Nuclear Medicine Review 2011, 14, 1: A20–A32

ISSN 1506–9680

VIA MEDICA

POSTER SESSION

P1

EFFICACY OF RADIOGUIDED SENTINEL LYMPH NODE BIOPSY IN BREAST CANCER PATIENTS AFTER NEOADJUVANT THERAPY

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Background: The role of sentinel lymph node biopsy after neoadjuvant therapy is not fully justified, but according to some authors, it can be used in this patient group almost as efficiently as in patients with no such treatment. Our workgroup applied radiogiuded method for the localization of the former or residual tumour and/or for sentinel lymph node biopsy, but it did not show the usual effectiveness in terms of sentinel node detection, therefore we aimed to compare the efficacy of our method in this two (neoadjuvant treated and non-treated) patient groups.
Material and methods: We enrolled 23 patients treated with neoadjuvant therapy (20 chemotherapy, 3 hormone therapy) and 1114 patients without such treatment in the study. The radiopharmaceutical (99mTc-Senti-Scint, 150 MBq, 0,4 ml) was administered by ultrasound or rarely by X-ray guidance or by palpation intra- or peritumourally, or (in 9 cases) to the ring marker placed into the tumour before the initialization of neoadjuvant therapy. We performed gamma camera acquisition and sentinel node mapping (including skin marking) at least 3 hours after administration. The next day, during the operation sentinel lymph nodes were detected by intraoperative gamma probe and by blue staining.
Results: In the neoadjuvant treated group sentinel node had been detected by gamma camera in 26% (6/23) of patients, during the operation we could remove sentinel lymph node in 30% (7/23) by gamma probe detection and in further 9% (2/23) of patients by blue staining. In the non-treated group these ratios were 82% (912/1114), 87% (965/1114) and further 7% (76/1114) consequently. We could remove sentinel lymph node by gamma probe detection in all 3 patients treated with only neoadjuvant hormone therapy, and in 2 of them gamma camera acquisition was successful as well.
Conclusions: According to our results, radioguided sentinel lymph node biopsy after neoadjuvant chemotherapy is much less effective compared to the non-treated group, but in patients undergoing only neoadjuvant hormone treatment the efficacy of the technique seems to be not affected.

P2

LONG TERM VALIDATION OF SENTINEL NODE TECHNIQUE IN MALIGNANT MELANOMA — MORE THAN FIVE-YEARS FOLLOW-UP

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Background: Radioguided sentinel lymph node (SN) biopsy in patients with malignant melanoma (MM) by now is a well accepted method however the validation of the method has to be proven on the basis of long-term follow-up. The aim of this study was to analyse the follow-up data of SN negative patients concerning to the later lymph node involvement.
Material and methods: Between September, 1999 and March, 2005 SN localisation was performed preoperatively by gamma-camera technique using 99mTc-nanocolloid (Senti-Scint), and intraoperatively with gamma-probe in 337 MM patients. In all cases the Breslow thickness of MM was more than 1 mm, or less than 1 mm, but grade Clark IV, or ulcerated or regressed, and clinically the lymph node stage was N0. The validity of the sentinel node biopsy was analyzed on the basis of the follow up of the lymph node status of the SN negative patients. The follow-up period was longer than 5 years (61–127 months).
Results: SN was identified in 313 patients in one region and in 24 cases in more then one region. In 135 cases (40%) SN was MM positive, and in 202 patients (60%) MM free. More than 5-yers clinical follow up was performed in 152 SN negative cases. In this group the MM associated mortality was 10% (15/152). The survival rate with active disease in SN negative cases was 5% (8/152) and the other patients were clinically tumour free (85%, 129/152). During the clinical follow-up lymph node metastasis was detected in 5% (8/151, lymphatic status of one patient is actually unknown), therefore these cases were classified as false-negative concerning the SN biopsy.
Conclusion: The low false negative rate confirms the validity of SN biopsy technique.

P3

THE IMPORTANCE OF BONE SCINTIGRAPHY IN PATIENTS WITH MANDIBLE DISORDERS

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Background: In patients with mandible malformations it is important to estimate the degree of maturation and the accurate mapping of the metabolism of the mandible in order to choose appropriate therapy. To decide about these questions are burdened not only by the asymmetric growth of the mandible, but one should also take into account the patients' earlier dental interventions (e. g. orthodontia, tooth extraction etc.); that is it is vital to get an accurate knowledge of dental history. Our goal was to study the possible use of bone scintigraphy with 99mTc-HDP in patients with mandible growth disorders.
Material and methods: In three patients with mandible disorders (male, age: 17–21) bone scintigraphy (99mTc-HDP) was performed with SPECT and targeted planar images (AP, RLAT, LLAT). The relative activity of each region was determined from count/pixel of the ROI. Standard transversal slices of the SPECT scans were used for quantitative ROI analysis. The percentage was calculated using the following formula: (counts/pixel in interested region)/(counts/pixel in left ROI + counts/pixel in right ROI) X 100. The SPECT scan was considered abnormal if the difference of activity between the two ROIs was grater than 10%. Standard software (GE Infinia) and a special code (Ortopan) that were developed before for analysing the data of SPECT, were used to analyse the ROI.
Results: the tracer uptake of the mandible was diffusely, slightly higher than usual in all three patients, which was caused the not to completed growth of mandible and the ongoing orthodontia. The difference between the two sides of corpus mandibulae was 10% in one patient and in one case it was slightly higher than 10%, which was also associated with increased blood pool activity. We did not find differences between the condyles of the mandibles.
Conclusion: We can conclude that the quantitative analysis is important to get additional information.

P5

COMPARISON OF UNSPECIFIC BONE SCINTIGRAPHY FINDINGS AND THEIR RADIOGRAMS OR CT IMAGES

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Background: The aim of this study is to compare unspecific bone scintigraphy findings with their radiograms or CT images, as well as to process the outcomes, and to draw the conclusion.
Material and methods: This study was performed on 128 patients, 83 women and 45 men with a mean age of 63 years, who presented unspecific bone scintigraphy findings. All of them are oncological patients. We did the bone cintigraphy as screening, then I suggest selective conventional radiography to specify the etiology of the unspecific findings. I compare the radiological images with scintigrams.
Results: Significant part of unspecific findings are localised on the vertebral column (ca. 70%), and mostly the cause of these is degenerative disease (ca. 80%). Their smaller part are localised ont he ribs (ca. 20%), and mostly the cause of these is fracture (ca. 90%).
Conclusion: Common use of bone scintigraphy and radiological methods is increases the diagnostic accuracy. The study is shows the importance of the SPECT-CT in present-day nuclear medicine.

P8

OPTIMIZATION OF THE IMAGE QUALITY OF MINIPET-II SCANNER BY AUTOMATED VERIFICATION PROCEDURE

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Background: Our goal was to develop an automated image processing system with which the impact of new image reconstruction software components on image quality can be studied. Furthermore, we expect the system to be capable to monitor the imaging performance parameters of the MiniPET-II scanner, on a daily bases.
Material and methods: The developed verification software automatically processes the list mode MiniPET-II data acquired with NEMA NU-4 image quality phantom. The measurements are performed with the activity rate and time duration defined in the NEMA standard. On the one hand, reconstruction is carried out by the algorithms used in the everyday practice, the image quality parameters are determined through the methods of the NEMA NU-4 standard, and the quality parameters of each acquisition are stored in a database to provide a tool for the continuous monitoring of the MiniPET-II instrument. On the other hand the software is modular, therefore the reconstruction with new software components and the comparison of their performance to the standard methods can also be performed automatically on a given acquisition. The software is integrated into the MultiModal Medical Imaging (M3I) framework.
Results: As the result of the development we have developed a multipurpose image quality verification system. Using the software, we can check the temporal alternation of imaging ability of the MiniPET-II instrument, failures of the scanner can be detected. Furthermore, the impact of new reconstruction software components on the image performance parameters can be studied in an automated way. Thus, the efficiency of development, testing and verification of new algorithms is definitely improved.
Conclusion: We have created a database supported, multipurpose verification system, which enable the failures of the MiniPET-II scanner to be detected in a reliable way. Besides, the software speeds up the development of image reconstruction components in the M3I environment.

