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Original article

Percutaneous Tenolig® repair under intra-operative ultrasonography guidance in acute Achilles tendon rupture

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ABSTRACT

Background: Acute Achilles tendon rupture can be treated conservatively or surgically. Open surgery restores tendon continuity but carries a risk of skin complications. Tenolig® is a device designed for the percutaneous biological treatment of acute Achilles tendon rupture. Earlier studies found high rates of recurrent tears and nerve injury after Tenolig® repair.
Hypothesis: We hypothesised that intra-operative ultrasonography during Tenolig® repair would decrease the post-operative complication rate and improve functional outcomes.
Materials and methods: We studied 75 consecutive patients with a mean age of 39.9 years. The injury was sports-related in 82.8% of cases. Mean distance from the calcaneal tendon attachment to the tear was 5 cm and mean time from injury to repair was 4.2 days. All patients underwent Tenolig® repair under ultrasound guidance followed by early rehabilitation therapy with partial weight bearing started after 3 weeks.
Results: Mean follow-up was 20.7 months and no patient was lost to follow-up. A single patient (1.3%) experienced rerupture and none had permanent sural nerve damage. Mean time to sports resumption was 8.6 months, with two-thirds of patients returning to their previous level of sporting activities. The mean AOFAS functional score was 95 and the mean ATRS score was 91.3.
Discussion: Our experience suggests that intra-operative ultrasonography, a non-invasive, widely available, and accurate tool, provided improved control of Tenolig® suture position. Ultrasonography provided valuable guidance during this demanding procedure and allowed the very early initiation of rehabilitation therapy. Another crucial factor is patient education about the physical therapy programme. Attention to this point allowed us to obtain robust and reliable functional outcomes in a population predominantly composed of athletes.
Level of evidence: Level IV.

1. Introduction

The management of acute Achilles tendon rupture has long been a focus of debate between those who advocate conservative methods and those who prefer surgery [1]. The first standardised orthopaedic treatment was developed by Lea et al. in 1968 [2]. Conservative treatment carries no risk of skin complications or infection. Its main drawbacks consist in high rates of rerupture, tendon stretching, and muscle wasting [3].

No consensus exists about the best surgical treatment. Open surgery restores tendon continuity but carries a risk of skin adhesions and infection, as well as of nerve injury, with a complication rate of up to 34.1% [4]. Several percutaneous techniques have been reported since the seminal description by Ma and Griffith in 1977 [5]. Tenolig® (FH Orthopedics, Heimsbrunn, France) is a device developed by Delponte et al. [6] to maintain the tendon stumps in contact with each other. Although the risk of infection is low, Maes [7] has reported rerupture in 10% of cases and sural nerve injury in 6.4%. In a study of 21 patients, Soubeyrand et al. [8] found that the Tenolig® needle was located outside the tendon in 45% of cases.

We sought to improve the outcomes of Tenolig® repair in patients with acute Achilles tendon rupture. Our goal was to increase the reliability of suture positioning while preserving the sural nerve and allowing early rehabilitation therapy in accordance

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Table 1
Epidemiological data. Among patients with sports-related injuries, only the 64 patients with injuries during impulsion were considered.

Epidemiological data	Sub-groups (units)	*n* – (%) mean (min–max)
Sex	Males	60 (80%)
	Females	15 (20%)
Age	(Years)	39.9 (17–63)
Occupation	Physical	17 (22.7%)
	Sedentary	51 (68%)
	None	7 (9.3%)
Sports	Professional	4 (5.3%)
	Competition	45 (60%)
	Recreational	26 (34.7%)
Type of sports	With pivoting	54 (72%)
	Without pivoting	15 (20%)
	All types	6 (8%)
Tendinopathy		13 (17,3%)
Smoker		22 (29.3%)
Type of injury	Impulsion	64 (86.3%)
	Steps	11 (14.7%)
Sports-related injury	*n* = 64	53 (82.8%)
Level of rupture	(cm)	5 (3–8)
Time to surgery	(Days)	4.2 (0–21)
Hospitalisation	Outpatient	71 (94.7%)
	1 night	4 (5.3%)
Anaesthesia	Regional	57 (76%)
	Spinal	15 (20%)
	General	3 (4%)
Operative time	(Minutes)	26 (10–40)

with current recommendations [9]. Our working hypothesis was that intra-operative ultrasonography to guide Tenolig® repair would decrease the post-operative complication rate and improve the functional outcomes.

