Case Report

Primary repair of complete Achilles tear augmented with amnion allograft wrap in college basketball player with a history of contralateral Achilles rupture: a case report

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Background: The Achilles tendon is the thickest tendon in the human body and is responsible for plantar flexion with muscle contraction. It is able to withstand tensile loads as large as ten times the body's weight or greater at times of peak stress on the tendon. Due to the repetitive and massive stress inflicted on the Achilles tendon, it is prone to injuries, especially in running and jumping athletes. Ruptures typically present after unsustainable stress placed on the tendon from rapid contraction with classic presentation of a sudden "pop". These injuries tend to occur in middle-aged men after atypical physical exertion with complaints of immense pain in the posterior lower leg.

Case Description: This case examines a 20-year-old athlete presenting to the emergency department after sustaining a left calf injury while playing basketball. The patient suffered a full-thickness tear of the Achilles tendon with retraction and subsequent anterior and posterior tibiofibular ligament deficiency. This presentation is unique as he has a past medical history of an Achilles tear in the contralateral limb.

Conclusions: This study concluded that the bilateral Achilles tears in such a young patient were caused by anatomical blood supply watershed area to the Achilles tendon and anatomical ankle alignment abnormalities. This study provided a viable option to successfully repair complex Achilles tears via close reduction internal fixation (CRIF) with allograft matrix.

Keywords: Achilles tendon; amnion allograft; case report

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Introduction

Known as the strongest tendon in the human body, the Achilles tendon attaches to the medial aspect of the calcaneus. The gastrocnemius and the soleus combine to form the origin of the Achilles tendon. The gastrocnemius is a two headed muscle that fuses into a single muscle belly in the posterior compartment of the leg. The main actions of these muscles are plantarflexion of the foot and flexion

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of the knee. Together, these two muscles conjoin to a single tendon, the Achilles tendon. Since the tendon is typically 12–16 cm long, there is multiple blood supplies to it. The midsection is supplied by the peroneal artery and the proximal and distal end is supplied by the posterior tibial artery.

Ruptures usually occur in the distal 2–6 cm portion that attaches to the calcaneus. A rupture is typically complete and occurs suddenly. The mechanism of rupture is from a rapid plantarflexion of the ankle that is too high of a load for the tendon to withstand. Age is a factor in rupture occurrence as degeneration occurs via increased amounts of vascular changes and disorganization of collagen (1). Poor vascularization from the peroneal artery to the midsection can be a reason for ruptures at this site. Repetitive motion in sports plays a role as well, especially in jumping sports, like basketball and track and field.

Bilateral Achilles ruptures are relatively uncommon injuries to have occurred on separate occasions; especially, in a college-aged student. Spontaneous bilateral Achilles tears are extremely rare and occur less than 1% of the time with fluoroquinolone use as the main precipitating factor (2). However, orthopedic literature has rarely mentioned case studies with young athletes who have experienced bilateral Achilles tears at different time periods. Factors that may play a role in weakening the Achilles tendon causing ruptures are renal conditions, diabetes mellitus, corticosteroid use, and fluoroquinolone use (2). It is rare for a patient to develop a tear in the contralateral Achilles as even re-rupture of a repaired Achilles tendon occurs less than 8% of the time. In this article, we present a rare case of a young patient with complete tear of the contralateral Achilles tendon, discuss surgical details, and review the literature. We present this article in accordance with the CARE reporting checklist (available at https://acr.amegroups.com/article/view/10.21037/acr-23-61/rc).

Highlight box

Key findings

- Anatomical abnormalities lead to bilateral Achilles tears in the young athlete. Repair via amniotic allograft patch provided a quick recovery.

What is known and what is new?

- Bilateral Achilles ruptures are relatively uncommon injuries; especially is young athletes.
- Amnion Matrix allograft provides growth factors to improve and quicken the healing process
- Bilateral ruptures occurred due to watershed area to the Achilles and abnormal ankle alignment.

