Journal of Ultrasound (2012) 15, 42—49

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Conflicts, snapping and instability of the tendons. Pictorial essay

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Translated from French into Italian by Anna Guja Draghi

KEYWORDS
Ultrasound;
Tendons;
Snapping;
Conflicts;
Instability.

Abstract Conflicts, snapping and instability of the tendons are common, and ultrasound (US) is the method of choice for evidencing these conditions thanks to the possibility to perform dynamic maneuvers during imaging studies. A conflict can occur between a tendon and a bone structure, other tendons, the retinacula or pulleys. Snapping can occur due to instability caused by rupture of the retinaculum, conflict between a thickened retinaculum and a bone prominence or due to an abnormal position of the tendon. Instability can occur due to insufficient ability of the retinaculum to keep the tendons in the bone groove or its failure to hold the tendons applied to the bone.
The technique for evidencing conflicts, snapping and instability of the tendons is very demanding because it requires a thorough knowledge of the US appearance and dynamic maneuvers. However, at the present time US examination completed with dynamic maneuvers is the investigation of choice for evidencing these disorders and providing the clinicians with the necessary information.

Sommario Conflitti, scatti ed instabilità dei tendini sono frequenti e l'ecografia è, per la possibilità di eseguire manovre dinamiche, la metodica di elezione per obbiettivarli.
I conflitti dei tendini possono realizzarsi rispetto a strutture ossee, ad altri tendini, a retinacoli e pulegge.
Gli scatti possono avvenire per instabilità da rottura di un retinacolo, per conflitto con un retinacolo ispessito o con una protuberanza ossea, per uno spostamento anomalo rispetto a un altro tendine.
L'instabilità può realizzarsi per insufficienza di un retinacolo nel chiudere una doccia ossea, o per insufficienza, sempre di un retinacolo, a stabilizzare i tendini contro un osso.
La tecnica per l'evidenziazione di conflitti, scatti ed instabilità dei tendini è molto impegnativa, perché richiede la conoscenza della semiotica e manovre dinamiche, ma l'ecografia, completata con manovre dinamiche è, al momento attuale, l'indagine di scelta per la comprensione di queste patologie e per fornire informazioni ai clinici.

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1971-3495/$ - see front matter
doi:10.1016/j.jus.2012.01.002

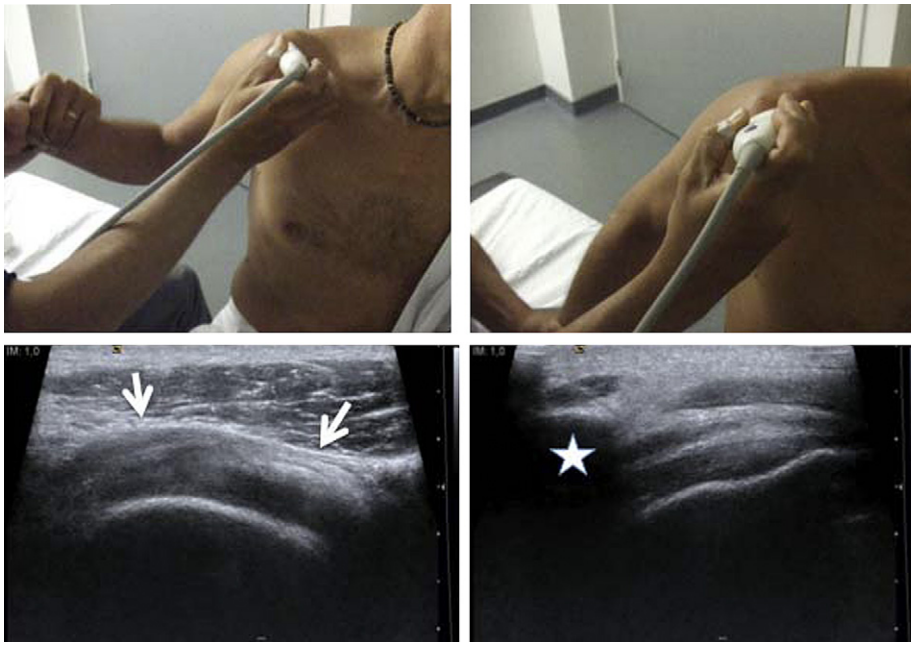

Figure 1 Searching for impingement syndrome. Oblique-sagittal scan on the coracoacromial ligament (white arrows) and rotational movements of the shoulder. Coronal scan of the supraspinatus at the acromion (asterisk) and abduction movements.

