p-ISSN 1859 - 3461
e-ISSN 3030 - 4008

EFFECTIVENESS OF AUTOLOGOUS PLATELET-RICH PLASMA IN THE TREATMENT OF DIFFICULT-HEALING PRESSURE ULCERS

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ABTRACTS

Objectives: *To evaluate the efficacy of autologous platelet-rich plasma (PRP) in the treatment of refractory pressure injuries and its effect on wound healing time and quality of life of patients.*

Subjects and methods: *A random number table method was used to group 102 patients with refractory pressure injuries into either a control group (CG) (51 cases) receiving negative pressure wound therapy (NPWT) or a study group (SG) (51 cases) receiving NPWT+PRP.*

Results: *The total efficacy rate in the SG (92.16%) was higher than that in the CG (76.47%) (p < 0.05). The SG exhibited lower visual analog scale (VAS) scores and pressure ulcer scale for healing (PUSH) scores, smaller wound sizes and depths, and shorter wound healing times than the CG after 21 days of treatment (p < 0.05). After 6 months of treatment, the SG scored higher than the CG on the psychological, physiological, social functions, and daily activity domains on the World Health Organization Quality of Life (WHOQOL-BREF) scale (p < 0.05). The incidence of postoperative complications in the SG (13.73%) was not significantly different from that of the CG (7.84%) (p > 0.05).*

Conclusion: *In the treatment of refractory pressure injuries, PRP can accelerate wound healing, reduce wound pain, shorten the treatment cycle and improve the quality of life of patients without increasing complications.*

Keywords*: Pressure ulcers; Autologous platelet-rich plasma; Quality of life*

1 INTRODUCTION

Pressure ulcers are localized injuries to the skin and/or underlying tissue, primarily caused by prolonged pressure or a combination of pressure and shear forces. These lesions commonly occur in bedridden patients, individuals with impaired mobility of the lower limbs, and those with altered consciousness. Pressure ulcers are associated with local tissue necrosis resulting from hypoxia and ischemia due to sustained compression [1], [2].

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Ngày gửi bài: 24/10/2025; Ngày nhận xét: 18/11/2025; Ngày duyệt bài: 26/11/2025
https://doi.org/10.54804/

p-ISSN 1859 - 3461
e-ISSN 3030 - 4008

Refractory pressure ulcers are most frequently observed in stage III and IV lesions. Stage III and IV pressure ulcers are characterized by full-thickness tissue loss, often complicated by bone necrosis and osteomyelitis, which increase the risk of nutrient loss and infection while impeding wound healing. Furthermore, chronic sinus tracts may develop as a result of excessive wound exudation, making the prevention and management of refractory pressure ulcers particularly challenging [3], [4].

Conventional treatments, such as antibiotics, wound dressings, and debridement, remain essential; however, the inherently prolonged healing period increases the likelihood of secondary infection. Negative Pressure Wound Therapy (NPWT) can effectively promote wound healing by improving local blood flow and reducing edema, yet the high cost of NPWT materials limits accessibility for some patients [5].

Autologous Platelet-Rich Plasma (PRP) has emerged as a promising therapeutic option for chronic wounds. PRP is easy to prepare and requires minimal consumable materials. It releases high concentrations of growth factors that stimulate cellular proliferation and differentiation, accelerate hemostasis, promote tissue repair, and enhance regeneration [6], [7]. However, clinical reports on the adjunctive use of autologous PRP in the treatment of refractory pressure ulcers remain limited. In this context, the present study aimed to investigate the therapeutic effects and underlying mechanisms of autologous PRP as an adjuvant treatment for refractory pressure ulcers.

2. MATERIALS AND METHODS

2.1. Study Population

A total of 102 patients (52 males and 50 females) with pressure ulcer injuries treated at our hospital between January 2024 and June 2025 were enrolled in this study. Patients ranged in age from 18 to 93 years and had received clinical treatment for a duration of 2 to 10 months. Using a random number table method, they were assigned to either the control group (CG, n = 51) or the study group (SG, n = 51). This study was approved by the Ethics Committee of Nghe An Friendship General Hospital.

2.2. Inclusion and Exclusion Criteria

- The inclusion criteria were as follows:

(1) Patients who met the diagnostic criteria for refractory pressure ulcers according to the 2016 JDA Trauma/Burn Guidelines: Diagnosis and Treatment of Pressure Ulcers [8] (stage III- V lesions); (2) Aged over 18 years; (3) Without diabetes mellitus; (4) Voluntarily agreed to participate in the study; (5) Demonstrated good treatment compliance; (6) Completed the full course of the study.

