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Original Research Article

Comparison of pain relief among patients with chronic plantar fasciitis treated with intralesional platelet-rich plasma injection versus corticosteroid injection in a tertiary care centre in Kerala - a prospective study

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ABSTRACT

Background: Aim of the study was to compare pain relief and functional outcome and between intralesional autologous platelet rich plasma injection (PRP) versus corticosteroid injection in the treatment of plantar, and fasciitis by using visual analogue score and American Orthopaedic Foot and Ankle Society (AOFAS) score.
Methods: The sample size for the study was 30 patients attending Dr. Somervell Memorial CSI Medical College. Patients were divided into two groups (PRP versus steroid) of 15 each. The study follows a prospective observational design with follow up at 2 weeks, 2 months and 3 months post procedure. The functional outcome of patients in each group was assessed using the visual analog scale and AOFAS score.
Results: Post-procedure, a significant decrease in VAS score was seen in patients treated with PRP injection (8.73 to 2.27) than those treated with Steroid injection (8.8 to 3.53). Also, there was a significant improvement in the AOFAS score from 72.73 to 88.67 while for those patients treated with steroid injection, the AOFAS score was comparatively low (65.87 to 82.2).
Conclusions: Plantar fasciitis is a prevalent condition in our community, and many treatment options typically offer only temporary relief from symptoms. Intralesional PRP injection emerges as a dependable treatment method that fosters the healing process of the affected fascia, resulting in improved functional outcomes. Our study indicates that a singular administration of platelet-rich plasma injection for plantar fasciitis yields substantial pain relief compared to the local steroid injection.

Keywords: Plantar fasciitis, PRP, VAS, AOFAS

INTRODUCTION

Plantar fasciitis is a degenerative condition that develops near the point of origin of the plantar fascia, specifically at the medial tuberosity of the calcaneum.[1] In India, it stands out as one of the primary causes of foot pain.[2] The prevalence of plantar fasciitis is highest among individuals aged 40 to 60, with no discernible gender bias. Plantar fasciitis significantly diminishes the quality of life, affecting approximately 10% of the global population over their lifetime.[3] The prevalence of plantar fasciitis varies globally, with rates of 7.5% in the United Kingdom (UK), 3.6% in Australia, 59% among individuals aged 40 to 50 in India, and 57.8% in Saudi Arabia. For approximately 90% of cases, conservative treatments like stretching, nonsteroidal anti-inflammatory drugs, night splints, strapping, orthoses, and adjustments to footwear prove effective. However, 10% of cases persist despite these measures, necessitating more assertive approaches, such as steroid injections, extracorporeal shock wave therapy

(ESWT), and, in certain situations, surgical release of the plantar fascia's origin.[3] Various interventional methods employed for treating plantar fasciitis include ultrasound therapy, laser treatment, extracorporeal shock wave therapy, botulinum toxin injections, steroid injections, platelet-rich plasma (PRP) injections, the Tenex procedure, open surgeries, and more.[1]

Steroids, a potent group of anti-inflammatory drugs, are often employed when other therapeutic options prove ineffective. Extensive research has explored the efficacy of steroids in managing inflammatory musculoskeletal disorders, demonstrating their utility across a wide range of conditions in the context of plantar fasciitis, numerous studies have highlighted the positive impact of steroid therapy in effectively reducing inflammation and providing relief.[5] The choice of corticosteroids for treating plantar fasciitis varies, with limited evidence supporting the superiority of one agent over another. Among the commonly utilized steroids for chronic plantar fasciitis treatment are methylprednisolone acetate, triamcinolone, dexamethasone, and betamethasone, favored for their relatively prolonged effectiveness. Standard preparations of these steroids, typically 1 ml, are administered as intralesional injections at the most sensitive site or the medial calcaneal tuberosity.[6] While this treatment proves highly effective, it is not without its share of complications, with plantar fascia rupture being one of them. Another recognized and usually reversible complication is the atrophy of the fat pad in the heel. Although this often does not result in noticeable symptoms, it can alter the biomechanics of the foot.

