

Endophthalmitis Following Pediatric Cataract Surgery: An International Pediatric Ophthalmology and Strabismus Council Global Perspective

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ABSTRACT (ENGLISH)

To compile international data on the risk factors, diagnosis, and treatment of endophthalmitis following pediatric cataract surgery.

An e-mail containing a link to an online survey was sent to all members of the American Association for Pediatric Ophthalmology and Strabismus. The questionnaire examined the incidence, risk factors, treatment, outcomes, and prophylaxis of endophthalmitis following pediatric cataract surgery around the world.

Two hundred thirty-seven ophthalmologists answered the questionnaire. Eight ophthalmologists (3.4%) encountered 22 cases of endophthalmitis following pediatric cataract surgery during their practice. Most patients with endophthalmitis following pediatric cataract surgery were 2 to 4 years of age (36.4%). An intraocular lens was implanted in 59.1% of cases, most of which were acrylic intraocular lenses (53.8%). The main presenting symptoms were photophobia (50%) and pain (40.9%). The most common signs were conjunctival injection (36.4%) and hypopyon (31.8%). The final visual acuity was counting fingers or worse in 86% of cases. The most common cultured organism was *Staphylococcus aureus* (31.8%). The most common management of endophthalmitis following pediatric cataract surgery was a combination of intravitreal, systemic, and topical antibiotics (36.4%). Most ophthalmologists (68.2%) administered prophylactic intracameral antibiotic treatment during surgery and 50% used vancomycin.

Endophthalmitis following pediatric cataract surgery is an uncommon, multifactorial complication with poor visual prognosis. Efforts directed at minimizing its risk, such as treating potential predisposing systemic conditions, improving sterilization techniques, optimizing operative conditions to reduce complications and surgery duration, and using subconjunctival and intracameral antibiotics, decrease its incidence. Early postoperative evaluation, subsequent follow-up visits, and keeping a high index of suspicion should facilitate the recognition of endophthalmitis following pediatric cataract surgery to avoid delaying treatment.

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FULL TEXT

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The authors have no financial or proprietary interest in the materials presented herein.

Introduction

Endophthalmitis following pediatric cataract surgery is a potentially blinding complication. ^{1,2} Due to its low incidence (0% to 0.45%), ³⁻¹⁰ it is difficult to conduct large-scale prospective studies. Our limited knowledge of this condition is derived from data extrapolated from studies on adults ¹¹ and the scarce pediatric literature available that consists mostly of case reports and small series. Collecting information worldwide can potentially enhance our understanding and decrease the occurrence of endophthalmitis following pediatric cataract surgery. The purpose of this study was to compile data from around the world on the risk factors, diagnosis, and treatment of endophthalmitis following pediatric cataract surgery.

Patients and Methods

An e-mail communication was sent to all American Association for Pediatric Ophthalmology and Strabismus members through the International Pediatric Ophthalmology and Strabismus Council secretariat between January and February 2016. The e-mail included an explanation of the study and a link to a 32-question online survey (www.surveymonkey.com) aimed at evaluating the responding ophthalmologist's experience with endophthalmitis following pediatric cataract surgery (Table 1). A contact e-mail and phone number were also provided for respondents wishing to obtain further information on the study. Follow-up e-mails were sent twice to non-responders. No formal consent was required given the retrospective nature of the study.

Statistical Analysis

Statistical analysis, including distribution, was performed with JMP Statistical Discovery Software (version 7.0; SAS Institute, Cary, NC). The overall significance level was set to an alpha value of 0.05.

Results

Ophthalmologist Demographics

Eight (3.4%) of the 237 respondents encountered a total of 22 cases of endophthalmitis following pediatric cataract surgery during their career. Of those, three ophthalmologists reported 1 case, three reported 2 cases, one reported 3 cases, and one reported more than 6 cases. One hundred sixty-three (68.8%) ophthalmologists who responded to the survey practiced in North America (Figure 1) and most cases of endophthalmitis following pediatric cataract surgery occurred in North America (27%) and the Middle East (27%) (Figure 2). Fifty-eight (24.5%) ophthalmologists had been in practice for more than 25 years (Figure 3).

Patient Demographics

Endophthalmitis following pediatric cataract surgery occurred in patients between the ages of 2 months and 10 years. Eight (36.4%) children developed endophthalmitis following pediatric cataract surgery between the ages of 2 and 4 years, 4 (18.2%) children between the ages of 1 and 2 years, and 3 (13.6%) children at an age of 2 months or younger.

