International Journal of Clinical Medicine, **2013, 4, 375-377**
http://dx.doi.org/10.4236/ijcm.2013.49067 Published Online September 2013 (http://www.scirp.org/journal/ijcm)

Impact of Ocular Compression on Ocular Surface Bacterial Contamination

Amir Reza Daneshmand Eslami[1*], Nikolai M. Sergienko[1], Ivan P. Bilko[2]

[1]Department of Ophthalmology, National Medical Academy of Postgraduate Education, Kiev, Ukraine; [2]Department of Microbiology and Epidemiology, National Medical Academy of Postgraduate Education, Kiev, Ukraine.
Email: *danshmann@gmail.com

Received June 12th, 2013; revised July 16th, 2013; accepted August 5th, 2013

ABSTRACT

Background: To study the impact of preoperative ocular compression on bacterial contamination of the lid margin and conjunctival sac. **Methods:** This study evaluated 106 eyes from 106 patients undergoing cataract surgery. Preoperatively, all of the patients received one drop of 0.5% levofloxacin eye drops 5 times per day for 4 days. The patients were divided into 2 groups after receiving retrobulbar anaesthesia. The study group (75 eyes) received 15 ± 2 minutes of ocular compression, and the control group (31 eyes) remained with their eyes closed for 15 ± 2 minutes without the application of ocular compression or digital massage. Following the device removal (study group only) and the opening of the eyes, bacterial cultures were taken from the lid margin and conjunctival sac. **Results:** The lid margin was positive for bacteria in 23 eyes (30.7%) in the study group vs. 3 eyes (9.7%) in the control group (P = 0.0223), and the conjunctival sac was positive for bacteria in 16 eyes (21.3%) in the study group vs. 5 eyes (16.1%) in the control group (P = 0.5409). **Conclusion:** Preoperative ocular compression is associated with the release of meibomian gland secretions and bacterial contamination of the eyelid edges.

Keywords: Bacteria; Conjunctival Sac; Endophthalmitis; Lid Margin; Ocular Compression

1. Introduction

Postoperative endophthalmitis (POE) remains a rare but severe complication in modern cataract surgery [1]. The most common sites of ocular bacterial contamination leading to POE include the eyelids, skin and conjunctiva [2,3]. The lid margins, which carry bacterial flora to the skin surface, and meibomian gland secretions also play an important role in POE development. However, it remains unclear whether preoperative ocular compression (OC), which is performed to reduce intraocular pressure (IOP), can promote bacterial contamination of the eyelids and conjunctiva. Although in recent years OC has become less popular, this technique is still commonly performed. Pressure delivered via the modified Honan's balloon is realised not only on the eyeball but also on the lid margin and may provoke the release of meibomian gland secretions that contain bacteria.

The aim of this study was to determine the impact of preoperative ocular compression on bacterial contamination in the lid margin and the conjunctival sac.

*Corresponding author.

2. Materials and Methods

2.1. Study Sample

This study evaluated 106 eyes from 106 patients undergoing cataract surgery. The exclusion criteria included systemic or local infection, conjunctivitis, blepharitis, dacryocystitis, meibomian gland dysfunction and diabetes mellitus. Preoperatively, all of the patients received one drop of 0.5% levofloxacin ophthalmic solution (Oftaquix®, Santen Oy, Niittyhaankatu 20, 33720 Tampere, Finland) 5 times per day for 4 days.

The patients were placed in the supine position prior to treatment and remained undisturbed throughout the test period. Retrobulbar anaesthesia was administered with a single injection of 0.5% bupivacaine hydrochloride, 2% lidocaine hydrochloride, and 0.5% hyaluronidase (3.75 IU/ml). The volume of the block ranged from 3.5 to 5.5 ml, depending on the patient's weight.

