Assessment of Visual Prognosis using Ocular Trauma Score in Open Globe Injury at a Tertiary Care Center

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Abstract

**Aims and Objectives:** The aim and objective of this study was to assess the visual prognosis in open globe injury patients using the “Ocular Trauma Score (OTS).” **Methodology:** A prospective study of 100 patients with open globe injury attending a tertiary referral eye care center, Chennai, was carried out for a period of 12 months from February 1, 2018, to February 1, 2019. **Results:** The mean age of presentation was 40 years. Males (75%) were more commonly injured compared to females (11%). The right eye (65%) was more commonly injured than the left eye (35%). Out of the 100 patients, 96 patients underwent surgical management and 4 patients were managed conservatively. Out of the 96 patients, 26% had globe ruptures, 11% had relative afferent pupillary defect, 10% had perforating injuries, 8% had retinal detachment, and 4% had endophthalmitis. OTS was 1 in 9% of patients, 2 in 30%, 3 in 35% patients, 4 in 15% patients, and 5 in 11% patients, indicating that most of the patients had poor visual acuity at the time of presentation with an OTS value of 1–3. At the end of 6 weeks, 18% of the patients had a vision of no perception of light, 21% had a vision of percentage of light/hand movements, 25% had 1/200–19/200, 18% had 20/200–20/50, and 18% had >20/40. Majority of the patients had a visual acuity between 1/200 and 19/200. The results were analyzed with the OTS value chart. **Conclusion:** OTS is a comprehensive score to predict final visual outcome in patients with open globe injury, which can be widely used for counseling ocular trauma victims. OTS calculated at the initial evaluation has predictive value in patients with open globe injury.

**Keywords:** Ocular Trauma Score, open globe injury, visual prognosis

**INTRODUCTION**

Ocular trauma is one of the major causes of ocular morbidity and blindness, especially in pediatric and young adult population. Ocular trauma may be either:

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

Patients with polytrauma or head injury require immediate evaluation and management of life-threatening emergency.

Based on the etiological factor causing the injury, it is further classified into:

1. Mechanical
2. Physical (thermal, ultrasonic, and electrical)
3. Chemical
4. Radiation

Among these, mechanical injury is the most common mode of injury.

Mechanical injuries can cause:[1]

- Open globe injury
- Closed globe injury.

**Ocular Trauma Score**

After classifying the injury, it is invaluable for both the patient and the ophthalmologist to obtain reliable information regarding the expected outcome of the injury. Several variables were studied and analyzed. Ocular Trauma Score (OTS) was designed on the basis of the Birmingham Eye Trauma Terminology System and information from Centers for Disease Control and Prevention.

- The OTS is easy to calculate and has the following significance:
  - For the patient – Anxiety relief, relief from...
quality-of-life issues, making economical decisions for the ophthalmologist triaging and management, counseling, rehabilitation, and research purposes

- For public health officials – Determining the regional/national injury scenario and planning of interventional strategies to manage and prevent injuries.

**Aims and objectives**
The aim and objective of this study was to assess the visual prognosis in open globe injury patients at the end of 6 weeks using OTS.

**Study population**
The study population included ocular trauma patients attending a tertiary referral eye care center, Chennai, with open globe injury.

**Inclusion criteria**
1. Patients with open globe injuries, who present within 48 h of injury
2. Patients with full-thickness corneal tear
3. Patients with sclera tear
4. Patients with perforating and penetrating injuries
5. Patients with intraocular foreign bodies (IOFBs)
6. Patients aged >5 years.

**Exclusion criteria**
1. Patients with isolated lid injuries and isolated orbital fractures
2. Patients with preexisting corneal or retinal anomalies/ degenerations
3. Patients with poor general condition requiring critical care.

**Methodology**
Patients with eye trauma might have sustained nonglobe injuries that may be life threatening and it must be addressed first. Assessment of general condition, evaluation of adnexal injury (bony injury as well as severe soft-tissue injury), visual acuity, pupillary reaction, slit-lamp biomicroscopy, indirect ophthalmoscopy, radio imaging (X-ray, B-scan, and computed tomography scan, as and when required) should be made.

