

Research Article

Ultrasonographic Assessment of the Foot Pseudotumoural Soft Tissue Lesions

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Abstract

Aim: To assess the usefulness of ultrasound in assessment and diagnosing foot pseudotumoural soft tissue lesions.

Material and Methods: We conducted a retrospective study of a 43 patients who presented to the Dallah hospital Riyadh, Saudi Arabia, Radiology department, with foot swelling+pain. All our cases have X-ray foot as well as, muscol-skeletal ultrasound, results of MRI study, and biopsy results of some cases were included.

Results: The mean age of the patients was 16 ± 35 years, Females to male's ratio was 4:1. The collected data of imaging US features, with exact lesion location, the relationship with surrounding structures and clinical features such as sex, age and symptoms in addition to X-ray, MRI findings as well as biopsy results if done allowing accurate diagnosis including; 9 cases (21%), Morton's neuroma, (16%), 7 cases synovial cysts, 9 cases ganglion cysts (21%), 3 cases post traumatic cyst (7%), 3 cases marked subcutaneous edema (7%), 2 cases gouty arthritis with tophi formation (5%), 2 cases bursitis (5%), while tenosynovitis seen in 8 cases (18%).

Conclusion: Musculo skeletal sonography is low in cost, easily available, highly efficient and can be used in the assessment of pseudo tumoural soft tissue lesions of the foot and ankle.

Keywords: Soft tissue; Pseudo tumours; Foot; Ultrasound; MRI; Musculoskeletal sonography

Introduction

In the United States, approximately 40% of adults experience foot problems [1]. The foot can be affected by a variety of congenital, inflammatory, infectious, degenerative, and neoplastic disorders [2]. Foot soft tissue lesions include benign and malignant neoplasms, as well as non-neoplastic or pseudotumoural lesions [3].

The pseudotumoural lesions of the foot comprise a diverse group with widely varying histopathology; the most common non-tumoral lesions are benign cysts, posttraumatic, reactive, and inflammatory lesions. These lesions include synovial cysts, ganglion cysts, tenosynovitis, epidermoid cysts, masses (abscess, necrosis and hematoma) that show cystic transformation, gout tophi, rheumatoid nodules, Morton's neuroma and granuloma annulare [3,4]. Aetio-pathogenesis of these lesions is varied, but in general degenerative, inflammatory and infectious phenomena may play a role [3].

Ganglion and synovial cysts are the most common soft tissue lesions in the ankle and foot region, most frequently located around the ankle or at the dorsum of the foot [5]. Morton's neuroma (fibroma) is a common cause of intermetatarsalgia, ultrasound examination is reliable in detecting Morton's fibroma [6]. MR imaging has been proven to be highly sensitive and specific in diagnosing Morton's fibroma, as well as providing an accurate preoperative assessment [7]. Tenosynovitis involves inflammation of the tendon sheath. The etiology includes acute and chronic trauma, infection or inflammatory or metabolic disease. Excessive fluid accumulation in the tendon sheath leads to a mass-like presentation [8]. Soft tissue lesions of the foot and ankle are a relatively rare cause of referral for medical imaging [3]. MR imaging is being recognized as the modality of choice for assessment of pathologic conditions of the ankle and foot, it demonstrates abnormalities in the bones and soft tissues before they become evident at other imaging modalities [9]. However, because of advances in technology, sonography offers significant advantages over other imaging techniques in assessing muscle trauma. High-frequency transducers yield images with excellent spatial resolution. The real-time capability allows dynamic evaluation of muscle and tendon injuries [4]. Diagnostic

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muscle-skeletal ultrasound (MSK US) is used to evaluate soft tissues (muscle, ligament, etc.) detect fluid collection, and can also be used to visualize other structures such as cartilage and bony surfaces [10]. MSUS is a safe (no ionizing radiation) portable, easily repeatable, and cheap form of imaging compared to other imaging modalities. Ultrasound is an excellent imaging modality to determine the nature of a mass lesion (cystic or solid) and its anatomic relation to adjoining structures [11]. Ultrasound also can be effectively used for guidance and localization during joint aspirations, injections, and biopsies [10].

