Ultrasound examination of the ankle: most prevalent disease in our environment

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Learning objectives

Exposing the musculo-skeletal pathology that located in the ankle region may be detected using ultrasound, with examples relating to group more prevalent in our environment.

Background

The ankle is, between the large joints of the body, which is most commonly injured. Although plain radiography remains crucial to assess and diagnose many of their diseases, ultrasound is increasingly important for the evaluation of abnormalities of the tendons, joints, ligaments, nerves and other soft tissue structures.

Ultrasound examination should focus on the clinical and be guided by her, to save time and increase efficiency, because are many explorable structures in the ankle joint.

Imaging findings OR Procedure details

MAIN INDICATIONS OF OF THE ANKLE ULTRASONOGRAPHIC STUDY

1. Tendon pathology of the different compartments of the ankle
2. Valuation of ligament injuries.
3. Bone and joint disorders (synovitis, chondral and osteochondral lesions, occult fractures)
4. Retroaquilles and preaquilles bursitis.
5. Characterization of tumors (accessory muscles, ganglia, neurogenic tumours, soft tissue abscesses, etc.)

1. ABNORMALITIES OF TENDONS

Tendon injuries include tenosynovitis, tendinosis, rupture and instability.

In the complete tear ultrasound can identify a palpable nodule, corresponding to the proximal end of the divided tendon, and also a defect hypoechoic tendon discontinuity
(Fig. 1 on page 10). In most cases, the distal tendon does not display properly. Also displayed is a spill in the tendon sheath.

When there is any type of tendinopathy, the tendon appears swollen and hypoechoic (Fig. 2 on page 10).

It is also possible to confirm the clinical diagnosis by ultrasound of tenosynovitis, tendon sheaths appreciating on the presence of liquid. In these cases the ultrasonography provides dynamic assessment and a direct correlation to the site of pain (Fig. 3 on page 10).

**ANTERIOR COMPARTMENT**

The tendons of the anterior ankle, compared with the rest of the ankle tendons are rarely affected by disease. The anterior tibial tendon is the most prone to abnormalities, and its place between the the most frequent rupture is extensor retinaculum and insertion into the first cuneiform and the base of the first metatarsal. Sometimes the retracted tendon stump causes a nodule on the anteromedial aspect of the distal portion of the leg, making clinically confused with a tumour or cyst.

**LATERAL COMPARTMENT**

**TENOSYNOVITIS OF THE PERONEAL TENDONS**

The main sign of ultrasound is the presence of liquid inside the common synovial sheath, whereas usually tendinous morphology is preserved (Fig. 4 on page 11). We must differentiate tenosynovitis of a spill within the common peroneal sheath secondary to a tear of calcaneofibular ligament (PCL).

**INSTABILITY OF THE PERONEAL TENDONS**

Subluxation or dislocation of these tendons in his 4 degrees invariably happens by the superior peroneal retinaculum rupture. The ultrasound diagnosis is the detection of the tendons in a lateral plane relative to the distal portion of the lateral malleolus, instead of behind it. The dynamic exploration foot dorsiflexion as both eversion may help identify cases of intermittent subluxation. In long-standing disease can be observed fusiform thickening of the peroneal tendons at the tip of the malleolus.

**TENDON RUPTURES**
The complete tears of the peroneus brevis tendon (PC) and peroneus longus (PL) are rare, occurring in the area of the lateral malleolus or midfoot. Seen in patients with ankle sprains or history of chronic instability, especially if they suffer widespread diseases (RA, DM,) or treated with corticosteroids. The peroneal tendon ruptures causing the inability to eversion of the foot and cavus foot varus.

