

C A S E R E P O R T

Allogeneic plasma gel in II Degree Burn: A case report

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Abstract. Skin burns are injuries caused by physical and chemical mechanisms, with thermal burns from fire being the most common. These injuries can cause death or long-term disability; The use of orthobiological agents such as platelet-rich plasma and its derivatives have shown good results in chronic wounds and skin lesions. The present study presents the case of a 1 year 6-month-old child who suffered a second-degree thermal burn on the palm of his right hand, which caused him a lot of pain and was resistant to analgesics. For this reason, it was decided to perform a regenerative therapy based on debridement and application of 2 sessions of allogeneic plasma gel, from the mother, as a biofilm, in addition, topical antibiotic cream was added to cover the wound. After 8 days of the first application, the wound had re-epithelialized adequately, with almost no evidence of the previous burn, which allowed rapid rehabilitation and complete recovery. Allogeneic plasma gel could be a safe, low-cost and effective option for the healing of second-degree burns and an alternative to skin autografts or xenografts. (www.actabiomedica.it)

Key words: plasma skin regeneration, allografts, plasma gel, regenerative medicine, burns

Introduction

Burns are a type of trauma that can affect anyone, at anytime and anywhere. These injuries, which usually affect the skin, are caused by friction, cold, heat, radiation, chemical or electrical sources, but most are caused by the heat of hot liquids, solids or fire (1). According to reports from the World Health Organization (WHO), about 300,000 people worldwide die from burns annually. In the United States, 500,000 patients suffer burns annually, of which more than 40,000 are hospitalized and 3,400 die (2). Burns can be devastating, producing significant injuries, high morbidity, deterioration of emotional well-being and quality of life. After an extenuating and stressful need for immediate care, they usually require long-term treatment with numerous dressings (dressing changes, etc.), multiple reconstructive surgical procedures, prolonged hospital stays, and

outpatient follow-up visits. These consequences are often accompanied by socioeconomic burdens for victims and their families (3). The average cost of wound care in clinical practice over 24 months from initial presentation, according to the UK National Health Service (NHS), was estimated at \$16,924 per burn, ranging from \$12,002 to \$40,577 for a healed and unhealed wound, respectively (4). Second degree burns are common in hospital care, are painful, and often leave sequelae (5). Regarding treatment, autografts are often considered the gold standard for care, but their application is limited by many factors. Therefore, skin substitute dressings are desirable. In this sense, with the development of biomaterials and the progress of tissue engineering technology, some innovative dressings and structures, such as nanofibers, films, foams and hydrogels, have been widely used in the field of biomedicine, especially in the wound treatment. Among

them, hydrogels have attracted great attention for their unique advantages (6). On the other hand, therapy with stem cells and concentrated growth factors has improved the prognosis of patients with burns. One of these treatments is platelet-rich plasma (PRP), which has been shown to speed up the healing process, reduce the chances of infection and the adverse effects of laser therapy (7). Likewise, topical treatment with platelet-rich plasma can improve healing and reduce the incidence of adverse events (8). In this article we present the case of a pediatric patient with a 2nd degree burn, who was treated with allogeneic plasma gel, from the mother, with excellent results.

Case report

Male patient, 1 year and 6 months old, who 3 days before his admission to the emergency service of a second level hospital, in the San Martín Region (Bellavista) in Peru, presented a burn on the palm of his right hand. due to direct contact with the hot metal surface of a motorcycle, the mother applied home care without improvement, presenting redness and blisters in the affected area. For this reason, he was taken to the emergency room, where the diagnosis of a second degree burn on the right palm was made (Figure 1). Subsequently, he was hospitalized in the General Surgery service, and due to the lack of a xenogeneic pig skin graft, discussions were held with the clinical pathology service to prepare allogeneic plasma gel from the mother, preventing any hemodynamic change in the patient infant by the extraction of autologous blood for the preparation of plasma gel. For processing, peripheral blood was extracted in 6 tubes of 3.6 ml containing 3.2% sodium citrate as anticoagulant, then centrifuged at 2500 RPM x 5 minutes and finally the total supernatant plasma was extracted. The plasma was subsequently heated at different temperatures (thermocycling), which followed a standardized protocol, which consisted of absorbing the blood plasma in a syringe, then it was placed inside the water bath at 70 °C x 5 minutes and finally at 80 °C x 10 more minutes. Finally, the allogeneic orthobiologic was transferred to the surgeon in charge of the surgical cure; The patient immediately entered the operating room for surgical cleaning of the wound; with debridement of



Figure 1. Second degree burn with the presence of erythema, blisters and skin efascellation.

