CLINICAL CHARACTERISTICS OF POSTERIOR SEGMENT OCULAR TRAUMA

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ABSTRACT
Background: Ocular trauma is an important cause of monocular visual impairment globally. It is unplanned yet preventable and potentially cause multiple injuries to eyelid, ocular surface, anterior and posterior segments, globe, and also orbital soft tissue. Posterior segment ocular trauma is still an important cause of visual loss and disability. The aim of this study is to report clinical characteristics of posterior segment ocular trauma.
Methods: This is a retrospective observational study including 1,531 trauma cases that within period of January to December 2018. Birmingham Eye Trauma Terminology System (BETTS), Ocular Trauma Score (OTS), and Pediatric Ocular Trauma Score (POTS) were used to classify the trauma and assess
Results: Of 1,531, 95.7% injured patients were male, 64.4% injuries occurred in young adult group, 26.7% patients were labors, and 94.6% injured tissue were corneas (96.8% due to foreign bodies); while 1.37% cases involved vitreous, 0.79% choroid, 0.74% retina, 0.07% macula, and 0.20% optic nerve. Unfortunately, 13 (20.6%) eyes had to become anophthalmous due to evisceration and enucleation. Ten (15.6%) eyes were found to be in 1/200 to 19/200 in final VA after surgical procedures.
Conclusion: Ocular injury commonly occurs in daily work activities and is mostly caused by the absence of protective eyewear. Poor visual prognosis commonly follows after posterior segments ocular trauma.

Keywords: ocular trauma, posterior segment injury, BETTS, OTS, POTS

INTRODUCTION

Ocular trauma is an unplanned and important cause of preventable monocular visual impairment globally. It is estimated that 55 million eye injuries occurred anually worldwide, of which 19 million result in blindness in one eye, 2.3 million in low vision in both eyes, and 1.6 million in blindness in both eyes. In United States, more than 2,000 ocular injuries occur at daily work, meanwhile pediatric ocular trauma forms about 20-50% of all eye injuries reported. It has great diversities and complexities, depending on the site of injury, mode and aetiology of injury, visual impairment following trauma and its outcome following management [1-8]

Ocular trauma may cause multiple injuries to eyelid, ocular surface and anterior segment, posterior segment and globe, and also orbital soft tissue. Posterior segment ocular trauma is still an important cause of visual loss and disability in working-age population. Many studies reported work-related injury as a leading cause of ocular trauma that presents in clinically diverse ways. Most study found that injured patients did not wear protective device at time of work-related ocular injuries occurred.[8-10]

The aim of this study is to report clinical characteristic of posterior segment involvement in ocular trauma.

METHODS

This is a retrospective observational study. The data of this study were taken from medical records within periode of January to December 2018. We collected

Table 1. Ocular Trauma Score (OTS) and scoring[11]

Variables	Raw Points
A. Initial visual acuity	
NLP	60
LP/HM	70
1/200-19/200	80
20/200-20/50	90
≥20/40	100
B. Rupture	-23
C. Endophthalmitis	-17
D. Perforating injury	-14
E. Retinal detachment	-11
F. Afferent pupillary defect	-10

NLP: no light perception; LP: light perception; HM: hand movement. The OTS is determined by calculating the sum of the raw points: A + B + C + D + E + F.

1,531 trauma cases with 10th revision of the International Classification of Disease (ICD-10) coding of S05.0 to S05.9 and T15.0 recorded in Department of Information Technology. Out of 1,531 cases, 64 trauma cases were found to undergo surgical interventions.

Demographic data included gender, age, occupation and place of injury, mechanism of injury, and safety pre-cautions. Initial visual acuity (VA), ophthalmological examination, surgical interventions, and surgical outcome were included in this study. We used Birmingham Eye Trauma Terminology System (BETTS) to classify the trauma and calculate the score with Ocular Trauma Score (OTS) to assess the severity. For pediatric patients under 15 years old, Pediatric Ocular Trauma Score (POTS) was applied.

According to BETTS, ocular trauma is divided into two major groups: closed and open globe injury. The wounds then are classified into contusion, lamellar laceration, rupture, laceration, penetrating injury, and perforating injury. The zone of injury was defined according to the OTS Group: zone I (the whole cornea, including corneoscleral limbus), zone II (corneoscleral limbus to a point 5 mm posterior into the sclera), and zone III (posterior to the anterior 5 mm of sclera).

Table 2. Pediatric Ocular Trauma Score (POTS) and scoring[12]

Variables	Raw Points
Initial visual acuity	
NLP	10
LP/HM	20
Counting fingers	30
0.1-0.5	40
0.6-1.0	50
Age of the pediatric patients	
0-5	10
6-10	15
11-15	25
Wound location	
Zone I	25
Zone II	15
Zone III	10
Concomitant eye pathologies	
Iris prolapse	-5
Hyphema	-5
Organic/unclean injury	-5
Delay of surgery (>48 h)	-5
Vitreous hemorrhage	-10
Retinal detachment	-20
Endophthalmitis	-30

NLP: no light perception; LP: light perception; HM: hand movement.

