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Prognostic factors affecting functional and anatomical outcome in globe injuries

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Abstract

To analyze prognostic factors associated with functional and anatomical results in closed globe injuries (CGIs) and open globe injuries (OGIs). One hundred and twenty patients who applied due to globe injuries were retrospectively examined in terms of prognostic factors affecting final visual acuity (FVA). The demographic features and clinical characteristics of the patients were evaluated in various parameters. Most traumas were open globe injuries (82.50%) and occurred at work (50%). CGIs had better baseline visual acuity (BVA) values and also showed better FVA outcomes. Among patients with OGIs, Intraocular foreign body (53.33%) and penetrating (36.11%) OGIs had the highest ratios for FVA $\geq$1/10. Eyes with zone II + III wounds had a tendency of FVA <1/10. Ninety percent of the globe injuries with concomitant retinal detachment resulted in FVA <1/10. Concomitant vitreous hemorrhage plus lens damage affected the level of FVA (r=-0.718, P=0.001). Additional vitreoretinal surgery and ocular trauma score category 1 had negative effects on FVA (P=0.002 and P<0.001, respectively). BVA <1/10, ocular trauma score category 1, perforating OGIs, wound location of Zone II + III, additional vitreoretinal surgery, concomitant findings of retinal detachment and vitreous hemorrhage plus lens damage showed poor prognostic and detrimental effects on FVA in multivariate analysis.

Keywords: Prognostic factors, globe injuries, closed globe injuries, open globe injuries

Introduction

Ocular trauma is a significant problem commonly encountered in healthcare settings all over the world [1]. Globe injuries are among the most significant causes of visual morbidity and preventable visual loss, including 10–15% of all ocular disorders [2-4]. It is estimated that roughly 55 million people around the world annually experience ocular trauma, resulting in relatively limited daily activities and approximately 750,000 hospitalized patients [5]. Approximately 200,000 of them present open globe injuries (OGIs) and 1.2–6.0 per 100,000 cases require medical care [6]. Approximately 19 million and 2 million individuals suffered from unilateral and bilateral visual loss due to ocular trauma, respectively [7]. Previous studies demonstrated that work-related OGIs accounted for nearly 1/3 of all OGI cases and nearly 80 % of the patients were young males [8-10]. Common reasons for OGIs comprise traffic accidents, occupational accidents, sports activities, fishing, and assaults [11].

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Ocular trauma terminologies have been well defined and standardized by the Birmingham Eye Trauma Terminology System (BETTS) to help clinicians to describe globe injuries: Closed globe injuries (CGIs) are not full-thickness injuries and include non-penetrating contusion wounds usually caused by blunt trauma (leading to intraocular pressure increase) and lamellar lacerations (partial-thickness injury of the eyewall) usually caused by sharp injuries, whereas open globe injuries (OGIs) are defined as full-thickness destruction of the eyewall including cornea, sclera, or both and include ruptures caused by blunt traumas and lacerations caused by sharp objects [12, 13]. Lacerations in OGIs are sub-grouped into penetrating injury (presence of entrance but no exit wound without intraocular foreign body [IOFB]), perforating injuries (presence of both entrance and exit wound without IOFB), and IOFB with entrance wounds [12]. Initial visual acuity, the zone of the injury or involvement of the posterior segment, endophthalmitis, and positive afferent pupillary defect are among the poor prognostic factors leading to high rates of permanent visual loss [14]. The ocular trauma score (OTS) described by Kuhn et al. [12] plays an important role in the evaluation of patients with globe injuries and in predicting the final visual acuity (FVA) of these patients. On account of efficient methods to reduce the frequency of globe injuries comprising a remarkable proportion of avoidable reasons in working population, the value and necessity of updated and novel knowledge regarding the process and reasons of globe injuries is undisputed for a public health and globe injury avoidance viewpoint.

In the present study, we assessed the characteristics and etiologic factors in open and closed globe injuries of the Turkish population to figure out the prognostic factors involved in the visual prognosis. Moreover, the associations between OTS, FVA, and other variables were examined in patients who experienced globe injuries and had the proper treatment in a tertiary eye clinic.

