Original Article

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Management of Chemical Burns: Our Experience

Debolina Pal[1], Ravi kumar Chitoria[2], Neljo Thomas[3]

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Abstract

Chemicals can harm cells directly by various mechanisms and cause an exothermic reaction which can cause thermal burns in addition to chemical burns. Acids and alkali are the two broad categories of chemicals that can cause burns and alkali burns have greater depth of injury than acids. Copious irrigation of chemical burns is the most critical step in management at presentation followed by which various novel methods could be implemented for enhanced healing of chemical burns such as topical wound management including sucralfate cream application, platelet rich plasma application, low level laser therapy, etc. in addition to usual management strategies used in burns patients.

Keywords: Chemical burns; LLLT; APRP; Platelet rich plasma; Sucralfate; Split thickness; Skin graft.

INTRODUCTION

Chemical burns account for only a small percentage of burn injuries, yet they account for up to a third of all burn related deaths.[1] When a chemical comes into touch with the skin, it causes a chemical burn. Chemicals can harm cells directly by a variety of methods, including oxidation, reduction, denaturation, and dehydration, depending on the chemical. Exothermic reactions (chemical reactions that release energy by light or heat) are common, which can result in thermal harm in addition to chemical injury.[2] Chemicals can broadly be classified as acid, alkali, organic, and inorganic compounds. Acids act by denaturation and coagulation of proteins. Alkaline burns cause deeper burns than acids.[3] The clinical appearance of a chemical burn is determined by the substance, its concentration, and the length of contact. A chemical burn may appear similar to a thermal burn at first, with erythema, discomfort, with or without formation of bullae. Chemical burns can also develop a hard, dry eschar, sometimes known as a scab, which darkens the area. Symptoms might be immediate or delayed, depending on the chemical, and determining the extent of the injury can be challenging.[4] Key to management of chemical injuries is to stop the burning process with copious irrigation, and depending on the depth of the injury, the normal burn management of topical medications versus grafting is used. Neutralizing agents are not recommended since they can cause more harm due to exothermic reactions.[1] In this article we have described the variousmethods that were used for management in a patient with chemical burns in a tertiary care center.

Author Affiliation: [1]Junior Resident, [2]Professor & Registrar (Academic) Head of IT Wing and Telemedicine, Department of Plastic Surgery & Telemedicine, [3]Senior Resident, Department of Plastic Surgery, Jawaharlal Institute of Postgraduate Medical Education and Research Pondicherry 605006, India.

Corresponding Author: Ravi Kumar Chittoria, Professor, Department of Plastic Surgery, Jawaharlal Institute of Postgraduate Medical Education and Research Pondicherry 605006, India.

E-mail: drchittoria@yahoo.com

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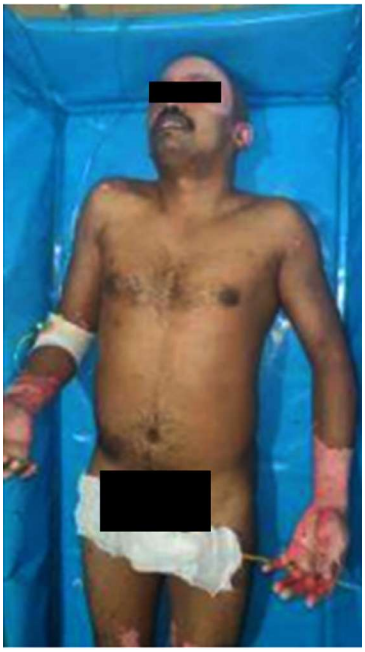
MATERIALS AND METHODS

This study was conducted in the department of Plastic Surgery at a tertiary care centre. The details of the patient are as follows:

A 45 year old gentleman, with no known co-morbidities, a manual labourer at a pharmaceutical company, presented with alleged history of blast injury at a pharmaceutical factory and sustained chemical/thermal burns on 5th June, 2021 at 3:15 pm at Pondicherry, India.

