

I International Conference of Nuclear Medicine Technologies

X Seminar of Nuclear Medicine from
Lisbon School of Health Technology

May, 30 and 31, 2014
Lisbon, Portugal

ESTeSL Auditorium, Parque das Nações

www.estesl.ipl.pt/icnmt

ABSTRACT BOOK

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Program

May 30th (Friday)

8h15 – Opening Session

8h40 – Symposium 1 – *Dosimetry and Radiation Protection*

10h20 – *Coffee Break* | ***Poster Presentation***

10h50 – Symposium 2 – *Radiopharmaceutical Therapy*

11h50 – Oral Communications

12h40 – Lunch

14h30 – Symposium 3 – *Nuclear Medicine – From bench to bedside*

16h00 – *Coffee Break* | ***Poster Presentation***

16h30 – Symposium 4 – *Quantification and Corrections in Nuclear Medicine*

18h00 – Cultural Moment

20h00 – Conference Dinner

May 31st (Saturday)

8h00 – Oral Communications

9h00 – Symposium 5 – *Nuclear Medicine Education and Competencies*

10h00 – *Coffee Break* | ***Poster Presentation***

10h30 – Symposium 6 – *International Round Table*

11h30 – Symposium 7 – *Erasmus+ Challenges and Possibilities for Networks*

12h30 – Closing Ceremony / Conference Highlights / Awards Ceremony

15h00-18h00 – *Workshop*

Tomographic reconstruction – a fundamental part in the future of medical imaging.



Scientific Committee

- Lina Vieira (President)
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- Durval Campos Costa
- Filipa Lucena
- Giorgio Testanera
- José Jorge
- Juan Ignacio Rayo Madrid
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- Oleh Stakhiv
- Soraia Mendes
- Susana Sá
- Vera Matos

Abstracts – Oral Communications

OC – 01

11h50-12h40, Friday, May 30, 2014

The impact of wearing lead aprons on the radiation exposure of staff performing nuclear medicine procedures using Tc-99m

Pestean Claudiu¹; Larg Maria Iulia¹; Sabo Alexandrina¹; Crisan Monica¹

¹ Oncology Institute "Prof. Dr. I. Chiricuta" Cluj-Napoca / Nuclear Medicine Department

Aim: We assess the impact of lead aprons on the annual effective dose of staff during elution of a Tc-99m generator, preparation and administration of radiopharmaceuticals. We evaluate the impact in relation with the annual staff exposure. We discuss the impact of these protective measures in relation with the optimization principle of radiation protection stated by the European regulations.

Methodology: The study was conducted over two weeks, a Tc-99m generator life. A physicist and a technologist were involved, performing preparation and administration of radiopharmaceutical. They had worn 0.5mm lead aprons. They have been equipped with two DMC2000S dosimeters, one under and one over the apron and they recorded the exposure. A total activity of 44GBq has been manipulated. The physicist spent 1h and 50min over the entire study for elution and preparation. The technologist spent 4h and 9min for administration. All the procedures have been performed using tungsten shields for syringes and vials.

Results: Physicist's dosimeter situated under the apron recorded an effective dose 0.020μSv and the dosimeter over the apron recorded 0.023μSv, which means a reduction of 0.003μSv (13.04%). Technologist's dosimeter worn under the apron recorded an effective dose of 0.018μSv and the dosimeter over the apron measured 0.022μSv. The reduction was 0.004μSv (18.18%).

Discussions and conclusions: Considering the work conditions described above as usual work conditions over a year and taking into account the exposure in our department, we estimated that the dose reduction wearing 0.5mm lead aprons would have a maximum value of 0.096μSv, which represents 0.0064% from the average annual exposure of the staff in our department, which is 1.5mSv. With these values and considering that the optimization of the radiation exposure must be applied taking into account all the societal and economical factors we consider that the reduction is minimal and it is reasonable to not wear lead aprons.

OC- 02

11h50-12h40, Friday, May 30, 2014

Synthesis of Porphyrin Derivatives and Labeling with ^{186}Re Rhenium

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Introduction: Porphyrin are versatile compounds. It bind to DNA of cancer cell selectively with higher binding constant compare to that of normal cell. Although porphyrin can not be coordinated by metal with large radii, its meso-substituens can be modify easily. By introducing two carboxylic groups at phenyl of meso-position, it will provide ligand for complexation with gamma and beta emitting radionuclides such as $^{99\text{m}}\text{Tc}$ and ^{186}Re . Thus, labelled-porphyrin can be used for cancer diagnosis and therapy. In the present research, novel porphyrins bearing two carboxylic groups at the meso-positions, meso-5,15-di[3,4-bis(carboxy-methylenoxy)phenyl] porphyrin (DCP) and meso-5,15-di[3,4-bis(carboxymethylenoxy)-phenyl],10,20-diphenyl porphyrin (DCDPP) have been synthesized. Labelling of DCDPP with ^{186}Re was also studied.

Methodology: Porphyrin was synthesized using starting material of dipyrromethane and related aldehyde. Labelling of porphyrin with beta emitting radionuclide of ^{186}Re at the carboxylic of -meso-substituent used indirect procedure. Radiochemical purification was performed using instant thin layer chromatography.

