Profile of Occupational Ocular Injury in a Tertiary Health Care Centre of Western Odisha - A Prospective Study

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ABSTRACT

BACKGROUND

Occupational ocular injuries are very common in industrial and agricultural workers. These are important and preventable causes of ocular morbidity. Objective of the study was to profile occupational ocular trauma clinico-epidemiologically.

METHODS

A prospective study was done by collecting data from a standardised questionnaire and complete ophthalmological examination of patients with occupational eye trauma attending VSSIMSAR, Burla, between January 2019 and October 2020.

RESULTS

Out of 128 cases of work related injuries, males were 85 %. 48 % of the cases were between 21 - 40 years. Out of all cases 66 % injuries were related to industrial work followed by 29 % in agricultural sector and farming. 3 % of cases were due to blast injury. Also there were 3 % cases of chemical conjunctivitis. Most injuries were closed globe (85 %), mostly involving zone 1 (91 %). Open globe injuries were 15 %, majority of them involved zone 2 (47 %). Ocular superficial foreign bodies were the most common clinical entity (60 %), majority of them being metallic in nature (37.5 %). In 4 % cases IOFBs were found. Cornea was the most common ocular structure to get injured (69 %). Out of all cases, 50 % had ocular trauma score (OTS) of 4, and 4 % cases had OTS 2. 48 % of patients presented within 6 hours of injury. 42 % patients were not aware of any eye protective gear at work and 30 % patients were aware but did not use any eye protection.

CONCLUSIONS

Eye trauma in workplace is an important public health concern in economically productive population. Significant proportion of these injuries is avoidable by using standardised eye protective devices. Attention need to be given for instruction, enforcement of protective eye wear use, and frequent prevention campaigns.

KEYWORDS

Ocular Trauma, Occupational Ocular Injuries, Eye Protective Devices, Western Odisha

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BACKGROUND

Ocular trauma is a major cause of visual impairment with its psycho-socio-economic sequel. These ocular traumas are modifiable risk factors for visual morbidity worldwide.[1,2] Significant cases of ocular traumas occur at work places.[2.3.4]

Incidence of occupational injuries was estimated to be 1.7 to 6.9 injuries per 1000 workers per year in Australia and 5.37 injuries per 1000 workers per year in USA.[5,6,7] In India occupational ocular injuries constitute almost 20 % cases of ocular trauma.[8]

Most of the occupational ocular injuries can be prevented by using some basic eye protective device and by giving some basic training and awareness at workplaces. As occupational ocular injuries have great impact on economy ; system investing on these training, awareness campaigns and provision of eye protective device will be very cost effective economically.

Objectives

Objective of the study was to assess the profile of occupational ocular injuries in terms of clinical presentation and their demographic pattern, presented to a tertiary health care centre of western Odisha. The objective of the study is also to analyse the eye protective device use behaviour in patients sustaining work-related ocular trauma.

METHODS

A prospective hospital based observational study was conducted in VSSIMSAR, Burla, Odisha, India, from January 2019 to October 2020. Approval from VSS institutional research and ethics committee (VIREC) was taken prior to conduction of the study (No. 2017 / I – F – CT – 01 / 098). Participants were informed regarding the purpose, procedure, benefit of this study. Consent was taken from all participants prior to participation in this study. There were 128 patients with occupational ocular injuries attending outpatient department of Ophthalmology and department of emergency, who were included in our study.

Inclusion Criteria

1. Patients above 18 years of age.
2. Patient sustaining ocular trauma at workplace.
3. Patients sustaining ocular trauma related to work.

Exclusion Criteria

1. History of trauma not related to occupation.
2. History of ocular trauma in domestic environment.

History was noted particularly the circumstances of injury, mechanism of injury and nature of work. Type and nature of object, which caused injury was also noted. Inquiry was made regarding use of eye protective devices (EPD) like protective glasses, helmet, eye shield, face shield. Reason behind non-compliance to use of EPD was asked. Patients were categorised into four groups on the basis of use of EPD. Time lag in first ophthalmic consultation was noted. Complete ophthalmic examination was done in all patients. Visual acuity was assessed by Snellen's chart in literates and with the help of 'E' chart in illiterates. Anterior segment examination was done by torch light and slit lamp bio-microscope.

Fundus was examined by direct ophthalmoscope, indirect ophthalmoscope and + 90 D lens in slit lamp Intra ocular pressure was measured by applanation tonometer and non-contact tonometer in all feasible cases. Gonioscopy was done with 2 mirror lens in required cases. Optical coherence tomography and B scan was done for appropriate cases. Necessary radiological investigation was sought for. Examination findings were recorded as diagrams. Important fundus findings were documented by colour fundus photograph and slit lamp photograph. Important OCT and B scan reports were also documented.

