lesions can seperated by the change in the count rate. Therefor a surgery can be more minimal invasive. By increasing the depth position, a greater distance of the sources is necessary in order to be able to clearly distinguish two lesions from each other.

EP-0069

Investigation of the axial sampling rate of helical mode multi-pinhole SPECT dedicated for human brain imaging with a Multi-Disk phantom

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Aim: Multi-Pinhole SPECT technology using organ specific apertures holds the potential to exceed the image quality of conventional parallel-hole SPECT imaging. Helical SPECT acquisition mode intended to extend the relatively small size of field of view in axial direction, and diminish differences due to the non-uniform 3D sensitivity profile, but at the expense of sensitivity and spatial resolution. We assembled a multi-disk phantom (even called Defrise phantom), originally developed for tomographic technics that use cone-beam projected data (typically CT). Furthermore our aim was to determine the optimal pitch factor (translational movement of patient bed) for the Multi-Pinhole SPECT acquisition based on visual and numerical evaluation of phantom measurement. **Materials and Methods:** The multi-disk phantom was assembled from 6 piece of Styrofoam disks (20mm thick, 110mm diameter) placed in 4mm distance next to each other, and the entire setup was inserted into a hollow plastic cylinder tube. The scanner in the investigation was a triple headed SPECT/CT system (Mediso AnyScan TRIO) equipped with organ specific multi-pinhole apertures dedicated for human brain imaging. Series of helical SPECT/CT scans were performed about multi-disk phantom that was filled with Tc99m water solution and positioned on the head holder. Scan parameters were 72 views, 128x128 image matrix, [0-8] cm axial bed motion. Total counts were identically ~100Mcts. For the iterative reconstruction with attenuation and scatter correction a spiral CT scan followed the SPECT acquisition. The reconstructed images were evaluated visually, by calculating line profiles and coefficient of variation on each active slices of the phantom. **Results:** The quality of reconstructed image is sensitive to the table motion length during the scan. The range of 4-6 cm of bed motion provided the lowest geometric distortion (ranking visually), along with the best coefficient of variation (<5%). **Conclusion:** Reconstructed data of multi-disk phantom measurements are sensitive indicators to express the impact of axial sampling rate in helical Multi-Pinhole SPECT technology. The results of this study indicate that this method is applicable for protocol optimization of patient examinations with multi-pinhole apertures.

EP-0070

Comparison of estimated and measured pixel variance in Whole Body PET affecting SUV uncertainty

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Aim: During the clinical reading process of Whole Body ^{18}F-FDG PET images constant signal-to-noise ratio (SNR) properties would be preferable, therefore a method to correctly determine SNR values for each slice would be necessary. The most straightforward way for this is repeated scans of the same subject, however this is mainly limited to phantom scans and cannot be performed at the human clinical level. Estimation of image pixel variance from image sets reconstructed using parts of a single acquisition raw data may provide results close to the expected repeated scan SNR values, and therefore give important information on regional SUV variance of WB PET images. **Materials and Methods:** We proposed a method that uses a special algorithm to assign an SNR value to each voxels of the reconstructed image. These values were calculated from the list-mode files of the routine clinical patient scan durations, while performing sub-reconstructions of identical image sets by splitting the original scan duration per bed position to 7, 6, 5, 4 and 3 parts identically. Standard deviation (Std) and mean values for each image voxel were determined for all of the image sets. From the Std/Mean images of shorter acquisitions the SNR values of each image voxel for the original scan duration/bed position scan were estimated with a linear regression method. On the other hand, Std/Mean calculations on series of the original time duration/bed position patient scan routine were also performed. SNR values of the estimated and measured noise image sets were investigated in the axial direction using a central region of interest (ROI) analysis. We performed PET scans of uniform cylindrical and various activity filled phantoms along with reconstructions from real human list mode data using the method described above. **Results:** SNR values gained using the estimation and the conventional method showed a high correlation qualitatively looking at the images and quantitatively after the ROI analysis. Differences between the estimated and repeated scan SNR values remained under 10% for both the phantom and patient scans. Body mass indices (BMI) of the investigated patients varied between 28 - 42, however, no major differences were found in SNR due to the applied time-of-flight reconstructions. **Conclusion:** With our method, the noise of individual PET-studies was simply measurable, and used for the determination of SUV variance during patient scan optimizations.

