Original Article

Clinical Features and Visual Outcomes of Eye and Orbital Injuries in Northern Thailand

Pipatrattanathaworn W, MSc[1], Ausayakhun S, MD[2], Tantraworasin A, MD, PhD[3], Ausayakhun S, MD, MHSc[2]

[1] Department of Occupational Medicine, Nakornping Hospital, Chiang Mai, Thailand

[2] Department of Ophthalmology, Faculty of Medicine, Chiang Mai University, Chiang Mai, Thailand

[3] Department of Surgery and Clinical Epidemiology and Clinical Statistic Center, Faculty of Medicine, Chiang Mai University, Chiang Mai, Thailand

Objective: To determine the characteristics and visual outcomes of eye and orbital injuries in northern Thailand.

Materials and Methods: Medical records of 997 patients who had eye and orbital injuries and were treated at Nakornping Hospital and Chiang Mai University Hospital between October 2010 and September 2014 were retrospectively reviewed. The clinical features of eye and orbital injuries and the visual outcomes after treatment were assessed. The effect of initial visual acuity and types of injury on the visual outcomes was analyzed using ordinal logistic regression analysis.

Results: Nine hundred ninety-seven patients (1,029 eyes) were included in the present study, 723 (72.5%) were male. The mean age was 43.5±18.7 years and 398 (39.9%) were employee. The median follow-up time was 0.1 (IQR 0 to 4.7) months. Most of the eye injuries occurred at the workplace (42.3%), followed by at home (32.4%). The most common causes were dirt, dust, or debris (30.6%) and blunt objects (21.9%). The common types of eye and orbital injuries were lamellar laceration (38.1%) and contusion (20.5%). The grades of severity of eye injury were grade 1 (66.6%), and grade 3 (16.7%). Visual acuity (VA) before and after treatment were unchanged (30.5%), better (46.9%), and worse (5.5%). Types of injury were not associated with change of visual outcome after treatment. Patients with initially legally blind or impaired vision were more likely to have improved visual outcomes than those with initially normal vision (odds ratio 8.9, 95% CI 6.37 to 12.53 and 7.9, 95% CI 5.03 to 12.47, respectively).

Conclusion: Most of the eye injuries in northern Thailand occurred at the workplace caused by dirt, dust, or debris and the most common type of injury was lamellar laceration. Visual outcome was affected by the initial VA. Primary prevention should be encouraged to reduce the significant social and personal costs resulting from vision loss.

Keywords: Eye injuries, Orbital injuries, Ocular trauma, Visual impairment, Visual outcome

J Med Assoc Thai 2019;102(5):564-9
Website: http://www.jmatonline.com
Recieved 16 May 2018 | Revised 25 Oct 2018 | Accepted 20 Nov 2018

Ocular trauma is a common and preventable accident. Approximately one in five adults reports a history of ocular trauma in the lifetime, although less than 2% of ocular trauma patients have severe enough injuries to warrant hospitalization[1,2]. Ocular trauma has an impact on the healthcare system and to the wider economy due to time taken away from work. Approximately 1.6 million people worldwide are blind due to injuries. An additional 2.3 million people have bilateral low-vision from this cause, and almost 19 million have unilateral blindness or low vision[3]. Ocular trauma, a leading cause of visual impairment, typically affects the active middle-aged male population[4]. Visual impairment in this age group can have significant social, psychological, and economic implications to individuals, not to mention the financial implication on the healthcare system[5].

The causes of ocular trauma have changed continuously over the course of the century. Almost 100 years ago, more than 70% of all serious injuries occurred in workplace[3].

Although prevention seems the best method to diminish the impact of eye injury, to date, epidemiologic studies have primarily focused on demographic characteristics and have paid little

Correspondence to:

Ausayakhun S.

Department of Ophthalmology, Faculty of medicine, Chiang Mai University, Chiang Mai, Thailand.

Phone: +66-86-9117181

Email: sausayakhun@gmail.com

How to cite this article: Pipatrattanathaworn W, Ausayakhun S, Tantraworasin A, Ausayakhun S. Clinical Features and Visual Outcomes of Eye and Orbital Injuries in Northern Thailand. J Med Assoc Thai 2019;102:564-9.

attention to characterizing other factors that may also facilitate prevention. The aim of the present study was to determine the characteristics and visual outcomes of eye and orbital injuries in northern Thailand.

