

ORIGINAL ARTICLE

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Comparison of preoperative anti-infective preparations for extracapsular lens extraction

ABSTRACT

Objective

To investigate the effect of three preoperative anti-infective regimens on the sterility of anterior-chamber aspirates (ACA) in eyes undergoing extracapsular cataract extraction (ECCE).

Methods

Ninety eyes scheduled to undergo ECCE were randomly assigned to receive one of the following preoperative anti-infective regimens: Group 1 (Control) – no additional preoperative preparation; Group 2 (Eye drop) – neomycin/polymixin B/gramicidin eye drops applied 3 times daily for 3 days prior to surgery; and Group 3 (Lid scrub) – neomycin/polymixin B/ bacitracin ointment lid scrub applied 3 times prior to surgery. ACAs were obtained from all eyes at the conclusion of surgery and cultured. The patients were followed up for 3 months after the surgery.

Results

Positive cultures developed from ACAs in 5 (16.6%) of 30 eyes from Group 1, in 0 of 30 from Group 2, and in 3 (10%) of 30 from Group 3. No eye developed endophthalmitis. Compared with the control group, preoperative neomycin/polymixin B/gramicidin eye drops significantly reduced the ACA contamination rate ($p = 0.03$).

Conclusion

Preoperative neomycin/polymixin B/bacitracin eyedrops can improve the sterility of the anterior chamber during ECCE.

Keywords: *Extracapsular lens extraction, Cataract, Endophthalmitis, Neomycin, Polymixin, Gramicidin, Bacitracin*

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No financial assistance was received for this study.

The authors have no proprietary or financial interest in any product used or cited in this study.

ONE of the most devastating complications of cataract surgery is endophthalmitis. Untreated, it may lead to blindness or poor visual outcomes. Even after vitrectomy and intravitreal antibiotic injection, up to half of patients who develop endophthalmitis can become legally blind. Most clinical investigations have looked at modes of treatment or risk factors for endophthalmitis while only a few studies have focused on preventive measures.^{1,2}

While cataract extraction is performed using sterile techniques, microorganisms can be found within the area of surgery and the eye itself.³⁻⁷ The size of bacterial inoculum⁸ and absence of an intact posterior capsule⁹ are risk factors for bacterial endophthalmitis. The role of host resistance is still not fully determined although diabetes mellitus is the most common systemic disorder associated with endogenous bacterial endophthalmitis.¹⁰

This study investigated the efficacy of 3 preoperative prophylactic anti-infective preparations on the sterility of anterior-chamber (AC) aspirates after uncomplicated cataract extraction.

METHODOLOGY

Ninety eyes of 90 patients admitted for extracapsular cataract extraction (ECCE) at the University of the Philippines–Philippine General Hospital from January 1 to December 30, 1994 were prospectively enrolled. Patients with previous eye surgery or trauma, concurrent ocular or systemic infection, intake or application of antibiotics within 1 month prior to surgery, and posterior-capsule rupture were excluded. Informed consent was obtained from all patients. The study protocol was approved by the institutional review board.

The patients were randomly assigned using a random number generator into 3 groups of 30 patients each: Group 1 (Control) eyes underwent the standard preoperative procedures outlined below; Group 2 (Eye drop) eyes received neomycin/polymixin B/gramicidin (NPG) eye drops 3 times daily starting 3 days prior to surgery; Group 3 (Lid scrub) eyes underwent lid scrub with neomycin/polymixin B/bacitracin (NPB) ointment 1 day, 12 hours, and 6 hours prior to surgery. The lid scrub was performed by one person (HSU). All 10 surgeons and concerned laboratory personnel were masked as to the treatment schedule of the individual patients.

Standard preoperative procedures

Eyelash clipping and gentamicin lid scrub were performed the night before surgery. The surgical field was prepared using povidone–iodine soap, taking care to scrub the eyelids, periorbital area, nose, and forehead thoroughly. This was followed by the application of povidone–iodine 10% solution onto the eyelids and the conjunctival fornices. The solution was then washed out

with sterile balanced saline solution. Sterile linen eye drapes were used for all eyes. Instruments used were sterilized by a 30-minute immersion in 0.55% orthophthalaldehyde (Cidex, Johnson & Johnson, Brunswick, NJ, USA). The intraocular infusion fluid was balanced saline solution (BSS).

Surgical technique

A superior fornix-based conjunctival flap was created. Hemostasis was achieved using a cautery ball. The AC was entered at the limbal area with a blade 11 and ophthalmic viscoelastic device (OVD) was injected to fill the AC. An anterior capsulotomy was created with a gauge-27 cystotome. A superior limbal incision was created with a blade 15 and corneal scissors. The lens nucleus was expressed and delivered out of the eye. The limbal incision was sutured with 5 nylon 10-0 sutures. Irrigation and aspiration of the remaining cortical-lens material was performed under continuous irrigation using a Simcoe tip. OVD was reinjected into the AC and a one-piece polymethylmethacrylate lens inserted into the capsular bag using forceps. The OVD was aspirated and nylon 10-0 sutures were added to achieve a watertight AC. Samples for microbial cultures were obtained as described in the next section. The total operative time rounded off to the nearest 5 minutes was recorded. The patients were followed up for a period of three months after surgery. No cases of acute endophthalmitis were observed among the patients during this period.

Specimen collection

The AC was reformed with infusion fluid and 0.1 ml of aqueous was removed using a sterile gauge-27 cannula attached to a tuberculin syringe.

