CASE REPORT

Primary End-end Tendo-Achilles Repair for Defect of 7 cm: A Case Report with Literature Review

Vishnu Senthil

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Abstract

Achilles tendon evolved in humans as a consequence of bipedal gait. We report a case of neglected tendo-Achilles injury in a 32-year-old female. Magnetic resonance imaging (MRI) showed a defect of 3.5 cm, about 5.5 cm from the calcaneal attachment. On debridement, a defect of 7 cm was found intraoperatively. It was repaired end-to-end with ultra braid suture with Krackow 90° locking stitch with gift box configuration along with V-Y plasty. Paratenon suturing was done to reinforce the repair. Now the patient is at an 18-month follow-up, showing intact repair in MRI and full weight-bearing. In our case, we want to bring out the mechanical properties of tendo-Achilles. Mechanical properties of tendo-Achilles with emphasis on its viscoelastic nature and repair in a high amount of tension produced good strong repair and functional outcome at final follow-up.

Keywords: Creep phenomenon, End-end repair, Tendo-Achilles tear, Ultrabraid suture, V-Y plasty.

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Introduction

Achilles tendon is the thickest and strongest tendon and is only found in humans; it evolved as a result of bipedal gait.[1] Achilles is a common tendinous lesion affecting 18 in 100,000. The ability to run is a feature present in humans where the spring-like tendon reduces the cost of energy during transport. Tendo-Achilles lesions >4 weeks are termed chronic lesions. Causes of chronic Achilles tendon lesion include neglected spontaneous rupture and failed repair. Spontaneous rupture occurs at 2–6 cm proximal to insertion because of the small cross-section of the tendon and limited vascular supply.

Case Description

A 32-year-old female presented with a left tendo-Achilles injury following a slip and fall from stairs. The tendo-Achilles injury was conservatively treated with below-knee plaster for 6 weeks at some other place. She presented to us with difficulty and pain while walking, inability to do heel rise, and plantar flex the ankle. Ultrasound showed bulbous thickening and heterogenicity of the distal portion just proximal to calcaneal attachment suggesting chronic tear (Fig. 1).

Magnetic resonance imaging showed near total rupture about 5.5 cm away from the calcaneal attachment. The defect measured in the MRI was approximately 3.5 cm (Figs 2 and 3). In our setup, suture anchors/tenodesis screw was not affordable for the patient. Since the defect was only 3.5 cm in MRI, we considered proceeding with primary end-end repair with/out V-Y lengthening. Intraoperatively, the tendon ends were tendinous and thickened. A degenerative portion of the tendon was removed and the defect that was achieved was 7 cm. We were skeptical, and in the absence of tenodesis screw, we did primary end-to-end repair with ultrabraid suture material with Krackow 90° locking stitch with gift box configuration. The paratenon suturing was also done to reinforce the repair. V-Y plasty was performed with the V at the gastrocnemius aponeurosis; the arms of V pulled down but could not bridge the gap. V was made into a Y configuration with 2–0 vicryl in the proximal part and 1–0 prolene in the distal part, and the

Department of Orthopedics, Government Royapettah Hospital, Chennai, Tamil Nadu, India

Corresponding Author: Vishnu Senthil, Department of Orthopedics, Government Royapettah Hospital, Chennai, Tamil Nadu, India, Phone: +91 9972017290, e-mail: vishsnake@gmail.com

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Fig. 1: Plain radiograph of left ankle anteroposterior and lateral view showing no bony abnormality

residual defect was 3.5 cm. The foot was placed in plantar flexion till the ends could be approximated and end-end repair was done with ultrabraid suture (Fig. 2).

Postoperatively (post-op), the patient was on above-knee Plaster of Paris for 2 weeks in plantar flexion. Following suture removal, below knee non-weight-bearing cast for 8 weeks. Post 8 weeks cast was removed and the patient was made to weight bear as tolerated. Now at post-op 18 months, MRI showed intact repair of the tendon with no evidence of tendinosis (Fig. 4). The patient was able to do heel rise and plantar flexion on prone compared to the normal side. The range of motion of the ankle was plantar flexion—0–20° and dorsiflexion—0–10° (Fig. 5).

Discussion

Achilles tendon is formed by the fusion of tendons of the two bellies of the gastrocnemius and soleus and the deep fibers insert into the posterior surface of calcaneum, and superficial fibers blend with the plantar fascia. Achilles tendon enthesis organ serves to dissipate the massive amount of torque during activities of running and jumping. Achilles tendon has multiple insertion points to help in the spread-out load transmission. Blood supply is divided into thirds; primary vessel is post tibial artery through the paratenon, middle third by peroneal artery, lower third by posterior tibial artery, and periosteal plexus over the calcaneum.

Fig. 2: Short tau inversion recovery MRI sagittal image of left ankle showing near total Achilles tendon tear at 5.5 cm from calcaneal attachment with subcutaneous inflammatory changes along the tendon. The defect was 3.5 cm in MRI

Chronic Achilles tendon injury may present with a palpable or visible defect. Clinical tests include Thompson's calf squeeze test, Matles test, O'Brien's needle test, and Copeland's sphygmomanometer test.[1]

Reconstruction of chronic Achilles tendon injury primarily on the age of injury, and the magnitude of the gap that exists between the proximal tendon with adaptive shortening and distal healthy tendon. The length of the final tendon is determined after debridement of fibrotic and degenerative areas.[2]

Meyerson protocol divided chronic Achilles tendon injuries based on the size of the defect. Lesions <2 cm are directly repaired, 2–5 treated by V-Y advancement, and >5 cm are treated with tendon transfer with V-Y lengthening.[3]

Kuwada protocol[4] divides lesions into four types. Type I consists of partial thickness tear, type II with defects up to 3 cm treated with end-end repair, type III with 3–6 cm with flexor hallucis longus (FHL) transfer, and type IV with gastric recession and FHL transfer.

