Section: Radiology

Original Research Article

ROLE OF HIGH-RESOLUTION ULTRASONOGRAPHY IN EVALUATION OF TENDON PATHOLOGY

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ABSTRACT

Background: Sonography is a noninvasive, simple, almost universal, inexpensive, accurate, repeatable, specifc, and sensitive method for the early diagnosis of Achilles tendinopathies. Moreover, its broad application to the analysis of musculoskeletal illnesses has enabled its indications and limits to be firmly established. **Materials and Methods:** The patient was examined while lying prone with their feet dangling off the edge of the exam table, using a Samsung sonoace R7 USG equipment equipped with a linear transducer (LN5-12). Both transverse and longitudinal imaging of tendons and associated structures was common practise. Paratendinous features (subcutaneous tissue, paratenon, Kager's fat pad, retrocalcaneal and precalcaneal bursae, calcaneal cortical outline), as well as the size, echogenicity, echotexture, and presence of calcifications of the tendon, were evaluated. Maximum anteroposterior diameter (calibre) of the Achilles tendon was assessed at three points: the musculotendinous junction, immediately proximal to the calcaneal insertion, and in the middle of these two points. **Result:** The diameter in anterio-posterior direction was statistically significant. Forty (57.1%) of the 70 tendinopathic tendons had localised areas of hypoechoic signal, twenty (28%) had more diffuse hypoechogenicity to the point where a normal fibrillar pattern could not be identified, and six (8%), located in the midportion and two at the calcaneal insertions, had localised calcification (figure 5 and 6). In 30 cases (42.8%), there was vascularity inside the tendon itself. **Conclusion:** The Achilles tendon seems to respond well to high resolution ultrasound (HRUS), suggesting that this modality is a great way to learn about the tendon's internal architecture. The sonographic image is a perfect match with the clinical one. Our research shows that the most prominent sonographic features of Achilles tendinopathy are an enlarged mid and distal tendon, a disrupted fibrillar pattern, and an increase in tendon vascularity.

INTRODUCTION

The calcaneal tendon, more frequently referred to as the Achilles tendon, is the largest and strongest tendon in the human body. Due to its high biomechanical stress and limited vascularity, it is also one of the most often damaged tendons.[1] Fibers from the gastrocnemius and soleus muscles join to generate the tendon that inserts into the calcaneus's posterosuperior region (the calcaneal tendon). Overuse and persistent stress on the Achilles tendon often lead to the pathological alterations known collectively as "tendinopathy." It is not limited to sportsmen but may be seen in the general population as well. In addition to having a significant impact on professional athletes' ability to perform, Achilles tendinopathies may be so painful that they preclude non-athletes from engaging in even the most basic of daily activities.[2] In the clinical arena, ultrasonography and magnetic resonance imaging (MRI) of tendons have been used to aid in the diagnosis of tendinopathy, monitor the effectiveness of therapies, and evaluate the risk of developing symptoms.

Sonography is a noninvasive, simple, almost universal, inexpensive, accurate, repeatable, specifc, and sensitive method for the early diagnosis of Achilles tendinopathies.[3-4] Moreover, its broad application to the analysis of musculoskeletal illnesses has enabled its indications and limits to be firmly established.[5,6,7]

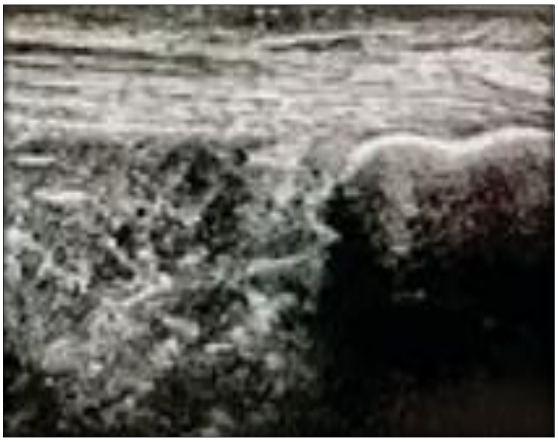
MATERIALS AND METHODS

The same radiologist who had previously assessed the patient's condition oversaw all of the sonographic evaluations. The patient was examined while lying prone with their feet dangling off the edge of the exam table, using a Samsung sonoace R7 USG equipment equipped with a linear transducer (LN5-12). Both transverse and longitudinal imaging of tendons and associated structures was common practise. Paratendinous features (subcutaneous tissue, paratenon, Kager's fat pad, retrocalcaneal and precalcaneal bursae, calcaneal cortical outline), as well as the size, echogenicity, echotexture, and presence of calcifications of the tendon, were evaluated. Maximum anteroposterior diameter (calibre) of the Achilles tendon was assessed at three points: the musculotendinous junction, immediately proximal to the calcaneal insertion, and in the middle of these two points. Two-tailed Student t-tests and nonparametric tests were used to compare the control group with the Achilles tendinopathy group. The SPSS software was used for the statistical analysis. P values and confidence intervals were computed, and results were deemed significant when the p value was less than 0.05.

