DOI: https://doi.org/10.30795/jfootankle.2023.v17.1663

Technical Tips

Description of minimally invasive technique for the surgical treatment of acute Achilles tendon ruptures with locking suture – a low-cost option

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Abstract

Acute Achilles tendon rupture is a frequent injury of the lower limbs, and there is controversy regarding the ideal treatment. Several methods are described in the literature, including conservative treatment, open repair, and minimally invasive surgery. Open repair is associated with a higher complication rate, while minimally invasive techniques present an increased risk of iatrogenic sural nerve injury. Some devices have been developed to reduce the complications of the first minimally invasive techniques described. We present a technique to repair acute Achilles tendon injuries in a minimally invasive surgery using simple materials available in most operating rooms without special instruments. Associated with this technique, we adopted a protocol of early functional rehabilitation, which has already proven beneficial in recovering the patient's functions.

Level of Evidence V; Therapeutic Studies; Expert Opinion.

Keywords: Achilles tendon; Minimally invasive surgical procedures; Rupture.

Introduction

The Achilles tendon is the largest and strongest tendon in the body but is also the most commonly ruptured tendon in the lower limbs[(1)]. The incidence of its rupture has recently increased due to the population's aging and the increase in sports practice[(2)].

The ideal treatment of acute Achilles tendon ruptures, whether conservative or surgical (open or minimally invasive), and the conduct in conservative or functional protocols (weight-bearing and early mobility) has been the subject of constant discussion in the literature in recent years. Recent studies have shown that functional rehabilitation implies better quality healing in addition to the surgical technique approach[(3)].

Based on previous studies, open surgical intervention was recommended, preferably than conservative treatment or minimally invasive techniques, because they were associated with high rates of re-rupture and loss of strength. Increasingly, conservative treatment, or minimally invasive techniques when opting for surgical treatment have been considered since it reduces complications associated with conventional surgical treatment or a no load protocol with long immobilization[(4)].

This study describes an adaptation technique for the minimally invasive technique of acute Achilles tendon ruptures, different from the others described for being low-cost and allowing the locking suture within the paratendon, currently possible only using specific and higher cost devices.

Study performed at the Hospital Márcio Cunha, Ipatinga, MG, Brazil.

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How to cite this article: Pereira VA, Oliveira Junior O, Bertolinni FM, Silveira GHCF, Pádua BJ, Marcatti MM. Description of minimally invasive technique for the surgical treatment of acute Achilles tendon ruptures with locking suture – a low-cost option. J Foot Ankle. 2023;17(1):79-85.

Technical tip

The study was approved by the Institution Ethics Committee of the Hospital Márcio Cunha/Fundação São Francisco Xavier.

The surgical procedure was performed under spinal anesthesia with the patient in a prone position, and it may be unnecessary to use a tourniquet if preferred by the surgeon. A transverse incision was performed at the rupture level, evidenced by the noticeable gap at the injury level (Figure 1).

Dissection under the paratendon was performed after hematoma drainage, exposing the proximal and distal stumps at the rupture level. If the proximal stump retracts, it can be brought distally using an Allis forceps (Figure 2).

Figure 1. Noticiable gap at the injury level (the procedure can be performed with or without a tourniquet). As the surgeon gains experience with the procedure, the tourniquet becomes dispensable.

By pulling the proximal stump using the Allis forceps, a long curved Foerster forceps was inserted inside the paratendon to capture the Achilles proximal stump. This justifies our option for the long forceps, making it possible to reach a better-quality portion of the stump outside the ruptured portion (Figure 3).

After passing the Foerster forceps, under controlled tension to capture the tendon without causing additional injury to the proximal stump, two guidewires or needles were passed through the hole of the forceps about 8 cm from the incision. The two guides or needles were passed at nearby points, separated by about 1 cm, so they serve as routes to the wires used for suturing, increasing the wires anchoring in the following steps (Figure 4).

Now the wires for suturing inside the forceps have been passed (in this case, we used three Vicryl® 1, two of which are passed in the most proximal guide and one in the distal one), the Foerster forceps are distally pulled, bringing the wires to the surgical incision (Figure 5).

The long curved Foerster forceps were then inserted again under the paratendon, with the proximal stump tensioned by the wires already passed, the tendon was captured at approximately 1.5 to 2 cm distally to the point where the Vicryl® wires were passed to be used for tenorraphy. Two other sutures (our preference in this step is for Ethibond® 5 since wires of lower resistance tend to break when pulled) were passed to cross the proximal stump of the three wires initially passed. These Ethibond® wires will only be used as guides to allow the looping of Vicryl® wires inside the tendon body to anchor to the proximal stump, consequently lowering the risk of fraying (Figure 6).

