure. Caution, however must be exercised in the interpretation of changes in cardiac MIBG kinetics since these changes may reflect adaptive or compensatory changes rather than pathologic changes in cardiac sympathetic nerves.

Keywords: MIBG, Heart failure, Sympathetic nervous system.

Friday
S3.Room1

The value of touch imprint cytology and frozen section for intra-operative evaluation of axillary sentinel lymph nodes

Narjess Khatoon Ayati[1], Bahram Memar[1], Ramin Sadeghi[1], Amir Aledavood[2], Mohamad Naser Forghani[1], Abbas Abdollahi[3].

[1]Nuclear Medicine Research Center of Mashhad University of Medical Sciences, Faculty of Medicine, Imam Reza Hospital, Mashhad, Iran.
[2] Cancer Research Center of Mashhad University of Medical Sciences, Mashhad, Iran.
[3] Endoscopic and Minimally Invasive Surgery Research Center of Mashhad University of Medical Sciences, Mashhad, Iran.

Presenter Address: Narjess Khatoon Ayati, Nuclear Medicine Research Center of Mashhad University of Medical Sciences, Faculty of Medicine, Imam Reza Hospital, Mashhad, Iran, Email:ayatin871@mums.ac.ir

Introduction: Sentinel lymph node (SLN) biopsy is the procedure of choice to determine the axillary involvement in breast cancer. The most important intraoperative evaluation methods are touch imprint cytology (TIC) and frozen section (FS). Each of these techniques has their own drawbacks and it is still unclear which are preferred.
Methods: 97 consecutive patients with recently diagnosed breast cancer and no clinical evidence of lymph node involvement were included in the study. The SLN was determined with lymphoscintigraphy.TIC and FS were performed and their results were compared with permanent histopathologic examination.
Results: Using permanent section as the gold standard TIC shoed sensitivity of 71.4%, specificity of 100%, positive predictive value of 100%, and negative predictive value of 88.7%. These figures were 87.5%, 98.5%, 96.5%, and 95% for FS respectively.
Conclusions: FS is a reliable method for SN involvement during surgery. Using frozen section during surgery can give the surgeon the opportunity to avoid second surgery. TIC is also a reliable method for intra-operative SN evaluation. Due to its high positive predictive value, TIC can be used first in the surgery room and FS can be saved for cases with negative results of TIC.

Keywords: Breast, Sentinel, Lymphoscintigraphy

Friday
S3.Room1

An establishment of nano-nuclear medicine fellowship: is it necessary?

Majid Assadi, Kolsoom Afrasiabi

Bushehr Research Center for Nuclear Medicine, The Persian Gulf Biomedical Sciences Institute, Bushehr University of Medical Sciences, Bushehr, Iran.

Presenter Address: Majid Assadi[1], Bushehr Research Center for Nuclear Medicine, The Persian Gulf Biomedical Sciences Institute, Bushehr University of Medical Sciences, Bushehr, Iran, Email: assadipoya@yahoo.com

The birth date of application of nanotechnology in the human life was 2000 years ago when sulfide nanocrystals was used to dye their hair and gold nanoparticles was exploited to color glass by ancient Greece's and Rome's people. Feynman for the first time presented the concept of nanotechnology in 1959. Nowadays, interdisciplinary nature of Nanotechnology is cause of phenomenal influence in various fields, especially medical science. So that a subcategory was founded that was entitled nanomedicine. We define it as knowledge and skill of manipulating and exploiting the unique chemical, physical, electrical, optical, and biological attributes of natural or synthesized material at the nano-sized scale for various medical purposes such as opportune prevention, early detection, and targeted treatment of disease. Nanomaterials interact with biological environment at the cellular and molecular level, where is the site of effect of nuclear medicine. Thus, nanomedicine can interconnect with nuclear medicine promisingly. In addition, fusion of nuclear medicine with nanoscience can advance this field as a part of molecular medicine that is recognized as future medicine. Application of nanotechnology knowledge in nuclear medicine can be found in areas of diagnostic, therapeutic, theranostics, and regenerative medicine. If the next generation of nuclear medicine specialists be trained to bring the essential knowledge and practical techniques of nanomedicine and nuclear medicine together, the ultimate goals of nuclear medicine will become more conceivable to offer to our patients. We briefly describe the various domains of nuclear medicine that nanotechnology has impressed such as diagnosis, therapy, thereanostic; which describe combination of diagnostic and therapeutic method, and regenerative medicine.

Keywords: Nuclear medicine, Nanotechnology, Thereanostic, Regenerative medicine.

Friday
S3.Room1

Ethical consideration in Nuclear Medicine practice

S.R. Zakavi

Nuclear Medicine Research Center of Mashhad University of Medical Sciences.Emam Reza Hospital, Mashhad, Iran.

Presenter Address: Seyed Rasoul Zakavi, Nuclear Medicine Research Center of Mashhad University of Medical Sciences.Emam Reza Hospital, Mashhad, Iran, E-Mail: zakavir@mums.ac.ir

The first Oath of Medical Ethics was developed in about 400 B.C. by Hippocrates. The main points in this oath was honoring the medical instructors, practicing for healthy benefit, giving no deadly medicine and abstaining from mischief and corruption as well as maintaining confidentiality with the patients. These ethical notes were discussed by following physicians. In 9th centuries the first book on medical ethics was written by Ishaq bin Ali Rahawi namely Adab-o-tabib or "Conduct of a physician". Mohammad ibn Zakariya Razi was one of Iranian physicians who has written codes for medical ethics too. Muslim, Jewish and Christian physicians have been contributed to development of ethical codes and not surprisingly, the main principles are common in all religions. These codes are completed in later centuries and medical ethics become more self-conscious subject by 18th-19th century. Although the main principles of medical ethics have not changed much during the time, our adherence to these codes appears to be waning. Also use of new technologies in medicine accompanied with economical constraints and new opportunities opened a new field for ethical codes to be tested and challenged. It seems that a gray area is also emerged in medical ethics compared to traditional black and white considerations. Rapidly evolving technologies, sharing projects, block leasing and incentives of companies for propagation of a product… are few examples. We as a nuclear medicine specialist need to review and discuss the ethical issues in new situations to prevent improper actions due to misunderstanding. In this article, different scenarios that we may encounter in day to day practice of nuclear medicine, are going to be discussed and the suggested solutions will be explained. These scenarios include; research situations, relation with other physicians, new technologies, telling the result of study to the patient, handling discrepant results, mis-administrations, Company incentives , Sharing projects and leasing blocks.

Key words: Ethics, Nuclear medicine, Practice

Saturday
S1.Room1

FCH-CT in prostate cancer (preoperative staging, Follow-up)

Werner Langsteger

Department of Nuclear Medicine and Endocrinology, PET-CT Center Linz, St Vincent's Hospital, Seilerstaette 4, A-4020 Linz, Austria.

[No abstract available]

Saturday
S1.Room1

Tracers beyond FCH in prostate cancer

Mohsen Beheshti

Department of Nuclear Medicine and Endocrinology, PET-CT Center Linz, St Vincent's Hospital, Seilerstaette 4, A-4020 Linz, Austria.

[No abstract available]

Saturday
S1.Room1

Assessment of correlation between peritoneal permeability by ^{99m}Tc-DTPA excretion with standard peritoneal equilibration test

Abbas Ali Zeraati[1], Seyed Rasoul Zakavi[2], Massih Naghibi[1], Farzaneh Sharifipour[1], Fatemeh Nazemian[1], Seddigheh Heyhat[3], Mehdi Momennezhad[4], Hosein Bakhtiari[4], Ahmad Yousefi[4], Mojdeh Malekzadeh[5]

[1] Nephrology Dept.Mahhad, Iran.
[2] Nuclear Medicine Research Center of Mashhad University of Medical Sciences, Emam Reza Hospital, Mashhad, Iran.
[3] Peritoneal Dialysis Center, Mashhad, Iran.
[4] Department of Nuclear Medicine, Mashhad, Iran.
[5] Peritoneal Dialysis Center, Mashhad, Iran.

Presenter Address: Abbas Ali Zeraati, MD, Assistant Professor of Nephrology, Professor of Nephrology Mashhad University of Medical Science, Imam Reza Hospital, Mashhad, Iran, Emai: zeraatia@mums.ac.ir

Introduction: The most widely used peritoneal function test is the peritoneal equilibration test (PET), developed and described by Twardowski in 1987. The objective of this study was to develop an alternative method that uses a radiopharmaceutical to calculate PET results and to compare this method with the conventional method, the peritoneal equilibrium test.
Methods: We conducted a prospective pilot study in 13 patients. Patients with a history of peritonitis were excluded from the study. Before starting the peritoneal dialysis10 mCi technetium-99m 99mTc-DTPA was injected intravenously. Excretion of 99mTc-DTPA into the dialysate fluid as a percentage of the injected dose was calculated. Simultaneously, standard peritoneal equilibrium test values were recorded for comparison.
Results: In this study 13 patients with mean age of 48.58±13.67 were included who 8 of them were male and 5 female.The PET results revealed 1 high transporters (7.75%), 8 high-average transporters (61.50%), and 4 low-average transporters (30.75%). Peritoneal excretion of 99mTc-DTPA ranged from 3.53% to 14.43% of the injected dose, depending on the peritoneal membrane permeability. When the results were compared with the conventional method, a good correlation (r=0.045, r=0.564) was found.
Conclusion: Our study suggests that Peritoneal excretion of 99mTc-DTPA may be used a radiopharmaceutical to calculate PET in patients undergoing peritoneal dialysis

Keywords: Peritoneal equilibration test, Peritoneal permeability, DTPA

Saturday
S1.Room1

How reliable is DMSA renal scan in renal length measurement?

Morteza Bostani, Azra Izanloo, Farah Raoofi

Nuclear Medicine Department, Razavi Hospital, Mashhad, Iran.

Presenter Address: Morteza Bostani, Nucler Medicine Department, Razavi Hospital, Shahid Kalantari Highway, Mashhad, Iran, E-mail: mza.bst51@gmail.com

Introduction: The purpose of this study was to determine the usefulness of DMSA renal scan for measurements of renal length.
Methods: The study comprised 67 subjects who had both renal sonography (US) and DMSA scan. In posterior image of DMSA scan, bipolar renal lengths were measured for right and left kidneys separately using specific software as well scaled metallic marker. Paired sample T-test was used to compare these results and sonographic renal length.
Results: 125 renal unite (61right & 64 left) were assessed from 24 men and 43 women (1 month to 73Y old). Good correlation was noted between renal length in DMSA scan and sonography in right kidneys (r=0.87) as well left kidneys (r=0.72) respectively.
Conclusion: this study demonstrated good agreement of renal length measured by ultrasound and DMSA renal scan. We conclude that bipolar renal length measured in posterior images of DMSA scan is a reliable method in clinical study.

Keywords: DMSA scan, Renal length, Kidney

Saturday
S1.Room1

F – 15 or F + 20 diuretic renography protecol in patients with dilated upper urinary

Rahim Taghavi[1], Kamran Aryana[2], Reza Mahdavi[1], Mohammad Reza Darabi[1], KamiarTavakoli[1]

[1]Urology Dept, Mashhad University of Medical sciences, Mashhad, Iran.
[2]Nuclear Medicine Research Center of Mashhad University of Medical Sciences, Faculty of Medicine, Imam Reza Hospital.

Presenter Address: Rahim Taghavi, Urology ward, Imam Reza Hospital, Mashhad, Iran, Email: taghavir@mums.ac.ir

Introduction: Diuretic renal scan is preferred noninvasive investigation in evaluating upper urinary tract function and assessing upper tract dilatation or obstruction. Timing of diuretic administration is not universally standardized in renography. In the present study we compared F-15, F+20 diuretic renography protocols in patient with upper urinary tract dilatation.
Methods: From Feb 2004 to Aug 2009, 48 patient were referred with flank pain and pyelocalyceal system dilatation without ureteral dilatation in ultrasonography IVP or retrograde pyelogram, F-15 and F+20 diuretic renal scans with TC-EC(Ethyiene dicysteine) were performed. Renal function data renograms were recorded and patients were undergone conservative or surgical therapy and followed up with physical exams and IVP or diuretic renal scan after 6 months and then we compared the results with two diuretic renal scan protocols. We used marginal homogeneity test to compare renograms and paired t-student test to compare renal function in two protocols.
Results: Among 48 cases, 32 were male and 16 were female. Mean age were 17.8 ± 23 years. Ultrasound showed pyelocalyceal dilatation without ureteral dilatation, delayed pyelogram. The results were equivocal in 11 cases (22.91%) of F+20 scans whereas they had complete obstructive pattern in F-15 scans. 6 cases (12.58%) had nonobstructive pattern in F+20 but equivocal or obstructive pattern in F-15 scans. Obstructions were diagnosed in 31 cases (64.56%) of patient by F+20 scan and in 43 cases (91.44%) by F-15 scan. Renal split function didn't change in both F-15 and F+20 protocols.
Conclusion: According to equivocal results of F+20 diuretic renal scans, F-15 can reduce equivocal results of F+20 diuretic renal scans. Of course we recommend future investigations to approve or disapprove this hypothesis.

Keywords: Renal Scan, Urinary obstruction, Lasix.

Saturday
S1.Room1

Association of enuresis and bedwetting with VUR and renal cortical damage

Mitra Naseri

Dr.Sheikh Hospital, Mashhad Univeristy of Medical Sciences, Mashhad, Iran

Presenter Address: Mitra Naseri, Assistant Professor, Mashhad University of Medical Sciences, Email: naserim@mums.ac.ir

Introduction: To clarify association of nocturnal enuresis and VUR and define enuretic children who are at risk of having urological abnormalities.
Methods: Patients who referred our clinic with chief complaint of nocturnal enuresis or bed wetting were prospectively evaluated for lower urinary tract anomalies and renal cortical defects by doing voiding cystourethrogram (VCUG) and TC99-DMSA scan in a 3 years period (2007-2009).Inclusion criteria were neurologically normal children with abnormal renal ultrasonography (US), daytime urinary incontinence, abnormality in urodynamic studies (UDS), history of UTI or cases with history of VUR in their siblings.
Results: 77 of 131 children (31 boys and 46 girls) between 3-17(mean ±SD 7.57±2.77) years of age enrolled study.16 patients were ‹ 5 years .In enuretic group (age ≥ 5 years)forms of enuresis were primary in 47 (77%) and secondary in 13 (21.3%) . 29 (47.5%) had monosymptomatic nocturnal enuresis (MNE) and 32(52.5%) non-monosymptomatic nocturnal enuresis (NMNE). urological abnormalities including VUR and PUV were reported in 17 (22%) and 1 (1.3%) respectively. Actually VUR was found at least in 17 of 131(13%) of total children. A statistical analysis was performed to determine the differences in clinical data between groups with and without VUR. VUR was reported in children with daytime symptoms with a statistically significant difference (P=0.012). Of 19 renal scintigram 8 (42.1 %) showed renal cortical defects uni or bilaterally;3 in patients with MNE ,4 in children with NMNE and one in a child ‹ 5 years with bedwetting. Interestingly the form of enuresis was primary in all cases with abnormal renal scan. It was true for 9 of children with normal renal scan. 2 children had secondary enuresis and normal renal scintigram. (P= 0.485)
Conclusion: Urological abnormalities such as VUR are not uncommon in enuretic Children, and Comparing to patients with MNE, cases with NMNE are at greater risk for having urological abnormalities especially VUR, So VCUG is recommended in all cases of NMNE. We found that positive family history of enuresis doesn’t guarantee the safe nature and course of enuresis.

Keywords: Nocturnal enuresis, Daytime incontinence, VUR, Elimination syndrom, UTI, Renal cortical damage

Saturday
S1.Room1

Evalution of risk factores for persistant renal scars in children with urinary tract infection

Fateme Ghane Sharbaf, Abdolali Kharazmi, Mohamad Esmaeili, Behjatalsadat Bolandi, Reza Gharaei, Farzad Ganji.

Pediatric Nephrology Ward, Dr Sheikh Hospital, Mashhad, Iran.

Presenter Address: Fateme Ghane Sharbaf, Nephrologist, Mashad, Dr Sheikh Hospital, Mashhad, Iran, Email: ghanef@mums.ac.ir

Introduction: Urinary tract infection (UTI) is one of the most common infection in children, and can lead to important coplications like renal scar,hypertension and chronic renal failure. To prevent this complication it is essential to detect all children who are at high risk for renal scar following UTI,treat and follow them seriously. The aim of this study is to discover the probable relation btween factors such as age,sex,fever,kind of organism,vesicoureteral reflux and the number of recurrence episode of UTI with occurrence of persistant renal scare in children sufferd from UTI.

Methods: This study was conducted during one year in nephrology unit of Dr. Sheikh Hospital, Mashhad,on Fifty 0 to 15 years old patients, who had proven UTI with urine cultule .After treatment with antimicrobial drugs,voiding cystouretrography (VCUG) was done. After 6 months of UTI detection, dimercaptosuccinic acid (DMSA) scanning was performed to detect perminant renal scars. Urinalysis and urine cultur was done serialy in order to detect the recurrent UTI.

Results: The mean age of study group was 5.14+3.96 (min=37 days, max=15 years).Renal scar was reported in 22 patients (44%). . In scar positive group, mean age was 6.05+4.01 years, and in scar negative group, mean age was 4.42+3.83 years. 9 cases (18%) were boy and 41 cases (82%) were girl, 7 boys (77.8%) and 15 girls (36.6%) were scar positive. prevalence of fever was more in positive scar group, but chi-square test didn't show any significant difference between two groups. Prevalence of Dilated reflux (VUR grade III,IV and V) is significantly higher in positive scar group compare to negative scar group .In scar positive group, E-coli were the cause of the infection in 16 patients (72.7%), and in other group, 26 children (92.9%) were infected with E-coli.In positive scar group, the average of recurrences was 3.9+3.2 and in negative scar group, it was 1.93+2.22 .

Conclusion: The risk factors for renal scar followed bu UTI were male sex,non Ecoli pathogen,VUR (grade III and more),and number of UTI recurrences.

Keywords: Urinary tract infection, Renal scar, Children, DMSA scan

Saturday
S2.Room1

Quantification of salivary gland Scintigraphy by means of factor analysis

Peter Knoll and Siroos Mirzaei

Department of Nuclear Medicine and PET Center, Wilhelminenspital Vienna, Austria.

Presenter Address: Institute of Nuclear Medicine with PET-Centre, Wilhelminenspital, Montleartstrasse 37, 1171, Vienna, Austria.

Introduction: In this study the automatic separation of oral and salivary gland activity and spontaneous secretion by means of factor analysis for quantitative salivary gland scintigraphy is introduced.
Methods: After intravenous administration of 99mTc sodium pertechnetate, dynamis scintigraphy was performed using a128x128 matrix, acquisition time 30 min, 2 frame/min). 20 minutes after tracer application 2 ml of lemon juice was delivered to stimulate the glands. Applying elliptical regions of interest (ROIs) for oral cavity and four major salivary gland and factor analysis of medical image sequences results in factor image and factor curves, which are used for quantification of the pre- and post-stimulatory oral activity index, and for the four major glands and the sublingual gland, the maximum accumulation (MA), the maximum secretion (MS) and the secretion velocity (SV).
Results: With FAMIS it is possible to fully separate automatic separate the three superimposed processes we have in salivary gland scintigraphy: glandular and oral activity and spontaneous secretion. Comparing our quantitative results obtained by FAMIS with ROI analysis we found significant different values that are due to the fact that the spontaneous secretion in the oral cavity superimposes the true oral and glandular activity curves.
Conclusion: The application of factor analysis improves the results of salivary gland scintigraphy by separation of superimposed dynamic processes of oral and glandular activity and spontaneous secretion.

Saturday
S2.Room1

Advances in Multimodality Molecular Imaging Instrumentation

Mohammad Reza Ay

Research Institute for Nuclear Medicine, Shariati Hospital, Tehran, Iran

Presenter Address: Mohammad Reza Ay, PHD, Tehran University of Medical Sciences, Email: mohammadreza_ay@tums.ac.ir

Molecular imaging is a rapidly emerging field, providing noninvasive visual quantitative representations of fundamental biological processes in intact living subjects. The novelty of multimodality molecular imaging lies in the fact that it seeks to shed new light on both structure and function by creating images that directly or indirectly reflect specific cellular and molecular events (e.g. gene expression) that can reveal pathways and mechanisms responsible for disease within the context of physiologically authentic and intact environments within living subjects. Since the commercial introduction of PET/CT in 2001 and SPECT/CT in 2004, adoption of the technology has been rapid, particularly for oncology. Advances in CT and PET instrumentation have been incorporated into the very latest PET/CT designs, and SPECT/CT has also benefited from the advances in CT technology. The latest addition to multimodality clinical imaging is a combined MR/PET device. The availability of fast scintillators with high stopping power has revived interest in PET time-of-flight in order to increase signal to noise ratio in PET imaging. There has been significant progress during the past few years in image reconstruction methods through the introduction of statistically-based algorithms and resolution recovery into the clinical setting. The idea of using energy resolve CT for attenuation correction of PET data is an active research arena in multimodality imaging. Within the past couple years, the most widely-addressed issue related to CT-based attenuation correction has been respiratory motion and the artifacts created by the mismatch between CT and PET. An application for which PET/CT is also having an impact is that of radiotherapy treatment planning. Molecular imaging is increasingly being used to monitor response to therapy, both for chemotherapy and for radiation therapy, and for combinations of each. This review talk will follow the development of multimodality molecular imaging instrumentation for clinical use from conception to present-day technology and assess the status and future potential for such devices.

Keywords: Multimodality, PET/CT, PET/MRI

Saturday
S2.Room1

A fast and precise algorithm for simultaneous attenuation correction and resolution recovery in brain SPECT: a simulation study

Faraz Kalantari[1], Hossein Rajabi[1], Mohsen Rajabi[1], Alireza Emami[2]

[1] Department of Medical Physics, Tarbiat Modares University, Tehran, Iran
[2] Research Institute for Nuclear Medicine, Tehran University of Medical Sciences, Tehran, Iran.

Presenter Address: Faraz Kalantari , Department of Medical Physics, Tarbiat Modares University, Tehran, Iran, Email: farazkalantari@gmail.com

Introduction: The goal of SPECT is determining activity distribution inside the patient body. To achieve this goal a rotating gamma camera acquires many projections around the patient. These projections are later used by reconstruction algorithms to reconstruct the slices corresponding to activity bio distribution. The primary assumption of these algorithms is that Radon transform is a suitable model for image formation. Therefore Filtered Back Projection (FBP) which used inverse Radon transform is the main method for reconstruction; however this model doesn't consider the effect of attenuation and non-ideal collimation. Therefore the final reconstructed slices degrade due to the effect of photons attenuation and are blurred due to collimator and detector response (CDR) which is the main cause of resolution degradation. In this study a more suitable model contains the effect of both attenuation and CDR is introduced and used during reconstruction by iterative OSEM algorithm to correct for their degrading effects.
Methods: at first a point source of Tc-99m is modeled and placed in different distances from the face of collimator. SIMIND Monte Carlo simulator is used to create projections from this activity source. After finding suitable models, a digital brain phantom (ZUBAL) with a typical Tc99m-ECD distribution is used to validate the ability of our algorithm. The effect of attenuation and CDR were modeled in both projection/backprojection of the OSEM algorithm.
Results: qualitatively, better match between activity phantom and reconstructed images are found in comparison with conventional reconstruction algorithms. Quantitatively, a dramatic increase in amount of activity in different parts of brain image is found. The contrast of gray to white matter is increased more than 30%. SNR is also increased by factor of 2. The FWHM of final reconstructed image of point source of activity is also reduced from 7mm at center of field of view to less than 4mm by suggested algorithm which shows a considerable improvement in image resolution.
Conclusion: by using more suitable models for image formation it is possible to reconstruct images with much higher quantitative and qualitative accuracy which is essential in both diagnostic and image guided therapy procedures.

Keywords: SPECT, Attenuation, Resolution, Brain simulation.

Saturday
S2.Room1

Quantification of Respiratory Induced Artifact in CT-Based Attenuation Correction of PET Data: A Simulation Study

Zahra Anvari[1], Mohammad Reza Ay[1], Babak Fallahi[2], Florian Büther[3]

[1] Department of Medical Physics and Biomedical Engineering, Tehran University of Medical Sciences, Tehran, Iran
[2] Research Institute for Nuclear Medicine, Tehran Univeristy of Medical Sciences, Tehran, Iran
[3] European Institute for Molecular Imaging

Presenter Address: Zahra Anvari , Department of Medical Physics and Biomedical Engineering, Tehran University of Medical Sciences, Tehran, Iran ,Email: z.anvari63@gmail.com

Introductions: Respiratory motion causes inaccurate PET and CT image co-registration especially in the thorax region and leads to non accurate attenuation correction, understimation of lesion's SUV and lesion volume overestimation, consequently leading to inaccurate PET data quantification. Different approaches have been developed to manage the respiratory motion problem, but the actual impact of respiratory motion artifact in routine clinical PET/CT imaging is not well characterized yet. The aim of this study is to quantify the impact of respiratory motion on CT-based attenuation correction of PET data during oncological imaging of lung lesions.

Methods: The 4D Extended Cardiac Torso (XCAT) software phantom was used to simulate respiratory motion cycle. Two sets of emission maps (activity distribution) and attenuation maps (μmap) of the chest were generated: the first was generated in one of the phases in respiratory period, at the end-expiration phase, called motion-free, and the latter was the average of 8 phases of the respiratory cycle, called motion-blurred. lesions with defined activity were simulated in the lung. In order to generate emission sinograms of mentioned emission images STIR (Software for Tomographic Image Reconstruction) was used. emission sinograms were attenuated with corresponding attenuation maps. Thereafter, attenuation correction of static emission sinograms was done with the matched attenuation maps. Also attenuation correction of motion-blurred emission data was performed with the motion-free attenuation maps leading to mismatched PET/CT image registration. Poisson noise was also added to the sinograms to simulate almost real PET/CT data. PET images were reconstructed with OSEM algorithm followed by a 6 mm Gaussian filter using STIR code. The variations of lesion Standardized Uptake Values (SUVmax) between motion-free and motion-blurred PET/CT images were measured and analyzed.