SHORT PERONEAL TENDON FISSURE

These are the most common presenting a typical longitudinal configuration, known as fissure or fissuration. Happens secondarily to recurrent lesions supinated foot inversion and are difficult to diagnose clinically. Typically have from 2.5 to 5 cm long distributed proximal to distal and lateral malleolus (Fig. 5 on page 11). Ultrasonography shaped notes "horseshoe" or "boomerang" partially enveloping the peroneus longus, which is subluxated in the fissural groove so that in the transverse plane, being bisected the PC tendons are 3 instead of 2 sides being the central tendon intact tendon PL. The presence of effusion facilitates visualization of this fissure, as the dynamic exploration during the maximum dorsal and plantar flexion of the ankle. The tendon can be seen even markedly swollen and oedematous area distant to tear.

Whenever spill is identified in the sheath of the peroneal or appreciates a decreased thickness of the PC, this diagnosis should be considered and should be sought in the second half of the tendon.

We must not confuse a muscle or fourth accessory peroneal tendon (image also shows three lateral tendons) with a longitudinal fissure PC, for which we must seek common peroneal insertion fourth retrotroclear eminence of the calcaneus.

MEDIAL COMPARTMENT

ANOMALIES POSTERIOR TIBIAL TENDON (TP)

It is the most frequently injured in this compartment, with ruptures in asymptomatic middle-aged obese women as a result of widespread disease (RA, seronegative spondyloarthropathy) or associated with bone fractures. It causes a gradual collapse of the medial longitudinal arch with hindfoot valgus deformity and excessive forefoot pronation.

The presence of small vessels in inflammatory diseases intratendinosos can simulate a fissuration tendon, confusion can be ignored using colour Doppler. Another possible
diagnostic difficulty is when the undamaged tendon flexor digitorum longus (FLD) moves back and simulates the TP unbroken, but it is smaller and in this case we only see in the groove retromalleolar 1 only tendon.

Ultrasound has also proven to be an effective resource for identifying alterations associated tendon tenosynovitis serosa and hypertrophic (Fig. 6 on page 12 and Fig. 7 on page 12).

Subluxation and dislocation anteriorly and medial TP relative to internal malleolus is rare and valued sonographically placing the foot in dorsiflexion with forced supination.

ACCESSORY NAVICULAR BONE

In the distal insertion site may exist TP 2 types of bones accessories:

*Accessory navicular bone type I* (os tibiale externum): size between the 2 and 6 mm, can be contained within the TP and being positioned immediately proximal posteromedial to the navicular bone. It generally produces symptoms and should not be confused with a tendon calcification or avulsion fracture (Fig. 8 on page 13).

*Type II accessory navicular bone*: is an accessory ossification centre of the navicular bone with size between 9 and 12 mm triangular shaped and articulated through a synchondrosis of the posterior and medial navicular bone. Its insertion site of some fibres of TP and is associated with a syndrome of pain and increased incidence of tendon rupture caused by abnormal overloads. Osteoarthritic changes may underlie this synchondrosis which mimic tendon pathology.

**POSTERIOR COMPARTMENT**

ACHILLES TENDINOPATHY

Can be classified as tendinosis and paratendinitis. The isolated paratendinitis shows intratendinous normal structure, exist paratendinoso spill, shown irregularities in the edges of the tendon, adhesions and scarring associated paratendon and a heterogeneous aspect preaquelea fat pad. (Fig. 9 on page 13)

In the *tendinosis* there is in swelling of the tendon, usually bilateral, and textural heterogeneity intratendinous focal hypoechoic areas (Fig. 10 on page 14).
The Achilles tendon is the most affected in metabolic diseases.

The calcaneal entesofitos are most common bone abnormalities in the Achilles tendon insertion, common in runners, often painful (Fig. 11 on page 15). In the ultrasound examination shows a prominent spur and hyperechogenic contour deformity of the back of the calcaneum being also possible to see in the insertion of the tendon in the bone linear low intensity echoes associated with calcified deposits (Fig. 12 on page 16).

TEAR OF ACHILLES

The rupture site is located generally between the 2 and 6 cm from the insertion into the calcaneus, in the called critical zone of relative hypovascularity.

