

Endophthalmitis after cataract surgery: results from seven years of epidemiological surveillance

Endoftalmite após cirurgia de catarata: resultado de sete anos de vigilância epidemiológica

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ABSTRACT

Purpose: This study aims to describe the incidence, clinical presentation, and evolution of endophthalmitis cases occurred at an ophthalmologic center in Brazil. **Methods:** This is a review of medical records of patients undergoing cataract surgery from 2008 to 2014. Clinical variables associated with the outcome of postoperative endophthalmitis were evaluated. **Results:** during the study period, 27,609 cataract surgeries were performed. It was identified 35 cases of endophthalmitis. The overall incidence of endophthalmitis was 0.13%, with an annual variation from 0.04% to 0.27%. The main signs and symptoms in patients with endophthalmitis were ocular pain and low visual acuity associated with conjunctival hyperemia and hypopyon. Gram-positive microorganisms were the most frequent etiological agents. All patients received an intra-vitreous injection of antibiotics as immediate treatment. The final visual acuity was equal to or worse than the ability to count the examiner's fingers in 57.1% of the patients. Evisceration or enucleation was required in 3 patients. **Conclusion:** The incidence of endophthalmitis and the majority of signs and symptoms found in this study were in agreement with literature in the field. Although the incidence rate is low, the loss of vision experienced by most patients with endophthalmitis after cataract surgery highlights the need for efforts to prevent infection and early diagnosis to avoid such complications.

Keywords: Endophthalmitis; Cataract extraction; Surgical wound infection; Epidemiological monitoring; Infection control

RESUMO

Objetivo: Descrever a incidência, a apresentação clínica e a evolução dos casos de endoftalmite ocorridos em um centro oftalmológico no Brasil. **Métodos:** Trata-se de uma revisão de prontuários dos pacientes submetidos à cirurgia de catarata no período de 2008 a 2014. Foram avaliadas as variáveis clínicas associadas ao desfecho de endoftalmite pós-operatória. **Resultados:** durante o período do estudo, foram realizadas 27.609 cirurgias de catarata. Foram identificados 35 casos de endoftalmite. A incidência global de endoftalmite foi de 0,13%, com variação anual de 0,04% a 0,27%. Os principais sinais e sintomas em pacientes com endoftalmite foram dor ocular e baixa acuidade visual associado à hiperemia conjuntival e hipópio. Os microrganismos gram-positivos foram os agentes etiológicos mais frequentes. Todos os pacientes receberam uma injeção intravítrea de antibióticos como tratamento imediato. A acuidade visual final foi igual ou pior que a capacidade de contar os dedos do examinador em 57,1% dos pacientes. Evisceração ou enucleação foi necessário em 3 pacientes. **Conclusão:** A incidência de endoftalmite e a maioria dos sinais e sintomas encontrados neste estudo estão de acordo com os reportados na literatura. Embora a taxa de incidência seja baixa, a perda de visão experimentada pela maioria dos pacientes com endoftalmite após a cirurgia de catarata destaca a necessidade de esforços para medidas de prevenção de infecção e diagnóstico precoce para evitar tais complicações.

Descritores: Endoftalmite; Extração de catarata; Infecção da ferida cirúrgica; Monitoramento epidemiológico; Controle de infecções

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INTRODUCTION

Endophthalmitis is a term that defines an intraocular infection, which is one of the most severe postoperative complications following cataract surgery. In the literature, the average incidence reported is 0,10%,⁽¹⁻⁷⁾ and the major etiological agents are gram-positive bacteria, mainly *Staphylococcus* spp.^(2-5,8,9)

The time of symptoms onset is usually around one week after surgery,^(5,8,10,11) although in many cases it may occur later, depending on the etiological agent such as fungus.⁽¹²⁾ Vitreous haze, hypopyon, conjunctival hyperemia, and corneal edema have been described as the most frequent signs at diagnosis.^(5,12-14)

Despite treatment, patients affected by endophthalmitis may develop visual acuity equal to or worse than the ability to count fingers.^(10,15,16) In some cases, more drastic interventions may be required, such as enucleation⁽¹⁵⁾ or evisceration,^(10,16) i.e. the removal of the globe or the ocular contents, respectively.

