

Incidence and Clinical Features of Endophthalmitis following Open Globe Injury in Khatam-al-Anbia Hospital, Mashhad

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Abstract

Purpose: The goal of this study was evaluation of the incidence rate of posttraumatic endophthalmitis, its clinical features and probable risk factors in repaired open globe injuries.

Methods: In this retrospective case series, surgical and medical records of 600 patients with open globe injury were reviewed. Patients who underwent primary repair (as soon as possible) in Khatam-al-Anbia Eye Hospital, Mashhad, Iran, were included. Traumatic eye injuries were evaluated with respect to place of occurrence, age of patients, time interval between trauma and repair, damaged tissues, incidence of endophthalmitis, and its probable risk factors.

Results: Endophthalmitis occurred in 25 patients (4.2%). The mean age of the patients was 23.5 year (SD=20.006). 76% of patients (456 cases) were males and 24% were females. 69.9% of injuries occurred in urban places (419 cases) and 181 cases were occurred in rural areas. Mean interval time between trauma and repair was 30.85 hour (SD=72.187), median was 9.5 hour, and 80.9% of cases repaired within first 24 hours. 32.3% of patients (193 cases) had traumatic cataract, vitreous prolapse occurred in 23.1% (139 cases), and 6.5% of cases (39 patients) had intraocular foreign body (IOFB). Sharp offending object and trauma in right eye were associated with significantly increased risk of endophthalmitis (P=0.009 and P=0.004 respectively), but age (P=0.336), gender (P=0.632), location in which trauma occurred [rural area (P=0.268)], vitreous prolapse (P=0.751) and IOFB (P=0.169) were not associated with statistically significantly increased risk of endophthalmitis. Intravitreal antibiotic had not been injected routinely. Endophthalmitis was more frequent in those who received intravitreal antibiotics, P=0.000.

Conclusion: Incidence of endophthalmitis was 4.2%, which is comparable with previous studies. Trauma with sharp objects and right eye were associated with increased risk of endophthalmitis. Despite previous studies IOFB and rural areas did not increase the risk of endophthalmitis, possibly due to vitrectomy in these cases. Probably, because of short time interval between trauma and primary repair in most cases, lag to repair was not a risk factor for development of endophthalmitis. Intravitreal antibiotic was injected only in severely damaged eyes, therefore its prophylactic effect against endophthalmitis could not be evaluated in this study.

Keywords: Endophthalmitis, Open Globe, Posttraumatic Endophthalmitis, Ocular Trauma, Intravitreal Injection, Intraocular Foreign Body

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Introduction

Ocular trauma (specially open globe injury) is one of the most important ophthalmic emergencies.

Open globe injury needs appropriate and prompt primary repair along with close follow-up for its complications. One of the major complications of open globe injuries is the development of posttraumatic endophthalmitis. Incidence of endophthalmitis following open globe injuries varies between 2.8% to 22.2%.^{1,2} Trauma is the cause of 13-25% of cases of exogenous endophthalmitis.^{3,4} Different studies have proposed different risk factors for development of endophthalmitis after trauma: delay in primary repair,^{6-9,12,14,16-18} and presence of intraocular foreign body (IOFB),^{6-9,12,16} trauma in rural areas^{6,7,12} and lens capsule breach.^{5,12,15} Because of the poor visual outcome of endophthalmitis specially in a globe affected by an open injury, detecting these risk factors may result in a better management of open globe injuries and better prophylaxis of posttraumatic endophthalmitis.

In this study, we investigated the risk factors for development of posttraumatic endophthalmitis in cases with open globe injuries.

Methods

This study was approved by ethics committee of eye research center and qualified by institutional review board of Mashhad University of Medical Sciences (MUMS) (No. 87255). All patients gave an informed consent.

This is a retrospective study of 600 cases admitted with the diagnosis of open globe injury in Khatam-al-Anbia Hospital, Mashhad, Iran. Patients were hospitalized for at least 3 days, unless complications occurred in which case they remained hospitalized until the treating physician judged necessary. All eyes were repaired as soon as possible, and received intravenous antibiotics for three days (usually intravenous cefazoline and amikacin). Intravitreal antibiotics (cefazoline and amikacin) were injected in severely damaged eyes with far posterior extension, dirty wounds, obvious IOFB, and in every case that was judged to have an increased risk for

development of endophthalmitis at the end of primary repair. In our center, the routine for vitrectomy surgery in traumatized eyes is delayed surgery between 7 to 14 days after primary repair, unless endophthalmitis develops in which case pars plana vitrectomy would be done promptly. Also earlier vitrectomy is considered for cases with IOFB. In exceptional cases of posttraumatic endophthalmitis, intravitreal injection of antibiotics may be tried first or as the sole treatment. Endophthalmitis was diagnosed by aggravation of the intraocular cellular and inflammatory response (if visible), aggravating ocular pain, lid edema, chemosis, conjunctival injection, a decrease in vision and development or aggravation of relative afferent pupillary defect (RAPD) in that eye. In cases with cataract, yellowish hue of the lens if accompanied by intravitreal opacities in echography was judged to be a clue to the presence of vitreous abscess needing pars plana vitrectomy as soon as possible.