Material and Method

The present study was reviewed and approved by the Faculty of Medicine, Chiang Mai University Review Board (Research ID: 2261/Study code: FAM-2557-02261). This retrospective study was conducted using patient medical chart data and visual outcomes of 997 patients diagnosed with injury of the eye and orbit using the International Classification of Disease Tenth Revision Hospital Discharge Diagnosis Code S05 (S05.0-S05.9) and treated in the emergency room, the ophthalmology outpatient department, or the inpatient ophthalmology ward at Nakornping Hospital and Chiang Mai University Hospital between October 1, 2010 and September 30, 2014.

The type and the severity of injuries were classified according to the Ocular Trauma Classification Group Guidelines[6] and the Birmingham Eye Trauma Terminology[7]. Type of injury was re-classified into three groups, 1) closed globe injury including lamellar laceration and contusion, 2) open globe injury including penetrating, perforating, intraocular foreign bodies (IOFB), and globe rupture, and 3) other injuries including adnexal injury, chemical burn, and heat or ultraviolet injury. The severity of injury was classified as grade 1 for injury to the cornea/anterior sclera with or without prolapsed of the iris, grade 2 for injury to the anterior segment plus lens damage, grade 3 for injury to the posterior segment with vitreous loss, and grade 4 for extensive anterior and posterior injuries. Visual acuity was categorized according to the International Statistical Classification of Diseases and Related Health Problems, Tenth Revision. The corrected distance visual acuity (VA) of equal or better than 6/18 is defined as normal vision, between 6/24 to 3/60 as impaired vision, and 2/60 to no light perception (NPL) as legal blindness[8].

The visual outcomes after treatment were evaluated and classified into three groups, worse (decreased visual acuity), unchanged, and better (improved visual acuity).

Statistical analysis was performed using Stata Statistical Package version 14.0 (StataCorp, College Station, TX). Categorical data was expressed as frequency and percentage, and continuous variables were expressed as mean and standard deviation (SD) or median and interquartile range (IQR) depending on data distribution. Multivariable ordinal logistic

Table 1. Baseline characteristics of patients with eye injuries (n = 997)

Characteristic	n (%)
Sex	
Male	723 (72.5)
Female	274 (27.5)
Age (year)	
<10	47 (4.7)
10 to 29	200 (24.8)
30 to 49	320 (32.1)
50 to 69	355 (35.6)
>70	75 (7.5)
Mean±SD	43.5±18.7
Occupation	
Employee	398 (39.9)
Farm worker/agriculture	174 (17.5)
Office worker	114 (11.4)
Retired	100 (10.0)
Student	95 (9.5)
Unemployed	20 (2.0)
Housewife	20 (2.0)
Merchant	21 (2.1)
Monk	8 (0.8)
Other	28 (2.8)
No record	19 (1.9)
Place of injury	
Workplace and farm	427 (42.3)
Home	323 (32.4)
Travel/street	131 (13.1)
School	29 (2.9)
Sport stadium	11 (1.1)
Recreation	1 (0.1)
Temple	8 (0.8)
Other	9 (0.9)
No record	58 (5.8)
Site of injury	
Unilateral	977 (98.0)
• Right eye	463 (47.4)
• Left eye	514 (52.6)
Bilateral	20 (2.0)

SD=standard deviation

Table 2. Causes, types and severity of injury

Variables	n (%)
Cause of injury (n = 1,029 eyes)	
Dirt/dust/debris	315 (30.6)
Blunt object	225 (21.9)
Sharp object/metal	140 (13.6)
Motor car/bike	108 (10.5)
Chemical	78 (7.6)
Insect/animal	44 (4.3)
Falling	40 (3.9)
Blast	32 (3.1)
Ultraviolet light/heat	19 (1.9)
Other	28 (2.7)
Type of injury (n = 1,029 eyes)	
Lamellar laceration	392 (38.1)
Contusion	211 (20.5)
Adnexal injuries	135 (13.1)
Penetrating	108 (10.5)
Chemical burn	82 (8.0)
Intraocular foreign bodies	61 (5.9)
Heat/ultraviolet light	22 (2.1)
Globe rupture	16 (1.6)
Perforating	2 (0.2)
Severity of injury* (n = 894 eyes)	
Grade 1	596 (66.6)
Grade 2	82 (9.2)
Grade 3	149 (16.7)
Grade 4	67 (7.5)

* Adnexal injury was excluded

regression was used to determine the effect of initial visual acuity and types of injury on the change of visual outcome, in terms of odds ratio (OR) with 95% confidence interval (CI). A p-value of less than 0.05 was considered statistically significant.

