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A study of Industrial Eye Injuries in Western Rajasthan

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Abstract

Background: Ocular injuries attain great socioeconomic importance in Ophthalmology due to industrialization in developing country like India. So, this study was planned to evaluate pattern of ocular manifestation of injuries, the modes of clinical presentation, their management and the visual outcome in Western Rajasthan. *Material and Methods:* This prospective study was conducted in all patients aged more than 18 years of industrial ocular injuries, who presented to Mathura Das Mathur Hospital, Jodhpur between September 2013 to September 2015. Detailed clinical history including type of industry, the nature of work, regarding the causation, the hours of work daily, time of occurrence, activity at the time of injury, nature/chemical composition of foreign body or chemical, time lapsed after injury etc. Detailed clinical examination was done. *Results:* A total of 52 patients of industrial ocular injuries were enrolled in study. Mean age of the patients was 31.25 years. All patients were males. 78.85% of the patients did not use any kind of ocular protection during work. Maximum number of patients with ocular injury came from steel industry (32.69%), followed by handicraft industry (30.76%), and stone mining (21.15%). 75% of all patients had significantly corneal foreign body injury and 15.38% had chemical injury. *Conclusion:* In Western Rajasthan, industrial ocular injuries were predominantly found in males. Most of the patients worked at steel industries and most of injury occurred to welders. Corneal foreign body was most common mechanical type of injury in industry confined to mostly anterior segment of eye.

Keywords: Industry; Ocular; Cornea; Vision.

Introduction

The eyeball is set into the orbit, a socket surrounded by a strong, bony ridge. These structures are well suited for protecting the eyes from injury. Despite this, injuries of the eye because of sports, road traffic accidents, agricultural and non-agricultural are not uncommon. These injuries are not free from short-term and long-term morbidity. The incidence of ocular injuries is constantly on the rise in this modern era of industrialization and lead to a significant proportion of eye injuries at workplace [1]. It is difficult to accurately measure or even estimate the incidence of eye injuries. Worldwide, there are approximately 1.6 million people who have become blind, 2.3 million who have become bilaterally visually impaired and 19 million with unilateral visual loss due to eye injuries. In the era of modern mechanised societies, trauma is the commonest cause of unilateral blindness. From the international perspective, an estimated 5,00,000 blinding eye injuries occur annually worldwide [2]. In an Indian survey, injuries were found to be the cause of blindness in 11.8% of the total blind subjects [3]. Occupational eye injuries are more common in younger men and comprise 70% of all the ocular injuries. Males have a 2.2 to 5.5 times higher risk of ocular injuries than females [4]. In India, the annual incidence is 9.75 severe eye injuries per 1,000 adults. The prevalence is higher in rural areas (4.5%) than in urban areas (3.97%) [5]. In developing countries like India,

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activities such as agriculture, carpentry, grinding, chiselling, hammering, welding, handicraft, automotive industries are responsible for many eye injuries. In a five year study of open globe injuries, 33% were occupation related and 79.06% of these were young adults [6]. Because of this reason ocular injuries attain great socioeconomic importance in Ophthalmology.

In this modern era of industrialization in our developing country where simple protective measures are not in use like wearing protective glasses lead to increase number of patients with ocular manifestation of injuries. So, this study was planned to evaluate pattern of ocular manifestation of injuries, the modes of clinical presentation, their management and the visual outcome in western Rajasthan region of India.

Materials & Methods

This prospective study was conducted in department of Ophthalmology only after approval from the Institutional ethics committee. All patients aged more than 18 years of industrial ocular injuries, who presented to Mathura Das Mathur Hospital, Jodhpur during emergency and out-patient department between September 2013 to September 2015 were enrolled in this study. All Ocular injuries caused by other than any industry i.e sports activities, at home, road traffic accidents and intentional altercations were excluded out. Data was collected from patient or attendants of patient in a standard clinical performa. Before starting the study all patients included in study were given patient information sheet and written informed consent was obtained from each patient in local language.

