Endoscopic Flexor Halluces Longus transfer for Chronic Achilles Tendon rupture - technique description and early post-operative results

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Summary

Background: **Achilles tendon ruptures may lead to proximal retraction of the stump if not treated acutely, increasing the chances of poorer functional outcomes. The flexor halluces longus transfer is a well-established treatment option, usually performed as an open procedure. The aim of this paper is to report the preliminary results and describe the technique of endoscopic flexor halluces longus transfer.**
Material and methods**: Six patients with chronic Achilles tendon injuries or re-ruptures were treated with endoscopic FHL transfer. The Achilles Tendon Rupture Score was used to clinically evaluate the patients. Single leg heel rise ability, functional hallux weakness, complications and procedure length were also checked.**
Results**: On average, we took 56 minutes to perform the surgery. All patients had a major increase in the ATRS score value postoperatively. Single leg heel rise was possible for all patients without limitation. None of the patients noticed functional weakness of the hallux during daily life activity and no wound or soft tissue complications were seen.**
Conclusion**: Endoscopic FLH transfer is a reliable option for patients with high skin risk and soft tissue complications. Other studies are needed to compare this technique with the open procedure, gold standard by now, to ensure its safety and efficacy.**
Level of evidence: 4.

KEY WORDS: Achilles tendon rupture, flexor halluces longus transfer, endoscopy, Achilles tendon re-rupture, minimally invasive surgery.

Introduction

A chronic degenerated Achilles Tendon (AT) is expected in a chronic rupture and on neglected injuries. This could compromise the reparability capacity of the tendon and predispose to a muscle insufficiency of the gastroc-soleous complex[1].
The management of acute and chronic AT ruptures is usually different due to the retraction and atrophy of the proximal stump and remaining gap between the proximal and distal stumps in the chronic setting. Moreover, the outcomes after chronic AT rupture or re-rupture treatment can be influenced by the time of injury, skin conditions, muscle contraction, muscle excursion and patient comorbidities[2,3].
Many procedures have been described to treat this condition, such as the gastroc-soleus complex V-Y myotendinous lengthening or a reinforcing flap from proximal AT[4]. Other surgical techniques use the peroneus brevis (PB), flexor digitorum longus (FDL) or flexor hallucis longus (FHL) tendon transfers[4-6]. All these surgical procedures have been shown to yield satisfactory clinical results, although ankle plantar flexion strength and peak torque deficits can persist[3-5,7]. These techniques require open incisions, making skin problems or other local complications a serious concern.
The purpose of this study is to report the technique and present the preliminary results of six patients submitted to an endoscopic FHL transfer to treat chronic AT ruptures.

Material and methods

From June 2015 to February 2016, six patients with

Achilles tendon chronic injuries or re-ruptures were treated with endoscopic FHL transfer. Chronic injuries were considered those with more than 6 weeks[8]. All lesions were at the AT zone 2 (2-6 cm proximal to its insertion).

One patient suffered a re-rupture in an acute injury and all other five were chronic injuries. They all presented loss of the physiologic equinus of the foot when positioned in prone position, difficulty walking and were not able to perform the single leg heel rise test. All patients were submitted to pre-operatory Magnetic Resonance to access tendon degeneration at the stumps level. Minimum follow-up was 5 months. Patients that presented with a persistent palpable gap with maximum plantar flexion were treated with the addition of the Percutaneous Achilles Repair System (PARS® - Arthrex, Naples).

All patients were evaluated and operated by the same fully trained foot and ankle surgeon. The Achilles Tendon Total Rupture Score (ATRS) was applied pre and postoperatively (at three months follow-up) in all patients[9]. Single leg heel rise and hallux strength were assessed at the post-operative period subjectively.

All patients signed an informed consent to be included in this study. Our local ethics committee has approved this work in accordance with previous described ethical requirements[10].

Surgical Technique

Under sedation and peripheral block, patients were positioned in prone position with a tourniquet on the thigh inflated to 280 mmHg.

The posterior ankle endoscopy was performed with a 30º and 4.0 mm optic. The standard posterolateral and posteromedial portals, as described by van Dijk[11], were used (Fig. 1). After debridement with shaver, the FHL tendon was identified (Fig. 2).

After proper identification of the FHL, the ankle and hallux were positioned at maximum plantar flexion. With an accessory clamp to pull proximally the tendon, we performed a tenotomy as distal as possible. (Fig. 3 a, b). The free FHL stump was externalized through the medial portal and a Krakow suture was applied using a nonabsorbable 2.0 fiber Wire® (Arthrex®, Naples) (Fig. 4). The tendon width was measured so we could drill the proper calcaneal tunnel.