- Exclusion criteria included:

(1) Patients who had received hormone or immunosuppressive therapy within 4 weeks prior to enrollment.

(2) Those with hemorrhagic disorders, malignancy, severe cardiovascular or cerebrovascular diseases, severe malnutrition, autoimmune disorders, or psychiatric illness, and (3) Any form of coagulopathy.

2.3. Methods

The wound surface was irrigated with 0.9% sodium chloride solution. Debris and

p-ISSN 1859 - 3461
e-ISSN 3030 - 4008

necrotic tissue were carefully removed using forceps, clamps, or scissors, and the wound surface was subsequently dried with sterile gauze. In patients with osteomyelitis, necrotic bone tissue was thoroughly debrided.

Patients in the control group (CG) were treated with NPWT. Depending on the shape and size of the wound, NPWT dressing materials were trimmed accordingly to fit and cover the wound area. Both the wound surface and drainage tube were covered with foam dressing and sealed using a transparent adhesive film. The negative pressure drainage device was connected to the tubing and set to either continuous or intermittent suction, with a negative pressure range of 110 - 125 mmHg. The NPWT dressing was replaced as clinically indicated.

In addition to the above treatment, the study group (SG) received PRP therapy. The PRP preparation was conducted in the hospital's clinical laboratory by a trained physician. The autologous PRP product was injected intradermally around the periphery of the wound, approximately 1 cm from the wound edge, at four equidistant points corresponding to the 3, 6, 9, and 12 o'clock positions, with approximately 1 mL injected per site. The injection technique was similar to that used in local anesthesia. After injection, a 3% betadine-soaked gauze and sterile dry dressing were applied and sealed. Dressings were changed daily with 3% betadine solution. The PRP treatment was repeated every seven days, for a total of three sessions.

2.4. Evaluation Indices

* Therapeutic efficacy: The treatment outcome was defined as "cured" if, after 21 days of treatment, the wound surface was completely covered by newly formed epithelium and granulation tissue. The result was defined as "improved" if purulent exudate decreased, the wound size was reduced by more than 25%, and new granulation tissue appeared. If purulent exudate did not significantly decrease and the wound either enlarged or decreased in size by ≤25%, the treatment was defined as "ineffective." The effective rate was calculated as (cured + improved) / total number of cases.

* Wound healing assessment indicators: The wound healing time, Visual Analog Scale (VAS) score, and Pressure Ulcer Scale for Healing (PUSH) score were recorded before and after 21 days of treatment. The VAS score ranged from 0 to 10, with higher scores indicating more severe pain. The PUSH score was used to evaluate the progression of pressure ulcer healing over time, including parameters such as wound size, exudate amount, and tissue type, with a total score of 17 points; higher scores indicated poorer wound healing.

* The size and depth of the wound surface: The wound size and depth were recorded before and after 21 days of treatment. For regular wound surfaces, the maximum diameters of the wound's length and width were measured using a ruler for calculation. For irregular wounds, multiple measurements of length and width were taken to determine the average dimensions. To measure wound depth, a probe was inserted to the base of the wound, and the point level with the epidermis was marked. The depth was then determined by measuring the distance from the probe tip to the level of the epidermis using a ruler.

p-ISSN 1859 - 3461
e-ISSN 3030 - 4008

* Quality of life: The World Health Organization Quality of Life-BREF (WHOQOL-BREF) instrument was used to evaluate patients' quality of life before and six months after treatment. The assessment covered psychological, physiological, social, and daily functioning domains, with scores ranging from 0 to 100 for each domain. Higher scores indicated a better quality of life [9].

* Complications: During the course of treatment, symptoms such as infection, allergic reaction, rash, fluid accumulation, redness, or swelling were recorded.

All indices were evaluated by the same attending physician.

2.5. Statistical Analysis

Data processing was performed using SPSS software version 22.0 for Windows. Measurement data were expressed as mean ± standard deviation (SD) and compared using the t-test, while categorical data were presented as percentages and analyzed using the chi-square (χ^2) test. A p-value of less than 0.05 was considered statistically significant.

