Visual Outcome and Prognostic Factors in Posterior Segment Intraocular Foreign Bodies

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***Objective**: To identify the prognostic factors that predict visual outcome in eyes with penetrating ocular injuries with retained intraocular foreign bodies (IOFBs).*
***Design**: Retrospective cases series*
***Material and Method**: The authors reviewed the records of 228 patients who had penetrating eye injuries with retained posterior segment IOFBs managed at Siriraj Hospital between June 1995 and February 2008. One hundred and forty-one patients (61.8%) were included in the present study. Associations between final visual outcome and various pre-operative and post operative variables were statistically analyzed.*
***Results**: After a mean follow-up of 10.4±7.7 months, 68 eyes (48.2%) achieved visual acuity of 6/18 or better. The final visual acuity ranged between 6/24 and 6/60 in 22 eyes (15.6%) and 51 eyes (36.2%) had visual acuity less than 6/60. Final visual acuity significantly depended on initial visual acuity (p = 0.002), size of entry wound (p = 0.020), size of foreign body (p = 0.018), presence of vitreous hemorrhage (p = 0.014), retinal detachment (p = 0.026) and endophthalmitis (p < 0.0001).*
***Conclusion**: Visual outcome in penetrating ocular injuries with retained IOFBs was affected by initial visual acuity, size of entry wound, size of foreign body, vitreous hemorrhage, retinal detachment and endophthalmitis. These factors may be helpful for pre-operative counseling and predicting the final visual outcome.*

***Keywords**: Penetrating ocular injury, Intraocular foreign body, Eye trauma*

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Open globe injury is a major cause of visual morbidity with significant socioeconomic impact[1]. An injury with retained intraocular foreign body (IOFB) is a serious condition which requires special investigations and interventions. According to the improvement of microsurgical and vitreoretinal instrumentation and techniques, the visual outcome in these patients seems to be better in recent times[2]. In the present study, the authors evaluate a large number of penetrating globe injuries with posterior segment IOFBs and determine predictive factors for final visual outcome.

Material and Method

The present study protocol was approved by Siriraj Institutional Review Board (Si030/2009). Two hundred and twenty-eight patients with retained posterior segment IOFBs presented to Siriraj Hospital from June 1995 to February 2008 were identified. Of the 228 patients, 141 (61.8%) who had follow-up time at least 3 months were included in the present study. All patients underwent removal of foreign bodies with or without pars plana vitrectomy and repair of additional structural damage if present.

The history, eye examination, operative records, progress notes and follow-up records were retrospectively reviewed to obtain age, sex, eye injured, activity at the time of injury, time from injury to removal IOFBs, initial visual acuity, findings on initial ocular examination, findings in operative field, type and size of IOFBs, surgical procedures, treatments, presentation of endophthalmitis, follow-up time, final visual acuity and anatomical outcome. A good, final visual outcome was defined as a visual acuity of 6/60 or better and a poor visual outcome was defined as visual acuity less than 6/60. Associations between final visual outcome

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and various pre-operative and post operative variables were statistically analyzed.

Statistical analysis

The data were analyzed based on SPSS version 11.5 with the assistance of the statistics unit of the department of Ophthalmology, Siriraj Hospital. The authors employed Chi-square tests (Pearson Chi-square and Fisher's Exact test) to determine which factors influenced or predicted the final visual acuity. A p-value of less than 0.05 was considered statistical significant.

Results

All but 3 of the 141 patients were male (97.9%). Age ranged from 13 to 66 years with a mean age of 32 $\pm$ 11.2 years. The right eye was affected in 70 cases (49.6%) and the left eye in 71 cases (50.4%). The mean follow-up time was 10.4 $\pm$ 7.7 months (range, 3-24 months). The presenting visual acuity (VA) was 6/18 or better in 33 eyes (23.4%), between 6/24 and 6/60 in 21 eyes 9 (14.9%) and less than 6/60 in 87 eyes (61.7%). Seventy-five eyes (53.2%) were injured as a result of hammering metal on metal, 23 eyes (16.3%) by the shaving metal, 10 eyes (7.1%) by cutting grass, 7 eyes (5%) as the result of an explosion and 26 eyes (18.4%) by other mechanisms. No patient was wearing protective glasses at the time of the accident. Demographic information is shown in Table 1.

