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Ultrasound-guided hyaluronic acid injection for the treatment of insertional Achilles tendinopathy: A prospective case series

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ABSTRACT

Background: Heel pain is a common condition and often involves the Achilles tendon and is classified as insertional or non-insertional. Several operative and non-operative treatments have been described, but there is no consensus on the most effective therapy. The aim of this study is to evaluate a case series of patients with insertional Achilles tendinopathy refractory to conservative treatment submitted to a single-dose ultrasound-guided injection of hyaluronic acid (40 mg/2.0 mL).

Methods: We prospectively included 25 patients (29 feet) who underwent a single ultrasound-guided injection of hyaluronic acid after conservative treatment failure. Clinical outcomes such as pain (using the Visual Analog Scale – VAS), function (using the American Orthopedic Foot & Ankle Society – AOFAS score), personal satisfaction, and complications were evaluated. Statistical analysis was performed using the R software.

Results: Most patients were female (80%) and there was a right-side predominance (55%). The median VAS was 8 points [range 4–10] at baseline, decreasing to 3 points [range 0–8] at the six-month follow-up, with statistical significance ($p < .001$). The median AOFAS score was 71 points [range 38–87] at baseline, increasing to 90 points [range 48–100] at the six-month follow-up ($p < .001$). The personal satisfaction level was 69%, and 48% of patients considered the result excellent. There were no Achilles tendon ruptures, infections, or allergic reactions post injection.

Conclusion: Single-dose injection of hyaluronic acid is a safe treatment option, improving function and reducing pain for six months in patients with insertional Achilles tendinopathy after conservative treatment failure.

Level of evidence: IV, case series.

1. Introduction

Heel pain is a common condition that often involves the Achilles tendon and is classified as insertional or non-insertional [1]. According to Van Dijk et al. [2] the insertional Achilles tendinopathy is characterized by its location at the insertion of the tendon onto the calcaneus, with possible site calcifications.

Current treatment for insertional Achilles tendinopathy varies substantially; several operative and non-operative treatments have been described, but there is no consensus on the most effective therapy [3–5]. Initially, the conservative, less invasive method is preferred—most commonly, eccentric exercise—, but the literature

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suggests that it may not be so successful in treating insertional tendinopathies [6].

Dextrose [7], polidocanol [8], or platelet-rich plasma (PRP) [9] injection may be an option in cases of chronic pain after conservative treatment failure. Hyaluronic acid (HA) injection first emerged as an option in the treatment of knee osteoarthritis [10]. In recent years, HA has been associated with extended therapeutic indications in extra-articular areas such as plantar fascia [11] and for Achilles tendon tendinopathy [12], ligament injuries [13], and neuroma [14], reducing the inflammatory process and having lubrication properties.

Thus, the aim of this study is to evaluate a case series of patients with insertional Achilles tendinopathy after failure of conservative treatment with rehabilitation programs. These patients were submitted to a single-dose ultrasound-guided injection of hyaluronic acid and evaluated according to their pain, function, and personal satisfaction outcomes.

2. Methods

This study was approved by the internal research committee of our institution (Instituto Prevent Senior) and by the local ethics committee, under registration no. 25444619.3.0000.8114 (CAAE - Plataforma Brasil). Besides, all stages of this study observed the Good Clinical Practice and the Declaration of Helsinki.

The sample was formed by 25 patients seen in an outpatient clinic, totaling 29 feet (four bilateral cases). Recruitment and intervention started in October 2020. All evaluations were conducted in person.

2.1. Eligibility

Inclusion criteria were pain in the insertional area of the Achilles tendon for at least six months of conservative treatment with physiotherapy, stretching, shoe changes, and analgesics; Visual Analog Scale (VAS) pain score higher than three on a scale from zero to 10; and patients having read and signed the study informed consent form.

Exclusion criteria were history of previous surgery, site injections, shock wave therapy, lower limb sequelae, neuropathies, local wound, previous allergy to hyaluronic acid, allergy to avian proteins, and patients under 16 years old.

2.2. Outcome measures

Patients were evaluated by interview and physical examination at baseline and the VAS and American Orthopedic Foot & Ankle Society (AOFAS) scores were applied [15]. Six months after the injection, patients were evaluated in person by the same research team and the same questionnaires were applied.

2.3. Intervention

Intervention was performed or supervised by the author (GFF) in an outpatient clinic, consisting in the injection of a single-dose of Osteonil Plus® (40 mg/2.0 mL; 2.0% sodium hyaluronate, TRB Chemedica, Munich, Germany) to the insertional area of the Achilles tendon (Fig. 1).

