



Predictive factors of open globe injury in patients requiring vitrectomy



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ABSTRACT

Background: To determine the outcomes and predictive factors of patients with open globe injury requiring pars plana vitrectomy (PPV).

Methods: The medical records of 114 patients age 10 years or older who had undergone PPV due to ocular trauma, with at least 6 months follow up, were retrospectively reviewed.

Results: The mean age of the patients was 42 (SD14) years, with males accounting for 89% of the cases. Penetrating eye injury was the most common injury mechanism (43%) with most injuries occurring secondary to work related incidents (54%). After surgical interventions, 78% of the patients had visual improvement of one or more Snellen lines, while no light perception occurred in 10%. Anatomical attachment was achieved in 87% of eyes at the final follow up. Logistic regression analysis showed that the presence of a relative afferent pupillary defect (RAPD) was a significant predictive factor of visual outcome, while initial retinal detachment was a significant predictor of anatomical outcome.

Conclusions: Pupillary reaction is an important presenting ocular sign in estimating the post-vitrectomy poor visual outcome for open globe injury. Vision was restored and improved in more than half of the patients in this study; however, long-term sequelae should be monitored.

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Introduction

Open globe injury remains a leading cause of acquired visual impairment despite a more thorough understanding of the pathological response following globe trauma. The ocular trauma score (OTS), published by Kuhn et al. in 2002, had been widely accepted as a model for estimating visual outcome after eye injury [1]. The initial predictors in OTS were endophthalmitis, retinal detachment (RD), initial visual acuity, rupture, perforating mechanisms of injury, and the presence of a relative afferent pupillary defect (RAPD). Subsequent studies have proposed additional prognostic variables, including age, wound length and location, iris prolapse, lens injury, hyphema, vitreous prolapse or haemorrhage, adnexal injury, causes of injury, and lag time between injury and surgery [2–9]. Previous studies have reported worse visual outcomes when open globe injury patients require vitreoretinal surgery, including pars plana vitrectomy (PPV) compared to patients not requiring surgery [3,10,11]. Pars plana vitrectomy is used in open globe injury to remove organised vitreous gel and repair traumatised intraocular structures, and

recent advances of medical and microsurgical techniques for posterior segment surgery, including high speed cutter devices, high viscosity silicone oil, and endophotocoagulation, have resulted in ocular salvage with useful vision in severely injured eyes following PPV. These positive outcomes have even been seen in eyes presenting with no light perception [12,13]. Despite reports of good ocular outcomes following PPV for trauma, there is limited data regarding prognostic factors in open globe injury managed with PPV [12,14]. The purpose of this study is to assess factors associated with anatomical and functional outcomes in patients requiring PPV following ocular trauma.

Materials and methods

A retrospective chart review was performed on 415 open globe injury patients presenting at both the emergency department and outpatient eye clinic of a tertiary referral centre. Data was collected from January 1, 2006 to December 31, 2010. Open globe injury was defined as a full-thickness laceration of the sclera and/or cornea. To be included in this study, patients had to meet the following criteria: age of 10 years old or greater, have undergone PPV as treatment for ocular trauma, and have at least 6 months of follow up. The study protocol was approved by the local medical research ethics committee and adhered to the tenets of the Declaration of Helsinki.

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The demographics and presenting information collected were age, gender, time and cause of injury, time interval between injury and PPV, and initial best-corrected Snellen visual acuity. The mechanism of injury (rupture, penetration, perforation, and intraocular foreign body (IOFB)) was defined according to the Birmingham Eye Trauma Terminology system [15]. Rupture was defined as a full-thickness wound of the eye wall caused by a blunt object. Penetration was defined as a single full-thickness wound of the eye wall usually caused by a sharp object, while two full-thickness wounds (entrance and exit) was defined as perforation. A retained foreign object inside the globe was defined as an IOFB. The following ocular signs were recorded at presentation: site and size of the laceration, RAPD, iris or uveal tissue prolapse, hyphema, lens status (aphakia, cataract, or rupture), choroidal damage, vitreous haemorrhage, retinal injury or detachment, IOFB, and endophthalmitis. A vitreoretinal specialist made the decision regarding whether or not a patient would undergo a therapeutic PPV. All PPVs were performed by a vitreoretinal specialist and surgical techniques varied based on each individual surgeon's preference. Surgical details of the initial PPV and subsequent operations were documented. Intravenous antibiotics (gentamycin and vancomycin) were given from the time of initial patient presentation and continued for approximately 3–7 days post-surgery. Topical antibiotics were initiated during the post-operative period and continued for at least 1 month. Intravitreal antibiotics were injected in cases of clinically suspected endophthalmitis.

The data assessed from the follow up visits were best-corrected Snellen visual acuity, corneal status, intraocular pressure, lens status, and retinal status. Final visual acuity worse than perception of light was considered a poor visual outcome.