Results: For respiration with 16 mm diaphragm motion and 1 cm lesion mismatched attenuation correction can cause lesion SUVmax underestimation of over 26% due to misaligned CT and PET images. For the lesions in the lower lung region, if the range of diaphragm motion varies from 6 to 16 mm, normalized error increases from 13% to 38% in motion-blurred images.

Conclusion: Respiratory motion can have a significant impact on CT-based attenuation correction of PET in lung imaging. In oncological PET/CT imaging where SUV and lesion volumes are important factors for evaluating response to therapy or radiotherapy planning, respiratory motion correction methods seems to be mandatory.

Keywords: PET/CT, Attenuation correction, Respiratory artifact simulation

Saturday
S2.Room1

Evaluation of the effect of backscatter material thickness on ^{99m}Tc sources responses in SPECT with Monte Carlo simulation

Jalil Pirayesh Islamian[1], Mohammad Taghi Bahreyni Toosi, Mahdi Momennezhad[2], Seyed Rasoul Zakavi[2], Ramin Sadeghi[2], Michael Ljungberg

[1]Department of Medical Physics, University of Medical Sciences,Tabriz, Iran.
[2] Nuclear Medicine Research Center of Mashhad University of Medical Sciences, Faculty of Medicine, Imam Reza Hospital, Mashhad, Iran.

Presenter Address: Jalil Pirayesh Islamian, PHD, Department of Medical PhysicsFaculty of MedicineTabriz University of Medical SciencesTabriz, Iran, Email: pirayeshj@gmail.com

Introduction: SPECT projections are contaminated by scatter radiation, resulting in reduced image contrast and quantitative errors. In SPECT, backscatter constitutes a major part of the scatter contamination in lower energy windows. In this paper, the effects of backscatter material thickness were investigated.
Methods: SIMIND monte carlo program was used for simulation of a Siemen's dual-head variable angle scintillation gamma camera. Planar and SPECT images of 99mTc sources for varying thickness of Perspex slabs, as backscatter media, were analyzed using the photopeak and scatter windows.
Results: In the 99mTc photopeak window no significant change in total counts due to backscatter material was measured. In the scatter windows an explicit influence of backscatter material was measured. For instance, at a thickness of 10 cm, total counts of a 99mTc source detected in the 72 keV windows eventually doubled with increasing backscatter material, compared to the situation without backscatter material. The backscatter contribution plateaued when more than 5 - 10 cm of scatter material was placed but there was an optimized result for a backscatter thickness of 4.5 cm.
Conclusion: In conclusion, backscatter should be taken into account, particularly in model based scatter correction methods in SPECT for a simulation system optimization.

Keywords: Backscatter media, SPECT, 99mTc

Saturday
S2.Room1

Assessment of the influence of PET and CT data misalignment errors in cardiac PET/CT Examination: Patient and phantom studies

Pardis Ghafarian[1], Seyed Mahmoud Reza Aghamiri[1], Mohammad Reza Ay[2], Armaghan Fard Esfahani[2], Habib Zaidi [3]

[1] Shahid Beheshti University, Tehran, Iran
[2] Research Institute for Nuclear Medicine, Tehran Univeristy of Medical Sciences, Tehran, Iran
[3] Geneva University, Geneva, Switzerland

Presenter Address: Pardis Ghafarian, PHD, Shahid Beheshti University, Tehran, Iran, Email: pardis.ghafarian@gmail.com

Introduction: Nowadays with the advent of 64-slice CT modules associated with PET scanners, full clinical cardiac assessment is possible. But, the use of CT for AC of PET image can introduce misalignment artifacts due to time discrepancy between CT and PET data acquisition and produce the artifactual distribution uptake values in all segments of the myocardial wall. The aim of this study is to evaluate the misalignment effect induced by spurious patient motion in-between the two modalities on regional uptake value in the myocardial wall.

Methods: The study was performed using 3 patients including one NH3 perfusion and two 18F-fluorodeoxyglucose viability examinations acquired on the Biograph TP 64 PET/CT scanners using routine cardiac PET/CT protocol. For accurate quantitative analysis, attenuation and emission data were also obtained using RSD thorax phantom . Manual shifts between the CT and PET images ranging from 0 to 20 mm in six different directions were applied. Thereafter, attenuation correction was applied to the emission data using the manually shifted CT images .The reconstructed PET images using shifted CT images for attenuation correction were compared with the reference PET image (PET image corrected with misalignment free original CT image). VOI-based analysis , regression and Box and Whisker plots were determined using 500 VOIs located within the myocardial wall in each PET dataset. For accurate assessment of the activity distribution in myocardium wall, 17-segment bull's eye view analysis was evaluated for PET images.

Results: The absolute percentage relative difference in uptake value increased in all simulated movements with increasing misalignments for both phantom and clinical studies. In patient studies, in reference to the bull's eye view models, VOI-based analysis and visual analysis of PET images in standard axes as evaluated by expert clinicians, the significant variation in uptake value in comparion with the reference PET images were observed in the anteroseptal (23.55±9.92) and lateroinferior (32.96±9.74)segments in backward and forward directions respectively.

Conclusion: although misalignment can introduce artifactual nonuniformities in myocardial wall but the anterior,lateral and septal regions were more vulnerable by misalignment. The variation were more significant for right,backward and forward directions.so that were caused erroneous clinical interpretation even in little misalignment(5 mm).but the significant errors can observe in medium(10mm) mismatch for PET image corrected using shifted CT in the left ,down and up directions.

Keywords: Cardiac PET/CT, Misalignment, Attenuation correction

Saturday
S2.Room1

Assessment of MIRD data for internal dosimetery using the GATE Monte Carlo code

Ali Asghar Parach, Hossein Rajabi, Mohammad Ali Askari, Mohammad Ali Tajik-Mansoury

Presenter Address: Ali Asghar Parach, Tarbiat Modares University, Tehran, Iran, Email: parach@modares.ac.ir

Introduction: Internal dose assessment is usually performed using pre-calculated reference data derived from humanoid anatomical models. Medical Internal Radiation Dose (MIRD) has been the main source of reference data for dose assessment in nuclear medicine for diagnostic and protection objectives. These reference data are calculated assuming uniform distribution of radioisotopes in the organs of some limited number of humanoid models. Practically, however, human anatomy is too much variable that can be represented using a limited number of models. But they are valid in simple conditions they have been derived. GATE is a dedicated code to nuclear medicine and has almost been validated for internal dosimetry application; however, GATE results have never been compared to MIRD reference data. In this study, we constructed the digital form of Snyder phantom and used it with GATE to calculate the doses to the organs from photons of different energies.

Methods: The mathematical Snyder phantom sampled digitally and converted to a voxel phantom. Activity was distributed uniformly within the kidneys, liver, lungs, pancreas, spleen and adrenals. The GATE Monte Carlo package was used for calculation of doses in the organs of phantoms. Simulations were performed for gamma photons of 10-1000keV. Data derived with GATE was then compared to MIRD published data.

Results: The results imply a negligible bias between MIRD and GATE data for self-irradiated organs. Bland-Altman analysis shows that the SAF values derived with GATE are on average 0.16% smaller than MIRD values for self-irradiated organs. Data derived for cross-irradiation shows a good linear relationship between SAF values derived with GATE and corresponding MIRD data. The average relative differences between MIRD and GATE data for self-irradiated organs are below 3%. For cross-irradiated organs, the relative difference was 6-10% for photon energy >30 and quite considerable (>25%) for photon energies of 10, 15, 20, and 30keV.

Conclusion: Comparison of our data with corresponding MIRD data for cross-irradiated organs showed a high dependency to absolute value of SAF. Correlation between our data and MIRD was high when SAF value was high and decreased as SAF value decreased. As a result the consistency between SAF values derived with GATE and corresponding MIRD data is high when absolute value of MIRD data are greater than 0.01.

Keywords: Voxel-based phantom, GATE, Monte-Carlo, MIRD, Internal-Dosimetry

Saturday
S2.Room1

Hybrid phantom approach for radiation dosimetry applications

Elie Hoseinian, Hashem Miri Hakimabad, Laleh Rafat Motavalli, Keyhandokht Karimi Shahri

Ferdowsi University of Mashhad, Mashhad, Iran.

Presenter Address: Elie Hoseinian, Ferdowsi University of Mashhad, Mashhad, Iran, Email: eliehssnn@yahoo.com

Introduction: In the present work, the steps of constructing hybrid phantoms have been studied. Mathematical and voxel phantoms are two various kinds of computational human body models which used in dose evaluations and estimations. In mathematical phantoms, organs contour define with mathematical equations and therefore they are not realistic, unlike voxel phantoms are image-based and more real. In turn, the disadvantage of voxel phantoms is extreme dependence of organs contour on CT and MRI image contrast. Hybrid phantoms are more realistic than mathematical phantoms and more desirable than voxel phantoms due to their flexibility in the shape and size of organs. In this approach, organs surface is defined with non-uniform rational B-spline (NURBS) surface which is a mathematical technique used in 3D graphics and animations extensively.

Methods: Three steps are carried out to generate a hybrid phantom. (1) Transforming 2D images of human body to 3D model (2) Producing a 3D polygon mesh model of human body and internal organs (3) Creating NURBS. Initially, CT and MRI images for identifying soft and hard tissues are used. Then, two first steps can be constructing with software codes such as 3D-Doctor. For third step, NURBS modeling software can be used such as Rhinoceros.

Results: We constructed hybrid phantoms with real CT and MRI images and the result is the Rhinoceros normal outcome file as *.rhp. It can be used for any size of human body because the size of organs is changeable. This pliability is the effect of NURBS control points which is the most important advantage of hybrid phantoms.

Conclusion: We used advantages of both mathematical and voxel phantoms in constructing hybrid phantoms and thus they have the desirable shape and flexibility in organs. We should transform this phantom to voxel for applying in Monte carlo codes (MCNP). This voxelisation could be performing with MATLAB codes. Furthermore heart and respiratory motions can be simulated with this technique in 4D phantoms.

Keywords: Hybrid phantoms, Dosimetry NURBS surface, Dosimetry.

Saturday
S2.Room1

An investigation on the performance of dose calibrators in nuclear medicine centers in Iran

Hossein Zamani Zeinali

Atomic Energy Organization of Iran, Tehran, Iran

Presenter Address: Hossein Zamani Zeinali, PHD, Atomic Energy Organization of Iran, Tehran, Iran, Email: hzeinali@nrcam.org

Introduction: To investigate the status of the nuclear medicine (NM) centers in Iran for the performance of dose calibrators, 18 out of 54 centers providing NM services in Iran were randomly selected and inspected in 1997. In this phase of the study the selected centers were inspected for the performing of the quality control (QC) tests of dose calibrators. The linearity of the activity response, precision, accuracy, and the physical functions of the instruments, were studied in this phase. In the second phase of the study, carried out in 2006, 28 out of 75 NM centers were investigated for QC tests performance.
Methods: The QC tests were performed by using standardized radio nuclides of Tc-99m and Cs-137 in the first phase, and Tc-99m and I-131 in the second phase of the studies. Standard procedures were used for carrying out the tests.
Results: According to the results obtained in the first phase of the study, 10 centers were found to be in unacceptable situation. Following this study, all the concerned NM centers were informed about the results and at the same time the repair and adjustment of the dose calibrators were requested. In addition, the appropriate training courses along with the QC testing manuals were provided to the centers.
Conclusion: Based on the results of the second phase of the study only 6 NM centers were in unacceptable situation. The results indicated the effectiveness of the improvements carried out in the working procedures of the centers during the years between two phases of the investigation.

Keywords: Iran, Quality control, Dose calibrator.

Saturday
S2.Room1

Ethical Consideration in Radiation Protection- Past, Present and Future

Ali Shabestani Monfared, Mehrangiz Amiri

Babol University of Medical Sciences, Babol, Iran

Presenter Address: Ali Shabestani Monfared , PHD ,Professor , Babol University of Medical Sciences , Department of Medical Physics, Faculty of Medicine, Babol University of Medical Sciences, Babol, Iran
Email: monfared_ali@yahoo.com

Since discovery of X and Gamma rays, the social status of ionizing radiation has oscillated between enthusiastic acceptance and rejection. Nowadays, great concern exists regarding the safety of radiation, radioactive materials, nuclear waste and the health of workers in the radiation medicine departments. However, there are reports indicating that radiation is beneficial not only in high doses applied for the treatment of malignant tumors, but also in small doses used in diagnostics. Some others even believe that ionizing radiation may be essential for life. This paper addresses the historical reviews of radiation protection as well as ethical concepts and wants to ask that how dangerous is ionizing radiation and try to give a straight answer to this simple question.

Keywords: Radiation protection, Historical reviews, Ethics.

Poster Presentations

Thursday
P:Session 1

The role and indications of nuclear medicine in dentistry

Majid Reza Mokhtari, Fateme Farazi

Presenter Address: Majid Reza Mokhtari, Assistant Professor, Mashhad Dental School, Mashhad, Iran, Email: mokhtarimr@mums.ac.ir

The role and indications of nuclear medicine in dentistry(a review article). Nuclear medicine and radioactive tracers have considerable application in dental research,because they provide one of the few practical methods for studying the limited metabolic activities of bones and teeth. The ease with which minute amounts of these radioactive materials may be accurately measured and distinguished from the mass of inert element in the tooth is particularly valuable. They are useful in studying many problems of calcification and mineral exchange .There are also opportunities of their use in investigating fluorosis, caries protection, periodontal disease,microleakage studies of dental materials, root resorption, nutritional and endocrine effects, and numerous other dental problems.Other usage of nuclear medicine in dentistry listed below:Age written in teeth by nuclear tests,Scintigraphic evaluation of osteoblastic activity,Evaluation of osteoblastic activity around dental implants using bone scintigraphy. .Nuclear medicine can be an indicator of "active" alveolar bone loss.Bone scintigraphy as an adjunct for the diagnosis of oral diseases.The value of the nuclear medical scan in the diagnosis of temporomandibular joint disease.This review article discusses these indications of nuclear medicine.

Keywords: Nuclear Medicine Dentistry, Diagnosis, Radioactive Tracer.

Thursday
P:Session 1

Recommendations in health protection and fitness for work for nuclear medicine specialists

Seyedeh Negar Assadi

Presenter Address: Seyedeh Negar Assadi, MD and Specialist in Occupational Medicine, Assistant Professor of Mashhad University of Medical Sciences, Mashhad, Iran, Email:assadin@mums.ac.ir

Introduction: Nuclear medicine is one of the most helpful and beneficial specialties for diagnosis and treatment of diseases and health protections are the most important subject in occupational medicine, Specially in exposure to ionizing radiation of radioactive materials are demonstrated for nuclear medicine specialists .Objective is determination of recommendations in health protection and fitness for work for nuclear medicine specialists and their nurses.

Methods: This is a review article thatdata have been gathered from our occupational medicine databases such as occupational safety and health administration (OSHA), national institute for occupational safety and health (NIOSH) from centers for disease control and prevention (CDC) , American conference of governmental industrial hygienists (ACGIH) ,international agency for research on cancer (IARC) ,environmental protection agency (EPA) for this study .

Results: Relative to kind of radioisotopes ,there are some precautions for health protection and fitness for work of nuclear medicine specialists and their nurses such as ; avoidance of unnecessary contact more than five minutes with the patient, should have more vacations , attention to radiation dosimetry , must be worn special examination gloves and aprons and some times surgical masks , pregnant physicians and nurses must be transfer to safer work place , cell blood count (CBC) and white blood cell (WBC) differentiation annually must be done for physicians and nurses , physicians and nurses with possible malignancy must be transferred to safe work place and others.

Conclusion: Institutes and agencies of occupational medicine have standard precautions for health protection and fitness for work of nuclear medicine specialists and their nurses and attention to these recommendations are necessary.

Key words: Nuclear medicine, Occupational medicine, Fitness for work, Health protection.

Thursday
P:Session 1

Fluorine-18 radiolabeling of peptides and prteins: Preparation and evaluation of [18F]– β-1-24-corticotrophin (melanocortin type 2 receptor)

Mehdi Akhlaghi[1], Amirreza Jalilian[1], Leila Pashaye Ahi [2]

[1]Tehran University of Medical Science-Research Institute for Nuclear Medicine, Tehran, Iran.
[2]Chemistry Department, Payame Noor University of Abhar, Abhar, Iran.

Presenter Address: Mehdi Akhlaghi , PHD Student, Polymer Research Laboratory, Department of Chemistry, Sharif University of Technology, Email: akhlaghi.mehdi@gmail.com.

In order to prepare a specific melanocortin type 2 receptor (Mc2r) ligand, [18F]-tetracosactide ([18F]-beta 1-24-corticotrophin) was prepared in one-step reaction using [18F]SFB and beta-1-24-corticotrophin pharmaceutical solution (1 mg/ml, pH=6.5). [18F]SFB was prepared in a semi-automated module in two steps with an overall radiochemical yield of 83% (decay corrected to E.O.B.), in 90 minutes. The production of all radiolabeled intermediates and radiolabeled peptide was checked by RTLC and HPLC
HPLC and Radio-thin layer chromatography showed overall radiochemical purity of >95%, 91% yield (decay corrected to [18F]SFB) and 76%(decay corrected to E.O.B.) for final radiolabeled peptide at optimized conditions. Preliminary in vivo studies in normal mice was performed to determine the biodistribution of the radiolabeled peptide up to 150 min. Testes and adipocytes showed to have the major tracer uptake which is consistent with the natural distribution of Mc2r receptors in mammals. Testes/blood, testes/muscle ratios for radioligand at 150 minutes were 184 and 1.56 respectively and adipocyte/blood and adipocyte/muscle ratios at 120 minutes were 221 and 142 respectively. These data support the specific receptor binding of the radiolabeled compound as reported for Mc2r receptor accumulation in adipocytes and testes and demonstrates the retention of biological activity of the ligand. This tracer can be used in detection of Mc2r distribution in malignancies and sex organ diseases.

Keywords: Mc2r Beta-1-24-Corticotrophin, Fluorine-18, Radiolabeling peptide.

Thursday
P:Session 1

Comparison of different commercial Ga-68 labelled human serum albumin kits as possible imaging surrogates for Tc-99m MAA

Stephan Maus, Hans Georg Buchholz, Stephan Amen, Mathias Schreckenberger.

Clinic and Polyclinic of Nuclear Medicine, University Medical Centre Mainz

Presenter Address: Stephan Maus, Clinic and Polyclinic of Nuclear Medicine, University Medical Centre Mainz, Stephan MausMainstrasse 365203 Wiesbaden, Deutschland, E-mail: Stephan.Maus@freenet.de.

Introduction: Ga-68 obtained by elution from a Ge-68/Ga-68 generator, blazes the trail for the production of PET radiopharmaceuticals independent from a cyclotron and represents an alternative to other positron-emitting nuclides used for positron emission tomography (PET) in research and clinical studies. We compare the Ga-68 direct labelling of three commercially available serum albumin kits, developed for the labeling with Tc-99m, and determined their bio-distribution in animal models.
Methods: The general procedure for the preparation of commercial for the Tc-99m labelling produced human serum albumin kits is based on the process described by Even, G.A., Green, M.A and Mathias C J. and Green M. A. Each kit was resuspended in sodium chloride and vigorously mixed to wash the particles free of contaminants, such as stannous chloride, polysorbate, and hydrochloric acid. After centrifugation the supernatants were discarded and the retained particles are reconstituted in sterile water or sodium chloride. The radioisotope was obtained by fractionated elution with 0.6 N HCl. Serum albumin and 1,5 ml containing 350 MBq activity were added to HEPES buffer and kept for 30 min at 75 °C. To determine the radiochemical purity the reaction mixture was centrifuged, and the 68Ga content of the supernatant and of the solid body was measured. Animal studies were carried out on Sprague Dawley rats anesthetized with Isoflurane. The bio-distribution of the radiolabeled serum albumin was visualized and quantificated using the micro PET scanner after i.v. application
Results: Using 1.5 ml generator eluat and ~ 260 mg HEPES buffer for each kit, the labelling yield was 70% ± 5% and the radiochemical purity > 97%. Thin layer chromatography showed a range of the labelling maximum between 9 and 12 min. The best labelling yield (~ 60%) was obtained with the MAA spheres followed closely by the HSA and Nanocoll. Minor differences occurred due to leakages during the purification process which is an expected consequence of the particle size.
Conclusion: We could show the simple and fast preparation of Ga-68 labelled human serum albumin kits, origin developed for the labeling with Tc-99m. Because of their in-vivo stability for a minimum of 2 hours they could possibly be surrogate markers for Tc-99m MAA and a real alternative for pre-therapeutic investigations by positron emission-tomography (PET).

Keywords: HSA, MAA, Nanocoll, DOTA, Micro-PET, Ga-68

Thursday
P:Session 1

Ready-For-Use-module full automated and standardized production of ^{68}Ga-DOTATOC

Stephan Maus, Mathias Schreckenberger

Clinic and Polyclinic of Nuclear Medicine, University Medical Centre Mainz.

Presenter Address: Stephan Maus, Clinic and Polyclinic of Nuclear Medicine, University Medical Centre Mainz, Clinic and Polyclinic of Nuclear Medicine, University Medical Centre Mainz, Email: Stephan.Maus@freenet.de

Introduction: Currently, the somatostatin imaging using DOTA conjugated peptides like DOTA-TOC, -NOC and –TATE are the common applications. Different 68Ge/68Ga generator systems and synthesis modules are described separately. We describe a new full automated and standardized production of 68Ga-DOTATOC.
Methods: The module has to fit with components like the pre-conditioned C18 purifications cartridge and the DOTATOC precursor solute in HEPES buffer. The generator was fractionally eluted in time steps of 30 sec. An elution profile was created and the time frame of the middle fraction was adjusted with the basis software and the flow rate of the peristaltic pump. The reaction vial was charged with 30 µg DOTATOC solved in 100µl HEPES buffer (150-200mg / 0.1 ml) and placed in the heating block. The generator was eluted with 0.6 N HCl and the reaction volume (~ 1ml) was collected at the reaction vial after switching the valves V2 and V3 for 40 s. The labeling was performed under 95°C for 12 min at pH 3.5-4. Purification was achieved by injecting the reaction mixture onto the C18cardridge, washing with 1,5 ml H2O and 10 ml air. The 68Ga-DOTATOC was transferred over a sterile filter to the product vial by elution with 1 ml ethanol and 9 ml of saline.
Results: The tin dioxide generator we used was specified with an elution yield in 5 ml not less than 80%. The rule of thumb prognosticates a durability of 200 elutions or 10 month. After ~ 70 elution the yield of our systems fall below the value of 80%. The typical overall elution, labeling and purification procedure took less than 25 min.The non-ionic buffer HEPES was most effective and the optimal amount was ~ 160 mg. Using 33 µg (23 nmol),the labeling yield was 60%-65% and their radiochemical purity was > 97%.
Conclusion: The combination of a 68Ge/68Ga generator, produced under cGMP guidelines and a “Ready for use” automated module allows a standardized production with high radiochemical yields for 68Ga-DOTATOC. This combination of both will provide the user with facile and reliable package for the preparation in routine clinical applications, especially und the aspect of cGLP and cGMP.

Keywords: 68Ge/68Ga generator, Ga-68-DOTATOC, Fully automated

Thursday
P:Session 1

Synthesis of novel phenothiazine derivatives: potential new compounds for the ^{18}F-labelling of imaging agents for anti oxidative and neuro protective activities

Stephan Maus, Maike Ohlow, Bernd Moosmann, Mathias Schreckenberger

Clinic and Polyclinic of Nuclear Medicine, University Medical Centre Mainz**.**

Presenter Address: Stephan Maus, Clinic and Polyclinic of Nuclear Medicine, University Medical Centre Mainz, Stephan Maus , Mainstrasse 3 ,65203 Wiesbaden, Deutschland, E-mail: Stephan.Maus@freenet.de

Introduction: Oxidative stress, as result of the activity of free radicals, has been shown to be involved in the pathogenesis of neurodegenerative diseases. It could play a role in the development of diabetes-related complications and cardiovascular diseases. The results of the affiliated reactive oxygen species (ROS) in neuronal cells are lipid peroxidation, protein and DNA damage and finally neuronal cell death. Several studies reported that the effect of ROS was severely limited by antioxidants. Unfortunatly the unfavorable pharmacological profile, for example the insufficient permeation through the blood-brain barrier, prevents the further evaluation of these compounds in established models. Therefore the aim of this study was to synthesize a 18F- labelled antioxidative compound in order to quantificate and visualize its brain

Methods: The synthetic route of the non-radioactive references as well as the labelling precursor started from commercially available 2-acetylphenothiazine. 1-(10H-phenothiazin-2-yl)-ethanol was obtained by reduction using NaBH4. The labelling precursors 1-(10H-phenothiazin-2-yl)-ethyl-4-methyl-benzene-sulfonate was synthesised via tosylation of the 1-(10H-phenothiazin-2-yl)-ethanol. The labelling experiments were performed under standard conditions via the common 18F-cryptate procedure providing a convenient method for future radiolabeling.After purification by HPLC, we measured the brain uptake by micro-PET-scans in two rat after injection of 25 MBq.

Results: With 2-(1-[18F]-fluoroethyl)-10H-phenothiazine a promising novel phenothiazine derivative has been prepared. The synthesis involved the labeling precursor 1-(10H-phenothiazin-2-yl)-ethyl-4-methylbenzenesulfonate, which was synthesized in yields ranging from 54-65%.The labeled compound 2-(1-[18F-fluoroethyl])-10H-phenothiazine was obtained in a radiochemical yield of 30 % within 10 min with radiochemical purity greater 99 %. Purification was achieved by passing a SepPak Alumina N and a C18 cartridge. Chemical purity was proven with HPLC. A first micro-PET-scan shows a permeation of 4-5% of the Blood-Brain Barrier within the first 15 minutes after application.