In ultrasound, complete rupture of the Achilles tendon is seen as a focal defect between the broken ends of the tendon. In the acute phase ends are contiguous, but the defect may be filled by the anechoic or hypoechoic hematoma (Fig. 1 on page 10). In most cases paratenon remains intact as a envelope straight echogenic contouring breakage. As a sign associated can exist distortion of the fibrillar configuration and loss of parallelism of the tendon fibers. Other signs are indicative fat herniation into the defect (Fig. 13 on page 16), better visualization of the plantar tendon and the existence of a posterior acoustic shadowing at the site of the tear (useful sign to differentiate partial thickness tears) (Fig. 1 on page 10).

When there is no retraction and the torn tendon ends are corrugated, or when the space created is filled with fluid, is useful passive mobilization tendon stretching which facilitates their separation.

Triceps surae atrophy, initially of soleus, is observed in chronic complete tears.

Differentiation between tendinosis or partial thickness tears is not always possible (Fig. 14 on page 17), which can be somewhat indifferent because the initial treatment is conservative for both anomalies. The partial thickness tear is more likely when the anteroposterior diameter of the tendon is very large (10 to 15 mm) and echotexture intratendinous abnormal, when a defect is visible interstitial hypoechoic, longitudinal and parallel to the fibers or obvious discontinuity exists in a portion of the tendon remaining normal. associated signs are Irregularity located on its surface or contour concavity of fat filled.

PLANTARIS MUSCLE TENDON
In full thickness tears the plantaris muscle tendon often remains unbroken moving in a posterior direction toward the defect created, which can lead to a false diagnosis of partial tear (Fig. 15 on page 18).

2. LIGAMENT INJURIES

The ligament partial tear ligament shows a hypoechoic areas swollen with internal focal or diffuse (Fig. 16 on page 19). In the complete ruptures within the substance of the divided ligament rift is observed corresponding to the hematoma hypoechoic, and the free ends of the divided ligament can be and retracted appreciated corrugated, in contrast with normal appearance straight (Fig. 17 on page 19).

Grade I: Mild stretching of the ligament, without breakage or instability
Grade II: Partial tearing of the ligament
Grade III: Complete tearing.

Degrees depending on the severity of the injury and the place of employment.

LATERAL COMPARTMENT

These injuries occur secondary to inversion sprains, with internal rotation of the foot combined with ankle plantar flexion.
The anterior talar fibular ligament tears (LPAA) usually occur as isolated involvement (70%) or associated with calcaneal fibular ligament (PCL) (20-40%), but the posterior talar fibular ligament (LPAP) affects only major trauma involving ankle dislocation.

LPAA breaks (Fig. 18 on page 20) is associated with breakage of the joint capsule and synovial fluid extravasation into the anterolateral soft ankle, whereas the complete tearing of LPC can communicate the ankle joint and synovial sheath peroneal tendons. Rupture of LPC (Fig. 19 on page 20) is rarely associated with superior peroneal retinaculum tear.
The LPC is tensioned during dorsiflexion pulling on peroneal tendons laterally, so that absence of its displacement is sign of a complete tear.
Within a damaged ligament can also observe calcifications that often correspond to fragments of avulsion bone. (Fig. 20 on page 21).
During the ultrasound can be performed forced maneuvers to detect to joint laxity and ligament injuries. The anterior drawer test is performed with the feet hanging over the edge of the examination table while the forefoot is pulled anteriorly when the foot is in plantar flexion and inversion. This maneuver helps differentiate partial tears (grade II) of the LPAA to complete (grade III), where the anterior displacement of the talus on the tibia open a crack in the substance becoming more visible the ligament injury.
The sindesmosys sprains are up to 10% of ankle injuries, happening in eversion and pronation movements (like the deltoid ligament injury) and primarily affect the anterior tibiofibular ligament (LTPA) (Fig. 21 on page 22), the failure is frequently associated with fracture of the fibula. According to the place of employment are 4 degrees, useful for prognostic evaluation and therapeutic strategy choice.

**Grade I**: stretch or partial tear of the LTPA  
**Grade II**: complete tearing but only the LTPA  
**Grade III**: complete tear of the LTPA and partial LPC  
**Grade IV**: complete tear of the LTPA and LPC.