The imaging features of pseudo tumoural soft tissue lesions of the foot and ankle themselves are often non-specific, but in combination with exact location, the relationship with surrounding structures and clinical features such as sex, age and symptoms, we can usually suggest a specific diagnosis [10]. The goal of our study is to evaluate MSK US imaging in diagnosis of foot pseudo tumoural lesions.

Materials and Methods

Musculo-skeletal ultrasound results of foot and ankles of 43 patients were collected, results of X-Ray foot and ankle, as well as MRI results and/or biopsy were also collected. All patients were referred to our radiology department, Dallah Hospital from April 2016 to January 2017 with complaints of foot/ ankle swelling. Human ethics committee approval for this study was obtained from the institutional review board of Dallah Hospital, Riyadh, Saudi Arabia. All patients were bilaterally examined by ultrasound using an ultrasound machine (HD II XE Ultrasound 2006, Philips medical system, Nederland B.V). A linear transducer (L12-5) was used for all the patients (B-Mode) as well as colour Doppler Mode also used in all cases. Dynamic MS US was done in some cases. Patient history were included, the exact location of pain, aggravated factors, the duration of symptoms, modes of treatment, and the degree of functional limitation.

Ultrasound scanning technique

Dorsal foot: The standard US examination of the foot begins with dorsal of the foot, keeping patient supine, with the knee flexed at about 90°. Transverse US imaging planes are the best to evaluate tendons as they course over the dorsum of the foot. US assessment includes extensor tendons, flexor tendons, as well as peroneal tendons, navicular bone, dorsal talo-navicular joint, and the cuneiforms. The extensor tendons can be imaged up to their distal insertion on the phalanges.

Sagittal US over the ankle joint allow detection of the dorsal aspect of talus, anterior joint recess,

Planter foot: It is performed with the patient supine and both legs on the bed or placed on a pillow for more comfortable position. Sagittal images obtained slightly medial to midline to image preinsertional portion of the planter fascia.

Statistical analysis

Data was evaluated by using statistical package for social sciences (SPSS) software version 10 for calculating percentages and frequencies.

Results

In our study, 43 patients were included, foot swelling was main complain, associated pain was seen in 38 patients (88%). The mean age of the patients was 16 ± 35 years, Females to males' ratio was 4:1. Associated complaints in included cases were pain in other regions of the leg such as the knee and thigh (21%), soft masses (14%), and leg swelling (2%).

The duration of symptoms until presentation was less than one month in 29 cases (67%) and more than 1 month in 14 cases (33%). Morton's neuroma seen in 9 cases (21%), all cases confirmed diagnosis with biopsy and MRI included for all 8 cases. All our 9 patients are middle age females in 2 of them the lesion was less than 5 mm diameter (Figure 1), while in 7 cases, the lesion is more than 5 mm (Figure 2) and all are complaining of web space pain radiating to the toe and the pain is worsen by wearing shoes and walking. 6 cases found in third inter metatarsal space while the other 2 cases found in 2 inter metatarsal space and only one case noted in 4th web space. In our study 7 cases (16%) diagnosed as synovial cysts (Figure 3), and 9 cases diagnosed as ganglion cysts (21%) (Figure 4), most of cases were simple cysts; however, 1 of 7 cases and 2 of 9 cysts were complicated and demonstrate partially or completely hyper echogenic content (Figure 5).

In our study 3 cases showing marked subcutaneous edema (7%) leading to foot swelling more marked at medial aspect (Figure 6). Sonography revealed 3 cases (7%) post traumatic cystic lesions (Figure 7), one of them less than 1 week duration and the other 2 cases more than one week duration. Sonography also revealed tenosynovitis (Figure 8) in 8 cases (18%), tibialis anterior tendon is the most affected tendon 5 cases, 2 cases showing tibialis posterior tenosynovitis. Peroneal tenosynovitis was seen in 1 patient.

Gouty arthritis was found in 2 cases (5%) with tophi formation, another 2 cases (5%) showing sonographic features of bursitis (Figure 9).

Discussion

The use of MR imaging is firmly established as a means of evaluating musculoskeletal abnormalities. Sonography is increasingly being used for evaluation of tendons, joints, and soft-tissue abnormalities [12].