Detailed clinical history including type of industry, the nature of work, regarding the causation, the hours of work daily, time of occurrence, activity at the time of injury, nature / chemical composition of foreign body or chemical, time lapsed after injury, any previous visual impairment, previous eye check-ups or any ocular surgery or any ocular intervention or ocular trauma or general surgery and the use of power glasses use of spectacles, protective glasses, shields, helmets and face protectors was asked. Any associated systemic diseases and alcohol consumption at time of injury was also asked.

Detailed clinical examination was done with torch light, double eversion of eyelids by Desmarre's retractor, slit lamp examination. Pupillary light reflex direct and consensual, relative afferent pupil defect (APD) if any was noted. Absence of APD was a crucial indicator of good gross vision. Laterality (eye involved in injury), closed/ open globe injury/chemical injury (whether injury compromised the regularity of the globe or not was noted), vision at the time of injury, type of injury sustained were noted. On slit lamp examination presence of any sand particle/ metallic foreign body/carbon soot/lime particles on cornea/conjunctiva/ or fornices were noted. Intraocular pressure (IOP) was recorded by non contact tonometer (NCT) preoperatively only in those cases where the wound was sealed and anterior chamber well formed and all postoperative cases. USG B-Scan was done for posterior segment in cases where optical media not clear. Optical coherence tomography (OCT), anterior segment optical oherence tomography was done for angle of anterior chamber and iris. Keratometry was done to evaluate the Intraocular lens power in case of traumatic cataract. If there is a foreign body on cornea or conjunctiva detected that was removed under topical anaesthesia. Other procedures or treatment as per the type of injury to patients were done. Other routine investigations were performed. All examination/investigations/procedures were done in the department of Ophthalmology under the direct guidance and supervision of experts. Follow up at regular intervals of 1 week for first 2 weeks there after every 3 weeks for 3 months and up to 1 year.

Data was expressed in numbers and percentages. Chi-Square test was used wherever applicable. A "p" value of <0.05 was considered to be statistically significant.

Results

A total of 52 patients of industrial ocular injuries were enrolled in study during the study period. Mean age of the patients was 31.25 years with age range of 19 year to 50 year (Table 1). All patients in present study were males. None of female presented with ocular industrial injuries. 92.3% of patients have closed globe injuries and 7.7% have open globe injuries. Eight patients (15.38%) have bilateral injuries. Right eye was injured in 23 (44.23%) patients and left eye in 21 (40.38%) patients. Only 21.15% used some kind of ocular protection during work. 78.85% of the patients did not use any kind of ocular protection during work. 71.15% of patients presented within 24 hours of ocular injury. 28.85% of patients presented late (>24hours). Maximum number of patients with ocular injury came from steel industry (32.69%), followed by handicraft industry (30.76%), stone mining (21.15%) (Table 1).

Table 1: Socio-demographic characteristics of ocular injury patients

	Numbers (%) n=52
Sex	
Male	52 (100)
Female	0
Age (in years)	
15-20	07 (13.46)
21-25	07 (13.46)
25-30	12 (23.07)
31-35	11 (21.15)
36-40	08 (15.38)
>40	07 (13.46)
Types of industries	
Cement	01 (1.92)
Chemical	02 (3.84)
Handicraft	16 (30.76)
Marble	01 (1.92)
Steel	17 (32.69)
Stone mine	11 (21.15)
Machine part manufacturing	01 (1.92)
Tractor repairing	01 (1.92)
Truck body building	02 (3.84)

Maximum number of ocular injuries occurred during welding work (30.76%) followed by quarrying (21.15%). (Table 2)