Introduction

Conflicts, snapping and instability of the tendons are frequent disorders which are better studied by ultrasound (US) than MRI thanks to the possibility to perform dynamic maneuvers during US examination. Particular dynamic maneuvers are required during the study of each specific disorder in order to evidence the abnormality [1,2]. The purpose of this paper is to describe the required dynamic maneuvers and the relative US appearance.

Tendinous conflicts

Conflicts with the bone structures

Dorsal carpal bones: conflict between the dorsal osteophytes of the carpometacarpal interline and the extensor tendons of the radius and fingers. They are evidenced by extension and flexion movements of the tendons and linked to carpometacarpal flexion.

Anterior conflict of the ankle: dorsal osteophytes and extensor tendons. Flexion and extension movements of the foot and toes [3].

Acromial vault and superior cuff (Figs. 1 and 2): oblique-sagittal scan of the coracoacromial ligament with medial rotation movements of the shoulder, coronal scan of the superior cuff [4] and movements of abduction and rotation involving a feeling of "sticking". The examination includes searching for bursitis, tendinitis and tendon rupture, particularly of the superficial portion.

Peroneal trochlea and peroneal tendons (Fig. 3). Peroneus longus tendinopathy. Greater tuberosity of the calcaneus and Achilles tendon (Haglund): dorsiflexion and plantar flexion, bursitis and anterior cleavage of the

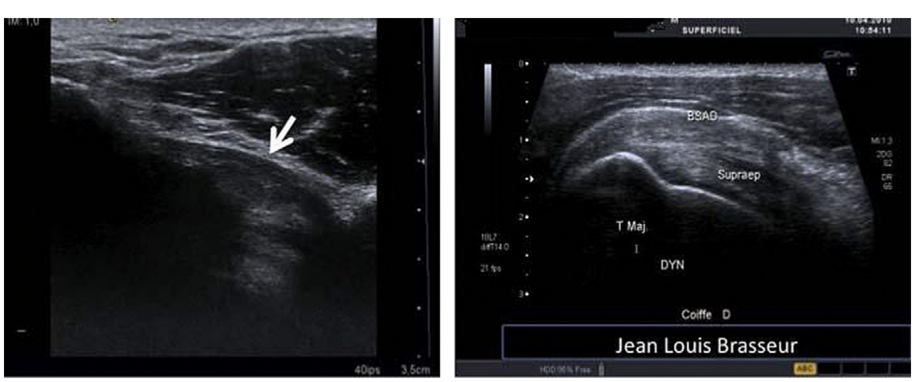

Figure 2 Impingement syndrome, pathological aspects. Convex aspect of the coracoacromial ligament (white arrow). Thickening of the subacromial bursa.

