Treatment outcome of plantar fasciitis with local steroid injection by ultrasound versus palpation technique

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Abstract
Introduction: Plantar fasciitis is a degenerative tissue condition that occurs at the site of origin of plantar fascia at the medial tuberosity of calcaneum. Most commonly reported symptom of plantar fasciitis is described as first step pain. Treatment of plantar fasciitis include methods such as heat modalities, patient education, massage, stretching and strengthening exercises, extracorporeal shockwave therapy, non-steroidal anti-inflammatory medications, injections (steroids, local anesthetics, PRP), and surgical interventions (fasciotomy).
Objective: The purpose of the study is to prospectively evaluate comparative efficacy of ultrasound guided steroid injection versus palpation technique.
Materials and Methods: It is a prospective and interventional randomized comparative study. Eighty cases (40 in each group) in otherwise healthy individuals with the diagnosis of unilateral or bilateral plantar fasciitis attending Outpatient department of PMR of VMMC & Safdarjung hospital were enrolled in this study. The diagnosis of plantar fasciitis was made based on history and clinical examination.
Patients who satisfied inclusion and exclusion criteria was randomly assigned by computerized block method to two groups-both groups were treated with injection of 40 mg(1ml) methyl prednisolone, one group with palpation guided (group A) and other with ultrasound guided(group B). All patients underwent pain intensity assessment (VAS), ultrasound examination of foot for plantar fascia thickness and x-ray foot for heel pad thickness at pre injection (0 week), 2 weeks and 8 weeks after steroid injection.
Result: Statistically significant improvement in pain (VAS) at the end of 2 weeks (3.25±0.95 vs 2.65±0.83, p=0.003) and 8weeks (2.28±1.24 vs 1.12±1.07, p=0.0005) of intervention in both groups but more in USG guided group. There was decrease in plantar fascia thickness at the end of 2 weeks (0.33±0.02 vs 0.31±0.02, p=0.0005) and 8 weeks (0.30±0.02 vs 0.28±0.02, p=0.0005) of intervention in both groups but more in USG guided group, this was statistically significant. No significant difference in heel pad thickness at the end of 2 weeks (18.08±0.76 vs 18.23±0.80, p=0.356) and 8weeks (18.00±0.75 vs 18.12±0.79, p=0.444) of intervention in both groups.
Conclusion: Ultrasound guided injection is better than palpation method as it enhances the accuracy of injection by precisely localizing the lesion and needle placement giving more relief in symptoms and normalization of plantar fascia thickness.

Keywords: Ultrasound (US), plantar fascia thickness (PFT), Heel pad thickness (HPT), Visual analogue scale (VAS), Corticosteroid.

Introduction
The plantar fascia is a thickened, fibrous sheet of connective tissue that originates from the medial tubercle of the calcaneum, attaching to the plantar plates of the metatarsophalangeal joints to form the medial longitudinal arch of the foot. It provides support of the longitudinal arch and serves as a dynamic shock absorber for the foot during walking and running.[1,2] Plantar fasciitis, the most common cause of heel pain, is a degenerative process of the plantar fascia. In the presence of aggravating factors, the repetitive movement of walking or running can cause micro tears in the plantar fascia. The word "fasciitis" assumes inflammation is an inherent component of this condition. However, recent research suggests that some presentations of plantar fasciitis manifest noninflammatory, degenerative processes and should more aptly be termed "plantar fasciosis".[3,4]

In plantar fasciitis patient experience insidious onset of pain at the bottom of feet, particularly around heel. The pain starts with first few steps after resting. It is diagnosed on the basis of history and careful examination. Physical examination reveals localized tenderness on palpation of plantar fascia at its origin at medial tubercle of calcaneal tuberosity.[5] Plain radiograph of foot are taken to exclude underlying conditions affecting bones or joint or stress fractures of the bones of the foot. One can also see a spur on the heel bone. It is not the cause, but effect of plantar fasciitis.[6,7] Ultrasonography can visualize the thickening of the plantar fascia, hypo echoic changes, perifascial fluid collections, and bony spur. The advantages of ultrasound are that its application is noninvasive and it is highly tolerable, free of radiation, and cost effective.[8-10] Corticosteroids have been shown to inhibit fibroblast proliferation and expression of ground substance proteins as increased proliferation of fibroblasts and excessive secretion of proteoglycans are commonly reported features of the condition.[11]

Treatment for plantar fasciitis can be divided into numerous categories like, patient education, non-invasive (heat modalities, electric modalities, patient education, soft tissue therapy, massage, taping, night splints, stretching, strengthening, extra-corporeal shock wave therapy, anti-inflammatory medications (aspirin, ibuprofen, naproxen), injections (steroids, local anesthetics, platelet reach plasma) and surgical intervention (endoscopic or open fasciotomy).[12-17] When we planned for the study there was few Indian study of such type in the searched literature made us decide to start this study.

