

# Incidence of endophthalmitis after cataract surgery (2002-2008) at a Brazilian university-hospital

## *Incidência de endoftalmite após cirurgia de catarata (2002-2008) num hospital universitário brasileiro*

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### ABSTRACT

**Purpose:** To report on the incidence, diagnostic technique, and microbiological features of endophthalmitis at a university-setting in Brazil.

**Methods:** All cases of presumed postoperative endophthalmitis from 2002 to 2008 at a teaching-hospital were included. Main data assessed were: number of cataract surgeries performed, incidence of endophthalmitis, microbiological outcome (aqueous and/or vitreous culture and Gram staining), and antimicrobial susceptibility testing of the positive cases.

**Results:** Seventy-three eyes of 73 patients (43 females and 30 males) developed endophthalmitis after 24,590 cataract surgeries. The incidence decreased from 0.49% in 2003 to 0.17% in 2006 and stabilized afterwards. Coagulase negative *Staphylococci* (CoNS) and *Streptococcus viridans* (56.5% and 15%, respectively) were the most common bacterial isolates. Culture and Gram stain were negative in 36.9%. CoNS presented susceptibility rates of 80%-sensitivity to oxacillin, 90% to fourth-generation quinolones and 100% to vancomycin.

**Conclusions:** The rate of endophthalmitis, diagnostic ability of conventional laboratory investigation, microbial isolates and antibiotic susceptibility are in accordance with other findings of the literature. Despite using prophylactic antibiotic drops, it was possible to identify cases that were susceptible to the antibiotics topically applied.

**Keywords:** Endophthalmitis/epidemiology; Endophthalmitis/etiology; Endophthalmitis/diagnosis; Endophthalmitis/microbiology; Cataract extraction/adverse effects

### RESUMO

**Objetivo:** Relatar incidência, técnica diagnóstica e características microbiológicas de endoftalmite numa instituição universitária no Brasil.

**Métodos:** Todos os casos de endoftalmite pós-operatória presumida de 2002 a 2008 foram incluídos. Os principais dados avaliados foram: número de cirurgias de catarata realizadas, incidência de endoftalmite, resultado microbiológico (bacterioscopia e cultura de aquoso e vítreo) e teste de sensibilidade antibiótica dos casos positivos.

**Resultados:** Setenta e três olhos de 73 pacientes (43 do sexo feminino e 30 do masculino) desenvolveram endoftalmite após 24.590 cirurgias de catarata. A incidência reduziu de 0,49% em 2003 para 0,17% em 2006 e estabilizou-se depois disso. *Staphylococcus coagulase-negativa* (SCoN) e *Streptococcus viridans* (56,5% e 15%, respectivamente) foram os isolados bacterianos mais comuns. Cultura e bacterioscopia foram negativas em 36,9%. SCoN apresentou taxas de sensibilidade de 80% à oxacilina, 90% às quinolonas de quarta geração e 100% à vancomicina.

**Conclusões:** A taxa de endoftalmite, a capacidade diagnóstica das técnicas laboratoriais convencionais, os microrganismos isolados e a sensibilidade aos antibióticos estão em acordo com outros achados na literatura. Apesar do uso profilático de colírio antibiótico, foi possível identificar casos de infecção em que as bactérias eram sensíveis aos antibióticos usados topicamente.

**Descritores:** Endoftalmite/epidemiologia; Endoftalmite/etologia; Endoftalmite/diagnóstico; Endoftalmite/microbiologia; Extração de catarata/efeitos adversos

### INTRODUCTION

Infectious endophthalmitis following cataract surgery still is a devastating condition, despite major improvements in surgical techniques in the last decades. Most series report on an

incidence rate ranging from 0.05% to 0.4% in different studies worldwide<sup>(1)</sup>.

Most cases are caused by Gram-positive microorganisms present in the conjunctiva and the eyelid. Prophylactic procedures include the use of preoperative and postoperative antibiotics and preoperative povidone. Its management requires a prompt intervention, such as a vitreous tap followed by intra-vitreous injection of antibiotics or vitrectomy<sup>(2)</sup>.

Herein, we present the rates of endophthalmitis at a university setting in Brazil, where surgeries are predominantly performed by residents and fellows. Additionally, we compare these rates prior and after the introduction of fourth-generation quinolones as postoperative prophylactic drops.

### METHODS

This was a retrospective study based on the medical records of the Departments of Ophthalmology and Ocular Microbiology Laboratory (LOFT) at the Federal University of São Paulo, Brazil.

Data from patients who had been previously submitted to cataract surgery (alone or combined with trabeculectomy)

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were examined and presented with presumed infectious endophthalmitis from 2002 to 2008.

