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Research Article

Optimizing Skin Graft Outcomes in Pediatric Electrical Burns with Autologous Platelet Rich Plasma

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ABSTRACT

Electrical burns in children, though less common than thermal injuries, often result in deep tissue damage, leading to substantial morbidity and long-term rehabilitation challenges. Autologous Platelet-Rich Plasma (APRP), rich in growth factors and cytokines, has emerged as a promising adjunct in burn wound management, promoting faster healing and improved graft uptake.

This case study was conducted at the Plastic Surgery Department of a tertiary care center in South India. A 12-year-old boy with high-voltage electrical burns (15% TBSA) involving the face, neck and lower limbs underwent two sessions of APRP application prior to split-thickness skin grafting.

Following APRP application, the wound bed showed healthy granulation tissue, allowing successful graft uptake within one week. The intervention contributed to enhanced wound healing and reduced hospital stay in case of deep burn wounds.

Keywords: Autologous, Burns, Electrical, Platelet, Plasma, Pediatric

1. Introduction

Electrical burns in children, while less common than thermal burns, can cause deep tissue damage and lead to significant morbidity, scarring and long-term rehabilitation. With advancements in wound care, Autologous Platelet-Rich Plasma (APRP) has shown promise as an effective adjunctive treatment for promoting wound healing in burn wounds.

Autologous platelet-rich plasma (APRP), as the name implies, is derived from the patient's own blood and is rich in platelets. These platelets contain growth factors and cytokines, which are believed to help reduce inflammation and promote healing. It is now commonly used in plastic surgery and cosmetic medicine due to its wound-healing abilities. Additionally, autologous platelet-rich plasma, abundant in growth factors, is increasingly being utilized in the treatment of adult burn wounds.

2. Methods and Materials

This study was conducted in the Plastic Surgery department of a tertiary care center in South India, after obtaining written informed consent from the patient and approval from the department. The patient was a 12-year-old male child who had sustained high voltage electrical burns of mixed second degree to his face, neck and both lower limbs involving 15% total body surface area. He was admitted to our Tertiary Burns Centre and initial fluid resuscitation was given as per standard guidelines. The burn area was treated with 2 sessions of autologous platelet-rich plasma (APRP) application weekly **(Figure 1)**.

Figure 1: Deep partial thickness burn wound in both feet.

The technique used for preparing the autologous platelet-rich plasma followed the standard method described by Franco et al. and Li et al. The preparation steps are as follows:

Step 1: A 10 ml sample of the patient's venous blood was drawn and treated with heparin.

Step 2: The blood sample was centrifuged at 3000 RPM for 10 minutes, resulting in three distinct layers in the tube.

Step 3: The upper layer was aspirated using a sterile needle and syringe.

Step 4: The sample was then re-centrifuged at 4000 RPM for 10 minutes, resulting in two layers. The bottom layer, which was rich in platelets, was aspirated using a sterile needle and syringe.

The autologous platelet-rich plasma was then injected into the burn wound site under strict aseptic conditions.

3. Results

After 1 session of autologous platelet-rich plasma, the burn site well granulated and skin grafting done **(Figure 2)**. Skin graft enriched with APRP taken well in one week **(Figure 3)**. Additionally, the use of autologous platelet-rich plasma contributed to a reduction in the patient's hospital stay.

4. Discussion

Autologous platelet-rich plasma (APRP) refers to plasma derived from the patient's own blood, with a platelet count higher than that found in their peripheral blood. Initially used to treat thrombocytopenia, APRP's application expanded to other fields, especially sports medicine, for treating musculoskeletal injuries. Its use in wound management stems from the observation that wounds often have a pro-inflammatory environment, which impairs healing. Additionally, wounds exhibit high protease activity, which negatively affects the function of growth factors. When used in chronic wounds, APRP serves as a source of growth factors, offering mitogenic, angiogenic and chemotactic properties.

Figure 2: APRP applied over skin graft.

Figure 3: Skin graft taken well after 1 week post grafting.

Platelet Rich Plasma (PRP) is a biological product defined as a portion of the plasma fraction of autologous blood with platelet concentration above the baseline (before centrifugation)[1,2]. PRP contains high levels of platelets and also the full complement. Of clotting factors, the latter remaining at their normal, physiologic levels. It is comprised of a range of growth factors, chemokines, cytokines and other plasma proteins[3]. PRP is a source of signaling molecules and upon activation of platelets in PRP, the P-granules degranulate and release GFs and cytokines that will change the pericellular micro environment. Some of the most important GFs released by platelets in PRP include vascular endothelial GF(VEGF), fibroblast GF (FGF), platelet derived GF (PDGF), epidermal GF, hepatocyte GF, insulin like GF 1,2 (IGF-1, IGF-2), matrix metalloproteinases (MMP)2,9 and interleukin 8[4].

Burn-related injuries are a leading cause of morbidity and mortality in children[5]. The ultimate aim of wound management in burns is to prevent wound infection and thereby facilitate closure of wounds either spontaneously as in superficial burns or provide coverage to the raw areas by autogenous skin grafts[6]. In severe burns, the separation of slough may expose tendons, joints or bone. If these structures are not protected by a viable flap with an independent blood supply, sloughing of tendons and sequestration of bone and cartilage may ensue. In domestic accidents, although burns can be deep, the lateral extent of the deep tissue damage generally corresponds to the visible area of skin injury, with minimal extension beneath intact skin.

Occasionally, major vessels located beneath or near the burn site may sustain significant damage. This can lead to progressive distal thrombosis, potentially resulting in gangrene of a digit or, in rare cases, the distal part of a limb even if that area was not directly burned[7].

APRP accelerates soft tissue wound healing by two to three times compared to normal healing processes. APRP enhances healing by supplying high concentrations of growth factors to the wound bed, promoting angiogenesis, fibroblast differentiation and epithelialization.

5. Conclusion

Autologous platelet-rich plasma is an effective method for enhancing scar remodeling and proves to be an excellent option for treating burn wounds. However, a significant limitation of APRP use is that wounds with large surface areas require a greater volume of extensive burn wound that require careful consideration.

6. References

1. Wroblewski AP, Melia HJ, Wright VJ. Application of platelet rich plasma to enhance tissue repair. Oper Tech Orthop, 2010;20: 98-105.
2. Lynch MD, Bashir S. Applications of platelet rich plasma in dermatology: a critical appraisal of the literature. J Dermatolog Treat, 2016; 27: 285-289.
3. Andia I, Abate M. Platelet rich plasma: underlying biology and clinical correlates. Regen Med, 2013;8: 645-658.
4. Ferrando J, García-García SC, González-de-Cossío AC, et al., A Proposal of an Effective Platelet-rich Plasma Protocol for the Treatment of Androgenetic Alopecia. Int J Trichology, 2017;9: 165-170.
5. Reed JL, Pomerantz WJ. Emergency management of pediatric burns. Pediatr Emerg Care, 2005;21: 118-129
6. Sharma RK, Parashar A. Special considerations in paediatric burn patients. Indian J Plast Surg, 2010;43: 43-50.
7. Knox KR, Mortin RJ, Fleegler EJ. Electrical burn of the upper extremity: interesting case series. New Jersey Medical School, Newark: Division of Plastic Surgery, 2009.