P9

REGISTRATION OF LOW-DOSE AND DIAGNOSTIC CHEST CT SCANS BASED ON SKELETAL AND BRONCHUS SURFACE MODELS

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Background: For the postprocessing of clinical PET data acquired from PET/CT studies of the human chest in some cases it is necessary to produce the fusion of the diagnostic CT and PET images. Due to the various scanning protocols different CT scans of the same subject may represent different morphological states of the target area. This effect makes the comparison of diagnostic and low-dose CT scans complicated. The purpose of this work is to develop an intrasubject chest CT registration method based on skeletal and bronchus surface models.
Material and methods: For both the diagnostic and low-dose CT scans, dedicated algorithms were developed for segmenting the regions of sternum, backbone and bronchus. Former problems were solved by a simple intensity-threshold based procedure, latter was performed by a particular adaptive region growing algorithm. Using the surface models and landmark points retrieved from the segmented regions, a complex transformation and deformation method was constructed, which solves the problem of the CT registration accurately in the important regions. In areas being less relevant, the criterion of registration accuracy is weaker.
Results: The developed method enables the local nonlinear registration of the diagnostic and low-dose CT scan of the same subject. Due to the nature of the method, the accuracy of the registration is highest in the featured environment of the skeleton and bronchus. The PET/CT data of 3 subjects was used in the testing and development of the proposed approach. The clinical validation of the method is in progress within the confines of the institutional virtual bronchoscopy project.
Conclusion: One possible application of the elaborated registration method is the PET-assisted virtual bronchoscopy. The method according to the primary registration tests proved to be effective, however the clinical validation is still in progress.

P10

INVESTIGATION OF SYNGENIC RODENT TUMOR MODELS USING MINIPET-II SCANNER

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Background: Earlier examinations showed, that carbohydrate and amino acid metabolism in cancer cells are more dynamic than in normal cells. To estimate the tumorogenic potential, the 18FDG uptake and expression of facilitative glucose transporters have been suggested. It is also well known that 11C-methionine is a useful radiotracer for the investigation of amino acid transport and metabolism in the living body. In our experiments, we wished to prove with MiniPET-II scanner that these radiotracers and modern PET imaging technics are useful tools to follow the growing of implanted tumor cells and metastases in different rodent models.
Material and methods: Rats were injected subcutaneously or intravenously with 5 $\times$ 106 rat hepatocellular carcinoma (He/De) and myelomonocytic leukemia (My/De) cells. In other experiments 5 $\times$ 106 He/De and My/De cells were placed under the left renal capsule by surgical procedure. After the implantation 18FDG and 11C-methionine scans were repeated at different time points. Control and tumor-bearing rats were injected *i.v.* with 5.5 $\pm$ 0.3 MBq 18FDG or 10.0 $\pm$ 0.5 (mean $\pm$ SD) MBq 11C-methionine.

50 min (18FDG) and 30 min (11C-methionine) after tracer injection animal were anaesthetized by 3% isoflurane. 10 minutes PET scans were acquired in each bed positions using a small animal PET scanner (MiniPET-II, Department of Nuclear Medicine, Debrecen) to visualize the primary tumor and the metastasis. The MiniPET-II consists of 12 detector modules in one ring with LYSO scintillator crystal blocks. The axial and the radial field of view (FOV) are 48 mm and 106 mm, respectively and the system absolute sensitivity is 10.14% (NEMA-NU4 2008). The 18FDG and 11C-methionine uptake were expressed in terms of standardised uptake values (SUVs) and tumour to muscle (T/M) ratios.

Results: By taking the SUV values from the MiniPET-II images the majority of the radioactivity (18FDG and 11C-methionine) was accumulated in the primary tumors: He/De 18FDG-SUVmean: 10.2 ± 3.0, 11C-methionine-SUVmean: 3.2 ± 1.0; My/De 18FDG–SUVmean: 4.7 ± 1.2, 11C-methionine-SUVmean: 3.2 ± 0.8. Two weeks after the implantation in rats bearing primary tumors under the renal capsule we found metastases at the parathymic lymph nodes (PTLN): He/De 18FDG-SUVmean: 3.5 ± 0.6, 11C-methionine-SUVmean: 1.7 ± 0.2; My/De 18FDG–SUVmean: 3.2 ± 0.7, 11C-methionine-SUVmean: 1.8 ± 0.5. In the subcutaneous models after two weeks only primary tumors (He/De — SUVmean: 9.0 ± 2.6, My/De — SUVmean: 7.7 ± 1.6) and no metastases were found by 18FDG scans. Three weeks after intravenous injection of He/De cells metastatic lesions were found by 18FDG scans in the liver and lungs with SUVmean 4.3 ± 0.7 and 2.3 ± 0.3 respectively.

Conclusion: This preclinical study showed that tumor cells implanted under the capsule of the kidney generate metastases in the PTLN. The renal capsule-parathymic lymph node complex seems to be suitable for the isolated *in vivo* examination of metastatic development. MiniPET-II scanner and the animal models are helpful appliances in preclinical research and drug development research.

P11

DEVELOPMENT OF WEB TECHNOLOGY SUPPORTED MULTIMODAL IMAGE PROCESSING SERVICES AT THE UNIVERSITY OF DEBRECEN

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Background: Our aim was to develop a web-based software environment that offers image processing services for our research partners, using the imaging infrastructure of the Institute of Nuclear Medicine. As important considerations we have defined ease of use, realization of automatic notification points in the co-operation process, centralized availability and management of information and state of data

Material and methods: The core of this service is the MultiModal Medical Imaging software system developed in the institute. Furthermore, database tools are provided on the R&D website (www.minipetct.hu) of our institute to manage the data flow and data states. The flexibility and scalability provided by the CMS (Content Management System) is utilized to generate the web pages dynamically. Analysis and modeling of the co-operation process and life cycle of the data packages had been performed. Points were identified in the process where the system notifies the participants via email. We have also examined the workflow of co-operation and identified the services that should be supported by web interface.

Results: As a result we can provide database supported image processing infrastructure for our partners that can be used effectively for research projects without advanced knowledge on the field of informatics. Our virtual bronchoscopy project is used to validate the web service and its infrastructure.

Conclusion: The web services provided for the clinical research projects and supported by the infrastructure developed in our institute simplifies the collaboration and increases its efficiency. Thus we can provide uniform communication system for our upcoming, long-term clinical projects with standardized image procession; the tasks can be performed in an efficient and controllable way.

P12

METHODOLOGICAL DEVELOPMENTS FOR AUTOMATED REGION ANALYSIS OF BRAIN SPECT AND PET EXAMINATIONS

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Background: The infrastructure for automated region analysis of brain PET and SPECT examinations was partly available in our institute, which was developed for image registration processes earlier. We broadened this automated process by software components, which were developed along the development of BrainLOC, made it possible to join these components to the automated image processing thread.

