department and low resolution CT. Realignment was performed using proprietary software to correct any registration errors and trans-axial slices reconstructed using OSEM with and without attenuation correction. Two sets of bulls-eye images were created for evaluation by two experienced observers (attenuation corrected (AC) and non-corrected (NAC)). These were evaluated for the presence of resolving defects between the NAC and AC images without knowledge of gender or clinical history. The observers were also asked to record whether the change in appearance affected the diagnostic outcome. The effect of scatter correction was also evaluated. **Results** Improvement in perfusion was apparent in a significant proportion of normal BMI patients with males showing more areas of improvement than females.

% of patients showing improvement in perfusion between NAC and AC images

	Observer 1	Observer 2
All patients (43)	53.5%	67.4%
Males only (16)	81.3%	93.8%
Females only (27)	37.0%	55.6%

Changes were most frequent in the inferior and inferolateral regions in both males and females although changes were also seen in the septal and anterior regions in some patients. **Conclusions** Attenuation artefacts are seen in a significant proportion of normal BMI patients, but are less frequently seen in females than males. Consideration should be given to using attenuation correction for all patients regardless of BMI value.

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Performance of iterative reconstruction in cerebral perfusion SPECT with x-ray CT based attenuation correction

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Aim We evaluated the number of iterations in ordered subset expectation maximization(OS-EM) algorithm to apply x-ray CT based attenuation correction(CT/AC) in cerebral perfusion SPECT. The scatter weight was estimated to use dual energy window scattered correction. Efficacy of "FMI Brain Sagging" software, which corrects mis-registration of emission data and CT/AC, was validated. The contrast obtained from OS-EM and CT/AC was compared with that from conventional filtered back projection(FBP) and Chang method. Materials Infinia Hawkeye 4 GE Healthcare Xeleris Processing GE Healthcare phantom IB-10 Kyoto Kagaku Co. Ltd. phantom CF Kyoto Kagaku Co. Ltd. Methods Cold spot phantom IB-10 and cylindric phantom CF were filled with 123I-IMP or 99mTc-HMPAO, and SPECT and CT images were acquired with Hawkeye4. Scatter weight was estimated by profile curve and CV value using phantom CF. The number of iterations 2,3,4,5,6,8,10 and 20 were studied and the optimal number of iteration with subset 10 was evaluated by profile curve and contrast value using cold spot phantom. Efficacy of FMI was validated with 123I-IMP in 20 patients.. Results The optimal number of iteration was 8 in 99mTc-HMPAO and 6 in 123I-IMP study, respectively. The scatter weight was 0.9 in 99mTc-HMPAO and 0.8 in 123I-IMP study, respectively. Contrast value after OS-EM algorithm was equal to that of FBP method. FMI improved table pallet sagging shift from 8.9mm±1.2mm to 1.9mm±1.4mm. Conclusion OS-EM with CT/AC showed equivalent contrast compared to FBP and Chang method in cerebral perfusion SPECT. OS-EM algorithm with optimal subsets and iterations using CT/AC may provide better images rather than use the conventional method. Improvement of CT/AC may contribute accurate diagnosis in cerebral blood flow SPECT.

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The Effect of Crystal Size on Position Detection Accuracy in PET Block Detectors: A Monte Carlo Study

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Aim: In recent years, PET scanner manufacturers have tried to optimize the spatial resolution and position detection accuracy (PDA) of PET scanners by decreasing the crystal size in the block geometry. In this study we utilized the MCNP4C Monte Carlo code to quantitatively evaluate the influence of crystal size on PDA. **Materials & methods:** The MCNP4C Monte Carlo code was used for detailed transport of 511keV photons originated as pencil beam from a point source toward the central crystal of a block detector consisting of a 13 mm× 13mm crystal array with different pixel dimension with the same crystal depth for LSO and LYSO. A total number of 50000 photons with energy of 511 keV transported from a point source toward the central crystal in each array. The code was validated through comparison with simulated data published by Shao et al. The history of each photon including the coordination, type of interaction, deposited energy and direction cosines for any interaction were registered in a separate matrix. In order to determine the effect of crystal pixel size on PDA, different crystal pixel size (from 1mm to 8mm) were used for calculation of PDA. **Results:** The results show that with increase in the crystal pixel size until 4 mm, the PDA will increase rapidly, the PDA in LSO crystal is 59.98% for 1 mm and 77.26% for 4 mm, but after 4 mm the PDA increase slowly and reach to almost a constant value, 77.86% for 5 mm and 79.31% for 8 mm. It should be noted that decreasing the PDA when decreasing the crystal pixel area is due to the fact the contribution of inter crystal scattering (ICS) in PDA increases with decreasing the pixel area. **Conclusion:** This paper includes investigating the effects pixel size (area) of PDA in PET block detector at 511keV photon irradiation, as is pertinent for PET studies. This information can be very useful for accurate measurement and modeling of ICS effect into reconstruction algorithms to produce images which have higher resolution, about which our group are investigating actively. The obtained results also suggest that the MCNP4C code is a useful appliance for investigation of photons interaction in PET block detectors to model the ICS behavior in details for the purpose of resolution recovery in modern PET image reconstruction algorithms.