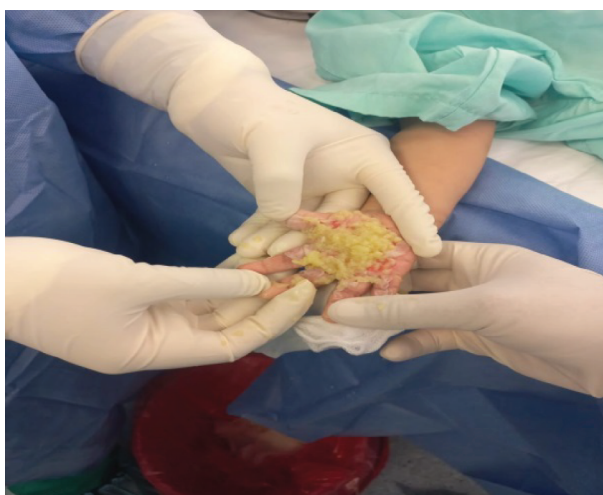


Figure 2. Application of allogeneic plasmagel to the debrided wound.

blisters, necrotic tissue and debris, it was immediately covered with the plasma gel (Figure 2), and on top of this paraffin gauze, followed by Silver Sulfadiazine in order to penetrate the wound (Figure 3). Finally, the bandage was carried out.

Evolution

The patient remained bandaged during his 3 days of hospitalization, without showing pain or any sign of



Figure 3. Wound on the third day, after application of plas-magel. Slightly reddened skin with abundant granulation tissue was seen.

infection. The application of plasma gel was then repeated on the general surgery topic, because the burn bed was only slightly red and with abundant granulation tissue. Discharge and control by office were indicated. Subsequently, 8 days after the first application of allogeneic plasma gel, the patient was evaluated in the outpatient clinic, where complete reepithelialization of the wound was evident, without tissue retraction and normal-looking skin. Finally, a follow-up was done for 6 months, the results were maintained, and complete healing of the wound was achieved, without any sequelae (Figure 4).

Discussion

Superficial and deep burns can lead to significant complications and physical sequelae, typical of healing (9). They usually heal in 3 to 4 weeks, and depending on their depth, they can give rise to significant retractions that alter the movement of the joints, especially in areas of high mobility such as the hands (10). In the present case, the initial indication was to refer him to a Hospital of Greater Complexity, for treatment with a possible allogeneic or xenogeneic skin graft. However, due to the difficult accessibility and requiring prompt



Figure 4. Reevaluation after 6 months, completely normal skin was observed, without any sequelae.

measures, the hospital's multidisciplinary team chose to perform a regenerative treatment with allogeneic plasma gel, from the mother, due to the previous experience of the clinical pathology service in the production of these orthobiological and of the General Surgery service in the application of these therapies in other pathologies such as diabetic foot. Subsequently, after 2 sessions, complete healing of the injury was achieved, which, during the 6-month follow-up, maintained full functionality of the affected hand.

It is currently known that the application of platelet-rich plasma to damaged tissues allows the local release of growth factors and cytokines contained in its alpha granules, which will accelerate and improve tissue repair processes (11). Plasma gel (also known as "albumin gel") has different densities depending on its thermocycling protocol (temperature and time changes) allowing its use as a three-dimensional scaffold that constantly releases different growth factors (12). Relating the immunomodulatory, molecular mechanisms and growth factors that intervene in the repair of tissue damage (13). Rossani et al (2014) detected that platelet-rich plasma shortens recovery time in second-degree burns, reduces hospitalization time and

