·Clinical Research·

Ocular trauma treated with pars plana vitrectomy: early outcome report

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Abstract

• AIM: To evaluate demographic variables and visual outcomes, among patients with ocular injuries involving the posterior segment, managed with pars plana vitrectomy.

• METHODS: The records of patients were studied retrospectively from March to September 2010, to determine the age, gender, place of occurrence of trauma, visual acuity, anatomical site, nature of injury, wound length, the presence of an afferent pupillary defect, and the timing of vitrectomy. The Ocular Trauma Score was measured. The minimum follow-up from presentation was 6mo.

• RESULTS: Ninety patients (77 males, 13 females), with a mean age of 32.7±15.8y were included over the 6-month period. The majority of cases occurred in the workplace (47 patients), followed by home (14 patients). The mean visual acuity (logMAR) of patients significantly improved from 2.36±0.72 preoperatively to 1.50±1.14 postoperatively. Twenty-three patients had preoperative vision better than 2.0 logMAR, the postoperative visual acuity was significantly better among these patients than patients with worse than 2.0 logMAR (P<0.001). Visual improvement between groups with early vitrectomy (<7d) and delayed vitrectomy (>7d) was not significantly different (P=0.66). Postoperative visual acuity was not significantly different between patients with injury in Zone I and II (P=0.64), but patients with injury in Zone III had significantly poorer visual acuity (P=0.02). Patients with relative afferent pupillary defect had significantly poorer postoperative visual acuity (P=0.02). Preoperative visual acuity, the difference of preoperative and postoperative visual acuity, and postoperative visual acuity were significantly different between groups with different ocular trauma scores (P<0.001).

• CONCLUSION: Trauma is more likely to occur in men under 40y of age and in the workplace. The favorable final visual outcome is associated with the absence of afferent pupillary defect, ocular trauma score and presenting visual acuity as well as the zone of injury, and not associated with the timing of vitrectomy.

• KEYWORDS: ocular trauma; vitrectomy; visual outcome; timing

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INTRODUCTION

Ocular trauma is known to cause remarkable morbidity as well as pain, psychosocial stress, and economic burden[1]. Proper diagnosis and treatment can decrease related morbidity and increase the patients' quality of life[2].

A major advancement in the management of all forms of posterior segment trauma has been the advent of pars plana vitrectomy. Using this method, previously hopeless traumatized eyes could be managed with better anatomic and also functional outcomes [3-7]. Vitrectomy allows the reconstruction of the posterior segment, clears vitreous opacities, controls the healing process and prevents endophthalmitis. Using the injury model with blood injection into the eyes of monkeys, it has been shown that pars plana vitrectomy performed after trauma markedly decreases the incidence of tractional retinal detachment. By excising both the blood and vitreous from these eyes, the stimulus and scaffold for fibroblastic proliferation are removed and tractional retinal detachment is prevented [6-7]. There is controversy in the management of posterior segment injuries and the timing of the surgery for perforating injuries with some advocating early (within 2d) versus delayed (7-14d) surgeries[8-11].

The aim of this study was to evaluate demographic variables of ocular injuries and also determine visual outcome of those

Table 1 Preoperative, postoperative and the difference of pre- and postoperative VA in different causes of trauma managed with vitrectomy

Causes of vitrectomy	Preop. VA	Postop. VA	Diff VA[a]	Lensectomy	Silicone oil injection	Gas (SF6) injection
IOFB (*n*=29)	2.02±0.91[b]	0.97±0.67	-1.03±0.84	15	6	3
Retinal detachment (*n*=39)	2.69±0.36	1.98±1.03	-0.70±0.85	31	37	2
Endophthalmitis (*n*=11)	1.92±0.85	1.74±1.31	-0.18±0.75	10	10	0
Vitrous hemorrhage (*n*=7)	2.47±0.34	0.39±0.22	-2.07±0.53	3	2	2
Dislocated lens (*n*=4)	2.36±0.30	1.93±1.33	-0.66±1.33	4	0	1

IOFB: Intraocular foreign body; VA: Visual acuity. [a]Diff VA was defined as difference between postoperative VA at 6mo and preoperative VA; [b]Numbers are presented based on logMAR.

injuries managed with vitrectomy and to compare pre- and post-operative variables among these patients. In this study we focused on posterior segment injuries requiring vitrectomy and evaluated the results of vitrectomy in ocular trauma.