He had sustained second degree burns (superficial and deep partial thickness) over face, bilateral hands, left thigh and bilateral feet which comprised 20 % burns (fig.1). Initial management included copious irrigation of raw areas using normal saline, dressing of the raw areas. On 9th June, 2021 he underwent wound debridement under general anesthesia along with additional procedures such as sucralfate application (fig. 2) and low level laser therapy (fig. 4). He also underwent autologous platelet rich plasma application (fig. 3) which was obtained by standard double centrifugation protocol using 10ml of patient`s blood which was used in 3 sittings. Split thickness skin grafting was done after wound bed preparation (fig. 5). At discharge, the raw areas healed with no significant remnant raw areas (fig. 6).



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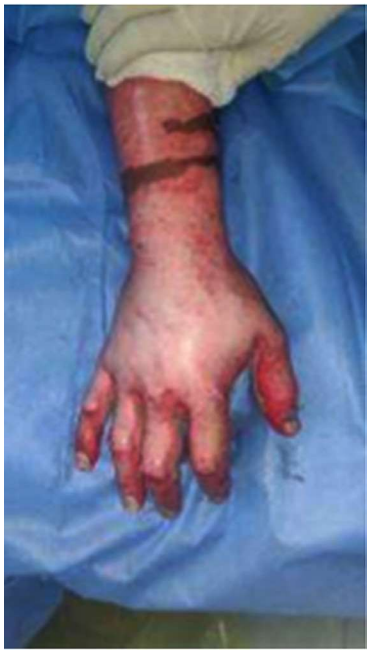

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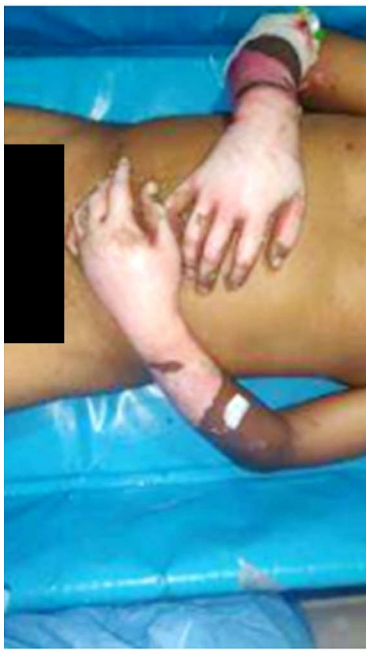

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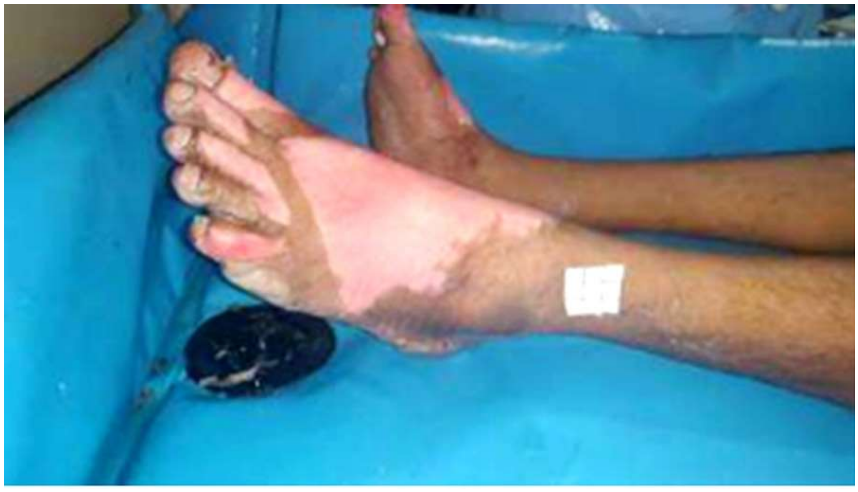