Conclusion: We have described an efficient method for the synthesis of 1-(10H-phenothiazin-2-yl)-ethyl-4-methylbenzene-sulfonate and 2-(1-[18F]-fluoroethyl)-10H-phenothiazine. This might open a versatile new class of PET-radio pharmaceuticals which allow the visualisation and quantification of the blood-brain barrier permeability of antioxidative and neuroprotective compounds. The general value of this new 18F-compound as a labelling precursor in radiochemistry is currently under investigation.

Keywords: Phenothiazine, Oxidative stress, PET, F-18 labeling.

Thursday
P:Session 1

Urine macrophage migration inhibitory factor (MIF) in children with urinary tract infection: a possible predictor of acute pyelo nephritis but not scar

Sepideh Hekmat, Mansour Movahed, Rozita Hoseini, Hasan Toukesh

Hasheminejad Hospital, Iran University of Medical Sciecnes, Tehran, Iran

Presenter Address: Sepideh Hekmat, Nuclear Medicine, Email: sepidhekmat@hotmail.com

Macrophase inhibitory factor (MIF) is an important pro-inflammatory cytokine found in the sites of inflammation. The aim of this study was to assess MIF in urinary tract infection and compare its urinary excretion in pyelonephritis, cyctitis and control group to find a new way to differentiate them. In this prospective case-control study 33 pediatric patients with UTI and 40 healthy children were recruited. Urinary MIF concentration was determined using ELIZA
DMSA renal scan was used as the gold standard to differentiate pyelonephritis from cystitis.Urine MIF/Cr ratio was significantly higher in pyelonephritis patients than the ones with acute cystitis and control group ($P< 0.001$). The optimal cut-off point of 4.90 pg/micromol creatinine for urine MIF/Cr ratio (which is determined by ROC analysis) could potentially separate acute pyelonephritis from acute cystitis. However, due to unability to evaluate renal scarring by this marker, DMSA renal scan would remain the more informative procedure.

Keywords: UTI, MIF, DMSA renal scan.

Thursday
P:Session 1

Synthesis and evaluation of a new ^{99m}Tc labeled bombesin analogue for imaging gastrin-releasing peptide receptor-positive tumors in nuclear medicine

Nourollah Sadeghzadeh[1], Mostafa Gandomkar[2], Reza Najafi[2], Seyed Esmaeil Sadat Ebrahimi[1], Mohammad Mazidi[2], Mostafa Godarzi[2]

[1]Department of Medicinal Chemistry and radiopharmacy, Mazandaran, Iran
[2]Nuclear Science Research School, Mazandaran, Iran

Pressent Adress: Nourollah Sadeghzadeh, PHD, Department of Medicinal Chemistry and radiopharmacy, Faculty of Pharmacy, Mazandaran University of Medical Sciences, Email: nsadeghzadeh@mazums.ac.ir

Introduction: Bombesin (BN), a 14-amino acid neuropeptide, shows high affinity for the human GRP (gastrin releasing peptide) receptors, which are overexpressed by a variety of cancers, including prostate, breast, pancreas, gastrointestinal, and small cell lung cancer. Due to this a new bombesin analogue was labeled with 99mTc via 6-hydrazinopyridine-3-carboxylic acid (HYNIC), tricine and ethylenediamine diacetic acid (EDDA) as coligand and investigated further.
Methods: Peptide was synthesized on a solid phase using Fmoc strategy. Labeling with 99mTc was performed at 100 °C for 10 min and radiochemical analysis involved ITLC and HPLC methods. The stability of radiopeptide was checked in the presence of human serum at 37 °C up to 24 h. Internalization was studied with the human GRP receptor cell line PC-3.The Biodistribution was studied in normal rats.
Results: Labeling yield of >94% was obtained. Radiopeptide internalization into PC-3 cells was moderate and specific (10.7% ± 1.2% for tricine and 10.9% ± 0.4% in exchange labeling at 4 h). A high and specific GRP receptor expressing pancreas uptake (1.14 ± 0.11 %ID/g in exchange labeling and 1.04 ± 0.11 %ID/g for tricine as a coligand after 1 h) was also determined.
Conclusion: In this study, labeling of this novel conjugate with 99mTc easily was performed using coligands. The Prepared 99mTc-HYNIC-BN conjugate has promising Characteristics for the diagnosis of malignant tumors.

Keywords: Bombesin, 99mTc, Tumor, labeling

Thursday
P:Session 1

Preparation of ^{131}I-labelled MIBG for diagnosis and therapy purposes in nuclear medicine

Mohammad Reza Davarpanah, Sima Attar Nosrati, Hossein Khoshhosn, Mostafa Kazemi Morteza Fazlali.

Nuclear Science and Technology Research Institute, Tehran, Iran.

Presenter Address: Simin Attar Nosrati, Nuclear Science and Technology Research Institute, Tehran, Iran, E.Mail: simanosrati@gmail.com.

Introduction: Meta-iodobenzylguanidine (MIBG) is an analogue of the adergenic neuron blocking guanethidine. MIBG labeled with radioiodine is a very valuable radiopharmaceutical, where it is intensively used in nuclear medicine for both diagnostic imaging and targeted radiotherapy of neural crest derived tumors, such as neuroblastoma and pheochromocytoma. We have developed in 2009 an in house method of labeling MIBG with 131I. Since then we are regularly preparing 131I-MIBG for scintigraphy, with a gradual increase in the number of preparations.

Methods: The procedure involved the addition of 1 mg of MIBG, 4 mg of ammonium sulfate, 50 µl of glacial acetic acid and 20 µl of freshly prepared CuSO4, 5H2O (3.25 mg/ml), followed by 131I-sodium iodide (supplied by the Nuclear Science Research School of NSTRI, AEOI, Tehran, Iran) in a vial. All the reagents were pure. After sealing the vial, the mixture was heated at 160 ºC for 30 min in an oil bath. The final product was cooled and dissolved in 2 ml of 0.15 M sodium acetate solution prepared by using sterile N2-purged water for injection. The radiochemical yield and the purity were determined by thin layer chromatography. Stability of the produced [131I]MIBG was evaluated at different time intervals by checking the RC purity with paper chromatography.

Results: In this work, we succeeded in direct radiolabeling of MIBG by means of isotopic exchange. It was found that the labelling efficiency could be affected by several factors such as the composition of the reaction mixture, the temperature and the period of reaction. The process produced high yields of radioiodination (>80%) with very high radiochemical purity (>98%) and high specific activity. The pH of the labelled product was between 5-6. The results of biodistribution as demonstrated in animal imaging studies, revealed physiologic distribution of the radiopharmaceutical and images were similar to those of the commercial product.

Conclusion: We have developed a method for 13lI-labeIled MIBG for routine-production process. This method has some acceptance because of the simplified set-up and fewer reagents required for the synthesis. The 131I-labelled MIBG has high radiochemical purity and the deiodination is low. The good images resulting from the use of locally prepared 131I-MIBG revealed a good quality.

Keywords: MIBG, Radioiodination, Neuroblastoma, Pheochromocytoma.

Thursday
P:Session 1

SPECT attenuation related artifacts and their removal by attenuation correction in uniform and non-uniform attenuating objects using iterative reconstruction algorithms

Faraz Kalantari[1], Hossein Rajabi [1], Mohsen Saghari[2], Alireza Emami[2]

[1]Department of Medical Physics, Tarbiat Modares University, Tehran, Iran
[2] Research Institute for Nuclear Medicine, Tehran University of Medical Sciences, Tehran, Iran

Presenter Address: Faraz Kalantari , Department of Medical Physics, Tarbiat Modares University, Tehran, Iran ,Email: farazkalantari@gmail.com

Introduction: Photon attenuation is one of the main causes of quantitative errors and artifacts in SPECT. CT based attenuation map is necessary to correct for this effect accurately. A number of attenuation related artifacts are described. A fast and memory efficient algorithm is proposed for attenuation correction.
Methods: In our CT based attenuation correction algorithm, attenuated projections of an arbitrary estimation are calculated. These projections are compared with real projections. The error due to comparison updates the first arbitrary image. This iterative procedure continues till there is no difference between mathematical and real projections. To consider the effect of Poisson noise during reconstruction, EM statistical reconstruction is used. The effect of attenuation is enrolled in both projection and backprojection steps. To accelerate the reconstruction algorithm, a rotating image in a fix grid with bilinear interpolation is used to simplify ray tracing for creating mathematical projections. OSEM with much faster convergence rate is also used instead of MLEM as iterative algorithm. Different phantom configurations with uniform and non-uniform attenuation map are used to evaluate the accuracy of this algorithm. Projections free from the effect of attenuation were also simulated. Reconstructed image from these attenuation free projections is considered as reference image. Normalized mean square error between reference and corrected image and image contrast were used for quantitative evaluation of this algorithm.
Results: contrast of central hot spot reduced to about half of its real contrast due to attenuation. Non-uniformities, like hot skin, bright long related spots and colds bone related spots were also created in non-corrected images due to attenuation. All attenuation related artifacts removed after attenuation correction. NMSE is reduced from 1 in non-corrected images to 0.1 in corrected images. Much better fit in line profile of corrected images and reference images were also observed.
Conclusion: By using more suitable models for image formation it is possible to reconstruct images with much higher quantitative and qualitative accuracy which is essential in both diagnostic and image guided therapy procedures.

Keywords: SPECT, Attenuation artifact correction, Iterative reconstruction

Thursday
P:Session 1

Outcome of fix and uncalculated dose of radioiodine in the treatment of hyper functioning thyroid nodules

Seyyed Morteza Taghavi

Presenter Address: Seyyed Morteza Taghavi, Assistant Proffessor, Mashhad Medical University, Mashhad, Iran, Email: taghavimr@mums.ac.ir.

Introduction: This is a prospective study of patients treated for a solitary toxic nodule with a fix dose of radioiodine (131I) and followed for at least 1 year in Mashhad, north east of Iran.
Methods: 780 patients with thyroid nodule presented to university hospital of Ghaem during 7 years were evaluated. 95 (12%) patients had hot thyroid nodule.49 thyrotoxic patients treated with 131I and followed for a minimum of 12 months. 131I dose was 15 mci for all patients. Thyroid function test performed before treatment and 6 months after treatment and, thereafter, once every year.
Results: 86 patients (90.5%) were female and 9 (9.5%) were male. 69 (72.6%) patients had thyrotoxicosis and 26 (27.4%) were euthyroid.The single fix dose (15 mci) of radioiodine was sufficient to control hyperthyroidism in most of patients (46/49, 93.8%) in 6 months. 3 patients (6.2%) required a second dose due to persistent hyperthyroidism 6 months after the first dose.
Conclusion: A cure rate of 93.8% can occur within 6 months with a fix and uncalculated dose of radioiodine and this result is similar to the results of treatment with calculated dose of radioiodine.

Keywords: Hot nodule, Radioiodine, Thyrotoxicosis.

Thursday
P:Session 1

Value of single injection-double acquisition stress gated SPECT before and during Low-dose Dobutamine infusion for prediction of improvement in myocardial perfusion and function after coronary artery bypass

Babak Fallahi[1], Morteza Bostani[2], Davood Beiki[1], Armaghan Fard Esfahani[1], Mohammad Eftekhari[1], Mohammad Hossein Mandegar[3], Mohsen Saghari[1]

[1] Research Institute of Nuclear Medicine, Tehran University of Medical Sciences, Tehran, Iran
[2]Nuclear Medicine Department, Razavi Hospital, Mashhad, Iran
[3]Department of Cardiac Surgery, Shariati Hospital, Tehran, Iran

Presenter Address: Babak Fallahi , Associate Professor, Research Institute for Nuclear Medicine, Tehran University of Medical Sciences, Tehran, Iran , Dr. Sahariati Hospital, North Kargar Ave. Tehran Iran ,Email: bfallahi@sina.tums.ac.ir.

Introduction: The assessment of myocardial viability is of critical importance before coronary artery bypass graft (CABG). We evaluate a new protocol single injection double acquisition stress gated before and during low-dose dobutamin infusion (SIDAGS) for assessment of contractility reserve as a marker of viability to predict improvement in the involved segments after CABG.
Methods: Twenty nine patient candidates for CABG underwent stress gated-rest scan with ^{99m}Tc-sestamibi (MIBI). Immediately after stress phase additional gated SPECT was performed during constant infusion of 7.5 μg/kg/min dobutamine. 1-3 months after CABG, myocardial perfusion and function evaluated using standard stress- gated- rest method. All images of perfusion and function interpret with two nuclear medicine physician using 20 segment and 5 point scoring system. Post-CABG improvement of perfusion, left ventricular ejection fraction (LVEF), wall motion (WM) and wall thickening (WT) were considered as gold standard. The percentage of changes in LVEF (%ΔEF) WM (%ΔWM) and WT (%ΔWT) during LDD infusion in SIDAGS protocol were used as the predictive markers of post CABG state. The receiver operating characteristic (ROC) analysis was used to identify the value of this protocol in prediction of post-CABG improvement.
Results: There was good correlation between improvement of post-CABG EF and %ΔEF (r=0.64, p=0.002). ΔEF at least 10% predicts, 5% EF improvement in post CABG with sensitivity of 100% and specificity of 60%(The area under the ROC curve= 0.97 ±0.813). Good correlation between %ΔWT and improvement of WT after CABG was noted (r=0.61, p=0.001). Any positive % ΔWT, predict post-CABG WT improvement with sensitivity of 73.3% and specificity of 80%. Presence of 7 viable segment on SIDAGS can predict at least 6 point improvement in post-CABG summed stress score (SSS) with 100% sensitivity and 60% specificity.
Conclusion: Due to significant lower cost and radiation exposure, no need for additional radiotracer injection, more save time and rather acceptable results, the proposed SIDAGS protocol seems to be a valuable method in detection of pre-CABG myocardial viability and.

Keywords: Viability, Low dose dobutamin, LVEF.

Thursday
P:Session 1

Prediction of bone loss using biochemical markers of bone remodeling in patients with multiple sclerosis

Majid Assadi[1], Hooman Salimipour[1], Iraj Nabipour[1], Samad Akbarzadeh[1], Zahra Nemati[2], Hamid Javadi[1], Reza Nemati[1], Mohammad Seyedabadi[1], Mohammad Seyedabadi[1], Moloud Abbaszadeh[1], Mahsan Assadi[1]

[1] Bushehr Research Center for Nuclear Medicine, The Persian Gulf Biomedical Sciences Institute, Bushehr University of Medical Sciences.
[2] Department of Nuclear Medicine.

Presenter Address: Majid Assadi, Bushehr Research Center for Nuclear Medicine, The Persian Gulf Biomedical Sciences Institute, Bushehr University of Medical Sciences, Bushehr, Iran.

Introduction: Bone mineral density (BMD) was known to be lower in multiple sclerosis (MS) patients at both the lumbar spine and hip. Several factors have been shown to be related to osteoporosis and MS including Matrix metalloproteinase 9 (MMP-9), Osteopontin (OPN), Osteocalcin (OC), receptor activator of nuclear factor Kappa-B ligand (RANKL), osteoprotegrin (OPG), C-reactive protein (CRP), PTH and Vitamin D. Interfron beta-1b (IFN beta 1-b) is one of the medications that is applied in the management of MS and has been shown to ameliorate disease activity and inhibit osteoporesis. The aim of this study was to investigate the effects of IFN-1b1 and IFN-1ba plus Ca-Vit D3 on BMD, EDSS and the abovementioned factors in MS patients.
Methods: Thirty-six patients with chronic progressive MS who have been receiving IFN beta-1b or IFN beta-1b plus VitD3-Ca were enrolled as a target group and 38 age and sex matched cases were considerated as a control group in the study. The level of serum CRP, MMP-9, OPN, OC, RANKL and OPG were investigated by ELISA. BMD was measured by dual-energy x-ray absorptiometery.
Results: BMD of L4 were lower in MS patients receiving IFN beta-1b or IFN beta-1b and VitD3-Ca in comparison to control ($p<0.01$), but there were no significant difference in BMD of femur neck, wards triangle, greater trochanter, L2, L3, L4 and total lumbar. We did not observe any difference in hsCRP, MMP-9, OPN, OPG, RANKL, OC and Vit D3. However PTH levels were significantly lower in MS patients receiving IFN-1ba plus Ca-Vit D3 compared to control ($P < 0.05$). Multiple linear regressions revealed that BMI was positively correlated with BMD in femur neck ($\beta=0.27$; $p=0.026$), greater trochanter ($\beta=0.32$; $p=0.007$), L2 ($\beta=0.31$; $p=0.01$), L4 ($\beta=0.4$; $p=0.0$) and lumbar ($\beta=0.4$; $p=0.001$). In multivariate linear analysis, after BMD adjustment for BMI as covariate, it was observed that OPG were independent predictor of BMD in L4 ($r2=0.78$; $p=0.02$) and Lumbar ($r2=0.74$; $p=0.03$), MMP-9 was correlate with lumbar BMD ($r2=0.731$; $p=0.046$), and PTH with BMD L3 (0.647; $p=0.008$).
Conclusion: We found that patients receiving IFN-1b1 or IFN-1ba plus Ca-Vit D3 show ameliorated BMD and other factors associated with osteoporosis in MS.

Keywords: Multiple sclerosis, Biochemical markers, DXA.

Thursday
P:Session 1

Use of macro aggregated albumin lung perfusion scan to diagnose hepato pulmonary syndrome

Enayatollah Nemat Khorasani

Presenter Address**:** Enayatollah Nemat Khorasani, Assossiated Proffessor, Kermanshah, Imam Reza Hospital, Kermanshah, Iran, Email: KHORASANI@DR.COM

Introduction: We have reported that contrast echocardiography is a sensitive screening test for the hepatopulmonary syndrome (HPS). However, contrast echocardiography lacks specificity because many cirrhotic patients have positive study results with normal arterial blood gases and therefore do not fulfill criteria for HPS. The aim of this study was to assess the role of macroaggregated albumin lung perfusion scans (MAA scans) in the diagnosis of HPS.
Methods: MAA scans were performed in 25 patients with HPS, 25 cirrhotic patients without HPS, and 15 hypoxemic subjects with intrinsic lung disease alone. An MAA shunt fraction was calculated from brain and lung counts.
Results: MAA scan results were positive in 21 of 25 patients with HPS and negative in all controls. All 21 patients with positive MAA scans had PO2 values of <60 mm Hg. There was a strong inverse correlation between the degree of the MAA shunt fraction and arterial hypoxemia ($r = -0.726$).
Conclusion: A positive MAA scan result in cirrhosis is specific for the presence of moderate to severe HPS. We speculate that MAA scans may be particularly useful in evaluating the contribution of HPS to the hypoxemia in cirrhotic patients with intrinsic lung disesase**.**

Keywords: Hepatopulmonary syndrome, Macroaggregated albumin, Scan.

Thursday
P:Session 1

Patterns of DMSA Renal Scan in Different Renal Abnormalities

Morteza Bostani, Azra Izanloo

Nucler Medicine Department, Razavi Hospital, Mashhad, Iran.

Presenter Address: Morteza Bostani , Nuclear Physician, Nucler Medicine Department, Razavi Hospital, Shahid Kalantari Highway, Mashhad, Iran, E-mail: mza.bst51@gmail.com.

DMSA renal scan is a helpful investigation in several conditions including acquired disease such as acute or chronic pyelonephritis, obstructive uropathy, renal insufficiency as well as renal anomalies, renal shape normal variations and genetic disease. In this poster we present many of these patterns.

Keywords: DMSA scan, Renal disease, Scintigraphy.

Thursday
P:Session 1

Preparation and evaluation of [^{67}Ga]-Tetra Phenyl Porphyrin complexes as imaging agents

Seyed Yousef Fazaeli Hoseini Nezhad[1], Amir Reza Jalilian[2], Mostafa Mohammadpour Amini[3], Ali Rahiminejad-kisomi[1], Saeed Rajabifar[1], Fatemeh Bolourinovin[1], Sedigheh Moradkhani[1]

[1]Nuclear Medicine Research Group, Agricultural, Medical and Industrial Research School (AMIRS)
[2]Radiopharmaceutical Research and Development Lab
[3] Department of Chemistry.

Presenter Address: Seyed Yousef Fazaeli Hoseini Nezhad, PH.D Student, Nuclear Medicine Research Group, Agricultural, Medical and Industrial Research School (AMIRS), Moazzen Blvd., Rajaeeshahr, Karaj, Iran, P.O. Box: 31485-498, Email: youseffazaeli@gmail.com

Introduction: Radiolabeled porphyrins have been developed for the therapeutic purposes such as, 109Pd-protoporphyrins [1], 109Pd-porphyrins [2], and 188Re-porphyrin [3].In this work we report, synthesis, radiolabeling, partition coefficient, quality control and biodistribution studies (using: SPECT and scarification) of 67Ga-TPP in wild-type rats. key words: [67Ga]-Tetra phenyl porphyrin, imaging agents

Methods: [67Ga]labeled tetraphenyl porphyrin ([67Ga]-TPP) was prepared using freshly prepared [67Ga]GaCl3 and tetraphenyl porphyrin (TPPH2) for 30-60 min at 25°C (radiochemical purity: >97% ITLC, >98% HPLC, specific activity: 13-14 GBq/mmol). Stability of the complex was checked in final formulation and human serum for 24 h. The partition coefficient was calculated for the compound (log P. 1.89). The biodistribution of the labeled compound in vital organs of wild-type rats was studied using scarification studies and SPECT imaging up to 24 h. A detailed comparative pharmacokinetic study performed for 67Ga cation and [67Ga]-TPP.

Results: Total labeling and formulation of [67Ga]-TPP took about 30-60 min (RCP >97% ITLC, >98% HPLC, specific activity: 13-14 GBq/mmol). The complex was stable in final formulation and human serum at least for 24 h. At the pH.7, the logP was 1.89. The biodistribution of the labeled compound in vital organs of wild-type rats was studied using scarification studies and SPECT imaging up to 24 h. The complex is mostly washed out from the circulation through kidneys and can be an interesting tumor imaging/targeting agent due to low liver uptake and rapid excretion through the urinary tract.

Conclusion: It is suggested that 67Ga-TPP could be a possible SPECT tracer, however considering the fast wash-out, the short half life gallium-68 can be a suitable candidate for tumor imaging applications and future 68Ga-PET studies and less imposed radiation doses to patients.

Keywords: [67Ga]-Tetra Phenyl Porphyrin, Imaging agents, SPECT.

Thursday
P:Session 1

Treatment of differentiated thyroid carcinoma, controversies and challenges.

Mohammad Eftekhari[1], Saeed Farzanefar [2]

[1] Research Institute for Nuclear Medicine, Tehran University of Medical Sciences, Tehran, Iran
[2]Vali Asr Hospital, Tehran, Iran

Presenter Address: Mohammad Eftekhari , Proffesor of Nuclear Medicine, Research Institute for Nuclear Medicine, Tehran University of Medical Sciences, Tehran, Iran, Email: meftekhari@yahoo.com

Thyroid cancer is a common endocrine malignancy. Despite long term experience concerning diagnosis and treatment of differentiated thyroid carcinoma especially more than 70 years experience with I-131 therapy, still controversies exist regarding appropriate diagnosis, treatment methods and follow up. Growing advances in technology including molecular imaging and introduction of new methods for tumor detection and dosimetry help the caring physicians for optimal individualized therapy. Type of surgical approach, staging methods, benefits of I-131 ablation depending on tumor size, ablation dosage, optimal method for replacement therapy and follow up by serological and/or different imaging modalities still remain controversial. Interesting issues such as low ablative dose of I-131, follow up according to thyroglobulin level and radioiodine whole body scan, long term side effects and possibility of second malignancies need well controlled studies and clarification. In this presentation these issues specially concerns regarding response versus adverse effects of I-131 are discussed.

Keywords: Thyroid carcinoma, I-131therapy, Controversies, Thyroglobulin, Repalcement-therapy

Thursday
P:Session 1

Impact of metal artifact reduction on cardiac FDG-PET/CT studies in the presence of pacemaker and implantable cardio verter defibrillator leads

Pardis Ghafarian[1], Seyed Mahmoud Reza Aghamiri[1], Mohammad Reza Ay[2], Arman Rahmim[3], TH Schindler[3], Osman Ratib[4], Habib Zaidi[4]

[1] Department of Radiation Medicine, Shahid Beheshti University of Medical Sciences, Tehran, Iran
[2] Research Institute for Nuclear Medicine, Tehran, Iran
[3] Department of Radiology
[4] Geneva Neuroscience Center, Geneva

Presenter Address: Pardis Ghafarian , PHD Student , Shahid Beheshti University, Email: pardis.ghafarian@gmail.com

Introduction: Metallic artifacts induced by pacemakers and implantable cardioverter defibrillator (ICD) leads are a limitation of CT-based attenuation correction (CTAC) of PET data in cardiac PET/CT imaging. In this study, the impact of metal artefact reduction (MAR) for CTAC of cardiac PET/CT images in the presence of pacemakers and ICD leads was investigated through both qualitative and quantitative analysis using phantom and clinical studies.

Methods: The study included seven patients (three with pacemaker leads and four with ICD leads) undergoing viability examinations using dedicated cardiac PET/CT protocols. For detailed analysis, CT and PET emission data were also obtained using an anthropomorphic thorax phantom and dedicated in-house made heart phantom incorporating pacemaker and ICD leads attached at the right ventricle of the heart. The PET data for both patient and phantom studies were corrected for attenuation using both artefactual CT as well as CT images enhanced using a MAR algorithm. The severity and magnitude of metallic artefacts arising from these leads were assessed on both μmaps and attenuation corrected PET images. VOI-based analysis and regression plots were performed for regions related to leads' location. Bull's eye view analysis was also performed on PET images corrected for attenuation with and without the MAR algorithm.

Results: In phantom studies, the mean percent difference between tracer uptake obtained without and with MAR were seen to be as much as 10.16±2.1 and 6.86±2.1 in the segments of the heart in the vicinity to the metallic object, whereas they were 4.43±0.5 and 2.98±0.5 in segments far from the metal, for ICD and pacemaker leads, respectively. In clinical studies, the visual assessment of PET images by experienced physicians and quantitative analysis did not report significant differences when PET images are corrected for attenuation with and without MAR.