Figure 2. Transverse incision at the injury level (the transverse incision facilitates the closure of the paratendon after tenorrhaphy).

Figure 3. On the left, long curved and straight Foester forceps and the guidewires; in this case, we use conventional guides, which needles or jelcos can replace. As for the forceps, we prefer the curve, which facilitates insertion inside the paratendon.

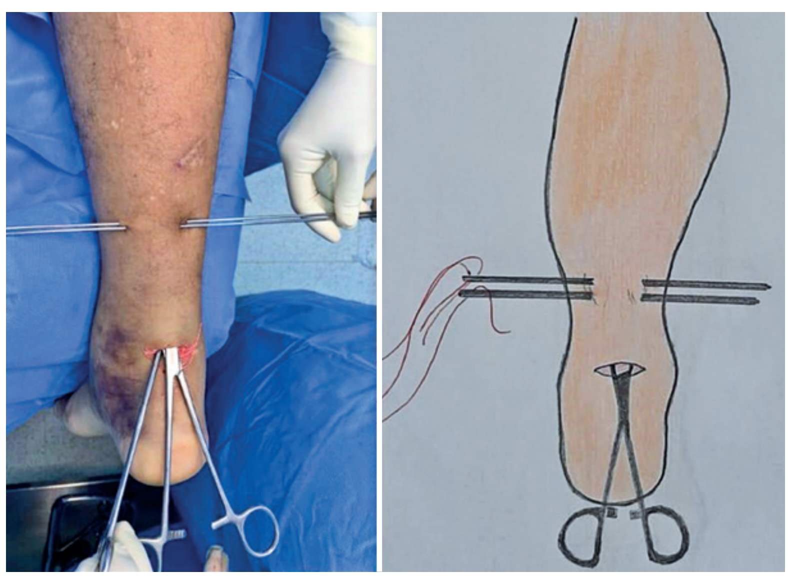

Figure 4. The guidewires are passed through the forceps hole inserted under the tendon approximately 8 cm from the incision.

Once the wires had been crossed, we performed traction to test their real anchorage at the proximal stump (Figure 7) and thus allowing satisfactory and reliable tenorraphy.

A similar procedure can be performed to pass the suture wires to the distal stump, but due to the smaller amount of subcutaneous in the insertional region of the calcaneal tendon, it is more easily palpable, and the same two guidewires or needles can be passed without the Foerster forceps by four incisions of approximately 3 mm (Figure 8). At this time, it is important to use the two guides or needles for the crossing suture wires since, if passed separately can occur the rupture of some of the wires by the pointed end of the guide or needle used to pass the distal suture wires, we also use three distal Vicryl® wires.

The ends of the wires are then sutured, observing the correct tensioning and positioning of the tendon stumps (Figure 9). It follows with the proper suture of the paratendon (Figure 10), an important structure in tendon nutrition[5], followed by the subcutaneous with absorbable wires and the skin with non-absorbable wires.

