



ISSN:

2542-2758 (Print) 2542-2804 (Online)

ARTICLE INFO:

Received Date: 18 Oct, 2023

Acceptance Date: 6 Dec, 2023

Published Date: 31 Dec, 2023

KEYWORDS:

Plantar fasciitis, platelet-rich plasma, steroids

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Access the article online

DOI: <https://doi.org/10.62065/bjhs463>

CITATION:

Nepal S, Gupta MK, Panthee R, Kafle G, Sah RK. Effectiveness of corticosteroid injection vs platelet rich plasma (PRP) injection in the treatment of plantar fasciitis. *Birat J. Health Sci.* 2023;8(3):2090-2096.

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Effectiveness of corticosteroid injection vs platelet rich plasma (PRP) injection in the treatment of plantar fasciitis

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ABSTRACT

Introduction: Plantar fasciitis is one of the most common causes for inferior heel pain in adults. Many noninvasive and invasive treatment modalities are available for its treatment. Local injection of corticosteroid and Platelet-rich plasma (PRP) is usually used in the treatment of chronic plantar fasciitis not responding to noninvasive conservative treatments.

Objectives: To compare the efficacy of local injection of corticosteroids and platelet rich plasma (PRP) in the treatment of plantar fasciitis.

Methodology: Patients diagnosed as plantar fasciitis and treated conservatively for at least 3 months and had no response to conservative treatment modalities were involved in this study and randomly allocated into 2 groups of 38 each (Group A and Group B). Patients were treated with local corticosteroid injection in group A and autologous PRP injection in group B. Clinical assessment was done prior to the injection and at 3 weeks and 3 months following the injection, which included visual analog pain scale (VAS), subjective rating using the modified Roles and Maudsley score (MRMS), functional outcome score by the Foot function Index (FFI).

Results: The mean age, sex and body mass index was comparable for both groups. Postinjection, there was significant improvement ($p < 0.05$) of visual analog score (VAS), modified Roles and Maudsley score (MRMS), Foot Function Index in both the groups. However, there was no significant difference ($p > 0.05$) in improvement of VAS, MRMS and FFI when compared between the 2 groups.

Conclusion: This study revealed that the treatment of plantar fasciitis with steroid or PRP injection was equally effective in patients who do not respond to conservative treatment.

INTRODUCTION

Plantar fasciitis, one of the most common causes of heel pain, is an inflammation of the plantar fascia, usually in the centro-medial subcalcaneal region. Adults with both sedentary and active lifestyles might experience the inferior heel discomfort.^{1,2} The condition's etiology is complicated and poorly understood, with 85% of cases occurring without any recognized risk factors.^{1,3}

Repetitive microtrauma to the plantar fascia at its origin due to poor biomechanics and changes in the structure of the foot can result in inflammation and degeneration.^{1,4,5} It is frequently described as a plantar fascia overload.⁶ The diagnosis is typically made

clinically based on the patient's complaints of a gradual onset of severe pain along the medial aspect of the heel that is aggravated by the first few steps in the morning or following periods of inactivity.^{7,8} The discomfort frequently decreases with additional ambulation but increases when the activity is continued for an extended period of time, limiting daily activities.⁹ Tenderness at the medial calcaneal tubercle is the only clinical sign.¹⁰

Exercises to stretch the plantar fascia, nonsteroidal anti-inflammatory medications (NSAIDs), extracorporeal shock wave therapy, arch supports, and heel pads are some of the noninvasive treatment options available for plantar fasciitis whose primary goal is to relieve inflammation.¹¹ When conservative noninvasive treatments for plantar fasciitis fail, invasive therapeutic techniques including platelets rich plasma (PRP) and corticosteroid injections can be used.^{1,11}

