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Case Report

Achilles tendon rupture preceded by normal asymptomatic imaging in a collegiate gymnast: A case report ☆☆☆

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ABSTRACT

Female gymnasts are the athletes that are most likely to experience Achilles tendon rupture, due to the high energy and eccentric load placed on their Achilles tendon related to their sport. It is postulated that degenerative changes, watershed vascular supply, calcifications, and high amounts of inflammatory cells may play a role. This case report highlights an athlete with an asymptomatic Achilles tendon that was visualized to be normal utilizing ultrasound. She was found to have no evidence of underlying tendon pathology. The athlete then ruptured her Achilles tendon 8 months later during a gymnastic meet with no preceding symptoms. This case report challenges the accepted theory that preexisting tendinosis or pathology precedes Achilles tendon rupture. In this case, it is postulated that tendon rupture may be secondary to significant mechanical force even without underlying pathology.

Level of evidence: Level 4.

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Introduction

The Achilles tendon is a multifunctional tendon that participates in ankle plantarflexion and inversion of the hind-foot; it is the most-commonly ruptured tendon in the hu-

man body, although it is considered the strongest and the largest. Patients with Achilles tendon ruptures will report a feeling of a sudden blow with swelling at the posterior ankle, with an audible pop or snap, inability to bear weight and weakness with the push-off aspect of their gait. The mechanism of injury is typically sudden dorsiflexion, a single high-

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load impact or an acceleration-deceleration mechanism, like running [1].

Achilles tendon rupture (ATR) incidence has risen in the last decades. Studies suggest that between 60% and 75% of Achilles tendon ruptures are associated with participation in sports. The incidence is much lower than in women compared to men overall, with the incidence being 5:1 [2]. Gymnastics places significant eccentric load on the AT because of jumping and landing required by the sport, with female gymnasts are more likely to experience ATR compared to other athletes. Repetitive overuse, increased tension on the tendon, difficult floor routines and a lack of footwear are thought to play a role in the higher rates of ATR noted in female gymnasts [3]. It is postulated that there are histological changes that may have contributed to their injury, such as degenerative changes, watershed vascular supply, calcifications, and high amounts of inflammatory cells [4].

To the authors' knowledge, no prior reports have demonstrated asymptomatic tendon structure on ultrasound in a young athlete prior to rupture. Prior studies have performed ultrasonographic imaging of the AT in gymnasts, noting increased size and neovascularization of the AT in female gymnasts, with a poor correlation between abnormalities and symptomatology [5]; thus, it remains unclear if pathology precedes rupture. This case report outlines a collegiate female gymnast who previously had asymptomatic imaging of her Achilles tendon as part of a research study, who went on to rupture her Achilles tendon.

Case presentation

A 20-year-old collegiate gymnast sustained a complete rupture of the right Achilles tendon during warm-ups of a floor

competition. She had solely participated in gymnastics since the age of 5 years old. She was competing at a collegiate level at the time of injury, but prior to that had competed at level 10 for the last 6 years. During her collegiate career, she specialized in vault and floor exercise. There was a remote history of ankle sprain and fracture in childhood, but no prior Achilles injury or family history of Achilles tendon ruptures. On the day of the injury, she reports that her calf felt "tight" for quite some time but she had been able to stretch leading to relief of the tightness. However, about a week prior she did have some Achilles pain during another competition briefly, which had completely resolved; she had no pain in the Achilles the day of the competition. She had not taken any medications associated with tendon rupture (glucocorticoids, anabolic steroids, fluoroquinolones, renin-angiotensin II receptor antagonists), but did report NSAID and acetaminophen intake the day of the meet, which was typical for her. She ruptured her Achilles tendon while performing a round off back handspring double back. An open repair was performed 2 days after the incident, which verified that the mid-substance of the tendon was completely ruptured with a "mop-ended" appearance on both the proximal and distal aspects of the residual Achilles tendon.

Eight months prior to the rupture, the student-athlete had participated in a research study examining the Achilles tendons of numerous asymptomatic athletes. This study included an ultrasound evaluation of the tendon (Sonosite PX, 15MHz linear probe) by an experienced sonographer, in which a video was recorded of each tendon in transverse and sagittal planes (Fig. 1, videos 1 and 2), in addition to utilization of power doppler to identify potential intratendinous vascularity. Two experienced, blinded reviewers had reviewed these videos and identified no abnormalities in the tendon, namely hypoechogenicity, thickening, or neovascularity.