Improved developments in digital ultrasound technology and the use of high-frequency broadband transducers make ultrasound imaging the first screening tool in investigating superficial tissue lesions [11].

Many articles [7-13] reported that ganglia are cystic lesions filled with gelatinous fluid usually located near, and in some cases communicating with, a joint or tendon sheath. On sonography, it appears as a well-defined completely anechoic or to hypo echoic with multiple internal septations. On MRI it appears as a hypointense lesion on T1-weighted imaging and hyper intense on T2- or proton density-weighted imaging with no enhancement.

In our study, on ultrasound examination, ganglion and synovial cysts appear as round to oval, mono loculated or multi loculated anechogenic lesions, with posterior acoustic enhancement. Few complicated cysts were found, it is complicated by chronic inflammation, infection or haemorrhage [5].

Morton's neuroma, or inter digital neuroma, is, despite its name, not a true neuroma but peri neural fibrosis and nerve degeneration due to repetitive compression and irritation of the inter digital nerve [6].

In our study, 6 of our 9 cases of Morton's fibromas are seen in third inter metatarsal space and 3 cases in 2nd space which is agree with literature that reported, it is most commonly found in the second and third inter metatarsal spaces [4] however, they also reported, it is less frequently in the first and fourth and more than one inter metatarsal space may be affected.

Although authors [14,15] reported that, Morton's fibroma with a transverse diameter smaller than 5 mm are often asymptomatic, while lesions with a transverse diameter of 5 mm or more are most likely symptomatic, all our 9 patients were symptomatic complaining of web pain exaggerated by wearing shoes and walking.

In our study, it appears on US as a well-defined hypo echoic mass in the plantar soft tissues at the level of the metatarsal heads. While On short-axis MR images, it appears as a tear-shaped, spindle-shaped or dumbbell shaped lesion in the region of the neurovascular bundle on the plantar side of the deep inter metatarsal ligament Sagittal images it is causing widening of the inter digital nerve. Some authors reported that Morton's fibromas display typical signal intensities on MR imaging sequences: iso intense to muscle on T1-WI and hypo intense relative to fat tissue on T2-WI and no typical enhancement pattern on (fat-suppressed) T1-WI after intravenous administration of gadolinium contrast medium, varying from low to moderate to marked enhancement [4-16]. Biopsy was done in all our 9 cases in our study after MRI confirm the diagnosis

In Tenosynovitis Ultrasound examination reveals an effusion in the tendon sheath, along with thickening of the synovial lining. Doppler signals in the synovium and the adjacent soft tissues may be increased [17]. MR imaging demonstrates a fluid collection in the tendon sheath with high SI on T2-WI and low SI on T1-WI [18].

Tibialis anterior tendon is the most affected tendon in our study followed by tibialis posterior tendon. Tophaceous gout is a pseudo tumoural process typically occurs at the meta tarsophalangeal or inter phalangeal joints. In extensive tophaceous gout can result in multiple soft tissue masses with destruction of multiple bones of the Foot [19,20]. In our 2 cases with gouty arthritis, a pseudo tumoural lesion was seen at the first meta-tarsophalangeal joints.

The bursa is a naturally occurring synovium-lined cavity containing a small amount of lubricating fluid, our 2 cases one was retro calcaneal bursitis and the other one was located immediately dorsal to the deep transverse metatarsal ligament at 2nd meta-tarsal head.

Finally, ultrasonography has many diagnostic advantages, it should be applied in the primary clinic, dynamically and in real time, as shown in our and other studies [21-23]. It has the capability of demonstrating physiological movement, and is simpler and more cost effective than MRI.

Conclusion

Ultrasound is practical and useful imaging modalities, which also have the advantage of being low in cost, easily available, and highly efficient in the assessment pseudo tumoural soft tissue lesions of the foot.

In conclusion, ultrasound is an efficient means of detecting and assessing foot disorders including pseudo tumoural soft tissue lesions of the foot.

