Repair of Achilles tendon ruptures with peroneus brevis tendon augmentation

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ABSTRACT

Purpose. To report 22 patients who underwent repair of compound Achilles tendon ruptures with peroneus brevis tendon augmentation.

Methods. Records of 6 women and 19 men aged 21 to 42 (mean, 28) years who underwent repair of compound Achilles tendon ruptures with peroneus brevis tendon augmentation were reviewed. All the wounds were transverse/oblique, minimally contaminated, and could be closed primarily. Patients were evaluated at months 3, 9, and 12, using the Foot and Ankle Outcome Score (FAOS) questionnaire.

Results. Of the 22 patients, 3 developed superficial skin complications that healed gradually, and 2 developed a superficial discharging sinus and underwent minor debridement. No patient had a re-rupture of the Achilles tendon. At the one-year follow-up, all patients achieved good functional outcome in terms of the FAOS.

Conclusion. Repair of Achilles tendon ruptures with peroneus brevis tendon augmentation achieved good functional outcome.

Key words: Achilles tendon; tendon transfer

INTRODUCTION

Achilles tendon ruptures are common.1,2 Compound ruptures of the Achilles tendon are difficult to treat, because end-to-end repair of such ruptured tendons is difficult and prone to failure, infection, and skin necrosis. Freshening of the tendon ends is necessary when they are shredded. Coaptation of the shortened ends may impair adequate dorsiflexion of the foot. Hence, even in fresh ruptures, the repair of Achilles tendon should be augmented with tendon grafting, tendon transfer, or reinforcement with synthetic materials. The tendon of the flexor hallucis longus, plantaris, and peroneus brevis are often used for augmentation.3,4 We report 22 patients who underwent repair of compound Achilles tendon ruptures with peroneus brevis tendon augmentation.

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MATERIALS AND METHODS

Records of 6 women and 19 men aged 21 to 42 (mean, 28) years who underwent repair of compound Achilles tendon ruptures with peroneus brevis tendon augmentation in our hospital between August 2008 and March 2010 were reviewed. All the wounds were transverse/oblique, minimally contaminated, and could be closed primarily. They were secondary to toilet seat injuries, industrial accidents, or sharp cuts. Patients who were diabetics, aged >60 years, or had a history of multiple steroid injections at the Achilles tendon were excluded.

The surgical technique was based on the study by Turco and Spinella. Patients were placed in a prone position under regional or general anaesthesia. An upper thigh tourniquet was used. Dirt and foreign bodies were removed. A posterolateral longitudinal incision was made and, if required, modified according to the transverse or oblique wound. Care was taken to avoid damage to the sural nerve. The ruptured tendon was trimmed and No.1 Vicryl was used as a locking suture along the free tendon edge to prevent separation of the bundles. Through a separate incision, the peroneus brevis tendon was identified at its insertion at the base of the fifth metatarsal. The tendon was released from the surrounding tissue using a tendon stripper. The aponeurotic septum separating the lateral and posterior compartment was also incised to deliver the peroneus brevis tendon through the proximal surgical wound. The muscular belly of the tendon proximally was then mobilised to increase the excursion of the tendon. The resting equine position of the uninjured leg was noted, so as to produce the same degree of equinus in the injured leg. The peroneus brevis tendon was then passed through a mid coronal slit in the distal stump of the Achilles tendon and then reversed upwards up to the proximal end of the tendon. The tendon graft was sutured to the distal and proximal stump of the Achilles tendon using multiple interrupted sutures with No.1 Vicryl (Fig.). In patients with an insufficient distal stump, the peroneus brevis tendon was passed through a drill hole at the calcaneal tuberosity.

Postoperatively, an above-knee posterior plaster of Paris slab was applied, with the ankle at gravity equinus and the knee at 45° of flexion. Active movement of the toes and isometric exercises of the calf muscles were encouraged. At week 2, suture was removed in the out-patient department and a below-knee slab was used for further 2 weeks. At week 4, ankle movement exercises focusing on plantar flexion, inversion, and eversion were started. Toe-touch weight bearing with the help of a walking aid was allowed. At week 8, full weight bearing was allowed after a full range of ankle movement had been regained. Patients were followed up every 2 weeks for the first 8 weeks and then every month for the next 3 months, and at 9 months and one year.

Patients were evaluated at months 3, 9, and 12, using the Foot and Ankle Outcome Score (FAOS) questionnaire, which consisted of 5 subscales: pain, other symptoms, activities of daily living, function in sport and recreation, and foot and ankle–related quality of life. Each question was scored 0 to 4. A normalised score (100 indicating no symptoms and 0 indicating severe symptoms) was calculated for each subscale.

