

# Ocular Morbidity in Acid Burn Patients in a Tertiary Care Hospital

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## ABSTRACT

### BACKGROUND

Causing acid burn to a fellow human being could be one of the most horrific acts that can ever be committed. It scars not only a person's face and eyes but also scars their soul for life. Chemical injuries of the eye may produce extensive damage to ocular surface, conjunctiva, corneal epithelium, stroma, sclera and eyelids resulting in permanent unilateral or bilateral visual impairment. We wanted to study the ocular morbidity in acid burn patients in a tertiary care hospital.

### METHODS

It is a prospective study of acid burn patients (18- to 60-yrs.) presenting to RIO, SCBMCH OPD between Aug 17 and Jan 18 and followed up till 3 months. They were subjected to slit lamp evaluation, fluorescence staining, tear film break up time, funduscopy examination, IOP measurement and gonioscopic examination. Patients with history of diabetes mellitus, hypertension, pseudophakia were excluded from study.

### RESULTS

Among the 29 patients with acid burn injury in their eyes, 22 patients were victims of accidental acid burns while working in acid factory, 4 suffered acid burns during household work and the rest 3 were homicidal victims (18-30 yrs.). Among the 26 patients, 20 were males (30-50-yrs.), 6 were females (30-45 yrs.)

### CONCLUSIONS

The sequelae of ocular burns can be severe, may lead to vision loss and may particularly be challenging to manage. Persons working in acid factories are more vulnerable to acid injury. So, immediately following acid injury, it is important to estimate and clinically grade the severity of limbal stem cell injury by assessing limbal cell ischemia. Stringent action should be taken to provide protective gears at workplaces to prevent future occurrences of such injuries.

### KEYWORDS

Chemical Injury, Burn, Tertiary Care Hospital

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## BACKGROUND

Causing acid burn to a fellow human being could be one of the most horrific acts ever committed. It scars not only a person's face and eyes but also scars their soul for life. J. Asaria, in his study in Uganda found Seventeen percent of the adult burns admitted over an 18-month period resulted from acid assault. Patients had a mean age of 33.1 years.<sup>1</sup> Similar statistics are not available for India.

Mostly these occur in industrial settings and now a days vitriolage has become a major cause of acid burn in young ladies. Chemical injuries of the eye may produce extensive damage to ocular surface, conjunctiva, corneal epithelium and stroma, sclera, eyelids resulting in permanent unilateral or bilateral visual impairment. It is a true ocular emergency and requires immediate and intensive management. Majority are accidental, few are due to assault.<sup>2</sup> As most of the patients are young, it is very important to prevent extensive damage to ocular structures to restore the visual function. The severity of a chemical injury is related to the properties of chemicals, area of the affected ocular surface, duration of exposure.<sup>2</sup> The most devastating sequelae of chemical injuries of eye are corneal melt, limbal stem cell deficiency and glaucoma.<sup>3</sup> Amniotic membrane transplantation, limbal stem cell transplantation and kerato-prosthesis may be needed according to the severity of ocular burn. Sudden change in pH of the eye followed by pH dependent chemical alteration inside eye is the main pathophysiological event in acid burn case. Alkalies penetrate rapidly as compared to acids thereby damaging trabecular meshwork, ciliary body and lens whereas acids coagulate the epithelium, denature the corneal protein on contact. This leads to opaque cornea formation in severe acid burn injury of eye. Contraction of cornea and sclera lead to rise in IOP. Hydrofluoric acid used in glass etching rapidly penetrate ocular tissue causing serious damage to cornea and anterior segmen.<sup>3</sup> Sulphuric acid destroys by thermal coagulation. Loss of limbal cells and necrosis of corneal and conjunctival epithelium causes conjunctivalisation and vascularisation of cornea.<sup>2</sup> Ciliary epithelial damage impair secretion of ascorbate which is required for collagen production and corneal repair.<sup>2</sup> Pathophysiological events which may influence final visual outcome and which are amenable to therapeutic modulation include ocular surface injuries and repair, stromal injury and ulceration. Extensive limbal ischaemia leads to limbal stem deficiency which leads to poor visual prognosis. Acid damage causes superficial injury to the eye. The patients with chemical burn of eye present with sudden onset of severe pain in eye, epiphora and blepharospasm. Conjunctival hyperaemia and goblet cell loss lead to dry eye, scarring and forniceal contracture which cause disfigurement.

### Aims and Objectives

- To study ocular morbidity in acid burn patients in a tertiary care hospital.
- To classify patients according to the severity and manage the cases.

- To study how effective management affected the outcome at follow up.

## METHODS

It is a prospective study of acid burn patients (18 to 60 yrs.) presenting to RIO, SCBMCH OPD between Aug 17 to Jan 18 and they were followed up till 3 months.