Conclusion: It was concluded that although the MAR algorithm can effectively improve the quality of μmaps, its clinical impact on the interpretation of PET images is not significant. Therefore cardiac PET images corrected for attenuation using CTAC in the presence of metallic leads can be interpreted without correction for metal artefacts. It should however be emphasized that in some special cases with multiple ICD leads attached to the myocardium wall, MAR might be useful for accurate attenuation correction.

Keywords: PET/CT, CTAC , Pacemaker, Cardiac.

Thursday
P:Session 1

Role of BrIDA scan in evaluating of a liver mass

Ali Reza Tavassoli[1], Asieh Sadat Fattahi Masoum[1], Seyyed Mousa Reza Hoseini[2], Kamran Adhami[1].

[1]Endoscopic & Minimally Invasive surgery Research Center, Department of surgery, Ghaem Hospital, Mashhad University of Medical Sciences.
[2]Intrnal Medicine Dep, Ghaem Hospital, Mashhad University of Medical Sciences.

Presenter Address: Ali Reza Tavassoli, MD, Endoscopic & Minimally Invasive surgery Research Center, Associated Prof, Department of Surgery, Ghaem Hospital, Mashhad University of Medical Sciences, Mashhad Iran. Email:tavassolia@mums.ac.ir

Diagnosis of a liver mass is so important in approaching to the patient. Hemangioma and Focal Nodular Hyperplasia can be managed conservatively. All other tumoral masses must be treated surgically. In addition to RBC scan for Heangioma, BrIDA scan for FNH can be diagnostic. We report a young woman with large liver mass that BrIDA scan showed FNH and we review the liturratures. Case presentation: A 23 year- old girl was referred to our department with epigastric and right upper quadrants pain from months ago. She had many imaging. In ultrasound and CT scan there was 100 x 70 mm mass in the caudate lobe. RBC liver scan was negative for liver hemangioma. Then we decide to use hepatobiliary scintigraphy. The TC-99m-Br-IDA scan showed radiotracer accumulation in the caudate lobe of liver in early and 4 hours image suggests FNH. This agent is taken up by kupffer cells in focal nodular hyperplasia. The patient managed conservatively after 5 month follow-up her mass had not increase in size.
In conclusion, BrIDA scan can help in diagnosis of focal nodular hyperplasia from other her masses especially adenoma, so we can manage patient conservatively.

Keywords: Liver, Mass, Scintigraphy

Thursday
P:Session 1

Use of sestamibi scan and radio-guided para thyroidectomy in persistent hyperparathyroidism

Asieh Sadat Fattahi Masoum[1], Ali Reza Tavassoli [1], Ramin Sadeghi[2], Kamran Adhami[1]

[1]Endoscopic & Minimally Invasive surgery Research Center, Department of surgery, Ghaem Hospital, Mashhad University of Medical Sciences, Mashhad, Iran.
[2] Nuclear Medicine Research Center of Mashhad University of Medical Sciences,Imam Reza Hospital, Ebn Sina Street, Mashhad, Iran.

Presenter Address: Asieh Sadat Fattahi, MD, Endoscopic & Minimally Invasive surgery Research Center, Assistant Professor, Department of Surgery, Ghaem Hospital, Mashhad University of Medical Sciences, Mashhad Iran , Email: fattahima@mums.ac.ir

We report a woman with severe hypercalcemia and adenoma of parathyroid that intra operative use of radiotracer and Sestamibi scan helped finding missed tumor in the second operation and we reviewed some literatures. Case presentation: a 42 years old woman with bone paint, fever and neurologic problems from months ago was referred to us. Severe hypercalcemia and increase parathyroid hormone with radiologic signs (salt and paper in skull imaging) showed primary hyperparathyroidism. Ultrasound reports a mass near lower lobe of left thyroid. In first operation 2×3cm mass at this place was removed but calcium was elevated after operation. Then Sestamibi scan showed increase uptake in left side again. Before the second operation radioisotope was injected and a hand-held gamma probe was used intraoperative. It identified the enlarged gland at the left side with 3 times more radioactivity counts. Frozen section and permanent pathology showed adenoma of parathyroid.
Sestamibi scan and radio-guided parathyroidectomy can be helpful in finding missed or ectopic parathyroid adenoma after first operation.

Keywords: Hyperparathyroidism, Sestamibi, Scan.

Thursday
P:Session 1

Application of radioprotective agents in cancer treatment

Ehsan Mihandoust[1], Alireza Shirazi[2]

[1]Department of Medical Radiation Engineering, Faculty of Engineering, Islamic Azad University, Science and Research Branch of Tehran, Tehran, Iran.
[2]Department of Medical Physics

Presenter Address: Ehsan Mihandoust, M.Sc, Department of Medical Radiation Engineering,Faculty of Engineering,Islamic Azad University,Science and Research Branch of Tehran,Tehran, Iran ,Email: e.mihandoust@gmail.com

Radiation exposures can occur without any prior warning in the following settings: radiography, nuclear medicine, radiotherapy, radiological imaging, radionuclide production, biomedical research, military, public domain, transportation, nuclear reactors, space flights etc. patients may be exposed to ionizing radiation during radiotherapy or following exposure to radionuclides in nuclear medicine. There is, therefore, a need to protect humans against planned(e.g. radiotherapy and nuclear medicine) and unplanned (e.g. industrial nuclear accident or nuclear war)exposures is necessary. radioprotectors are compounds that have the ability to reduce the biological effects of ionizing radiation on normal tissues, including lethality, mutagenicity and carcinogenicity, and have applications in clinical oncology, space travel, radiation site clean-up, radiological terrorism and military scenarios . The radioprotectors can elicit their action by various mechanisms such as: suppressing the formation of free radicals, inducing the cellular radioprotectors such as superoxide dismutase (SOD) , enhancing the DNA repair and inducting hypoxia in the tissues. The most effective radioprotectors developed so far are aminothiols and their derivatives. Some of these compounds have been successfully used to prevent complications of radiation therapy in patients with cancer. Unfortunately, all of the aminothiols have toxic side effects that limit their use in medical practice.
Results from animal experiments indicate that antioxidant nutrients, like vitamin A, C ,E and selenium compounds, are protective against lethality and other radiation effects but to a lesser degree than most synthetic protectors. a large number of plants contain antioxidant phytochemicals reported to be radioprotective in various model systems. Clinical trials have not yet been undertaken with most herbal radioprotectors. If these are performed, herbal radioprotective drugs for human use from several of plants may soon be available. Therefore, the activity of numerous investigators is directed towards finding an effective radioprotective agents that would successfully prevent development of radiation syndrome and protect cells and tissue from deleterious effects of radiation. most of the compounds failed in their transition from laboratory to clinic. Acute toxicity and their inability to differentiate between tumor and normal cells are the main reasons for their failure in clinical applications. However, Early research on radiation protection has unraveled the basic mechanisms and yielded a large number of radioprotecting compounds.

Keywords: Radioprotectors, Aminothiols, Antioxidants, Amifostin, Vitamin E

Thursday
P:Session 1

Comparison of GATE and MCNP Monte Carlo codes for internal dosimetery

Ali Asghar Parach, Hossein Rajabi, Mohammad Ali Tajik-Mansoury, Hadi Taleshi Ahangari .

Dept. of Medical Physics, Faculty of Medical Sciences, Tarbiat Modares University, Tehran Iran

Presenter Address: Ali Asghar Parach, Tarbiat Modares University, Tehran, Iran, Email**:** parach@modares.ac.ir

Introduction: GATE is practically the only nuclear medicine dedicated code with the option to determine the dose distribution inside the body. This code has been designed as upper layer of the GEANT4 toolkit and has been used for internal dosimetery. However, its results have not been compared to other well-developed codes. Moreover anthropomorphic voxel phantoms have never been used with GATE for internal dosimetry. The aim of present study was to compare the dose calculated with GATE to MCNP4B published data.
Methods: The Zubal voxel phantom was used to model a typical adult male. Activity was assumed uniformly distributed in liver, kidneys, lungs, spleen, pancreas and adrenals. GATE Monte Carlo package was used for estimation of doses to the organs of phantom. Simulations were performed for photon energy of 0.01-1 MeV and mono-energetic electrons of 935 keV. Specific absorbed fractions for photons and s-values for electrons were calculated.
Results: On average, GATE produces higher SAF values (+2.7%) for self-absorption and lower values (-2.9%) for cross-absorption. The SAF values calculated with MCNP4B for lungs as source organ at the energy of 200 and 500 keV was considerably higher than GATE data.
Conclusion: Despite of differences between the GATE4 and MCNP4B, the results can be considered ensuring. This difference was almost at the same level as the reported difference between MCNPX and MCNP4b. As a result, this may be considered as validation of GATE as a proprietary code in nuclear medicine for radionuclide dosimetry applications.

Keywords: GATE, MCNP, Monte-Carlo, Internal dosimetry, Validation

Thursday
P:Session 1

Assessment effect of wavelet transform in precision of motion detection for renal dynamic scintigraphy: simulation study

Mohammad Ali Tajik Mansoury[1], Hossein Rajabi[1], Ali Reza Emami-Ardakani[2], Ali Asghar Parach[1]

[1] Department of Medical Physics Tarbiat Modares University Tehran Iran.
[2] Department of Nuclear Medicine Research Institute for Nuclear Medicine Tehran University of Medical Sciences Tehran Iran.

Presenter Address: Mohammad Ali Tajik Mansoury, PHD Student, Tarbiat Modares University, Tehran, Iran, Email: ehsantajikmansoury@gmail.com.

Introduction: Motion detection in nuclear medicine imaging because of restrictions of images such as high level of noise and fading of organs boundary that are inherent characteristics of images, have insufficiency. These restrictions can cause to decrease precision of motion detection especially in two methods of center of gravity and cross correlation in renographics images. That in this research we used approximation part of decomposed image with wavelet transform, for increase precision of motion detection or decrease minimum amount of detectable motion.
Methods: In this study 4D NCAT phantom was used to generate a typical human torso and the SimSET Monte Carlo nuclear medicine (NM) simulator was used to generate phantoms images. Dynamic images were adjusted to construct 180 phantoms that each representing a 10 second duration. 5 type of phantom and 3 type of motion direction was simulated and we used 7 families of wavelet for decomposition of images. Motion detection algorithms, center of gravity and cross-correlation, (were implemented in Matlab 7.1 environment) were used for motion determination in renal imaging data and Finally minimum amount of detectable motion for each of them was measured.
Results: results show that 2 families of wavelet Daubechies and Reversbio in first level of decomposition can significantly (p-value <0.05) increase precision of motion detection in two algorithms of center of gravity and cross correlation. Also results show these two methods can determine direction of motion.
Conclusion: results show that use of approximation part of decomposed imaged with wavelet transform can increase precision of motion detection in renal dynamic imaging. However for two families of wavelet and in first level of decomposition we were to fulfill this aim. But it showed the positive effect of wavelet transform for increase precision of motion detection algorithms in nuclear medicine imaging.

Keywords: Motion detection, Wavelet transform, Renography, Simulations.

Thursday
P:Session 1

The value of the nuclear medical scan in the diagnosis of oral diseases

Ali Bagherpour

[1] Department of Oral Radiology, Faculty of Dentistry & Dental Research Center, Mashhad University of Medical Sciences.

Presenter Address: Ali Bagherpour , Assistant Professor, Department of Oral Radiology, Faculty of Dentistry & Dental Research Center, Mashhad University of Medical Sciences, Vakilabad Boulevard, Mashhad, Iran
Email: bagherpoura@mums.ac.ir.

Bone scintigraphy is a very sensitive technique for the detection of metabolic activity of the skeleton.
This method consists of imaging the uptake of bone-seeking radiopharmaceuticals, especially technetium-99m labeled diphosphonates, in the mineral part of bone, which consists of hydroxyapatite crystals and calcium phosphate, as well as in the organic matrix such as collagen fibers. Conventional radiographs, computed tomography, and magnetic resonance imaging are categorized as structural imaging methods, whereas bone scintigraphy is a functional method. In many cases, radionuclide imaging techniques are the only means by which early physiologic changes that are a direct consequence of biochemical alteration may be evaluated, before significant bone mineral changes can be detected by other means. Because many oral diseases may cause metabolic changes in the oromaxillofacial complex, it would be of great value to apply bone scintigraphy to assess more completely some conditions involving the bones in the region to construct more appropriate treatment plans. Based on the current literature, the author discusses the possible applications of bone scintigraphy as a diagnostic and treatment planning adjunct for oral diseases. Nuclear medicine has proven particularly useful in the study of malignant lesions and in the assessment of vascularized bone grafts used for maxillofacial reconstructions.

Keywords: Nuclear Medicine, Oral diseases, Radionuclides, Dentistry

Thursday
P:Session 1

Preparation and quality control of ^{153}Sm-[tris(1,10-phenanthroline) samarium (III)] complex as a therapeutic compound

Amir Hakimi, Amir Reza Jalilian, Simindokht Shirvani Arani[2], ZohreNaseri[3], Ali Bahrami Samani[3], Mohammad Ghannadi Maragheh[2], Azim Arbabi[4]

[1] Islamic Azad University, Science and research Unit, Tehran, Iran [2]Radiopharmaceutical Research and Development Lab (RRDL)
[3]School of chemistry
[4]Shahid Beheshti University, Mashhad, Iran

Presenter Address: Amir Hakimi, Islamic Azad University, Science and research Unit, Tehran, Iran, E-mail: amir_1985us@yahoo.com

Introduction: In view of development of targeting therapeutic compounds for malignancies, and interesting in vitro anti-tumor activities of lanthanide phenanthroline complexes, the 153Sm-[tris(1,10-phenanthroline) Samarium(III)]
complex (153Sm-PL3) was prepared.
Methods: Sm-153 chloride was obtained by thermal neutron flux (4 × 1013 n.cm-2.s-1) of enriched 152Sm2O3 sample, dissolved in acidic media. The labeling was performed in ethanol in 24h, controlled by ITLC (1.0mM DTPA, pH.5, as mobile phase). The partition coefficient for the labeled compound was determined.
Results: A radiochemical yield of more than 95% was obtained. Radiochemical purity of 96% was obtained using ITLC with specific activity of about 27.75 GBq/mg . The radio-labeled complex was stable in aqueous solution at least 24 hours and no significant amount of free 153Sm was released from the complex. The partition coefficient for the labeled compound was determined (log P. 3.4). The complex was stable in final formulation for 66h. The biological evaluation of the compound is under investigation.
Conclusion: The radiolabeled compound used in this study is a very inexpensive and useful agent for use as a therapeutic compound.

Keywords: Samarium-153, 1, 10-Phenanthroline, Radiolabeling, Quality control

Thursday
P:Session 1

Accurate 3D Dosimetry for Internal Radiotherapy By Considering the Effect of Nonuniform Activity Distribution

Elham Saeedzadeh[1], Ali Abbaspour Tehrani-Fard[1], Saeed Sarkar[2], Mohammad Reza Ay[2,3], Hamid Reza Khosravi[4]

[1]Faculty of Engineering and Technology, Tehran, Iran.
[2]Department of Medical Physics and Biomedical Engineering, Tehran, Iran.
[3]Research Institute for Nuclear Medicine, Tehran University of Medical Sciences, Tehran, Iran.
[4]Nuclear Science and Technology Institute, Tehran, Iran.

Presenter Address: Elham Saeedzadeh , PHD, Faculty of Engineering and Technology, Science and Research Branch, Islamic Azad University, Tehran,Email: esaeedzadeh@gmail.com

Introduction: Many methods like Dose Point Kernels and MIRD calculations, have been evolved for improving the accuracy of dosimetry in the context of 131I radionuclide therapy. However studies have not shown a strong relationship between tumor absorbed dose and response, due to inaccuracies in activity and dose estimation.
Methods: GATE Monte Carlo code was used in this study, because it simply takes into account the accurate inhomogeneities in organs and activity distribution and distant energy deposition in a voxel based dosimetry approach. The activity of all organs and tumors were derived, using data from thyroid cancer patients treated with radioiodine. The realistic human phantom of Zubal with 56 segmented tissues was used.
Results: The tumor activity was considered constant but with uniform and nonuniform distributions in different simulation setups and its calculated mean absorbed dose was respectively 0.65E-5 and 0.61E-5 (mGy/Mq.s) which does not vary considerably. However the Dose volume histograms shown that the tumor nonuniform activity distribution decreases the effective dose to most parts of the tumor volume by a factor of 3.
Conclusion: In this case it can be misleading to quote the mean or maximum absorbed dose, because overall response is likely to be dependent on the extent of the volume that receives a low absorbed dose. So the more comprehensive approach is to consider the activity and dose distribution throughout the tumor to improve the response assessment and treatment planning for radionuclide therapy.

Keywords: Internal radiotherapy, 3D-Dosimetry, I-131

Thursday
P:Session 1

^{99m}Tc- RBC liver SPECT versus ultrasonography in diagnosis of liver hemangioma

Morteza Bostani, Azra Izanloo, Farah Raoofi

Nuclear Medicine Department, Razavi Hospital, Mashhad, Iran

Presenter Address: Morteza Bostani , Nuclear Medicine Department, Razavi Hospital, Shahid Kalantari Highway, Mashhad, Iran, Email: mza.bst51@gmail.com

Introduction: Hemangioma is the most common benign liver mass that usually needs no medication; however, distinction from other lesions including malignant or benign tumors is of crucial importance. We describe 66 patients with suspected liver hemangioma admitted in nuclear medicine department of razavi hospital and compared RBC-SPECT with sonographic (US) results.
Methods: 66 patients with suspicious liver hemangioma base on US, underwent dynamic as well SPECT scan after injection of in vitro labeled RBCs with 99m Tc- pertechnetate. All images of perfusion, blood-pool and SPECT interpret as positive or negative for hemangioma. The US results classified base on size (> 10 mm) and echo-pattern (hyperecho) as well as final diagnosis. McNemor test was used to detect relation-ship between sonography and RBC-scan results.
Results: 42 women (63.6%) and 24 men with age between 13-84 years were evaluated. US of 42 (63.6%) subject show lesions greater than 10 mm suggest hemangioma; however, in 28 (42.4%) patients liver hemangioma confirmed in scintigraphy. McNemor test depicted significant different between US and RBC-scan results (p=0.02) in diagnosis of liver hemangioma.
Conclusion: however, US is a valuable procedure in evaluation of liver mass, in diagnosis of hemangioma is unreliable and establish of liver hemangioma diagnosis need complementary studies including RBC-Liver SPECT.

Keywords: Liver hemangioma, 99mTc-RBC SPECT, Ultrasonography.

Thursday
P:Session 1

Synthesis and biodistribution study of a chlorotoxin derivative peptide labeled with Iodine-131 for tumor therapy

Seyed Pezhman Shirmardi[1], Mojtaba Shamsaei[1], Mostafa Gandomkar[2], Mohammad Ghannadi Maragheh[2]

[1] Nuclear Engineering and Physics, Amirkabir University of Technology, Tehran, Iran
[2] Nuclear Sciences and Technology Research Institute, Tehran, Iran

Presenter Address: Seyed Pezhman Shirmardi, PHD, Nuclear Engineering and Physics, Amirkabir University of Technology, Tehran, Iran, E-mail: p_shirmardi@aut.ac.ir

Introduction: Chlorotoxin is a 36-amino acid peptide found in the venom of the Leiurus quinquestriatus which blocks small-conductance chloride channels. Chlorotoxin binds preferentially to glioma cells that allow development of new methods for the treatment and diagnosis of several types of cancer. Due to this a chlorotoxin derivative was labeled with 131I and investigated further.
Methods: A chlorotoxin derivative was synthesized on a solid phase using a standard Fmoc strategy. Labeling with iodine-131 was performed through chloramine-T method and radiochemical analysis involved sephadex G-25 and HPLC methods. The stability of radiopeptide was checked in the presence of PBS and human serum at 37 °C up to 24 h. The biodistribution was studied in mice.
Results: The chemical purity of synthesized peptide as assessed by analytical RP-HPLC was 95%. Labeling of peptide resulted in a radiochemical yield of 80% with radiochemical purity of > 95% with specific activity of 0.740 GBq/μmol. Results of In vitro studies demonstrated acceptable stability of compound in human serum and PBS solution.
Conclusion: Biodistribution data showed moderate blood clearance, with concentration of radioactivity in the kidneys, liver, intestine and stomach.

Keywords: Cancer, Peptide, 131I, Labeling, Chlorotoxin

Thursday
P:Session 1

Preparation and investigation of a toxic fraction of mesobuthus eupeus labeled with ^{99m}Tc

Seyed Pezhman Shirmardi[1], Mostafa Gandomkar[1], Mojtaba Shamsaei[1], Abbas Zare Mirakabadi[3], Mohammad Ghannadi Maragheh[2]

[1] Nuclear Engineering and Physics Faculty, Amirkabir University of Technology, Tehran, Iran
[2] Nuclear Sciences and Technology Research Institute (NSTRI), Tehran, Iran
[3] Razi Vaccine and Serum Research Institute, Tehran, Iran.

Presenter Address: Seyed Pezhman Shirmardi, PHD, Nuclear Engineering and Physics Faculty, Amirkabir University of Technology, Tehran, Iran, Email: p_shirmardi@aut.ac.ir

Introduction: Iranian scorpion species are classified in Buthidae and Scorpionidae with 16 genera and 25 species. In Iran, similar to other parts of the world, there are a few known species of scorpions responsible for severe envenoming. Mesobuthus eupeus is the most common species in Iran. Its venom contains several toxin fractions which can affect the ion channel. In this study purification, labeling and biological evaluation of Mesobuthus eupeus scorpion venom are described.
Methods: To separate different venom fractions, soluble venom was loaded on a chromatography column packed with sephadex G50 gel then the fractions were collected according to UV absorption at 280 nm wavelength. Toxic fraction (F3) was loaded on anionic ion exchanger resin (DEAE) and then on a cationic resins (CM). Finally toxic fraction F319 was labeled with 99mTc and radiochemical analysis was determined by paper chromatography. The biodistribution was studied after injection into normal mice.
Results: Toxic fraction of venom was successfully obtained in purified form. Radiolabeling of venom was performed at high specific activity with radiochemical purity more than 95% which was stable for more than 4 h. Biodistribution studies in normal mice showed rapid clearance of compound from blood (2.64% ID at 4 h) and tissue except the kidneys (27% ID at 4 h).
Conclusion: As tissue distribution studies are very important for clinical use, results suggest that 99mTc labeling of venom can be a useful tool for in vivo studies and is an excellent approach to follow the process of biodistribution and kinetics of toxins.

Keywords: Mesobuthus eupeus, Venom, Purification, Radiolabeling, Chromatography.

Thursday
P:Session 1

Performance assessment and optimization of pixelated crystal gamma camera with small field of view: a Monte Carlo study

Farzaneh Adibpour[1], Mohammad Reza Ay[1,2], Saeed Sarkar[1], George Loudos[3]

[1] Department of Medical Physics and Biomedical Engineering, Tehran University of Medical Sciences, Tehran, Iran
[2]Research Institute for Nuclear Medicine, Tehran University of Medical Sciences, Tehran, Iran
[3]Department of Medical Instrument Technology, Technological Educational Institute of Athens, Greece

Presenter Address: Farzaneh Adibpour, Department of Medical Physics and Biomedical Engineering, Tehran University of Medical Sciences, Email: adibpour@tums.ac.ir

Introduction: Developing pixelated scintillation camera with small field of view is one of the most suitable tools for scintimammography, linphoscintigraphy and Small animal imaging. The principal aim is to improve diagnostic accuracy with better spatial resolution and sensitivity. The aim of this study is to asses the trade-off between spatial resolution and sensitivity in pixelated crystal camera as function of pixel size and crystal material.
Methods: In this study Geant4 Application for Tomographic Emission (GATE) Monte Carlo package was used for accurate modeling of pixelated crystals. GATE is a dedicated simulation toolkit originally designed for modeling in emission tomography. The geometry of small animal gamma imager precisely described in GATE. The crystal array has 5 mm thickness, including square pixels, separated by 0.2 millimeter epoxy. The candidate crystal materials in this study are NaI, CsI and LaBr3.To assess the pixel size dependency, simulation were carried out for pixel size ranging between 0.5mm*0.5mm and 3mm*3mm.The spatial resolution of gamma camera was characterized by line spread function in air at 4 cm from collimator. All simulations were done with a TC source consisting of a 1.1 mm diameter capillary of 8 cm length. The activity of the source was set to 401 µCi. The system sensitivity defined as counts per second per MBq were calculated for the mentioned source located at the centre of FOV at 4 cm from collimator.
Results: Simulation results demonstrated that spatial resolution for pixelated CsI scintillator varies from 1.8 to 3.98 for pixel sizes of 0.5mm*0.5mm till 3mm*3mm. On other hand, sensitivity drops dramatically for crystal array with size of 0.5mm*0.5mm. The results also indicate, LaBr3 and CsI possess higher sensitivity due to shorter attenuation length and decay time.
Conclusion: crystal array 0.5mm*0.5mm shows very good spatial resolution value and pixel size 3mm*3mm improves the sensitivity. However, the optimum pixel size seems to be 1mm*1mm because of appropriate trade-off between spatial resolution and sensitivity. Furthermore, because pixelated LaBr3 combine excellent spatial resolution with increased efficiency, it has the potential to replace Nal as the scintillator of choice for SPECT.

Keywords: Pixilated scintillator, Gate, High resolution, LaBr3

Thursday
P:Session 1

Preparation of the diagnostic kit for measuring of free Thyroxin (FT4) in human blood by RIA method

M. Moharamzadeh[1], M.H. Babaei[1], R.H Hosseini[2], F.H. Talebi[1], Sh. Sheybani[1]

[1] Radioisotope Research Group, Karaj, Iran.
[2] Biochemistry Dept.