Materials and methods: We have used the MultiModal Medical Imaging software system to develop the main software components required by the automated regional analysis service: pre-defined functional and anatomical brain structures as part of the VOI database of the BrainLOC application; 3rd party (MNI, FSL) and in-house developed mulimodal registration and standardization software; utilities for ROI analysis. We have also developed the DicomBBox software to receive and convert images, which is built on the basis of the DICOM server in our institute. Processing and monitoring services are available through the interfaces developed for the R + D web site of our institute.

Results: In contrast with our goals, a completely automated software system was developed to evaluate regional analysis of brain PET and SPECT data using arbitrary regional definitions of various brain atlases. The user requesting this service could select regions from more than 20 brain atlases and for spatial standardization T1-weighted MRI, PET or SPECT templates. The results of analysis carried out on the images received by our DICOM server can be accessed by email or through the web site of the institute. The standardization was carried out by the automated system.

Conclusion: We expanded the automated image processing in our institute with a service of automated region analysis of brain PET and SPECT examination. This service can be accessed by other institutes who does not have this kind of image processing infrastructure.

P13

INTEGRATION OF PET-CT IN THE MANAGEMENT OF PATIENTS' TREATED WITH RADIOSURGERY: DEBRECEN'S EXPERIENCES

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Background: The first hungarian gamma radiosurgery center was opened at 2007 in Debrecen. Until now 1500 patients have been treated. Radiosurgery is based on different imaging modalities that are used for targetting. In the currenct clinical practise we use contrast-enhanced CT and T1 weighted contrast-enhaced,3D SPGR MR sequences.We report our clinilcal experience with the combined use of metabolic (18F-FDG-PET-CT, 11C-MET-PET) and anatomic (CT,MR) images for the radiosurgical treatment of patients, to determine whether these imaging methods can be useful for further clinical management.

Material and methods: Four patients with brain metastases were treated with stereotactic radiosurgery. MRI and 11C-Met-PET examinations were done before the treatment and 2 and 6 months following the radiosurgical procedure. PET/MR fusions were also conducted. In the PET-scans we measured the size of the lesions and the tumor activity. Data was compared to the MRI findings. In one brain metastatic case radiosurgeons used 11C-MET-PET/ contrast-enhanced CT fused images for treatment planning.

In another case of recurrent nasopharyngeal carcinoma 18F-FDG-PET/MR fusion was used to determine the target.

Results: All PET-guided radiotherapy was succesful.Using fused images the delineation of viable tumor tissue was more accurate. All the four followed patients displayed good regression, decreased lesion size and tracer uptake. In one case we didn't find any metabolic activity in the treated metastases after 2 months following radiosurgical treatment. We compared our data to the MR-scans and it seemed to be useful in differentiation of radionecrcosis from residual/recurrenct viable tumor tissue.

Conclusion: The integration of PET in radiosurgery provides additional information that opens new perspectives for the optimization of the treatment and follow-up stereotactically treated patients. Our results requires confirmation by further clinical study with larger patient group and a longer follow-up period.

P14

THE EFFECT OF COMBINED TREATMENT BLOCKING P-GLYCOPROTEIN FUNCTION MEASURED USING MINIPET IN XENOGRAFT TUMOR MODEL

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Background: P-glycoprotein (Pgp) is one of the active efflux pumps that are able to extrude a large variety of chemotherapeutic drugs from the cells, causing multidrug resistance. It has been shown earlier that the combined application of a class of modulators used at low concentrations and UIC2 antibody is a novel, specific, and effective way of blocking P-glycoprotein (Pgp) function. *In vivo* study of this combined treatment was developed using xenograft multidrog resistant and sensitive human tumors model. The effect of this combined treatment by Pgp modulator and UIC2 antibody was monitored using MiniPET-II camera and tumor diagnostic PET tracers.

Material and methods: Female SCID mice were injected subcutaneously with KB-3-1 (Pgp negative) cells on the left and KB-V-1 (Pgp positive) cell on the right side. Four days after the injection mice were treated with doxorubicin (5 mg/kg, *i.v.*) combined with UIC2 monoclonal antibody (5 mg/kg, *i.v.*) and cyclosporine A (10 mg/kg, *i.p.*). After the implantation 18FDG/PET and 18F-FLT/PET scans were repeated at different time points. Control and tumor-bearing mice were injected *i.v.* with 5.5 ± 0.2 MBq 18FDG or 18F-FLT. 40 min after tracer injection animal were anaesthetized by 3% isoflurane and 20 minutes PET scans were acquired using a small animal PET scanner to visualize the tumors. The 18FDG and 18F-FLT uptake were expressed in terms of standardised uptake values (SUVs) and tumour to muscle (T/M) ratios.

Results: In the non-treated mice palpable tumors developed 4 days after the implantation. By taking the SUV values from the MiniPET-II images a higher 18F-FLT uptake was observed in the Pgp positive (SUVmean: 4; SUVmax: 5–7) than in the Pgp negative tumors (SUVmean: 3; SUVmax: 4). The FDG accumulation rate of the tumors showed a similar trend as FLT. In the Doxorubicin-UIC2-CSA treated group the regression of tumors was observed. The size of tumor, the accumulation rate of 18FDG and 18F-FLT was decreased significantly. In the KB-V-1 tumors high expression of Pgp was found by immunohistochemical analysis.

Conclusion: Combined treatment with UIC2 antibody and low concentrations of Pgp modulators effectively blocked the function of the Pgp pump in human epidermoid carcinoma tumors and this effect could be followed *in vivo* by using 18F-FLT and 18FDG tumor-diagnostic tracers and MiniPET-II camera.

P15

ISOLATION, DIFFERENTIATION AND RADIOLABELLING STUDIES OF CANINE ADIPOSE TISSUE DERIVED MESENCHYMAL STEM CELLS (CAD-MSC) — THE VERY PRELIMINARIES

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Background: Dogs (Canis lupus familiaris) are a reliable model of human diseases in a wide variety of disorders. The autologous adipose-derived stem cell therapy (cAD-MSC) can be a promising new treatment in the field of regenerative medicine and tissue engineering for both human and veterinary medicine. Our aim was to develop stem cell therapy for veterinary patients suffering diseases and parallelly to prove the usefulness of canine model for human biomedical tasks.

Material and methods: The subcutaneous adipose tissue was harvested from the thoracic fat depots of Beagle dogs using standard sterile surgical procedures. The SVF (Stromal Vascular Fraction) was obtained by digestion with collagenase. Following centrifugation and washing of the pellet, cells were incubated in Dulbecco modified Eagle's medium (DMEM) supplemented with 10% Fetal Bovine Serum (FBS), in incubator supplied with humidified air and 5% CO2. Mesenchymal stem cells may also be represented in cell mixture. To evaluate this hypothesis the cells were successfully differentiated towards adipogenic, osteogenic and chondrogenic lineages. Moreover, FACS measurements are carried out to identify the expression of the appropriate cell surface markers. Radiolabelling (99mTc-HMPAO, Leuco-Scint® kit) method was performed following the producer's (Medi-Radiopharma Ltd) instructions.

