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Original Research Article

Platelet rich plasma versus corticosteroid injection in the treatment of plantar fasciitis: A prospective randomized controlled trial

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Abstract
Background: Plantar fasciitis is one of the most common causes of heel pain. This prospective study compared the efficacy of local injection of corticosteroids vs platelet-rich plasma (PRP) in the treatment of plantar fasciitis.
Methods: Patients were randomly allocated into 2 groups of Corticosteroid (Group A) and PRP (Group B) with 38 and 37 patients respectively. Patients were treated with local corticosteroid (cs) injection in group A and autologous PRP injection in group B. Clinical assessment was done prior to the injection and at 1, 3, 6 and 12 months following the injection, which included visual analog pain scale, subjective rating using the modified Roles and Maudsley score, functional outcome score by the American Orthopaedic Foot & Ankle Society (AOFAS) ankle-hind foot scale. The mean age, sex, and body mass index of both groups were comparable.
Results: Post-injection we found that both PRP and CS significantly improved VAS, R&M, and AOFAS scores compared to the pre-injection condition. In addition, CS has better pain relief and improved function in the short term (within the first month) compared to PRP; however, PRP has better pain relief and improved function in the long term (after 6 months) compared to the CS group.
Conclusion: The observations made in the present study suggest that the treatment of plantar fasciitis with steroid or PRP showed no significant difference at 12 months of follow up but corticosteroid showed better results in the short term (1-3 month), whereas PRP was found to be better in the long term follow up (6 months).

Keywords: Platelet rich plasma, corticosteroid injection, plantar fasciitis

Introduction

Plantar fasciitis, which is often described as an overload of the plantar fascial, is the most common cause of heel pain in adults [2]. Chronic plantar fasciitis is a common orthopedic problem affecting 10% of the population. It is characterized by the gradual onset of a sharp pain along the medial part of the heel that is worse with the first few step in the morning or at the beginning of activity and decreases as the person warms up. The etiology of plantar fasciitis is multifactorial and poorly understood. Poor biomechanics and deviations in the structure of the foot [3] can lead to repeated microtrauma of the plantar fascia at its origin,

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leading to inflammation and degeneration [4, 5]. A large number of non-operative and operative approaches have been used without uniform or reproducible success. Non-operative approaches include rest, stretching exercises, immobilization, non-steroidal and steroidal anti-inflammatory drugs, and physiotherapy [6].

Corticosteroid injections are often reserved for resistant plantar fasciitis after failure of conservative management. They have been shown to effectively reduce heel pain in patients with plantar fasciitis [7, 8, 9]. The strong anti-inflammatory effect of corticosteroids can speed up the pain relief process. They can also inhibit the proliferation of fibroblasts and the proteins of the basic substances [10]. However, the use of corticosteroid injections to treat plantar fasciitis has been shown to be associated with plantar fascia rupture, infection, skin pigmentation changes, peripheral nerve injury, muscle damage, post-injection flare-ups, and fat pad atrophy [11, 12, 13, 14].

Platelet-rich plasma (PRP) is a concentrate of platelets, which are the source of autologous growth factors. Cytokines present in platelet α-granules have been shown to increase fibroblast migration and proliferation, regulate vascularization, and increase collagen deposition under various conditions [15]. Based on these properties, the injection of PRP into the affected tissue should promote healing and reverse the degenerative processes that occur at the origin of the plantar fascia.

This prospective randomized trial was conducted to compare the efficacy of local corticosteroid injection and PRP in the treatment of plantar fasciitis.

Methods

The study was conducted for a period of 1 year from October 2021 to September 2022. Approval was obtained from the ethical and scientific committee of the hospital, and written valid informed consent was obtained from all patients before participating in the study, both for the research investigation and for the treatment.

Patients with a primary diagnosis of plantar fasciitis who met the inclusion criteria were included in the study.

- Patient diagnosed with plantar fasciitis.
- Failure of conservative treatment (stretching exercises, non-steroidal anti-inflammatory drugs and physiotherapy) for at least 3 months.
- Visual analog scale pain greater than 5 (on a 10-point visual analog scale).
- The patient should be able to understand informed consent.

Exclusion criteria in the study were:

- Any previous local injection treatment for heel pain,
- Any history of surgery for heel pain,
- Associated pathology affecting the lower limb, such as

1. history of tarsal tunnel syndrome,
2. ankle effusion indicating intra-articular disease, old healed heel bone fracture,
3. Achilles tendinopathy
4. Any deformities of the foot and ankle, including pes planus or pes cavus,

- Patients with a systemic disorder such as diabetes mellitus, rheumatoid arthritis, hematological disease or gout.
- Pregnancy.
- Any recent history of aspirin or aspirin-like drugs.