Results and discussion: The results showed that reduction using NaBH_4 was comparable to SnCl_2 in low concentration. The trans-chelating reaction was carried out to stabilize the unstable $^{186}\text{Re}(\text{v})$, due to $^{186}\text{Re}(\text{v})$ was easily back-oxidized to $^{186}\text{Re}(\text{vii})$. Due to the problem, first the $^{186}\text{Re}(\text{v})$ was complexed using Na-gluconate to form a stable Re-gluconate chelate. The trans-chelation reaction with porphyrin can be then carried out because porphyrin has higher affinity to the $^{186}\text{Re}(\text{v})$ than that of gluconate. The optimum condition of labeling using trans-chelation reaction applied 2 mg of SnCl_2 as the reductor, pH of 4-5, and 60 min incubation at rt.

Conclusion: Two novel porphyrins bearing two carboxylic groups at the meso-positions (DCP and DCDPP) have been synthesized. Labelling efficiency of DCDPP with ^{186}Re was 92%.



OC – 03

11h50-12h40, Friday, May 30, 2014

Phytochemicals as Radio-sensitizing agents in Nuclear Medicine therapy

Nuno Lemos¹

¹Nuclear Medicine Technologist

⁹⁰Y-Zevalin and ¹³¹I-Bexxar are both radiopharmaceuticals of choice in the treatment of Non-Hodgkin lymphoma. However treatment with these radiopharmaceuticals is not without side effects. One of the ways to try to reduce these effects is by reducing the dose administered to the patient. However decreasing the dose administered brings a reduction of its therapeutic effectiveness. Maintain or increase the clinical benefits of radioimmunotherapy and lower radiation doses is only possible if the cell finds itself more vulnerable to the effects of radiotoxic radiopharmaceuticals. Radiosensitizers agents are beginning to be studied using the traditional pharmacopoeias as a starting point. Phytochemicals have proven themselves promising as radioprotective, radiorecovery and/or radiosensitizers agents. Curcumin is a phytochemical present in curries, with strong radiosensitizer effect and proven antitumorigenic activity. However bioavailability has been weak so it's necessary to think of different strategies to ensure maximum radiosensibilization. A strategy that is beginning to be explored is the encapsulation of curcumin into nanoparticles. This project aims to stimulate interest in this area of therapeutic nuclear medicine. The project consists of preparing nanoparticles containing curcumin and functionalized with antibodies having affinity for antigens present on cells of non-Hodgkin lymphoma and in the evaluation of the influence of curcumin nanoparticles to the cytotoxic effects of radiopharmaceuticals with consequent studies of associated cellular mechanisms.



OC – 04

11h50-12h40, Friday, May 30, 2014

Nuclear Pharmacy Integrated Course For Students In Pharmacy, Medicine, Medical Physics and Nuclear Chemistry (NuPhICoS)

E. Milieva¹, M. Murdjeva¹, A. Soylu², A. Yordanov², M. Yaneva¹, I. Kostadinova³, P. Trindev³, B. Todorov⁴, M. Karaivanova¹, D. Adliene⁵, E. Soura⁶, Cs. Pesznyak⁷, V. Zemite⁸, D. Legrady⁷, M. Anagnostakis⁹, F. Lucena⁶, D. Bosnar¹⁰, G. Adlys⁵, T. Dimitrova¹¹, V. Stanchev¹, S. Ivanova³, J. Krasteva³, N. Veleva¹, P. Michailova¹, T. Petrov³, M. Garcheva³, U. Tansel¹², A. Filazi¹²

1 MU-Plovdiv, BG; 2 Eczacıbaşı Monrol, TR; 3 MU-Sofia, BG; 4 SU-Sofia, BG; 5 KTU-Kaunas, LT; 6 ESTeSL-Lisbon, PT; 7 BME-Budapest, HU; 8 RTU-Riga, LV; 9 NTU-Athens, Greece; 10 UZ-Zagreb, HG; 11 PU-Plovdiv, BG; 12 AU-Ankara, TR

The projected annual sales of radiopharmaceuticals in the U.S.A. and Europe are expected to reach 5.4 bln \$. This is in conjunction with the development and the introduction of new diagnostic and therapeutic methods in the nuclear medicine (NM) field. The goal of this project is to develop an educational programme in nuclear pharmacy for integrated interactive education of students from different majors - Nuclear Pharmacy Integrated Course for Students in Pharmacy, Medicine, Medical Physics and Nuclear Chemistry - NuPhICoS (Erasmus Projects 2012-1-BG1-ERA 10-07058; 2013-1-BG1-ERA10-00320). The major activities correspond to the requirements for innovation and multidiscipline studies: lectures, laboratory exercises, learning projects, presented/defended during topic-oriented seminars. Targeted group: 11 Higher Education Institutions (HEI) from 8 countries (Bulgaria, Greece, Lithuania, Portugal, Latvia, Hungary, Croatia and Turkey). The students (mostly undergraduate) are majors in 5 disciplines (pharmacy, medicine, medical physics/physics, radiochemistry/chemistry, and NM technologies) are directly involved in the method development, production and applications of radionuclides and radiopharmaceuticals in NM. Closer collaboration within the HEI through the establishment of bilateral agreements between all programme partners for students and teachers mobility; adaptation/moderation of the current curriculums of the majors in the participating HEI; joint training of more than 80 students; production of learning materials; development of more than 30 student projects. Work in progress: an optional course in Nuclear Pharmacy; common MSc in Nuclear Pharmacy between the IP partners. The development of NuPhICoS under the European umbrella, with focus on the education of students from different majors has evidenced several results, both in the Institutional level and in the scientific and pedagogical level, with positive outcomes for the students and for the majors involved.

