

Treatment of chronic plantar fasciitis-A Comparative study of platelet-rich plasma versus corticosteroid injections

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Abstract: Plantar fasciitis is defined as localized inflammation and degeneration of the plantar aponeuroses. Heel pain is the most common reason for presentation. Approximately 10% of the population will experience heel pain in their life Today, there is no effective nonsurgical treatment option for plantar fasciitis, The use of corticosteroids is particularly troubling as several studies have linked plantar fascia rupture to repeated local injections of a corticosteroid .Studies in the literature have reported the use of PRP in plantar fasciitis and chronic tendinopathy.

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I. Introduction

Plantar fasciitis is defined as localized inflammation and degeneration of the plantar aponeuroses. Heel pain is the most common reason for presentation. Approximately 10% of the population will experience heel pain in their life¹. Reduced ankle dorsiflexion, standing for long periods of time at work, obesity, female gender and advancing age are listed as risk factors. The underlying condition that causes plantar fasciitis is a degenerative tissue condition that occurs near the site of origin of the plantar fascia at the medial tuberosity of the calcaneus². In acute cases, plantar fasciitis is characterized by classical signs of inflammation including pain, swelling and loss of function. For more chronic conditions, however, inflammation is not the underlying tissue disruption³. In fact, histology of chronic cases has shown no signs of inflammatory cell invasion into the affected area⁴. The tissue instead is characterized histologically by infiltration with macrophages, lymphocytes and plasma cells; tissue destruction; and repair involving immature vascularization and fibrosis⁴. The normal fascia tissue is replaced by an angiofibroblastic hyperplastic tissue which spreads itself throughout the surrounding tissue creating a self-perpetuating cycle of degeneration⁵⁻⁷. Numerous methods have been advocated for treating plantar fasciitis, including rest, nonsteroidal anti-inflammatory medication, night splints, foot orthosis, stretching protocols and extracorporeal shock wave therapy. Steroid injections are a popular method of treating the condition but only seem to be useful in the short term and only to a small degree⁸. The use of corticosteroids is particularly troubling as several studies have linked plantar fascia rupture to repeated local injections of a corticosteroid⁹. When neither rest and neither activity restriction nor conservative treatments result in a satisfactory outcome, the patient is often interested in treatment options other than surgery⁸.

Today, there is no effective nonsurgical treatment option for plantar fasciitis. Ideal nonsurgical treatment for plantar fasciitis should be as effective as other treatment options with minimal complications¹⁰.

Platelet-rich plasma (PRP) is promoted as an ideal autologous biological blood-derived product, PRP stimulates the natural healing process through growth factors contained in the platelets. PRP applied to the wound area accelerates the physiological healing process, provides support for the connection of cells, reduces pain and has anti-inflammatory and anti-bacterial effects. Studies in the literature have reported the use of PRP in plantar fasciitis and chronic tendinopathy¹¹⁻¹⁵. The rationale for using PRP in this degenerative and chronic process is to restart the inflammatory process that commonly ceases following failed conservative treatment, thus, turning the chronic injury into a new acute injury¹⁵. The high content of growth factors in PRP increases tissue regenerative abilities and regeneration processes. PRP has been proved to improve the early neotendon properties and improve tissue healing by enhancing cellular chemotaxis, proliferation and differentiation, removal of tissue debris, angiogenesis and the laying down of extracellular matrix¹³.

The aim of this study was to compare the effectiveness of Corticosteroid injections and Platelet rich Plasma injections in the treatment of chronic plantar fasciitis.

II. Materials and methods

This Non Randomized Intervention Study was done in Department of Orthopaedics, RIMS, Imphal between May 2018 to May 2019. 60 patients suffering from chronic plantar fasciitis were divided into two groups -Group A(n=30) and Group B(n=30), Group A patients received corticosteroid injections. Group B patients received platelet rich plasma injections.

Study Design: Non Randomized Intervention study

Study Location: This was a tertiary care teaching hospital based study done in Department of Orthopaedics, RIMS, Imphal

Study Duration: May 2018 to May 2019

Sample size: 60 patients with plantar fasciitis were recruited from May 2018 to May 2019

Subjects & selection method: The study population was drawn from consecutive chronic plantar fasciitis patients who presented to RIMS Hospital, Imphal with heel pain from May 2018 to May 2019.

Group A (n=30 patients) received corticosteroid injections;

Group B (n=30 patients) received platelet rich plasma injections.