RESULTS

Of the 22 patients, 3 developed superficial skin complications (edge necrosis and/or inflammation) that healed gradually with regular dressing over 2 to 5 weeks. Two others developed a superficial discharging sinus and underwent minor debridement. All wound swab cultures were sterile. No patient had a re-rupture of the Achilles tendon. The mean FAOS of each subscale improved significantly from months 3 to 12 (Table). At the one-year follow-up, all patients achieved good functional outcome in terms of the FAOS.
In compound Achilles tendon ruptures, the overlying skin and subcutaneous tissue are often devascularised and contaminated. The torn tendon ends may be so shredded and necessitate trimming. End-to-end tendon repair is difficult and prone to failure and wound healing problems. Nonetheless, the compound wounds in our patients could be closed primarily, and thus no rotation flap was needed.

Wound complications tend to occur at the repair site, because of increased tissue bulk and compromised blood supply. In one study, 20% of surgically repaired Achilles tendons developed wound complications. In another study, a mere 1.5% infection rate occurred in 67 Achilles tendon repairs, but whether the injuries were open or closed was not mentioned. The infection rate is usually higher in compound ruptures. The thin subcutaneous tissue over the Achilles tendon, the limited blood supply, and mobilisation of the skin all contribute to higher complication rates. Resorting to a transverse incision is suggested to overcome these wound complications. In our study, the incision was not strictly vertical and was modified according to the transverse wound. Therefore, tension along the sutured wound was reduced at the transverse segment.

Achilles tendon repair is commonly augmented with the plantaris tendon, peroneus brevis tendon, and flexor hallucis longus tendon. The latter 2 have comparable mechanical properties. Plantar flexors are the muscles that push off the ground during walking. Harvesting the plantar flexors results in weakening the push-off phase of walking, and is distressing, particularly in young persons. In cadavers, the failure load was significantly higher in Achilles tendons reconstructed with the peroneus brevis tendon. After peroneus brevis tendon augmentation, the strength of eversion may be mildly weakened but that of plantar flexion can be maintained. The 2 peroneal muscles contribute only 4% of the work capacity for plantar flexion, but for eversion the peroneus brevis tendon contributes about 28% of the total work strength. Thus, the use of the peroneus brevis tendon may cause a strength deficit in eversion of the ankle but a negligible deficit in planter flexion. Nonetheless, the peroneus longus, which is the major evertor of the hind foot, may take over some of the functions of the peroneus brevis. Thus, subjective weakness in ankle function after peroneus brevis tendon augmentation is minimal. Nonetheless, in our patients, ankle movement exercise was performed during rehabilitation.

The plantaris tendon may not be present in all individuals or capable of producing a strong reconstruction because of its thin structure, although it may be hypertrophied after chronic tears. The flexor hallucis longus tendon is an alternative, but its detachment from insertion can cause forefoot morbidity. In addition, there may be weakness of the hallux, reduced pressure under the great toe, and impaired load transfer to the metatarsal heads resulting in gait asymmetry, as well as decreased flexion power at the inter-phalangeal joints. This may be troublesome in young athletic patients, as it may impair the push-off phase in running activities.

The rupture sites may exhibit profound biochemical and gene expression changes and result in degeneration and reduction in tendon strength, even after end-to-end repair. Augmentation with tendon transfers may supply healthy tissues to the area with degenerative changes and aid healing. Furthermore, the muscular belly of the peroneus brevis tendon is close to the tendinous part of the Achilles tendon (which is less vascular and compromised by the surgery itself) and thus acts as a muscular flap that promotes vascularisation of the repaired tendon.

**DISCUSSION**

**Table**

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<thead>
<tr>
<th>Subscale</th>
<th>Mean±SD FAOS</th>
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<tbody>
<tr>
<td></td>
<td>3 months (n=15)</td>
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<tr>
<td>Pain</td>
<td>61.3±2.0</td>
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<tr>
<td>Other symptoms</td>
<td>58.3±3.5</td>
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<tr>
<td>Activities of daily living</td>
<td>53.0±7.5</td>
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<tr>
<td>Function in sport and recreation</td>
<td>51.3±10.4</td>
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<td>Foot and ankle–related quality of life</td>
<td>55.8±10.2</td>
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No conflicts of interest were declared by the authors.
REFERENCES