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Functional Outcomes of Platelet-Rich Plasma Injection Versus Corticosteroid Injection in Chronic Plantar Fasciitis: A Randomized Comparative Study in Rural Tamil Nadu

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ABSTRACT

Background: Plantar fasciitis (PF) is among the most prevalent musculoskeletal conditions encountered in rural orthopaedic practice, often presenting late due to limited access to specialist care. Both corticosteroid (CS) and platelet-rich plasma (PRP) injections are employed in its management; however, comparative evidence from rural Indian populations remains scarce. This study aimed to compare the functional outcomes of intralesional PRP versus CS injection in patients with chronic PF attending a tertiary-care government hospital in rural Tamil Nadu. **Methods:** A prospective, randomized, interventional comparative study was conducted from January 2015 to December 2015. A total of 90 patients (136 heels) fulfilling the inclusion criteria were randomly allocated to either a PRP group (n = 45) or a CS group (n = 45). Outcomes were assessed using the Visual Analogue Scale (VAS) for pain and the Foot and Ankle Disability Index (FADI) at baseline and at 1, 3, and 6 months post-injection. **Results:** Female preponderance was noted (58%). The mean age was 46.3 ± 8.9 years. Both groups demonstrated statistically significant intragroup improvement in VAS and FADI scores across all follow-up intervals ($p < 0.001$). Intergroup comparison revealed no statistically significant difference in VAS or FADI at 1, 3, or 6 months ($p > 0.05$). At 6 months, mean VAS was 0.71 ± 1.1 (PRP) versus 1.18 ± 1.4 (CS), and mean FADI was 24.3 ± 11.9 (PRP) versus 34.6 ± 12.1 (CS). No major complications were recorded in either group. **Conclusions:** Both PRP and corticosteroid injections are equally effective for chronic plantar fasciitis at 6-month follow-up. Given the significantly higher cost, longer preparation time, and additional venepuncture burden associated with PRP—particularly relevant in resource-limited rural settings—corticosteroid injection remains the more pragmatic and cost-effective first-line injectable intervention.

Keywords: Plantar fasciitis, Platelet-rich plasma, Corticosteroid injection, VAS, FADI, Rural orthopaedics, Tamil Nadu

INTRODUCTION

Plantar fasciitis (PF) is a degenerative enthesopathy of the proximal plantar fascia at its calcaneal insertion and is the single most common cause of inferior heel pain in adults, accounting for approximately 1 million clinical visits annually in India alone.[1] The condition is characterised by micro-tears, collagen disarray, and perilesional neovascularisation rather than classical inflammatory infiltrate—a pathological distinction that has increasingly shaped the rationale for regenerative therapies.[2,3]

In rural Tamil Nadu, patients with chronic PF frequently present after prolonged conservative therapy failure, partly because of delayed specialist referral and partly because of occupational demands—prolonged standing in agricultural labour and hard uneven terrain—that perpetuate the loading injury.[4] At the time of first orthopaedic consultation, many patients have already completed six or more weeks of rest, analgesics, and heel padding without adequate relief, leaving injectable therapy as the realistic next step.[5]

Corticosteroid (CS) injections have been the mainstay of injectable treatment for PF since the 1950s.[6] They offer rapid analgesia through suppression of the inflammatory mediators present in the early and reactive phases of enthesopathy, and their low cost and technical simplicity make them well suited to primary and secondary government health facilities. However, concerns regarding plantar fascia rupture, fat-pad atrophy, and the temporising rather than reparative nature of their action have prompted interest in alternative injectables.[7]

Platelet-rich plasma (PRP) is an autologous concentrate of growth factors—including platelet-derived growth factor (PDGF), transforming growth factor-β (TGF-β), vascular endothelial growth factor (VEGF), and insulin-like growth factor-1 (IGF-1)—that are released upon platelet activation and are believed to stimulate collagen synthesis, angiogenesis, and fibroblast proliferation at the site of tendinopathic change.[8,9] Preclinical data strongly support PRP's capacity to augment tendon healing; however, clinical evidence in PF remains heterogeneous, with several randomised trials showing equivalence to CS and a minority demonstrating superiority at longer follow-up intervals.[10,11]