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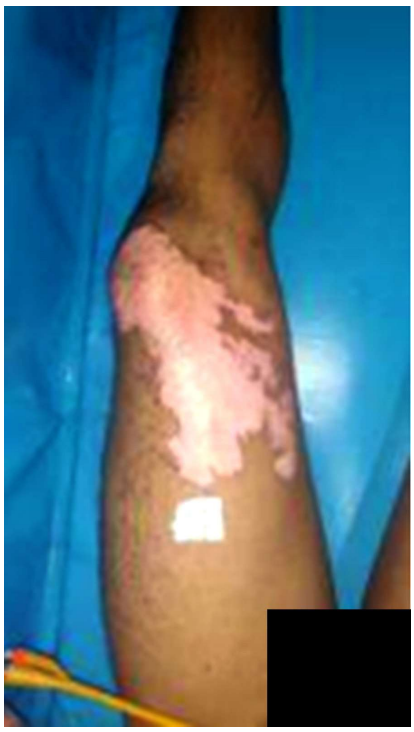
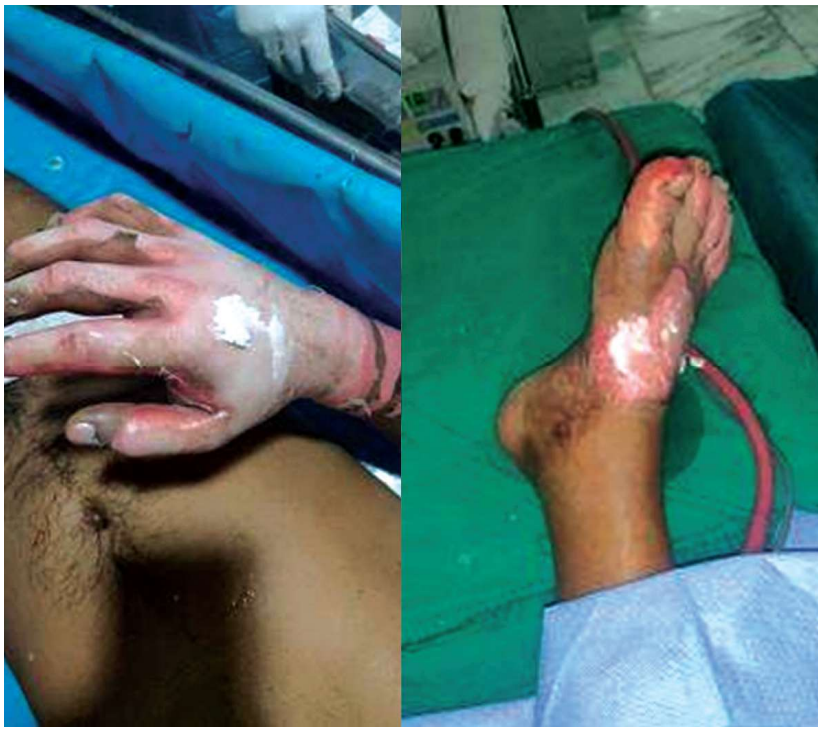


