CT metal artefact reduction for internal fixation of the proximal humerus: Value of mono-energetic extrapolation from dual-energy and iterative reconstructions

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AIM
To assess the value of dual-energy computed tomography (DECT) and an iterative frequency split-normalized metal artefact reduction (IFS-MAR) algorithm compared to filtered back projections (FBP) from single-energy CT (SECT) for artefact reduction in internally fixated humeral fractures.

MATERIALS AND METHODS
Six internally fixated cadaveric humeri were examined using SECT and DECT. Data were reconstructed using FBP, IFS-MAR, and mono-energetic DECT extrapolations. Image analysis included radiodensity values and qualitative evaluation of artefacts, image quality, and level of confidence for localizing screw tips.

RESULTS
Radiodensity values of streak artefacts were significantly different ($p < 0.05$) between FBP (-104 ± 222) and IFS-MAR (73 ± 122), and between FBP and DECT (32 ± 151), without differences between IFS-MAR and DECT ($p < 0.553$). Compared to FBP, qualitative artefacts were significantly reduced using IFS-MAR ($p < 0.001$) and DECT ($p < 0.05$), without significant differences between IFS-MAR and DECT ($p < 0.219$). Image quality significantly ($p = 0.016$) improved for IFS-MAR and DECT compared to FBP, without significant differences between IFS-MAR and DECT ($p < 0.553$). The level of confidence for screw tip localization was assessed as best for DECT in all cases.

CONCLUSION
Both IFS-MAR in SECT and mono-energetic DECT produce improved image quality and a reduction of metal artefacts. Screw tip positions can be most confidently assessed using DECT.