RESULTS

Control participants' longitudinal sonograms of the Achilles tendon exhibited a uniformly fibrillate sonographic structure, with a thickness of 4-7 mm and more echoic, even boundaries. Without any intratendinous hyper-, hypo-, or anechoic regions or peritendinous effusion, the transverse slice reveals an oblong shape lying obliquely in postero-anterior and lateromedial directions. The triangle of Kager is often echoic (Figs. 1, 2). Tendinosis is shown on sonography by a larger fusiform hypoechoic region in the tendon's longitudinal section. The tendon's thickness ranges from 5 to 15 millimetres (with 10 millimetres being the norm), and its edges are often imperceptible. Degeneration or, in chronic forms, calcification and microcalcification cause the structure to be dishomogeneous, with hypoechoic and hyperechoic patches alternating with one another. The tendon's rounded appearance cross-sectionally is further evidence of its hypoechogenicity. It seems that Kager's triangle has a low echo. In cases of tendinopathy, tendon antero-posterior diameters were consistently bigger than those of healthy individuals (fig. 3and4). The diameter in anterio-posterior direction was statistically significant. Forty (57.1%) of the 70 tendinopathic tendons had localised areas of hypoechoic signal, twenty (28%) had more diffuse hypoechogenicity to the point where a normal fibrillar pattern could not be identified, and six (8%), located in the midportion and two at the calcaneal insertions, had localised calcification (figure 5 and 6). In 30 cases (42.8%), there was vascularity inside the tendon itself. Color Doppler imaging showed hyperemia in 6 of 24 (34% of all instances) tendons with increased Kager's fat pad echogenicity and paratenon thickness.

Thirty tendonitis cases (42.8%) were linked to fluid in the retrocalcaneal bursa (3 mm thick). Although tendinopathic tendons were more likely to have bursal distension than normal tendons, this difference did not reach statistical significance. The calcaneal insertion was smooth in ten (14%), irregular in twenty (28%), and contained calcaneal spurs in forty (58%).



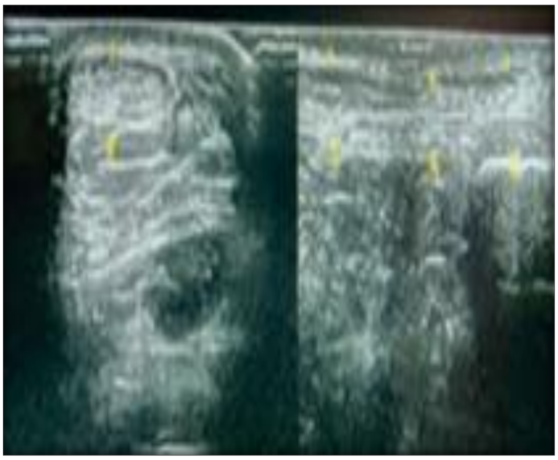
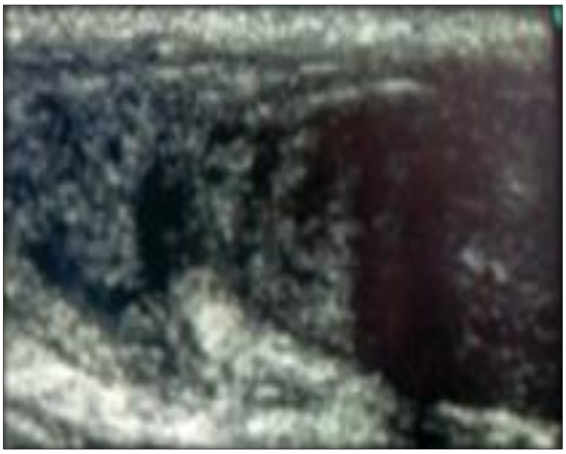


Figure 1,2: Longitudinal and Transverse ultrasound images of a normal Achilles tendon



