



Long term results of acute Achilles repair with triple-bundle technique and early rehabilitation protocol



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ABSTRACT

Background: The best treatment for acute rupture of the Achilles tendon is still under debate. Our purpose was to evaluate surgical triple-bundle technique in selected patients with full subcutaneous rupture of Achilles tendon.

Methods: Sixty-six consecutive patients (56 men, 10 women; age range 20–61 years) with full unilateral rupture of the Achilles tendon were surgically treated by the triple-bundle technique. Seventy-four percent of the lesions occurred during sport activity. Each patient was assessed by: (1) The American Orthopaedic Foot and Ankle Society (AOFAS) score; (2) the Leppilahti score; (3) the range of movement measurement of ankle joint; (4) ipsilateral thigh, calf, and ankle circumferences compared to the contralateral limb; (5) functional evaluation with isokinetic dynamometry of both limbs.

Results: 80.3% of the patients were fully satisfied (AOFAS ≥ 90) with treatment and resumed their previous level of sport. Concerning the outcomes, (1) the mean AOFAS score at 36 months was 93.9; (2) the mean Leppilahti score at 36 months was 91.8; (3) the mean difference in dorsiflexion and plantarflexion between the healthy side and the operated side was 4.3° and 6.9°, respectively. We observed calf muscle hypotrophy in two cases and scar complication in one. No re-ruptures occurred. Isokinetic tests performed 36 months after surgery showed a good restoration of plantarflexion. At univariate analysis AOFAS was influenced by age and difference between the healthy side and the operated side in dorsiflexion, plantarflexion, and circumference at all three levels and strength at 60°/s. At univariate analysis, Leppilahti score confirmed the significant parameters of the AOFAS with the exception of age and difference of thigh circumference. The only predictive parameters in multivariate analysis were dorsiflexion difference (O.R. = 0.831; 95% C.I. 0.694–0.995; $p = 0.044$) and plantarflexion difference (O.R. = 0.777; 95% C.I. 0.631–0.958; $p = 0.018$).

Conclusion: In this case series the triple-bundle technique showed a low rate of complications and good functional restore tested with isokinetic tests. For these reasons afforded by biomechanical strength test reported in literature, this technique has to be considered a valid choice for the treatment of Achilles tendon rupture in young patients with a high level of sport activity.

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Introduction

The best treatment for acute rupture of the Achilles tendon is still debated [1,2]. Literature exists to support non-operative treatment [3], traditional open repair, percutaneous repair [4–6], and repair with a “mini-open” technique [7,8]. Rehabilitation protocols also vary tremendously, with some data suggesting good success with early mobilization, particularly in young active patients [9–11]. In a systematic review of the literature, surgical

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treatment has been recommended as the optimal strategy based on an assessment of outcome probabilities with particular attention paid to re-rupture and complications [12]. It has been suggested that patients should be allowed to make an informed decision based upon the probability of success and complications. But there is no absolute consensus about the best type of surgical repair: there is some evidence to suggest that an end-to-end suture technique leads to more successful outcomes with a reduced rate of complications [13] when compared to approaches utilising tendon augmentation [13,14]. Jaakkola et al. in 2000 [15] designed a study to compare the tensile strength of ruptured Achilles tendons repaired using either the triple bundle technique or the Krakow locking loop technique. Eight pairs of fresh frozen cadaver Achilles tendons were harvested. A simulated “Achilles tendon rupture” was created 4 cm from the calcaneal insertion in all sixteen tendons by transversely cutting the tendon with a scalpel. One Achilles tendon “rupture” of a pair was repaired using the triple bundle technique, while the other tendon of the pair was repaired using the Krakow locking loop technique. Then, using a servo-hydraulic testing machine, each tendon was tested to failure in tension. The difference in average rupture load for the triple bundle technique and the average rupture load for the Krakow locking loop technique represented a statistically significant superiority in favour of the triple bundle technique. Jaakkola et al. in 2001 [16], realised a study to evaluate the triple bundle technique for acute Achilles tendon rupture repair followed by early (14 days) postoperative ankle range of motion compared to non-operative treatment with delayed ankle range of motion. They retrospectively reviewed 73 patients with an acute Achilles tendon rupture treated with either a plantar flexed cast or with surgical repair. Operative treatment reduced immobilization time, allowed safe early return to weight bearing, and diminished risk of re-rupture compared to non-operative treatment. However, at an average follow-up greater than 3.5 years, there was no statistical difference in AOFAS hindfoot scores, strength, or patient satisfaction between the two groups. Significant complications were higher in the non-operative group manifested by three re-ruptures vs. one deep wound dehiscence in the operative group (3%).

