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Brief communication (Original)

Visual outcome in open globe injuries in Thailand: a prospective study

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Background: Eye injuries, especially open globe injuries, cause visual morbidities and socioeconomic burden. It is urgent have good database and stakeholder involvement for open globe injuries.
Objectives: Investigate the epidemiology and predictive factors of visual outcome in open globe injuries in an industrial area in Thailand.
Methods: Consecutive cases of in-patient open globe injuries in Mettapracharak Eye Centre between February 2009 and January 2010 were examined. Patients were interviewed at first visit and followed-up for six months. The Birmingham Eye Trauma Terminology was used to classify types of injuries. Demographic data, cost of treatment, length of stay, and predictive factors (initial visual acuity, presence of relative afferent pupillary defect, hyphema, vitreous hemorrhage, intraocular foreign bodies, retinal detachment, time-duration to surgery, and wound length) were assessed.
Results: Fifty-two out of 60 eyes were included. Most (82.7%) of patients were men and average age was 34.1 years (range: 8-68 years). About half (51.9%) graduated from primary school and 65.3% were labourers. Most patients had not used protective devices. The endophthalmitis rate was 13.5%, and panophthalmitis rate was 5.8%. The enucleation rate was 9.6%. The median length of stay was nine days. Poor initial visual acuity and intraocular foreign bodies were significantly associated with poor visual outcome ($p < 0.05$).
Conclusion: Open globe injuries caused visual morbidity especially in young adult male, laborers with low education. Initial visual acuity and intraocular foreign bodies were significant predictive factors of poor visual outcome.

This article has been retracted.

Keywords: Eye trauma, ocular trauma, open eye, prognostic factors, risk factors

Eye injuries are major causes of visual morbidity and loss of eyeball. Patients with eye injuries have poor prognosis despite modern microsurgical techniques. Healthy and safety laws, proper education, risk identification, and using protective devices may reduce the incidence of eye injuries.

"Open globe injuries" is an eye wall injury of full thickness, which are one of most common causes among eye injuries [1-3]. Most patients with open injuries are young males [2, 4, 5] and very few patients had used protective devices [6]. There are reports about their predictive factors and visual outcome. The predictive factors include initial visual acuity [4, 7], presence of relative afferent pupillary defect [7], wound length [4], and retinal detachment [7].

Very little information is available for the predictive factors in Thailand except a report by Saensupho B [9]. According to his retrospective analysis of 10-year data of a provincial hospital in Northeast Thailand, the incidence of open globe injuries was 22% per year.

In a previous study [8], we treated about 100 hospitalized eye injury cases at the Mettapracharak Eye Centre at an industrial area in the centre of Thailand. Forty-four percents were open globe injuries. In this study, we investigated the predictive factors of poor visual outcome for open globe injuries in the industrial area.

Materials and methods

This prospective study was undertaken in Mettapracharak Eye Centre. All in-patients with open globe injuries between February 2009 and January

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2010 were recruited. We examined the patients who met the criteria at the first visit. We interviewed the patients again at least six months after their previous surgery. The initial data included age, sex, race, side of injury, protective device used, whether the injury was related to work, place of injury, history of alcohol consumption during injury, type of injuries, causes of injuries, tissues involved, initial visual acuity, presence of relative afferent pupillary defect (RAPD), initial diagnoses, initial treatments, time to surgeries, lengths of stay in hospital, patients' health providers, and costs of medical care. The data included follow-up visual acuity (FUVA). All patients included in the study were new cases of open globe injuries, had good consciousness, and could cooperate. We excluded any patients who were admitted on a follow-up of less than six months after a previous surgery and any patients for whom we had unreliable information on their visual acuity.

This study was conducted according to the Declaration of Helsinki, and ethical approval was obtained from the Ethics Committee for Research in Human Subject, Thai Ministry of Public Health. All participants gave informed consent in the local language.

This article has been retracted.

For eye injuries classification, we used the Birmingham Eye Trauma Terminology (BETT) [10]. Initial visual acuity, presence of RAPD, hyphema, vitreous hemorrhage, intraocular foreign bodies, retinal detachment, time-duration to surgery and wound length were defined as predictive factors. We defined poor follow-up visual acuities as a main outcome. We also calculated the Ocular Trauma Score (OTS) for comparison of the probabilities of final visual acuity.

