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Original Article

Pattern of Chemical Ocular Injury: A Clinical Study

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Abstract

Background: Chemical ocular injury is a common injury among the population of Bangladesh. This present study in aimed to evaluate the pattern of chemical ocular injury in our context. **Methods:** This cross-sectional observational study was done among 50 patients of chemical ocular injury by different substances between January and June 2013. After initial evaluation patients were also followed up for next 3 months to evaluate the visual outcome. **Results:** Male to female ratio was 1.7:1. Males between 21-30 years and 41-50 years were mostly affected whereas females of 41-50 were affected most. Most commonly affected occupation was service (36%) followed by housewives (22%) and majority (58%) were from low socio-economic conditions. Thirty five (70%) cases were alkali burn and remainder 15 (30%) were acid burn. Among alkali, hydrated lime Ca $(OH)_2$ had highest percentage 82.8%. Most (46%) patients with good visual acuity i.e. 6/12 – 6/24 belongs to early (less than six hours) reporting time interval. It was found that 48% were grade – I and 34% cases were grade – II injury and other grades were not pronounced. Study showed that improvement of visual acuity after initial management and subsequent treatment was significant. **Conclusion:** Alkali burn is the common pattern of ocular injury in our country where lime is the common chemical substance. Early intervention is essential to avoid long term visual disability.

Key words: Chemical ocular injury; alkali; acid; visual acuity.

INTRODUCTION

Chemical injuries to the eyes are common and represent one of the true ophthalmic emergencies. Practically any chemical can cause ocular irritation. Most of these injuries are inconsequential and do not cause serious lesions (e.g. shampoos, defense sprays, household cleaning solutions etc.) while other may result in permanent morbidity. Severe ocular damage is most commonly associated with strong alkaline or acidic compounds[1]. Chemical burns may be induced by means of vapor, solid or liquid. Nonetheless the majority occur in industrial environment, in laboratories, in combative environments or as a result of an accident[2]. Chemical injures are potentially devastating ocular surface injures that can result in permanent visual impairment. They may cause extensive damage to the eyelids, conjunctiva, cornea and anterior segment resulting in severe morbidity including permanent unilateral or bilateral blindness. As with other injuries the nature of the chemical burning is variable and dependent on local circumstances. It is important to note the type of chemical, because the mechanism of injury varies between acidic and alkaline exposure[3-4]. Common acids are sulfuric acid (car batteries), hydrofluoric acid (glass polishing), acetic acid, hydrochloric acid and nitric acid(gold maker). Common alkalis are lime(plaster),ammonia/ammonium hydrochloride (cleaning solution, drain cleaner), potassium hydrochloride, magnesium hydrochloride (fireworks). Acid burns is usually less severe than that caused by alkali burn. When acid comes contact with corneal surface they cause coagulation of tissue protein forming a barrier, which prevents deep penetration[5].

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But alkalis in contrast, cause saponification of cellular lipids disrupt the normal barrier of the cornea resulting in deep penetration to internal structures causing severe damage to the lens and anterior uvea. In severe cases phthisis bulbi may be the tragic end result[6]. The severity of a chemical injury is related to the concentration of the chemical, properties of the chemical, the duration of contact with the ocular tissue, the area of the effected surface, retention of the particulate chemical on the surface of the globe, the chemical reaction with the tissue component and the diffusibility of the agent[7]. Chemical injury is the one of the true ophthalmic emergency and it needs immediate management. Chemical burns have a major impacts in terms of long term morbidity and so is a matter of major socio-economic importance[8-9]. The squeals of chemical burn may have significant detrimental visual and psychological effects on the affected individual. Chemical injury to the eye accounts for a significant portion of ocular trauma. Proper management in the acute setting as well as follow-up by an ophthalmologist is crucial in limiting adverse effects of ocular tissue damage secondary to the chemicals. So this cross sectional study is aimed to describe the common pattern of chemical ocular injury and its type and short term outcome so that it can be used in future for planning to prevent chemical ocular injury in our context.

