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Spectrum of orbital injuries with special reference to road traffic accidents

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Abstract
Ocular trauma is a potentially hazardous event with a multitude of pathologies and complications. It is important for patients and ophthalmologists to have, at the earliest possible time, reliable information regarding the expected outcome of a serious eye injury. F. Kuhn *et al.* [1] in 2002 formulated the OTS to help estimate the outcome of a serious eye injury. A vast number of studies have been conducted to estimate the prognostic value of OTS ever since then. Most of these studies have been retrospectively done. Also, the few prospective studies done over time, have had a low sample size. POTS, on the other hand, was developed in 2011, by U Acar *et al.* as a way to better estimate the visual prognosis following penetrating ocular injuries in children. This, being a prospective study, with a larger sample size, compared to previous studies, and a wide range of patient pathologies, and inclusion of patients of all age groups, provides reliable results to estimate the prognostic value of OTS and POTS. According to the results of this study, OTS has been a reliable predictor of final visual outcome, both in blunt and penetrating injuries, in patients of all age groups. Our study shows that ocular trauma mostly occurs in men, with majority being young adults, usually under the age of 40 years, with the left eye being more vulnerable to trauma that the right. There were nearly equal incidences of blunt and penetrating trauma, as seen in our study.

Keywords: Spectrum, orbital injuries, ocular trauma

Introduction
Ocular trauma is a significant cause of eye morbidity worldwide and a leading factor in non-congenital, monocular blindness, especially in young infants. Eye injuries result in considerable morbidity, including discomfort, emotional stress, and economic burden, in addition to visual impairment [1]. A reliable functional prognosis is crucial for selecting appropriate treatment options, involving the patient and their family. According to the World Health Organization, approximately 55 million eye injuries are reported annually, leading to limitations in daily activities for one or more days, affecting 0.8% of the global population [2]. Ocular trauma is responsible for around 19 million unilateral blindness cases and 1.6 million bilateral blindness cases. In India, ocular damage affects an estimated 2.4% of the urban population each year, with complete blindness occurring in 11.4% of those affected. India, as a developing nation, unfortunately has a high rate of road accidents, with 469,418 individuals injured and 151,417 fatalities in 2018 [3, 4]. Road traffic accidents incur significant socio-economic costs. Eye injuries, often accompanied by facial injuries and swelling, frequently occur in cases of vehicle collisions. For a long time, there was a lack of a reliable and comprehensive approach to objectively determine the functional prognosis of the eye. In 2002, the Birmingham Eye Trauma Terminology (BETT) was developed, categorizing ocular injuries into Open Globe Injury and Close Globe Injury and providing a standardized language to assist in predicting visual acuity post-therapy [5]. This led to the creation of the Ocular Trauma Score, which utilizes specific characteristics observed during the initial examination to predict the eventual visual outcome with a 77% probability ± one visual category. Road accidents can cause blunt trauma to the orbital rim, resulting in orbital fractures and injuries to the surrounding facial bones and soft tissues [6]. Orbital fractures may be accompanied by traumatic iritis, corneal abrasion, hyphema, acute glaucoma, lens trauma, vitreous hemorrhage, commotio retinae, retinal tears and detachment, and traumatic optic neuropathy. Orbital roof fractures may require early neurosurgical consultation if complications such as pneumocephalus, hemorrhage, or cerebrospinal fluid (CSF) leaks are present [7]. Treatment of any vision-threatening conditions typically excludes fracture healing until stabilization is achieved. Computed tomography (CT) scan is a primary imaging option

for evaluating orbital fractures, providing detailed measurements and shape analysis to guide clinical evaluation and surgical planning. Advanced technology allows for the creation of customized implants using computer-assisted simulations and 3D models for precise orbital reconstruction [8]. Given the high rate of accidents in India, with 1,280 injuries and 415 deaths occurring daily in road accidents, facial injuries combined with orbital injuries are common in traffic accident patients. Limited research has focused on road traffic collision trauma with orbital damage [9, 10]. Further exploration is needed to understand the spectrum of road accident trauma, particularly orbital injuries, and to utilize CT scans and computer-guided design and modeling simulations for accurate orbital reconstruction with patient-specific implants.