Materials and Methods

This retrospective study based on the review of medical charts was conducted in adherence to the principles of the Declaration of Helsinki, and approval was received from the Institutional Ethics Committee. All adult patients and the parents or guardians of the pediatric patients included in the study signed the informed consent form. The study comprised 120 patients with globe trauma who were admitted to a tertiary referral eye clinic within five years. Patients with low cooperation, unconsciousness cases, and patients with irregular postoperative visits were not included in the study. Following the approval for surgery in the baseline or preoperative evaluation, all patients underwent primary repair surgery and were followed up regularly for at least six months. Eyes with an anterior capsular rupture of crystalline lens ± vitreous prolapse into the anterior chamber had combined primary repair surgery and lensectomy ± anterior vitrectomy if required. Any intraocular lens (IOL) was not implanted in the first operation, and for aphakic eyes with possible favorable visual prognosis IOL implantation was performed within three months following the primary repair surgery.

All cases received preoperative and postoperative detailed ophthalmic examinations including visual acuity evaluation, intraocular pressure (IOP, mmHg), slit-lamp biomicroscopic examination, and fundoscopic assessment with B-scan ultrasonography and orbital computed tomography scans. Mean patient baseline visual acuity (BVA) and FVA were described as best-corrected visual acuity (BCVA) and converted from decimal to the logarithm of the minimum angle of resolution (log MAR) values. In the evaluation of mean BVA and FVA, counting fingers (CF, 1/200-19/200), hand motion (HM), light perception (LP), and no light perception (NLP) were assigned log MAR values of 1.85, 2.3, 2.8, and 2.9, respectively. Based on the ophthalmic examination of the eyes included in the study at the time of approval, OTS was assessed retrospectively according to a calculation chart that was first described by Kuhn et al. and used to predict the final visual acuity range [12].

We used BETTS for the classification of globe injuries. The localization of OGIs was classified as follows: zone I injuries were limited to the cornea and limbus, zone II injuries were confined to the sclera within the 5 mm from the limbus, and zone III injuries involved full-thickness scleral defects more than 5 mm posterior to the limbus. The age of eighteen years was considered as the cut-off to describe pediatric patients. An IOP value < 10 mmHg was considered a hypotonic globe, > 21 mmHg was considered a hypertonic globe. The patients were statistically evaluated in several subgroups according to BVA (preoperative) and FVA (postoperative 6th month) at 1/10 cut-off point. Visual acuity (VA) $< 1/10$ was accepted as poor vision and VA $\geq 1/10$ was considered a good vision. Several demographic, categorical, and continuous variables were analyzed in association with FVA outcomes. Assessment of various variables including BCVA level and IOP; age, gender, laterality, and occupation of the patients; type, environment, and etiology of the injuries; wound location and size; concomitant ophthalmic pathologies such as retinal detachment (RD), vitreous hemorrhage (VH), other posterior segment findings, hyphemia, intraocular foreign body, lens damage, phthisis, and surgical interventions were reviewed for the present study. Follow-up duration, the total number of operations for each case, and the time interval between globe injury and surgical repair were also noted.

The statistical analysis of the data obtained from the included patients was assessed by using SPSS for Windows version 21.0 software (IBM Corp., Armonk, NY, USA). Continuous variables were described as mean±standard deviation. Categorical data were shown as either percentage or rate. The normal distribution of the data was tested with the Kolmogorov-Smirnov test. The Chi-square test (frequency analysis), Mann-Whitney U test, Wilcoxon signed ranks test, Kruskal-Wallis test, independent and paired samples t-test, and Spearman and Pearson correlation tests were used for the appropriate statistical analysis. BCVA levels of <1/10 were defined as poor visual acuity. A value of $P < .05$ was considered statistically significant within the 95 % confidence interval.