11h50-12h40, Friday, May 30, 2014

Differences in the concentration of cholecystokinin and infusion duration: does the manipulation of these two parameters result in similar values of gallbladder ejection fraction?

Marta S. Prates¹; Marta D. Azêdo⁴; Russell Arey^{3, 4}; James Milton^{3, 4}; Rebecca Modiste⁴; Melinda Walker^{3, 4}; Tânia F. Vaz²

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² Lisbon School of Health Technology – Lisbon Polytechnic Institute

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⁴ Salem State University – Nuclear Medicine Technology Program

Introduction: The Hepatobiliary Iminodiacetic Acid scan (HIDA scan) is widely used in the United States of America due to the incidence of hepatobiliary disease. Even though guidelines have been published in order to standardize practice, hospitals tend to adapt these to their own daily routine. Therefore, our purpose was to assess the influence of two protocols (0.02µg/kg or 0.04µg/kg of cholecystokinin (CCK) infused during 45 or 30 minutes, respectively) in the values of gallbladder ejection fraction (GBEF), being the cut-off value of 35%.

Methodology: This was a retrospective study where 48 symptomatic patients, referred for HIDA scan due to clinical reasons, were randomly chosen and divided in two groups of 24 patients each, according to the performed protocol (Group I (GI): 0.02µg/kg of CCK infused during 45 minutes; Group II (GII): 0.04µg/kg of CCK infused during 30 minutes). Statistical analysis was applied to assess the characteristics of the groups and also to evaluate if there were statistically significant differences in the GBEF.

Results: Among other results, GI showed generally higher GBEF with 71±24.9% (mean±SD) and only 8.3% (2 patients) of the patients had GBEF≤35%, compared with GII (56±30.2% and 8 patients (33.3%), respectively). Despite this, the results demonstrated no statistically significant differences for the GBEF.

Conclusions: It's possible to vary the CCK concentration and infusion duration, without significantly changes of the GBEF. However the topic should be further investigated due to some limitations of this study.



OC – 06

8h00-9h00, Saturday, May 31, 2014

Performing PET/CT studies: do they create Anxiety?

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Introduction: Anxiety is a common problem in primary care and specialty medical settings. Treating an anxious patient takes more time and adds stress to staff. Unrecognised anxiety may lead to exam repetition, image artifacts and hinder the scan performance. Reducing patient anxiety at the onset is probably the most useful means of minimizing artifactual FDG uptake, both fat brown and skeletal muscle uptake, as well patient movement and claustrophobia. The aim of the study was to examine the effects of information giving on the anxiety levels of patients who are to undergo a PET/CT and whether the patient experience is enhanced with the creation of a guideline.

Methodology: Two hundred and thirty two patients were given two questionnaires before and after the procedure to determine their prior knowledge, concerns, expectations and experiences about the study. Verbal information was given by one of the technologists after the completion of the first questionnaire.

Results: Our results show that the main causes of anxiety in patients who are having a PET/CT is the fear of the procedure itself, and fear of the results. The patients who suffered from greater anxiety were those who were scanned during the initial stage of a disease. No significant differences were found between the anxiety levels pre procedural and post procedural. Findings with regard to satisfaction show us that the amount of information given before the procedure does not change the anxiety levels and therefore, does not influence patient satisfaction.

Conclusions: The performance of a PET/CT scan is an important and statistically generator of anxiety. PET/CT patients are often poorly informed and present with a range of anxieties that may ultimately affect examination quality. The creation of a guideline may reduce the stress of not knowing what will happen, the anxiety created and may increase their satisfaction in the experience of having a PET/CT scan.



8h00-9h00, Saturday, May 31, 2014

¹⁸F-FDG measurement in primary lung cancer: SUV normalization to different distribution volumes

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Introduction: Standard Uptake Value (SUV) is a measurement of the uptake in a tumour normalized on the basis of a distribution volume and is used to quantify ¹⁸F-Fluorodeoxiglucose (FDG) uptake in tumors, such as primary lung tumor. Several sources of error can affect its accuracy. Normalization can be based on body weight, body surface area (BSA) and lean body mass (LBM). The aim of this study is to compare the influence of 3 normalization volumes in the calculation of SUV: body weight (SUVW), BSA (SUVBSA) and LBM (SUVLBM), with and without glucose correction, in patients with known primary lung tumor. The correlation between SUV and weight, height, blood glucose level, injected activity and time between injection and image acquisition is evaluated.

Methods: Sample included 30 subjects (8 female and 22 male) with primary lung tumor, with clinical indication for ¹⁸F-FDG Positron Emission Tomography (PET). Images were acquired on a Siemens Biography according to the department's protocol. Maximum pixel SUVW was obtained for abnormal uptake focus through semiautomatic VOI with Quantification 3D isocontour (threshold 2.5). The concentration of radioactivity (kBq/ml) was obtained from SUVW, SUVBSA, SUVLBM and the glucose corrected SUV were mathematically obtained.

Results: Statistically significant differences between SUVW, SUVBSA and SUVLBM and between SUVWgluc, SUVBSAgluc and SUVLBMgluc were observed ($p=0.000<0.05$). The blood glucose level showed significant positive correlations with SUVW ($r=0.371$; $p=0.043$) and SUVLBM ($r=0.389$; $p=0.034$). SUVBSA showed independence of variations with the blood glucose level.