Table 2: Ocular injury with respect to nature of works

Nature of works	Number (%) n=52
Assembly workers	05 (9.61)
Chemical handler	04 (7.69)
Diamond stone maker	01 (1.97)
Labourer	01 (1.97)
Labourer painter	02 (3.84)
Labourer carpanter	04 (7.69)
Labourer Welder	15 (30.76)
Labourer grinder	03 (5.91)
Machine tool operators	05 (9.61)
Quarry workers	11 (21.15)
Shift incharge	01 (1.97)

75% of all patients had significantly corneal foreign body injury and 15.38% have chemical injury. (Table 3)

Table 3: Distribution of patients according to types of injury

Type of injury	Number (%) n=52	Corneal vs others P value
Corneal foreign body	39 (75)	P<0.0001
Globe rupture	1 (1.92)	
Chemical injury	8 (15.38)	
Intraocular foreign body, lid tear	1 (1.92)	
Conjuctival foreign body	1 (1.92)	
Corneal tear, traumatic cataract	2 (3.84)	

Table 4: Correlation between types of industries with types of injury

Types of Industry	Corneal Foreign body	Globe rupture	Chemical injury	Intraocular foreign body, lid tear	Conjuctival Foreign body	Corneal tear, traumatic cataract
Cement	01	00	00	00	00	00
Chemical	00	00	02	00	00	00
Handicrafts	10	00	05	00	00	01
Steel	15	00	00	01	01	00
Stone mine	08	01	01	00	00	01
Others	05	00	00	00	00	00
Total	39	1	8	1	1	02

Corneal foreign bodies were most common ocular injuries in all type of industries except chemical industries. Corneal foreign bodies were found most common in steel industries (15) followed by handicraft (10) and stone mine (08). (Table 4)

Table 5: Correlation between nature of work with types of eye injury

Nature of works	Corneal Foreign body	Globe rupture	Chemical injury	Intraocular foreign body, lid tear	Conjuctival Foreign body	Corneal tear, traumatic cataract
Cutting	07	01	00	00	00	01
Grinding	13	00	00	00	00	00
Hammering	02	00	01	00	00	01
Chemical	00	00	04	00	00	00
Machine operation	04	00	00	01	00	00
Welding	11	00	00	00	01	00
Others	02	00	03	00	00	00
Total	39	1	8	1	1	02

During grinding, all 13 patients had corneal foreign bodies. During welding, 11/12 patients have corneal foreign bodies except one who have conjunctival foreign body. During cutting, 7/9 patients have corneal foreign bodies, 1/9 have globe rupture, 1/9 have corneal tear. (Table 5)

Discussion

Eye injuries are a major and under recognized cause of disabling ocular morbidity that especially affect the young. The public health importance of such ocular trauma is undeniable. Injuries generate a significant and often unnecessary toll in terms of medical care, human suffering, long-term disability, productivity loss, rehabilitation services, and socioeconomic cost [7]. In present study majority of the ocular injuries were found in the 26 to 30 years age group followed by 31 to 35 age groups. These findings were similar to that of other studies which reported that a high number of males were affected as compared to the females varying from 80-90% [3,8,9]. This may be due to under training of patients in their respective areas and hence were more exposed to the injuries due to ignorance or inexperience or accidentally. All patients were males. This could be due to less number of women in the industries, women being employed in less dangerous departments or women being very careful in their work and adhering to the safety measures.

Most of the patients presented to trauma centre within 24 hrs. Only one patient presented late i.e. after 120 hrs. This patient was being treated for the same problem somewhere else. The presentation to the clinic was also early in a majority of the cases in a study done by Biradar et al. [4]. This shows that eye injuries are real ophthalmic emergencies which demand prompt and early attention. The presentation to the hospital is influenced by the type and severity of the injury.

Most of the patients did not use any kind of protection gear. Only 21.15% patients were using protective gear. These all were welders. Similar findings were found in Biradar et al. study [4]. 12.3% had an injury in spite of wearing protection at the time of the injury. 15.38% patients had bilateral injuries. Right eye was injured in 44.23% and left eye in 40.38% patients. 9.2% cases had injuries in both eyes as a result of chemical splashing in Biradar et al. study [4]. This indicates that chemical injuries were the most common cause of the bilateral eye injuries. Most of the ocular injuries in present study occurred in steel and handicraft followed by mining industries. In Biradar et al. study, the place of work at which the injuries occurred was mostly workshops followed by textile mills [4].

