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Comparison of Prognostic Prediction Value by Ocular Trauma Score with Visual Outcome in Ocular Foreign Body Trauma

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Abstract

Purpose. To analyze and compare prognostic prediction value by Ocular Trauma Score (OTS) with visual outcome in patients with Intraocular Foreign Body (IOFB)

Methods. A total of 34 eyes from 34 patients who underwent intraocular foreign body removal during a three-year period were retrospectively reviewed. Ocular trauma score was calculated for each eye.

Results. The most common initial visual acuity was Light Perception/Hand Movement (50%) and No Light Perception (29,4%). The most common final visual acuity was Light Perception/Hand Movement (41,2%) and No Light Perception (38,2%). The most common anatomical complications are rupture (43,7%), endophthalmitis (31,2%), and perforating (18,7%). Patients was divided by Ocular Trauma Score with 42% presented with Score 3. Patients with six-month follow-up (67,6%) calculated for Prognostic Prediction Value with OTS. There were significant differences between the results of visual outcome of the subjects and OTS Prognostic Prediction Value from each scale(p>0,005). There were no differences between initial visual acuity and final visual acuity in six-months follow-up patients(p=0,481) and three-months follow-up patients(p=0,481).

Conclusion. There were significant differences of the prognosis in patients with IOFB using OTS. There were no significant changes between initial and final visual acuity of IOFB patients, concluding that initial visual acuity may be used for prognosis in patients with IOFB. Keywords: Intraocular foreign body, ocular trauma score, eye trauma, visual outcome, open globe

Introduction

Eye injury with Intraocular foreign body is one of the most common cause of severe visual loss [1]. The accident mostly happened in work-related place. leading cause is hammering [2]. The most common complications are lens injury, endophthalmitis, retinal detachment [3]. In this study we analyzed the results of 34 consecutive eyes treated for penetrating or perforating eye injury with IOFB. Our intention was to identify and analyzed the prognostic value used with

OTS and to compare our results with the estimated follow-up BCVA based on OTS parameters. We have used Birmingham eye Trauma Terminology.

Patients and methods

We studied a consecutive series of 34 eyes from 34 patients with IOFB at the Soetomo Hospital, Surabaya, Indonesia for a three-year period (from January 1,2016 to December 31,2018). Data on the history of injury, preoperative status of the eye, and management of injuries were collected retrospectively. Slit lamp examination was carried out on all eyes. Best corrected visual acuity(BCVA) was determined with the Snellen chart. Results of the visual acuity was then converted and extrapolated into logMAR according to standard visual reports [4,5]. We used a value of 1/400 Snellen (logMAR = 2.6) to represent vision of counting fingers and used extrapolated values of 2.7, 2.8, and 2.9 logMAR to represent hand movement, light perception, and no light perception, respectively. We collect the initial ocular findings, the OTS scores [1], the number of IOFB, the interventions, and visual outcome. OTS was calculated by summing the raw points based on initial BCVA (no light perception = 60 raw points, hand motion perception = 70 raw points, 1/200 to 19/200 = 80 raw points, 20/200 to 20/50 =90 raw points, ≥20/40 = 100 raw points), and other injury related factors including: globe rupture = minus 23 raw points; endophthalmitis = minus 17 raw points; perforating injury = minus 14 raw points; retinal detachment = minus 11 raw points; and afferent papillary defect = minus 10 raw points. IOFB extraction was performed by senior specialists. Statistical analysis was performed with SPSS.

Results

From 34 patients, 97% were male, and the average age was 31,1 years (4-52 years) (Table 1). The left eye was involved in 21 patients, the right in 13 patients. The patients were followed for 3-6 months (mean 5,02 months). Injury occurred in work-related was 9 cases, and non-work related was 23 cases. The most frequent cases were air-riffle related injury.

More of the half of the Initial BCVA was severe with Light Perception/Hand Movement is the most common (50%), followed by No Light Perception (29,4%) (Table 1). Complications include rupture (43,7%), endophthalmitis (31,2%), perforating (18,7%), and retinal detachment (6,4%). OTS was assessed, with category 3 being the most common (42%). The IOFB was removed with simple extraction (50%), c-arm guiding (26,5), vitrectomy (5,9%), and vitrectomy and c-arm combination (2,9%). Five cases were decided to be done by removal of the eyeball: evisceration (8,9%), enucleation (2,9%), and exenteration (2,9%). All of the cases were managed with surgery management after 24 hours from the initial visit (Table 1).