3. RESULTS

* Comparison of Baseline Data

Table 1. General characteristics of the study population

				Ulcer classification	**Wound location**
Group	Male/Femal	Age (years)	Duration of ulcer (months)	Stage II / Stage III / Stage IV	Buttock/ Sacral / Greater trochanteric region
Control group (n = 51)	27/24	59.36 ± 6.21	6.21 ± 2.12	15/24/12	28/20/3
Study group (n = 51)	25/26	60.79 ± 6.38	6.34 ± 2.34	13/25/13	30/17/4
$t/\chi^2/Z$	0.157	1.147	0.294	0.413	0.203
p	0.692	0.254	0.769	0.680	0.903

All 102 patients with refractory pressure ulcers met the inclusion and exclusion criteria, and none were excluded from the study. There were no significant differences between the two groups in terms of gender distribution, age, disease duration, pressure ulcer stage, or ulcer location ($p > 0.05$).

* Comparison of Clinical Efficacy

Table 2. Comparison of clinical efficacy between the two groups

Group	**Cured n (%)**	**Improved n (%)**	**Ineffective n (%)**	**Total effective rate n (%)**
Control group (n = 51)	16 (31.37)	23 (45.10)	12 (23.53)	39 (76.47)
Study group (n = 51)	21 (41.18)	26 (50.98)	4 (7.84)	47 (92.16)
χ^2				4.744

p-ISSN 1859 - 3461
e-ISSN 3030 - 4008

p				0.029

The overall effective rate was significantly higher in the study group (SG) (92.16%) compared with the control group (CG) (76.47%) ($p < 0.05$).

*** Comparison of Wound Healing-Related Indicators**

Before treatment, there were no significant differences between the two groups in terms of VAS score, PUSH score, or wound healing time ($p > 0.05$). However, after 21 days of treatment, the VAS and PUSH scores were significantly lower, and the wound healing time was markedly shorter in the study group compared with the control group ($p < 0.05$) (Figure 1).