leads to a high degree of patient satisfaction with the results obtained (14). On the other hand, Hernández-Patiño (2020) reported that allogeneic platelet-rich plasma (from the mother) allowed the recovery of a second-degree burn in a patient, 14 days after application, however at that time it was still noticeable the difference of sequalae skin compared to healthy skin (15). In both cases, platelet-rich plasma activated with calcium gluconate in its liquid form was used, which has certain limitations such as: 1) the time available for post-activation application, which is approximately 8 minutes, before the activation is activated coagulation and then fibrin does not allow the plasma to be applied through a needle, 2) the difficulty in covering irregular areas of the body such as the face where due to movement, the plasma can drip when applied topically, 3) The rapid absorption of plasma by the skin and dry or paraffin gauze that do not allow permanent contact of the skin with the regenerative factors, 4) possibility that the gauze remains stuck to the skin, detaching part of the re-epithelialization surface achieved by the regeneration (16). On the other hand, plasma gel has an availability of up to 1 month, before its complete reabsorption in the body, its ability to permanently release regenerative factors and the possibility of using autologous or allogeneic plasma for its preparation, make it orthobiological a feasible and hopeful option in cases of 2nd degree burns (17). This article shows a new way of treating second-degree burns, using allogeneic plasma gel, in this case from the patient's mother, which could be done even in first-level care centers. Furthermore, in some larger hospital centers, it could be obtained directly from blood banks, where the blood plasma undergoes greater quality controls and the orthobiologicals obtained from these blood products would have even greater security. On the other hand, the use of pig skin xenografts for this type of burns can be an alternative since it has been demonstrated that this type of cells do not express markers such as CD31 and CD45, but express CD73, CD105 and the mesenchymal stem cell marker CD90, which are essential for tissue regeneration due to their chemotactic, paracrine and immunomodulatory actions (18), CD105 and the mesenchymal stem cell marker CD90, are essential for tissue regeneration due to their chemotactic, paracrine and immunomodulatory actions (18), they usually

secrete an angiogenic, immunosuppressive and anti-oxidant cytokine profile (19). In addition, they have immune privileges due to lack of human leukocyte antigen-DR expression and suppression of activated allogeneic lymphocyte proliferation (20). However, their application in this case can be very costly depending on their extension and tissue banks are scarce in developing countries such as Peru. Although it is true that with the allogeneic plasma gel, the patient was completely cured and that even after a few months the complete functionality of the hand has been maintained, without evidence of scars or retractions, these particular cases still correspond to a level of type IV evidence, which must be endorsed by future randomized controlled clinical trials and Meta-analysis to determine the magnitude of its effectiveness and perhaps later it can be integrated into public health systems.

Conclusion

Plasma gel is a safe, low-cost orthobiologic that could be effective for the treatment of second-degree burns. The availability of allogeneic plasma may be an alternative in patients who cannot access autologous plasma extraction. However, more human studies such as randomized controlled clinical trials and systematic reviews are lacking to quantify the effectiveness of plasmagel in second-degree burns.

Ethic Approval: The patient's mother was informed that the hospital did not have a plastic surgery service or xenogeneic skin grafts, however, some autologous regenerative medicine procedures were being performed on diabetic foot; and she agreed to accept the option of using plasma gel as a regenerative alternative for her son's skin. It was specified that it should be allogeneic, due to the difficulty of venous access of the patient, his age, weight and the risk of some hemodynamic alteration, and he was also mentioned about the low rates of adverse reactions in the applications of allogeneic plasma, even in patients of different type of group and factor. However, the mother had the same group and factor as her son. On the other hand, she gave her consent for the publication and academic dissemination of the case of her minor son.

Conflict of Interest: Each author declares that he or she has no commercial associations (e.g., consultancies, stock ownership, equity interest, patent/licensing arrangement etc.) that might pose a conflict of interest in connection with the submitted article.