The grade I and II injuries usually scarred without any significant instability, whereas grade III and IV injuries can cause chronic pain and require surgical treatment.

**MEDIAL COMPARTMENT**

Because of the low incidence of eversion ankle sprains and the thickness of the deltoid ligament is rarely injured in isolation and when the injury does not usually full thickness. Usually accompanied by lesions of the medial malleolus and lateral displacement of the talus, with consequent widening of the ankle mortise. Ultrasound is useful for differentiating ligament injury of the posterior tibial tendon injury (TP) adjacent, they have similar symptoms (Fig. 3 on page 10). The inability to visualize the deltoid ligament may indicate tear, but this is not considered a reliable sign as its full ultrasound is not always possible.

**3. JOINT AND BONE DISORDERS**

Ultrasound reliably detect spills mild (> 2 ml) inside of the ankle joint, by exploring the front and rear recess (Fig. 22 on page 22) as well as areas of synovial proliferation, and may even display using the colour Doppler hyperemic areas, in arthritis patients (Fig. 23 on page 22).

The intraarticular joints are displayed surrounded fluid in one of the recesses of the ankle or subtalar joint. Sonographically diagnosed when changing position to perform flexion and extension.
Fracture of the lateral process of the talus is overlooked up to 50% of cases with plain radiography. Ultrasound may suspect the presence of focal cortical disruption, helping further to exclude concomitant ligament injury (Fig. 24 on page 23).

4. PREAQUILLES AND RETROAQUILLES BURSITIS

Although bursitis can occur in isolation, often are related and systemic inflammatory diseases.

In the ultrasound examination the distended retrocalcaneal and preaquilles appears are a hypoechoic structure shaped coma, interposed between the Achilles tendon and the posterosuperior aspect of the calcaneus (Fig. 25 on page 24). Care must be taken not to confuse it with the fatty space Kager containing oval lobules of hyperechoic fat. When bursitis is a manifestation of synovitis is appreciated hypervascular area with Doppler ultrasound (Fig. 26 on page 25).

In the retroaquilles bursitis exists thickening and collection of fluid in the subcutaneous tissue superficial to the tendon retrocalcaneal portion.

5. TUMOURS

Ultrasound can differentiate between a mass complex and solid and a cystic, in addition to verifying the existence of accessory muscles (peroneus fourth, accessory flexor digitorum longus and accessory soleus). As in any other location can be found neoformative soft tissue tumors, inflammatory, infectious, etc. (Fig. 27 on page 26).

Ganglions of this location are more often symptomatic and larger with multiple partitions branched and lobed edges (Fig. 28 on page 27). Differential diagnosis must be made with tenosynovitis, abscesses, seromas and varicosities.

Neurogenic tumours are described as pathognomonic homogeneous hypoechoic oval mass in continuity with a nerve of origin (Fig. 29 on page 28).

6. LOCATING FOREIGN BODIES

As in any other location, the ankle area is also subsidiary host foreign whose classification, location and existence can be defined perfectly by ultrasound. Being a focused study to the area of interest and with great resolution for surface structures, can be considered more resolute examination to screen these cases (Fig. 29 on page 28).
Images for this section:

Fig. 1: Complete rupture of the Achilles tendon with focal defect between the ends of the tendon and posterior acoustic shadowing at the site of the tear, useful sign to differentiate partial thickness tears.

Fig. 2: Important thickening and decreased echogenicity left posterior tibial tendon referenced to the contralateral in its path premaleolar, in relation to severe tendinosis.
Fig. 3: Moderate amount of fluid in the sheath of tibialis posterior related to tenosynovitis, patients with subacute pain derived for suspected involvement of the deltoid ligament.

Fig. 4: Important thickening of both peroneal tendons (longus and brevis) associated with moderate amount of fluid and thickening of the synovial sheath.
**Fig. 5:** Discreet amount of fluid in the common sheath of the peroneal tendons associated with disorganization and a heterogeneous appearance peroneus brevis tendon related to longitudinal rupture.

