

Metal artifact reduction algorithms for lower extremity CT angiography with hip prostheses: Experimental phantom study

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Introduction: Image quality reduction due to metallic artifacts is a significant challenge during vascular CT imaging of the lower extremity in patients with hip prostheses. This study aims to analyze various reconstruction algorithms' ability to reduce metal artifacts due to hip prostheses for lower extremity CT angiography.

Methods: Multi-modal images were acquired using different kilo voltage peak (kVp) settings and reconstructed with different algorithms such as filtered back projection (FBP), iterative reconstruction (iDose4), iterative model-based reconstruction (IMR) and orthopedic metal artifact reduction (O-MAR). The image quality was assessed based on image noise, signal-to-noise ratio (SNR), and Hounsfield unit (HU) deviation and analyzed by five regions of interest (ROIs).

Results: IMR approach significantly improves the image quality when compared to iDose4 and FBP. For vascular region R1, O-MAR improves SNR by 5 ± 1 , 23 ± 5 , and 42 ± 9 for FBP, iDose4, and IMR ($p < 0.05$) respectively, and improves HU precision toward the baseline values by 49% and 83% for FBP and IMR ($p < 0.05$), respectively. The noise reduction was found to be 71% and 89% for FBP and IMR ($p < 0.05$), while 57% ($p > 0.05$) for iDose4. For region R5, O-MAR was able to enhance CT-number accuracy by 81%, 89%, and 92% for FBP, iDose4, and IMR respectively ($p < 0.05$). Also, O-MAR reduced noise values by 79 %, 90 %, and 92 % for FBP, iDose4, and IMR respectively ($p < 0.05$). O-MAR greatly enhances SNR corrections among the most severe artifacts with 29 ± 1 and 43 ± 4 for FBP and IMR ($p < 0.05$), compared to iDose4 by 37 ± 7 ($p < 0.05$).

Conclusion: IMR Combined with O-MAR could improve the CT angiography of the lower extremity for patients with a hip prosthesis.

Implications for Practice: Appropriate selection of imaging filtration algorithm is crucial to reduce metallic artifact effects due to hip prostheses during lower extremity CT vascular imaging.

Keywords: lower extremity CT angiography, CT metal artifacts, iterative model-based reconstruction, O-MAR.

Biography

Omarah AbdAlqader is a skilled radiology professional at Allmed Medical Center, Palestine, with expertise in advanced imaging techniques. Her work focuses on optimizing diagnostic accuracy through innovative imaging solutions. Her recent study, "Metal Artifact Reduction Algorithms for Lower Extremity CT Angiography with Hip Prostheses: Experimental Phantom Study," explores cutting-edge methods to improve imaging quality in challenging scenarios. Omarah's contributions aim to enhance patient outcomes by refining CT angiography techniques. Her research reflects a dedication to advancing radiological practices in clinical settings.

Received: September 12, 2024 ; **Accepted:** September 12, 2024 ; **Published:** December 13, 2024