

# Topical anesthesia: Possible risk factor for endophthalmitis after cataract extraction

Jose Garcia-Arumi, MD, Alex Fonollosa, MD, Laura Sararols, MD, Francesc Fina, MD, Vicente Martínez-Castillo, MD, Ana Boixadera, MD, Miguel A. Zapata, MD, Magda Campins, MD

**PURPOSE:** To assess the relationship between the risk for acute endophthalmitis after cataract extraction and whether certain factors, such as surgeon qualification, numerical order, duration of surgery, operating theater, and type of anesthesia (topical or retrobulbar), could be modified to decrease the risk.

**SETTING:** Single-center academic practice.

**METHODS:** Two epidemiological studies were performed: a case-control study and a retrospective cohort study. The surgical records of all patients with clinically diagnosed endophthalmitis within 30 days after cataract surgery performed between February 2002 and September 2003 were reviewed. The endophthalmitis cases were compared with 108 randomly selected controls (4 controls per case). The global incidence of endophthalmitis and the incidence according to type of anesthesia were calculated.

**RESULTS:** Of 5011 cataract extractions performed, 27 cases of endophthalmitis occurred. The incidence was 5.39 per 1000 procedures. An independent statistically significant relationship was found between endophthalmitis and the use of topical anesthesia (odds ratio [OR], 11.8; 95% confidence interval [CI], 2.4-58.7) and surgery longer than 45 minutes (OR, 7.2; 95% CI, 1.7-29.7) but not between the other variables. The incidence of endophthalmitis was 1.8 per 1000 cataract extractions with retrobulbar anesthesia and 6.76 per 1000 with topical anesthesia (relative risk [RR], 3.76; 95% CI, 0.89-15.85). After the start of the study period was extended to May 2001, the incidence of endophthalmitis was 1.3 per 1000 cataract extractions with retrobulbar anesthesia and 8.7 per 1000 with topical anesthesia (RR, 6.72; 95% CI, 1.63-27.63).

**CONCLUSION:** Results suggest that there may be an association between topical anesthesia and endophthalmitis after cataract extraction.

*J Cataract Refract Surg 2007; 33:989-992 © 2007 ASCRS and ESCRS*

Acute postoperative endophthalmitis is a rare but severe complication of cataract extraction. Several factors, such as vitreous loss, the patient's relative immunosuppression, and chronic dacryocystitis, are known to increase the risk. The clear corneal incision<sup>1</sup> and the use of topical anesthesia<sup>2</sup> are currently being investigated as potential risk factors for the development of this sometimes devastating complication.

In 2003, an increase in endophthalmitis after cataract extraction was detected at our center. Hence, an epidemiological study was set up to determine the incidence of endophthalmitis and investigate the modifiable risk factors associated with this infection. These included the surgeon's qualification (specialist or resident), the operating theater, the numerical order and duration of surgery, and the type of anesthesia used (topical

or retrobulbar). This information would allow us to implement control measures.

## PATIENTS AND METHODS

### Setting

The center is a public referral hospital providing surgical procedures and outpatient visits for the population of northern Catalonia (approximately 3 million inhabitants). The Department of Ophthalmology has 20 consulting ophthalmic surgeons and 14 residents. This department performs 6800 surgeries, 25500 emergency visits, and 62000 outpatient visits per year.

### Preoperative Preparation and Surgical Technique

All patients received the same preoperative and intraoperative preparation. Starting 1 week before the procedure, the

eyes were treated with ciprofloxacin (1 drop every 8 hours) and the eyelids and eyelashes with a hygienic solution of boric acid 1.5%, ethylenediaminetetraacetic acid 0.1%, and propylenglycol 1.9% (Cilclar) twice a day. In the operating room, the lids were prepped with povidone-iodine 10% solution. The lids were covered with povidone-iodine swabs, and the surrounding skin was painted with the swabs in a spiral fashion. Diluted povidone-iodine (5%) was then instilled in the cul-de-sac. The eyelids were dried 3 minutes later and surgery started.

Cataract extraction was performed with a standard 2-port phacoemulsification technique with insertion of a foldable intraocular lens. Incisions were made in clear superior cornea in all cases. No preincisions were created. The corneal incisions were hydrated after surgery and sutured when leaking was observed. If vitreous loss occurred, an anterior vitrectomy was performed.