Materials and Methods

This study was a single center randomized interventional study conducted in department of PMR of a tertiary care hospital during September 2014 to January 2016. Eighty cases (40 symptomatic feet in each group) in otherwise healthy individuals with the diagnosis of unilateral or bilateral plantar fasciitis attending Outpatient department of PMR of Safdarjung hospital after satisfying the inclusion criteria (Age: 18 years and above, Patient diagnosed with unilateral or bilateral plantar fasciitis, Physical examination revealing maximum tenderness at the attachment of the plantar fascia on the medial tubercle of the calcaneus) and exclusion criteria (Received local steroid injection within 3months, History of bleeding disorders, Previous surgery for plantar fasciitis, Local malignancy, Achilles tendon pathology, Patients on anticoagulation therapy, Pregnancy, Diagnosis of vascular insufficiency or neuropathy related heel pain like radiculopathy, tarsal tunnel syndrome and other causes of heel pain Uncontrolled Diabetes, Any local trauma or infection) were enrolled in this study. We took one symptomatic foot as one case. The diagnosis of plantar fasciitis was made based on history and clinical examination. Then they were divided into two groups using computerized block randomization. One group was treated with palpation guided injection (group A), the other with ultrasonographically guided injection (group B). All patients underwent pain intensity assessment by VAS, ultrasonographic examination of foot and X-ray foot lateral view at pre-injection (0 week), 2 weeks and 8 weeks after steroid injection.

Assessment parameters

1. Pain Intensity

Heel pain was assessed with a numerical visual analogue scale (VAS) of 0 to 10, in which 0 represented no pain and 10 represented the worst pain in each subject's experience.

2. Plantar Fascia Thickness by Ultrasonographic Examination

Real-time ultrasonography was performed with a 6–13-MHz linear-array transducer of ultrasound machine (Sonosite system p08840-22 Sonosite ultrasound system). Patients were in prone position with the feet hanging over the edge of the examination table to facilitate examination of both heels. Real-time scanning during dynamic dorsiflexion of the toes was occasionally performed to stretch the plantar fascia and allowed easier delineation of its margins.

Longitudinal ultrasonograms were taken of the plantar aspect of the foot, and the thickness of the plantar fascia was measured at its proximal end near its insertion to the calcaneus at its thickest portion using the electronic calipers of the scanner.[18]

3. Heel Pad Thickness Measurement by X-Ray Foot lateral view

Shortest distance between the calcaneus and plantar skin surface was taken as heel pad thickness; normal is 19mm for both sexes.[19]

Steroid injection in plantar fasciitis

A 22-gauge, 1.5-inch needle connected to a 2ml syringe filled with 1 ml (40mg) of depomedrol (methylprednisolone acetate) was used for injection. The skin was sterilized with povidone-iodine.

1. Ultrasonography Guided injection

The patient was kept lying in prone position with foot hanging from edge of the couch. The needle was inserted through the posterior heel parallel to the long axis of the transducer and entered the thickened hypo echoic proximal plantar fascia under real-time ultrasonography guidance. After negative aspiration injection was given in the region of maximal fascia thickening.[20]

2. Palpation guided injection

The patient was kept lying in lateral position of affected site with foot hanging from edge of the couch. The heel was palpated at the site where the medial calcaneus starts to curve superiorly to confirm the injection site for maximal tenderness near calcaneal tuberosity. The needle was inserted from the medial aspect of heel to the point of maximal tenderness. The needle was gently advanced until the tip touched the underlying bone and then was withdrawn 2 mm. After negative aspiration injection given above the plantar fascia attachment at calcaneum.[21]

Post-injection Protocol

Cold treatment was applied, and Patients were instructed to limit extensive use of their leg for the next 24 hours. Pain killers were not allowed throughout the study period of 12 weeks, except paracetamol (maximum dose of 1.5 gram/day), when the pain was unbearable. Patients were given a standardized stretching protocol to follow for 2 weeks, beginning 24 hours after injection. After the stretching program was complete, a formal strengthening program was initiated.

