Case 8
Metal Artifact Reduction using Dual Energy CT Monoenergetic Imaging

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HISTORY

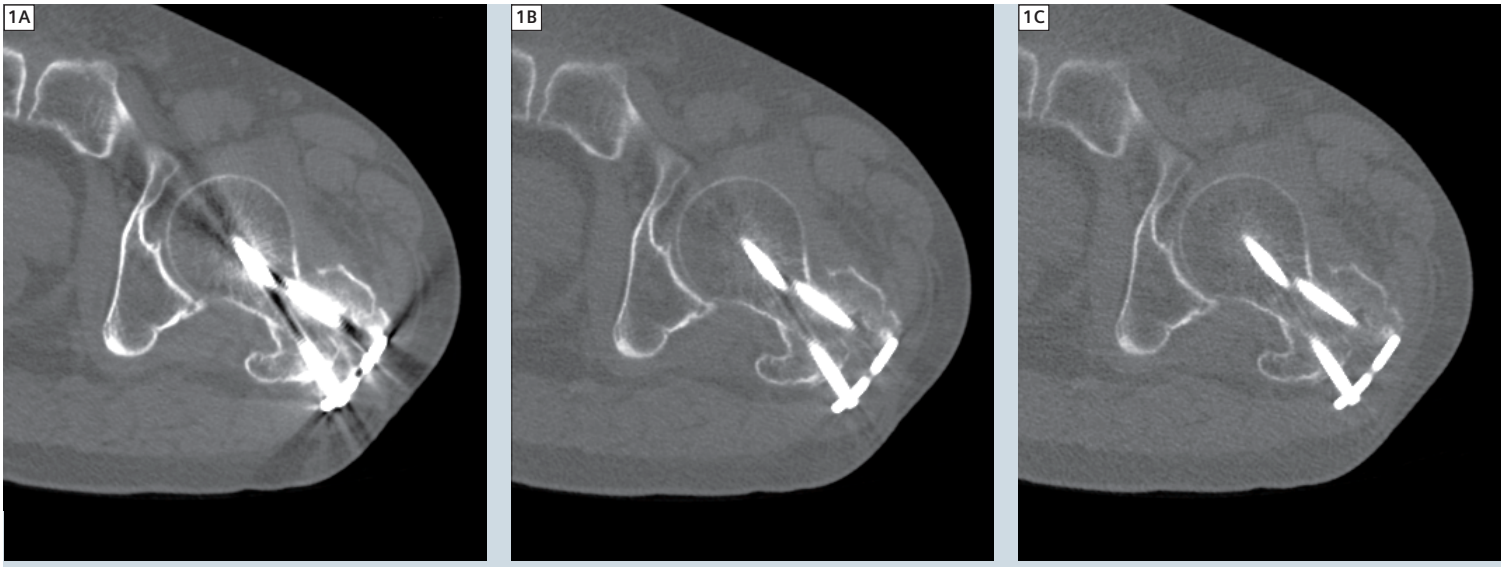
A 65-year-old male patient, who had undergone an ORIF (Open Reduction Internal Fixation) procedure for a lateral femoral neck fracture the previous year, was referred to the CT department for a follow-up assessment. A Dual Energy CT scan was performed using monoenergetic imaging to reduce the metal artifacts.

DIAGNOSIS

The metal artifacts were pronounced at 70 keV (proximately equivalent to 120 kV setting, Fig. 1A), but were substantially reduced by increasing the energy level, e.g. to 110 keV (Fig. 1B) and 150 keV (Fig. 1C). A transversal break through the proximal section of the implant was also found (Figs. 2 and 3).