1(E)
Fig. 1: raw areas at presentation



1(E)
Fig. 2: Sucralfate cream application

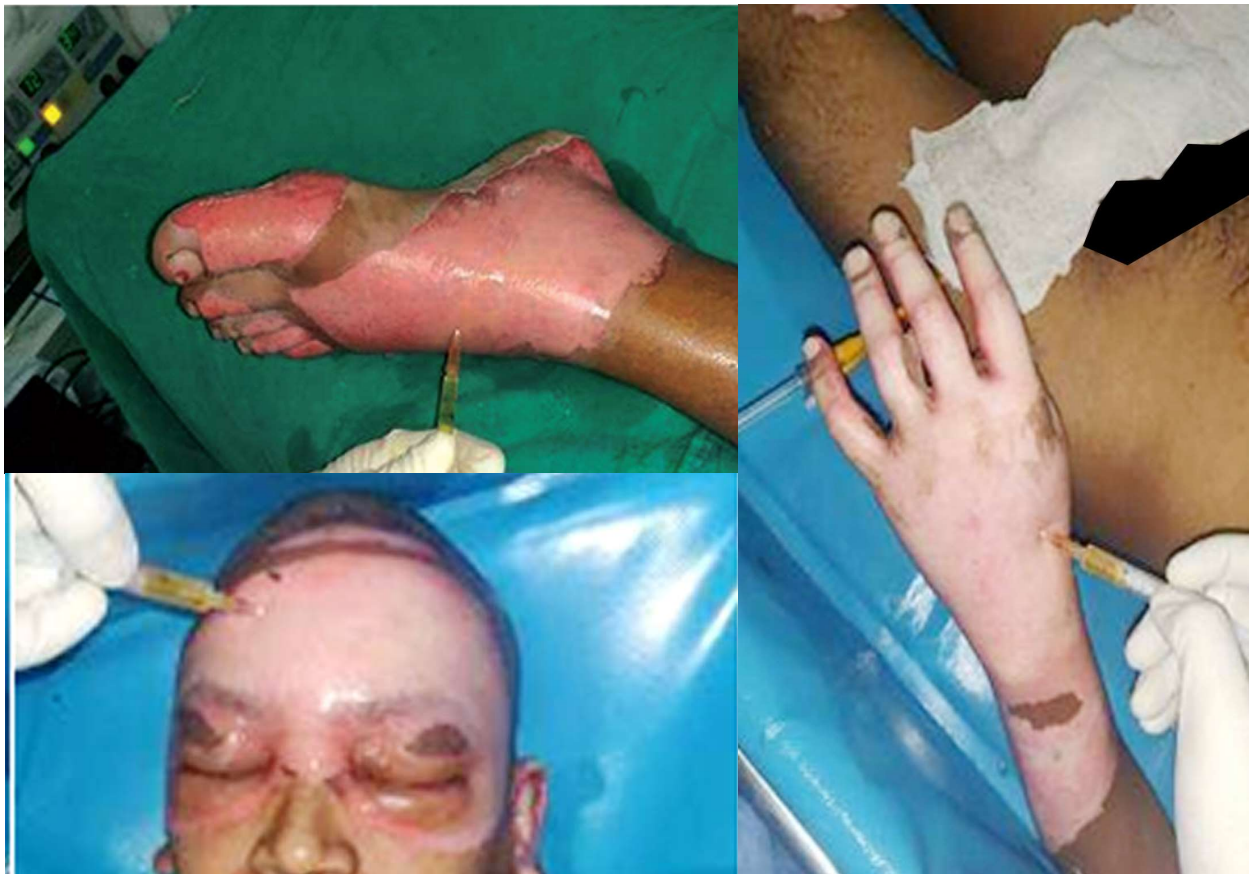


Fig. 3: Autologous platelet rich plasma application

Fig. 4: LLLT (Low level laser therapy)

