

CHEMICAL BURNS FROM ASSAULT: A REVIEW OF SEVEN CASES SEEN IN A NIGERIAN TERTIARY INSTITUTION

Tahir C.,* Ibrahim B.M., Terna-Yawe E.H.

Plastic and Reconstructive Surgery Unit, Department of Surgery, College of Medical Sciences, University of Maiduguri Teaching Hospital, Maiduguri, Nigeria

SUMMARY. Chemical burns represent a major challenge for reconstructive surgeons. They are caused by exposure to acids, alkalis or other corrosive substances which result in various degrees of injury. This report highlights the challenges faced in managing such patients in a Nigerian teaching hospital. The medical records of seven patients (four females and three males) treated for chemical burns injury from January 2001 to December 2010 were retrospectively reviewed. All patients were younger than 30, with a mean age of 23.3. Most of them (85.7%) had sustained full thickness burns ranging from 8% to 33% of their body surface area. All cases were result of assaults. The male to female ratio was 1:1.3, and the average duration of hospital stay was 7.5 months. The face was affected in all patients. Patients presented with multiple deformities, like ectropion of eyelids, keratopathies, blindness, nasal deformities, microstomia, loss or deformities of the pinna, mentosternal contractures, and severe scarring of the face. Twenty-nine surgical procedures were performed, which included nasal and lip reconstruction, ectropion release, commissuroplasty, contracture release, and wound resurfacing. Management of chemical burns, especially in a developing country lacking specialised burn centres with appropriate facilities, is challenging. Prevention through public awareness campaigns, legislation for control of corrosive substances, and severe punishment for perpetrators of assaults using these substances will go a long way in reducing the incidence of chemical burns.

Keywords: chemical, burn, assault

Introduction

Chemical burns are caused by exposure to acids, alkalis or other corrosive substances which result in various degrees of injury. In developing countries, chemical assault injuries are more prevalent than work-related chemical injuries. The head and neck region is the commonest part of the body affected in the victims of these assaults.¹ The variety of deformities that may follow this type of injury is kaleidosopic. The severe cosmetic disfigurement and multitude of functional losses like visual impairment, airway obstruction, feeding difficulties and psychological trauma will require a long series of surgical corrections and rehabilitation. Chemical burns, especially on the face, represent the most demanding and complex challenge for the reconstructive surgeon. The challenges faced by plastic surgeons in the management of such patients in developing countries is compounded by paucity of facilities, collaborating skilled manpower, late presentation and poor economic status of patients.

Patients and methods

The medical records of seven patients (four females and three males) with chemical burns managed at the University of Maiduguri Teaching Hospital, Borno State, Nigeria, from January 2001 to December 2010 were retrospectively reviewed. Information was extracted on patient demographics, total body surface area (TBSA) burned (% head involved), duration of injury before presentation, mode of injury, nature of chemical, deformities sustained, procedures performed, and challenges faced.

Results

All patients were younger than 30 (mean age 23.3), and the male to female ratio was 1:1.3 (*Table I*). Eighty-five per cent of patients had sustained full thickness burns ranging from 8% to 33% of their body surface area. All cases were due to assaults; love affair problems were the cause in 5 patients while robbery attacks were the cause

* Corresponding author: Dr C. Tahir, Department of Surgery, University of Maiduguri, PO Box 4088, Maiduguri, Nigeria 234 8034235784. E-mail: faridhtahir28@yahoo.com

Table I - Demographics, percentage surface area burnt, duration before presentation, mode of injury and type of chemical used

Name	Age (yr)	Sex	Occupation	% TBSA (Head)	Duration before presentation	Reason for chemical attack	Type of chemical
Case 1	22	F	Student	25 (5)	2 weeks	love affair	unknown
Case 2	27	M	Commercial Motorcyclist	33 (6)	12 months	robbery	unknown
Case 3	22	M	Driver	8 (5)	30 minutes	robbery	unknown
Case 4	18	F	Student	24 (2)	30 minutes	love affair	unknown
Case 5	22	F	Student	12 (1)	2 months	love affair	unknown
Case 6	25	M	Businessman	15 (4)	1 hour	love affair	unknown
Case 7	20	F	Housewife	20 (5)	2 months	love affair	unknown