Results: The adipose derived MSC cells — similarly to the human adipose derived cells — showed fibroblast-like morphology in light microscope. The phenotype of the isolated cAD-MSC was identified by detecting cell surface markers with flow cytometry (FACS); that is we successfully isolated canine adipose derived stem cells. The induced differentiation, further FACS measurements are in progress. Non-specific radiolabelling with 99mTc-HMPAO (Leuco-Scint®, Medi-Radiopharma Ltd.) resulted high labelling efficiency with retained functional abilities so that labelled MSCs are available for reinjecting and further SPECT/CT imaging.

Conclusions: Our preliminary results suggest that isolation-, identification-, differentiation- and radiolabelling of cAD-MSC are feasible. Canine adipose tissue represents an easily available source for veterinary stem cell therapies. Beside dog proved to be a promising biomedical model for evaluation of novel therapies such as applying stem cells.

Acknowledgements: Scientific work was supported by several national (OTKA-68376, JEDIONKO, KMOP-1.1.1-08/1-2008-0017, GOP-1.1.1.-09/1-2010-0107) and international projects (IAEA-CRP, EMIL NoE).

P16

INVESTIGATION OF PGP PUMP FUNCTIONS WITH PET RADIOTRACER 11C-VERAPAMIL

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Background: Chemotherapy failure due to multidrug resistance (MDR) is a common problem in cancer treatment, because of the overexpression of the drug efflux pump P-glycoprotein (Pgp). Detection of the Pgp pump functions is an essential aspect in the treatment of cancer patients. The 11C-verapamil — substrate of the Pgp pump — could be a useful *in vivo*

PET radiotracer. The Aim of our study was the evaluation of the uptake of the radiotracer 11C-verapamil in Pgp negative and Pgp positive cells.
Material and methods: For *in vitro* study human epidermoid carcinoma KB-3.1 Pgp negative and KB-V-1 Pgp positive cell lines were used. The accumulation of the 11C-verapamil was measured by a calibrated gamma-counter. The Pgp functions were tested with rhodamine 123 by flow-cytometry. The pump functions were attested in an *in vivo* mouse model by MiniPET-II scanner.
Results: We found that 11C-verapamil accumulation were higher in Pgp negative than in Pgp positive cells. The accumulation was decreased in Pgp positive cells in a time dependent manner. The treatment with ciklosporin A (CSA) — which is a Pgp inhibitor — increased the 11C-verapamil uptake in Pgp positive cells but it did not modulate the uptake in Pgp negative cells. In the presence of verapamil the 11C-verapamil uptake was lower in both cell lines than that by the verapamil-untreated cells. Norverapamil — the precursor of 11C-verapamil — influenced the 11C-verapamil uptake in both Pgp positive and negative cells. 1 μM Norverapamil treatment increased the uptake to 70% while incubation with 10 μM norverapamil reduced 11C-verapamil uptake to 25%. The Pgp pump functions were studied *in vivo* by MiniPET-II scanner. The main function of the Pgp pump in the blood-brain barrier is to protect the brain against of the accumulation of toxic chemical agents. In our *in vivo* experiments by analysing the MiniPet-II images we found that there was no 11C-verapamil accumulation in the brain. When we inhibited the Pgp pump functions with CSA we measured an increased 11C-verapamil uptake in the brain.
Conclusion: From our measurements we concluded that 11C-verapamil can serve as a useful tool in *in vivo* and *in vitro* demonstration of Pgp pump functions.

P17

[11C]CHOLINE SYNTHESIS WITH THE NEW SYNTHESIS MODULE

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Background: [11C]Choline has been reported to be useful for the detection and differential diagnosis not only of prostate cancer, but also in case of brain tumors, lung cancer and esophageal cancer, whereas generally used [18F]FDG lacks of specificity or sensitivity. In order for [11C]Choline to become available for human PET investigation marketing authorization is needed from the National Institute of Pharmacy. For this purpose a new synthesis module has been created which is suitable for the aseptic production of [11C]Choline and the optimal parameters of the process were also investigated. With the new module we started to compile the registration documentation which will be submited to the authority this year.
Material and methods: In our Institute [11C]Choline production was started many years ago for biological experiments. The synthesis module used was not suitable in aseptic conditions therefore a new module was created using the experience acquired during the development of the 11C-methionine module. The quality of the materials used for the production were if possible of GMP standard pharmaceutical quality the production and dispensing were done in aseptic conditions. The 11CO2 content of the irradiated target gas was first converted into [11C]methyl iodide in a gas phase reaction and then it passed into the new module where the [11C]methyl iodide reacted with the precursor that had been loaded into a solid phase cartridge. The main goal of the solid phase method is that both the methylation of the precursor and the cleaning procedure take place on the solid phase cartridge and then the product was eluted. At the end of the process the isotonic solution was moved into the dispensing unit and dispensed into sterile vials. The process was simplified according to the literature and the optimal parameters were determined. The examination of the quality of the product can be found in the literature and in the Draft of [11C]Choline in the European Pharmacopeia. The radiochemical purity was measured by using the HPLC method: LiChrospher NH2 column, eluent MeCN/KH2PO4 pH:4 80/20, UV:205 nm. The chemical purity (precursor and ethanol content) was measured with gas chromatography: Carbowax amine column, sample/internal standard 20/1.
Results: It was found in the optimisation experiments that the precursor can be loaded into the system more easily (in the top of the cation exchange cartridge, without using a second cartridge). The amount of the precursor was decreased without the yield decreasing and the optimal reaction time was determined (2 minutes). The [11C]Choline yield with the new module was 814 $\pm$ 89 MBq/μAh (n = 9) in 18 minutes. The radiochemical purity was more than 98% in all experiments, the content of precursor and ethanol was below the set limits.
Conclusion: [11C]Choline can be synthesised quickly and effectively with the new synthesis module. After the registration procedure [11C]Choline injection will be available for human PET investigation.

P18

PET AND MR INVESTIGATION OF NOVEL SUPERPARAMAGNETIC NANOCOMPOSED CONTRAST AGENT

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Background: Non-invasive diagnostic tools, such as MRI (magnetic resonance imaging), CT (computer tomography) and PET (positron emission tomography) have become the most important methodologies in the field of medical diagnostics. In radiology, contrast means the difference between the darkest and lightest points of the image. In optimal case, contrast facilitates the diagnosis of different diseases, which could be enhanced using contrast agents. The aim of our research work was to develop a novel, tumor specific, nanocomposed superparamagnetic MR contrast agent using biocompatible, biodegradable, non-immunogenic macromolecules.
Material and methods: Physico-chemical characterization was performed using dynamic light scattering, electron microscope and surface charge measurements. For *in vitro* experiments, tumor cells incubated with the nanoparticles were studied using confocal microscope and flow cytometer. *In vivo* experiments were performed on a Fischer rat model. A total of 5 $\times$106 HeDe (hepatocellular carcinoma) cells were placed under the left renal capsule of rat xenografts by surgical procedure. Nanoparticulate contrast agent was added intravenously to the rats on the 9th day after implantation. PET and MRI investigations were performed within 24 h after injection. When taking multimodal images PET measurement was performed right before MR scanning in anesthesia, placing the animal in a fixed position for both experiments. For PET investigations rats were injected *i.v.* with 5.5 $\pm$ 0.3 MBq 18FDG. After one hour incubation 10-minute PET scans were acquired in each bed position using a small animal PET scanner.
Results: Targeted nanoparticles containing superparamagnetic iron oxide (SPION) were prepared, which could specifically accumulate in the tumor cells overexpressing folate receptors. These nanoparticles reduce the T2 relaxation time, change the signal intensity and cause considerable contrast enhancement. In our research work, SPION-loaded nanoparticles were prepared. First folic acid as targeting ligand was conjugated to the poly-gamma-glutamic acid (PGA) and then SPION was synthesized in the presence of this modified biopolymer. Stable nanoparticles were produced by self-assembly of the SPION-loaded PGA and chitosan. One of the main advantages of this system, that the biopolymers maintain their favorable biological properties due to the lack of new covalent bonds. Physico-chemical characterization of nanoparticles was performed by investigation of concentration and ratio of biopolymes, sequence of their mixing and the SPION concentration in the nanoparticles. The effect of the reaction conditions on the formation and parameters (e.g. surface charge, size, size distribution) of self-assembled nanoparticles was also studied. *In vitro* experiments were performed using several tumor cell lines, which overexpress folate receptors (e.g., HeLa, Jimt-1, A2780, AD2780, and HeDe). Confocal microscopic images show that the nanoparticles internalize into the targeted tumor cells, and accumulate in them. Flow cytometry results demonstrate that the selectivity of nanoparticles is about 100%, whereas the number of cells that do not contain nanoparticulate contrast agent is negligible. Cell suspensions treated with nanoparticulated contrast agent were measured