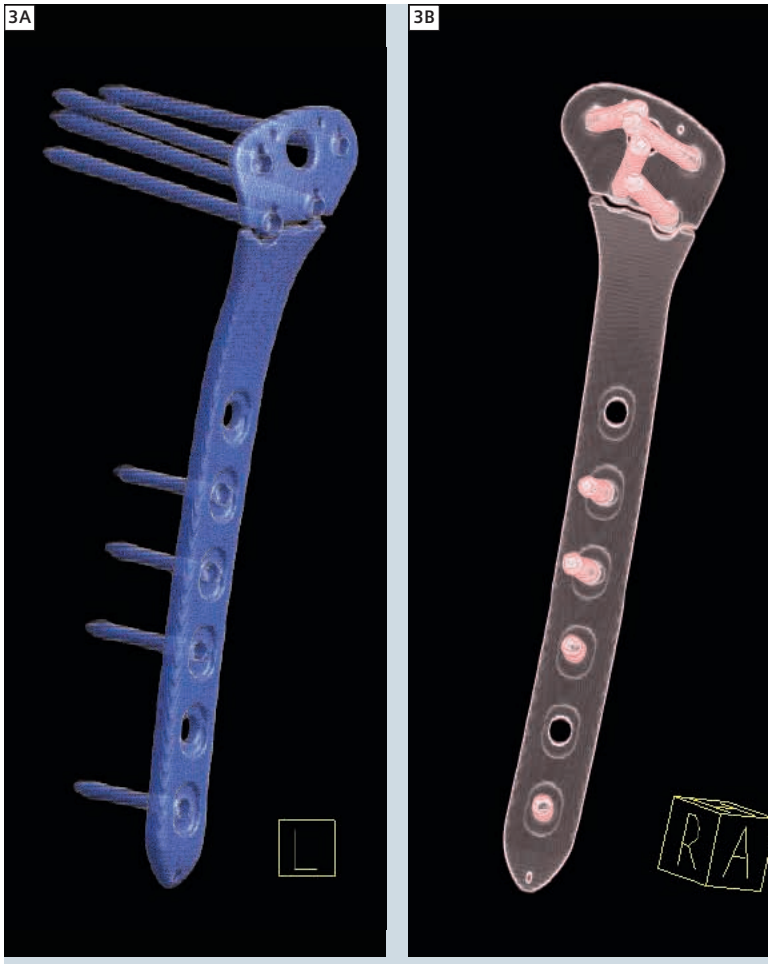
COMMENTS

In ORIF follow-up examinations, it is important to assess the metal implant, the interface between the implant and the bone structures, as well as the surrounding tissues. Metal artifacts, however, represent a significant limitation in CT assessment. Structures are sometimes not interpretable even when using hard



1 Axial images present significant metal artifact reduction from 70 keV (Fig. 1A), to 110 keV (Fig. 1B) and 150 keV (Fig. 1C) settings.

2 VRT image shows the location of the implant in the left femur.



3 VRT images demonstrate the transversal break in the proximal section of the implant.

convolution kernels and widened CT window settings. Dual Energy CT with monoenergetic imaging method allows dose-neutral acquisition at 100 kV and 140 kV simultaneously. It provides a wider range of energy settings (50 to 190 keV) which the users can freely apply to achieve the optimal level for substantial metal artifact reduction. Thus, the image quality can be greatly improved for diagnosis.

EXAMINATION PROTOCOL

Scanner	*SOMATOM Definition Flash*		
Scan area	*Hip*	***DLP***	*303.6 mGy cm*
Scan length	*253 mm*	***Effective dose***	*4.6 mSv*
Scan direction	*Cranio-caudal*	***Rotation time***	*0.5 s*
Scan time	*18 s*	***Pitch***	*0.6*
Tube voltage	*100 kV / Sn 140 kV*	***Slice collimation***	*40 x 0.6 mm*
Tube current	*95–231 eff. mAs / 85–163 eff. mAs*	***Slice width***	*1 mm*
Dose modulation	*CARE Dose4D*	***Reconstruction increment***	*1 mm*
$CTDI_{vol}$	*12 mGy*	***Reconstruction kernel***	*D40f*