Firstly, local anesthesia was performed with 0.3 mL of 2% lidocaine hydrochloride (20 mg/mL), then, injection was guided using the Butterfly iQ® portable ultrasound device (Butterfly Network, New York, USA) to increase the intervention precision and efficacy.

The transducer was positioned on the long axis of the Achilles tendon and an alcoholic solution of 2% chlorhexidine was used to transmit the ultrasound waves (Fig. 2). The needle was then directed to the insertional area of the Achilles tendon aligned with the ultrasound transducer, in the topography of the retrocalcaneal bursa area, and 2 mL of hyaluronic acid was injected (Video 1).

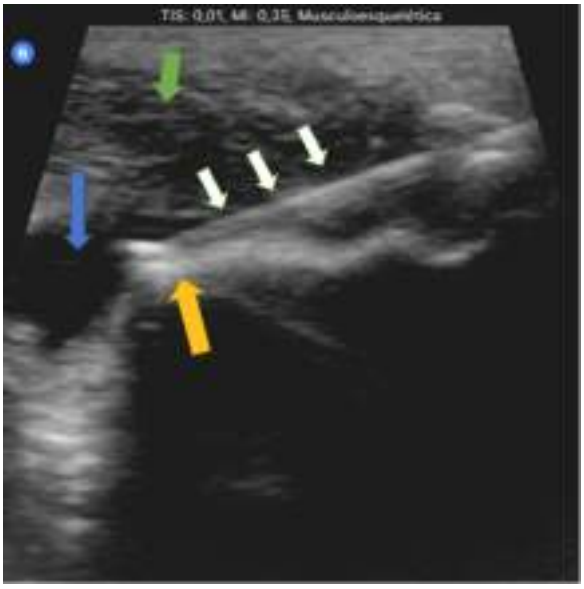

Fig. 1. Ultrasound imaging during the intervention. White arrow: needle; green arrow: Achilles tendon; blue arrow: retrocalcaneal bursa with hyaluronic acid; orange arrow: calcaneal cortical. (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article.)

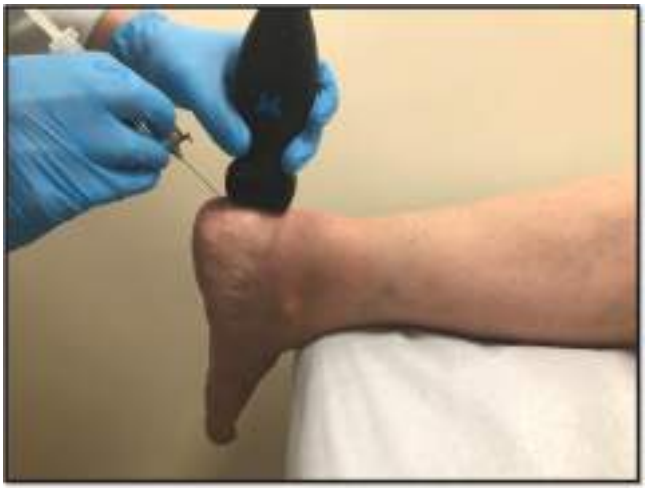

Fig. 2. Clinical image of the ultrasound position and needle with hyaluronic acid.

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After intervention, daily posterior chain stretching exercises were recommended for patients, who were also followed up by the physiotherapy team according to the rehabilitation protocol described by Alfredson et al. [6,16] Additionally, analgesics for mild pain and opioids for severe pain were prescribed where required.

2.4. Statistical analysis

Statistical analysis was performed using the R software stats package [17]. Continuous variables were measured using descriptive statistics, by the median, maximum, and minimum measures, being tested for distribution using the Shapiro test.

The analysis of continuous variables (VAS and AOFAS) at baseline and six months after the intervention was performed using the

Wilcoxon Signed Rank Paired Test (non-parametric distribution of variables).

3. Results

The median age of participants was 64 years old [range 49–78], with a prevalence of female patients (80%). The right side was the most predominant, representing 55% of the sample. Only two patients reported being smokers and four, diabetics. During follow-up, none of the patients underwent operative treatment or any other intervention for insertional Achilles tendinopathy, such as another injection or shock wave therapy.

The median VAS was 8 points [range 4–10; mean 7.43; standard deviation (SD) 1.92] at baseline, decreasing to 3 points [range 0–8; mean 3.37; SD 3.00] at the sixth-month follow-up, with statistical significance ($p < .001$). The median AOFAS score was 71 points [range 38–87; mean 65.14; SD 12.96] at baseline, increasing to 90 points [range 48–100; mean 84.31; SD 14.94] at the six-month follow-up, also showing a statistical significance ($p < .001$).