Materials & Methodology

The present study is a prospective interventional study. The study was conducted over a span of one year, from August 2021 to July 2022. All the population attending Department of Ophthalmology clinic at Heritage Institute of Medical Sciences (HIMS) Varanasi, after taking clearance from the ethical committee. The study was carried out in total of 50 patients who attended the ophthalmic clinic of Department of Ophthalmology, Heritage Institute of Medical Sciences (HIMS) Varanasi, during the span of study, who met the inclusion criteria and were found to be eligible were included in the study. During the study period all the cases of ocular trauma who met the inclusion criteria were considered for the study sample. The Inclusion criteria were as follows: 1. Patients of all ages and genders were included in the study, 2. Patients exhibiting clinical signs of damage to any ocular structure following trauma to eye, including cornea, anterior chamber or posterior chamber, 3. All cases should manifest with diminution of vision following ocular trauma, 4. All patients who provided signed and dated consents for any procedures undertaken to restore vision, 5. All patients who complied with the study procedures and were available during the course of the study.

The exclusion criteria Included: 1. Any patients suffering no diminution of vision following ocular trauma, 2. Any patients with damage to the integrity of the lid or adnexa but no damage to cornea, anterior chamber or posterior chamber, 3. Patients who could not participate in the treatment or be monitored frequently according to the study protocol, 4. Patients presenting to the center after initial treatment elsewhere, 5. Patients with other ocular diseases affecting visual function, 6.Patients with previous intraocular surgeries, 7. Patients with No Perception of Light.

Result

Table 1: Distribution of Study Subjects According to Age

Age in Years	No. of Eyes	%
<18 YEARS	35	70.00%
>18 YEARS	15	30.00%

Table 2: Distribution of Pots Subjects According to Age

Age	0 To 5 Years	6 To 10 Years	11 To 18 Years
No. of eyes	6	10	4
%	30.00%	50.00%	20.00%

Table 3: Distribution of OTS Subjects According to Age

Age	≤18 Years	18 To 40 Years	>40 Years
No. of eyes	14	12	4
%	70.00%	60.00%	20.00%

Table 4: Distribution of Study Subjects According to Gender

Gender	No. of eyes	%
Male	42	84.00%
Female	8	16.00%

Table 5: Distribution of Subjects According to Laterality of Eye

	No. of Eyes	%
Left eye	39	78.00%
Right eye	11	22.00%

Table 6: Distribution of Patients According to The Score used for Their Initial Evaluation

	No. of Eyes	%
Ocular trauma score	41	82.00%
Pediatrics penetrating ocular trauma score	9	18.00%

Table 7: Distribution of Patients According to the type of Injury Suffered

	No. of Eyes	%
Blunt ocular injury	40	80.00%
Penetrating ocular injury	10	20.00%

Table 8: Distribution of Subjects according to Wound Location in Pots

	Zone 1	Zone 2	Zone 3
No. of eyes	12	6	2
%	60.00%	30.00%	10.00%

Table 9: Distribution of OTS Subjects Comparing their Initial and Final Visual Acuity

	PL-	PL+/HM	1/200 to 19/200	20/200 to 20/50	≥20/40
Initial visual acuity	0	11	13	5	1
Final Visual acuity	1	4	3	9	13

Table 10: Distribution of POTS Subjects Comparing their Initial and Final Visual Acuity

	PL-	PL+/HM	1/200 to 19/200	20/200 to 20/50	≥20/40
Initial visual acuity	0	13	4	3	0
Final visual acuity	1	2	1	8	8

Table 11: Distribution of Subjects according to Predicted Visual Prognosis using Ocular Trauma Score

	PL-	PL+/HM	1/200 to 19/200	20/200 to 20/50	≥20/40
Predicted vision acc to OTS	0	6	0	0	24
Final vision	1	4	4	7	14

Table 12: Distribution of Subjects according to Predicted Visual Prognosis Using Pediatric Penetrating Ocular Trauma Score

	PL-	PL+/HM	1/200 TO 19/200	20/200 TO 20/50	≥20/40
Predicted vision acc to pots	11	9	0	0	0
Final vision	1	2	1	8	8

Table 13: Distribution of Subjects according to Best Corrected Visual Acuity 6 Months After Injury

BCVA 6 Months after Surgery	PL-	PL+/HM	1/200 to 19/200	20/200 to 20/50	≥20/40
No. of eyes	2	7	6	15	20

Table 14: Distribution of Pots Subjects according to Signs at Presentation

Signs	No. Of Eyes
Iris Prolapse	12
Hyphaema	5
Unclean injury	10
Delayed surgery	14
Traumatic cataract	11
Vitreous haemorrhage	2
Retinal detachment	1
Endophthalmitis	0