The following definitions were used.

- Open globe injuries: an eyewall injury of at least one full thickness.
- Poor initial visual acuity: best corrected visual acuity that are less than or equal to 20/200 at first visit.
- Poor visual outcome (or poor follow-up visual acuity, FUVA): best corrected visual acuity that are less than or equal to 20/200 at least six months after the previous surgery.
- "Long time to surgery" was defined as the time from injury to surgery that lasts more than 24 hours.
- Endophthalmitis: an inflammation of the intraocular cavities.
- Panophthalmitis: an inflammation of all coats of the eye including intraocular structures.

Statistical analysis

Descriptive statistics were presented using mean (SD) or median (IQR) as appropriate. The association between poor visual outcome and each factor was assessed using Pearson's chi-square test or Fisher's exact test along with relative risk (RR) and its 95% CI. Factors with p-value of less than 0.2 were then included in the multiple logistic regression model to determine the effect of each variable after controlling for the effect of other variables in the model. All statistical data analyses were performed by SPSS version 16.0 (SPSS Inc, Chicago, USA).

Results

Out of the 60 patients, 52 who had open globe injuries and admitted in Mettapracharak Eye Centre, met the inclusion criteria and had follow up for at least six months after the previous surgeries. All eight patients were excluded due to incomplete follow-up. The mean age of the patients was 34.1 (14.3) years (range: 8-68 years). Forty-three (82.7%) patients were males. Twenty-seven (51.9%) patients graduated from primary school and 14 (26.9%) patients graduated from secondary school. Four (7.7%) of 52 patients were not educated and only two (3.8%) graduated from universities. Forty-eight (92.5%) of 52 patients were Thai and the rest were Burmese. Thirty-seven (71.2%) patients came to the hospital by the referral system. Thirty-four (65.3%) of 52 patients were labourers, six (11.5%) were farmers, six (11.5%) were students, one (1.9%) was a merchant, and one (1.9%) was unemployed.

Thirty-six (69.2%) patients came to hospital and obtained treatment within one day. Twenty-nine (55.8%) had unilateral injuries on their right eye. Of the 52 patients, 38 (73%) had not worn protective devices and the rest of them were unknown. Twenty-three (44.2%) had work-related injuries. Seventeen (32.7%) patients had been injured at home, nine (17.3%) in the factories, four (7.7%) in the field, and three (5.8%) on the road. Two (3.8%) patients were drinking alcohol prior to being injured. Forty-eight (92.3%) were the result of accidents and two (3.8%) were the result of physical abuses.

Sources of injuries were steel (34.6%), nail (11.5%), wood (9.6%), wire (9.6%), lawn equipment (7.7%), glass (7.7%), grinding wheel (3.8%), and other causes (15.4%).

Among the 52 patients, 20 (38.5%) had hand motion as initial visual acuity. Eleven (21.2%)

responded to light projection and five (9.6%) could complete a finger count. For initial diagnosis, 40 (77.0%) were penetrating injuries and 10 (19.2%) were blunt trauma. Forty (77.0%) had wound length of less than 10 mm. Intraocular foreign bodies were reported in 19 (36.5%) patients. Thirteen (25%) patients had infection. Seven (13.5%) patients had endophthalmitis and three (5.8%) had panophthalmitis.

For the treatment, 28 (53.8%) were given a posterior vitrectomy. Five (9.6%) had enucleation. Out of the 52 patients, 12 (23.1%) could perceive hand movement as visual acuity at the six month follow-up. Nine (17.3%) had no light perception and only eight (15.4%) could correctly respond to a finger count. **Figure 1** compares initial visual acuity with visual acuity at six months.

The effects of potential predictive factors on visual outcome were shown in **Table 1**. Initial visual acuity, time to surgery, relative afferent pupillary defect, wound length and intraocular foreign bodies were the potential predictive factors (p-value <0.2). Due to a very small number of subjects in RAPD and wound length, only three variables were included in the multiple logistic regression model.

Table 2 shows predictive factors of poor visual outcomes in open globe injuries using multiple logistic regression analysis. Initial visual acuity and intraocular foreign bodies were significant predictive factors of open globe injuries.

Table 3 compares the present study with Ocular Trauma Score (OTS). Interestingly, our study was similar to the OTS study except for the OTS score 4.