Results

The present study included 997 patients (1,029 eyes) with eye or orbital injuries. The median follow-up time was 0.1 (IQR 0 to 4.7) months. Twenty patients (2%) in the present study had bilateral injuries. Seven hundred twenty-three (72.5%) patients were male and 747 (75.2%) were 15 to 60 years old. The mean age ± SD was 43.5±18.7 years and 398 (39.9%) were employees. Most of the eye injuries occurred at the workplace (42.3%), followed by at home (32.4%), as shown in Table 1.

Table 3. Initial visual acuity and Final visual acuity of eye injuries

Visual acuity	Initial n (%)	Final n (%)
Normal vision (6/6-6/18)	359 (34.9)	507 (49.3)
Impaired vision (6/24-3/60)	144 (14.0)	171 (16.6)
Legally blind (2/60-NPL)	348 (33.8)	187 (18.2)
No record	178 (17.3)	164 (15.9)
Total	1,029 (100)	1,029 (100)

NPL=no light perception

Table 4. Change in visual acuity after treatment

Visual acuity	Total n (%)
Unchanged	314 (30.5)
Improved	483 (46.9)
Gain 1 line	95 (9.2)
Gain 2 lines	62 (6.0)
Gain >2 lines	326 (31.7)
Not improved	56 (5.5)
Lose 1 line	20 (2.0)
Lose 2 lines	19 (1.8)
Lose >2 lines	17 (1.7)

Table 2 shows the causes, type and severity of the injuries. The most common cause of eye injuries was dirt, dust, or debris, followed by blunt object, and sharp object or metal. The most common type of injuries was lamellar laceration. Most of patients in the present cohort had grade 3 of severity of injuries. Table 3 shows the initial VA and final VA of eye injuries.

VA after treatment compared to those before treatment were unchanged in 30.5%, improved in 46.9%, and not improved in 5.5%, as shown in Table 4.

Types of injury were not associated with change of visual outcome after treatment. There were some correlations between initial VA and change of visual outcome. Patients with initially blind or impaired VA were more likely to have a change in visual outcomes than those with initially normal VA (OR 8.9, 95% CI 6.37 to 12.53 for initially blind patients, and OR 7.9, 95% CI 5.03 to 12.47 for impaired vision patients), as shown in Table 5.

Table 5. Correlation between type of injury, initial visual acuity (VA), and change of visual outcome

	Change of visual outcome, n (%)			Odds ratio (95% CI)	p-value
	Worse	Unchanged	Improved		
Type of injury					
Closed globe injury	28 (4.65)	195 (32.39)	286 (47.51)	1 (reference)	
Open globe injury	14 (7.49)	30 (16.04)	138 (73.80)	1.05 (0.78 to 1.39)	0.760
Others	13 (5.44)	90 (37.66)	58 (24.27)	1.26 (0.94 to 1.70)	0.110
Initial VA					
Normal vision	19 (5.29)	252 (70.19)	88 (24.51)	1 (reference)	
Impaired vision	15 (10.42)	14 (9.72)	115 (79.86)	7.9 (5.03 to 12.47)	<0.001*
Legally blind	21 (6.05)	46 (13.26)	279 (80.40)	8.9 (6.37 to 12.53)	<0.001*

CI=confidence interval

Discussion

The present study, similar to other studies in the medical literature on eye injuries, was a hospital-based study. Therefore, it shows only a small portion of the overall orbital injuries[9,10]. Hospital patients are a non-representative group of the overall population in terms of wealth, education, and other factors correlated with access to health care and hospital services.

Most injuries in the present study occurred in males, similar to other studies[11-17]. A male predominance is thought to be related to occupational exposure, participation in dangerous sports and hobbies, and higher risk-taking behavior[11,12].

