counts) and volume estimations were obtained. **Results:** The measured volumes are always threshold-dependent. Under the same conditions of background and BPF, the threshold at which the measured volume is the closest to the real one ("best threshold") is not correlated with real phantom volume (even if more constant values are obtained with smooth filters). Pre-filtering doesn't change the "best threshold" except for the ramp-filter (threshold increase). On the contrary high background levels strongly raise the "best threshold". When interpolative background subtraction on transaxial slices (post-processing) is performed after ramp and Butterworth BPF reconstruction, this effect is reduced. Only Butterworth BPF reconstructions are not affected by either the phantom volume or the background level (if post-processing is used). Under this conditions, the threshold at which measured volumes better correlate with real volumes is 43% of phantom maximum counts (R^2=0.982; error = +/-3 ml). **Conclusion:** Estimation of the functional thyroid volume with ^{99m}Tc SPECT seems feasible and accurate if 1) the thyroid profile is detected with a thresholding of 43% of thyroid maximum counts, 2) Butterworth BPF and post-processing background subtraction are used and 3) a voxel method is applied to calculate volumes.

P744

A planar method to estimate the thyroid volume.

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Dosimetric planning of radioiodine therapy of Graves' and Plummer's diseases requires accurate estimation of functional thyroid volume. **Purpose:** a) To detect the feasibility of a semi-automatic processing of planar thyroid 99mTc-scan, based on thresholding and geometric algorhythm, to measure the thyroid volume; b) to detect the best threshold to draw automatic contour of the gland c) to evaluate the accuracy of this method to predict the real thyroid volume. **Methods:** Four small phantoms, filled with ^{99m}Tc solution (2000 cps), different in volume and shape (16, 27, 35, 66 ml; 2 spheres, thyroid-shaped; egg-shaped) were scanned in different conditions of background (0, 7, 33% of phantom activity) and distance from the camera (7,14,21 cm). Smoothing and interpolative background subtraction were applied to the 19 acquired images. For each image, volume was measured with an ellipsoid algorhythm setting the edge threshold at 15 different levels (from 20% to 50% of phantom maximum counts) and the results were compared to the real volumes of the phantoms. **Results:** The measured volumes depend on the threshold but they are more dependent the larger the phantom is. For each image we detected the threshold at which the measured volume is the closest to the real one. It shows a poor dependence on the distance from the camera (significant only if > 20 cm). It is not correlated with the background level (except in the rare case of high background + distance > 20 cm). It shows inverse correlation with the real volume. The best results (error = +- 8 ml) were obtained using a threshold of 33% of phantom maximum counts. As a consequence, at each threshold, the accuracy of measured volume is related to the real volume itself: the former is under-estimated if the latter is large and vice versa. In order to avoid this dependence, for each threshold, linear regression equation between measured and real volumes was calculated and applied to correct measured volume. The best results (R^2= 0.98; error = +- 5 ml) were obtained with a threshold of 35% and the equation: *corrected measured volume = (measured volume - 4.46) / 0.74.* **Conclusion:** Estimation of the functional thyroid volume with ^{99m}Tc planar scintigraphy seems feasible and accurate if 1) the thyroid profile is detected with a thresholding of 35% of thyroid maximum counts, 2) an ellipsoid method is applied and 3) calculated volumes are corrected by a regression equation.

P745

Quantitative Analysis of Tumor Glucose Utilization in Mice with Human Colon Cancer and Photodynamic Therapy by Means of 18F-FDG Dynamic PET and Patlak Plot Analysis

