ORIGINAL ARTICLE

Profile of Ocular Trauma at Tertiary Eye Centre

D.V. Singh, Yog Raj Sharma, R.V. Azad, Dinesh Talwar, Rajpal

Abstract

This prospective study reveals the epidemiological profile of ocular trauma referred to a tertiary eye centre over one year. All consecutive patients referred to Vitreo-retina service during 1 year period were examined.Out of total 523 eyes registered large proportion was <25years of age (67%), males (88%) and literate (77%). Forty-four percent belonged to rural area and 38% were students. Most of the open globe injuries were Zone 1(50.8%). 75% presented >1 week after injury. The incidence of intraocular foreign body and retinal detachment was 17.4, and 11.3% respectively. Diagnosis of post traumatic endophthalmitis was made in 20.5% of open globe injuries. Development of endophthalmitis correlated with younger age, rural setting, illiteracy, presence of foreign body and lens disruption. Ocular trauma requiring tertiary care commonly affects young students, labourers and factory workers. Younger, rural and illiterate patients are more likely to develop infection especially if they have lens injury or intraocular foreign body.

Key Words

Ocular Trauma, Open Globe, Epidemiology, Endophthalmitis.

Introduction

The impact of trauma on a human eye may range from occurrence of minute corneal abrasions/innocuous sub-conjunctival hemorrhage to a badly lacerated globe. A large number of ocular injuries require posterior segment intervention. The profile of these injuries remains unknown. Few studies exist on the epidemiological profile of posterior segment injuries requiring tertiary care. Most of these studies including three large series reported recently from United States were retrospective (1-3) or from emergency room data (4,5). We therefore decided to carryout a prospective study on patients of ocular trauma patients referred to the trauma clinic at our centre, which is a large 300-bed ophthalmic tertiary eye care centre in North India. The objective of this study was to analyze the epidemiological profile of patients with ocular trauma requiring tertiary care and the risk factors for development of retinal detachment and endophthalmitis.

Material and Methods

All the patients visiting Trauma Clinic at our institute from July 1999 to July 2000 with primary diagnosis of ocular trauma were included. Patients were referred to us from our own emergency department, outdoor patient department and the eye care centres from all over the country. Eyes with pre-existing diseases like glaucoma, operated eyes (injury to previously operated eyes) or where clinical findings were determined to be of non-traumatic nature (trauma bringing to notice of some other pathology) were excluded from the study. The demographic data of each patient including address (rural/urban), literacy status, occupation, and financial status were recorded in addition to a complete history of the mishap and the nature and circumstances of the injury. Patients residing in a place with no district hospital were categorized as rural. The literacy was determined on basis of educational status as reported by patients themselves. Financial status was based on monthly income per person. The detailed ophthalmic work up of all the patients including slit lamp examination, +90D examination and indirect ophthalmoscopy was carried out. Ultrasonography was used whenever unclear

From Dr. Rajindera Prasad Centre for Ophthalmic Sciences, AIIMS, Ansari Nagar, New Delhi.
Correspondece to: Prof.Yog Raj Sharma, Room No. 493, Dr. Rajindera Prasad Centre for Opthalmic Sciences AIIMS, Ansari Nagar, New Delhi.

media prevented fundus evaluation. Intraocular pressure was measured in all eyes except in fresh open globe injuries. Gonioscopy was done in all closed globe injuries. In eyes with corneal oedema and or hyphaema gonioscopy was done at next follow up. Complete details of ophthalmic examination including (1) initial best corrected visual acuity (2) lid or facial injury, sub-conjuctival haemorrhage or laceration (3) presence or absence of corneal/scleral perforation, hyphaema, iris injuries and afferent pupillary defect (4) presence or absence of vitreous haemorrhage, retinal detachment or foreign body, endophthalmitis, retinal breaks, choroidal rupture and or macular hole were noted. The record of investigations and surgeries already done were also noted from the records available with the patients. In patients who were initially treated else where, findings at the time of initial presentation to the physician were also noted. All the patients were followed up at 2 monthly intervals with at least 3 visits during the initial six months with a follow up visit scheduled at or more than 6 months following the injury. Standardized Ocular trauma classification described by Pieramici *et al* (6) was used to grade all injured eyes at initial examination. Ocular trauma classification variables were tested by univariate and multivariate analysis. All the candidate variables were categorized and there association with development of *endophthalmitis* and *retinal detachment* was tested by univariate analysis (categorical chi-square) and variables possessing significant univariate association were analysed by unweighed logistic regression analysis.