**Calculating the ocular trauma score**
- Step 1: Collecting the variables and the raw points
- Step 2: Calculating the sum of the raw points: $A + B + C + D + E + F$
- Step 3: Converting raw points into the OTS and calculating the likelihood of the final visual prognosis.

**Data analysis**
Pearson’s correlation analysis was used for data analysis.

**Results**

**General characteristics**
In our study, among the 100 patients, the patient’s age ranged from 6 to 81 years, with a mean age of 40 years. The raw score ranged from 13 to 100. The mean OTS score was 2.89.

The visual acuity in Snellen chart (LogMAR) at presentation ranged from 6/9 (0.25) to no percentage of light (PL) (4), with a mean visual acuity of 2.05.

**Gender distribution**
Men (75%) were more commonly affected than women (15%), and pediatric population comprised 10% in our study.

**Mode of injury**
In our study of open globe injuries, the common mode of injury was sharp objects (45%).

Most commonly, injury occurred at workplace (41%) followed by residence (31%) [Figure 1].

**Time of presentation**
As open globe injury is associated with a gross diminution of vision, 84% of the patients presented within 24 h from the time of injury. The delay in presentation is mainly due to referral from distant places as well as loss of vision without pain and ignorance of the patient [Figure 2].

**Morbidities**
Morbidities included 26% globe rupture, 4% endophthalmitis, 10% perforating injuries, 8% retinal detachment, 11% relative afferent pupillary defect (RAPD), 23% cataract, 20% vitreous hemorrhage, and 9% glaucoma.

**Various modalities of management**
Simple corneal tear suturing with or without iris tissue repair was done in 44% of the cases. Scleral tissue repair was done in 16% of cases. Out of the seven IOFB cases, two were in the posterior segment and the remaining were in the anterior segment. Enucleation was done as the primary procedure in a traumatic globe luxation. Evisceration was done after 3 weeks of treatment when endophthalmitis progressed to panophthalmitis despite treatment.

**Distribution of Ocular Trauma Score**
The distribution of OTS among the study group is shown in Figure 3, with maximum patients having an OTS value of 3.

**Mean visual acuity according to Ocular Trauma Score**
As the OTS increases, vision by logMAR decreases [Figure 4].
Pearson’s correlation – Ocular Trauma Score and vision at 6 weeks in logMar

Pearson’s correlation shows that as the OTS increases, vision by logMAR decreases, which is statistically significant.

Distribution of vision at the end of 6 weeks

Figure 5 depicts the number of persons in each range of visual acuity at the end of 6 weeks of treatment. Majority of patients had a visual acuity between 1/200 and 19/200.

Mean vision improvement in various management groups

In our study group, visual acuity improvement was maximum for the sclerocorneal tear suturing patients, whereas there was a reduction in vision following the repair in sclera tear suturing patients [Figure 6].

Discussion

In our study, 100 patients with open globe injury were analyzed.

The analysis of age distribution in our study showed that the dominant group is between 40 and 59 years, with the mean age of presentation being 40 [Table 1], which is comparable with the results of Agrawal et al.,[2] in which 121 out of 176 patients were aged <40. Cases were reported between the ages of 6 years and 81 years.

Males (75%) were more commonly injured in our study when compared to females (11%). Working site (41%) was the most commonplace of injury. The results of our study were in line with a study by Shailaja Karve et al., with 71.6% of males.

Sharp objects contributed 47% to the cases with open globe injury when compared to 16% due to blunt objects. Blunt injuries and road traffic accidents were associated with globe rupture and poor visual outcomes in our study.[3] The statistical analysis of studies by Rahman et al. and Agrawal et al. were also similar.

Analyzing the time elapsed between the injury and hospitalization, majority of the patients presented in the first

| Variable         | Mean   | SD    | Minimum | Maximum |
|------------------|--------|-------|---------|---------|
| Age              | 40.11  | 20.17 | 6       | 81      |
| Raw score        | 68.17  | 23.00 | 13      | 100     |
| OTS score        | 2.86   | 1.15  | 1       | 5       |
| Vision           | 2.05   | 1.28  | 0.25    | 4       |
| Vision at 6 weeks| 1.91   | 1.37  | 0       | 4       |

SD: Standard deviation, OTS: Ocular Trauma Score
24 h after injury. Delayed hospital presentation was associated with a poor visual prognosis.[3]

The right eye (65%) was more commonly injured than the left eye (35%). These reports were similar to the studies reported by Saxena et al.,[4] where right eye preponderance was seen in 68.4%, and also a study conducted in Aravind Hospital, rural South India. In the study by Shalija Karve et al., there was an equal percentage of injury to both the eyes.