Surgical Factors

In 16 (72.7%) cases of endophthalmitis following pediatric cataract surgery, the procedure was performed by the consultant (Figure 4). An intraocular lens (IOL) was implanted in 13 (59.1%) cases, with 7 (53.8%) acrylic, 4 (30.8%) silicone, and 2 (15.4%) polymethylmethacrylate IOLs. Eight (61.5%) IOLs were implanted in the bag, 4 (30.8%) in the sulcus, and only 1 (7.7%) in the iris (Artisan; Ophtec B.V., Groningen, Netherlands). Vitrectomy and posterior capsulotomy were performed through the anterior chamber before IOL insertion in 10 (45.5%) cases, after IOL insertion in 6 (27.3%) cases, and through the pars plana in 3 (13.6%) cases. Two (9.1%) patients did not undergo vitrectomy and posterior capsulotomy. A surgical complication that prolonged the surgical time (equatorial tear of the capsular bag forcing IOL sulcus implantations) was reported in only 1 (4.5%) case.

Postoperative Follow-up

Complaints at presentation were photophobia (11, 50%), pain (9, 40.9%), crying (5, 22.7%), sleeplessness (1, 4.5%), and poor feeding (1, 4.5%). The most common initial clinical signs of endophthalmitis were conjunctival injection (8, 36.4%), hypopyon (7, 31.8%), fibrinoid anterior chamber reaction (6, 27.3%), and vitritis (1, 4.5%). The amount of time that elapsed between surgery and the diagnosis of endophthalmitis was between 1 and 13 days in most cases (19, 86.4%) (Figure 5). Visual acuity at presentation ranged from no light perception to 20/160 (Figure 6) and final visual acuity ranged from no light perception to 20/50 (Figure 7). The organisms cultured included *Staphylococcus aureus* (7, 31.8%), *Streptococcus pneumoniae* (4, 18.2%), methicillin-resistant *Staphylococcus aureus* (1, 4.5%), *Haemophilus influenzae* (1, 4.5%), enterococci (1, 4.5%), and other pathogens that were not specified. Three cases (13.6%) had negative cultures.

Further complications of endophthalmitis following pediatric cataract surgery included retinal detachment (6, 27.3%), phthisis (6, 27.3%), corneal edema or opacification (5, 22.7%), posterior capsule opacification (5, 22.7%), and hypotony (4, 18.2%) (Figure 8).

Practice Patterns Among Ophthalmologists Who Encountered Endophthalmitis

In 17 (77.3%) cases, subconjunctival antibiotics and/or steroids were injected at the end of cataract surgery. Of those, antibiotics and steroids were combined in 14 (82.4%) cases and only steroids were injected in 3 (17.6%). In 15 (68.2%) cases, prophylactic intracameral antibiotics were administered during surgery as recommended in adults. Of these, ophthalmologists in 4 (26.7%) cases began using intracameral prophylaxis after its use was advocated in adults, whereas the ophthalmologist in 1 (6.7%) case began using it after experiencing a case of endophthalmitis following pediatric cataract surgery. In 10 (67%) cases in which intracameral antibiotics were injected, the type of antibiotic used was specified: vancomycin (5, 50%), cefuroxime (3, 30%), and moxifloxacin (2, 20%).

The ophthalmologists in 12 (54.5%) cases reported that they usually perform a pars plana vitrectomy when they suspect endophthalmitis following pediatric cataract surgery. In 19 (86.4%) cases, the reporting ophthalmologists stated that they usually perform a tap and inject antibiotics into the vitreous, whereas the ophthalmologists in 9 (40.9%) cases reported usually performing a tap and injecting antibiotics in the anterior chamber. The ophthalmologists in 19 (86.4%) cases reported that they routinely obtain Gram-stain aerobic and anaerobic cultures, whereas only some order a fungal culture (8 cases, 36.4%) or potassium hydroxide (5 cases, 22.7%).

The most common therapeutic modality used was a combination of intravitreal, systemic, and topical antibiotics (8, 36.4%), followed by a combination of intravitreal and topical antibiotics with corticosteroids (5, 22.7%) and the

use of only intravitreal antibiotics (5, 22.7%). Intravitreal and topical antibiotics were combined in only 3 (13.6%) cases and 1 (4.5%) case did not specify the treatment modality.

