

A Comparative Study of Platelet Rich Plasma Dressing versus Conventional Dressing in Chronic Non Healing Ulcer

Sandeep Chandrakar¹, Saumitra Dube², Siddharth Shankar Satapathy³

¹Professor, Department of General Surgery, Pt JNM Medical College & Dr BRAM Hospital, Raipur, Chhattisgarh, India

²Assistant Professor, Department of General Surgery, Pt JNM Medical College & Dr BRAM Hospital, Raipur, Chhattisgarh, India

³Third Year Post Graduate, Department of General Surgery, Pt JNM Medical College & Dr BRAM Hospital, Raipur, Chhattisgarh, India

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Corresponding Author: Dr. Siddharth Shankar Satapathy

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Abstract:

Background: Chronic non-healing ulcers represent a major healthcare challenge, given their resistance to conventional treatments and the burden they place on patients and healthcare systems. Platelet-rich plasma (PRP), rich in growth factors, has emerged as a potential treatment to enhance healing in chronic ulcers. This study aimed to assess the efficacy of PRP in promoting wound healing in chronic non-healing ulcers compared to conventional dressing methods.

Materials and Methods: This prospective, randomized controlled study was conducted at Dr. B.R. Ambedkar Hospital, Raipur, involving 50 patients with chronic non-healing ulcers. Participants were randomized into two groups: Group A (PRP dressing, n = 25) and Group B (conventional dressing, n = 25). PRP dressings were prepared from autologous blood and applied every third day, while conventional dressings followed standard debridement and infection control protocols. Primary outcomes included healing rate and time to complete wound closure, while secondary outcomes included frequency of dressings required and incidence of complications. Data analysis was conducted using SPSS version 20.0.

Results: Patients in the PRP group experienced significantly faster healing (8.08 ± 2.19 weeks) compared to those in the control group (15.56 ± 5.70 weeks), with a p-value of 0.0001. The mean number of dressings required was also significantly lower in the PRP group (24.24 ± 6.59) versus the control group (46.92 ± 17.03 , p = 0.0001). Minimal complications were observed, with 80% of patients reporting no adverse effects, and mild pain or fever occurring in 10% of cases.

Conclusion: PRP dressing significantly enhances healing rates, reduces dressing frequency, and promotes granulation tissue formation in chronic non-healing ulcers, presenting as a safe and cost-effective treatment alternative. PRP may reduce the socioeconomic burden associated with chronic ulcers and could serve as an effective primary treatment. Further large-scale studies are recommended to establish standardized PRP protocols and validate these findings.

Keywords: Chronic ulcers, platelet-rich plasma, wound healing, randomized controlled trial, PRP dressing, wound management.

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Introduction

Chronic wounds, particularly non-healing ulcers, are a significant health concern that challenge healthcare providers globally due to their complexity and resistance to conventional treatment. A chronic wound is commonly defined as one that fails to progress through an orderly and timely reparative process to restore anatomical and functional integrity, generally persisting without healing for 1–3 months [1]. This delayed healing often results in tissue loss beyond the epidermis and dermis, sometimes extending to the adipose tissue and muscle fascia, creating a fibrous scar in

the process [2]. Chronic non-healing ulcers, therefore, represent a major burden on healthcare systems and significantly impact patients' quality of life. The prevalence of chronic non-healing ulcers worldwide is estimated to range between 1.9% and 13.1% (3). The incidence of these ulcers is rising due to an aging population and the growing prevalence of risk factors like smoking, obesity, and diabetes [4]. It is estimated that up to 10% of people may develop a chronic wound in their lifetime, with lower extremity ulcers being a leading cause of limb amputations [5]. Traditional

wound care methods, including debridement and dressing, aim to promote an optimal healing environment. However, recent advancements in wound care have introduced novel adjunctive therapies like cellular therapies. Platelet-rich plasma (PRP) and collagen-based wound dressings are emerging options with potential to enhance the healing process [6,7]. PRP, a concentration of autologous platelets in plasma, is rich in growth factors such as platelet-derived growth factor (PDGF), epidermal growth factor (EGF), and platelet factor 4, which have shown promising results in accelerating tissue repair and regeneration by stimulating angiogenesis and fibroblast activation [8,9]. Using PRP for chronic non-healing wounds is particularly advantageous as it can be prepared from the patient's own blood, offering a cost-effective alternative to commercially available recombinant platelet gels. This approach can potentially improve the healing rate, reduce complications, and even prevent amputations in patients with persistent ulcers [10]. The present study aims to evaluate the efficacy of PRP in enhancing wound healing rates in chronic non-healing ulcers and to compare its outcomes with conventional dressing methods, focusing on the rate and duration of healing and the incidence of complications associated with each treatment approach.