All trauma were classified according to Birmingham eye trauma terminology system (BETTS). As per this classification, all injuries were divided into closed globe injury (CGI) and open globe injury (OGI). Closed globe injuries were further divided into contusion and lamellar laceration. Open globe injuries were further divided into laceration and rupture. Laceration was sub divided into penetrating injury, perforating injury and intra ocular foreign body (IOFB).

Another categorisation was done according to ocular trauma classification group. The open globe injuries and closed globe injuries were classified on the basis of type, grade, pupil and zone. Presence or absence of RAPD was taken as pupil positive and pupil negative respectively. Visual acuity on presentation was recorded and categorised as grade A - ≥ 20 / 40, B - 20 / 50 to 20 / 100, C - 19 / 100 to 5 / 200, D - 4 / 200 to light perception and E - no light perception. Zones in open globe injury were divided as zone 1: cornea and limbus, zone 2: limbus to 5 mm posterior to sclera, zone 3: posterior to 5 mm from limbus. Zones of closed globe injury were divided as zone 1: external (limited to bulbar conjunctiva, sclera and cornea), zone 2: structure of anterior segment including lens and zonules, zone 3: posterior segment (all internal structure posterior to posterior capsule; vitreous, retina, choroid and optic nerve).

Ocular Trauma Scores were calculated to prognosticate the injuries for their visual outcome. Initial raw score from visual acuity were recorded. From those raw scores; globe rupture, endophthalmitis, perforating injury, retinal detachment, RAPD were deducted as - 23, - 17, - 14, - 11 and - 10 respectively. The final raw score sum were calculated and categorised into ocular trauma score ranging from 1 to 5.

Statistical Analysis

Data was entered in Microsoft excel sheet and statistical analysis was done with the help of Statistical Package for Social Sciences (SPSS) version 23.

RESULTS

Gender Distribution

Among 128 patients sustaining work related ocular trauma, 109 cases were male (85 %) and 19 cases were female (15 %). Figure 1 shows gender distribution of patients.

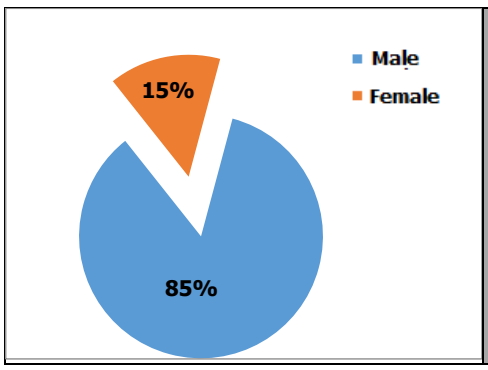

Figure 1. Gender Distribution

Age Distribution

Most of the patients belonged to 21 to 40 years of age group with 61 cases (47 %). There were also 31 patients (24 %) above 50 years of age. There was peak incidences in 31 - 40 years group beyond which there were almost uniform decrease in cases. Mean age of presentation was 39 ± 8.48 year (2 SD). Table 1 shows age distribution of patients.

Age Group	No of Cases	Percentage
18 - 20 yrs.	11	9 %
21 - 30 yrs.	30	23 %
31 - 40 yrs.	31	24 %
41 - 50 yrs.	25	20 %
51 - 60 yrs.	20	16 %
61 - 70 yrs.	7	5 %
71 - 80 yrs.	4	3 %

Table 1. Age Distribution

Side of Involvement

There was no laterality observed in affected eyes. Left eye was involved in 66 cases (51 %), right eye was involved in 61 cases (48 %) and both eyes were involved in 1 case (1 %).

Place of Injury

Most of the occupational ocular trauma was from industrial sector with 85 cases (66 %). Second most common sector to contribute to ocular injury were agricultural and farming with 38 cases (30 %). Other occupations like carpentry, electric work and wall painting contributed 5 cases (4 %).

Objects of Injury

Most common type of ocular trauma was ocular surface foreign bodies (OSFB) with 77 cases (60 %) out of which 48 were metal particle, 11 were sand or stone particles, 5 were wood particles and 6 were vegetative matters like rice grain, bran etc. Mechanical objects were responsible for 22 cases (18 %) out of which 7 were sharp objects like iron nail, copper wire and 15 were blunt objects like wooden rod, tree branch, paddy stump etc. Welding arc was responsible in 48 cases of injuries presenting with combinations of thermal burn, superficial foreign body and photo-keratitis. There were 9 cases of open globe injuries which were attributed to wood splitting and chopping. There were four blast injuries (3 %) out of which two were from refractory factory, one in capacitor blast and one in helium cylinder blast. Intra ocular foreign bodies (IOFB) were encountered five in number (4 %); two intra cameral and one each in cortical matter of lens, vitreous cavity and retina.