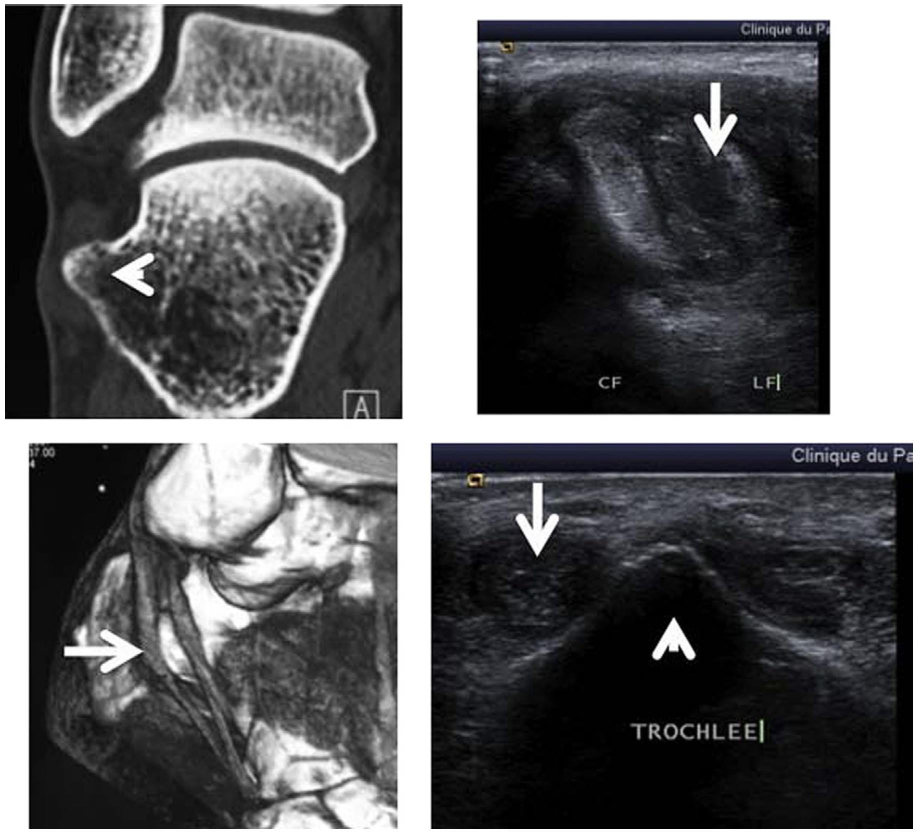

Figure 3 Hypertrophy of the peroneal trochlea and conflict with the peroneus longus tendon. Coronal CT reconstruction and VCR, axial retromalleolar US image showing tendinopathy of the peroneus longus tendon (arrow) and axial submalleolar image showing hypertrophy of the trochlea (arrowheads).

tendon. Iliotibial band syndrome between the lateral epicondyle and the distal iliotibial band [5]: axial scan at the lateral epicondyle, and flexion-extension of the knee, bursitis between the tendon and the lateral epicondyle.

Patellar tendon and the inferior surface of the trochlea.

Coracoid and anterior cuff: axial scan at the coracoid and medial rotation movements. Conflict between the acromion and the anterior surface of the subscapularis tendon. Posterior superior conflict according to Walch between the posterior edge of the glenoid and the deep surface of the superior cuff [6]: posterior axial scan of the infraspinatus starting from the position of medial abduction-rotation, the hand resting on the opposite shoulder and moving progressively in external abduction-rotation of the shoulder. Lesion of the deep surface of the superior cuff and bone abnormalities of the posterior surface of the glenoid.

Conflicts with other tendons: intersection

Intersection of the abductor pollicis longus and the extensor pollicis brevis tendons with the carpi radialis tendons (Fig. 4): tendinitis, bursitis and tenosynovitis; Doppler image shows hyperemia [7,8].

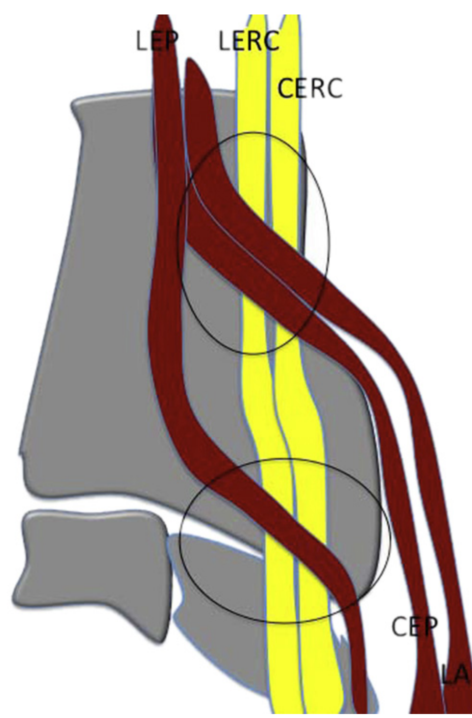

Figure 4 Diagram showing proximal intersection between the radial tendons (LERCH and CERC) and short extensor tendons (CEP) and abductor pollicis longus (LABP); intersection between the radial tendons and the extensor pollicis longus tendon(LEP).