Results

A total of 120 eyes of 118 patients with globe injuries between the age of 2 and 75 were enrolled in the study with at least a 6-month follow-up period (13.26±3.86 month). OGIs had a greater tendency for FVA of NLP and/or phthisis than CGIs (26.26% versus 9.52%, P=0.001). Most of the eyes (60.71%) with FVA of NLP and/or phthisis had only one surgical intervention, but no correlation was noted with the number of operations and the number of cases with FVA of NLP and/or phthisis (r=+0.236, P=0.122). No correlation was observed with the wound size and the number of cases with FVA of NLP and/or phthisis (r=+0.236, P=0.122). OGIs were presented with a similar incidence of postoperative complications as CGIs (20.20% versus 28.57%, P=0.282) (Table 1).

The largest sample size of the patients (52.50%) had BVA of LP/HM. Nevertheless, a considerable ratio (10%) of the patients had NLP in the initial evaluation. The ratios of the patients with BVA of NLP during admission were similar in both CGIs and OGIs (9.52% and 10.10%, respectively) as in all globe injuries (10%). A relatively higher ratio (33.33%) of eyes with CGIs presented with BVA ≥1/10 than the eyes with OGIs (33.33% versus 20.20%, P=0.208). Penetrating and IOFB OGIs had similar ratios (25.00% and 33.33%) for BVA ≥1/10, and higher ratios than rupture (0%) and perforating (5.56%) OGIs for BVA ≥1/10. We found that 100% and 94.44% of the eyes in rupture and perforating OGIs presented with BVA <1/10, respectively, representing detrimental effects on BVA (P<0.001, RR=0.548; P=0.002, RR=0.456, respectively) (Table 2).

Eyes with CGIs had a relatively higher ratio for FVA ≥1/10 than OGIs (42.86% versus 37.37%, P=0.186). The grade of hyphemia showed a significant correlation with the level of FVA (r=0.588,

Table 1. Demographic, occupational, surgical and some clinical characteristics and follow-up duration of the patients and injured eyes in the study population

