Physical Therapy in Sport 14 (2013) 163–167

Contents lists available at SciVerse ScienceDirect

Physical Therapy in Sport

journal homepage: www.elsevier.com/ptsp

Original research

High volume image guided injections for the management of chronic tendinopathy of the main body of the Achilles tendon

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ARTICLE INFO

Article history:
Received 22 December 2011
Received in revised form
19 April 2012
Accepted 2 July 2012

Keywords:
Achilles tendon
Neovascularization
Injections
Athletes
Sports

ABSTRACT

Objectives: Several substances are routinely injected in and around tendons. The present study evaluated the long term effects of high volume image guided injection (HVIGI) of normal saline, local anaesthetic and aprotinin in athletic patients with resistant tendinopathy of the main body of the Achilles tendon.
Design: Case series.
Methods: The study included a series of 94 athletes (69 men and 25 women; average age 37.5 years, range 22–63) with ultrasound confirmed tendinopathy of the main body of the Achilles tendon. All the patients had not improved after at least three months of conservative management. Patients were injected with 10 mL of 0.5% Bupivacaine Hydrochloride, 25 mg aprotinin, and up to 40 mL of injectable normal saline. We prospectively administered the Victorian Institute of Sport Assessment–Achilles tendon (VISA-A) to assess the short- and long-term pain and functional improvement.
Results: At baseline ($n = 94$), the VISA-A score was 41.7 ± 23.2 (range 11–60), and had improved to 74.6 ± 21.4 (range 71–100) by 12 months ($n = 87$) ($p = 0.003$), with no significant difference between sexes.
Conclusion: HVIGI with aprotinin significantly reduces pain and improves function in patients with chronic Achilles tendinopathy in the short- and long-term follow up.

1. Introduction

Tendinopathy of the main body of the Achilles tendon (AT) is a clinical triad of pain, impaired performance, and swelling in and around the tendon (Longo, Rittweger, et al., 2009). Achilles tendinopathy (ATpathy) is common in athletes, accounting for 6–17% of all running injuries (Longo, Rittweger, et al., 2009), with risk of long-term morbidity with unpredictable clinical outcome (Longo, Ramamurthy, Denaro, & Maffulli, 2008; Maffulli & Longo, 2008a,b; Maffulli, Longo, & Denaro, 2010). The aetiology of ATpathy is multi-factorial (Ames, Longo, Denaro, & Maffulli, 2008; Longo, Oliva, Denaro, & Maffulli, 2008; Longo, Rittweger, et al., 2009). Patients with chronic painful tendinopathy of the main body of Achilles tendon often present neovascularisation outside and inside the ventral part of the tendinopathic area (Longo, Ronga, & Maffulli, 2009). However, neovascularity in absence of pain is not necessarily pathological, and, in athletes, it can just indicate a physiological response to physical training (Longo, Rittweger, et al., 2009).

In preliminary studies in patients with recalcitrant tendinopathy of the main body of the Achilles tendon (Chan et al., 2008; Humphrey et al., 2009), a high volume image guided injection (HVIGI) of normal saline solution, local anaesthetic and corticosteroid decreased the amount of pain perceived by patients, and improved functional activities in the short- and long-term. Aprotinin is a broad spectrum serine protease inhibitor, with inhibition of plasmin, trypsin and kallikrein, forming reversible competitive bonds with these enzymes, inhibiting their proteolytic action and their vasoactive effect in the first stages of inflammation. It can block matrix metalloproteinases (MMPs), including MMP-1, MMP-8 and MMP-13 (collagenases) and MMP-2 and MMP-9 (gelatinases), either directly or via inhibition of plasminogen and plasmin. Aprotinin has been used for over 35 years as an offlabel injection for management of tendinopathy (Maffulli et al., 2010).

The present study evaluated the long term effects of high volume image guided injection of normal saline solution, local anaesthetic and aprotinin in patients with resistant tendinopathy of the main body of the AT.

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http://dx.doi.org/10.1016/j.ptsp.2012.07.002

2. Methods

The study had the approval of the local ethics committee (08/h1042/108/2009), following the Helsinki guidelines. Written consent was obtained from each patient prior to the injection.

Ninety-four athletic patients (69 men and 25 women; average age 37.5 years, range 22–63; mean time of self-reported physical activity per week: 236.8 ± 113.6 min, range 45–720) (Table 1) who received HVIGI between 2004 and 2007 for the management of recalcitrant tendinopathy of the main body of the AT were enrolled in this clinical study. These patients were tertiary referrals to the senior author, presenting after an average of 13.4 ± 21 months (range 4–55 months) from onset of symptoms. All patients had failed at least three months of a program of eccentric rehabilitation, and had received a variety of conservative management measures, including modification of activities, extracorporeal shock wave therapy, massage, ultrasonotherapy, hyperthermia, laser therapy. In addition, 28 patients had been immobilized in a cast or a walker for 4–9 weeks, and 42 had received a corticosteroid injection.

Patients were included in the study if they had a diagnosis of tendinopathy of the main body of the Achilles tendon, performed on the basis of clinical examination and ultrasonography, and a VISA-A score of 60 or less. Also, patients were included in the study if they practised a sport at least twice a week.

Patients with concurrent musculoskeletal ankle problems, tears of the Achilles tendon, inflammatory joint disease, insertional tendinopathy, workers' compensation claims, prior surgery on the affected Achilles tendon, and inability to complete questionnaires because of language problem were excluded from the study.