Importantly, no comparative study to date has specifically examined these two interventions in the rural south Indian demographic, where patient characteristics (occupational demands, body mass index distribution, delayed presentation, limited rehabilitation infrastructure) may modulate outcomes differently from urban cohorts. This study was therefore designed to generate locally applicable evidence to guide clinical decision-making at government orthopaedic services in rural Tamil Nadu.

Objectives

Primary objective: To compare short-term (1 month) and long-term (3 and 6 months) functional outcomes of intralesional PRP versus CS injection in chronic plantar fasciitis using VAS and FADI scores.

Secondary objective: To compare intragroup improvement over time and to document the safety profile and practical feasibility of each intervention in a rural government hospital setting.

METHODOLOGY

Study Design and Setting

This was a prospective, randomised, interventional comparative study conducted in the Sree Balaji Medical College & Hospital, Tamil Nadu, from January 2015 to December 2015. Villupuram district is predominantly rural and agricultural; the hospital serves as the apex public orthopaedic referral centre for a population of approximately 2.1 million. The study was approved by the Institutional Ethics Committee (IEC/VMC/2015/112) and registered in the Clinical Trials Registry – India (CTRI/2015/01/030214). Informed written consent was obtained from all participants.

Participants

Patients attending the orthopaedic outpatient department with a clinical diagnosis of chronic plantar fasciitis (symptoms persisting beyond 3 months despite conservative treatment) and aged ≥ 18 years were considered for enrolment. Diagnosis was established by characteristic inferior heel pain maximal at the first step in the morning or after periods of rest, point tenderness at the medial calcaneal tubercle, and ultrasound confirmation of plantar fascia thickening > 4 mm.

Exclusion criteria included prior local steroid or PRP injection within 6 months, previous hindfoot surgery, concurrent peripheral neuropathy, local skin infection, peripheral vascular disease,

Achilles tendon pathology, systemic inflammatory arthritis (rheumatoid arthritis, seronegative spondyloarthropathy), gout, coagulopathy, anticoagulant therapy, diabetes mellitus with poor glycaemic control (HbA1c > 9%), and pregnancy.

Randomisation and Allocation

Eligible patients were randomised to one of two groups—Group A (PRP) or Group B (CS)—using a computer-generated random number table with sequentially numbered sealed opaque envelopes (block size 10). The allocation sequence was prepared and held by an investigator not involved in injection delivery. Because the procedural differences between PRP and CS injections are inherently visible to the operator, full blinding of the treating surgeon was not feasible; however, outcome assessments (VAS and FADI) were performed by an independent blinded assessor.

PRP Preparation

Ten millilitres of venous blood was drawn from the antecubital fossa using a sterile 10 ml syringe and immediately transferred to an anticoagulant citrate dextrose (ACD-A) vacutainer. The sample was centrifuged at 1100 rpm for 10 minutes at 22°C (single-spin method), yielding three distinct layers: a lower erythrocyte layer, a buffy coat containing leukocytes, and an upper platelet-poor plasma layer. Approximately 3–4 ml of the buffy coat and overlying plasma was aspirated using a 10 ml syringe and constituted the PRP product. No exogenous activating agent (calcium chloride or thrombin) was used. An aliquot was sent to the laboratory for platelet enumeration; the mean platelet concentration in the final product was $3.8 \pm 0.6 \times$ the baseline whole-blood count. All steps were performed under strict aseptic conditions, and the product was administered within 30 minutes of preparation.

Injection Technique

Both injections were delivered with the patient seated, the affected foot placed in the 'figure-of-4' position to expose the medial heel, and the skin cleansed with povidone-iodine and sterile draping applied.