Although literature reports the incidence of this type of infection, there is a gap on detailed descriptions of clinical presentations, treatment, and evolution.^(1,2,4,6,7,9)

Given the importance of this postoperative adverse event, the aim of this study is to describe the incidence, clinical presentation, and evolution of endophthalmitis cases occurred at an ophthalmologic center in Brazil.

METHODS

Study Design. This is a descriptive study based on the review of medical records. Setting. The study was conducted at a nonprofit institution located in the city of São Paulo, approved by the Brazilian Ministry of Education as a teaching institution for medical ophthalmology residency program. Most surgeries are usually performed under local anesthesia, under aseptic conditions, with the surgeons wearing sterile surgical gowns and gloves, and caps and masks. Routine infection prevention procedures include the application of polyvinylpyrrolidone-iodine (PVPI) 0.05% eye drops prior to surgery, and the antisepsis of the eyelids and surrounding area done with PVPI in 10% aqueous solution. There is no standard protocol for intraoperative antibiotic prophylaxis; however, most surgeons administer 20 mg of subconjunctival gentamicin at the end of surgery in cases of major surgical trauma. All surgical instruments and phacoemulsification tubing packs are sterilized prior to each surgical procedure by means of steam sterilization method.

Study Subjects. The study included medical records of patients undergoing cataract surgery from 2008 to 2014 who received a diagnosis of acute endophthalmitis.

Data Collection. The incidence data of endophthalmitis was gathered from the institutional database. An active surveillance system for postoperative endophthalmitis is in place at the institution since 2008; details regarding this system were published elsewhere.⁽¹⁷⁾

Acute endophthalmitis was defined as an infection confined to the interior of the eye, with clinical presentation within 6 weeks of surgery and characterized by the postoperative presence of at least 3 of the following signs or symptoms: rapid decrease of visual acuity, pain, hypopyon, anterior chamber reaction, vitreous haze, the presence of fibrin in the anterior chamber, conjunctival hyperemia, or eyelid edema. The diagnosis was confirmed by intraocular ultrasonography, positive vitreous culture or clinical

diagnosis by a retinal physician. Data were exclusively collected by the first 3 authors of this study through a review of patient medical records in cases diagnosed with endophthalmitis.

The study was conducted according to the principles of the Declaration of Helsinki⁽¹⁸⁾ being approved by the Ethics Committee of the institution where the work was undertaken under the protocol number CAAE: 11211413.6.0000.5392.

RESULTS

During the study period, 27,609 cataract surgeries were performed, of which 35 cases developed endophthalmitis. The cumulative incidence rate was 0.13%, with an annual variation range of 0.04% to 0.27% (Table 1).

Table 1
Incidence rate of endophthalmitis after cataract surgery per year

Year	Number of surgeries	Cases of endophthalmitis	Incidence (%)
2008	4,944	2	0.04
2009	5,116	5	0.10
2010	3,979	3	0.08
2011	3,543	2	0.06
2012	4,458	12	0.27
2013	3,040	7	0.23
2014	2,529	4	0.16
Total	27,609	35	0.13

Among the affected patients, 18 were females and 17 were males. Average patient age was 68.1 ± 9.9 years (range, 47–83 years).

The most commonly used surgical technique for cataract extraction in cases that have evolved to endophthalmitis was phacoemulsification, used on 31 (89%) patients, followed by extracapsular extraction in 3 (9%) patients and intracapsular extraction in 1 (3%) patient. The most frequently used surgical incision type was a clear corneal incision, used in 19 (54%) patients, followed by the near-clear approach, used in 9 (26%) patients. Intraoperative complications occurred in 16 (46%) patients with diagnosis of endophthalmitis; among them, the posterior capsule rupture with vitreous loss was the most frequent, occurring in 10 (63%) patients (Table 2).

The time from the surgery up to endophthalmitis diagnosis ranged from 1 to 37 days (mean 7 ± 8.3 days), being 19 (54%) cases diagnosed within 4 days of post-surgery. At diagnosis, more than 60% of the patients presented with flare, corneal edema, hypopyon, and cells in the anterior chamber. Corneal haze and conjunctival hyperemia were present in 16 (46%) patients, and vitreous haze was detected in 14 (40%) patients. Visual acuity worse than or equal to the ability to count fingers was present in 33 (94%) patients, and 24 (69%) patients reported ocular pain (Table 2).

