

TENDOACHILLES TURN DOWN PLASTY IN CASES OF CHRONIC TENDOACHILLES INJURIES

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Abstract

Background: Reconstruction of Achilles tendon is a challenging problem. Multiple techniques like tendon graft have been used. All these options are technically demanding. Mechanism of its action has been analysed by MRI and M-mode ultrasound. This study deals with the primary reconstruction of Achilles Tendon. AIM-This study deals with the reconstruction of the tendoachilles using turn down plasty of the Achilles tendon. Advantages include single stage surgery, technically feasible simple procedure. **Materials and Methods:** This study was held in our Institution from January 2019 to January 2022 for a period of three years. 70 patients were examined with injury to the Achilles tendon during this period. Of which 46 were acute injuries with minimal or no loss of the tendoachilles were repaired primarily, 24 cases were reported as crush injury of the Achilles tendon with a loss and having a gap of around 3cm-6cm between the proximal and the distal ends. Simultaneous reconstruction of the tendoachilles using varied techniques were performed. **Result:** Segmental defects of the Achilles tendon pose a real reconstructive challenge, but the outcome has been analysed well clinical, functional outcomes, patient satisfaction, standing in tip toes, by MRI and M-mode ultrasound, which can provide enough confidence for anyone to try this solution in a demanding situation. Tendoachilles turn down plasty uses the native tissue for reconstruction of defect in the tendon ranging from 3 – 8cm, single stage, through a single incision with excellent outcome. **Conclusion:** Turn down plasty is the best method for chronic tendoachilles injury with larger defect of 3-6cm. Single stage procedure with single incision and native reconstruction and less morbidity. Excellent outcome with regain of full function of plantar flexion and dorsiflexion.

INTRODUCTION

Reconstruction of Achilles tendon is a challenging problem. Multiple techniques like tendon graft have been used. All these options are technically demanding. Mechanism of its action has been analysed by MRI and M-mode ultrasound. This study deals with the primary reconstruction of Achilles Tendon.^[1-5]

Achilles tendon is the largest tendon of the body. It is formed by the confluence of the soleus muscle tendon and the medial and lateral heads of Gastrocnemius tendon. Commonly the patient presents with the history of flush out injuries, road traffic accidents presenting with acute pain, with or without the open wound, loss of plantar flexion. On examination reveals Thompson's test negative with visualisation of the cut, crushed, avulsed ends of the tendon with or without skin loss.^[6-10]

AIM

This study deals with the reconstruction of the tendoachilles using turn down plasty of the Achilles tendon. Advantages include single stage surgery, technically feasible simple procedure.

This study was held in our Institution from January 2019 to January 2022 for a period of three years. 70 patients were examined with injury to the Achilles tendon during this period. Of which 46 were acute injuries with minimal or no loss of the tendoachilles were repaired primarily, 24 cases were reported as crush injury of the Achilles tendon with a loss and having a gap of around 3cm-6cm between the proximal and the distal ends. Simultaneous reconstruction of the tendoachilles using varied techniques were performed.

Diagnosis was confirmed by clinical examination that is the loss of plantar flexion demonstrated by Thompson test, Xray of posterior heel to rule out other pathology, ultrasound examination which

determines whether the rupture is complete or parital, MRI indicated when the findings are equivocal and in chronic ruptures demonstrates the retracted tendon edges proximally and distally with the gap in between.

Treatment consists of functional bracing or casting the foot in plantar flexion, primary repair in acute ruptures, percutaneous repair, reconstruction with V-Y advancement, Flexor Hallucis Longus transfer, peroneus brevis transfer, Turn down plasty, Using Fascia Lata as a graft

HISTORY
Achilles was the famous warrior who played a heroic role in Homer's Iliad, made invulnerable by being immersed in the river Styx. He had one weakness: his heel, which had missed being dipped in the Styx, and was eventually killed after being shot with a poisoned arrow into his heel.

Relevant Anatomy

The tendinous portions of the gastrocnemius and soleus muscles merge to form the Achilles tendon, the largest and strongest tendon in the human body. The gastrocnemius tendon emerges as a broad aponeurosis at the distal margin of the muscle bellies, whereas the soleus tendon begins as a band proximally on the posterior surface of the soleus muscle. The Achilles tendon becomes progressively rounded in cross section until about four centimeters from its insertion into the calcaneum, where it flattens out prior to inserting into the proximal calcaneal tuberosity. The calcaneal insertion is specialized: it is composed of an attachment of the tendon, a layer of hyaline cartilage, and an area of bone not covered by periosteum. There is a subcutaneous bursa between the tendon and the skin, and a retrocalcaneal bursa between the tendon and the calcaneum.

