The short-term effects of high volume image guided injections in resistant non-insertional Achilles tendinopathy

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Abstract

We investigated neovascularisation, tendon thickness and clinical function in chronic resistant Achilles tendinopathy following high volume image guided injections (HVIGI). The subjects involved 11 athletes (mean age 43.5 years ± 11.6, range 22–59) with resistant tendinopathy of the main body of the Achilles tendon for a mean of 51.4 months (±55.6, range 4–144) who failed to improve with an eccentric loading program (mean 11.8 months ± 2.6, range 8–16). The morphological features, neovascularisation and maximal tendon thickness were assessed with power Doppler ultrasound. Clinical function was measured with the Victorian Institute of Sports Assessment-Achilles tendon (VISA-A) questionnaire. All the tendinopathic Achilles tendons were injected with 10 mL of 0.5% bupivacaine hydrochloride, 25 mg of hydrocortisone acetate, and 40 mL of 0.9% NaCl saline solution under real time ultrasound guidance. All outcome measures were recorded at baseline and after a short-term follow-up (mean 2.9 weeks, range 2–4). The results showed a statistically significant difference between baseline and 3-week follow-up in all the outcome measures after HVIGI. The grade of neovascularisation reduced (3–1.1, \(p = 0.003\)), the maximal tendon diameter decreased (8.7–7.6 mm, \(p < 0.001\)), and the VISA-A scores improved (46.3–84.1, \(p < 0.001\)). In conclusion, HVIGI for resistant tendinopathy of the main body of the Achilles tendon is effective to improve symptoms, reduce neovascularisation, and decrease maximal tendon thickness at short-term follow-up.

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Keywords: Tendinopathy; Non-operative management; Peritendinous injection; Ultrasound

1. Introduction

Achilles tendinopathy occurs most commonly in the midportion of the tendon1 is difficult to manage, and the pain mechanism is not completely understood. The ingrowth of new vessels and associated nerves from the ventral side of the tendon may be a source of pain.2

High volume image guided injections (HVIGI) significantly reduce pain and improve function in patients with resistant Achilles.3 The effects of HVIGI on neovascularisation and tendon thickness are not known. This prospective short-term 3-week follow-up study assessed the effect of HVIGI on patients’ function, neovascularisation and tendon thickness. It also assessed the relationship between neovascularisation of painful Achilles tendons and tendon thickness and the possible association between clinical severity and these two morphological features.

2. Methods

Patients were recruited consecutively from athletes referred to the London Independent Hospital Sports Medicine Clinic. The cohort included 11 subjects (7 males and 4 females; mean age 43.5 years ± 11.6, range 22–59), who had resistant tendinopathy in the main body of the Achilles tendon for a mean of 51.4 months (±55.6, range 4–144). All had failed to improve with an eccentric loading program (mean 11.8 months ± 2.6, range 8–16). The subjects regularly exercised with a mean sporting participation of 236.8 min per week ± 223.6 (range 45–720). The sporting activities of the
Table 1
Sports activities of the 11 patients with resistant tendinopathy of the main body of the Achilles tendon prior to their symptoms.

<table>
<thead>
<tr>
<th>Sporting activity</th>
<th>Level of sport</th>
<th>Duration of activity/week (min)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Running, n = 4</td>
<td>International (professional), n = 1</td>
<td>Mean: 236.8</td>
</tr>
<tr>
<td>Gym training, n = 2</td>
<td>National (professional), n = 1</td>
<td>Range: 45–720</td>
</tr>
<tr>
<td>Badminton, n = 2</td>
<td>Club level, n = 2</td>
<td>Standard deviation: 223.6</td>
</tr>
<tr>
<td>Walking, n = 1</td>
<td>Recreational/fitness, n = 7</td>
<td></td>
</tr>
<tr>
<td>Pole vault, n = 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Football, n = 1</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The cohort are summarised in Table 1. The mean follow-up was 2.9 ± 0.51 weeks (range 2–4).

1. Morphology at Doppler ultrasound—Maximal anteroposterior thickness of the Achilles tendon was measured in mm using the scanner’s digital measuring device. Neovascularisation was evaluated with a modified Ohberg’s semiquantitative grading system using the same machine (Siemens Medical Systems Incorporation, high specification Sonoline Elegra scanner, and linear high resolution probe at 13 MHz) and settings for all the scans, performed by the same experienced musculoskeletal radiologist.

2. Victorian Institute of Sport Assessment Scale-Achilles (VISA-A) Questionnaire, an index of the clinical severity of Achilles tendinopathy to evaluate patients’ symptoms and their effect on activity.

The VISA-A questionnaire was completed at baseline before the Doppler ultrasound. Patients were then positioned supine on a couch with their hip externally rotated, the knees flexed to 45° and the ankle plantigrade. Both Achilles tendons were scanned in the longitudinal and transverse planes throughout their length, recording the neovascularisation and tendon thickness outcome measures immediately prior to the HVIGI. All subjects were only administered one HVIGI during their involvement in the study. Using an aseptic technique, a 21-gauge needle was inserted under real time ultrasound guidance between the anterior aspect of the Achilles tendon and Kager’s fat pad, targeting the area of maximal neovascularisation (Fig. 1). A mixture of 10 mL 0.5% bupivacaine hydrochloride and 25 mg of hydrocortisone acetate was injected, followed by 4 × 10 mL of injectable normal saline.

