**CURRENT SCENARIO IN CHEMICAL BURNS IN A DEVELOPING COUNTRY: CHENNAI, INDIA**

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**SUMMARY.** Chemical burns are not uncommon in India. Both accidental and non-accidental chemical burns are encountered in our setting. In the paediatric age group, chemical burns are mainly accidental. Analysis of chemical burn admissions to the Burn Units of a medical college hospital, and to an exclusively tertiary care children’s hospital in Chennai, India, from 2001 to 2010 is described. A total number of 75 adults and 38 children are included in the study. Detailed analysis of age, sex, percentage of burn total body surface area (TBSA %), causative agents, aetiology (accidental or non-accidental), treatment instituted, mortality, and outcome are reported.

**Keywords:** chemical burns, adults, children, outcome

### Introduction

Modern society uses several chemical products. These are manufactured and utilized by industries. They are also used in the cottage industry. There are about 600,000 chemical substances identified today and about 95,000 have been marketed. Some are also used for medicinal purposes. Industries manufacture acids, alkalis, neutral substances, and by-products of petroleum. Common chemicals used in daily life are fertilizers, pesticides, cleaning products, disinfectants, paints, solvents and building materials like cement.

In 2006, a review of 24 studies has defined the major aetiology of such burns as either secondary to an assault or accidental. Low- and middle-income countries, particularly in south-east Asia, have had an increasing incidence in assaults.

Chemical burns can be caused by acids, alkalis, neutral substances like urea, organic substances and particularly by petroleum by-products and the combination of some chemicals that can cause the most severe types of chemical burns.

In large chemical industries where chemicals are manufactured it is mandatory to specify safety measures that must be implemented and the ideal neutralizing agent. Unfortunately, these rules are sometimes not respected.

In the case of chemicals in household products, burns are produced because of the hazardous nature of the product and the ignorance of handling precautions. Sometimes information is not mentioned on the container or cartons. Children are not aware of the chemical nature of materials and often misuse them.

**Classification of chemicals that caused burns in this study**

<table>
<thead>
<tr>
<th>Acid/Alkali/Substance</th>
<th>Acid/Alkali/Substance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acetic Acid (Vinegar)</td>
<td>Ammonia</td>
</tr>
<tr>
<td>Formic Acid</td>
<td>Caustic Soda</td>
</tr>
<tr>
<td>Hydrochloric Acid</td>
<td>Cement</td>
</tr>
<tr>
<td>Phosphoric Acid</td>
<td>Soda Lime</td>
</tr>
<tr>
<td>Sulphuric Acid</td>
<td></td>
</tr>
</tbody>
</table>

**Suльphuric acid burns** related to industry often occur whenever containers explode with a subsequent leakage occurring.

**Hydrochloric acid burns** occur when the acid is spilled, often when plumbers clean toilets.
In chemical laboratories of institutions, students accidentally sustain chemical burns while experimenting with the products.

Petroleum by-product burns are seen in petroleum industries.

Pesticide and urea burns have been encountered in the agricultural domains.

People die quickly of hydrogen sulphide burns due to rapid desaturation.

Lysol burns occur in the cottage industry where Lysol is bottled is undertaken.

In cases of child abuse a caustic soda stick has been used to injure a child’s cheek. Acid burns occur also by acids thrown on the face of young girls as part of revenge for non compliance to sexual advances.

The pathophysiology of chemical burns is extremely varied. Acids produce coagulation necrosis by denaturing proteins forming a thick eschar which limits further penetration of the acid. Alkalis also cause protein denaturation and saponification of fats, typically producing liquefaction necrosis which does not limit tissue penetration hence resulting in a more severe injury. Burn severity is related to a number of factors, including the agent’s pH, duration of contact, the concentration, and its physical form. Industry-related chemical burns in the paediatric age group are surprising. The Child Labour’s Act preventing young children from getting employed in factories was passed in India only in 1996, but some are still working illegally.

The nature of the scar depends on the site and type of chemical causing the burn. Acid thrown on the face results in more severe scarring and disfigurement than alkalis or other chemical substances. Ocular burns usually lead to opacification of the cornea resulting in loss of vision. Ingestion of acid in cases of attempted suicide leads to long strictures of the oesophagus often requiring bypass surgeries and major oesophageal reconstruction.

Materials and methods

This paper reports chemical burn admissions to the Burn Unit of a medical college hospital and an exclusively tertiary care children’s hospital in Chennai, India, from 2001 to 2010. A total number of 75 adults and 38 children are included in the study.

Although the incidence of burns in both the adult and paediatric population is not high, each chemical burn had a different aetiology, manifestation, causative chemical and outcome. Every case is a lesson in itself.