The patients were divided into two groups. The study group (75 eyes of 75 patients) received retrobulbar anaesthesia in addition to the preoperative application of

OC (approximately 30 mm Hg) for 15 ± 2 minutes using a modified Honan's balloon, and the control group (31 eyes of 31 patients) received retrobulbar anaesthesia without the preoperative application of OC or digital massage. In the control group, the patients' eyes remained closed for 15 ± 2 minutes after the anaesthesia administration. Approval for accessing the patient health records was obtained from the local research ethics committee. Informed consent was obtained from each patient. The study protocol and the safety and efficacy of the interventions were explained to all of the participants prior to their enrolment.

2.2. Bacteriological Investigation

After the specified period of 15 ± 2 minutes and following the device removal (study group only), the eyes were opened, and bacterial cultures from the conjunctival sac and lid margin were immediately initiated using sterile cotton swabs moistened with sterile saline solution. In addition, swabbing was performed for the lower lid margin by rolling the swab from the lateral canthus up to the lacrimal point. The samples from each eye were placed in separate tubes containing thioglycolate broth and incubated at 37˚C for 24 h. The bacterial isolation and identification were performed using standard methods, as described elsewhere [4].

2.3. Statistical Analysis

The chi-squared test was used to compare the studied variables. A *P* value less than 0.05 was considered statistically significant.

3. Results

The results of this study are summarised in **Tables 1** and **2** Coagulase-negative staphylococci were the most commonly cultured bacteria identified on both the lid margin and the conjunctiva sac. In the study group, approximately 3 times as many organisms were isolated from the lid margin compared to the control group ($P = 0.0223$). There was no statistically significant difference between the groups in the total positive culture from the conjunctival sac ($P = 0.5409$).

Table 1. Characteristic changes in the lid margin bacterial flora after preoperative ocular compression.

Isolated bacteria	Lid margin	
	Study group (n = 75)	*Control group* (n = 31)
Coagulase-negative staphylococci	12 (16%)	2 (2.8%)
Staphylococcus aureus	2 (2.8%)	1 (3.2%)
Streptococcus viridans	2 (2.8%)	0 (0%)
Gram-positive bacilli	7 (9.3%)	0 (0%)
Total positive culture	23 (30.7%)*	3 (9.7%)

*$P = 0.0223$ compared with control.

Table 2. Characteristic changes in the conjunctival sac bacterial flora after preoperative ocular compression.

Isolated bacteria	Conjunctival sac	
	Study group (n = 75)	*Control group* (n = 31)
Coagulase-negative staphylococci	7 (9.3%)	5 (16.1%)
Staphylococcus aureus	2 (2.8%)	0 (0%)
Streptococcus viridans	2 (2.8%)	0 (0%)
Gram-positive bacilli	6 (8.5%)	0 (0%)
Total positive culture	16 (21.3%)*	5 (16.1%)

*In one case, 2 strains were isolated.

4. Discussion

An analysis of the bacteria present at the edge of the eyelids and the conjunctiva (**Tables 1** and **2**) demonstrated that increased bacterial contamination levels were substantially more pronounced at the edge of the eyelids after the ocular compression.

This finding indicates that the probable source of contamination was the lid margin, specifically the meibomian gland ducts. The impact of pressure on the eyeball indirectly triggers an increase in the meibomian gland secretion; multiple studies have demonstrated an increased frequency of meibomitis in patients undergoing cataract surgery [5,6]. Meibomitis has a bacterial origin, which likely explains the contamination of the lid margin after the compression. In addition, there was less time for the released secretion to move into the conjunctival sac during the evaluated procedure, which likely explains why less significant levels of bacterial contamination were observed in the conjunctival sac. Although all of the patients received a 0.5% levofloxacin ophthalmic solution preoperatively, this administration could not prevent contamination in the lid margin after the compression, which is likely explained by the fact that the bacteria reside deep within the meibomian glands. In addition, the meibomian gland secretions contain a large proportion of fat, which makes the lid margin hydrophobic and thus impenetrable by the 0.5% levofloxacin ophthalmic solution.

It is well known that the eyelid edges can negatively impact eye wounds, which is why eyelids are often covered with an adhesive film. Although this technique is beneficial and has become the modern standard in ophthalmic surgery, we believe the use of this adhesive film could be improved. For example, the eyelids are covered in a fatty substance; therefore, the film does not

reliably adhere to the eyelids. Moreover, the liquid filling the conjunctive sac washes the free edge of the eyelids and transfers bacteria from the lids to the surgical wound.