The median length of stay in hospitals was nine (5, 13) days (range: 1-59 days). The median of costs of medical care were 39,127 Thai Baht (range: 4,554-132,553) corresponding to 1,238 USD. The median number of hospital admissions was 1.5 visits (range: 1-5).

Out of 52 patients, 30 were provided with health care funding through the Universal Coverage Scheme, nine were funded by the Workmen's Compensation Fund, six were self-funded, four were funded under the Social Security Scheme, and only three were funded through the Civil Servant Medical Benefit Scheme.

This article has been retracted.

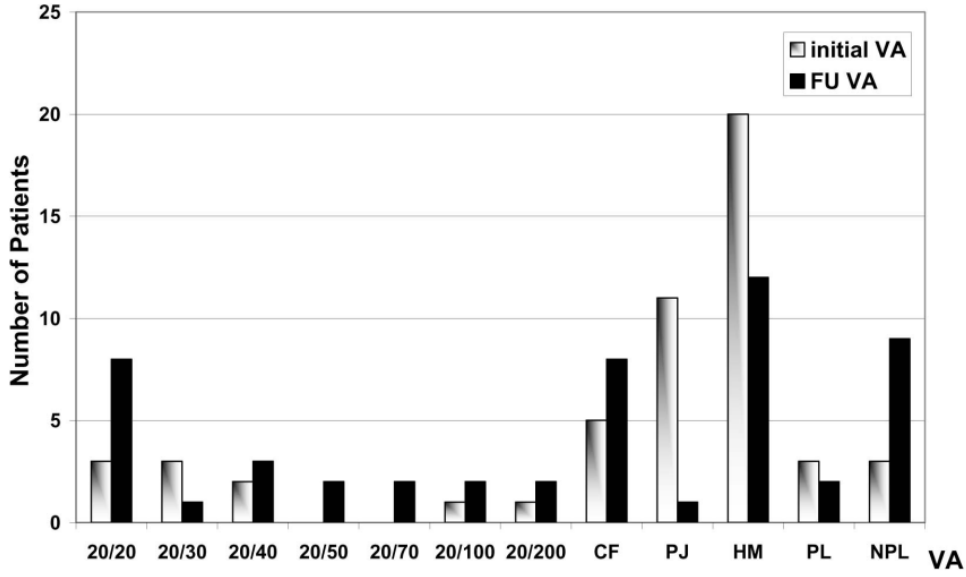

Figure 1. Comparison between initial visual acuity and follow up visual acuity. VA=visual acuity, FUVA=follow-up visual acuity, CF=count fingers, PL=perception of light, HM=hand motion, PJ=projection of light, NPL=no perception of light

Table 1. Predictive factors of poor visual outcomes in open globe injuries using chi-square analysis

	Visual Outcome Good number (%)	Poor number (%)	RR (95% CI)	P-value
Initial visual acuity				
Poor	12 (28.6%)	30 (71.4%)	3.6 (1.0, 12.5)	0.004
Good	8 (8%)	2 (20%)		
Time-duration to surgery				
>24 hours	4 (25.0%)	12 (75.0%)	1.3 (0.9, 2.0)	0.183
≤24 hours	16 (44.4%)	20 (55.6%)		
RAPD				
Positive	0 (0%)	8 (100%)	1.8 (1.4, 2.4)	0.017
Negative	20 (45.5%)	24 (54.5%)		
Wound length				
≥10 mm	0 (0%)	12 (100%)	2.0 (1.5, 2.7)	0.002
<10 mm	20 (50.0%)	20 (50.0%)		
Intraocular foreign body				
Positive	4 (21.1%)	15 (78.9%)	1.5 (1.0, 2.3)	0.05
Negative	16 (48.5%)	17 (51.5%)		
Hyphema				
Positive	3 (30.0%)	7 (70.0%)	1.2 (0.7, 1.9)	0.722
Negative	17 (40.5%)	25 (59.5%)		
Vitreous hemorrhage				
Positive	8 (44.4%)	10 (55.6%)	0.9 (0.5, 1.4)	0.519
Negative	12 (35.3%)	22 (64.7%)		
Retinal detachment				
Positive	3 (27.3%)	8 (72.7%)	1.2 (0.8, 1.9)	0.497
Negative	17 (41.5%)	24 (58.5%)		

This article has been retracted.

