Original Article

Outcome and risk factors of post-traumatic endophthalmitis over a 5-year period in North China

Lin Yao[1], Haiqing Bai[2]

[1]Department of Ophthalmology, Qingdao Xinshijie Eye Hospital, Qingdao 266041, China; [2]Department of Ophthalmology, Affiliated Hospital of Qingdao University, Qingdao 266003, China

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Correspondence to: Haiqing Bai. Department of Ophthalmology, Affiliated Hospital of Qingdao University, 16th Jiangsu Road, Qingdao 266003, China. Email: haiqing_bai@126.com.

Background: To study the outcome and risk factors of post-traumatic endophthalmitis over a 5-year period in North China.

Method: We reviewed the medial records of 66 consecutive patients presenting with post-traumatic endophthalmitis and having more than 6 months follow up.

Results: During the last 5 years, we treated 66 post-traumatic endophthalmitis cases, representing 77.65% of all types of endophthalmitis. The infection rate in open globe injuries was 12.92% and 25.30%, if intraocular foreign body (IOFB) was associated. Culture was positive in 18 cases (27.3%). We administered antibiotic and anti-inflammatory drugs, systemically and intravitreally, in all cases. We performed pars plana vitrectomy (PPV) with silicone oil tamponade in 68.2% of cases. We also performed enucleation/evisceration in 22.7% of cases. In 36.4% of cases, the final visual acuity was 0.1 or more.

Conclusions: Post-traumatic endophthalmitis are associated with significant visual impairment. IOBF significantly increased the risk for endophthalmitis. The most common time occurred endophthalmitis was 72 hours to 1 week after the primary injury. The factors associated a worse prognosis in post-traumatic endophthalmitis were retinal detachment (RD), delayed primary repair, poor initial best corrected visual acuity (BCVA) and fungal infection.

Keywords: Endophthalmitis; ocular trauma; treatment

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Introduction

Post-traumatic endophthalmitis is a severe complication of open globe injuries (1). The prognosis of post-traumatic endophthalmitis is much worse than post-operative endophthalmitis, because the physical effect of the trauma itself has a major consequence on the visual function and the pathogens of post-traumatic endophthalmitis are more virulent than those involved in other types of ocular infection (1,2). Also, the visual outcome of post-traumatic endophthalmitis is usually poor than other similar open globe injuries without endophthalmitis (3). Even evisceration or enucleation of eyeball is performed in some severe cases.

Some studies have revealed that the outcome of post-traumatic endophthalmitis is influenced by various risk factors, such as type of injury, microbiological profile, with or without intraocular foreign body (IOFB) and retinal detachment (RD), and time from injury to treatment (1-5). However, in China, especially North China, there are more population engaged in agriculture than industry. Therefore, the characteristic of post-traumatic endophthalmitis may

be different from other countries and regions. The purpose of this study is to evaluate the outcome and risk factors of post-traumatic endophthalmitis as resulting from our own experience in North China.

Methods

A retrospective analysis was performed on 66 consecutive patients presenting with post-traumatic endophthalmitis at the Affiliated Hospital of Qingdao University, Qingdao, China, from 1 January 2011 to 31 December 2015. The study was approved by the Research Ethics Committee of Affiliated Hospital of Qingdao University (ID: 2010-102). And the records of the patients were anonymized and de-identified prior to analysis.

The diagnosis of post-traumatic endophthalmitis was based on clinical symptoms (worsening vision, eye pain, photophobia and tearing) and signs (purulent exudate at the site of injury, chemosis, hypopyon, fibrin in the anterior chamber, and vitreous haze/opacification) following previous ocular injury.

In all cases, first of all, immediate systemic and topical antibiotic and anti-inflammatory therapy were initiated. In cases in which the retina could be observed, vitreous tap and intravitreal antibiotics were given according to the Endophthalmitis Vitrectomy Study (EVS) protocol (6), and then based on culture-sensitivity reports, if required. In severe cases in which the retina could not be observed, pars plana vitrectomy (PPV) with 23-gauge was performed (7). And all the PPV cases were combined with silicone oil (Bausch & Lomb, NY, USA) tamponade. In all cases, aqueous humor and vitreous samples were collected for microbiological analysis before the operation. Evisceration also was performed in some severe cases which with visual acuity of no light perception (NLP). Eviscerated material was also collected for microbiological analysis.