Due to their potent anti-inflammatory action and ability to decrease fibroblast proliferation and ground substance proteins, corticosteroid injections have been proven to successfully relieve heel pain in patients with plantar fasciitis.¹¹⁻¹⁴ However, its use for the treatment of plantar fasciitis is linked to the rupture of the plantar fascia, infection, alteration of skin pigmentation, injury to the peripheral nerve, muscle damage, postinjection flare, and atrophy of the fat pad.¹⁵

According to several recent studies, plantar fasciitis is a degenerative pathology rather than an inflammatory condition. The degenerative changes in plantar fascia and chronic inflammation, with or without fibroblastic growth, are also visible in the histological analysis of surgical specimen of heel spur.^{16,17} The findings, which included myxoid degeneration, plantar fascia fragmentation and degeneration, and vascular ectasia of the bone marrow, supported degenerative fasciosis rather than inflammation.¹⁶

PRP, a concentrate of platelets that is a source of autologous growth factors, is currently undergoing extensive testing in a variety of medical specialties for its potential to assist in the regeneration of tissue with poor healing ability.¹⁸⁻²¹ Numerous studies have demonstrated that the cytokines found in platelet's α -granules enhance collagen deposition, vascularization, and fibroblast migration and proliferation and pain or discomfort at the injection site for 2 to 3 days was the only complication encountered by the patients receiving PRP injection.¹⁸⁻²¹ Based on these characteristics, PRP injection into the affected area should encourage healing and stop the degenerative processes that are occurring at the plantar fascia's origin.²¹

The purpose of this prospective randomized study was to determine the effectiveness of local injections of corticosteroids and PRP in the treatment of plantar fasciitis.

METHODOLOGY

After receiving approval from the Institutional Review Committee of Birat Medical College Teaching Hospital, the study was carried out from July 2021 to December 2022. Patients with a diagnosis of plantar fasciitis who met the inclusion and exclusion criteria

were recruited for the study from the orthopaedics outpatient department after receiving informed consent. Plantar fasciitis was diagnosed clinically using the guidelines established by McPoil et al for plantar fasciitis.⁸ The clinical signs that were used to make the diagnosis of plantar fasciitis were: palpable tenderness in the plantar medial heel region, pain most obvious with initial steps after a period of inactivity but often gets worse after prolonged weight bearing, and pain often brought on by a recent increase in weight bearing activities.

Patients 18 yrs of age or older diagnosed with plantar fasciitis with visual analogue scale score for pain higher than 5 and failure of conservative treatment (stretching exercises, nonsteroidal anti-inflammatory drugs, and heel pads) for at least 3 months were included in the study. Patients with any previous local injection treatment for heel pain, any history of surgery for heel pain, systemic disorder like diabetes mellitus, rheumatoid arthritis, hematological disease, or gout, pregnancy, presence of infection at the site of injection and presence of associated pathology involving the lower limb such as history of tarsal tunnel syndrome, effusion of the ankle indicating an intra-articular disease, old healed calcaneal fracture, achilles tendinopathy, any deformity of foot and ankle (including pes planus or pes cavus), were excluded from the study.

Age, sex, height, weight was recorded. A history of prior treatments, any foot injuries, and the existence of any systemic diseases were noted. In addition to other standard investigations, a lateral radiograph of the afflicted side's heel was done to rule out any related pathology. Patients were randomly divided into two groups (group A and group B) of 38 each as per sample size calculation, with each patient enrolled in an odd number in group A and an even number in group B. In group A, patients received local corticosteroid injections; in group B, autologous PRP injections were used. For preparation of PRP, patient's peripheral whole blood was drawn under aseptic conditions, and 27 mL of it was mixed with 3 mL of sodium citrate (in ratio of 1:9). Around 3ml PRP was extracted using a double centrifugation technique that separated erythrocytes for 10 minutes at 1300 rpm and then concentrated platelets for 10 minutes at 3500 rpm.^{22,23} The injection was administered under strict aseptic conditions after the region to be injected was painted with 10% povidone iodine and draped with sterile towels. Injection was administered by the principal investigator palpating the maximally tender point of heel with the patient in a prone position and ankle in a neutral position.²⁴ Patients were blind for the agent used in the treatment. Patients in group A (the corticosteroid group) received 1 mL (40 mg) methyl prednisolone mixed with 2 mL of 2% lidocaine hydrochloride, while patients in group B (the PRP group) had an injection of 3 mL PRP after receiving 2 mL of 2% lidocaine hydrochloride through a 22-gauge needle into the most painful location on the heel at the origin of the plantar fascia using a peppering technique (a single skin portal and 4-5 penetrations of the plantar fascia).²⁵ Following injection, participants were instructed to apply ice to the area to reduce swelling and pain, use soft sole footwear and to refrain from running and other high-impact activities for a week.