Ultrasound examinations of the ocular globe were performed in 24 (69%) patients. Punctate echoes and high-mobility echoes suggestive of inflammatory processes were the most frequent findings, followed by vitreous opacities and the thickening of the choroid.

Among the 35 cases, 27 (77%) had ocular samples collected for microbial culture. Gram-positive microorganisms were identified in 12 (44%) patients, *P. aeruginosa* infection was

identified in 5 (19%) patients, and there was no growth in 10 (37%) samples.

All patients received an intra-vitreous injection of ceftazidime and vancomycin as immediate treatment. Concomitantly, as an additional procedure, 22 (63%) patients underwent posterior vitrectomy surgery. Among them, 9 (26%) presented visual acuity worse than or equal to the perception of light at the time of the diagnostic, and 3 (9%) patients underwent anterior chamber washout.

Regarding the evolution of the cases, 7 (20%) patients showed the final visual acuity better than or equal to 20/40, 8 (23%) patients showed a final visual acuity between 20/50 and 20/200, and 20 (57%) patients showed a final visual acuity worse than or equal to the ability to count fingers. Among the cases with the worst final visual acuity, 5 (14%) exhibited only light perception, while 12 (34%) exhibited no light perception. Evisceration or enucleation was required in three cases.

Table 2
Visual acuity, surgery data, treatment and evolution of endophthalmitis cases (n = 35).

Case	PVA	Surgical technique	Type of incision	Intraoperative complication	Nº of days to diagnosis	VA to Diagnostic	Vitreous culture	Immediate intervention	FAV
1	20/200	Phaco	CC	None	3	LP	P. aeruginosa	PV + IA	NLP
2	20/ 70	Phaco	CC	None	3	HM	P. aeruginosa	PV + IA	NLP
3	20/ 70	Phaco	CC + CT	None	3	SPL	P.aeruginosa	PV + IA	NLP
4	20/100	Phaco	CC	None	20	MM	No growth	PV + IA	20/100
5	20/ 50	Phaco	NC	None	37	20/100	CNS	PV + IA	20/40
6	20/ 50	Phaco	CC	None	2	HM	P. aeruginosa	IA	LP
7	CF	Phaco	CC	None	1	HM	No growth	CW+IA	20/100
8	20/ 60	Phaco	CC	None	8	HM	Streptococcus spp.	PV+IA	20/200
9	CF	Phaco	CC	None	3	LP	No growth	ACW + IA	NLP
10	20/ 50	Phaco	CC	None	11	LP	No growth	PV + IA	LP
11	HM	Phaco	CC	None	1	LP	No growth	PV + IA	NLP
12	20/200	Phaco	CC	None	8	LP	No growth	PV + IA	20/ 20
13	CF	Phaco	CC	PCR; VL	6	LP	Not Performed	PV + IA	HM
14	CF	Phaco	CC	PCR; VL	21	HM	No growth	IA	20/ 50
15	CF	ECE	ST	VL; Dialysis	1	HM	Not Performed	IA	LP
16	HM	ICE	PP	Corneal ulcer	30	HM	P. aeruginosa	PV + IA	NLP
17	20/ 50	Phaco	CC	PCR; VL;	8	CF	No growth	IA	20/ 30
18	20/ 40	Phaco	CC	PCR; VL	2	HM	S. epidermidis	PV + IA	20/ 30
19	20/ 70	Phaco	CC	PCR; VL; NV	7	CF	Streptococcus spp.	IA	20/ 30
20	20/100	Phaco	CC	None	3	LP	S. epidermidis	PV + IA	LP
21	HM	Phaco	NC	None	5	HM	CNS	PV + IA	NLP
22	20/ 70	Phaco	NI	None	4	HM	Not Performed	IA	LP
23	20/ 70	Phaco	CC	PCR; Posterior capsulorhexis	2	CF	Not Performed	IA	20/ 40
24	20/ 50	Phaco	NC	None	1	CF	CNS	IA	20/ 70
25	CF	Phaco	NC	PCR; VL; NV	2	HM	S. pneumoniae	PV + IA	NLP
26	20/100	Phaco	NC	Dialysis	1	NI	S. aureus	PV + IA	20/200
27	20/200	Phaco	CC	PCR; VL	5	HM	No growth	IA	20/200
28	HM	ECE	ST	None	4	HM	Not Performed	IA	CF
29	20/200	Phaco	NC	VL; Dialysis	6	HM	S. aureus	PV + IA	NLP
30	20/200	Phaco	NC	PCR; VL	1	HM	Not Performed	PV + IA	20/ 30
31	CF	Phaco	CT	Subluxated lens	7	LP	Not Performed	PV + IA	NLP
32	20/100	Phaco	NC	PCR; VL	1	HM	Streptococcus spp.	AV + IA	CF
33	HM	ECE	ST	PCR; VL	14	LP	S. aureus	PV+IOL explant+IA	NLP
34	20/ 50	Phaco	CC	None	2	HM	Not Performed	PV + IA	NLP
35	CF	Phaco	NC	None	11	HM	No growth	PV + IA	20/200