The calculation of OTS estimates the probability of an eye trauma patient will obtain visual acuity within a spesific visual range by 6 months after trauma. This scoring system includes initial visual acuity, globe rupture, endopthalmitis, perforating injury, retinal detachment, and relative afferent pupillary defect (RAPD) pupil. The score is obtained by accumulating all the variables (Table 1).

Pediatric Ocular Trauma System (POTS) is similar to OTS but with different variables, including initial visual acuity, age of pediatric patients, wound location, and concomitant eye pathologies (Table 2).

Both of the OTS and POTS were categorized into the same five categories based on the trauma evaluation score: (1) 0-44; (2) 45-65; (3) 66-80; (4) 81-91; and (5) 92-100. Higher category is presumed to have better prognosis.

RESULTS

In this study, overall, we found that 95.7% injured patients were male and in

Table 3. Patient profile (n=1,531)

Gender		
Male	1,465	95.7%
Female	66	4.3%
Age group (years)		
0-1	3	0.2%
2-10	13	0.8%
11-17	23	1.5%
18-40	986	64.4%
41-65	492	32.1%
>65	14	0.9%
Occupation		
Labors	409	26.7%
Private-sector and civil-service workers	393	25.7%
Self-employed and merchants	276	18.0%
Students	20	1.3%
Housewives	15	1.0%
Pre-school children	9	0.6%
Farmers	7	0.5%
Polices and soldiers	4	0.3%
Infants	3	0.2%
Retirees	2	0.1%
Unknown	393	25.7%

young adult group (64.4%). Labors were the most common occupation that was related to penetrating injury in this study, contributed 26.7% of all cases (Table 3).

Cornea was the most injured tissue in this study, counts up to 1,449 (94.6%) cases, with 1,402 (91.57%) injuries were caused by foreign body in corneal surface.

Sixty-three (4.2%) ocular trauma underwent major surgical interventions were studied further. Of the 63 patients, 87.3% were males and 12.7% were females. One (1.6%) patient had bilateral injury. Young adult and adult groups contributed up to 79.4% cases. Labors were still the frequent occupation involved among all of these subjects (23.8%). Metallic materials were found to be the major cause of all cases (42.9%). Up to 60.3% patients had history of not wearing any safety preacaution (such as goggles) during work or helmet while riding the bikes.

Thirty-four (53.1%) eyes were in LP to hand movement in initial assessment, with 43.8% eyes fell into OTS category 1 (raw OTS of 0-44). Primary wound suturing were done in 48 eyes. Unfortunately, 4 eyes had to undergo evisceration and 9 eyes had enucleation (including one patients with bilateral injury). Final VA (in 1 or 3 months follow-up) showed that 10 eyes were in 20/200 – 19/200. It seemed to be uncomparable with initial VA because 18 patients did not showed up post-operative follow-ups.

Table 4. Ocular tissue involvement in injuries

Anterior segments		
Eyelids		
laceration	13	0.85%
canaliculi rupture	4	0.26%
Conjunctiva		
foreign body	65	4.25%
Sclera		
laceration	46	3.01%
Cornea		
foreign body	1,402	91.57%
laceration	45	2.94%
Anterior chamber		
hyphema	30	1.96%
Iris		
prolapse	19	1.24%
iriodialysis	4	0.26%
Lens		
traumatic cataract	18	1.18%
anterior capsule rupture	4	0.26%
subluxated lens	2	0.13%
decentrated IOL	1	0.07%
aphakic (dropped lens)	1	0.07%
Posterior segments		
Vitreous		
bleeding	13	0.85%
prolapse	7	0.46%
fibrosis	1	0.06%
Retina		
detachment	5	0.33%
tear	3	0.20%
dyalisis	1	0.07%
commotio	1	0.07%
intraretinal bleeding	1	0/07%
Macula		
atrophy	1	0.07%
Choroid		
prolapse	5	0.33%
SCH	4	0.26%
detachment	2	0.13%
rupture	1	0.07%
Optic nerve		
TON	3	0.20%
Others		
IOFB	6	0.39%
Endophthalmitis	2	0.13%
Intraocular tissue prolapse	2	0.13%

IOL: intraocular lens; IOFB: intraocular foreign body; SCH: suprachoroidal hemorrhage; TON: traumatic optic neuropathy