Data on gender, age, presenting clinical features, complications, timing of primary repair, interval between injury and diagnosis of endophthalmitis, initial and final best corrected visual acuity (BCVA), and treatments were recorded and analyzed. All patients were followed up at least 6 months. At each follow-up visit, BCVA was examined by an E vision acuity eye chart and recorded in decimal format. In every case, we considered the BCVA tested at the last visit as final BCVA. A good outcome was defined as BCVA ≥0.1 and a poor visual outcome was defined as BCVA <0.1.

The statistical analysis was performed with the program SPSS version 13.0 (Chicago, IL, USA). Chi-square test was used to determine which factors were individually associated with the outcome. A $P<0.05$ was take as the level of statistical significance. In case of unequal data distribution, the P value was calculated by Fisher's exact test.

Results

During the last 5 years, we treated 66 post-traumatic endophthalmitis cases, representing 77.65% of the 85 infectious endophthalmitis cases that we treated within the same time frame. Over the same period, we treated 511 open globe injuries including 83 cases of IOFB, meaning that the overall post-traumatic endophthalmitis incidence was 12.92% and 25.30%, if IOFB was associated. Statistically, associated with IOFB significantly increased the risk for endophthalmitis on our cases (P=0.002). The ratio of males to females was 6.33:1, and 36 (54.55%) right eyes were involved. Their age ranged from 20 to 80 years (mean ± SD, 39.25±17.32). All patients had a follow-up of 6 to 24 months (10.55±6.35 months). The ocular signs were summarized in *Table 1*.

Culture was positive in 18 eyes (27.3%) and negative in 48 eyes (72.7%). The most common bacteria isolated was *Staphylococcus epidermidis* (5 eyes, 7.6%), followed by *Streptococcus pneumoniae* (4 eyes, 3.0%) and *Bacillus sp*. (4 eyes, 3.0%). The most common fungus was *Aspergillus fumigatus* (6 eyes, 9.1%), followed by *Fusarium solani* (3 eyes, 4.5%) (*Table 2*).

The interval between injury and endophthalmitis diagnosis was less than 24 hours in 6 eyes (9.1%), between 24 and 72 hours in 12 eyes (18.2%), between 72 hours and 1 week in 27 eyes (40.9%), and more than 1 week in 21 eyes (31.8%) (*Table 3*).

Table 4 showed the distribution of various treatment modalities used in the management of post-traumatic endophthalmitis along with the respective outcomes. There were 6 cases (9.1%) treated with intravitreal drugs once or more times, and all of them obtained good visual outcomes; 45 cases (68.2%) were treated with intravitreal drugs combined with vitrectomy with or without lensectomy. In addition, evisceration was performed in 15 cases (22.7%).

Retinal detachment, delayed treatment over 24 h and poor initial BCVA predicted poor final BCVA (P=0.010; P=0.030; P=0.001). About the microorganism, compared with bacterial infection, fungus infection was more likely to commit worse final BCVA (P=0.009). The association between final BCVA and various factors were illustrated in *Table 5*.

Table 1 Ocular clinical features of the post-traumatic endophthalmitis series

Clinical feature	No. of eyes (%)
Wound location	
Corneal	30 (45.5)
Scleral	36 (54.5)
Wound size, mm	
<2	32 (48.5)
≥2	34 (51.5)
IOFB	
Yes	21 (31.8)
No	45 (68.2)
Direct traumatic cataract	
Yes	18 (27.3)
No	48 (72.7)
Ocular tissue prolapses	
Yes	3 (4.5)
No	63 (95.5)
Retinal detachment	
Yes	12 (18.2)
No	54 (81.8)

Table 2 Microorganism of the post-traumatic endophthalmitis series

Microorganism	No. of eyes (%)
Bacteria (n=9)	
Staphylococcus epidermidis	5 (7.6)
Streptococcus pneumoniae	2 (3.0)
Bacillus sp.	2 (3.0)
Fungus (n=9)	
Aspergillus fumigatus	6 (9.1)
Fusarium solani	3 (4.5)

Discussion

Post-traumatic endophthalmitis is an uncommon but severe complication of open globe injuries (1). Because of the large population and poor protection awareness for ocular trauma, open globe injury and post-traumatic endophthalmitis are more common in our country. In this study, we analyzed the characteristic, outcome and relative risk factors in post-traumatic endophthalmitis cases in the North China.