Discussion

Endophthalmitis following pediatric cataract surgery is uncommon but usually leads to a poor visual outcome. A PubMed search using the search terms "endophthalmitis," "postoperative," "cataract," and "pediatric" (either separately or combined as appropriate) revealed few principal studies on the subject (Table 2). Only 3.4% of participants in our survey had such a complication, thus illustrating the rarity of endophthalmitis following pediatric cataract surgery. Furthermore, the total number of 22 cases encountered by 237 surgeons in our series may be an over-estimation of the true incidence of endophthalmitis following pediatric cataract surgery because one surgeon alone reported more than 6 cases. Unfortunately, the nature of our survey and the anonymous status of our responders prevented us from pursuing further information regarding factors that may have led to an increased risk of endophthalmitis following pediatric cataract surgery in a particular surgeon's practice. Wheeler et.al. 6 found an incidence of 0.07% after pediatric cataract or glaucoma surgery, again emphasizing the rarity of this condition. Smaller studies also describe low incidences of endophthalmitis following pediatric cataract surgery, ranging from 0% 9,10 to 0.45%.6 Most of the cases we reported occurred in North America, the Middle East, and Central America (27%, 27%, and 18%, respectively). This may indicate a higher incidence of endophthalmitis following pediatric cataract surgery in the latter two geographic areas compared to North America because the number of surgeons in Central America exceeded that of the other two areas significantly (Figure 1). However, this must be interpreted carefully given the design of our survey.

All ophthalmologists who encountered endophthalmitis following pediatric cataract surgery in our study had at least 5 years of surgical experience. Prolonged surgical time in a case of endophthalmitis following pediatric cataract surgery related to tearing of the bag that prompted implantation of the IOL in the sulcus was reported in only 1 (4.5%) case. This finding is in disagreement with findings from the European Society of Cataract and Refractive Surgery Endophthalmitis Study Group, which reported a 4.95 times higher risk of infection in patients suffering complications at the time of surgery, namely a torn posterior capsule. 11 In other adult studies, posterior capsule rupture has also been associated with endophthalmitis. 12,13 Unfortunately, preserving the posterior capsule is hardly ever possible in younger children, in whom posterior capsulotomy and anterior vitrectomy are commonly performed to prevent opacification of the visual axis. In our study, 86% of the reported cases of endophthalmitis following pediatric cataract surgery had undergone such a procedure.

Other cataract surgery aspects not addressed by our research have been linked to adult endophthalmitis, including zonular complications, sutureless incisions, and wound leak on the first postoperative day. 12 Preexisting systemic conditions such as upper respiratory tract infection and nasolacrimal duct obstruction were not evaluated in our study either, but they have been related to endophthalmitis following pediatric cataract surgery and it seems important to screen for them and treat them before performing cataract extraction. 7

Most of the reported endophthalmitis cases occurred in children 2 to 4 years of age (36.4%), followed by children 1 to 2 years of age (18.2%). Whether this is related to the fact that IOL implantation is more frequent in children after 1 year of age 3 remains unknown. In this study, slightly more eyes with endophthalmitis following pediatric cataract surgery were pseudophakic (59.1%). Silicone IOLs have been associated with a higher risk of infection, 14 but the role of the material of an IOL as a source of pathogens is not free of controversy. 15 More than 50% of eyes with endophthalmitis following pediatric cataract surgery that were pseudophakic in our survey received acrylic lenses. However, this is likely explained by the preferred use of acrylic lenses in children because the lenses are linked to a lower risk of posterior capsular opacification. 16

More than 50% of the cases of endophthalmitis following pediatric cataract surgery in the current study presented within 4 days after surgery. Therefore, early postoperative evaluation is important because endophthalmitis following pediatric cataract surgery can manifest as soon as the first postoperative day. ⁷ According to our findings, subsequent evaluations for the first 2 weeks are necessary to identify additional cases. Moreover, because it is known that children are unable to express their symptoms accurately, ⁵ it is important to maintain a high index of suspicion. Early identification of symptoms such as photophobia, pain, crying, sleeplessness, and poor feeding and signs such as conjunctival injection, hypopyon, fibrinoid anterior chamber reaction, and vitritis should help establish an earlier diagnosis of endophthalmitis following pediatric cataract surgery.

Similar to other authors, ^{6,7} Gram-positive bacteria that normally belong to the conjunctival and upper respiratory tract flora were the most common organisms identified in this study. *Staphylococcus aureus* (31.8%) and *Streptococcus pneumoniae* (18.2%) were cultured in 50% of the cases of endophthalmitis following pediatric cataract surgery reported. Among ophthalmologists who responded to the survey, the use of prophylactic antibiotics was common; more than three-quarters of the ophthalmologists injected subconjunctival antibiotics at the end of the procedure and 68% injected intracameral antibiotics. There is no comparative data on the use of intracameral antibiotics in pediatric cataract surgery, but vancomycin was the most common medication used, followed by cefuroxime. Use of the latter antibiotic, which promotes strong activity against Gram-positive bacteria, is in keeping with a 5- to 6-fold decreased risk of endophthalmitis found in the European Society of Cataract and Refractive Society multicenter study when the medication was used. ¹¹

The overall visual outcome of endophthalmitis following pediatric cataract surgery in this review was poor, despite the different therapeutic modalities used by participants once the diagnosis was established. Early intervention was the only factor that resulted in good vision, 5 and 3 eyes in this study had a final visual acuity of 20/60 or better. Nevertheless, 18 (81%) and 8 (36.3%) eyes had a final visual acuity of counting fingers or worse and no light perception, respectively.