Materials and Methods

This prospective, randomized-controlled clinical study, was conducted at the Department of Surgery, Dr. B.R. Ambedkar Hospital, Raipur, from April 2022 to April 2024. The study was approved by the institutional scientific and ethical committee, and written informed consent was obtained from all participants. A total of 50 patients with chronic non-healing ulcers were included in the study.

Criteria for Selection: Patients with chronic non-healing ulcers attending the surgery outpatient department, those referred from other departments, and those admitted to the surgery department at Dr. B.R. Ambedkar Hospital, Raipur, were screened according to the following inclusion and exclusion criteria:

Inclusion Criteria

1. Patients aged 15 to 80 years with chronic non-healing ulcers.
2. Ulcer duration of ≥ 4 weeks.
3. Ulcer size ≤ 15 cm².
4. Hemoglobin level ≥ 10 g%.
5. Wound culture negative.
6. Platelet count > 1 lakh per microliter.
7. Diabetic ulcer (controlled) and traumatic or venous ulcers.

Exclusion Criteria

1. Platelet count < 1 lakh per microliter.

2. Suspected or confirmed osteomyelitis.
3. Chronic kidney disease (CKD).
4. Severe infection.
5. Presence of gangrene or malignant ulcer.
6. Cellulitis.
7. Culture-positive wounds.

Study Design and Measurements: Patients meeting the inclusion criteria were randomly assigned to two groups using a random number table: Group A (experimental, n = 25) received PRP dressing, and Group B (control, n = 25) received conventional dressing. The patients' detailed history, including duration, onset, progression, and symptoms, was recorded. Etiological factors were noted, and ulcers were examined and photographed for follow-up. Ulcer size was measured by placing a metric scale along the longest dimension of the wound.

Dressing Techniques: Conventional Dressing: After ensuring no active discharge or slough, the ulcer was cleaned with 0.9% saline and covered with a sterile pad and roller bandage. Conventional treatment included adequate debridement, infection control (betadine and systemic antibiotics), and pressure avoidance.

Platelet-Rich Plasma (PRP): Fresh PRP, prepared by the hospital blood bank, was injected around the ulcer's healing margins using a 26 G insulin syringe after cleaning with 0.9% saline. Up to 5 mL of PRP was used per sitting. Both PRP and conventional dressings were changed every third day. PRP was screened for routine blood-borne pathogens, and potential risks were explained to patients.

Ulcer Assessment: The ulcers were assessed based on anatomical site, size, depth, edge characteristics, local blood supply, and systemic symptoms.

Measurements included blood sugar, arterial/venous Doppler, angiography, discharge culture and sensitivity, and biopsy. In cases of suspected tuberculosis, chest X-ray and Mantoux tests were performed.

Outcome Measurement: The primary outcome was wound reduction, documented by measuring the ulcer's length and width. Secondary characteristics (presence of granulation tissue, pain, color, and edges) were also recorded. The endpoint was complete wound closure or the conclusion of the follow-up period.

Statistical Analysis: Data were analyzed using SPSS version 20.0. Continuous variables were expressed as mean \pm standard deviation, while categorical variables were presented as absolute numbers and percentages. Normally distributed data were analyzed using the unpaired t-test; non-normally distributed data were assessed using the Mann-Whitney U test.

Categorical variables were analyzed using the Chi-square or Fisher's exact test.

Results

This study was conducted at Dr. J.N.M. Medical College and Dr. B.R.A.M. Hospital, Raipur, to assess the efficacy of platelet-rich plasma (PRP) versus conventional dressing in patients with chronic non-healing ulcers. A total of 50 patients were randomized into two groups: Group A (PRP

group, n = 25) and Group B (control group with conventional dressing, n = 25). The data was analyzed using Student's paired t test for intra-group comparisons and unpaired t test for comparisons between the two groups.