3.1. Personal satisfaction

Regarding the injection, 48% of patients considered the result excellent; 27%, good; 14%, fair; and 11%, poor. Out of the total participants, 69% of patients reported being satisfied with the procedure and 79% of patients said they would undergo the procedure again if they could go back in time. Regarding the improvement in symptoms after the intervention, half of patients considered it partial; 28%, total; and 21% of patients reported having no improvement after receiving the injection.

3.2. Complications

During follow-up, there was no Achilles tendon rupture, infection, or allergic reaction to hyaluronic acid. Some patients reported an increased site sensitivity and stiffness for one to two days after the injection, which was quickly resolved using analgesics.

4. Discussion

The initial treatment of insertional Achilles tendinopathy is generally conservative, with operative procedures being recommended after six months without improvement [18,19]. Several non-operative treatment options are described in the literature, ranging from specific rehabilitation exercises to more invasive procedures, such as injections and shock wave therapies [6,9,20–23].

A more invasive conservative treatment, such as injections, is indicated in cases that are refractory to rehabilitation programs lasting at least three to six months. There are several injection options available, but the use of corticosteroids in Achilles tendinopathies has been decreasing due to the risk of tendon rupture and degeneration [24–26]. Because of these complications, some researchers have started using hyaluronic acid for extra-articular areas such as tendons, fasciae, and entheses [12,27,28].

In 2021, Omer et al. have published (*pre-print without peer review*) a case series of patients with insertional Achilles tendinopathy submitted to three consecutive hyaluronic acid injections [29]. In their article, there was a function improvement after injection lasting six months, but the authors used only one score for evaluation and the number of patients was smaller than that used in our study. The authors also stated not having found any type of tendon reaction or rupture after injection, which is similar to our findings.

By comparing the pain and function improvement with that obtained with other types of invasive treatment, a decrease in the VAS score similar to that found with the injection of PRP, as published by Erroi et al. [9], can be observed. The study showed a decrease of 2.5 points in two months, 2.9 points in four months, and 3.3 points in six months following the intervention.

Fogli et al. [30] presented the HA effect in peritendinous injections (Achilles tendinopathy, lateral elbow tendinopathy, and patellar tendinopathy), showing a satisfactory, safe, and well-tolerated intervention, resulting in a significant pain relief and neovascularization in ultrasound assessments.

Another important aspect to be explained is the type of hyaluronic acid used. Products vary in regard to their molecular weight (kDa) and origin, being produced by the extraction of avian-derived molecules or by biological fermentation [31]. In our study, we used a semi-synthetic HA (biological fermentation) of intermediate molecular weight (1.800 kDa). However, there is no consensus in the literature on which one is more beneficial in tendinous and extra-articular injections.

Prolotherapy is another treatment that has been increasing in popularity. In this therapy, the insertional area of the Achilles tendon is injected with dextrose/glucose to promote analgesia, stimulating both inflammatory and non-inflammatory pathways throught a direct sensorineural analgesic mechanism. Two studies published with this type of intervention showed good long-term results (one to two years of follow-up), but both included mid-tendon and insertional tendinopathies. Another difference is that these studies included several weekly procedures, ranging from four to 12 [7,32].

The advantage of prolotherapy is its low cost when compared to hyaluronic acid injections, while presenting a similar method safety. However, in the abovementioned studies, prolotherapy required several injections, which is usually very painful and has little acceptance among patients, even under local anesthesia. Our study showed pain and function improvement with a single hyaluronic acid injection.

Our study has some limitations. First, this is a study with a short follow-up when compared to other studies. Additionally, subgroup analysis was not performed according to the degree of tendon degeneration and inflammation. Finally, this was a prospective case series study, lacking a control group to better support the results found. Further comparison through a randomized, controlled clinical trial is recommended using a method of recognized efficacy.

5. Conclusion

Single-dose injection of hyaluronic acid is a safe treatment option for insertional Achilles tendinopathy after conservative treatment failure, promoting function improvement and reducing pain for six months in treated patients.

Author contributions

All authors contributed equally throughout the stages of the study.

Declaration of conflicting interests

The authors declare no potential conflicts of interest with respect to the research, authorship, and/or publication of this article. ICMJE forms for all authors are available online.

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Informed consent

All included patients read and signed an informed consent form.

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