The present study confirmed that most eye injuries happened at the workplace, followed by home accidents, as reported by other studies[11,15,18,19] and in other countries[20-24]. The results of the present study suggest the need to explore workplace strategies to minimize ocular trauma as a major priority care. Eye care programs targeting high-risk ocular trauma groups may need to consider ocular trauma as a priority in eye health awareness strategies to reduce blindness due to trauma.

The common causes of eye and orbital injuries in the present study were dirt, dust, or debris followed by blunt objects. Overall, blunt objects are the major cause of eye and orbital injuries[25,26].

The most common types of eye and orbital injuries in the present study were lamellar laceration followed by contusion. The most common severity of injury was grade 1 followed by grade 3, 2, and 4 respectively. Contrasting the present study results with other studies[27], that most common types of eye and orbital injuries were contusion and the majority of severity of injury was grade 4. The difference may be due to inclusion of outpatients in the present study, which comprised of 53.1% of our cases.

Approximately 70% of patients with initially normal VA had an "unchanged" status in visual outcome, while 80% of patients with initially legally blind or impaired vision had "better" status (Table 5). These results did not mean that patients with initially normal VA had worse outcomes than those with initially legally blind or impaired vision. Most patients with initially normal VA still had normal VA after treatment; therefore, there was no significant change in visual outcome. On the contrary, patients with initially legally blind or impaired vision had a greater chance to improve their visual outcome after treatment. Thus, patients with initially legally blind or impaired vision were more likely to have a positive change of visual outcome than those with initially normal VA.

The major limitation of the present study is its retrospective nature. Some information was incomplete, such as the history of wearing protective devices, alcohol consumption, etc. Findings from the operating room were not available. The strength of the present study was the recruitment of both admitted patients and the outpatients, allowing for a large sample size, as well as the inclusion of all type of orbital injuries (not limited to solely open globe injuries or posterior segment IOFB, as in previous studies)[15-17,27].

Conclusion

The present study demonstrated that most of the eye injuries occurred at the workplace and the most common cause was dirt, dust or debris. Furthermore, the most common type of eye and orbital injury was lamellar laceration. Eye injuries are a significant problem in the realm of occupational injuries. Occupational safety and educational promotion

should be encouraged in all workplaces to reduce the significant social and personal costs resulting from vision impairment or blindness. The risk factors of severe visual impairment or blindness after treatment in eye or orbital trauma patients should be explored further in future studies.

What is already known on this topic?

For open globe injuries and the posterior segment IOFB, poor initial visual acuity and the IOFB were significant predictive factors.

What this study adds?

For eye and orbital injuries in northern Thailand, most eye injuries occurred at the workplace and the common cause was dirt, dust, or debris. The most common type of eye and orbital injury was lamellar laceration. Types of injury were not associated with change of visual outcome after treatment. Visual outcome was affected by the initial VA.

Acknowledgement

The present study was supported by the Faculty of Medicine Endowment Fund, Faculty of Medicine, Chiang Mai University, Chiang Mai, Thailand. (Grant Number 069/2559).

Conflicts of interest

The authors declare no conflict of interest.