Features	Number of Cases
Patient Gender: M / F	118: 97 / 21
Mean Age (y): M / F	30.6±5.2: 27.2±5.3 / 33.4±4.8
Eye Laterality: R / L / B	120: 47 / 69 / 2
Patient Age Distribution: 0-17y / 18-35y / 35-50y / 51y	118: 25 / 58 / 23 / 12
Patient Occupation: RM / CW / S / HW / F / H / R / Pp	118: 29 / 23 / 25 / 15 / 8 / 3 / 3 / 8
Patient Follow-up Duration: 6-9m / 9-12m / 12-18m / 18-24m / >24m	118: 48 / 23 / 14 / 9 / 24
Globe Injury Type	120
CGI Contusion / lamellar laceration	14 / 7
OGI: Rupture / Penetrating / Perforating / IOFB	99: 15 / 36 / 18 / 30
Environment for Globe Injuries	120
Home (19) CGI	3
OGI: Rupture / Penetrating / Perforating / IOFB	16: 5 / 10 / 0 / 1
Outdoors (41) CGI	7
OGI: Rupture / Penetrating / Perforating / IOFB	34: 5 / 9 / 18 / 2
Work (60) CGI	11
OGI: Rupture / Penetrating / Perforating / IOFB	49: 5 / 17 / 0 / 27
Wound Size: No Wound (CGI) / 0-2 mm / 2-10 mm / >10 mm	120: 21 / 36 / 43 / 20
Hyphemia Grade	40
G4 (CGI – OGI) / G3 (CGI – OGI) / G2 (CGI – OGI) / G1 (CGI – OGI)	15 (8-7) / 10 (5-5) / 10 (4-6) / 5 (2-3)
Intervention Types for Globe Injuries	120
Surgical (PRS plus): Lens extraction / VRS+S / VRS-S / *Other Surgeries	114: 52 / 22 / 37 / 3
InOp / Medical Treatment	2 / 4
Time Interval to Primary Surgery (114): <6h / 6-12h / 12-24h / >24h	15 / 72 / 19 / 8
VRS Globe Injuries	59
Operation Time: 0-72h / 4-14d / 15-30d / 30-90d / 90-180d / >6m	5 / 26 / 6 / 4 / 2 /16
Injury Type	59
CGI	7
OG (52)I: Rupture / Penetrating / Perforating / IOFB	5 / 12 / 12 / 23
Posterior Segment Findings: (CGI – OGI)	90: (25 – 65)
All Cases (90): RD / ODM / CM / ERM / ODA / MH / ChR	20 / 9 / 18 / 11 / 12 / 13 / 7
CGI (13): RD / ODM / CM / ERM / ODA / MH / ChR	2 / 1 / 1 / 2 / 2 / 3 / 2
OGI-Rupture (13): RD / ODM / CM / ERM / ODA / MH / ChR	2 / 2 / 3 / 0 / 1 / 2 / 3
OGI-Penetrating (24): RD / ODM / CM / ERM / ODA / MH / ChR	8 / 1 / 6 / 4 / 2 / 3 / 0
OGI-Perforating (15): RD / ODM / CM / ERM / ODA / MH / ChR	3 / 2 / 3 / 2 / 2 / 2 / 1
OGI-IOFB (25): RD / ODM / CM / ERM / ODA / MH / ChR	5 / 3 / 5 / 3 / 5 / 3 / 1
Eyes with Final VA of NLP &/or Phthisis According to Injury Type (All Cases)	28
CGI	2
OGI (26): Rupture / Penetrating / Perforating / IOFB	4/ 7 / 7 / 8
Number of Operations in Eyes with Final VA of NLP &/or Phthisis: 0 / 1 / 2 / 3	28: 2 / 17 / 6 / 3
Wound Size in Eyes with Final VA of NLP &/or Phthisis	28
No Wound (CGI) / 0-2 mm / 2-10 mm / >10 mm	2 / 7 / 11 / 8
Complications: (CGI – OGI)	26: (6 – 20)
All Cases (26): Glaucoma / Strabismus / Keratopathy / Lagophthalmia	6 / 9 / 10 / 1
CGI (6): Glaucoma / Strabismus / Keratopathy / Lagophthalmia	1 / 3 / 2 / 0
OGI-Rupture (5): Glaucoma / Strabismus / Keratopathy / Lagophthalmia	2 / 2 / 1 / 0
OGI-Perforating (6): Glaucoma / Strabismus / Keratopathy / Lagophthalmia	1 / 2 / 2 / 1
OGI-IOFB (4): Glaucoma / Strabismus / Keratopathy / Lagophthalmia	1 / 1 / 2 / 0
OGI-Shot-gun missile (4): Glaucoma / Strabismus / Keratopathy / Lagophthalmia	0 / 1 / 3 / 0

M: Male, F: Female, y: Years, R: Right, L: Left, B: Bilateral, RM: Repairman, CW: Construction worker, S: Student, HW: Housewife, F: Farmer, H: Hunter, R: Retired, Pp: Pediatric patient, CGI: Closed globe injury, OGI: Open globe injury, IOFB: Intraocular foreign body,, G: Grade, PRS: Primary repair surgery, VRS: Vitreo-retinal surgery, S: Silicone, *1 / 1 / 1 patients had glaucoma / amniotic membrane transplantation / enucleation surgeries, respectively, InOp: Inoperable, h: Hour, d: Day, m: Month, RD: Retinal detachment, ODM: Optic disc membrane, CM: Cicatricial maculopathy, ODA: Optic disc atrophy, ERM: Epiretinal membrane, MH: Macular hole, ChR: Choroidal rupture, VA: Visual acuity, NLP: No light perception

Table 2. Baseline visual acuity (BVA) analysis for all cases and regarding injury types

	BVA					
Features ± (Total numbers)	**≥5/10**	**≥1/10-5/10**	**FC***	**LP / HM**	**NLP**	**Total**
CGI	2	1	5	11	2	21
OGI - Rupture	0	0	3	8	4	15
OGI - Penetrating	6	3	6	19	2	36
OGI - Perforating	0	1	3	10	4	18
OGI - IOFB	5	5	5	15	0	30
Total	13	10	22	63	12	120

