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**THE EFFECT OF VANCOMYCIN INTRACAMERAL  
INJECTION IN CATARACT SURGERY**

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## ABSTRACT

**Introduction:** Bacterial contamination of the anterior chamber during cataract extraction is a frequent occurrence. Intracameral injection of antibiotics is an effective method to deliver drugs into eyeballs, and rapidly achieve therapeutic concentrations. Vancomycin is stable and bactericidal for Gram-positive bacteria, including gentamycin-resistant *Staphylococci* and *Streptococci*

**Purpose:** To investigate the toxicity of vancomycin on human corneal endothelium in cataract surgery

**Material and Methods:** A group of 90 patients having cataract extraction by phacoemulsification with IOL was divided into two consecutive, non randomized groups: the first group (45 eyes) received vancomycin (1 mg/0,1 ml) as one dose intracameral injection at the end of surgery; the second group (45 eyes) served as control. Specular microscopy was performed preoperatively and one month after cataract extraction

**Results:** Decrease in cellular density and increase in mean cellular area were registered in both groups when comparing the corneal endothelium before and after surgery, but there was no between-group statistical difference.

**Conclusion:** Intracameral injection of vancomycin at the end of cataract surgery has no effects on corneal endothelium and represents a safe procedure to prevent intraocular bacterial contamination.

**Key words:** vancomycin, intraocular injection, endothelium, endophthalmitis, specular microscopy.

## **ΤΟ ΑΠΟΤΕΛΕΣΜΑ ΤΗΣ ΕΝΕΣΗΣ ΒΑΝΚΟΜΥΚΙΝΗΣ ΣΤΟΝ ΠΡΟΣΘΙΟ ΘΑΛΑΜΟ ΣΤΗΝ ΧΕΙΡΟΥΡΓΙΚΗ ΤΟΥ ΚΑΤΑΡΡΑΚΤΗ.**

**Πανεπιστήμιο της Μόντενα και του Ρέτζιο Εμίλια - Ιταλία  
Τμήμα Νευροψυχολογίας Παθολογίας - Οφθαλμολογική Κλινική  
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### **ΠΕΡΙΛΗΨΗ**

**Εισαγωγή:** Η βακτηριακή μόλυνση του πρόσθιου θαλάμου κατά την αφαίρεση του καταρράκτη είναι μια συχνή πραγματικότητα. Η ένεση αντιβιοτικών στον πρόσθιο θάλαμο είναι μια αποτελεσματική μέθοδος χορήγησης φαρμάκων στους οφθαλμούς, που επιτυγχάνει γρήγορα θεραπευτικές συγκεντρώσεις. Η βανκομυκίνη είναι σταθερό και βακτηριοκτόνο αντιβιοτικό για τα Gram θετικά μικρόβια, περιλαμβάνοντας τους σταφυλόκοκκους και στρεπτόκοκκους ανθεκτικούς στην γενταμικίνη.

**Σκοπός:** Να μελετηθεί η τοξικότητα της βανκομυκίνης στο ανθρώπινο ενδοθήλιο του κερατοειδούς στην χειρουργική του καταρράκτη.

**Υλικό και μέθοδος:** Μια ομάδα 90 ασθενών που χειρουργήθηκαν για αφαίρεση καταρράκτη με την τεχνική της φακοθρυψίας με ένθεση ενδοφακού, διαιρέθηκε σε δύο non randomized ομάδες: στην πρώτη (45 οφθαλμοί) χορηγήθηκε βανκομυκίνη (1 mg/0,1 ml) σε μια δόση, ενέσιμη στον πρόσθιο θάλαμο στο τέλος της επέμβασης; η δεύτερη ομάδα (45 οφθαλμοί) λειτούργησε ως ομάδα ελέγχου. Εγινε ενδοθηλιοσκόπια με specular microscope προεγχειρητικά και ένα μήνα μετά την επέμβαση αφαίρεσης του καταρράκτη.