Inclusion criteria:

1. Patients with age 20-75 years
2. Either sex
3. Duration of symptoms more than 3 months
4. Patients not responsive to oral medications

Exclusion criteria:

1. Pregnancy
2. Patients with systemic disease
3. Active tumor or haematological malignant disease
4. Infection
5. History of Anti-coagulant use
6. History of calcaneus fracture
7. Surgery in the heel area

Procedure methodology:

For group B patients, 30 ml of blood was collected in an acid citrate dextrose vacutainer and centrifuged at 1500 rpm for 15 minutes to separate the blood into layers of red blood cells, buffy-coat of leucocytes, and plasma. PRP was prepared under aseptic conditions as per the procedure standardized in the departmental laboratory. A 9001:2000 ISO certified R-23 centrifuge was used for the purpose of platelet concentration. 3 ml of PRP was injected at the most tender point over the origin of plantar fascia on the medial tubercle of the calcaneus, using the peppering technique using a 22 gauge needle with a single skin portal and five penetration of the tendon in a clockwise manner under sterile conditions. The patients were kept in the supine position for 20 minutes following administration and they were advised to not take anti-inflammatory medication for several weeks after the procedure.

For patients in group A, 80 mg methyl prednisolone was injected at the most tender point over the origin of plantar fascia using the peppering technique using a 22 gauge needle with a single skin portal and five penetration of the tendon in a clockwise manner under sterile conditions. After the procedure patients were advised to limit the use of their feet for 48 hours.

After injection both group patients were advised to rest and not stand for the first day after the injection. Standard Achilles tendon and plantar fascia stretching regimen was advised for 2 weeks, after that a formal strengthening exercise program was started, then after 4 weeks after the injection patients were allowed to proceed with their normal sporting or recreational activities as tolerated.

No NSAID, orthosis or splint was given to any patient.

Statistical Analysis:

The patients were asked to come for follow up visits on the 2,4,8,12,26,52 weeks. At each followup, The American Foot and Ankle Score (AFAS) and Foot and Ankle Ability Measure score (FAAM) was measured, Data was entered and Analysed using Statistical Product and Service Solutions (SPSS) version 21 for windows, Independent T test was used to analyse association of Effective Response across the Study groups and with other predictor variables, P value less than 0.05 was taken as significant, 25 % increase in The American Foot and Ankle Score (AFAS) and Foot and Ankle Ability Measure Score (FAAM) was taken as a successful result.

III. Result

From May 2018 to May 2019, a total of 60 patients with chronic plantar fasciitis were assorted into either corticosteroid group or platelet rich plasma group. after giving the injections the patient was followed up for 1 year and their Foot and ankle ability measure score (FAAM) score and the American foot and ankle score (AFAS) was recorded.

The mean age of the patients in corticosteroid group was 38 and mean age in platelet rich plasma group was 45, there were 21 male patients in corticosteroid group and only 9 male patient in platelet rich plasma group.

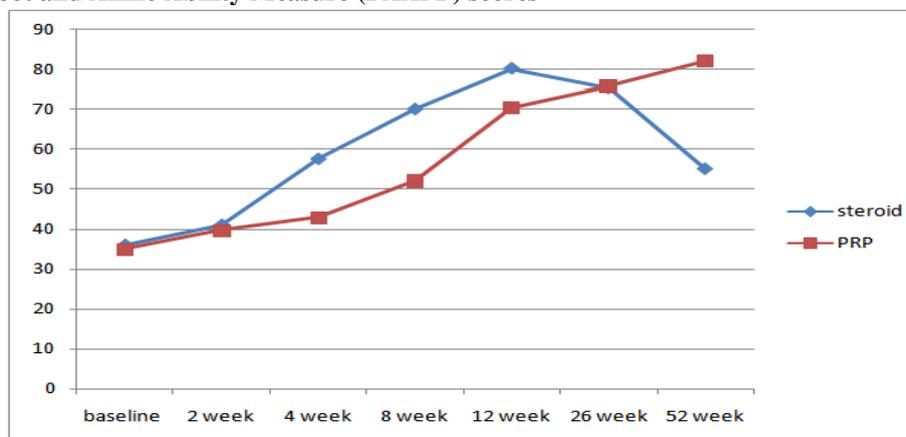
Table no 1: The baseline characteristics of the patient are as follows

variables	measures	Corticosteroid group	PRP group	P value
age	Mean ± sd	38.63 ± 12.31	45.20 ± 9.95	0.027
sex	Male %	21(61.8%)	13(38.2%)	0.37
sex	Female	9(34.6%)	17(65.4%)	0.35
Baseline AFAS score	Mean ± sd	50.91 ± 8.54	52.65 ± 6.13	0.47
Baseline FAAM score	Mean ± sd	36.23 ± 5.29	34.97 ± 5.67	0.000