Table 1 Demographic findings

Variables	**N**	**%**
Sex		
Male	33	97
Female	1	3
Age		
0-15	6	17,6
16-30	8	23,5
31-50	18	52,9
51-70	2	6,0
Initial VA		
NLP	10	29,4
LP/HM	17	50,0
1/200-19/200	3	8,8
20/200-20/50	2	5,9
≥20/40	2	5,9
Final VA		
NLP	13	38,2
LP/HM	14	41,2
1/200-19/200	2	5,9
20/200-20/50	1	2,9
≥20/40	4	11,8
IOFB		
Type		
Metal	24	70,5
Organic	9	29,5
N		
Single	32	94,1
Multiple	2	5,9
Laterality		
Right	13	38,2
Left	21	61,8
Place of Injury		
Work Related	9	26,5
Non-work related	25	73,5
Outdoor	25	
Indoor	-	
Management		
Surgery Extraction	34	100
C-arm	17	50
Vitrectomy	9	26,5
C-arm + Vitrectomy	2	5,9
Evisceration	1	2,9
Enucleation	3	8,9
Exenteration	2	5,4

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Conservative	-	
Time Management		
<24h	-	
>24h	34	100
Complications		
Rupture	7	43,7
Endophthalmitis	5	31,2
Perforating	3	18,7
Retinal Detachment	1	6,4
Afferent Pupillary Defect	-	-
Ocular Trauma Score		
1	9	27,5
2	8	21,2
3	14	42,0
4	2	6,0
5	1	3,3
Follow-up		
3 months	11	32,5
6 months	23	67,5

A complete data was shown in table 3. Table 3 represents that from 34 cases, 23 cases was followed –up within six months period, meanwhile 11 cases was followed-up within 3 months period. All data was counted into ocular trauma score and categorized based on the result. The visual acuity was then converted into logMAR unit. Final BCVA of the six-month follow-up patients was compared with the OTS, and the estimated probability of follow-up BCVA by OTS can be found in Table 3. Table 4 compared final outcome in BCVA and expected BCVA by OTS prediction value. There were significant differences in all OTS category ($p<0,05$).

Table 2. OTS count with initial and final VA patients in this study (M=Male, F= Female, HM=Hand Movement, LP= Light Perception)

No	Age	Sex	OTS	Category	VA Initial	VA Final	VA Initial (LogMar)	VA Final(LogMar)	Follow up (months)
1	49	M	39	1	HM	NLP	2.7	2.9	6
2	51	M	37	1	NLP	NLP	2.9	2.9	6
3	33	M	33	1	NLP	NLP	2.9	2.9	6
4	39	M	37	1	NLP	NLP	2.9	2.9	6
5	34	M	42	1	HM	HM	2.7	2.7	6
6	31	M	29	1	NLP	NLP	2.9	2.9	6
7	46	M	37	1	NLP	NLP	2.9	2.9	6
8	29	M	44	1	NLP	NLP	2.9	2.9	3
9	38	M	40	1	HM	HM	2.7	2.7	3
10	33	M	53	2	HM	HM	2.7	2.7	6
11	3	M	60	2	NLP	NLP	2.9	2.9	6

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12	52	F	57	2	20/400	20/25	1.3	0.1	6
13	50	M	47	2	NLP	NLP	2.9	2.9	6
14	4	M	60	2	NLP	NLP	2.9	2.9	3
15	19	M	60	2	LP	LP	2.8	2.8	3
16	48	M	56	2	LP	NLP	2.8	2.9	3
17	12	M	60	2	LP	LP	2.8	2.8	3
18	35	M	70	3	HM	NLP	2.7	2.9	6
19	22	M	70	3	LP	NLP	2.8	2.9	6
20	28	M	70	3	HM	HM	2.7	2.7	6
21	36	M	70	3	HM	HM	2.7	2.7	6
22	18	M	70	3	LP	LP	2.8	2.8	6
23	40	M	70	3	LP	HM	2.8	2.7	6
24	43	M	70	3	HM	HM	2.7	2.7	6
25	34	M	80	3	20/400	20/400	1.3	1.3	6
26	43	M	70	3	LP	20/60	2.8	0.5	6
27	13	M	70	3	LP	LP	2.8	2.8	6
28	28	M	70	3	HM	HM	2.7	2.7	3
29	49	M	70	3	HM	HM	2.7	2.7	3
30	40	M	70	3	HM	HM	2.7	2.7	3
31	6	M	80	3	20/400	20/400	1.3	1.3	3
32	21	M	86	4	20/25	20/25	0.1	0.1	6
33	11	M	90	4	20/150	20/40	0.9	0.3	6
34	22	M	100	5	6/6	6/6	0.0	0.0	3