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Aim: In static 18F-FDG PET the Standard Uptake Value (SUV) and the metabolic size is used to characterize tumors. Compared with that, dynamic data and the use of kinetic models should yield reliable results, especially in early therapy controls of small tumors.**Material and Methods:** Fifteen NMRI-mice (nu/nu female) with xenotransplanted human colon cancer cells (HT29) were treated by photodynamic therapy. There were three groups, one group without an injection of a photo sensitizer as controls and two groups with different concentrations of a new liposomally formulated sensitizer (mTHPC). Tumor growth and the effects of treatment were controlled permanently. Additionally PET was examinated before, 1, 2 and 3 weeks after treatment. Dynamic whole-body PET scans were acquired for 28 time frames of between 0.5 min an 10 min length (total scan duration 60 min) in each mice after i.v. bolus injection of approx. 20 MBq 18F-FDG with an ECAT Exact 47. Emission data were corrected for decay, attenuation, scatter, and random coincidences and reconstructed by iterative reconstructions (6 iterations, 16 subsets). Radioactivity concentrations (Bq/cc) were measured within the tumor and the contra-laterally muscle over the time to induce time-activity-curves (TAC). The Patlak-Plot (a well-known two tissue compartment model for FDG) was used for fitting by the PMOD-Software. Resulting metabolic rates of glucose utilization (MRGlu) were compared with static results and the clinically progression.**Results:** 10 days after implantation the non-treated tumors showed an MRGlu of 0.36 - 0.49 mg/min/100 ml. Group 1 (without sensitizer) and group 2 (low dose treatment) showed an increasing MRGlu up to 1.08 - 1.38 mg/min/100 ml correlating to a continuous tumor growth. Group 3 showed tumor necrosis and decreasing of MRGlu to 0.83 mg/min/100 ml two weeks after therapy. MRGlu in femoral muscle were relatively constant in all examinations about 0.19 mg/min/100 ml. SUVmax and its tumor-/muscle ratio did not correlated very well with the differences of the groups. Metabolic sizes were increasing cardinally and showed also no differences between the groups.**Conclusion:** Tumor characterisations by static PET were inferior to quantitative analysis of dynamic data in the circumstances of photodynamic therapy of small tumors. One explanation is the assumption that the partial necrosis at tumor surface caused by the laser treatment did not influence the measurement of SUV and metabolic size.

P746

Automatic Diagnostics of Whole-body Scintigrams Using Image Segmentation and Parametrization

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The aim of our study was to develop an algorithm for automatic detection of changes in osteoblastic activity on whole body bone scintigrams.Methods: Our study includes 467 consecutive, non-selected scintigrams of patients examined in nine months period. All age groups were present. 99m-Tc-DPD, 750 MBq, was used, the dosis was adjusted for children. The whole body acquisition was performed on Siemens MultiSPECT 2, equipped with LEHR collimators, 8 cm/minute, 2-3 hours after radiopharmaceutical application.A robust knowledge based methodology for automatic detection of relevant reference points which describe individual bones and bone regions was developed first and was simultaneously applied on anterior and posterior whole-body bone scintigrams.Bone scans were then segmented using the detected reference points providing the images of each individual bone or bone region.A machine learning classifier, which can produce independent diagnosis, was added. When all reference points were obtained, every bone was assigned a portion of original scintigraphic image, according to relevant reference points.Obtained images were parameterized using five different algorithms (ArTex, Wavelet transform using Haar and Gabor wavelets, Laws' texture measures and Image processor, that implements many parameters of the first and second order statistics). Output assigned the bone to one of the known pathologies.Results: Following accuracy of bone segmentation was achieved:• ilium region 95,9%• pubis region 96,8%• trochanter region 99,5%• shoulders 99,5%• extremities 92,8%• spine 98,6%• ribs 86%• neck 97,3%Accuracy of 84,4% was achieved for detecting pathologies and abnormalities.Conclusions: Results of our expert system for recognition of bone pathologies are promising and the system will soon be used in practice as an additional diagnostic tool in bone scintigraphy. Automatic analysis of whole body bone scans using our segmentation algorithm gives more accurate and reliable results than previous studies negligent to the segmentation.

P747

Heart Surface Extraction from Dynamic PET Heart Data Using Deformable Model

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Introduction: Automatic heart surface extraction from PET heart dynamic image is a particularly challenging problem due to the complixity and variability of heart anatomy. Deformable models use image independent information, internal enery (elastic and rigid) and image data to extract object by avoiding ill-posed problems. In the present study, using deformable model, left ventricular inside and outside surfaces are extracted from several PET heart dynamic studies by reasonable initialization and constraints. **Materials and Methods**: MunichHeart's (MH) coordinate-system is employed for describing left ventricle by defining cardiac base, apex and long axis position manually. Deformable mesh is set up based on MH coordinate system. Defomable mesh evolution is controlled by its energy, which is defined as E=alfa*Eint+beta*Eext, where Eint is internal energe and Eext, external energe, alfa and beta are deformable controlling parameters for internal and external energe respecitively. External energy employs gradient vector flow (GVF). GVF is computed as a diffusion of the gradient vectors of a gray-level or binary edge map derived from the image. The resultant field has a large capture range and forces mesh to move into concave regions. Sevel preprocessing methods have been applied, such as Gauss filter, summaring or differencing image in time domain. Espeically, pricincle component analysis (PCA) and independent component analysis (ICA) are used for water studies. F-18-FDG, C-11-palmitate/acetate and O-15 water heart dymatic images have been tested in present study. Furthermore, this study has been implemented to the PET heart analysis package, SpringThunder (http://www.turkupetcentre.fi/staff/chuhan/springthunder) as an ROI (region of interest) or VOI (volume of interest) option. **Results:** For well preprocessed (preprocessing method is data-type dependent), left ventricular inside and outside surfaces usually can be extracted satisfied by reasonable initialization (such as manual definition of cardiac base, apex and long axis position) and parameter setting. However, it is found that final result still depends strongly on 1) preprocessing, 2) initial conditions, and 3) parameters, such as elasticity, stiffness etc. Especially for O-15 water studies, preprocessing plays a critical role. **Conclusion:** Deformable model is a useful method for heart surface extraction from PET dynamic images. However, the human intervention is still necessary for ideal results, such as defining initial condition and adjusting controlling parameters accordingly.