Out of the 100 patients, 96 underwent surgical management, whereas 4 patients were managed conservatively [Table 2]. Most of the patients were operated under local anesthesia (87%). Out of the 96 patients, 10% had perforating injuries; 4% had endophthalmitis,[5] out of which one progressed to panophthalmitis; and 8% had retinal detachment at the time of presentations. Ten patients had perforating injury, 26% had globe ruptures, and 11% had RAPD [Table 3].

Patients with afferent pupillary defect had a worse prognosis, with less visual acuity at the time of presentation and a low OTS value [Table 4]. This was also shown in the studies by Schmidt et al.[6] and Agrawal et al.[2]

Lens became cataractous either at the time of presentation or during the treatment period in 23% of patients.

Simple corneal tear suturing with or without iris tissue repair was done in 44% of the cases. Scleral tissue repair was done in 16% of cases, and sclerocorneal tears and globe ruptures were closed in 26% of the patients.

Nearly 7% of IOFBs were found in our study, which is in par with the results of the study by Shailaja Karve et al. Four cases (7.02%) had IOFB out of the 46 cases of open globe injury. Out of the seven IOFB cases, two were in the posterior segment and the remaining were in the anterior segment.

Enucleation was done as the primary procedure in a traumatic subluxted patient. Evisceration was done 3 weeks of treatment when there was no improvement of endophthalmitis and it progressed to panophthalmitis.

The OTS was 1 in 9% of patients, 2 in 30%, 3 in 35% patients, 4 in 15% patients, and 5 in 11% patients, indicating that most of the patients had poor visual acuity at the time of presentation with an OTS value of 1–3 [Table 5].

At the end of 6 weeks, 18% of the patients had a vision of no perception of light, 21% had a vision of PL/hand movements, 25% had 1/200–19/200, 18% had 20/200–20/50, and 18% had >20/40. Majority of patients had a visual acuity between 1/200 and 19/200. The results were analyzed with the OTS value chart [Table 6].

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**Table 3: Morbidities**

| Condition                      | n (%) |
|-------------------------------|-------|
| Globe rupture                 | 26 (26) |
| Endophthalmitis               | 4 (4) |
| Perforating injuries          | 10 (10) |
| Retinal detachment            | 8 (8) |
| RAPD                          | 11 (11) |
| Cataract                      | 23 (23) |
| Vitreous hemorrhage           | 20 (20) |
| Glaucoma                      | 9 (9) |

RAPD: Relative afferent pupillary defect

**Table 4: OTS for each comorbidity**

| 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 | -10 |

Raw score sum = sum of raw points

NPL: Nil percentage of light, PL: Percentage of light, HM: Hand movement

**Table 5: Visual acuity vs OTS**

| Raw score sum | OTS score | NPL | PL/HM | 1/200-19/200 | 20/200-20/50 | >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: No perception of light, PL: Perception of light, HM: Hand movements

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**Figure 6: Mean vision improvement in various management groups**
Pearson’s correlation analysis showed that visual acuity improves with the increase in OTS value at presentation, which is statistically significant. These results were in line with the original OTS model designed by Khun et al. and Yu Wai Man and Steel.[7] Patients with OTS value of 1 will have a higher risk of poor final visual outcome, whereas patients with a higher value of 5 will have a higher probability of getting a better visual outcome.

**CONCLUSION**

OTS is a comprehensive score to predict final visual outcome in patients with open globe injury, which can be widely used for counseling trauma victims. OTS calculated at initial evaluation has predictive value in patients with open globe injury.

| Correlation coefficient | Value       |
|-------------------------|-------------|
| Correlation coefficient | −0.7417     |
| *P*                     | <0.001      |

**Financial support and sponsorship**

Nil.

**Conflicts of interest**

There are no conflicts of interest.

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