Table 3. Final Outcome of BCVA depending on OTS in six-month follow-up patients

Expected BCVA	NLP	LP/HM	1/200-19/200	20/200-20/50	>20/40
OTS 1	71%	29%	0	0	0
OTS 2	50%	25%	0	0	25%
OTS 3	20%	60%	10%	10%	0%
OTS 4	0%	0%	0	0	100%
OTS 5	0%	0%	0	0	0%

Table 4. Comparison of Final Outcome in BCVA and Expected BCVA by OTS prediction value (A=Final Outcome; B=Expected BCVA; all in percentage)

OTS	**NLP (A/B)**	**LP/HM A/B**	**1/200-19/200 A/B**	**20/200-20/50 A/B**	**≥20/40 A/B**	***P****
1	71/74	29/15	0/7	0/3	0/1	0.004
2	50/27	25/26	0/18	0/15	25/15	0.000

3	20/2	60/11	10/15	10/31	0/41	0.000
4	0/1	0/2	0/3	0/22	100/73	0.000
5	0/0	0/1	0/1	0/5	0/94	-

*chi-square

There were no differences between initial BCVA and final BCVA in six-month follow up patients (p=0.481) (Table 5). There were also no differences between initial BCVA and final BCVA in all patients (mean follow up= 5,02 month) (Table 6). Four subjects had decreased visual acuity, four subjects had increased visual acuity, and twenty-six subject did not have any change in visual acuity.

Table 5. Comparison of Initial BCVA and final BCVA in six month follow up patients

BCVA	n	Mean	SD	p
Initial BCVA Final BCVA	23 23	2.465 2.309	0.767 1.022	0. 481 p>0,05

Table 6. Comparison of Initial BCVA and final BCVA in all patients

BCVA	n	Mean	SD	p
Initial BCVA Final BCVA	34 34	2.441 2.338	0.804 0.976	0. 481 p>0,05

Discussion

IOFB can be found in 16% of the cases among open globe injuries [2]. Based on literature, young productive males are the most common demographic finding. The data is similar with what we found in this series (97% male, mean age 31,1 years). It is reported that the injuries usually occur at workstations, meanwhile the case with 26,5% of the injuries presented in our series. IOFB has been found to be multiple in 25% of the cases in the literature [7] and 5,9% in our series.

Previous study reported that final visual acuities of 20/40 of more were obtained in 71% of IOFB-associated open globe injuries [6]. Another study reported that functional outcomes is not more common in eyes with IOFB [7]. Study from Kuhn et al reported that variable of IOFB was not included in OTS prognostic parameter [1]. These findings probably result from the fact that the patients with IOFB are a heterogeneous group with different clinical characteristics that are dependent on the nature of the injury and the foreign body.

Literature data regarding the optimal time for intervention are conflicting. Endophthalmitis prevention is the primary goal, for which as early surgery as reasonably possible is recommended for both medical and legal reasons. Conversely, a recent study has confirmed earlier reports that there is no difference whether surgery is performed in the first 48 hours or later. Delaying the intervention nevertheless requires vigilance to quickly note signs of a developing infection. Meanwhile in this study, all of the cases were treated with more than 24 hours after initial visit [8,9].

The IOFB in this study was removed with simple extraction (50%), c-arm guiding (26,5), vitrectomy (5,9%), and vitrectomy and c-arm combination (2,9%). Five cases were decided to be done by removal of the eyeball: evisceration (8,9%), enucleation (2,9%), and exenteration (2,9%). Management of IOFBs remains a challenge despite the advances in the surgical techniques. Most commonly posterior segment IOFBs are removed. According to Kuhn et al, If the IOFB is in the vitreous and no significant other pathology (media opacity interfering with retinal inspection or major retinal damage) is present, the IOFB can be removed with forceps or an Intra Ocular Microscope (IOM) via ophthalmoscopic control. For ferrous IOFBs, a strong IOM is the most ideal instrument; for nonmagnetic IOFBs, several other options are available such as forceps. If IOFB removal is decided upon and the eye shows associated tissue damage, it is better to perform complex reconstruction simultaneously than as a secondary reconstructive procedure because vision is not improved just by IOFB removal, the risk of endophthalmitis is reduced only if the "cultured media" (i.e., vitreous) is also promptly removed.

In other literature, surgical approach for FB removal is determined based on size and location of FB in orbit. FB can be accessed by exploring from entry site or through fistula pathway, if cutaneous fistula is present. It may be difficult to find small FBs encapsulated by fibrous scars in orbit. In such cases, it is helpful to use operation microscope and to follow scar tissue. Some authors use intraoperative fluoroscopy to locate radio-opaque FBs. Organic FBs degrade over time, therefore removal as a single piece may not be possible. These cases may require further dissection in soft tissue for complete removal of FB [10].