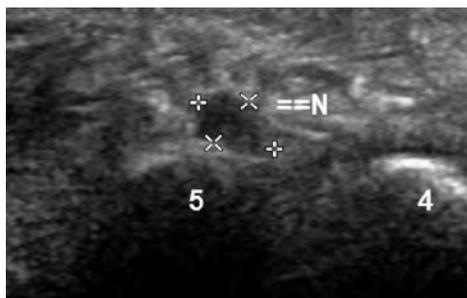


Figure 1: (Small Morton neuroma) Left foot MK US showing small non vascular hypoechoic solid mass lesion arising in 4th web space measures 3 x 5 mm.



Figure 2A: (Morton's neuroma) X-ray showing wide 3rd web space (star).

Figure 2B: (Morton's neuroma) Ultrasound of the foot showing a well-defined hypoechoic mass in the plantar soft tissues at the level of the metatarsal heads at the 3rd web space (curved arrow).

Figure 2C: (Morton's neuroma) T2-WI and fat-suppressed contrast-enhanced T1-WI.

Figure 2D: (Morton's neuroma) Showing a well-defined dumbbell shaped lesion at the third inter metatarsal space (arrows), located plantar to the deep transverse inter metatarsal ligament displaying intermediate signals on T2 weighted images. There is moderate homogenous contrast enhancement of the fibroma with mild surrounding subcutaneous edema.

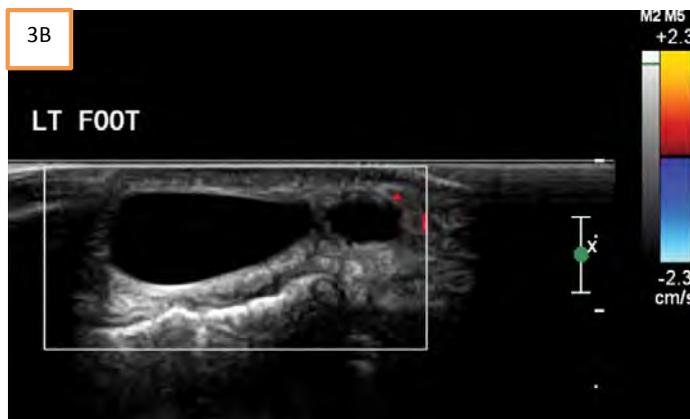


Figure 3A: (Synovial cyst) Long axis plan colour Doppler study.

Figure 3B: (Synovial cyst) Demonstrates a well-circumscribed, avascular, bilobular, mostly anechoic lesion with posterior acoustic enhancement, correlating with a cystic nature.

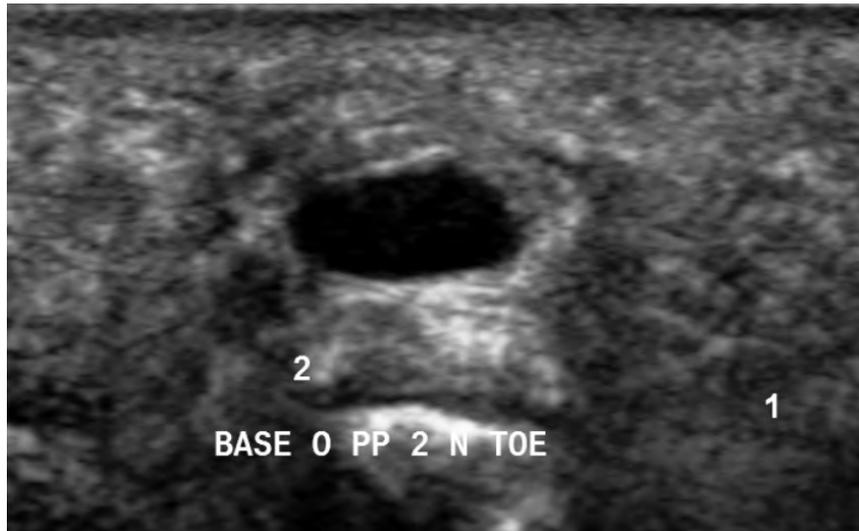


Figure 4: (Simple Ganglionic cyst) Ultrasound of the foot revealed a well-defined completely anechoic cystic lesion, with smooth regular outline, no internal septations.