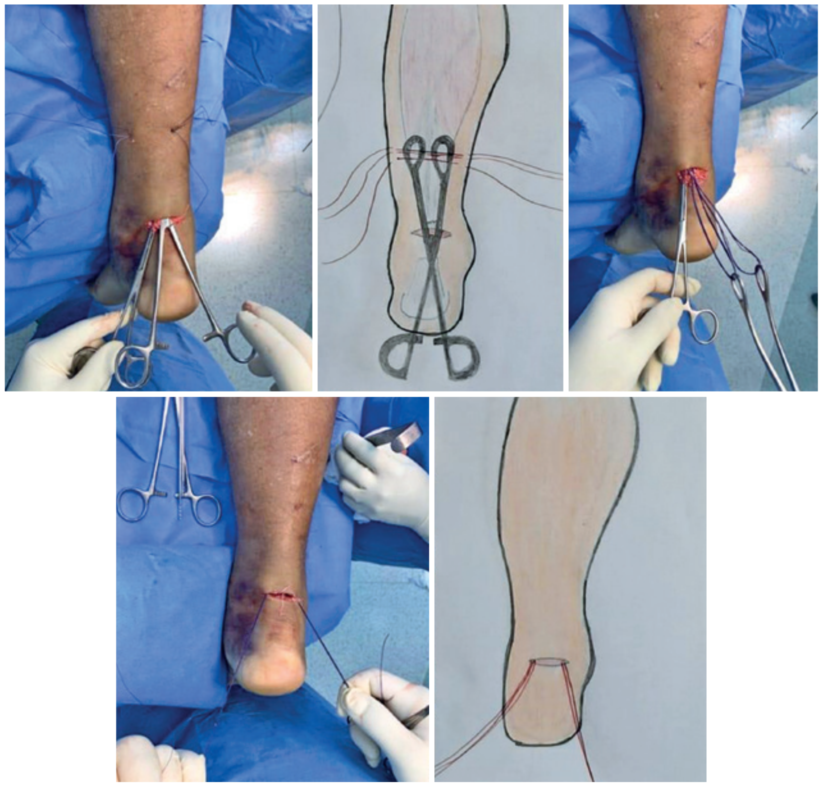

Figure 5. The wires of the proximal stump to be used for tenorrhaphy, at this moment, were passed only once by the tendon and brought to the surgical incision.

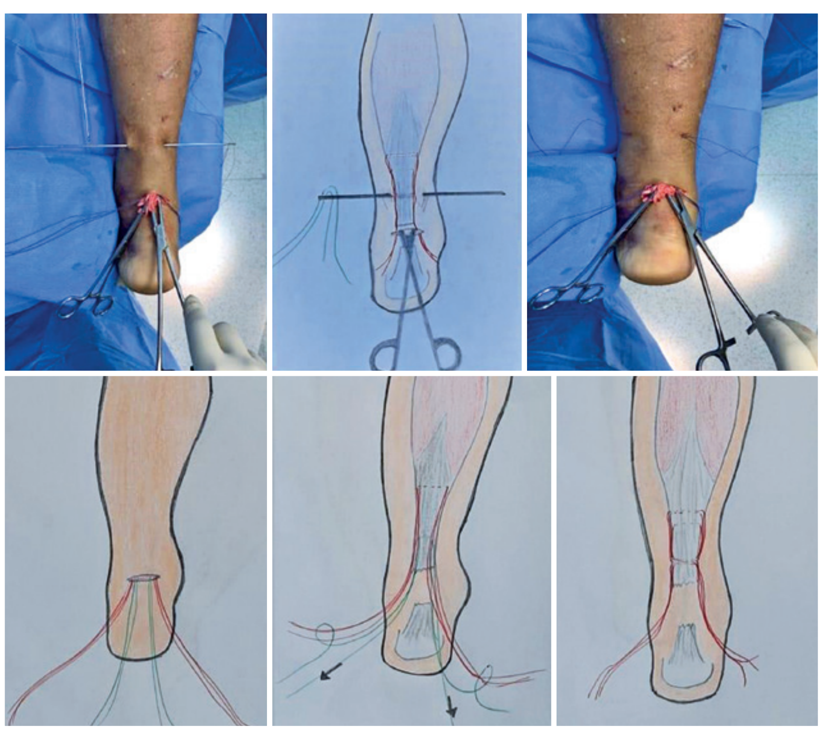

Figure 6. We pass two Ethibond® wires at a point 1.5-2 cm distally to the previously passed Vicryl® wires that will be used in tenorraphy; we cross the Vicryl® wires by tying them to one end of the Ethibond® that will be pulled by the other end.

Figure 7. Once the sutures were already anchored to the proximal stump, the sutures were passed twice, then traction was performed to test the fixation of the proximal wires.

