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ORIGINAL RESEARCH ARTICLE

Clinical Study and Profile of Corneal Trauma in Tertiary Care Center

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ABSTRACT

Background: Ocular trauma is a major cause of ocular morbidity and blindness, especially in children and young adults.

The trauma can range from minor cuts to more serious penetrating injuries to the globe. To assess the risk factor and management outcome of Corneal Trauma in Tertiary Care Center.

Methods: This study evaluated 200 patients presented to Regional Institute of Ophthalmology with corneal trauma after obtaining informed consent with respect to inclusion and exclusion criteria

Results: Most of the patients with closed globe injury had a good visual improvement whereas patients with open globe injury with visually acuity less than 1/60 who underwent surgery, only the globe integrity was achieved but the visual acuity did not improve resulting in significant ocular morbidity.

Conclusion: Corneal injuries continued to be important causes of corneal morbidity. By understanding the different types of injuries to which the cornea is exposed the practitioner may more capably manage these injuries and minimize the structural and visual sequelae of corneal injury. Early treatment can restore good vision and use of protective glass while working will be the preventable measure and use of antibiotic drops after injury will be the proper method of treatment. Thus, corneal trauma can be prevented by health education and awareness created among the people.

Keywords: Corneal trauma, Ocular trauma score, Corneal abrasions, Open globe injuries, Workplace injury.

INTRODUCTION

One of the major causes of ocular morbidity &blindness is ocular trauma occurring mostly in paediatric and young adults. The trauma may range from superficial injuries to more devastating penetrating injuries of the globe.

Ocular trauma may be

- Local - eyeball and adnexal injury (or)
- Associational - association with head trauma or polytrauma

Cases with polytrauma or head injury requires immediate evaluation and management.

A uniform classification system should be used for accurate understanding, planning the management and delivering optimal patient care. Ocular trauma is classified based on Birmingham Eye Trauma Terminology System(BETTS)[1]

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Ocular trauma score

Once injury was classified, its invaluable for both the patient and the ophthalmologist to obtain reliable information regarding the outcome of the injury. Ocular trauma score was designed on the basis of BETT and information from CD

Calculating the OTS

Step 1: The variables and the raw points

Initial visual factor	Raw points
A. Initial raw score (based on initial visual acuity)	NPL = 60 PL or HM = 70 1/200 to 19/200 = 80 20/200 to 20/50 = 90 ≥ 20/40 = 100
B. Globe rupture	-23
C. Endophthalmitis	-17
D. Perforating injury	-14
E. Retinal detachment	-11
F. Relative afferent pupillary defect (RAPD)	-10
Raw score sum = sum of raw points	

Step 2: The sum of the raw points: A+ B + C + D +E +F is calculated

Raw score sum	OTS score	NPL	PL/HM	1/200–19/200	20/200 to 20/50	≥ 20/40
0–44	1	73%	17%	7%	2%	1%
45–65	2	28%	26%	18%	13%	15%
66–80	3	2%	11%	15%	28%	44%
81–91	4	1%	2%	2%	21%	74%
92–100	5	0%	1%	2%	5%	92%

NPL: nil perception of light; PL: perception of light; HM: hand movements

Step 3: Raw points are converted into the OTS and the final visual prognosis is calculated

Among the ocular trauma, corneal injuries contribute to highest of 50%. The cornea, the most anterior structure of the eye, is exposed to various hazards ranging from airborne debris to blunt trauma of sufficient force to disrupt the globe itself. Because the cornea is also the major refracting surface of the eye, even minor changes in its contour result in significant visual problems.