Results

A total of 920 eyes were examined in trauma clinic during one-year period. 523 eyes fulfilled the inclusion criteria. Follow up period ranged from 6 months to 35 months with all eyes having at least one follow up visit no sooner than 6 months after the injury. Table 1&2 show the profile of all eyes. Large proportion (88.5%) of these was males. While the age ranged from 6 months to 98 years with a mean of 22.74 and standard deviation of ±14.7 years, 175 (33.5%) patients were less than 14 years of age. Percentage of patients categorized was 36.9% as rural and 23.7% as illiterate. Most of the patients had unilateral ocular involvement, right eye was involved in 262 (50.1%), the left in 245(46.8%) and both eyes were involved in 16 (3.1%).

Table 1. Profile of injured eyes.

Variable	Catagories	Incidence
Age	<!4 Yrs	33.5%
	15-25 Yrs	31.2%
	26-40 Yrs	24.7%
	>40 Yrs	10.7%
Sex	Male	88.55
	Female	11.5%
Residential address	Rural	36.9%
	Urban	63.1%
Educational Status	Illitrate	23.7%
	Litrate <10std.	24.9%
	11std.	29.6%
	>Graduate	21.6%
Financial Status (Monthly income per person)	Poor {<1000}	44.4%
	Lower -middle {1000-3000)	49.5%
	Upper -middle (3000-5000)	5.9%
	Welloff(>5000)	0.2%

Table 2. Profile of injured eyes.

Variable	Catagories	Incidence
Facial Injury	Present in	20.1%
Sub-conjuntivital	Present in	8.6%
Time of presentation	<2 days	18(3.4%)
	2-7 days	111(21.1%)
	8-30 days	236(45.1%)
	>30 days	158 (30.2%)
BCVA presentation	>20/40	61 (11.7%)
	20/50-5/200	103(19.7%)
	4/200-light perception	300 (57.4%)
	No light perception	46 (8.8%)
Size of wound (292eyes)*	>10 mm	20 (6.8%)
	3-10 mm	151 (51.7%)
	<3 mm/occult	97+24=121
Relative Afferent Pupillary Defect	Present in	12.4%
Lens involvement	Present in	43.1%
Vitreous hemorrhage	Present in	34.3%
Intraocular Foreign body	Present in	17.4%
Retinal detachment	Present in	11.3%
Endophthalmitis	Present in	11.5%

n= 523 eyes *(except for size of wound)

Closed globe injuries were present in 231 (44.2%) and open globe in 292 (55.8%) eyes. All open globe injuries were repaired previously. Mechanism of injury and occupation of the patients is given in (Table

3&4). Ocular injuries were most commonly caused by metallic objects (8.9%) and vegetable matter (8.9%). Other causative agents included bow and arrows (7.46%), sports related {including cricket and tennis balls, badminton rackets and shuttle cocks, bat and *gillie*} (7.6%), Hammer and chisel (6.7%), gunshot (3.2.%), blast injuries (2.5%) and other occupational injuries (6%). Bow and arrow injury, with a broomstick commonly used as an arrow, is a common mode of injury in our set up. Associated facial injury was present in 20.1% of eyes. Sub-conjunctival hemorrhage as an isolated/associated finding was present in 8.6% of the injured eyes. Only 3% of the patients were able to reach a tertiary care centre within 48 hours. The majority of patients (75%) presented more than one week after the injury. At initial presentation most eyes (57.4%) had best-corrected visual acuity (BCVA) of less than 5/200 but better than no light perception. 46(8.8%) eyes had no light perception at presentation and only 61 (11.7%) had BCVA better than or equal to 20/40.