ACW = Anterior chamber washout; AV = Anterior vitrectomy; CC = Clear Cornea; CF = Count fingers; CNS = Coagulase-negative staphylococci; CT = Corneal tunnel; ECE = Extra-capsular extraction; FAV = Final visual acuity; HM = Hand motion; IA = Intravitreal antibiotic; ICE = Intra-capsular extraction; IOL = Intraocular lens; LP = light perception; NC = Near clear; NI = Not informed; NLP = No light perception; NV = Nucleus into the vitreous; PCR = Posterior capsular rupture; Phaco = Phacemulsification; PV = Posterior vitrectomy; PVA = Preoperative visual acuity; ST = Scleral tunnel; VA = visual acuity; VL = Vitreous loss;

Table 3
Clinical presentation of endophthalmitis cases at diagnosis (n = 35).

Signs and symptoms	Yes n (%)	No n (%)	NI n (%)
Cells in AC	22(63)	13(37)	0 (0)
Ciliary Injection	13(37)	9(26)	13(37)
Conjunctival hyperemia	16(46)	7(20)	12(34)
Conjunctival secretion	6(17)	25(71)	4(11)
Corneal edema	24(69)	1(3)	10(29)
Corneal haze	16(46)	19(54)	0 (0)
Eyelid edema	6(17)	14(40)	15(43)
Fibrin in AC	10(29)	19(54)	6(17)
Flare	26(74)	9(26)	0 (0)
High IOP	10(29)	21(60)	4(11)
Hyphema	1(3)	32(91)	2(6)
Hypopyon	23(66)	12(34)	0(0)
Irregular pupil	3(9)	22(63)	10(29)
Keratic precipitate	5(14)	20(57)	10(29)
Ocular pain	24(69)	10(29)	1(3)
Pupil Membrane	12(34)	18(51)	5(14)
Visual acuity equal \leq CF	32(91)	1(3)	2(6)
Vitreous haze	14(40)	21(60)	0 (0)
Vitreous strands	5(14)	18(51)	12(34)

AC = Anterior chamber; IOP = Intraocular pressure; CF = Count fingers;

DISCUSSION

Cataract is one of the leading causes of blindness worldwide, particularly in developing countries, and cataract surgery is being increasingly performed globally.^(2,6,7) Endophthalmitis is a serious complication that can lead to blindness and may affect a large number of patients, mainly when it occurs as an outbreak.⁽¹³⁻¹⁶⁾

The mean incidence rate of postoperative endophthalmitis found in this study is slightly higher than those presented in the literature, which is 0,10%.⁽¹⁻⁷⁾

Although a clear corneal incision has been pointed out in the literature as a risk factor for endophthalmitis,⁽¹⁹⁾ this is a preferred type of incision in cataract surgeries performed using phacoemulsification technique.^(4, 5, 20) This preference is due to several advantages including shorter surgical time, lack of conjunctival trauma, less discomfort and bleeding, less manipulation, and faster visual recovery.⁽²¹⁾

As similarly shown in other studies, the posterior capsule rupture with vitreous loss was the most common intraoperative complication of cataract surgeries.^(2,4,7,20)