BVA: Baseline visual acuity, HM: Hand motion, FC: Finger counting, *≥1/200-20/200 (HM-1/10), HM: Hand motion, LP: Light perception, NLP: No light perception, CGI: Closed globe injury, OGI: Open globe injury, IOFB: Intraocular foreign body

P=0.018). The presence of VH alone, lens damage alone, and VH + lens damage had significant correlations with the level of FVA (r=-0.602, P=0.014; r=-0.534, P=0.022; r=-0.718, P=0.001). We did not note any correlation between the number of operations and the FVA levels (r=0.218, P=0.102). Vitrectomized eyes with silicone tamponade had a lower ratio for FVA of NLP than the vitrectomized eyes without silicone tamponade (9.09% versus 16.67%, P=0.032). However, no difference was noted between the ratios for FVA ≥1/10 (13.64% versus 19.44%, P=0.076). The presence or absence of the wound did not affect prognosis on FVA ≥1/10 (46.46% versus 42.86%, P=0.238); whereas the presence of the wound had a higher ratio for FVA of NLP than the absence of the wound (25.25% versus 9.52%, P=0.026), but no correlation was noted with wound size (Table 3).

More than half (53.85%) of the eyes with BVA ≥5/10 maintained their vision, whereas the remaining eyes (46.15%) had a reduction in VA at the final visit. Twenty percent of the eyes with BVA ≥1/10-5/10 had better FVA, half of them maintained their vision, but the remaining eyes presented a decrease in VA at the final visit. Nearly half of the eyes (45.45%) with BVA of FC experienced a better VA, and more than 1/3 (36.36%) of them maintained their VA; unfortunately, the remaining eyes (18.18%) showed decreased VA at the final visit. Approximately half (53.97%) of the eyes with BVA of LP/HM showed an increase in VA, 23.81% of them maintained their VA, whereas the remaining 22.22% of the eyes had a visual loss of NLP at the final visit. Two eyes (16.67%) with BVA of NLP gained FVA of LP/HM, but the remaining (83.33%) eyes continued with FVA of NLP. Approximately 4/5 (78.26%) of the cases presented with BVA ≥1/10 had FVA ≥1/10, the remaining cases (21.74%) showed poor prognosis of FVA <1/10. Nearly 7/10 (71.13%) of the cases with BVA <1/10 had FVA <1/10, the remaining (28.87%) cases showed a good prognosis of FVA ≥1/10. These results represented a significant effect of BVA on the level of FVA (P=0.001). The mean OTS of globe injuries was 64.52±18.46, and OTS showed a correlation with FVA (r=0.608, P= 0.001) (Table 4).

Table 4. Distribution of the cases according to final visual acuity (FVA) regarding baseline visual acuity (BVA) and ocular trauma score (OTS) category

	FVA					
	≥5/10	**≥1/10-5/10**	**FC***	**LP / HM**	**NLP**	**Total**
BVA						
≥5/10	7	4	2	0	0	13
≥1/10-5/10	2	5	3	0	0	10
FC*	7	3	8	1	3	22
LP / HM	11	7	16	15	14	63
NLP	0	0	0	2	10	12
Total	27	19	29	18	27	120
OTS Category (Raw score)						
1 (0-44)	6	9	10	8	12	45
2 (45-65)	6	8	11	6	8	39
3 (66-80)	7	1	4	2	6	20
4 (81-91)	5	0	4	2	1	12
5 (92-100)	3	1	0	0	0	4
Total	27	19	29	18	27	120

BVA: Baseline visual acuity, FVA: Final visual acuity, FC: Finger counting, *≥1/200-20/200 (HM-1/10), HM: Hand motion, LP: Light perception, NLP: No light perception, OTS: Ocular trauma score