We recorded the demographic data of patients, location of trauma, lag time between accident and repair, type of offending object and findings of the first examination such as visual acuity (VA), RAPD, vitreous prolapse and uveal prolapse.

Because of the wide range of lag-time we classified our patients into four groups according to their lag-time. The first and the largest group included 424 patients that were repaired within the first 24 hours (80.9%), the cases of second group were repaired between 25-48 hours of accident; this group included 42 patients (8%). The patients of the third group were repaired 49-72 hours after ocular trauma (21 patients, 4%). The cases of the last group were repaired after 72 hours, this group included only 37 patients (7.1%).

To analyze the correlation and associations with patients' age, we classified our patients to three groups. First group were patients under age 20 (319 cases, 53.3%); second group were case 21-40 year-old (174 cases, 29.1%), and the third group were 41 years and over (105 cases, 17.6%) (Table 1).

Patients with at least one month follow-up time were included. Statistical analysis has been done with PASW statistics 18 (formerly SPSS statistics) software.

Table 1. Demographic data

	Number	Percentage (%)
Age group		
0-20 years old	319	53.3
21-40 years old	174	29.1
>40 years old	105	17.6
Gender		
Male	456	76
Female	144	24
Location		
Urban areas	419	69.9
Rural areas	181	30.1
Time to repair		
Within first 24 hours	424	80.9
24-48 hours	42	8
48-72 hours	21	4
>72 hours	37	7.1
Type of object		
Splinters	144	26.4
Sharp objects	265	48.5
Blunt objects	137	25.1
Eye		
Right	289	48.2
Left	311	51.8

Results

Patients' demographic data are shown in table 1.

The number of the cases in different ages is indicated in table 1.

Minimum age of the patients was one year, and the maximum was 91 years. Average age was 23.5 year (SD=20.006).

76% of patients were males (456 cases). 419 injuries (69.9%) took place in urban areas, and 181 cases (30.1%) occurred in rural areas.

In 311 patients, left eye was injured (51.8%) and 289 cases had injury to the right globe (48.2%). Time to repair was available in 524 cases. Minimum time was 1 hour and maximum was 960 hours, mean lag-time was 30.85 hours, and the median was 9.5 hours (SD=72.187).

Sharp objects were the most common offending objects (265 patients, 48.5%), splinters resulted in open globe injury in 144 patients (26.4%), and blunt objects were the cause in 25.1% of injuries (137 patients).

First examination data

Findings of slit-lamp exam of the traumatized eyes have been summarized in table 2.

VA is expressed in log MAR units. 129 eyes had logMAR VA of 0 (21.5%), 54 eyes (9%) had logMAR VA=1, 121 eyes had logMAR VA=2 (20.2%), logMAR VA=3 was seen in

172 eyes (28.6%). We had 23 patients (3.8%) with poor LP vision (and even NLP). 101 patients were not cooperative for VA testing, and the majority of these patients (80 cases) were under age 10.

RAPD was positive in 110 (18.3%), negative in 399 (66.5%) and was not determined in 91 cases (15.1%). Because of such a variable data for VA and RAPD, and facing frequent missing data, a statistical analyze for any association with VA and RAPD were not scientific, thus we ignored it.

Cornea was clear in 93 cases (15.5%). 45 patients had partial thickness corneal laceration (7.5%), 452 cases (75.3%) had full thickness corneal laceration, and 10 cases were not assessable (1.6%). Crystalline lens was clear in 290 patients (48.5%). Twenty-one cases (3.6%) were pseudophakic, and traumatic cataract occurred in 193 eyes (32.3%). Lens was not visible in 94 cases (15.7%).

Sclera was intact in 342 eyes (57%), partial and full thickness scleral laceration occurred in 5 (0.8%) and 253 patients (42.1%) respectively. According to the site of the laceration, patients were divided into 3 subgroups: clear corneal wound was the main group accounting for 57% (342 cases). The second group was sclerocorneal laceration that included 173 patients (28.8%). The third

group had scleral wounds without involvement of cornea; accounting for 14.1% of all wounds (85 cases). Uveal prolapse was present in 227 eyes (37.8%). Vitreous prolapse occurred in 139 eyes (23.1%). An IOFB was present in 39 cases (6.5%).