The calcaneal tunnel was performed under endoscopy and fluoroscopy visualization through the posterolateral portal (Fig. 5). The tunnel was 30 mm deep and 0.5 mm wider than the tendon. The FHL was pulled out through the tunnel and externalized on the plantar surface of the hindfoot using the guide wire. At this moment, the ankle was maintained in 5 to 10° of plantar flexion (physiological equinus) while the proper tension on FHL was stablished pushing the fiber wire. After checking the correct tension endoscopically, the FHL tendon was fixed with a metallic interference screw with the same tunnel width (7x25mm) (Fig. 6A-B). After that, the ankle was positioned in maximum plantar flexion, observing by palpation if there was any gap between the tendon stumps. If present, the tendon gap was sutured using

Figure 1. Posterolateral and posteromedial portals for posterior ankle endoscopy

Figure 2. FHL identification.

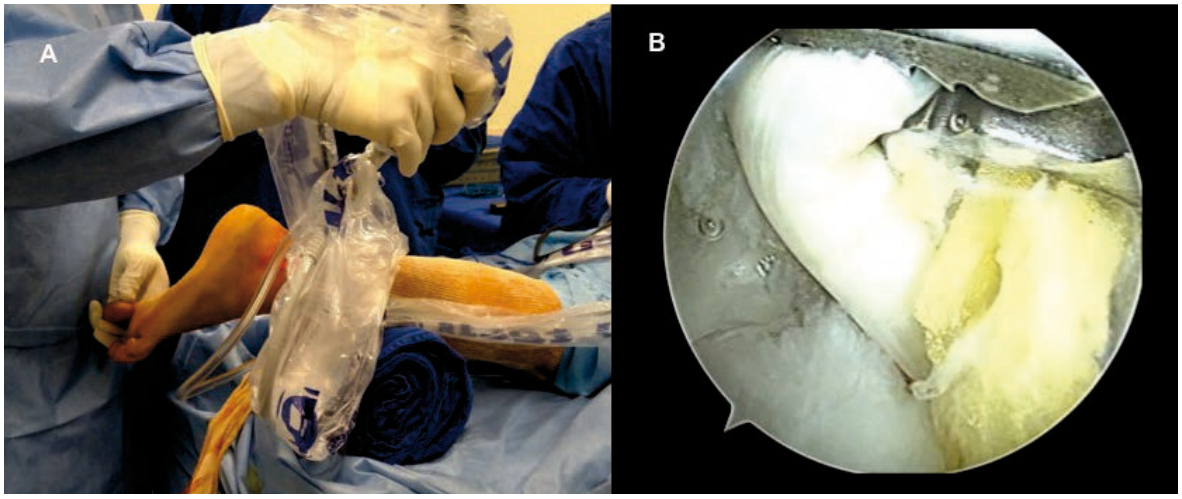

Figure 3. a. Ankle and hallux positioned in maximal plantar flexion, seeking the maximum tendon length; b. FHL proximal traction.

Figure 4. Tendon stump externalized through de posteromedial portal.

the PARS® (Arthrex, Naples) technique to approximate the Achilles tendon stumps.
A cast with the foot in 10° of plantar flexion was applied. All patients had the same postoperative protocol using plantar flexion cast immobilization for 2 weeks and then, a weight-bearing boot with progression to neutral position for the next 4 weeks.

Results

We evaluated all patients after an average follow-up of nine months (range, 5-12 months). Chronic ruptures ranged from 6 to 36 weeks after injury. Four males and two females, and four left and two right sides were included. Patients were 50 years old on average (33-65 years). Three patients had an associate procedure (PARS® - Arthrex, Naples) to repair the pre-existent gap (Tab. I).
All patients treated chronically had more than 50% of tendon degeneration. On average, we spent 56 minutes to perform the surgery, ranging from 45 to 70 minutes. No major or minor complications with regard to wound healing was noted. All patients had a major increase in the ATRS score values postoperatively, with an average of 17,8 (range from 11 to 28) preoperatively and 83,3 (range from 79 to 87) postoperatively.
Single leg heel raise was possible for all patients without limitation at the final follow-up. None of the patients noticed functional weakness of the hallux during daily life activity after the tendon transfer. One patient was athletic active and returned to play at 18 weeks. All other patients were sedentary.

Discussion

Chronic AT rupture can be treated with direct repair, AT advancement, tendon transfers or reconstructions

Figure 5. Calcaneal tunnel performed under endoscopy and radioscopic visualization through the posterolateral portal.