The use of autologous PRP was initially introduced by Ferrari et al in 1987.[5] PRP is a bioactive component derived from whole blood, exhibiting elevated platelet concentrations above baseline and containing substantial levels of various growth factors. The rationale behind the perceived benefits of PRP involves altering the blood composition by reducing red blood cells (RBC) to 5%, which are considered less conducive to the healing process, and increasing platelets to 94% to promote recovery.[5]

PRP is essentially an elevated concentration of a patient's own platelets suspended in a small volume of plasma, achieved through centrifugation, and is abundant in growth factors.[7] Platelets play a vital role in hemostasis and also act as a natural reservoir of growth factors. These growth factors, housed within platelet α-granules, include platelet-derived growth factor, insulin-like growth factor, vascular endothelial growth factor, platelet-derived angiogenic factor, and transforming growth factor-beta. The activation of platelets, stimulated by different substances like thrombin, calcium chloride, or collagen, leads to the discharge of these growth factors.

Besides growth factors, platelets also release various other substances, including fibronectin and sphingosine 1-phosphate, which play crucial roles in the process of wound healing.

This research holds significant relevance for developing countries where there is a high prevalence of barefoot activities, contributing to foot pronation anatomy and leading to chronic plantar fasciitis (PF), which affects a substantial proportion of patients (around 70-86%).[8] Moreover, a substantial portion of the population (ranging from 63 to 72%) wears unsuitable footwear, exacerbating the likelihood of developing plantar fasciitis. On the other hand, the utilization of intra-articular or soft tissue steroid injections may lead to diverse health complications, such as a sevenfold rise in acute coronary syndrome occurrences, resulting in increased healthcare expenses and decreased productivity.[9-11] On the contrary, PRP treatment emerges as a cost-effective, straightforward, and minimally invasive alternative.[12] It demonstrates a safer and more advantageous alternative compared to steroid injections for addressing plantar fasciitis.[13] This implies that PRP treatment could present a more readily available and effective remedy, especially in areas where going barefoot is common and footwear practices are insufficient.

Multiple research studies have suggested that PRP treatment can serve as a practical substitute for surgery.[14,15] Surgical procedures may be required in around 5–10% of instances involving chronic plantar fasciitis.[16] Considering that homemade standard PRP is considered more dependable and economical than commercially accessible PRP kits, creating a standardized laboratory infrastructure and developing PRP preparation protocols in developing nations could potentially alleviate the economic strain on the healthcare system.

METHODS

The ethical clearance for the study was obtained on 20/11/2019 with the reference number SMCSIMCH/EC(PHARM)02/20/23 from the ethical committee of Dr. SMCSI MCH. This hospital-based prospective observational study was conducted among 30 patients with plantar fasciitis who attended orthopedics department of Dr. SMCSI Medical College, Karakonam, Kerala, India, study period was from October 2019 to November 2021. The inclusion criteria for the study involve individuals aged 18 to 60 years who have been clinically diagnosed with plantar fasciitis, undergone a minimum of 6 weeks of conservative treatment, and provided their consent to participate in the research. Both male and female participants are eligible for inclusion. Individuals who are suspected of having an incorrect diagnosis, those who do not consent to participate in the study, and those with infections or ulcers at the injection site are excluded from the study. Additionally, individuals with rheumatoid or seronegative spondyloarthritis, as well as pregnant women, are not eligible for inclusion.

The study population consists of two groups of patients in which the first group who received intralesional autologous PRP injection and another group that has received intralesional corticosteroid injection for the treatment of plantar fasciitis in the orthopedics department at Dr. SMCSI Medical College, Karakonam, where both treatments are routinely administered.

