Comparative Study of Efficacy of Single Injection of Platelet-rich Plasma with Steroid Injection in Treatment of Plantar Fasciitis

Vanamali B Seetharam¹, B Sunil¹, K B Srinath Reddy¹, Narayan Naik¹

Abstract

Background: Plantar fasciitis (PF) is a degenerative condition which can be painful and debilitating with well-recognized clinical presentation. Although most patients with this condition eventually have satisfactory outcomes with nonsurgical treatment, sometimes PF can be a difficult problem to treat. For patients who do not improve after initial treatment, corticosteroid injection or dexamethasone iontophoresis may provide short-term benefit. However, these therapies do not improve long-term outcomes and may cause plantar fascia rupture. Recent studies have indicated platelet-rich plasma (PRP) might be promising treatment modality in chronic cases of PF.

Materials and Methods: Prospective study conducted at tertiary care research institute comparing the efficacy of single injection of PRP with a steroid. A total of 80 patients with PF of more than 3 months were subjected to routine blood investigation, X-rays of the foot with ankle and were categorized into two groups. The first group received local infiltration of 1 ml of autologous PRP and the second group received 1 ml Triamcinolone injection. After injection, all patients were prescribed combination of paracetamol and tramadol orally for pain relief and were advised plantar fascia stretching exercises, soft footwear. Visual analog scale and foot and ankle outcome scores were recorded on day 0, at 12 and 24 weeks.

Results: The results were analyzed using nonparametric tests such as Chi-square and Fisher Exact tests. The pain relief at 3 months was comparable in both groups, but at 6 months pain relief was greater in the PRP group, and the difference was statistically significant (P < 0.001). The complications in steroid group were hypopigmentation with subdermal atrophy, and no complications were reported in PRP group.

Conclusion: Efficacy of single injection of PRP to relieve the pain of PF is better than triamcinolone over a short-term follow-up period. However, more multicenter studies are required to evaluate the efficacy of PRP over the long term.

Keywords: Plantar fasciitis, platelet-rich plasma, steroid, visual analog scale score, foot and ankle outcome score.

Introduction

Plantar heel pain is a common presenting condition to orthopedic outpatient department. There are many causes of this ailment, but one of the most common is plantar fasciitis (PF). PF can be a painful and debilitating condition, the clinical presentation is well recognized, typical findings of the condition include: Pain and palpable tenderness in the area of the medial calcaneal tuberosity, significant “start-up pain” when taking the first few steps in the morning and worsening pain with prolonged weight-bearing, but there are no “gold standard” diagnostic tests to verify the diagnosis of PF [1]. Till date, there is no universally accepted treatment protocol for this condition, but fortunately, more than 90% of cases resolve with non-surgical conservative care. The condition is bilateral in up to a third of cases. It affects up to 10% of general population and accounts for 11%–15% of all foot pain symptomatology [2]. The diagnosis can be established clinically, and ultrasonography, bone scintigraphy, and magnetic resonance imaging have been used in doubtful cases to evaluate PF. Increased thickness, hypoechogenicity, and biconvexity are the main diagnostic findings on sonography [3, 4, 5, 6]. PF is generally considered to be a self-limiting condition. However, the time taken for the symptoms to resolve is highly variable. Prolonged symptoms, increased disability and limitation of activity is most often seen in obese patients, patients with bilateral symptoms and in those who had symptoms for more than 6 months.
before seeking medical advice [7]. PF can be a difficult problem to treat. No evidence strongly supports the effectiveness of any treatment for PF. Fortunately, most patients with this condition eventually have satisfactory outcomes with non-surgical treatment. Traditionally, the first line of treatment of PF has been rest, analgesics, night splints, and orthoses. For patients who do not improve after initial treatment, corticosteroid injection or dexamethasone iontophoresis may provide short-term benefit. However, these therapies do not improve long-term outcomes [8] and may cause plantar fascia rupture [9]. However, steroid injections are often not successful after 1 injection and can thus require multiple injections, which may be associated with potential complications, including plantar fascia rupture, and fat pad atrophy [10, 11]. Therefore, the study of alternative therapies is important. A local injection of platelet-rich plasma (PRP) is an emerging therapy for ligament pathologies and recalcitrant tendinopathies, including PF [12]. PRP is a good source of many growth factors and cytokines. It has shown promise in many studies as compared to steroid injection and other modes of conservative treatment [13]. Recently, many studies have focused on the effectiveness of PRP as a treatment for PF; however, the results are inconsistent. In addition, the relationships between PRP and pain relief and improvements in functional restoration are unknown [12]. Well designed and conducted randomized trials are suggested to evaluate the role of these treatment modalities [14]. It is thus suggested that trials evaluating a treatment modality should be designed to eliminate these biases [15]. Additional high-quality randomized control trials with more patients and a uniform scoring standard are needed to confirm the effectiveness and safety of PRP and steroids as treatments for PF [12]. The present study was undertaken to evaluate the efficacy and role of autologous PRP injection in chronic PF in pain alleviation and consequent functional improvement by comparing with the local injection of corticosteroid.