Presenter Address: M. Moharamzadeh, M.Sc., Radioisotop Research Group, P.O. Box: 31585-1549, Karaj, Iran, Email: mmoharam@aeoi.org.ir

Introduction: The main hormone of thyroid gland is T4. Only 0.3 % of T4 is free and the rest has been binded mostly to Thyroxine Binding Globulin (TBG), then Throxine Binding Pre Albumin (TBPA)& Throxine Binding Albumin(TBA). While 99.7% of T4 is bound to protein, it is the free fraction (FT4) which is considered to be biologically active. The normal range of FT4 is about 10 – 24 pico mole per liter. FT4 levels in serum or plasma have been recognized as an important indicator of thyroid status.T4 secretion from the thyroid gland is regulated by a sensitive feedback system which involves the hypothalamus and the pituitary gland.

Methods: Radio Immunoassay is one of the sensitive & specific methods for measuring the hormones. It is one example of saturation analysis, a particular type of immunoassay (an analytical technique which utilizes antibody). An analyte in a saturation analysis is called a ligand and the specific reagent in such assay is called a binder. T4 is labelled with I-125 by chloramines–T method .After purification by coloumn Chromatography (Sephadex G-25) and dilution, we adjust the activity of labelled T4 (or tracer) for a 50% binding with T4-Ab. The tracer competes with the unlabeled T4 in binding to the limit amount of T4-Ab which have already been coated in polystyrene tubes. After the incubation period, the Ag*-Ab complex which has been formed in solid phase (polystyrene tubes) could easily be measured in Gamma counter. By plotting the standard curve, we can estimate the concentration of free T4 in unknown samples.

Results & conclusion: After running the assay we obtained a good standard curve. All the controls were within the range and the sensitivity (Minimum detectable dose) of the kit was 3.5 pmole/L , also the amount of coefficient variation (%CV) was less than 10% . All these results show that the local kit could be accepted as a cost effective & reliable kit for measuring of the FT4 in human serum. Although the incubation period during the assay is a little longer than it's equivalents which imported from the abroad, but however if we have a better Ab with higher affinity this period could be potentially decreased.

Keywords: Immunoassay, Saturation analysis, Tracer, Antibody

Thursday
P:Session 1

The distribution of bone metastases on 146 whole body scans

Davood Beiki, Babak Fallahi, Mohammad Bagher Khodaparast, Mohammad Eftekhari, Armaghan Fard-Esfahani, Mohsen Saghari, Alireza Emami Ardakani

Research Institute for Nuclear Medicine, Tehran University of Medical Sciences, Tehran, Iran.

Presenter Address: Davood Beiki, Research Institute for Nuclear Medicine, Shariati Hospital, North Kargar Ave., Tehran, Iran. Email: beikidav@sina.tums.ac.ir

Introduction: Bone scan as an appropriate procedure with high sensitivity and moderate specificity is currently accepted by many clinicians for early detection of metastasis; however, characterizing scintigraphic patterns of bone metastases in each type of cancer may still help physicians to improve their skills for more accurate and faultless judgment about the scan findings.
Methods: A cross-sectional study was conducted to explore the specific patterns of bone metastases in 146 patients with different types of cancers using a multitude of imaging modalities including bone scan.
Results: The most common locations of bone metastases on scan images of patients with prostate cancer (71 cases) were pelvis, thoracic vertebrae, proximal femur, ribs and lumbar vertebrae, respectively, which in most cases were not accompanied with significant localized pain. Very intense uptake was noted in about 95% of cases with metastases to the thoracic vertebrae and 50% of cases with metastatic lesions in the common sites of metastasis, i.e. lumbar spine and proximal femoral bone. The most common sites of bone metastases in 61 patients with breast cancer were pelvis and hip, lumbar vertebrae, thoracic vertebrae, ribs, sternum and cervical spine. As well, an intensely higher uptake was observed in most of metastases to the sternum (86%), hip (79%), lumbar and thoracic vertebrae (75-78%); however in contrary to the prostate cancer, in most cases of breast cancer, the skeletal metastasis accompanied by significant localized pain. The most common sites of bone metastasis due to gastrointestinal (GI) cancers were cervical (100%), lumbar (100%), thoracic (84%) vertebrae and sternum (50%) with more intense uptake in all cervical spine and sternal metastases. Localized pain was detected in almost all cases with metastases to the lumbar spine and sternum while the other metastatic lesions were associated with localized symptom in more than 50% of cases with GI cancer.
Conclusion: The pattern of metastases (common sites, association with localized symptoms and intensity of uptake) are important factors for better characterization of lesions on bone scan as to whether this lesion is truly metastatic or represents a benign lesion.

Keywords: Bone Scan, Malignancy, Scintigraphy pattern.

Thursday
P:Session 1

The effectiveness of ^{153}Sm-EDTMP for palliative therapy of patients with painful multiple bone metastases

Davood Beiki[1], Babak Fallahi[1], Arash Keyvan[1], Peiman Haddad[2], Armaghan Fard-Esfahani[1], Farnaz Ammozegar Hashemi[2]

[1] Research Institute for Nuclear Medicine, Tehran University of Medical Sciences, Tehran, Iran
[2] Department of Radiation Oncology, Faculty of Medicine, Tehran Unniversity of Medical Sciences, Tehran, Iran

Presenter Address: Davood Beiki, Research Institute for Nuclear Medicine, Shariati Hospital, North Kargar Ave., Tehran, Iran. Email: beikidav@sina.tums.ac.ir

Introduction: Samarium-153 ethylene diamine tetramethylene phosphonate (^{153}Sm-EDTMP) is an available and approved radiopharmaceutical for palliative therapy of patients with painful multiple bone metastases. The aim of this study was to evaluate the palliative effect and myelotoxicity of ^{153}Sm-EDTMP treatment in patients with painful bone metastases.
Methods: Sixteen cases (9 male, 7 female, mean age: 57.25±16.74 yrs) with severe refractory painful bone metastases from the malignancies of prostate (n=7), breast (n=7) and endocrine glands (n=2) were entered in a before-after study. A standard questionnaire for numeric rating of pain severity, quality of life (QL) and the dose of analgesic drugs was applied for all patients and the scores (ranged between 0 and 10) before treatment as well as the scores at the end of the 2nd, 4th and 8th weeks after treatment were recorded. Cell blood count was measured at the baseline and weekly up to 4 weeks after treatment. A standard common toxicity criteria (CTC) was defined for scoring the degree of myelotoxicity. Repeated measures analysis of variances was applied to analyze within subject effects of treatment on the scores over different time points of the study.
Results: A significant pain relief was found in 68.7% of patients by the 2nd week after treatment. The rate of significant pain relief at the end of the 8th week was 75%. Average total pain scores in repeated measures were significantly reduced from 5.68±1.97 to 4.42±2.44 (p=0.048) and 4.12±1.61 (p=0.032) by the 2nd and 4th weeks after treatment, respectively. The QL scores was also improved over three time points of the study (p=0.002). Although average cell blood counts in every four weeks after treatment were diminished as compared to the baseline counts, all patients were in grade 1 or 2 of myelotoxicity based on CTC scores.
Conclusion: The present study reveals a significant analgesic effect for ^{153}Sm-EDTMP in patients suffering from metastasis-related bone pain refractory to the other analgesic drugs or narcotics. This treatment may also improve the quality of life and reduce the dose of analgesic and narcotic drugs during the period of 8 weeks after treatment while resulting in only mild and trivial adverse effects.

Keywords: Samarium, EDTMP, Palliation therapy

Thursday
P:Session 1

Assessment of the influence of crystal material and size on the sensitivity of dual head small animal PET scanner

Nafise Ghazanfari[1], Mohammad Reza Ay[2,3], Saeed Sarkar[2], George Loudos[2]

[1] Physics and Biomedical Engineering, Tehran University, Tehran, Iran
[2] Department of Medical Instrument Technology, Technological Educational Institute of Athens, Greece
[3]Research Institute for Nuclear Medicine, Tehran University of Medical Sciences, Tehran, Iran

Presenter Address: Nafise Ghazanfari, Tehran University, Iran,Tehran,Emam Khomeini Hospital, Research Center for Science and Technology in Medicine (RCSTIM), Tehran University of Medical Sciences, Email: ghazanfari@razi.tums.ac.ir

Introduction: Small animal Positron Emission Tomography (PET) is becoming an essential modality for preclinical research in order to develop molecular medicine strategies. However, any developing on this modality is highly appreciated by research communities. It is well known that optimizing current designs in order to improve sensitivity and resolution of these systems is an active research arena. In this study the influence of crystal size and material on the performance of dual-head coincidence imaging system (DHCI) with pixilated crystal has been evaluated.
Methods: The GATE Monte Carlo code used in this study for defining the geometry and photon transport into the crystals. The geometry of the systems was well defined in the GATE for each crystal dimension. Scintillation materials which employed as the crystal materials were BGO and LSO with the pixel size of 1.5:0.5:3 millimeters and assessment considered for two crystal thickness of 10 and 15 mm, moreover for accurate simulation 0.2 millimeters Epoxy as their inter crystal material was considered. The FOV for all crystal dimensions and measurements considered 110 mm and an ideal point source with the activity 27 μCi was placed at the center of FOV. The simulation was performed at the 300-650 keV energy window with the assumption of 25% energy resolution.
Results: The sensitivity varies for BGO between % 0.34 and % 0.42 and for the LSO between % 0.19 and % 0.31 when the crystal pixel size increase from 1.5 to 3 millimeters and also by increasing the crystal thickness, the sensitivity of the scanners for all the pixel dimension increased.
Conclusion: The simulation illustrated that BGO based scanners have higher sensitivity than equivalent size of LSO based one, and also by increasing the crystal thickness, the sensitivity of the scanners increased, Due to its higher stopping power more annihilated of 511 keV photons were stopped in the crystal. The results indicate that the GATE Monte Carlo code is a useful tool for investigation of system performance in order to design detection system in small animal PET imaging system.

Keywords: Small animal PET, DHC, GATE, BGO

Thursday
P:Session 1

Nasolacrimal duct obstruction as a complication of iodine-131 therapy in patients with thyroid cancer

Armaghan Fard-Esfahani, Saeed Farzanefar, Babak Fallahi, Davood Beiki, Mohsen Saghari, Alireza Emami Ardakani, Mina Majdi.

Research Institute for Nuclear Medicine, Tehran University of Medical Sciences, Tehran, Iran

Presenter Address: Armaghan Fard-Esfahani, Tehran, Kargar Shomali Ave, Shariati Hospital, Research Institute for Nuclear Medicine, Email: fardesfa@sina.tums.ac.ir

Introduction: I-131 has been widely used in treatment of differentiated thyroid carcinoma for almost 70 years. During this period many complications such as sialadenitis and lacrimal gland dysfunction have been established. This study argues a new complication "symptomatic or asymptomatic nasolacrimal duct obstruction".
Methods: 81 patients (162 eyes) treated with more than 100 mCi I-131 were categorized in 4 groups based on received cumulative dose and were evaluated in a historical cohort study. In addition 17 (34 eyes) age and sex matched persons were selected as control group. Using dacroscintigraphy, patients and control group were evaluated for partial or complete nasolacrimal duct obstruction. The data on different groups of patients were compared with the data of control group. Fisher's exact and Mann-Whitney U tests were applied for analyses of categorical and numeric variables, respectively. The analyses were considered significant with $p<0.05$.
Results: 18% of exposed eyes (29 out of 162) and 9% of control eyes (3 out of 34) had evidences of nasolacrimal duct obstruction on the scan images. Among the patients treated with less than 300 mCi of I-131,12.8% (5 out of 39) had asymptomatic nasolacrimal duct obstruction and 2.6% (1 out of 39) had symptomatic obstruction. These values for patients treated with more than 300 mCi were 19% (8 out of 42) and 35.7% (15 out of 42), respectively. Mean cumulative I-131 dose that lead to nasolacrimal duct obstruction was 429±264 mCi. This value was 273±173 mCi for the patients without obstruction ($p<0.05$).
Conclusion: This study confirms nasolacrimal duct obstruction as a complication of I-131 therapy. The symptomatic form of this complication occurs mainly in cumulative dose more than 300 mCi.

Keywords: Nasolacrimal, Radioiodine therapy, Thyroid cancer

Thursday
P:Session 1

Nuclear medicine in investigations of cerebral hemodynamics and cerebral blood flow regulation

Saeed Samarghandian[1], Mohammad Ali Ghodsi rad[2]

[1] Department of Physiology, School of Medicine, Mashhad University Medical Sciences, Mashhad, Iran.
[2] Department of Nuclear Medicine, Imam Reza Hospital, Mashhad University Medical Sciences, Mashhad, Iran.

Presenter Address: Saeed Samarghandian, Neromolecular medicine, Physiology Department, Mashhad University of Medical Sciences, Mashhad, Iran, Email:SamarghandianS@mums.ac.ir

To maintain adequate cerebral blood flow despite frequent changes in systemic arterial blood pressure and to constantly adjust blood supply to the current metabolic demand dictated by neuronal electrical activity, brain developed a myriad of mechanisms. These are designed to protect central nervous system from fatal consequences of hypoxia and energy deficit and are collectively called “cerebral autoregulation”. Despite years of research mechanisms responsible for regulation of CBF functioning under physiologic and pathologic conditions are still not clear. When these mechanisms are damaged or exhausted, patients life is in danger, as even slight, negligible under normal conditions, systemic hemodynamic disturbances might lead to cerebral infarct. Even perfect imaging of the irreversible brain damage with MR for the particular patient is too late action. Thus, detection of cerebral blood flow disturbances and impaired autoregulation, which are known to be associated with high risk of stroke, are extremely important in clinical practice.
Several methods have been developed to quantify this process and thus evaluate risk of cerebral ischemia and guide therapeutic process. In this article we focus on current knowledge on physiology of regulation of cerebral blood flow, mechanisms responsible for brain damage resulted from cerebral ischemia and noninvasive diagnostic tests to assess cerebral autoregulation.

Key words: Brain, Cerebral circulation, Cerebrovascular reactivity, Autoregulation, Hemodynamics.

Thursday
P:Session 1

Comparison between Gated myocardial perfusion SPECT using QGS software and 2D-echocardiography in assessment of ventricular functional indices

Vahid Reza Dabbagh Kakhki[1], Seyed Rasoul Zakavi[1], Seyed Hashem Danesh-Sani[1], Leila Oskoeian[2]

[1]Nuclear Medicine Research Center, Mashhad university of Medical Sciences, Mashhad, Iran
[2]Department of Cardiology, Imam Reza Hospital, MUMS, Mashhad, Iran

Presenting author: Dr. V.R. Dabbagh Kakhki, Assistant Professor, Nuclear Medicine Research Center, MUMS, Mashhad, IRAN, E-mail: Dabbaghvr@mums.ac.ir

Introduction: Left ventricular systolic functional indices influence the management of coronary artery disease (CAD). Gated myocardial perfusion SPECT(GMPS) allows the computation of left ventricular volumes (ESV & EDV) and ejection fraction (LVEF). Echocardiography is considered to be a routine method for the quantification of these indices. We sought to compare QGS GMPS with 2D echocardiography in the evaluation of LV functional indices.
Methods: 50 patients underwent Rest Tc99m-MIBI GMPS and 2D echocardiography. QGS software was used for computation of LV volumes and LVEF in GMPS.
Results: There was good correlation between GMPS and echocardiography in ESV, EDV and LVEF ($P<0.001$). In patients with small heart (ESV in GMPS$\leq$25 ml) , calculated LVEF using GMPS was significantly higher than echocardiography($p<0.001$).
Conclusion: In patients undergoing diagnostic work-up for CAD, the measurement of LV functional indices GMPS (QGS algorithm) provides high correlation and satisfactory agreement with the results of echocardiography specially in larger LV cavities. The largest discrepancies were observed in patients with small ventricular volumes.

Key words: Echocardiography, GATED SPECT, LVEF, LVEDV, LVESV

Thursday
P:Session 1

^{99m}Tc-RBC liver Scintigraphy: Planar vs. SPECT in liver hemangioma

Vahid Reza Dabbagh Kakhki, Mina Akbari-Rad, Ramin Sadeghi

Nuclear Medicine Research Center, Mashhad university of Medical Sciences, Mashhad, Iran

Presenting author: Dr. V.R. Dabbagh Kakhki, Assistant Professor, Nuclear Medicine Research Center, MUMS, Mashhad, IRAN, E-mail: Dabbaghvr@mums.ac.ir

Introduction: Hepatic cavernous hemangioma (HCH) is the most frequent benign liver lesion, with an incidence of 5-7%. Tc99m-RBC scintigraphy has highest specificity for diagnosis of HCH. However, It has some limitations in small sized lesions due to low resolution of gamma cameras. The purpose of this study was to determine the value and diagnostic accuracy of Tc-99m RBC scintigraphy on SPECT mode in comparison to planar images.
Methods:Planar and SPECT images of 49 patients referred to Department of Nuclear Medicine for Tc999m-RBC scintigraphy were interpreted by two nuclear medicine specialists. All patients were followed up to 2 years.
Results: From 69 HCHs, 37(53.6%) and 61(88.4%) of masses showed increased tracer activity respectively. Mean size of HCHs with increased tracer activity in SPECT, planar, anterior and posterior planar images was 13.37, 23.09, 25.41 and 27.35 mm respectively.Smallest and greatest HCHs were 6 and 189 mm in size, while the smallest HCH that distinguished in SPECT and planar images were 13 and 17.3 mm in size. The sensitivity of planar and SPECT for diagnosis of HCH>10 mm was 56.3% and 93.8% respectively. For HCH>15 mm, these were 61% and 96.6% respectively. Left lobe HCH was better seen on planar images specially on the anterior views. So we need SPECT more frequently in the HCH of the right liver lobes.
Conclusion: The prevalence of HCH in females is more than the males. The sensitivity of the Tc99m-RBC SPECT is more than the Planar images. This difference specially is more prominent in the HCH with 10 to 20 mm in size. We can distinguish HCH>30 mm with planar images, while the sensitivity of the SPECT for 10 to 20 mm HCHs was 80%.

Keywords: Liver hemangioma, Tc99m-RBC scintigraphy, Planar, SPECT

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P:Session 1

Double-phase ^{99m}Tc-MIBI scintigraphy as a predictor response to induction chemotherapy in Osteosarcoma

Vahid Reza Dabbagh Kakhki[1], Mohammad Gharedaghi[2]

[1]Nuclear Medicine Research Center, Mashhad university of Medical Sciences (MUMS), Mashhad, Iran
[2]Department of Orthopedic, Imam Reza Hospital, MUMS, Mashhad, Iran

Presenting author: Dr. V.R. Dabbagh Kakhki, Assistant Professor, Nuclear Medicine Research Center, MUMS, Mashhad, IRAN, E-mail: Dabbaghvr@mums.ac.ir

Introduction: The occurrence of multidrug resistance (MDR), which is in part due to the overexpression of P-glycoprotein (Pgp) and/or MRP, is a major problem in neoadjuvant therapy of osteosarcoma. The aim of this study was to investigate the role of 99mTc-MIBI scintigraphy as a functional imaging for predicting the response to pre-operative chemotherapy. We aimed to compare 99mTc-MIBI uptake and washout kinetics with chemotherapy response.
Methods: Twenty-five patients (12 males and 13 females, aged between 8 and 52 y) with osteosarcoma were studied. Before the chemotherapy planar 99mTc-MIBI anterior and posterior images of the involved area were obtained after 10-min [$(T_1/B_1)_{10min}$] and 3-hr after tracer injection. After completion of chemotherapy, again 99mTc-MIBI scan was performed at 10-min after tracer injection. Decay corrected tumor to background (T/B) ratios were calculated. Using the 10-min and 3-hr images of the pre-chemotherapy scintigraphy, percent wash-out rate (*WR*%) of 99mTc-MIBI were calculated. Using the 10-min images of the pre- and post-chemotherapy scans, the percentage reduction of tumour uptake after treatment (*Rn*%) was also calculated. Then after neoadjuvant therapy, tumour response was assessed by examining the ratio of viable cells and by detecting percent necrosis. Scintigraphic results were compared with therapy response.
Results: All patients showed significant 99mTc-MIBI uptake in early images. Only 9 patients showed good response to chemotherapy (necrosis≥90%) while 16 patients were considered as non-responder(necrosis<90%). There was no statistical significant difference between non-responders and responders in $(T_1/B_1)_{10min}$.There was a significant negative correlation between *WR%* and percent of necrosis(P=0.001). On the other hand, there was a significant correlation between *Rn%* and percent of necrosis(P<0.001).There was also statistical significant difference in *WR%* and *Rn%* between non-responders and responders(both P< 0.001)**.** Areas under the curves of the ROC curves analysis between *WR%* , *Rn%* and good response to chemotherapy were 0.889 (P=0.002) and 0.931 (P<0.001) respectively. No any distant metastasis was found using 99mTc-MIBI scan.
Conclusion: High washout of 99mTc-MIBI in pre-chemotherapy scintigraphy is a useful method for predicting to multidrug resistance. Assessment of wash-out analysis of MIBI using early and delayed images is recommended to predict the response. *Rn%* using pre- and post-chemotherapy MIBI scintigraphy is also useful for assessment of response to chemotherapy.

Keywords: Osteosarcoma, Tc99m-sestamibi, Chemotherapy response, P-glycoprotein, Multidrug resistance.

Friday
P:Session 2

Development of ^{177}Lu-EDTMP as a possible therapeutic complex

Akbar Anvari[1], Seyed Mahmoud Reza Aghamiri[1], Mohammad Ghannadi-Maraghe[2]

[1]Faculty of Nuclear Engineering of Tehran University of Medical Sciences
[2]Radiopharmaceuticals Research and Development Laboratory, Tehran, Iran

Presenter Address: Akbar Anvari, Faculty of Nuclear Engineering of Tehran University of Medical Sciences, Email: anvariz@tums.ac.ir

177Lu-EDTMP complex is proposed as a proper alternatives to other radiopharmaceuticals as the relatively long half-life (T1/2=6.71 days), maximum energy β- particle Eβ-=498keV (78.6%), low abundance gamma emission 208keV (11%), 111keV (6.4%) and easy production are considered advantageous in the wider use of this product. In this study, 177Lu was produced by thermal neutron bombardment on 176Lu2O3 target in the 5MW Tehran Research Reactor. Radionuclide purity of the 177Lu was ascertained by recording the gamma ray spectra using a gamma spectrometer with an HPGe detector. 177Lu-EDTMP complex was prepared at room temperature. The radiochemical purity of the preparation was determined by thin layer chromatography which showed high purity of more than 98% for the resulted complex. The quality control and biodistribution studies of 177Lu-EDTMP were performed in wild-type rats. The result showed favorable biodistribution features of 177Lu-EDTMP, indicating significant accumulation in bone. Also, it was observe that clearance of the activity from other organs happens after 7 days. This research presents 177Lu-EDTMP as a suitable therapeutic radiopharmaceutical with proper half-life and low dose for bone palliation of skeletal metastases.

Keywords: Bone metastases, Lutetium-177, EDTMP, Radiopharmaceutical, Biodistribution.

Friday
P:Session 2

Influence of thyroid volume on energy deposition from I-131 radionuclide

Ali Asghar Mowlavi[1], Mariarosa Fornasier[2], Mario Denaro[2]

[1] Physics Department, Sabzevar Tarbiat Moallem University, Sabzevar, Iran

[2] Servizio di Fisica Sanitaria, A.O.U. Ospedali Riuniti di Trieste, Trieste, Italy

Presenter Address: Ali Asghar Mowlavi , Sabzevar Tarbiat Moallem University, Physics Department, School of Sciences, Sabzevar Tarbiat Moallem University, PO box 397, Sabzevar Iran , E mail: aa_mowlavi@yahoo.com

In this study, we have used the MCNPX code, with full transport of beta and gamma rays, to calculate the influence of thyroid volume on energy deposition from beta and gamma rays of 131I. We have considered the thyroid lobes having an ellipsoidal shape, with a density of 1.05gr/cm3 and the material composition suggested by ICRP. When thyroid gland uptakes radioactive iodine, it is source and target organ at the same time and energy deposition of 131I rays depend on the thyroid volume. We have calculated the total energy deposition for different volumes of thyroid lobe. The results show that total energy deposition has a significant difference, till 11%, when the lobe's volume varies from 1 ml to 25 ml respect to the value presented in MIRDOSE for a 10 gr sphere.

Keywords: Thyroid gland, 131I, Radionuclide, MCNPX Code.

Friday
P:Session 2

Does the breast cancer age at diagnosis differ by ethnicity? A study on immigrant to Sweden

Kari Hemminki[1], Seyed Mohsen Mousavi[1], Jan Sundquist[2], Andreas Brandt[1] .

[1] German Cancer Research Centre (DKFZ), Heidelberg, Germany
[2] Stanford Prevention Research Center

Presenter Address: Kari Hemminki, German Cancer Research Center DKFZ, Im Neuenheimer Feld 280, D-69120 Heidelberg, Germany

Introduction: Age-specific incidence rates for breast cancer in low-risk and high-risk ethnic populations differ by age at which the incidence maximum is reached: around 50 years in low-risk populations and over 60 years in high-risk populations. The interpretation of these differences has been controversial, one line referring to biological differences, second one to cohort effects of rapidly increasing rates in young populations and third one to incomplete registration of cancer in the old.
Methods: The nation-wide Family-Cancer Database was used to analyze standardized incidence ratios (SIRs) and age at diagnosis of breast cancer in female immigrants to Sweden by their region of origin compared to Swedish women matched on birth year and other relevant factors.
Results: We showed first that the SIRs for breast cancer were lower in many immigrant groups compared to Swedes; Turkish women had the lowest SIR of 0.45, followed by Chileans (0.54) and Southeast Asians (0.57). Women from nine regions showed an earlier mean age at diagnosis than their matched Swedish controls, the largest differences being 5.5 years for Turkish, 5.1 years for Asian Arab and other African, 4.3 years for Iranian and 4.0 years for Iraqi women.
Conclusion: The results show that in many immigrant groups the diagnostic age is earlier than in Swedes, suggesting that biological factors underlie the differences. These factors are mainly related to postmenopausal breast cancer and they should explain much of the international variation in breast cancer incidence. Identifying these factors should advance understanding on breast cancer etiology and prevention.