The early onset of signs and symptoms observed in this study is similar to that reported by other authors, who have demonstrated that in most cases the diagnosis of endophthalmitis occurs within the first 4 days after surgery.^(8,10,11) The most frequent signs observed in our study were corneal edema and hypopyon, and other less frequent signs such as conjunctival secretion, eyelid edema and keratic precipitate, what is in agreement with the reports of other studies on endophthalmitis cases following cataract surgeries.^(5,13,14,22)

Pain and low visual acuity experienced in the postoperative period by most of the patients in this study represent the symptoms

that enable an early diagnosis. Similarly, other studies have also reported pain^(14,22) and low visual acuity^(8,11-13) as frequent symptoms at the time of the diagnostic. Ophthalmologists should be aware of these symptoms as a potential alert for endophthalmitis since these are usually the primary complaints when patients seek for postoperative care ahead of schedule.

In a retrospective study of 60 endophthalmitis cases following cataract surgery, Kelkar et al.⁽⁵⁾ have observed that all patients were diagnosed with vitreous haze and conjunctival hyperemia. Their results differ from our study in which less than half of cases exhibited these symptoms.

The microbiological profiles of the main etiological agents of postoperative endophthalmitis have been reported in the literature.^(1-5,8,9) Although in our casuistic no fungi were detected, the overall microbiological profiles were consistent with other studies that reported the Staphylococci spp as the most frequent agents, followed by gram-negative bacteria and fungi.^(2-5,8,9)

Our study reinforces the findings from others that the percentage of negative cultures in clinically confirmed cases is high and may even be greater than 50%.^(2,4,9) This fact points out that the active search of cases should not rely only upon positive results from the cultures of vitreous contents. This is highly relevant when establishing a surveillance system to monitor the occurrence of postoperative surveillance system.

Intraocular antibiotics are not routinely applied as a mean of surgical prophylaxis at the end of surgeries in our institution. In cases that are more traumatic or in those with complications, such as posterior capsule rupture or vitreous loss, 20 mg of subconjunctival gentamicin is administered by the end of surgery. In a systematic review of the literature on antibiotic prophylaxis, Kessel et al.⁽²³⁾ have noted that the intracameral administration of cefazolin or cefuroxime at the end of surgery was effective in the prevention of endophthalmitis and that vancomycin did not produce the same results. Huang et al.⁽²⁴⁾ have also reported that vancomycin use does not produce protective effects against endophthalmitis.

The treatment with the intraocular injection of ceftazidime and vancomycin administered to all cases in this study was in accordance with Endophthalmitis Vitrectomy Study Group recommendation.⁽²⁵⁾ Posterior vitrectomy is recommended only in cases in which visual acuity at the time of the diagnostic evaluation is worse than or equal to the perception of light. However, due to assumptions of the possibility of insufficient follow-up of patients who are mostly poor and with low educational level, more than half of the cases received this treatment. Similar rates have been reported in other studies.^(5,8,11) Gower et al. have emphasized that vitrectomy in patients with visual acuity better than light perception does not produce better benefits than treatment with the administration of intravitreal antibiotics alone.⁽²⁶⁾

Despite proper treatment, final visual acuity remained poor in many cases. Some studies have reported that an average of 16% of the patients with endophthalmitis achieved final visual acuity greater than or equal to 20/60.^(10,11,15,16) Jeong et al. have reported that risk factors for low visual acuity following endophthalmitis include a gram-negative bacterium as the etiological agent and early clinical presentation.⁽⁸⁾ In other studies, more than 30% of the patients developed visual acuity below the ability to detect hand motion, and few patients require enucleation or evisceration.^(10,15,16) The percentage of cases that required evisceration was small compared with that reported in the literature,^(10,16) indicating that appropriate treatment was provided.

CONCLUSIONS

The overall incidence rate of endophthalmitis presented in this study is similar to the average rates found in the literature. The most frequent etiologic agents matched those present in the normal microbiota of the skin and conjunctiva of humans.

Endophthalmitis was frequently diagnosed within the first week of surgery, when patients returned early due to complaints of poor visual acuity and pain. The main symptoms observed in this study were corneal edema, hypopyon, and the presence of cells in the anterior chamber.

The vision loss experienced by most of the patients with endophthalmitis after cataract surgery highlights the need of efforts toward infection prevention measures and early diagnosis to avoid such complications.

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