Under aseptic precautions, autologous PRP is prepared by collecting 55 milliliters of patient blood in a sterile centrifugal vial containing 3 ml of anticoagulant citrate dextrose, followed by a centrifugation process at 700 rpm for 20 minutes. The resulting upper layer, rich in platelets and white blood cells, is transferred to sterile tubes, subjected to a second spin at 1750 rpm for 15 minutes, and the upper 2/3rd portion, mainly composed of platelet poor plasma, is extracted to create PRP for injection into the designated areas for patients in group 1. Following sterile aseptic precautions, patients in group 2 were given 1 ml injection of either 25 mg methylprednisolone acetate at the medial calcaneal tuberosity or at the most tender spot. The study variable involves the assessment of pain relief and functional outcomes, categorized as excellent, good, fair, and poor, determined by visual analogue score (VAS), and AOFAS score (AOFAS), considering pain, function, and foot alignment.

The VAS for pain is a measurement tool used to assess pain intensity. It typically consists of a straight line, with one end representing "no pain" and the other end indicating "worst possible pain". Patients are asked to mark on the line to indicate the severity of their pain, and the distance from the "no pain" end is measured to quantify the pain level on a scale, often ranging from 0 to 10. This provides a subjective but quantifiable measure of pain intensity.

The AOFAS scoring system consists of nine questions distributed among three categories: pain, function, and alignment, with scores of 40, 50, and 10 assigned to each category, respectively. These scores are collectively totaled to reach a maximum of 100 points, providing physicians with a standardized tool for assessing patients with foot or ankle disorders. The research employs a prospective observational design, where patients were scheduled for follow-up assessments at intervals of 2 weeks, 2 months, and 3 months following the procedure.

Statistical analysis

The gathered data were inputted into a Microsoft excel sheet, and statistical analysis was conducted using the trial version of statistical package for the social sciences (SPSS) software. Qualitative variables were expressed as frequencies and percentages, while quantitative variables were presented as mean and standard deviation. To compare the pain relief between patients treated with PRP injection and steroid injection for chronic plantar fasciitis, a suitable test of significance such as the Chi-square test and paired t-test was employed.

RESULTS

The mean age within the study groups was 41.2±13.26 years for the PRP-injected group and 45.4±11.67 years for the steroid-infiltrated group. The gender distribution is equal between the PRP and steroid groups, with 2 males and 13 females in each group, there is no statistically significant difference in the ages and gender between the two groups at the beginning of the study with a p value of 0.38 and 1 respectively. We observed that, at the initiation of therapy, there was no statistically significant difference in the duration of pain present before administering the injection.

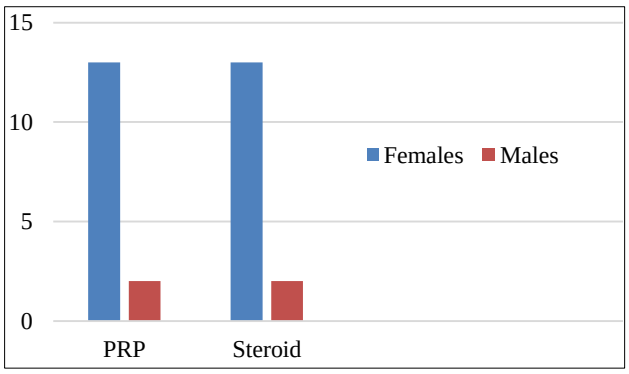

Figure 1: Gender distribution in the PRP group and steroid group.

Table 1: Duration of pain in months before giving injection.

Duration of pain in months	Group	Value
Mean	PRP injected	8.80
	Steroid injected	8.73
SD	PRP injected	0.80
	Steroid injected	0.46
P value		0.67

Test applied: Chi square test, p value <0.05 statistically significant

Table 2 shows that the PRP-injected group shows consistently lower pain scores at each follow-up interval compared to the steroid group. The VAS scores at various time intervals indicate that the PRP-injected group tends to have lower pain scores compared to the steroid group, and these differences are statistically significant at the specified follow-up time points. Table 3 indicates that the AOFAS scores in the PRP-injected group tends to have higher scores at each follow-up interval compared to the Steroid group, and these differences are statistically significant at the specified follow-up time points.