Conclusion: The measurement of a radiopharmaceutical tumor uptake normalized on the basis of different distribution volumes is still variable. Further investigation on this subject is recommended.



Myocardial partial volume effect: the importance of intra-ventricular structures

Mauro Sousa¹

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Introduction: In emission tomography, the system's limited spatial resolution leads to three-dimensional image blurring, a phenomenon called partial volume effect (PVE). The limited resolution gives rise to activity spillover between regions in the imaging object, producing significant alterations in the activity distribution, especially for small structures. In this sense, precise quantification based on image activity values depends on a rigorously implemented partial volume correction (PVC) plan. In nuclear medicine images some PVC methodologies make use of corresponding anatomical images in order to provide additional information which assist in the correction procedure. This approach is popular for cardiac emission images. However, in previous PVC literature, cardiac intra-ventricular structures (IVS), namely papillary muscles and trabeculae carneae, have been largely ignored, while they may potentially have a significant influence in terms of activity spillover.

Methods: A simulation study to investigate the effect of IVS was performed in Matlab. A diastolic left ventricle (LV) model with IVS was constructed, according to the 17 segment clinical model. The model was blurred and the amount of activity spilled from the IVS to the wall was quantified in a total and segment-wise way. The parameters of IVS diameter, distance to the LV wall and LV wall thickness were varied. The blood pool (BP) influence was also determined.

Results: The studies showed essentially that for the typical range of parameter values, IVS PVE influence was determined to be comparable with that of the BP.

Conclusion: Since the BP is regarded as significant in PVC literature, the study showed evidence that the influence of IVS in terms of myocardial PVE is therefore relevant as well. Despite the assumptions used in the simulation, this study justifies a similar implementation with clinical functional and corresponding anatomical images.

OC – 09

11h50-12h40, Friday, May 30, 2014

Cardiac Rb-82 PET/CT: Optimization of image acquisition and reconstruction parameters

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Purpose: To investigate the influence of Time-of-Flight (TOF)+Point Spread Function (PSF) corrections, and reconstruction parameters (iterations×subsets numbers, as well as filters FWHM) in ordered-subsets expectation maximization (OSEM) algorithms in ⁸²Rb cardiac PET/CT.

Materials and Methods: Rest and adenosine-induced stress listmode data from 10 patients with myocardial blood flow (MBF) abnormalities and 10 patients without were reconstructed with different parameters (OSEM; OSEM+TOF; OSEM+TOF+PSF). In total, 320 reconstructions were performed with 4-, 6- and 8-mm FWHM Gaussian filters and different iterations×subsets numbers (2×24; 2×16; 3×16; 4×16). Segmental MBF were computed using FlowQuant[®] (OHI, Ottawa, Canada). We analysed differences to the original clinical reconstruction protocol using Lin's coefficient of concordance (ρ_c , a measure of precision and accuracy) and Bland-Altman (BA) plots.

Results: Mean differences in MBF were small with excellent concordance as compared to the clinical protocol (all $\rho_c > 0.94$), except for when TOF was removed (rest: $\rho_c = 0.79$, stress: $\rho_c = 0.86$, $P < 0.05$). Changes in iterations×subsets or filters did not influence ($P > 0.05$).

Conclusion: Changes in reconstruction iterations×subsets numbers or filters only remotely influenced MBF measurements. The only significant, but small differences were observed in rest+stress MBF for reconstructions without TOF. Further work is needed to optimize the protocol for cardiac PET/CT with ⁸²Rb.

Abstracts – Poster Presentation

PP – 01

10h20-10h50, Friday, May 30, 2014

Clinical findings and protocol modification in the scintigraphy with ^{99m}Tc -Sestamibi for evaluation of the parathyroid glands

Daniela Ribeiro^{1,2}; Marco Pinheiro²; Elvira Fonseca²; Guilhermina Cantinho²

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² Atomedical, Laboratory of Nuclear Medicine

Introduction: This clinical case will demonstrate the clinical findings that can be observed in a Scintigraphy with ^{99m}Tc -Sestamibi for evaluation of the parathyroid glands and which can be correlated with the variable biodistribution of the radiopharmaceutical and with the pathophysiology of Hyperthyroidism. Due to the possibility of ectopic parathyroid tissue and to determine the origin of the Hyperthyroidism, a modification to the department's protocol was performed.

Methodology: Initially it was administered 740 MBq of ^{99m}Tc -Sestamibi, intravenously. Twenty minutes after the administration, an early static image was acquired, followed by the acquisition of a later static image, three hours after the administration. A whole body image was also acquired, reflecting a modification to the protocol, due to the clinical indication. A tomography study was performed in order to increase sensitivity. The exam ended with the acquisition of a static image, twenty minutes after the administration of 555 MBq of $^{99m}\text{TcO}_4^-$.

Results: The early and later static images, the whole body image and the tomography image reflected the ^{99m}Tc -Sestamibi's biodistribution and the thyroid image reflected the $^{99m}\text{TcO}_4^-$ biodistribution. However, the first set of images demonstrated a diffuse and symmetrical uptake on both axillae which can be related to the ^{99m}Tc -Sestamibi's uptake in the sweat glands. It was also visualized an uptake on the left humerus.

