Spinal osteosynthesis complicated by postoperative osteolysis and foraminal stenosis

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History

A 52-year-old female patient, suffering from spinal canal stenosis, myelopathy and radiculopathy, underwent spinal osteosynthesis a year ago. She returned to the hospital complaining of chronic and refractory lower back pain, which had worsened over the past 5 months, with radiation into and paresis of the right lower limb. A Dual Energy (DE) CT was performed to assess the integrity and position of the osteosynthesis device and to rule out osteolytic destruction as well as compression of the spinal canal and neuroforamina.

Diagnosis

DECT images displayed at 70 keV (equivalent to 120 kV of conventional CT) showed severe metal artifacts, caused by the osteosynthesis device, which was intact. The artifacts were significantly reduced in images displayed at 140 keV. A lucency was seen around the screw margins in the right ilium, indicating osteolysis. A right foraminal stenosis, compressing the nerve root at L5-S1, was also visualized. There were no signs of a spinal canal stenosis.

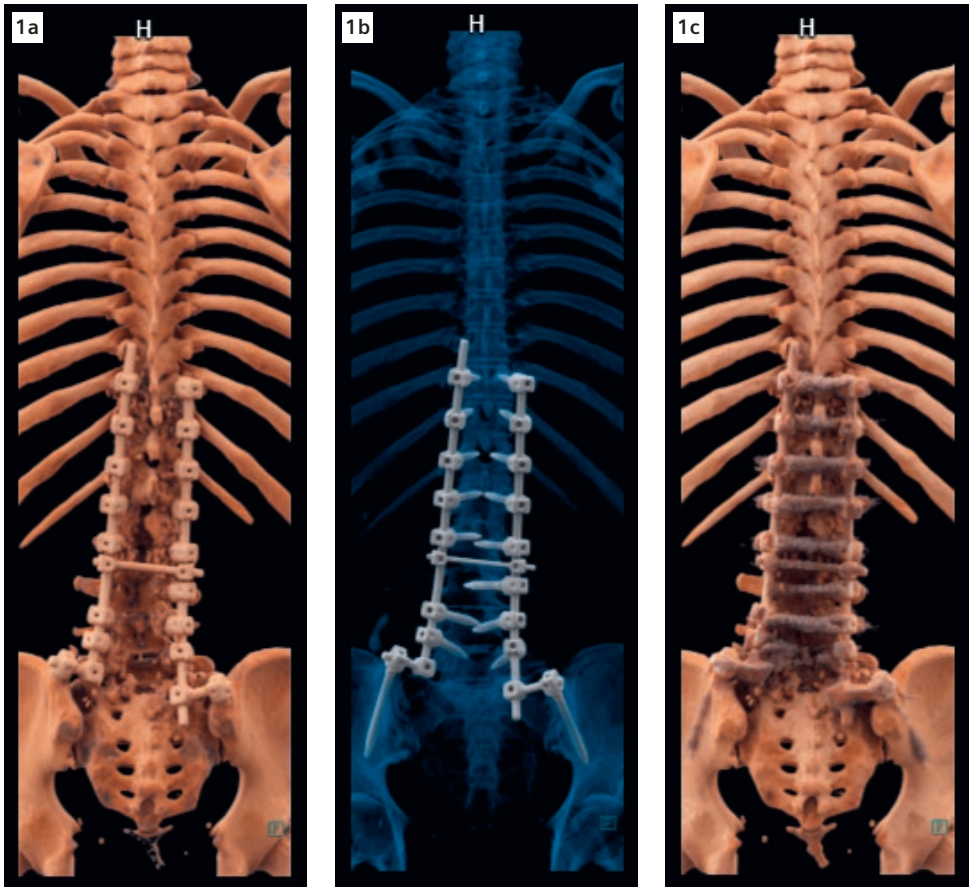
Comments

CT is commonly performed for postoperative evaluation in orthopedic patients with spinal osteosynthesis. However, metal artifacts caused by the osteosynthesis devices impose a significant diagnostic challenge on accurate CT interpretation. To overcome this challenge, a TwinSpiral scan technique is applied, to acquire two successive scans in opposite directions and at different kV and mA settings. The second scan uses a tin filter to optimize the spectral separation of materials, improving image results. This approach has a lower temporal coherence, and is therefore focused on imaging static structures, such as a spine with an osteosynthesis device. The acquired images are processed using *syngo*.CT DE Monoenergetic Plus, which allows users to display monoenergetic images within a range of 40–190 keV. Metal artifacts can be effectively reduced by generating images extrapolated to higher photon energies, such as 140 keV in this case, facilitating the identification of osteolytic changes around a loosening screw. On the other hand, it is also observed that contrast resolution for soft tissue assessment is well preserved at lower photon energies, such as 70 keV in this case, leading to a better appreciation of the compressed nerve root. TwinSpiral DE allows monoenergetic images to be displayed at different photon energies levels assisting accurate diagnosis and optimizing workflow. ●

