WWW.IJRPR.COM

International Journal of Research Publication and Reviews

Journal homepage: www.ijrpr.com ISSN 2582-7421

Platelet-Rich Plasma Therapy for Chronic Angiopathy non-Diabetic Wounds: A Case Study

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ABSTRACT

Platelet Rich Plasma (PRP) therapy has emerged as an innovative approach in wound management, particularly in cases of chronic ulcers not related to diabetes. This study aims to explore the effectiveness of PRP therapy in wound healing in patients with non-diabetic chronic angiopathy. Through this case study, we analyzed the wound healing response after the application of PRP therapy in a 67-year-old male patient without comorbidities with chronic wounds in the legs for more than 6 months, the results of treatment and wound care in these patients were previously unsuccessful and the wound developed necrosis. The results showed a significant improvement in the healing process, characterized by a reduction in wound size, increased angiogenesis, and tissue repair after intralesional PRP injection therapy. These findings support the potential of PRP therapy as an effective therapeutic option for patients with chronic injuries due to non-diabetic angiopathy, as well as paving the way for further research into its mechanisms and clinical applications.

Keywords: Platelet-Rich Plasma, Chronic Foot Ulcer, Chronic Non- Diabetic Ulcer, Wound Healing

1. INTRODUCTION

Chronic foot ulcers that do not heal are defined as "the loss of subcutaneous skin and tissue on the foot or sole, which requires a healing time of more than 6 weeks" (Suryanarayan *et al*., 2014). About 69–77% of all types of wounds fall into the category of chronic ulcers that do not heal. Ulcers on the legs are usually associated with diabetes and can be a significant burden on patients as well as the health system, especially if there is a recurrence or not healing. However, foot ulcers can also appear in individuals who do not have diabetes. Like foot ulcers caused by diabetes, these ulcers can develop as a result of a variety of interconnected factors, including neuropathy, peripheral artery disease, overpressure, trauma, and foot conditions such as fissures and calluses. However, information on the characteristics of non-diabetic foot ulcers is still relatively scarce (Haji *et al*., 2016).

The pathophysiology of chronic angiopathic wounds involves impaired microcirculation, inadequate oxygen delivery to tissues, as well as imbalances in the inflammatory response, all of which inhibit the natural healing process. It is estimated that wounds require at least 20 mmHg of tissue oxygen pressure to heal and wounds that do not heal have been measured to have oxygen pressures as low as 5 mmHg (Han & Ceilley, 2017). Platelet-rich plasma (PRP) therapy has emerged as a promising alternative in the management of chronic wounds. Platelet-rich plasma (PRP) is a fraction of plasma that contains a higher concentration of growth factors than whole blood, usually 3 to 7 times the average platelet concentration of whole blood. (Wang et al., 2023) PRP is used as an interesting alternative treatment for stubborn wounds because it is a source of Growth Factor that has mitogenic, angiogenic and chemotactic properties (Alves & Grimalt, 2018). PRP contains a variety of growth factors that have a crucial role in various stages of wound healing, including hemostasis, inflammation, cell migration, proliferation, extracellular matrix production, as well as tissue renovation (Miłek *et al*., 2019). Based on the results of the meta-analysis, it was found that both autologous and allogenic PRPs have the same potential to significantly increase wound healing rates, shorten the time to complete wound healing, while not increasing the risk of infection. and resulted in total cure of chronic foot ulcers in all patients suffering from venous insufficiency (Li *et al*., 2024;Meznerics *et al*., 2022; Jaseem *et al*., 2020;Wang *et al*., 2023). Many studies have shown the effectiveness of PRP therapy in treating chronic wounds with various causes, but the results cannot be considered conclusive yet (Salgado-Pacheco *et al*., 2024).