P748

Automatic and distributed image reconstruction environment for large-scaled tasks: grid computing with heterogeneous computer systems

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Aim: The study established a distributed image reconstruction environment for large-scaled tasks. The environment can implement the distribution of the tasks at multi-tasks level and inner-task level. **Material and Methods:** The environment is build as a cross-platform java application server integrated into the PMod software (PMod Ltd., Adlisvil, Switzerland). The server uses the sharing file system as the center of data storage and task distribution. Based on a flexible reconstruction parameter templates mechanism, we have implemented the automatic creation of reconstruction tasks. The system periodically scans the sinogram data directory for finding new PET data, automatically transferred from the PET system. Once the reconstruction data set is complete, the scanner will match the data set to the templates according the header information of data files and create the reconstruction mission. The user also can manually create the tasks for special reconstruction requests. Based on the LAN sharing system and the java implementation, a

heterogeneous network of computers, connected via the LAN, can be used to join the distributed calculation of image reconstruction. Besides the above distributed processing at multi-tasks level, for the more time-demanding tasks like reconstruction of animal pet data, the system will divide one task into many sub-tasks and distribute them to the LAN at inner-task level to provide parallel processing e.g. of dynamic PET data. Subsequently, the server simply combines the sub-result files to a final image file. **Results:** The distributed image reconstruction server was tested and evaluated on a heterogeneous local area network environment including PCs with Windows XP professional (Microsoft Co., Redmond, WA, USA), iMacs G5 and Powerbooks G4 with MAC OS X 10.3.8 (Apple Computer Inc., Cupertino, CA, USA) and Linux systems (Fedora Core 3, Red Hat Inc., Raleigh, NC, USA). We did a series of experiments at different arriving rates of data files to simulate the different situations including the smooth and outburst stream. At the crowd phase of beginning, the system can finish the data reconstruction created by a middle-scaled PET lab in less than an hour using all calculating resource. Later the system can release some computers and just wait for new data. **Conclusions:** The results indicate that the server can achieve the target of totally automatic process of image reconstruction including automatic data scanning, data-template matching, task distribution and task calculation. The distributed nature of image reconstruction makes itself very suitable for our distributed system.

P749

The medical images management into the Hospital Information System The case study of Monaldi Hospital in Naples

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Aims: The purpose of this paper is to report the state of the art of the PACS/RIS system at the Monaldi Hospital with special attention to the integration aspects and workflow problems among Radiology and NM Dpt's and the rest of the Hospital Dpt's. **Material & Methods:** A.O. Monaldi network consists of 2400 double plug in all the rooms of the hospital; the present RIS/PACS architecture is based on two clusters with 900 GB HD and 2 NAS (Network Attached Storage) 1 TB each. The RIS/PACS system is connected on the basis of Dicom standard with:
n.3 Computer Radiography Kodak
n.1 Digital Radiography Kodak,
n.1 CT spiral Toshiba
n.1 CT Philips 16 slice
n.2 Nuclear medicine Cameras Philips
n.1 PET/CT Siemens
Particular attention has been paid for set-up of reporting workstations in order to satisfy the SIRM requirements (Italian Medical Radiology Society). All the workstions have RIS+PACS integrated software in order to recall the patient images at the same time of RIS reporting. The reference integration for the integration with HIS system model is IHE, where applicable, in the mean time, before to make all the applications compliant to the IHE model, we have adopted an alternative integration model which is focused on "admission number" which is provided to the patient at the time when the patient comes into the hospital. The most of the PC Workstation into the LAN are basically equipped for accessing the Radiology and Nuclear Medicine Images and Reports, through one specific web based application, therefore all the Clinical Dpt and particularly the Critical Area make an intensive use of medical images distributed through the Hospital Intranet. **Results:** The Radiology and NM Dpt use the information system for 100 % of the images and traditional procedures are fully replaced by the informatics workflow. The system is widely used, in all the hospital areas, the use of admission number as unique key for identifying the patient is a quick and reliable integration solution in all these cases where the ADT system is not fully accessible and is not compliant HL7. The adoption of bar code labels and bracelet with bar code printed, allows to reduce mistakes and improve efficiency in the patient management in the clinical workflows. All the applications are supported for 1st level technical support by an internal staff which guarantee high Quality Of Service.