Table no 2 At the end of one year follow up, both the groups AFAS score and FAAM score are as follows

time	intervention	FAAM score		AFAS score	
		Mean ± sd	p value	Mean ± sd	p value
0 week (baseline)	Corticosteroid	36.23 ± 5.29	P=0.53	50.91 ± 8.54	P=0.47
	PRP	34.97 ± 5.67		52.65 ± 6.13	
2 week	Corticosteroid	41.62 ± 6.49	P=0.009	60.3 ± 7.12	P<0.001
	PRP	39.61 ± 6.70		54.73 ± 4.93	
4 week	Corticosteroid	57.61 ± 6.95	P<0.001	65.42 ± 4.42	P=0.009
	PRP	42.87 ± 7.12		62.7 ± 8.26	
8 week	Corticosteroid	70.14 ± 6.21	P<0.001	67.92 ± 3.31	P=0.008
	PRP	52.11 ± 7.12		69.11 ± 8.24	
12 week	Corticosteroid	80.10 ± 8.12	P<0.001	74.32 ± 4.15	P<0.001
	PRP	70.41 ± 4.62		70.34 ± 6.53	
26 week	Corticosteroid	69.82 ± 7.40	P<0.001	69.73 ± 3.77	P<0.001
	PRP	75.92 ± 6.33		79.54 ± 7.76	
52 week	Corticosteroid	55.14 ± 7.62	P<0.001	60.65 ± 7.43	P<0.001
	PRP	81.94 ± 8.60		85.45 ± 10.34	

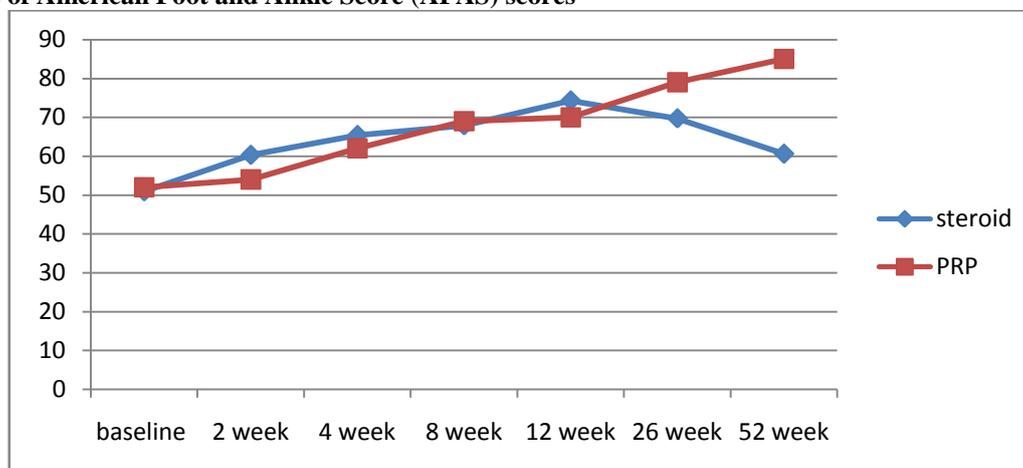
Course of Foot and Ankle Ability Measure (FAAM) scores



As shown in the graph the FAAM score of the patients in the PRP group increased gradually during the follow up for 1 year, but the FAAM score of the patients in the corticosteroid group was gradually increasing till 12 weeks, then it got significantly worse during 26, 52 weeks, at the end of 1 year follow up the FAAM scores of the corticosteroid group was found to be returning to baseline values.

At the final follow up 24 (80%) out of 30 patients in PRP group had more than 25% increase in their final FAAM scores, but only 8 (26%) patients had more than 25 % increase in the corticosteroid group. Patients in the PRP group was more often successfully treated than the patients in the corticosteroid group ($p < 0.001$) on comparing FAAM scores.