Table 2: VAS score at various time intervals.

VAS scoring	Pain score at time of injection	Pain score at 1st follow up	Pain score at 2nd follow up	Pain score at 3rd follow up
PRP injected	8.73	3.87	2.53	2.27
Steroid	8.8	5.27	3.73	3.53
PRP injected (SD)	0.8	0.35	4.9	0.41
Steroid (SD)	0.46	0	6.26	0.46
P value	0.67	0.024	0.033	0.031

Test applied: students t test, p value <0.05 statistically significant

Table 3: AOFAS score at different time intervals.

AOFAS score	AOFAS score at time of injection	AOFAS score at 1st follow up	AOFAS score at 2nd follow UP	AOFAS score at 3rd follow up
PRP injected	72.73	78.47	85.87	88.67
Steroid	65.87	71.20	77.20	82.20
PRP injected	13.14	12.82	9.74	9.59
Steroid	7.77	7.91	7.91	7.91
P value	0.18	0.0161	0.0363	0.041

Test applied: students t test, p value <0.05 statistically significant

The mean patient satisfaction score at end of the study was higher in those who received PRP (8.33) than the steroid group which was 6.93 with a p value <0.001 as in Figure 1.

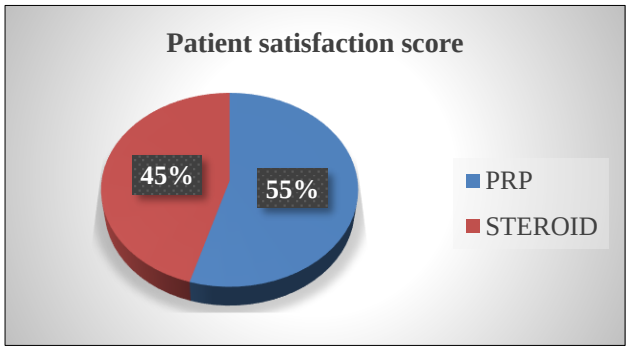

Figure 2: Patient satisfaction score.

DISCUSSION

The objective of this research was to evaluate the efficacy of PRP injection versus steroid injection for treating plantar fasciitis. The findings indicate that PRP yielded superior results than PRP at 2 weeks, 2 months and 3 months post procedure. PRP demonstrated a reduction in significant pain and showed a more enhanced AOFAS score compared to steroids. The effective use of PRP formulations in treating chronic tendinopathies has led to its application in the management of severe instances of plantar fasciitis.[17,18] In a study by Barrett and Erredge, both PRP and ultrasonography (USG) were employed in evaluating the thickness of the plantar fascia in nine patients.[18] Following the treatment, changes in signal intensity and a reduction in the thickness of the plantar fascia were detected through USG. One year later, 77.9% of the patients were reported to have experienced relief from symptoms.

In our study male to female ratio was 14:1 with a majority of patients fallingbetween the age group of 31-50 years which is similar to the results by Sarad et al, who stated that the majority of patients (152) fell between the age group of 31-50 years whereas in study by Sharma et al, majority falls in the category of 41-65 years of age.[3,19]

In our investigation, both steroid and PRP injections resulted in a noteworthy reduction in pain based on the VAS score for patients with plantar fasciitis. Specifically, our study demonstrated a substantial decrease in the VAS score from 8.73 to 2.27 in the PRP group, as opposed to the reduction observed in the steroid group from 8.8 to 3.5. Despite pain relief being notable in both groups, the PRP group exhibited a more substantial improvement. Similarly, in a prospective non-randomized study by Vijay et al, significant clinical improvement in pain relief and functional outcomes was confirmed in the PRP group three months post-injection.[20] Additionally, Martinelli et al found, in their study, a significant reduction in VAS score from 7.1±1.1 before treatment to 1.9±1.5 at the last follow-up in patients who received PRP injection ($p<0.01$).[17] These findings align with the results reported by Sharma et al, where there was a notable reduction in the mean (±standard deviation) VAS score in the PRP group (1.97±1.13) in comparison to the steroid group (2.71±0.94) during the 6-month follow-up period.[19] Likewise, the study conducted by Yang et al in 2017, concluded that PRP surpasses steroid injection in delivering prolonged pain relief for plantar fasciitis, with no significant difference noted in the short- and intermediate-term effects.[21]