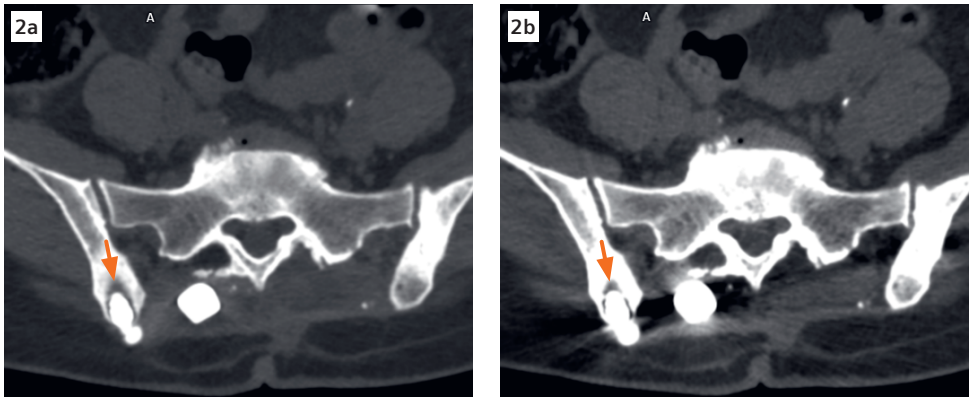
Examination Protocol

Scanner	SOMATOM go.Top
Scan area	Spine
Scan mode	TwinSpiral
Scan length	538.8 mm
Scan direction	Cranio-caudal/ Caudo-cranial
Scan time	28 s
Tube voltage	100 / Sn140 kV
Effective mAs	110 / 347 mAs
Dose modulation	CARE Dose4D
$CTDI_{vol}$	15.24 mGy
DLP	857 mGy*cm
Rotation time	0.5 s
Pitch	0.5
Slice collimation	64 x 0.6 mm
Slice width	1.5 mm
Reconstruction increment	1.0 mm
Reconstruction kernel	Qr40

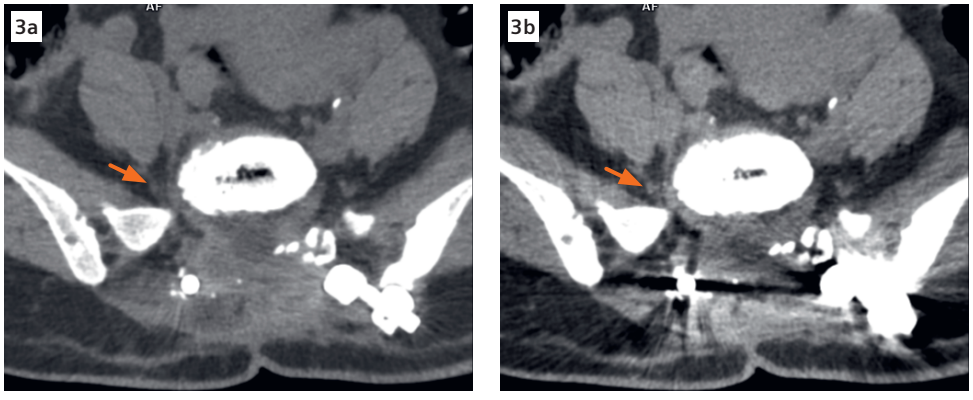
The statements by Siemens Healthineers' customers described herein are based on results that were achieved in the customer's unique setting. Because there is no "typical" hospital or laboratory and many variables exist (e.g., hospital size, samples mix, case mix, level of IT and/or automation adoption) there can be no guarantee that other customers will achieve the same results.



1 Cinematic volume rendered images, using monoenergetic images displayed at 140 keV (Figs. 1a & 1b), clearly show an intact osteosynthesis device implanted in the lower back. The same structures are blurred and hard to interpret when using monoenergetic images displayed at 70 keV (Fig. 1c).



2 An axial image, displayed at 140 keV (Fig. 2a), clearly shows osteolytic changes (arrow) around the right iliac screw margins. The 70 keV image is more challenging to interpret (Fig. 2b) due to severe metal artifacts. Both images are presented at the same window settings.



3 Metal artifacts are significantly reduced in an axial image displayed at 140 keV (Fig. 3a), however a right foraminal stenosis, compressing the nerve root at L5-S1 (arrow), is more clearly demonstrated in the image displayed at 70 keV (Fig. 3b). Both images are presented at the same window settings.