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References

- Jeschke MG, van Baar ME, Choudhry MA, Chung KK, Gibran NS, Logsetty S. Burn injury. *Nat Rev Dis Primers*. 2020;6(1):11. doi: 10.1038/s41572-020-0145-5
- Roshangar L, Kheirjou R, Ranjesh R. Skin burns: review of molecular mechanisms and therapeutic approaches. *Wounds*. 2019;31(12):308-15.
- Smolle C, Cambiaso-Daniel J, Forbes A, et al. Recent trends in burn epidemiology worldwide: a systematic review. *Burns*. 2017;43(2):249-257. doi: 10.1016/j.burns.2016.08.013
- Guest JF, Fuller GW, Edwards J. Cohort study evaluating management of burns in the community in clinical practice in the UK: costs and outcomes. *BMJ Open*. 2020;10(4):e035345. doi: 10.1136/bmjopen-2019-035345
- Jiménez R, García F. Manejo de las quemaduras de primer y segundo grado en atención primaria. *Gerokomos*. 2018; 29(1):45-51.
- Yao Y, Zhang A, Yuan C, Chen X, Liu Y. Recent trends on burn wound care: hydrogel dressings and scaffolds. *Biomater Sci*. 2021;9(13):4523-40. doi: 10.1039/d1bm00411e
- Zheng W, Zhao DL, Zhao YQ, Li ZY. Effectiveness of platelet rich plasma in burn wound healing: a systematic review and meta-analysis. *J Dermatolog Treat*. 2022;33(1):131-7. doi: 10.1080/09546634.2020.1729949
- Huang H, Sun X, Zhao Y. Platelet-rich plasma for the treatment of burn wounds: a meta-analysis of randomized controlled trials. *Transfus Apher Sci*. 2021;60(1):102964. doi: 10.1016/j.transci.2020.102964
- Hernández-Patiño I, Rossani G, De La Cruz VJA, Casado FL, Trelles MA. Tratamiento de quemaduras mediante plasma heterólogo rico en plaquetas (PRPh). *Cir Plast Ibero-Latinoam*. 2020;46(4):483-8. doi: 10.4321/s0376-7892202000400013
- Benavides J. Reparación de heridas cutáneas. *Rev Asoc Colomb Dermatol Cir Dermatol*. 2019;16(1):29-35.
- Dos Santos RG, Santos GS, Alkass N, et al. The regenerative mechanisms of platelet-rich plasma: a review. *Cytokine*. 2021;144:155560. doi: 10.1016/j.cyto.2021.155560
- Jiménez N, Pino A, Segurado G, et al. Autologous platelet-rich gel for facial rejuvenation and wrinkle amelioration: a pilot study. *J Cosmet Dermatol*. 2019;18(5):1353-60. doi: 10.1111/jocd.12823
- Poon IK, Hulett MD, Parish CR. Molecular mechanisms of late apoptotic/necrotic cell clearance. *Cell Death Differ*. 2010;17(3):381-97. doi: 10.1038/cdd.2009.195
- Rossani G, Hernández I, Alcolea JM, Castro-Sierra R, Pérez-Soto W, Trelles MA. Tratamiento de quemaduras mediante plasma rico en plaquetas (PRP): parte I. *Cir Plast Ibero-Latinoam*. 2014;40(2):229-38. doi: 10.4321/s0376-78922014000200015
- Moya GM, Muñoz PD, Poquiza PA, Apolo KY, Lema IA. Actualidad del manejo de las lesiones por quemaduras críticas: update on the management of critical burn injuries. *Lat Am*. 2024;5(1):1531-46. doi: 10.56712/latam.v5i1.1691
- González M, Arteaga-Vizcaíno M, Benito M, Benito M. Aplicación del plasma rico en plaquetas (PRP) y sus derivados en implantología dental y cirugía plástica. *Invest Clin*. 2012;53(4):408-18.
- Fujioka-Kobayashi M, Schaller B, Mourão CFAB, Zhang Y, Sculean A, Miron RJ. Biological characterization of an injectable platelet-rich fibrin mixture consisting of autologous albumin gel and liquid platelet-rich fibrin (Alb-PRF). *Platelets*. 2021;32(1):74-81. doi: 10.1080/09537104.2020.1717455
- Bertozzi N, Simonacci F, Grieco MP, Grignaffini E, Raposio E. The biological and clinical basis for the use of adipose-derived stem cells in the field of wound healing. *Ann Med Surg (Lond)*. 2017;20:41-8. doi: 10.1016/j.amsu.2017.06.058
- Raposio E, Simonacci F, Perrotta RE. Adipose-derived stem cells: comparison between two methods of isolation for clinical applications. *Ann Med Surg (Lond)*. 2017;20: 87-91. doi: 10.1016/j.amsu.2017.07.018
- Simonacci F, Bertozzi N, Raposio E. Off-label use of adipose-derived stem cells. *Ann Med Surg (Lond)*. 2017;24: 44-51. doi: 10.1016/j.amsu.2017.10.023

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