P58 - Monday, October 12, 2009, 16:00 - 16:30, Poster Exh. Hall

Physics/instrumentation: integrated multi-modality systems, PET/CT, SPECT/CT and others

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PET/CT GE STE16 tomograph performance at different 18F doses and 3-D acquisition times

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Phantom study. NEMA 2001 IQ phantom was used to evaluate lesion detectability at different 18F doses and 3-D acquisition times. Six spheres were used (17,13,10,8,5,3 mm) to simulate lesions. Phantom tank was filled with a solution of 18F with a concentration of 1.85 MBq/Kg in order to simulate an injected dose (ID) of 3.7 MBq/Kg (0,1 mCi) 1 hr after injection. Spheres were filled with a radioactivity concentration ratio of 4:1 compared to BKG. A series of 3D PET scans (5-min each) was acquired in list-mode (VIP) until the radioactivity decayed to a level similar to a clinical WB acquisition. A second series of scans was acquired after a time enough long to have 1.11 MBq/Kg inside the tank, in order to simulate an ID of 2.22 MBq/Kg (0,06mCi). Acquisitions were done both putting the spheres in the centre of the FOV and on the overlap, in order to evaluate how the eventual decreased image quality may influence the detectability of the lesion. **Patient study**. 2 groups of pts (20 pts/group) were studied: one with an ID of 3.7 MBq/Kg, the other of 2.22 MBq/Kg of 18F-FDG. 3D VIP acquisition mode was used. **Data reconstruction.** The data acquired in VIP mode were used to obtain acquisitions at 3, 2.5 and 2 min/bed. The unlisted data were processed using the onboard system algorithm VUEPOINT HD, composed of a fully 3D-OSEM algorithm with all corrections (randoms, scatter, attenuation, geometry) included in the iterative process. Parameters were: subsets 28; iterations 2; image matrix 256x256 and 128x128 pixels; post filter 3.7 and 4.5 mm; FOV 70 cm. **Data analysis.** Phantom images were evaluated by two physicians. The quantitative evaluation was done drawing ROIs on lesion and on BKG and evaluating contrast values. The lesions' ROIs were drawn using CT images in order to avoid partial volume problems. The parameters evaluated for the quantitative analysis were the recovery coefficient and lesion variation. **Results.** On both dose concentrations all the simulated lesions were able to be seen. The contrast values for the more little lesion (1.0 cm diameter) were 24% at 1.85 MBq/Kg and 21% at 1.11 MBq/kg. This little gap was more and more less with the biggest lesions. These finding were confirmed in patients' study. **Conclusion.** Our data show that a low 2.22 MBq/Kg 18F injected dose is adequate to obtain good quality images using a PET/CT GE STE16 tomograph.

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Iodine contrast enhanced CT-scan during 18F-fluorodeoxyglucose Positron Emission Tomography: technical and practical considerations

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Aim With technical advances in PET-CT cameras, iodine contrast enhanced CT-scan during 18F-fluorodeoxyglucose Positron Emission Tomography (18FDG PET-CT) in clinical current practice remains an opened question. We report our experience, the conditions we use this method and the advantages for the patient. **Materials and methods** We have first studied the influence of high density on CT attenuation corrected PET (CTAC) images on 3 PET-CT cameras with a Jaszczak modified phantom (containing 3 pairs of vials with water, alcohol and KI solutions, with equal activities of 18-FDG in one vial of each pair). After reconstruction, scaling and segmentation, attenuation correction with procedures proposed by the constructors, we measured the activities of the 6 vials and of the background using the ROIs method on CTAC and NAC images. Then, a prospective study with our camera (Gemini Philips) has evaluated the feasibility of contrast enhanced CT-scan for diagnosis purpose, performed during 18FDG PET-CT study in 25 lymphoma staging. 2 CT scans were acquired: lCT (usual low dose CT before PET) and dCT (CT after PET, with classical parameters and iodinated contrast). For each patient, CTAC PET images were visually compared. Density in Hounsfield units (HU) and maximum Standardized Uptake Value (SUVmax) were measured on different organs and specific lymphoma localizations (294 measurements). Finally, a retrospective study was done to evaluate the clinical advantage of this method. 50 lymphoma staging were separately analyzed by a physicist and a radiologist on CTAC PET, CT and fusion images. **Results** Phantom study showed that attenuation correction by CT for high atomic number may produce artifact depending on the camera (false activity measured in vial containing KI solution on the CTAC images). Our camera (Gemini Philips) was not affected by high atomic number neither elevated density. In the in vivo prospective study, visual analysis was similar for the 2 modalities, without discordant interpretation for the pathologic sites. SUVmax means and standard deviation of each organ for lCTAC and dCTAC were comparable. The equation of the fitted multiple linear regression model was: dCT=0.0748191 + 1.17024*lCT (98.71%; p<0.01). In the in vivo retrospective study, enhanced CT scan showed less indeterminated data (N = 8/76) thus improving diagnosis accuracy. **Conclusion** With our camera, the use of iodine contrast enhanced CT during 18FDG PET-CT studies is possible. We now currently use this method in current clinical practice and great benefit is obtained on diagnostic, logistic ("one stop shot") and radioprotection purposes.

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Integrated PET/MRI (iPET/MRI) for small animals: Performance characteristics and initial experiences

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