by MRI, and images clearly show a remarkable decrease of T2 relaxation time values as expected. These results confirmed that the targeted tumor cells internalize and accumulate the novel T2 contrast agent.
Conclusion: Based on the results, it can be established that the primary tumor and the metastasis could be visualized and fusion images of PET and MRI results could be made. The development of this contrast agent opens many opportunities for localization and early diagnosis of solid tumors.
Acknowledgements: This work was supported by Baross Gábor Program (MNDMRICA, OMFB-00500/2010).

P19

PET/CT IMAGING IN DOGS AND CATS — THE FEASIBILITY AND RADIOTOXICOLOGICAL ASPECTS

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Background: In this study we present an overview of the impact and advantages of PET/CT fusion imaging in the practice of veterinary oncology. FDG-PET imaging is useful and essential in disease staging, monitoring response to treatment, planning and choosing appropriate therapies, detecting recurrence and predicting prognosis.
Material and methods: Between December 2009 and February 2011 75 PET/CT examinations were performed in 60 referred client-owned dogs and cats in the Department of Nuclear Medicine, University of Debrecen. Pets were sedated and injected iv. with 18F-fluoro-deoxy-glucose (FDG) 15 MBq/bwkg and one hour later after the injection whole body fusion images were taken. We also collected blood samples from patients to check the haematological and biochemical parameters.
Results: A number of neoplastic diseases have been recognised in this study; include soft tissue sarcoma (16%), mastocytoma (11%), mammary tumours (10%), osteosarcoma (11%), lymphoma (3%) and squamous cell carcinoma (25%). In 6 cases we performed follow-up examinations to monitor response to treatment or to detect recurrence. Meanwhile the applied method proved to be well-tolerated in even late stage diseases.
Conclusion: This diagnostic imaging technique is non-invasive and provides important information to veterinary clinicians and biomedical researchers. The relatively high incidence rate of some cancers, similar biological behaviour, large body size, comparable response to chemotherapeutic agents, shorter overall lifespan and shorter latency period are the factors that contribute to the advantages of the companion animals as a model for human neoplastic diseases.
Acknowledgements: Scientific work was supported by several national (OTKA-68376, JEDIONKO, KMOP-1.1.1-08/1-2008-0017, GOP-1.1.1.-09/1-2010-0107) and international projects (IAEA-CRPs, EMIL NoE).

P20

TC-99M LABELED SELF-ASSEMBLED BIOPOLYMER BASED NANOPARTICLES FOR IMAGING RECEPTOR MEDIATED UPTAKE AND APPLICATION IN TUMOR DIAGNOSIS

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Background: A new biocompatible and biodegradable self-assembling nanoparticulate product was investigated as a potential new SPECT imaging agent. Previously this new polyelectrolyte was investigated as a novel nanoscale drug carrier system and then presented as a new folate receptor targeting MRI contrast agent. In present study we examined possibility of application of these nanoparticles in SPECT imaging of folate receptor overexpressing tumors using technetium-99m. The aim of our preliminary *in vitro* and *in vivo* examinations was to verify that nanoparticles can labeled and followed up with Tc-99m with appropriate radiochemical stability, and they show the proper distribution according to their particle size and stability.
Material and methods: Nanoparticles with a hydrodynamic size of 150 nm were prepared by self assembly. Particle sizes were measured by dynamic light scattering (Malvern Zetasizer Nano, Malvern Instruments) before and after labeling. SnCl2 was used to reduction of 900 MBq [Tc-99m] pertechnetate solution for labeling in 3 ml total volume. *In vitro* radiochemical purity was examined by thin layer chromatography (ITLC-SG developed in MEK and saline) up to 24 hours after labeling. Biodistribution values were determined by scintigraphic imaging studies in healthy Beagle dogs and Wistar rats. Images were taken by gamma camera at several times and organ uptakes were estimated by quantitative ROI analysis.
Results: Radiolabeled products showed high degree and durable labeling efficiency (99%) during 24h *in vitro* radiochemical stability follow-up. *In vitro* measured particle size distributions were stable before and after the labeling up to 24h. The *in vivo* biodistribution examinations of nanoparticles had close correlation to earlier described products which have similar particle size distributions. Images and calculated injected dose percentage values validated that *in vivo* radiolabeling efficiency and particle diameters were relative stable and constant after IV application. In the Beagle dogs and Wistar rats the injected labeled compound showed retained blood-background, liver, kidneys, urinary bladder and slight bone-marrow uptake was seen in the scans.
Conclusions: Our preliminary examinations verified that the self assembled nanoparticles are able to label and follow-up using technetium-99m isotope and gamma-camera. In our further examinations Tc-99m-radiolabeled nanoparticles were followed-up in folate receptor overexpressing tumor cell lines in biological experiments.
Acknowledgements: Scientific work was supported by several national (OTKA-68376, JEDIONKO, KMOP-1.1.1-08/1-2008-0017, GOP-1.1.1.-07/1-2008-0082, GOP-1.1.1.-09/1-2010-0107) and international projects (IAEA-CRP, EMIL NoE).

P21

SYNTHESIS OF FLUORINE-18 LABELED RHODAMINE B: A POTENTIAL PET MYOCARDIAL PERFUSION IMAGING AGENT

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Background: There is considerable interest in developing an 18F-labeled PET myocardial perfusion agent. Rhodamine dyes share several properties with 99mTc-MIBI, the most commonly used single-photon myocardial perfusion agent, suggesting that an 18F-labeled rhodamine dye might prove useful for this application. In addition being lipophilic cation, like 99mTc-MIBI, rhodamine dyes are known to accumulate in the myocardium and are substrates for Pgp, the protein implicated in MDR1 multidrug resistance. Fluorine-18-labeled rhodamine B was developed as a potential positron emission tomography (PET) tracer for the evaluation of myocardial perfusion.
Material and methods: Rhodamine B was chosen as the prototype compound for development of the synthesis because the ethyl substituents on the amine moieties of rhodamine B protect them from side reactions, thus eliminating the need to include (and subsequently remove) protecting groups. The 2'-[18F] fluoroethyl ester of rhodamine B was synthesized by heating rhodamine B lactone with [18F] fluoroethyltosylate in 1-butyl-3-methylimidazolium tetrafluoroborate at 165°C for 15 min. [18F] fluoroethyltosylate was prepared by the reaction of ethyleneglycol ditosylate with Kryptofix 2.2.2, K2CO3, and [18F] in acetonitrile for 5 min at 80°C. The internal and the final product were purified by semi-preparative HPLC.
Results: We produced the 2'-[18F] fluoroethylester in > 98% radiochemical purity and a total synthesis time of 150 min.