A standardized stretching exercise for the plantar fascia and Achilles tendon was taught to all the patients. The patients were permitted to take paracetamol for pain at injection site, however wearing night splints or orthoses was not permitted.

Clinical evaluation, which included measuring pain on a 0–10 Visual Analog Scale, was done prior to the injection as well as during follow-up visits three weeks and three months post-injection (0 reflects absence of pain, 10 indicates the worst imaginable pain). The modified Roles and Maudsley score was used to evaluate subjective rating.^{3,10,26} The modified Roles and Maudsley scoring system is a 4-point, subjective patient evaluation of pain and activity restrictions. The results were categorized as excellent (no pain, patient satisfied with the treatment outcome, and unlimited pain-free walking), good (symptoms decreased significantly, patient satisfied with the treatment outcome, and the ability to walk pain-free for more than an hour), fair (symptoms decreased somewhat, pain at a more tolerable level than before treatment, and patient slightly satisfied with the treatment outcome), and poor (symptoms same as earlier or worse and patient not satisfied with the treatment outcome). In order to calculate the functional outcome score, the Foot Function Index (FFI) was used.²⁷ Statistical Package for the Social Science system version 25 (SPSS 25) was used to conduct statistical analyses. Continuous variables were reported as mean ± SD; but if the data were not evenly distributed it is

shown as median. Frequencies and percentages were used to represent categorical variables. The Student t test was used to compare normally distributed continuous variables between the groups. Depending on the situation, the χ^2 test or Fisher exact test was used to compare nominal categorical data between the groups. The Mann-Whitney U test was used to compare continuous variables that weren't regularly distributed. A significant difference was considered to exist for all statistical tests when the P value was less than 0.05.

RESULTS

We included a total of 76 patients divided into two groups of 38 patients each in the steroid group and the PRP group. 4 patients from steroid group lost to follow-up at both follow-ups while in PRP group, 3 patients did not come for follow-up at 3 months and 1 patient did not come for both follow-ups. Thus, data of total 68 patients were analyzed. The median age of the patients was 47 (IQR: 41 – 54) years. 54.4% (n=37) of the patients were female and 46.6% (n=31) were male. The median body mass index of the patients was 22.8 (IQR: 22.2 – 26.7) kg/m². There was no significant difference between groups with respect to average age, body mass index, and the baseline visual analog scale score (P> 0.05). The patients did not experience any complications due to the treatment in either group.

Table1: Baseline characteristics in 2 groups

	Steroid		PRP		p-value ⁺
	Mean ± SD	Median (IQR)	Mean ± SD	Median (IQR)	
Age (yrs)	49.5 ± 9.4	51 (42.7 – 56)	45.7 ± 8.9	44 (38.7 – 52.5)	0.069
Weight (kg)	66.1 ± 8.8	68 (59 – 72)	64.4 ± 7.9	63 (59.7 – 70.2)	0.448
Height (cm)	163.7 ± 8.5	162 (158 – 170)	163 ± 8.4	162 (157 – 169)	0.763
BMI (kg/m ²)	24.7 ± 2.9	22.9 (22.3 – 26.7)	24.2 ± 2.8	22.8 (21.9 – 26.8)	0.575