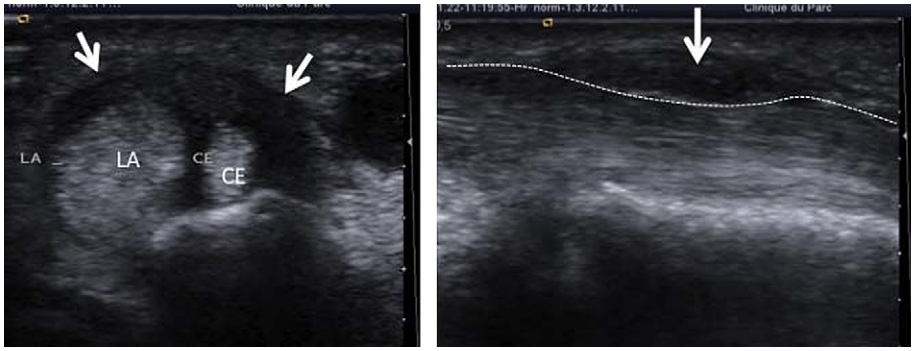

Figure 5 De Quervain's tendinitis. Coronal and axial US scans showing thickening of the retinaculum of the first osteofibrous tunnel due to stenosing tenosynovitis of the short extensor tendons (CE) and abductor pollicis longus (LA).

Intersection of the extensor pollicis longus tendon and extensor carpi radialis longus (Fig. 4): tendinitis, bursitis and tenosynovitis.

Conflicts with retinaculum or a thickened pulley

De Quervain's tendinopathy: the abductor pollicis longus and the extensor pollicis brevis (Fig. 5): thickening of the retinaculum of the first dorsal compartment, stenosing tenosynovitis [9]. Finger flexor tendons and A1 pulley (Fig. 6) [10,11]: thickening of the pulley (>1 mm) where Doppler image shows hyperemia with attachment of the superficial flexor to the pulley during flexion of the finger.

Tendons of the ankle and retinaculum: post-traumatic thickening of the retinaculum and tenosynovitis with Doppler image showing hyperemia.

Tendon snapping

Due to instability caused by rupture of the retinaculum

Posterior tibial tendon [12]: evidenced by resisted inversion movements. Peroneal tendons [13]: resisted subversion. Extensor carpi ulnaris tendon (Fig. 7): supination and ulnar deviation. Tendon of the long head of the biceps muscle: lateral rotation of the shoulder.

Due to conflict with a thickened retinaculum [14]

Finger flexor and A1 pulley.

