Case 14

CT-guided Biopsy Assisted by Iterative Metal Artifact Reduction

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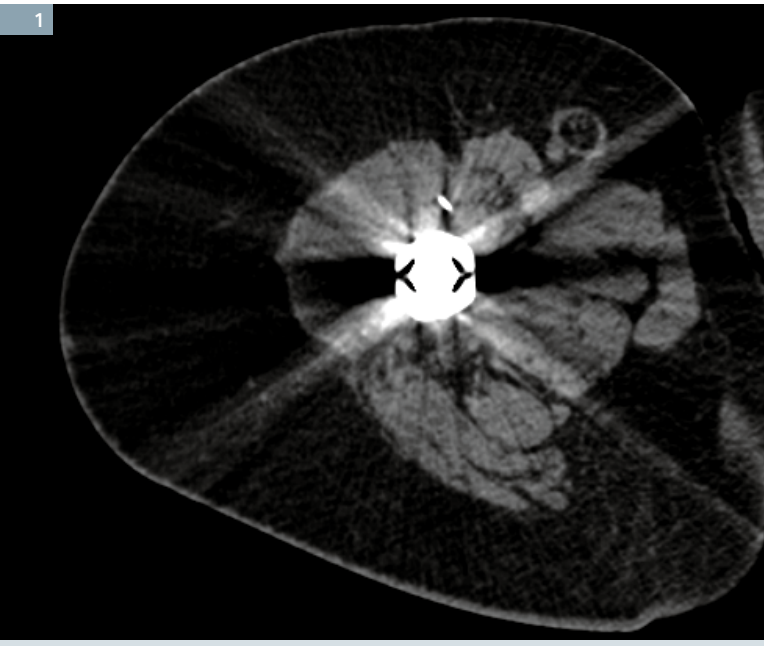
History

A 65-year-old female patient, with a known history of pleomorphic soft-tissue carcinoma G3 at the proximal end of the right thigh, had undergone neo-adjuvant combined radio-chemo-therapy, followed by resection and prosthetic replacement. A follow-up MRI showed a vague contrast enhancing mass lateral to the prosthesis. The image visualization however, was compromised by the metal artifacts.

A CT-guided biopsy was requested for a histopathological diagnosis of scar versus recurrent tumor tissue.

Diagnosis

Conventionally reconstructed CT images showed extensive metal artifacts, caused by the prosthesis (Fig. 1). Theses artifacts, which impaired the proper visualization of the hypodense lesion, were significantly absent in images reconstructed using iMAR (iterative metal artifact reduction) and ADMIRE[1] (advanced modeled iterative reconstruction) (Fig. 2). The biopsy was performed under CT guidance (Fig. 3) and confirmed the suspicion of a recurrence of the pleomorphic soft tissue sarcoma. The patient was treated with a wide resection followed by adjuvant chemotherapy.



1 An axial conventionally reconstructed CT image for planning of the CT-guided biopsy: Note the extensive artifacts caused by the prosthesis. The hypodense lesion cannot be properly visualized.

2A An axial CT image reconstructed with iMAR: Note the significant reduction of the artifacts and a much better visualization of the hypodense lesion (arrows).