⁺ Mann Whitney U Test; SD: Standard Deviation; IQR: Inter-quartile Range; Bold signifies statistical significance at p<0.05

The median preinjection VAS score was 7 (IQR: 7 – 8) in the steroid group and 7 (IQR: 7 – 8) in the PRP group, and this difference was not significant (P= 0.781). Postinjection, there was a decreasing trend in the values of the VAS score in both the groups on 3 wks and 3 months follow-ups (Table 2). With the

available data, this downward trend in VAS score at each follow-up was statistically significant compared to the preinjection score. However, the difference of VAS score between the groups (group A and group B) was not statistically significant.

Table 2: VAS Score

	Steroid		PRP		p-value ⁺
	Mean ± SD	Median (IQR)	Mean ± SD	Median (IQR)	
Pre	7.39 ± 0.92	7 (7 – 8)	7.45 ± 0.79	7 (7 – 8)	0.781
3wks	4.0 ± 1.25	4 (3 – 5)	3.87 ± 1.19	4 (3 – 5)	0.669
3mo	2.18 ± 1.18	2 (1 – 3)	2.16 ± 1.10	2 (1 – 3)	0.864
p-value [*]	< 0.001		< 0.001		

⁺ Mann Whitney U Test; ^{*} Friedman Test; SD: Standard Deviation; IQR: Inter-quartile Range; Bold signifies statistical significance at p<0.05

The post hoc pairwise comparison showed statistical significance between VAS pre injection scores and VAS 3 weeks scores ($P < 0.001$); VAS pre injection scores and VAS 3 months scores ($P < 0.001$); VAS 3 weeks scores and VAS 3 months scores ($P < 0.001$) in both steroid and PRP group.

During the initial evaluation, the median FFI score in the steroid group 167 (IQR: 157.7 – 186.5) and PRP group 165 (IQR: 155.5 – 185) were comparable ($p = 0.959$). During follow-up at 3 weeks and 3 months, a progressive decrease in the FFI score

was observed in both groups of patients, reflecting clinical improvement. However, the difference in improvement between the two groups during the follow-up visits was not statistically significant (Table 3).

The post hoc pairwise comparison showed statistical significance between FFI pre injection scores and FFI 3 weeks scores ($P < 0.001$); FFI pre injection scores and FFI 3 months scores ($P < 0.001$); FFI 3 weeks scores and FFI 3 months scores ($P < 0.001$) in both steroid and PRP group.

Table 3: FFI Score

	Steroid		PRP		p-value*
	Mean ± SD	Median (IQR)	Mean ± SD	Median (IQR)	
Pre	170.1 ± 22.54	167 (157.7 – 186.5)	170.2 ± 20.24	165 (155.5 – 185)	0.959
3wks	92.5 ± 29.32	93 (70 – 112)	89.45 ± 28.01	90 (69.5 – 116)	0.689
3mo	48.6 ± 29.25	47 (27 – 70)	47.61 ± 27.49	46 (22 – 70.5)	0.905
p-value*	< 0.001		< 0.001		

* Mann Whitney U Test; * Friedman Test; SD: Standard Deviation; IQR: Inter-quartile Range; Bold signifies statistical significance at $p < 0.05$

Subjective evaluation of the outcome of the treatment was done using modified Roles and Maudsley scores (MRMS) which showed that only 16 patients in the steroid group and 17 patients in PRP group rated the outcome good to excellent after 3 weeks of injection; this number increased to 25 in both groups at the end

of 3 months. After 3 months of treatment, it was seen that only four patients (11.7%) in steroid group and five patients (8.8%) in PRP group had poor results. However, with the available data, no significant difference could be detected between the scores of the 2 groups at the 3 weeks and 3 months follow-ups (Table 4).

