

# Acute Achilles tendon ruptures treated with minimally invasive Dresden technique

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## Abstract

**Introduction:** Ruptures of the Achilles tendon are the most frequent injuries caused by impact. In general, patients undergo surgical treatment. It can be open or percutaneous surgery. The aim of this study is to evaluate medical-functional results in patients with acute ruptures of the Achilles tendon treated by the Dresden's minimally invasive technique.

**Materials and methods:** Comparative prospective study on 15 cases with acute rupture of the Achilles tendon. We analyzed surgical details, hospitalization, functional results and evaluation by the AOFAS score. Average follow-up was 18 months.

**Results:** We report results on surgical timing, hospital staying, time passed until the surgery, weight-bearing and the post-operative protocol. AOFAS score at month 5 was 94.66. Work retaking was, on average, at 3.53 months, whereas sport retaking was at 6.53 months.

**Conclusions:** Percutaneous techniques for the acute rupture of the Achilles tendon are a good option; patients do well and complications rates are low.

**Key words:** Ruptures; Achilles tendon; percutaneous techniques; Dresden.

**Level of evidence:** IV

## ROTURAS AGUDAS DEL TENDÓN DE AQUILES TRATADAS CON TÉCNICA MÍNIMAMENTE INVASIVA DE DRESDEN

## Abstract

**Introduction:** The Achilles tendon ruptures are common traumatic injuries. Treatment is usually surgical. Surgery may be open or percutaneous. The aim of this study is to evaluate the clinical and functional outcomes in patients with acute Achilles ruptures treated by minimally invasive Dresden technique.

**Methods:** Prospective study of 15 patients with acute Achilles tendon ruptures. Intraoperative characteristics, hospitalization, functional outcomes and evaluation according to AOFAS score were evaluated. The average follow-up was 18 months.

**Results:** Results are listed based on the surgical time, hospital stay, time to surgery, weight load and postoperative protocol. The AOFAS score at five months was 94.66 points. Patients returned to work at 3.53 months on average and to their sport activities at 6.53 months

**Conclusions:** The percutaneous technique for the repair of acute Achilles tendon rupture is a good choice. Patients have a good outcome and the rate of complications is low.

**Key words:** Ruptures; Achilles tendon; percutaneous technique; Dresden.

**Level of Evidence:** IV

Conflict of interests: The authors have reported none.

## Introduction

Although there are multiple reports on the treatment of the acute rupture of the Achilles tendon, there is not a reference pattern yet.<sup>1,2</sup> Minimally invasive repair is an option that combines the advantages of the open technique with orthopedic treatment.<sup>3,4</sup> Risk factors for primary rupture are male sex, age >40 years old, corticoid/fluoroquinolone treatment, and contralateral previous tendon rupture. Diagnosis is made basically by medical history. Palpation evidences a gap in the area of the injured tendon, and the Thompson's test is positive. If in diagnostic doubt, it is possible to resort to ultrasound or MRI.<sup>5,7-9</sup>

The aim of the minimally invasive technique is to get second rupture incidence similar to that of open surgery, but with lower rates of local complications, such as infection of the surgical area, adhesions, suture dehiscence, and large scars.

The aim of this study was to evaluate medical-functional results in patients with acute rupture of the Achilles tendon treated with the Dresden's minimally invasive technique.

We describe a surgical alternative whose surgical foundations are the preservation of the hematoma within the para-tendon, minimizing the risks of damaging the sural nerve with anatomic overlapping of the ends and no additional costs.<sup>4</sup>

## Materials and Methods

We carried out an observational prospective study between 2012 and 2014. We evaluated 15 patients with acute rupture of the Achilles tendon. Thirteen were males, and two, females, and they averaged 40.66 years old (ranging from 31 to 49). Five injuries were on the left tendon, whereas 10 were on the right one. No patient had medical history of Achilles tendon rupture.

The mechanisms of injury were diverse: rupture secondary to exercise (7 patients), to walking (3 patients), to stairs fall (3 patients), and to direct impact (2 patients) (Figure 1). All patients received surgical treatment with the Dresden's technique within the first seven days following the injury. As suture material we used Ethibon.<sup>2</sup>

Patients were evaluated using the AOFAS score at month five, when they were also asked to take MRI.

The inclusion criteria were: 1) acute rupture of the Achilles tendon, 2) closed and complete rupture of the tendon, 3) rupture between the distal 2 and 8 cm of the tendon, 4) age >18 years old and <55 years old, 5) minimal follow-up of 18 months, 6) surgical treatment of the rupture by Dresden's minimally invasive surgery.