SUBJECTS AND METHODS

This retrospective study involved all patients diagnosed with a open globe injuries whether by blunt or sharp force presenting to the Farabi Eye Hospital from March to September 2010 requiring vitrectomy. Farabi Eye Hospital is a major eye trauma centre managing the majority of serious ocular injuries in Iran. This center offers both emergency eye care and specialized care for patients of all ages with specific and complicated ocular or orbital diseases and conditions with a full time ophthalmic emergency department. The research adhered to the tenets of the Declaration of Helsinki. The study was approved by the ethics committee of Tehran University of Medical Sciences, Tehran, Iran, and all participants were gave an informed written consent form before the patient being included into the study.

The records of all patients were studied to determine the age, sex and place of occurrence of trauma, initial and final visual acuity, anatomical site, nature of the trauma, operations performed, complications, wound length and timing of the vitrectomy as well as the follow up results. The difference of visual acuity (VA) was defined as the difference between postoperative VA at 6mo and preoperative VA. The minimum follow-up from presentation was 6mo. The zone of injury was defined as follows: Zone I (isolated to cornea), Zone II (limbus to a point 5 mm posterior into the sclera) and Zone III (posterior to the anterior 5 mm of sclera) for penetrating injuries.

The Ocular Trauma Score (OTS) was measured as described by Kuhn *et al* [12]. OTS is a system for predicting the prognosis of trauma based on one functional (initial VA), and five anatomical (rupture, endophthalmitis, perforating injury, retinal detachment, afferent pupillary defect) characteristics. The OTS value is immediately available at the conclusion of the evaluation/initial surgery with reasonably reliable prognostic implications.

The initial VA was the acuity measured on presentation to the hospital. The final VA was taken 6mo after vitrectomy. All vitrectomies were performed by two surgeons (Tabatabaei SA and Mansouri MR). The indications for vitrectomy were injury in Zone III, retinal detachment, vitreous hemorrhage and the presence of intra ocular foreign body (IOFB) according to the decision made by these two experienced surgeons. Tamponing was performed using silicone oil or gas if necessary. Vitrectomy was performed using 3-port standard technique. We did not use any encircling or local scleral buckle in these cases. No case underwent silicone oil removal during this early outcome report.

The timing of vitrectomy was different for different cases but was performed at the latest two weeks after trauma. Vitrectomies performed within seven days were considered early. In cases of penetrating injury, the laceration was repaired firstly and then vitrectomy was performed one week later. Exclusion criteria were: previous ocular trauma, history of any ocular disease, and inadequate follow up (less than 6mo).

Statistical Analysis Data were analyzed using SPSS version 16.0 (SPSS, Inc., Chicago, IL, USA). Frequency distributions were created for injury type and the cause of injury. Statistical analysis of quantitative data, including descriptive statistics, parametric and non-parametric comparisons, was performed for all variables by analysis of variance (ANOVA) and t test. Frequency analysis was performed using the chi-square test. t-test was used to evaluate differences between pre- and post-operational values. P-values less than 0.05 were considered statistically significant.

RESULTS

Ninety patients (77 men, 13 women) with the mean age of 32.7±15.8 (Range: 18-92)y were included over the 6-month period. The majority of trauma occurred in the workplace (47 patients), followed by home (14 patients).

Seventy-three patients had sharp trauma whereas 17 patients had blunt trauma. In cases of open globe injury, the average wound length was 4.79 ±3.77 mm. In patients with blunt trauma the average wound length was 7.5 ±2.87 mm versus 3.5±1.65 mm in patients with sharp trauma.

The indications for vitrectomy are summarized in Table 1.

