ORIGINAL ARTICLE

Aqueous humor contamination during phacoemulsification in a university teaching hospital

Contamination bactérienne de la chambre antérieure après phacoémulsification dans un centre hospitalo-universitaire

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KEYWORDS
Anterior chamber; Aqueous humor; Contamination; Cataract surgery; Endophthalmitis

Summary
Purpose. — To evaluate the intraoperative contamination of the anterior chamber in eyes undergoing phacoemulsification in a university teaching hospital.
Design. — Prospective, non-randomized clinical trial.
Methods. — This study included 113 eyes of 113 consecutive patients undergoing cataract surgery performed by experienced surgeons and residents. Phacoemulsification was conducted through a scleral tunnel incision or through a corneal incision. The intraocular lens was implanted with an injector. Aqueous fluid was obtained at the end of surgery before viscoelastic removal, with a cannula through the corneal paracentesis. Povidone-iodine 10% solution was used to prepare the eyebrow and eyelids and povidone-iodine 5% to disinfect the ocular surface. All patients were given a single oral dose of 400 mg ofloxacin 2 h before surgery. No preoperative antibiotics were administered locally.
Results. — Anterior chamber fluid aspirates were positive for bacteria in two eyes (1.8%). No eye developed endophthalmitis during the follow-up period.

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Introduction

Postoperative endophthalmitis is still the most feared complications of cataract surgery. Most cases result from microorganisms coming from the patient’s conjunctival flora carried into the eye at the time of surgery by irrigation, instruments or intraocular lenses [1,2].

Several studies have determined the frequency of anterior chamber bacterial contamination after phacoemulsification, but many discrepancies were found, with rates of culture positivity ranging from 0 to 46% [3–9]. Such variations may be explained by the lack of similarity between pre- and peroperative conditions such as antisepsis regimens, surgical techniques and methods of aqueous fluid withdrawal.

The purpose of this study is to determine the anterior chamber bacterial contamination rate after routine phacoemulsification conducted in our department. We wanted to evaluate the influence of our preoperative regimen and operative techniques on bacterial contamination, considering the variety of skills and experience of surgeons at a university teaching hospital.

Patients and methods

This prospective study comprised 113 eyes of 113 consecutive patients having routine phacoemulsification cataract surgery. The study was conducted in accordance with ethical principles stated in the Declaration of Helsinki. Informed consent was obtained from all patients before surgery. Operations were performed, over 1 month in 2008, by eight different surgeons including experienced and in-training practitioners.

For all patients, the brow, eyelids, eyelashes and adjacent forehead, nose, cheek and temporal orbital area were scrubbed with 10% povidone-iodine. Then the pericocular area and the ocular surface were scrubbed with 5% povidone-iodine. Surgery was initiated 2 minutes after a third application of povidone-iodine 5% instilled into the eye. The eyelids and lashes were retracted from the operative field by using a sterile plastic self-adhesive drape. No preoperative antibiotics were administered locally. All patients were given a single oral dose of 400 mg ofloxacin 2 hours before surgery. Pupils were dilated with single-dose mydriatics (0.5% tropicamide, 10% phenylephrine).

Phacoemulsification was performed with a “divide and conquer” technique through a 3.2 mm scleral tunnel incision or through a 3.2 mm corneal incision. Scleral tunnels and corneal 3-step incisions were always constructed in the superior quadrant. Incisions were enlarged to 6 mm in case of PMMA IOL implantation. All scleral tunnels were created using a fornix-based conjunctival flap. A foldable intraocular lens (IOL) was implanted using an injector device. In all cases, the wounds were sutured using a 10.0 nylon suture. The anterior chamber aspirate was collected using a 23 gauge cannula passed through the paracentesis site created during the surgical procedure. The aqueous fluid samples were taken at the end of surgery before the viscoelastic removal from the anterior chamber. The specimens of approximately 200 to 400 μL were immediately inoculated in paediatric haemoculture sets and sent to the microbiology laboratory, where the material was cultured for aerobic and anaerobic organisms in suitable media.
intracameral or subconjunctival antibiotics were used at the end of surgery. Postoperatively, topical corticosteroids (dexamethasone) and antibiotics were used over 4 weeks. Statistical analysis was performed by the χ² test.

Results
The study included 43 men and 70 women. The mean age was 74.3 years. Forty-seven (41.6%) procedures involved the right eye and 66 (58.4%) the left eye. One hundred and one (89.4%) patients were operated by an experienced surgeon and 12 (10.6%) by a learning resident. There were 89 corneal phacoemulsifications and 24 sclero-coneal phacoemulsifications. The mean time between incision to wound closure was 21.9 minutes (19.2 minutes for the experienced surgeon group and 52 minutes for the resident group). All IOL implantations were realised with an injector. Fifty-eight (51.3%) eyes received a hydrophilic acrylic IOL, 25 (22.1%) a hydrophobic acrylic IOL, 23 (20.4%) a PMMA IOL, and seven (6.2%) eyes received a silicone IOL. Intraoperative complications included four ruptured posterior capsules, three of them with vitreous loss. Two cases of ruptured posterior capsules belonged to the experienced surgeon group and the other two to the resident group.