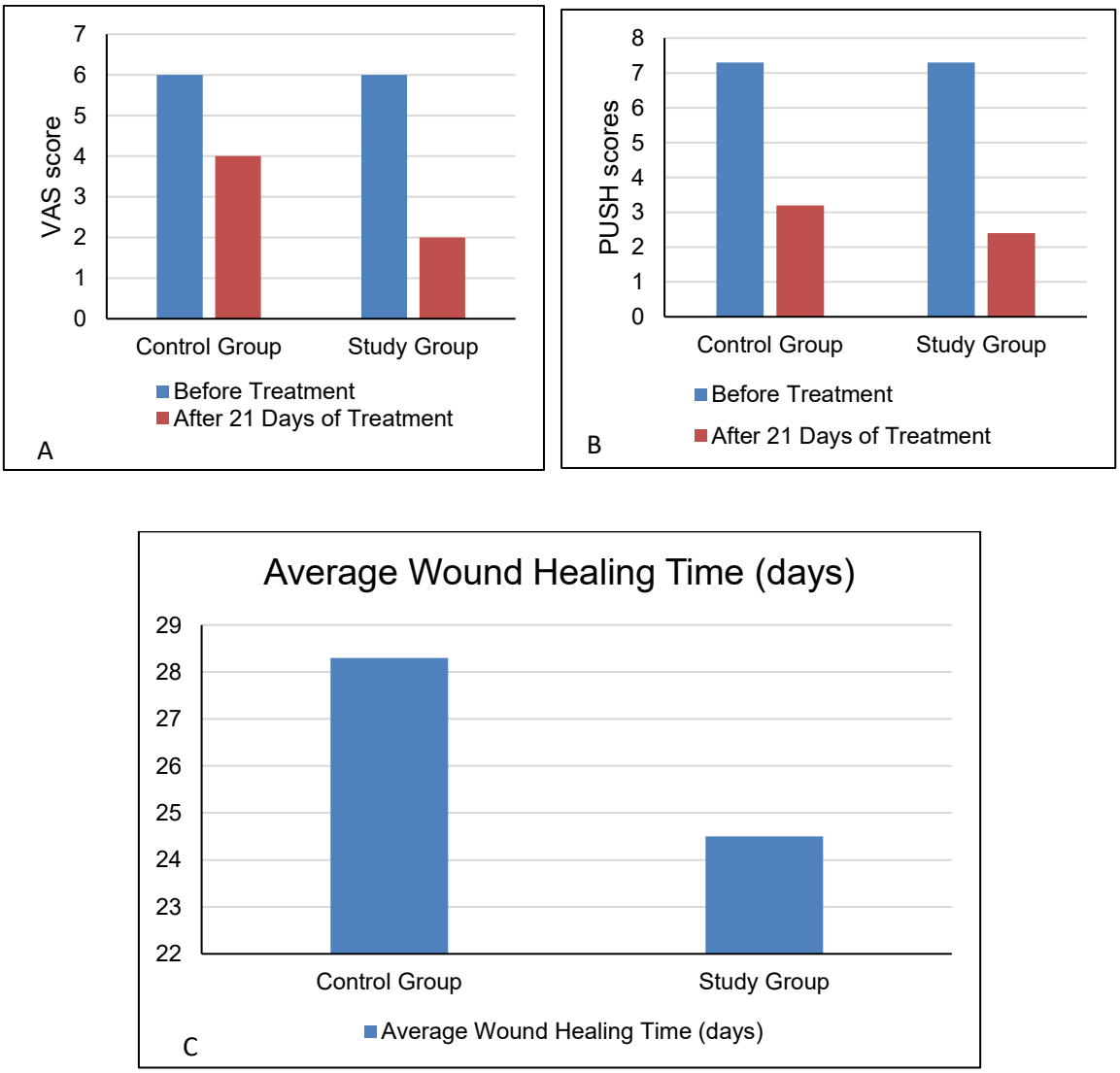

Figure 1. Comparison of wound healing indicators between the two groups. A: VAS score; B: PUSH score; C: Wound healing time.

p-ISSN 1859 - 3461
e-ISSN 3030 - 4008

*** Comparison of wound size and depth**

Before treatment, there was no significant difference in wound size and depth between the two groups (p > 0.05). After 21 days of treatment, both wound size and depth were significantly reduced in the study group (SG) compared with the control group (CG) (p < 0.05) (Figure 2).

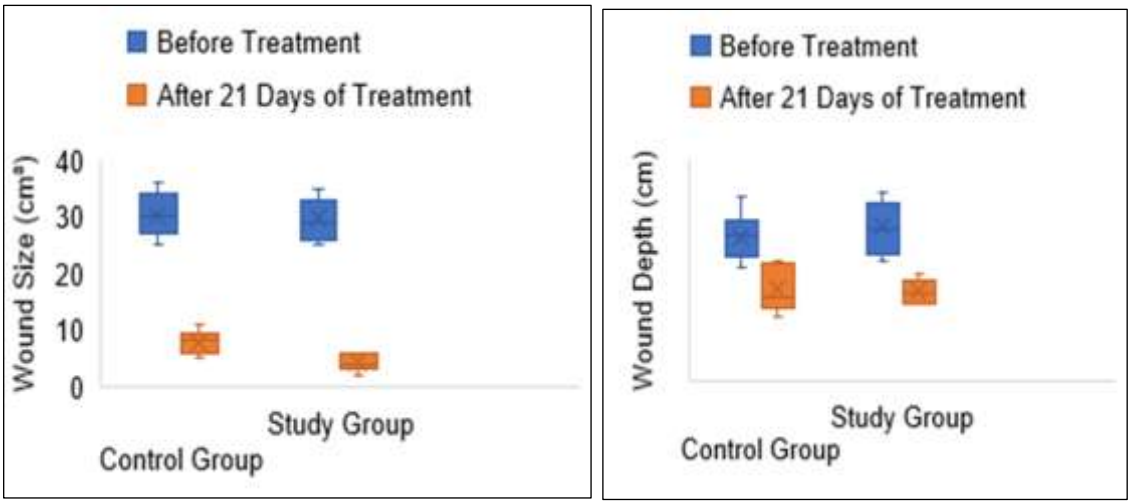

Figure 2. Comparison of wound size and depth between the two groups. A: Wound size; B: Wound depth.

