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Case Report

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Management of the burn patient with human epidermal allograft cultured *in vitro*

Abstract

In Mexico a biological dressing was developed based on the culture of human keratinocytes in vitro. As a result, these procedures allow the expansion of keratinocytes in approximately 10,000 times their initial number, used in the treatment to cover the areas affected by burns, being a more important factor in obtaining this adequate result in the healing with its respective advantages both in social and economic terms.

Keywords: burn wound, reepithelialization, grafts, keratinocytes, wound, healing

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Huitrón Muñoz Jorge Alfredo,[1] Gallardo Navarro Elias,[1] Méndez Granda Andrés Ludwing,[1] Adame Paredes Raúl,[1] Mansilla Alba Armando,[1] Cuéllar Pérez Grovas Juan Esteban[2]

[1]General Surgery Resident, Hospital Español de México, Mexico City, Mexico

[2]Doctor, attached to the department of Plastic and Reconstructive surgery, Hospital Español de México, Mexico City, Mexico

Correspondence: Gallardo-Navarro Elias, General Surgery Resident, Hospital Español de México, Mexico City, Mexico, Email gallardo18@gmail.com

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Introduction

In Mexico, statistics show that burn injuries are the thirteenth leading cause of death with 2,775 deaths per year, according to members of the National Center for Research and Care of Burn Patients (Ceniaq).[1,2] The first health unit that prioritizes the care of burn patients was created during the Second World War in England; in Mexico in 1959 at the Dr. Rubén Leñero General Hospital, the first protocol for the care of burn patients was created; the treatment is multidisciplinary, requiring care from an integral point of view to improve the patient's quality of life.[3] Burns are serious injuries that involve significant morbidity and mortality, and delayed healing causes painful and unsightly scars.[2] Cutaneous traumas cause important losses of water, electrolytes and proteins from the living site, currently these wounds can be managed if the injured skin is replaced by biological substitutes, since wound re-epithelialization is the highest priority in the burned patient.[4] Different therapies attempt to accelerate the wound healing process and control local inflammatory conditions.Cryopreserved allogeneic epidermal allogeneic cell grafts have been proposed as a method to accelerate the healing process, Epifast®, manufactured by BIOSKINCO S.A. de C. V,[5] is used to cover areas of the body that are exposed by burns or dermabrasions, from a HE-120 cell line obtained from a biopsy of a single newborn donor, the HE-120 cell line has been tested by quantitative polymerase chain reaction for human viruses, sterility, and is free of endotoxins and isoenzymes harmful to the recipient, according to European Pharmacopoeia standards,[6] is composed of three to four layers of keratinocytes, the primary epidermal cells, are mounted on a vaseline sterile gauze, the mechanism of action is through stimulation and migration of the remaining cells at the wound site, release of growth factors such as transforming growth factor (TGF) alpha and TGF beta, and early formation of granulation tissue through deposition of proteins such as collagen type IV, laminin and tenascin.[7] As a result, significant advances have been made in reducing complications in the treatment of severe burns, including tangential excision, skin grafting, aggressive resuscitation, and improvements in antimicrobial therapy.[8] Cultured keratinocytes were postulated as a promising method for rapid re-epithelialization in the 1950s and have been shown to be beneficial in providing early coverage and functional outcome. These fully differentiated mature cells do not secrete cytokines and extracellular matrix proteins modulate cell proliferation, migration, and differentiation during skin wound healing.[9] Cryopreserved *in vitro* cultured epidermal allografts produce growth factors that stimulate the proliferation of the patient's own cells, the production of new cells and release growth factors continuously, through the aforementioned growth factors. A disadvantage of non-cultured skin allografts is that they can cause a rejection reaction by the host, due to the presence of allogeneic major histocompatibility class II antigens, expressed in the epidermis only by Langerhans cells.[10] It was found in Morehen's study that when the epidermis is cultured, it loses the Langerhans cells between the seventh and tenth day of culture, so it will not be able to express the main histocompatibility class II antigens,[11] thus obtaining adequate results in healing.

Case description

74-year-old male with third-degree burns due to immersion in high-density liquid over 41% of the total body surface. The patient was admitted to the hospital the same day of the accident, with lesions located on the thorax, face and back (Figure 1 & 2). The patient underwent surgery for debridement of devitalized tissue of the affected areas and they were covered with cryopreserved allografts of cultured epidermis 1:3 in anterior thorax - face and 1:6 in abdomen (Figure 3), the cultured epidermis allografts presented complete epithelialization at 10 days, ten days after the last surgical session, the grafted area had 88% epithelialization. Finally, the patient underwent a final surgical procedure to graft the residual areas.