P750

System for Complex Analysis of Functional Scintigraphy on PC

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The software for the complex mathematical analyses of scintigraphic examinations performed on the standard PC computers, has been developed in the Nuclear Medicine Department at University Hospital in Ostrava. Besides conventional procedures for the individual (manual) processing of pictures and curves, our software contains a lot of complex programmes for the mathematical analyses of the dynamic scintigraphic examinations (e.g. for MUGA studies, the first pass radiocardiographic studies, dynamic kidneys and liver studies, myocardial perfusion studies etc.). A lot of original methods and procedures have been applied in these programmes. They give us quick, automatical and exact evaluation with the maximal complexity. Operating these programmes is very easy, time and labour saving for a user. The output of each programme is an entire protocol containing information about patient, scintigraphic and parametric pictures of all important examination phases, time-activity curves of ROI´s, numerical values of quantitative parameters as well as the verbal evaluation of whole examination with a short conclusion. It is very easy to use this system on any PC by means of Windows 3.1 or Windows 95 or higher and it is able to evaluate studies taken from various scintillation cameras.

P61 — Monday, October 17, 2005, 2:30 pm — 4:00 pm

Radiochemistry: PET

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In vitro metabolism studies of radiotracers using mouse liver S9 fraction

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Aim: Metabolism of radiotracers is very important when novel radiotracers are pharmacokinetically characterized. In this study, we investigated a simple and efficient in vitro method for metabolism studies of model radiotracers, 1-(4-[^{18}F]fluoromethylbenzyl)- ([^{18}F]**1**) and 1-(4-[^{18}F]fluorobenzyl)-4-phenylpiperazine ([^{18}F]**2**) using mouse liver S9 fraction, and the results were compared to those of in vivo studies using the bone as well as the blood and in vitro studies using mouse liver microsomes. **Materials and Methods:** The radiotracer [^{18}F]**1** was prepared by nucleophilic substitution of 1-phenylpiperazine with 4-[^{18}F]fluoromethylbenzyl methanesulfonate ester, and [^{18}F]**2** was synthesized by reductive alkylation of 1-phenylpiperazine with 4-[^{18}F]fluorobenzaldehyde. Mouse liver S9 fraction was obtained in the early stage during the preparation of microsomes. For in vivo metabolism studies, mice were injected with the radiotracer via tail vein and the bone as well as the blood was collected at 1, 5, 15, 30 and 60 min postinjection. For in vitro metabolism studies, the radiotracer was incubated with either S9 fraction or microsomes in the presence of NADPH. The metabolites were analyzed by radio-TLC. An aliquot of the in vitro sample was incubated with calcium phosphate and centrifuged. The supernatant and the calcium phosphate precipitates were counted. **Results:** In the in vivo studies, [^{18}F]**1** underwent severe metabolic defluorination based on the increase of bone uptake over time (6.8% at 30 min and 14.0 %ID/g at 60 min) and appearance of [^{18}F]fluoride ion from 5 min postinjection in the blood samples. This result was consistent with the in vitro data using either S9 fraction or microsomes based on the comigration of the metabolite with the authentic [^{18}F]fluoride ion on radio-TLC and uptake of the metabolite by calcium phosphate. On the other hand, [^{18}F]**2** was converted into the unidentified polar metabolites both in vivo and in vitro. The metabolites were not taken up by both bone (in vivo) and calcium phosphate (in vitro). The in vitro metabolism of [^{18}F]**1** and [^{18}F]**2** using S9 fraction gave the similar patterns to those using the blood as well as microsomes. **Conclusion:** The results demonstrated that the in vitro method using S9 fraction can be widely used to predict in vivo metabolism of radiotracers. Moreover, S9 fraction is easily prepared and contains both microsomal and cytosolic fractions, which can provide additional metabolic information than microsomes.