Table 3.

Hammer & chisel	35 (6.7%)
Bow & arrow	39 (7.5%)
Fire cracker	26 (5.0%)
Metallic object (screw drivers, needles)	47 (8.9%)
Vegetable matter	47 (8.9%)
Finger/elbow/fist	24 (4.6%)
Road accidents	23 (4.4%)
Stone	28 (5.3%)
Sports related (ball, gilli, bat)	40 (7.6%)
Blast & gunshot injury	30 (5.7%)
Other occupational	32 (6.12%)
Miscellaneous	152 (29.1%)

Table 4.

Occupational status	
Student	200(38.2%)
Factory worker	57 (10.9%)
Manual laborer	39 (07.4%)
Farmer	47 (08.9%)
Mechanics	6 (01.1%)
Economically inactive	06(20.3%)
Business	21 (04.0%)
House wife/ nil	47 (08.9%)

New ocular trauma classification (6) was used to assess all eyes and results are depicted in (Table 8). Zone 1was affected in 50.7% of the open globe injuries. Site of the laceration was scleral and corneo-scleral in 18% of cases each. 8% eyes didn't show any entry wound, but further clinical examination suggested that they were open globe injuries. Intra-ocular foreign bodies (IOFBs) constituted a major part of this group.

Intraocular foreign body (IOFB) was present in 91 eyes constituting 31.16% of the open globe injuries. Vitreous hemorrhage as an associated or isolated finding was present in 34.8% of the eyes. The incidence in open globe injuries (41.44%) was higher than closed globe injuries (26.4%). The clinical diagnosis of posttraumatic endophthalmitis was made in 20.5% (60eyes) of the open globe injuries. No eye with closed globe injury developed endophthalmitis. This complication, which worsens the prognosis, was more common in younger and illiterate patients from rural background.

On categorical CHI SQUARE analysis patient's younger age (<6yrs), rural background, illiteracy, large lacerations, lens injury and mode of injury were significantly (p-value <0.05) associated with development of endophthalmitis (Table 5. The variables not found to be associated with endophthalmitis were sex, financial status, time of presentation and presence of intraocular foreign body. The retinal detachment was found in 11.3% of all the cases. In contrast to endophthalmitis the development of retinal detachment was significantly associated with open globe injuries, larger lacerations (>10mm) and delayed presentation as compared to closed globe injuries or smaller lacerations (Table 6). Other findings seen in a few patients included macular edema (40), Choroidal rupture (22), macular hole (13) and traumatic optic neuropathy (23 eyes). During 1 year period 201 out of these 523 patients required admission to the hospital. Table 7 shows the details of the procedures done during hospital stay. 20.2% of the patients had excellent outcome defined by a visual acuity better than or equal to 20/40 at six months. Another 38.6% had at least ambulatory visual acuity of 5/200 or better but less than 20/40 in the injured eye. Best corrected visual acuity at presentation and relative afferent papillary defect were highly associated with visual outcome (p-value<0.0001). Closed globe injuries with lamellar laceration had best visual outcome with as many as 91% eyes achieving =20/40 BCVA. Ruptures were associated with worst out come with only 22% eyes regaining =4/200 BCVA.

