Percutaneous Repair of Achilles Tendon Rupture with Calcaneal Anchors

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Statement of Purpose

Despite numerous treatment modalities the surgical approach to mid-substance acute achilles tendon ruptures (AATR) is still widely debated. Surgical approaches including percutaneous versus open have historically been compared regarding outcomes and complications. This case series presents a novel percutaneous surgical approach for treatment of mid-substance AATR without reported complication to date.

Literature Review

First reported by Ma and Griffith in 1977, there have been advancements made in the surgical technique for minimally invasive (MIS) or percutaneous achilles tendon repair.[3,7] The goal of performing this procedure is to minimize soft tissue dissection while restoring function.[3,4,7] The technique is indicated in patients with an active lifestyle and is not intended for chronic pathology such as tendon degeneration or adhesions.[3,6] In the past, percutaneous repair had a high complication rate of sural nerve injury.[1,3] Due to new assistive devices and progressive techniques, the incidence of sural nerve injury has decreased.[3,4,7] In regards to function, previous studies report higher re-rupture rates and lower functional outcomes in percutaneous repair versus open due to inadequate apposition of tendon ends.[6] A more recent study by Hsu et al, with a mini-open technique found patients who received MIS returned to baseline physical activity earlier than open repair. This was attributed to decrease in concern for soft tissue healing.[4] A systematic review, performed by Lohrer et al, compared open repair versus MIS and found no statistically significant differences between patient satisfaction or success rates. There was a statistically significant difference in the complication rates of those who received open repair (10.5%) versus vs. MIS (5.3%), such as wound infections.[5] This trend in literature demonstrates a movement toward mini-open or percutaneous repair, this case series demonstrates a novel approach.

Case Series

This case series includes six patients who underwent percutaneous surgical repair of complete mid-substance AART with a single surgeon (C.C.) that had a minimum follow-up of one year. The average age of patients was 43 years old (range 31-54), with four males and two females. All AATR were diagnosed clinically based on physical exam findings without advanced imaging. Physical exam findings included lack of plantar flexion with palpable defect overlying the achilles tendon. Mid-substance AATR were confirmed intraoperatively. Postoperative course included 2 weeks of non-weightbearing in fiberglass cast, followed by protected weightbearing in CAM boot, and a course of physical therapy. To date there have been no re-ruptures, sural nerve injuries, wound dehiscence, or postoperative infection. All patients have returned to full activity without complication.

Figure 1: Operative technique. Incision planning(1A), incision(1B), proximal achilles stump(1C), proximal achilles stump lateral view(1D), suture repair laterally(1E), suture repair medial/lateral PA view(1F), suture repair medial/lateral lateral view(1G), calcaneal drill hole(1H), swivel lock suture retraction(1I), anchor placement(IJ), incisions(IK), wound closure PA view(1L), wound closure lateral view (1M)

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Surgical Technique

A small longitudinal incision is made to overlie the palpable mid-substance defect within the achilles tendon (Figure 1A, 1B). Layered dissection is carried down to the achilles tendon through the paratenon, where an acute complete mid-substance achilles rupture is identified. All hematoma and nonviable soft tissues are resected. The proximal stump of the achilles tendon rupture site is grasped with an allis camp and brought to the wound margin (Figure 1C, 1D). It is exposed through the small longitudinal incision and directly repaired using polyethylene suture material with locking and non-locking sutures (Figure 1E, 1F, 1G). The sutures and tendon are placed subcutaneously with the suture lying on the medial and lateral aspects of the tendon between the paratenon. Two stab incisions are made approximately 1.5cm apart over the medial and lateral aspect of the calcaneus distal to the achilles tendon insertion. A 3.5mm drill is used to drill pilot holes in each stab incision into the calcaneus and then tapped (Figure IH). The suture from the proximal achilles tendon stump is then pulled distally with the use of two swivel locks to the posterior aspect of the calcaneus (Figure 1I). A 4.75mm anchor is placed into each the medial and lateral aspect of the calcaneus where pilot holes were made (Figure 1J). As a result, the achilles tendon rupture site is re-approximated subcutaneously under tension with the foot in plantarflexion (Figure 1K). Wound closure with minimal soft tissue disruption is obtained (Figure 1L, 1M). It is confirmed intraoperatively that the achilles tendon has appropriate tension with restoration of plantarflexion with calf squeeze.

Analysis & Discussion

This case series presents a novel percutaneous repair approach for management of AATR. The goal of this surgical technique is to limit incision length and decrease soft tissue dissection, while also reapproximating the achilles tendon and restoring function. In this series of six patients, all have returned to their baseline physical activity without incidence of complications. AATR occurs in 6-18 out of every 100,000 people in North America.[1,6,8] In regards to surgical intervention, the most common approaches are open versus percutaneous repair. Prior literature has debated whether a percutaneous approach provides optimal outcomes with more recent studies demonstrating less complications, earlier healing, and accelerated post-operative rehabilitation.[4,5,8] With new advancements made, this percutaneous technique is a unique viable surgical option for treating AATR with a small linear incision, direct visualization of the achilles tendon allowing for direct suture repair of the proximal achilles tendon stump, subcutaneous re-approximation of the rupture site, and calcaneal anchors.