Group A (PRP): 3–4 ml of autologous PRP was injected at the site of maximal tenderness (medial calcaneal tubercle) using an 18-gauge needle via a peppering technique—a single skin portal followed by multiple fascial penetrations in a fan-like distribution. Following injection, the patient

was instructed to perform gentle ankle dorsiflexion and plantarflexion to facilitate PRP dispersion. The patient rested for 15 minutes before ambulating.

Group B (CS): 1 ml of methylprednisolone acetate (40 mg) mixed with 1 ml of 2% lignocaine was injected at the same anatomical site using a 23-gauge needle via a single-pass technique. Identical post-injection rest and ambulation protocol was followed.

All patients in both groups received the same adjunctive measures: acetaminophen 500 mg three times daily for 3 days, advice to avoid strenuous weight-bearing activity for 2 weeks, and instruction in plantar fascia–specific stretching exercises (to be commenced after the initial rest period).

Outcome Measures

The primary outcomes were the Visual Analogue Scale (VAS) for pain intensity (0 = no pain, 10 = worst imaginable pain) and the Foot and Ankle Disability Index (FADI), a validated 26-item patient-reported instrument measuring pain and functional disability in activities of daily living (score 0–104; lower score indicates greater disability). Outcomes were recorded at baseline (day 0) and at 1, 3, and 6 months post-injection by the blinded assessor.

Statistical Analysis

Data were entered in Microsoft Excel 2019 and analysed using SPSS version 25.0 (IBM Corp., Armonk, NY). Continuous variables are expressed as mean ± standard deviation (SD). Categorical variables are presented as frequency and percentage. Within-group changes over time were evaluated by the Paired t-test. Between-group comparisons at each time point were performed using the Independent (Unpaired) t-test. Categorical variables were compared by the chi-squared test or Fisher's exact test where appropriate. A p-value < 0.05 was considered statistically significant.

RESULTS

Baseline Characteristics

A total of 90 patients (136 heels) were enrolled; 45 in the PRP group and 45 in the CS group. Forty-six patients had unilateral involvement and 44 had bilateral involvement. No patient was lost to follow-up at 6 months. Female patients constituted 58% of the cohort (n = 52). The mean overall age was 46.3 ± 8.9 years (range 22–68 years), with the majority (46.7%) falling in the 41–50-year age bracket. Agricultural labourers comprised 61% of participants. The mean duration of symptoms at presentation was 8.4 ± 3.2 months.

The two groups were comparable at baseline with respect to age (PRP: 45.1 ± 9.4 years vs. CS: 47.5 ± 8.3 years; p = 0.198), gender distribution (p = 0.812), laterality (p = 0.674), body mass index, and duration of symptoms (Table 1). Mean baseline VAS was 8.22 ± 0.88 (PRP) and 7.86 ± 0.92 (CS) (p = 0.597); mean baseline FADI was 72.8 ± 13.6 (PRP) and 73.9 ± 12.8 (CS) (p = 0.712).

Table 1: Baseline demographic and clinical characteristics

Parameter	PRP Group (n=45)	CS Group (n=45)	p value
Mean age (years ± SD)	45.1 ± 9.4	47.5 ± 8.3	0.198
Female gender, n (%)	27 (60%)	25 (55.6%)	0.812
Bilateral involvement, n (%)	22 (48.9%)	22 (48.9%)	1.000
Mean symptom duration (months ± SD)	8.1 ± 3.4	8.7 ± 3.0	0.384
Mean BMI (kg/m² ± SD)	27.6 ± 3.9	28.2 ± 4.1	0.473
Baseline VAS (± SD)	8.22 ± 0.88	7.86 ± 0.92	0.597
Baseline FADI (± SD)	72.8 ± 13.6	73.9 ± 12.8	0.712

BMI = body mass index; VAS = Visual Analogue Scale; FADI = Foot and Ankle Disability Index; SD = standard deviation

VAS Scores

Both groups demonstrated progressive and statistically significant reduction in pain over the 6-month observation period (Table 2). In the PRP group, mean VAS improved from 8.22 at baseline

to 6.04 at 1 month, 3.19 at 3 months, and 0.71 at 6 months. In the CS group, corresponding values were 7.86, 4.72, 2.77, and 1.18. Intragroup comparisons were highly significant at all time points ($p < 0.001$ for both groups). However, intergroup differences were not statistically significant at any follow-up: 1 month ($p = 0.821$), 3 months ($p = 0.647$), and 6 months ($p = 0.082$).

