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Microbiologic Analysis of Aqueous Humor in Phacoemulsification

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Purpose: This study was designed as a microbiologic survey of the fluids aspirated from the anterior chamber at the end of cataract extraction performed by phacoemulsification, and to correlate the contamination rate of the anterior chamber to the surgical technique used.

Methods: One hundred and one consecutive patients (126 eyes) who underwent cataract extraction by phacoemulsification and posterior chamber intraocular lens implantation were included in the study. Microscopical examination, culture, and determination of the number of colonies were carried out on the bacteria and fungi in the anterior chamber fluids aspirated at the end of surgery, before final suture placement.

Results: Anterior chamber fluids yielded positive cultures in nine specimens (8.14%), six of which were identified as coagulase-negative staphylococci. Quantification disclosed colony counts ranging between 2–10 and 10–40 per mL.

Conclusions: Preliminary results in a small population show that the contamination of the aqueous humor is significantly less frequent if the cataract extraction is performed by phacoemulsification. **Jpn J Ophthalmol 1999;43:162–165** © 1999 Japanese Ophthalmological Society

Key Words: Bacterial contamination, cataract surgery, phacoemulsification.

Introduction

Despite improved methods of prophylaxis and treatment, postoperative endophthalmitis remains an often devastating complication of cataract extraction. Because patients expect good visual outcome now more than ever, the development of postoperative endophthalmitis, despite its rarity, is extremely serious for both patient and physician. Its incidence is actually under 0.1%.[1–3] However, cataract surgery is the most frequently performed operation by ophthalmologists, and this percentage means too many cases of endophthalmitis.

The main sources of infection are contaminated fluids and equipment, the patient's endogenous bacterial flora, and airborne bacteria.[4,5] When endophthalmitis occurs, the source is likely to be bacteria from the anterior chamber at the conclusion of surgery.[6] It was determined that bacteria routinely enter the anterior chamber during cataract surgery, but there was no report of endophthalmitis in these culture-positive cases.[7,8]

Contamination of the anterior chamber might be correlated to the surgical technique used. The contamination rate of the aqueous humor is significantly lower (4–5%) if the cataract extraction is performed by phacoemulsification rather than by other methods (25–43%).[7,9–11] The probable reason for this is the very small corneoscleral incision required and the lower fluid exchange between the anterior chamber and the conjunctival sac during phacoemulsification.[12,13] This study was designed to microbiologically survey anterior chamber fluids at the end of cataract extraction performed by phacoemulsification, and to correlate the contamination of the anterior chamber to the surgical technique used.

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Materials and Methods

The study participants were 101 consecutive patients who had senile cataracts (126 eyes); 59 women and 42 men, ranging in age from 23–74 years (mean age = 60.6 ± 6.70 years). These patients underwent cataract removal followed by intraocular lens implantation at the Department of Ophthalmology of the Harran University School of Medicine, Sanliurfa, Turkey, between March 1997 and December 1997.

All patients met the following inclusion criteria: no previous surgery or penetrating injury to the eye, and no topical or systemic infection at the time of surgery and during the previous 3 weeks before surgery. Written informed consent was obtained from each patient. All operations were performed by the same eye surgeon (MG).

Postoperatively, each patient received 0.5% tropicamide drops (5 mg tropicamide preserved in 0.01 mg phenylmercuric nitrate), 10% phenylephrine drops (stabilized in 0.05% disodium ethylenediamine tetracetate and 0.1% sodium pyrosulfite), and diclofenac. No antibiotic drops or ointment were used. In the operating room the usual aseptic conditions were strictly observed. We keep the number of staff members in the surgical room as small as possible. In addition, requiring the surgical staff members to walk as quietly as possible in the operating room may contribute to the low contamination rate.

After eyelashes had been trimmed, the eyelids, eyebrows, nose, cheek, and forehead were scrubbed in concentric rings outward from the eye with a cotton ball dipped in 10% povidone iodine. New cotton balls were used for each cleaning. After a 3.2-mm-wide scleral Tunel incision was placed between the 10 o'clock and 1 o'clock positions, 2 mm away from the limbus, sodium hyaluronate was injected into the anterior chamber. A continuous curvilinear capsulorrhexis was made, approximately 6 mm in diameter. Hydrodissection and hydrodelineation of the lens were performed and the nucleus was phacoemulsified (Alcon Universal I; Alcon Labs, Fort Worth, TX, USA). An irrigating balanced salt solution was used for phacoemulsification and aspiration. After the scleral incision was widened to 5.5–6.0 mm, a single-piece intraocular lens then was implanted in the bag. Table 1 shows the types and manufacturers of intraocular lenses used. The surgery was finished with one 10/0 monofilament nylon suture.