Table 15: Distribution of OTS Subjects according to Prognostic Features

Prognostic Feature	No. of Eyes
Rupture	2
Endophthalmitis	0
Perforating injury	0
Retinal detachment	3
Afferent Pupillary defect	5

Table 16: Distribution of OTS Subjects according to Presenting Signs

Signs	No. of Eyes
Traumatic cataract	25
Hyphaema	5
Iris prolapses	2
Corneo-scleral tear	8
Retinal detachment	3
Vitreous haemorrhage	2
Mydriasis	2
Afferent Pupillary defect	5

Discussion

Ocular trauma is a sudden and usually unanticipated event to the person involved, and can occur to any person at any time. Though majority of the cases occur to males, who are generally more involved in outdoor and risk-taking activities than females. Traumatic ocular injuries often cause significant visual loss in young patients, as well as adults, and is a leading cause of non- congenital, monocular blindness, especially in children [8, 9, 10].

In our study, 50 patients with ocular trauma were included, categorized into OTS and POTS based on age and type of injuries. Among them, 35 patients were <18 years old (70%) and 15 patients were >18 years old (30%). Similar numbers of cases were included in studies conducted by Morgan *et al*., Kasahara *et al*., Pahor *et al*. to compare ocular trauma score and pediatric ocular trauma score [11, 12].

Out of the 50 patients, 20 were categorized under POTS due to penetrating ocular injury. Among them, 6 patients (30%) were aged 0-5 years, 10 patients (50%) were aged 6-10 years, and 4 patients (20%) were aged 11-18 years. The ocular trauma score was recorded according to age, with 70% of cases being less than 18 years old, 60% between 18-40 years old, and only 20% being over 40 years old.

In our study, the majority of patients were males, accounting for 84%, while females accounted for 16%. This finding is consistent with previous studies that have reported a male preponderance in ocular trauma. The higher number of male patients may be attributed to societal roles and occupational hazards. Regarding the laterality of eye involvement, left eye injuries were more prevalent (78%) compared to right eye injuries (22%). This may be due to protective reflexes favoring the right eye. However, no other studies have reported similar associations. In our study, the laterality of the involved eye did not impact the final visual outcome [13, 14, 15].

Blunt ocular trauma was more common than penetrating ocular trauma, accounting for 80% and 20% of cases, respectively. This finding is consistent with previous studies conducted in different regions, which also identified blunt injuries as the most common type of ocular trauma. The distribution of subjects according to wound location in POTS showed that 60% of cases had injuries within the cornea (zone 1), 30% in the limbus and sclera (zone 2), and only 10% in the posterior zone (zone 3). Other studies have also reported similar findings, with zone 1 being the most common location of injuries [16, 17].

In our study, initial visual acuity at presentation did not predict the final visual acuity post-operatively. However, previous studies have identified pre-operative visual acuity as a strong prognostic factor for poor visual outcome. This discrepancy may be due to the exclusion of eyes with very poor initial visual acuity in our study.

The best corrected visual acuity 6 months after injury showed varying outcomes. A significant number of patients had visual acuity greater than 20/40, while others had poorer outcomes. Afferent pupillary defect and retinal detachment were found to be indicators of poor visual outcome, while traumatic cataract was associated with visual improvement.

In summary, our study analyzed patients with ocular trauma and identified various factors related to age, gender, injury type, and visual outcomes. The findings were consistent with some previous studies, while differing from others. Further research is needed to better understand the prognostic factors and improve the management of ocular trauma.

Conclusion

This, being a prospective study, with a larger sample size, compared to previous studies, and a wide range of patient pathologies, and inclusion of patients of all age groups, provides reliable results to estimate the prognostic value of OTS and POTS. According to the results of this study, OTS has been a reliable predictor of final visual outcome, both in blunt and penetrating injuries, in patients of all age groups. Our study shows that ocular trauma mostly occurs in men, with majority being young adults, usually under the age of 40 years, with the left eye being more vulnerable to trauma that the right. There were nearly equal incidences of blunt

and penetrating trauma, as seen in our study. Further studies, with a larger sample size, longer follow-up period, and including patients of different ocular pathologies, might be necessary to address some of the limitations identified in this study.

Conflict of Interest
Not available

Financial Support
Not available

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