Conclusion: There was a hyperfunction of the right inferior parathyroid, which is the result of the presence of a solitary adenoma. There was no evidence of ectopic tissue. It is of importance to know the biodistribution of the radiopharmaceutical in order to distinguish the sweat glands' uptake from extravasation or lymphatic metastasis, and also to be aware of the uptake mechanism and the pathophysiology of the disease, to relate the uptake in regions of elevated metabolism and cellular proliferation dependent of energy.



PP – 02

10h20-10h50, Friday, May 30, 2014

A renal fusion case: the nuclear medicine approach

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Introduction: Nowadays, nuclear medicine (NM) is very useful in paediatric evaluation, especially in the urinary system. This case shows a renogram in a child with 1 month that was admitted to the Instituto de Medicina Nuclear da Faculdade de Medicina da Universidade de Lisboa with suspicion of hydronephrosis, and pelvic left kidney with possible renal fusion. **Methodology:** The renogram was performed with a double injection of ^{99m}Tc-MAG₃ because there was no progression of the radiopharmaceutical (RF) into bloodstream with the first injection. It was performed in anterior and posterior projections because of suspected pelvic kidney. Two dynamic evaluations (standard and diuretic renogram), a static image after voiding and the processing phase were performed according to the institutional protocols. Two regions of interest (kidney and bladder) were drawn in the dynamic evaluations and time/activity curves were obtained. **Results and Discussion:** During the processing phase was observed that the patient change his position and the cardiac region was out of the field of view in the beginning of the study. So, the renographic curves and the quantitative values presented by the processing application were skewed. Results' distortion was also due extravasation of the RF at the site of administration. Visual analysis and time/activity curves of bladder and kidney showed an evident function of the pelvic renal mass. Diuretic renogram revealed the absence of mechanic obstruction. One week later, a renal scintigraphy with ^{99m}Tc-DMSA was performed to clarify the presence of renal fusion. It included anterior, posterior and oblique posterior static images of the abdominopelvic area. We also acquired a tomographic study that confirmed the presence of renal fusion. **Conclusion:** This case shows the importance of the quality control during processing's phase in NM, because without that approach the quantitative results wouldn't be representative of the clinical condition of the child.



PP – 03

10h20-10h50, Friday, May 30, 2014

Multi-imaging modalities in refractory Idiopathic Thrombocytopenic Purpura (ITP): A case report

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Introduction: Idiopathic Thrombocytopenic Purpura (ITP) is due to autoantibodies against platelets causing thrombocytopenia. Splenectomy is the surgical procedure of choice for refractory ITP treatment, however; some patients continue to suffer from thrombocytopenia after surgery due to presence of accessory spleen. Scintigraphic imaging with ^{99m}Tc-labeled agents has important diagnostic role in this setting.

Method: Our patient was a 31-year old woman, with multiple episodes of ecchymosis and thrombocytopenia due to ITP, refractory to corticosteroids, intravenous immunoglobulin therapy and splenectomy. On her last episode of thrombocytopenia, abdominal and pelvic ultrasound (US) and CT scan, ^{99m}Tc-phytate and ^{99m}Tc- denatured RBC (Tc-DRBC) scans were performed.

Results: Abdominal US showed one hypoechoic lesion in the superior aspect of the left kidney. Abdominal CT scan revealed one soft tissue lesion posterior to the stomach. ^{99m}Tc-Phytate imaging showed no abnormality. ^{99m}Tc- DRBC scan (planar and SPECT images) revealed two discrete foci of abnormal uptake: one located posterior to the stomach and the other in the left paraspinal region superior to the left kidney (corresponding to the lesions reported in the CT scan and US respectively).

Discussion: Treatment of patients with refractory ITP after splenectomy can be quite challenging. In cases of accessory spleen, surgical removal of the splenic tissue maybe necessary for treatment of thrombocytopenia. Anatomical imaging cannot easily distinguish splenic tissue from other abdominal lesions. In our case, ^{99m}Tc-DRBC scan was the most sensitive and specific imaging modality for identification and localization of accessory spleen. It showed more abnormal sites of splenic tissues than either US, CT scan or ^{99m}Tc-phytate scan. We suggest that ^{99m}Tc-DRBC scan be performed for assessment of the presence and location of the accessory splenic tissues which can substantially change the patient management.



10h20-10h50, Friday, May 30, 2014

Clinical case: gastroesophageal reflux scintigraphy in adult man with technical changes

Ana Correia¹; Denise Calado²; Nadine Silva²; Ana Alvernaz²; Eva Sousa¹

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Introduction: The clinical case described is a gastroesophageal reflux scintigraphy, a method for the detection and evaluation of gastroesophageal reflux (GER). This exam presents changes from that described in the literature. We used a different radiopharmaceutical (RF), ingested food, acidic solution, projections, position and time of image acquisition. These changes were applied because we didn't have the recommended things to perform the exam. We want to prove the viability of the applied techniques.

Methodology: We did the exam in adult man with 15.54 MBq of ^{99m}Tc-nanocolloid albumin mixed in orange and lemon juice and water (total of 300ml) that are administered *per os*. After that, the man drank a coffee (15ml) and water (50ml). We perform a dynamic study in orthostatic position (30s/frame) and static images in orthostatic position, supine position, prone position and knee-chest position. Were made maneuvers to induce reflux like valsalva maneuver and manual increased abdominal pressure. At 2 hours after RF administration and after ingestion of solid food with chocolate we perform a static image in supine position. All images were acquired with a low energy high resolution collimator and 128x128 matrix.