Table 3 Interval between endophthalmitis diagnosis and trauma

Time interval	No. of eyes (%)
≤24 hours	6 (9.1)
24–72 hours	12 (18.2)
>72 hours to 1 week	27 (40.9)
>1 week	21 (31.8)

Table 4 Treatments of the post-traumatic endophthalmitis series

Treatments	Final VA, n (%)	
	Good	Poor
IV	6 (9.1)	0 (0.0)
IV + V	3 (4.5)	9 (13.6)
IV + L + V	15 (22.7)	18 (27.3)
Enucleation/evisceration	0 (0.0)	15 (22.7)

IV, intravitreal drugs; L, lensectomy; V, vitrectomy; AP, adjunct procedure.

Open globe injury was responsible for 77.65% of all the endophthalmites that we treated during the last 5 years. It is a higher incidence compared with previous similar studies (25–30%) (1) that could partly be explained, by the fact of lower cataract surgical rate in our region. As well known, post-cataract surgery endophthalmites is one of the most common post-operative endophthalmitis (8). Our study found a 12.92% incidence of post-traumatic endophthalmitis in the open globe injury cases, which is a higher incidence as compare to the literature: 4-8% (9). However, it is similar to another study from China performed by Zhang and coworkers. In their study, they found the incidence of post-traumatic endophthalmitis was 11.91% (10). The presence of IOFB increases the risk for endophthalmitis (1,9). It was also confirmed by our study. During the same period, we treated 83 cases of IOFB, of which 21 were complicated by endophthalmitis (25.30%), matched the data of the previous study: 6.9–30% (9).

We should also consider the diagnosis of endophthalmitis in all eyes with a history of trauma as the time between the injury and the onset of symptoms which could be highly variable (1). Therefore, besides timing of primary

Table 5 Prognostic factors of post-traumatic endophthalmitis series

Factor	Final VA, n (%)		P
	Good	Poor	
Retinal detachment			0.010
Yes	0 (0.0)	12 (18.2)	
No	24 (36.4)	30 (45.5)	
Timing, hours			0.030
≤24	18 (27.3)	20 (30.3)	
>24	6 (9.1)	22(33.3)	
Age, years			0.640
>50	10 (15.2)	20 (30.3)	
≤50	14 (21.2)	22 (33.3)	
Initial VA			0.001
≥0.1	6 (9.1)	0 (0.0)	
<0.1	18 (27.3)	42 (63.6)	
IOFB			0.369
Yes	6 (9.1)	15 (22.7)	
No	18 (27.3)	27 (40.9)	
Wound location			0.327
Corneal	9 (13.6)	21 (31.8)	
Scleral	15 (22.7)	21 (31.8)	
Wound size, mm			0.085
≥2	9 (13.6)	25 (37.9)	
<2	15 (22.7)	17 (25.8)	
Lens breach			0.158
Yes	9 (13.6)	9 (13.6)	
No	15 (22.7)	33 (50.0)	
Tissue prolapse			0.295
Yes	0 (0.0)	3 (4.5)	
No	24 (36.4)	39 (59.1)	
Culture			0.754
Positive	6 (9.1)	12 (18.2)	
Negative	18 (27.3)	30 (45.5)	
Microorganism			0.009
Bacteria	6 (9.1)	3 (4.5)	
Fungus	0 (0.0)	9 (13.6)	
Nature of trauma			0.083
Metal	15 (22.7)	9 (13.6)	
Vegetable	9 (13.6)	15 (22.7)	

VA, visual acuity.

repair, we also recorded the time from primary injury to diagnosis of endophthalmitis. We found higher probability that the patients were diagnosed with endophthalmitis was occurred 72 hours to 1 week after the primary injury (27 cases, 40.9%), followed by over 1 week (21 cases, 31.8%). Therefore, in order to screen the endophthalmitis, it is important to follow up at the early stage after the primary repair.

