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R. Azzoni
P. Cabitza

Achilles tendon pathology: the role of ultrasonography

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R. Azzoni (✉)
Istituto Policlinico San Donato
San Donato Milanese (MI), Italy
E-mail: roberto.azzoni@unimi.it

P. Cabitza
Orthopaedics Clinic
Department of Medical-Surgical Sciences
Faculty of Medicine and Surgery
University of Milan, Italy

Abstract Today the Achilles tendinopathies can be diagnosed early by means of sonography, which is non invasive, easy to perform, pratically ubiquitous, economic, precise, repeatable, specific and sensitive. The purpose of this retrospective study was to verify the usefulness of sonography in the diagnosis of Achilles tendinopathies in 158 cases (105 patients). The sonograms revealed 67 cases of tendinosis with peritendinitis, 40 cases of peritendinitis and 30 cases of tendinosis; 21 Achilles tendons with achillodynia had normal sonograms. The results confirm that sonography is a rapid, safe and accurate means of verifying the extension and location of tendinous lesions, as well as the severity of intratendinous degeneration. During the acute phase of inflammatory Achilles tendinopathy, sonography reveals early peritendinous alterations; in chronic forms with intratendinous degeneration, it shows the loss of the normal anatomy of the tendon, which increases in volume, takes on a spindle-like and rounded appearance, and loses its normal oval shape in transversal sections. Sonography also consents to follow the evolution of tendinopathies during treatment, allowing the therapy to be modified in the absence of improvement and providing instrumental confirmation of treatment.

Key words Sonography • Achilles tendon • Tendinopathies

Introduction

Achilles tendinopathies are relatively frequent disorders, mainly observed in subjects dedicated to sporting activities such as athletics, tennis, basketball and volleyball, all of which require frequent sprints and sudden bursts [1]. Achilles tendinopathies are found not only in professional and semi-professional athletes who subject their tendons to excessive fatigue, but also in amateurs and occasional enthusiasts, particularly adults and the elderly who often lack adequate physical preparation. Achilles tendinopathies are painful and not only seriously impair the performance of professional athletes (in whom the incidence ranges from 6% to 14% [2]), but can also prevent amateurs from pursuing everyday activities.

The Achilles tendon is usually affected by tendinosis with peritendinitis, and only sometimes by isolated peritendinitis. The Achilles tendon is more rarely affected by pure peritendinitis of the acute, crepitating type.

The terminology used to describe Achilles tendinopathies is controversial [3, 4] because not all authors agree on the best way to describe the relationship between the clinical manifestations and the corresponding pathological anatomy picture. We used the 1981 classification of Perugia et al. [4], which considers the chronic adhesion forms of peritendinitis that are often associated with phenomena of metaplasia and degeneration. It also includes tendinopathies at insertion which, like the more often complete but sometimes partial tears that occur in about 30% of the cases affected by tendinosis, we did not consider in this study.

Particularly in cases of tendinosis, the initial phases of tendon disease are often asymptomatic and therefore underestimated by patients, who tend to seek orthopaedic surgical aid at a late stage. This explains the diagnoses of advanced disease and the finding of more severe clinical pictures in subjects who have experienced pain for some time and who, if they had been diagnosed earlier, could have been treated and rapidly cured of less severe conditions.

Achilles tendinopathies can today be diagnosed early by means of sonography, which is noninvasive, easy to perform, practically ubiquitous, economic, precise, repeatable, specific and sensitive [5, 6]. Furthermore, its widespread use in the study of diseases of the musculoskeletal apparatus has allowed its indications and limitations to be clearly established [3, 7, 8]. The aim of this sonographic study of 158 pathological Achilles tendons was to confirm the accuracy and preciseness of this technique and therefore the possibility of using it in order to make an early diagnosis.

Materials and methods

We retrospectively studied 158 echograms of the Achilles tendon of 105 consecutive patients with achillodynia seen between January 1998 and December 2002.

The study population consisted of 73 males (33 with bilateral disease) and 32 females (20 with bilateral disease) with a median age of 37 years (range, 14–67). Of the 32 patients practising active sport, four were professionals (two football players, one volleyball player and one tennis player) and 28 were amateurs or enthusiasts (14 tennis players, six footballers, two cyclists, two volleyball players, two basketball players, one golfer and one track athlete).