Materials and Methods
The study was conducted at tertiary care research institute after getting Ethical Committee Clearance. A total number of 80 patients in the age group of 20–60 years of either sex who are clinically having symptoms suggestive of PF for more than 3 months, with no relief after initial conservative treatment, were included for the study. Patients who had received any previous treatment in the form of local injections of steroid and other interventions were excluded from the study. Patients with anteromedial heel pain due to other reasons such as calcaneal spur, calcaneal osteomyelitis, old calcaneal fracture, and compression neuropathies such as tarsal tunnel syndrome or impingement of the medial calcaneal nerve, gout, and rheumatoid arthritis were excluded from the study. Patients’ details were recorded in appropriate pro forma. Consent for the procedure was obtained. All patients were subjected to routine blood investigation including the markers for inflammatory arthropathy and radiographic examinations of the foot with heel lateral view under study. Patients clinically diagnosed to have PF and after excluding all other causes of heel pain were subjected to ultrasonographic examination of the foot under study to confirm the diagnosis of plantar fasciitis. Ultrasonography findings in case of PF involve hypoechoic signal from the plantar fascia origin suggestive of degeneration of plantar fascia insertion. The patients were randomized into two groups using the computer-generated an alphabetic sequence by randomization software. The first group of patients was given autologous PRP and the second group was given steroid-Triamcinolone. After giving injection patients were advised for hot fomentation, plantar fascia stretching exercises, and microcellular rubber footwear usage after the injection. To prepare PRP, around 15 mL of patient’s blood was obtained using scalp vein catheter to avoid turbulence while drawing the blood. The PRP is prepared by differential centrifugation technique with two spins. The blood is collected in four citrate tubes having 0.9% sodium citrate as an anticoagulant. The first spin was performed at 1500 rpm for 15 min using laboratory centrifuge machine. This spin separated the RBCs from the rest of the components. The upper half of the supernatant was discarded. The lower halves of the supernatant from all the four tubes were transferred into another plain tube for the second spin. The second spin was performed at 2500 rpm for 10 min. The upper half of the supernatant of the second spin sample was discarded. 1 mL of lower half was taken into a syringe having 0.1 mL of calcium chloride. The site of injection was an anteromedial heel at the point of maximum tenderness. The skin was painted with 7.5% povidone-iodine solution and surgical spirit. 1 mL of 2% lignocaine was injected at the injection site after giving test dose. After 10 min the proposed injection was given around the plantar fascia insertion by peppering technique. If any resistance was felt during the injection, the needle is withdrawn a bit and again injected. Patients were advised regarding post-injection care. Patients were advised not to overuse lower limb for 24–48 h. The results were recorded by visual analog
score (VAS) and foot and ankle outcome scores (FAOS). These scores were recorded in the prepared pro forma on the day of injection before giving the injection, then at 12 and 24 weeks. The data were analyzed using ANOVA methods – Chi-square test and Fisher exact test which showed significant pain relief with PRP as compared to the steroid.

Statistical methods
Descriptive and inferential statistical analysis has been carried out in the present study. Results on continuous measurements are presented on Mean standard deviation (Min-Max) and results on categorical measurements are presented in number (%). The significance is assessed at 5 % level of significance. The following assumptions on data are made Assumptions: (1) Dependent variables should be normally distributed and (2) samples drawn from the population should be random, cases of the samples should be independent [16, 17, 18, 19]. Chi-square/ Fisher Exact test has been used to find the significance of study parameters on a categorical scale between two or more groups, the non-parametric setting for qualitative data analysis. Fisher Exact test used when cell samples are very small [20, 21, 22, 23].