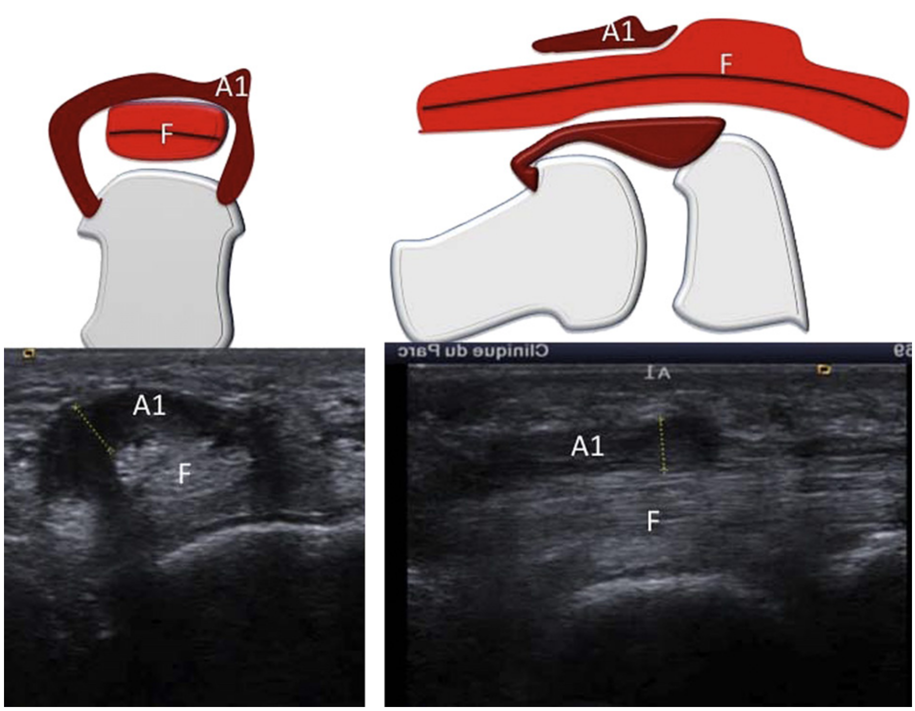

Figure 6 Finger with snapping due to thickening of the A1 pulley, which causes conflict with the superficial flexor during flexion.

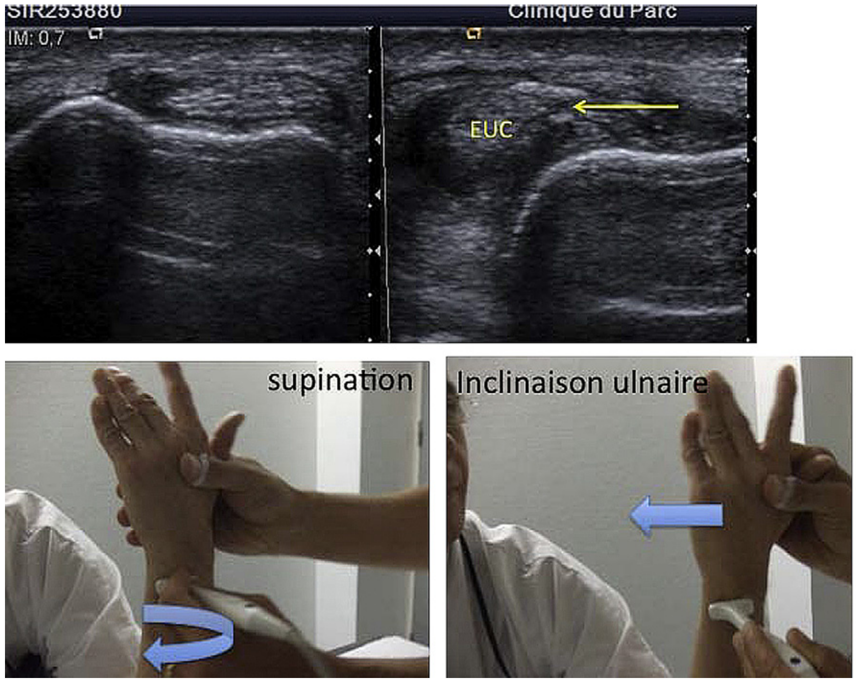

Figure 7 Instability of the extensor carpi ulnaris tendon due to rupture of the sheath. Two dynamic maneuvers are required: supination and ulnar deviation of the wrist.

Conflict with a protruding bone

Flexor hallucis longus and protruding posterior process of the talus.

Abnormal displacement

Lateral snapping of the tensor fasciae latae of the hip [1] (Fig. 8); the tendon passes forward from the greater

