

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:  $10.2 \pm 3.0$ , 11C-methionine-SUVmean:  $3.2 \pm 1.0$ ; My/De 18FDG-SUVmean:  $4.7 \pm 1.2$ , 11C-methionine-SUVmean:  $3.2 \pm 0.8$ . Two weeks after the implantation in rats bearing primary tumors under the renal capsule we found metastases at the parathyroid lymph nodes (PTLN): He/De 18FDG-SUVmean:  $3.5 \pm 0.6$ , 11C-methionine-SUVmean:  $1.7 \pm 0.2$ ; My/De 18FDG-SUVmean:  $3.2 \pm 0.7$ , 11C-methionine-SUVmean:  $1.8 \pm 0.5$ . In the subcutaneous models after two weeks only primary tumors (He/De — SUVmean:  $9.0 \pm 2.6$ , My/De — SUVmean:  $7.7 \pm 1.6$ ) 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  $4.3 \pm 0.7$  and  $2.3 \pm 0.3$  respectively.

**Conclusion:** This preclinical study showed that tumor cells implanted under the capsule of the kidney generate metastases in the PTLN. The renal capsule-parathyroid 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](http://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 processing; 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; 3<sup>rd</sup> party (MNI, FSL) and in-house developed multimodal 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 targeting. In the current clinical practise we use contrast-enhanced CT and T1 weighted contrast-enhanced, 3D SPGR MR sequences. We report our clinical 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 successful. 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 radionecrosis from residual/recurrent 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 XENOGRFT 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 multidrug 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  $5.5 \pm 0.2$  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% CO<sub>2</sub>. 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.

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## 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*