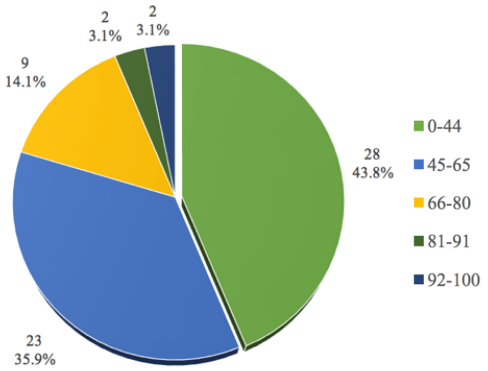

Figure 1. Distribution of OTS in 64 eyes

Table 6. Surgical interventions performed in 64 eyes

Primary wound suturing	48
Pars plana vitrectomy	10
IOFB removal	6
Evisceration	4
Enucleation	9

DICUSSION

The eyeball is filled with incompressible liquid. When a blunt trauma (contusion) with rupture of the eye due to a sudden marked increase in intraocular pressure thus overcome any innate tensile strength of the eye wall and rupturing the sclera. Open globe injury (OGI) remains a significant cause of visual loss and many eyes are enucleated secondary to severe injuries.[13,14]

Our study found that 95.7% patients were males. This finding is similar to many ocular trauma studies worldwide. Males are affected more due to their adventurous and aggressive nature, occupational exposure, participation in dangerous sports and hobbies, alcohol use, and risk-taking behaviour. A marked percentage is found higher in 18-40 years of age group. Compared with males, females are more likely to have an injury in the home and as result of a fall or households. Ocular trauma in infants and pre-school children were caused by toys and might be in the absence of any adult supervision, similar to a report by Al Wadeai et al. Khan et al reported that wood or wooden stick, household pair of scissor, and toys were the frequent objects causing ocular trauma in children.[2,6,8,10,15,16]

Labors were the most frequent occupation experienced ocular trauma in our study, while Chaikitmongkol et al reported the construction workers experienced a higher number of ocular injuries than other occupations. Extraocular foreign bodies and metallic materials were the most responsible cause of ocular trauma, in accordance with studies reported by Cai M et al, Haring et al, Chaikitmongkol et

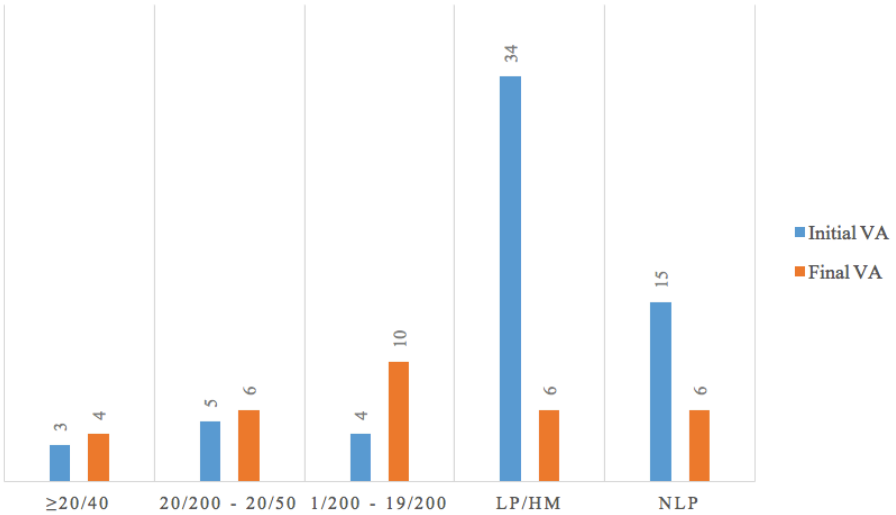

Figure 2. Initial VA and final VA in first or third month postoperative follow-ups. Three patients could not be included into category due to difficulty to evaluate their VA. Thirteen patients were anophthalmous after surgical procedure of evisceration and enucleation. VA: visual acuity

al, and Pramananda et al. Despite of unknown occupations and were quite higher in our study, contributing 25.7% of all cases, we assume that most of them might be labors and get the injury from metal grinding without protective eyewear based on our working experience in Emergency Department. [4,10,17,18]

Posterior segment involvement proved to be visually morbid in many cases, although number of cases were fewer than cases with anterior segment involvement. Our study found 40 of 63 (63.5%) patients suffered from posterior segments involvement ocular trauma, while Rout et al reported involvement of posterior segment seen in 22.4% cases.[8]

Primary wound suturing was performed in 48 eyes, including additional pars plana vitrectomy (PPV) in 10 eyes and removal of IOFB in 6 eyes (Table 6). Pimolrat et al reported that 89% patients with OGI required PPV due to IOFB and retinal detachment. One of the patients had both of his eyes enucleated due to severe injury (ocular rupture).[19]

Improvement in VA after surgical procedure was shown by reduced number in LP/HM group and increased number in 1/200 – 19/200 group. However, this visual outcome could not be compared accurately because many patients did not show up for first and/or third month post-operative follow up. Visual rehabilitiation must be given to patients with post-traumatic low vision, especially to those who are still in productive ages.