Chemical injuries were present in 4 cases (3 %), most of them were alkali; the agents being lime, cloth dye, wall paint and weedicide. Animal causes were responsible for 14 cases which included bee stings, insect bites, cow horn injury, ophthalmia nodosa in agricultural sector and bear maul during firewood collection.

Ocular Structure Involved

Cornea was the most common ocular structure to get injured. Corneal injuries were found in 88 cases (69 %). Other ocular structures contributed like the sclera and uveal tissue with 15 cases each (11 %), conjunctiva with 12 cases (9 %) and lens with 8 cases (6 %). Lid and adnexal injuries were found in 5 cases (4 %). Some patients presented with involvement of multiple ocular structures.

Structure	No of Cases	Percentage
Lid & adnexa	5	4 %
Conjunctiva	12	9 %
Cornea	88	69 %
Sclera	15	11 %
Lens	8	6 %
Uveal tissue	15	11 %

Table 2. Ocular Structures Involvement

Time Lapse in First Ophthalmic Consultation

Most of the patients of ocular trauma presented early to our institution. There were 61 cases (48 %) who presented within 6 hours of injury, 12 cases (9 %) presented within 6 to12 hrs of injury, 22 cases (17 %) presented between 12 to 24 hours of injury. There were 31 cases who presented between 1 to 7 days of sustaining injury. There were also two cases who came beyond 7 days of trauma. The time lag in presentation resulted in complications like corneal ulcers in five cases and more even in endophthalmitis in two cases.

Type of Injury

There were 109 cases (85 %) of closed globe injuries in which 91 % were in zone 1, 8 % were in zone 2 and 1 % in zone 3. 19 cases (15 %) were open globe injuries in which 37 % were zone 1, 47 % were zone 2 and 16 % were zone 3. Table 3 shows per cent of closed globe injury and open globe injury and their zones of involvement.

Type of Injury	Zones of Injury	No. of Cases	%
Close globe injury 109 (85 %)	Zone 1	99	91 %
	Zone 2	09	08 %
	Zone 3	01	01 %
Open globe injury 19 (15 %)	Zone 1	07	37 %
	Zone 2	09	47 %
	Zone 3	03	16 %

Table 3. Zones of Injury

There were 5 number of cases of corneal ulcer, 2 cases of endophthalmitis and 5 number of cases of intra ocular foreign bodies (IOFB) encountered.

Best Corrected Visual Acuity (BCVA) at Presentation

Visual acuity was graded at the time of presentation as per BETTS. In grade A - 41 cases (32 %), grade B - 59 cases (46 %), grade C - 11 cases (9 %), grade D - 16 cases (12 %) and grade E - 1 case (1 %) were there.

Ocular Trauma Score (OTS)

In all cases ocular trauma scores were calculated. Out of all cases 41 patients (32 %) had OTS 5, 64 number of cases (50 %) had OTS 4. There were 18 number of cases (14 %) who had OTS 3 and five patients (4 %) had OTS 2.

Eye Protective Device (EPD) Use Behaviour

Patients were categorized into 4 groups according to their awareness and EPD use behaviour.

Category A: These patients were aware about the usefulness of eye protective devices and used them during injury.

Category B: these patients were aware about the use of protective eyewear but did not use during the incident.

Category C: these were the patients not aware of use any protective eye wear.

Category D: these were a group of patients who did not have any provision of eye protection or there were no available scope.

There were 17 cases (13 %) who used eye protection at the time of injury, most of them were welders, electricians and who got blast injury. One third of cases (39 patients) were very much aware about the use of EPD but did not use them during sustaining injury, most of them being welders. There were 54 cases (42 %) were not aware even about any use of eye protection, most of them being from workers in stone crusher, building construction, road construction etc. There were 18 patients (14 %) who were not provided any such eye protection or there were no feasible assess of such thing in their vicinity. This group comprises mainly of farmers, small scale timber industry. Figure 2 shows categories of patients according to their EPD use and their respective percentage.

