

Ultrasound-guided injection for plantar fasciitis: A brief review

ABSTRACT

Plantar fasciitis (PF) is a distressing condition experienced by many patients. Although self-limiting, it tends to become a chronic ailment if the precipitating factors are not addressed. One of the modality of treating PF is intra-lesional corticosteroid injection. This was done using palpation technique earlier but nowadays many specialists use ultrasound (US) imaging as a guide to give injection accurately instead of inadvertently damaging the plantar fascia or injecting into surrounding soft tissue, both of which can have serious implications. We did a literature search in Medline, Scopus, and Embase databases to find out articles describing US-guided corticosteroid injection for treating PF and whether guided injection was effective than injection given by palpation.

Key words: Chronic pain, corticosteroid, nonsteroidal anti-inflammatory agents, plantar fasciitis, tendinopathy, ultrasonography

Introduction

Plantar fasciitis (PF) is the most common cause of heel pain in adults. Usually, it is self-limiting, gets subsided with lifestyle modification and use of appropriate footwear. The predisposing factors for PF are prolonged standing (athletes), tight foot muscles (Achilles tendon, intrinsic foot muscles). Histologically, the lesion shows degenerative changes along with increased vascularity, proliferation of fibroblast, and destruction of collagen fibers.^[1,2] The prevalence of PF is described as between 3.6% and 7% in general population among runners, it is around 8% of the sport associated injuries.^[3]

Imaging is not done routinely for diagnosis of PF. The diagnosis is usually based on history and at times tenderness that can elicited at the heels. However, ultrasound (US) of foot is inexpensive and is used to rule out soft tissue pathology of the heel. On US, proximal plantar fascial

thickness of more than 4 mm with areas of hypogenicity goes in favor of PF. For recalcitrant heel pain, magnetic resonance imaging is recommended to determine the severity of inflammation.^[4]

Conservative management of PF includes foot and ankle stretches, eccentric stretches, deep myofascial massage, and iontophoresis. The mentioned modalities are usually used together with suggestion to avoid prolonged standing, to loose weight, use of proper sized footwear, etc. Therefore the efficacy of any one of the conservative approach is hard to establish. Pharmacological management involves use of acetaminophen and nonsteroidal anti-inflammatory drugs which benefits in early stages.

Corticosteroid injection is required when the conservative and pharmacological line of treatment fails. It was found in a few surveys that the American Podiatrists and Orthopedicians suggest corticosteroid injection for chronic plantar pain.^[5]

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The advantages of corticosteroid injections are it reduces the edema and inflammation of the fascia. This injection combined with physiotherapy is usually sufficient for most of the patients. Other injections which are mentioned in literature are hyperosmolar dextrose or prolotherapy, whole blood, platelet rich plasma, and Botox. Extracorporeal shock wave therapy and plantar fasciotomy are reserved for patients with chronic recalcitrant PF.^[6]

Theoretically, role of corticosteroid is controversial because PF is a degenerative disease resembling tendinopathy. Corticosteroid works well in chronic inflammatory conditions by suppressing prostaglandin mediated inflammation and pain. However, corticosteroids can interfere with fibroblast proliferation which is responsible for the chronic nature of the condition thereby providing significant relief. For patients with chronic PF, corticosteroid has been successfully used and patients usually have significant pain relief especially up to 4 weeks after the injection. This intervention also has shown to reduce the thickness of fascia on subsequent follow-up.

Choice of Corticosteroid

Usually nonflourinated, long acting corticosteroids are used. On literature review, we found use of dexamethasone, methyl prednisolone, and beclomethasone more frequently with lignocaine. Physicians have used triamcinolone, prednisolone effectively.

Many podiatrists and orthopedicians use landmark technique for giving injection for PF. Although it is successful on several occasions, there are several factors which contribute to either failure or less effective injection, at times leading to avoidable problems such as soft tissue atrophy, postinjection flare, and rupture of plantar fascia.

