

THERAPEUTIC APPROACH TO ELECTRIC BURN WITH PLATELET RICH PLASMA, GRAFTS AND HYPERBARIC OXYGENATION

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Abstract Contact electrical burns are more severe than other forms of contact burn injury. Moreover, treatment of hand burns is an important therapeutic challenge. We present a 17 year-old female of low voltage electric hand injury, admitted 5 days after injury. The patient was treated with autologous platelet rich plasma, porcine dermis heterograft and partial autologous skin graft, all of them with hyperbaric oxygen therapy (HBOT) at 1.45 ATA \approx 100% O₂ like adjuvant therapy. Good evolution and acceptable aesthetic results were reported. Although more studies are required, we suggest that multi-therapeutic approach could be effective in treatment for electric burns in hands.

Key words: electrical injuries, burns in hands, grafts, hyperbaric oxygen therapy

Resumen *Enfoque terapéutico de quemadura eléctrica con plasma rico en plaquetas, injertos y oxigenación hiperbárica.* Las quemaduras eléctricas por contacto son más graves que otras formas de quemaduras. Además, el tratamiento de las mismas en las manos es un importante desafío terapéutico. Presentamos el caso de una mujer de 17 años de edad con lesión en la mano por quemadura por electricidad de baja tensión. Fue ingresada 5 días después de la lesión y tratada con plasma rico en plaquetas autólogo, heteroinjerto de dermis porcina e injerto de piel autólogo parcial, todo con oxigenoterapia hiperbárica (TOHB) a 1.45 ATA \approx 100% O₂ como terapia adyuvante. Tuvo buena evolución y resultados estéticos aceptables. Aunque se requieren más estudios, sugerimos que el enfoque multi-terapéutico podría ser eficaz en el tratamiento de las quemaduras eléctricas en las manos.

Palabras clave: lesiones eléctricas, quemaduras en manos, injertos, terapia de oxigenación hiperbárica

Contact electrical burns are more severe than other forms of burns and the most frequent are low voltage (less than 1000V) injuries, especially in pediatric population^{1,2}. In Argentina, a total of 16% of electrical burns were reported between the pediatric burns treated at *Hospital de Quemados* of Buenos Aires, Argentina (a major burns reference center) in the period from 2014 to 2018. Most of them were on hands and due to domestic accidents (data provided of statistical division of that hospital).

The upper extremities are involved in most electrical injuries because they are typically the contact points to the voltage source³. Moreover, treatment of hand burns is

an important therapeutic challenge and amputation rates for upper extremity electrical injuries are typically reported between 35% and 40%³.

The therapeutic approach to electrical burns, as well as thermal burns, consists of different tools and requires systemic management^{1,4}. Skin grafting is often necessary and surgical procedures like escharotomy, fasciotomy, grafts and flaps are more effective with adjuvant therapies (like platelet rich plasma and hyperbaric oxygen therapy)^{5,6}. Although therapeutic algorithms are useful, there is no recommendation of individual surgical procedures. Inappropriate initial treatment or delay of initial treatment may exert adverse effects on the subsequent treatment and course. Adequate surgical approach and early rehabilitation, wound coverage, and delayed deformity reconstruction are important concepts in treating electrical injuries³.

Here, we describe a case of a low voltage electrical burn on a hand and the therapeutic approach with platelet rich plasma, grafts and hyperbaric oxygenation.

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Clinical case

A 17-year-old female patient was admitted to our hospital in Jan 2019 because of a low-voltage household electric injury with five days of evolution. She had history of alcoholism and peripheral facial paralysis 3 years ago, with restitution without sequelae. She suffered electric shock burns by touching the plug metal, compromising distal area of I to III fingers. Burn of 0.1% of total body surface area (TBSA), type B and severity group I was diagnosed (Fig. 1A). The patient was lucid, oriented in time and space and with good diuresis and received analgesia with a good response in the duration of her hospitalization. After cures with collagenase and petroleum gauze dressing during two days, she was treated with three daily enzymatic debridement with papain and carbopol prepared in hospital and an immediate session of hyperbaric oxygen therapy at 1.45 ATA \approx 100% O₂ (*Revitalair 430*). By the fifth day of admission in the hospital, the patient had received three enzymatic debridements and three hyperbaric chamber sessions (one before each debridement), and then, she received two days of cures with silver sulfadiazine and lidocaine topical in occlusive petroleum gauze dressing and film was performed.