Keywords: Ethnic-differences, Age-incidence, Risk factors, Environmental effect.

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P:Session 2

Monte Carlo study of the effect of collimator thickness on ^{99m}Tc sources responses in SPECT

Jalil Pirayesh Islamian[1], Mohammad Taghi Bahreyni Toosi, Mahdi Momennezhad [2], Seyed Rasoul Zakavi [2],Michael Ljungberg[1]

[1]Physics Faculty of Medicine, Tabriz University of Medical Sciences,Tabriz
[2]Nuclear Medicine Research Center of Mashhad University of Medical Sciences, Faculty of Nuclear Medicine, Imam Reza Hospital.

Presenter Address: Jalil Pirayesh Islamian, PHD, Assistant Professor, Department of Medical PhysicsFaculty of MedicineTabriz University of Medical SciencesTabriz, Iran, Email: pirayeshj@gmail.com

Introduction: In SPECT the collimator is a crucial element of the imaging chain and controls the noise resolution tradeoff of the collected data. The detection of photons in SPECT is seriously affected by collisions of the photons with atoms inside the patient (photon attenuation and scatter), and the inevitable inaccuracy of the collimator used (collimator blurring). The images are also severely degraded because of noise, partly due to the Poisson nature of the photon emission. Accordingly, it is very difficult to obtain high quality and quantitative accurate SPECT images. The lead x-rays, collimator scatter and partial energy deposition in the detector crystal are the effects that contribute to the 99mTc camera down-scatter in the energy range of 100±10%keV or 72±10%.The current study is an evaluation of the effects of low energy high resolution collimator thickness, commonly used in SPECT, on tomographic spatial resolution.
Methods: SIMIND Monte Carlo program was used for simulation of a Siemen's dual-head variable angle scintillation gamma camera and also a related Low Energy High Resolution (LEHR) collimator. For this study a point source of 99mTc and also an acrylic cylindric Jaszczack phantom, with cold spheres and rods, and a NCAT phantom were used. Quantitative and qualitative studies were performed for obtained acquired projections and also reconstructed images.
Results: Results for calculated detector parameters, contribution of Compton scattering, photoelectric reactions, and also peak to Compton (P/C) area in the obtained energy spectrums from scanning of the sources with 11 collimator thickness, ranged from 0.400 to 0.410 cm, were tabulated. The Image quality analyses by SSIM algorithm and also by eye interpretation were provided.
Conclusion: There was a suitable quality and also performance parameters analysis results for the projections and reconstructed images prepared with a 0.405 mm LEHR collimator thickness compared to other thicknesses.

Keywords: SPECT, Phantom, Resolution, Image quality.

Friday
P:Session 2

Nurses role in nuclear medicine team

Rafat Rezapour

Department School of Nursing and Midwifery, Tehran University of Medical Science, Tehran, Iran

Presenter Address: Rafat Rezapour , PHD Nursing Student, Tehran University of Medical Science , Department- School of Nursing and Midwifery-Tehran University of Medical Science, Tohid SQ- Tehran-Iran, Email: sebda50@yahoo.com

The multidisciplinary team, comprising doctors, physicists, pharmacists, radiographers, technologists, nurses and administrative staff contribute to the work in nuclear medicine. The nurse can have a vital role in ensuring effective liaison between staff. Since many in-patients attend Nuclear Medicine, the nurse can be a key point of contact for communication between the wards/units and the department, not only in ensuring the best possible continuity of care for the patients, but also in updating and developing the knowledge of ward nurses and doctors. Key Words: Nurse, Nuclear Medicine, Skills, Roles The Nurse Place in Nuclear Medicine Team Nuclear Medicine Nurses educate patients and their careers in order that they can make informed choices about their investigations and treatment. They educate nursing and medical staff about basic nuclear medicine principles and procedures and support training with supervised practice. They inform other nuclear medicine staff about nursing care such as assessment of patient's condition, pain control and comfort. They train staff to recognize emergency situations such as hypoglycemia, anaphylaxis and problems associated with the critically ill. Nurses working in Nuclear Medicine are often involved in or instigate audit and research in order to assess quality of care provided and where possible improve the way in which procedures are performed. Also Nurses may co-ordinate some sessions or clinics to ensure smooth running and continuity of care. The nurse has an important role in the procedures which are undertaken in Nuclear Medicine. What Skills is required? As Nuclear Medicine departments provide a wide variety of investigations to patients from such a large background, the nurse needs to be aware that the role can be diverse and change quite quickly. The following specific skills are required: • Adaptable to changing situations • Be flexible to meet the needs of patients and procedures. • Good communication skills • Provide support and education to patients and staff. • Ability to learn in a changing and growing specialty. . Many departments have services for adults and pediatrics, therefore an understanding of the needs of pediatrics is important to meet their needs. **Conclusion:** The role of the nurse varies somewhat between departments, so qualifications will depend upon what each specific department expects and desires.

Keywords: Nurse, Nuclear Medicine, Skills, Roles.

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P:Session 2

Comparison of Tc-99m Ubiquicdin(UBI)29-41 and Tc-99m MDP scintigraphy in patients suspected to orthopedic infections before and after antibiotic therapy

Babak Nazari, Zahra Azizmohamadi, Morteza Rajaei, Babak Shafiei, Mohsen Karami, Mohammad Emami, Isa Neshandar Asli.

Nuclear Medicine Department,Taleghani Hospital,Yaman Street, Chamran Highway, Tehran, Iran .

Presenter Address: Babak Nazari , Nuclear Medicine Department- Taleghani Hospital, Yaman st.,Chamran Highway, Tehran, Iran, Email: babak_nazari@yahoo.com

Introduction: anionic microbial cell membrane, at the site of infection. Higher number of viable bacteria in site of infection results in higher UBI accumulation. The current study evaluates the potential ability of Tc-99m-UBI 29-41 to assessment of response to antibiotic therapy in orthopedic infection.
Methods: 12 patient, 10 male and 2 female (mean age 41.6y; rang 23-75y) with suspected orthopedic infection (Bone, soft tissue or prosthesis) and positive UBI scan for infection were included in the study. One day after UBI scan; Bone scan was done as well. 9 of 12 patients underwent appropriate treatment including empirical antibiotics and three patient refuse treatments. After 10-14 day interval all patient divided in two groups: a) Responder to therapy and 2) No responder – None treated with respect to orthopedic specialist judgment. In all 12 patients ESR and CRP and in most of them specimen culture before and after 10-14 day interval was done. 3 patient of 4 non responder – non treated group underwent antibiotic therapy and was evaluated 10-14 day after again. One of these patient responded to recent therapy and two patient not. Thus, 15 cases were evaluated in this study that divided in two groups: a) nine Responder and b) six non responder – none treated.
Results: Quantitative analysis of ESR, CRP and Bone scan before and after 10-14 day interval in two groups show no significantly change, But quantitative UBI scan in 30, 60 &120 minute after tracer injection indicates significantly reduction in tracer uptake after 10-14 day interval compared to UBI scan before this interval in responder group but changes not significant in non responder – non treated group.
Conclusion: Quantitative UBI scan can determine response to antibiotic therapy in orthopedic infection in humans and with conjunction UBI scan and Bone scan we can rapidly diagnose orthopedic infection and determine that bony structure is involved or not.

Keywords: Ubiquicdin(UBI) scintigraphy, MDP scintigraphy, Orthopedic infections.

Friday
P:Session 2

The importance of mild inferolateral wall ischemia on myocardial single photon emission computed tomography (SPECT) with ^{99m}Tc-MIBI using 20 left ventricular segments model

Majid Assadi[1], Alireza Abdi-Ardekani[2], Mohammad Reza Pourbehi[1], Lati Amini[1], Hamid Javadi[2], Moloud Abbaszadeh[1], Mahsan Assadi[1] .

[1]Bushehr Research Center for Nuclear Medicine, The Persian Gulf Biomedical Sciences Institute, Bushehr University of Medical Sciences, Bushehr, Iran
[2]Department of Cardiology, Bushehr University of Medical Sciences, Bushehr, Iran

Presenter Address: Majid Assadi , Bushehr Research Center for Nuclear Medicine, The Persian Gulf Biomedical Sciences Institute, Bushehr University of Medical Sciences, Bushehr, Iran,Email: assadipoya@yahoo.com

Introduction: The mild ischemia in the inferolateral wall on myocardial perfusion imaging was seen frequently in practice .The aim of this study is to assess the importance of the above issue on myocardial perfusion SPECT with coronary angiography.
Methods: All patients with mild ischemia of the inferolateral wall on the myocardial single photon emission computed tomography with 99mTc-MIBI using 20 left ventricular segments model were enrolled to this study. For all cases, a questionnaire including type of chest pain, risk factors and , previous examinations were filled out. Then, all case was follow up for one year. Luminal stenosis of >50% was classified as significant stenosis on coronary angiography. A p value < 0.05 was considered to be statistically significant.
Results: During 2 year investigation, 105 cases had mild ischemia on MPI which 36 subjects (22 male and 14 female) underwent coronary angiography. The mean age was 56 year old (age range ; 36-73 year). In total, 25 cases had stenosis in angiography. Ten cases had stenosis in one vessel, 3 in two vessels and 12 cases had stenosis in three vessels. The inferolateral wall was corresponded to left circumflex territory. Nineteen out of 36 (52.7%) cases had stenosis in LCX. Twenty-three of them (63.9%) underwent revascularization during one year follow up. In multiple logistic regressions with LCX stenosis on angiography as dependent variable, we observed that only the abnormal MPI was independently associated significantly.
Conclusion: The findings of the study may indicate that even mild perfusion defect in the inferolateral wall especially in high risk subjects for coronary artery disease should be carefully managed.

Keywords: Mild inferolateral ischemia, SPECT, Myocardial perfusion imaging.

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High prevalence of silent ischemia in asymptomatic type II Diabetic patients using myocardial perfusion imaging

Mozhdeh Nasiri Ahmadabadi, Mohammad Reza Pourbehi, Majid Assadi

Bushehr Research Center for Nuclear Medicine, The Persian Gulf Biomedical Sciences Institute, Bushehr University of Medical Sciences, Bushehr, Iran.

Presenter Address: Mozhdeh Nasiri Ahmadabadi, Bushehr Research Center for Nuclear Medicine, The Persian Gulf Biomedical Sciences Institute, Bushehr University of Medical Sciences, Bushehr, Iran.

Introduction: myocardial perfusion single-photon emission computed tomography (SPECT) has been extensively applied in the clinical assessment of patients with diabetes mellitus. The aim of the present study was to evaluate stress technetium-99m sestamibi SPECT MPI perfusion in silent myocardial ischemia and its association with some clinical and laboratory parameters in an asymptomatic diabetic population. Material and .

Methods: 83 subjects (age: 57.1± 6.9 years) with at least 5 years history of type 2 diabetes, and no suspected or documented coronary artery disease (CAD) accomplished myocardial perfusion imaging; angiography was also performed in patients with abnormal MPI.

Results: MPI results showed that 58 patients had normal myocardial perfusion, while 25 cases showed perfusion defects (23 reversible and 2 fixed) on MPI. Twelve out of the 25 (48%) abnormal MPI findings represented abnormal angiography. We observed that pretest likelihood of CAD (odds ratio =2.32; 95% CI: 1.05-5.13; p = 0.038) and higher HbA1c level (odds ratio= 1.70; 95% CI, 1.07- 2.71; p = 0.02) were independently associated with abnormal MPI.

Conclusion: Occult CAD was frequently present on MPI in patients with DM without abnormal electrocardiographic findings or evidence of peripheral arterial disease**.**

Keywords: MPI, Diabetes, Silent Ischemia.

Friday
P:Session 2

DHC-PET ^{18}F-FDG brain scintigraphy in tinnitus patient, the first experience of FDG images in Iran

Fariba Saddadi[1], Sedigheh Moradkhani[2]

Iran Imaging Group, Iran University of Medical Sciences, Tehran, Iran

Presenter Address: Fariba Saddadi**,** Nuclear Medicine Specialist, Saadatabad Ave,16th Street, No 24 First Floor,Tehran, Email: dr_fsaddadi@yahoo.com.

Introduction: Brain FDG PET scan is ideal for assessment of some brain disease. Iran, cause of some problem, has no experience of PET yet but 3 years ago the first FDG imaging was started in cooperation with a national research group from ENT and Head & Neck Research Center, Iran University of Medical Sciences which their main goal is to evaluate treatment response of patients with tinnitus to gabapantine and to find any brain changes as a document. They came to us to nuclear medicine department of atomic energy organization of Iran to do scan in two periods of time as pre and post treatment.
Methods: The interesting part of this research for our department which made us to involve is two things, first to assess the efficiency of FDG that produced in the first time in cyclotron and the second to test DHC system for brain PET image. Although we did both SPECT and FDG PET scan for almost 65 subjects with DHC system but only PET images is our mandatory focus at least for our department. With FDG images data they found that Brain PET scan can be valuable imaging technique in the assessment of patients with tinnitus which Characteristics of abnormalities depend on age and side of tinnitus.
Results: We found that although the DHC-PET scan has not as good quality as real ring PET but it still can work.
Conclusion: The more disadvantage and in the other word the limitation of this system is the lower resolution and more attenuation of DHC which is a defect for this system to assess the sub-cortical tissue and to evaluate the small lesion in brain and the other one is a weak anatomical mapping which needs a precise fusion of those image with MRI.

Keywords: Brain, FDG, PET

Friday
P:Session 2

An accurate model base on Monte Carlo for simulation of converging collimator in nuclear medicine

Hamidreza Baghani[1], Alireza Kamali Asl[2]

Presenter Address: Hamidreza Baghani , Phd Student,Email: hamidreza.baghani@gmail.com.

Introduction: Converging collimator has special application in nuclear medicine. Converging collimator are used primarily with cameras having large-area detectors to permit full utilization of the available detector area for imaging of small organs such as thyroid. Because of inherent magnification of converging collimator, it can provide higher image quality of small objects. Accurate spatial resolution and efficiency Measurement of this collimator, therefore, can have significant role in design and development of these collimators. The aim of this research is accurate modeling of converging collimator for surveying of spatial resolution and efficiency as a function of axial distance from collimator face by Monte Carlo code.

Methods: A simplified model of converging collimator based on an actual model was simulated by MCNP Monte Carlo code. The spatial resolution was measured in 2cm, 5cm, 8cm and 10 cm from collimator face. The efficiency was also measured in 1cm, 2cm, 3cm, 4cm and 5cm from collimator face.

Results: From the results, the spatial resolution of the system (MTF=0.1) increased from 2.15 cycle/cm at axial distance of 2 cm to 1.05 cycle/cm at axial distance of 10 cm. (1.75 and 1.4 cycle/cm at axial distances 5 and 8 cm, respectively). The efficiency of the system at mentioned axial distances increased from 8.9E-5 to 7.97E-4. In addition, the results of this simulation have acceptable accordance with prior analytic results in this field that can validate simulated system.

Conclusion: From results of simulation one can deduce that spatial resolution of this collimator will decrease with increase in axial distance from collimator face. Because of magnification effect, rate of spatial resolution reduction in axial distance is lesser than parallel hole collimator. Thus, this feature of converging collimator provides better image quality in nuclear images at expense of decreased field size. The efficiency of these collimators has a direct proportion with axial distance from collimator face and improved with increasing distance. Thus, a design of a collima¬tor that provides both high spatial resolution and acceptable efficiency has noticeable importance.

Keywords: Converging collimator, Spatial resolution, Efficiency, Monte Carlo simulation.

Friday
P:Session 2

New method for automatic preparation and evaluation of [^{111}In]-Oxinate complexes as imaging agents by programming logic control (PLC)

Abbas Bahrami, Mohammad Mirzaii, Yousef Fazaeli, Ali Rahiminejad-kisomi, kamran Yousefi-Mojir, Koroush Aghighi

Nuclear Medicine Research Group, Agricultural, Medical and Industrial Research School (AMIRS), Karaj, Iran

Presenter Address:Abbas Bahrami, MSc, Nuclear Medicine Research Group, Agricultural, Medical and Industrial Research School (AMIRS), Karaj, Iran, P.O.Box: 31485-498 , Email: bahrami@nrcam.org

Introduction: The interesting physical assets and accessibility of indium-111 make it an engrossing radioisotope for radiopharmaceutical research [1-2]. The increasing trend in the production and use of PET radionuclides in nuclear medicine has offered new opportunities for researchers to focus on new methods for production of radiopharmaceuticals for their future PET radio nuclides. In this way, automation and use of computers,PLCs, sensors, electronic boards are favor to manual production line and so our aim is to develop the present AMIRS' production line of Indium-111 oxyquinoline by PLCs. Key words: [111In]-Oxinate, imaging agents, Automatic Preparation,PLC

Methods: Indium-111 oxyquinoline (oxine) is a diagnostic radiopharmaceutical intended for radio labeling autologous leukocytes.[111In]-Oxinate is the Agricultural, Medical and Industrial Research School (AMIRS) product that supplied as a sterile, non-pyrogenic, isotonic aqueous solution with a pH range of 6.5 to 7.5. The radionuclide impurity limit for indium 114m is not greater than 37kBq, per 37 MBq, of indium 111 at the time of calibration. All steps of the process were carried out manually and hence it increases the risk of human mistakes. In this work, the Indium-111 oxyquinoline production line is redesigned by using mini Logo PLC to decrease the role of human operating to produce medical drugs in a precision and repeatable manner.

Results: By means of PLC's total production it minimizes radiation exposure to production line personnel and minimum adequate shielding of the preparation that must be maintained at all the production time. Accurate amounts of HBr are used and so the final products have accurate PH as programmed in PLCs.

Conclusion: This study was conducted to investigate and illustrate the use of PLC's in production of [111In]-Oxinate Complexes as imaging agents. Through the automatic production we obtain high quality radiopharmaceutical with low cost and minimum waste produced.

Keywords: PLC, Automation, 111In

Friday
P:Session 2

Improving the packaging and transportation of Tl-201 and Ga-67 radiopharmaceuticals for imaging and therapy centers

Abbas Bahrami[1], Mohsen Kiyomarsi[1], Fatemeh Bolourinovin[1], Behnaz Piroozfar[1], Abbas Rahimi[2]

[1]1Nuclear Medicine Research Group, Karaj, Iran
[2] Nuclear Science and Technology Research Institute, Tehran, Iran

Presenter Address: Abbas Bahrami , MSc, Nuclear Medicine Research Group, Agricultural, Medical and Industrial Research School (AMIRS), Karaj, Iran, P.O.Box: 31485-498, Email: bahrami@nrcam.org

Introduction: Radiopharmaceuticals, drugs whose molecular composition includes a radioactive isotope, are extremely important in the diagnosis and treatment of disease. Handling radiopharmaceuticals presents health concerns, not only for patients, doctors, and nurses, but also for production and transportation personnel and the general public. Our aim is to impediment IAEA standards procedure and to minimize exposure. In this work we improve the packaging and transportation system of Tl-201 and Ga-67 radiopharmaceuticals for Imaging and Therapy Centers.
Methods: The packaging which was designed at the Nuclear Science and Technology Research Institute had passed all the standard quality control tests by the National Radiation Protection Department (NRPD) and approved as type A radioactive packaging. These packaging are white buckets with light preservative polymer as holder of lead shield containing radiopharmaceutical vial. The packages are marked with a yellow II category label which includs the type of radiopharmaceutical, the activity and transport index (TI). The second label on the top of package includes the name and address of consignor, consignee and the activity of radiopharmaceutical.
Results: The radiopharmaceutical production and distribution process must balance health, economic, and safety concerns. This paper proposes a method for evaluating current and proposed patterns in the radiopharmaceutical transportation. The benefit of this packaging system is the minimum exposure to personnel (the average doses rate by the buckets are 1.97 µ Sv/h for Tl-201 and 43.6 µ Sv/h for Ga-67 respectively, which is less than 2 mSv/h, the standard given by IAEA[1].
Conclusion: By applying Regulations for the safe Transport of Radioactive Material, in addition the reduction of surface contamination and increasing the satisfaction of consignee, it will open the way to export radiopharmaceutical. References 1. IAEA " Regulations for the safe Transport of Radioactive Material",S.S No.ST, 1996

Keywords: Radiopharmaceuticals, Safe transportation, Type A packaging

Friday
P:Session 2

Preparation and biological evaluation of ^{153}Samarium-maltolate compound

Zohreh Naseri[1], Amir Reza Jalilian[2], Ali Nemati Kharat[1]

[1]Department of Chemistry, University of Tehran, Tehran, Iran.
[2] Nuclear Science and Technology Research Institute, Atomic Energy Organization of Iran, Tehran, Iran

Presenter Address: Zohreh Naseri, P.H.D, Student of University, Tehran, Enqelab squre, University of Tehran, Faculty of Science, Department of Chemistry, Labratory of Dr.Nemati, Email: zo_naseri@yahoo.com

Introduction: Sm-153 has found widespread use in nuclear medicine. It has favorable radiation characteristics, such as the medium-energy beta particles emission (Emax = 810 keV) which is desirable for treatment, the medium-energy gamma photon (103 keV) which is suitable for imaging and dosimetry measurement and the short half-life (46.3 h). Both emissions allow to use Sm(III) complexes as therapeutic radiopharmaceutical and to follow the distribution of the radionuclide in vivo. Maltol (3-Hydroxy -2-methyl-4-pyron) is produced by some plants and is commonly formed when sugars are heated. Maltol loses its hydroxyl proton from neutral to basic pH levels, forming the Maltolate anion; this anionic molecule forms a strong bidentate chelate with gallium, as well as with iron, zinc, aluminum, vanadium, and many other metals.
Methods: Production of 153Sm was performed at the Tehran Research Reactor (TRR) using 152Sm (n, gamma) 153Sm nuclear reaction. Radiochromatography was performed by counting of Whatman No. 2 using a thin layer chromatography scanner. Gama-Spectroscopy on the base of 103 keV peak was carried out by using the HPGe. 153Sm-Maltolate was produced using 153Sm-SmCl3 and was purchased Maltol in 2h at 60°C. The analytical data for the structure determination and purity of the compound was obtained. The Radiochemical purity of 153Sm-Maltolate was checked by RTLC. Also the biodistribution of 153Sm-Maltolate in normal rat was checked.
Results: The radiolabeled Sm complex was prepared in high radiochemical purity (>90%, RTLC). In this study, at first stability test was done in normal saline and then checked by RTLC. For investigation of biodistribution in different tissues and comparing with free Sm, SmCl3 and labeled compound were injected to the tail vein of the rat normal tissues, then absorption dose was determined.
Conclusion: RTLC test results show that this complex synthesize with high percentage (radiochemical purity (>90%)), and the biodistribution of 153Sm-Maltolate in the normal tissues of rat show that it has high value in lymphoma tissues (Lung, Liver, Spleen and Sternum), especially in liver respect to the other tissues. Also its stability in normal saline is high.

Keywords: Sm-153, Maltol, RTLC, Radiopharmaceutical, Therapy.

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P:Session 2

Preparation and quality control of ^{177}Lu-DOTA-anti-CD20 for Radio immunotherapy

Hassan Yousefnia, Amir Reza Jalilian , Samaneh Zolghadri, Simindokht Shirvani-Arani, Ali Bahrami-Samani, Mohammad Ghannadi-Maragheh[1], Mohammad Ghannadi-Maragheh .

Radiopharmaceutical Research & Development Laboratory (RRDL), Nuclear Science & Technology Reaserch Institute (NSTRI),Tehran, Iran.

Presenter Address: Hassan Yousefnia, Radiopharmaceutical Research & Development Laboratory (RRDL), Nuclear Science & Technology Reaserch Institute (NSTRI),Tehran, Iran. P.O.Box: 14155-775, Email: hasan_usefnia@yahoo.com

Introduction: The importance of existence and application of radiolabeled anti-CD20 monoclonal antibodies at nonmyeloablative doses in treating B-cell NHL is well recognized throughout the world. In this work, Rituximab was successively labeled with 177Lu-lutetium chloride.
Methods: Lu-177 chloride was obtained by thermal neutron flux (4 × 1013 n.cm-2.s-1) of natural Lu2O3 sample with a specific activity of 2.6-3 GBq/mg. The macrocyclic bifunctional chelating agent, N-succinimidyl-1,4,7,10-tetraazacyclododecane-1,4,7,10-tetraacetic acid (DOTA-NHS) was prepared followed by conjugation. The radioimmunoconjugate was analyzed for integrity by SDS-polyacrylamide gel electrophoresis (SDS-PAGE). Stability of 177Lu-DOTA-rituximab in PBS was determined by storing the final solution at 4°C for 14 days and performing frequent ITLC analysis to determine radiochemical purity followed by administration to wild-type rats for biodistribution studies.
Results: DOTA NHS reaction is performed at room temperature and can be done overnight. High uptake in spleen and reticoloendothelial organs was observed. At all time intervals post injection, the activity is mainly removed from the blood which is in agreement with the other reported labeled antibodies. Likewise other radiolabeled proteins the labeled antibody is accumulated in the liver. As a natural reaction to the depletion of the lymphocytes the reticulloendothelial system including spleen will be the final possible reservoir of the depleted lymphocytes
Conclusion: [177Lu]-DOTA-rituximab is potential radioimmunotherapeutic agent for B-lymphoma treatment.

Keywords: Lu-177 anti-CD20, Targetted therapy, Biodistribution

Friday
P:Session 2

Production, quality control and bodistribution studies of labeled (ethylenediamine tetra (methylene phosphonic acid) with thulium-170.