The diagnosis of plantar fasciitis was made on clinical grounds according to the guidelines described by McPoil *et al*[16] for plantar fasciitis. The following clinical findings were used to diagnose plantar fasciitis:

1. Tenderness in the medial plantar heel area on palpation,
2. Pain most noticeable with initial steps after a period of inactivity but also worse after prolonged weight bearing, and

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3. Pain often triggered by a recent increase in weight-bearing activity.

Age, gender, height, weight and types of shoe wear were recorded. A detailed history of previous treatment, any previous leg injury or the presence of any systemic disease was recorded.

Preparation of PRP

We used a double centrifugation technique to concentrate platelets from autologous blood. 25 cc of venous blood was centrifuged at 1800 rpm for 15 minutes to separate the erythrocytes and a second time at 3500 rpm for 10 minutes to concentrate the platelets to produce a 3 mL unit of PRP.

The injection was given under strict aseptic precautions. The area to be injected was prepared with a 10% povidone-iodine scrub and covered with sterile towels. The injection was given by palpation of the most sensitive heel point (tender point) with a medial approach.

Patients in group A (corticosteroid group) were administered 1 mL (40 mg) of triamcinalone with 2 mL of 2% lidocaine hydrochloride, while patients in group B (PRP group) were injected with 3 mL of PRP after infiltration of 2 mL of 2% lidocaine hydrochloride with a 22 gauge needle to the most sensitive area of the plantar fascia at its origin on the heel using the peppering technique[19] (one skin portal and 4-5 penetrations of the plantar fascia.

After injection, patients were observed for 15 to 20 minutes. They were released if it suited them. They were advised to apply ice to the injection site to control swelling and pain and to avoid high-impact activities for a week. All patients were advised to follow stretching exercises for the plantar fascia and Achilles tendon. Patients could take paracetamol for pain after the injection.

Evaluation of outcome

Patients will be followed up clinically at 3 weeks, 6 weeks, 3 months, 6 months and 12 months. At each subsequent clinical examination, an assessment of the severity of pain is done by VAS score, functional outcome is measured with AOFAS score and modified roles and maudsley score (subjective evaluation) and the ability to walk without pain will be carried out.

Primary outcome-pain relief is assessed with visual analog scale

- Visual analogue scale-0 to 10 (0 reflects absence of pain, 10 indicates the worst imaginable pain), to assess pain relief.

Secondary outcome- functional outcome assessed with AOFAS score and moodified roles and mausdley score

- Functional outcome scores were measured by the American Orthopedic Foot and Ankle Society (AOFAS) score.
- Subjective evaluation was assessed using the modified Roles and Maudsley score [20, 21]. The modified Roles and Maudsley scoring system is a subjective four-point assessment of pain and activity limitation by the patient.

The results were considered

1. Excellent (no pain, patient satisfied with the treatment result and unrestricted pain-free walking).
2. Good (symptoms significantly reduced, patient satisfied with treatment result and ability to walk without pain for > 1 hour).
3. Fair (symptoms have somewhat decreased, pain is at a more tolerable level than before treatment and the patient is moderately satisfied with the treatment result) and bad (symptoms the same or worse and the patient is not satisfied with the treatment result).

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Statistical analysis

Data will be presented as mean, ± SD for continuous variables and will be analyzed using appropriate statistical tests such as Student's t test. Nominal categorical data between groups were presented as percentages and analyzed using the Chi-square test. Data will be compiled in an MS Excel spreadsheet and analyzed using SPSS version 20, with a p value of 0.05 considered significant.

Results

A total of 38 patients in the steroid group and 37 in the PRP group were included in the study. During the study, 8 patients in the steroid group and 6 patients in the PRP group were lost to follow-up. The corticosteroid group included 16 men and 14 women (n=30) with a mean age of 39.5 ± 4.5 (range 26-50 years) with a BMI of 29.7 ± 3.08 (range 26.62-32.78) and the PRP group included 16 men and 15 women (n=31) with a mean age of 42.5±6.2 (range 28-48) with a BMI of 30.2±3.5 (26.7-33.7). Demographics are shown in Table 1.