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In vivo biodistribution, biokinetics and blood metabolism of ^{11}C-PK11195 in rats - a PET tracer for peripheral benzodiazepine receptor

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Aim. [*N*-methyl-^{11}C]-1-(2-chlorophenyl)-*N*-(1-methylpropyl)-3-isoquinoline carboxamide (^{11}C-PK11195) is a peripheral benzodiazepine receptor (PBR) antagonist and a potential PET radiopharmaceutical for neuroinflammatory imaging. In this study, the whole-body distribution and biokinetics of ^{11}C-PK11195 were determined after bolus intravenous administration in normal rats by using PET. The methodology of high-performance liquid chromatography (radio-HPLC) and thin-layer chromatography (radio-TLC) to clarify the in vivo metabolism of ^{11}C-PK11195 was also investigated.**Materials and Methods.** Dynamic PET imaging, lasting up to 2 hours, was performed immediately after intravenous injection of the tracer. Quantitative analysis of ^{11}C-PK11195 uptake was performed on standardised circular regions of interest (ROI) in different organs. Tracer accumulation was reported as the standardised uptake value (SUV). Biokinetic curves, representing the radioactivity concentration in the organ of interest versus time after injection, were determined accordingly. Radio-HPLC and radio-TLC were used for the analysis of ^{11}C-PK11195 and its radioactive metabolites in blood plasma and various tissue homogenates.**Results.** Our results revealed that the radioactivity distributed particularly in kidneys, heart, liver and thyroid, respectively. Lower uptake was seen in salivary glands, brain and lungs. The time course of ^{11}C-PK11195 in kidneys, liver and heart showed fast uptake and moderate decline. Salivary glands, thyroid and brain showed a very fast uptake in 5 min followed by a plateau. A fast decline and moderate uptake was seen in the lung. Radio-HPLC and radio-TLC showed that the level of unmetabolised ^{11}C-PK11195 in rat plasma decreased from 87% at 15 min to 39% at 60 min after injection.**Conclusions**. ^{11}C-PK11195 showed a fast uptake in many tissues and it was metabolised relatively fast in vivo. Our results of whole-body distribution of ^{11}C-PK11195 are in accordance with previously reported PBR expression sites. The results obtained in rats can be used to estimate human absorbed doses of ^{11}C-PK11195.

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Vascular Endothelial Growth Factor (VEGF) Stimulates 18F-FDG Uptake in Human Endothelial Cells and Some Tumour Cells

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Aim: Recent studies suggests that vascular endothelial growth factor (VEGF) may play a role in the accumulation of fluorine-18 fluorodeoxyglucose (^{18}F-FDG) in human endothelial cells. However, little is known about the effect of VEGF on ^{18}F-FDG uptake in human tumour cells. The aim of this study was to determine the influence of VEGF on ^{18}F-FDG uptake into human endothelial cells and various tumour cell lines. **Materials and Methods**: ^{18}F-FDG uptake measurements were performed in human umbilical vein endothelial cells (HUVECs) and a variety of human tumuor cell lines (human gastrointestinal carcinoid cell line CRO2B, colon cancer cell line SW620, pancreatic tumour cell line BxCP-3, human colon adenocarcinoma cell line HT-29, etc.) treated with or without various concentrations of rhVEGF$_{165}$ (5 µg/L-40 µg/L) by adding 370 kBq (10 µCi) of ^{18}F-FDG to the culture medium of the cells and incubation in a humidified atmosphere of 5% CO_2 at 37°C for up to 24h. ^{18}F-FDG uptake levels of each sample were corrected for protein content as determined by the Bradford method and expressed as percentage of uptake relative to that of control cells. **Results**: Exposure of HUVECs to VEGF resulted in a significant enhancement in ^{18}F-FDG uptake in a dose-dependent manner. VEGF stimulated significantly also the ^{18}F-FDG uptake in the carcinoid cells (CRO2B), the increase in ^{18}F-FDG uptake was dose dependent. However, no effects of VEGF were observed on other human tumour cell lines. **Conclusion:** VEGF stimulates not only the ^{18}F-FDG uptake in human endothelial cells but also in some human tumour cells.