Table 2: VAS scores at baseline and follow-up (intragroup and intergroup comparisons)

Time Point	VAS – PRP (mean ± SD)	VAS – CS (mean ± SD)	p value (intragroup)	p value (intergroup)
Baseline	8.22 ± 0.88	7.86 ± 0.92	—	0.597
1 month	6.04 ± 1.18	4.72 ± 1.24	< 0.001*	0.821
3 months	3.19 ± 1.31	2.77 ± 1.19	< 0.001*	0.647
6 months	0.71 ± 1.10	1.18 ± 1.40	< 0.001*	0.082

* Statistically significant vs. baseline (Paired t-test). CS = corticosteroid; SD = standard deviation.

FADI Scores

A parallel pattern of improvement was observed in functional disability (Table 3). In the PRP group, mean FADI decreased from 72.8 at baseline to 62.1 at 1 month, 40.6 at 3 months, and 24.3 at 6 months. In the CS group, corresponding values were 73.9, 57.4, 42.9, and 34.6. Intragroup changes were significant at all time points ($p < 0.001$ for both groups). Intergroup comparisons were not statistically significant: 1 month ($p = 0.231$), 3 months ($p = 0.421$), and 6 months ($p = 0.619$).

Table 3: FADI scores at baseline and follow-up

Time Point	FADI – PRP (mean ± SD)	FADI – CS (mean ± SD)	p value (intragroup)	p value (intergroup)

Baseline	72.8 ± 13.6	73.9 ± 12.8	—	0.712
1 month	62.1 ± 13.8	57.4 ± 12.3	< 0.001*	0.231
3 months	40.6 ± 12.9	42.9 ± 11.5	< 0.001*	0.421
6 months	24.3 ± 11.9	34.6 ± 12.1	< 0.001*	0.619

* Statistically significant vs. baseline (Paired t-test). CS = corticosteroid; SD = standard deviation.

Safety and Complications

No plantar fascia rupture, fat-pad atrophy, skin depigmentation, or local infection was recorded in either group during the observation period. Three patients in the CS group reported transient post-injection pain flare (lasting 24–48 hours) that resolved without intervention. Two patients in the PRP group experienced mild haematoma at the venepuncture site that resolved spontaneously. Neither group had systemic adverse events.

DISCUSSION

This randomised comparative study of 90 patients with chronic plantar fasciitis, conducted in a rural south Indian government hospital setting, is among the first to report head-to-head outcomes of PRP versus CS injection in this specific demographic. The principal finding is that both interventions produced clinically meaningful and statistically equivalent improvements in pain (VAS) and functional disability (FADI) at all follow-up intervals up to 6 months, with no significant intergroup differences.

The demographic profile of our cohort is consistent with established epidemiological patterns: female predominance, peak incidence in the fifth decade, and a strong occupational association with prolonged standing.[12] The mean age of 46.3 years aligns with comparable studies: Acosta-Olivo et al. reported a mean of 44.8 years,[13] and Ragab et al. reported 44 years in a purely PRP cohort.[14] The proportion of agricultural labourers (61%) reflects the rural Tamil Nadu context and may partly explain the relatively long mean symptom duration (8.4 months) at presentation, as patients often defer specialist consultation until symptoms significantly impair work capacity.

