Agustin Garabito · Jesus Martinez-Miranda ·
Joaquin Sanchez-Sotelo

Augmented repair of acute Achilles tendon ruptures using gastrocnemius-soleus fascia

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Abstract Fifty-four consecutive acute Achilles tendon ruptures were treated with end-to-end suture augmented with gastrocnemius fascial flaps. Surgery was performed within 24 h. Mean patient age was 35 (23–57) years, and 46 were men. Mean follow-up time was 4.8 (2–8) years. At follow-up, the mean visual analogue scale for pain was 0.49, and the mean AOFAS ankle–hindfoot score was 95 (74–100) points. Fifty-three patients were able to stand on their tiptoes for 30 s and perform repeated toe raises, and 50 patients were able to perform single-limb hopping. Complications included rerupture in one case, deep infection in three cases, delayed wound healing in eight cases, and deep venous thrombosis in one case. Reconstruction of acute ruptures of the Achilles tendon augmented with gastrocnemius-soleus fascial flaps provided a good outcome but was associated with a high complication rate.

Résumé Cinquante-quatre ruptures récentes, consécutives, du tendon d’achille ont été traitées par suture bout à bout augmentée par un lambeau fascial du muscle jumeau. La chirurgie a été exécutée dans les vingt-quatre heures suivant la rupture. L’âge moyen des malades était de 35 ans (23–57) et 46 étaient de sexe masculin. Le temps de suivi moyen était de 4,8 ans (2–8). Au dernier examen la cotation visuelle moyenne pour la douleur était 0,49 et le score moyen de cheville AOFAS était de 95 points (74–100). Cinquante-trois malades étaient capables de se tenir sur la pointe des pieds trente secondes et d’exécuter des extensions d’orteils répétées, et 50 malades étaient capables d’exécuter un sautiller monopodal. Les

complications ont été une rupture itérative dans un cas, une infection profonde dans trois cas, un retard de cicatrisation cutanée avec évolution favorable dans huit cas, et une thrombose veineuse profonde dans un cas. La reconstruction des ruptures récentes du tendon d’achille avec utilisation d’un lambeau du fascia des jumeaux a fourni un bon résultat mais avec un taux élevé de complications.

Introduction

The treatment of acute ruptures of the Achilles tendon remains controversial. Some authors recommend non-operative treatment whereas others advocate surgical treatment [9, 20, 21]. In a prospective randomized study, Nistor found similar outcomes with surgical and non-surgical treatment [12]. However, several recent reports have favoured operative treatment in order to allow a faster recovery and minimize the rerupture rate. Surgical techniques include simple end-to-end suture [1, 2, 16, 17, 19] and several procedures for augmented reconstruction [5, 13, 22].

Augmented reconstruction, initially developed for chronic or neglected ruptures, is now also used for acute ruptures by some authors [22]. Simple end-to-end suture is easier and can be performed through a more limited approach [2, 16]. However, surgical augmentation may provide a stronger reconstruction, allow a more intensive rehabilitation program, and decrease the rerupture rate. At our institution, most acute ruptures of the Achilles tendon are treated surgically with augmented reconstruction using the gastrocnemius-soleus fascia. The purpose of this study was to report the results and complications of a consecutive series of acute ruptures of the Achilles tendon using this technique.

A. Garabito · J. Martinez-Miranda · J. Sanchez-Sotelo
Department of Orthopaedic Surgery, Hospital “La Paz”,
Madrid, Spain

J. Sanchez-Sotelo (✉)
Department of Orthopedic Surgery, Mayo Clinic,
200 First Street SW,
Rochester, MN 55905, USA
e-mail: sanchezsotelo.joaquin@mayo.edu
Tel.: +1-507-5381953
Fax: +1-507-2664234

Materials and methods

Patients

From 1995 to 2001, 54 patients with an acute rupture of the Achilles tendon were treated consecutively at our institution with surgical reconstruction augmented with gastrocnemius-soleus fascial flaps. There were 48 men and six women with a mean age at the time of the injury of 35 (range, 23–57) years. The injury occurred during the practice of sports in 43 cases. The remaining 11 patients sustained the rupture as a result of a simple fall. Prior to the injury, 49 patients practiced sports from one to three or more times per week. Thirty had a sedentary profession, and 24 had a physically active job.

On physical examination, all patients complained of pain and impaired gait and presented a palpable gap in the Achilles tendon associated with a positive Thompson test. Anteroposterior and lateral radiographs were made in order to exclude the possibility of associated fractures. The diagnosis was confirmed with ultrasound in ten cases.