Simindokht Shirvani-Arani

Radiopharmaceutical Research and Development Laboratory (RRDL), Nuclear Science and Technology Research Institute (NSTRI)

Presenter Address: Simindokht Shirvani-Arani, PHD, Radiopharmaceutical Research and Development Laboratory (RRDL), Nuclear Science and Technology Research Institute (NSTRI), Email: smshirvani@aeoi.org.ir

Introduction: Thulium-170 [T1/2=128.4 days, Eβ(max)=968 keV, Eγ=84 keV (3.26%)] has radionuclidic properties suitable to be used -in combination with phosphonic compound such Ethylenediamine tetra (methylene phosphonic acid) (EDTMP)- in palliative therapy of bone metastases as an alternative to 89SrCl2. In the case of thulium-170, requirement for an enriched target does not arise and radionuclidic impurities are not formed by radiative capture during neutron activation**.**
Methods: In this study 170Tm was produced using Tm (NO3)3, prepared by neutron activation (3-4 × 1013) of a natural sample with a radio-nuclidic purity of >99.99% (RTCL, DTPA 1mM and Whatman3MM as stationary phase). EDTMP was synthesized by following a Mannich-type reaction and radiolabeled with 170Tm. Complexation parameters were optimized to achieve maximum yields (>99%). The Radiochemical purity of 170Tm-EDTMP was checked by RTLC and ITLC. It was found to retain its stability at room temperature even after 2 months of preparation (> 95%). Biodistribution studies carried out in wild-type rats for both free 170Tm cation and the complexed ion with EDTMP.
Results: It was observed that complexation gradually increased with increase in ligand concentration and reached to ~ 100% at a ratio of [ligand]/[metal] ~ 20:1. The in vitro stability studies were performed by incubating the complex at room temperature and showed that the radiochemical purity of the complex remained >95% up to 2 month after preparation. A volume of 50-100 ml containing 180±5 mCi of radioactivity was injected through a lateral tail vein. The animals were sacrificed at the exact intervals of 2, 4, 24 and 48 h, and one and two month post injection. Based on these results, it was concluded that the major portion of injected activity was extracted from blood circulation into bones. Serial scintigraphic images were recorded at 2h, 4h, 24h and 48h post injection (pi) for free 170Tm and also at 2h, 48h and 1w pi for 170Tm-EDTMP injected to the rats, by a single-head SPECT system (Siemens) based on 84 keV peak.
Conclusion: The produced 170Tm-EDTMP properties suggest applying a new efficient bone pain palliative therapeutic agent in the country instead of some other in use radiopharmaceuticals, such as 89SrCl2 and 32P, in order to overcome the metastatic bone pains.

Keywords: Thulium-170, Bone pain, Palliatives, EDTMP

Friday
P:Session 2

Production of ^{177}Lu and formulation of EDTMP kits as a bone-Seeking radiopharmaceutical

Fariba Johari Daha, Mohammad Hossein Babaei, Mohammad Shafiei, Shahab Sheybani

Nuclear Science & Technology Research Instiute, Atomic Energy Organization of Iran, Tehran, Iran.

Presenter Address: Fariba Johari Daha, Nuclear Science & Technology Research Instiute, E mail: fjohari@aeoi.org.ir

Introduction: Owing to its favourable decay characteristics 177Lu [T1/2= 6.71 d, Eβ(max)= 497 keV] is an attractive radionuclide for various therapeutic applications. Ethylene diamine tatramethylene phosphonate (EDTMP) is one of the most widely used ligands which form stable complexes with various radionuclides and all the complexes.

Methods: Enriched 176Lu2O3 was dissolved in 0.1 N HCl and evaporated several times and 176LuCl3 target was irradiated at 2.6×1013 n.Cm-2.S-1 thermal neutron flux for 14 days.177LuCl3 was dissolved in 1N HCl. EDTMP was dissolved in double distilled water at pH=7.5-8.5 and freeze-dried kits was radiolabeled with 177LuCl3. Distribution studies were done in healthy mice.

Results: The yield of 177Lu was (~220 TBq/g; 6000 Ci/g), the radionuclidic purity was ~99%.The radiolabeling yield of EDTMP kits at 37°C after 30 min and 4 hours was 98±0.5% and after 72 hours was 90±2.1%, the in vitro stability in human serum at 37°C up to 72 hours post radiolabeling was 85±1.8%.The biodistribution studies of 177Lu-EDTMP and 177LuCl3 in normal mice showed skeleton uptake and low soft-tissue concentration.

Conclusion: 177Lu has got very good potential as a therapeutic radionuclide. The present study shows ~220 TBq/g (6000 Ci/g) of 177Lu. Our results showed 177Lu-EDTMP as a bone-seeking radiopharmaceutical. Due to its suitable nuclear characteristics 177Lu appears to be worthwhile for palliative therapy of bone metastasis.

Keywords: EDTMP, Bone seeking radiopharmaceuticals, 177Lu.

Friday
P:Session 2

Preparation and preliminary biological evaluation of ^{177}Lu-labeled hydroxyapatite particles with PEG-6000 as a promising agent for radiation synovectomy of small joints

Fariba Johari Daha, Mahyar Roshani, Shahab Sheybani, Mohammad Mazidi, Yaser Hossein Tavakol

Nuclear Science & Technology Research Instiute, Atomic Energy Organization of Iran, Tehran, Iran.

Presenter Address:Fariba Johari Daha, Nuclear Science & Technology Research Instiute, Atomic Energy Organization of Iran, Tehran, Iran, Email: fjohari@aeoi.org.ir

Introduction:177Lu is considered to be a promising radionuclide for use in radiation synovectomy of small-sized joints.
Methods: Enriched 176Lu2O3 was dissolved in 0.1 N HCl and 176LuCl3 target was irradiated at 2.6×1013 n.Cm-2.S-1 thermal neutron flux for 14 days.177LuCl3 was dissolved in 1N HCl. The radionuclidic purity of the radioisotope was confirmed by Gamma spectroscopy. Hydroxyapatite [Ca10(PO4)6(OH)2] particles are regarded as one of the most suitable carriers for application in radiation synovectomy with 177Lu.
Results: Labeling yield up to 100% could be achieved at pH=7, with 5 mg of HA particles and 1% w/v PEG6000 and 1mCi of 177Lu.The high labeling yield and good stability of the 177Lu labeled particles indicated that these particles could be applyed for radio synovectomy after obtaining satisfactory biodistribution results. The biological efficacy of the radiolabeled preparation was tested by biodistribution after injecting the agent in both normal and arthritic knee joints of Rats (Rattus Norvegicus Albinus).
Conclusion:177Lu has got very good potential as a therapeutic radionuclide. The present study shows 220 TBq/g (6000 Ci/g) of 177Lu. Our results showed 177Lu-HA particles with PEG-6000 as a satisfactory agent in radio synovectomy, due to its suitable nuclear characteristics. 177Lu appears to be worthwhile for digital joints.

Keywords : Radiosynovectomy, Hydroxy apatite, Lutetium-177.

Friday
P:Session 2

Production and evaluation of Lutetium-177 Maltolate as a possible therapeutic agent

Amir Hakimi[1], Amir Reza Jalilian[2], Simindokht Shirvani Arani[2], Ali Bahrami Samani[3], Mohammad Ghannadi Maragheh[2], Azim Arbabi[4]

[1] Islamic Azad University, Science and research Unit, Tehran, Iran
[2] Radiopharmaceutical Research and Development Lab (RRDL), Tehran, Iran
[3] School of chemistry
[4] Shahid Beheshti University, Tehran, Iran

Presenter Address: Amir Hakimi, Islamic Azad University, Science and research Unit, Tehran, Iran , Email: amir_1985us@yahoo.com

Introduction: Development of oral therapeutic radiopharmaceuticals is a new concept in radiopharmacy. Due to interesting therapeutic properties of 177Lu and antineoblastic activity of maltolate (MAL) metal complexes, 177Lu-maltolate (177Lu-MAL) was developed as a possible therapeutic compound for ultimate oral administration. Materials and

Methods: The specific activity of 2.6-3 GBq/mg was obtained by irradiation of natural Lu2O3 sample with thermal neutron flux of 4 × 1013 n.cm-2.s-1 for Lu-177. The product was converted into chloride form which was further used for labeling of maltol (MAL). In optimized conditions a radiochemical purity of about 100% was obtained for 177Lu-MAL shown by ITLC (Specific activity, 970-1000 Mbq/mmole).

Results: The stability of the labeled compound was determined in final solution up to 24h as well as the partition coefficient determination. Biodistribution studies of Lu-177 chloride, 177Lu-EDTMP and 177Lu-MAL were carried out in wild-type rats comparing the bone uptake among 3 species.

Conclusion: Lu-MAL is a possible therapeutic agent in human malignancies and/or bone palliation therapy so the efficacy of the compound should be tested in various animal models.

Keywords: Maltolate, Lu-177, Biodistribution, Radiolabeling

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P:Session 2

Production, quality control and biodistribution studies of ^{166}Ho-EDTMP therapeutic radiopharmaceutical

Reza Bagheri[1], Ali Bahrami-Samani[2], Simindokht Shirvani-Arani[2], Mohammad Ghannadi-Maragheh[2]

[1] Nuclear Engineering and Physics, Amirkabir University of Technology, Tehran -Iran
[2] Radiopharmaceuticals Research and Develop Laboratory, Tehran, Iran

Presenter Address: Reza Bagheri, Facuilty of Nuclear Engineering and Physics, Amirkabir University of Technology, P.O. Box: 15875-4413, Tehran-Iran, Email: reza_bagheri@aut.ac.ir

Introduction: Bone metastases are a frequent complication of cancer that frequently causes intense pain. Pain palliation of these cancers is one of important goals in nuclear medicine. Therapeutic radiopharmaceuticals are widely used to palliate pain of bone metastases. Among some radiopharmaceuticals which are useful for radiotherapy, holmium-166 ethylenediamine-tetramethylenephosphonicacid (166Ho-EDTMP) is of particular interest for larger tumors. 166Ho is a beta and gamma emitter with a high beta energy and appropriate half-life and gamma ray (81 keV) for imaging studies**.**
Methods: 166Ho was prepared by neutron activation of natural 165Ho sample (purity > 99/8%) and complex was obtained in room temperature by adding EDTMP ligand. In this research radiochemical purity was checked by paper chromatography and radionuclidic purity by recording the gamma ray spectra using a gamma spectrometer with an HPGe detector. The biodistribution studies of radiopharmaceutical, then was performed using wild type rats. In addition, the image was taken at 4 hours after administration of the radiopharmaceutical by a dual-head SPECT system.
Results: 166Ho-EDTMP was prepared in excellent purity (above 99% in 30 minutes) and with high in-vitro stability. The major deposition of radiopharmaceutical (>70%) was found in bone, while radiopharmaceutical did not practically accumulate in other organs.
Conclusion: 166Ho-EDTMP is a promising agent for bone pain palliation therapy in skeletal metastases in human with low undesired dose to other organs in rodents.

Keywords: Bone metastases, 166Ho-EDTMP, Radiopharmaceutical, Biodistribution.

Friday
pSession 2

Dental implants artifacts and PET/CTimages

Masume Johari

Tabriz University of Medical Sciences, Tabriz, Iran

Presenter Address: Masume Johari, Tabriz University of Medical Sciences,E-mail: dr_masume@yahoo.com

PET/CT imaging is particularly performed for diagnosis and staging of head and neck malignancies. The x-ray attenuation coefficient based on computed tomography (CT) images is used for attenuation correction in PET/CT. A CT-based attenuation correction method can generate artifacts. The findings of Shimamoto and Goerres studies confirmed that the dark streak artifacts of the CT (underestimation of radioactivity of accumulated tracer), may cause false negative finding of PET/CT in detecting small tumor in oral cavity. However these artifacts can be reduced by using an appropriate algorithm. The algorithm suppresses streak artifacts, thereby decreasing the HUs in areas where these values have been overestimated and increasing the HUs in areas where they have been underestimated. The results of Nahmias et al study, demonstrated that the metallic artifact reduction algorithm can enhance the structural and spatial content of CT images in the presence of metallic artifacts. Also, they have found that the considerable changes in CT images do not change the PET images. In PET/CT images of head and neck area, the dental artifacts and reduction of them should be considered.

Keywords: PET/CT, Dental implant, Artifacts.

Friday
P:Session 2

SPECT imaging quality improvement and de-noising of [^{67}Ga]-β-HCG in normal rats with using WAVELET transformations

Mohamad Reza Khoshdel[1], Amir Reza Jalilian[2], Babak Ebrahimi[1]

[1] Islamic Azad University
[2] Nuclear Medicine Research Group, Agricultural, Medical and Industrial Research School (AMIRS), Karaj, Iran

Presenter Address: Mohamad Reza khoshdel, Nuclear Medicine Research Group, Agricultural, Medical and Industrial Research School (AMIRS), Karaj, Iran ,Email: M.R.KHOSHDEL@GMAIL.COM

Introduction: The functional information and precise physiological uptake of radioactivity would be provided by SPECT imaging in a patient's body. But the low signal to noise ratio (SNR) due to photon noise is the weak point of SPECT. The noise may influence image quality, and cause the mistake of clinical interpretation. This paper presents a study on the quality improvement and Noise reduction of gamma camera and SPECT images by Wavelet denoising technique for animal study.in the other hand there is a study about biodistribution of 67Ga-DTPA-hCG by the SPECT imaging in body of the wild type rats.
Methods: By doing variety of wavelets and getting the CV and SNR images and comparing them together , we will catch the best wavelets and parameter and results due to use them in nuclear medicine studies as we keep the resolution and contrast but reduce CV in the region of interest of SPECT images.
Results: Images clearly shows us that we can have the excellent denoising by wavelet transforms and the edges of them some how is clearer than past , although after de-noising with low pass filters the contrast of images become lower .counters shows us result of de-nosing by wavelets is much better than low pass filters and wavelet reforms the curve of line better.
Conclusion: SPECT images of 67GA-DTPA-hCG demonstrated significant gonadal uptake at 24 hours both in agreement with the biodistribution studies and reported -HCG receptors . as we know one the major problem in medical imaging is having noise in the images . comparing the results of wavelets and low pass filters in SPECT images , we got that de-noising by wavelet transform is more effective than doing low pass filters .as the methods of de-noising by wavelets, maintained the contrast and reduce the Coefficient of variation and increasing the signal to noise ratio significantly . consequently , wavelet transformer is one of the efficient tools for de-noising in nuclear medicine imaging . so using wavelet transforms for de-noising SPECT images is completely practical and improve the quality of images .

Keywords: Radiolabeled HCG ,WAVELET denoising, SPECT.

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P:Session 2

Evaluation of prevalence and patterns of bone metastases in locally advanced breast Cancer patients

Fatemeh Homaei, Fatemeh Nosrati, Mohammad Afshari

Cancer Research Center, Mashhad University of Medical Sciences, Mashhad, Iran

Presenter Address: Fatemeh Homaei, Cancer Research Center, Mashhad, Iran, E.Mail:HomaeeF@mums.ac.ir

Introduction: According to routine clinical observations, Iranian breast cancer patients refer with advanced stages and skeletal system is the most common site of metastases, among them Objective: This study is aimed to evaluate the frequency and patterns of bone metastases in new locally advanced breast cancer patients, before treatment. Materials and

Methods: A descriptive study was done on 30 patients with locally advanced Breast cancer (all T4,T3,N1,N2,N3) retrospectively, referred to Ghaem hospital from 2005 to 2010. In all patients result of Bone Scan, X-Ray imaging, tumor markers (CEA,CA15-3)and serum ALP enzyme were collected.

Results: The mean age of patients was 47.8y. Bone metastases were found in 6 (20%) patients. The most common sites of bone involvement were lumbar and thoracic vertebrae and Ribs respectively. In patients with positive bone scan, 5 (83%) patients have X-Ray abnormalities, 4 (66%) patients have raised tumor markers, all (100%) patients were menopause, all (100%) patients have ductal carcinoma pathology, and none of patients have raised Alp.

Conclusion: Frequency and patterns of bone metastases in locally advanced breast cancer among our patients were similar to most of other studies, which occurred in the world.

Keywords: Bone metastases, Breast cancer, Bone scan.

Friday
P:Session 2

Establishing of quality assurance system in Karaj cyclotron

Ali Sattari, Mohammed Reza Aboudzadeh, Kamran Yousefi

Nuclear Medicine Research Group, Nuclear Science and Technology Research Institiute, Atomic Energy Organization of Iran, Tehran, Iran

Presenter Address: Ali Sattari, Pharm.D, Radiopharmacist, Nuclear Medicine Research Group, Nuclear Science and Technology Research Institiute, Atomic Energy Organization of Iran, Email:asattari@nrcam.org

Introductions: In this article the efforts on establishment of QC and QA on produced radiopharmaceuticals at Agriculture, Medicine and Industry Research School is explained.
Methods: From 1994, when the first radiopharmaceutical was produced, production of medical radioisotopes was gradually expanded, until now which is six radioisotopes contain; Tl-201, Ga-67, In-111, Kr-81m, F-18 and I-123 produce. In 1997 production of 18FDG was begun which enables to perform PET examination. Quality control tests on produced radiopharmaceuticals according to European Pharmacopeias have been performed by QC group. Due to increasing regulation and standards imposed by EP and USP, continuous upgrading of QC procedures and methods has been started. Mean time the department was received the ISO 9001-2000 RW-TÜV certificate. Surveillance of the dispatched radiopharmaceuticals is organized by QA.
Results and Conclusion: These efforts were programmed to establishment of some GMP criteria on radiopharmaceutical production, although all activities for receiving the GMP still continue. Clear definition of the responsibilities for different aspects of production, quality control and quality assurance has established. In this direction several activities by support of IAEA in the form of TC projects, experts' missions and training of staff have been performed. This efforts summarized on appropriate and adequate laboratories equipments, validation, consistency, accuracy and precision in QC tests, safety, strength, identity of productions, and building facilities, documentation and record of history .

Keywords: QA, QC, ISO.

Friday
P:Session 2

Three gamma PET, a new imaging modality

Amir Hakimi[1], Maryam Ghazi Zahedi[2], Nikta Jalayer[1], Dariush Sardari[1]

[1] Islamic Azad University, Science and Research Unit, Tehran, Iran
[2] School of Physics, Islamic Azad University, Tehran, Iran

Presenter Address: Amir Hakimi, Master of Science, Islamic Azad University, Science and research Unit, Tehran, Iran, Email: amir_1985us@yahoo.com

Introduction: PET is a technique for measuring the concentrations of positron-emitting radioisotopes within the body by registering the emitted annihilation radiation. At present, the basic process employed in PET is the annihilation of the emitted positron an electron that results in two almost co-linear gamma-photons travelling in opposite directions, each with 511 keV energy. In the conventional PET decay events are just localized in space and counted, but no other characteristics of the annihilation radiation is explored. Recently it has been shown, that extra information could also be obtained in PET by registering the annihilations into three photons. In spite of the relative rareness of positron annihilation into three photons, it may still be exploited to develop a new imaging modality. Although the rate of 3gamma decays is small, the positioning information conveyed by a single event is much larger than in the case of two gamma, so the total information gained from three gamma may be significant.
Methods: Three high resolution detectors arranged in a plane forming angels of about 120° with respect to each other to form a primitive 3-gamma scanner. Each detector generates pulse, which passes to a time pick-off units. Timing signals from the pick-off units are passed to a coincidence unit with timing window of τ. If pulses overlap, then logic signal is generated and passed as a trigger to simultaneous sampling analogue-to-digital converter (ADC).
Results and Conclusion: Three gamma imaging would provide information not only about the local concentration of radionuclide, but also, by virtue of chemical interactions of Positronium, the local chemical environment in tissue. In particular, the concentration of free oxygen could be determined, which would be a significant advantage in oncological applications of PET.

Keywords: Three gamma, PET, Imaging, Positron annihilation

Friday
P:Session 2

Preparation and biodistribution studies of ^{165}Dy-FHMA for radiosynovectomy

Simindokht Shirvani-Arani, Amir Mahmoodabadi, Ali Bahrami-Samani, Mohammad Ghannadi-Maragheh

Radiopharmaceutical Research and Development Lab (RRDL), Nuclear Science and Technology Research Institute (NSTRI), Tehran, Iran

Presenter Address: Simindokht Shirvani-Arani, PHD, Radiopharmaceutical Research and Development Laboratory (RRDL), Nuclear Science and Technology Research Institute (NSTRI), Tehran, Iran, Email: smshirvani@aeoi.org.ir

Introduction: Synovectomy is a method capable of easy removal of inflamed region of synovium by beta-radiation through the direct injection with radioactive materials labeled with beta-emitting radio nuclide. In the treatment of cancers or arthritis by radiation emitted from radioactive materials in the lesions, the administrated material to lesion should be retained only in the lesion, and not leaked from the lesion. One of the most effective approaches to retain the radionuclide in the administrated site is to prepare its ferric hydroxide macro aggregates.

Methods: The preparation of 165Dy labeled FHMA (ferric hydroxide macro aggregate) for radiosynovectomy applications is described in this study. 165Dy was prepared by the irradiation of natural Dy (NO3)3.5H2O at a flux of 3-4 × 1013 neutrons/cm2/s for about 2 hours. The irradiation resulted in the production of 18.5 GBq (500 mCi) of 165Dy activity. At the end of 7 hours after bombardment the corresponding specific activity was 2.3 GBq/mg (62.5mCi/mg). The irradiated target was dissolved in 0.1 N HCl. Radionuclidic purity was ascertained by high resolution gamma-spectrometry. FeSO4 and Fe(N03)3 X 9H20 were dissolved in 0.1 M H2SO4 and diluted with H2O. Then NaOH were slowly added while shaking the vial. The resulted macro aggregates was labeled with 165Dy to prepare 165Dy –FHMA complex. Bio-evaluation of the prepared 165Dy –FHMA was carried out by injecting 37 MBq (1mCi) dose in 100 µl directly into knee joints of wild type rats. The biodistribution studies were performed to investigate the leakage of the injected 165Dy –FHMA.

Results: It was observed that there was no significant extra articular leakage of the injected activity over the study period of 10 h post injection.

Conclusion: The produced 165Dy –FHMA properties suggest applying a new efficient synovectomy therapeutic agent in the country.

Keywords: Radiosynovectomy, Dy-165, FHMA

Friday
P:Session 2

Improvement of image quality using interpolated projection in myocardial SPECT

Mohamad-Ali Askari[1], Hossein Rajabi[1], Armaghan Fard-Esfahani[2]

[1] Dep.Med.Phys Collage of Medicine Tarbiat Modares University, Tehran, Iran
[2] Research Institute for Nuclear Medicine, Tehran University of Medical Sciences, Tehran, Iran

Presenter Address: Mohamad-Ali Askari , MSc Dep.Med.phys Collage of Medicine Tarbiat Modares University, Tehran, Iran, Velenjak-11th_sharghi-No.3, postal Code:1985964783, Email: normanaskari@yahoo.com

Introduction: Myocardial SPECT imaging is usually performed acquiring 32 views in 180 degree with equal steps of 5.625 degrees. Acquiring more images requires spending more time or injection of more activity to the patients. An idea to improve the quality reconstructed images without acquiring extra images is producing the extra images interpolating the data between adjacent projections. The aim of present study was investigation the feasibility of this idea.
Methods: Obviously such investigation cannot be performed on real patient's data. Therefore, data were simulated using NCAT digital phantom and SimSET Monte Carlo code. The imaging was performed as usual, acquiring 32 views from right anterior oblique to left posterior oblique. The data were interpolated to construct 5 images between adjacent projections convert it into 187 projections. The simulation was performed again acquiring 187 images as the reference. The conventional, interpolated and reference data set were reconstructed and compared for improvement and degradation in quality of final images. The above procedure was repeated for phantoms representing different types of heart disease, different cardiac size and different count densities.
Results: The results showed that Hermit interpolation technique produces better quality images comparing to other interpolation methods tested. Results also confirmed that streak artifacts decreases, signal to noise ratio and contrast increased due to increasing the number of samples.
Conclusion: These results indicate that the physical properties of reconstructed images improve significantly. This directly must improve the lesions delectability of images. However the matter is still under investigation

Keywords: Myocardial SPECT, Projection interpolation, Image quality.

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P:Session 2

A Study on produced radioactive wastes in nuclear medicine

Arsalan Mohammadi

Presenter Address: Arsalan Mohammadi, Unite 1, no 6, Baran Bulding, Keyan street, Sarafhay e shomali, Kaj Sq, Saadat abad, Tehran, IRAN, Email: arsalanbavy@yahoo.com

Today the radioactive wastes produced in different sections nuclear medicine disciplines forms a significant part of the produced nuclear wastes. The issue of nuclear wastes production has been considered by the mankind since the discovery of radioactive materials. However, certain consideration on the same has been after discovering the fission process and the increasing application of radio-isotopes in the agricultural, industrial, research sections as well as the mankind\'s extensive and increasing utilization of the radio-pharmacy in various medical disciplines; so that today the increasing utilization orientation of the nuclear techniques for the diseases diagnosis and treatment has caused that the level of the produced radioactive wastes in such section to be subjected to an ascending trend. Whereas due to the radioactivity the radioactive wastes produced in the nuclear medicine are hazardous for both the man\'s life and the environment, thus the issue of being well introduced to and having enough cognition with respect to such wastes and eventually the categorization, separation, and their safe disposal operations are mandatory and requires special consideration for such issue. Due to the importance of the issue, it has been tried in this article that a certain significance and consideration to such wastes is studied, apart from introduction and presentation of the categories and mentioning the various types of the radioactive wastes produced in the field of nuclear medicine.

Keywords: Radioactive wastes, Nuclear medicine

Friday
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Probing targets for antipsychotic drug action with PET and SPET receptor imaging

Mahdi Akhbardeh.

Presenter Address: Mahdi Akhbardeh, PHD, Mishigan, Clinical Nutritionist, TEI: 0014578578/5,Email: mahdi_akhbardeh14@yahoo.com.