The time from the onset of painful symptoms ranged from 15 days to seven months (median, 25 days). Before our sonographic evaluation, all of the patients had previously undergone medical therapies, generally with non-steroidal anti-inflammatory drugs (NSAIDs) or instrumental physical therapies. Patients who had received local infiltrative corticoid or other local invasive therapies were excluded, as were those with Achilles tendon tears, achilleobursitis and tendinopathies at insertion.

The sonographic examination consisted of longitudinal and transversal scans comparing the two sides. We used an ATL HDI 5000 sonoCT (ATL Ultrasound, Bothell, WA, USA) in 99 cases and a Hitachi Eidos EUB-525 (Hitachi Denshi, Tokyo, Japan) in 59 cases; both instruments were equipped with linear probes of 7.5 and 10 MHz. The images were obtained using a Sony Video Graphic Printer UP-895CE (Sony, Tokyo, Japan). A 1 cm stand-off pad was always used.

The patients were examined in the prone position, with the talocrural joint at 90° and in maximum active flexion and extension; dynamic scans were also made. The scans were always made with the ultrasound waves perpendicular to the long axis of the tendon in order to avoid artefacts. Sonographic examinations were performed by the same orthopaedic surgeon (R.A.). We have studied in the same period considered in this study, also 50 subjects with normal clinical findings and normal echography of Achilles tendon, as control patients.

Results

The ecography of control patients showed: in the longitudinal section of a normal Achilles tendon [10, 11] a homogeneous fibrillate sonographic structure, with uniform dimensions (a thickness of 4–7 mm) and more echoic, even borders. The transversal section has an oval form lying obliquely in a postero-anterior and lateromedial directions, without any intratendinous hyper-, hypo- or anechoic areas, or peritendinous effusion. Kager's triangle is generally echoic (Figs. 1, 2).

The sonographic image of a tendon affected by tendinosis is characterised by a longitudinal section showing a larger fusiform hypoechoic area. The tendon can be as thick

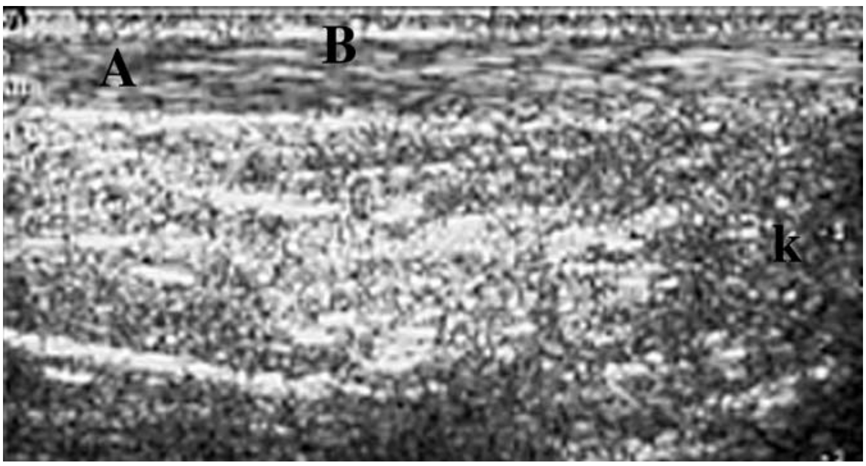

Fig. 1 Longitudinal echogram of a normal Achilles tendon in a 27-year-old woman not engaged in sporting activities. The tendon (*A*) is regular in shape and has a maximum thickness of 4 mm; its echogenicity is homogeneous, and clearly shows its fibrillate component. The peritenoneum (*B*) is echoic, homogeneous and clearly distinguishable from the tendon and peritendinous tissue. *k*, Kager's triangle