Table 4: Distribution of Modified Roles and Maudsley Score in 2 Groups

	Poor	Fair	Good	Excellent	p-value^
At 3 weeks					
Steroid	10	8	14	2	0.969
PRP	11	6	15	2	
At 3 months					
Steroid	4	5	16	9	0.915
PRP	3	6	14	11	

^ Chi-square Test; Bold signifies statistical significance at $p < 0.05$

DISCUSSION

In our study, the average age of the patients was similar to the average age of patients in other similar studies.^{10,24} According to certain studies, obesity is a common factor in plantar fasciitis,⁷ and study done by Akoahin E et al.¹⁰ and Monto et al.²⁸ even suggests that people with plantar fasciitis have a mean BMI of roughly 30 kg/m². In our study, patients with plantar fasciitis had a mean BMI of 24.7 kg/m². When compared to other research, our study population’s low average BMI may be the result of the patients’ poor socioeconomic status. The literature does not support the hypothesis that sex influences plantar fasciitis. 54.4% of the 68 patients in the current study were female ($n = 37$), compared to 46.6% of the patients ($n = 31$), demonstrating a little female preponderance, but this difference was not

statistically significant.

In this study, local injection of both corticosteroid and PRP in the treatment of chronic plantar fasciitis that did not respond to conservative therapy was equally effective. Due to their potent anti-inflammatory action and ability to decrease fibroblast proliferation and ground substance proteins, corticosteroid injections have been proven to be successful in the treatment of plantar fasciitis.¹²⁻¹⁴ In the current study, corticosteroid injection significantly decreased the VAS score in the 3-week post-injection follow-up compared to the pre-injection status, and the situation got better by the 3-month follow-up. The finding of our study was similar to the results shown by various previous studies.^{3,10,29,30} PRP has been described as a safe and efficient treatment for plantar fasciitis in studies done by Martinelli et al, O’Malley et al and Mohamed E et al.^{20,21,24} For the treatment of plantar fasciitis, some recent research have demonstrated that PRP injection

produces superior results than corticosteroids,^{23,28} while other studies have shown that the outcomes of both treatments are equivalent.^{3,10,29,30} The results of our investigation are in line with studies indicating an equal efficacy of corticosteroid and PRP injection in lowering VAS scores (post-injection on subsequent follow-up).

In our study, the evaluation of functional outcome was done by using foot function index (FFI) scores which was significantly improved on subsequent follow-up on 3 weeks and 3 months post injection in both steroid and PRP groups, but there was no significant difference in the score between the two groups. The results of functional evaluation in some other studies also showed the significant clinical improvement in both steroid and PRP groups but the difference in score between the groups was not statistically significant.^{3,10,30}

Corticosteroid injection is a less expensive and easier way to treat plantar fasciitis, but there are potential side effects like rupture of plantar fascia, infection, post-injection flare, fat pad atrophy, change in skin pigmentation, peripheral nerve injury and muscle damage. However, no cases in our study were associated any complications. On the other hand, PRP is more expensive than steroid injection and the process to obtain the PRP is time consuming for the patient and the clinician; whereas its benefits are sparing the patients from the possible complications of steroid injection and the regenerative properties of PRP on soft tissues providing additional benefit to patients by reducing inflammation and promoting the regeneration of damaged tissue.

CONCLUSION

Local injection of corticosteroid or platelet-rich plasma is equally effective treatment option for chronic plantar fasciitis.

LIMITATIONS OF THE STUDY

The limitations of our study are a small number of patients studied, a short follow-up period and lack of a control group. Further study with a larger sample and longer follow-up is required to confirm the results and provide a better insight of the efficacy of the two treatment modalities. Another limitation of our study is that it was not blinded for the treating physician which can create some bias.

ACKNOWLEDGEMENT

Department of Orthopaedics, BMCTH and my colleagues, and my friend Dr Ujwal Gautam for his support in statistical analysis.

CONFLICT OF INTEREST

None

FINANCIAL DISCLOSURE

None

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