What is the implication, and what should change now?

- The study indicates the need for further analysis in relatively healthy young athletes who present with Achilles tendon.

Case presentation

A 20-year-old male presented to the Illinois Valley Community Hospital after suffering an injury to the left lower extremity, complaining of feeling a “pop” and severe pain in his calf. The patient is a basketball player enrolled at a local community college and experienced these symptoms while planting his foot suddenly preparing to spring off the ipsilateral foot. The ankle experienced rapid plantarflexion prior to the rupture. Prior to the tear, the patient had not experienced any symptoms in his left lower extremity. He had no prior history of trauma in this leg. He has a past medical history of a previous Achilles’ tendon tear in the right lower extremity, which also occurred while playing basketball. Prior surgical intervention was performed at an outside hospital and detailed operative report was not available. It was a successful repair as the patient has been playing basketball post first operation for a couple of years now. The patient believes that his tendon was repaired with approximation without the use of any graft material. The patient was physically fit of normal body mass index (BMI) and lived an active lifestyle. He is an above average height male at just over six feet. He had no anatomical abnormalities on physical exam that could have led to this. His heal arch was within normal range and no supination or pronation of the ankles were noted with full weight bearing. He denied any recent antibiotic or steroid usage prior to his injury. He did not know of any family medical conditions or genetic disorders that could have predisposed him to these injuries. On physical exam, range of motion was significantly limited in plantar-flexion and pain was elicited with light palpation of the distal gastrocnemius muscle. An initial anterior/posterior plain radiography film was obtained and found to show no osseous abnormalities. A magnetic resonance imaging (MRI) was ordered to better visualize potential tendon damage and a visit was scheduled at the outpatient orthopedic office.

Two weeks after the basketball injury, a left ankle MRI without contrast was conducted (*Figure 1*). Unenhanced multiplanar, multisequence magnetic resonance (MR) images of the left ankle and hindfoot helped identify the

Figure 1 T1 weighted spin echo sagittal view. Sagittal view with a complete tear of Achilles tendon with a defect of 5 cm above the upper margin of the calcaneus. Noted minimal posterior tibial tendon peritendinitis and minor effusions. S is indicative of sagittal view. The bar is a scale to measure size as each dash in one centimeter.

patient's source of pain and physical limitation. Analysis of the MRI showed a small posterior ankle joint effusion and posterior subtalar effusion. Ligament damage was noted in the anterior and posterior tibiofibular ligaments as both anterior and posterior distal tibiofibular ligaments were diminutive; however, they lacked adjacent fluid aggregation indicating this was not an acute injury. The anterior talofibular ligament appeared to be torn without expected fluid accumulation, most likely a chronic injury. The posterior tibial tendon had minimal peritendinitis directly above the medial malleolus and analysis of the Achilles tendon showed a complete tear with a defect 5 cm above the upper margin of the calcaneus making this a complete rupture in the mid-portion of the tendon. Finally, there was a thickened heterogeneous appearance remaining in the distal tendon. This finding on imaging aided in determining surgical fixation of the tendon; allowing for the distal tendon to be approximated without requiring the removal of any portions.