Surgical technique

Surgery was performed within 24 h under spinal anesthesia and antibiotic prophylaxis with intravenous cefazolin (2 g 30 min prior to inflation of the tourniquet and 1 g every 6 h for 48 h) in all cases. All patients were operated

on in the prone position. The mean operative time was 71 (range, 40–145) min, and the mean tourniquet time was 68 (range, 35–125) min.

Reconstruction was performed through a posteromedial skin incision. The deep fascia was divided along the course of the skin incision without prior elevation of subcutaneous flaps; the sural nerve was left included in the lateral flap. The peritenon was then incised in the midline to avoid scarring of the peritenon closure to the skin incision. The frayed tendon ends were lightly debrided and approximated with a number 2 nonabsorbable braided nylon suture using a Kessler configuration, taking care to reproduce the position of the opposite noninjured ankle. The end-to-end suture was completed with multiple interrupted stitches using number 2-0 Vicryl absorbable suture.

Augmentation was then performed with the gastrocnemius-soleus fascia in all cases (Fig. 1). Two fascial flaps were used in 26 cases according to the Lindholm technique, and a single central fascial flap was used in 28 cases. The length of the flaps was measured in order to reinforce the repair from 2 cm proximal to the rupture site to the Achilles tendon insertion into the calcaneus. The flaps were secured with number 2-0 Vicryl absorbable suture. The fascial defect proximal to the augmentation was closed side to side, and the peritenon was meticulously repaired to cover the area of repair. Fascial and skin closures were routine. After surgery, a compressive dressing was applied, and the limb was immobilized

Fig. 1 a Acute complete rupture of the Achilles tendon. b End-to-end suture. c Augmentation is performed with one or two flaps from the gastrocnemius-soleus fascia. d The flaps are sutured over the repair, and the proximal fascial defect is closed side to side.

with a below-the-knee posterior plaster slab keeping the ankle in slight plantar flexion.

Postoperative management

The immobilization splint and skin sutures were removed at the end of the third week. Active-assisted range-of-motion exercises were allowed at that point, and protected weight-bearing with crutches was allowed at 6 weeks. A more intensive program of ankle motion, stretching, isometric, and proprioceptive exercises was begun at 8–10 weeks, running on an even surface was allowed at 3 months, and unlimited activities at 6 months.

Evaluation

All patients were requested to return for an evaluation performed by one of the authors that had not been involved in the surgical treatment of any of the cases. The evaluation included pain rating using a visual analogue scale (VAS), measurement of ankle range of motion using a goniometer, a detailed neurological examination with particular attention to the sural nerve, and questions about subjective satisfaction and sports, work, and activities performed before surgery and at final follow-up. Complications were recorded both from the charts and at the evaluation interview. Patients were also requested to perform three tasks more specific to repair of an Achilles tendon rupture, namely, the ability to stand on the tiptoes for 30 s, to perform repeated toe raises for 30 s, and single-limb hopping [2, 7]. For single-limb hopping, patients were requested to hop as many times as possible until they could not lift the heel off the floor. The overall clinical outcome was assessed using the ankle–hindfoot scale of the rating system of the American Foot and Ankle Society (AOFAS) [7]. Results were rated as excellent (100–90 points), good (89–80 points), fair (79–70 points), or poor (<70) according to Kitaoka et al. [8].

Results

None of the patients was lost to follow-up. Mean follow-up time was 4.8 (range, 24–96) months. At the most recent follow-up, the mean VAS for pain was 0.49 (range, 0–4.5). There was no pain in 31 cases and mild pain (VAS score ≤ 3) in 23 cases. None of the patients complained of moderate or severe pain. The mean VAS score for patient satisfaction was 8.9 (range, 4–10). The mean ankle plantar flexion was 136° (range, 120–140°) on the injured side compared to 138° (range, 120–150°) on the normal side. The mean ankle dorsal flexion was 12° (range, 0–20°) on the injured side compared to 17° (range, 5–21°) on the normal side.

Before the injury, 49 patients practiced sports on a regular basis. At the most recent follow-up, 23 had returned to their preinjury level, 25 had some kind of

limitation, and six were not practicing any sports at all. None needed to change their job because of the injury. On physical examination, 53 patients were able to stand on their tiptoes for 30 s and were able to perform repeated toe raises for 30 s, and 50 were able to perform single-limb hopping. At most recent follow-up, the mean AOFAS score was 95.4 (range, 74–100) points. According to this score, 45 cases were considered excellent, eight good, and one fair.