This superiority of PRP can be attributed to its rich content of growth factors and various bio-regenerative molecules

that facilitate healing.[21] Approximately 70% of these growth factors are released within the first hour after PRP injection, and they continue to synthesize and secrete additional growth factors for about eight days until the platelets die. Achieving full activity typically takes six to eight weeks' post-injection.

Jain et al observed that at six months, there was no statistically significant difference between the two groups, although there was a trend for the PRP scores to show improvement compared to the steroid scores.[22] They deduced that PRP proves to be equally effective as a steroid injection in offering symptom relief three and six months after the injection for treating plantar fasciitis. Furthermore, in contrast to steroids, the impact of PRP does not diminish with time, which contradicts the outcomes observed in our study.

In our study, the AOFAS score had increased from 72.73 at the time of injection to 88.67 at the 3rd follow-up. In a parallel manner, in the study conducted by Monto et al the cortisone group initially exhibited a pretreatment average AOFAS score of 52.[23] This score improved to 81 at 3 months post-treatment but declined to 74 at 6 months. Subsequently, it regressed to near baseline levels of 58 at 12 months and continued to decrease, reaching a final score of 56 at 24 months. In contrast, the PRP group commenced with an average pretreatment AOFAS score of 37, which saw a significant increase to 95 at 3 months. This elevated score persisted at 94 at both 6 and 12 months, and the final score was 92 at 24 months. Our findings align with the research conducted by Say et al where the mean AOFAS score in the PRP group was 85.5±4.2 at 6 weeks and 90.6±2.6 at 6 months, compared to 75.3±4.8 and 80.3±4.7, respectively, in the steroid group ($p<0.001$).[24] Similar outcomes were observed in studies by Sharma et al and Shetty et al both of which concluded a highly significant difference in post-operative AOFAS outcome measures between the two groups, with markedly greater improvement in the PRP group compared to the steroid group.

In contrast, a study by Jain et al found no statistically significant difference between the two groups at 6 months.[22] However, at 12 months, the AOFAS scores in the PRP arm (88.5) were markedly superior to the steroid arm (75), with respective p values of 0.033.

This study had several limitations. Firstly, it lacked randomization and a placebo control group, which could introduce biases in the interpretation of results. The absence of radiological and biological data limited the comprehensive evaluation of functional outcomes, and pain scores. Another limitation was the relatively small number of patients included in the study, which may impact the generalizability of findings. Additionally, the relatively short follow-up period constitutes a limitation, as it may not capture long-term effects or potential changes over an extended duration. These limitations should be taken into consideration when interpreting and applying the study results. Nevertheless, to provide more conclusive evidence and gain a deeper understanding of the effects of PRP, there is a need for prospective, randomized, placebo-controlled, multicenter studies. These investigations should encompass a substantial number of participants and extend the duration of follow-up. Such an approach would help overcome the limitations of the present study and provide more robust insights into the effectiveness and potential advantages of PRP in treating the examined condition.

CONCLUSION

In contrast to many treatment approaches that primarily offer symptomatic and temporary relief, intralesional PRP injection stands out as a dependable treatment modality that actively facilitates the healing process of the affected tendon. As a result, it contributes to achieving a more sustained and improved functional outcome. Notably, a single injection of platelet-rich plasma administered directly at the site of pain demonstrated prolonged pain relief for patients, surpassing the duration of relief observed with local steroids and other conservative treatments. This highlights the potential of PRP as a therapeutic intervention with lasting benefits for individuals experiencing tendon-related issues.

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