Analysis of chemical burns

1. Age group

In adults, incidence is high, perhaps due to accidents at work place particularly in the age group of 19-30. As age increases, the incidence decreases and becomes negligible above 50 years of age. In the paediatric age group, only two cases below two years of age were seen. With advancing age, the incidence becomes higher and reaches its peak between 13-18 years of age. In all groups above two years of age, female chemical burns are reported to be higher than male burns (Charts 1, 2).
2. Nature of burns & TBSA

When the nature of burns was analysed in the adult group, accidents were found to be the main cause, especially in young adults. Non-accidental aetiology was very low.

In the paediatric age group, accidental chemical burns are also most commonly non-accidental, namely: abuse, homicide, and suicide, constituting a higher percentage in the age group 13 – 18 years among females (Chart 3).

3. Causative Agent

Special types of chemical burns encountered in this study (Fig. 1):

- Bitumen: Child accidentally touched molten tar on the roadside – Hand Burn.
- Caustic Soda: Child accidentally put his leg in a container of caustic soda that the mother was working with.
- Turpentine: Child playing with a turpentine container not realizing it was not empty and spilled it on her body accidentally.
- Lysol: Bottling Lysol is a cottage industry. The patient dropped a bottle containing full Lysol that splashed on his face.
- Cement Burns: Cement is an alkali in a liquid state during manufacturing that causes immediate desiccating of the skin on contact.
- Child abuse: The cheek of an unwanted child was burnt with a caustic soda stick (Fig. 2)
4. Treatment method

The treatment provided in both adults and children is mainly surgical. Non-surgical therapy was applied to only few cases of minor burns (Chart 4).

5. Outcome

In the adult group, there were four deaths in males and four in females (Chart 5). Mortality occurred mostly in patients with more than 30% TBSA. In the paediatric age group there were seven deaths (six females), with more than 30% in the TBSA group. In infant burns the cause may be due to abuse, and in adolescents it may be intentional. The resulting morbidity may range from minor scarring to severe scar contractures, hypertrophic scars, and keloids. If early physiotherapy is instituted contraction can be minimized. Delay in wound coverage also contributes to severe contractures.

Discussion

There are many reported incidents of chemical burns around the world. In India, we see chemical burns in adults, adolescents and children. The incidence of acid burns is higher than the one of other types of chemical burns, as in the rest of the world.

In adults, accidental chemical burns occur in manufacturing and bottling units. We have had cases of chemical burns when chemicals, transported in glass containers in open lorries, bump into each other and spill acid. In certain states of India, like Madhya Pradesh, Bihar, and Orissa, throwing acid on the enemy is a rather common practice, and if the victim’s face is involved, the eye suffers maximum onslaught (Fig. 1).

In recent years, the state of Tamilnadu has witnessed chemicals, particularly acid, being thrown on the face of young girls to harass them or for their refusing to get involved in sexual activities.

Children are victims of chemical burns, accidentally in the domestic setup, when they ingest and spill toilet cleaning substances, which contain many chemicals, namely diluted hydrochloric acid.

Children are also victims of abuse when their unwed mothers or other perpetrators throw acid on their bodies. Sometimes parts of the face are wilfully damaged with application of caustic soda sticks. The law is not very strict in giving punitive punishment, although there is a slow awakening on the part of the government to adopt more severe measures against perpetrators.

Reconstruction in chemical burns is undertaken by plastic surgeons; however, when the scars become very severe, repeated reconstructive procedures are required.

The challenges ahead are the difficulties encountered in aesthetic reconstruction, in order to presentably send back the victims to the society, as well as the development of strong campaigns to identify and severely punish the child abuse perpetrators.

Conclusion

The incidence of chemical burn patients admitted in a medical college hospital, and in a burn unit of an exclusive children’s hospital in Chennai has been analysed over the last ten years, between 2001 and 2010. The adults numbered 75 and children were 38.

This retrospective analysis has brought out the fact that acid burn is the most common type of chemical burn we have encountered. Acids that caused harm were mainly hydrochloric and sulphuric acids. Child abuse due to acid throwing also has been identified.

Incidence of special types of chemical burns like cement burns, particularly in factories, has decreased due to the strict enforcement of the Child Labour Act, 1996, where children below 18 are not allowed to work in manufacturing units of corrosive acids, cement and cracker manufacturing units.

The scenario of chemical burn injuries has also changed. More adolescents are victims of acid attacks now than before. We have seen this in the southern states of Tamilnadu. All the centres that treat chemical burns must be equipped with a good Reconstructive Unit.


Mots-clés: brûlures chimiques, adultes, enfants, résultats
BIBLIOGRAPHY


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