The syringe was closed with a sterile cap and immediately sent to the microbiology lab where the aspirated fluid was divided and incubated onto the following media: thioglycolate broth, blood agar plate, MacConkey agar plate, chocolate agar plate, and Sabouraud's agar. These media were chosen so as to facilitate growth of a wide variety of organisms. The cultures were incubated at 37 degrees Centigrade for 2 weeks to allow growth of slowly growing organisms such as fungi. Bacterial growths were termed positive only if present within 4 days of incubation in the inoculated areas. Growths were analyzed for organisms. All laboratory procedures were performed by experienced laboratory personnel using accepted microbiological techniques.

The culture results were tabulated according to treatment group, length of surgery, and surgeon. The contamination rate was determined for each group. Descriptive statistics are reported. Fisher's exact test was used to determine whether significant differences in contami-

nation rates existed for each treatment group. The mean duration of surgery among the treatment groups was compared using t-test. The *p* value was considered significant if less than or equal to 0.05.

RESULTS

There were no significant differences in the length of surgery among the three groups. None of the patients developed endophthalmitis.

In Group 1 (Control), AC aspirates were positive for bacterial contamination in 5 (16.6%) of 30 eyes; in Group 2 (Eye drop), no positive cultures were obtained from 30 eyes; while in Group 3 (Lid scrub), AC aspirates were positive for bacterial contamination in 3 (10%) of 30 eyes. There were no significant differences in contamination rates between Groups 1 and 3 (*p* = 0.12) and between Groups 2 and 3 (*p* = 0.35). However, Group 2 had a significantly lower contamination rate than Group 1 (*p* = 0.03).

The most common organism isolated was *Staphylococcus epidermidis*. Other organisms were *Bacillus sp.*, *Acinetobacter sp.*, *Achromobacter sp.*, and *Enterococcus sp.* There were no cases of mixed bacterial cultures or fungal growth.

The distribution of contaminated AC aspirates per surgeon was as follows: 4 surgeons did not submit contaminated AC aspirates, 4 surgeons submitted 1 contaminated sample, and 2 surgeons submitted 2 contaminated samples.

One patient developed toxic keratitis after instillation of preoperative eyedrops. However, the keratitis was of a mild degree and did not prevent continuation of the planned surgery. No other complications attributable to preoperative anti-infective preparation were observed.

DISCUSSION

Despite following preoperative aseptic procedures, we still isolated bacteria in a significant number of eyes undergoing uneventful cataract extraction. This study supports the findings of previous reports that revealed AC contamination rates of up to 43% following cataract surgery.¹¹ These findings emphasize the importance of prophylactic measures to minimize microbial contamination during cataract surgery.

There are several sources of microbial contamination during cataract surgery, including intraocular fluids used for irrigation and aspiration, surgical instruments, and surrounding anatomical structures such as the eyelids and conjunctiva.¹² The microorganisms found in this study have been previously isolated from different ocular tissues particularly *S. epidermidis*, which is the most frequent organism found in lens-extraction-related endophthalmitis.¹³

The major source of bacterial contamination during cataract surgery is a subject of controversy. This study

demonstrated that consistent sterility of the anterior chamber was best achieved with application of preoperative antibiotic eye drops to the conjunctival fornices rather than with antibiotic lid scrub. This finding suggests that the conjunctiva rather than the eyelids are the major source of bacteria entering the AC during cataract extraction. However, other studies pointed to the eyelids as the main source of intraoperative contaminants.¹⁴ Because there are multiple sources of microbial contamination, the logical strategy to avoid contamination is to combine different aseptic regimens, including preoperative antibiotic eye drops, antibiotic eyelid scrub, sterile drapes to isolate the eyelashes, povidone-iodine instillation prior to the start of surgery, intracameral antibiotics, and postoperative antibiotic eye drops.

NPG eye drops and NPB ointment have multiple active agents and have been shown by Whitney and colleagues to be effective antibiotic combinations against a broad spectrum of bacteria.¹⁵ While NPG eye drops are frequently administered for postoperative chemoprophylaxis, preoperative NPG is not routinely used. The main disadvantage of preoperative antibiotic eye drops is the potential for toxic keratitis which may lead to patient discomfort, delayed visual recovery, and even postponement of the surgery because of decreased corneal clarity. However, given the catastrophic consequences of endophthalmitis, the risk-to-benefit ratio will likely favor preoperative antibiotic use. Newer antibiotics with single active agents, such as fluoroquinolones, may cause less toxic keratitis and may be more suitable for chemoprophylaxis.

The factors that prevented endophthalmitis in this series despite several cases of AC contamination include intact posterior capsules that block microbial entry into the vitreous cavity, use of aseptic procedures that likely limited the number of bacteria entering the eye, innate intraocular protective mechanisms that eliminate bacterial contaminants, and use of postoperative antibiotics. Animal eyes have been demonstrated to possess an ability to clear a small number of bacterial inoculum from the AC.⁸ Despite these protective mechanisms, it is still prudent to institute measures to prevent sight-threatening endophthalmitis that often strikes without warning.

Perioperative application of povidone-iodine 10% solution can reduce conjunctival bacterial counts.⁵ When combined with preoperative antibiotic eye drops, an even greater reduction in conjunctival microbial contamination can be achieved.⁴ The use of multiple aseptic measures may synergistically decrease the risk of postoperative infection especially in susceptible cases such as eyes with compromised posterior capsules, eyes of immunocompromised patients, or eyes undergoing prolonged, multiple procedures.

The primary limitation of this series is the small sample size, which does not allow for direct determination of endophthalmitis rates. We also did not obtain colony counts of the specimens that were positive for microbial growth. This would have allowed quantitative analysis of bacterial loads.

In conclusion, preoperative topical NPG eye drops significantly decrease AC contamination in eyes undergoing uncomplicated cataract surgery. We recommend the use of multiple aseptic measures to minimize the risk for postoperative endophthalmitis.

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