New irrigating tubing, aspiration tubing, phaco tip, and drainage bag were used for each patient, and the phaco handpiece was sterilized between operations by flash autoclave. At the end of surgery, before final suture placement, a sterile syringe was placed into the anterior chamber and fluid (0.2 mL) was aspirated. The procedures used for the culturing and identification were consistent with current laboratory methods.[14,15] Blood, chocolate, Eosine Methylene Blue, and Saboraud dextrose agar were used as culture media for the growth of aerobic organisms and fungi. Cultures were incubated at 37°C and held for 14 days to evaluate the number of colonies, bacterial types, and fungus. The first inspection of the cultures was carried out to detect aerobic bacteria 48–72 hours after the beginning of incubation. The culture media was defined as positive if one or more colony was present. All these examinations were performed at the Clinical Microbiology Laboratory of Harran University School of Medicine.

Table 1. Types and Manufacturers of Intraocular Lenses Used

No. of Patients	Types of Intraocular Lenses
50	5.75 mm optic–12 mm haptic (Alcon-Cilco LX 90BD)
36	5.5 mm optic–12 mm haptic (Alcon-Crystal Type O5)
22	5 × 6 mm optic–12.5 mm haptic (Smart Ioptex)
18	6.25 mm optic–13 mm haptic (Alcon-Cilco LC 80BD)

Results

Nine (8.14%) of the 126 eyes were culture-positive. The most commonly isolated organisms were coagulase-negative staphylococci, occurring in six of the nine isolates. In the other two eyes, *Streptococcus pneumoniae*, and in the remaining eye, Gram-negative rod *Escherichia coli* were identified (Table 2). No fungus grew in any eye. Six of the nine positive cultures had between 2 and 10 colonies and the other three had between 10 and 40 colonies.

Table 2. Bacteria Identified in Anterior Chamber Fluids

Microorganism	No. of Positive Cultures
Coagulase-negative staphylococci	6
Streptococcus pneumoniae	2
Gram-negative rods (*Escherichia coli*)	1

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Discussion

The incidence of postoperative endophthalmitis has been lowered from 10% at the beginning of this century to 0.1% at present.[1–3] Despite improved methods of prophylaxis and treatment, however, postoperative endophthalmitis remains an often devastating complication of cataract extraction.

Egger et al[12] reported that the contamination rate of the aqueous humor is significantly lower if the cataract extraction is performed by phacoemulsification than if the operation is done by other means. A probable reason is that phacoemulsification requires a very small corneoscleral incision and there is less fluid exchange during the operation.[12,13] We conjecture that the most effective feature of the phacoemulsification method is that it is a closed system and the fluid in the conjunctival sac can be prevented from invading the anterior chamber.

Sherwood et al[8] demonstrated that the anterior chamber is contaminated during cataract surgery but they did not determine the specific organisms or inoculum sizes. Dickey et al[7] published details of contamination rate and species of organisms entering the anterior chamber during cataract extraction. A contamination rate of 43% was determined, with coagulase-negative staphylococci (44%) as the most commonly isolated organisms.[7] Egger et al[13] and Hara et al[6] demonstrated the same microorganism as commonly isolated. We cultured the aqueous humor of the 126 patients in our study; the contamination rate was clearly lower (8.14%) than in the Dickey et al[7] study, where coagulase-negative staphylococci were the most frequently isolated bacteria (66%).

No case in our study developed postoperative endophthalmitis. There may be different reasons for this fact. Because of the low virulence of the microorganisms and the small inoculum sizes (2–10 colonies in 6 eyes and 10–40 colonies in 3 eyes), the bacteriocidal properties of the aqueous humor were probably able to prevent bacterial growth. On the other hand, preservation of the posterior capsule is an important precaution for endophthalmitis. Two animal and a few clinical studies showed that injection of a very high inoculum into the anterior chamber was necessary to induce endophthalmitis when the posterior chamber was intact, compared to a very small inoculum if the posterior capsure had been incised.[16–19] Although postoperative ophthalmitis was not seen in our patients, nine specimens (8.14%) showed positive cultures. Therefore, systemic antibiotics should be administered postoperatively for a few days to prevent postoperative endophthalmitis in cataract extraction patients.

In conclusion, postoperative endophthalmitis remains extremely serious and devastating to both patients and physicians at present. Preliminary results in a small population show that contamination of the aqueous humor is significantly less frequent if cataract extraction is performed by phacoemulsification.

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