The entrance wound located at cornea in 113 eyes (80.1%), at sclera in 25 eyes (17.7%) and corneoscleral in 3 eyes (2.1%). Thirty-six eyes (25.5%) had entry wound length longer than 3 mm. Vitreous hemorrhaging was found in 66 eyes (46.8%). Retinal injury was detected in 120 eyes (85%), whereas 26 eyes (18.4%) had retinal detachment at presentation. The maximum length of foreign bodies ranged from 0.6 mm to 19 mm. Most of IOFBs (97%) were metallic in nature.

Removal of the IOFBs was carried out within 24 hours following injury in 39.6% of cases. Most of IOFBs (83%) were removed within 24 hours after admission. Culture-positive endophthalmitis was found in 19 eyes (13.5%). The most common organism was *Staphylococcus* (7 eyes). Five eyes had positive cultures for *Bacillus cereus*. The other organisms included *Streptococcus* (3 eyes) *and Pseudomonas* (4 eyes). Panophthalmitis developed in 4 eyes (2.8%) and enucleation was carried out during the follow-up period.

For the removal of IOFBs, pars plana vitrectomy was performed in 123 eyes (87.2%). The authors used an electrical hand-held magnet and intraocular pencil magnet for removal metallic IOFBs. Endolaser and/or cryotherapy were applied around retinal injury. An ocular endotamponade, using gas (69 eyes, 48.9%) or silicone oil (10 eyes, 7.1%), was performed at the discretion of operating surgeon. Almost all patients included in the present study received preoperative intravenous antibiotics, intravitreous antibiotics injection and post operative topical and systemic antibiotics.

Table 1. Demographic data of patients with penetrating ocular injury with retained intraocular foreign body (total 141 eyes)

Age	
Mean (range, SD)	32.01 (13 to 66, 11.17)
Gender	Number (%)
Male	138 (97.9)
Female	3 (2.1)
Eye	
Right	70 (49.6)
Left	71 (50.4)
Injury mechanism	
Hammering	71 (50.4)
Shaving	23 (16.3)
Cutting grass	10 (7.1)
Burst	7 (5.0)
Watching hammering	4 (2.8)
Other	26 (18.4)
Type of IOFB	
Metallic	137 (97.2)
Glass	1 (0.7)
Wood	1 (0.7)
Other	2 (1.4)

Final VA ranged between 6/6 and no light perception. Sixty-eight eyes (48.2 %) had final VA 6/18 or better. The final visual acuity ranged between 6/24 and 6/60 in 22 eyes (15.6%) and 51 eyes (36.2%) had visual acuity less than 6/60 (Fig. 1).

The association between each presenting factor (initial VA, time of surgery, presence of; corneal injury, scleral injury, vitreous hemorrhage, retinal injury, retinal detachment and endophthalmitis; size of entry wound and size of IOFBs) and final VA was statically analyzed. The final VA significantly depended on initial visual acuity ($p = 0.002$), size of entry wound ($p = 0.020$), size of foreign body ($p = 0.018$), presence of vitreous hemorrhage ($p = 0.014$), retinal detachment ($p = 0.026$) and endophthalmitis ($p < 0.0001$) (Table 2).

Discussion

The association between pre-operative

clinical findings and final visual outcome in the present series are similar to previous studies[2-5]. Final visual outcomes depended on size of entry wound. Longer wound length represents more tissue destruction than shorter wound length regardless of the entry site. Size of IOFB was the risk factor with impact on the development of proliferative vitreoretinopathy (PVR)[3]. The presence of PVR initiates the destruction of retinal tissue and retinal detachment. As shown in previous studies, PVR is recognized as one of the factors associated with poor visual outcome[2-3,6].