Table 3. Final visual acuity (FVA) outcomes for various subgroup analysis

	FVA					
Features ± (Total numbers)	**≥5/10**	**≥1/10-5/10**	**FC***	**LP / HM**	**NLP**	**Total**
Injury Type for All Cases	27	19	29	18	27	120
CGI	7	2	6	3	3	21
OGI - Rupture	0	4	1	4	6	15
OGI - Penetrating	9	4	10	5	8	36
OGI - Perforating	1	3	5	3	4	18
OGI - IOFB	10	6	7	3	4	30
Wound Location in OGIs	20	17	23	15	24	99
zone I	13	9	10	3	0	35
zone I + II	4	3	4	1	2	14
zone I + II + III	1	1	2	1	3	8
zone II	1	3	1	5	7	17
zone II + III	0	0	2	3	5	10
zone III	1	1	4	2	6	15
Wound Location in Rupture + Penetrating	9	9	11	8	14	51
zone I	5	4	5	1	0	15
zone I + II	2	1	2	0	2	7
zone I + II + III	0	1	1	0	3	5
zone II	1	3	1	3	4	12
zone II + III	0	0	0	3	3	6
zone III	1	0	2	1	2	6
Wound Location in IOFB	10	6	7	3	4	30
zone I	7	4	5	2	0	18
zone I + II	2	2	0	0	0	4
zone I + II + III	1	0	1	0	0	2
zone II	0	0	0	1	1	2
zone II + III	0	0	1	0	0	1
zone III	0	0	0	0	3	3
Wound Location in Perforating	1	2	5	4	6	18
zone I	1	1	0	0	0	2
zone I + II	0	0	2	1	0	3
zone I + II + III	0	0	0	1	0	1
zone II	0	0	0	1	2	3
zone II + III	0	0	1	0	2	3
zone III	0	1	2	1	2	6
RD	0	2	8	4	6	20
CGI	0	0	2	2	0	4
OGI-Rupture	0	0	0	1	1	2
OGI-Penetrating	0	0	2	0	4	6
OGI-Perforating	0	2	2	1	1	6
OGI-IOFB	0	0	2	0	0	2
Concomitant Hyphemia (40): G4 / G3 / G2 / G1 t7	1 / 1 / 2 / 2	1 / 2 / 2 / 2	3 / 5 / 3 / 0	3 / 2 / 3 / 1	6 / 1 / 0 / 0	14 / 11 / 10 / 5
Concomitant VH: + / –	2 / 24	10 / 8	23 / 10	8 / 6	22 / 7	65 / 55
Concomitant Lens Damage: + / –	11 / 16	10 / 11	25 / 6	12 / 3	20 / 6	78 / 42
Concomitant VH + Lens Damage: + / –	5 / 11	8 / 3	18 / 2	10 / 1	12 / 0	53 / 17
Number of Operations: 0 / 1 / 2 / 3	4 / 18 / 3 / 2	0 / 8 / 10 / 1	1 / 13 / 11 / 4	0 / 8 / 6 / 4	2 / 15 / 7 / 3	7 / 62 / 37 / 14
VRS: S+ / S-	1 / 4	2 / 3	14 / 13	3 / 10	2 / 6	22 / 36
Wound Size for All Cases	27	19	29	18	27	120
No Wound	5	4	9	1	2	21
0-2 mm	11	5	9	5	6	36
2-10 mm	10	7	7	7	12	43
>10 mm	1	3	4	5	7	20

FVA: Final visual acuity, FC: Finger counting, *≥1/200-20/200 (HM-1/10), HM: Hand motion, LP: Light perception, NLP: No light perception, CGI: Closed globe injury, OGI: Open globe injury, IOFB: Intraocular foreign body, G: Grade, VH: Vitreous hemorrhage, VRS: Vitreo-retinal surgery, S: Silicone, RD: Retinal detachment

Mean baseline BCVA significantly improved from a poor vision of 1.903 log MAR to a final mean BCVA value of 0.921 log MAR (P<0.001), representing a good prognostic effect of the surgical interventions on mean FVA. Cases with CGIs presented with a better mean initial BCVA (1.456 log MAR versus 2.018 log MAR) and also recovered with a better mean final BCVA (0.745 log MAR versus 1.094). Mean baseline IOP showed a slight increase from 12.46±4.84 mmHg to a mean final value of 15.91±5.06 mmHg in the 6th month of the postoperative period (P=0.076).

