

Study of Visual Outcomes in Ocular Trauma in Paediatric Population

Dr. Nitin P. Pawar¹, Dr. Sheela P. Kerkar²

¹MBBS, MS., Senior Registrar, Department of Ophthalmology, Seth G.S.M.C. & K.E.M. Hospital, Parel, Mumbai 400012, India

²MBBS, MS, Professor and Head of Department, Department of Ophthalmology, Seth G.S.M.C. & K.E.M. Hospital, Parel, Mumbai 400012

Abstract: Ocular trauma is a leading cause of ocular morbidity in children and young adults with a male preponderance. Four to five % of all blindness in the world is due to childhood blindness. This was observational study of 100 patients, aged 1-18 years with mechanical eye injuries. The Birmingham Eye Trauma Terminology (BETT) system classified different types of injury. Accidental blunt trauma among boys in 5 to 10 years age group was common, Ocular trauma score (OTS) predicted final visual acuity of paediatric ocular trauma patients.

Keywords: paediatric ocular trauma, ocular trauma score, visual outcome

1. Introduction

Ocular trauma is a leading cause of ocular morbidity in children and young adults with a male preponderance; the former accounting for 20% to 50% of all ocular injuries^[1, 2]. These include approximately 200,000 open-globe injuries; with around 1.6 million people blind from such injuries, 2.3 million people with bilateral low vision from this cause, and almost 19 million people with unilateral blindness or low vision^[3]. The prevalence of childhood blindness varies according to the socioeconomic development of the country and the mortality rate of those under five years of age. Four to five per cent of all blindness in the world is due to childhood blindness.

Because of difficulty in classifying different types of ocular injuries, International Society of Ocular Trauma of The United States Eye Injury Registry had formulated a standardized terminology for eye injury to facilitate a uniformed definition to characterize the ocular condition. The Birmingham Eye Trauma Terminology (BETT) system (figure 1) provided definitions for commonly used the eye trauma terms^[4].

The Ocular Trauma Score was designed to provide a single probability estimate that an eye trauma patient would obtain a specific visual range after 6 months. It is used for standardizing assessment and visual prognosis in ocular injury by considering several parameters. The probability of all potential visual outcomes after 6 months showed in table 1.

Fig. 1. BETTS. The double-framed boxes show the diagnoses that are used in clinical practice

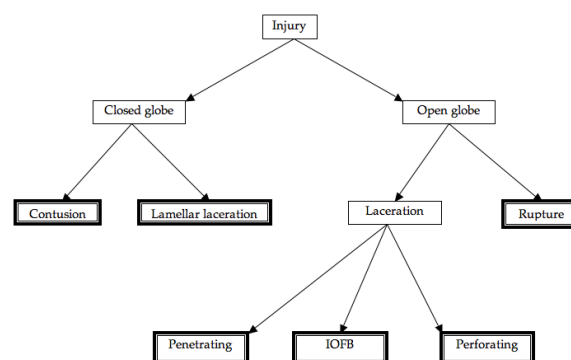


Figure 1: BETT system of classification of eye trauma

Table 1: Estimated probability of follow-up visual acuity category at 6 month as per OTS STUDY

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 movement.

2. Material and Methods

This study was an observational study of 100 patients, aged 1-18 years with mechanical eye injuries, conducted in ophthalmology department at K.E.M. Hospital during 2016-17. Enrolled children after taking consent from their parents underwent complete ophthalmic check-up. Patients age, sex & type, pattern, location of injury and visual acuity were recorded. Ocular trauma was classified by the standardized international classification of ocular trauma, Birmingham Eye Trauma Terminology system (BETTS).

Based on the findings on initial consult, the ocular trauma score was calculated. A numerical value (raw score) was

assigned to each of the following variables: a) initial visual acuity (VA), b) relative afferent pupillary defect (RAPD), c) retinal detachment, d) perforating injury, e) endophthalmitis, f) globe rupture. The OTS was determined by calculating sum of raw scores: a+b+c+d+e+f. If a specific variable was not present its value considered zero. Initial VAs were classified under no light perception (NLP), light perception (LP)/hand motion (HM), 1/200–19/200, 20/200–20/50, and $\geq 20/40$ (table 2). Certain numerical values rendered to OTS variables were converted to OTS categories. The lowest possible OTS was zero and the highest 100. OTS was compared with final visual acuity at 3 months.