Table 5. Categorical Chi-square analysis of variables for association with Endophthalmitis

Variable	P-value
Age	0.0001**
Sex	0.1631
Rural status	0.0263*
Literacy	0.0011*
Financial status	0.2410
Lens Injury	0.0004*
Presence of IOFB (Intra Ocular Foreign Body)	0.0027*
Size of laceration	0.0000**
Duration of injury	0.0467*

Unweighted Logistic Regression For Development Of Endophthalmitis

Predictor Variables	Coffficient	STD/ Eror	COEF/SE	P
Constant	1.08878	0.93149	1.17	0.2425
Rural Status	0.33234	0.32095	1.04	0.3004
Financial	0.18268	0.30349	0.60	0.5472
Literacy	0.41957	0.16077	2.61	0.0091*
Laceration Size	0.59067	0.14100	4.19	0.0000**
IOFB	0.41083	0.38041	1.08	0.2802

*Significant ($p<0.05$), **Highly significant ($p<0.001$)

Table 6. Chi-square analysis of variables for association with Retinal Detachment

Variable	P-value
Age	0.3555
Sex	0.7389
Rural status	0.6117
Literacy	0.5488
Financial status	0.5028
IOFB	0.5322
Size of laceration	0.0113*
Type of injury (Closed Globe/ Open Globe)	0.0065*
Duration of injury	0.0857

Unweighted Logistic Regression For Develop Ment Of Endophthalmitis

Predictor Variables	Cofficient	STD Error	COEF/SE	P
Constant	2.01695	0.87443	2.31	0.0211
Rural Status	0.04370	0.32784	0.13	0.8940
Financial	-0.17178	0.28186	-0.61	0.5422
Litracy	-0.14152	0.15260	-0.93	0.3537
Lens Involment	0.07643	0.27446	0.28	0.7806
Laceration size	0.39289	0.13920	2.82	0.0048*
IOFB	0.04987	0.34367	0.15	0.8846

*Significant($p<0.05$),**Highlysignificant($p<0.001$)

Table 7. Surgical procedures done during hospital stay

Hospital Admission	201(38.4%)
Foreign body removal	50 (24.9%)
Vitreoretinal surgery for retinal detachment and or macular hole	31 (15.4%)
Lens aspiration/ Hyphaema drainage	38(18.9%)
Pars plana vitrectomy/ Pars plana lensectomy or both	11(11.9%)
Others(posterior dislocated lens,trabeculectom/ phacoemulsification, intravitreal antibiotics)	58(28.8%

Table 8. Ocular Trauma Classification

Type Of Injury	Closed Globe(231)	Contusion	199
		Lamellar Laceration	22
		Mixed	10
	Open Globe(292)	Penetrating	157
		Perforating	23
		IOFB	91
		Mixed	3
		Rupture	18
BCVA at presentation		>20/40	61 (11.6%)
		20/50-20/100	41
		19/200-5/200	62
		4/200-LP	313
		No LP	46
Zone of Injury	**Closed globe**	**1**	48
		2	70
		3	113
	Open globe	**1**	148
		2	31
		3	113
RAPD	**Present**		65 (12.4%)
	Absent		458 (87.6%)

Discussion

Ocular trauma is an important cause of blindness and ocular morbidity. Most previous studies on the profile and prognostic factors in ocular trauma have been carried out in more developed countries where modern facilities for managing ocular trauma are widely available (1,2). There is paucity of studies on the profile of ocular trauma from the less developed countries (5-7).

Such studies can play an important role not only in defining the target groups for prevention and education on ocular trauma but also in prognosticating ocular injuries at the time of presentation, prevent many unnecessary surgical procedures, and also help ophthalmologists dealing with ocular trauma in making clinical decisions.