Table 2. Predictive factors of poor visual outcomes in open globe injuries (multiple logistic regression analysis)

	b	SE(b)	P-value	OR (95%CI)
Initial visual acuity: Poor	2.8	1.1	0.008	16.95 (2.1, 136.3)
Time to surgery: >24 hours	0.9	0.7	0.209	2.50 (0.60, 10.46)
Intraocular foreign body: positive	1.8	0.8	0.028	6.35 (1.2, 33.1)

b=coefficient

Table 3. Comparison of Ocular Trauma Score (OTS) (OTS study group/our study)

Raw score sum	OTS score	NLP	LP/HM	1/200-19/200	20/200-20/50	≥20/40
0-44	1	73/75	17/25	7	2	1
45-65	2	28/25	26/33	18/25	13/8	15/8
66-80	3	2/4	11/26	15/17	28/35	44/17
81-91	4	1	2	2	21/100	74
92-100	5	0	1	2/12	5	92/88

NLP=No light perception, LP=light perception, HM=hand motion

Discussion

The present study has showed that high incidences of open globe injuries appeared in young adult male with low education and low socioeconomic level. Most patients had not been wearing protective devices, and half of the injuries were work-related. Cillinio et al. [1] reported that the average age of open globe injuries patients was 35.6 years, which was similar to the findings of our study and the study by Kanoff et al. [5]. However, there was lower average age founded in Parver et al. [11] and Soylu et al. [12]. In the present work-related injuries, no patients used protective devices during injuries, compared to 29.3% reported by Woo and Sundar [13], and 6.8% by Pinna et al. [6].

In our study, the endophthalmitis and panophthalmitis rates (19.3%) were high compared to Cillino et al. (1.4%) [1], Entezari et al. (3.5%) [7], Soylu et al. (6.3%) [12] and Soliman et al. (8%) [3]. For endophthalmitis cases, all patients had vitreous penetration, and only one case had an IOFB. In panophthalmitis cases, all patients had vitreous penetration and IOFB. The causes of injuries were metallic (40%), organic (40%) and unknown (20%) materials. The time-duration to treatment in these cases varied from within 1-13 days. Although systemic antibiotics were used in every open globe injury patient, half of patients were referred by other hospitals. Therefore, we could not make sure about the proper doses and administered time of systemic antibiotics. From our data, a patient with history of open globe injury with vitreous penetration might be treated as endophthalmitis. The Clinical Practice Guideline for open globe injury could reduce the number.

In our study, the enucleation rate (9.6%) was high compared to the result of Pinna et al. (1.7%) [6], Mansouri et al. (5.1%) [4] and Savar et al. (8.3%) [14]. However, it was lower compared with those by Gyasi et al. (20.9%) [15], and Entezari et al. (14%) [7]. Out of the five enucleated patients, three were diagnosed panophthalmitis and two were severely injured beyond repair. Usually, operable open globe injury was enucleated to prevent sympathetic ophthalmia. Surachatkumtonekul et al. [16] reported one case of sympathetic ophthalmia in Thailand that improved after enucleation and steroid administration. Savar et al. [14] reported rate of sympathetic ophthalmia of 0.3%. All of them responded well to treatment without enucleation. In Thailand, further investigation for this controversy may be required in the future.

The present univariate analysis showed five factors including initial visual acuity, time to surgery, RAPD, wound length, and IOFB that had p-value less than 0.2. RAPD and wound length had no patients in one cell of table (2x2). Therefore, we chose the remaining factors to analyze using the multiple logistic regression model. Initial visual acuity and IOFB were the predictive factors ($p < 0.05$) in our analysis. A greater sample size may be required in future research.

The median cost of treatment of in-patient open globe injuries were approximately 40,000 Thai Baht, which is significantly low compared to approximately 3,350 EUR by Pinna et al. [6]. Fifty-seven percent were work-related but about half of the injuries were paid by Universal Coverage Scheme (UCS) instead of the Workmen's Compensation Fund (WCF), which is intended to be the main health provider for labourers. The reason was that some laborers might not be enrolled in the Social Security Scheme.

In conclusion, predictive factors help us determining visual outcomes in open globe injuries. However, it is much better to avoid them. Education, legislation, and awareness would be helpful to decrease visual morbidity and socioeconomic problems from open globe injuries.

This article has been retracted.

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This article has been retracted.