Conclusion: The synthesized 18F-labeled rhodamine will be a promising candidate for more extensive evaluation as PET tracers for the evaluation of myocardial perfusion.

P22

SELECTIVE OH SCAVENGERS WITH HIGH KOH EFFECTIVELY STABILIZE [18F]FDG AGAINST RADIOLYSIS

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Background: The radiochemical purity of [18F]FDG at high radioactive concentrations decreases in time rapidly due to active species formed during the radiolysis of water. In this study we intended to clarify the effect of selective scavengers of hydroxyl radicals and hydrated electrons on the stability of [18F]FDG. Our goal was also to examine the stabilization effect of various salts, B-vitamins, sugars and amino acids, which are effective hydroxyl radical scavengers.
Material and methods: We studied the impact of stabilizers using 50–100 μL of samples of [18F]FDG treated with reagents to the concentrations of 50 mmol/L. The initial radioactive concentrations of samples were approximately 2 GBq/ml. Both treated and untreated [18F]FDG samples were stored at room temperature (25°C). Stability was tested by analyzing the samples at appropriate time intervals. We determined the radiochemical purity of [18F]FDG samples by thin layer chromatography method: Merck TLC Silica gel 60, acetonitrile/water 95/5V/V%, 18F Rf = 0, [18F]FDG Rf = 0.45, Acetyl-[18F]FDG Rf = 0.65.
Results: We found that the radiochemical purity of the untreated [18F]FDG sample after 210 minutes decreased to 94.70%. In the presence of ammonium formate (selective hydroxyl radical scavenger) and sodium nitrate (selective scavenger of hydrated electrons) the radiochemical purities were 96.76% and 95.35%, respectively. On the other hand the [18F]FDG sample treated with the mixture of formate and nitrate had a purity of 96,13%. Consequently, selective hydroxyl radical scavengers are the most effective stabilizers for [18F]FDG. We also investigated the relationship between the effectiveness of stabilizers and the rate constants of their reactions with hydroxyl radicals (kOH). We found that the purity of samples treated with selective OH scavengers, namely with potassium iodide (kOH: 1.1·1010 L·mol-1·s-1), ethanol (kOH: 1.9·109 L·mol-1·s-1) and sodium acetate (kOH: 7.4·107 L·mol-1·s-1) were 98.90%, 98.74% and 97.96%, respectively. Consequently, the higher the kOH of the stabilizer the more effective for stabilizing [18F]FDG. In addition we found that several OH radical scavengers effectively suppress the radiolytic decomposition of [18F]FDG. For instance, the purity of samples treated with glucose, thiamine and methionine decreased with 1.5%.
Conclusion: Selective OH scavengers with high kOH should be chosen to effectively stabilize [18F]FDG against radiolysis. Among the examined stabilizers glucose could be ideal, as it meets the above mentioned requirements and there is no need for a new analytical method for its quantification, since the HPLC method recommended by the Ph. Eur.6.2 for the determination of radiochemical purity of [18F]FDG can be used for this purpose.

P23

EXAMINATIONS OF DIFFERENT SIZED DOXORUBICIN-LOADED NANOPARTICLES AND COLLOIDS

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Background: Nanoparticles represent promising drug carrier systems. In the case of cytostatics such as doxorubicin, carrier colloid nanoparticles may increase their therapeutical efficiency, decrease their side-effects (toxicity) and any potential multidrug resistance. In present study, doxorubicin, as a widely used antineoplastic agent, was incorporated into the matrix of human serum albumin and three different particle-sized doxorubicin-loaded HSA nanoparticles were prepared. The three prepared colloids were labeled by technetium (Tc-99m) to *in vivo* examinations and they were tested for their physicochemical, colloidal quality, fluctuations and radiochemical stability. The aim of *in vivo* examinations was to verify that colloid carriers have right stability, insignificant size fluctuations after an intravenous application and they show the proper distribution according to their particle size.
Material and methods: Particle sizes and their stabilities, fluctuations were measured by dynamic light scattering and examinations were reinforced by TEM images. Radiochemical purity was examined by thin layer chromatography. Biodistributions of different-sized, radiolabeled colloids were determined by means of scintigraphic imaging studies in healthy male Wistar rats. Images were taken by gamma camera at several times and organ uptakes were estimated by quantitative ROI analysis.
Results: Non-adsorbed doxorubicin quota was checked and followed-up respectively, until 7 days after preparation and verified that more than 95% of doxorubicin proportion was permanently adsorbed to human serum albumin. Mean diameters of the prepared doxorubicin-loaded fractions were 180 nm, 430 nm and 1800 nm. Products were radiolabeled with Tc-99m with high-degree and durable labeling efficiency (99%) as *in vitro* radiochemical stability measurements demonstrated. Particle size was observed for 1 week. Each product showed a high degree of colloid size-stability: diameters and polydispersities of particle fractions were fluctuating within a relatively narrow range and changes were not unidirectional, nor trend-like. The *in vivo* biodistribution data of doxorubicin-loaded radiocolloids had a very close correlation to earlier described results. Images and calculated injected dose percentage values emphasized that directly post-injection, the greatest particle-sized compounds were located especially in the lungs and they slowly disaggregated. The smaller particle fractions were relocated mainly in the liver and they also had slow elimination.
Conclusions: Doxorubicin or different cytostatics loading in these nanoparticulate and colloid formulations can lead to an improvement of cancer therapy. Moreover the methods of nuclear medicine can provide useful possibilities for follow-up colloid carrier systems. Our examinations verified that manufacturing stable different sized HSA colloid carriers for cytostatics is possible. In addition different sizes of particles can raise the question of different application possibilities.
Acknowledgements: Scientific work was supported by several national (OTKA-68376, JEDIONKO, KMOP-1.1.1-08/1-2008-0017, GOP-1.1.1.-09/1-2010-0107) and international projects (IAEA-CRP, EMIL NoE).

P24

PREPARATION OF HIGH SPECIFIC ACTIVITY 11C ISOTOPE LABELLED VERAPAMIL SUITABLE FOR BIOLOGICAL TESTING

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Background: 11C labelled tracer molecules are often used in PET examination. In most cases the labelling procedure is methylation with [11C] methyl-iodide reagent. In most cases the labelled compound used to the receptor investigations requires high specific activity, to avoid pharmacological effects. Objective: In this study our aim was the synthesis of 11C labelled verapamil with the most optimal parameters: high purity and specific activity. The verapamil is a calcium antagonist, what prevents Ca ions to diffuse across the membrane into the cell. In biological investigation it can be used for examination of multidrug resistance in the presence of Pgp pump.
Material and methods: The 11C radionuclide was produced by the 14N(p, α)11C nuclear reaction and the PETtrace MeI MicroLab synthesis module manufactured by GE was used to synthesize [11C]CH3I, for methylation. In the literature different reaction parameters can be found, such as the amount of the precursor, solvent, temperature, HPLC method. We tried to find the optimum of these parameters in our system. In our work we prepared a process control panel which helps us to control the

parameters of reaction and flow of materials from outside of the hot cell. The starting material was norverapamil, dissolved in it in acetonitrile. The [11C] CH3I bubbled (50 ml/min flow) in this solvent. The efficiency of the reaction was enhanced by using aluminium oxide/potassium-fluoride catalyst. The reaction mixture was heated for 10 minutes, when the reaction took place, then the reaction mixture was diluted with HPLC eluent and filtered from the catalyst. The generated [11C]verapamil was separated on preparative HPLC from other impurities and from the precursor. The collected fractions of [11C]verapamil was diluted with water and adsorbed on a C18 column. For elution small volume of ethanol was used to get concentrated solution, what later can be diluted with saline for biological investigation.