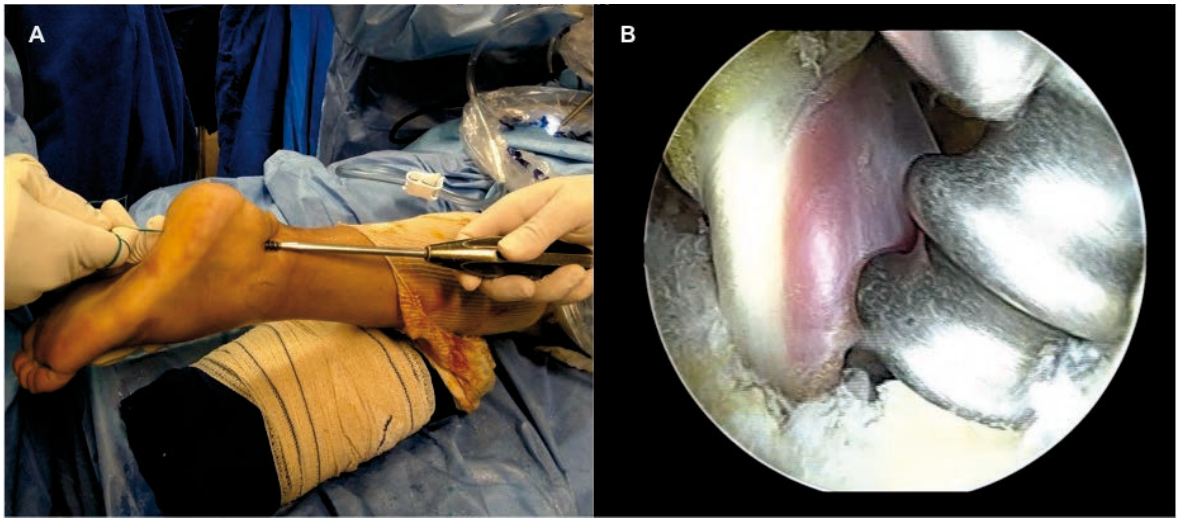

Figure 6. A. Introduction of the interference screw; B. Endoscopic view of the tunnel after fixation.

with autograft, allograft, or synthetic material[4,12-14]. The best surgical management modality for the chronic AT rupture remains undetermined[5]. The size of the gap after debridement of the tendon ends has to be considered before choosing the surgical technique[11-13]. PB and FHL are the two most common transfered tendon, with similar mechanical properties[3, 6, 15]. The first usually results in diminished strength of eversion, but has good rates of return to pre-injury sport and daily activities with minimally invasive techniques[16].

The FHL transfer to the calcaneus is traditionally performed through one or two long incision with extensive soft tissue dissection. Open surgery with a longitudinal incision can strip the peritendon, which is responsible for the blood supply to the damaged tendon. Wound complication rates among patients treated operatively are about 2,5 to 4%. Some Authors report an overall complication of 36% for open procedure and 10% for percutaneous repair[5, 7, 17].

Endoscopic techniques allow direct visualization of the tendon ends without any additional incisions and a FHL tenotomy proximal to the knot of Henry, transferring it to the calcaneus in a minimally invasive way. We report in this study lower morbidity and postoperative complications compared to those reported for open procedures[12, 18]. We consider this technic a valuable option for patients with high risk for skin and soft tissue complications.

This study reports our experience and the technique of an endoscopic FHL transfer performed in six AT chronic ruptures or re-ruptures with a 9-month average follow-up. Functional outcome improved significantly with the mean ATRS of 17,8 preoperatively in-

Table I – Patients submitted to the surgical procedure.

Variables	Patient 1	Patient 2	Patient 3	Patient 4	Patient 5	Patient 6
Gender	F	M	F	F	M	F
Age	65	33	52	60	43	47
Side	L	L	L	R	R	L
Time before treatment	4 months	No delayed	6 months	7 months	6 weeks	2 months
Acute/chronic	Chronic	Acute-rerupture	Chronic	Chronic	Chronic	Chronic
Gap	Np	Palpable	Np	Palpable< 1cm	Palpable >1cm	Palpable
Degeneration	> 50%	No	> 50%	> 50%	> 50%	> 50%
Comorbities	Dm + tabagism	No	Local corticoid injection	Dm	Heavy tabagism	Wegner syndrome + corticoid
Follow-up	8 months	1 year	5 months	11 months	6 months	1 year
Surgery time	60 min	56 min	45 min	48 min	70 min	61 min
Associate pars	No	Yes	No	No	Yes	Yes
ATRS pre	83	87	82	79	85	NC
ATRS post	17	13	28	11	16	NC

*NP - Not Palpable / NC - Not Collected / PARS - Percutaneous Achilles Repair System / ATRS - Achilles Tendon Total Rupture Score

creasing to 83,3 postoperatively (at last follow-up). In our series, none of the patients reported functional weakness of the hallux during athletic or daily life activity.

Although we did not experienced complications in our case series, it is well known that this procedure is technically demanding, requires high level arthroscopic experience and is associated with potential complications as fixation failure and neurovascular bundle lesion[11, 12]. This approach needs further comparative studies with the open procedure.

Conflict of Interest

Caio Nery has received Consultor and Speaker honorarium from Arthrex. All the other Authors declare they have no conflict of interest.

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