The primary outcome is pain relief and is assessed using a VAS score. The pre-injection VAS score was 8.5±1.2 in the steroid group and 8.0±1 in the PRP group, and this difference was not significant. After injection, there was a downward trend in VAS scores in both groups at follow-up up to 12 months compared to baseline in both groups. There was a significant decrease in VAS scores after the injection. There was a significant difference between the two groups at 1 month and 3 months, with the steroid having a better effect on pain relief - corticosteroid (CS) vs. PRP was 5±2.5 vs. 6.5±1.5 at 1 month, 4.0±2.1 vs 5.1±2.1 at 3 months. At 6-month follow-up, the VAS score is significantly better in the PRP group compared to the steroid group – PRP vs. CS is 3.0±2 vs 4.5±2.9. After 1 year of follow-up, there was no significant difference between the two groups in terms of VAS scores, indicating the same effect on pain relief. (Table 2).

The secondary outcome is functional outcome and is assessed using modified Roles and Maudsley scores (Subjective evaluation). It showed that 86.6% (n=26/30) of patients in the steroid group and 48.38% (n=15/31) of patients in the PRP group rated the result as good to excellent after 1 month of injection, with corticosteroid being better than PRP, which is statistically significant. At 3 months, 73.33% (n=22/30) of patients in the steroid group and 51.61% (n=16/31) in the PRP group had a good to excellent score, with steroid still being better than PRP and was statistically significant. At 6 months, patients with good to excellent results were 46.67% (n=14/30) in the steroid group and 77.41% (n=24/31) in the PRP group, with PRP being better than corticosteroid and statistically significant. At 12 months it was 33.33% (n=10/30) in the corticosteroid group and 32.25% (n=10/31) in the PRP group with no statistically significant difference between the two groups.

Functional outcome was statistically significant between the two groups with steroid groups showing a good to excellent outcome at 1 month and 3-month follow-up-CS vs. PRP was 86.6% vs. 48.3% at 1 month, 73.3% vs 51.61% at 3 months. At 6-month follow-up, there is again a significant difference between the two groups, but PRP shows a better functional outcome-PRP vs. CS is 77.42% vs. 46.67%. At the final follow-up at 12 months, there is no significant difference between the 2 groups PRP vs. CS 33.33% vs. 32.25%. Functional outcome in the steroid group was good at 1 month and progressively decreased at follow-up-86.6%, 73.3%, 46.67%, 33% at 1, 3, 6, and 12 months. While the functional outcome in the PRP group gradually improved from 1 month to 6 months of follow-up-48.3%, 51.61%, 77.42% at 1, 3 and 6 months. (Table 3).

Functional outcome as assessed by the AOFAS Score-The corticosteroid group had an AOFAS score of 65±10 (range 55-75) before treatment, which initially improved to 86±8 (range 78-94) 1 month after treatment. It was 80 ± 8 (range, 72-88) at 3 months and decreased to 76 ± 12 (range, 64-88) at 6 months and returned to levels of 70 ± 15 (range, 55-85) at 12 months. Compared to the results of the corticosteroid group, the PRP group started with a pre-treatment AOFAS score of 67±12 (range 55-79). At 1 month it was 79±11 (range, 68-90) and at 3 months it increased to 83±6 (range 77-89), remaining elevated at 89±9 (range 80-98)

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at 6 months. Decreased to 74±9 (range, 65 to 83) at 12 months. The pre-injection AOFAS scores between the 2 groups were not statistically significant. At 1 month follow-up, there was a significant difference between the 2 groups with the steroid group having a better outcome. After 3 months, again no significant difference was found between the two groups. At 6 months, there was a significant difference between the 2 groups with PRP having a better outcome. After 12 months, the final follow-up result was similar to the pre-injection status (Table 4).

1) Demographical data (Table 1)

Variables	Steroid Group (Mean ± SD) (N=38)	PRP Group (Mean ± SD) (N=37)	P value
Age			0.127 (not significant)
Mean Age	39.5 ± 4.5	42.5 ± 6.2	
Range	26 - 50 years	28 – 48years	
Sex			0.074 (not significant)
Male	16/38(42.10%)	16/37(43.24%)	
Female	14/38(36.84%)	15/37(40.54%)	
Lost to follow	8	6	
BMI			0.27 (not significant)
Mean	29.7 ± 3.08	30.2 ± 3.5	
Range	26.62-32.78	26.7-33.7	

2) Visual Analog scale (Table 2)

Follow up period	Steroid	PRP	P value
Pre injection	8.5 ± 1.2	8 ± 1	p = 0.0848 (not significant)
1 month	5 ± 2.5	6.5 ± 1.5	p = 0.006 (significant)
3 month	4.0 ± 2.1	5.1 ± 2.1	p = 0.045 (significant)
6 month	4.5 ± 2.9	3.0 ± 2	p = 0.021 (significant)
12 month	5.3 ± 1.6	4.7 ± 1.8	p = 0.174 (not significant)