The mean OTS was 47.21 ±14.59. Eyes were categorized based on OTS as follow: category 1 (0-44), category 2

(45-65), category 3 (66-80), category 4 (81-91), and category 5 (92-100). The details of the preoperative and postoperative VA for these categories are summarized in Table 2.

Preoperative best corrected VA, the difference of preoperative and postoperative VA, and postoperative VA were significantly different between groups with different ocular trauma scores (P<0.001).

Preoperative retinal detachment was observed in 39 patients. At 3mo postoperatively, 8 patients and at 6mo, 5 patients had persistent retinal detachment. From the 8 patients with retinal detachment after 3mo, 5 patients had proliferative vitreoretinopathy (PVR). From 5 patients with retinal detachment after 6mo, 4 patients had PVR (4.4% PVR 6mo postoperatively). Twenty-nine patients had IOFB and metallic foreign bodies were most common, they were found in 16 eyes. Sand, plastic, glass, and animal bone were other removed foreign bodies .

The mean preoperative VA (logMAR) of patients was 2.36± 0.72 which significantly improved postoperatively to 1.50 ± 1.14 (P<0.001). Twenty-three patients had preoperative VA better than 2.0 logMAR. The postoperative VA was significantly better among these patients (P<0.001) (Table 3).

We compared the results of early vitrectomy (<7) with delayed vitrectomy and the change in VA from preoperative vision was not significantly different between the two groups (P=0.66). Twenty-four (26.7%) patients had a relative afferent pupillary defect (RAPD) at presentation. The mean postoperative VA in these patients (2.65 ±0.84) was significantly poorer in comparison to patients without RAPD (1.09±0.70) at presentation (P=0.02) (Table 4).

Thirty-six patients had injury in Zone I and 36 patients had injury in Zone II and 18 in Zone III. Postoperative mean VA was not significantly different between patients with injury in Zone I and II (P=0.64), but patients with injury in Zone III had significantly poorer VA (P=0.02) (Table 5).

Table 2 Preoperative, postoperative and the difference of pre- and post-operative VA in different subgroups based on Ocular Trauma Score

OTS	Preop. VA	Postop. VA	Diff VA[a]
0-44 (n=30)	2.77±0.27[b]	2.65±0.54	-0.11±0.48
45-65 (n=44)	2.49±0.48	1.17±.95	-1.32±0.94
66-80 (n=15)	1.24±0.71	0.27±.13	-0.97±0.70
81-91 (n=1)	0.70	0.05	-0.65
P	<0.001	<0.001	<0.001

OTS: Ocular Trauma Score; VA: Visual acuity. [a]Diff VA was defined as difference between postoperative VA at 6mo and preoperative VA; [b]Numbers are presented based on logMAR.

Table 3 Postoperative VA in subgroups of patients based on preoperative VA

Preoperative	Postoperative	P
VA<2 logMAR	0.58±0.17	0.01
VA>2 logMAR	1.82±1.08	0.02

VA: Visual acuity.

Table 4 Postoperative VA results based on the timing of surgery

Timing	Preop. VA	Postop. VA	Difference	P
<7d	2.11	1.22	0.89	<0.001
7-14d	2.69	1.89	0.80	<0.001
P	0.66	0.79	0.90	

VA: Visual acuity.

Table 5 Visual aquity change based on the zone of injury

Zone	Preop. VA	Postop. VA	Difference	P
I	2.31±0.78	1.20±1.07	1.10	<0.001
II	2.23±0.76	1.32±1.11	0.90	<0.001
III	2.74±0.83	1.93±1.42	0.81	<0.01

VA: Visual acuity.

DISCUSSION

The majority of patients in our cohort were male and the majority of injuries occurred in the workplace. A male preponderance is a universal characteristic of eye trauma and is thought to be related to occupational exposure, participation in dangerous sports and hobbies, alcohol usage and risk-taking behavior[13].

In our study, vitrectomy improved the VA of patients significantly. Globocnik Petrovic *et al*[14] reported that half of the eyes managed with pars plana vitrectomy for open eye injury after trauma had a good final visual outcome.

