

## Impact of metal artifact reduction on cardiac FDG-PET/CT studies in the presence of pacemaker and implantable cardio verter defibrillator leads

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**Introduction:** Metallic artifacts induced by pacemakers and implantable cardioverter defibrillator (ICD) leads are a limitation of CT-based attenuation correction (CTAC) of PET data in cardiac PET/CT imaging. In this study, the impact of metal artefact reduction (MAR) for CTAC of cardiac PET/CT images in the presence of pacemakers and ICD leads was investigated through both qualitative and quantitative analysis using phantom and clinical studies.

**Methods:** The study included seven patients (three with pacemaker leads and four with ICD leads) undergoing viability examinations using dedicated cardiac PET/CT protocols. For detailed analysis, CT and PET emission data were also obtained using an anthropomorphic thorax phantom and dedicated in-house made heart phantom incorporating pacemaker and ICD leads attached at the right ventricle of the heart. The PET data for both patient and phantom studies were corrected for attenuation using both artefactual CT as well as CT images enhanced using a MAR algorithm. The severity and magnitude of metallic artefacts arising from these leads were assessed on both  $\mu$ maps and attenuation corrected PET images. VOI-based analysis and regression plots were performed for regions related to leads' location. Bull's eye view analysis was also performed on PET images corrected for attenuation with and without the MAR algorithm.

**Results:** In phantom studies, the mean percent difference between tracer uptake obtained without and with MAR were seen to be as much as  $10.16 \pm 2.1$  and  $6.86 \pm 2.1$  in the segments of the heart in the vicinity to the metallic object, whereas they were  $4.43 \pm 0.5$  and  $2.98 \pm 0.5$  in segments far from the metal, for ICD and pacemaker leads, respectively. In clinical studies, the visual assessment of PET images by experienced physicians and quantitative analysis did not report significant differences when PET images are corrected for attenuation with and without MAR.

**Conclusion:** It was concluded that although the MAR algorithm can effectively improve the quality of  $\mu$ maps, its clinical impact on the interpretation of PET images is not significant. Therefore cardiac PET images corrected for attenuation using CTAC in the presence of metallic leads can be interpreted without correction for metal artefacts. It should however be emphasized that in some special cases with multiple ICD leads attached to the myocardium wall, MAR might be useful for accurate attenuation correction.

**Keywords:** PET/CT, CTAC , Pacemaker, Cardiac.