




Original Article

Prospective Comparative Short-Term Study of Autologous Leucocyte-Rich Platelet-Rich Plasma vs. Local Steroids in Chronic Plantar Fasciitis

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ABSTRACT

Objectives: Plantar fasciitis is the most common cause of heel pain and is difficult to treat in most chronic and severe forms. Management of plantar fasciitis includes non-surgical options such as non-steroidal anti-inflammatory drugs and corticosteroids, physical therapy, orthotics, and surgical management includes plantar fasciotomy. Local injection of platelet-rich plasma as well as local steroids is an emerging concept in treating recalcitrant tendon and ligament pathology, including plantar fasciitis.

The aim of the study was to evaluate and compare the outcome of patients treated with a single injection of autologous leucocyte-rich platelet-rich plasma with single-injection local steroids triamcinolone in chronic plantar fasciitis.

Material and Methods: The study was conducted for a duration of 24 months. In total, 60 patients with clinically diagnosed chronic plantar fasciitis were selected for study and divided in two groups using the single allocation randomization method as those treated with autologous injection leucocyte-rich platelet-rich plasma and those with injection local steroid triamcinolone and prospectively followed and compared.

Results: Both groups were evaluated subjectively and functionally at primary visit and then on follow-up at 2 weeks, 4 weeks, 8 weeks, and 12 weeks by VAS and hind foot AOFAS score.

Conclusion: We concluded that both injection platelet-rich plasma-treated and injection local steroid-treated patients provide symptomatic relief in the treatment of chronic plantar fasciitis both subjectively and functionally. The steroid treated group showed early symptomatic improvement at 2 weeks, and results at 12 weeks to further follow-up were suggestive that single-injection leucocyte-rich platelet-rich plasma provided better functional results.

Keywords: Chronic plantar fasciitis, LR-PRP, Local steroids

INTRODUCTION

Plantar fascia has its origin from calcaneal tuberosity and run forward toward the metatarsals and is a thick fibrous structure. Plantar fascia gives support to longitudinal arch of the foot in the static mode along with shock absorption function, which is dynamic.^[1] Plantar fasciitis ranks the highest amongst the common causes of heel pain. It becomes difficult to treat when it becomes chronic or is in severe forms.^[1] It is estimated that 10% of the population will be affected by this condition at some point during their lifetime.^[2,3] Peak incidence occurs between 40 and 60 years.^[3] Though plantar fasciitis is well-recognized clinical entity, there are no “gold standard” tests for diagnosis or to verify it.^[4]

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Typical clinical findings of plantar fasciitis are

- medial calcaneal tuberosity area pain and palpable tenderness
- painful first few steps in the beginning of the activity after long rest called as “startup pain,” which lessens over as the activity progresses partially or totally.
- The pain worsens toward the end of the day in severe cases.

Management of plantar fasciitis includes nonsurgical and surgical modalities. Nonsurgical management includes physiotherapy (hot and cold-water therapy, shock wave therapy) and drugs such as nonsteroidal anti-inflammatory drugs (NSAIDs) and corticosteroid and surgical management includes plantar fasciotomy.^[5] Conservative measures are successful in resolving symptoms of 80% of patients, while these nonoperative measures may be unsuccessful in 20% of cases which may become chronic.^[6] Local injection of autologous leucocyte-rich platelet-rich plasma and local injection of triamcinolone (steroid) have been used in treating recalcitrant and chronic tendon and ligament pathology, including plantar fasciitis, which is an emerging concept. Leucocyte-rich platelet-rich plasma is derived from autologous blood that contains a higher platelet count than baseline while containing all the necessary clotting factors, growth factors, and proteins.^[7] There have been several studies demonstrating the use of leucocyte-rich-platelet rich plasma in the management of soft tissue and bony injuries in the past three decades, including orthopedics. It has recently been shown that leucocyte-rich platelet-rich plasma can be used for cartilage regeneration and chronic enthesopathies such as tennis elbow and plantar fasciitis.

Among chronic enthesopathies such as tennis elbow or plantar fasciitis, treatment and complete recovery from these conditions has always been among the most challenging and frustrating problems for both patients and treating doctors. Repeated micro trauma make these conditions difficult to treat.^[8-11]

Aims and Objectives

The study was conducted to evaluate and compare the clinical outcome and efficacy of leucocyte-rich platelet-rich plasma (L-PRP) in chronic plantar fasciitis of heel using a single injection without activator and single injection of local corticosteroids in short term.

MATERIAL AND METHODS

The study was conducted in a tertiary care hospital in central India from Jan 2018 to July 2020. Ethical committee

approval was obtained. Informed consent from patients was taken. Sixty patients with chronic plantar fasciitis (16 males, 44 females) were enrolled and were allocated in two groups using the alternate randomization method.

