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Attenuation correction in PET/CT: optimum imaging parameters derived from ultra low dose calcium score CT

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Introduction: In cardiac PET/CT, coronal calcium scoring CT (CCSCT) not only is a noninvasive assessment of the presence and location of calcified plaque but also could provide as attenuation correction (AC) maps. However, the optimal radiation dose saving of CCSCT scan has not been studied. The purpose of this study is to determine optimum imaging parameters for attenuation correction in PET/CT based on ultra-low dose CCSCT with various body size.
Materials and methods: The study was performed using a modified QRM-cardiac phantom including CCSCT scan and emission scan. The phantom containing calibration inserts and additional phantom rings were used to simulate small, medium-size, and large patients. Agaston scores were calculated using CCSCT images (120 kV, 300 mA) as standard and compared with low-dose parameter scans (from 300 to 10 mA, 50 intervals). The assessment of Agaston scores and standard uptake value (SUV) were carried out by paired t test and Pearson' s correlation coefficient. Radiation doses from CCSCT were expressed by using CT dose index (CTDI).
Result: The result showed optimum tube current in small, medium, and large size was 50, 100, and 150 mA, respectively. It was good correlation between Agatston score values, calculated by 300 mA and low-dose CCSCT images, as expressed by correlation coefficient and p value ($r>0.9$, $p<0.002$). There was no difference when comparing the SUV between 300 mA and each low-dose parameter scans. Radiation dose was reduced by 83.34, 66.67, and 50 % when using 50, 100, and 150 mA CCSCT image, compare to 300 mA CCSCT image.
Conclusion: The data of this preliminary study demonstrates that increasing body size is associated with increasing radiation exposure and image noise. Using low-dose CCSCT scan results in good assessment of Agatston score and SUV and make it possible to reduce radiation dose by more than 50 %.

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