The use of in vivo receptor imaging by positron emission tomography (PET) and single photon emission tomography (SPET) has permitted exploration of targets for antipsychotic drug action in living patients. Early PET and SPET studies focused on striatal D2 dopamine receptors. There is broad agreement that unwanted extrapyramidal (parkinsonian) side effects of antipsychotic drugs result from high striatal dopamine D2/D3 receptor blockade by these drugs. The dopamine hypothesis of antipsychotic drug action suggests that clinical response is directly related to the level of striatal D2/D3 receptor occupancy of antipsychotic drugs. This may be true for classical antipsychotic drugs, but recent evidence suggests that novel, atypical antipsychotic drugs produce efficacy in association with modest and transient striatal D2/D3 receptor occupancy levels. Furthermore, atypical antipsychotic drugs appear to show preferential occupancy of limbic cortical dopamine D2 receptors. Cortical dopamine D2/D2-like receptors may be a common site of action for all antipsychotic drugs. Data from receptor challenge paradigms has highlighted the need to explore the neurotransmitter systems involved in regulating or stabilising dopamine transmission, either via dopamine autoreceptors or non-dopaminergic pathways. These may be promising targets for drug development. In vivo PET and SPET imaging has produced unique data contributing to the design of better, less toxic drugs for schizophrenia.

Keywords: Probing, PET, SPET

Friday
P:Session 2

Preparation and biodistribution studies of ^{99m}Tc-cefotaxime as another infection imaging agent

Seyedeh Fatemeh Mirshojaei, Mostafa Gandomkar, Reza Najafi, Mohamad Hosein Talebi, Mohamad Mazidi.

Nuclear Science Research School, Nuclear Science and Technology Research Institute (NSTRI), Atomic Energy Organization of Iran, Tehran, Iran

Presenter Address: Seyedeh Fatemeh Mirshojaei, PHD student, Nuclear Science Research School, Nuclear Science and Technology Research Institute (NSTRI), Atomic Energy Organization of Iran, Tehran, Iran. P.O.Box:11365-3486,Email: fmirshojaei@aeoi.org.ir

Introduction: Nuclear medicine imaging has an important role in infection detection. Inflammatory processes can be visualized in their early phases, when anatomical changes are not yet apparent since Scintigraphic images are based on functional changes of tissues. Radiolabeled antibiotics have been also investigated for infection imaging. Cefotaxime a cephalosporin antibiotic used to treat bacterial infections was investigated to label with 99mTc.

Methods: labeling of Cefotaxime with 99mTc was performed by using sodium dithionite as reducing agent. Labeling was performed at 100 ºC for 10 min and radiochemical analysis involved ITLC and HPLC methods. To determine the optimal amount of reducing agent, sodium dithionate in different concentrations was investigated. The effect of pH and reaction temperature was evaluated on the radiolabeling yield. The stability of labeled antibiotic was checked in the presence of human serum at 37 ºC up to 24 h.

Results: Labeling was performed using sodium dithionite as reducing agent at 100 ºC for 10 min and radiochemical analysis involved ITLC and HPLC methods. The stability of labeled antibiotic was checked in the presence of human serum at 37 ºC up to 24 h. The maximum radiolabeling yield was 92±2%. Bacterial binding assay was performed with S. aureus and the in vivo distribution was studied in mice. Images showed minimal accumulation in non-target tissues, with an average target/non-target ratio of 2.89±0.58

Conclusion: Cefotaxime, with the biological half life of 0.8-1.4 h (MW=445.47) has a lower degree of interaction with plasma protein (25-30 %). New radiotracer eliminates mainly from the kidney and the amount of log P value proves this matter. 99mTc-cefotaxime has a higher uptake in the septic abscess than the non-infected muscle and its uptake in the septic muscle remains stable along 1 h post injection. Finally, considering the criteria for obtaining an ideal radiopharmaceutical, 99mTc-cefotaxime fits the criteria better and may be applied for infection imaging.

Keywords: 99mTc Cefotaxime, Radiolabeling optimization, Infection imaging

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A new method for measuring gamma camera uniformity

Hossein Zamani Zeinali

Atomic Energy Organization of Iran, Tehran, Iran

Presenting Adress: Hossein Zamani Zeinali, PHD, Atomic Energy Organization of Iran, Tehran, Iran, Email: hzeinali@nrcam.org

An Adaptive Quality Control Phantom (AQCP) was designed and constructed to perform QC tests. AQCP is the computerize phantom which moves a radioactive source in the FOV of an imaging Nuclear Medicine device on a definite path to produce any spatial distribution of gamma rays to simulate QC phantoms. Systematic uniformity test was performed by AQCP and the result compared with classic method and the differences have been discussed in details. The results show AQCP method has some advantages such as: Reduction in radioactive material consumption, radiation exposure to staff and systematic uniformity test

Keywords: Systematic uniformity, Gamma camera, SPECT

Friday
P:Session 2

Monitoring and determination of doses of Tehran research reactor staff during with various dosimetees and comparision of their responses

Navideh Aghaei Amirkhizi, Elham Shahhoseini, Ahmad Mohammadzadeh.

Atomic Energy Organization of Iran, Nuclear science & Technology Institute Nuclear Science, Tehran, Iran.

Presenter Address: Navideh Aghaei Amirkhizi, Tehran, Atomic Energy Organization of Iran, Nuclear Science & Technology Institute Nuclear Science.

It is a requirement according to ALARA to minimize radiation exposure of radiation workers and the public as low as reasonably achievable. To achieve this goal it is important to consider the following factors: an accurate recognition of radiation sources, measurement of environmental dose and workers' exposure, and reasons for radiation exposure. In this study, entitled "Evaluation of Personnel and Environmental Dose of Tehran Research Reactor's Radiation Workers with Various Dosimeters and Comparison of their Responses," personnel and environmental dose of the Tehran Research Reactor (TRR) was investigated. The personnel dose was evaluated with various dosimeters such as film badge, digital, Rados, pen and neutron dosimeters and the environmental dose was evaluated by using a Rados monitoring network which consisted of a number of dosimeters installed at various locations. The measured dose was then compared with the national and international dose level standards. In conjunction with the personnel dose assessment, a medical examination of the personnel including blood and urine analysis was performed. Final results of this study show that the environmental dose level of various locations of the reactor under monitoring is comparable to the international standards limits and the environmental dose level increase has a direct correlation with the TRR operating power and the release of irradiated samples from the reactor pool. Moreover, the personnel dose of TRR during operating hours did not exceed the standard limits and the results of the medical examinations confirm such findings.

Keywords: Personnel and Environmental Dose, TRR.

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Which factors affect on Estimation of absorbed dose and effective dose?

Keyhandokht Karimi Shahri, Hashem Miri Hakimabad, Lale Rafat Motavalli

Ferdowsi University of Mashhad, Mashhad, Iran.

Presenter Address: Keyhandokht Karimi Shahri, Ferdowsi University of Mashhad, Mashhad, Iran
Email: karimi062@yahoo.com

Introduction: Assessment of radiation dose is an important task in radiation protection dosimetry whereas absorbed and effective dose measurements directly in body organs are impossible. So Monte Carlo simulations is necessary to estimate radiation dose. The method of dose calculation, the body model and the computational code can be mentioned as three main factors that have an affect on dosimetric quantities. The aim of this study is the determination of the above factors influence on the absorbed dose and effective dose evaluation. For this purpose different comparisons between the mathematical and the voxel phantoms were done.
Methods: ORNL modified adult phantom is the mathematical phantom which is described by Cristy and Eckerman in 1987. This phantom is utilized for calculation of the absorbed dose. The effective dose is calculated according to the manner which is introduced in the ICRP reported 60 and 103.
Results: All of the doses Evaluation have an uncertainty less than 0.5%. MCNPX code and ORNL modified adult phantom are applied for the dose assessment in the energy range 10-9 – 20 MeV, under AP, PA, RLAT, LLAT, ROT and ISo irradiation conditions. The results are then normalized to the unit of neutron fluence. The calculated absorbed dose was compared with ICRP74 data in 9 organs and with Bozkurt et al data in 18 organs. The effective dose was calculated for whole body. Then these data were compared with results of a mathematical phantom and some voxel models in different irradiation geometries.
Conclusion: Although the absorbed dose results of ORNL show fewer differences with ICRP data than Bozkurt et al data, one can deduce neither complete agreement nor disparity between the ORNL data and the other two data sets. Totally 73% of the ORNL data in comparison with MIRD data and 48% of data in comparison with VIP_MAN results have difference less than 15%. Comparison of the ORNL effective dose with some male and female voxel phantoms (TARA, HANAKO, GSF, VIP_MAN) and an analytical model (MIRD) show that the changing of body model and computational code have few influence (less than 15%) on the effective dose results. But changing of wR and wT parameters have a significant effect on the results so that the largest discrepancies are about 100% on some data.

Keywords: ORNL phantom, MCNPX, Neutron effective dose.

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P:Session 2

Using cubic Bezier spline curves and active contours in surface reconstruction (Phantom study)

Atefeh Foroozandeh, Mahdi Momennezhad, Shahrokh Nasseri, Asghar Kerayechian, Morteza Gachpazan.

Nuclear Medicine Research Center of Mashhad University of Medical Sciences, Faculty of Medicine, Imam Reza Hospital, Mashhad, Iran

Presenter Address: Atefeh Foroozandeh, Numerical Analysis, South khorasan, Birjand, Pasdaran avenue, on 21th Pasdaran, Plaqute 68, Email; at_foroozandeh@yahoo.com

Introduction: SPECT imagery gives functionality information about the organ with no clue on it's anatomy. This data shows the activity inside with no information about shape. Thus the accurate determination of borders is difficult and perior knowlage of shape is usually required to estimate borders. The reconstruction is a first process that will serve as an important diagnosis tool for hospital. This paper presents a novel surface reconstruction.
Method: based on cubic Bezier spline curves and active contours, applied to SPECT image segmentation. Methods: The PHANTOM is a test-method that offers known geometry and volume, allowing us to compare with the obtained results. We use deformable model called GVF snake. GVF snake is based on the energy minimization approach. The use of GVF vector field avoids some of the limitations of traditional snakes related to initial distance to data and robustness in concave regions. This snake like other active contour models often produced rough edgs and protrusions. We use one of the best curve in Computer Aided Design (CAD) called cubic Bezier spline curve to approximate the detected contour at each slices. Then we matched points on every contour with parameter-based match method. After this step we interpolate corresponding points of different contours by using cubic Bezier spline curve, too.
Results: We use Matlab 7.8 language. The computer configuration is CPU P4/3.20 GHZ with memory of 1GB. The parameters in the model were determined empirically and were kept constant throughout the experiments. We can extract edge at each slices and then compute volume of phantom.
Conclusion: The reconstructed surface is smooth because every two cubic Bezier spline curves is patched with G2 continuity. The reconstruction speed is fast because we can use the forward elimination and backward substitution method to solve the system of tridiagonal equations. Finally, using GVF snake makes high precision for this method. There is a good agreement between experiment results and real values, that shows our method is acceptable. We hopefully applied this method to segmentation of the left ventricle of the heart in SPECT images, in the next stage.

Keywords: SPECT, Cubic Bezier Spline curve, Active contour, Segmentation, G2 continuity.

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P:Session 2

Gama radiation dose from building materials in Hbr regions of Ramsar

Elham Bavarnegin, Masoud Vahabi-Moghaddam, Asad Babakhani, Nasrin Fathabadi.

Presenter Address: Elham Bavarnegin, Email: ebavarnegin@gmail.com

Introduction: The main natural contributors to external exposure from gamma rays are 226Ra, 232Th and 40K. Ramsar, an Iranian northern city in Mazandaran Province has some high background radiation areas (HBRA) due to the presence of considerable amount of 226Ra along with its decay products brought to the Earth surface by numerous hot springs. Many residents of these areas have used local stone as a convenient building material. The main objective of this research is to quantify the inventories of natural radionuclides in natural building materials and to estimate the indoor/outdoor absorbed dose rate and annual effective dose equivalent due to gamma radiation from 226Ra, 232Th and 40K in building materials in these regions.
Methods: Methods Building materials were collected from different areas of Ramsar. Exploranium- GR-130 miniSPEC survey-meter was used in the selection process of samples. The specific activities were determined by a gamma spectrometry system using a hyper pure germanium detector with a relative efficiency of 40% and a resolution of 1.87 keV at 1.332 MeV. Calibration sources used were IAEA reference materials RGU-1, RGTh-1, and RGK-1. The measurements were carried out at the Environmental Radiological Protection Division of the National Radiation Protection Department (NRPD) at the Atomic Energy Organization of Iran (AEOI).
Results: Results The mean activity concentrations of 226Ra, 232Th and 40K were 9384±4897, 30±11 and 310±75 Bq kg-1, respectively. The average outdoor and indoor absorbed dose rates are estimated as 26261±5638 nGy h-1 and 55842±11993 nGy h-1 , respectively. The annual indoor effective dose ranges from 0.04 to 384.85 mSv with an average value of 273.94±58.83 mSv, whereas the annual outdoor effective dose ranges from 0.01 to 45.25 mSv with an average value of 32.21±6.91 mSv.
Conclusion: Results indicate that the estimated average annual indoor/outdoor effective dose for the study area is much higher than the worldwide average figure of 0.41/0.07 mSv reported by UNSCEAR. It can therefore be concluded that an assessment of the radiological hazard of using these building materials is crucial.

Keywords: Natural radioactivity, External exposure, HBRA, Ramsar.

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P:Session 2

The influence of CT protocols use for attenuation correction of cardiac PET/CT

Mahdi Sedighpoor, Parastoo Farnia

Department of Medical Physics and Biomedical Engineering, Tehran University of Medical Sciences, Tehran, Iran

Presenter Address: Mahdi Sedighpoor, Student of MSE biomedical Engineering, Department of Medical Physics and Biomedical Engineering, Tehran University of Medical Sciences, Tehran, Iran, Email; msedighpoor@yahoo.com

In modern PET/CT systems, the CT provides a fast and relatively noise-free attenuation map and improving lesions localization and the possibility of accurate quantitative analysis. In cardiac imaging, there is a strong attenuation gradient along the myocardial free wall, with muscle next to the air of the lung space and heart has movement and located in the place that move due to breathing cause misalignment increases in this area. If misalignments occur along these boundaries, the attenuation correction factors are potentially inaccurate, causing as much as a 60% error in the PET tracer emission image in the critical regions of diagnostic interest. Artifacts caused by misalignment are particularly disconcerting in cardiac imaging because they can present themselves as perfusion abnormalities or erroneous information on myocardial viability. In This paper the accuracy of some CT protocols such as gated, normal (a high-pitch helical CT), slow ct, low-temporal-resolution helical CT, time-averaged CT (ACT), ultra low dose CT that normally used for attenuation-correction in PET/CT were compared, moreover the image quality and dose that induced to patient from each protocols. Acquiring a slow CT improved registration between the transmission and emission. Potential for a heightened radiation dose delivered by the slow CT was compensated by doubling the default noise index and increasing the slice thickness to 5 mm. In the low-dose average cine CT, Further reduction in dose is possible by lowering the upper threshold of the auto-mA settings or modulation of the CT tube current based on anatomy. ACT protocols consist of multiple images acquired sequentially (also referred to as cine or axial) along the bed length over the span of one or more respiratory cycles. 2% average increase in ACT-PET rest reconstruction values compared the HCT-PET rest reconstruction values was slightly higher than the bias calculated. Contrary to the HCT protocol, the ACT protocol provides more flexibility in addressing artifacts such as varying the respiratory phases used to create the time-averaged CT to suppress respiratory artifacts. In addition, photon starvation can be addressed by optimizing the acquisition parameters, such as increasing the tube voltage and current in patients with high BMI values .Ultra-low-dose CT's shorter duration and the lower radiation and revealed no severe shift of the myocardium between the CT-based transmission and the emission in the patients.

Keywords PET/CT Attenuation Correction, CT Protocol, Cardiac misalignments

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Biological effects (health risks) of radio-frequency electromagnetic radiation due to entrance of mobile phone into human's life

Majid Assadi, Kolsoom Afrasiabi.

Bushehr Research Center for Nuclear Medicine, The Persian Gulf Biomedical Sciences Institute, Bushehr University of Medical Sciences, Bushehr, Iran

Presenter Address: Majid Assadi, Bushehr Research Center for Nuclear Medicine, The Persian Gulf Biomedical Sciences Institute, Bushehr University of Medical Sciences, Bushehr, Iran, Email: assadipoya@yahoo.com

Antennas, as an essential part of radio tools, deal in transduction, transmission, and reception of radio waves which they can be used for television and radio broadcasting, radar, wireless LAN, and cell phones communication. The number of people who use cell phones and the number of mobile phone base stations has increased dramatically in recent years all over the world. Whereas biological effects and conceivable health risks still are uncertain. Some studies have showed radio frequency electromagnetic radiation can induct the oxidative stress response and heat shock in biological environments which can carry deleterious effects on human health. Other studies have reported detrimental effects of this type of radiation on reproduction. In addition, a survey has evaluated the effect of exposure to mobile electromagnetic radiation on the function of blood-brain barrier, which has a critical role to sustain the cerebral homeostasis.

Represented radio-frequency electromagnetic radiation can alter the expression of tight junction proteins and can distribute the function of blood-brain barrier after exposure. Likewise, there are various epidemiological studies that proffer the relation between radio-frequency radiations and nonspecific complaints such as tiredness, headache, dizziness, sleep disorders, memory impairments, irritability, depression, nausea, loss of appetite, concentration difficulties, and visual perturbations in people living in vicinity of phone masts. Also there are some controversial research findings about increased risk of cancerous disorders in people who have exposed to radio frequency radiation. It seems because the mobile phone is a new technology and some disease have long incubation period we cannot express our definitive opinion about all of its health risks. These adverse effects are not limited to human's health. Radiofrequency pollution can be cause of abnormal behaviors, destruction, and deterioration of animals and plants exposed to mobile phone radiation and living near the electromagnetic radiation fields, base stations, and phone masts. In view of people's concerns and the duty of medical community, it is necessary to lead scientists and governments towards more experimental and epidemiological researches about health risks of radio-frequency radiation of cell phone, of base stations, and of communication processes in countries to clarify this issue and to recommend a precautionary approach.

Keywords: R-frequency, Mobile phone, Biological effects.

Friday
P:Session 2

Development of Ho-166 chitosan for radiosynovectomy

Samaneh Zolghadri, Amir Reza Jalilian, Hassan Yousefnia, Ali Bahrami-Samani, Simindokht Shirvani-Arani, Mohammad Mazidi, Mohammad Ghannadi-Maragheh

Radiopharmaceutical Research and Development Lab (RRDL), Nuclear Science & Technology Reaserch Institute (NSTRI),Tehran, Iran

Pressent Adress:Samaneh Zolghadri, Radiopharmaceutical Research & Development Laboratory (RRDL), Nuclear Science & Technology Reaserch Institute (NSTRI),Tehran, Iran. P.O. Box: 14155-775,Email: s_zolghadri63@yahoo.com.

Introduction: Chitosan (CHITO), a natural and biodegradable polysaccharide with wide range applications in bio-pharmaceutics, agriculture and water treatment purposes, is an excellent molecule for intra-cavital therapy. In this research, 166Ho-CHITO complex production is described in details, followed by determination of complex radiochemical purity, stability and biodistribution (after intra-articular injection) in wild-type male rats. Finally a Ho-166 based chitosan kit for ultimate radiosynovectomy applications in the country was developed.
Methods: Production of 166Ho was performed at the Tehran Research Reactor (TRR) using natHo (n, gamma)166Ho nuclear reaction. 166Ho-Holmium chitosan complex was prepared and Radiochemical purity was determined using ITLC. The stability of prepared 166Ho-holmium chitosan complex was checked up to 48 hours after preparation. The distribution of injected dose in rat organs up to 144 h after intra-articular injection of 166Ho-holmium chitosan complex (60 µCi/100ul) solution was determined for control studies.
Results: Labeling yield increased with increasing chitosan concentration and reached above 98% when the concentration reached 35 mg/3 ml. The highest labeling yield was achieved at pH=2.8-3.2 while decreased beyond this range. The labeling yield of 99% was achieved after 30 minutes. The effect of absence and presence of ascorbic acid (at various concentrations) as a complex stabilizer were also studied.
Conclusion: A kit formulation was developed for the in-situ preparation of the radiopharmaceutical in remote clinical centers.

Keywords: Chitosan, Radiosynovectomy, Holmium-166, Biodistribution

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P:Session 2

Delayed imaging for detection of Meckel's diverticulum in Tc-99m pertechnetate scintigraphy

Narjess Khatoon Ayati, Seyed Rasoul Zakavi, Ramin Sadeghi, Vahid Reza Dabbagh Kakhki

Nuclear Medicine Research Center of Mashhad University of Medical Sciences,Imam Reza Hospital, Ebn Sina Street, Mashhad, Iran.

Presenter Address: Ayati, MD, Nuclear Medicine Research Center, Imam Reza Hospital, Ebn Sina Street, Mashhad, Iran ,Email: ayatin871@mums.ac.ir.

Tc-99m pertechnetate scintigraphy is the modality of choice for diagnosis of Meckel's diverticulum. Interpretation of Meckel's scan identifies a focal area of radiopharmaceutical uptake in the anterior abdomen similar to normal gastric mucosa. The activity must be of the same pattern and intensity as gastric uptake. We present a 13-year-old patient with gastrointestinal bleeding and anemia. Tc-99m pertechnetate scintigraphy was performed and initial images did not show any abnormal tracer activity in the abdomen. However, imaging continued and a focal activity was detected on the right side of the abdomen 60 minutes delayed image. Follow laparascope operation the Meckel's diverticulum was removed and the patient's symptoms disappeared completely. It is suggest to pay special attention to delayed images (60 minutes or beyond) especially when earlier images are negative.

Keywords: Scintigraphy, Meckel's diverticulum, Gastrointestinal bleeding.

Friday
P:Session 2

Systemic absorption of Tc-99m-pertechnetate during dacryoscintigraphy: A Note of caution

Narjess Khatoon Ayati, Reza Gholami Malekshahi, Seyed Rasoul Zakavi, Vahid Reza Dabbagh Kakhki, Kamran Aryana, Ramin Sadeghi.

Nuclear Medicine Research Center of Mashhad University of Medical Sciences, Imam Reza Hospital, Ebn Sina Street, Mashhad, Iran.

Presenter Address: Narjess Khatoon Ayati, Student, Nuclear MedicineResearch Center, Emam Reza Hospital, Ebne Sina Street, Mashad, Iran ,Email: ayatin871@mums.ac.ir

We report a 37-year-old patient with the history of bilateral epiphora, who was referred to our department for dacryoscintigraphy imaging. The patient had bilateral obstruction of the lacrimal apparatus at the sac-duct level on the scintigraphy images. Delayed imaging showed Tc-99m pertechnetate uptake in the thyroid due to systemic absorption of the tracer from the conjunctiva. We recommend using tracers with large particle size and lower possibility of mucosal absorption for dacryoscintigraphy in order to decrease unnecessary thyroid radiation.

Keywords: Dacryoscintigraphy, Systemic absorption, Thyroid uptake, Lacrimal.

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P:Session 2

The value of polyclonal human immunoglobulin tagged with Tc-99m-pertechnetate in detection of acute appendicitis in patients with intermediate probability of appendicitis

Mehdi Asadi[1], Mostafa Mehrabi Bahar[1], Ramin Sadeghi[2], Ali Jangjoo[2], Vahid Reza Dabbagh Kakhki[2], Mostafa Gandomkar[3] and Seyed Rasoul Zakavi[2]

1-Department of Surgery, Emam Reza Hospital, Mashhad, Iran
2-Nuclear Medicine Research Center, School of Medicine, Mashhad University of Medical Sciences, Mashhad, Iran
3- Department of Pharmacy, Tehran University of Medical Sciences, Tehran, Iran

Presenter Address: Seyed Rasoul Zakavi, Nuclear Medicine Research Center, School of Medicine, Mashhad University of Medical Sciences, Mashhad, Iran, Email: zakavir@mums.ac.ir

Introduction: Acute appendicitis is one of the most common diseases requiring emergent abdominal operation. However negative appendectomies range from 20-30% throughout the world. Different nuclear medicine imaging techniques has been used to decrease the frequency of negative appendectomies. This study tries to assess the value of a Tc-99m-polyclonal antibody in detection of appendicitis in patients with intermediate probability of appendicitis.
Methods: Forty patients with intermediate probability of appendicitis according to Alvaredo scoring system (Score 5 or 6) were studied. After IV injection of 740MBq flow and blood pool image was obtained followed by two sequential 10 minutes anterior images and SPECT from lower abdomen and pelvic region. Planar and SPECT images were interpreted by two experienced nuclear physicians. Any level of increased uptake was considered positive for appendicitis. Quantitative analysis also was performed. Patients were followed clinically and the surgeon decided to operate or observe the patient according to the clinical findings. The surgeon was blind to the results of Tc-99m-polyclonal IgG images. Pathology result was considered as gold standard if patients underwent operation. If patients improved without surgery, it was considered negative for appendicitis.
Results: Forty patients (21 male, 19 female) with mean age of 24.6 ± 6.9 years were studied. Alvarado score was 5 in 22 patients and 6 in 18 patients. Thirty one patients were operated, 21 patients had acute appendicitis and 10 patients had normal appendix. Nine patients followed by observation and released from hospital. These patients were followed up for one month and no complication was observed. Sensitivity of planar images for diagnosis of appendicitis was 19% for static images and 24% by adding data from flow images and specificity was 100%. Sensitivity of the SPECT for diagnosis of appendicitis was 62% , specificity of the test was 68% and negative predictive value was 62%. Quantitative analysis showed that using a cut-off of >1.2 for mean right to left count per voxel ratio, the sensitivity of the test for detection of appendicitis was 54% and specificity was 86%.
Conclusion: Tc-99m-Polyclonal IgG planar scan has a very low sensitivity for detection of appendicitis SPECT imaging has a moderate sensitivity, specificity and negative predictive value so it is not a suitable tracer for exclusion of appendicitis.

Keywords: Appendicitis, IgG, Scintigraphy

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Editorial Office
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Tel: ++98 21 88633333, 4 Fax: ++98 21 88026905
E-mail: irjnm@tums.ac.ir http://irjnm.tums.ac.ir