The following data were assessed: number of cataract surgeries performed per year and number of endophthalmitis cases, gender, age, interval from surgery to diagnosis, prophylactic use of antibiotics eye drops, microbiological outcome (aqueous and/or vitreous culture and Gram staining), and antimicrobial susceptibility testing of the positive cases.

The incidence of endophthalmitis was established per year and for the whole period of the study based on its clinical diagnosis. It should be stated that all patients were operated on and followed at the same institution. Patients operated on elsewhere were excluded from this analysis. Antibiotic drops were administered 30 minutes before surgery and for 7 days afterwards (q.i.d.).

The patients were submitted to either vitreous/aqueous tap or vitrectomy followed by intravitreal injection of antibiotics. Intraocular specimens were collected and cultured on blood agar, chocolate agar, fastidious anaerobic thioglycolate broth, and Sabouraud agar for aerobic and anaerobic bacteria, and fungi. Gram stain and acid-fast stain were performed immediately. A positive culture was defined as either separate colonies of the same organism on two or more separate culture plates or confluent growth at the site of inoculation. Antimicrobial susceptibility testing was performed by the disc diffusion method. Current version of CLSI document M-100, published annually, was used for zone diameter interpretation.

## RESULTS

Seventy-three eyes of 73 patients (43 females and 30 males) developed presumed postoperative endophthalmitis after cataract surgery alone (71 cases) or combined with trabeculectomy (2 cases) from 2002 to 2008 at our institution. Demographic data are disclosed in table 1. Most patients were elderly and were under antibiotic drops after surgery until the development of the infection. Mean time interval from surgery to clinical diagnosis was 8.5 days.

In the period of time of this study (2002-2008), 24,590 cataract surgeries were performed at our setting, keeping a regular distribution yearly. Incidence of presumed endophthalmitis varied from a peak of 0.49% in 2003 to a trough of 0.17% in 2006. The rate of endophthalmitis decreased by half when the last 3 years were compared to the 2 initial years. Detailed data are presented in table 2. Overall incidence of endophthalmitis was 0.29%. Microbiological techniques were able to confirm 63% of the clinically suspected cases.

Bacterial species identified are disclosed in table 3. Coagulase negative *Staphylococci* (CoNS) were responsible for 56.5% of all positive cases from 2002 to 2008; *Streptococcus viridans* was positive in 15% of the identified cases; *Proteus mirabilis*, *Pseudomonas aeruginosa* and *Staphylococcus aureus* corresponded each to 4% of these cases; other microorganisms were identified in one case each. Among all 73 presumed cases of endophthalmitis, 27 (36.9%) were negative either in culture or in Gram staining.

Antimicrobial susceptibility testing was performed for every positive case of infectious endophthalmitis. None of the Gram-positive isolates were resistant to vancomycin. Five samples of CoNS, and 2 of *Staphylococcus aureus* were resistant to oxacillin. Among these, one sample of CoNS was also resistant to gatifloxacin and another one to moxifloxacin. These patients were under prophylactic drops of moxifloxacin postoperatively. No other sample of bacteria isolated from these endophthalmitis cases was resistant to the fourth-generation quinolones. It is important to state that during the period of time

**Table 1. Demographic data from the cases (n=73)**

Age (mean±SD)		67.6 ± 11.4
Gender	Male	30
	Female	43
Interval (days) between surgery and diagnosis (mean ± SD)		8.5 ± 10.11
Prophylactic postoperative use of antibiotic drops	Yes	57
	No	1
	Not available	15

assessed in this study, antibiotic susceptibility with fourth-generation quinolones was applied to 10 positive samples. Therefore, there was an 80%-sensitivity to this class of antibiotic (90% to gatifloxacin and 90% moxifloxacin each).

## DISCUSSION

The incidence of endophthalmitis following cataract surgery has varied over the last decades as described in the literature. In the 1970s, it was 0.32%; 0.16% in the 1980s; 0.08% in the 1990s; and showed a trend to increase in the early years of the 21st century, reaching 0.26%<sup>(1)</sup>. The increased rate of endophthalmitis after cataract extraction has been temporally associated with the use of sutureless clear cornea incisions. This may be caused by wound defect (including wound leakage), early postoperative hypotony (leading to the inflow of the eyelid microorganisms) and possibly the lack of the conjunctiva covering the corneal incision. The overall rate of endophthalmitis at our setting from 2002-2008 (0.29%) was very similar to the one reported on this systematic review of the literature.