### Patients and Epidemiological Investigation

**Case-Control Study** A case was defined as a patient with clinically diagnosed endophthalmitis (major inflammation of the vitreous cavity and anterior chamber) occurring within 30 days after cataract surgery. Cases were identified from the Ophthalmology Department's clinical records of patients who had surgery between February 1, 2002, and September 30, 2003. The same person (A.F.) collected all data. Controls for each endophthalmitis case were randomly selected from the surgical activity records. The controls had cataract extraction at the hospital during the same period as the cases: February 1, 2002, to September 30, 2003.

The following information was recorded for each patient: date of surgery, order and duration of surgery (from the time of the incision to the time of completing the last part of surgery), operating theater (A or B), surgeon's qualification (staff or intern-resident), and type of anesthesia (topical or retrobulbar). The variables order of surgery and duration of surgery were categorized in 4 strata that were homogeneous according to the rate of patients included.

Univariate and multivariate logistic regression analyses were used to identify independent risk factors for endophthalmitis. Crude and adjusted odds ratios (ORs) and 95% confidence interval (CIs) were obtained.

**Retrospective Cohort Study** The incidence of endophthalmitis (95% CI) was calculated as the number of endophthalmitis cases detected during the study period per 1000 cataract extractions. Information about the type of anesthesia was obtained from all patients operated on at the center

during the study period. The same person (A.F.) collected these data. The incidence of endophthalmitis was calculated for each type of anesthesia. Relative risk (RR) (95% CI) for topical anesthesia was obtained by comparing the 2 incidence rates.

To prove the reliability of the results and increase the statistical power, information about endophthalmitis and type of anesthesia was recorded for all patients operated on during the 9 months before the study period (May 2001 to January 2002). The incidence for each type of anesthesia and the RR for topical anesthesia were then recalculated for the whole period (May 1, 2001, to September 30, 2003).

### RESULTS

From February 2002 to September 2003, 5011 cataract extractions were performed; 27 cases of endophthalmitis occurred in this group. Microbiological investigation was performed in 89% of cases (92% of samples were obtained from vitreous humor), and 87.5% were positive. Coagulase-negative *Staphylococcus* was the most frequently isolated microorganism (62% of positive cases), followed by *Staphylococcus aureus*. There were no cases of postoperative wound leaks or hypotony. Three intraoperative complications occurred: capsule rupture with vitreous loss in 2 cases and capsule disinsertion in another, which was treated with insertion of a capsular ring. A suture was used in these complicated cases. The rest of the patients did not have a suture placed. Two of the cases of endophthalmitis were diabetic patients. Among controls, complications occurred in 10 cases: 7 capsule ruptures with vitreous loss and 3 capsule disinsertions. Again, sutures were used only in complicated cases. The prevalence of diabetes was 7%.

The incidence of endophthalmitis was 5.39 per 1000 procedures (95% CI, 3.7-10.3). Case occurrence did not show a seasonal pattern. Incidence rates for endophthalmitis according to operating theater were 5.89 per 1000 procedures in operating theater A and 4.94 per 1000 procedures in operating theater B ( $P = .64$ ).

The 27 endophthalmitis cases were compared with 108 randomly selected controls (4 controls per case). **Table 1** shows bivariate and multivariate analysis between cases and controls. The type of anesthesia was an important risk factor for developing endophthalmitis. Patients in whom topical anesthesia was used were 5.9 times more likely to develop endophthalmitis (OR, 5.9; 95% CI, 1.3-26.4). An independent relationship was also observed between duration of surgery and type of anesthesia. The mean duration of cataract extraction was 33 minutes with topical anesthesia and 45 minutes with retrobulbar anesthesia ( $P < .001$ ). After categorizing the variable of duration of surgery, longer surgery was associated with an increased risk for endophthalmitis (trend  $P < .001$ ). Surgery longer than 45 minutes was also an independent risk factor

---

Accepted for publication February 11, 2007.

From the Department of Ophthalmology (Garcia-Arumi, Fonollosa, Sararols, Martínez-Castillo, Boixadera, Zapata) and Department of Preventive Medicine and Epidemiology (Fina, Campins), Hospital Valle d'Hebrón, Universidad Autónoma de Barcelona, and the Instituto de Microcirugía Ocular (Garcia-Arumi), Barcelona, Spain.

No author has a financial or proprietary interest in any material or method mentioned.

Corresponding author: Alex Fonollosa, MD, Hospital Valle de Hebron, Paseo Valle de Hebron 119-129, 08035, Barcelona, Spain. E-mail: 36427afc@comb.es.