Course of American Foot and Ankle Score (AFAS) scores



As shown in the graph the AFAS score of the patients in the PRP group increased gradually During the follow up for 1 year, but the AFAS score of the patients in the corticosteroid group was gradually increasing till 12 weeks .then it got significantly worse during 26, 52 weeks, at the end of 1 year follow up the AFAS scores of the corticosteroid group was found to be returning to baseline values.

At the final follow up 25 (83%) out of 30 patients in PRP group had more than 25% increase in their final AFAS scores, but only 9 (30%) patients had more than 25 % increase in the corticosteroid group.

Patients in the PRP group was more often successfully treated than the patients in the corticosteroid group($p < 0.001$) on comparing AFAS scores.

None of patients in our study had any complications related to the PRP or corticosteroid injections. All 60 patients came for follow-ups regularly.

IV. Discussion

Several nonsurgical treatment methods are available for the treatment of plantar fasciitis with various success rates. Ideal treatment for plantar fasciitis has not been determined^{4,16}. The use of PRP in foot and ankle pathologies has begun to increase⁷. Our study was designed to compare the effect of PRP and steroid injection in the treatment of chronic plantar fasciitis.

The important finding of our study is that, Following a single injection, the effect of corticosteroid in terms of pain relief and functional capacity was satisfactory till 12 week, after which the condition of the patient starts worsening again as evident from the graphs, on the other hand the patients in the PRP group had no such decline in the one year follow up period, in fact they showed a gradual improvement in their pain and functional capacity as evident from the graphs.

A single dose of manually obtained PRP was found to be more effective than steroid injection in terms of pain and functional results in the treatment of chronic plantar fasciitis^{16,17}. The etiology of plantar fasciitis is not fully known. According to the commonly accepted view in the literature, it is the steroid injections for plantar fasciitis has been reported to be useful in the short-term. In our study, we found a positive effect on pain and functional scores in the steroid group which can be explained by the anti-inflammatory effect¹⁸. However, steroid injections have been reported to be related to plantar fascia tear, fat pad atrophy, abscess and osteomyelitis¹⁹.

Platelet-rich plasma stimulates the proliferation of various cell types in cells and tissue and activates repair cells in the blood circulation^{20,8}. More than 30 bioactive proteins are found within the alpha granules of platelets. Growth factors, such as platelet-derived growth factor, transforming growth factor, vascular endothelial growth factor and insulin-like growth factor, and proteins such as fibrin, fibronectin, vitronectin, and thrombospondin, found in PRP, play a role in many stages of tissue healing. These growth factors activate some of the cells that play a function in tissue healing and thus provide soft tissue healing and bone regeneration. With its growth factors, PRP stimulates the local stem cells and activates the repair cells in the circulation and bone marrow. Excessive inflammation inhibits apoptosis and metalloproteinase activity²¹⁻²³.

Moreover, in tendon recovery, PRP increases tenocyte proliferation in the injured area by providing revascularization by means of the included growth factors and is effective in increasing collagen expression in the tenocytes²⁴.

Growth factors and cytokines are revealed with the formation of platelet gel from the activated PRP. Some authors used PRP without activation. There is no consensus with usage of PRP in ideal concentration, application frequency or platelet activation. In the current study, PRP was prepared manually as single-spin rotation. In the analysis of the prepared PRP, concentration was determined as four times greater than the thrombocyte count in the peripheral blood. The prepared PRP was activated collagen of the plantar fascia by pepping technique²⁵.

For PRP obtained from autologous blood, there is no risk of immune reaction or disease transfer. There are no studies in the literature warning of hyperplasia, carcinogenesis or tumor growth of PRP. No complications were encountered in any patient in the PRP group^{14,18}.

V. Conclusion

In conclusion, the administration of PRP in chronic plantar fasciitis treatment appears to be a more effective method than corticosteroid injection for the reduction of pain and provide better functional results at 1 year follow-up.