Group A (*n*-30): received single injection of autologous L-PRP

Group B (*n*-30): single dose of local steroid (injection triamcinolone 40 mg)

No local anesthesia was used

Inclusion criteria-Adult patients of chronic plantar fasciitis of greater than 3 months duration and not responding to conservative treatment such as orthotics, analgesic and physiotherapy treatment, old patients of plantar fasciitis with wash out period of 15 days for local treatment and 1 month for systemic treatment.

Exclusion criteria-Patients with active bilateral plantar fasciitis secondary to systemic disease, patients with uncontrolled diabetes mellitus, local infection, vascular insufficiency, neuropathy, and patients with previous surgery for plantar fasciitis were excluded.

Informed consent from patients was obtained and patients were explained about visual analog score (VAS) scoring system of pain. 0-to-10-point VAS scale was used. Before undergoing treatment, each patient underwent a weight-bearing radiograph of the foot to identify any structural changes in the arch or hind foot.

VAS scores were noted prior to procedure on day 0, after 2 weeks of injection, at 6 weeks post injection, and at 3 months, and 6 months post injection. Hand foot AOFAS score was also used for evaluation.

Single spin method of harvesting LR-PRP, 20 mL of autologous blood was collected from the patients under all aseptic precautions using a 22-gauge needle. Collected blood was centrifuged with 2700 rpm for 12 minutes. Two layers were formed, upper layer including buffy coat with the majority of cells and lower layer poor in cells concentration. The upper 3 to 4 mL of the blood was removed, followed by sequential pipetting. There was a massive increase in platelet concentration specifically at the buffy coat above the red cells layers. Leucocyte-rich platelet-rich plasma obtained using the single spin method.

Injection technique The injection procedure was done under all aseptic precautions. Next, 3 mL of concentrate LR-PRP or steroid injection (1 mL triamcinolone 40 mg) was injected using 22-gauge needle. We used a single portal injection technique followed by peppering technique that is 4 to 5 penetrations of fascia into the most tender area of plantar fascia. The patient was under observation for half an hour and discharged with instruction and follow-up advice.

Post injection protocol The patients were asked to elevate the limb and limit their activities for 24 to 48 hours. They were counseled that they might experience some discomfort at injection site for the first few days. The use of acetaminophen for pain control was allowed along with ice application. The patient was taught and encouraged to start stretching exercises for plantar fascia for 2 weeks, followed by intrinsic muscle strengthening exercises of foot after 2 weeks. Stretching and strengthening exercises for achilles-calcaneal plantar system was indicated for entire follow-up period.

Statistical analysis-The data were analyzed by using the statistical package for social sciences (SPSS) software. Comparison of mean (VAS and AOFAS) between two groups tested was done using an independent *t*-test. The *P*-value was calculated for significance; $p < 0.05$ was considered as significant.

They were also examined for complications such as soft tissue infection, stiffness, and fat pad atrophy.

RESULTS

In this study, chronic plantar fasciitis is more common in females than males and its prevalence is more in patients having age more than 50 years.

The VAS score in the group A and group B did not differ significantly from the pretreatment group. At 14 days, there was more fall in the VAS score in the steroid group but was not statistically significant. At 1 month, VAS score significantly decreased in LRPRP group, which was significant. At 3 months' increase in the VAS in the steroid group, which was significant. At 3 to 6 months, the VAS score was significantly low in the LRPRP group [Table 1].

The mean AOFAS score at 4 weeks showed no significant improvement in leucocyte-rich platelet-rich plasma group compared with local steroid injection group ($P=0.051$), this might be due to the latency in action of leucocyte-rich platelet-rich plasma. There was a significant AOFAS score

improvement at 8 weeks ($P < 0.001$) and 12 weeks ($P < 0.001$) in leucocyte-rich platelet-rich plasma group as compared with local steroid injection group [Table 2].

No patient experienced any disabling complications. No changes in arches or deformities of the foot were observed after injections. Acetaminophen was used by six patients, out of 30 in the LRPRP group and 3 in 30 in the steroid group patients. No patients required surgery for treatment during this period.

DISCUSSION

Generally, plantar fasciitis is a self-limiting disease; however, sometimes it takes 6 to 8 months for it to resolve, which could lead to morbidity. A repetitive micro trauma overwhelms the body's healing process, causing collagen degeneration at origin site leading to pain. According to Lemont, plantar fasciosis is a degenerative process, not characterized by the inflammation of the plantar fascia but by necrosis of the ligaments; hence, the better name plantar fasciitis. Most patients get relief by conservative treatment, which may include medications, soft gel pad, physiotherapy, stretching, extra wave shock wave therapy, and local steroids injections.