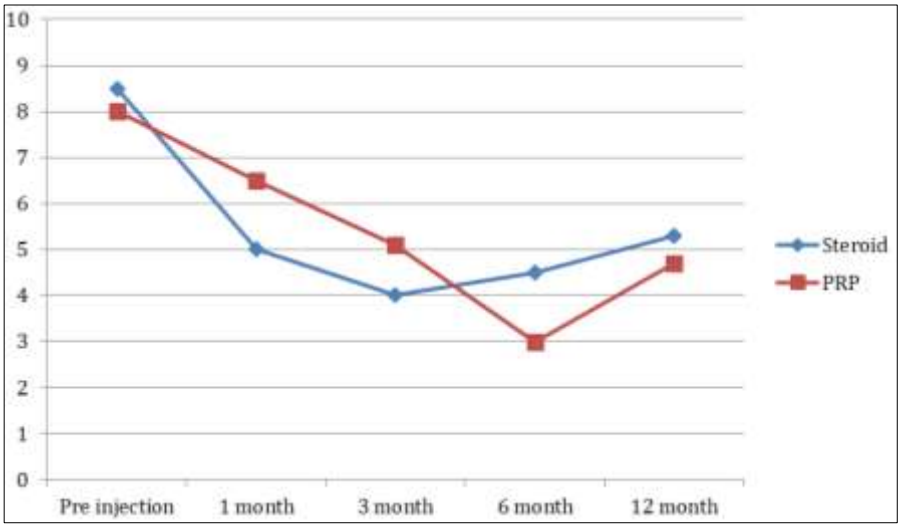

Fig 1: VAS score in both the groups at pre injection and follow up

3) Modified Roles and Maudsley Score: (Table 3) Steroid group: (n=30), PRP group: (n=31)

Duration		Excellent	Good	Fair	Poor	p value
1 month	Steroid group	8 (26.6%)	18 (60%)	3 (10%)	1 (3.3%)	<0.01 (significant)
	PRP group	7 (22.5%)	8 (25.8%)	14 (45.1%)	2 (6.4%)	

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3 month	Steroid group	6 (20%)	16 (53.3%)	5 (16.6%)	3 (10%)	0.024 (significant)
	PRP group	9 (29.03%)	7 (22.58%)	14 (16.6%)	1 (3.23%)	
6 month	Steroid group	5 (16.67%)	9 (30%)	12 (40%)	4 (13.33%)	0.045 (significant)
	PRP group	10 (32.26%)	14 (45.16%)	6 (19.35%)	1 (3.23%)	
12 month	Steroid group	3 (10%)	7 (23.3%)	14 (46.6%)	6 (20%)	0.934 (not significant)
	PRP group	4 (12.9%)	6 (19.35%)	16 (51.61%)	5 (16.13%)	

4) AOFAS Score (Table 4)

	Steroid	PRP	P value
Pre injection	65± 10	67± 12	0.483(not significant)
1 month	86± 8	79 ± 11	0.006(significant)
3 month	80±8	83± 6	0.102(not significant)
6 month	76± 12	89± 9	<0.001(significant)
12 month	70± 15	74± 9	0.209(not significant)

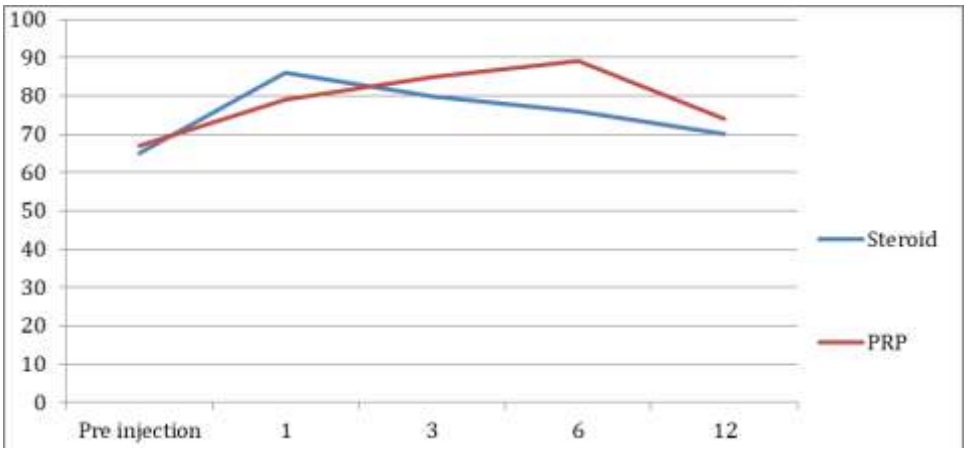

Fig 2: Functional outcome using AOFAS score in both the groups at before and after intervention

Discussion

In our study of 61 patients, comparing PRP vs. corticosteroids in plantar fasciitis, we found no difference between the 2 groups in terms of age, sex, duration of symptoms, and duration of failure of conservative treatment, implying that these factors were not confounding variables. Not significant enough to create prejudice between groups.