EP-0071

Robustness and reproducibility PET image radiomic features: the impact of delineation and segmentation

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Aim: Radiomics (quantification of tumors phenotype by extracting and mining large number of quantitative metrics) and radio-genomics (linking radiomics and genomics) are active areas of research in cancer diagnosis, prognosis and treatment response evaluation. As crucial steps for subsequent informatics analyses in radiomics, methods of Gross Tumor Volume (GTV) delineation (manual or automatic) have varying impacts on radiomic feature values. The main aim of this study was to evaluate impact of different delineation and segmentation methods on PET image radiomic features. **Material and Method:** Thirty-two patients who underwent 18F-FDG PET/CT scans were subjected to the study. GTVs were delineated using manual segmentation on CT, and on PET using the following segmentation methods: 42, 50 and 70 % of the maximum SUV threshold, as well as Nestles and fuzzy locally adaptive Bayesian methods. Following 3D segmentation, 55 quantitative radiomic features including SUV-based, histogram-based, shape-based, and texture-based methods including those based on gray level co-occurrence matrices (GLCM), gray level run length matrices (GLRLM), neighboring gray-level dependence matrix (NGLDM) and gray-level zone length matrix (GLZLM) were extracted. **Result:** SUVmax, SUVpeak and SULpeak from SUV-based/ Entropy and Energy from histogram-based/ sphericity and compacity from shape-based/ Homogeneity and Entropy form GLCM/ SRE, LRE, GLNU and RP from GLRLM/ Coarseness from NGLDM / SZE, ZP and GLNU from GLZLM showed very good robustness and reproducibility over segmentations method. SUVstd from SUV-based/ skewness from histogram-based/ Energy and Contrast from GLCM/ LGRE, SRLGE and RLNU from GLRLM/ Busyness from NGLDM/ LGZE and LZHGE from GLZLM exhibited poor robustness and reproducibility across delineation and segmentation methods. **Conclusion:** The robustness and reproducibility of PET radiomic features due to different segmentation methods is feature dependent. Despite increasing use of such quantitative metrics as potential imaging biomarkers, robustness and reproducibility of radiomic features in different delineation and segmentation methods must be considered. Quantitative radiomic features with high robustness and reproducibility could be considered as good potential imaging biomarkers in different applications.

EP-06 during congress opening hours, e-Poster Area

Physics & Instrumentation & Data Analysis: Miscellaneous

EP-0072

Comparison of estimated and measured isotope specific spatially variant point spread functions on the HRRT PET scanner

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Aim: To compare spatially variant isotope specific point spread functions (PSF) derived from published positron range data with measured data on a the high resolution research tomograph (HRRT, Siemens). **Materials and Methods:** Spatially variant PSFs have previously been measured using an array of printed sources between 5-mm Perspex sheets for Fluorine-18 and Carbon-11 on the HRRT scanner [1]. In this work, these measurements were extended to Gallium-68 after modifying the method to use 1) a concentrated isotope solution of 0.50 GBq/mL, 2) thicker 10-mm Perspex sheets, and 3) points spaced hexagonally 2.4 mm apart to account for the longer positron range. Additionally, using the Fluorine-18 measurements and previously published data on positron range simulations [2,3], we have estimated PSFs for Carbon-11 and Gallium-68. For the estimated and measured PSFs, a double 3D Gaussian function was fitted to each printed source and used to model the PSF response over the scanner field of view (FOV). Differences between the measured and estimated PSFs were quantified using full-width-at-half-maximum (FWHM) and full-width-at-tenth-maximum (FWTM) in the tangential, radial and axial directions. **Results:** For Carbon-11, (radial, tangential, axial) FWHM of (2.95, 2.92, 2.99) mm and FWTM of (5.58, 5.52, 5.67) mm were measured at 15mm radially from the FOV centre, increasing to (3.13, 2.77, 3.10) mm and (5.88, 5.26, 5.84) mm at 35mm. For Gallium-68, the FWHM and FWTM were (4.19, 4.19, 4.14) mm and (8.56. 8.52, 8.47) mm at 15mm and (4.37, 4.09, 4.34) mm and (8.73, 8.31, 8.63) at 35mm. The estimated PSFs were generally in agreement with the measured PSFs. In comparison, and when using the data from [2], the PSFs had wider tails with FWHM values 3-7% and FWTM values 5-9% higher for Carbon-11, and 0-3% (FWHM) lower and 9-15% (FWTM) higher for Gallium-68. When using the data from [3], better agreement was observed with FWHM values 1-4% and FWTM values 1-5% higher for Carbon-11 and 2-5% (FWHM) and 0-3% (FWTM) lower for Gallium-68. **Conclusion:** Spatially variant isotope specific point spread functions can be estimated with a good degree of accuracy from Fluorine-18 measurements and published positron range data. We have validated this approach for Carbon-11 and Gallium-68, but such an approach may be appropriate for other isotopes such as Oxygen-15 for which measurements are not practical. **References:** [1] F.A. Kotasidis ***et al,*** MP 2014 [2] L. Jodal ***et al***, PMB 2012 [3] J. Cal-Gonzalez ***et al***, PMB 2013

EP-0073

Computational 3D Preoperative Simulation As Useful Tool For Sentinel Lymph Node Detection In Breast Carcinoma Surgery

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