The aim of this study was to present the clinical (Range of motion, AOFAS score, Leppilahti score, and circumference of tight, calf and ankle) and functional results (Isokinetic tests) at 36 months follow up obtained in 66 consecutive patients treated surgically by the same surgeon by the triple-bundle technique with end-to-end suture according to Marti et al. [17] and an early rehabilitation protocol.

Materials and methods

Sixty-six consecutive patients (56 men; 10 women) presenting with complete unilateral rupture of the Achilles tendon, treated by a single surgeon at our institution between February 1995 and December 2007, were included in this study. During this period, patients with a history of diabetes, hyperuricemia, vasculopathy, and systemic diseases requiring immunosuppressive agents were not treated surgically due to the higher potential for wound complications. All patients were previously evaluated in our emergency room and then hospitalised in the same day. Six patients (12%) had been previously treated with corticosteroid injections in or around the tendon. Demographic and clinical variables are reported in Table 1. The rupture involved the left limb in 30 patients and the right limb in 36 patients. The mean age in the cohort was 38.3 years (range 20–61). The highest number of ruptures occurred in the fourth decade of life (31/66, 47%), followed by the fifth decade (19/66, 29%), the third decade (11/66, 17%), and finally the sixth decade (3/66, 4%). Two patients aged 61 years-old were treated in their seventh decade of life (2/66, 3%). Nineteen

Table 1
Demographic and clinical variables.

Variables	Mean	SD	Range
Age (years)	38.3	8.8	20–61
Weight (kg)	76.2	10.9	51–109
Height (cm)	172.0	8.0	150–186
BMI (kg/m ²)	25.7	3.5	17–36
Male:female	56:10		
Side	Left 30	Right 36	

patients (29%) were smokers (more than 10 cigarettes/day). The majority of ruptures (49/66, 74%) occurred during recreational sports activity (tennis, soccer, basketball). A surprising audible pop at the moment of the rupture was reported by 78% of the patients.

The diagnosis of Achilles tendon rupture was initially made clinically on the basis of a palpable defect at the site of the rupture and a positive Thompson test. However, an ultrasound scan was performed in all cases to detect and confirm the diagnosis. The rupture was localised at 3–8 cm and at 2–3 cm from the calcaneal insertion in 58 patients (88%) and 8 patients (12%) respectively. All ruptures showed signs of tissue degeneration and fraying of the tendon stumps.

Surgical technique

The patient was positioned prone on the operating table. Repair was performed under spinal (48%), general (34%), or combined sciatic-femoral regional block (18%) anaesthesia. A non-sterile thigh tourniquet was applied and inflated after exsanguinations of the injured limb in all cases.

A posteromedial longitudinal approach was used, making a full-thickness incision down to the paratenon. Care was taken to avoid subcutaneous tissue dissection and tissue flaps. The paratenon was incised in line with the skin incision. Then the torn fibres of the tendon were exposed, irrigated, and debrided, taking care not to damage the anterior vascular supply of the tendon (Fig. 1A). Degeneration of ruptured tendon ends was detected in 39 cases (59%), without involvement of the paratenon. After accurate debridement, all of the tendons were considered repairable without sliding using the above mentioned triple-bundle technique. The tissue was organised into three bundles, two proximal and one distal. Reabsorbable no. 2 sutures (Polysorb, Covidien) were used to gain good purchase into each bundle using the Bunnell-type technique (Fig. 1B). Then these three bundles were repaired to each, end to end, with the suture ends from each tendon bundle (Fig. 1C). The resting tension was restored in all cases, taking care not to create excessive shortening (maximum 10° of plantarflexion). The mechanical strength of the repair was tested gently before closure. The paratenon was closed over the repaired tendon using 2/0 absorbable suture (Polysorb, Covidien). Then the skin was approximated using 3/0 absorbable suture (Polysorb, Covidien). A sterile dressing was placed, followed by a walker brace applied with 10° of plantar-flexion.

Postoperative protocol

All patients were discharged the day after surgery if the condition of the patient was not complicated by other factors (mean hospitalization 1.4 days). The patients were allowed to get out of bed on the first postoperative day, with the help of two forearm crutches. The walker boot was maintained for the first 6 weeks. During the first 2 weeks after surgery, the patient was kept non weight bearing and instructed to elevate the leg when sitting. However, they began passive motion of the ankle.

At the beginning of the third week, the sutures were removed and the walker boot was moved to and locked in neutral position.

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