Interestingly, this rate significantly decreased by half from 2002 and 2003 to the following years. Within this period, there was no significant difference in surgical techniques in worldwide phacoemulsification that could explain these data. We hypothesize two possible explanations. First, the phacoemulsification teaching method changed at our institution. Previously, residents that had never done a phacoemulsification would simply begin operating on patients with the assistance from the first to the last step. Later on and nowadays, the residents have to do their first surgeries by performing the last steps, such as corneal suturing and IOL implantation. Only after acquiring some experience, they can perform initial steps and the whole surgery. It is believed that this method might have decreased the rate of surgical complications. However, the impact of the new teaching methodology has not been assessed into details and there are no published data from our service to clearly support this theory. Another possible explanation to a decreased incidence in the latest years is the use of fourth-generation quinolones. They have been routinely used as a postoperative prophylaxis since 2004/2005. And besides, they have been donated to the patients for the postoperative period. Although this association is hardly proven, another study showed a marked reduction in endophthalmitis incidence with fourth-generation quinolones in comparison to the third-generation ones<sup>(3)</sup>.

One might expect our incidence would be higher than the average since the majority of the cataract surgeries are performed either by residents or fellows. It is well known that surgical complications, such as posterior capsule disruption with vitreous loss, are significant risk factors for the development of this infection. It is also expected that surgeons-in-training be responsible for more cases developing complication<sup>(4)</sup>. However, a small case series did not show an increa-

**Table 2. Number of performed cataract surgeries, presumed endophthalmitis cases, culture-proven cases and incidence of endophthalmitis per year and overall rates**

Year	Number of surgeries	Presumed endophthalmitis	Culture-proven cases	Incidence (%)
2002	3876	18	11	0.46
2003	3663	18	13	0.49
2004	3596	10	5	0.28
2005	3248	8	5	0.24
2006	3572	6	4	0.17
2007	3164	6	4	0.19
2008	3471	7	4	0.20
Overall	24590	73	46	0.29

**Table 3. Microbiological characterization for the whole period of the study (2002-2008). Percentage refers only to the positive cases**

Bacterial species	n	%
Coagulase negative <i>Staphylococci</i>	26	56.5
<i>Streptococcus viridans</i>	7	15.2
<i>Proteus mirabilis</i>	2	4.3
<i>Pseudomonas aeruginosa</i>	2	4.3
<i>Staphylococcus aureus</i>	2	4.3
<i>Streptococcus pneumoniae</i>	1	2.1
$\beta$ -hemolytic <i>Streptococcus</i> (group G)	1	2.1
<i>Morganella morganii</i>	1	2.1
<i>Enterococcus spp</i>	1	2.1
<i>Haemophilus spp</i>	1	2.1
<i>Acinetobacter</i>	1	2.1
<i>Weeksella virosa</i>	1	2.1
Positive Gram staining/negative culture	1	2.1
Negative culture/Gram staining	27	NA
Total positive cases	46	100
Total	73	NA

NA= not applicable

sed incidence of endophthalmitis after cataract surgery performed by residents<sup>(5)</sup>. We believe that our results, although presenting an average rate of infection according to the systematic review of literature, is probably higher than it could be due to the higher rate of surgical complications found in surgeries performed by surgeons-in-training.

Laboratory investigation was able to diagnose 63% of the presumed infectious endophthalmitis cases. This is in accordance with most studies, in which culture sensitivity varies from 30 to 80%<sup>(6-7)</sup>. The sensitivity is increasingly higher with vitreous tap and vitrectomy in comparison to aqueous tap<sup>(6)</sup>.

CoNS are the most common causative microorganisms of infectious endophthalmitis in most series, usually followed by *Streptococci*<sup>(8-9)</sup>. This was exactly what we found in our study. In the Endophthalmitis Vitrectomy Study, for example, 70% of the causative microorganisms were CoNS and about 9% were *Streptococci* and *Staphylococcus aureus* each<sup>(8)</sup>. A previous study published by our group also showed a similar distribution of microorganisms regarding all cases of endophthalmitis, including the endogenous and traumatic ones<sup>(9)</sup>.

Despite the lack of clear evidence favoring the use of prophylactic postoperative antibiotics, they are commonly used in most clinical settings. However, this may trigger antibiotic resistance. In two previous studies, it was shown that 68% of

CoNS were sensitive to third generation quinolones<sup>(10-11)</sup>. We showed a 92%-susceptibility to ciprofloxacin in our previous report<sup>(9)</sup>. In our current series, we found an 80%-susceptibility of CoNS to oxacillin, and a 90%-sensitivity to gatifloxacin or moxifloxacin.

In summary, this study provides information on a large series of endophthalmitis in a single-center from 2002 to 2008. Overall incidence was 0.29% and showed a marked decrease from 2004 on; laboratory investigation was able to diagnose 63% of the presumed infectious cases; CoNS were the most common microorganisms; and there still is a high rate of antibiotic susceptibility in our institution. These data are consistent with other studies in worldwide literature. One of the main points raised by this report and whose answer remains unknown is how prophylactic antibiotic drops can influence the rate of infectious endophthalmitis. Other important issue is the low sensitivity of the conventional laboratory diagnostic techniques. The clinical application of molecular diagnostic tools should be taken into account. These topics should be addressed in future studies.

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