Review of Literature Pertaining to Ultrasound-Guided Injection for Plantar Fasciitis

We searched Medline, Embase, and Scopus databases using keywords PF, Ultrasonography, and Corticosteroid so as to find relevant articles were corticosteroid injection was used for PF. Many articles are available describing corticosteroid injection for PF, but we have restricted our review to studies which involve use of US comparing to palpation technique or use of US alone [Table 1].

McMillan *et al.* conducted a randomized, investigator and participant blinded, placebo-controlled trial by enrolling 82 patients with PF and divided into two groups of 41 each. Participants in both group were given a posterior tibial nerve block to avoid pain during injection. One group received dexamethasone sodium phosphate and the other group received placebo (normal saline). Primary outcome was pain at 4, 8, 12 weeks and plantar fascia thickness assessed by US. The secondary outcome defined was function and first step pain at 4, 8, and 12 weeks after injection. On data analysis, participants in dexamethasone group had better pain score, reduced fascial thickness and improved function at 4, 8, and 12 weeks. The investigators concluded by mentioning that corticosteroid injection for PF was effective in providing short-term pain relief, i.e., 4 weeks.

Yucel *et al.* conducted a study involving 32 patients with PF who were randomly assigned to receive corticosteroid injection using US, palpation, and scintigraphy based.

On analysis of data, they concluded that corticosteroid injection are effective in providing good pain relief in these patients. However, it should ideally be done US-guided or by palpation.^[7]

A randomized, placebo-controlled, double-blind trial with 12-week follow-up was done by Schulhofer. Eighty-two patients were randomized to receive US-guided

Table 1: Efficacy of ultrasound guided injection for plantar fasciitis

Authors	Type of study	Number of patients	Groups	Conclusion of study
McMillan <i>et al.</i>	Randomized, investigator and participant blinded, placebo-controlled trial	82 (41 in each group)	41 patients-corticosteroid, 41-placebo (saline)	Short-term effective pain relief provided (up to 4 week) by corticosteroid injection
Yucel <i>et al.</i>	Randomized study	32 patients	Patients randomly received corticosteroid (by palpation, US, scintigraphy)	Effective pain relief with US use
Schulhofer	Randomized, placebo-controlled, double-blind trial with 12-week follow-up	82 patients	Dexamethasone versus placebo (saline)	Pain relief up to 4 weeks, plantar fascia thickness reduced even at 12 weeks
Chen <i>et al.</i>	Randomized study	33 patients	US injection versus injection by palpation	Pain scoreless with US use
Tsai <i>et al.</i>	Randomized study (assessed at 2 weeks, 2 months, 1 year)	25 patients	US versus palpation injection	Pain score, fascial thickness, recurrence less in patients with US injection

US: Ultrasound

dexamethasone in one group and placebo (normal saline) in another and followed up at 4, 8, and 12 weeks. The pain was significantly better in dexamethasone group at 4 weeks although after that the difference was not much in either groups (similar to the results of McMillan *et al.*). However, plantar fascia thickness was reduced significantly in dexamethasone group even at the end of 12 weeks which was not seen in placebo group.^[8]

Similar to above study, Genc *et al.* conducted a study to evaluate the long-term efficacy of steroid injection (after 6 months) involving 27 patients. Pain score and plantar fascia thickness were significantly less in patients who received steroid injection. However, in the study, injection was given by palpation technique.^[9]

Chen *et al.* conducted a study to investigate the effectiveness of device-assisted US-guided steroid injection for treating PF by recruiting 33 patients with unilateral PF. The patients received either US-guided or palpation-guided betamethasone injection. The follow-up for a period of 3 months revealed that patients who received US-guided injection had better therapeutic outcomes than palpation-guided injection.^[10]

The study by Tsai *et al.* involving 25 patients who received either US-guided or Palpation-guided injection were followed up to assess pain intensity, thickness, and echogenicity of the proximal plantar fascia at 2 weeks, 2 months, and a year after the injection. The results revealed that pain, plantar fascia thickness, and recurrence was less when US was used to give injection.^[11]