Patients were allowed to walk on the injected leg immediately, but were strictly advised to refrain from high impact activity for 72 h. After this period, they were instructed to re-start heavy eccentric loading physiotherapy regime twice daily until they stopped their sporting career. Patients attended a 3-week follow-up for repeated data collection of all the outcome measures and advice on return to sport.

One sample Kolmogorov–Smirnov tests were used to determine whether the outcome measures were normally distributed. Wilcoxon Signed Rank (non-parametric) test was used to compare baseline and follow-up neovascularisation grades. Paired t-tests were used to assess differences of tendon diameter and VISA-A scores between baseline and follow-up. The Pearson two-tailed test was used to analyse any correlations between outcome measures and any correlations between changes in outcome measures. Significance was set at p < 0.05. Data were analysed using the SPSS Statistical Package for Social Scientists, version 16.

3. Results

All outcome measure data collected were normally distributed. Doppler ultrasound confirmed the diagnosis of Achilles tendinopathy and the presence of neovascularisation in all the symptomatic tendons prior to the HVIGI. There was a statistically significant difference between baseline and 3-week follow-up in all the outcome measures after HVIGI. The mean neovascularisation grade reduced from 3 (±1.1, range 1–4) to 1.1 (±1.0, range 0–3) (p = 0.003). The maximal tendon thickness decreased from 8.7 mm (±2.0, range 5.7–12.3 mm) to 7.6 mm (±2.1, range 4.5–11.6 mm) (95% CI of 0.723–1.4908; p < 0.001). The VISA-A scores improved from 46.3 (±15.1, range 6–68) to 84.1 (±10.6, range 61–96) points (95% CI of 27.909–45.727; p < 0.001).

At baseline, there was a statistically significant association between the VISA-A scores and maximal tendon diameters (r = 0.704, p = 0.016). At follow-up, there was a statistically significant association between maximal tendon diameter and neovascularisation (r = 0.734, p = 0.01). There was no evidence of statistically significant associations between changes in any of the outcome measures before and after treatment. No other statistical correlations between the outcomes were identified.

4. Discussion

HVIGI targets the neurovascular bundles growing into the anterior aspect of the tendinopathic tendon, which have been implicated in the aetiology of pain in Achilles tendinopathy. We hypothesised that the high volume injection would produce local mechanical effects, causing the neovascularity to stretch, break or occlude.

Hence, the vascularity and the accompanying nerve supply are damaged, thus decreasing the pain in patients with resistant Achilles tendinopathy.

The present study provides prospective data to confirm the clinical short-term success of HVIGI to reduce recalcitrant Achilles tendinopathy symptoms. Our subjects would have previously been surgical candidates: one study showed that 28% of patients with Achilles tendinopathy required surgery.7

Neovascularisation was significantly reduced after 3 weeks following HVIGI. Chronic painful tendons treated with sclerosing polidocanol injections or eccentric exercises show an increase in neovascularity up to 3 weeks following the injection.3 The neovascularity then decreases in patients in whom the injection has been successful.8

A decreased tendon diameter after treatment with HVIGI is reported. This is also evident in other successful treatments for Achilles tendinopathy: for example, after sclerosing polidocanol injections at 2-year follow-up.9 This confirms that the essential lesion in tendinopathy is a failed healing response, which, following the correct stimulus, does exhibit remodelling capacity.

Several authors showed a relationship between the number of vessels seen on power Doppler ultrasound and tendon size.10 The present study shows evidence of a statistically significant association between tendon thickness and neovascularisation only after treatment.

We did not demonstrate a statistically significant association between neovascularisation and clinical severity at baseline or after HVIGI treatment. So, although neovascularisation increases the chance that a tendon is painful, it is not a useful tool in assessing function and clinical severity.

A previous prospective study showed a slight positive correlation between maximal tendon diameter and VAS scores at baseline and 3 months.1 In the present study, we showed a statistically significant association between VISA-A and tendon thickness at baseline, but not at follow-up. It is not obvious what underpins these different observations.

The procedure is practically advantageous, as only one intervention is required, and patients require a relatively short time to return to full impact activity with no reported complications to date.

We used hydrocortisone acetate in the high volume injections, primarily to prevent an inevitable acute mechanical inflammatory reaction produced by the large amount of fluid injected in the proximity the tendon. The injection is performed under ultrasound guidance, so the steroid has no direct action on the tendon itself. The role of steroids in management of tendinopathy is still debated, and we do not advocate their intra-tendinous injection.

The study was limited by patient numbers, and lacks a control group. Also, the subjects, the clinicians and the radiologist were not blinded. HVIGI are now being integrated into musculoskeletal radiology practice within our service. This potential patient cohort could be used for a larger and more robust randomised controlled trial.

5. Conclusion

HVIGI is an effective treatment to improve the symptoms of resistant tendinopathy of the main body of the Achilles tendon, reduce neovascularisation grade and decrease maximal tendon thickness in the short term.

Practical implications

- HVIGI is effective to improve the symptoms of resistant Achilles tendinopathy in the short term.
- Athletes with persistent recalcitrant symptoms have the potential to return to full activity quicker and avoid surgery if treated with the HVIGI.
- HVIGIs warrant further investigation to try and understand the bases of its effects, and to better study its role in the management of Achilles tendinopathy.

Conflict of interest

The authors have no financial conflict of interest and no external financial support.

Ethical standards

Ethics approval for the study was granted by our Local Research Ethics Committee.

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References