One patient who suffered a new traumatic event sustained a partial disruption of the reconstruction that was treated conservatively; at most recent follow-up, 3 years after the surgery and 2.2 years after the second injury, the patient had mild pain, was satisfied with the outcome, practiced soccer and running, and his AOFAS score was 90 points. Three patients experienced transient paresthesias in the territory of the sural nerve in the first postoperative months. However, at most recent follow-up, none of the patients had neurological abnormalities, and the sensation in the territory of the sural nerve was preserved in every case. Three patients developed a deep infection that required surgical debridement and intravenous antibiotic therapy: at most recent follow up, one had no pain, was satisfied with the outcome, practiced sports with some limitations, and her AOFAS score was 87; the second had no pain, practiced sports without any limitations, and had an AOFAS score of 97; and the third had mild pain, practiced sports with limitations, and had a AOFAS score of 82. In addition, eight patients had delayed healing of the surgical wound that did not affect the final outcome. Finally, one patient with Factor V Leiden developed a deep venous thrombosis that resolved with antithrombotic therapy for 3 months and did not affect the final outcome.

Discussion

The treatment of Achilles tendon rupture remains controversial. Most published reports have included patients treated either conservatively or surgically. In one of the few prospective randomized studies published to date, Nistor found only minor differences between the final results of surgical and nonsurgical treatment. There were more reruptures in the conservative group, but infection complicated two of the surgically treated patients [12]. However, at the present time, many authors favour operative treatment for acute ruptures of the Achilles tendon [2, 9, 10, 17, 19, 22].

When surgery is considered, controversy also persists about the ideal surgical technique for this injury [2, 13]. Simple end-to-end suture is easier to perform and requires a less extensive dissection [16], but the poor quality of the tendon at the rupture site may compromise the strength of the repair. Surgical techniques have been developed to perform end-to-end suture of the Achilles tendon percutaneously [11, 15, 17, 19], though the incidence of rerupture and sural nerve injury seems to be higher with percutaneous techniques [1, 3, 18]. On the contrary,

augmented reconstruction provides a stronger repair that may allow a more aggressive rehabilitation program and reduce the incidence of rerupture. These advantages have to be balanced against the potential for an increased rate of wound complications and infection [14] due to the more extensive approach and prolonged operative and tourniquet times.

The data of our study show that augmented repair of acute Achilles tendon ruptures using gastrocnemius-soleus fascial flaps provides a satisfactory result in many cases. After a mean follow-up of 4.8 years, most patients had no pain, were subjectively satisfied with the outcome, and had good or excellent results according to the ankle-hindfoot AOFAS score. These results compare favourably with those reported with both open and percutaneous end-to-end suture [1, 2, 3, 11, 16, 17, 19]. Nyyssonen et al. [13] retrospectively compared 39 repairs and 59 augmented reconstructions and found no differences in outcome. However, maybe the benefit of augmented reconstruction was not shown because patients were rehabilitated similarly regardless of the strength of reconstruction. In a prospective randomized study, Cetti et al. found better results with early motion after surgery [4]. Zell and Santoro [22] reported on 25 acute Achilles tendon ruptures managed with an augmented repair using the gastrocnemius-soleus fascia and found no reruptures and full ankle motion by 4–8 weeks.

However, augmented repair of Achilles tendon ruptures is not devoid of complications. Three of our patients developed a deep infection that required surgical debridement. Infection is a serious complication that can compromise final outcome [14]. The other feared complication of Achilles tendon rupture, rerupture, may actually be diminished by an augmented reconstruction although we did have one case in our series [22]. Injury to the sural nerve can also be avoided if the skin incision is placed posteromedially and the sural nerve is kept within the lateral skin flap. In order to avoid wound complications when augmented reconstruction is performed, we believe it is critical not to place the skin incision in the midline, to be extremely careful with soft-tissue handling, and to use mainly absorbable sutures.

One of the interesting findings of our study was the relatively low return to the practice of sports several years after reconstruction at the same level as before the injury in spite of the good objective and subjective results. This could be due to several factors, including the limited number of professional sport players in our series, fear to a new injury, or lack of leisure time. Similar findings have been reported in other sports-related injuries, such as anterior cruciate ligament injuries; a significant number of patients with a successful anterior cruciate ligament reconstruction do not practice sports several years after the surgery [6].

In conclusion, augmented repair of acute Achilles tendon ruptures using gastrocnemius-soleus fascial flaps provides good subjective and objective results in most patients. Augmentation adds a sufficient amount of collagen to allow early range of motion and weight

bearing with a reasonable rerupture rate. The main disadvantages of this technique are the need for a more extensive dissection, the longer operative time, and the risk of complications, including deep infection and wound problems. In spite of the satisfactory ankle function obtained in this series, a significant number of patients do not return to their preinjury level of sport practice.

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