Age Distribution: The age of patients ranged from 21 to 70 years, with a majority (34%) in the 41–50-year range. The age distribution did not show statistical significance, with a p-value of 0.805 (Table 1).

Table 1: Age Distribution

Age Group (years)	No. of Patients	Percentage
21-30	7	14%
31-40	15	30%
41-50	17	34%
51-60	7	14%
61-70	4	8%
Total	50	100%

Sex Distribution: Out of the 50 patients, 66% were male, showing a male predominance for chronic non-healing ulcers. The sex distribution was not statistically significant, with a p-value of 0.370 (Table 2).

Table 2: Sex Distribution

Sex	Cases (n = 25)	Controls (n = 25)	Total (N = 50)	Percentage
Male	15 (60%)	18 (72%)	33	66%
Female	10 (40%)	7 (28%)	17	34%

Duration of Ulcer: The majority of patients (34%) had an ulcer duration of 16–20 weeks, with no significant difference in ulcer duration between groups ($p = 0.998$) (Table 3).

Table 3: Duration of Ulcer

Duration (weeks)	Cases (n = 25)	Controls (n = 25)	Total (N = 50)	Percentage
10-15	7 (28%)	7 (28%)	14	28%
16-20	8 (32%)	9 (36%)	17	34%
21-25	7 (28%)	6 (24%)	13	26%
26-30	1 (4%)	1 (4%)	2	4%
31-35	2 (8%)	2 (8%)	4	8%

Etiology of Ulcer: Trauma was the leading cause of chronic ulcers (62%), followed by diabetes (24%). There was no significant difference in etiology between the groups ($p = 0.654$) (Table 4).

Table 4: Etiology of Ulcer

Etiology	Cases (n = 25)	Controls (n = 25)	Total (N = 50)	Percentage
Diabetic	7 (28%)	5 (20%)	12	24%
Traumatic	14 (56%)	17 (68%)	31	62%
Trophic	1 (4%)	0 (0%)	1	2%
Venous	3 (12%)	3 (12%)	6	12%

Ulcer Location: The majority (92%) of chronic ulcers were located on the lower limb, with no statistically significant difference between the groups ($p = 1.000$) (Table 5).

Table 5: Ulcer Location

Ulcer Location	Cases (n = 25)	Controls (n = 25)	Total (N = 50)	Percentage
Upper Limb	1 (4%)	1 (4%)	2	4%
Lower Limb	23 (92%)	23 (92%)	46	92%
Torso	1 (4%)	1 (4%)	2	4%

Complications: Most patients (80%) did not experience complications. Among the few who did, pain and fever were observed in 10% of the cases. This difference was not statistically significant ($p = 0.819$) (Table 6).

Table 6: Complications

Complications	Cases (n = 25)	Controls (n = 25)	Total (N = 50)	Percentage
None	20 (80%)	20 (80%)	40	80%
Pain	2 (8%)	3 (12%)	5	10%
Fever	3 (12%)	2 (8%)	5	10%
Infection	0 (0%)	0 (0%)	0	0%
Bleeding	0 (0%)	0 (0%)	0	0%

Days to Healing Completion: The average duration of healing was significantly shorter in the PRP group (8.08 ± 2.19 weeks) compared to the control group (15.56 ± 5.70 weeks), with a p-value of 0.0001 (Table 7).

Table 7: Days to Healing Completion (Weeks)

Group	Mean Healing Duration (weeks)	SD	N	P-value
Cases	8.08	2.19	25	0.0001
Controls	15.56	5.70	25	

Number of Dressings Required for Complete Healing: The PRP group required significantly fewer dressings (24.24 ± 6.59) compared to the control group (46.92 ± 17.03), with a p-value of 0.0001 (Table 8).

Table 8: Number of Dressings for Complete Healing

Group	Mean Number of Dressings	SD	N	P-value
Cases	24.24	6.59	25	0.0001
Controls	46.92	17.03	25	

The results demonstrate a statistically significant advantage of PRP treatment over conventional dressing in terms of faster healing time (Table 7) and fewer dressings required (Table 8).