No eye developed endophthalmitis during the follow-up period. Bacteria were isolated by culture from two cases (1.8%). One of the isolates was identified as *Staphylococcus epidermidis*, and the other one as a *Bacillus* species. The first patient was operated by a confirmed surgeon, the second one by a resident. The duration of surgery was 20 and 70 minutes respectively. No complications occurred during these two surgeries. The incisions were corneal. The two patients had received a foldable hydrophilic acrylic IOL.

Discussion
To reduce the risk of endophthalmitis after phacoemulsification, the primary objectives are to minimize the entry of microorganisms into the anterior chamber during the surgery and to destroy remaining ones at the conclusion of the operation. To achieve this goal, we had firstly to evaluate the anterior chamber contamination rate obtained in our teaching hospital under standard surgical practice. We conducted this study prior to the planned modification of our operative regimen with systematic intracameral injection of ceftazidime at the end of all cataract surgeries [10].

To minimize the rate of false-negative, we decided to collect the aqueous humor aspirates right after lens implantation before the viscoelastic removal. The purpose was to avoid the dilution effect on bacterial concentration of the high-flow irrigation/aspiration created when washing the viscoelastic [11]. We also chose reliable sensitive culturing methods with immediate inoculation of the aspirates into paediatric haemoculture sets followed by cultures in media appropriated in cultivating small numbers of bacteria.

We found that, despite cases of surgery performed by inexperienced surgeons, our anterior chamber contamination rate after phacoemulsification was low (1.8%).

Our results differ from those found by Srinivasan et al., Ta et al. or John et al., who reported a contamination rate of 46.25%, 8% and 7.5% respectively [4,5,12]. However, they are comparable to those reported by Weindler et al., Bausz et al. and Parmar et al. who reported a contamination rate of 2%, 2.09% and 2.7% respectively [6,7,13].

Other authors, like Cornut et al. and Leong et al. [3,8], found that the anterior chamber bacterial contamination after phacoemulsification was null whether they used conventional culture or eubacterial polymerase chain reaction [8].

Such variations are probably largely the results of a lack of similarity between pre and peroperative conditions such as antisepsis regimens, surgical techniques and methods of aqueous fluid collection and evaluation.

It is possible that a 2% contamination rate could be caused when preparing the aspirates. Indeed, Ta et al. have demonstrated the difficulty in obtaining an aqueous fluid sample free of contamination from the ocular surface [5]. Their study has showed that 9% of aqueous samples obtained using a cannula were culture-positive, whereas 15% of aqueous samples obtained through a needle through clear cornea showed contamination. All these anterior chamber aspirates where collected at the beginning of surgery when the anterior chamber is expected to be free from bacteria. In our study, we tried to minimize the possibility of sample contamination from surface organisms. Anterior chamber aspirates were collected through the paracentesis site without touching the ocular surface. We also tried to minimize the number of persons handling the samples: the surgeon inoculated the aspirates in the haemoculture sets immediately after collection.

We believe that our low anterior chamber contamination rate is mainly due to our prophylactic measures with several applications of povidone-iodine disinfectant solution on the ocular surface. It is a proven method of prophylaxis against infective endophthalmitis after cataract surgery [14–16] as it decreases significantly the ocular surface bacterial population [1,7,9,17].

The administration of a single dose of oral ofloxacin 2 hours before surgery is controversial. It is recommended by the French Society of Anaesthesia and Intensive Care for patients with high-risk medical conditions. However, its efficiency in reducing the incidence of endophthalmitis is questioned. Its effect on the anterior chamber bacterial contamination rate is also difficult to evaluate. Still, the aqueous humour levels after oral ofloxacin administration have been shown to exceed the minimum inhibitory concentrations for many bacteria species causing endophthalmitis [18].

The influence of surgeon experience or surgery duration seems to have a marginally significant association with the incidence of endophthalmitis [14,19,20] or with the anterior chamber bacterial contamination rate [21]. Surgical complications do increase the risk for endophthalmitis [10], but they are not associated to resident cases only as they are also encountered by experienced surgeons who are more likely to be involved in complicated cases.

The aqueous bacterial contamination may also be lowered by the systematic use of an injector to implant intraocular lenses. Injectable IOLs have been shown to lower incidence rates of endophthalmitis [22] as they allow little contact between the lens and the conjunctival bacterial flora. However, previous studies who compared anterior
chamber bacterial contamination with IOL implantation using an injector or a forceps [7,13] failed to detect a statistically significant difference. One explanation is that contaminating bacteria firmly adhere to the IOL in order to settle and initiate biofilm formation [23,24]. Therefore, planktonic bacteria may not be present in the aqueous humor taken just after implantation.

We know that our study suffers from its non-randomized design. In view of the limited number of patients in each group associated with a markedly disproportionate distribution (particularly with respect to incision location, IOLs’ biomaterial or surgeons experience), a meaningful interpretation of our data is not possible.

Conclusion

Our results suggest that low anterior chamber contamination rate is achievable with routine phacoemulsification in a teaching hospital. Careful preoperative antisepsis preparation with use of effective antiseptic solution and operating room procedures may be very important in reducing anterior chamber bacterial contamination after cataract surgery. However, as our bacterial contamination rate was still positive after cataract extraction, the use of additional prophylactic measures against endophthalmitis such as intracameral injection of cefuroxime seems to be justified.

Disclosure of interest

The authors declare that they have no conflicts of interest concerning this article.

References