Visualization of Tendons and Ligaments

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Dual energy techniques based on the recently introduced Dual Source CT with Spiral Dual Energy capabilities promise to offer additional diagnostic information regarding the integrity of ligaments, tendons, and potentially cartilage. However, MRI remains the imaging modality of choice in many cases.

Dual Energy CT makes it possible to differentiate and visualize tendons and ligaments. This can be of great value in trauma patients where CT is performed to evaluate fractures. If the CT scan is performed in dual energy technique, bones can be assessed as well as tendons and ligaments in the same dataset. Although MRI is necessary to detect minor abnormalities, such as edema in a tendon, dual energy evaluation is available with the dataset obtained for the initial evaluation, and it is generally sufficient to exclude tendon ruptures or to display dislocations. Also, the differentiation of cartilage may be of interest, for example, to weigh the possibility of joint reconstruction against the necessity of replacement in elderly trauma patients.

Case 1 – Tendons of Foot and Ankle

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History

After a bicycle accident, a 27-year-old man was referred for CT to rule out bony extensor hallucis longus tendon avulsion.

Diagnosis

On the anterior aspect of the right foot there was a defect and proximal retraction of the extensor hallucis longus tendon. There was no bony avulsion and no evidence of fractures or other injuries.

Comments

With Dual Energy CT it is possible not only to exclude a fracture or bony avulsion but also to evaluate the tendons and ligaments directly. Without Dual Energy CT, the relevant diagnosis would not have been made in this patient.

Examination Protocol

Scanner	SOMATOM Definition
Scan area	foot and ankle
Scan length	274 mm
Scan time	55 s
Scan direction	craniocaudal
kV	140 kV and 80 kV
Effective mAs	50 mAs and 90 mAs
Rotation time	1.0 s
Slice collimation	20 x 0.6 mm
CTDIvol	9.2 mGy
Sex	M
Postprocessing application	
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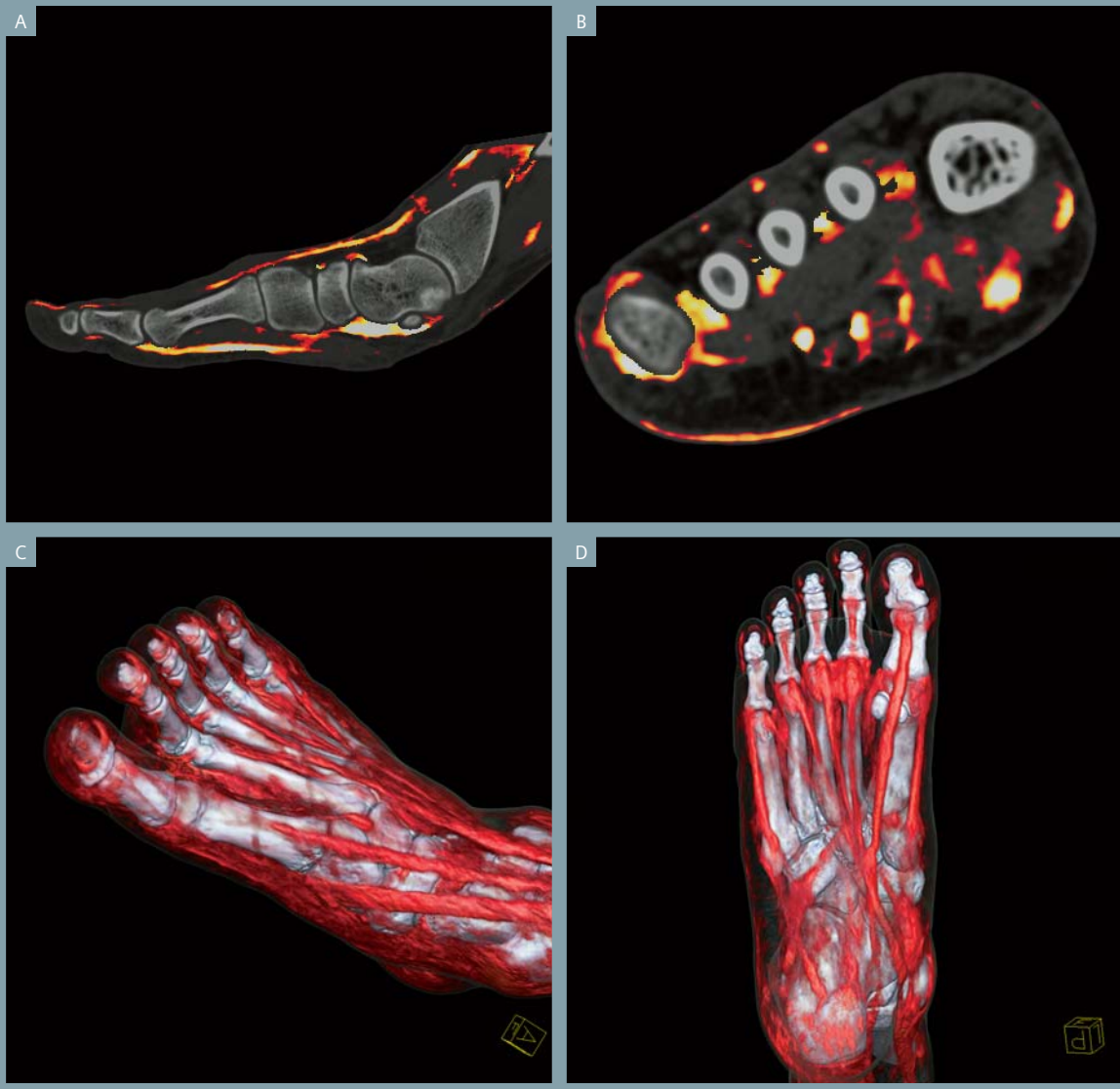
[A] Sagittal MPR image with color-coded tendons. Note the interruption of the extensor hallucis longus tendon.

[B] Axial MPR image. Note the color-coded flexor and extensor tendons and the absent first extensor.

[C] Volume-rendered image from a superior view showing the extensor tendons and the interrupted hallux tendon.

[D] VRT in a plantar view showing the flexor tendons.



Case 2 – Tendons of Hand and Wrist

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History

A 45-year-old female patient was referred for diagnostic workup of chronic pain in the wrist six years after an intraarticular fracture of the radius.

Diagnosis

The SL joint space showed a triangular configuration, and the color-coding of the ligaments and tendons showed no signal in the area of the scapholunate interosseous ligaments. Rupture of the ligaments with scapholunar dissociation was suspected. Additionally, there was severe radiocarpal arthrosis with an uneven articular surface as remnant of the previous fracture. Joint space to os lunatum was noticeably narrowed.

Comments

Dual Energy makes it possible to visualize both bones and ligaments in a single exam. Although Dual Energy CT cannot replace MRI for a detailed evaluation, it can be useful to assess the presence and continuity of ligaments and tendons without additional radiation exposure. Considering that CT is mostly performed as primary modality to rule out fractures, this technique can help to route the further diagnostic workup.

Examination Protocol

Scanner	SOMATOM Definition
Scan area	wrist
Scan length	133 mm
Scan time	4 s
kV	140 kV and 80 kV
Effective mAs	38 mAs and 100 mAs
Rotation time	1.0 s
Slice collimation	64 x 0.6 mm
CTDIvol	9.1 mGy
Sex	F
Postprocessing application	
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[A] + [B] Volume-rendered images showing the continuity of the flexor tendons.

[C] + [D] Color-coded reconstructions in coronal and sagittal orientation.