The exclusion criteria were: 1) ruptures treated after the first 10 days following the injury, 2) open rupture of the Achilles tendon, 3) rupture at the myotendinous junction level, 4) rupture at the calcaneal attachment level, 5) lack of follow-up, 6) previous local or systemic treatment which could have weakened the tendon (such as local infiltration with anesthetic substances or corticoids in the area of the Achilles tendon, immunosuppressive treatment in transplanted patient, autoimmune conditions, etc.) 7) other ruptures of or previous surgeries in the Achilles tendon.

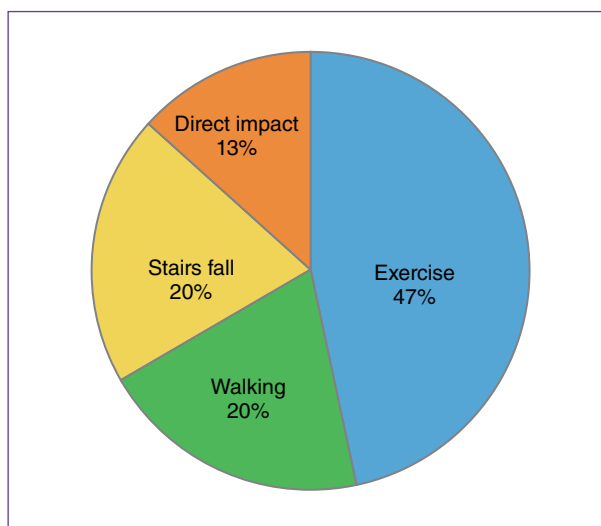
### Description of the surgical technique

We perform a small approach 2 cm proximal to the gap. Once the crural fascia is open, we introduce carefully the Dresden instruments or a Foester clamp going beyond the gap up to the distal end of the tendon (Figure 2). We thread this distal fragment of the tendon and pull it to the rupture to knot it proximally to it, at the level of the initial approach using Ethibon stitches for suture.<sup>2</sup> We repeat this procedure with a second thread (Figures 3 and 4).

The post-operative protocol consists of three weeks with drop foot short leg cast, two weeks with neutral walker and two weeks with walker, when the patient is allowed to start physiotherapy and mobility exercises in 90° plantar and dorsal flexion. Weight bearing allowed is 50% at week five, and 100% at week six, always with the assistance of walker orthosis.

For the repair of the tendon to be objective, we asked the patients to take MRI five months after the surgery.

We evaluated the following parameters: 1) time passed until the surgery, 2) surgical timing, 3) AOFAS score, 4) ankle plantar and dorsal flexion, 5) scar length, 6) time passed between surgery and retaking of work and sport activities, 7) complications.



▲ Figure 1. Mechanism of injury.



▲ **Figure 2.** Approach and surgical gestures with Foester clamp.



▲ **Figure 4.** Suture of the proximal end of the Achilles tendon.



▲ **Figure 3.** Distal end threading.

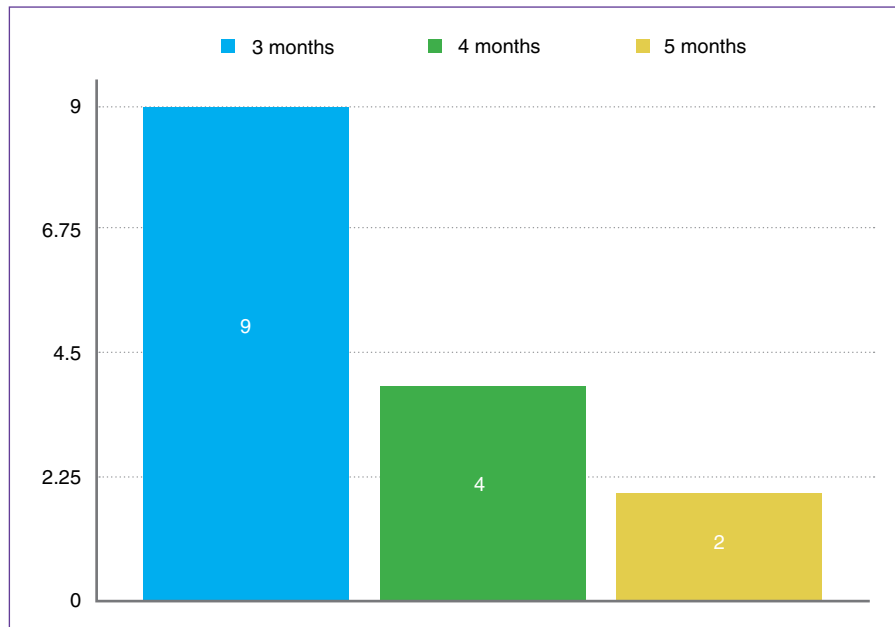
## Results

All the patients showed rupture between the 2 and 5 tendon distal cm. The time passed since the impact and the injury until the surgical procedure was, on average, 2.86 days (ranging from 1 to 7) and surgical timing averaged 17.13 mm (ranging from 13 to 20). The average ankle AOFAS score evaluated 5 months after the surgery was 90 (ranging from 90 to 100).