*** Comparison of quality of life**

Table 3. Comparison of WHOQOL-BREF scores between the two groups (Mean ± SD)

	Psychological Function		Physiological Function		Social Function		Daily Activities	
Group	Before treatment	6 months after treatment	Before treatment	6 months after treatment	Before treatment	6 months after treatment	Before treatment	6 months after treatment
Control group (n = 51)	57.76 ± 8.67	69.26 ± 11.24 ***	59.34 ± 9.37	70.26 ± 10.49 ***	61.51 ± 10.65	72.36 ± 12.26 ***	54.32 ± 9.16	66.37 ± 13.34 ***
Study group (n = 51)	58,86± 9,31	76,37± 12,27 ***	60,08± 10,05	78,85± 11,37 ***	62,37± 11,29	81,36± 13,37 ***	56,29± 10,87	73,64± 14,29 ***
t	0,617	3.051	0,385	3,965	0,396	3.543	0,990	2.656

p-ISSN 1859 - 3461
e-ISSN 3030 - 4008

P	0,539	0,003	0,701	0,000	0,693	0,001	0,325	0,009

Before treatment, psychological, physiological, and social functions, as well as daily activity scores of the WHOQOL-BREF scale, showed no statistically significant differences between the two groups (p > 0.05). Six months after treatment, all scores increased significantly in both the control group (CG) and the study group (SG), but the SG showed higher scores in all aspects (p < 0.05).

Comparison of Complication Rates

Table 4. Comparison of postoperative complications between the two groups (n (%)

Group	Infection	Allergy and rash	Fluid accumulation	Redness	Total
Control group (n=51)	1 (1,96)	0	2 (3,92)	1 (1,96)	4 (7,84)
Study group (n=51)	1 (1,96)	3 (5,88)	2 (3,92)	1 (1,96)	7 (13,73)
χ^2					0,917
P					0,338

There was no significant difference in the incidence of postoperative complications between the study group (SG) (13.73%) and the control group (CG) (7.84%) (p > 0.05) (Table 4).

4. DISCUSSION

Refractory pressure ulcers are primarily characterized by persistent symptoms and severe wound infections. These conditions are associated with impaired microcirculation, reduced local blood flow, decreased phagocytic activity, accelerated tissue protein degradation, and wound infection. Therefore, enhancing cell migration within the scaffold, activating cellular proliferation, and reducing the inflammatory response at the wound site are key factors in accelerating wound healing [10], [11]. Negative pressure wound therapy (NPWT) is a commonly used approach for the management of refractory pressure ulcers and offers several advantages: it provides thermal insulation for the wound, prevents secondary infection, promotes drainage of exudate and necrotic tissue, enhances local blood perfusion, and accelerates granulation tissue formation through negative pressure stimulation. However, NPWT materials are expensive and can only be applied as a transitional therapy.

In this study, compared with the control group (CG), the study group (SG) treated with PRP demonstrated a higher overall efficacy rate and higher WHOQOL-BREF scores, along with lower VAS and PUSH scores, smaller wound areas, and shallower wound depths after 21 days of treatment. Fu et al. reported that the overall efficacy rate of autologous PRP gel combined with NPWT in the treatment of diabetic foot ulcers was 95.74% [12], which was significantly higher than that achieved with conventional therapies findings consistent with the results of the present study.

p-ISSN 1859 - 3461
e-ISSN 3030 - 4008

These outcomes suggest that within the context of NPWT, the adjunctive use of autologous PRP gel produces remarkable therapeutic benefits, including accelerated wound healing, pain reduction, decreased wound size, and improved patient quality of life. The underlying mechanisms behind these effects may be attributed to several biological actions of PRP gel. Autologous PRP contains fibrin, platelets, cytokines, and growth factors which, upon gel formation, create a low-oxygen and moist microenvironment that facilitates the sustained release of growth factors and cytokines, promotes cellular proliferation within the wound, and regulates extracellular matrix synthesis and degradation [13].

Furthermore, autologous PRP enhances angiogenesis, fibroblast proliferation, and local microcirculation, supplying additional growth factors to the wound and exhibiting antimicrobial effects by stimulating endothelial and fibroblast proliferation, activating monocytes and neutrophils, and promoting chemotaxis and phagocytosis thereby accelerating granulation tissue formation [14], [15]. The preparation of PRP gel involves fully automated plasma separation and density gradient centrifugation, making the procedure simple, convenient, safe, and with minimal risk of immune rejection. In the present study, no significant differences in complication rates were observed between the two groups.

Guoyou et al. [16] applied PRP gel to 12 patients with stage IV pressure ulcers, all of whom developed new granulation tissue after two dressing changes, without any notable adverse reactions or complications. These findings further support the safety profile of PRP gel therapy.

5. CONCLUSION

PRP exhibits a pronounced effect in accelerating wound healing, alleviating pain, shortening the treatment course, reducing inflammation, and enhancing patients' quality of life, without increasing the incidence of complications.

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