

Original Research Article

Surgical Management of Neglected Achilles Tendon Rupture

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Abstract: This retrospective study concerns 40 cases of neglected rupture of the Achilles tendon listed in the Traumatology-Orthopedics department of the Avicenne Military Hospital in Marrakech over a period of 7 years, between 2017 and 2022. Our patients are 34 men and 6 women, the average age was 37 years (between 27 and 59 years). The average consultation time was 8 weeks. The causes of the delay in diagnosis are, on the one hand, the negligence of the patients (85%) and, on the other hand, the error of initial diagnosis and the traditional practice. The clinical examination was sufficient to make the diagnosis, although all patients received standard x-ray and ultrasound to eliminate other differential diagnosis. The treatment was surgical in all cases. Three surgical techniques were performed; V-Y plasty as described by Abraham, Bosworth plasty and the transfer with tendon of the flexor hallucis longus muscle. The long-term results were evaluated according to the score of AOFAS (American Orthopaedic Foot & Ankle Society) with a follow-up between a minimum of 2 years and a maximum of 7 years. The aim of our work is to describe the epidemiological, clinical and diagnostic profiles of patients and to evaluate the value of surgery in neglected ruptures of the Achilles tendon, by studying the indications of the different surgical techniques used.

Keywords: Achilles tendon, neglected rupture, surgical treatment.

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INTRODUCTION

Neglected Achilles tendon rupture is defined as a delay of more than four weeks between the initial trauma and diagnosis [1]. The incidence of such cases has increased in recent years, particularly in our setting. Surgical management is almost always required in the absence of contraindications. However, choosing the most appropriate surgical technique is often challenging due to tendon retraction and substance loss. This study aims to describe the epidemiological, clinical, and diagnostic profiles of patients with neglected Achilles tendon ruptures and evaluate the effectiveness of surgical intervention by analyzing the indications and outcomes of different surgical techniques.

MATERIALS AND METHODS

This retrospective study involved 40 cases of neglected Achilles tendon rupture, diagnosed more than four weeks post-injury, and treated using three different surgical techniques: V-Y myotendinous advancement (Abraham technique), Bosworth flap, and flexor hallucis longus tendon transfer. All cases were managed in the Department of Orthopedics and Traumatology at

Avicenne Military Hospital, Marrakech, over a seven-year period (January 2017 to December 2022).

The cohort included 34 males and six females, with a mean age of 37 years (range: 27–59 years). The right side was affected in 30 cases, and the left in 10 cases. Sports injuries were the primary etiology (33 cases), followed by road traffic accidents (five cases) and occupational injuries (two cases). The mean delay between the initial trauma and treatment was eight weeks (range: 4–16 weeks).

Twenty-one patients initially underwent unsuccessful functional treatment, while 19 neglected the injury, considering it minor and untreated. Diagnosis was based solely on clinical findings, including a palpable gap in the tendon, inability to perform single-leg tiptoe, absence of physiological equinus, exaggerated ankle dorsiflexion, and a positive Thompson test. All patients underwent ultrasonography, confirming total rupture of the Achilles tendon. Magnetic resonance imaging (MRI) was performed in 20 cases to confirm the diagnosis and measure the extent of tendon substance loss.

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Surgical procedures were conducted under spinal anesthesia with the patient in the prone position. A medial para-Achilles approach was used with careful opening of the tendon sheath. In all cases, intraoperative findings revealed full-thickness tendon discontinuity with scar tissue at the rupture site. After excision of fibrosis, the mean tendon substance loss was 6 cm (range: 4–10 cm). V-Y plasty (Abraham technique) was performed in 25 patients with substance loss ranging from 6–10 cm. All cases included reinforcement with the plantaris tendon. Bosworth technique was applied in 10 cases with substance loss between 4–7 cm. Flexor hallucis longus tendon transfer was utilized in five patients with substance loss exceeding 7 cm or in cases of calcaneal tuberosity avulsion.