Discussion

Chronic wounds, particularly non-healing ulcers, are a significant health burden, especially in developing countries like India. These wounds lack essential growth factors for healing, often complicating recovery and leading to secondary infections. The primary goal of treatment is to promote rapid wound closure, typically achieved through conventional methods like debridement, infection control, tissue revascularization, and pressure management [1]. Although skin grafting has shown efficacy, it fails to deliver growth factors essential for healing and is often cost-prohibitive [2,3].

Age: In our study, the highest incidence of chronic non-healing ulcers was observed in patients aged 41–50 years, consistent with findings from Rajendran et al. who reported similar age distribution among patients with diabetic foot ulcers [4]. Agrawal et al. also observed a higher prevalence of non-healing ulcers in older adults, highlighting the age-related susceptibility to these chronic wounds [5].

Sex: Our study revealed a male predominance (66%) in chronic non-healing ulcer cases, which aligns with studies by R. Laxmi Devi et al. and

Gogineni et al., both of which reported a higher incidence of non-healing ulcers in males [6,7]. This male preponderance may be attributed to occupational and lifestyle factors that increase their risk of trauma and chronic diseases.

Etiology of Ulcer: In our study, trauma was the leading cause of chronic non-healing ulcers (62%), followed by diabetes (24%). Similar findings were reported by Gade et al., where traumatic ulcers were the most common type of chronic wounds [8]. However, studies by Suryanarayan et al. and Babaei et al. identified venous and diabetic ulcers as predominant etiologies, respectively, underscoring the role of underlying conditions in ulcer development [9,10].

Days of Healing Completion (in Weeks): Our findings indicate that the PRP group had a significantly shorter healing duration (8.08 ± 2.19 weeks) compared to the control group ($p = 0.0001$).

This result corroborates findings by Gogineni et al., who reported faster healing in PRP-treated wounds (6.75 ± 1.47 weeks) (7). Similarly, Ahmed et al. observed a shorter healing time in the PRP group, demonstrating PRP's potential to expedite the wound healing process [11].

Number of Dressings Required for Complete Healing: The mean number of dressings required for healing was significantly lower in the PRP group (24.24 ± 6.59) compared to the control group (46.92 ± 17.03 , $p = 0.0001$), a finding consistent with Agrawal et al.'s

study, which also observed a reduced need for dressings in PRP-treated wounds [5]. This reduction in dressing frequency highlights PRP's role in accelerating wound healing, reducing patient burden, and potentially lowering healthcare costs.

Complications: In our study, complications were minimal, with only 10% of patients reporting pain and fever, and no cases of adverse effects associated with PRP. This aligns with findings from Kumar et al., who noted the safety of autologous PRP with no adverse reactions [12]. Cochrane reviews have shown that while multiple dressing types (e.g., hydrocolloids, alginates) can aid healing, they lack growth factors and infection-prevention properties provided by PRP [13,14].

Efficacy of PRP: PRP has shown promising results in chronic wound healing due to its high concentration of growth factors and white blood cells, which facilitate tissue repair and infection prevention. Sacchidanand et al. demonstrated PRP's effectiveness in healing chronic venous ulcers, with marked improvements in wound area and volume [15].

Growth factors like PDGF, TGF- β , and angiogenic factors in PRP play a critical role in stimulating fibroblast activity, extracellular matrix synthesis, and angiogenesis, essential processes in wound repair [16].

Limitations of the Study

This study had limitations, including a small sample size and short follow-up duration, which may restrict the generalizability of findings to the broader population. Additionally, standardization of PRP preparation remains a challenge, as there is no universal protocol. Further studies with larger sample sizes and standardized PRP preparation protocols are recommended to validate these findings and enhance the clinical applicability of PRP in chronic wound management.

Conclusion

In conclusion, our study demonstrates that PRP dressing significantly improves healing rates, reduces the frequency of dressings, and promotes granulation tissue formation in chronic non-healing ulcers compared to conventional methods. PRP emerges as a safe and cost-effective treatment, potentially reducing the socioeconomic burden of chronic wounds and offering a viable first-line treatment for chronic non-healing ulcers. Further research and randomized controlled trials are warranted to establish PRP's efficacy and optimize its use in clinical practice.

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