We studied the effect of ocular compression using the modified Honan's balloon, although the use of an eyelid speculum may have a similar but less dramatic effect. Presumably, the factors that contribute to the release of meibomian gland secretions may be related to the manipulations performed during retrobulbar or peribulbar anaesthesia. Theoretically, even eye movements during surgery and immediately after surgery (performed while the patient is under topical anaesthesia) could place pressure on the meibomian glands. Improperly applying antibiotics on the first postoperative day might also result in negative consequences. Garcia-Arumi further reported that the POE rate was higher following the administration of local anaesthesia compared to retrobulbar anaesthesia [7].

The most effective method of suppressing bacterial surface contamination may be via the isolation of the lid margin during surgery. We initiated this type of study and evaluated the effects of covering the lid edges with textile napkins impregnated with 0.02% aqueous solution of chlorhexidine. The results indicated that the continued presence of a strong antiseptic intraoperatively reduced the POE rate [8].

5. Conclusion

Preoperative ocular compression performed with the goal of reducing IOP was associated with the release of meibomian gland secretions and bacterial contamination of the eyelids. Thus, reliable intraoperative isolation of the eyelids and the postoperative application of antibiotics are required for effective POE prophylactic measures.

6. Acknowledgements

The authors thank the individuals who participate in this study. None of the authors had financial or personal conflict of interest with regard to this study. This paper was derived from a PhD thesis.

REFERENCES

[1] J. C. Lloyd and R. Braga-Mele, "Incidence of Postoperative Endophthalmitis in a High-Volume Cataract Surgicentre in Canada," *Canadian Journal Ophthalmology*, Vol. 44, No. 3, 2009, pp. 288-292.

[2] R. G. Ariyasu, T. Nakamura, N. D. Trousdale and R. E. Smith, "Intraoperative Bacterial Contamination of the Aqueous Humor," *Ophthalmic Surgery*, Vol. 24, No. 6, 1993, pp. 367-374.

[3] M. G. Speaker, F. A Milch, M. K. Shah, W. Eisner and B. N. Kreiswirth, "Role of External Bacterial Flora in the Pathogenesis of Acute Postoperative Endophthalmitis," *Ophthalmology*, Vol. 98, No. 5, 1991, pp. 639-649.

[4] G. L. Wood, "Microbiology," In: K. D. McClatchey, Ed., *Clinical Laboratory Medicine*, Lippincott Williams & Wilkins, Philadelphia, 2002, pp. 1024-1175.

[5] F. A. Bucci Jr., "Prevention of Endophthalmitis and Ocular Absorption of Fluoroquinolones," *Ocular Surgery News*, November 2003, pp. 5-8.

[6] E. Knop, N. Knop, T. Millar, H. Obata and D. A. Sullivan, "The International Workshop on Meibomian Gland Dysfunction: Report of the Subcommittee on Anatomy, Physiology, and Pathophysiology of the Meibomian Gland," *Investigative Ophthalmology & Visual Science*, Vol. 52, No. 4, 2011, pp. 1938-1978. doi:10.1167/iovs.10-6997c

[7] J. Garcia-Arumi, A. Fonollosa, L. Sararols, F. Fina, V. Martinez-Castillo, A. Boixadera, M. A. Zapata and M. Campins, "Topical Anesthesia: Possible Risk Factor for Endophthalmitis after Cataract Extraction," *Journal Cataract Refract Surgery*, Vol. 33, No. 6, 2007, pp. 989-992. doi:10.1016/j.jcrs.2007.02.030

[8] N. M. Sergienko, Y. N. Kondratenko, N. V. Chumak and A. Daneshmand, "Results of Prophylaxis of Bacterial Endophthalmitis in Cataract Surgery," *Proceedings of the Joint Congress of SOE/AAO*, Geneva, June 2011, p. 51.

