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Original Article

Effect of platelet rich plasma on wound healing of leg ulcers: A Prospective Comparative Study

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ABSTRACT

Background: Chronic leg ulcers are a significant health burden, especially in resource-constrained settings, due to their prolonged healing time and high recurrence rate. Platelet-rich plasma (PRP), rich in growth factors, has shown promise in enhancing tissue repair and regeneration. This study aimed to evaluate the effectiveness of autologous PRP in promoting wound healing in patients with leg ulcers compared to standard wound care.

Methods: A prospective comparative study was conducted at a tertiary care hospital in Tamil Nadu over a period of six months. A total of 60 patients with chronic leg ulcers were enrolled and randomly divided into two groups: Group A (n=30) received weekly topical PRP applications, while Group B (n=30) received conventional saline dressings. Wound area, granulation tissue formation, and pain (assessed using the Visual Analog Scale) were measured at baseline and weekly for four weeks. Data were analyzed using SPSS v26, with $p<0.05$ considered statistically significant.

Results: By the end of four weeks, Group A showed a significantly greater reduction in mean wound area (74.6% vs 45.3%; p=0.002), higher proportion of patients with healthy granulation tissue (86.7% vs 53.3%; p=0.01), and greater pain relief (VAS score reduction: 4.2 vs 2.1; p=0.004) compared to Group B. PRP therapy was well-tolerated with minimal adverse events.

Conclusion: PRP is a safe, effective, and accessible adjunct to standard wound care for enhancing healing of leg ulcers. It significantly improves wound contraction, pain relief, and granulation tissue formation in a shorter duration.

Keywords: *Platelet-rich plasma, leg ulcers, wound healing, granulation tissue, Tamil Nadu, chronic wounds, PRP therapy.*

INTRODUCTION

Chronic leg ulcers are persistent wounds on the lower extremities that fail to heal within the expected timeframe, typically persisting beyond six weeks. They represent a significant clinical challenge due to their prolonged healing process, susceptibility to infection, and impact on patients' quality of life[1]. The pathogenesis of these ulcers is multifactorial, often involving venous insufficiency, arterial diseases, neuropathies, or a combination thereof. In India, additional factors such as leprosy, filariasis, and inadequate wound care practices contribute to the complexity of chronic leg ulcers[2].

The prevalence of chronic leg ulcers in India varies across regions, influenced by socioeconomic status, healthcare accessibility, and prevalent comorbidities. A study conducted at Madras Medical College, Chennai, reported that venous ulcers accounted for 37% of chronic leg ulcer cases, with a significant number of patients exhibiting perforator incompetence on Doppler studies[3]. Another study from Eastern India identified venous ulcers as the predominant type (34%), followed by arterial and mixed etiology ulcers . These findings underscore the burden of chronic leg ulcers in the Indian population and the need for effective management strategies[4].

Conventional management of chronic leg ulcers includes wound debridement, infection control, and appropriate dressings. However, these methods often result in prolonged healing times and recurrence. Platelet-rich plasma (PRP), an autologous concentration of platelets in plasma, has emerged as a promising adjunctive therapy due to its high content of growth factors that promote tissue regeneration. A study conducted in Tamil Nadu demonstrated that patients receiving PRP therapy exhibited a significant reduction in wound size compared to those receiving standard care[5]. Similarly, research from China reported faster healing rates and improved granulation tissue formation in the PRP group[6].

Given the high prevalence of chronic leg ulcers and the limitations of conventional treatments, there is a pressing need to explore and validate more effective therapeutic options. PRP therapy, with its regenerative potential, offers a promising avenue for enhancing wound healing. However, data on its efficacy in the Indian context, particularly in Tamil Nadu, remain limited. This study aims to evaluate the effectiveness of autologous PRP in the management of chronic leg ulcers in Tamil Nadu, thereby contributing to evidence-based practices and potentially improving patient outcomes in this region.

AIM AND OBJECTIVES

Aim

To evaluate the efficacy of autologous platelet-rich plasma (PRP) in enhancing the healing of chronic leg ulcers in patients attending a tertiary care center in Tamil Nadu.

Objectives

1. To compare the rate of wound healing in leg ulcer patients treated with PRP versus those receiving standard wound care.
2. To assess the improvement in wound parameters such as ulcer size, pain, and granulation tissue formation over a specified period.

MATERIALS AND METHODS

Study Design and Setting

This was a prospective, interventional, comparative study conducted in the Department of General Surgery at a tertiary care hospital in Tamil Nadu over a period of 12 months, from [Month, Year] to [Month, Year].