Table 2: Computational method for deriving the OTS score

Initial visual factor	Visual acuity	Raw points
A. Initial Raw Score (based on initial Visual Acuity)	NLP=	60
	LP/HM=	70
	1/200 TO 19/200	80
	20/200 TO 20/50	90
	$\geq 20/40$	100
B. Globe rupture		-23
C. Endophthalmitis		-17
D. Perforating injury		-14
E. Retinal detachment		-11
F. Relative Afferent Pupillary Defect (RAPD)		-10

3. Results

There were 74 (74%) boys and 26 (26%) girls with ratio of 2.85:1 while children in age group of 5 to 10 years were involved most (57%). Contusion was most common pattern, accounting for 52% injuries; followed by penetrating injury, accounting for 31% injuries. Most injuries occurred at home (45%) followed by outside (24%). At initial consult, 2 cases presented with perforation, 2 with IOFB, 2 with endophthalmitis, 4 with retinal detachment and 2 cases with RAPD. Children were injured by pencil, glass, wooden stick, metal nail, scissor, stones accidentally (table 3). 66.7% of open globe injury cases and 12.3% of closed globe injury cases were associated with final VA $< 20/200$. 33.3% cases of open globe injury and 87.7% cases of closed globe injury were associated with final VA $\geq 20/200$. Final VA improved in most patients. 62% cases had final VA in mild to no visual impairment group (6/6 – 6/18) and 22% cases had final VA in blind group ($< 3/60$ -NLP). 1 case was classified under OTS 1 (raw score 0-44), 9 under OTS 2 (raw score 45-65), 47 under OTS 3 (66-80), 12 under OTS 4 (81-91) and 31 cases were classified under OTS 5 (92-100) (table 4).

Table 3: Characteristics of study population of ocular trauma

		Percentage
Age	1-4 years	6
	5-10 years	57
	11-18 years	37
Gender	Male	74
	Female	26
Type	Open	35
	Closed	65
Pattern	Contusion	52
	Lamellar laceration	2
	Superficial FB	5

	Mixed	6
	Penetrating	31
	IOFB	2
	Perforation	2
	Globe rupture	0
Location	Home	45
	Sports	21
	School	7
	Outside	24
	RTA (road traffic accident)	3

Table 4: Final visual acuities and Ocular Trauma Score (OTS) categorical distributions in the OTS study and in our study

OTS	NLP	LP/HM	1/200 TO 19/200	20/200 TO 20/50	$\geq 20/40$
1	100% (1) 73%	0% 17%	0% 7%	0% 2%	0% 1%
2	34% (3) 28%	33% (3) 26%	33% (3) 18%	0% 13%	0% 15%
3	0% 2%	19% (9) 11%	21% (10) 15%	30% (14) 28%	30% (14) 44%
4	0% 1%	0% 2%	0% 2%	17% (2) 21%	83% (10) 74%
5	0% 0%	0% 1%	0% 2%	3% (1) 5%	97% (30) 92%

% of final visual acuity observed in Current Study.

% indicates % final visual acuity expected at follow up by OTS STUDY.

4. Discussion

Ocular trauma is a leading cause of ocular morbidity in children and young adults with a male preponderance; the former accounting for 20% to 50% of all ocular injuries^[1, 2]. In general, children are more susceptible to eye injuries because they have immature motor skills and limited common sense. They have a natural curiosity and are often seen imitating without regard to the risks and outcomes. Although most eye injuries are avoidable by simple preventive measures, many children suffer visual impairment that can affect their psychosocial development^[5, 6]. This study focussed on various causes, nature, distribution, complications and visual outcomes of mechanical ocular injury and provided recommendations for prevention.

Similar to other studies^[7, 8] boys were affected more commonly than girls, which is in keeping with our findings. This probably reflects boys' more adventurous or possibly aggressive behaviour^[5, 6]. School aged children are more susceptible than the younger age group as, although they are still relatively immature, these children are slightly more independent and under less parental guidance^[8, 9]. Mean age of injury was 9.47 ± 3.75 years in this study. Similar to other studies,^[5, 10] home was commonest site of injury showing that such injuries can be prevented with preventive measures like strict supervision on children, keeping children away from causative objects and reflecting both the amount of time that all children spend at home and the risks around the home. In current study Blunt trauma was commonest type of injury occurred during home, sports, outdoor and RTA accounting 38% followed by penetrating injury which accounted for 31%^[6, 10]. We observed that, zone 3 injury