Fortunately, endophthalmitis following pediatric cataract surgery is uncommon. Because the visual prognosis is usually poor and this complication is multifactorial, all efforts directed at minimizing the risk of endophthalmitis must be made. Our understanding of potential risk factors is only partial and needs further research. Treating potential predisposing systemic conditions and improving sterilization techniques seem intuitively reasonable. Optimizing the operative conditions to reduce complications and surgery duration and using subconjunctival and intracameral antibiotics with activity against Gram-positive organisms may decrease the incidence of endophthalmitis following pediatric cataract surgery. Early postoperative evaluation, subsequent follow-up visits, and keeping a high index of suspicion should facilitate the recognition of endophthalmitis following pediatric cataract surgery to avoid delaying treatment.

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- 1. How many years have you been practicing pediatric ophthalmology?
- 2. Where do you practice ophthalmology?
- 3. How many cases of endophthalmitis after cataract surgery in children did you encounter?
- 4. What was the age of the patient with endophthalmitis after cataract surgery?
- 5. Who performed the cataract surgery?
- 6. In the case of endophthalmitis that you encountered, was an intraocular lens implanted?
- 7. What kind of lens was implanted in this case?
- 8. Where was the lens implanted?
- 9. Was a vitrectomy and posterior capsulotomy performed?
- 10. Did a surgical complication prolong the surgery?
- 11. If yes, please specify the complication.
- 12. What was the first common clinical sign of endophthalmitis?
- 13. What was the time interval between surgery and the diagnosis of endophthalmitis?
- 14. What was the visual acuity at presentation?
- 15. What were the child's or guardian's complaints?
- 16. Diagnosis-do you usually perform a pars plana vitrectomy in cases of suspected endophthalmitis?
- 17. Diagnosis-do you usually perform a tap and inject into the vitreous in cases of suspected endophthalmitis?
- 18. Diagnosis-do you usually also perform an anterior chamber tap and inject?
- 19. What type of cultures do you request?
- 20. What kind of organism was found in the culture?
- 21. Did you encounter any complications of the pars plana vitrectomy or tap and inject into the vitreous?
- 22. What kind of complications?
- 23. What is your common management of endophthalmitis?
- 24. What was the final visual acuity?
- 25. What are the common complications of endophthalmitis that you encounter?
- 26. Do you administer prophylactic intracameral antibiotic treatment during surgery as recommended in adult cataract surgery?
- 27. Why did you start intracameral prophylaxis?
- 28. What intracameral antibiotic do you inject?
- 29. Do you inject intracameral steroids at the end of surgery?
- 30. Did you have any complications?

•31. Do you inject subconjunctival antibiotics and/or steroids at the end of the surgery?

•32. Comments.

Author (Year)	Type of Study	Number of Cases	Age Range (Mean)	Culture Site (%)	Most Common Organism	Management	Follow-up (Mean)	Final Visual Acuity (BCVA)	NLP (%)	DL (%)	OC (%)
Agarkar et al. 4 (2016)	Case series	9	5 months to 14 years (6.6 years)	Vitreous (5/9; 0.56%)	G +ve cocci (2/9; 22%); G -ve bacilli (2/9; 22%); G +ve bacilli (1/9; 11%); G -ve coccobacilli (1/9; 11%)	IOAB 100%; vitrectomy (5/9; 0.56%)	0.8 to 7 years (4.8 years)	200/20 to 20/400 (6/9; 67%); HM-CF (1/9; 11%); LP 0%; NLP (1/9; 11%)	0%	0%	0.376%
Smith et al. 5 (2006)	Case report	1	6 years	Vitreous	G +ve cocci	IOAB + vitrectomy	6 weeks (0.1 years)	20/20	0%	0%	Wheeler et al. 6 (1992)

Survey	17	(0.04 to 0.2 years)	N/A	G +ve cocci (36%)	IOAB (64%); vitrectomy (50%)	N/A	20/20 to 20/400 (29%); HM (6%); NLP 65%	47%	0.07% (of infants)	Good et al. 7 (1990)
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DETAILS

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