Table II - Deformity sustained and surgery performed

Case	Deformity	Procedures	No. of surgeries performed
Case 1	Ectropion both upper and lower eyelids Loss of right pinna Nasal destruction with stenosis Ectropion both upper and lower lips Microstomia Mentosternal contracture	Escharotomy + Debridement STSG Eyelid ectropion release + FTSG Mentosternal contracture release 2x Commissuroplasty Upper and lower lip reconstruction Staged nasal reconstruction Sponsored for further treatment abroad	11
Case 2	Bilateral blindness Destroyed eyebrows and lids Obliteration of the nasal aperture Upper lip ectropion	Rhinoplasty x 2 Release of contracture x 2	4
Case 3	Right eye lids ectropion Bilateral corneal scarring Right nasal deformity Contracture of the right oral commissure Mentosternal contracture	Debridement, STSG Ectropion release upper lid Ectropion release lower lid + Z-plasty of Rx commissural contracture	5
Case 4	Wound infection Hypertrophic scar	Debridement STSG	1
Case 5	Lower lip ectropion Chronic ulcer Mentosternal contracture	Wound excision + contracture release + STSG Ectropion release	3
Case 6	Spontaneous epithelisation	–	–
Case 7	Exposed calvarium Bilateral blindness Destroyed upper and lower eyelids Nasal deformity Loss of right pinna Mentosternal contracture	Debridement + trepanation of calvarium STSG Mentosternal contracture release 2x	5

in the remaining 2 patients. Only 3 patients presented immediately after injury, the rest presented weeks to months after injury as shown in *Table I*. Five patients had ectropion of the eyelids with eye involvement and variable visual loss, two had bilateral blindness (*Table II*). Nasal deformity was seen in four patients, with pinna loss in 2 patients. Commissural contractures and microstomia were ob-

served in 3 patients; lip ectropion in 2 patients. One patient presented with full thickness burns of the forehead with calvarial exposure (Case 7, pictures A & B).

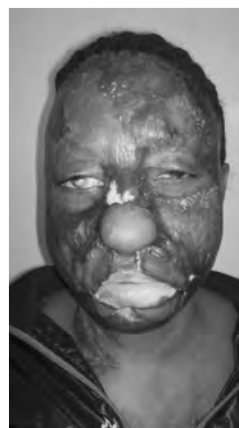
Twenty-nine surgical procedures were done which included facial resurfacing with split thickness skin graft in 6 patients, 4 ectropion release with full thickness skin graft (FTSG), 1 commissuroplasty with skin grafting, one bi-



Case 1A - At presentation.



Case 1B - After skin grafting and ectropion release.



Case 1C - After commissuroplasty, lip and nasal reconstruction.



Case 1D - After commissuroplasty, lip and nasal reconstruction.



Case 7A - At presentation.



Case 7B - At presentation.



Case 7C - After multiple skin grafting and contracture release.



Case 7D - After multiple skin grafting and contracture release.

lateral commissuroplasty with triangular scar excision and mucosal V-Y advancement flaps (Case 1, picture D) and mentosternal contracture release. One patient had multistage nasal reconstruction with Tagliacozzi flap, and one had calvarial trephinations and subsequent skin grafting for exposed calvarium.

Discussion

Chemical agents cause burns by various mechanisms; tissue destruction caused by acid results in coagulative necrosis while alkalis cause burns by liquefactive necrosis. Tissue damage may continue for several minutes to hours after exposure. Since severity depends on the nature, concentration, volume and duration of contact with the chemical agent, it is difficult to assess the severity of injury immediately after exposure.² The use of these agents of destruction for assault is on the increase in some African and Asian countries, with incidence in Uganda as high as 17% of all burn patients.^{3,5} The nature of chemicals used in assaults is not usually known as shown in our series: assailants are typically at large. The face is the primary target area in assaults with the intent to disfigure or incapacitate their victims. In our environment, the reasons for assault were love revenges and robbery. This may explain the slight female preponderance in this series which is similar to other series reported from Bangladesh and Taiwan.^{6,7}

The face provides identity to an individual and features three-dimensional structures that are difficult to reconstruct. Also, scars and deformities are difficult to conceal in this region. Blacks and Orientals scar badly after chemical injuries because of their thick oily skin.⁸ Sixty per cent of our patients present with severe facial mutilation that requires a series of surgeries which are similar to those reported by Yeong et al. in Seattle USA.⁹ These patients come to the plastic surgeon with high hopes and expectations. It is advisable to let them know the limitations of facial reconstruction so as to minimise post-operative discontent.¹⁰