Corneal trauma is one of the preventable causes of monocular visual impairment. Corneal injuries can occur either by direct trauma with sharp objects, blunt objects and foreign bodies or by exposure with chemicals, radiations and thermal sources. Corneal trauma may vary

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from minor abrasion to perforating injuries, partial and full thickness corneal laceration. It may produce insignificant to profound visual loss. Corneal trauma may occur in working places, domestic places, road traffic accidents and school. Corneal trauma may be associated with trauma of other ocular structures like sclera, lid, conjunctiva, uveal tissue, optic nerve and retina.[2]

Corneal opacification, as a cause of blindness, is second only to cataract in magnitude. One of the most important preventable and avoidable causes of corneal blindness is corneal injuries. By understanding the different types of injuries to which the cornea is exposed, the practitioner may more capably manage these injuries and minimise the structural and visual sequelae of corneal injury. This study aims to assess the risk factors and management outcome of Corneal Trauma in Tertiary Care Center.

MATERIALS &METHODS

Study population

200 Patients presented to Regional Institute of Ophthalmology with corneal trauma registered, evaluated and followed up during the study period. Informed consent is obtained from all patients, in case of children below 13 years, consent obtained from parents

Inclusion criteria

1. All patients with corneal trauma irrespective of the age group and sex
2. Patients with Corneal trauma presenting within 1 week of injury

Exclusion Criteria

1. Patients with Corneal trauma presenting after 1 week of injury
2. Patients with Ocular trauma not involving cornea
3. Patients with History of previous corneal surgery
4. Patients with Surgical induced corneal injuries
5. Patients with Unconscious state
6. Patients who are all not available for follow-up
7. Patients who are not giving consent for the study
8. Patients with pre existing corneal opacity
9. Patients diagnosed previously with blind eye

Assessment at the time of presentation

- Detailed history includes demographic data including age, sex, occupation, address, mode of injury, place of injury, time of presentation to hospital from the time of injury, previous corneal injury/ocular injury, previous ocular trauma, treatment history.
- Uncorrected visual acuity by Snellen’s chart
- Best corrected visual acuity(snellen’s chart)
- Slit lamp biomicroscopy using Topcon Slit lamp 2802214
- Intraocular pressure by I care tonometer
- Flouerscein staining to know the layers of cornea involved
- Fundus examination (Slit lamp biomicroscopy with 90D/Indirect ophthalmoscopy)
- X ray orbit, CT orbit, USG B scan were done as and when indicated.

Ocular trauma was classified according to Birmingham Eye Trauma Terminology System(BETTS). Ocular trauma score was used to classify the injuries.

Outpatient basic treatments were given for most of the closed globe injury patients. Patients with open globe injury were advised admission for surgical management and further

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observation. Admitted patients included patients with partial and full thickness corneal lacerations, corneal perforations, chemical and thermal burns with 360 limbal ischemia.

Follow up

The patients were followed up after one day, one week, two weeks, 1 month and up to 3 months as per requirement.

Parameters assessed

- Best corrected Visual acuity by Snellen's Chart(1^{st}, 7^{th},14^{th} , 30^{th}, and 90^{th} day),
- Slit lamp biomicroscopy using Topcon Slit lamp 2802214(1^{st}, 7^{th},14^{th} , 30^{th}, and 90^{th} day),
- Intraocular Pressure using ICare Tonometer (1^{st}, 7^{th},14^{th} , 30^{th}, and 90^{th} day),
- Fundus examination(30^{th} and 90^{th}day)

Statistical Analysis

Patient's data collected were periodically updated and stored in Microsoft Excel Data has been segregated based on different criteria's given below,

- Numerical Distribution
- Percentage Frequency
- Time Frequency

RESULTS

Age group (in years)	Male		Female		Total	
	Cases	%	Cases	%	Cases	%
<15 years	32	16	8	4	40	20
16-30 years	48	24	21	10.5	69	34.5
31-45 years	36	18	7	3.5	43	21.5
45-60 years	33	16.5	6	3	39	19.5
>60 years	5	2.5	4	2	9	4.5

Table 1: - Age and Sex Wise distribution of corneal trauma cases

Based on age group distribution table, observed that maximum affected age group is in the range of 16 to 30 years(34.5%), followed with 31 to 45 years (21.5%), <15 years (20%), 45 to 60 years (19.5%), >60 years (4.5%)

Gender Distribution	Total	Percentage
Male	154	77%
Female	46	23%

Table 2: Gender distribution

The above table shows that 77% were Male and 23% were Female

Eye Distribution	Total	Percentage
Right Eye	102	51%
Left Eye	98	49%

Table 3: Distribution of Right Eye and Left Eye

Based on the above distribution table, Right eye affected (51%) more than Left eye affected (49%).

