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The impact of prompt gamma compensation on myocardial blood flow measurements in dynamic rubidium-82 PET

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Introduction: There is increasing evidence demonstrating a clinical role for myocardial blood flow (MBF) and myocardial flow reserve (MFR) - the ratio of MBF at stress to rest. There are however technical factors that might have an impact on these measurements. The desire for a standardised technique necessitates an understanding of these factors. Unique to rubidium-82 is the Prompt Gamma Compensation (PGC) to compensate for the 776 keV gamma-ray emissions that can cause erroneous coincidence events. PGC has been shown to improve image quality but its impact on MBF or MFR has not been evaluated. **Methods:** 50 sets of routine dynamic rubidium-82 stress and rest images from 29 male (median [inter-quartile range] BMI: 28.4 [25.2-30.5]) and 21 female (median [inter-quartile range] BMI: 33.8 [26.7-38.7]) were acquired on Siemens Biograph mCT. 1110 MBq of rubidium-82 was used for stress and rest; 18-frame dynamic images were reconstructed with and without Siemens PGC using 3D-OSEM (2i24s, 6.5mm post-filter). The area under the curve (AUC) for the blood input function (BIF) was calculated. Stress MBF, rest MBF and resulting MFR were calculated using Siemens syngoMBF. Relative differences of values with and without PGC were calculated along with Wilcoxon rank test and Mann-Whitney U test for statistical analysis. **Results:** With PGC applied, the BIF AUC was significantly greater by +14.0% stress and +14.6% at rest ($p<0.001$) with no significant differences between the relative BIF AUC increases during stress or rest. Over all patients, no significant differences were observed for stress MBF, rest MBF or MFR. However, significant differences in stress and rest MBF were seen in obese (BMI > 30) patients ($n=23$) but not in non-obese patients. With PGC applied, the median [inter-quartile range] relative change of MBF was -7.0% [-13.3% to +1.8%] for stress ($p<0.01$) and -5.8% [-16.1% to +3.0%] for rest ($p=0.02$) in the obese patients. No significant difference was observed in MFR for either obese patients or non-obese patients. **Conclusion:** The use of PGC in rubidium-82 dynamic image reconstruction can result in a small but significant reduction of measured absolute MBF in obese patients. Stress and rest values are reduced by similar relative amounts and, as such, MFR is preserved. The use of PGC does not appear to result in any significant differences in MBF or MFR for non-obese patients.

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Radiomics texture features variability and Reproducibility in advance image reconstruction setting of oncological PET/CT

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Aim Radiomics features derived from oncological PET images are now recognized as valuable tool for future prognostic and predictive models, knowledge about their variability and Reproducibility is essential. The purpose of current study was to investigate the variability and reproducibility of radiomics texture feature in oncological PET/CT due to different advance image reconstruction parameters. **Material and method** PET images of the NEMA-IQ phantom containing 6 hot spheres (diameter10 to 37mm) were acquired on GE Discovery 690 PET/CT scanner. The 3D iterative reconstruction was done using OSEM + PSF and OSEM+ PSF + TOF with two and three iteration and eight post-reconstruction filters width 1 to 6.4 mm. The five largest spheres were analyzed. PET-based VOIs were drawn automatically by applying a threshold of 50% of SUVmax. All analysis was performed in Matlab R2013b. For each VOI, 80 radiomic features were based on intensity histograms (IH), gray level co-occurrence (GLCM), gray level run-length (GLRLM), neighborhood-difference matrices (NDM), gray level size-zone texture matrices (GLSZM) and SUV statistics. All radiomics features were categorized into 4 groups based on coefficient of variation (COV): a very small (COV≤5%), small (5%<COV≤10%), intermediate (10%<COV≤20%) and large (COV>20%) range of variation with respect to the mean. **Result** Approximately 71% of the radiomics features (57/80) had a significantly smaller variance. TLG, SUVmean, 10 SUV statistics and 27 texture feature had the best performance with a COV less than 5%. 18 features had COV between 5 and 10%,12 features had COV between 10 and 20%, Whereas 11 features such as LZE and HGLZE from GLSZM were the least robust. SUVSkewness, Coarseness, RLV are in the large variation group for all reconstruction algorithms. **Conclusion** The sensitivity of PET Radiomics textural features to advance reconstruction parameters is feature-dependent. Therefore, texture Features with high COV are more prone to errors if employed to quantitative oncological PET image. Radiomics texture Features with low COV over different reconstruction are better candidates for reproducible tumor quantification. Robustness of (57/80) texture feature between different advance images reconstructions may be high enough to allow the extraction of texture feature values for oncological PET image.

1307 – Tuesday, October 18, 2016, 11:30 - 13:00, Hall 116
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PET/MR in Clinical Oncology - State of the Art

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Evaluation of primary prostate pathologies by large-scale analysis of non-invasive PET-MRI features with Machine-Learning approaches

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Introduction Prostatic tissue offers a wide range of pathologies from benign alterations and non-significant cancers up to aggressive tumor patterns. So far imaging has played a minor role in tissue characterization. Our goal was to provide a PET-MRI based classification model built on