



# Endophthalmitis in the Tertiary Referral Center in Iran; Etiology and Causative Organisms

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Received May 7, 2017; Accepted July 27, 2017; Online Published August 8, 2017

## Abstract

**Background:** Endophthalmitis is a severe and sight-threatening complication of ocular surgery or ocular trauma. The identification of common types and causative organisms is essential for prevention and management.

**Objective:** The current study describes the prevalence of various types of endophthalmitis and the causative microbiological spectrum of each type treated in the Tertiary Referral Center in Iran.

**Methods:** All cases of endophthalmitis admitted to the Emergency Department of Farabi Eye hospital (Tehran, Iran) between July 2013 and December 2014 were included in this study. The patients' demographic data, type of endophthalmitis, aqueous or vitreous culture results, and treatment methods were recorded.

**Results:** From 108 presumed endophthalmitis cases, post-operative endophthalmitis (68.5%) was the most frequent type followed by post-traumatic (25%), bleb-associated (4.6%), and endogenous (1.9%) types. *Streptococcus viridians* (37.5%) was the most common isolated organism in post-operative cases. In post-traumatic endophthalmitis patients, the most frequent causative organism was *Staphylococcus epidermidis* (70%).

**Conclusion:** Many studies from other countries have reported that *S. epidermidis* is the leading cause of endophthalmitis after either intraocular surgeries or open-globe injuries, but the current study has shown that *S. viridians* is the most common isolated organism in post-operative endophthalmitis.

**Keywords:** Endophthalmitis, Post-cataract Endophthalmitis, Posttraumatic Endophthalmitis, Bleb-Associated Endophthalmitis, Vitreous Culture

## 1. Background

Endophthalmitis is an uncommon, but catastrophic complication of intraocular surgeries and open-globe injuries. Various types of intraocular surgeries may cause endophthalmitis, but improvements in aseptic and microsurgical techniques and the use of antibiotics has reduced the incidence of endophthalmitis.<sup>1,2</sup>

The incidence of acute-onset endophthalmitis after cataract surgery has been estimated to be 0.07% to 0.26%,<sup>3</sup> and it occurs in approximately 4% to 8% of eyes with open-globe injury.<sup>4-6</sup> Some studies have reported a much wider variation in incidence rates of endophthalmitis following traumatic injury (4% to 17%).<sup>7-11</sup> In Iran, the frequency of endophthalmitis was reported as 0.023% after cataract surgery<sup>12</sup> and 2.1% after open-globe injury.<sup>13</sup> Likewise, a wide variation in incidence of bleb-associated endophthalmitis, from 0.17% to 13.2%, has been reported.<sup>14-29</sup>

Considering these wide fluctuations in incidence rates

of various types of endophthalmitis and the obvious difference among them, this study aimed to determine the prevalence of various types of endophthalmitis and the causative organism in Iran's Tertiary Referral Center.

## 2. Objective

The current study aimed to determine the frequency of different types of endophthalmitis and the most common causative organisms in the Tertiary Referral Center of Iran.

## 3. Methods

In this prospective observational case series, approved by the local Ethics Review Committee of Tehran University of Medical Sciences, all patients admitted to Farabi Eye Hospital (Tehran, Iran) between July 2013 and December 2014 were included; no case was excluded. An initial diagnosis of endophthalmitis was ascertained clinically based on the presence of decreased vision, loss of red reflex, marked fibrinoid anterior chamber reaction or hypopyon,

vitreous cells, or marked vitreous consolidation on B-scan ultrasonography.

Each patient's age and gender, type of endophthalmitis, aqueous or vitreous culture results, and treatment method were recorded.

Post-cataract surgery endophthalmitis cases were treated based on the Endophthalmitis Vitrectomy Study results.<sup>30</sup> Patients with an initial visual acuity of light perception underwent a pars plana vitrectomy, vitreous sampling, and intravitreal injection of 1 mg per 0.1 mL vancomycin and 2.25 mg per 0.1 mg ceftazidim. Aqueous and vitreous aspiration and intravitreal antibiotic injection (1 mg per 0.1 ml vancomycin and 2.25 mg per 0.1 mg ceftazidim) were performed for patients with a visual acuity of hand motion or higher.

Aqueous or vitreous samples obtained by either needle tapping or pars plana vitrectomy were processed for direct smear using Gram and Giemsa stains. Specimens were inoculated onto blood agar, chocolate agar, and thioglycolate broth and incubated at 37°C. Furthermore, cultures on Sabouraud agar at room temperature were used for fungal isolates. Descriptive statistics were used to present quantitative descriptions in this study.

#### 4. Results

A total of 108 patients had clinical presentation of endophthalmitis and were admitted to Farabi Eye hospital during the study period. The mean patient age was 54.7±19 years. Endophthalmitis involved the left eye in 61.1% of cases, and the right eye was involved in 38.9% of cases.