This case study aims to explore the effectiveness of PRP therapy in the treatment of chronic angiopathic wounds in patients. By documenting the characteristics of the wound, the treatment process, and the healing response that occurs. This study seeks to provide valuable insights into the potential benefits and limitations of PRP therapy in this clinical context. The findings of this study are expected to improve understanding of the role of PRP in the management of chronic non-diabetic angiopathic wounds and can inform future clinical practice guidelines.

2. MATERIAL AND METHODOLOGY

2.1 Patient

Patient A 67-year-old male patient was admitted to the emergency department with complaints of blackened wounds on the sole of his foot and one of the toes of his left foot that had not healed for 6 months. The wound was initially hit by thorns which then puruled. The patient had previously had an abscess incision and also an amputation of one of the left toes at one of the clinics, and carried out routine control for 6 months, but the wound blackened and did not improve.

2.2 Current disease history

After entering the emergency department, the stitches on the wound were opened and debridement was carried out in the operating room. Oral therapy of the first line of dual antibiotics is prescribed for 10 days in doses of amoxicillin and clavulanic acid 875 mg + 125 mg, three times daily, and clindamycin 600 mg, three times daily, and routine daily wound care is performed in the surgical zaal.

2.3 Past Medical History

The patient has no history of hypertension, diabetes mellitus, heart disease or other comorbidities. The patient had a history of smoking and often did not use footwear when administering herbicidal poison when cleaning oil palm plantations.

2.4 Personal and Family History

The patient's personal and family history does not contain significant events.

2.5 Physical Examination

When he arrived, the patient experienced swelling and inflammation in the lower leg area and appeared to have black suture wounds and amputation scars and pale soles of the feet. The patient feels pain when the wound is touched, but when it is cleaned, the wound does not bleed.

2.6 Laboratory Examination

The results of the patient's laboratory test showed that the number of lecocytes was 10.08 x 103/ul, erythrocytes 4.13 x 106/ul, platelets 331 x 103/ul, Lymphocytes 20%, Monocytes 8.8%, Neutrophils 64.3%, GDS (70 mg/dl), HbA1c 4.9%, Cholesterol (129 mg/dl), Triglycerides (98 mg/dl), HbsAg (negative), urea levels (13 mg/dl), creatinine levels (0.8 mg/dl), albumin levels (4.7 gr/dl).

2.7 Platelet-Rich Plasma (PRP) Separation Procedure

Fresh autologous PRP is obtained through taking 10 ml of the patient's venous blood using a sterile 10 ml syringe, the blood is then slowly inserted into a sterile tube containing sodium citrate anticoagulant. The tubes containing blood are centrifuged at a speed of 1,500 rpm for 10 minutes. From the separated plasma we obtain 3 ml of PRP, which will then be injected intralesotically with a needle measuring 30 G (4 mm) at several points at a dose of 0.1 ml per point. Wound care after that is carried out every 2 days with the application of 0.9% NaCl and sterile cotton gauze.

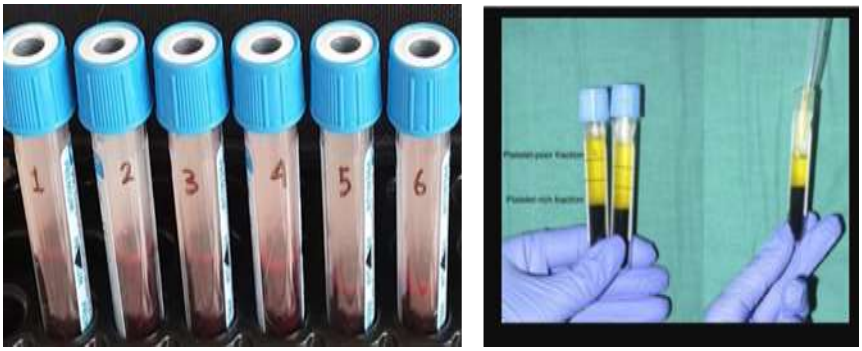

Figure 1. Venous blood and centrifugation results to separate the buffy coat from the plasma

Figure 2. Platelet- Rich Plasma that has been transferred into a sterile tube and then injected intralesotically.