Results: During the image acquisition we didn't observe abnormal RF uptake suggestive of GER, except in the last acquired image after ingestion of a solid food with chocolate.

Conclusions: The ingestion of solid food with chocolate was responsible for the detection of GER that means only the presence of reflux after ingestion of solid food. With the results of this exam we proved the viability of the applied techniques to detect GRE that can be implemented especially in cooperating individuals.

16h00-16h30, Friday, May 30, 2014

Comparative study of four methods of Quality Control for determination of the Radiochemical Purity of ^{99m}Tc -HMPAO

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Introduction: ^{99m}Tc -HMPAO is a molecule with an unstable chemical structure, so it is essential to submit it to strict measures of quality control (QC). Innumerable procedures of QC have been studied, in order to present alternatives to obtain good results. The objective of the present study is to compare 4 methods of QC to determine the percentage of radiochemical purity (%RQP) of ^{99m}Tc -HMPAO.

Methodology: The RQP was analysed through solvent extraction (SE), paper chromatography (PC), solid phase extraction (SPE) and thin layer chromatography (TLC) of 20 kits of Ceretec® stabilized and then measured at 0; 1.5; 2.5; 3.5 and 4.5 hours. The analysis was done through the comparison of the reference method (SE) with the other methods.

Results and Discussion: There was a decrease of %RQP during the interval of time in which the study was carried out due to an instability in vitro of ^{99m}Tc -HMPAO. However, TLC method never presented an average of %RQP higher to 80% due to an undesirable migration of $^{99m}\text{TcO}_4^-$ and ^{99m}Tc -HMPAO. PC was the most accurate method at 0h, but the time was 00:14:10. SPE method presented the most higher mean values, however it overestimates the %RQP. The SE method presented a good reproducibility, $92.5 \pm 3.3\%$ at 0h, and it's practical, faster and cheaper.

Conclusion: There are other methods that can be good alternatives for the QC described in the insert package of Ceretec®. Taking into consideration factors such as time, accuracy and economy, it is suggested the use of SE method as a routine QC.

16h00-16h30, Friday, May 30, 2014

Development of peptides for alpha-synuclein imaging

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Progressive neurodegenerative disorders, such as Alzheimer's (AD) and Parkinson's (PD) diseases, affect millions of persons worldwide and pose a significant impact in public health, especially as more people approach old age. An essential process for the development of these diseases is the misfolding of proteins like A-beta, tau and alpha-synuclein (aSyn) and subsequent aggregation (amyloid deposits). In PD, Dementia with Lewy bodies (DLB) and other synucleinopathies, aSyn was identified as the main component of Lewy bodies and Lewy neuritis, being considered a key pathological hallmark of these diseases. Therefore, compounds that target aSyn fibrils in vivo can be explored to design imaging agents for diagnosis and prognosis of PD. Herein, we describe the design, synthesis, characterization and pre-clinical evaluation of a number of peptides targeting aSyn fibrils. The peptides have been synthesized by solid-phase peptide synthesis (SPPS) and characterized by ESI-MS. The synthesized peptides were conjugated to fluorescein and to a prosthetic group in order to be visualized by optical imaging and to be labeled with ¹⁹F/¹⁸F, respectively. Moreover, the peptides contain a glucose unit to facilitate the crossing to the brain through the GLUT1 transporter. The metabolic stability of these peptides has been assessed in mice's liver and kidney homogenates and they have shown to be fairly stable. The evaluation of the binding of the several peptides to aSyn fibrils is underway. In this way, we expect to identify a selective aSyn-targeting peptide with biological features suitable for in vivo application.



16h00-16h30, Friday, May 30, 2014

Impact of residual catheter ^{18}F -FDG activity on determination of SUV

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Introduction (aim): The standardized uptake values (SUVs) are widely used in PET/CT for measuring the uptake of ^{18}F -FDG in various tumors and it is of main importance in assessing the patient response to therapy. There are several factors that can introduce variation in the measurements of ^{18}F -FDG uptake in tumors. Sometimes after the acquisition the residual activity in catheter visually seems significant. The aim of this study is to recognize if the residual activity of ^{18}F -FDG introduces a significant variation in SUV value.

Methodology: This study included 276 tumor lesions, primaries and metastases, from patients who performed PET/CT with ^{18}F -FDG. The PET/CT acquisition was started about 1hour after the injection of 314.77 ± 47.14 MBq (mean \pm SD). Patients with blood glycemia higher than 140mg/dL were excluded. The SUV_{max} was determined with and without the residual activity of the catheter, both according to maximum pixel (threshold of 42%).

Results: The mean value of SUV determined including the activity of the catheter (CAT+) was 7.13 ± 5.01 (mean \pm SD) and did not differ highly from SUV determined when the activity of the catheter was subtracted (CAT-), 7.35 ± 5.19 (mean \pm SD). The mean residual activity measured in the catheter was 7.64 ± 6.11 (mean \pm SD). From the application of the non-parametric test Wilcoxon to compare if the SUV CAT- is higher than the SUV CAT+, as the $p(0.00) < \alpha(0.05)$. We also verified that the SUV CT+ is significantly higher. The SUV values range variation between CAT+ and CAT- was between 0.0 and 4.5, with 0.21 ± 0.4 (mean \pm SD).

Discussion / Conclusions: Even considering that the residual activity of ^{18}F -FDG did not introduce a significant variation in SUV value it is important to measure it mainly in small lesions and when the SUV is low, because they can easily introduce an error in comparative studies, used to evaluate therapy response.