Buda et al., in their protocol, considered the factors like the extent of injury, time since injury, presence of MRI signs with tendinopathy and tendinosis, and insertional tendinopathy. Around 1–2 cm defect was treated with primary end-end repair, >2–5 cm tear was treated with turn down flap or V-Y plasty. Gaps >5 cm were treated with tendon transfers and V-Y tendinous flap.

Shanmuganathan et al.[5] in their article have recommended if gaps after debridement are <2 cm, then primary repair with/without gastric lengthening was recommended. If the tendon gap is 2–5 cm with intact enthesis, lengthening with primary repair/FHL transfer was recommended.

The enthesis organ is tendinous, and following debridement, if the proximal part of the tendo-Achilles is healthy then it is fixed to the decorticated bone with the help of suture anchor ± tendon transfer (peroneus brevis or FHL). Occasionally V-Y lengthening or gastric lengthening wasperformed to reinforce primary repair.

If the tendon gap is >5 cm with intact enthesis, fascia lata graft is used and when the tendon is tendinous and degenerated, debridement with FHL transfer is recommended.[6]

In our case, with a defect of 7 cm postdebridement, we have done primary end-to-end repair with V-Y lengthening.

According to the article by Javier Maquirrian on discussing the mechanical properties of the tendon, tendon transmits loads across joints with minimal energy loss and deformation. Tendon has both elastic and viscous properties. Elastic properties are present at minimal strain and later viscous deformation occurs.[7] The

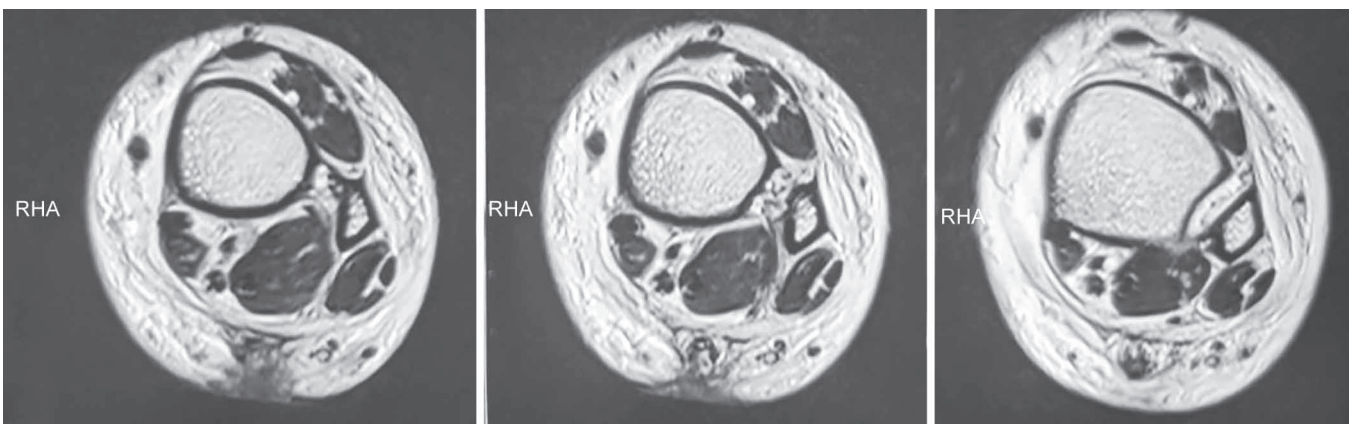

Fig. 3: 1.5T MRI (T1W axial image) of left ankle showing focal thickening with tendinopathy and peritendinitis

Figs 4A to C: Follow-up 1.5T MRI at 18 months with a sagittal image: (A) Coronal Image; (B) Axial image; (C) Showing postoperative changes

Figs 5A to D: (A) Showing the heel rise without support, the operated site is shown with an arrow; (B) Showing plantar flexion against gravity; (C) Shows the side view; (D) Follow-up at 18 months showing clinical outcome with good functional outcome

quantitative parameters include force and deformation, while stress and strain are included in the qualitative parameters. Stiffness is an important constituent of the tendon, which is defined as the resistance of tendon to an increase in length. Stiffness has a significant influence on force transmission, muscle power, energy absorption, and release during locomotion.

Mechanical properties of tendons include stress relaxation, creep, and hysteresis loop. Stress relaxation implies with the same degree of tendon stretch or extension, the load required to maintain extension decreases with time.[8] Crimp phenomenon occurs in the toe region of the tendon where the stretching out of tendon fibrils occurs with the initial strain. Creep implies with constant load, deformation increases over time. The hysteresis loop is a measure of energy that is dissipated or lost during loading and unloading of the tendon, indicating viscous property of tissue.[9]

In our case, long-segment primary tendo-Achilles repair under high tension without FHL transfer has shown good clinical outcome due to mechanical properties of crimp and creep in tendon.[10,11]

Hence our repair, with a good amount of tension and a great cross-sectional area of the tendon with polyblend ultrabraid suture, since polyblend repair resulted in 260% higher load to failure and 33% less gap formation. Krackow locking suture technique with five stitches in the proximal stump and three stitches in the distal part with gift box formation and burial of knots. One strand of suture material passes through the tendon with paratenon repair, and the creep phenomenon of the tendon leads to the stretch and remodeling of tendinocytes producing good functional outcomes.

Conclusion

Achilles tendon post debridement with good distal and proximal stump produced a gap of 7 cm. Primary end-to-end repair with V-Y lengthening with good tension produced a good functional outcome without FHL transfer because of creep and adaptive lengthening of the tenocytes in the tendon.

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