References

1. Scott R. The injured eye. Philos Trans R Soc Lond B Biol Sci 2011;366:251-60.
2. Wong TY, Klein BE, Klein R. The prevalence and 5-year incidence of ocular trauma. The Beaver Dam Eye Study. Ophthalmology 2000;107:2196-202.
3. Négrel AD, Thylefors B. The global impact of eye injuries. Ophthalmic Epidemiol 1998;5:143-69.
4. McGwin G Jr, Xie A, Owsley C. Rate of eye injury in the United States. Arch Ophthalmol 2005;123:970-6.
5. Frick KD, Gower EW, Kempen JH, Wolff JL. Economic impact of visual impairment and blindness in the United States. Arch Ophthalmol 2007;125:544-50.
6. Kuhn F, Morris R, Witherspoon CD, Heimann K, Jeffers JB, Treister G. A standardized classification of ocular trauma. Graefes Arch Clin Exp Ophthalmol 1996;234:399-403.
7. Kuhn F, Morris R, Witherspoon CD, Mester V. The Birmingham Eye Trauma Terminology system (BETT). J Fr Ophtalmol 2004;27:206-10.
8. World Health Organization. Chapter VII: H54 visual impairment including blindness (binocular or monocular). International Statistical Classification of Diseases and Related Health Problems, 10th Revision [Internet]. Current Version for 2014 [cited 2018 Jan 17]. Available from: http://www.who.int/classifications/icd/en/.
9. Ho CK, Yen YL, Chang CH, Chiang HC, Shen YY, Chang PY. Epidemiologic study on work-related eye injuries in Kaohsiung, Taiwan. Kaohsiung J Med Sci 2007;23:463-9.
10. Xiang H, Stallones L, Chen G, Smith GA. Work-related eye injuries treated in hospital emergency departments in the US. Am J Ind Med 2005;48:57-62.
11. McCarty CA, Fu CL, Taylor HR. Epidemiology of ocular trauma in Australia. Ophthalmology 1999;106:1847-52.
12. Cillino S, Casuccio A, Di Pace F, Pillitteri F, Cillino G. A five-year retrospective study of the epidemiological characteristics and visual outcomes of patients hospitalized for ocular trauma in a Mediterranean area. BMC Ophthalmol 2008;8:6.
13. Jahangir T, Butt NH, Hamza U, Tayyab H, Jahangir S. Pattern of Presentation and factors leading to ocular trauma. Pak J Ophthalmol 2011;27:96-102.
14. Pandita A, Merriman M. Ocular trauma epidemiology: 10-year retrospective study. N Z Med J 2012;125:61-9.
15. Thoongsuwan S, Rodanant N, Namatra C, Trinavarat A, Tantaterdtum J, Singalavanija A, et al. Visual outcome and prognostic factors in posterior segment intraocular foreign bodies. J Med Assoc Thai 2012;95(Suppl 4):S82-6.
16. Mekhasingharak N, Namatra C. Classification and regression tree analysis for predicting visual outcome after open-globe injuries in Siriraj Hospital. J Med Assoc Thai 2014;97:939-46.
17. Sintuwong S, Winitchai R. Predictive factors of visual outcome in open globe injuries in Thailand: a prospective study. Asian Biomedicine 2011;5:289-94.
18. Larque-Daza AB, Peralta-Calvo J, Lopez-Andrade J. Epidemiology of open-globe trauma in the southeast of Spain. Eur J Ophthalmol 2010;20:578-83.
19. Mela EK, Dvorak GJ, Mantzouranis GA, Giakoumis AP, Blatsios G, Andrikopoulos GK, et al. Ocular trauma in a Greek population: review of 899 cases resulting in hospitalization. Ophthalmic Epidemiol 2005;12:185-90.
20. Khan S, Maqbool A, Abdullah N, Keng MQ. Pattern of ocular injuries in stone pelters in Kashmir valley. Saudi J Ophthalmol 2012;26:327-30.
21. Shahwani MA, Hameed K, Jamali B. Ocular Injuries: Its etiology and consequences in Balochistan. Pak J Ophthalmol 2006;22:82-6.
22. Krishnaiah S, Nirmalan PK, Shamanna BR, Srinivas M, Rao GN, Thomas R. Ocular trauma in a rural population of southern India: the Andhra Pradesh Eye Disease Study. Ophthalmology 2006;113:1159-64.
23. Kinderan YV, Shrestha E, Maharjan IM, Karmacharya S. Pattern of ocular trauma in the western region of Nepal. Nepal J Ophthalmol 2012;4:5-9.
24. Sharp NE, Svetanoff WJ, Desai A, Alemayehu H, Raghavan MU, Sharp SW, et al. Radiation exposure

from head computed tomography scans in pediatric trauma. J Surg Res 2014;192:276-9.
25. Chua D, Wong W, Lamoureux EL, Aung T, Saw SM, Wong TY. The prevalence and risk factors of ocular trauma: the Singapore Indian eye study. Ophthalmic Epidemiol 2011;18:281-7.
26. Mukherjee A, MacEwen CJ. Ocular trauma: The burden of preventable eye injury [abstract 0041]. Int J Surg 2011;9:502.
27. Karaman K, Gverovic-Antunica A, Rogosic V, Lakos-Krzelj V, Rozga A, Radocaj-Perko S. Epidemiology of adult eye injuries in Split-Dalmatian county. Croat Med J 2004;45:304-9.