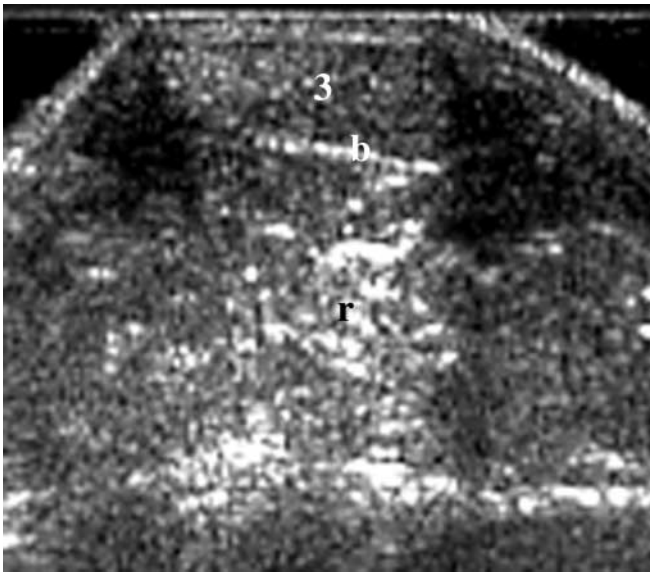

Fig. 2 Transverse echogram of a normal Achilles tendon (the same subject as in Fig. 1). Oval in shape, with a slightly oblique, longer axis in the medial-lateral direction, its punctate fibrillate structure (*3*) can be clearly seen. The peritenoneum (*b*) is echoic and clearly distinguishable from the tendon and peritendinous tissue; it is recognisable anteriorly and posteriorly, but not laterally for the absence of perpendicular echoes. Stronger signal can be seen anterior to the tendon (*r*) towards the bottom of the figure

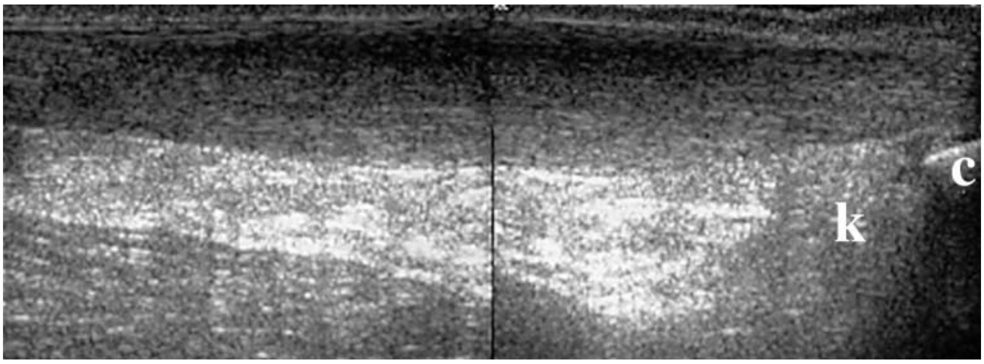

Fig. 3 Longitudinal scan of Achilles tendinosis (two juxtaposed images) in a 33-year-old woman who performs competitive running and who has suffered from post-effort achillodynia for three months. Mainly posterior hypoechoic tendon thickening for a length of 50 mm, with a maximum thickness of 12.5 mm. Heel (*c*) and Kager's triangle (*k*)

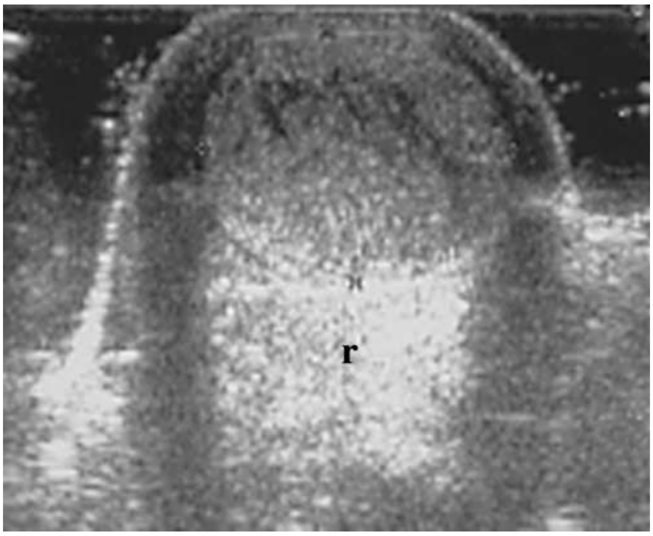

Fig. 4 Transverse scan of Achilles tendinosis in the same patients as in Fig. 3. The tendon is completely rounded and hypo-echoic, with posterior hyper-echoic reinforcement; the inner part of the tendon has same irregular hypo-echoic areas indicating degeneration, with a maximum size of 14.5x11.9 mm^2. *r*, tendon