Type of OGIs, perforating OGIs, work environment, time interval to primary surgery > 24-hour, zone II + III, BVA< 1/10, additional vitreoretinal surgery (VRS), VH, RD, lens damage, VH+lens damage, and grade 4 hyphemia were the variables had statistically significant poor prognostic effects on FVA in univariate analysis. OTS category 1, BVA <1/10, injury type perforating OGIs, wound location in zone II + III, additional VRS, concomitant findings of RD, and VH + lens damage showed poor prognostic and detrimental effects on FVA in multivariate analysis (binary logistic regression) (Table 5).

Table 5. Prognostic variables on Final visual acuity (FVA) of patients with globe injuries in multivariate analysis

Variables	P*	CI	B	OR
OTS Category I	<0.001	5.246 – 14.054	2.456	9.126
BVA <1/10	<0.001	4.665 – 11.723	2.035	6.757
Zone II + III	<0.001	4.044 – 8.036	1.582	4.843
Additional VRS	<0.001	3.648 – 7.856	1.409	4.148
VH + Lens Damage	<0.001	3.088 – 6.580	1.256	3.988
RD	0.016	2.778 – 5.989	1.208	3.652
Perforating OGIs	0.038	1.806 – 3.204	0.546	2.067

*Multivariate analysis (binary logistic regression), CI: Confidence interval, B: Regression coefficient, OR: Odds ratio, OTS: Ocular trauma score, BVA: Baseline visual acuity, VRS: Vitreo-retinal surgery, VH: Vitreous hemorrhage, RD: Retinal detachment

Discussion

Globe injuries have been accounted the most common cause of hospitalization in the attribution of ophthalmology in industrialized countries [15]. Primary repair surgery is the main approach for OGIs, whereas CGIs can be managed with conservative treatment options [16]. It is critical to predict FVA in the initial evaluation. Additionally, prognostic factors should be kept in mind in case enucleation surgery is a possible consideration due to phthisis and/or poor visual potential in severely injured cases. In the present study, we reported demographic features of the cases, and prognostic factors affecting FVA.

Acar U et al. used the pediatric OTS in pediatric penetrating globe injuries, which is similar to the OTS but not identical [17]. The age was considered an important parameter and was included in their scoring. The trauma score they used awards fewer points for initial VA than the OTS, in consideration of the probability of obtaining false initial VA scores or the inability to obtain VA scores in children 15 years of age or younger. However, the vast majority of our cases were aged between 18-50 years, but we did not note any difference between the age groups in the success rate. It has been reported that patients aged 0-18 had a significant success rate, although approximately 90% of their cases were aged between 18 and 50 years, which they thought was due to disparities between the age groups [18]. As reported in the previous studies we found that male patients were predominantly affected in both OGIs and CGIs [18, 19]. Similar to the literature, we noted the inconsiderable ratio of bilateral involvement, but some studies reported higher ratios of bilateral involvement, possibly due to terror-associated injuries [20-22]. Supporting the literature, we observed that most of the CGIs and OGIs occurred in work environments, which might be due to unprotective working conditions [23].

Consistent with previous studies, we found that the type of globe injuries influence FVA [24, 25]. In contrast to CGIs, the type of OGIs was a predictive parameter for poor prognostic factors on FVA results in the current study. Compared with CGIs, OGIs had a worse destructive effect on the global structure, leading to orbital damage and prolapse of the intraocular contents with poor recovery of visual function. Among OGIs, penetrating injuries had high success rates regarding FVA with favorable functional and anatomical outcomes, whereas perforating injuries showed a poor prognostic effect on FVA similar to previous studies [20, 22]. In contrast to some studies, we did not note the poor prognostic effect of IOFB on FVA, since approximately all IOFBs in our study were metallic but the mentioned studies included toxic IOFBs [26, 22].