The aim of this study was to find out the pattern of ocular injury, nature of causative chemicals, the disabilities incurred and the outcome of treatment.

MATERIALS & METHODS

This descriptive cross-sectional study was carried out in the Department of Ophthalmology of Chittagong Medical College Hospital (CMCH), Chittagong, Bangladesh between January 1, 2013 and June 30, 2013. All 50 patients of documented ocular chemical injury admitted in Department of Ophthalmology, CMCH were included.

Inclusion Criteria:

1. Patients with chemical injury to the eyes.
2. Age 12 – 60 years.
3. Voluntarily given consent to participate in the study.

Exclusion criteria

1. Associated injury to other parts of the body.
2. Preexisting ocular pathology.
3. Senility (Age>60 years).

Chemical Injury to eye was defined as any insult to one or both eye external or internal with chemical substances, irritant powder or gas. Acidity or alkalinity was confirmed by litmus paper test.

From all eligible subjects after getting consent clinical history was taken and clinical examination was done to elicit findings related to eye injury and its complication. Related ocular examination like slit lamp examination, visual acuity test and ophthalmoscopy was also done. Conjunctival swab was taken to find out any eye infection. All relevant data were included in the data sheet. All data were collected by researcher himself. All data were recorded systematically in preformed data collection form and quantitative data were expressed as mean and standard deviation and qualitative data were expressed as frequency distribution and percentage.

Statistical analysis was performed by using SPSS (Statistical Package for Social Sciences) for windows version 19.0. 95% confidence limit was taken. Probability value <0.05 was considered as level of significance. Prior to the commencement of this study, the protocol was approved by the ethical committee of Chittagong Medical College Hospital, Chittagong.

RESULTS

Male to female ratio was 1.7:1. Males between 21-30 years and 41-50 years were mostly affected whereas females of 41-50 were affected most (Table 1). Affected males were predominantly service holders whereas females were housewives (Table 2). Majority (58%) were from low socio-economic conditions. Thirty five (70%) cases were alkali burn and remainder was acid burn. Among alkali, hydrated lime Ca $(OH)_2$ had highest percentage 82.8% (Table 3). Large number of patients (46%) with good visual acuity i.e. 6/12 – 6/24 belongs to early (less than six hours) reporting group (Table 4). It was found that 48% were grade – I and 34% cases were grade – II injury and other grades were not pronounced (Table 5). Stromal edema was the leading complication (Table 6). Improvement of visual acuity after initial management and subsequent treatment was significant (Table 7 & 8; figures 1 & 2).

Table 1: Prevalence of eye lesion by age and sex (n=50):

Age (years)	Male	Female
12 – 20	3 (6%)	3 (6%)
21 – 30	12 (24 %)	2 (4%)
31 – 40	4 (8%)	3 (6%)
41-50	10 (20%)	7 (14%)
51-60	3 (6%)	3 (6%)
Total	32	18

Table 2: Occupation of the patient (n=50):

Occupation	Male	Female	Total
Student	1	4	5
Housewife	0	11	11
Service	17	1	18
Business	8	0	8
Others	6	2	8

Table 3: Showing prevalence of different types of alkali and acid (n=50):

	Type of chemical	No. of patient / Percentage	
Acids	Sulfuric acid	6 (40%)	(p>0.05)
	Nitric acid	5 (33.33%)	(p>0.05)
	Others	4(26.77%)	(p>0.05)
Alkali	Lime	29 (82.8%)	(p>0.05)
	Ammonia	6 (17.2%)	(p>0.05)

Table 4: Shows visual outcome in relation with reporting time interval (n=50):

Reporting time interval	6/9 or better	6/12 – 6/24	6/36 – 6/60	CF (5-10) Feet	CF (1-4) Feet	HM	PL	NPL
6 hours	8	23	0	1	0	1	0	0
12 hours	4	7	1	1	0	0	0	0
24 hours	0	0	1	1	0	1	0	1