Comments

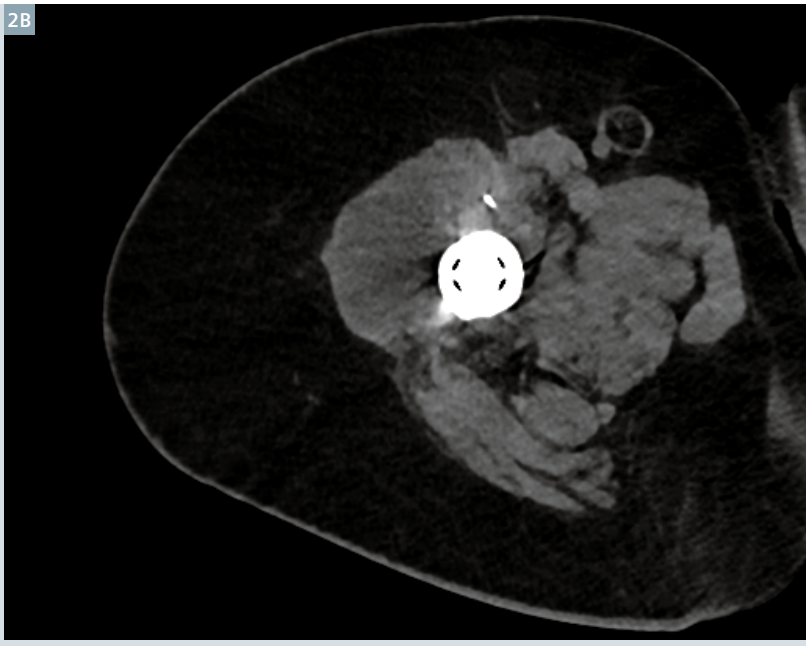
Metal artifacts caused by implants or a prosthesis may lead to non-diagnostic images possibly concealing relevant pathologies. In this case, the lesion was not well visualized on the MRI and was not seen in ultrasound. Without artifact reduction, the needle positioning during CT-guided biopsy would have been vague and difficult. iMAR is an image reconstruction algorithm which uses an iterative approach for metal artifact reduction. ADMIRE allows dose reduction while maintaining a natural image impression.[2] The combination of both was very helpful in performing a successful biopsy and in establishing the diagnosis. ■

[1] In clinical practice, the use of ADMIRE may reduce CT patient dose depending on the clinical task, patient size, anatomical location, and clinical practice. A consultation with a radiologist and a physicist should be made to determine the appropriate dose to obtain diagnostic image quality for the particular clinical task.

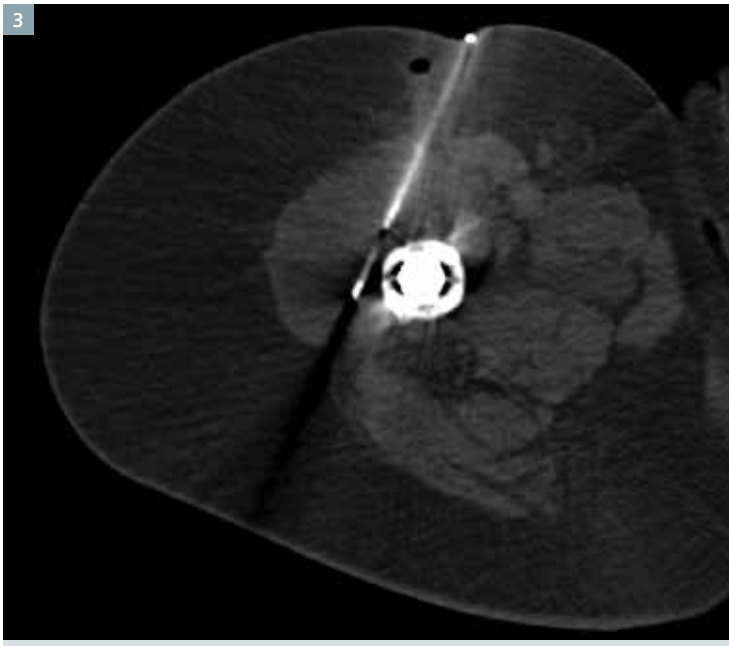
[2] In terms of outliers in the pixel noise structure.

Examination Protocol

Scanner	SOMATOM Definition Edge
Scan area	Femora
Scan length	147 mm
Scan direction	Cranio-caudal
Scan time	4.4 s
Tube voltage	120 kV
Tube current	157 mAs
Dose modulation	CARE Dose4D
$CTDI_{vol}$	10.6 mGy
DLP	173.3 mGy cm
Effective dose	2.6 mSv
Rotation time	0.5 s
Pitch	0.8
Slice collimation	128 × 0.6 mm
Slice width	3 mm
Reconstruction increment	3 mm
Reconstruction kernel	B30f / I30f (ADMIRE)



2B With ADMIRE additionally applied to the image reconstruction, the visualization is further improved.



3 A low-dose CT-fluoroscopy image serves as a final documentation of the CT-guided biopsy with a 15G coaxial needle and a 16G core biopsy needle, prior to the retrieval of the biopsy specimen.