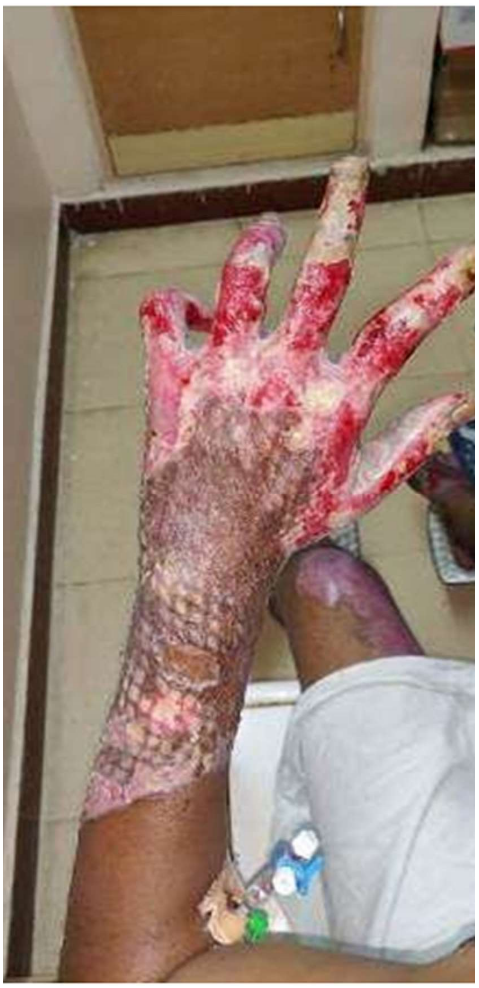


Fig. 5: split skin grafting

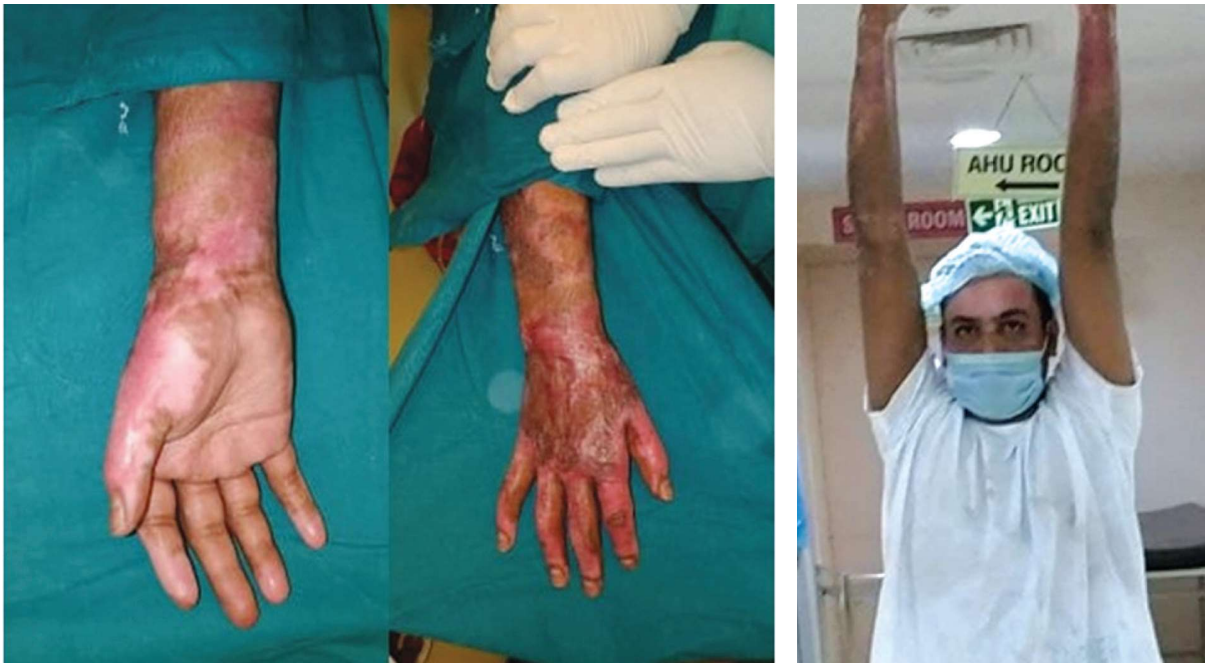


Fig. 6: At discharge Healed wound with no raw area

DISCUSSION

Neoangiogenesis, stimulation of the local immune response, and the presence of growth factors such as epidermal growth factor (eGF), transforming growth factor (TGF), and basic fibroblast growth factor all play a role in wound healing (bFGF). Sucralfate works by boosting the levels of both bFGF and eGF in the injured tissue. It also prevents inflammation and has a soothing effect by inhibiting the release of interleukin-2, interferon gamma, and cytokines from burnt injured skin cells.[6] Topical sucralfate has been reported to promote wound healing and reduce discomfort in the treatment of resistant perineal and peristomal excoriation, stomatitis, decubitus ulcers, and radiation proctitis.[5] The role of topical sucralfate in the treatment of burn injuries was investigated in a study which showed that sucralfate increased the rate of epithelialization and lead to an earlier appearance of healthy granulation tissue in second and third degree burns, respectively. [6]