Table 5: Severity of injury (n=50)

Grading	Male	Female	Total	
Grade – I	15	9	24(48%)	(p>0.05)
Grade – II	11	6	17(34%)	(p>0.05)
Grade – III	4	2	6(12%)	(p>0.05)
Grade – IV	2	1	3(6%)	(p>0.05)

Table 6: Complications following chemical burn (n=50):

Complications	Male	Female
Stromal edema	23 (56%)	14 (28%)
Sterile corneal ulcer	2 (4%)	0 (00%)
Corneal perforation	0	0
Corneal opacity with or without vascularization	5 (10%)	3 (6%)
Symblepheron	4 (8%)	2 (4%)
Cataract formation	3 (6%)	1 (2%)
Ectropion	1 (2%)	0
Entropion	2 (4%)	1 (2%)
Phthisis bulbi	1 (2%)	0

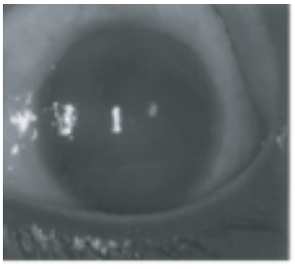
p>0.05: Stromal edema

Table 7: Showing follow up monitoring of visual acuity between one to three months after initial injury (n=50):

Visual acuity	After admission	During discharge	After 1 month	After 2 months	After 3 months
6/9 or better	0	6	8	10	10
6/12-6/24	12	20	22	24	27
6/36-6/60	23	15	12	10	5
CF(5–10 ft)	6	5	4	3	4
CF(1–4 ft)	4	1	1	0	0
HM	3	2	1	1	2
PL	1	0	0	0	0
NPL	1	1	1	1	1

Table 8: Showing visual outcome after chemical injuries (n=50)

Visual acuity	Male	Female	Total	
6/9 or better	5 (10%)	5 (10%)	10	(p>0.05)
6/12-6/24	20 (40%)	8 (16%)	28	(p>0.05)
6/36-6/60	3 (6%)	2(4%)	5	
CF(5–10 ft)	2 (4%)	2(4%)	4	(p<0.05)
CF(1–4 ft)	0	0		
HM	1 (2%)	1(2%)	2	(p<0.05)
PL	0	0		
NPL	1 (2%)	0	1	



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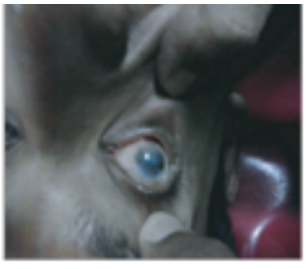
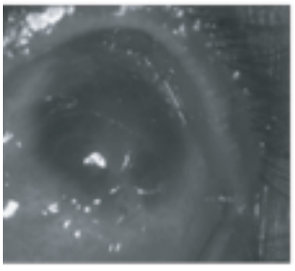


Figure 1b: Case 1- After treatment



igure 2a: Case 2- Alkali urn before treatment

Figure 2b: Case 2- After treatment

DISCUSSION

The distribution of the injuries on various ages has shown considerable variations. Majority of the patient with ocular affection was young adult. It was about two third of total patients; which is almost similar findings of Saini-Sharma[8]. They stated that young people works in laboratories and factories constitute two-thirds of the patients of chemical injury. This assumption perhaps true on our study as well, more over in Bangladesh this age group sometimes become victim for assault leading to higher prevalence. As the age advanced the incidence of chemical injuries is gradually decreased. Among the victim majority of the patients (36%) were service man. Their nature of the job was different, like industrial worker, building construction worker, fertilizer industry etc. They were accidentally injured by the chemical substance at their work place. Also accidental injury to housewives and children by hydrated lime was common. Here we classified them in different income group in the basis of per day income and presence of land and other properties.