In our study ocular trauma requiring referral to a tertiary care centre predominantly affected young males (88.53%). One-third patients were in pediatric age

group (<14yrs), and males outnumbered females in ratio of 8:1. This is comparable to the demographic profile of ocular trauma patients found by recent study from south India where males (86.8%) outnumbered the females (13.2%) and children (<16 years) constituted 46.8% of the total affected population (6). The children and young males due to their outdoor and high-risk activities are at more risk than other groups. While most (94%) of the patients were from poor and lower middle class, this probably reflects a *selection bias* since our centre has predominance of patients from poor and lower middle class.Although students (38%) formed the largest subgroup, the factory workers (11%), manual laborers (7.5%), and farmers (9%) were also commonly affected. Higher proportion of the students can be explained by increased involvement in activities at risk; playing bow and arrow, unsupervised fire works and also due to a large (67%) number of young patients (<25years) affected by ocular trauma. Factory workers and manual laborers are more exposed to ocular trauma than general population (3,8,9). The usual causes of ocular trauma in previous studies were work related, sports related, articles of common use and road accidents (1-3). In our study household metallic objects, hammer and chisel and bow and arrow commonly caused ocular trauma. 59% of all patients recovered ambulatory vision at six months. The visual acuity at the final follow up of less than 5/200 was seen in 40% of the patients. Poor prognosis can be explained on the basis of "selection bias" in referring patients to trauma clinic. Eyes that had only anterior segment involvement and hence better prognosis were managed by anterior segment surgeons and not referred to trauma clinic. This is the reason why our study cannot be compared with previous studies (4,5,10) that have retrospectively analyzed data of trauma patients seen at OPD or emergency department (1,2,4,5,11,12).

New ocular trauma classification (6), now widely accepted, has been assessed for its prognostic significance (10,13). This study once again emphasizes the importance of classifying and grading ocular injuries. The best-corrected visual acuity and presence of relative afferent papillary defect are strongest predictors of long-term visual outcome. Indirect traumatic rupture of globe carried a poorer prognosis as reported earlier (14). The visual acuity of light perception or less, abnormally deep anterior chamber and very low intraocular pressure are indicators of occult globe rupture. Early detection and repair may improve prognosis in such cases.

The incidence of endophthalmitis in open globe injuries was found to be 20.55% which is slightly higher than previous studies (15). The younger illiterate patients from rural background were more likely to develop endophthalmitis after trauma. The delayed presentation to the tertiary eye care centre was found to be significantly associated with the development of endophthalmitis only on univariate analysis. The delayed presented to primary or secondary eye care centre for primary repair might have significantly correlated with the endophthalmitis. The data on time interval between injury and primary repair was not available for all the patients and hence was not analyzed.

The young age, illiteracy and rural status are probably partly responsible for delayed presentation and thus more risk of infection. The larger lacerations were also more likely to develop infection. As reported previously injury to lens capsule was significantly associated with endophthalmitis development (15,16). Disruption of lens removes barrier between anterior and posterior segment, provides culture media for microorganisms and also disturbs the ocular currents and thus prevents clearing of pathogens (15). Eyes with IOFBs are more likely to develop endophthalmitis. The presence of IOFB, rural setting and delayed repair has been reported to be associated with endophthalmitis (16,17).

11.3% of the injured eyes developed retinal detachment over a period of 6 months. The open globe injuries were significantly more likely to have retinal detachment than closed globe injuries. This can be explained by higher incidence of vitreous disturbance, incarceration and resultant traction in open globe injuries. Also the incidence of vitreous hemorrhage was more (41.4% Vs 26.4%) in open globe than closed globe injuries. Blood in vitreous in presence of scleral wound leads to fibro-vascular proliferation and tractional retinal

detachment (18,19). The target groups for the purpose of prevention of ocular trauma are; young males less than 40 years especially less than 25 years; students and those involved in mechanical jobs, where they are working in close proximity to revolving machinery. These groups should be focused and made aware of the ocular trauma, its consequences, and measures for prevention and *early visit* to eye care centre. Resources should be mobilized to provide quality ocular emergency care to our rural and illiterate population with emphasis on immediate attention to any ocular trauma. Most of our patients were from low socio-economic status. Electronic and mass media should be used to disseminate ocular trauma related information. Factory workers and others in high-risk jobs should be educated about protective eyewear. Certain legislative directives for protection of laborers and factory workers should be enacted.

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