Delay in IOFBs removal is one of the risk factors for developing endophthalmitis[3,7]. The incidence of infectious endophthalmitis in our series (13.5%) is relatively higher than previous reports (4-7.5%)[3,7,8]. It is possible that, in the majority of the present patients (60%), IOFBs removal was carried out later than 24 hours after the accident according to either late presentation or being referred to Siriraj Hospital after primary repaired. Time of surgery is not associated with poor visual outcome in the present study. However, infectious endophthalmitis was more likely to develop in eyes with delayed primary repaired (more than 24 hours)[3,9]. Therefore, the authors suggest removing IOFBs as soon as possible to decrease the risk of endophthalmitis, which is one of the significant risk factors associated with poor visual outcome, especially in eyes that have not been repaired so far.

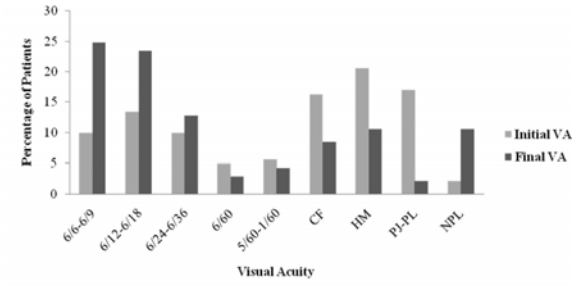
Retinal detachment was associated with poor visual outcome in many studies[2,3,5,6]. Unlike retinal detachment, presence of retinal injury was not the predictive factor for visual outcome. The authors postulate that the improvement in vitreoretinal surgical instruments and surgical techniques, for example, endolaser and wide angle lens system, allowing better surgical result and preventing retinal detachment. A sufficient retinopexy at retinal breaks can prevent retinal detachment. A vitreous hemorrhage may represent a high severity of injury and was one of the significant predictive factors.

In the present series, about 50% of patients had excellent vision (VA $\geq$ 6/18) while one-third of them had poor vision (VA less than 6/60). This result may help in pre-operative counseling. Wickham et al[2] showed that the final visual outcome was significantly improved in the patients who underwent surgery from 1999 resulting from the advance development of vitreoretinal surgical techniques. Unfortunately, the present study started over a 12-year period since 1995, but we did not analyze the association between final VA and the period of surgery.

These injuries usually occur in a working population and can lead to permanent visual loss. Lack of awareness in eye protection remains the problem in this population. In previous studies, less than 10 % of their patients used eye protection at the time of injury[4,8,10]. None of the present patients wore the protective eyeglasses during the injuries. The use of eye protection should be emphasized and health education should be provided to the high-risk population. The present study is limited by its retrospective nature. Multiple biases can impact the results including missing data and surgeon preference. However, it would be difficult to perform a prospective randomized control trial according to the nature of IOFBs injuries. The results from retrospective review provide the majority information of these injuries. The findings of the present study may be helpful for pre-operative

Table 2. Prognostic factors for visual outcome in patients with penetrating ocular injury with retained intraocular foreign body

Prognostic factors	Final VA$\geq$6/60 number/total (%)	Final VA<6/60 number/total (%)	p-value
Initial VA < 6/60	47/90 (52.2)	40/51(78.4)	0.002
Time of surgery < 24 hours	27/73 (37)	8/18 (44.4)	0.560
Size of wound $\leq$ 3 mm	71/88 (80.7)	32/51 (62.7)	0.020
Size of IOFB $\leq$ 3 mm	61/88 (69.3)	25/51 (49)	0.018
Presence of corneal injury	77/90 (85.6)	39/51 (76.5)	0.175
Presence of scleral injury	15/90 (16.7)	13/51 (25.5)	0.207
Presence of retinal injury	76/90 (84.4)	44/51 (86.3)	0.769
Presence of retinal detachment	10/51 (19.6)	16/39 (41)	0.026
Presence of vitreous hemorrhage	36/89 (40.4)	30/48 (62.5)	0.014
Presence of endophthalmitis	4/90 (4.4)	13/51 (25.5)	<0.0001



CF = counting finger, HM = hand movement, NPL = no light perception

Fig. 1 Percentage of initial and final visual acuity (total 141 eyes)

counseling and predicting the final visual outcome.