**Αποτελέσματα:** Κατά τη σύγκριση του ενδοθηλίου προ- και μετεγχειρητικά καταγράφηκε μια μείωση της κυτταρικής πυκνότητας και μια αύξηση της μέσης κυτταρικής περιοχής και στις δύο ομάδες, χωρίς να υπάρξει μια στατιστικά σημαντική διαφορά μεταξύ των ομάδων.

**Συμπέρασμα:** Η ένεση βανκομυκίνης στον πρόσθιο θάλαμο στο τέλος της επέμβασης του καταρράκτη, δεν είναι τοξική για το ενδοθήλιο του κερατοειδούς και αποτελεί μια ασφαλή διαδικασία για την πρόληψη της ενδοφθάλμιας βακτηριακής λοίμωξης.

**Λέξεις κλειδιά:** βανκομυκίνη, ένεση στον πρόσθιο θάλαμο, ενδοθήλιο, ενδοφθαλμίτιδα, ενδοθηλιοσκόπια, specular microscopy.

## INTRODUCTION

Postoperative endophthalmitis is the most important complication in the ocular surgery producing in 35-40% of cases final visual acuities of under 20/400 (1). Endophthalmitis occurs after cataract surgery in 0.05 to 0.50% of patients (2-7), while bacterial contamination of the anterior chamber during cataract extraction rates from 5 to 43% have been reported (8). The prophylaxis of postoperative endophthalmitis still generates controversies; both systemic and topical antibiotics are administered preoperatively, and intraoperatively is widely accepted the use of antibiotics as subconjunctival or intraocular injection (9-13). The intraocular drug must not be toxic for the retina or the corneal endothelium, must penetrate all ocular tissues and stay for a sufficient time (14,15).

The most common drugs used during ocular surgery are aminoglycosides (gentamicin, amikacin), 3<sup>rd</sup> generation cephalosporines (ceftazidime) and glycopeptides such as vancomycin. The latter is the more used antibiotic for its action against coagulase + and - *Staphylococci*.

The purpose of this study was to investigate vancomycin toxicity for the corneal endothelium of the human eye following one dose intracameral injection at the end of surgery.

## MATERIAL AND METHODS

The study involved 90 eyes of patients which underwent cataract surgery from March 98 to June 98 in the University Eye Clinic of Modena. Surgery was performed by the same surgeon (R.G.). All subjects were affected by senile cataract uncomplicated by other ocular pathologies (glaucoma, uveitis, ecc.). Informed consent was obtained by all patients.

The patients were divided into two groups:

Group 1) - n. 45 subjects (22 males and 23 females) aged from 61 to 87 years (medium age  $74.08 \pm 8.84$ ) treated with vancomycin (1 mg/0,1 ml) by one dose intracameral injection at the end of surgery.

Group 2) - n. 45 subjects (20 males and 25 females) aged from 28 to 89 years (medium age  $71.66 \pm 10.89$ ) as a control group.

The surgical procedure was as follows: aseptic preparation was performed by scrubbing eyelids, nose, cheek, eyebrow and forehead with povidone-iodine 5%, and two or three drops were placed in the conjunctival fornices; a sterile, self-adhesive plastic drape was placed over the eyelids. Phacoemulsification was performed in local anesthesia with retrobulbar injection of marcaine 0.5% and xilocaine 2% using the same technique: a 3.2 mm superior corneal tunnel and a side-port incision were made; a poly(methyl methacrylate) IOL was implanted in the capsular bag. After viscoelastic substance aspiration, the anterior chamber was refilled and washed with the vancomycin solution.

Vancomycin solution was prepared using the endovenous tailoring of 500 mg. Every phial was diluted in 10 cc of physiological solution. One cc of this solution was diluted in 500 cc of physiological solution and conserved at 4°C (1mg/0.1ml).

To evaluate the corneal endothelium toxicity we studied the variation of the cellular density and the mean cellular area in the two groups of eyes using the specular non contact endothelial microscopy (Konan). Specular endothelial microscopy was performed preoperatively and one month after surgery. The statistic analysis was carried out with the t-test.