Orthobiologics is a growing science involving the use of patients' own biological tissues to promote healing. Autologous blood is used to create leucocyte-rich platelet-rich plasma, a product that releases high concentrations of various growth factors to accelerate healing.

LRPRP has been in use for nearly three decades in various medical fields such as sports medicine, neurosurgery, urology, and orthopedics. It does not have side effects such as tears of tendon and fibrosis. Local steroids injections are also in long-term use for plantar fasciitis. Local steroids are associated with complications such as plantar fascia rupture and fat pad atrophy.

Autologous blood preparation can be divided into four main categories according to the composition of leucocyte platelets

Table 1: Mean VAS scores at different follow-up periods.

	At first visit	2 weeks	4 weeks	8 weeks	12 weeks
PRP-treated group	7.87	7.12	4.83	3.5	2.17
Local steroid-treated group	7.97	6.93	6.77	5.87	6.17

VAS, visual analog score; PRP, platelet-rich plasma

Table 2: Mean and standard deviation of AOFAS scale in both groups.

	Pretreatment AOFAS	AOFAS at 4 weeks	AOFAS at 8 weeks	AOFAS at 12 weeks
PRP-treated group	52.4	60.1	69.67	84.07
Local steroid-treated group	54.0	57.0	60.47	62.1

PRP, platelet-rich plasma; AOFAS, American Orthopedic Foot and Ankle Society

and fibrin architecture. These include pure platelet-rich plasma (PRP) or leucocyte poor platelet-rich plasma (LPPRP), leucocyte-rich platelet-rich plasma (LRPRP) or leucocyte and platelet-rich fibrin (LPRF) or second-generation platelet-rich plasma.

Plasma enriched with platelets does not only contain biologically active substances but also adhesive proteins, protease inhibitors, and growth factors such as TGF-beta 1, CGF, VEGF, and PDGF. A complex interaction of growth and different factors is responsible for promoting a healing response and regenerative process. Various factors augment the healing cascades. LRPRP is believed to induce regenerative effect and anti-inflammatory effect whereas steroids have more of anti-inflammatory actions.

Several studies have been conducted to investigate the efficacy of injecting LRPRP to treat plantar fasciitis. Ragab *et al* injected platelet-rich plasma in 25 patients with plantar fasciitis. The outcome of the study was compared between pre-injection and post-injection VAS and plantar fascia thickness by ultrasound.^[11] No control group was included. Aksahin *et al.* studied the effects of PRP and steroid injections on plantar fasciitis. The study population was 60 patients, 30 had PRP injections, and 30 had steroids injections.^[11] At 4 weeks, the effect of platelet-rich plasma was promising and consistent until 12 weeks, this is similar to the study done by Tiwari and Bhargawa,^[12] in which a VAS score fell ($P < 0.001$) significantly after 1 month of treatment and remained constant for 6 months.

AOFAS of our study was comparable with that of Acosta *et al.*,^[13] in which there was clinical improvement in patients throughout the evaluation period. Lopez *et al*^[14] also showed similar results to our study, in which the initial AOFAS score was 39 (range 28–68) and the VAS score was 9 (range 7–10). At week 16, the AOFAS score had grown to 97 (range 88–99) and the VAS score was 2 (range 1–4).

While there were no serious complications following local steroid injections such as local fat pad atrophy, iatrogenic fascia rupture, or osteomyelitis, LRPRP appears to be safer when these factors are taken into consideration. The preparation of LRPRP requires centrifugation machine and is more time consuming than steroid injection. We did not use guided injection techniques such as ultrasonography that would have increased precision but also the cost and time per patient. Using ultrasound or scintigraphy findings such as stage and extent of a disease to compare treatment outcomes may provide additional information about which agent to use and at what stage.

CONCLUSION

Both single-injection LR-PRP and local steroids are effective but the effect of LRPRP is statistically more at 6 months on

the VAS score. The use of leucocyte-rich platelet-rich plasma in the treatment of chronic plantar fasciitis may become a common method for those who do not respond to non-surgical treatments.

- Leucocyte-rich platelet-rich plasma groups showed significant improvement in symptoms (decrease in VAS and increase in AOFAS score scale) compared with baseline value.
- Leucocyte-rich platelet-rich plasma showed statistically significant results compared to local steroids.
- Both treatments did not impair biomechanical function of the foot and no major complications were noted. Leucocyte-rich platelet-rich plasma is as safe and outpatient procedure as steroids. Considering the economical aspect, it is expensive than steroid, it offered better relief at a follow-up period of 6 months.
- A single-spin technique is used to separate platelet-rich plasma from the whole blood.
- Leucocyte-rich platelet-rich plasma provides long-term pain relief in plantar fasciitis and with a high compliance. Hence, platelet-rich plasma could be a better alternative for conventional therapy in terms of long-term effect.

Conflicts of interest

None declared.

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