A correlation has been claimed between zone 3 and prognosis of FVA in OGIs [27]. Soni et al. conducted a study comprising patients only with initial negative perception and they noted that all patients with primary enucleation presented with zone III injuries [28]. Knzayer et al. proposed that initial visual acuity was the prominent prognostic factor for FVA in zone III injuries [29]. Slightly different from these studies, we found that zone II + III injuries resulted in poor final visual outcomes.

It is known that less severe globe injuries require a lower number of surgeries compared to severe injuries requiring a higher number of surgeries with more subsequent complications, low success rates, and poor prognosis [20, 30]. However, we did not note any correlation between the number of surgeries and the level of FVA. Although previous studies did not report significant effects of time interval to primary surgeries on FVA, we observed a significantly better FVA in patients who had primary surgery intervention before 24 hours [20, 22, 30]. VRS may have a positive effect on gaining satisfactory FVA in cases with OGIs [31]. Moreover, we noted that vitrectomized cases with silicone tamponade had a lower ratio for FVA of NLP than the vitrectomized cases without silicone tamponade (P=0.032). In contrast to previous studies, we observed that additional VRS was a poor prognostic factor on FVA in globe injuries, which might be due to a larger ratio of zone II + III in these cases.

A study reported that lens damage and traumatic cataract development showed a poor effect on functional outcomes in the pediatric population due to aphakia [32]. However, 21.19% of our cases were in the pediatric age and only 6.22% of them had lens damage. VH and lens damage were the most frequent ocular manifestations of globe traumas in our study, as previously reported [15]. We observed that concomitant findings of VH, lens damage, IOFB, and hyphemia had negative impacts on FVA in univariate analysis, but we did not note them as independent factors in multivariate analysis. Meanwhile, concomitant findings of VH+lens damage and RD were represented as poor prognostic factors on FVA in multivariate analysis. We think that poor FVA results in these cases might be due to coexisting severe posterior segment damage. Some studies reported that maculopathy, proliferative vitreoretinopathy, persistent RD, macular scarring/hole, optic neuropathy, choroidal hemorrhage, globe perforation, central corneal opacity, endophthalmitis and the presence of afferent pupillary defect showed poor prognostic effects in ocular traumas [33, 34]. We noted that similar posterior segment findings such as RD, optic disc, and macular pathologies showed a negative impact on globe injuries. It has been reported that RAPD is a well-known prognostic factor in OGIs, but we did not include RAPD as a parameter in our study, which might be a shortcoming [30]. Similar to a previous study, we did not observe any case with endophthalmitis, which might be due to the sterilization effect of thermal injury [35], so we could not evaluate endophthalmitis as a prognostic factor in the present study.

We used the OTS classification for the prediction of FVA at 6 months. However, we observed a considerable outcome in the prediction of FVA only in OTS category 4 and 5, which might be due to relatively larger sample sizes in OTS category 1 and 2. Cases in OTS category 1 showed a poor prognosis on FVA.

Despite some limitations such as relatively small sample size, short period follow-up, the retrospective and non-randomized nature, and possible treatment option bias, we think that the present study might make a scientific contribution regarding the prognostic factors on FVA in globe injuries. Concerning these limitations, new prospective and controlled studies are warranted to work on prognostic factors for the prediction of final visual acuity in globe injuries.

In conclusion, we reported a study regarding globe injuries, most of which occurred at work and were relatively severe injuries. We noted several main parameters that significantly associated with poor final visual outcome, including BVA< 1/10, OTS category 1, zone II + III injury, perforating open globe injuries, additional vitreoretinal surgery, vitreous hemorrhage + lens damage, and retinal detachment.

Conflict of interests

The authors declare that they have no competing interests.

Financial Disclosure

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Ethical approval

Ethics approval was received from the Institutional Ethics Committee (07/10/2019-2454).

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