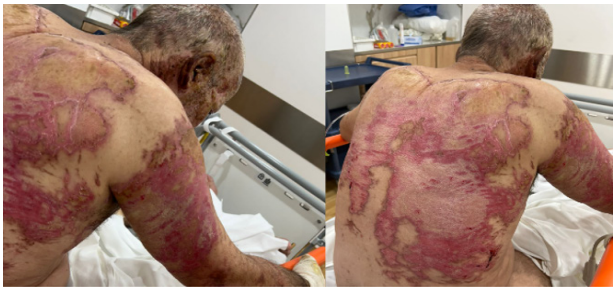

Figure 1 Second degree face burns affecting back and thorax.

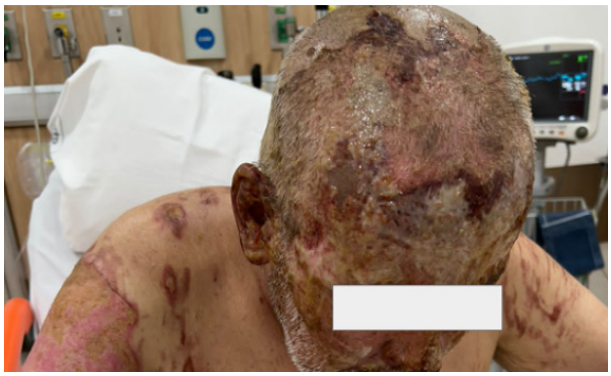

Figure 2 Second degree face burns affecting face.

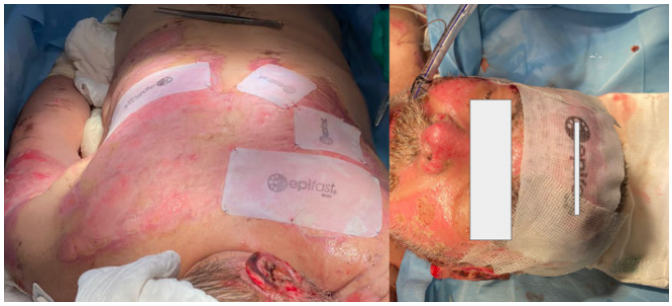

Figure 3 Debridement of devitalized tissue from the affected areas and covered with cyropreserved allografts of cultured epidermis.

Discussion

Since 1981, cultured skin autografts have been widely used as part of the therapy of extensively burned patients in more than 80 burn units worldwide.[1] The characteristics of the skin, is that it is an organ embryologically comes from two distinct layers, the epidermis, is an avascular structure and is the most superficial layer of the skin, composed of 5 strata, going from the depth to the surface we find, the stratum basale, stratum spinosum, stratum granulosum, stratum lucidum and stratum corneum. The dermis is the largest fraction of the skin, intended to give elasticity and protection, has two layers which are reticular and papillary dermis, both layers have collagen fibers of type l and lll, and finally the hypodermis or also called subcutaneous cellular tissue is composed of adipose cells,[3,4] The depth of the burns depends on the temperature, which if higher than 70 ºC causes a third degree burn in one second, also on the time of contact with the skin and the time of the first attention, so that scald burns are usually superficial and not extensive, while the lesions produced by immersion are deep and very extensive.[12,13] The pathophysiology of a burn is mainly due to the denaturation of proteins and cellular metabolic processes, which results in ischemia and necrosis. In 1953 Jackson described three concentric zones in a burn, the coagulation zone, the stasis zone, which comprises a period of 24 to 48 hours in this zone the damaged tissues are found with edema and hypoperfusion and the hyperemia zone which lasts from 7 to 10 days. Within the initial management of treating a burn patient is the proper use of solutions, analgesia and wound protection with cold sterile gauze or dressings, early surgery with the removal of devitalized tissue and skin coverage of the affected areas are the most important factors, since the removal of devitalized tissue eliminates the substrate where infections occur and the release of chemical mediators, thus reducing the systemic inflammatory response and preventing the deepening of the lesions, at the same time it is recommended the application of human epidermis allografts cultivated *in vitro* accelerates the re-epithelialization of superficial and deep second degree burn injuries.[13,14]

Conclusion

In these cases, cultured skin allografts are replaced by migration of autologous keratinocytes from wound edges and remnant epithelial elements, besides being an effective biological dressing, they are immediately available and have a lower cost compared to cultured autografts. This strategy helps epidermal regeneration and also reduces complications, number of surgeries and hospital stay.

Acknowledgments

None.

Conflicts of interest

The authors declare that there are no conflicts of interest.

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