16h00-16h30, Friday, May 30, 2014

Performance measurements of parallel hole collimators of a Philips Brightview gamma camera

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Introduction: Collimators are one of the main gamma camera components affecting image quality. Lower quality or damaged collimators may affect certain performance parameters. In this way, a robust periodical QA protocol is of utmost importance in order to assure optimal clinical image quality. Thus, the main goal of this work was to assess the performance parameters of the parallel hole collimators of a Philips Brightview camera. Additionally, an optimized protocol for collimator performance assessment was suggested.

Methods: The study involved the measurement of the following collimator parameters, according to IAEA and manufacturer's specifications: integral uniformity, septal angulation, spatial resolution, sensitivity, and centre of rotation (COR). The proposed protocol suggests a collimator integrity screening in terms of uniformity and septal angulation assessment, followed by spatial resolution and sensitivity evaluation, only if needed. COR is always performed. The set of available collimators was tested: low energy high resolution (LEHR), medium energy general purposes (MEGP) and high energy general purposes (HEGP).

Results: Integral uniformity for each pair of collimators was LEHR1: 9.48%, LEHR2: 9.46%, MEGP1: 9.37%, MEGP2: 9.40%, HEGP1: 9.41%, HEGP2: 9.92%. The septal angulation test showed slight misalignments for LEHR collimators. Mean spatial resolution was 3.84mm and 3.91mm (LEHR2). Sensitivity tests showed similar values for both collimators, rounding 0.008%. COR errors were safely below the specifications.

Conclusion: The obtained values showed a fair agreement with the manufacturer's specifications, although the septal angulation test evidenced slight collimator hole misalignments in LEHR collimators, suggesting a foil fabrication method, which is more prone to defects. Additionally, the proposed optimized protocol seems to be more efficient, allowing to save time and avoid unnecessary collimator QA testing.



PP – 09

16h00-16h30, Friday, May 30, 2014

Patient Satisfaction in Nuclear Medicine Department of Royal Sussex County Hospital

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Introduction: Assessment of patient satisfaction levels is a main item in evaluation of the quality of provided care. It intends to demonstrate if the care that is being provided suits patient's expectations and it allows public recognition of good practices. **Aim:** To evaluate satisfaction of attended patients in Nuclear Medicine Department of Royal Sussex County Hospital (RSCH).

Methodology: Retrospective study done in October 2011, with non-probabilistic sampling, based on the analysis of surveys filled by patients attended in Nuclear Medicine department of RSCH. For each answer option, a score and a classification were given: 0, 5, 10, being 10 the best feedback and 0 the worst one. Statistical analysis was done with the help of Excel (Microsoft®). Some of the evaluation factors were: staff dedication, ethics of healthcare professionals, privacy provided, communication performance, quality of given explanations, information transmission, patients' comfort and opportunity to express themselves, conflict of information, improvements needed to be made.

Results: Average scores ranged from 7.7 to 10. There was no question scored below 5.0. Mean score for the survey was 9.4 ± 0.7 .

Conclusion: Overall results indicated high degree of satisfaction shown by the patients, with the only exception for the waiting times which showed the highest percentage of the lowest score.

10h00-10h30, Saturday, May 31, 2014

Contribution of SPECT-IBZM in the differential diagnostic of Parkinson Syndromes

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² Nuclear Medicine Technologist

Introduction: The Parkinsonian syndromes reach worldwide 1-2 persons per 1,000 people, which reflect in the research of new methods of diagnostic. The brain Single Photon Emission Computed Tomography (SPECT), with the use of ¹²³I-IBZM, has been promoted as important in the differential diagnosis of Parkinsonian syndromes (Parkinson's disease, Progressive Supranuclear Palsy (PSP), Multisystemic Atrophy (MSA) and Essential Tremor). The IBZM demonstrates affinity for D2 receptors located postsynaptically, which compared with DaTSCAN that demonstrates fixation on presynaptic receptors, gives additional clinical information to complement the primary evaluation of the neurologist, confirming the existence of PSP, MSA, or Essential Tremor.

Methodology: Literature search was undertaken through the portal b-on and in scientific journals, where the search words SPECT, IBZM, Parkinson Syndrome, Lewy Dementia and DaTSCAN were used to select several studies, which were subsequently revised.

Results: The combination of DaTSCAN and IBZM allows differentiating and confirming, with 94% sensitivity and 94% specificity, the existence of Parkinson's disease, PSP/MSA, and Essential Tremor. However, studies have shown that the use of IBZM-SPECT in conjunction with the study of cardiac innervation with MIBG allows for a differential diagnosis of Parkinsonian syndromes, with the benefit of reducing radiation exposure and exam cost.

Conclusions: Given that DaTSCAN only identifies the presence of Parkinsonian syndromes in the patient, the combination with the IBZM study allows distinguishing between Parkinson's disease and PSP/MSA with a great sensitivity and specificity. By these factors the IBZM-SPECT shows to be important in the differential diagnosis of Parkinsonian syndromes.