Postoperatively, immobilization was achieved using a cast with six weeks of non-weight-bearing (three weeks in equinus and three weeks in neutral position). Rehabilitation commenced gradually from the seventh week, focusing on restoring joint mobility and strengthening the triceps surae muscle. Weight-bearing was resumed progressively after six weeks. Patients were monitored at three weeks, six weeks, three months, six months, and annually thereafter, with an average follow-up of 3.5 years (range: 2–7 years). Functional and clinical outcomes were assessed using the following criteria:

1. Functional:
 - **Pain:** Absent, mild, or debilitating.
 - **Socio Professional Impact:** Time to return to work or sports and overall satisfaction.
 - **Functional State:** Improved, unchanged, or worsened.
2. Clinical:
 - **Tibio-Talar Joint Mobility:** Normal, increased, or reduced.
 - **Thompson Test:** Normal, reduced, or absent.
 - **Single-Leg Tiptoe:** Normal, incomplete, or impossible.

RESULTS

- **Complications:** A single case of superficial skin infection was treated successfully with antibiotics and local care. One case of superficial skin necrosis healed with local management. No sural nerve injury, thromboembolic events, or recurrent ruptures were observed.
- **Functional Outcomes:** Thirty-four patients reported no pain, while six experienced residual discomfort during exertion. The average time off work was 3 months, with extremes of between 2 and 4 months. Among the 33 patients known to be practising sport activities before the injury, 26 returned to sports within a mean duration of nine months. Overall, 29 patients were satisfied with their outcomes, whereas 11 expressed dissatisfaction.

Clinical Outcomes:

- **Triceps Atrophy:** Present in all cases, averaging 10 mm in calf circumference reduction compared to the contralateral side.
- **Thompson Test:** Normal in 20 cases, reduced in 15, and absent in five.
- **Single-Leg Tiptoe:** Normal in 18 cases, incomplete in 16, and impossible in six.
- **Tibio-Talar Mobility:** Comparable to the contralateral side in 24 cases, increased in eight, and decreased in eight.

Overall Results:

We used the AOFAS [the American Orthopaedic Foot and Ankle Society] score developed by Kitaoka *et al.*, [2] to assess and monitor patients after surgery. The postoperative AOFAS score was excellent in 5 patients, good in 26 patients, fair in 7 patients and poor in 2 patients.

DISCUSSION

Neglected Achilles tendon ruptures are relatively common, both in our clinical context and in the broader literature. Kouvalchouk and Watin-Augouard [3] reported that 20–30% of Achilles tendon ruptures are not diagnosed until after the third week post-injury.

The diagnosis of old Achilles tendon rupture is clinical. Ultrasound does not seem necessary for diagnosing acute ruptures. Several authors have highlighted that ultrasound performed immediately after the injury does not show direct ultrasound signs of rupture [4]. This is currently the main cause of diagnostic errors or delays, which can have serious consequences for therapeutic choices. However, ultrasound coupled with power Doppler is the examination of choice for exploring tendons [5]. In cases of old ruptures, ultrasound might be useful for assessing the degree of interfragmentary gap and could be helpful for postoperative monitoring of tendon healing. MRI remains the gold standard for old ruptures, providing precise measurements of tendon retraction, the site of rupture, and the interfragmentary gap [6]. This imaging modality plays a crucial role in preoperative planning by guiding the selection of appropriate surgical techniques.

The treatment of neglected Achilles tendon ruptures presents a real challenge for orthopedic surgeons [7, 8]. Non-surgical treatment is only proposed as a first-line option when surgery is contraindicated [9]. The goal of surgical treatment for neglected Achilles tendon ruptures is to restore the tendon to its normal length to ensure an optimal functional outcome, particularly in terms of triceps surae strength [10, 11].

Indications are based on preoperative MRI findings, the size of the substance loss after fibrotic resection, and its location relative to the calcaneal insertion [12]. Neglected Achilles tendon ruptures with a

defect of less than 3 cm can be treated with end-to-end sutures [9, 13]. For ruptures with a defect between 2 and 5 cm, several surgical techniques can be used: V-Y plasty (Abraham technique), tendon transfer (fibularis brevis, flexor hallucis longus, or flexor digitorum longus), or a triceps aponeurosis turnover flap [14]. For extensive substance loss (5 cm or more) or involving the calcaneal tendon insertion, the flexor hallucis longus tendon transfer has become a preferred technique for reconstruction. It can be modified from the original description for reinforcement, either with residual calcaneal tendon fibrous flaps or a Bosworth triceps turnover flap [15], rather than associating it with V-Y plasty as proposed by other authors [16]. The role of free augmentation grafts from hamstring tendons (gracilis and/or semitendinosus), more recently described, remains to be clarified.