Injuries	Total
Closed globe Injuries	148
Open globe Injuries	52

Table 4: Globe Injuries distribution

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The above table shows 74% injuries were Closed globe injuries and 26% were open globe injuries.

Type of Injuries	Total count	Percentage
Corneal Abrasion	52	26%
Corneal foreign body	50	25%
Corneal lacerations – Partial	10	5%
Blunt Trauma	10	5%
Corneal lacerations - Full Thickness	49	24%
Perforating	3	2%
Chemical injury	16	8%
Thermal injury	10	5%

Table 5: Types of injuries

The above table shows 26% of cases were corneal abrasions, followed by 25% of corneal foreign body, 24% of corneal lacerations Full thickness, 8% of chemical injury, 5% of Corneal lacerations (Partial thickness), 5% of blunt trauma, 5% of thermal injury and 2% of perforating injuries.

Causative Agents	No. Of cases	Percentage
Blunt	25	12.5
Foreign body	66	33
Sharp	42	21
Chemical	16	8
Fire Cracker	24	12
Finger/ Fist	15	7.5
Others	12	6

Table 6: Causative Agents

Based on above table, foreign body acts as a most causative agent with 33%, followed by Sharp objects with 21%, followed by blunt with 12.5%.

Places	No. Of Cases	Percentage
Work places	123	61.5
Home	34	17
Street	28	14
Others	15	7.5

Table 7: Distribution of corneal trauma as per place of injury

The above table shows more injuries happened at workplace with 61.5% overall, followed by home (34%), street (28%) and others (15%)

Time of Reporting	No. Of cases	Percentage
Within 24 Hours	167	83.5
24-48 Hours	20	10
48-72 Hours	10	5
> 72 Hours	3	1.5

Table 8: Distribution of corneal trauma cases as per reporting time after injury

Based on the above table, most of the cases reported within 24 hours of injuries i.e. 83.5%, followed by 10% of injuries reported within 24 – 48 hours, followed by 5% injuries reported within 48-72 hours, 1.5% injuries reported after 72 hours from the time of injury

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Treatment	No of cases	Percentage
Medical	138	69%
Surgical	62	31%
Table 9: Treatment		

Out of 200 cases, 138 cases were undergone medical treatment and 62 cases were undergone surgical treatment

Visual acuity at time of presentation	No. of Cases	Percentage
6/18 to 6/6	94	47%
6/24 to 3/60	45	23%
<3/60 to NO PL	53	27%
Table 10: Visual Acuity at the time of presentation		

Based on the above table, 47% of cases presented with visual acuity in the range of 6/18 to 6/6(normal vision) followed by 27% of cases with visual acuity range between< 3/60 to NO PL(blindness), 23% cases within 6/24 to 3/60 (low vision).

Visual acuity at 3rd month	No. of Cases	Percentage
6/18 to 6/6	133	67%
6/24 to 3/60	15	8%
<3/60 to NO PL	44	22%
Table 11: Visual Acuity at 3rd Month		

Patients were followed up closely and visual acuity has been validated at 3rd month. Based on above table, around 133 cases had visual acuity(20% cases showed improvement from visual acuity at the time of presentation) within(6/18 to 6/6)normal vision range.