Results
This study included 80 patients; participants were clinically evaluated, a baseline VAS and FAOS scores were recorded. Patients were treated with PRP or corticosteroid after randomization. After the procedure patients were followed up at 12 weeks and 24 weeks interval. Of the 80 participants, 32 (40%) were males and 48 (60%) were females. In PRP group 15 were males and 25 were females. In corticosteroid group 17 were males and 23 were females. P = 0.104 which is not significant. Thus, both the groups were comparable in terms of gender. Most of the patients (80%) in our study were aged between 30 and 50 years with an average age 42.94 ± 8.73 years. The mean age of patients in PRP group was 43.60 years and in steroid group, it was 41.48 years. Thus, both the groups were comparable in terms of age distribution in each group. Of the 80 participants, 45 (55.8%) participants had their right heel affected, and 35 (44.2%) had their left heel affected. P = 0.789 which is not significant. Thus, both groups were comparable in terms of the side of heel involved. The mean duration of the symptoms in all 80 patients was 6.86 ± 2.86 weeks. The mean duration in PRP group was 6.80 ± 2.94 months and in corticosteroid group was 6.68 ± 2.82 months. In this study, the mean VAS score at presentation was comparable in both groups (8.25 ± 0.63 vs. 8.23 ± 0.53, P = 0.347). At 12 weeks these scores reduced significantly in both groups. Further, at 6 months the mean VAS scores in PRP group significantly reduced to 0.36 ± 0.58 compared to steroid group with 2.70 ± 1.90 (P < 0.001). At the beginning, P value for FAOS score is 0.682 which are statistically not significant. Hence, the outcome values before the injection are comparable. At 12 weeks mean FAOS score in PRP group was 77.70 ± 6.23 and steroid group was 73.48 ± 13.48. At 6 months mean FAOS score in PRP group was 95.08 ± 1.37 and steroid group was 80.23 ± 16.95 with P < 0.001 which is statistically significant. Hence, at 6 months the FAOS score improvement is statistically significant in PRP injection group compared to corticosteroid injection group. Only the second group of patients who received triamcinolone complained of local skin hypopigmentation and subcutaneous atrophy. Of the 40 patients, 4 patients presented with hypopigmentation and 1 patient had associated subcutaneous atrophy. None of the complications were reported in the groups that received PRP injection. There was no statistical significance related to post-intervention local skin atrophy. One (2.5%) patient who received triamcinolone presented with recurrence of symptoms at 24 weeks with VAS and FAOS scores more than 50% of the initial scores before injections.