Results: In receptor binding studies the specific activity of [11C]verapamil is very important. In our experiments 100 ± 20 GBq/μmol was achieved, with the radiochemical purity of more than 98%. We had got large problem the separation from the precursor, because it can reduce the acummulation of radioactive verapamil in cells. We had optimized the separation what resulted of greater purity of the product.

P26

OVERWEIGHT IN DOGS AND IN HUMANS — WHAT DIFFERS?

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Background: Obesity is an enlarging problem is companion animals (dogs, cats) too similarly to the tendency observed in human population. Nowadays veterinary clinicians take a special emphasis to reach an early diagnosis and preceed in obesity diseases and metabolic disorders that develop as consequences. Parallely investigators often use the canine model in obes research based on genetical and physiological similarities. As in human beings also in dogs could be important to develop novel methods for measuring type-, and regionality obesitas, subcutaneous and visceral distribution of fat deposits. Not even in human obes patients is clear the distribution of fat in different deposits and their correlations to many metabolic disorders. However references are not perfectly consistent in the task, several data showed that quantity of abdominal fat deposits correlate closer with insulin resistency and insulin-resistency based metabolic disorders while subcutan fat sizes better correlate with serum leptin levels. In this present study we goaled to work-out a method available to examine the regional distribution of fat deposits and their metabolic effects in canine obes patients.

Material and methods: Suspected oncological patients altogether 25 dogs were underwent PET/CT whole body examinations and blood sampling for measuring the metabolic status. Following earlier published data we also choosed 2nd–3rd lumbal transversal slices to measure the subcutan fat diameter calculated the subcutan/visceral fat deposit rates too. Metabolic status was evaluated as follows: after 12 hours fasten glucose-, insulin-, thyroxin-, cortisol- and leptin levels were measured from serum samples. HOMA index was choosed to evaluate the level of insulin resistency in our patients.

Results: Our data showed basic differences in regionality of fat deposits. Canine obes patients had either visceral or subcutan type-deposits where major part of fat stayed. Serum leptin levels varied between 0.4–20.1 ng/ml. Elevated serum leptin levels correlated closely with visceral fat deposit quantities but not with subcutan ones. HOMA-IR index did not showed correlation with regionality neither with total fat quantities. It is clear that dogs having visceral-type fat deposits insulin sensitivity is worse (HOMA-IR: 0.15–2.42), and insulin level is higher (0.66–11.65 μU/ml). This tendency is higher (however not significantly) if we measure subcutaneous deposit at 3rd lumbal transversal images. Similar tendency (significant!) is seen in thyroxin levels (3.19–250 nmol/l) but in cortisol-, and leptin levels there is no correlation.

Conclusion: Further histopathological work to measure the fat cell sizes and leptin-receptor immunohistochemistry and blood chemistry is still ongoing for better understand the effects of fat deposit sizes and the regionality in dogs.

Acknowledgements: Scientific work was supported by several national (OTKA-68376, JEDIONKO, KMOP-1.1.1-08/1-2008-0017, GOP-1.1.1.-09/1-2010-0107) and international projects (IAEA-CRP, EMIL NoE).

P27

INITIAL EXPERIENCES WITH MEDICHECK Q.C. KIT

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Background: The aim of the study was to look over the experiences with application of MEDICHECK Q. C. kit.

Material and methods: In the department prepared radiopharmaceuticals werre by a preliminary determined system examined.

Results: The examined radiofarmaceuticals generally fill reqiurements. The study is under way, for this reason it is impossible to give numerical data.

Conclusion: The MEDICHECK Q. C. kit seems an adequat tool in quality controll of radiofarmaceuticals.

P28

RADIOGUIDED LYMPH NODE BIOPSY OF A CHEMORESISTANT LYMPH NODE DETECTED ON INTERIM FDG PET-CT IN HODGKIN LYMPHOMA

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Background: Interim FDG PET has high prognostic value in Hodgkin lymphoma and can detect early inadequate therapy response. Positive findings may require histological clarification for further therapy guidance. However nonpalpable lesions may be difficult to localise intraoperatively. This case report presents the successful surgical biopsy with the Radioguided Occult Lesion Localisation (ROLL) technique of a chemoresistant lymph node detected by interim FDG PET-CT.

Material and methods: A 32 years old male patient was diagnosed with nodular lymphocyte-predominant Hodgkin lymphoma. Staging FDG PET-CT detected large right axillary lymph node conglomerate and splenic manifestation. Interim PET-CT following two cycles of ABVD chemotherapy revealed good metabolic response with the exception of one single axillary lymph node. A second "interim" PET-CT after two further cycles had similar result. A biopsy of the metabolically active nonpalpable lymph node was performed by using the ROLL technique with ultrasound guidance.

Results: The lymph node was successfully removed with a minimal invasive procedure. Histological evaluation revealed a transformation into T cell rich diffuse large B cell lymphoma. Based on this finding a relevant therapy change was introduced.

Conclusion: The ROLL technique is an appropriate method for the biopsy of chemoresistant non palpable lymph nodes suspected by interim PET-CT. The anatomic information given by the CT part of the combined PET-CT method has great relevance for a multimodality approach i.e. ultrasound guidance during ROLL procedure.

P29

PREOPERATIVE SCINTIGRAPHYC PARATHYROID GLAND LOCALISATION IN SECONDARY HYPERPARATHYROID PATIETS TREATED WITH DIALYSIS

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Background: The most important pathology associated with chronic renal failure patients requiring dialysis is secondary hyperparathyreosis which sometimes need surgical treatment removing three and a half glands. The histological examination finds hyperplasia or adenoma in these hyperfunctioning glands. We aimed to locate the most normal parathyroid gland using parathyroid scintigraphy.
Material and methods: 36 patients with secondary hyperparathyreosis were examined before parathyroidectomy. 99m-Tc MIBI and pertechnetate subtraction was used. This method uses a reference ROI for proportional subtraction. Four ROIs were used as reference: thyroid tissue (thyroid gland without the parathyroid), whole thyroid gland and right and left lobes separately. We determined the mean counts per pixel in the regions of the parathyroid lobes and compared the results with the histological findings.
Results: The least active gland in a certain patient had a 3% probability to contain adenoma. Considering a gland positive if the mean count per pixel is above 10 the sensitivity, specificity, NPV and PPV are 77%, 100%, 77% and 100% respectively.
Conclusion: The 99m-Tc MIBI-pertechnetate subtraction parathyroid scintigraphy is a very reliable tool to choose the one parathyroid lobe which must be retained. The best reference ROI for the proportional subtraction method is the thyroid gland without the parathyroid glands.