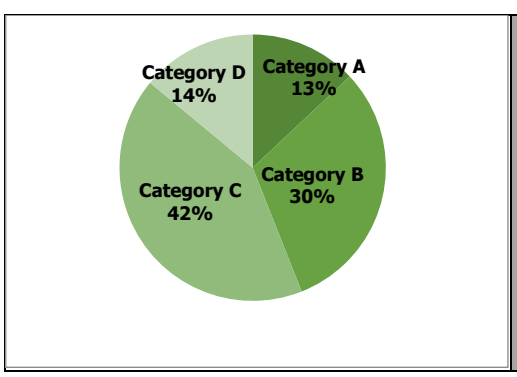

Figure 2. Eye Protective Device Use Behaviour

Figure 3. (a). Open Globe Injury Caused by Wooden Fragment. Leaking Lens Matter Seen

Figure 3. (b). Copper Wire Penetrating into Anterior Chamber

Figure 3. (c). Corneal Laceration Caused by Crushed Stone. Prolapsed Iris Can Be Seen.

Figure 3. (d). Subluxation of Lens with Papillary Capture Caused by Cow Horn Injury

DISCUSSION

In western Odisha there are relatively few number of tertiary health care centres. VSSIMSAR receives a large proportion of patients from most part of western Odisha, adjoining area of Chhattisgarh and Jharkhand. Our study shows male preponderance with 85 % of all cases. This may due to involvement of more number of male in work related activities in our area.

Most affected age group were 21 to 40 years which consisted 47 % of cases. Our study also shows 24 % of cases who were more than 50 years. It shows that work experience confers little immunity to ocular injuries.

Both industrial and agricultural sectors contributed the ocular injuries with 66 % cases and 30 % of cases respectively. This may be explained by the geographical location which is a conglomeration of agriculture belt of Sambalpur, Bargarh and Sonepur district in one side and growing industries of Jharsuguda and Anugul on the other side. This finding is consistent with similar type of studies conducted by Dahiya et al.[8] and Kundu et al.[9]

Most cases showed unilateral eye involvement (99 %) and both the eyes were nearly equally involved. Right eye involvement was in 48 % cases and left eye in 51 % of cases.

In our study, most common clinical diagnosis was ocular surface foreign bodies (60 %), out of which corneal foreign bodies were 37 % and conjunctival foreign bodies 23 %. Similar results were observed in Thompson et al. they found corneal foreign body (59 %) as the most common injury. Foreign body of cornea and conjunctiva was also observed as commonest entity (60 %) by Dahiya M et al.

We found 37.5 % cases due to welder's arc injury which were a varied combination of superficial foreign body, thermal injury and photo-keratitis. This may be attributed to non-use or improper use of protective eye wears.

We encountered 15 % cases of open globe injuries predominantly corneo-scleral laceration. Most of these injuries were caused by projectile wooden piece penetrating into eyes while splitting or chopping wood. None of the patients during these type of activities used any eye protective measures.

Most common ocular structure involved during injury in our study is cornea (68 %). Similar results were observed in Arvind H.S. et al.[10] Kavol et al.[11] and Malik[12] et al. who found corneal involvement in 73 %, 81 % and 55.8 % respectively.

In our study 87 % of patients did not use any eye protective devices. This observation is very much consistent with the study conducted by Thompson et al. Apart from these 87 %, rest cases were aware and used eye protective device. Most of them were from construction sectors like welding. Injury inflicted by these group of patients may be due to improper use of protective eyewear or erroneous history. In agriculture sector none them used any eye protection and they constituted the second common sector to contribute to ocular trauma. There is provision of eye protection in many industries but very little of such things in agriculture sector. This shows there is a great need of awareness towards ocular safety in every work places be it large or small, organised or unorganised.

CONCLUSIONS

Occupation related ocular injuries are very much preventable using standardised eye protective devices. These injuries occur maximum in 21 to 40 years age group. Severe forms of ocular injuries can affect an individual's job prospects and economy badly. Open globe injuries occur in timber industry and animal husbandry. Agriculture sector presents large number of ocular injuries. Programme development and implementation in this sector would reduce major proportion of cases.

Easy availability and cost effectiveness of protective eyewear in this sector is important. Strict implementation of law for use of protective eye gear, and regular standard audit will decrease many ocular injuries in industrial sectors.

Safety education, training and provision of protective eyewear will lessen the burden of occupational ocular injuries. Community level awareness campaign, and participation, will surely strengthen this preventive drive.

Limitations

Our study could not assess the type and standard of eye protective device used by the workers at their workplace. This study was conducted in a tertiary health care centre and so could not depict the exact demographic profile of occupational ocular injury at community level but can be taken as a reference baseline.

Data sharing statement provided by the authors is available with the full text of this article at jebmh.com.
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