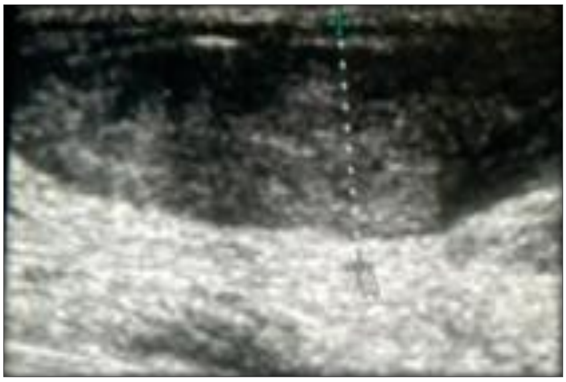


Figure 3,4: Transverse ultrasonographic image of an Achilles tendinopathy. The tendon is thickened, heterogeneous, and hypoechoic

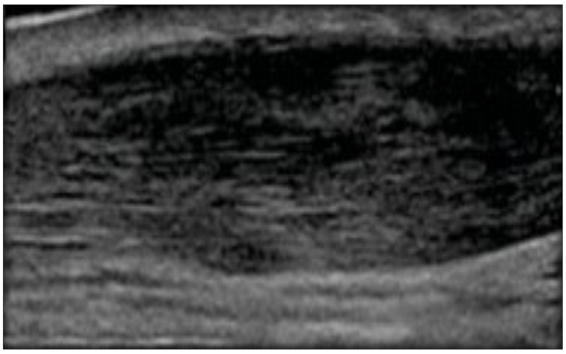


Figure 5: Longitudinal extended field of view ultrasonography image of Achilles tendinopathy demonstrating fusiform thickening of the Achilles tendon

Table 1: Various Measurements of Achilles tendon

Measurement of Achilles tendon	Cases	controls
myotendinious junction	11mm ±1.7mm	4.4mm±0.05mm
mid portion	11.5mm±1.5mm	4.1mm±0.04mm
at calcaneal insertion	10mm±1.7mm	4.0mm±0.03mm

DISCUSSION

As a fast, safe, and reliable method of establishing the size and localization of tendinous lesions, as well as assessing their severity, sonography is finding growing application in the study of illnesses of the musculoskeletal system, especially those affecting the tendons.[8] Technology advancements such as higher frequency transducers (7-15 MHz), smaller footprint probes,[9] power Doppler, increased field of view capabilities, 3D imaging, and tissue harmonics,[10] have contributed to this rising need. When compared to MRI, MSK US (Musculoskeltal Ultrasonography) provides a number of significant benefits, including being easily assessable, having a short scan time, and being more patient-friendly. Contralateral comparison is also made simple with MSK US.[11-18] Our findings corroborate those of prior studies indicating a reduction in antero-posterior diameter and an increase in radial width of the tendon in normal persons just before its insertion into the calcaneus.[19] Increase in tendon diameter, changed fibrillar echotexture, and increased tendon vascularity are all sonographic signs that may imply a diagnosis of tendinopathy in clinical practise today.[20,21] Midtendon and calcaneal insertion sizes of tendinopathic tendons were substantially larger compared to healthy subjects. Most instances of tendinopathy were characterised by focal or generalised thickening of the Achilles tendon. Similar to earlier studies,[13,24] the tendon thickness of individuals with a clinical diagnosis of tendinopathy varied from 7 mm to 16 mm. It has been shown that the typical human Achilles tendon has a fat to concave anterior surface and an AP (Anterio-posterior) diameter of 4 mm to 7 mm.[12,25,26] Comparatively, Zanetti et al,[21] showed tendon vascularity in 30/55 (54.5%) painful tendons, which is consistent with our findings. Calcification of a tendon is a somewhat unusual occurrence.[22,23] In 34% of instances with Achilles tendinopathy, paratenon thickening and enhanced echogenicity of the Kager's fat pad were seen, but in normal participants, none of these findings was present. Regularities in the calcaneus's shape and the presence of retrocalcaneal bursal fluid are frequent observations in Achilles tendinopathy. Sonography indicates early peritendinous abnormalities in the inflammatory stages of Achilles tendinopathies. A tendon's natural anatomical shape is lost in chronic forms with intratendinous degeneration, with the volume increasing and the tendon taking on a rounded spindle-like appearance, with the characteristic oval shape in transverse section being lost.

One of our study's flaws is that we didn't check for any correlations to surgery or pathology. Second, we did not include tendon ruptures in our analysis. Finally, since all exams were done by the same radiologist, interobserver reliability could not be determined.

CONCLUSION

The Achilles tendon seems to respond well to high resolution ultrasound (HRUS), suggesting that this modality is a great way to learn about the tendon's internal architecture. The sonographic image is a perfect match with the clinical one. Our research shows that the most prominent sonographic features of Achilles tendinopathy are an enlarged mid and distal tendon, a disrupted fibrillar pattern, and an increase in tendon vascularity.