Repair of the Achilles tendon took place three weeks after the injury. A linear incision was made along the posteromedial aspect of the left lower extremity, directly superior to the Achilles tear. The dissection approach was conducted medial to lateral to avoid injury to the sural nerve. Dissection was carried down through skin and subcutaneous tissue down to the paratenon. The paratenon was incised and the Achilles tendon rupture was encountered. At this point, the Achilles tendon complete rupture could be visually appreciated at the musculotendinous junction. A small amount of tendon was identified approximately. The proximal Achilles tendon was freed up using blunt finger dissection. This was done to prevent any scar tissue and encouraged excursion. Using suture tape, Krackow sutures were placed up and down the Achilles tendon both proximally and distally. The suture tape had great fixation and hold in the proximal musculotendinous portion. The suture tapes were passed into the opposing tendon with a Keith needle using a gift box technique. This led to reduction of the Achilles tendon and the suture tape was tied off. Once this Achilles tendon was reduced, the Thompson test was utilized to observe function. At this time, the patient had a negative Thompson test. Squeezing the calf did produce plantar flexion of his ankle. Passive range of motion of the ankle was tested and dorsi and plantar flexion was possible. Following motion testing, an Arthrex Amnion Matrix skin substitute of 3 cm × 8 cm was applied over the Achilles tendon. This was used to improve healing rates due to the abundant amount of growth factors in the matrix. Thus, the skin substitute was applied over the Achilles tendon repair and sutured in using 3-0 Vicryl. Closure of the incision was conducted, and the patient was then placed in a posterior short-leg splint with the ankle held in approximately 20 degrees of plantar flexion.

The patient was instructed to be nonweight bearing until the 2-week follow up appointment. At 2 weeks follow up, the cast and sutures were removed, and the patient was transitioned into a fracture boot with a heel lift. One-month post-operation, the patient noted no numbness of the posterior calf but did note weakness and minor stiffness which he has been working on at physical therapy. At three month follow up visit, the patient started to regain full range of motion in his left ankle. He has returned to regular daily activities while maintaining the heel lift inside his boot. He started to participate in stationary biking at a low resistance at this time with no pain of the lower extremity. The patient noted continued tenderness in his posterior calf and ankle; however, it has reduced since his one-month visit. At his sixth month follow up visit, his physical therapy

progression has been satisfactory as he has been cleared to return to low impact sports participation. He had full motor control of his lower extremity with good balance. At this time, he is cleared to start running and slowly return to basketball court with caution on pivoting motions. He also is instructed to return to normal sneakers without the heel lift. At the one year follow up, the patient notes he feels his strength has returned fully and has no complaints. He has returned to the basketball court and is continuing his college basketball career.

All procedures performed in this study were in accordance with the ethical standards of the institutional and/or national research committee(s) and with the Helsinki Declaration (as revised in 2013). Written informed consent was obtained from the patient for publication of this case report and accompanying images. A copy of the written consent is available for review by the editorial office of this journal.

Discussion

Men aged 30–49 are at the greatest risk of Achilles tendon ruptures (3). Degenerative changes have been observed in a vast majority of Achilles ruptures indicating acute trauma from chronically degenerated tendons (4). Up to 90% of competitive athlete's injuries can be attributed to repetitive microtraumas occurring throughout months and even years of use (4). Microtraumas can be caused by incorrect training practices dependent on the sport in which the patient is playing. Common training errors include a rapid increase in intensity of training and altering training surfaces, which are similar causative factors in Achilles paratenonitis (5). The final insult to cause an Achilles tendon tear is an acute overloading of the tendon causing the rupture. Other, less common etiologies can include, malalignments of the tendon, and varus foot (forefoot or rearfoot varus) which increases the stress on the Achilles tendon in the mid stance phase due to a whipping action on the tendon (5).

Various factors make the injury, presented in our article, particularly unique, including the young age of the patient, a past medical history of an Achilles tear on the contralateral leg, and the patient's history of high-intensity sports. Achilles tendons are typically found in older men, who are not physically active and rarely have a past medical history of the same injury to the contralateral leg. The unique nature of this case lends the need for further evaluation of risk factors of this patient. He had not been taking any medications with a reputation of tendinopathy (fluoroquinolones, corticosteroids, etc.), and he had no family history of any collagen disorders or genetic predisposition to Achilles rupture. He had no environmental stresses on the Achilles tendon either. Typically, a change in training surfaces can create a new stressor to the athlete. Athletes who maintain a consistent training environment, such as paved running trails or basketball courts, have less incidence of tendon injuries. We know this patient had been adapted to a basketball court having been playing at a high level for years (6).