as 15 mm (with an average of 10 mm), and its borders are often unrecognisable. The structure is dishomogeneous for of the presence of alternating hypo- and hyperechoic areas due to degeneration (mucoid, hyalin, fat) and necrosis (fibrinoid) or, in chronic forms, due to calcification and microcalcification. Transversally, the tendon looks rounded, thus confirming its hypoechogenicity. Kager's triangle appears hypo-echoic (Figs. 3, 4) [12].

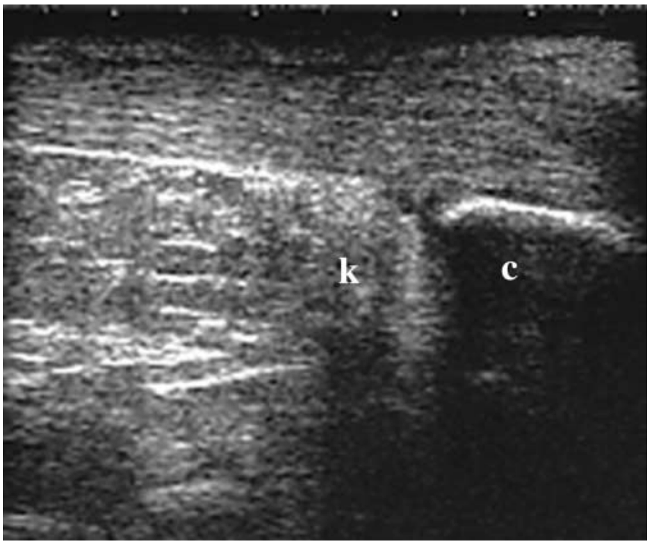

Fig. 5 Longitudinal scan of Achilles peritendinitis in a 28-year-old male amateur tennis player who had experienced achillodynia upon normal gait for 20 days. The distal third of the tendon is slightly thickened (7.8 mm instead of the normal 5.7 mm), homogeneous, with the posterior of the peritenoneum sonographically blurred. *k*, Karger's triangle; *c*, heel

Fig. 6 Transverse scan of Achilles peritendinitis in the same patient as in Fig. 5. The tendon preserves its oval shape, is sonographically homogeneous and measures 18.8x8.5 mm^2. The posterior blurring of the peritenoneum is confirmed. *r*, tendon

Peritendinitis presents sonographically as a non-omogeneous hypoechoic halo around the tendon; its localisation may be anterior or posterior or both (Figs. 5, 6) [11].

In pathological cases, sonographic exams showed: 67 cases of tendinosis with peritendinitis (25 bilateral), including 50 males (18 bilateral); 40 cases of peritendinitis (17 bilateral), including 27 males (10 bilateral); 30 cases of tendinosis (nine bilateral), including 23 males (five bilateral); and 21 normal echograms in subjects with achillodynia (eight bilateral), including seven males (three bilateral).

Of the 32 patients practising sporting activities, the four professionals all had tendinosis with peritendinitis. The distribution of the pathologies among the amateurs or occasional practitioners was as follows: 14 tennis players, six with tendinosis and peritendinitis, five with tendinosis, three with peritendinitis; six footballers, three with tendinosis and peritendinitis, three with peritendinitis; two cyclists with peritendinitis; two volleyball players with peritendinitis; two basketball players with peritendinitis; one golfer with tendinosis and peritendinitis; and one track athlete with peritendinitis.

The patients with tendinosis and peritendinitis had a median age of 45 years; those with tendinosis a median age of 56 years; and those with peritendinitis had an median age of 26 years. The patients with normal sonographic findings had a median age of 39 years.