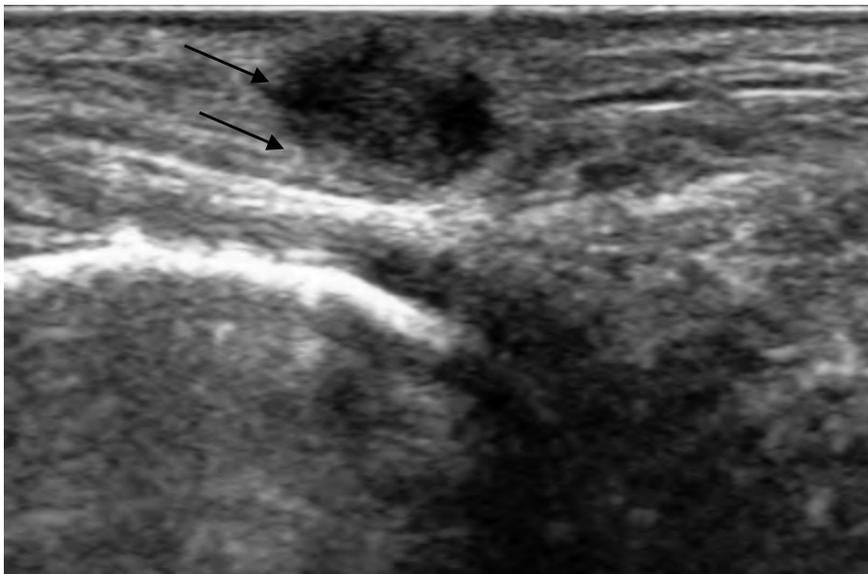


Figure 5: (Complicated ganglionic cyst) The ultrasound images demonstrate a hypoechoic lesion containing some scattered echogenic reflective material (arrows). The cyst is located superficial to the extensor tendon (tibialis anterior tendon) dorsal aspect of the foot.

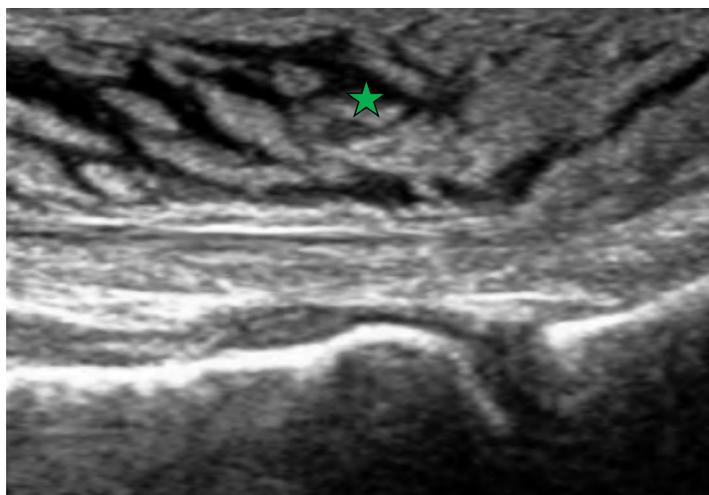


Figure 6: Marked subcutaneous edema ultrasound showing subcutaneous edema at the dorsal aspect of the foot (star).