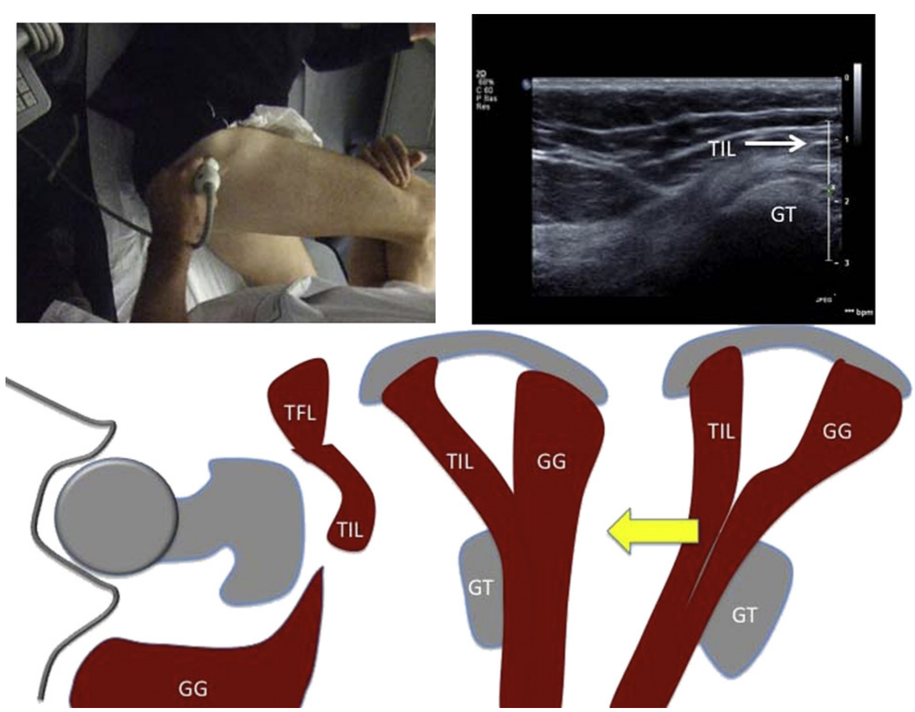

Figure 8 Lateral snapping of the hip due to the iliotibial band (TIL) passing forcefully forward from the greater trochanter (GT) during hip flexion.

trochanter during hip flexion: axial scan of the greater trochanter with the patient in the lateral decubitus position performing a hip flexion maneuver, which reproduces the snapping. Lateral snapping of the hip with anterior fibers of the gluteus maximus: the same appearance as that of the tensor fasciae latae.

Snapping of the distal biceps femoris tendon (Fig. 9) [15]: this condition occurs for numerous reasons. It can be due to snapping of the tendon on an epiphysis of the hypertrophic fibula, to snapping of a tendon caused by the union with the iliotibial band, to a too anterior insertion of the biceps on the fibula or to a bifid insertion of the tendon with an additional insertion on the head of the tibia in conflict with the lateral collateral ligament. These conditions can be identified during flexion-extension movements of the knee.

Snapping of the iliopsoas muscle (Fig. 10): during flexion, abduction and external rotation of the hip, the enveloped muscle is interposed between the tendon and the anterior cortical bone of the pelvis. While returning to extension, the tendon snaps against the bone before it finds its initial position.

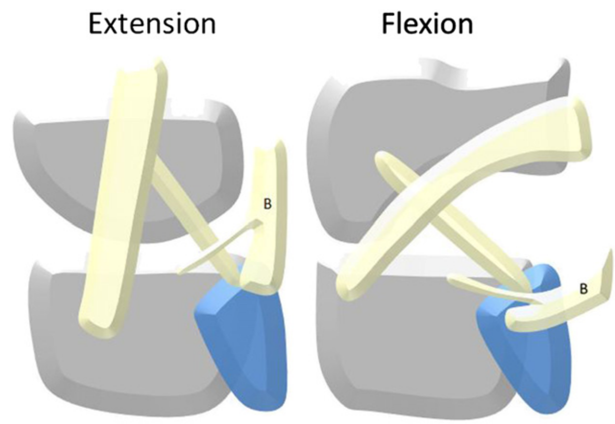

Figure 9 Snapping of the biceps femoris at the knee due to the presence of an accessory head arising from the tibia.

Snapping against another tendon

Sartorius and semimembranosus tendon reflex (Fig. 11) during flexion; the Sartorius tendon is behind the semimembranosus tendon reflex and runs posteriorly during extension. This movement can be sudden and cause snapping, particularly in the presence of semimembranosus tendinopathy.

