

Scaphoid fracture associated bone marrow edema

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History

A 23-year-old male patient, presented himself to the emergency department one day after a fall from a bicycle onto his left wrist. At initial presentation, the patient had no pain at rest, but complained when pressure was applied over the scaphoid bone (snuffbox tenderness). Radiographs, with scaphoid-specific projections, were taken but no fractures were demonstrated. Due to clinical suspicion of a radiographically occult scaphoid fracture, the patient was referred to a Dual Energy CT (DECT) scan of the wrist.

Diagnosis

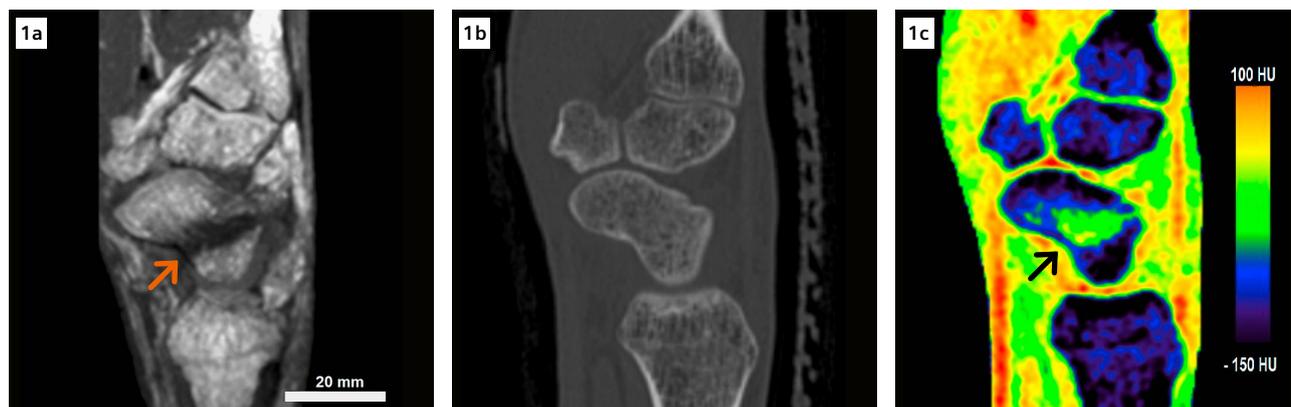
DECT images revealed bone marrow edema (BME) and an undislocated fracture through the waist of the scaphoid bone. The scapholunate distance was normal. No fractures in other wrist bones were seen. CT findings were subsequently confirmed

by MRI (1.5T), performed the same day. The patient was treated with immobilization in cast for 6 weeks. Follow-up imaging after 8 weeks, showed signs of healing and ruled out non-union.

Comments

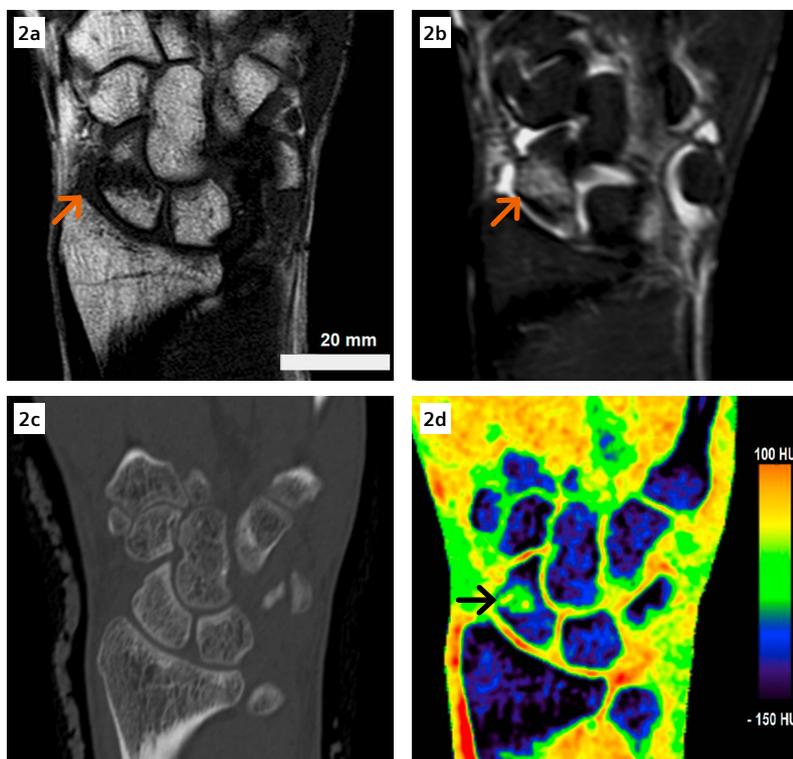
Missed scaphoid fractures on radiographs are a concern, as untreated scaphoid fractures can lead to non-union.[1] Up to 40% of patients with clinical signs of a scaphoid fracture with negative radiographs have a scaphoid or distal radius fractures.[2] Therefore, patients with wrist trauma routinely undergo MRI or CT examinations. Both modalities have a high specificity for the detection of scaphoid fractures, however, CT had a lower sensitivity than MRI. This is, in part, due to the fact that a conventional CT couldn't detect BME and failed to detect trabecular fractures.[3–5]

DECT scans with virtual non-calcium (VNCa) applications were recently introduced to our institution, allowing us to diagnose patients suspected of wrist fractures with negative radiographs. The application allows calculation of the calcium content and reconstruction of VNCa images demonstrating bone marrow edema. The VNCa images are reconstructed in *syngo.via* (VB20, Resolution 1, Maximum 1,500 HU, Threshold -300 HU) and visualised with a color look-up table (atomic number, window level 0 HU, window width 300 HU) at 2 mm slab thickness. Due to the novelty of the examination technique, patients subsequently undergo MRI as well. A recent study [6] demonstrated the ability of DECT scans to show such occult fractures with a diagnostic accuracy similar to MRI. Due to the short duration of the DECT examination (approx. 1 minute in scanner), it offers logistical advantages over MRI.



1 Fig. 1: Sagittal reformats from MRI T1w 3D sequence (Fig. 1a), conventional CT (Fig. 1b) and DECT color-coded VNCa (Fig. 1c). BME (arrows) through the waist of the scaphoid is clearly shown in both MRI and DECT. The fracture is not visible in conventional CT.

In this patient, the undislocated scaphoid fracture was difficult to visualize in the conventional CT images alone, but the fracture associated bone marrow edema was clearly visible in the DECT VNCA images, allowing the physicians to make a confident diagnosis. ●



2 Fig. 2: Coronal reformats from MRI T1w (Fig. 2a), MRI STIR (Fig. 2b), conventional CT (Fig. 2c) and DECT color-coded VNCA (Fig. 2d). BME (arrows) through the waist of the scaphoid is clearly shown in both MRI and DECT. The fracture is not visible in conventional CT.

Reference

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

Examination Protocol

Scanner	SOMATOM Force
Scan area	Left wrist
Scan mode	Dual Source Dual Energy
Scan length	225 mm
Scan direction	Caudo-cranial
Scan time	9.2 s
Tube voltage	80/ Sn150 kV
Effective mAs	150 / 100 mAs
Dose modulation	CARE Dose

CTDI _{vol}	6.2 mGy
DLP	146 mGy cm
Rotation time	0.5 s
Pitch	0.3
Slice collimation	128 x 0.6 mm
Slice width	0.75 mm
Reconstruction increment	0.5 mm
Reconstruction kernel	Qr40