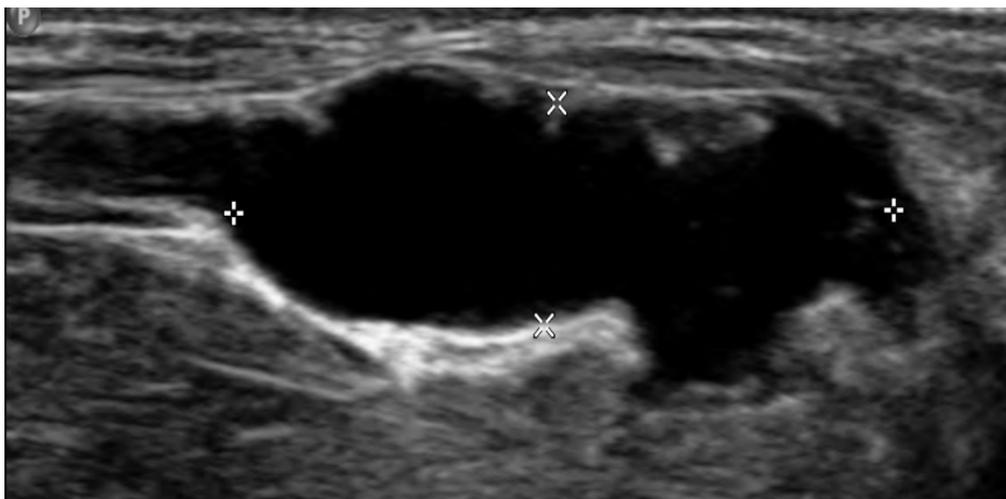


Figure 7: (Post traumatic cyst) Ultrasound revealed a well-defined elongated with irregular outline echo free cystic lesion at the planter aspect of the foot overlying the base of 2nd measures 24 x 7 mm in 60 years male with history of trauma.

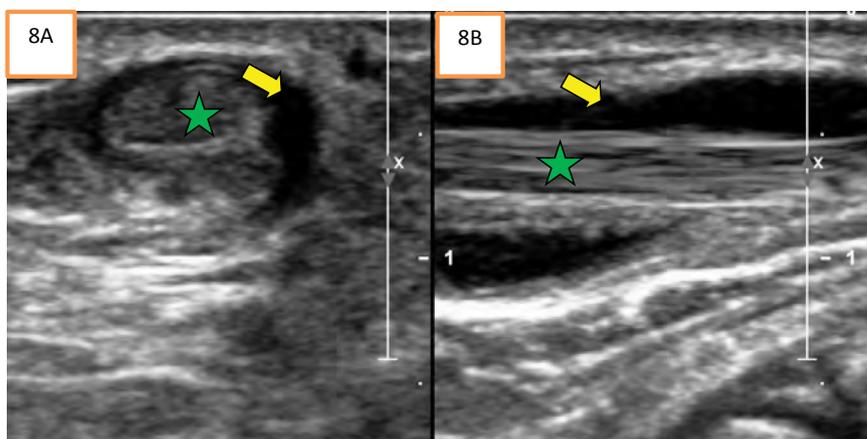


Figure 8: (Tenosynovitis) Ultrasound short axis A) and long axis plane. B) showing an effusion (arrow), in the sheath of peroneal tendon (star) at lateral aspect of the ankle.

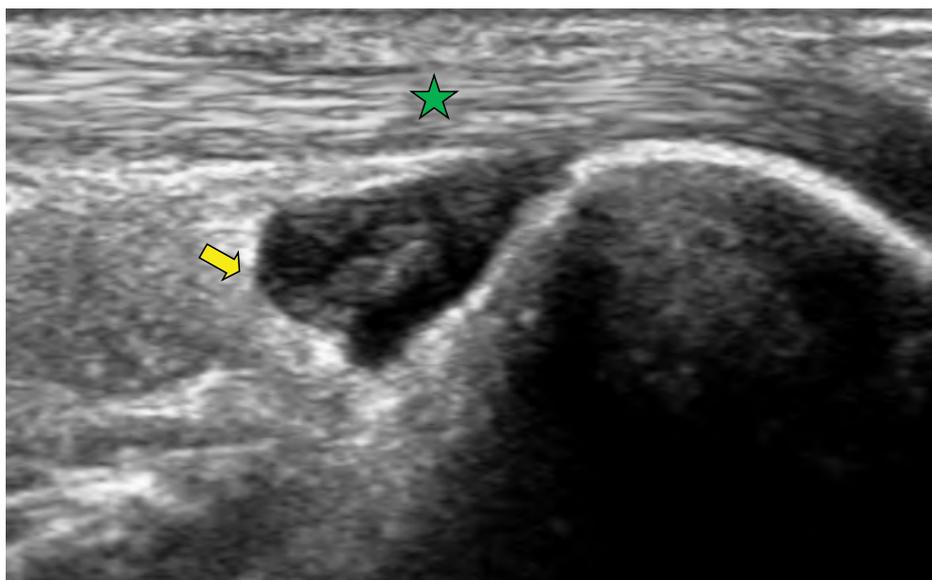


Figure 9: (Retrocalcaneal bursitis) Ultrasound showing enlarged retrocalcaneal bursa (arrow) with relatively turbid fluid. Intact the overlying Tendo-Achilles fibers (star).

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