Instability

Due to failure of the retinaculum to keep the tendons in the bone groove

Extensor carpi ulnaris and the ulna: the instability must be sought in supination and ulnar deviation of the wrist. A comparative study should be performed to evidence congenital laxity, which frequently occurs. Long head of the humeral bicipital groove of the humerus: lateral rotation [1]. Long head of the biceps and humeral bicipital groove: lateral rotation [1]. Peroneal tendons and lateral retromalleolar groove due to insufficiency of the proximal retinaculum of the peroneal tendons: resisted eversion maneuver of the foot. Search for indirect signs: thickening of the retinaculum and bone avulsion.

Failure of a retinaculum to hold the tendons applied to the bone structure

Flexors of the fingers and pulley (Fig. 12) [10]: resisted flexion, the image shows pathological detachment from the bone. Extensors of the fingers and sagittal band: the extensors are laterally dislocated from the metacarpal heads during flexion [16]. Extensors of the feet and extensor retinaculum: pathological detachment between the extensors and the bone during resisted dorsiflexion.

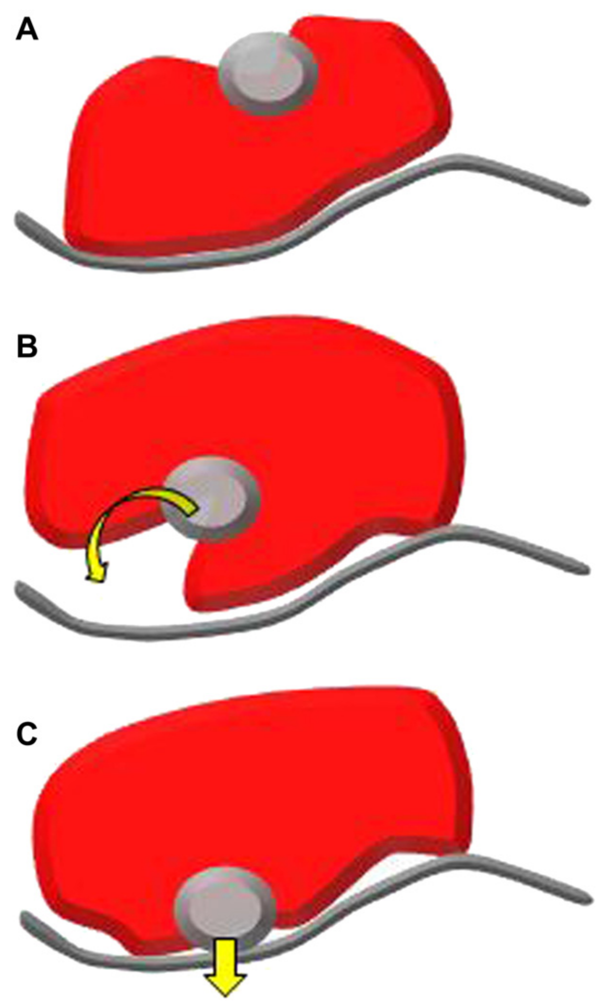

Figure 10 Snapping mechanism of the iliopsoas muscle with the muscle interposed between the tendon and the anterior cortex of the pelvis during flexion, abduction and external rotation of the hip (A). During return to extension, the tendon snaps against the bone while regaining its original position (B, C).