**Table 1.** Bivariate and multivariate analysis of the variables investigated as risk factors for endophthalmitis.

Variable	Cases (n = 27)	Controls (n = 108)	Crude OR (95% CI)	Adjusted OR (95% CI)
Order of surgery (median)	5	6	—	—
Order of surgery (%)				
1-3	25.9	27.1	1	1
4-5	25.9	21.5	1.3 (0.4-4.1)	2.0 (0.5-7.8)
6-7	14.8	21.5	0.7 (0.2-2.8)	1.3 (0.3-5.9)
8-12	33.3	29.9	1.2 (0.4-3.6)	2.1 (0.6-7.5)
Surgeon (%)				
Staff	51.9	68.3	1	1
Intern-resident	48.1	31.7	2.0 (0.8-4.7)	1.5 (0.6-3.9)
Duration of surgery (median)	36	40		
Duration of surgery (%)				
10-28 min	14.8	27.1	1	1
29-34 min	11.1	18.7	1.1 (0.2-5.4)	1.4 (0.3-6.9)
35-44 min	40.7	30.8	2.5 (0.7-8.4)	3.4 (1.0-12.3)
45-90 min	33.3	23.4	2.6 (0.7-9.5)	7.2 (1.7-29.7)
Type of anesthesia (%)				
Retrolubar	7.4	32.1	1	1
Topical	92.6	67.9	5.9 (1.3-26.4)	11.8 (2.4-58.7)

CI = confidence interval; OR = odds ratio

significantly associated with endophthalmitis (OR, 7.2; 95% CI, 1.7-29.7) (Table 1).

No statistically significant associations were detected for the rest of the variables investigated.

Information about the type of anesthesia was available for 4807 of 5011 patients (95.3%) operated on between February 1, 2002, and September 30, 2003. The incidence of endophthalmitis during this period was 1.80 per 1000 cataract extractions with retrolubar anesthesia and 6.76 per 1000 extractions under topical anesthesia (RR, 3.76; 95% CI, 0.89-15.85). During the 9 months before the study period, the incidence of

endophthalmitis was 0 per 1000 cataract extractions with retrolubar anesthesia and 12.67 per 1000 extractions with topical anesthesia.

For the entire period, the incidence of endophthalmitis was 1.3 per 1000 cataract extractions with retrolubar anesthesia and 8.7 per 1000 extractions with topical anesthesia (RR, 6.72; 95% CI, 1.63-27.63) (Table 2).

## DISCUSSION

Endophthalmitis is probably the most severe complication of cataract extraction. Several factors (eg, vitreous loss, patient's relative immunosuppression, chronic dacryocystitis) are known to increase the risk for this complication, whereas the potential role of other variables remains controversial.<sup>3</sup> Some authors suggest that topical anesthesia is a possible risk factor for the development of endophthalmitis. Ellis<sup>2</sup> conducted a retrospective study to investigate this issue. He performed 219 surgeries using topical anesthesia and 414 using retrolubar anesthesia during a 31-month period. The rate of endophthalmitis was 1.8% for topical anesthesia and 0.48% for retrolubar anesthesia. After this, there was a change to performing all cataract surgery using retrolubar anesthesia. No cases of endophthalmitis were noted in the next consecutive 453 cases over 17 months. Monica and Long<sup>4</sup> report their complication rate after 9 years of topical clear corneal cataract surgery. No endophthalmitis cases were observed. An explanation for this could be that these authors make a more stable incision.

**Table 2.** Incidence rate and relative risk for endophthalmitis according to type of anesthesia (May 2001 to January 2002 and February 2002 to September 2003).

Type of Anesthesia and Dates	Cases	n	Incidence Rate (×1000)	Relative Risk (95% CI)
May 01-Jan 02				
Retrolubar	0	432	0	
Topical	23	1815	12.67	5.66 (0.77-41.73)
Feb 02-Sep 03				
Retrolubar	2	1111	1.80	
Topical	25	3696	6.76	3.76 (0.89-15.85)
Global				
Retrolubar	2	1543	0.65	
Topical	48	5511	8.17	6.72 (1.63-27.63)

CI = confidence interval

They perform pachymetry over the temporal corneal area and calculate 75% of the corneal thickness to set the depth of the incision with a diamond knife. They complete the 3-plane incision with a 3.0 mm metal keratome blade.

We found a statistically significant independent association between the use of topical anesthesia and endophthalmitis. According to our data, the risk for endophthalmitis was 6-fold greater when topical anesthesia was used than with retrobulbar anesthesia, despite the longer surgery and baseline complexity of cataract extraction performed under retrobulbar anesthesia. A possible bias could be that older (more skilled) surgeons would use retrobulbar anesthesia and be less likely to have endophthalmitis develop in their patients because they have been doing the procedure for a much longer time. We excluded this possibility because both variables—surgeon qualification and type of anesthesia—were introduced in the multivariable analysis and only topical anesthesia maintained an association with endophthalmitis.