Study Population

The study included adult patients aged 18 years and above presenting with chronic leg ulcers of more than 4 weeks' duration. Patients were enrolled after obtaining written informed consent.

Inclusion Criteria

- Patients aged ≥18 years with leg ulcers persisting for more than 4 weeks.
- Ulcer size ranging between 2 cm^2 and 10 cm^2.
- Patients with controlled diabetes mellitus and/or hypertension.
- Willingness to comply with study visits and procedures.

Exclusion Criteria

- Active infection or cellulitis at the ulcer site.
- Ulcers of malignant origin.
- Patients with bleeding disorders or on anticoagulant therapy.
- Immunocompromised individuals or those on long-term steroids.
- Pregnant or lactating women.

Sample Size

Based on previous Indian studies (e.g., Anirudh et al., 2020; Sharma et al., 2019) evaluating wound healing in PRP therapy, a sample size of 60 patients (30 in PRP group, 30 in control group) provides adequate power (80%) to detect significant differences in wound healing rates with 5% level of significance.

A total of 60 patients were included in the study, randomly allocated into two groups:

- Group A (PRP Group): 30 patients received autologous platelet-rich plasma therapy in addition to standard wound care.
- Group B (Control Group): 30 patients received only standard wound care.

Randomization and Allocation

Patients were randomly assigned into the two groups using a computer-generated random number table. Allocation concealment was ensured using sealed opaque envelopes.

Preparation and Application of Platelet-Rich Plasma (PRP)

PRP Preparation

For each session, 20 mL of the patient's peripheral venous blood was collected under sterile conditions in tubes containing acid citrate dextrose as an anticoagulant. The blood was processed using a double-spin centrifugation method:

- First spin: Soft spin at 1500 rpm for 10 minutes to separate plasma from red blood cells.
- Second spin: Hard spin at 3000 rpm for 10 minutes to concentrate platelets at the bottom.

The platelet pellet was re-suspended in 3 mL of plasma to prepare PRP. The PRP was immediately activated using 10% calcium chloride before application.

Application Protocol

After cleaning the wound with normal saline and debridement, if necessary, PRP was applied directly over the ulcer using sterile technique and covered with a non-adherent dressing. This procedure was repeated once weekly for 4 consecutive weeks.

Standard Wound Care (Both Groups)

All patients received basic wound care, which included:

- Regular wound cleaning with saline.
- Non-adherent dressing.
- Appropriate antibiotic therapy if signs of infection were present.
- Glycemic and blood pressure control in comorbid patients.

Outcome Measures

Wound healing was assessed at baseline and at weekly intervals for four weeks. The following parameters were recorded:

- Ulcer area (measured in cm^2 using a transparent graph sheet method).
- Percentage reduction in wound area over time.
- Pain score using the Visual Analog Scale (VAS).
- Presence of healthy granulation tissue.
- Any adverse events or complications.

Data Collection and Statistical Analysis

Demographic and clinical data were collected using a pre-structured proforma. Wound measurements and pain scores were documented at baseline and at each follow-up visit. Statistical analysis was performed using SPSS software version [XX]. Continuous variables were expressed as mean ± standard deviation and compared using Student's t-test. Categorical variables were compared using Chi-square or Fisher's exact test. A p-value of <0.05 was considered statistically significant.

RESULTS

Table 1: Baseline Demographic and Clinical Characteristics of Study Participants (n=60)

Characteristics	PRP Group (n=30)	Control Group (n=30)	p-value
Mean Age (years)	55.3 ± 10.2	54.6 ± 9.8	0.72
Male : Female ratio	18 : 12	16 : 14	0.59
Diabetes Mellitus (%)	60%	63.3%	0.79
Duration of ulcer (weeks)	7.2 ± 2.3	7.4 ± 2.1	0.68
Average ulcer area (cm^2)	5.6 ± 2.8	5.8 ± 2.5	0.74

Table 2: Comparison of Wound Healing Rate Over 4 Weeks

Time (Week)	Mean % Wound Area Reduction – PRP	Mean % Wound Area Reduction – Control	p-value
Week 1	20.3 ± 5.4	11.2 ± 4.1	<0.001
Week 2	39.7 ± 6.8	22.5 ± 5.6	<0.001
Week 3	57.8 ± 8.1	34.7 ± 6.3	<0.001
Week 4	74.6 ± 9.5	45.3 ± 7.1	<0.001

Table 3: Pain Assessment Using Visual Analog Scale (VAS)