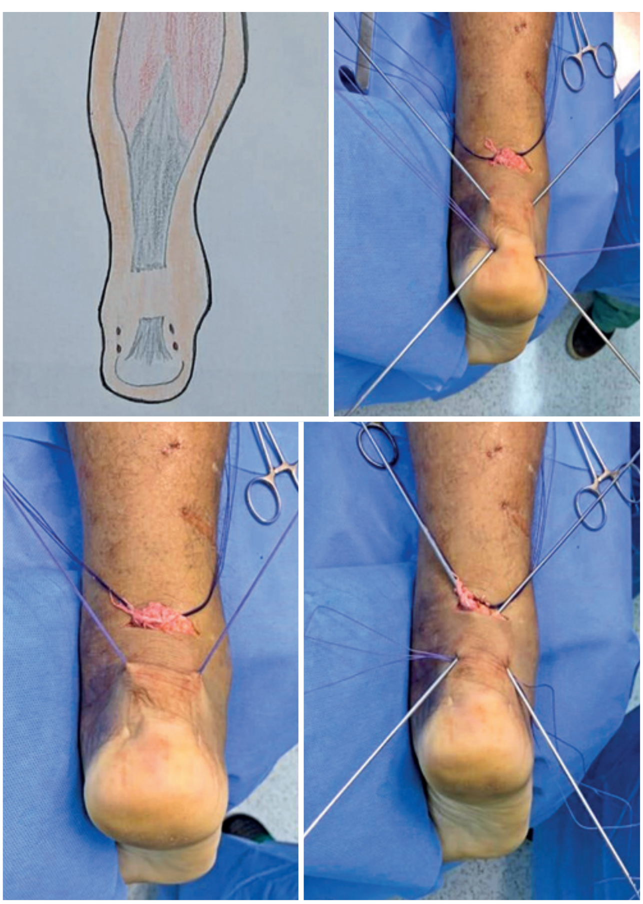

Figure 8. The suture wires were passed through the distal stump for two punctiform incisions performed in the insertional region of the Achilles, and two others performed 1.5-2 cm proximally.

Figure 9. Once the suture wires have been passed to the distal stump, proceed with the tenorraphy of the wires proximal to the distal.

Figure 10. Paratendon closure.

Based on Brumann et al.[6] recommendations, rehabilitation begins in the second week after surgery, allowing loading with the operated limb initially with partial weight-bearing with crutches, using a 30° plantar flexion brace or shim with the same purpose, with the progressive reduction of plantar flexion performed between four and eight weeks. Weight unloading occurs progressively in the postoperative period, and the crutch is dispensed according to the patient's tolerance and adaptation from the fifth week. At eight weeks, the total range of motion is released, and physiotherapy can progress with dorsiflexion, limited to neutral until this stage.

Discussion

Despite the controversy regarding the modality of the treatment of acute Achilles tendon injuries, many authors prefer the surgical approach due to the lower rate of re-rupture compared to conservative treatment[7]. However, this approach entails other risks, such as infection, necrosis, and wound dehiscence, which can be considerably reduced using minimally invasive techniques[8], as first described by Ma and Griffith[9].

For a few years now, studies have shown favorable results for treating acute injuries of the calcaneal tendon using the minimally invasive technique[10], which also allows accelerated functional rehabilitation. This accelerated functional rehabilitation and the protected weight-bearing have been more effective since it stimulates the deposition of type I collagen, not type III fibrous scar tissue. In addition, it has the best alignment of the fibrous scar tissue and, thus, forms a better quality tissue, reducing re-rupture rates, especially when compared to prolonged immobilization[11,12].

Compared with conventional open treatment, the first percutaneous techniques described presented a lower rate of surgical wound complications but a higher risk of sural nerve injury[13], in addition to scar tissue adhered to the subcutaneous[14] or iatrogenic compressions of the sural. New devices, such as the PARS Artrhex®[15] and Achillon®[16,17], have emerged to minimize these risks and with better suture strength. Despite this, many surgeons do not have access to these devices with higher operating costs and supply availability by large companies.

The technique used in this study does not require special instruments, so it does not add cost to the treatment. The use of forceps as a guide inside the paratendon prevents the adhesion of nodes to the subcutaneous since the wires are carried inside the paratendon.

Avoiding complications of surgical treatment of Achilles tendon injuries remains a challenge, but by minimizing dissection and exposure of the tendon, associated with an accelerated rehabilitation protocol, we believe it is possible to achieve an excellent result with the technique described, results that will be demonstrated in later studies.

Authors' contributions: Each author contributed individually and significantly to the development of this article: VAP *(https://orcid.org/0000-0002-1797-3955) Conceived and planned the activities that led to the study, interpreted the results of the study, performed the surgeries, data collection, formatting of the article, clinical examination, approved the final version; GHCF *(https://orcid.org/0000-0001-8689-3417) Bibliographic review, interpreted the results of the study, performed the surgeries, data collection, formatting of the article, clinical examination; OOJ *(https://orcid.org/0000-0001-8689-3417) Participated in the review process, bibliographic review, formatting of the article, approved the final version; FMB *(https://orcid.org/0000-0001-6700-0513) Participated in the review process, bibliographic review, formatting of the article, approved the final version; BJP *(https://orcid.org/0000-0001-5470-8766) Participated in the review process, bibliographic review, formatting of the article, approved the final version; MMM *(https://orcid.org/0000-0002-8045-3178) Participated in the review process, bibliographic review, formatting of the article, approved the final version. All authors read and approved the final manuscript.*ORCID (Open Researcher and Contributor ID) iD.

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