On the seventh day, the patient received autologous platelet rich plasma prepared by the hemotherapist and a session of hyperbaric chamber. The lesions were occluded for 3 days, until 16/1 inclusive (Fig. 1B).

Three days after the platelet rich plasma, she received a session of hyperbaric chamber and heterograft of porcine dermis and the wounds were occluded for 4 days with petroleum gauze dressing to reduce maceration (Fig. 1C).

Fourteen days after admission, a partial autologous skin flap and a new session of platelet rich plasma and hyperbaric session were performed (Fig. 1D) and after seven days of cures and control, the patient was discharged (Fig. 1E).

During hospitalization, serological diagnosis of VDRL (+) 1/64 dilution titer was confirmed by interconsultation with an infectologist. She received antibiotic treatment and completed serological studies with authorization from the patient and her mother.

Lack of follow-up due to patient inconstancy was reported, but a control visit, performed repeatedly by social worker, after two months of discharge, good evolution and acceptable aesthetic results were reported (Fig. 1F). Dediles pressotherapy and hydration were indicated for complete rehabilitation with support from the kinesiologist in charge.

Discussion

Despite of its low frequency, electrical burns are considered complex wounds but there are no specific guidelines for their treatment^{1,4,7}.

Therapeutic approach for complex burns might be adequate for treating low voltage electrical injuries on hands because a good rehabilitation and functional restoration is necessary^{4,7}.

Fisher et al reported that enzymatic early debridement in deep burns of the distal upper extremity prevents operative escharotomy and compartment syndrome⁸. In the case

reported here, the enzymatic debridement was performed with collagenase and papain at different times of healing.

Among the therapeutic interventions, the application of platelet rich plasma (PRP) is one of the most widely used strategies as a simple and cheap way for promoting tissue regeneration using autologous growth factors. It was demonstrated that PRP prevents healing delay and structural alterations in different models of wounds, including burns⁵.

Moreover, many factors can impair wound healing, but a crucial factor is tissue hypoxia. Hyperbaric oxygen therapy is indicated in burns to accelerate healing, prevent sepsis and for improving the graft and flap survival^{6,9}. To sum up, the hyperbaric oxygenation of the tissues contributes to restore the perfusion of viable tissues and repair damaged nervous tissue, contributing to decrease limb necrosis as it was described in two case of electrical burn^{10,11}. In a previous report, hyperbaric oxygen therapy was used to improve the effectiveness of debridement and conditioning of the skin grafts¹⁰.

A previous case report was done by some of us. It was used hyperbaric oxygen therapy to improve oxygenation in a two-years-old girl with a low-voltage electric burn. In this case, it was done an autologous flap and the amputation was limited to the first phalanx of the hand, using that therapeutic scheme¹¹.

Soft injuries are devastating and surgically demanding and autologous skin grafts and flap coverage were common strategies of wound management in electrical burns¹. The patient presented here required two types of grafts for a complete coverage which improved healing and ensured a good rehabilitation. The reconstruction phase which focuses on restoring sensory and motor function, can last several years^{1,2}.

In this case, the patient was discharged after 21 days after admission with excellent results in rehabilitation after a multi-therapeutic approach of an electrical burn. A posterior control after two months revealed good evolution and satisfactory functional and sensory rehabilitation.

This is a report of a therapeutic approach to a low-voltage-electrical burn. There are required more studies to define and propose the treatment, considering accessibility to different therapeutic tools in each institution. Because of its low frequency, it would be optimal to have more observational studies and case reports. Additional reports of low-voltage electrical injury cases should be made to lay the groundwork for a future consensus in the treatment of different kinds of electrical burns.

Consent for publication was obtained from the patient

Conflict of interest: None to declare

Fig. 1.– A. A therapeutic approach of a 17 years-old- patient with a low-voltage electric burn at the admission. B. After autologous platelet-rich plasma (PRP) and hyperbaric oxygen therapy (HBOT). C. A heterograft of the porcine dermis and HBOT. D. A new session of PRP and HBOT. E. At discharge. F. At discharge.



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