10h00-10h30, Saturday, May 31, 2014

Multimodal Nuclear Imaging in Alzheimer's Disease

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Introduction: Alzheimer Disease (AD) is a progressive neurodegenerative disease associate to a neuronal function disruption and to a gradual cognition, function and individual behaviour deterioration. For his early diagnose, Nuclear Medicine (NM) offers functional methods such as Single Photon Emission Computed Tomography (SPECT) and Positron Emission Tomography (PET), that combined with morphologic studies like Computed Tomography and Magnetic Resonance Imaging , provide cerebral perfusion and metabolism information, attenuation correction and anatomic mapping, that increase its sensibility and specificity. Brain SPECT using radiopharmaceuticals as ^{99m}Tc-HMPAO, ^{99m}Tc-ECD, ¹²³I-IMP and ¹³³Xe-SPECT, enables the therapeutics planning, patients follow-up and the estimation of Regional Cerebral Blood Flow that is helpful in AD diagnosis. On the other hand, PET scan features a vast amount of radiopharmaceuticals where ¹⁸F-FDG and ¹¹C-PIB are the major examples. The first is clinical indicate for the glucose mechanism absolute quantification (decreased in AD patients) and the second is specific for β A plaques (degenerate in AD patients).

Methodology: Data were obtained through bibliographic research, considering the PubMed®, international organizations and societies (WHO, SNM, EANM, Alzheimer's Association, European Association for Brain Perfusion SPET), scientific journals (The Journal of Nuclear Medicine, International Journal of Alzheimer's Disease), and standard guidelines. Key words: Alzheimer's disease; SPECT; PET; dual-modality.

Results: Considering the investigation typology it wasn't obtain overall results.

Discussion/Conclusion: NM exercises an important role on complementary diagnose for providing functional techniques, that early detect perfusion and metabolic changes, before the expression of structural changes. The fusion methods extensive development enables a more complete and exact knowledge about AD, with advantages for the patient.

10h00-10h30, Saturday, May 31, 2014

PET Choline in Nuclear Medicine

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Introduction: In Nuclear Medicine, the use of choline radiolabelled analogues as positrons emitters, like ^{11}C and ^{18}F , becomes a useful tool in malignancies detection and localization through Positron Emission Tomography (PET) and PET/Computed Tomography (CT). There are a vast amount of clinical applications namely for oncologic findings. The major application is on prostate cancer being referenced for the primary prostate cancer early detection, tumoral staging, presence of lymphatic involvement and tumoral recurrence. In cerebral cancer has been successful applied in cerebral lesions characterization and seems, when combined with Magnetic Resonance Imaging (MRI) to be a precise tool on high-risk gliomas and meningioma detection. Image with ^{11}C on pulmonary cancer is used on malignant lesions and residual tumors detection. In the universe of digestive tract cancers stands out the esophagus and hepatocellular cancer. In bladder cancer emerges like a promising tool for the bladder transactional cell carcinoma pre-operative staging and contribute positively for the therapeutics selection distinguish patients who benefits of neo-adjuvant treatment from radical surgery.

Methodology: Data were obtained through bibliographic research, considering the PubMed®, international and scientific organizations (Society for Experimental Biology and Medicine, EANM, Society of Nuclear Medicine and Molecular Imaging, American Cancer Society), scientific newspapers (The journal of Nuclear Medicine, The Journal of Urology), as well standard guidelines. Key-words: choline; radiopharmaceuticals; oncology; PET; PET/CT.

Results: Considering the investigation typology it wasn't obtain overall results.

Discussion/Conclusion: Prostate, cerebral, such as meningioma and gliomas, pulmonary, digestive tract, on liver and esophagus, and bladder cancer are presented as the major areas of interest to approach with greater benefits providing a high sensibility in these pathologies detection.

PP – 13

10h00-10h30, Saturday, May 31, 2014

Renal Function in Renogram: Comparison of Two Algorithms for Image Processing

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Introduction: The renogram (RNG) enables the evaluation of morphology and function of the urinary system. ^{99m}Tc-MAG3 is the most widely used radiopharmaceutical for studies in pediatric settings. For calculation of the parameters of renal function (RF) some processing algorithms are used. We studied the MAG3 Without Samples (MWS) and QuantEM Expert (QEE), the most applied in Portugal in nuclear medicine. Aim: evaluate the correlation of RF in RNG, with the processing algorithms MWS and QEE.

Methods: Retrospective study, with non-probabilistic sampling by convenience of 21 pediatric patients with clinical indication to ^{99m}Tc-MAG3 diuretic RNG with furosemide. Protocols were made in agreement with the standards of the department where the data were collected. The following variables were calculated: depth, time to peak, differential RF and time to ½ Lasix®, of the right and left kidney; effective renal plasma flow (ERPF); MAG3 clearance (body surface area and weight, normalized). For calculation of the MAG3 clearance, QEE had different weightings (pediatric (QEE-p) and adults (QEE-a)) and MWS applied the same coefficients in the two studies. Descriptive and inferential statistical analysis (Shapiro-Wilk test, T-test and Wilcoxon test), with $\alpha=0.05$. The ethical and confidentiality principles were considered.

Results: The depth, time to peak, differential RF and time to ½ Lasix®, of the right and left kidney, and ERPF, didn't show statistically significant differences ($p>0.05$). The average MAG3 clearance given by MWS is lower than by QEE-a, with exception of MWS/total-QEE-a, which didn't show statistically significant difference ($p>0.05$). The average MAG3 clearance in total-MWS/total-QEE-p and total-MWS/QEE-p, show statistically significant difference ($p\leq 0.05$).

Conclusion: MWS and QEE provide the same outputs but with variation on standardization parameters. It's important that the operator understand the algorithm used in order to obtain standardization of results.