Biomechanics

The Achilles tendon has a high capacity to withstand the tensional forces created by the movements of the human body. Approximately 95% of the collagen present in tendons is type 1 collagen, with a small amount of elastin. Ruptured Achilles tendons contain a substantial proportion of type 3 collagen. Type 3 collagen is less resistant to tensile forces, and therefore is predisposed to spontaneous rupture. The tenocytes within the tendon contain both actin and myosin, allowing for the contraction - relaxation mechanism of the tendon. In vivo peak force of the Achilles tendon has been measured at 2,233 Newton. Achilles tendon ruptures occur commonly in the mid-substance of the tendon, usually two to six centimeters proximal to the insertion to the calcaneum. Other less common locations are the musculotendinous junction and the insertion into the calcaneum.

The injury can be open or closed, and may be caused by a direct blow or an indirect force. Most injuries tend to occur when pushing off with the weight-bearing foot while extending the knee. Some Achilles tendon ruptures occur following sudden ankle dorsiflexion or violent dorsiflexion of a pantar flexed foot.

Symptomatology

Generally, most people who present with rupture of the Achilles tendon give a history of sudden sharp pain in the back of the calf of the affected leg. It is often described as if they had been kicked. An audible snapping sensation has also been described. Patients then may have difficulty in weight bearing on the affected side, and may describe ankle stiffness. Patients can also present with a chronically ruptured Achilles tendon, and they will often recall a minor trauma with pain in their heel. It then is apparent that routine day-to-day tasks, including climbing stairs, become difficult.

A direct injury mechanism to the Achilles tendon is also common, such as when sustained in an Indian type closet, or by cutting equipment in industrial injuries.

Clinical Examination

At examination there will be a laceration in case of open injuries, in the skin overlying the Achilles tendon, or swelling and sometimes bruising in and around the region of the Achilles tendon in case of closed injuries or rupture. A palpable gap can often be felt along the line of the tendon. The gap is most often felt approximately two to six centimeters proximally from the insertion of the tendon. The average location of rupture has been measured to be 4.78cm proximal to the calcaneal insertion.

In chronic rupture of the Achilles tendon, the pain and swelling may have subsided, and the gap between the tendon ends may have filled with fibrous tissue. If there is uncertainty or clinical confirmation is required, several tests can be undertaken.

Clinical tests such as the Thompson's /Simmond's test and Matles' test are carried out to ascertain the integrity of the Achilles tendon.

Imaging

If there is clinical doubt about rupture of the Achilles tendon, imaging may be of help.

For the trained eye, lateral radiographs of the ankle can be used to aid the diagnosis of rupture. The triangular fat-filled space between the anterior aspect of the Achilles tendon, the posterior aspect of the tibia, and the superior aspect of the calcaneum is called Kager's triangle. This area loses configuration and can be distorted if there is a rupture. Deformation of the contours of the distal segment of the tendon from loss of tone is the most likely radiographic change associated with rupture.

Real-time high-resolution ultrasonography is another useful diagnostic aid, though it is user dependent. Ideally, a linear array transducer probe with spacer gel should be held at 90 degrees to the tendon, ensuring the optimum amount of ultrasonic energy is returned to the transducer. The longitudinally arranged collagen bundles of the Achilles tendon reflect the ultrasound beam. High-frequency probes provide the best results, although they have a short focusing distance.

Magnetic resonance imaging is the gold standard of imaging. Both T1 and T2 weighted images should be used to evaluate the tendon for rupture. The images

should be in the axial and the sagittal planes. A normal Achilles tendon is viewed as an area of low signal intensity on all sequences. High signal intratendinous intensity is viewed as abnormal. In T1 weighted images, a complete rupture is visualized as disruption of the signal within the tendon. T2 images are not as specific, and generalized increased signal intensity represents the edema and hemorrhage within and around the ruptured tendon.

Management

The goals of management of Achilles tendon ruptures are to minimize the morbidity of the injury, optimize rapid return to full function, and prevent complications. To measure whether the management of Achilles tendon rupture has been successful, one needs to examine different variables. The variables most frequently studied in modern outcome studies after Achilles tendon rupture include complications, calf muscle strength, endurance, tendon configuration, patient satisfaction, and the impact of Achilles tendon rupture on absence from work and sports participation.

The management options are either surgical or nonsurgical, with surgical management involving open or percutaneous methods.

Management to some degree depends on the time of presentation, and the patient's degree of athleticism, age, fitness, and personal preference. The preference of the surgeon will also be a factor. There is as yet no established protocol for the management of ruptures. Management of Achilles tendon ruptures should allow the tendon to heal and enable the patient to return to an acceptable functional level. Factors such as age, occupation, and recreational activities should be taken into account when counseling patients.

Non operative management includes immobilisation in a cast, and functional rehabilitation with orthosis. Surgical management for acute injury includes end to end repair, and tendon augmentation

Chronic Achilles Tendon Rupture

The definition of chronic rupture is variable. The most commonly used point of differentiation is timeframe, which is four weeks from the time of injury.