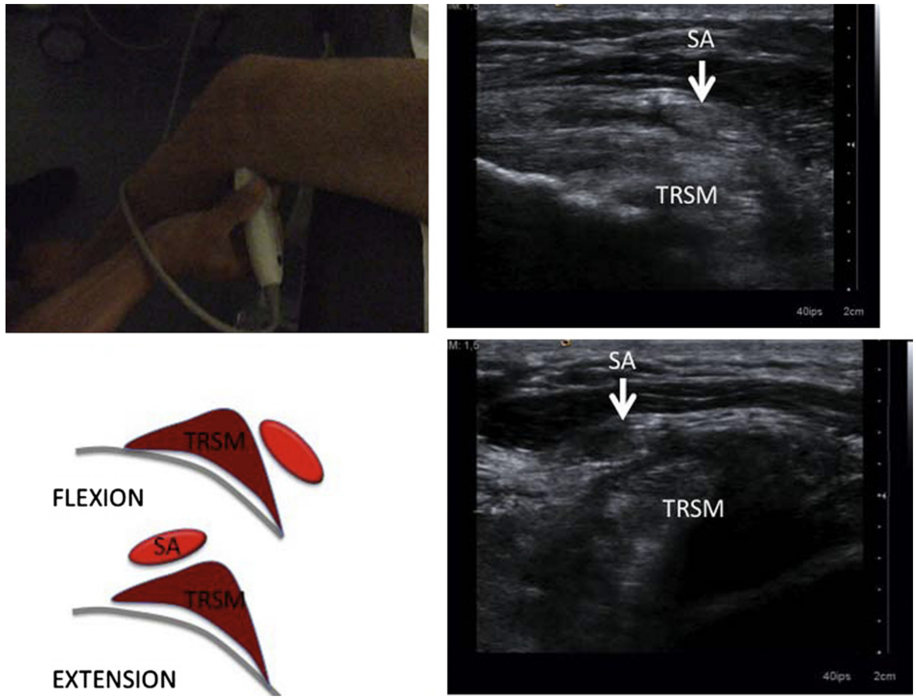

Figure 11 Snapping of the knee. During flexion, the sartorius (SA) is behind the semimembranosus tendon reflex (TRSM) passing anterior to it during extension. This movement may be sudden and cause snapping particularly in the presence of semimembranosus tendinopathy.

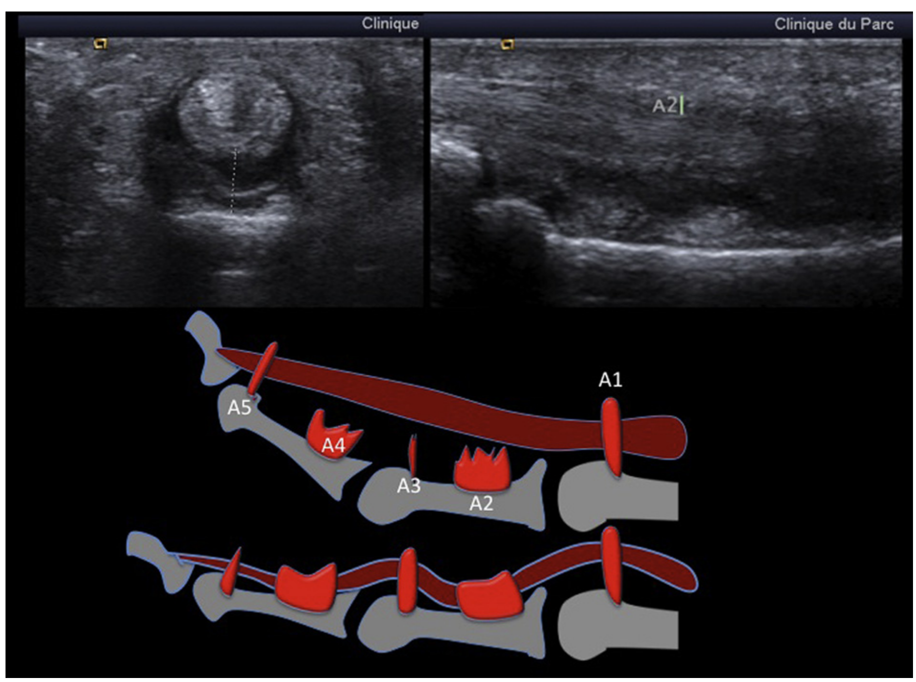

Figure 12 Rupture of the flexor pulleys, identified by resisted flexion, causing a pathological detachment of the phalanx flexor tendons from the bone.

Conclusions

The described disorders are common and US diagnosis is essential. The technique is very demanding because it requires knowledge of US appearance and the required dynamic maneuvers. Video recordings are crucial for understanding the disorders in order to provide the clinicians with correct clinical information.

Conflict of interest

The authors have no conflict of interest to declare.

Appendix. Supplementary data

Supplementary data related to this article can be found online at doi:10.1016/j.jus.2012.01.002.

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