Discussion
PF is one of the most common causes of heel pain for which professional care is sought and an important public health disorder due to its frequent occurrence [25]. Although thought of as an inflammatory process, Lemont et al. claim that this is not an inflammatory condition, and there is much evidence that this disorder is associated with degenerative changes in the fascia, which may best be classified as a “fasciosis” rather than fasciitis [16]. Riddle and Schappert in their study opined that PF is more common in the middle-aged women and athleticism active younger males. Their study also shows the predominance of this condition in females [2]. Most of the patients in our study were women who were involved in prolonged standing and weight bearing occupations. Plantar fasciopathy is commonly described as a self-limiting condition [16, 17]. Crawford and Thomson [18] undertook a systematic review supporting this observation. However, PF can be a painful and disabling condition with detrimental effects on health-related quality of life and subsequently be frustrating for patients. Patients are unlikely to be satisfied with evidence of the self-limiting nature of the condition, and most are likely to demand treatment for their symptoms [19]. Clinicians’ primary concerns in treating PF are pain relief and functional improvement, which are also the main...
concerns of patients [12]. Numerous therapies have been reported, but the available evidence supporting a preferred treatment is inadequate or even conflicting. Initial treatment of PF is conservative, which should focus on decreasing the pain, promote healing, restoring range of motion and strength, correcting training errors, and limiting biomechanical deviations caused by structural abnormalities [26]. The major component contributing to discomfort is the irritation occurring secondary to the disease process, rather than a spur or other mechanical factor. Traditional therapeutic efforts have been directed at decreasing the presumed inflammation. These treatments include icing, nonsteroidal anti-inflammatory drugs, rest and activity modification, corticosteroids injections, botulinum toxin type A, night splinting, shoe modifications, taping, and orthoses. Steroid injections are considered one of the first-line treatments in chronic cases and have been found to produce satisfactory short-term results by blocking the inflammatory response and improving local edema, swelling, pain, and foot function. Unfortunately, steroid injections have been reported to be related to abscesses, osteomyelitis, fat pad atrophy, and plantar fascia rupture [27, 28]. McMillan et al. stated that steroid provides greater pain relief than placebo at 4 weeks and reduces abnormal swelling of the plantar fascia for up to 3 months. However, clinicians offering this treatment should also note that significant pain relief did not continue beyond 4 weeks [29]. Various authors inferred that local infiltration of steroids such as Triamcinolone or Betamethasone to the plantar fascia can produce short-term (weeks to months) alleviation of pain [30, 31, 32]. Infection has also been observed following steroid infiltration, and one case of calcaneal osteomyelitis has been so far reported in the literature [33]. Long-term complications of local steroid infiltration are fat pad atrophy and rupture of the plantar fascia [34, 35, 36]. Surgery in the form of fasciectomy, neurolysis of the nerve to abductor digit minimi and excision of the heel spur has been successfully used in resistant cases [37, 38, 39, 40, 41] biomechanical alteration is the main concern of plantar fascia release. Complete release can lead to significant loss of windlass mechanism and increase bony stress reactions of the calcaneus [42, 43]. Other reported complications of plantar fascia release are scar tenderness, superficial cellulitis, deep vein thrombosis, superficial phlebitis [44], partial wound dehiscence, mild dorsal midfoot pain [45], lateral heel pain, superficial wound infection, and transient lateral paresthesia [46]. In the recent times, newer treatment techniques have been directed at resolving the degeneration caused by the disease process. In general, these techniques are designed to create an acute inflammatory reaction with the goal of restarting the healing process. These techniques include autologous blood injection, PRP injection, nitroglycerin patches, extracorporeal shock-wave therapy, and surgical procedures. Recently, research has focused on regenerative therapies with high expectations of success. The use of autologous growth factors is thought to heal through collagen regeneration and the stimulation of well-ordered angiogenesis. These growth factors are administered in the form of autologous PRP, prepared by centrifugation technique. The desmoplastic of the α-granules in the platelets releases different growth factors that play a role in tissue regeneration processes. Platelet-derived growth factor, transforming growth factor-β, vascular-derived endothelial growth factor, epithelial growth factor, Hepatocyte growth factor, and insulin-like growth factor are examples of such growth factors. Woefer et al., in his study concluded that, when the potential complication of corticosteroid treatment was taken into consideration, PRP injection seems to be safer and at least having same efficacy in the treatment of PF [40]. In the present study, mean VAS and FAOS scores were comparable in both PRP and steroid groups at the time of injection that is at 0 weeks. At 12 weeks, VAS and FAOS scores improved in both the groups with no statistical significance but the scores were more sustained in PRP group at 24 weeks with statistically significant improvement compared to the steroid group. In the present study, patients recurrence was not observed in patients with PRP group, whereas 2.5% patients in steroid group reported recurrences at 6 months follow-up suggesting significantly less recurrence rates (P = 0.003) which are statistically not significant. At 6 months of follow-up, significantly more number of patients (92.50%) patients in PRP group were completely relieved of pain whereas more than half (77.5%) patients in steroid group were not relieved of pain (P ≤ 0.001) completely. Thus, PRP is a promising method of treating recalcitrant cases of PF with durable results and minimal/no complications.

**Conclusion**

The efficacy of single injection of PRP to relieve the pain of chronic PF is better than triamcinolone over a short-term follow-up period. However, multicenter randomized controlled trials with long-term follow-up are required to establish the efficacy of PRP and to further strengthen evidence-based practice in the treatment of chronic PF.
References

42. Conflitti JM, Tarquino TA. Operative outcome of partial plantar
fasciectomy and neurolysis to the nerve of the abductor digiti minimi muscle for recalcitrant plantar fasciitis. Foot Ankle Int 2004;25:482-7.


Conflict of Interest: NIL
Source of Support: NIL

How to Cite this Article