They were subjected to-

- Slit lamp examination for anterior segment evaluation.
- Fluorescein staining for detection of conjunctival and corneal epithelial defect
- Limbal ischaemia, corneal opacity/ulcer/oedema/perforation/iris details were studied.
- Fundusoscopic examination.
- IOP measurement by Non-contact tonometry.
- Tear film breakup time (TBUT)
- Assessment of visual acuity by using Snellen's chart.

### Inclusion Criteria

- Any patient attending OPD/emergency with acid/chemical burns who had not been treated elsewhere.
- Patients who gave consent for the study.

### Exclusion Criteria

Patients with history of Diabetic Mellitus, Hypertension, Pseudophakia, children were excluded from study.

Numerous classifications are there to classify the severity of chemical injuries to ocular surface. Presence and degree of limbal ischaemia and corneal haze are the key factors for initial assessment of severity.<sup>3</sup> The depth of corneal involvement including endothelial injury is a prognostic indicator.<sup>3</sup> We have taken ROPER HALL classification in categorising the patients of ocular burn in our study.

### Standard Treatment Procedures

Grade 1 and grade 2 injuries were treated with topical eye ointment like polymyxin B, moxifloxacin ointment, topical steroids like prednisolone, fluorometholone and cycloplegics. Topical steroids reduce inflammation, prevent corneal ulceration.<sup>2</sup> Dose of steroid eye drop is 4 to 8 times daily and reduced over 7 days. Topical antibiotic eyedrop like ciprofloxacin or moxifloxacin were given 4 to 5 times daily to combat superadded bacterial infection. Ascorbic acid supplementation in a dose of 1-2 gram improves wound healing by promoting collagen synthesis by corneal fibroblasts. Topical sodium citrate was given in a tapering dose to reduce inflammation by decreasing the number of secondary phagocytes. Tetracycline eye ointment was tried 4 times per day in case of corneal melting. 10% N acetyl cysteine was given topically. IOP is controlled with oral carbonic anhydrase inhibitors. Surgical management was required to establish limbal vascularisation. This is done by suturing tenon capsule with limbus. Amniotic membrane

transplantation, autografting from patient's better eye or allografting was done to regain the normal corneal epithelium. In severe cases, keratoplasty was deferred for at least 6 months till complete resolution of inflammation.

### Management

Affected eyes of all the patients who sought medical attention immediately after the incidence were subjected to thorough wash of eyes with normal saline. It was done to minimize the duration of acid contact with eye and neutralise the pH of the affected eye. IOP was monitored with oral acetazolamide. Local anaesthetic eye drop was instilled prior to irrigation. After irrigation, all patients were screened thoroughly under slit lamp. Necrosed corneal epithelium was debrided. The eyes were graded using Roper Hall classification. The eyes which were categorised into grade 1 were given topical e/o erythromycin 4 times per day, e/d prednisolone one drop 4 times per day and cycloplegic like cyclopentolate 1% eye drop twice a day. Grade 2 category eyes received topical e/d fluroquinolone 4 times per day, atropine eye ointment 1%, artificial tear drop 3 times per day, vitamin C tablet orally 2 grams per day. Grade 3 and grade 4 categories were referred to special eye care centre for management. All eyes were followed up for 3 months.<sup>2,3</sup>

## RESULTS

Among the 29 patients with acid burn injury in their eyes 22 patients were victims of accidental acid burn while working in acid factory (sulphuric acid), 4 suffered acid burn during household work and the rest 3 are homicidal victims (18-30 years). Among the 26 patients 20 were males (30 -50 yrs.), 6 were females (30-45 years). Out of 22 cases of accidental acid burn injury, 14 cases were having bilateral involvement and 8 cases had unilateral involvement of eyes, out of 4 household acid burn cases, 4 cases had unilateral eye affected. Out of 3 homicidal cases, 2 cases were unilateral, and 1 case was having bilateral eyes involvement. 44 eyes of 29 patients with acid burns were assessed using ROPER-HALL classification. The above table showed that 20 eyes constituting 45.5% of total eyes presented with VA 6/60 - 6/18. 19 eyes (43.2%) with VA 6/12 - 6/9. During follow up total of 16 eyes have improved after treatment.

Sex	No. of Cases	Percentage
Males	20	68.9
Females	9	31.1

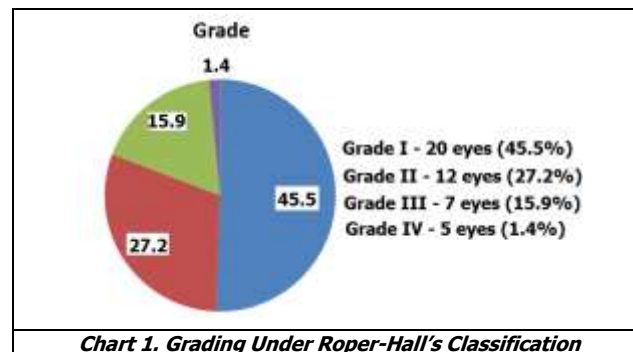
**Table 1. Sex Based Distribution of Cases Under Study**