Welders were the most prone to injury followed by quarry workers and machine tool operators. In Biradar et al. study, machine tool operators or mechanics constituted a major part of the patients in the study [4]. Similar results were reported by other studies with occupational injuries [9-12]. A majority of the injuries occurred when the subject was grinding, followed by welding, and cutting. In present study only one patient was bystander (not involved directly in activity) and exposed to chemical accidentally. In Biradar et al. study, the injury occurred while handling hot metals in 7.7% cases [4]. 4.6% were bystanders when the injury occurred. Patients who were working in other industries apart from the chemical industry were also exposed to chemicals at work. For example, chemicals such as bleach, caustic soda and other acids are used in the textile industry during the processing of yarn and during the dyeing and finishing of the garments. Similarly, various chemicals are used in the tools and during the stages of cleaning, treatment and polishing.

Mechanical injuries are broadly classified as open globe and closed globe injuries. 90% of mechanical injuries were closed globe injuries and 10% were open globe injuries. Open globe injuries include IOFB (Intraocular Foreign Body), globe rupture, penetrating injuries and injury to lens i.e. Traumatic Cataract. Closed globe injuries include superficial foreign body on cornea or conjunctiva or lid tear. Closed globe injuries include contusion, lamellar laceration and superficial foreign body [13]. The injuries which were caused by machines or mechanical forces formed the major proportion of the injuries.

All mechanical injuries were involving anterior segment except one which involved posterior segment. In Biradar et al. study also, majority of the cases had an injury in the structures in the anterior segment, while the posterior segment injuries were less [4]. This was similar to the findings of other authors who have reported a higher incidence in the anterior segment of the eye than in the posterior segment. The most common involvement was of the anterior segment structures. The cornea was the most commonly involved site, followed by the conjunctiva, lens and eyelids. In the cornea, the most common was foreign body followed by chemical burn and corneal tear. Shallowing of the anterior chamber and hyphema, iris prolapse, and cataract were most common lens change following open globe injury. Biradar et al. study had also shown cornea as the most commonly involved site [4]. Retinal oedema and tear were the common posterior segment changes. Other studies had also reported highest incidence of injuries in the cornea followed by the iris and the eyelids [9,11,14]. Mukherjee et al. also reported the cornea as the most common site of perforation in 62.21% [15].

Visual acuity at presentation ranged from 6/6 to perception of light negative in affected eye. Most

of the patients had 6/9 vision which were mostly affected by corneal foreign bodies. The presenting visual acuity of the injuries was associated with the type of injury, the experience of the work, the time of presentation and with the wearing of protective gear [4].

Conclusion

In Western Rajasthan, industrial ocular injuries were predominantly found in males. Most of the patients worked at steel industries and most of injury occurred to welders. Mechanical type of injury in industry confined to mostly anterior segment of eye that predominantly involved cornea i.e. corneal foreign body was most common. Most of these workers are not using eye protection/ safety measures. So in our developing country there is an urgent need to step up the safety precautions to prevent such disabling eye injuries. Improved machines, provision of adequate illumination at work, selection of trained workers with adequate vision and alertness, periodic testing for alcohol and finally making the use of eye protection mandatory are some of the steps along with education and knowledge of hazards, that can be taken towards this goal. So by updating the knowledge about industrial eye injuries, we can help Government to make policies and their implementation into industries. The ultimate goal is to prevent secondary complications and to maximize the patients' visual prognosis, so as to enable the patients to carry on their normal activities and occupations. This study can guide researchers to carry out a large scale study at state or national level to assess the epidemiology of ocular industrial injuries.

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