With inherited risk factors in this patient excluded, anatomical abnormalities become the main concern for the pathogenicity of the bilateral tears. The blood supply distribution to the Achilles tendon creates a fragile point in which complete ruptures of the tendon can occur most often in the midsection of the tendon. This pathology may be a cause due to the tendon rupture occurring 5 cm from the attachment point of the calcaneus which would classify this as a midsection tear. Another risk factor analyzed was the change in the alignment of the feet, as we found that more varus-oriented feet could potentially lead to bilateral weakness of the Achilles tendons, making them more prone to rupture (2). This change in the alignment of the feet could potentially lead to bilateral weakness of the Achilles tendons, making them more prone to rupture. Given this patient's active lifestyle and a complete rupture of the tendon, it was decided that surgical repair would be most beneficial. This repair would ensure he could return to basketball after an appropriate recovery period with adequate physical therapy.

To create an optimal recovery for the patient, it is important to create a rehabilitation program that delicately balances immobilization with overuse. To accomplish this, anatomy and function of the tendon must be considered (4). Conservative management entails a 6–8-week cast immobilization with varying ankle positions during those two months. Choosing conservative management or surgical repair has been debated amongst the literature, surgical repairs tend to be the treatment of choice for athletes and this management is associated with a lower risk of repeat tearing of the tendon (7). Patients with less active lifestyles may benefit from a more conservative approach for their management (7). A major drawback to conservative approach is the need for aggressive rehab during the first year after injury to gain back function and muscle definition. In a more sedentary patient, this tends to be a challenge. When comparing re-rupture rates based on treatment modality, there was no significant difference between surgical and

conservative treatment could be observed (7). Determining the appropriate management and treatment of acute Achilles tendon repair should be an individualized approach. Physicians must consider the lifestyle of the patient and their functional status at baseline when selecting the best treatment modality for the tendon tear.

Amnion allografts can be a great resource to help facilitate recovery. The use of amnion to treat Achilles tendon tears in the adolescent population is a novel approach to the surgical treatment of these complex injuries. The amnion allograft is derived from the amnion sac that surrounds the fetus during pregnancy and helps to regulate temperatures of the fetus (8). It also contains an abundant amount of growth factors and anti-inflammatory proteins that are suspected to help with healing processes. Dehydrated amnion has been utilized in the repair of complete ruptures of the Achilles in diabetic animals. The results show that compared to unwrapped ruptures, the tendons treated with amnion had reduced failure rates, increased cell migration, and improved mechanical properties (9). Amniotic allograph use in animal studies has shown tendon regeneration and physiologic recovery of the ruptured Achilles tendon. The improved recovery using the amniotic allograft is suspected to be due to the remodeling of the extracellular matrix by increased growth factor production. These growth factors include transforming growth factor beta 1 (TGF-b1) and vascular endothelial growth factor (VEGF), which have been shown to be increased at 14- and 28-day post-operative (10). Overall, as clinical research is developing on the use of amniotic allograft patches *in vivo*, early animal models show clear scientific benefits for its use.

Conclusions

This case provides a unique use of amnion allograft matrix in a collegiate athlete, who sustained bilateral Achilles tendon ruptures. The uneventful and quick recovery of this patient should encourage the use of this novel patch and further use may indicate faster tendon regeneration and increased tendon strength as compared to traditional repair. Based on the potential causational factors presented, more detailed analysis needs to be performed, as a specific etiology has yet to be determined for this individual.

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Footnote

Reporting Checklist: The authors have completed the CARE reporting checklist. Available at https://acr.amegroups.com/article/view/10.21037/acr-23-61/rc

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Ethical Statement: The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. All procedures performed in this study were in accordance with the ethical standards of the institutional and/or national research committee(s) and with the Helsinki Declaration (as revised in 2013). Written informed consent was obtained from the patient for publication of this case report and accompanying images. A copy of the written consent is available for review by the editorial office of this journal.

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