Fifty percent of our patients presented 2 weeks after with significant scars and deformities. Anaesthesia for these patients remains a great challenge. Limited access to airways may result from mentosternal contractures, nasal stenosis, and microstomia. Local anaesthesia was used to release mentosternal contracture in case 3, and bilateral commissuroplasties in case 1 which was suboptimal. The absence of a fiberoptic laryngoscope led to the use of a laryngeal mask airway (LMA) for releasing mentosternal contracture and ectropion in case 1. The frequent turning of the head during the procedure resulted in inadvertent extubation and the procedure was abandoned. Anaesthetic complications are common in these patients because of the long duration of the anaesthesia and multiple surgeries performed at short time intervals.¹¹

Early excision and skin grafting is the best approach in full thickness burns, this is both blood product and donor site intensive. In our cases, initial conservative management for 3 to 4 weeks before skin grafting was done partly because of late presentation, infected wound and limited blood product supply, but the high vascularity of the face leads to profound inflammation and early granulation tissue formation and fibroplasia after 2 weeks of injury.¹² In facial resurfacing, full thickness skin grafting is preferred over split thickness graft because of better aesthetic results. Tissue expanders can be used to expand donor site for full thickness skin graft which will be available for covering a large surface area with very minimal donor site morbidity.¹³ Tissue expanders are scarcely available in our environment, and when available they are too expensive for our patients.

Nasal deformity was seen in case 1, which required grafting of more than 75% of the face. Because of the paucity of local tissue and lack of microvascular setup for the use of free flap reconstruction, Tagliacozzi multistage nasal reconstruction was done. This patient would have benefited from total face reconstruction with one expanded flap as described by Sakurai et al.¹⁴ Chemical injury to the face is potentially blinding, even more so with alkalis.¹⁵ Four patients had involvement of the eye with variable degree of loss of vision. Adepoju et al. found that in northern Nigeria, the major cause of chemical injury to the eye was work-related but blindness and disability occur more in cases of chemical assault.¹⁶

Chemical assaults are a major economic burden on otherwise overwhelmed health services in developing countries.¹⁷ Until 12 years ago (year 2000), only two plastic surgery units existed in the northern half of Nigeria, with only two plastic surgeons catering for over 70 million people. In early 2001, our unit was established, catering for over 30 million people in the north-eastern part of the country, some parts of Cameroun and the Republic of Chad.¹⁸ Over the years, many more units have been established. However, there is no purpose-built burn centre in the country as of today, therefore burn cases are also managed in these units. In addition, only two centres, one in the south west and one in the south east, occasionally perform microvascular free tissue transfer, so skin grafting, local and regional flaps and staged distant flap transfer, and tissue expanders are occasionally used. In our setting, patients bear most of or all costs of care and most of them have severe financial constraints. The paucity of funds for multiple surgeries makes early intervention difficult to be achieved. Some of these patients manifest with different psychological trauma. Because of poor psychosocial support system, their psychological needs are often unmet. This leads to development of chronic pain, anxiety and frequent emotional breakdown, social isolation, and suicidal tendencies.

Conclusion

Management of chemical burns in black people, especially in a developing country like Nigeria - where there are no dedicated and well-equipped burns centres - can be challenging. However, prevention through public aware-

ness campaigns, legislation to control the use of corrosive substances and severe punishment for perpetrators of chemical assaults will reduce the incidence of chemical burns. Improvements in infrastructural facilities, skilled manpower development and subsidising the cost of treatment for these patients will reduce the challenges faced.