Mode of Injury	No. of Patients (n=29)	Percentage
Accidental	22	75.86
Household	4	13.8
Homicidal	3	10.3

**Table 2. Distribution of Modes of Injuries among Cases**

Grade	Prognosis	Limbal Ischaemia	Corneal Involvement
I	Good	Nil	Epithelial damage
II	Good	< 1/3	Corneal haze Iris details visible
III	Guarded	1/3 - 1/2	Stromal haze Iris details obscured
IV	Poor	> 1/2	Cornea opaque Iris and pupil details obscured

**Roper-Hall's Classification<sup>2</sup>**



Visual Acuity at Presentation	No. of Eyes (n=44+)	%
< 6/60	5	11.4
6/60-6/18	20	45.5
6/12-6/9	19	43.2

**Table 3. Visual Acuity of Patients at the Time of Presentation**

VA at Presentation	No. of Eyes	BCVA after Treatment	No. of Eyes Improved
<6/60	5	<6/60	Nil
6/60	6	6/36, 6/60	3, 3
6/36	5	6/24, 6/36	2, 3
6/24	4	6/18, 6/24	3, 1
6/18	5	6/12, 6/18	4, 1
6/12	12	6/9, 6/12	3, 9
6/9	7	6/6, 6/9	1, 6

**Table 4**

The above table shows 5 eyes who presented with VA <6/60 in grade I did not improve. Out of 20 eyes which presented with VA 6/60 - 6/18, 12 eyes (60%) improved. 4 eyes of pre-treatment VA 6/12-6/9 improved after treatment. Corneal opacity was found in 13 eyes (29.5%). Symblepharon occurred in 6 eyes (13.6%). 4 eyes (9.1%) referred for keratoplasty. Visual acuity remained <6/60 in 5 eyes (11.4%).

## DISCUSSION

Male to female ratio of affection in chemical burns was found to be 2.2 (20/9). Study done by Clare et al<sup>4</sup> in 2012 found that two thirds of these injuries occur in young men and children age 1-2 years are particularly at risk.

J. S. saini,<sup>5</sup> in his study, found 42.1% patients suffered bilateral injuries. Acids and alkalis were responsible for 80 per cent of the chemical injuries. Young people constituted two-thirds of the patients. In our study bilaterality was seen in 63.6% cases. A study done in the united states, Haring RS et al found children aged 1 to 2 years to be at a significantly higher risk for ocular chemical burns than any other group. Ocular chemical burn injuries were most common among individuals aged between 18 and 64 years (73.2%). Men represented 56.6% of total cases studies.<sup>6</sup>

In our study among the 29 patients with acid burn injury in their eye, about 76% patients were victims of accidental acid burn while working in acid factory, 13.8% suffered acid burn during household work and the rest 10.3% were victims of homicidal attack. In a retrospective study done by Kuckelkorn R,<sup>7</sup> on the incidence and prevalence of ocular chemical burns, Industrial accidents caused 61% of these burns; 37% were domestic in nature. In another study done

by same author, majority of the accidents occurred at work (72.3%); the majority of the burns were chemical (84.2%), of which 79.8% were caused by alkalis.<sup>8</sup>

Upon grading with ROPER-HALL method, we found Grade I in 20 eyes (45.5%), Grade II in 12 eyes (27.2%), Grade III in 7 eyes (15.9%), Grade IV in 5 eyes (1.4%). Study done by Subudhi et al.<sup>9</sup> found Grade I in 16.675% eyes, Grade 2 in 39.58%, Grade 3 in 31.25% and Grade 4 in 12.50% eyes. All eyes with grade I and grade II improved after treatment. In grade 3 improvement was less. They Took 84 Cases and 96 Eyes for Study. After management of the cases and follow up for 3 months, an improvement in visual outcome was seen in 36% eyes.

Whereas, Kuckelkorn in 1995 reported that optical rehabilitation (visual acuity >0.3) was achieved only in a few cases (14.5%).<sup>7,8</sup> This might be due to better facilities and more energetic management being done at most facilities, at present. The key points of this study is that it is first of its kind done at our institute. Acid burn and chemical injuries are fairly common in our region and state due to overall poor economy and socio-economic status. People working in most industries do not get adequate protective gear and most are not aware of the risk and prevention. This study sheds light on incidence of such happenings and how timely management could help in restoring useful vision.

#### Limitations

Limitations of this study lies in small sample size and small time period. Continuation of this study for a long term will definitely yield more conclusive results. Secondly, we haven't included children or anyone less than 18 years of age. Many national and international studies have found children aged less than 10 years to be at a much higher risk. So, a study including all age groups would be preferable.

### CONCLUSIONS

The sequelae of ocular burns can be severe, may lead to vision loss and may particularly be challenging to manage. Persons working in acid factories are more vulnerable to acid

injury. So, immediately following acid injury, it is important to estimate and clinically grade the severity of limbal stem cell injury by assessing limbal cell ischemia. Stringent action should be taken to provide protective gears at workplaces to prevent future occurrences of such injuries.

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