2. Material and methods

Between 2008 and 2012, 85 patients were managed in our department for Achilles tendon rupture. For this study, we prospectively enrolled consecutive patients.

2.1. Inclusion and exclusion criteria

Acute Achilles tendon rupture was the only inclusion criterion. Exclusion criteria were chronic tendon rupture (time since rupture longer than 21 days), recurrent tendon rupture, proximal rupture at the muscle-tendon junction, distal tendon detachment, and contra-indications to surgery.

2.2. Patients

We included 75 patients, all of whom were managed by percutaneous implantation of the Tenolig® device under intra-operative ultrasound guidance, followed by early rehabilitation therapy.

Table 1 reports the main epidemiological data. The patients fell into three categories based on the type of sports they engaged in: pivoting-contact sports (badminton, volleyball, tennis, basketball, judo, handball, and hip-hop), straight-line sports (swimming, running, hiking, all terrain bicycling), and both (pivoting and straight-line). Three patients had a remote history of contralateral Achilles tendon rupture; 1 had been treated by open surgery and 2 by Tenolig® repair.

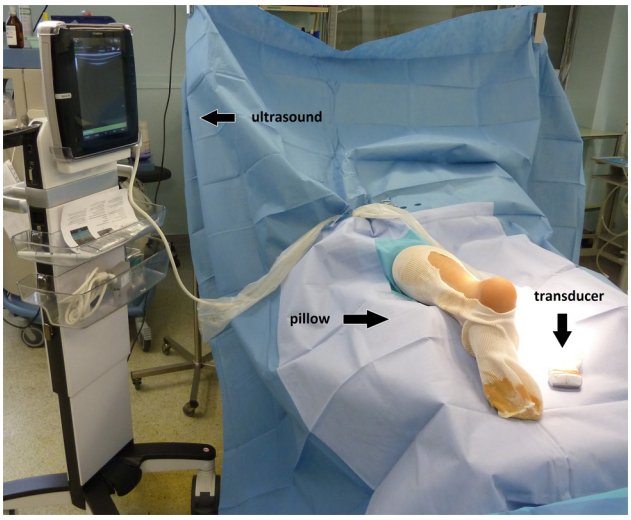

Fig. 1. The patient is in the prone position with a pad under the ankle. Note the ultrasound machine and transducer.

2.3. Operative technique

The patient was prone with a pad under the ankle (Fig. 1). The procedure was performed without a tourniquet. The ultrasound machine was a portable M-Turbo® (SonoSite Inc., Bothell, WA, USA). A Tenolig® kit was used.

After palpation of the gap, the surgeon identified the ultrasound landmarks alone. None of the surgeons received any specific training from radiologists. Ultrasonography was used to determine the location of the stumps and to identify the lateral and medial posterior edges of the tendon. Disappearance of the gap upon flexion of the foot was checked on the ultrasound images. The sural nerve was identified from the lateral retro-malleolar groove near the saphenous vein to the intersection with the lateral edge of the tendon (Figs. 2–4), with the help of the anaesthesiologists given their expertise in this area. The proximal stab incisions and distal exit points were determined based on the location of the tear. If required by the level of the intersection with the sural nerve, the lateral entry point was shifted medially to avoid injuring the sural nerve during insertion of the needle (Fig. 5). Progression of each needle was monitored on the transverse ultrasound image to allow proper positioning within the tendon down to the exit point (Fig. 6). After tensioning and tightening of the sutures, ultrasonography was used to check that the two tendon stumps were in close contact with each other.

2.4. Post-operative care

Anticoagulation in prophylactic dosages was given for 45 days. An anterior splint maintaining the ankle in 30° of plantar flexion

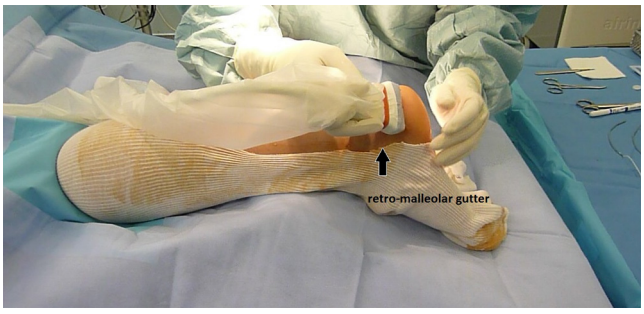

Fig. 2. Identification of the sural nerve, starting at the retro-malleolar groove.