Guidelines and Classification

Myerson treats ruptures of the Achilles tendon based on the size of tendon defect:

- Defects of 1 to 2 cm are treated with end-to-end anastomosis and posterior compartment fasciotomy
- Defects between 2 and 5 cm are repaired using V-Y lengthening, and occasionally augmented with a tendon transfer
- Defects greater than 5 cm are repaired using tendon transfer alone or in combination with V-Y advancement.

Kuwada grades Achilles tendon injuries I to IV:

- Type I injuries are advanced as partial tears treated with cast immobilization
- Type II injuries are complete ruptures with a defect up to 3 cm. These are treated with end-to-end anastomosis

- Type III injuries have a 3–6-cm defect after debridement of the proximal and distal ends of the Achilles tendon to healthy tissue. This grade of defect requires a tendon graft flap, possibly augmented with synthetic graft
- Type IV injury is a defect that is greater than 6 cm and requires gastrocnemius recession, a free tendon graft, and/or synthetic graft

Methods of Operative Management for Chronic Rupture: Various methods are described. Some of the commonly used methods are

- V Y tendinous flaps
- Turn down flaps
- Peroneus brevis transfer
- FHL graft
- Free Gracilistransfer
- Fascia Latabridge
- Allografts
- Synthetic materials

Turn Down Flaps: Turn-down flaps of the Achilles tendon have been used to repair acute injuries or augment chronic ruptures of the Achilles tendon.

Christensen's technique was used for chronic and acute ruptures of the Achilles tendon. A distally based 2-by-10-cm flap was cut in the proximal tendon fragment, turned down to cover the tendon defect or previous repair, and then the defect created by the flap was closed. Using Silfverskiold's technique the graft was rotated through 180°, hence the smooth surface faced posteriorly.

Operative Technique of Turn Down Flap: The patient is placed in prone position. Anesthesia should ensure maximal muscle relaxation. A linear/curvilinear medial incision is made on the posterior aspect of the leg (to minimize the risk of injuring the sural nerve) from the midcalf to the calcaneum, taking care not to cross the midline in the distal part, in order to avoid scarring the tendon.

An incision over the deep fascia is made in the midline after freeing it from the skin, thus making sure that the fascial incision lies fully under the skin flap. The site of the Achilles tendon rupture and the proximal gastrocnemius muscle are thus exposed.

Debridement of the tendon stumps as necessary is done, excising any fibrous tissue that may have formed in between the torn edges.

Next, a flap approximately 2.0–2.5 cm broad and 11–12cm long is raised (depending on the gap to be bridged in case of neglected ruptures) from the middle of the proximal tendon and the gastrocnemius aponeurosis, thus creating a central flap, making sure that the flap is long enough to bridge the gap and it can be sutured securely to the distal tendon.

The flap is left attached for at least 3 cm proximal to the proximal cut end. Next, the central flap is turned upside down on itself and suture it to the distal stump taking care to keep the ankle in appropriate position (neutral to 20 degrees of plantar flexion).

The defect in the proximal tendon and gastrocnemius muscle belly is closed with interrupted sutures.

This step is followed by closure of the tendon sheath and the deep fascia, followed by skin closure and

application of a plaster cast/slab with the ankle in appropriate position.

Post OP Protocol: Above knee anterior POP slab with ankle in neutral or upto 20 degrees of plantar flexion.

Suture line inspection after 2 days and subsequently every 2-3 days till suture removal.

At the end of two weeks, suture removal after ensuring uncomplicated wound healing, and removal of the above knee slab. Another short leg (below knee) cast is applied for two weeks.

After four weeks from surgery, the foot is gradually brought to the neutral position over the next two weeks by serial changes of cast. The patient can gradually resume walking with partial weight bearing on crutches during a two-week period.

At six to eight weeks, a short leg walking cast with the foot in the plantigrade position is applied, and full weight bearing is allowed. Alternatively, a removable brace allowing only plantar flexion is also used.

Gentle active range-of-motion exercises and isometric ankle exercises are started from 6 - 8 weeks. Toe raises, progressive resistance exercises, and proprioceptive exercises, in combination with a general strengthening program, constitute the next stage of rehabilitation.

At 12 weeks, a reverse-90-degree ankle stop brace or similar device can be used and continued until a nearly full range of motion and strength 80% that of the opposite extremity has been obtained within 6 months.



DISCUSSION AND RESULTS

Segmental defects of the Achilles tendon pose a real reconstructive challenge, but the outcome has been analysed well clinical, functional outcomes, patient satisfaction, standing in tip toes, by MRI and M-

mode ultrasound, which can provide enough confidence for anyone to try this solution in a demanding situation.^[11-15]

Tendoachilles turn down plasty uses the native tissue for reconstruction of defect in the tendon ranging from 3 – 8cm, single stage, through a single incision with excellent outcome.^[16]

CONCLUSION

Turn down plasty is the best method for chronic tendoachilles injury with larger defect of 3-6cm. Single stage procedure with single incision ,native reconstruction and less morbidity. Excellent outcome with regain of full function of plantar flexion and dorsiflexion

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