The AT was palpated for tenderness, heat, thickening, nodule and crepitation (Teitz, Garrett, Miniaci, Lee, & Mann, 1997). The sensitivity of palpation is 0.583 (CI 0.393, 0.752), and specificity is 0.845 (CI 0.745, 0.911) (Maffulli, Kenward, Testa, Capasso, Regine, & King, 2003).

The "painful arc" sign was performed to distinguish between tendon and paratenon lesions. In paratendinopathy, the area of maximum thickening and tenderness remains fixed in relation to the malleoli from full dorsi- to plantar-flexion; lesions within the tendon move with ankle motion (Maffulli et al., 2003). The sensitivity of the painful arc sign is 0.525 (CI 0.347, 0.697), and specificity is 0.833 (CI 0.717, 0.908) (Maffulli et al., 2003).

The Royal London Hospital test was performed. The clinician elicits local tenderness by palpating the tendon with the ankle in neutral position or slightly plantar flexed. The tenderness significantly decreases or becomes totally painless when the ankle is dorsiflexed (Maffulli et al., 2003). Sensitivity of the Royal London Hospital test is 0.542 (CI 0.345, 0.726), and specificity is 0.912 (CI 0.858, 0.952) (Maffulli et al., 2003).

Maximal antero-posterior thickness of the Achilles tendon was measured in mm using the scanner's (Logiq 9, GE Healthcare, Chalfont St Giles, Bucks, England) digital measuring device. Grey scale ultrasound was performed using a dedicated high resolution 8–12 MHz probe (GE Healthcare, Chalfont St Giles, Bucks, England). Neovascularisation was evaluated with a modified Ohberg's semi-quantitative grading system using the same machine, by the same experienced musculo-skeletal radiologist who used a standardised protocol for both baseline and follow up measurements (Malliaras, Richards, Garau, & Maffulli, 2008).

The primary endpoint was the difference in the VISA-A score from baseline to 1 year. For clinical purposes, patients were examined and VISA-A score were collected at baseline and at 1 year. In the event of adverse events and serious adverse events, it was planned that the investigators would have assessed whether they were related to the procedure. Investigators would have informed the local ethical committees/institutional review board of any serious adverse events or serious adverse effects.

At the latest follow up, we had data on 87 of the 94 patients. Of these 87 patients, a research assistant not involved in the clinical management of the patient reviewed 71 in person, and interviewed 11 telephonically. The remaining 5 patients filled in the VISA-A questionnaire and sent it to us by post.

We proposed to perform and US scan with grey scale and colour Doppler evaluation on all 71 patients who were reviewed in person. Of these, 63 agreed, with the other eight patients stating that they could see no point in receiving the scan as they had achieved acceptable control of symptoms. For technical reasons, we succeeded in obtaining 59 US scans with grey scale and colour Doppler evaluation.

The Victorian Institute of Sports Assessment–Achilles (VISA-A) questionnaire specifically measures the severity of ATpathy (Robinson et al., 2001). It covers the domains of pain, function, and activity. Scores are summed to give a total out of 100. An asymptomatic person would score 100. In clinical care, the VISA-A questionnaire provides a valid, reliable, and user friendly index of the severity of ATpathy. The VISA-A questionnaire showed good responsiveness in a randomized controlled trial (it was sensitive for clinically important changes over time with treatment, easy for the patients to fill out, and the data were easily handled) (Silbernagel, Thomee, Eriksson, & Karlsson, 2007). The VISA-A score has been cross-culturally adapted to Swedish (Silbernagel, Thomee, & Karlsson, 2005), Italian (Maffulli, Longo, Testa, Oliva, Capasso, & Denaro, 2008), Turkish (Dogramaci et al., 2009), and German (Lohrer & Nauck, 2009).

Patients were positioned prone on a couch. Both Achilles tendons were scanned by a board certified musculo-skeletal radiologist using a US scanner (Sonoline Elegra; Siemens, Erlangen, Germany) equipped with a 13 MHZ probe in both the longitudinal and transverse planes throughout their length. The Achilles tendon was assessed for any thickening, degeneration, hypo-echogenic areas and presence of any other surrounding soft tissue abnormality. The thickness of the tendon was recorded in mm. Colour Doppler was used to ascertain the presence of intra-tendinous neovascularization. The same board certified musculo-skeletal radiologist scanned and injected every patient.

Using an aseptic technique and assisted by a nurse, a 21 gauge needle attached to a 30 cm connecting tube was inserted from the lateral aspect of the tendon under real-time ultrasound guidance between the anterior aspect of the Achilles tendon and Kager's fat

Table 1
Sports activities of the 94 patients with resistant tendinopathy of the main body of the Achilles tendon prior to their symptoms.

Sporting activity	Number of subjects	Level of sport ($N = 94$) international (professional)/national (professional)/ club/recreational	Outcome ($N = 87$) return to sport same level/return to sport lower level/No sport/surgery
Running	16	2/3/8/3	13/0/1/1
Soccer	17	2/2/8/5	12/1/1/1
Badminton	9	0/2/4/3	6/1/1/0
Rugby	7	0/2/2/3	3/1/1/1
Gymnastics	3	0/0/3/0	2/1/0/0
Tennis	4	0/0/3/1	1/2/1/0
Squash	5	0/0/4/1	3/1/0/1
Keep fit	4	0/0/0/4	3/0/0/1
Sport aerobics	3	0/2/0/1	1/1/1/0
Cricket	5	0/2/3/0	3/0/1/0
Trekking	7	0/0/0/7	4/1/0/1
Martial Arts	5	0/1/4/0	4/0/0/1
Gaelic football	3	0/3/0/0	3/0/0/0
Others	6	0/2/2/2	3/1/1/1