Intravitreal antibiotic was injected into 26 eyes (4.3%) after primary repair. Endophthalmitis occurred in 25 cases (4.2%). Total of 81 patients (13.5%) underwent pars plana vitrectomy.

Endophthalmitis occurred in 7 females and 18 males ($P=0.632$). Patients were mainly in the 2 first decades of life (53.3%). Ocular trauma occurred in urban areas (69.9%) more than rural areas (30.1%). As table 3 shows; gender, age and location where the trauma occurred were not associated with increased risk of endophthalmitis.

Endophthalmitis occurred more commonly in the right eye (18 cases vs. 7 cases) and this relationship was statistically significant ($P=0.004$).

The vast majority of our patients were repaired within the first 24 hours (80.9%) but to our surprise, the time to repair was not related with increased risk of endophthalmitis ($P=0.352$).

Trauma with sharp objects was the main cause of open globe injury (48.5%), and these

objects were related with higher risk of endophthalmitis (18 cases), $P=0.009$.

192 cases had lens damage and traumatic cataract (32.3%). Lens capsule breach was significantly related to the development of endophthalmitis ($P=0.039$).

We had 452 cases (75.3%) of full thickness corneal laceration. The presence of clear corneal laceration was not associated with increased risk of endophthalmitis ($P=0.962$). 42.1% of patients (253 cases) had full thickness scleral or sclerocorneal laceration which also was not associated with increased risk of endophthalmitis ($P=0.918$).

Uveal prolapse and vitreous prolapse occurred in 37.7% and 22.9% of cases and neither was related to the development of endophthalmitis, $P=0.751$ and $P=0.313$, respectively.

IOFB was seen in 6.5% (39 cases) and in these patients no relation with increased risk of endophthalmitis was detected ($P=0.169$). Intravitreal antibiotics were injected in 26 (4.3%) eyes. These eyes developed endophthalmitis ($P=0.000$) more than others, because 18 cases of totally 25 cases of endophthalmitis occurred in this subgroup. Only 7 cases of 574 patients developed endophthalmitis without intravitreal injection. Clinical significance of this point is discussed below.

Table 2. First examination data

		Number	Percentage (%)
Visual acuity	logMAR		
	0	129	21.5
	1	54	9
	2	121	20.2
	3	172	28.6
	4 (poor LP, NLP)	23	3.8
	Uncooperative	101	16.8
RAPD	Negative	399	66.5
	Positive	91	15.1
	Not determined	110	18.3
Lens	Clear	290	48.5
	Traumatic cataract	193	32.3
	Pseudophakic	21	3.6
	Not visible	94	15.7
Cornea	Clear	93	15.5
	Partial thickness L.	45	7.5
	Full thickness L.	452	75.3
	Not assessable	10	1.6
Sclera	Intact	342	57
	Partial thickness L.	5	0.8
	Full thickness L.	253	42.1

RAPD: Relative afferent pupillary defect; L: Laceration

Table 3. Association between some variables and endophthalmitis

Variable	More prevalent group	Percentage (%)	Higher risk of endophthalmitis	P
Gender	Male	76	No	0.632
Age group	0-20 years	53.3	No	0.336
Location of trauma	Urban area	69.9	No	0.268
Eye	Right	48.2	Yes	0.004
Time to repair	0-24 hours	80.9	No	0.352
Type of object	Sharp objects	48.5	yes	0.009
IOFB		6.5	No	0.169
Intravitreal injection of antibiotics		4.3	yes	0.000

IOFB: Intraocular foreign body

Discussion

Detecting risk factors of posttraumatic endophthalmitis helps designing better protective strategies.

Different studies have shown several risk factors for posttraumatic endophthalmitis:

Presence of IOFB,^{6-9,12,16} delay in wound repair,^{6,7,9,12,14,16-18} trauma in rural areas^{6,7,12} lens capsule breach^{5,12,15} purely corneal wound^{16,17} and delay in intravenous antibiotic administration.¹⁶

Essex et al¹² reviewed 250 patients with open globe injury, and found the following factors causing greater risk for development of endophthalmitis: dirty wounds, lens capsule breach, and delay in primary repair. According to their results there were no association between posttraumatic endophthalmitis and the following factors: age, gender, injury setting, zone of injury, and antibiotic administration. But sample size of this study seems small, and the risk of endophthalmitis was 6.8%.