were associated with poor visual acuity while zone 1 injury were associated with better visual acuity ($p < 0.001$). These findings were consistent with previous studies [11, 12&13]. There was statistically significant association between initial visual acuity and final visual acuity ($p < 0.001$) in this study which were similar with previous studies [8, 11, 14]. Similar to previous studies [11, 14], OTS correlated statistically significantly with final VA (Spearman's correlation test, $r = 0.664$, $p < 0.001$). Thus OTS can play major role in determining management of ocular trauma. The OTS had high prognostic accuracy and could be used in counselling patients and in management for decision making after injury. OTS was able to predict visual outcomes in this study after 3 months. Our results were similar to OTS study indicating role of prognostic factors such as globe rupture, endophthalmitis, retinal detachment, relative afferent pupillary defect, perforating and penetrating injuries in determining final visual outcomes. Surgical interventions were required in all open globe injuries. Thompson, Kumar, Billson & Martin [2] provided tips for making the home environment safe which included: adequate supervision; restriction of access to using sharp tools, scissors, knives; furniture with round corners; no plants with thorns in gardens.

5. Conclusions

Accidental blunt trauma among boys in 5 to 10 years age group were common and should be attended immediately. Most injuries occurred at home. Prognostic factors such as poor initial VA, RAPD, retinal detachment, globe rupture, penetrating injury, perforating injury, endophthalmitis significantly affected final visual outcomes at 3 months. Ocular trauma score (OTS) predicted final visual acuity of paediatric ocular trauma patients.

References

- [1] Négrel AD, Thylefors B. The global impact of eye injuries. *Ophthalmic Epidemiol* 1998;5:143-69.
- [2] Thompson CG, Kumar N, Bilson FA, Martin F. The aetiology of perforating ocular injuries in children. *Br J Ophthalmol* 2002;86:920-2.
- [3] Prevention of Blindness America 2004 http://www.preventblindness.org/resources/fact_sheets.html
- [4] Kuhn F, Morris R, Witherspoon D, Heimann K, Jeffers JB, Treister G. A standardized classification of ocular trauma. *Ophthalmology* 1996;103:240-3.
- [5] Harrison A and Telander D. Eye injuries in the young athlete: a case-based approach. *Pediatric Annuals* 2002;31:33-40.
- [6] Caroline M, Baines P and Desai P. Eye injuries in children: the current picture. *British Journal of Ophthalmology* 1999;83:933-6.
- [7] Soyly M, Demircan N, Yalaz M and Isiguzel I. Etiology of pediatric perforating eye injuries in Southern Turkey. *Ophthalmic Epidemiology* 1998;5:7-12.
- [8] Katiyar V, Bangwal S, Gupta SK, Singh V, Mugdha K, Kishore P. Ocular trauma in Indian pediatric population. *J Clin Ophthalmol Res* 2016;4:19-23.

- [9] Saxena R, Sinha R, Purohit A, Dada T, Vajpayee RB and Azad RV. Pattern of pediatric ocular trauma in India. *Indian J Pediatr* 2002;69:863-7.
- [10] Theresa GB, Merca MD, Marissa V. Epidemiology and Visual Outcomes of Pediatric Ocular Trauma Cases in a Tertiary Hospital. *Philipp J Ophthalmol* 2014;39:27-32.
- [11] Yu Meng, Hua Yan. Prognostic Factors for Open Globe Injuries and Correlation of Ocular Trauma Score in Tianjin, China. *Journal of Ophthalmology* Volume 2015, Article ID 345764.
- [12] Mashaal A. Makhrash MD, Ibrahim M. Open globe eye injury characteristics and prognostic factors in Jazan, Saudi Arabia. *Saudi Med J* 2016;37:1328-33.
- [13] Madhusudhan P, Evelyn-Tai LM, Zamri N, Adil H, Wan-Hazabbah WH. Open globe injury in Hospital Universiti Sains Malaysia—a 10-year review. *Internat J Ophthal* 2014;7:486–90.
- [14] Xi Zhang, Yuqing Liu, Xiangning Ji, Yuanyuan Zou. A Retrospective Study on Clinical Features and Visual Outcome of Patients Hospitalized for Ocular Trauma in Cangzhou, China. *Journal of Ophthal* 2017; article ID 7694913.

Author Profile



Dr Nitin Pawar did MS Ophthalmology (affiliated to MUHS, Maharashtra and MCI recognised) from Seth G.S.M. College and K.E.M. Hospital, Mumbai. I am currently working as Senior Registrar in Ophthalmology Department, K.E.M. Hospital under guidance of **Dr Sheela P Kerkar**, HOD, Ophthalmology Department, K.E.M. Hospital.

Dr Sheela P. Kerkar did MS Ophthalmology from T.N.M. College & Nair Hospital, Mumbai. She is serving patients of Municipal Corporation of Greater Mumbai since many years. Currently working as HOD, Ophthalmology department, K.E.M. Hospital.