At the early stage, the treatment of an open globe injury was primary closure of the wound as soon as possible. If with IOFB, it should be removed at the same time. Meanwhile, systemic and topical antibiotics were given empirically in our series. If endophthalmitis was diagnosed, the treatment was according to recommendation of French Institutional Endophthalmitis Study (FRIENDS) Group (7). In cases in which the retina could be observed, vitreous tap and intravitreal antibiotic injections (vancomycin and ceftazidime) were given. Some severe cases in which the retina could not be observed, PPV was executed. In our series, 6 cases (9.1%) were treated by intravitreal antibiotic injection alone, and all of them got good visual outcomes. In the PPV cases, if the patients with rupture of lens capsule or cataract, lensectomy was performed at the same time. And all the PPV cases were given silicone oil tamponade. The use of silicone oil tamponade in PPV for endophthalmitis had been shown to be useful in some studies where a concurrent RD was present or when the risk of retinal tear was high (11,12). Another advantage of silicon oil tamponade was that it may prevent re-infection of the vitreous space because of its antimicrobial properties (11,13,14). However, there were also several studies reported that oil-filled eyes developed endophthalmitis (15,16). In our study, 45 cases treated by PPV with silicone oil tamponade, the endophthalmitis of them were controlled and none of them re-infected or underwent enucleation/evisceration at the follow-up.

Zhang and coworkers had demonstrated that enucleation/evisceration is more frequent in eyes with post-traumtic endophthalmitis (10). In our series, 15 cases (22.7%) underwent evisceration. It is more frequent than other previous studies reported as 17% (7,10,17). Some patients were first recommended PPV treatment in our hospital. They refused because of the expensive cost and uncertain prognosis. Therefore, expensive medical cost of PPV treatment was also an issue we need to face.

The status of the retina plays an important role in the final BCVA. Previous studies had reviewed that patients with post-traumatic endophthalmitis and RD on presentation

generally had a poor visual prognosis (18,19). It was also confirmed by our study. In our series, the association of RD (12 cases, 18.2%) determined a significantly worse prognosis of post-traumtic endophthalmitis (P=0.010). And all the 12 cases had final BCVA <0.1.

Time to primary repair is the most important factor in developing post-traumatic endophthalmitis and there is no safe delay period in surgery (4). And in our series, time to primary repair was also an independent risk factor for the prognosis of post-traumatic endophthalmitis. Delayed primary repair beyond 24 h after open globe injury was a significant risk factor for poor final BCVA (P=0.030). This was similar to other previous studies (10,20).

There is evidence that post-traumatic infectious endophthalmitis cases with better initial BCVA have better final visual outcome (1). We also confirmed this observation according to our findings (P=0.001).

The major causative agents for post-traumatic endophthalmitis are bacteria and occasionally, fungus (5). However, in our series, 9 cases were fungus in all the cultured positive cases (18 cases, 27.3%). Among them, 6 cases were *Aspergillus fumigatus* and 3 cases were *Fusarium solani*. And all the 9 cases were vegetable injured. The proportion of post-traumatic fungal endophthalmitis was much higher than other studies (4,19,21). As more population engaged in agriculture than industry in China, so vegetable injury might be more common. This was the reason why so many post-traumatic fungal endophthalmitis in our series. We also found that fungal infections meant poor visual prognosis compared to the bacterial infections in our cultured positive cases (P=0.009).

The prognosis of post-traumatic endophthalmitis in our series was not influenced by age, IOFB, wound location, size, lens breach, tissue prolapse, positive culture, and nature of trauma.

Conclusions

In our study, open globe injury was responsible for 77.65% of all the endophthalmitis and the occurrence rate was 12.92% in the open globe injury series. The incidence of endophthalmitis was 25.30% in the IOFB cases. We found the most common time occurred endophthalmitis was 72 h to 1 week after the primary injury. The factors associated a worse prognosis in post-traumatic endophthalmitis in our series were RD (P=0.010), delayed primary repair beyond 24 h after open globe injury (P=0.030), poor initial BCVA (P=0.001) and fungal infection (P=0.009).

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Footnote

Conflicts of Interest: Both authors have completed the ICMJE uniform disclosure form (available at http://dx.doi.org/10.21037/aes.2019.01.04). The authors have no conflicts of interest to declare.

Ethical Statement: The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. The study was conducted in accordance with the Declaration of Helsinki (as revised in 2013). The study was approved by the Research Ethics Committee of Affiliated Hospital of Qingdao University (ID: 2010-102) and written informed consent was waived.

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