Type of injury	Normal vision (6/6 to 6/18) cases	In Percentage
Corneal Abrasion	47	100
Corneal foreign body	48	96
Corneal lacerations – Partial	2	25
Blunt Trauma	10	100
Corneal lacerations - Full Thickness	6	12
Perforating	0	0
Chemical injury	12	80
Thermal injury	8	80
Total	133	66.5
Table 12: Visual Outcome in various types of corneal injury with Normal vision range		

At the end of 3rd month, all Corneal abrasions cases had normal vision, whereas penetrating and perforating injuries showed less improvement

Type of injury	Low Vision (6/18 to FC 3 meter)	Percentage
Corneal Abrasion	0	0
Corneal foreign body	2	4
Corneal lacerations – Partial	6	75
Blunt Trauma	0	0
Corneal lacerations - Full Thickness	4	10
Perforating	0	0
Chemical injury	1	6.66
Thermal injury	2	20
Table 13: Visual Outcome in various types of corneal injury with Low vision range		

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Most of the partial thickness laceration 75%)(healed with low vision, followed by thermal injury(20%), followed by full thickness corneal laceration.

Type of injury	Blindness (FC 3 meter to No PL/PR)	Percentage
Corneal Abrasion	0	0
Corneal foreign body	0	0
Corneal lacerations – Partial	0	0
Blunt Trauma	0	0
Corneal lacerations - Full Thickness	39	78
Perforating	3	100
Chemical injury	2	13.33
Thermal injury	0	0

Table 14: Visual Outcome in various types of corneal injury with Blindness

All perforating injuries (100%), 78% corneal lacerations full thickness cases didn't show much improvement from the visual acuity at the time of presentation

The data collected from 200 patients were analysed. Among 200 cases, 148 cases (74%) were closed globe injuries and 52 cases (26%) were open globe injuries (Table 4). Age and Sex wise distribution of corneal trauma is summarized (Table 1). The number of persons sustaining injuries was highest i.e., 69 (34.5%) in the age group 16-30 years, followed by 31-45 age group people (21.5%), <15 years age group (20%), 45-60 years age group(19.5%) and >60 years age group(4.5%). Males (77%)were affected 3.3 times more than females (23%) (Table 2). All patients were involved of one eye. Right eye being involved in 102(51%) cases and left eye being involved in 49% cases(Table 3)

Corneal abrasions (26%) is the most common type of injury followed by corneal foreign body(25%), corneal laceration (Full Thickness)(24%), Chemical injury(8%), corneal laceration (Partial Thickness)(5%), Blunt Trauma(5%), Thermal injury(5%), perforation injuries(2%) (Table 5). Among 16 chemical injuries, Alkali injuries (56.25%) were more than acid injuries (43.75%). According to roper hall classification, chemical injuries were classified. Among 16 cases,

- 10 cases were grade I
- 3 cases were grade II
- 4 cases were grade III
- 2 cases were grade IV

Most of the injuries were caused by foreign bodies (33%), followed by sharp objects (21%), blunt objects (12.5%), fire cracker (12%), chemical (8%), finger/fist (7.5%), others (6%) (Table 6). Most of the cases (83.5%) reported within 24 hours of injury, followed by 10% of cases within 24-48 hours, 5% of cases within 48 – 72 hours and 1.5% of cases reported > 72 hours (Table 8). Mostly injuries occurred in workplaces (61.5%) , followed by home (17%) , street(14%) and others (7.5%) (Table 7). A total of 94 patients (47%) had visual acuity within the range of normal vision (6/18 to 6/6), 45 patients (23%) had visual acuity within the range of low vision (6/24 to 3/60) and 53 patients (27%) showed visual acuity within the range of < 3/60 to No PL (Blindness) at the time of presentation. (Table 10) . Visual acuity cannot be assessed for 8 patients as they are less than 5 years of age. During follow-up at the end of 3rd month, total of 133 cases (67%) showed visual acuity within the range of 6/18 to 6/6, 8% of cases within the range of 6/24 to 3/60 and 22% of cases within the range of <3/60 to No PL. (Table 11).