Patients were permitted to continue with activities of daily living immediately; however, they were cautioned to refrain from any activities that reproduced the heel pain for the next 4 weeks. Return to recreational and/or sporting activity was allowed once the patient was pain free during activities of daily living and asymptomatic during resistive testing. The exercise was repeated 30 times in each sitting and was done twice a day throughout the study period.

Results

Patients with 80 symptomatic feet satisfying the inclusion criteria and exclusion were enrolled in the study and randomly allocated in two groups. Out of Eighty patients (40 in group A and 40 in group B) completed the 8 week follow-up period. Group A received palpation guided and group B received USG guided injection.

The mean duration of the symptoms in group A was 15.1 ± 4.02 weeks and in group B was16.08 ± 3.75 weeks. Both the groups are comparable in age, sex & duration of symptoms

Statistically significant improvement in pain (VAS) at the end of 2 weeks and 8weeks of intervention in both groups more in USG guided group. Statistically significant decrease in plantar fascia thickness at the end of 2 weeks

and 8weeks of intervention in both groups but more in USG guided group. No statistical significant difference noted in heel pad thickness at the end of 2 weeks and 8weeks of intervention in both groups.

Table 1: Visual analogue scale

Time interval in weeks	Group-A (P-Value)	Group-B (P-Value)
Between baseline and 2 weeks	<.0005	<.0005
Between baseline and 8 weeks	<.0005	<.0005
Between 2 weeks and 8 weeks	<.0005	<.0005

Within group A & group B in sequential follow up:

Table 2

VAS	Group-A	Group-B	P-Value
At 0 Week	7.08±0.76	7.12±0.76	0.682
At 2 Week	3.25±0.95	2.65±0.83	0.003
At 8 Week	2.28±1.24	1.12±1.07	0.0005

Between group A & group B in sequential follow up:

Table 3: Visual analogue scale

Plantar fascia thickness	Group-A	Group-B	P-Value
At 0 Week	0.44±0.03	0.45±0.03	0.012
At 2 Week	0.33±0.02	0.31±0.02	0.0005
At 8 Week	0.30±0.02	0.28±0.02	0.0005

Table 4: Plantar fascia thickness

Heel pad thickness	Group-A	Group-B	P-Value
At 0 Week	18.1 ± 0.84	18.23 ± 1.27	0.718
At 2 Week	18.08 ± 0.76	18.12 ± 0.94	0.598
At 8 Week	18 ± 0.75	18.02 ± 0.86	0.812

Heel pad thickness

Fig. 1: USG guided injection

Discussion

Plantar fasciitis is the most common type of plantar fascia injury and is reported to be the most common cause of inferior heel pain in adults. It is a degenerative syndrome of the plantar fascia resulting from micro tears with subsequent repeated trauma due to repetitive strain through weight bearing, low or high arches or over-pronation of the foot, systemic disease, or obesity may exacerbate pain. Conservative therapy for plantar fasciitis is the standardized management. When conservative treatment fails, minimally invasive techniques such as corticosteroid injection may be used for the management of plantar fasciitis. Local corticosteroid injection for plantar fasciitis can be performed by many methods. It can be palpation-guided injection, ultrasonography-guided injection or scintigraphic-guided injection. Of them Palpation-guided injection is the approach traditionally used. Sonographically guided injection provides real-time imaging of the plantar fascia during needle insertion and corticosteroid delivery, leading to better therapeutic efficacy. It is considered to be associated with lower recurrence rates. The aim of this study was to prospectively compare the effect of ultrasound (US)-guided versus palpation-guided local corticosteroid injection in patients with chronic plantar fasciitis.

Patients (total 80 symptomatic feet) who satisfied the inclusion and the exclusion criteria were randomly assigned by the Computerized Block Randomization method into two groups: one group (40 symptomatic feet) was treated with palpation guided injection (group A), the other (40 symptomatic feet) with ultrasonographically guided injection (group B). In our study, classical history of first step pain and clinical examination of tenderness at medial calcaneal tuberosity, were used to diagnose plantar fasciitis, supported by radiographic finding of inferior calcaneal spur occasionally on lateral film of ankle and foot.Longitudinal sonographic images of plantar fascia were obtained. The sonographic diagnosis was based on the presence of plantar fascia thickening of greater than the reference cut-off value, fusiform thickening of the plantar fascia close to the calcaneal enthesis and an abnormal fascia echo texture. The thickness of the plantar fascia was measured at its proximal end near its insertion to the calcaneus at its thickestportion.