Two patients suffered pain immediately after the surgery, and they were treated with p.o. pain killers. The average scar length was 2.04 cm (ranging from 1 to 3).

The average time until working activities retaking was, on average, 3.53 months (ranging from 3 to 5) (Figure 5). Sport activities retaking was, on average, 6.53 months after the surgery (ranging from 6 to 7). No patient suffered complications.

Active and passive plantar flexion (PF) and dorsal flexion (DF) evaluated comparatively between the limb operated on and the healthy limb were: right active PF 27° and left, 27.3°; right active DF 17°, and left 17.3°; right passive PF 29.6° and left, 30.3°; right passive DF 19°, and left 21.3° (Table).



▲ **Figure 5.** Working activities re-taking.

**Table.** Active and passive mobility assessed comparatively in plantar and dorsal flexion in the ankle operated on and the healthy ankle.

	Active		Passive	
	Right	Left	Right	Left
Plantar flexion	27°	27.3°	29.6°	30.3°
Dorsal flexion	17°	17.3°	19°	21.3°

## Discussion

The Achilles tendon is the largest and strongest tendon in the body; it is made up of medial and lateral tendinous fibers coming from the gastrocnemius and soleus muscles.<sup>7</sup> It is surrounded by a paratenon, which is a soft tissue structure that helps in tendon sliding. Blood supply comes from the myotendinous junction, the bone attachment and mesotendon vases. There is an area of short blood supply located approximately 2-6 cm proximal to the calcaneal bone.<sup>7</sup>

The treatment of the acute rupture of the Achilles tendon remains controversial.<sup>1,26,10,11</sup> However, some studies conclude that surgical treatment is the best option for patients with high functional demands.<sup>12-14</sup> Nowadays, there is not a unique repair method, so, most surgeons do as dictated by personal experiences and preferences.<sup>5,11,15-17</sup>

The thread and the suture technique should guarantee the approximation and closing of the tendinous gap until full tendon healing.<sup>18,19</sup>

The percutaneous repair of the Achilles tendon was first described in 1977 and gave place to higher re-rupture rates.<sup>14,20</sup> The suture used initially was criticized, because it gave approximately 50%-resistance as compared to open repair.<sup>8</sup> The percutaneous technique was associated with high risk of sural nerve injury (up to 60%)<sup>8,12</sup> and re-rupture rates were high (6.4%).<sup>11</sup>

Klein et al.<sup>21</sup> reported three new ruptures in 38 patients with the use of the Ma-Griffith's technique; Webb and Bannister<sup>22</sup> found new ruptures in five out of 78 patients with percutaneous repair. Hynes et al.<sup>23</sup> reported five cases in 48 patients. Henriquez et al.<sup>2</sup> did not find new ruptures, nor did we in our series.

There are reports on high risk of sural nerve injury with the Ma-Griffith's percutaneous repair.<sup>3,21,24</sup> Hockenbury et al.<sup>25</sup> in a corpse study described sural nerve injury in 60% of the cases; these injuries were secondary to nerve enclosure 2.5 cm proximal to the tendon gap. Majewski et al.<sup>26</sup> reported an 18%-incidence of sural nerve-related complications.

To minimize the risk of sural nerve injury, Webb and Bannister described a percutaneous repair technique using posterior approaches. In this series of 27 cases there were neither new ruptures nor nerve injuries.<sup>22</sup> As reported by Amlang et al.<sup>4</sup> in our series there were neither new ruptures nor sural nerve injuries.

Henriquez et al.<sup>2</sup> reported on patients operated on by percutaneous techniques retaking working activities at 2.8 months. In our series, we found that working retaking was, on average, at 3.5 months and sport retaking was, on average, at 6.5 months.

In numerous studies, they showed the advantages of early mobility and weight-bearing following Achilles tenorrhaphy.<sup>10,27</sup> Contrarily to Amlang et al.<sup>4</sup>'s reports, in our protocol, post-operative weight-bearing and mobility got delayed out of precaution in those patients that had undergone percutaneous techniques.

With respect to the AOFAS functional scale, Cretnik et al.<sup>11</sup> reported an average AOFAS of 96. In our study, the average AOFAS score was 90. Similarly to our team's reports, Ceccarelli et al.<sup>28</sup> reported an AOFAS score of 90, and that active and passive PF and DF did not show differences between the limb operated on and the healthy limb.

## Conclusions

Percutaneous repair techniques reported by Amlang and Zwipp should be considered as an alternative to the conventional open treatment, because it minimizes risks of sural nerve injury. The modifications to the original technique set out by our team makes this method advisable for any institution, because it does not increase costs and post-operative results are the same.

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