The appropriate timing of vitrectomy is one of the challenging issues in management of posterior segment trauma. Immediate vitrectomy is indicated when posttraumatic endophthalmitis or IOFB with high risk of infection is present, but timing of surgery for other causes is less clear [15]. Two major indications for delayed vitrectomy performed within 5-14d have been described: choroidal hemorrhage and large posterior wound in perforating globe injuries [16-21]. Early vitrectomy decreases the chance of fibrocellular proliferation and retinal tears. However, early vitrectomy may lead to higher rate of bleeding, wound leakage and increased difficulty to detach the posterior hyaloids [14]. In our study, vitrectomies performed early and late had similar prognosis. In agreement with our study, Agrawal *et al*[18] have reported that the timing of surgery seems to have very little effect on the final outcome and concluded that final VA is determined by the type and extent of trauma rather than the timing of surgery. In earlier vitrectomy, we could have higher risk of intraoperative complications; conversely, in late vitrectomy, there is higher incidence and severity of postoperative complications such as PVR [10]. In a large review of controversial issues in the management of open globe injury, it was suggested that vitrectomy is better to be performed earlier after open-globe injury; although early vitrectomy is technically more challenging due to wound leaks and greater difficulty controlling hemorrhage. Also, delayed surgery allows one to obtain serial echographic and or electrophysiologic data[21].

In our study preoperative retinal detachment was seen in 39 patients and after 6mo, 5 patients remained detached. In the patients with open globe injury the risk of PVR increases[20]. In our study, the incidence rate of PVR was 4.4% 6mo postoperatively.

The presence of relative afferent pupillary defect is a strong predictive factor of visual outcome in the ocular injury[14-19,22-24], regarding this fact, 24 patients in the present study who had RAPD at presentation, had statistically poorer postoperative VA than those without RAPD at presentation. In Pimolrat *et al* [22] study pupillary reaction has been reported as an important prognostic factor for the final visual outcome.

In other studies, preoperative VA has been considered as a good predictor of visual outcome[19,25-26]. In our study, patients with presenting VA less than 2 logMAR, had significantly better postoperative VA (P <0.001). This shows the importance of careful initial examination.

In open globe injuries, more posterior wounds are associated with poorer prognosis [27]. Lacerations confined to the cornea had a better prognosis than eyes with sclera or corneoscleral wounds [19]. However, in our study the postoperative VA in Zone I and II were not significantly different(P=0.64) which may be due to improved techniques of primary repair in recent years, but patients with injury in Zone III had significantly poorer VA (P=0.02).

With 6mo follow up after vitrectomy, glaucoma and endophthalmitis, as complications of the surgery, occurred in 4 and 1 of our cases, respectively.

Assessment of severity of ocular injury at presentation using a standardized scoring system is helpful in prognostication. There are various ocular trauma-scoring systems in use today including the Trauma Index (TI), Ocular Trauma Severity Score (OTSS), and OTS. Bhargava and Vasu [28] evaluated accuracy of these scoring systems in predicting visual disability after open globe injuries. They found that OTS achieved the best overall predictor value of severity with respect to grading of open globe injuries at presentation. OTSS tends to underestimate severe injuries and TI tends to overestimate mild injuries. In our study the preoperative VA, difference between pre- and postoperative VA and postoperative VA were statistically different between subgroups of OTS and the patients that had high OTS at presentation had worse final recovery.

We showed that in 94% of eyes treated with vitrectomy, VA is improved. Vitrectomy after globe trauma is not just an anatomic reconstruction but it is also helps in restoration of useful vision to the patient.

In this study, data were derived from a single hospital that limits the generalization of the results of our survey. Further multicentre investigations are recommended to validate the findings reported here.

In conclusion, trauma was more likely to occur in men under 40y of age and in the workplace. The favorable final visual outcome was associated with the absence of afferent pupillary defect, ocular trauma score and presenting VA as well as the zone of injury, and not associated with the timing of vitrectomy.

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