The most common type of endophthalmitis was post-operative (68.5%); other less frequent types included post-traumatic (25%), bleb-associated (4.6%), and endogenous (1.9%). The demographic data of study subjects is shown in Table 1.

Positive culture results were found in 43.5% of patients. Hypopyon was absent in 23.1% of patients. The culture positivity rate in patients with hypopyon was 49.4%, but only 24% of patients without hypopyon had positive culture results.

##### 4.1. Postoperative Endophthalmitis

The mean age of patients with postoperative endophthalmitis was 63.4±14 years, and 58.1% of cases were men. All patients had unilateral endophthalmitis, and the left eye was affected in 66.2% of cases.

Postoperative endophthalmitis in 68 patients (91.9%) was acute (less than 6 weeks from surgery to presentation) and was chronic in 6 patients (8.1%). All chronic cases had

occurred after cataract surgery. The mean time between surgery and presentation to the Tertiary Referral Center was 8.1±7 days for acute cases.

The most frequent causative factor for surgery was cataract occurring in 65 patients (87.8%). Other etiologic surgeries included a pars plana vitrectomy in 4 patients (5.4%), intravitreal bevacizumab injection in 2 patients (2.7%), phakic IOL implantation in 2 patients (2.7%), and silicone oil removal in one patient (1.4%).

Culture results were positive in 32 cases (43.2%), and the most commonly isolated organism was Gram positive bacteria in 23 cases (71.9% of culture positive cases). Among the bacteria, *Streptococcus viridans* was the most common isolate (Table 2).

##### 4.2. Posttraumatic Endophthalmitis

The mean age of 27 patients with post-traumatic endophthalmitis was 31.4±14 years. Twenty-five patients (88.9%) were men. The right eye was affected in 51.9% of cases. The mean time between trauma and presentation was 3.6±3 days.

Culture results were positive in 10 eyes (37%), and *Staphylococcus epidermidis* was the most common isolate (Table 3). Intraocular foreign bodies were present in 15 eyes (55.6%).

##### 4.3. Other Types of Endophthalmitis

Culture results were positive in 3 of 5 cases with bleb-associated endophthalmitis. *S. viridians* was isolated in two cases, and *Candida albicans* was isolated in one other patient.

Both patients with endogenous endophthalmitis had undetermined collagen vascular disease and were treated using systematic corticosteroids. Culture results were positive in both of them. *Haemophilus* sp. was isolated in one case and *C. albicans* was isolated in the other.

#### 5. Discussion

The most common type of endophthalmitis in the current study was post-operative endophthalmitis with cataract surgery most frequently contributing to this condition. Somani et al<sup>31</sup> (Canada), Pei-Chang et al<sup>32</sup> (Taiwan), and Falavarjani et al<sup>33</sup> (Iran) reported that cataract surgery was the most common predisposing surgical procedure in postoperative endophthalmitis patients. Since cataract surgery is the most common intraocular surgery, most cases of post-operative endophthalmitis occur after cataract extraction.<sup>34</sup>

In the current study it was noted that 66.2% of post-

**Table 1.** Demographic Data of 108 Study Subjects

	Postcataract Endophthalmitis, n = 74	Posttraumatic Endophthalmitis, n = 27	Bleb-Associated Endophthalmitis, n = 5	Endogenous Endophthalmitis, n = 2
Males (%)	58.1	88.9	20	0
Females (%)	41.9	11.1	80	100
Mean age ± SD (y)	63.4±14	31.4±14	66±11	39
Incidence (%)	68.5	25	4.6	1.9

Abbreviation: SD, standard deviation.

**Table 2.** Microbiological Spectrum in Patients With Postoperative Endophthalmitis

Organism	Number	Percent
Gram positive		
<i>Streptococcus viridans</i>	12	37.5
<i>Staphylococcus epidermidis</i>	7	21.9
<i>Staphylococcus aureus</i>	2	6.3
<i>Streptococcus pneumoniae</i>	1	3.1
<i>Enterococcus</i> sp.	1	3.1
Gram negative		
<i>Pseudomonas aeruginosa</i>	4	12.5
<i>Haemophilus</i> sp.	1	3.1
<i>Escherichia coli</i>	1	3.1
<i>Stenotrophomonas maltophilia</i>	1	3.1
<i>Enterobacteriaceae</i> sp.	1	3.1
Fungi		
<i>Fusarium</i> sp.	1	3.1

**Table 3.** Microbiological Spectrum in Patients With Posttraumatic Endophthalmitis

Organism	Number	Percent
Gram positive		
<i>Staphylococcus epidermidis</i>	7	70
<i>Bacillus cereus</i>	1	10
Gram negative		
<i>Pseudomonas aeruginosa</i>	1	10
<i>Enterobacteriaceae</i> sp.	1	10

operative endophthalmitis cases occurred in the left eye. This result is not in agreement with Hani et al<sup>3</sup> and Miller et al<sup>35</sup> who reported that most cases occur in the right eye. They believed that the characteristics of corneal incisions performed by right-handed surgeons may contribute to the higher prevalence of endophthalmitis in the right eye. However, the hand dominance of surgeons was not described in this report; thus, the higher prevalence of endophthalmitis in the right eye may not be correct.