The V-Y plasty was used for 25 patients in our series. Traditionally, it is indicated for substance loss of 3 to 5 cm [17], but the defect in our series ranged from 6 to 10 cm. Reinforcement was systematically performed using the tendon of the plantaris muscle in all patients treated with this surgical technique. The postoperative AOFAS score in these patients was excellent in 3 cases, good in 18, fair in 3, and poor in only 1 case. The complications observed in patients operated on with this technique were residual pain in 3 cases and functional impairment in 1 case. Yangjing Lin *et al.*, [18] used the V-Y plasty to treat 18 cases of neglected Achilles tendon ruptures with defects of 3 to 9 cm, reporting a significant improvement in the AOFAS score without serious complications in their patients. Ahmed *et al.*, [19] concluded that reconstructing a defect larger than 6 cm with V-Y plasty would constitute a real challenge for surgeons. Khiami *et al.*, [17] reported that the V-Y plasty would be preferable for defects of 3 to 5 cm. McClelland and Maffulli [20] reported that the V-Y plasty technique could yield satisfactory results in treating neglected Achilles tendon ruptures with defects greater than 6 cm. Our results also align with these conclusions.

The Bosworth technique is chosen for substance loss beyond 5 cm by some authors. Lee *et al.*, [21] used it in 12 patients to address an average substance loss of 4.2 cm. The technique proposed by F. Khiami *et al.*, [17] is applicable regardless of the size of the area to be filled. In our study, it was performed on 10 patients to address tendon substance losses between 4 and 7 cm. The AOFAS score was excellent in only 1 case, good in 6 cases, and fair in 3 cases. Complications included one case of skin necrosis and functional discomfort in another patient. This technique was described by Christensen [22] and Bosworth [23], who reported 75% satisfactory results. Yangjing Lin *et al.*, [18] used this technique in 8 patients, including 1 with a 10-cm defect, achieving satisfactory functional outcomes. Some authors have noted that the Bosworth technique can pose issues due to the bulk of the graft at its turnover zone [17]. This zone represents a double tendon thickness,

increasing the risk of skin complications at this site. Determining the exact graft size to restore length can also be challenging, prompting the use of a free aponeurosis transposition, whose main advantage is eliminating the bulk. F. Khiami *et al.*, [17] preferred retaining fibrous tissue, even if it has no mechanical or biological value, unlike Nilsson-Helander *et al.*, [24].

The flexor hallucis longus tendon transfer technique was used in 5 patients in our series, filling substance losses greater than 7 cm or in cases of calcaneal tendon avulsion at the calcaneal tuberosity. The AOFAS score was excellent in 1 case, good in 2 cases, fair in 1 case, and poor in 1 case. Two complications were observed with this technique: functional discomfort in 1 patient and superficial infection in another. Wegrzyn [25] used it to repair an average substance loss of 7.4 cm. Yangjing Lin *et al.*, [18] performed this technique in 3 patients, achieving satisfactory functional outcomes. However, they noted that such interventions could affect hallux function and should therefore not be routinely recommended for young patients. Ahmad *et al.*, [19] showed, through a series of 32 patients with defects larger than 6 cm, that combining their new variant of the Bosworth technique with flexor hallucis longus tendon transfer could significantly improve functional outcomes and reduce residual pain rates.

We conducted a retrospective and non-comparative study of the three most commonly used surgical techniques for repairing neglected Achilles tendon ruptures. We acknowledge that our study has limitations due to its sample size and short average follow-up duration. Nevertheless, we demonstrated that all three techniques can yield satisfactory functional outcomes with no major complications, even for more extensive substance losses. We believe that a randomized study over a longer duration is necessary to assert the superiority of one technique over another.

CONCLUSION

Neglected Achilles tendon ruptures are becoming increasingly common. The diagnostic delay is due partly to patient negligence and partly to initial diagnostic errors. MRI is particularly useful in cases of neglected ruptures for assessing the extent of retraction and defining the anatomical form.

The treatment of neglected Achilles tendon ruptures is surgical. Numerous surgical techniques are available, all adhering to the same principles: preserving the vascular environment by avoiding skin detachment, combined with a solid and minimally bulky reinforcement plasty to allow early rehabilitation and ensure good functional recovery.

The indications for treating neglected Achilles tendon ruptures are primarily determined by the size of the tendon substance loss and the anatomical conditions.

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