**Fig. 6:** Thickening, moderate amount of fluid surrounding, calcifications and hyperemia affecting the sheath and the posterior tibial tendon related to chronic tenosynovitis in patient affects rheumatoid arthritis.
Fig. 7: Thickening, moderate amount of surrounding fluid, and calcifications (arrow) affecting the posterior tibial tendon related to chronic tenosynovitis in patient affects rheumatoid arthritis.

Fig. 8: Accessory navicular bone within the posterior tibial tendon, as anatomical variant.
**Fig. 9:** In the isolated paratendinitis intratendinous structure is normal, existing paratenon spill, irregularities the edges of the tendon and adhesions associated with the scarring of paratenon.
Fig. 10: Patient with psoriasis which identifies tendinosis and Achilles tendon swelling bilateral and textural heterogeneity with intratendinous focal hypoechoic areas.
Fig. 11: Ultrasound and radiological correlation calcified Achilles enthesitis. Calcaneal spur as associated finding.

Fig. 12: Discreetly thickened right Achilles tendon at its insertion, combining linear hyperechoic and hypoechoic areas on small breaks intrasubstance and calcifications of the enthesis.
Fig. 13: Fat herniation into the defect by complete tear of the Achilles tendon.
Fig. 14: Differentiation between tendinosis and partial tear is not always possible, possible technical assistance is the color doppler.
**Fig. 15:** Complete tear of the Achilles tendon with retraction of ends and integrity thin plantaris tendon

**Fig. 16:** Thickening but continued LTPA right in relation to partial rupture
**Fig. 17:** Grade III sprain of right LTPA.

**Fig. 18:** Complete rupture of right LTPA.
Fig. 19: Thickening and hypoechoic right LPC (top left) compared to the contralateral (top right) for partial rupture, and there is a picture of 4 mm hyperechoic area coincident with cortical disruption at its calcaneal insertion for bone avulsion associated.
**Fig. 20:** Bony avulsion with radiographic evidence as visible calcification in a grade III sprain LTPA.

![Image](image1.png)

**Fig. 21:** Comparative view of LTPA, showing poor definition and presence of calcifications in the region of the right in relation to LTPA grade III sprain.

![Image](image2.png)

**Fig. 22:** Fluid in the anterior tibiotalar recess in patient affects of rheumatoid arthritis.
Fig. 23: Synovial proliferation with mild hyperemia tibiotarsianas located in both joints in patients with suspected inflammatory arthritis.
Fig. 24: Internal malleolus fracture sonographically visible in both the axial and coronal plane.
**Fig. 25:** Bursitis preaquílea with typical morphology, appreciating accumulation of fluid in a "coma" between the anterior portion of the Achilles tendon and the calcaneus.
Fig. 26: Bursitis preaquílea that associated synovitis, showing hyperemia with increased Doppler flow.
Fig. 27: Patient with bulotma in the inside of the ankle, which is appreciated ultrasound nodular formation of echogenicity-like fat which communicates via a narrow orifice herniary with the package muscular and modified by volume with pressure transducer. Corroborate these findings MRI demonstrating fat tumor with fascial herniation.
Fig. 28: Multiseptate cystic tumor on the lateral aspect of the right ankle, adjacent to the peroneal tendondes, in relation to ganglion.
**Fig. 29:** Patient with bultoma, neuropathic pain and foreign body sensation external supramalleolar region after subsection-contused wound one month ago. Identified sonographically hypoechoic fusiform thickening with internal ecorrefringentes images (foreign bodies) of the musculocutaneous nerve in relation to neuroma fusiform and hypoechoic scar tissue surrounding undefined.
Conclusion

Ultrasound is a diagnostic technique accessible and effective for the initial diagnosis of the pathology that settles at the ankle, in addition is totally resolutive in the most of the cases.

Can be combined in the same act with direct and dynamic exploration of the patient as well as the association of colour Doppler which substantially increases performance.

References


Personal Information