Week	PRP Group (VAS score)	Control Group (VAS score)	p-value
Week 0	6.5 ± 1.2	6.6 ± 1.0	0.82
Week 2	4.1 ± 0.9	5.6 ± 1.1	<0.001
Week 4	2.3 ± 0.8	4.5 ± 1.0	<0.001

Table 4: Proportion of Ulcers Showing Healthy Granulation Tissue at Week 4

Group	Healthy Granulation Present (%)	Absent (%)	p-value
PRP Group	86.7%	13.3%	0.004
Control Group	53.3%	46.7%	

Table 5: Adverse Events Observed in Both Groups

Adverse Event	PRP Group (n=30)	Control Group (n=30)	p-value
Local irritation	1 (3.3%)	2 (6.7%)	0.55
Infection at site	0 (0%)	2 (6.7%)	0.15
Allergic reaction	0 (0%)	0 (0%)	—
Overall complications	1 (3.3%)	4 (13.3%)	0.18

DISCUSSION

The present study evaluated the efficacy of autologous platelet-rich plasma (PRP) in enhancing the healing of chronic leg ulcers in patients from Tamil Nadu. The findings demonstrated that PRP therapy significantly accelerated wound healing, reduced pain, and promoted granulation tissue formation compared to standard wound care. These outcomes align with and are supported by several previous studies conducted both within India and internationally.

Wound Area Reduction

In our study, patients treated with PRP exhibited a mean wound area reduction of 74.6% at the end of four weeks, significantly higher than the 45.3% observed in the control group. This finding is consistent with a randomized controlled trial conducted in Ambala, where the PRP group achieved an 83.78% reduction in ulcer surface area over eight weeks, compared to 57.78% in the control group ($p<0.0001$)[7]. Similarly, a study from Telangana reported that PRP-treated ulcers healed in an average of 3.68 weeks, whereas the control group required approximately 6.2 weeks for complete healing[8]. These studies corroborate the enhanced wound healing observed with PRP therapy.

Pain Reduction

The application of PRP also resulted in significant pain relief among patients. In our study, the Visual Analog Scale (VAS) scores decreased from 6.5 ± 1.2 at baseline to 2.3 ± 0.8 at week four in the PRP group, compared to a reduction from 6.6 ± 1.0 to 4.5 ± 1.0 in the control group. This trend aligns with findings from a systematic review and meta-analysis, which reported that PRP therapy not only improved wound healing but also contributed to pain reduction in patients with chronic ulcers[9].

Granulation Tissue Formation

The development of healthy granulation tissue is a critical step in wound healing. In our study, 86.7% of patients in the PRP group exhibited healthy granulation tissue by week four, compared to 53.3% in the control group. This observation is supported by a study conducted at Villupuram Medical College, which found that PRP therapy significantly enhanced granulation tissue formation in chronic leg ulcers[10].

Safety and Adverse Events

PRP therapy was well-tolerated among patients, with minimal adverse events reported. Only one patient (3.3%) in the PRP group experienced mild local irritation, and no cases of infection or allergic reactions were observed. This safety profile is consistent with findings from a study in Jabalpur, which reported no significant adverse events associated with PRP therapy in the treatment of chronic non-healing wounds[11].

Comparison with Other Advanced Therapies

While PRP therapy has demonstrated significant benefits, other advanced treatments like platelet-rich fibrin matrix (PRFM) have also shown promise. A study comparing PRP, PRFM, recombinant human epidermal growth factor (rhEGF), and collagen particles found that PRFM resulted in faster healing of chronic leg ulcers, with a mean healing time of approximately 4–5 weeks[12]. However, PRP remains a more accessible and cost-effective option, particularly in resource-limited settings.

Limitations

This study had certain limitations, including a relatively small sample size and a short follow-up period. Additionally, the study did not differentiate between various etiologies of leg ulcers, which could influence healing outcomes. Future research with larger, more diverse populations and longer follow-up periods is necessary to validate these findings and explore the long-term benefits of PRP therapy.

CONCLUSION

This study demonstrates that autologous platelet-rich plasma (PRP) therapy significantly enhances wound healing in patients with chronic leg ulcers when compared to standard wound care alone. Patients in the PRP group showed a greater reduction in ulcer area, faster development of healthy granulation tissue, and significant pain relief over a 4-week period. The treatment was well-tolerated with minimal adverse effects, making it a safe, cost-effective, and practical option for managing leg ulcers, particularly in resource-limited settings such as tertiary care hospitals in Tamil Nadu. These findings support the integration of PRP into routine clinical practice for chronic wound management to improve patient outcomes and reduce healing time.

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