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Original Research

Achilles Tendon Open Repair Augmented With Distal Turndown Tendon Flap and Posterior Crural Fasciotomy

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ABSTRACT

The aim of the present study was to investigate the outcomes after open repair of Achilles tendon rupture augmented with a distal turndown gastrocnemius flap and deep posterior crural fasciotomy based on the modified Lindholm technique. Twenty-three patients with acute Achilles tendon injury underwent open end-to-end tendon repair augmented with a distal turndown gastrocnemius flap and deep posterior compartment fasciotomy. The concentric and eccentric muscle strength was measured using a functional squat system, and dynamic balance was assessed using the Y-balance test with anterior, posteromedial, and posterolateral reach distances. Jump performance was assessed using the vertical jump and 1-leg hop tests. All patients returned to their preinjury activity level, and their mean American Orthopaedic Foot and Ankle Society hindfoot scale score was 98.2 ± 2.3 after surgery. No significant difference was found between the involved and uninvolved extremities in terms of concentric and eccentric muscle strength ($p = .82$ and $p = .53$, respectively). In addition, no significant differences were seen between legs in the vertical jump ($p = .16$), one-leg hop ($p = .15$), and balance ($p > .05$) tests. Open end-to-end repair of the Achilles tendon rupture with augmentation and fasciotomy of the deep posterior compartment healed without any major complications. Functional performance of the involved leg after recovery was similar to that of the uninvolved leg. The modified Lindholm surgical technique described in our report appears to be a useful intervention for acute Achilles tendon rupture.

Achilles tendon injuries are frequently encountered in middle-age people participating in sports activities (1,2). Controversies are ongoing regarding treatment of Achilles tendon injuries, and a general consensus regarding the optimal treatment strategy has not yet been reached (3–11). Achilles tendon rupture generally occurs 2 to 5 cm above the insertion of the tendon into the calcaneus (Fig. 1). In many cases, the requirements for nonoperative treatment will not be met. (11) It is known that the ruptured ends of the proximal and distal segments of the tendon often retract and remain separated, with fibrous tissue filling the cleft, and thus the tendon fails to function properly (12). Complications such as wound dehiscence, infection, and repeat rupture have been accepted as contraindications for surgical repair in many patients (13–15). However, because of the desire of the active patients to return to their preinjury activity levels, physicians are often prompted to perform surgical repair (3,7–9), and foot and ankle surgeons have continued to search for constructive techniques to decrease the problems associated with open surgical repair (5,6,14–18). However, a high incidence of failure has been reported with novel surgical approaches (5,15,17). Nonoperative and endoscopic techniques have also been used to restore continuity of the Achilles tendon in an effort to avoid complications such as wound dehiscence and repeat rupture, which often occur after open surgical repair. A meta-analysis of treatment of acute Achilles tendon rupture showed a significantly reduced rate of repeat rupture with surgical repair compared with nonoperative treatment (18,19). Although very low rates of complications have been reported with endoscopic techniques, the sural nerve is at risk during the passage of sutures through the tendon by way of small stab incisions (20). Some investigators have argued that such complications might be reported and the symptoms might resolve spontaneously during the follow-up period (21,22).

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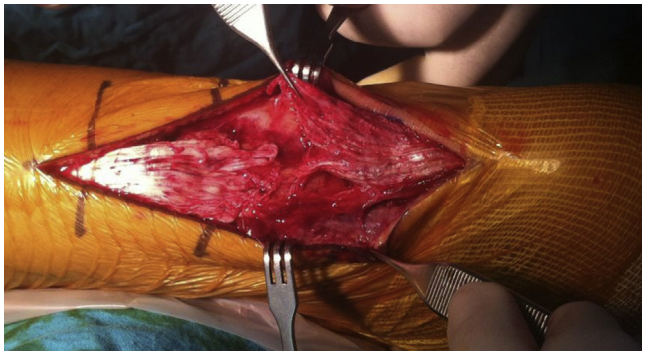

Fig. 1. Intraoperative view showing "horsetail appearance" of the injured Achilles tendon.

In the present study, an augmented repair using a modified Lindholm technique was performed with a single gastrocnemius tendinous flap that was turned down distally and bridged over the repair site in patients with an acute Achilles tendon rupture. Additionally, a fasciotomy through the deep posterior compartment was used to decrease the tension after skin closure. The purpose of the present study was to evaluate the outcomes associated with open repair of acute Achilles tendon rupture using the distal turndown flap and posterior crural fasciotomy.

Patients and Methods

The institutional review board of Gazi University approved the present study. A total of 28 patients with a unilateral acute Achilles tendon rupture who had been admitted to our hospital from March 2005 to December 2011 were screened for the present study. They had been treated with a distal turndown flap and posterior crural fasciotomy, and the same surgeon (H.Ö.) performed all the operations.