Potential conflicts of interest

None.

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ผลการรักษาและปัจจัยที่มีผลต่อการมองเห็นในผู้ป่วยบาดเจ็บทางตาที่มีสิ่งแปลกปลอมตกค้าง

โสมนัส ถุงสุวรรณ, ณัฐวุฒิ รอดอนันต์, จักรพงศ์ นะมาตร์, อดิศักดิ์ ตรีนวรัตน์, จุฑาไล ตัณฑเทอดธรรม, อภิชาติ สิงคาลวณิช, ศุภมาส โรจนนินทร์

***วัตถุประสงค์**: เพื่อศึกษาถึงปัจจัยที่มีผลต่อการมองเห็นในผู้ป่วยที่ได้รับการบาดเจ็บทางตาและมีสิ่งแปลกปลอมตกค้างในลูกตา*

***วัสดุและวิธีการ**: ศึกษาเวชระเบียนผู้ป่วยย้อนหลังจากผู้ป่วยที่ได้รับการบาดเจ็บทางตาและมีสิ่งแปลกปลอมตกค้างในลูกตา ที่ได้รับการรักษาที่โรงพยาบาลศิริราช ระหว่างเดือนมิถุนายน พ.ศ. 2538 ถึงเดือนกุมภาพันธ์ พ.ศ. 2551 มีผู้ป่วยจำนวน 141 ราย (141 ตา) ที่ได้รับการศึกษา ปัจจัยต่างๆ ทั้งก่อนและหลังการผ่าตัดถูกนำมาวิเคราะห์ทางสถิติเพื่อหาความสัมพันธ์กับผลของการมองเห็นหลังการรักษา*

***ผลการศึกษา**: จากการตรวจติดตามเฉลี่ย 10.4 $\pm$ 7.7 เดือน พบว่าผู้ป่วยที่มีการมองเห็นหลังการรักษาดีกว่าหรือเท่ากับ 6/18 มีจำนวน 68 ตา (ร้อยละ 48.2) การมองเห็นอยู่ระหว่าง 6/24 และ 6/60 มีจำนวน 22 ตา (ร้อยละ15.6) และการมองเห็นแย่กว่า 6/60 มีจำนวน 51 ตา (ร้อยละ 36.2) โดยปัจจัยที่มีผลต่อการมองเห็นอย่างมีนัยสำคัญได้แก่การมองเห็นเบื้องต้น ($p = 0.002$), ขนาดของแผล ทางเข้า ($p = 0.02$), ขนาดของสิ่งแปลกปลอม ($p = 0.018$), เลือดออกในวุ้นตา ($p = 0.014$), จอตาหลุดลอก ($p = 0.026$) และการติดเชื้อในตา ($p < 0.0001$)*

***สรุป**: ผลของการมองเห็นในตาที่ได้รับการบาดเจ็บทางตาและมีสิ่งแปลกปลอมตกค้างในลูกตามีผลกระทบมาจากการมองเห็นเบื้องต้น ขนาดของแผลทางเข้า ขนาดของสิ่งแปลกปลอม เลือดออกในวุ้นตา จอตาหลุดลอก และการติดเชื้อในตา โดยปัจจัยเหล่านี้อาจมีประโยชน์ในการให้คำปรึกษาก่อนผ่าตัดและช่วยในการบอกพยากรณ์โรคแก่ผู้ป่วย*