The culture positivity rate in patients with postoperative endophthalmitis was 43.2% in this study, which is lower than previously reported, such as the Endophthalmitis Vitrectomy Study that had 67% culture-positive cases<sup>9</sup> and other series seen in the Netherlands (66.4%),<sup>36</sup> India (52.6%),<sup>37</sup> and Taiwan (55%).<sup>32</sup> Furthermore, a retrospective study in China recorded a culture-positive rate of 44.2%.<sup>38</sup>

Additionally, the current study detected positive cultures in 37% of patients with posttraumatic endophthalmitis, which is lower than other reports such as in Saudi Arabia (63.2%).<sup>39</sup> This discrepancy may be due in some part to the method of sample collection which was performed by needle aspiration in most cases in the current study. In patients with endophthalmitis, the vitreous body contains inflammatory condensations; so, specimens obtained through needle aspiration may not be sufficient for analysis. Also, the lower culture positivity rate in the current study may be attributable to inappropriate sample collection or handling or the higher frequency of sterile endophthalmitis in the series of this study.

In a retrospective study, Melo et al reported that only

42% of all presumed endophthalmitis cases have had culture-positive results, and most of culture-positive cases were secondary to surgical procedures (62%).<sup>40</sup>

In the current study, *S. viridans* was found to be the most frequent cause of postoperative endophthalmitis (37.5%) followed by *S. epidermidis* (21.9%) and *Pseudomonas aeruginosa* (12.5%) as the second and third most common organisms, respectively.

In their report, Hani et al. (Saudi Arabia) isolated *S. viridans* in one case (from 18 cases) of postoperative endophthalmitis, and *S. epidermidis* was the most frequent causative organism. Pei-Chang et al<sup>32</sup> also reported that *S. epidermidis* was the most frequent organism causing post-operative endophthalmitis. Furthermore, Zhu et al reported that *S. epidermidis* was the most common isolated organism in culture-positive post-operative endophthalmitis cases.<sup>38</sup> Therefore, some geographic variations may contribute to the prevalence of *S. viridians* infection in Iran.

The most common organism identified in patients with post-traumatic endophthalmitis in the current study was *S. epidermidis* (70%). This result is compatible with those of Abdulrahman et al<sup>39</sup> and Abu el-Asrar et al.<sup>41</sup>

Hani et al<sup>3</sup> reported a lack of hypopyon in 30% of cases. Hypopyon was lacking in 23.1% of cases in the current study. The culture positivity rate was higher in patients who had hypopyon in the initial examination. Thus, the presence of hypopyon at presentation is a strong predictor of positive culture results.

Intraocular foreign bodies (IOFB) were present in 55.6% of posttraumatic endophthalmitis cases in the current study. IOFB were reported in 43% of cases in one study<sup>39</sup> and in 50% of cases in another.<sup>41</sup> Education for high risk occupational groups and use of protective eye wears are important factors in the prevention of open-globe injuries and trauma-associated endophthalmitis.

## 6. Conclusion

There appears to be a wide variation in endophthalmitis incidence rates; therefore, this study was conducted. Post-cataract surgery endophthalmitis is the most frequently seen type of endophthalmitis in the Tertiary Referral Center of Iran. In contrast to many previous reports from other countries, *S. viridans* is the most common organism contributing to culture-proven endophthalmitis in post-operative patients at this center. Furthermore, *S. epidermidis* is the most common microbiologic cause of post-traumatic endophthalmitis in this study.

## Authors' Contributions

Study Design: HT and MRE; data collection: HT; data analysis: HT; manuscript writing: HT; Supervision: MRE and SAT.

## Conflict of Interest Disclosures

No conflicts of interest are declared.

## Ethical Approval

The current study was approved by the local Ethics Review Committee of Tehran University of Medical Sciences.

## Research Highlights

### What Is Already Known?

Cataract surgery is the most common type of operation that may cause post-operative endophthalmitis. The most frequently isolated organisms in both post-operative and post-traumatic endophthalmitis cases were *S. epidermidis* in most previous studies.

### What This Study Adds?

Like studies from many other countries, the most frequent causative surgery in post-operative endophthalmitis cases was cataract surgery in the Tertiary Referral Center; *S. viridans*, however, was the most common isolated organism in such cases. Also, like other reports, *S. epidermidis* was the most frequent organism to cause post-traumatic endophthalmitis in this center.

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