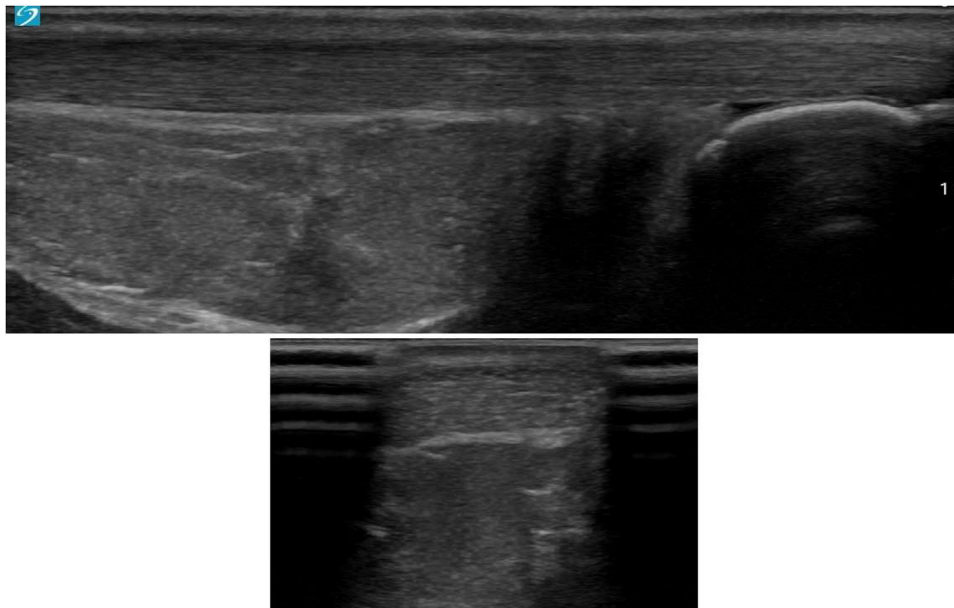


Fig. 1 – Ultrasound images of an asymptomatic Achilles tendon that later went on to rupture. Notably, no significant abnormalities of the tendon can be seen. Top frame shows a longitudinal (sagittal) view of the Achilles tendon, while the bottom frame shows a transverse (axial) view of the Achilles tendon at the mid-portion.

Discussion

This case represents the first known case of an Achilles tendon rupture with asymptomatic advanced imaging preceding the injury. There is a commonly held belief that ruptured tendons are the last stage in a continuum of degeneration, tendinosis, and eventually rupture [6]. To date, retrospective studies are mixed on whether most ruptured Achilles tendons show signs of prior pathology [7]. Furthermore, older patients may be viewed in a similar manner as younger athletes, where older patients appear to progress from tendinopathy to rupture with some frequency [8]. While numerous studies have examined the relationship between asymptomatic sonographic tendon appearance and subsequent tendinopathy, none have identified a later rupture [9].

For young athletes, though, who have a much lower incidence of Achilles tendinopathy, little is known about preceding tendinopathy. In a case series of 4 elite adolescent gymnasts, none had reported prior Achilles injury, though 2 had reported preceding “tightness” of the Achilles [10]. The aforementioned case series did not utilize ultrasonography. This case report adds valuable information to the available literature, demonstrating a normal-appearing Achilles tendon on ultrasound imaging 8 months preceding a complete rupture at the mid-substance of the tendon. This suggests that different mechanisms may account for ruptures in younger athletes. A rapid eccentric or explosive concentric load may be causative, as most athletes will note the rupture occurring in one of these motions [4]. This mechanism should especially be considered in female gymnasts, as noted in this case. This study is mostly limited by the 8-month break between imaging and rupture; the tendon could have changed and developed pathology over that time.

In conclusion, this case study highlights an elite collegiate gymnast with a normal asymptomatic ultrasound scan of her Achilles tendon preceding a complete midsubstance rupture 8 months later. The commonly-held belief that pre-existing Achilles tendinosis precedes rupture may not be the causative mechanism in the young athlete and may support a mechanical theory leading to Achilles tendon rupture.

Author’s contribution

DC contributed to data acquisition, writing, and editing. EC contributed to writing and editing. JH contributed to data acquisition and edited this paper. EC edited this paper. All authors provided substantial contributions to the conception of this work, critically revised the work, and gave final approval of the work.

Patient consent

Consent was obtained from this patient and athlete about the case report that we are submitting for publication. This consent was written and informed consent.

Supplementary materials

Supplementary material associated with this article can be found, in the online version, at [doi:10.1016/j.radcr.2024.05.028](https://doi.org/10.1016/j.radcr.2024.05.028).

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