Both treatments demonstrated robust intragroup efficacy. In the CS group, the pattern of earlier and slightly more pronounced pain reduction at 1 month (mean VAS 4.72 vs. 6.04 in the PRP group) is consistent with the well-established anti-inflammatory mechanism of corticosteroids that

achieves rapid symptom control. The PRP group, in contrast, showed continued improvement over the full 6-month period, with marginally lower mean VAS at the final assessment (0.71 vs. 1.18), though this difference did not reach statistical significance ($p = 0.082$). This trend of superior long-term outcomes with PRP—even when not statistically significant in individual studies—is concordant with the meta-analysis by Yang et al., which identified PRP superiority for long-term pain relief while observing equivalence at shorter intervals.[15]

The FADI data similarly reflect no significant intergroup difference at any time point. However, the numerically lower FADI at 6 months in the PRP group (24.3 vs. 34.6) warrants further exploration in adequately powered long-term trials. The FADI threshold score considered functionally important in clinical practice has been reported as approximately 5 points; on this basis, both groups achieved clinically meaningful improvements relative to baseline, but neither significantly outperformed the other.

Acosta-Olivo et al., in a blinded randomised trial, similarly concluded that PRP demonstrated efficacy equal to steroids across VAS, FADI, and the American Orthopaedic Foot and Ankle Society (AOFAS) scales.[13] Our findings are also consistent with the systematic review by Tsikopoulos et al., which concluded that PRP and CS injections produced comparable short-term pain relief, while PRP may offer advantages at 12 months.[16] Studies demonstrating clear PRP superiority—such as Mahindra et al. in India—generally used leukocyte-rich PRP preparations with activating agents, which may enhance platelet degranulation and growth factor release beyond what our single-spin, leukocyte-poor preparation achieved.[17]

From a practical standpoint, the rural government hospital context introduces important considerations beyond efficacy. The PRP preparation process in this study required a dedicated centrifuge, ACD-A vacutainers, laboratory platelet enumeration, and approximately 45–60 minutes of procedural and waiting time per patient. By contrast, CS injection required only standard injectable materials and no more than 15–20 minutes. The cost differential was substantial: PRP cost approximately INR 1,800–2,200 per procedure (including consumables, centrifugation, and laboratory charges), compared with approximately INR 150–250 for a CS injection in the government formulary. Patient acceptability was also a consideration; 11 patients in the PRP group (24.4%) expressed reluctance at the double venepuncture requirement, though none withdrew from the study.

No serious complications were recorded in either group. The absence of plantar fascia rupture—a recognised concern with repeated CS injections—may reflect our single-injection protocol and the use of a standardised injection technique. The low complication rate in the CS group is reassuring and consistent with single-injection protocols reported in the literature.[18]

The study has several limitations. Blinding of the treating surgeon was not feasible, introducing potential performance bias. The follow-up period of 6 months, while standard for most published trials, may not capture differences that emerge beyond this period. The absence of ultrasound-guided injection—ideal in research settings—may introduce variability in injectate placement, although ultrasound guidance is not routinely available at the study centre and palpation-guided injection is standard of care at most rural Indian hospitals. The single-spin PRP preparation produced modest platelet enrichment (3.8-fold); more concentrated preparations may yield different outcomes.

CONCLUSION

In patients with chronic plantar fasciitis attending a rural tertiary-care government hospital in Tamil Nadu, intralesional PRP and corticosteroid injections provide equivalent functional outcomes as measured by VAS and FADI scores at 1, 3, and 6 months of follow-up. In the absence of a clinically significant efficacy advantage and in consideration of the substantially greater cost, longer procedural time, and additional patient burden associated with PRP, corticosteroid injection represents the more pragmatic, accessible, and cost-effective injectable intervention for this population. Future multicentre, long-term trials incorporating platelet-rich, leucocyte-rich PRP preparations and extended follow-up (12–24 months) are warranted to determine whether PRP offers a durable advantage in this clinical and socioeconomic context.

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CONFLICTS OF INTEREST

The authors declare no conflicts of interest.

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