REFERENCES

1. Schweitzer ME,Karasick D.MR imaging of disorders of the Achilles tendon.AJR J Roentgenol.2000;175(3):613-25,

ISSN (O): 2687-5365; ISSN (P): 2753-6556

2. Clement DB, Taunton JE, Smart GW (1984) Achilles tendinitis and peritendinitis: etiology and treatment. Am J Sport Med 12:179–184
3. Grassi W, Filippucci E, Farina A, Cervini C (2000) Sonographic imaging of tendons. Arthitis Rheum 43:969–976
4. Fornage B (1991) Sonography of limbs [French]. Vogot, Paris
5. Paavola M, Kannus P, Jarvinen T, Khan K, Josza L, Jarvinen M (2002) Achilles tendinopathy. J Bone Joint Surg Am 84:2062–2076
6. Azzoni R, Cabitza P (2002) Is there a role for sonography in the diagnosis of tears of the knee menisci? J Clin Ultrasound 8:472–476
7. Azzoni R, Cabitza P, Borromei R (2002) Sonographic evaluation of shoulder impingement: about 6496 cases [Italian]. G Ital Ortop Traum 28(2):57–62
8. Peers KH, Brys PPM, Lysens RJJ (2003) Correlation between power Doppler ultrasonography and clinical severity in Achilles tendinopathy. Int Orthop 27(3):180–183
9. Barberie JE, Wong AD, Cooperberg PL, et al. Extended eld-of-view sonography in musculoskeletal disorders. AJR Am J Roentgenol 1998;171(3):751 – 7.
10. Adler RS. Future and new developments in musculoskeletal ultrasound. Radiol Clin N Am 1999; 37:623 – 31.
11. Bertolotto M, Perrone R, Martinoli C, et al. High-resolution ultrasound anatomy of normal Achilles tendon. Br J Radiol 1995;68(813):986 – 91.
12. Fornage BD. Achilles tendon: US examination. Radiology 1986;159(3):759 – 64.
13. Fornage BD, Rifkin MD. .Ultrasound examination of tendons. Radiol Clin N Am 1988;26(1): 87 – 107.
14. Maffulli N, Regine R, Angelillo M, et al. Ultrasound diagnosis of Achilles tendon pathology in runners. Br J Sports Med 1987;21(4):158 – 62.
15. Mathieson JR, Connell DG, Cooperberg PL, et al. Sonography of the Achilles tendon and adjacent bursae. AJR Am J Roentgenol 1988; 151:127 – 31.
16. Rupp S, Tempelhof S, Fritsch E. Ultrasound of the Achilles tendon after surgical repair: morphology and function. Br J Radiol 1995; 68:454 – 8.
17. O'Reilly MA, Massouh H. Pictorial review: the sonographic diagnosis of pathology in the Achilles tendon. Clin Radiol 1993;48(3):202 – 6.
18. Maffulli N, Dymond NP, Capasso G. Ultrasonographic findings in subcutaneous rupture of Achilles tendon. J Sports Med Phys Fitness 1989; 29:365 – 81.
19. O'Reilly MA, Massouh H. Pictorial review: the sonographic diagnosis of pathology in the Achilles tendon. Clin Radiol 1993; 48:202.
20. Gibbon WW, Cooper JR, Radcliffe GS. Distribution of sonographically detected tendon abnormalities in patients with a clinical diagnosis of chronic achilles tendinosis. J Clin Ultrasound 2000; 28:61.
21. Zanetti M, Metzdorf A, Kundert HP, et al. Achilles tendons: clinical relevance of neovascularization diagnosed with power Doppler US. Radiology 2003; 227:556. 22.Blankstein A, Cohen I, Diamant L, et al. Achilles tendon pain and related pathologies: diagnosis by ultrasonography. Isr Med Assoc J 2001;3: 575. 28.
22. Yu JS, Witte D, Resnick D, et al. Ossification of the Achilles tendon: imaging abnormalities in 12 patients. Skeletal Radiol 1994; 23:127.
23. Gibbon WW, Cooper JR, Radcliffe GS. Sonographic incidence of tendon microtears in athletes with chronic Achilles tendinosis. Br J Sports Med 1999; 33:129 – 30]
24. Kainberger FM, Engel A, Barton P, et al. Injury of the Achilles tendon: diagnosis with sonography. AJR Am J Roentgenol 1990; 155:1031 – 6.
25. Civeira F, Castillo JJ, Calvo C, et al. Achilles tendon size by high resolution sonography in healthy population. Med Clin (Barc) 1998;111(2):41 – 4. [25] 27. Koivunen-Niemela T, Parkkola K. Anatomy of the Achilles tendon (tendo calcaneus) with respect to tendon thickness measurements. Surg Radiol Anat 1995; 17:263 – 8.