3. RESULT

3.1 When Patients Arrived

Figure 3. The condition of the suture wound has necrosis

3.2 When debridement will be carried out

Figure 4. Stitches on the wound are opened, the tissue looks pale and infected

3.3 After debridement

Figure 5. The wound was post-debridement and had been treated for an open wound

3.4 Results after PRP injection

Figure 6. Wounds improve significantly within 10 days of intralesional PRP injection

4. DISCUSSION

More than 85% of amputations of the lower limbs occur after the appearance of ulcers on the legs or ankles. It is estimated that the incidence of chronic ulcers will increase as the population ages, as well as increasing risk factors for atherosclerotic occlusion such as smoking, obesity, and diabetes. About 10% of the population is expected to experience chronic wounds throughout their lives, with the mortality rate associated with such wounds reaching 2.5% (Suthar *et al*., 2017). Ulcers with a black necrotic base that cannot survive, indicating the presence of peripheral arterial disease or infection. Ulcers with a fibrotic base have a white to yellowish fibrous appearance and tend to stop the formation of granulating tissue. Ulcers with a granular base have a red appearance like beef and indicate positive healing potential (Abid A, 2025).

PRP is a complex mixture consisting of platelets, cytokines, and various growth factors, such as EGF (epithelial growth factor) that promotes the proliferation of fibroblasts; TGF (transforming growth factor) which has mitogenic and chemotactic properties and increases collagen production; VEGF (vascular endothelial growth factor) which plays a role in the angiogenesis process; and PDGF (platelet-derived growth factor) which contributes to increasing the migration of macrophages and fibroblasts. (Jaseem *et al*., 2020). The most commonly used technique is to take a blood sample from the patient himself (autologous); The blood is then centrifuged to separate platelets from red and white blood cells. Given that most individuals have a basal platelet count of around 200,000 (±75,000)/μL, the ideal PRP platelet count has been established at 1 million/μL as the optimal dose of PRP therapy (Dashore *et al*., 2021; Martinez-Zapata *et al*., 2016; Vladulescu *et al*., 2024). Rich Plasma Platelet (PRP) is most commonly used as an autologous, but in situations where autologous PRP is not available or is not suitable, allogeneic PRP is a safe alternative. Testing in the study showed allogeneic PRP was safe from adverse immune reactions. However, its efficacy requires larger-scale studies with precise controls. Standardization in PRP preparation and treatment regimens is also needed to be able to interpret the efficacy of allogeneic PRP (Du, 2020; Akbarzadeh *et* al., 2021).

In the results of a meta-analysis conducted by (Meznerics et al., 2022), it was found that PRP administered by injection to venous ulcers showed better results, as the injection provided a selective distribution in the target area of the wound that needed more help in the healing process (Jee et al., 2016) and all included studies reported shorter healing times in the PRP group. Chicharro-Alcántara et al., 2018 also reported non-healing ulcers with different

etiologies treated with subcutaneous autologous PRP injections along with topical application of PRP gel showing good safety potential and efficacy for chronic non-healing ulcers with significant reduction in wound size in all treated patients without side effects, and also the reduction of pain and inflammation at the site of injury thanks to the suppression of cytokine release. A study conducted by Jee *et al*., 2016, wounds treated with PRP showed more granulation formation and angiogenesis on day 7, and faster epithelialization, more granulation formation and collagen deposition were observed on day 14 than in control wounds.

5. CONCLUSION

Studies have shown interesting results regarding the use of PRP for chronic ulcer. However, the lack of clear clinical protocols and guidelines hinders the expansion of its use. There is a need to conduct comprehensive clinical trials to determine the most appropriate indications and preferred methods for obtaining PRP and its application protocols. Based on this study, intralesional injection of PRP is considered a beneficial alternative in the management of chronic ulcers due to the healing effect it offers as well as its practicality. Further research is needed to determine the appropriate use and identify complications so that clinical application can be better carried out.

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