Our study is limited by registered data in medical records. A structured and complete history taking is necessary to determine the causative agents of ocular trauma and its relation to patient's activities and safety precaution. Complete data collection in every medical record is important to describe the factual information. The ICD-10 codes used in this study are limited in the level of detail they provide, resulting in lack of detail diagnosis and obscuring subjects selection.

CONCLUSION

Ocular injury commonly occurs in daily work activities. Males in working age working age group are more prone to ocular trauma. When it comes to the involvement of posterior segments, visual prognosis could be poor. Education regarding possible serious eye injuries at work and the proper use of protective eyewear should be promoted more aggressively to the public and directly to every kind of occupations at risk. Further study can be conducted to focus on posterior segments involvement in ocular trauma within longer period of time.

References

1. Low L, Hodson J, Morris D, Desai P, MacEwen C. Socioeconomic deprivation and serious ocular trauma in Scotland: a national prospective study. Br J Ophthalmol 2017;101:1935-8
2. Desai P, Morris D, Minassian D, MacEwen C. Trends in serious ocular trauma in Scotland. Eye 2015;29:611-8
3. Patel D. Eye injuries: improving our practice. Community Eye Health Journal 2015;28(91): 41-3
4. Cai M, Zhang J. Epidemiological characteristics of work-related ocular trauma in Southwest region of China. Int J Environ Res Public Health 2015;12:9864-75
5. Zakrzewski H, Chung H, Sanders E, Hanson C, Ford B. Evaluation of occupational ocular trauma: are we doing enough to promote eye safety in the workplace? Can J Ophthalmol 2017;52(4):338-42
6. Al Wedeai EA, Osman AA, Macky TA, Soliman MM. Epidemiological features of pediatric ocular trauma in Egypt. Hindawi Journal of Ophthalology 2016:1-6
7. Wahyuni L, Sari M, Kartasasmita A. Characteristics and management of pediatric ocular trauma. Ophthalmol Ina 2015;41(1):
8. Rout JP, Soni S, Samikshya S, Sharma PK, Tudu KC, Dora J. Prevalence of devastating ocular trauma, it's emergency and secondary management and outcome in a tertiary care centre. J Evid Based Med Healthc 2017;4(85): 4980-7
9. Rejdak R, Juenemann AG, Natarajan S. Posterior segment ocular trauma: timing and indications for vitrectomy. Hindawi Journal of Ophthalmology 2017:1-2
10. Chaikitmongkol V, Leeungurasatien T, Sengupta S. Work-related eye injuries: important occupational health problem in Northern Thailand. Asia-Pac J Ophthalmol 2015;4:155-60

11. Kuhn F, Maisiak R, Mann L, Mester V, Morris R, Witherspoon CD. The ocular trauma score (OTS). Ophthalmol Clin North Am 2002;15(2):163-5
12. Acar U, Tok OY, Acar DE, Burcu A, Ornek F. A new ocular trauma score in pediatric penetrating eye injuries.
13. Toride A, Toshida H, Matsui A, Matsuzaki Y, Honda R, Ohta T, Murakami A. Visual outcome after emergency surgery for open globe eye injury in Japan. Clinical Ophthalmology 2016;10:1731-6
14. Feng K, Wang C, Hu Y, Yao Y, Jiang Y, Shen L. Clinical features and prognosis of eyeball rupture: eye injury vitrectomy study. Clinical and Experimental Ophthalmology 2015;43: 629-36
15. Singh K, Mutreja A, Bhattacharyya M, Dangda S. Epidemiology and implications of ocular trauma admitted to a tertiary care hospital in North India. US Ophthalmic Review 2017; 10(1):64-8
16. Khan MN, Qadir A, Gul N, Sultan M, Laiq N, Saeed N. Penetrating pediatric eye trauma. Ophthalmology Update 2017;15(4):408-10
17. Haring RS, Canner JK, Haider AH, Schneider EB. Ocular injury in the United States: emergency department visits from 2006-2011. Injury 2016; 47(1):104-8
18. Pramananda M, Min EL, Noordin Z, Hussein A, Hitam WH. Open globe injury in hospital Universiti Sains Malaysia – a 10-year review. Int J Ophthalmol 2014;7(3):486-90
19. Pimolrat W, Choovuthayakorn J, Watanachai N, Petikulsila D, Kunavisarut P, Chaikitmongkol V, Ittipunkul N. Predictive factors of open globe injury in patients requiring vitrectomy. Injury 2014;45:212-6