The inclusion criteria of the study were complete rupture of the Achilles tendon and presentation to our clinic within 72 hours of the injury. The diagnosis of the rupture was determined from the clinical and medical history findings, including a positive Thompson-Dougherty squeeze test and palpation of a gap in the injury region of the tendon. Patients with chronic Achilles tendon injury and partial Achilles tendon injury and those who had undergone revision of Achilles tendon repair and/or had a history of lower extremity injury during the previous 6 months in the contralateral limb were excluded from the present study.

Of the 28 injuries, 22 (79%) were left-sided and 6 (21%) were right-sided tendon injuries. Five of the subjects (17.9%) had a chronic tendon injury, and their data were not included in the present study. Conservative treatment with early rehabilitation was encouraged for the partial tendon injuries. Thus, 23 patients were included in the present study (Table 1).

The mean follow-up duration was 28.6 ± 13.5 (range 18 to 72) months. Of the 23 Achilles tendon ruptures, 15 (65.2%) were associated with sports injuries and 8 (34.8%) had been sustained during activities of daily living. All the operations were conducted with the use of spinal anesthesia, and prophylactic antibiotic therapy was performed with cefazolin, and low-molecular-weight heparin (enoxaparin sodium or dalteparin) was started at 12 hours postoperatively and continued for 2 weeks to prevent deep vein thrombosis.

Table 1
Demographic characteristics

Characteristic	Value
Patients (n)	23
Gender	
Male	22 (96)
Female	1 (4)
Age (y)	
Mean ± SD	39 ± 8.9
Range	28 to 57
Body weight (kg)	81.4 ± 7.7
Height (cm)	176.3 ± 8.1
BMI (kg/m^2)	26.2 ± 1.8
Injured side	
Left	17 (74)
Right	6 (26)
Injury type	
SI	15 (65)
DA	8 (35)

Abbreviations: BMI, body mass index; DA, daily activity; SD, standard deviation; SI, sports injury.
Data presented as mean ± SD or n (%).

Fig. 2. Intraoperative view of deep posterior crural fasciotomy performed before tendon repair.

Surgical Technique

The patients were placed in the prone position, with a tourniquet applied to the upper thigh of the affected site. An incision was placed on the medial border of the Achilles tendon. Subcutaneous tissue and the edematous paratenon were incised. The ruptured ends of the tendon were trimmed, and ≥3 rows of no. 5 Ethibond locking sutures (Ethicon, Somerville, NJ) were placed using the Krackow technique in each end. The stitches were placed away from the repair site. Digital palpation was performed to check the repair construct anteriorly after the stitches had been secured. A distal augmentation procedure was performed in cases with a gap of 5 mm at the repaired tendon ends that had resulted from stretching of the sutures by passive ankle movement. Next, a single-strip turndown tendon flap, 1 to 1.5 cm wide, and 6 to 8 cm long from the proximal portion of the Achilles tendon was raised. The flap was turned down 180° anteriorly and advanced distally without rotation of the tendon slip on itself with adequate tension (Fig. 2). The tendon flap bridged the repair site distally, and sutures were placed beginning from distally to proximally on both sides of the tendon slip over the repair area. After the sutures were placed, the repair site was checked again by digital palpation on both sides of the tendon. The deep posterior crural fascia was incised along the repair site proximally and distally (Fig. 3) either by retracting the repaired tendon laterally or performing the fasciotomy before the repair had been completed. The harvest site proximal to the repair area was then closed with interrupted absorbable sutures (Fig. 4). The paratenon was carefully repaired, and a closed suction drain was placed in the wound and exited percutaneously. The subcutaneous tissue and skin were closed, and the leg was placed in a well-padded splint with the ankle in 20° of plantarflexion.

Physiotherapy

Toe curls and gentle foot movements were allowed in the splint immediately after surgery. Additionally, knee flexion and extension exercises and straight leg raises were encouraged. Motion of the ankle from 20° of plantarflexion to neutral was gradually achieved during the first 2 postoperative weeks. After removal of the sutures, weightbearing from toe touchdown to partial weightbearing was allowed, starting in a walking boot assisted with crutches, beginning at 3 weeks postoperatively. Assisted exercises were also allowed 2 to 3 times daily, beginning at 4 weeks postoperatively, with dorsiflexion restricted and plantarflexion of the operated side encouraged. The patients were instructed to walk without support beginning at 5 weeks postoperatively. Stretching of the tendon was allowed gradually after 8 weeks, with great care not to cause excessive stress on the Achilles tendon. Forceful active and passive range of motion exercises of the Achilles tendon were initiated at 10 to 12 weeks after surgery. Regular soft tissue treatment, including scar mobilization and friction massage on the incision area and tendon, were carefully managed to decrease fibrosis of the skin and tendon. Running, jumping, and sudden accelerated activities were not recommended before 5 months after surgery.