The result of our study showed statistically significant decrease in symptoms with local corticosteroid (methyl prednisolone) injection in both group A (palpation guided) and group B (USG guided group) assessed by VAS (for pain score).

We observed statistically significant decrease in pain score in VAS scale in group A comparing from baseline (0 week) with mean VAS 7.08 ± 0.76 to 2 weeks with mean VAS 3.25 ± 0.95 (p value<0.0005). Also statistically significant reduction in pain score with baseline VAS from 7.08 ± 0.76 to 8 weeks VAS 2.28 ± 1.24 (p value<0.0005) and from VAS score 3.25 ± 0.95 at 2 weeksto8 weeks2.28 ± 1.24 (p value <0.0005) noted.

In study group B also we observed statistically significant reduction in pain with mean VAS score from baseline (0 week) 7.12 ± 0.76 to 2weeks with mean VAS score 2.65 ± 0.83 (p value <0.0005), from baseline (0 week) mean VAS score 7.12 ± 0.76to8 weeks VAS 1.12 ± 1.07 (p value <0.0005) and also from 2weeks with VAS score 2.65 ± 0.83 to 8 weeks VAS 1.12 ± 1.07 (p value <0.0005).

These findings of changes in VAS score is consistent with the study by Wen Chungtsai et al[23] showed statistically significant improvement in pain scale recorded over the VAS.

Decrease in pain following the injections in both groups is also supported by a study done by Chien-Min Chen et al showed corticosteroid was more effective for pain reduction than non-invasive treatments.[22]

The result of our study showed statistically significant decrease in plantar fascia thickness with local corticosteroid (methyl prednisolone) injection in both group A (palpation guided) and group B (USG guided group) assessed by US digital caliper but more in group B. We observed statistically significant decrease in plantar fascia thickness (PFT) in group A from baseline (0 week) with mean value 0.45 ± 0.03cm to 2 weeks with mean value 0.31 ± 0.02cm (p value <0.0005), from baseline (0 week) with mean value 0.45 ± 0.03cm to 8 weeks with mean value 0.28 ± 0.02cm (p value <0.0005) and from 2 weeks with mean value 0.31 ± 0.02cm to 8 weeks with mean value 0.28 ± 0.02cm (p value <0.0005).In group B the baseline mean plantar fascia thickness also decreased which was statistically significant from baseline (0 week) 0.45 ± 0.03cm to 0.31 ± 0.02cm (p value <0.0005) in 2 weeks followed by 0.28 ± 0.02cm (p value <0.0005) in last follow up at 8 weeks.

These changes in mean plantar fascia thickness were also supported by study of Wen Chungtsai et al showed statistically significant changes in plantar fascia in there subsequent followups.[23]

The result of our study showed statistically insignificant change in mean heel pad thickness (HPT) with local corticosteroid (methyl prednisolone) injection in both group A (palpation guided) and group B (USG guided group) assessed by X-ray lateral view.

In group A the mean heel pad thickness changes were statistically insignificant from baseline (0 week) 18.1 ± 0.84cm to 18.08 ± 0.76cm (p = 0.808) in 2 weeks followed by 18 ± 0.75 (p= 0.371) in last follow up at 8 weeks. On comparing mean Heel pad thickness between 2weeks and 8 weeks follow-up also showed statistically insignificant changes (p= 0.083). In group B the mean heel pad thickness changes were also statistically insignificant from baseline (0 week) 18.23 ± 1.27cm to 18.12 ± 0.94cm (p = 0.419) in 2 weeks followed by 18.02 ± 0.86 (p= 0.186) in last follow up at 8 weeks. On comparing mean heel pad thickness between 2weeks and 8 weeks follow-up also showed statistically insignificant changes (p= 0.083). These changes in mean heel pad thickness were also supported by study of Wen Chungtsai et al showed statistically insignificant changes in mean symptomatic heel pad thickness 10 in there follow-ups.[23]

Conclusion

Ultrasound guided injection is better than palpation method as it enhances the accuracy of injection site by precisely localizing the lesion and needle placement giving more relief in symptoms and normalization of plantar fascia thickness.

Conflict of interest

None.

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