Two pathophysiological mechanisms might explain the association between topical anesthesia and endophthalmitis. Eyes that have been operated on under topical anesthesia blink immediately after surgery; this pressure could cause the surgical incisions to open during the first few hours before the wounds have healed and bacteria from the patient's periocular flora might enter through the unstable incisions. A way to avoid this mechanism could be Monica and Long's<sup>4</sup> technique of making corneal incisions.

Moreover, during surgery, some patients cannot keep their eyes still. Hence, the corneal incisions might reach the conjunctival fornix, eyelids, and eyelashes, which can harbor microorganisms.

Reported endophthalmitis rates from specific centers after 1990 range from 0.36 per 1000 surgeries to 4 per 1000 surgeries.<sup>5-9</sup> The incidence at our center was 5.39 per 1000 procedures, which is a bit higher than these reported rates. Taban et al.<sup>1</sup> conducted a systematic review to determine the reported incidence of acute endophthalmitis after cataract surgery and investigate possible risk factors. The authors report that the incidence increased over the past decade, coinciding with the development of sutureless clear corneal incisions. Nevertheless, Miller et al.<sup>10</sup> found no upward trend in endophthalmitis frequency after this type of incision was introduced into surgical practice at their institution. West et al.<sup>11</sup> conducted a study to estimate the annual incidence of presumed endophthalmitis cases after cataract surgery. Their findings suggest that endophthalmitis rates increased in the U.S. between 1994 and 2001.

Our results indicate a possible association between topical anesthesia and endophthalmitis and may explain the growing incidence of endophthalmitis some authors report. Because topical anesthesia has become very popular over the past few years and most cataract extractions are performed using this type of anesthesia, we believe a prospective study is warranted to confirm our findings.

## REFERENCES

1. Taban M, Behrens A, Newcomb RL, et al. Acute endophthalmitis following cataract surgery: a systematic review of the literature. *Arch Ophthalmol* 2005; 123:613-620
2. Ellis MF. Topical anesthesia: a risk factor for post-cataract-extraction endophthalmitis? *Clin Exp Ophthalmol* 2003; 31: 125-128
3. Menikoff JA, Speaker MG, Marmor M, Raskin EM. A case-control study of risk factors for postoperative endophthalmitis. *Ophthalmology* 1991; 98:1761-1768
4. Monica ML, Long DA. Nine-year safety with self-sealing corneal tunnel incision in clear cornea cataract surgery. *Ophthalmology* 2005; 112:985-986
5. Eifrig CWG, Flynn HW Jr, Scott IU, Newton J. Acute-onset postoperative endophthalmitis: review of incidence and visual outcomes (1995-2001). *Ophthalmic Surg Lasers* 2002; 33: 373-378; erratum 2003; 34:80
6. Mayer E, Cadman D, Ewings P, et al. A 10 year retrospective survey of cataract surgery and endophthalmitis in a single eye unit: injectable lenses lower the incidence of endophthalmitis. *Br J Ophthalmol* 2003; 87:867-869
7. Riley AF, Malik TY, Grupcheva CN, et al. The Auckland Cataract study: co-morbidity, surgical techniques, and clinical outcomes in a public hospital service. *Br J Ophthalmol* 2002; 86:185-190
8. Bohigian GM. A study of the incidence of culture-positive endophthalmitis after cataract surgery in an ambulatory care center. *Ophthalmic Surg Lasers* 1999; 30:295-298
9. Aaberg TM Jr, Flynn HW Jr, Schiffman J, Newton J. Nosocomial acute postoperative endophthalmitis survey; a 10-year review of incidence and outcomes. *Ophthalmology* 1998; 105:1004-1010
10. Miller JJ, Scott IU, Flynn HW Jr, et al. Acute-onset endophthalmitis after cataract surgery (2000-2004): incidence, clinical settings, and visual acuity outcomes after treatment. *Am J Ophthalmol* 2005; 139:983-987
11. West ES, Behrens A, McDonnell PJ, et al. The incidence of endophthalmitis after cataract surgery among the U.S. Medicare population increased between 1994 and 2001. *Ophthalmology* 2005; 112:1388-1394



First author:

**Jose Garcia-Arumi, MD**

*Department of Ophthalmology, Hospital Valle d'Hebrón, Universidad Autónoma de Barcelona, and Instituto de Microcirugía Ocular, Barcelona, Spain.*