Gupta et al¹³ studied risk factors of posttraumatic endophthalmitis, and despite their small sample (just fifty patients) which were divided into 2 groups, they mentioned these risk factors: delay in primary repair, wound length more than 8 mm, and isolation of special organisms (*Bacillus cereus*, fungus, *Pseudomonas aeruginosa*). Schmideder et al compared a group of 18 cases of posttraumatic endophthalmitis with 54 eyes with open globe injury as control group. Purely corneal wound, delay in repair more than 24 hours, and initiation of intravenous antibiotic later than 24 hours were associated with significantly increased risk of endophthalmitis; other risk factors such as IOFB, lens injury,

and wound length more than 5 mm were associated with increased relative risk.¹⁶

A study on posttraumatic endophthalmitis by Zhang et al showed the following as protective factors: early primary repair, intraocular tissue prolapse, and self sealing wound.¹⁸

A recently published article by Dr Faghihi et al showed that pure corneal wounds with shorter length have the higher risk for development of endophthalmitis. One of the other findings of this long term study was the lower rate of endophthalmitis in association with hyphema and iris prolapse.²⁰

One of the strengths of our study is its acceptable sample size (600 patients), another study with comparable size was done in Vietnam by Tran et al¹⁷ where they studied 515 patients and the risk factors for posttraumatic endophthalmitis they found were: purely corneal wound, wound length more than 5 mm, time to repair more than 24 hours, inadequate antibiotic treatment, and finally rural injury setting.

There were more cases of endophthalmitis in young male patients in this series which follows the demographics of our patients and as the vast majority of our patients were males in lower age group; statistically significant relation was not seen between either age (P=0.336) and gender (P=0.632) and the incidence of endophthalmitis. Of the risk factors studied, most did not affect the incidence of endophthalmitis. IOFB (P=0.169), location of trauma (P=0.268), prolapse of uvea (P=0.751) and vitreous (P=0.313), and delayed time to repair (P=0.352) did not cause any increase in the incidence of

endophthalmitis. 80.9% of injured eyes (424 eyes) were repaired in the first 24 hours of injury; despite our expectation delayed time to repair was not associated with higher risk of endophthalmitis. It seems that due to the small number of cases that had delay in primary repair, (only 7.1% of eyes were repaired after 72 hours) there was not enough statistical power for detection of the effect of this factor on the incidence of endophthalmitis, and a larger sample size is needed to show the effect.

Lens capsule damage was related with higher risk of endophthalmitis ($P=0.039$). But the site of laceration (corneal versus scleral) was not risk factor for development of endophthalmitis ($P=0.918$ and $P=0.497$, respectively). As mentioned above, earlier studies^{16,17} showed that clear corneal wound may increase the risk of endophthalmitis, but our results did not confirm this point.

Trauma with sharp objects ($P=0.009$) was a risk factor for development of endophthalmitis. Although we did not find any effect for prolapse of intraocular contents to be protective for development of endophthalmitis, it seems plausible to think that as in open globe injuries due to blunt objects, there usually is globe rupture with an outward direction of the force of the opening of the globe wall resulting in vitreous loss which will extrude most contaminating materials and bacteria with it. As the extruded and probably contaminated vitreous will be cut during primary repair, there will be minimal risk of endophthalmitis. But in trauma with sharp objects, as the open globe injury occurs with an outward-in mechanism, there is usually

minimal prolapse of the vitreous, so any contaminating material or bacteria will remain in the vitreous cavity and will raise the risk of endophthalmitis. The right eye was more affected by endophthalmitis ($P=0.004$). We do not have a plausible explanation for this finding. An explanation may be that many self induced injuries specially in younger children are with sharp objects and usually result in a small wound with inoculation of bacteria into the vitreous cavity. Most people are right handed so self induced injuries may be more common in the right eye than the left. As these injuries may be more prone to endophthalmitis, this effect may show itself in the right eye. Other injuries must theoretically involve the 2 eyes equally. Intravitreal antibiotic injection was associated with higher incidence of endophthalmitis ($P=0.000$). It may mean that the patients who had been selected for intravitreal antibiotic injection were more prone to endophthalmitis, but the injection had been ineffective in preventing it and early vitrectomy may be a more effective preventive option in these cases.

Conclusion

We found only lens capsule breach and trauma with sharp objects as risk factors for development of endophthalmitis in open globe injuries. In severely traumatized eyes with dirty wounds when the risk of endophthalmitis is judged to be high, although intravitreal antibiotic injection may be judicious, it may not prevent the development of endophthalmitis and in these cases, prompt vitrectomy may be a better option.

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