The underlying pathology of plantar fasciitis is uncertain. Common pathologic features include increased vascularity, excess essential proteins, and focal areas of fibroblast proliferation and damaged collagen fibers [22, 23]. Additionally, several studies have found evidence of nonspecific inflammation in plantar fasciitis [24, 25, 26]. Corticosteroid have been shown to inhibit fibroblast proliferation and expression of essential proteins [27, 28]. The literature also supports the efficacy of corticosteroid injections for the treatment of plantar fasciitis on a short-term and long-term basis [29, 30]. In this study, steroids were effective in reducing the VAS score compared to pre-injection and improving it in the immediate post-injection period. 1 month follow-up and the effect gradually decreased during each follow-up. PRP, which is a platelet concentrate that is a source of autologous growth factors such as insulin-like growth factor-1 (IGF-1), transforming growth factor β (TGF-β), vascular endothelial growth factor (VEGF), growth derived from platelet-derived growth factor (PDGF) and basic fibroblast growth factor (bFGF), aids in cell migration, collagen synthesis and angiogenesis, thereby aiding tendon and ligament healing and is now widely used in various fields of medicine and orthopedics to promote healing.[31,32]The literature has shown that PRP is safe, effective, and used by some physicians in the treatment of plantar fasciitis.[33,34,35] Several recent studies have shown superior results of PRP compared to corticosteroids for the treatment of plantar fasciitis [36, 37], while several other studies have

shown that the results of both types of treatment are the same [33, 34]. The observations of this study are consistent with the recent claim that PRP and corticosteroid injections are equally effective in reducing plantar fasciitis.

Subjective assessment of treatment of plantar fasciitis using the modified Roles and Maudsley score has shown contrasting results in the literature [34, 37]. Akşahin *et al*. [34] showed that PRP and corticosteroid treatment is similar at 6-month follow-up, while Vahdatpour *et al*. [37] showed better results with PRP treatment in compared with corticosteroids at 6-month follow-up. The subjective assessment results of our study showed that the functional outcome was statistically significant between the 2 groups with steroid group showing a good to excellent outcome up to 3 months of follow-up. After 6 months of follow-up, there is again a significant difference between the 2 groups, but PRP shows a better functional outcome. At the final follow-up at 12 months, there is no significant difference between the two groups. Functional outcome in the steroid group was good at 1 month and progressively decreased at follow-up. While the functional outcome in the PRP group gradually improved from 1 month to 6 months of follow-up.

Functional assessments using the AOFAS hind foot ankle score in 2 studies showed conflicting results [33, 36]. Acosta-Olivo *et al*. [33] demonstrated an improved functional outcome in both groups over 16 weeks, but no significant difference was observed between groups, while Monto [36] observed a significant improvement functional outcome of the PRP group compared to the corticosteroid group during the 2-year follow-up. In our study, at 1 month (short term) follow-up, there was a significant difference between the 2 groups with the steroid group having a better outcome. At 6 months (long term), there was a significant difference between the 2 groups with PRP having a better outcome. After 12 months, the final follow-up result was similar to the pre-injection status in both the groups.

Regarding pain and function, we found that both PRP and CS significantly improved VAS, R&M, and AOFAS scores compared to the pre-injection condition. In addition, CS has better pain relief and improved function in the short term (within the first month) compared to PRP; however, PRP has better pain relief and improved function in the long term (after 6 months) compared to the CS group.

Both methods were equally effective in treating plantar fasciitis in our study. Although treatment of plantar fasciitis with steroid injections is simpler and cost-effective, it can be associated with complications such as rupture of the plantar fascia, infection, change in skin pigmentation, peripheral nerve injury, muscle damage, post-injection flare-up, and fat pad atrophy. On the other hand, PRP injection treatment requires phlebotomy to obtain blood and prepare PRP, which is a time-consuming process. The equipment used is expensive, but it is considered safer because patients are spared the complications associated with steroid injections. No complications were detected during the follow up because of the injection procedure in both the groups.

Conclusion

The observations made in the present study suggest that the treatment of plantar fasciitis with steroid or PRP showed no significant difference (both are equally effective in reducing pain and improving functional outcomes) at 12 months of follow up but corticosteroid showed better results in the short term (1-3 month), whereas PRP was found to be better in the long term follow up (6 months).

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