References

- [1]. League AC. Current concepts review: plantar fasciitis. *Foot Ankle Int* 2008;29:358-66.
- [2]. Crawford F, Thomson C. Interventions for treating plantar heel pain. *Cochrane Database Syst Rev* 2010;1:CD000416.
- [3]. Riddle DL, Pulisic M, Pidcoe P, Johnson RE. Risk factors for Plantar fasciitis: a matched case-control study. *J Bone Joint Surg Am* 2003;85-A:872-7.
- [4]. Scher DL, Belmont PJ Jr, Bear R, Mountcastle SB, Orr JD, Owens BD. The incidence of plantar fasciitis in the United States military. *J Bone Joint Surg Am* 2009;91:2867-72.
- [5]. Jarde O, Diebold P, Havet E, Boulu G, Vernois J. Degenerative lesions of the plantar fascia: surgical treatment by fasciectomy and excision of the heel spur. A report on 38 cases. *ActaOrthopBelg* 2003;69:267-74.
- [6]. Lemont H, Ammirati KM, Usen N. Plantar fasciitis: a degenerative process (fasciosis) without inflammation. *J Am Podiatr Med Assoc* 2003;93:234-7.
- [7]. Healey K, Chen K. Plantar fasciitis: current diagnostic modalities and treatments. *Clin Podiatr Med Surg* 2010;27:369-80.
- [8]. Davis PF, Severud E, Baxter DE. Painful heel syndrome: results of nonoperative treatment. *Foot Ankle Int* 1994;15:531-5.
- [9]. Gill LH, Kiebzak GM. Outcome of nonsurgical treatment for plantar fasciitis. *Foot Ankle Int* 1996;17:527-32.
- [10]. Sánchez M, Anitua E, Orive G, Mujika I, Andia I. Platelet-rich therapies in the treatment of orthopaedic sport injuries. *Sports Med* 2009;39:345-54.
- [11]. Barrett SL, Erredge SE. Growth factors for chronic plantar fasciitis? *Podiatry Today* 2004;17:36-42.
- [12]. Akşahin E, Doğruyol D, Yüksel HY, Hapa O, Doğan O, Celebi L, et al. The comparison of the effect of corticosteroids and platelet-rich plasma (PRP) for the treatment of plantar fasciitis. *Arch Orthop Trauma Surg* 2012;132:781-5.
- [13]. Ragab EM, Othman AM. Platelets rich plasma for treatment of chronic plantar fasciitis. *Arch Orthop Trauma Surg* 2012;132:1065-70.
- [14]. Martinelli N, Marinozzi A, Carni S, Trovato U, Bianchi A, Denaro V. Platelet-rich plasma injections for chronic plantar fasciitis. *IntOrthop* 2013;37:839-42.
- [15]. de Vos RJ, van Veldhoven PL, Moen MH, Weir A, Tol JL, Maffulli N. Autologous growth factor injections in chronic tendinopathy: a systematic review. *Br Med Bull* 2010;95:63-77.
- [16]. Castillo TN, Pouliot MA, Kim HJ, Dragoo JL. Comparison of growth factor and platelet concentration from commercial platelet-rich plasma separation systems. *Am J Sports Med* 2011;39:266-71.
- [17]. Anitua E. Plasma rich in growth factors: preliminary results of use in the preparation of future sites for implants. *Int J Oral Maxillofac Implants* 1999;14:529-35.
- [18]. Anitua E, Andia I, Ardanza B, Nurden P, Nurden AT. Autologous platelets as a source of proteins for healing and tissue regeneration. *ThrombHaemost* 2004;91:4-15.
- [19]. Maffulli N, Del Buono A. Platelet plasma rich products in musculoskeletal medicine: any evidence? *Surgeon* 2012;10:148-50.
- [20]. Kitaoka HB, Alexander IJ, Adelaar RS, Nunley JA, Myerson MS, Sanders M. Clinical rating systems for the ankle/hindfoot, midfoot, hallux, and lesser toes. *Foot Ankle Int* 672 *ActaOrthopTraumatolTurc* 1994;15:349-53.
- [21]. Crawford F, Atkins D, Young P, Edwards J. Steroid injection for heel pain: evidence of short-term effectiveness. A randomized controlled trial. *Rheumatology (Oxford)* 1999;38:974-7.
- [22]. Acevedo JI, Beskin JL. Complications of plantar fascia rupture associated with corticosteroid injection. *Foot Ankle Int* 1998;19:91-7.
- [23]. Buccilli TA Jr, Hall HR, Solmen JD. Sterile abscess formation following a corticosteroid injection for the treatment of plantar fasciitis. *J Foot Ankle Surg* 2005;44:466-8.
- [24]. Gidumal R, Evanski P. Calcaneal osteomyelitis following steroid injection: a case report. *Foot Ankle* 1985;6:44-6.
- [25]. Lucarelli E, Beccheroni A, Donati D, Sangiorgi L, Cenacchi A, Del Vento AM, et al. Platelet-derived growth factors enhance proliferation of human stromal stem cells. *Biomaterials* 2003;24:3095-100.

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