P31

THE ROLE OF NUCLEAR MEDICINE IN THE DIAGNOSTICS OF DIABETIC FOOT

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Background: To present in basics literary facts and own experiences the role of nuclear medicine in the diagnostics of diabetic foot.
Material and methods: Scintigraphy with 99mTc-HMPAO labelled autolog leukocytes or immunscintigraphy.
Results: It was made in 10 years period 41 leukocytescintigraphy and 47 immunscintigraphy because of suspicion a muskuloskeletal disease, out of these in 3 — 3 cases was the probably diagnosis diabetic foot.
Conclusion: In the authors opinion — on basisc literary facts — it is needed more often nuclear methods to apply in the diagnostics of diabetic foot.

P32

EVALUATION OF PATIENT DOSES RELATED TO THE NUCLEAR MEDICINE INVESTIGATIONS IN THE PAST 20 YEARS IN HUNGARY

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Background: International reports dealing with the exposure of the population to radiation from medical sources describe a continuous increase during recent years due to the increase in the number of medical investigations (CT scans, interventional radiological examinations, unnecessarily repeated investigations, etc.). The radiation protection scientific committees are making great efforts to assess the patient doses, to follow up the cases, and, if possible, to decrease these doses. The aim of our study was to evaluate the patient doses in nuclear medicine in Hungary in representative years during the past two decades.
Material and methods: For the calculation of the effective doses, we used the mSv/MBq values from the ICRP 53. Publication; the data relating to the different types of nuclear medicine examinations were provided by the Hungarian College of Nuclear Medicine and the National Registry.
Results: During the analysed years 1991, 1997, 2004, 2005, 2007 and 2009; the total number of investigations was 155682, 177208, 173385, 187184, 156534, and 171846, respectively, while the collective effective doses (man Sv) were 471, 1025, 1010, 1016, 812 and 835, respectively. The total numbers of bone, lung, brain, kidney, thyroid (between 2004 and 2009), inflammation and tumour investigations exhibited good correlations ($R2 = 0.9$) with the corresponding effective doses; for cardiology and gastroenterology, R2 was 0.6; and for all different types of examinations combined, R2 was 0.8.
Conclusions: during the past 20 years, the patient doses in nuclear medicine in Hungary have varied in proportion to the total number of investigations and did not display a continuous increase.

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THE IMPORTANCE OF RENOGRAPHY IN FOLLOWING OF RENAL TOXICITY CAUSED BY RADIOTHERAPY IN GASTRIC CANCER PATIENTS

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Background: Postoperative chemoradiotherapy in gastric cancer improves locoregional control and survival. Renal toxicity is one of the most serious complications in upper abdominal radiotherapy; we prospectively analyzed kidney function in patients, who underwent postoperative chemoradiotherapy for gastric cancer.
Material and methods: In 25 patients (age 39–81, average age: 61.4) renography was performed after the surgery, but before the postoperative chemoradiotherapy. In 20 patients the control renography was performed within 6–24 months, in 10 patients within 24–60 months after postoperative chemoradiotherapy. In 5 patients it was performed during both time intervals. The kidney in-damage to kidney in-safe (D/S) ratio was used as an index of the relative kidney function.
Results: for patients in the first group the D/S ratio decreased according to pre-radiotherapy investigation from 0.95 to 0.79 ($p < 0.05$). In the second group, where the control investigation were 24–60 month after the chemotherapy, the decline of D/S ratio was more significant, from 1.03 to 0.6 ($p < 0.01$).
Conclusion: The relative function impairment of the damaged kidney in patients after postoperative chemoradiotherapy for gastric cancer is demonstrated. In case of long survival, renography is recommended to monitor the state of the damaged kidney after years of radiotherapy.

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PET-CT APPEARANCE OF RELEVANT RADIOLOGICAL PULMONARY FINDINGS IN PATIENTS WITH LYMPHOMA

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Background: Pulmonary abnormalities are not uncommon on 18FDG PET-CT in patients diagnosed with lymphoma and may often cause differential diagnostic problems. These abnormalities may represent manifestation of lymphoma, inflammation, other pathology or might be clinically irrelevant. The aim of our retrospective study was the evaluation of relevant pulmonary findings with a follow-up period of 1-24 months.
Material and methods: The analysis involved 1085 PET-CT examinations of 721 lymphoma patients. Pulmonary nodules smaller than 5 mm and fibrotic

changes were regarded as radiologically irrelevant. A distinction was made between infiltrative and solid lesions based on their radiological appearance, and lesions were further characterised by their FDG-PET positivity. Differential diagnosis was made according to histology, clinical course of the disease, laboratory and microbiology results.

Results: Relevant radiological abnormalities were found in 116 patients (10.7%), of which 36 were diagnosed with Hodgkin (HL) and 80 with non-Hodgkin lymphoma (NHL). There were 45 infiltrative (8 FDG negative and 37 FDG positive) and 59 solid lesions (19 FDG negative and 40 FDG positive). Twelve patients were lost to follow-up. With regard to PET negative pathologies other than inflammation or lymphoma, there were 2 benign pulmonary nodules and interstitial lung disease was found in one case. Apart from the non-neoplastic cases, there were 2 primary lung tumours amongst the PET positive cases. The pulmonary manifestation of NHL was found to be solid PET-positive in all cases in our study, whereas infiltrative PET-positive finding was twice as common as the solid appearance in HL patients.

Conclusions: Our results draw attention to the different appearances of pulmonary manifestations of lymphoma, which can be very useful for the correct staging of the disease.

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INEFFECTIVNESS OF BONE PAIN PALLIATION THERAPY WITH RADIONUCLIDES

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Background: We experienced a growing number of ineffective bone pain paliation therapy with radionuclides in the last years. We examined the reasons of this in a retrospective study.

Material and methods: In the last 8 years 191 patient with multiple bone metastasis were treated with radionuclides for pain palliation. We split the group in two parts: the first group results(135 patients) were reported in a study in 2007.The second group (51 patients) were treated in the last 3 years. The patients age: 21–87, average: 57,3 years, man : 85 women: 101. Treated tumor types: breast 73 (47 + 21), prostate: 71 (52 + 19), other : 47 (36 + 11). The applied radiopharmaceuticals : Sm — 153 Multibone 161 (125 + 36), Y-90 Multibone 20 (8 + 12), Sm-153 Quadramet 6 (4 + 2) Sr-89 4 (3 + 1) with repeated terapies if needed.The patients were questioned in detail about the pain scale, blood results and about the applied other oncological therapies and about the alternative methods which were widespread used in the last years: special diets, vitamins, flavins, Avemar, Culevit, water types, mushrooms. We compared the data of the first group patients with the data of the second group.

Results: In case of breast tumors previously in the first group 95% of patients became painless , in the second group 76% of patients became pain free.In case of prostate cancer the first result was: 85%, the second result: 78%. In the first group we did not found patients with increasing pain but in the second group 4% of patients with breast tumor and 8% of the patients with prostate cancer reported increase of the bone pain after radionuclide therapy. Analizing the patients with ineffective therapy we found the following results: out of 7 patients with breast tumor 5 had increasing pain, 2 were with constant pain, from the group of prostate cancer 4 had increasing pain, 2 were with constant pain. Out of 7 patient with breast tumor 2 rejected the chemotherapy, 3 rejected the bisphosphonate and hormone therapy. Out of patients with prostate cancer 2 rejected the hormone therapy and 4 the bisphosphonate therapy. 5 patients used only alternative therapy and 20% of patients used the alternative therapy in combination with the usual oncological protocols.

Conclusions: analyzing the results of the patients with bone palliation therapy with radionuclides we found an increasing number of ineffective pain palliation. According to our results the reason of this ineffective cases were that patients ignored the traditional oncological protocolls and there were a widespread use of the alternative methods.

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