In all cases, physical examination allowed a correct diagnosis of Achilles tendinopathy, which sonography confirmed in 137 cases and also made it possible to establish the involvement or otherwise of the peritendinous structures, and the presence and extent of intra-tendinous echo-structural alterations, thus allowing a more precise diagnosis also in prognostic and therapeutic terms. The 21 cases of achillodynia with normal sonographic findings were due to peritendinous inflammatory conditions in an early phase, before causing any sonographic detectable pathological-anatomic alterations; nobody practising active sports.

In relation to the precocity of diagnosis, the median time to the performance of the examination was 25 days (range, 15 days to 7 months), and so the patients came to our observation relatively soon after the onset of the first symptoms. The diagnosis was made earlier in the cases of peritendinitis (median, 31 days) and in younger patients (median age, 26 years), whereas the median time from the onset of achillodynia to the sonographic diagnosis of tendinosis with peritendinitis was three months.

Discussion

Sonography is being increasingly used to study diseases of the musculoskeletal apparatus, particularly those affecting the tendons, because it is a rapid, safe and accurate means of verifying the extent and localisation of tendinous lesions, and evaluating their severity [13]. The well known disadvantages of sonography include its operator dependence and the fact that it is less clear than magnetic resonance imaging [14], although it is certainly cheaper and faster to perform than the latter.

As previously stated in a paper [15], we believe that the problem of operator dependence can be reduced if all of the sonographic examinations of patients are performed by the same orthopaedic surgeon, who not only knows orthopaedic diseases in depth, but is also capable of performing a careful physical examination before the instrumental one. In this way, it is possible to obtain a sonographic evaluation supported by clinical and historic findings for the purposes of formulating a more correct and rapid diagnosis with the aim of initiating immediate treatment.

In the acute phases of inflammatory Achilles tendinopathies, sonography reveals early peritendinous alterations. In chronic forms with intratendinous degeneration, the tendon loses its normal anatomic shape: its volume increases, and it takes on a rounded spindle-like appearance, with the loss of the normal oval shape in transversal sections. The sonographic picture exactly corresponds to the clinical picture.

In chronic forms, sonography during dynamic testing reveals that the peritendinous adherences impeding the sliding of the tendon over surrounding tissue, causes poorly defined tendinous borders, increased tendinous volume, and the presence of a dishomogeneous echo-structure with hypoechoic intratendinous areas, calcifications and microcalcifications. A clinical evaluation is not capable of revealing the majority of these alterations, and it is above all in such cases that sonography provides further diagnostic and prognostic data.

It is therefore clear that sonography accurately reveals pathological-anatomical damage and therefore allows an equally precise diagnosis. This considerably aids the clinical diagnosis and consequent therapy, as well as the formulation of a more precise prognosis even though aetiology, pathogenesis and natural history of Achilles tendinopathies are still largely unknown [3].

In our cases series, the accuracy and the precision of sonography gave prominence to figures, that are in line with much of the published data [5, 16].

The data concerning the precocity of the diagnosis are probably due to the greater attention of the young towards musculoskeletal disturbances that may affect both their sporting and everyday performances, whereas older subjects more frequently underestimate the problem and, to a certain extent, are more resistant to pain and impaired physical efficiency. In any case, in the subjects examined sooner after symptoms onset, sonography led to more frequent diagnoses of peritendinitis than of tendinosis with tendinous degeneration, which was prevalently observed in those examined later after the onset of symptoms.

Sonography proved to be an indispensable clinical aid in diagnosing Achilles tendinopathies not only in terms of diagnostic confirmation, but also by allowing a correct differential diagnosis between pertendinitis and tendinosis, and an evaluation of the extent and severity of the disease. Sonography also permits precocius diagnosis, every patient affected by achillodynia should undergo an early sonographic examination. If this shows the absence of pathological-anatomical alterations, it should be repeated at periodic intervals in order to reveal any change in the echogenicity of the tendon as an index of worsening regardless of clinical findings. Finally, but not least in terms of importance, sonography also consent to follow the evolution of tendinopathies during treatment allowing the therapy to be modified in the absence of improvement and providing instrumental confirmation of cure.

The possibility of having the examination performed by an orthopaedic surgeon is a concept that is still resisted by themselves, who more readily leave instrumental sonographic diagnoses to radiologists. However, we believe that this is an opportunity that should be taken, because it provides an element of information and training for orthopaedic surgeons, who should not see themselves as only surgeons.

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