Technique of Ultrasound-Guided Corticosteroid Injection for Plantar Fasciitis

Sonographically guided injection is done in lateral position with the affected limb independent position, with slight flexion at knee, and the patient told to keep the foot was in a relaxed manner. The injection can also be performed with the patient in prone position. The injection site is prepared in a sterile manner using chlorhexidine spray or solution and covered in a sterile manner exposing the injection area. A 6-13 MHz high frequency linear array US probe is used and longitudinal scan of the heel is done to look for the calcaneum, plantar fascia, and changes in echogenicity of the fascia and perifascial edema. The diagnosis is typically based on the fascial thickness >4.0 mm at its thickest portion 10-15 mm from the insertion at calcaneum, and abnormal fascial echo texture.

After initial scanning in longitudinal axis of the fascia, the corticosteroid injection is given in an out-of-plane approach

from the medial side of the heel [Figure 1]. The mid-point of the maximal thickness of the fascia and its corresponding area over the medial fat pad of the sole is marked and the needle entry point anesthetized with 1% lidocaine with a 26-gauge needle.

Then a 24-gauge hypodermic 1.5 inch needle is inserted perpendicular to skin and parallel to the probe aiming to deposit the medicine just above the plantar fascia avoiding needle entry into the fascia and injection into the fat over the fascia. A volume of 1-2 ml containing 0.25% bupivacaine and 4 mg of dexamethasone sodium phosphate after negative aspiration and continuous visualization of accurate spread in sonographic image is given.

During postinjection, all patients are advised to apply ice pack along with simple nonsteroidal anti-inflammatory medicines (ibuprofen, ketorolac) for couple of days and not to bear full weight for 2 days.

An in-plane approach of injection can also be used were the needle will enter from the sole directed toward the toes [Figure 2]. We feel out-of-plane injection is better than the in-plane approach as the tissue distance the needle has to penetrate is much less and patient co-operation is better.

Advantages of Ultrasound-Guided Injection

The US imaging definitely has several advantages over landmark technique. With training and experience, inadvertent soft tissue and intravascular injection can be avoided leading to a more reliable and successful injection. Inadvertent plantar fascial rupture can be avoided with the use of US for injection. In case of rupture, an inflammatory

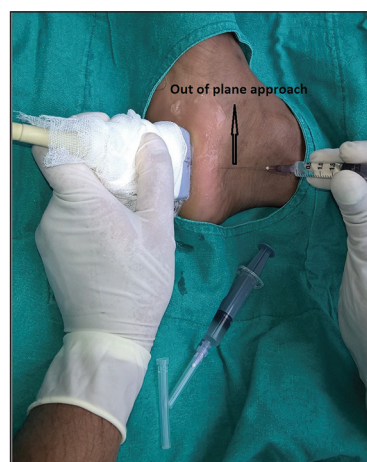


Figure 1: Out-of-plane injection for plantar fasciitis: The needle is entered in an out-of-plane approach from the medial side. The arrow shows the point of needle entry in an out-of-plane approach



Figure 2: In-plane approach for plantar fascia. The advantage of in-plane approach is that the needle is visualized in its entire course. The arrow points toward entry of needle in an in-plane approach

process sets in and can increase the suffering of patient due to unbearable pain. In case of fat atrophy due to steroid injection, the cushion effect provided for weight bearing is lost leading to more degeneration of plantar fascia.

The preinjection and postinjection images captured during scan can be stored and used for comparison during follow-up.^[12-14]

Conclusion

Patients requiring injection for chronic pain due to PF benefits from an US-guided injection. The injection done is site specific, image guided and done in real time. The already ongoing conservative therapy should also be continued with regular follow-up with the physician for having a long-term relief from the distressing entity of PF. Surgery for this condition can be avoided by avoiding the aggravating factors and addressing the risk factors.

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Conflicts of interest

There are no conflicts of interest.

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