On comparing Table 10 and Table 11, 30 cases within the range of low vision (6/24 to 3/60) and 11 cases within the range of <3/60 to No PL(i.e. Total of 20% of cases) showed improvement in visual acuity at the end of 3rd month from the time of presentation. Overall, 138 cases (69%) undergone medical treatment and 62 cases (31%) required surgical

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treatment. On comparing table 12, 13 and 14 the visual outcome of various types of corneal injuries at the end of 3rd month follow-up is as follows,

- Corneal abrasion – All cases (100%) showed visual acuity within the range of normal vision (6/18 to 6/6)
- Corneal foreign body – 96% of cases showed visual acuity within normal vision range, 4% of cases showed visual acuity within the range of low vision (6/24 to 3/60)
- Blunt Trauma – All cases (100%) showed visual acuity within the range of normal vision (6/18 to 6/6)
- Corneal laceration (Partial Thickness) – 25% of cases showed visual acuity within normal vision range, 75% of cases showed visual acuity within the range of low vision (6/24 to 3/60)
- Corneal laceration (Full Thickness) – 12% of cases showed visual acuity within the range of normal vision, 10% of cases within the range of low vision, 78% of cases showed within the range of blindness (< 3/60 to No PL)
- Chemical Injury – 80% of cases showed visual acuity within normal vision range, 7% of cases within the range of low vision, 13% of cases within the range of blindness (< 3/60 to No PL)
- Thermal injury – 80% of cases showed visual acuity within normal vision range, 20% of cases within the range of low vision
- Perforating injuries – All cases (100%) showed no improvement in visual outcome and they remain the range of <3/60 to No PL

70% of cases were central involving pupillary area and 30% of cases were in paracentral area. Most of the patients with closed globe injury had a good visual improvement. Patients with open globe injury with visually acuity less than 1/60 who underwent surgery only the globe integrity was achieved but the visual acuity did not improve resulting in significant ocular morbidity.

DISCUSSION

Corneal trauma is a preventable cause of monocular blindness. This study is a hospital based, single center, observational study on the profile of corneal trauma. Most common age group affected is between 16 to 30 years followed by 31 to 45 years. This is because, people in this age group were bread winners of their families. This is similar to other studies done by researches in India.[2,3] Males are affected more than females because males are most exposed in outside activities and preferred for early treatment, similar to other studies.[2,3] Regarding the type of injuries, corneal abrasions were most common, followed by foreign body and corneal laceration. In a study of corneal abrasions in Bhaktapur(Nepal) evaluating sequencing corneal ulceration, the annual incidence of corneal abrasions was estimated at 789/100,000.[4]

In Aarudhra et al study only 2% cases accounts for the penetration injuries but in this study around 25% cases showed penetration/perforation injuries Among chemical injuries, alkali injuries were more common than acid injuries which was similar to other studies.[5] This study also clearly states the mode of injuries that foreign bodies, sharp objects and blunt objects were the most common causes for corneal trauma. Most of the cases presented within 24 hours of injury, this is similar to the Adhikari study.[3]

Medical and conservative management was sufficient for superficial minor injuries which was proved by other studies like Adhikari[3] & Caroline studies.[6] Open globe injuries needed surgical management.

Most of the cases occurred in work places like industries, farmlands and construction sites followed by home; this is similar to other studies.[2,3] Most of the patients with closed globe injury had a good visual improvement. Poor visual outcome was seem to be associated with corneal lacerations and perforating injuries and they have to be visually rehabilitated.

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Aarudhra et al, in their analysis of visual outcome of corneal injuries have also demonstrated that corneal injures affecting the pupilary area of the cornea posed a greater threat to the final visual outcome as opposed to the paracentral and peripheral corneal involvement.[2] This study gives detailed information about the profile of cornea which are additive and supportive to other studies.

LIMITATION OF THE STUDY

- small sample size
- cases of corneal trauma associated with polytrauma and poor general condition could not be included as they have to be referred elsewhere

CONCLUSION

Corneal injuries continued to be important causes of corneal morbidity. By understanding the different types of injuries to which the cornea is exposed the practitioner may more capably manage these injuries and minimize the structural and visual sequelae of corneal injury. Early treatment can restore good vision and use of protective glass while working will be the preventable measure and use of antibiotic drops after injury will be the proper method of treatment.

Thus, corneal trauma can be prevented by health education and awareness created among the people. Health education may be targeted mainly with the working adult population as they are most affected and prevention of ocular morbidity among them may lead to development of country.

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