The most common anatomical complications in this series are rupture (43,7%), endophthalmitis (31,2%), and perforating (18,7%). Endophthalmitis carries a high risk to worsen the prognosis. A study reported by Sjizarto et al reported that 18% of cases with posterior segment IOFB was complicated with endophtalmitis. In their study, prognosis was significantly worse in cases with lower trauma score, initial visual acuity less than 0.1 Snellen E, large foreign body, upset of bacterial endophthalmitis, and with proliferative vitreo retinopathy [3]. A study from China resulted that from a total of 279 patients with IOFB(16.4%) developed endophthalmitis, where older age was a risk factor[11]. Complications of the injury weighted on ocular trauma score result, which the more complications it involved, the worsen prognosis it had.

The term IOFB or Intraocular Foreign Body was established by BETT and included as a separate term from penetrating injury. Shukla stated a new classification due to that Foreign bodies (FBs) in the eye are usually classified as intraocular (IOFB) or extraocular (EOFB). In IOFB the FB is within the eye ball and in EOFB it is outside. This classification seems oversimplified. Hence a new classification is proposed on the basis of FB locations, in which adnexal FBs (in orbit, lids, conjunctiva and lacrimal apparatus) are also included. Ocular trauma also includes trauma to ocular adnexa and hence the terms IOFB and EOFB have been replaced by IGFB (intraglobal foreign body) and EGFB (extraglobal foreign body) [12].

OTS has been widely in open and closed globe trauma. However, it had been validated in only a few subgroups of patients with IOFBs. A study from Yasa et al reported that OTS, which provides prognostic information after general ocular trauma, may also provide valuable prognostic information for patients who undergo 23-G PPV for the surgical removal of metallic posterior segment IOFBs [8]. Meanwhile in this study, there were significant differences between outcome of BCVAs and prognostic score from OTS. Here we showed that OTS could not be predicted the functional outcome in IOFB-related injuries. Several variables in eye trauma such as IOFB existence, IOFB location have been described in other studies as not having any impact on the outcome.

Table 7. Comparison of our results of the study with previous studies

Study	Results
Current Study	OTS not able to predict visual outcome in IOFB, Initial visual acuity as good prognostic value
Yasa et al.	OTS as predictor for metallic posterior segment IOFB
Liu et al	Age, initial visual acuity, wound length, complications, surgical approach as prognostic value
Greven et al	Initial visual acuity, afferent pupillary defect, vitreous hemorrhage as prognostic value

We analyze the result of BCVA and showed there were no significant differences between initial and final VA either on three-months follow-up and six-months follow-up, meaning that visual acuity could be assessed as prediction of visual outcome. The result in our study was similiar by study by Greven et al. Their study reported from 59 patients with IOFB that was undergoing IOFB removal with a minimum 6 months follow up. Final visual outcomes were excellent in 71% of patients. Presenting visual acuity was the strongest predictor of final visual outcome in their series. Prognostic factors for a poor outcome included poor presenting visual acuity, the presence of an afferent pupillary defect, and vitreous hemorrhage [13]. Another study by Liu et al reported that multiple prognostic factors that were identified may predict visual outcome and globe survival after IOFBs injury. Age, initial presenting visual acuity, wound length, complications (vitreous hemorrhage, retinal breaks, and endophthalmitis), surgical approach, and intraocular tamponade were significant predictors of visual outcome [14]. Other study reported about the prognosis was not good for those patients who had macular injury or underwent several surgeries because of retinal detachment, epiretinal membrane or proliferative vitreous retinopathy. It is also advised that good facilities for eye protection are urgently in demand for the workers indeed [15]. The comparison of the results of current study with previous study were shown in table 7.

There were significant differences of the prognosis in patients with IOFB using OTS. It suggests that the use of OTS was not able to predict visual outcome significantly in our study. The limitation in our study is that the small amount of data, the difficulties of assessing the complications during initial visit, and duration of surgery waiting time that could further emphasize the result of complications. OTS was based on a system that appears to satisfy all criteria regarding eye trauma that has been developed using over 2,500 cases from the USEIR which followed within 6 months. We decide to calculate OTS score with patients that were only success fully followed within 6 months. The other 11 cases were difficult to reach that they were only able to reach within 3 months after initial visit. However, the wound healing process after the surgery was within 2-6 months [1]. The process of suture removal recommendations is 2−6 months in adults after surgery, and 6-8 months in children. Although patching may be preferred by the patient, it can extend the healing process by causing corneal temperature elevation. Patient noncompliance is also a risk of decreasing the speed of wound healing (e.g., rubbing of the eye likely before complete wound healing) [1]. Here, the present study support that the initial visual acuity may be used for prognosis in patients with IOFB.

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