RÉSUMÉ. Les brûlures chimiques représentent un défi majeur pour les chirurgiens de reconstruction. Les brûlures chimiques sont causées par l'exposition aux acides, aux alcalis ou à d'autres substances corrosives qui aboutissent à des degrés divers de lésion. Les Auteurs mettent en évidence les difficultés rencontrées dans la gestion de ces patients dans un hôpital universitaire nigérian. Les dossiers médicaux des sept patients (quatre femmes et trois hommes) traités pour des brûlures chimiques dans la période janvier 2001/décembre 2010 ont été revus rétrospectivement. Tous les patients avaient moins de 30 ans (âge moyen, 23,3 ans). La plupart d'entre eux (85,7%) avaient subi des brûlures au troisième degré allant de 8% à 33% de leur surface corporelle. Dans tous les cas il s'agissait d'agressions. Le ratio homme-femme était de 1:1,3, et la durée moyenne d'hospitalisation était de 7,5 mois. Le visage a été la partie du corps la plus gravement atteinte chez tous les patients, qui présentaient des malformations multiples, comme ectropion des paupières, kératopathies, cécité, malformations nasales, microstomie, perte ou malformations du pavillon, contractures mentosternales, graves cicatrices au visage. Vingt-neuf procédures chirurgicales ont été réalisées, qui comprenaient la reconstruction nasale et des lèvres, la libération de l'ectropion, la commissuroplastie, la libération des contractures, et le resurfaçage de la plaie. La gestion des brûlures chimiques, en particulier dans un pays en développement qui ne possède aucun centre spécialisé de brûlures doué d'installations appropriées, est un défi. Pour réduire la fréquence des brûlures chimiques, il faut intensifier la prévention par des campagnes de sensibilisation du public, par la législation pour le contrôle des substances corrosives, et par de graves sanctions pour les auteurs d'agressions qui utilisent ces substances.

Mots-clés: chimique, brûlure, agression

BIBLIOGRAPHY

1. Kardnadasa KP, Perera C, Kanagaratnum V et al.: Burns due to acid assaults in Sri Lanka. *J Burn Care Res*, 31: 781-5, 2010.
2. Sanford AP, Herndon DN: Chemical burns. In Herndon DN, "Total Burns Care" (2nd ed.), 475-9, WB Saunders, 2002.
3. Olaitan PB, Jiburum BC: Chemical injuries from assaults: An increasing trend in a developing country. *Indian J Plast Surg*, 41: 20-23, 2008.
4. Young RC, Ho WS, Ying SY et al.: Chemical assaults in Hong Kong: a 10 year review. *Burns*, 28: 651-3, 2002.
5. Asaria J, Kobusingye OC, Khingi BA et al.: Acid burns from personal assaults in Uganda: 78-8, 2004.
6. Shahidul B, Mahmud CI: Acid burns in Bangladesh. *Ann Burns Disasters*, 14: 115-8, 2001.
7. Mannan A, Ghani S, Clarke A et al.: Cases of chemical assault worldwide: A literature review. *Burns*, 33: 149-54, 2007.
8. Joethy J, Tan BK: Multi-stage approach to reconstruction of a burnt Asian face. *Indian J Plast Surg*, 44: 142-6, 2011.
9. Yeong EK, Chen MT, Mann R et al.: Facial mutilation after assault with chemicals. 15 cases and literature review. *J Burn Care Rehabil*, 18: 234-7, 1997.
10. Funke M, Spies M, Vogt PM: Evaluation of the burned face. In: McCauley RL (eds), "Functional and Aesthetic Reconstruction of Burned Patients", 205-16, Taylor & Francis, 2005.
11. Woodson LC, Sherwood ER, Cortiella J et al.: Anaesthesia for reconstructive burn surgery. In: McCauley RL (eds), "Functional and Aesthetic Reconstruction of Burned Patients", 85-100, Taylor & Francis, 2005.
12. Blome-Eberwein S: Facial burns. *Plast Surg Pract*, Jan. 2006, www.plasticsurgerypractice.com. Accessed 2 Oct. 2011.
13. Basha H: Full thickness skin graft for burned face. *Egypt J Plast Reconstr*, 29: 1-4, 2005.
14. Sakurai H, Takeuchi M, Fujiwara O et al.: Total face reconstruction with one expanded free flap. *Surg Technol Int*, 14: 329-33, 2005.
15. Khaw PT, Shah P, Elkington AR: Injury to the eyes. *BMJ*, 328 (7430): 36-8, 2004.
16. Adepoju FG, Adeboye A, Adigun IA: Chemical eye injuries. Presentation and management difficulties. *Ann Afr Med*, 6: 7-11, 2007.
17. Milton R, Matheu L, Hall AH et al.: Chemical assault and skin/eye burns: Two representative cases, report from acid survivors foundation and literature review. *Burns*, 36: 924-32, 2010.
18. Tahir C, Bakari AA: Setting up a plastic surgery Unit in a Nigerian teaching hospital: The Maiduguri experience. *Nigerian J Plast Surg*, 2: 30-3, 2006.

This paper was accepted on 5 December 2011.