LLLT or low level laser therapy has been tried for wound management. The photobiomodulation effect of LLLT on tissue is photochemical and photomechanical, with no photothermal effect.[7] A number of different modes of action have been proposed which include activation/deactivation of mitochondrial enzymes, transformation of photonic energy to chemical energy which leads to ATP production, increase in DNA replication which in turn increases neurotransmission and various physiological changes result from a cascade of metabolic consequences, resulting in better tissue regeneration, faster resolution of the inflammatory response, and pain reduction.[7,8]

Platelet rich plasma (PRP) is a new adjunct that is increasingly being used to treat soft tissue defects in order to speed up healing of chronic non-healing wounds.[10-13] Platelet rich plasma is made by combining centrifuged blood with thrombin and calcium chloride to form a viscous coagulum gel that is rich in growth factors released by activated platelets[11,12,14] After preparation, platelet rich plasma is stable for around 8 hours.[11,12] TGF-b and PDGF are the most essential growth factors in PRP. They have an impact on every stage of wound healing because they stimulate cell proliferation and differentiation. PRP also enhances tissue incorporation of biological mesh.[15]

Early burn wound excision and wound closure with immediate autologous skin or skin substitutes, has lowered the mortality rate of severe burns and improved survival chances by minimising infections and metabolic problems. Split thickness skin grafting restores epidermal function, avoids further hypothermia, protein and fluid losses, and infection risk, and integrates itself into the healing process, remains the primary permanent source of burn wound closure.[9]

CONCLUSION

Our experience in management of chemical burns has showed to have positive results with usage of methods such as sucralfate cream application, platelet rich plasma application, low level laser therapy, and split thickness skin graft. There was significant improvement noted with the above methods in healing of raw areas. However, to strengthen the concept, multicentric experiments with a larger sample size are required.

REFERENCES

1. Williams FN, Lee JO (2018) Chemical burns. In: Herndon DN (Hrsg) Total burn care, 5. Aufl. Elsevier, S 408–413.
2. Yin S. Chemical and Common Burns in Children. Clinical Pediatrics. 2017;56(5_suppl):8S-12S. doi:10.1177/0009922817706975.
3. Richards A, Dafydd H. (2015) Burns. In: Key Notes on Plastic Surgery. Chichester, UK: John Wiley & Sons, Ltd; 521-522.
4. Sawhney, CP, Kaushish, R. Acid and alkali burns: considerations in management. Burns. 1989;15:132-134.
5. Hayashi A, Lau H, Gillis D. Topical sucralfate: effective therapy for the management of resistant peristomal and perineal excoriation. J Pediatr Surg. 1991;26:1279–1281.
6. Banati A, Chowdhury SR, Mazumder S. Topical use of sucralfate cream in second and third degree burns. Burns. 2001;27:465–469.
7. Hawkins D, Houreld N, Abrahamse H. Low level laser therapy (LLLT) as an effective therapeutic modality for delayed wound healing. Ann N Y Acad Sci 2005;1056:486-93.
8. Farivar S, Malekshahabi T, Shiari R. Biological effects of low level laser therapy. J Lasers Med

Sci 2014;5:58-62.

9. Nguyen TT, Gilpin DA, Meyer NA, Herndon DN. Current treatment of severely burned patients. Ann Surg 1996;223:14–25.
10. Iesari S, Lai Q, Rughetti A et al: Infected nonhealing wound in a kidney transplant recipient: Successful treatment with topical homologuos platelet rich gel. Exp Clin Transplant, 2015 [Epub ahead of print].
11. Pallua N, Wolter T, Markowicz M: Platelet-rich plasma in burns. Burns, 2010; 36(1): 4–8.
12. Yol S, Tekin A, Yilmaz H et al: Effects of platelet rich plasma on colonic anastomosis. J Surg Res, 2008; 146(2): 190–94.
13. Kazakos K, Lyras DN, Verettas D et al: The use of autologous PRP gel as an aid in the management of acute trauma wounds. Injury, 2009; 40(8): 801–5.
14. Carter CA, Jolly DG, Worden CE Sr et al: Platelet-rich plasma gel promotes differentiation and regeneration during equine wound healing. Exp Mol Pathol, 2003; 74(3): 244–55