Wound length and hyphema were not documented as presenting clinical signs in 2 eyes (1 eye each). Therefore, these 2 eyes were not included in the specific variable analysis. Furthermore, data on uveal prolapse and vitreous incarceration at the time of primary repair was unidentified in a number of cases and consequently not included in the statistical analysis.

Statistical analysis

Chi square or Fisher's exact test was analysed for categorical data. A Mann–Whitney U test or unpaired Student's *t*-test was analysed for continuous data. Forward logistic regression was conducted to evaluate the association of predictive variables and visual outcome. SPSS version 16.0 software (SPSS Inc., Chicago, IL) was used for data analysis. A *P* value of less than 0.05 was considered statistically significant.

Results

In the five-year study period, 170 eyes (168 patients) underwent PPV for open globe injury; 115 eyes in 114 patients were followed for at least six months and were included in this study. Of the 114 patients included in this study, 89% (101/114) were male, and 11% (13/114) female. The mean age of the patients was 42 (SD14) years (median, 43; range, 12–77 years), with most patients between 40–59 years old (60/114, 53%), followed by patients between 20–39 years old (40/114, 35%), more than 60 years old (9/114, 8%), and 10–19 years old (5/114, 4%). The most common cause of injury was work-related (54%, 62/115 eyes), followed by weapon-related (14%, 16/115), vehicle accident (13%, 15/115). The remaining cases (19%, 22/115) were injuries secondary to accidents, falls, sports, and assaults. The most common injuries were penetrating injuries in 43% (49/115 eyes), followed by IOFB in 29% (34/115), ruptured globe in 22% (25/115). Perforating injuries occurred in 6% (7/115). Presenting visual acuity was less than 6/60 in 92% (106/115 eyes), which included no light perception (NLP) in 1 eye. Patient characteristics and visual acuity distributions are listed in Tables 1 and 2.

Surgical intervention

Primary repairs were performed before PPV in 83% (96/115 eyes), and at the time of initial PPV in 8% (9/115). Primary repairs were not performed in 9% (10/115), due to a self-sealing primary wound associated with a retained IOFB. The mean interval between initial injury and PPV was 22 days (median, 12; interquartile range (IQ), 6–20 days). At the time of initial PPV, 9% (10/115 eyes) underwent a combined scleral buckling procedure and 71% (82/115) underwent combined lens surgery. Of 37 patients with RD, final anatomical attachment was achieved in 70% (26/37 eyes), 8 eyes under silicone oil tamponade and 18 under gas tamponade. Excluding primary globe repairs, 24% (28/115 eyes) had 1 surgery, 57% (66/115) had 2 surgeries, and 18% (21/115) had 3 or more surgeries performed. The mean follow up period was 14 months (median, 11; IQ, 8–17 months).

Functional outcomes

Visual thresholds were improved by one or more Snellen lines in 78% (90/115 eyes), stabilised within one line in 9% (10/115), and decreased by one or more lines in 13% (15/115). Final visual acuity of NLP occurred in 10% (11/115 eyes). Three of 11 NLP eyes (27%) underwent enucleation. Endophthalmitis occurred in 22 eyes, with

Table 1
Presenting characteristics of patients distributed by injury types.

	Rupture (N=25)	Penetrating injury (N=49)	Perforating injury (N=7)	Intraocular foreign body (N=34)	<i>P</i> Value
Age (years), mean [SD]	42.3 [15.5]	42.2 [14.4]	37.3 [14.1]	42.2 [12.9]	0.883 ^a
Sex, male:female	4:1	45:4	6:1	31:3	0.374 ^b
Initial VA of \leq projection of light, eyes (%)	12 (48)	20 (41)	3 (43)	6 (18)	0.051 ^b
Zone III injury, eyes (%)	10 (40)	6 (12)	2 (29)	3 (9)	0.038 ^b
Wound length \geq 10 mm, eyes (%)	13 (52)	12 (25)	2 (29)	0 (0)	<0.001 ^b
RAPD, eyes (%)	11 (44)	16 (33)	4 (57)	6 (18)	0.063 ^b
Hyphema, eyes (%)	16 (64)	22 (46)	5 (71)	7 (21)	0.002 ^b
Vitreous haemorrhage, eyes (%)	23 (92)	30 (61)	2 (29)	15 (44)	0.001 ^b
Choroidal injury, eyes (%)	14 (56)	15 (31)	0 (0)	2 (6)	0.001 ^b
Retinal detachment, eyes (%)	10 (40)	17 (35)	3 (43)	7 (21)	0.327 ^b
Adnexal injury, eyes (%)	8 (32)	11 (22)	0 (0)	2 (6)	0.030 ^b
Associated lens surgery, eyes (%)	17 (68)	33 (67)	6 (86)	26 (77)	0.685 ^b

SD, standard deviation; VA, visual acuity; RAPD, relative afferent pupillary defect.

^a ANOVA test.

^b Fisher Exact test.

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