## RESULTS

The mean cellular density of the corneal endothelium before surgery was  $2374.58 \pm 374.24$  cell/mm<sup>2</sup> in group 1) and  $2199.55 \pm 488.29$  cell/mm<sup>2</sup> in group 2). One month after surgery the mean  $\pm$  SD of the cellular density was  $1941.40 \pm 488.29$  cell/mm<sup>2</sup> in the first group ( $p < 0.0001$ ) and  $1783.53 \pm 535.17$  cell/mm<sup>2</sup> in the second group ( $p < 0.0001$ ). The variation of this parameter did not result statistically different between the two groups ( $p = 0.869$ ).

The mean cellular area revealed the same trend. Preoperatively the mean cellular area was  $431.13 \pm 67.31$  in group 1) and  $418 \pm 137.40$  in group 2). One month postoperatively the media  $\pm$  SD was  $562.73 \pm 208.53$  in the first group ( $p < 0.0001$ ) and  $642.73 \pm 243.72$  in the second group ( $p < 0.0001$ ). The variation of this parameter did not result statistically different between the two groups ( $p = 0.075$ ).

The variation of cellular density and mean cellular area before and after surgery revealed a statistically significant difference in both groups ( $p < 0.0001$ ), but no between-group difference was evident. Undoubtedly the surgical trauma as well as pseudophakia induce an endothelial damage, but no toxic effect on the corneal endothelium may be attributed to vancomycin.

## DISCUSSION

Prophylaxis is necessary to prevent postoperative endophthalmitis (16-20). Antibiotics injection in the anterior chamber at the end of cataract extraction and IOL implant is one of the ways to prevent intraocular contamination.

Vancomycin is a glycopeptide with a broad spectrum of activity that includes almost all gram+ bacteria. At first the use of this drug was not diffuse among ophthalmologists, while today it is considered a selective drug for the prevention and therapy of postoperative endophthalmitis caused by methicillin-resistant bacteria and in patients allergic to penicillin or cephalosporines. Vancomycin antibacterial activity depends on the inhibition of the cellular wall biosynthesis by inhibiting the synthesis of fosfolipids and peptidoglycan.

The lack of toxicity for the corneal endothelium makes vancomycin saver and more useful in order to prevent infection in cataract surgery.

The effect of vancomycin on the corneal endothelium has been studied by some authors in rabbit eyes (21). No statistically significant difference in mean endothelial cell change was observed in that study. Other authors analyzed the corneal endothelial toxicity of corneal storage medium supplemented with vancomycin for donor corneas (22-24). No toxicity of the drug to the corneal endothelium was proved by these studies.

Adenis e coll. evaluated the anterior chamber concentrations of vancomycin diluted in the irrigating solution at the end of cataract surgery (25). The drug was found in the anterior chamber at concentrations effective to prevent endophthalmitis. There was no reference to the corneal toxicity.

Feys and coll. (26) studied the prophylaxis of vancomycin using the drug in the irrigating solutions during cataract surgery. In that study intraocular fluid was aspirated at the end of the operation and injected into a blood culture bottle to evaluate bacterial contamination of

the anterior chamber. The authors asserted that vancomycin had no effect on the occurrence of intraocular contamination, but no mention of vancomycin toxicity on the corneal endothelium was reported.

Gimbel and coauthors (27) found no significant endothelial loss in 50 patients receiving 8 mg/L of gentamicin in the irrigating solution and 1 mg of vancomycin in the capsular bag at the end of surgery. In that study there were no cases of endophthalmitis.

To our knowledge our study is the first study on the effect of one dose intracameral injection of vancomycin on the corneal endothelium in human eyes in vivo. In our cases we had no patients with postoperative endophthalmitis.

We demonstrated by using specular non contact endothelial microscopy that there is no clinical evidence of corneal toxicity using vancomycin as prophylaxis in cataract surgery.

The decrease of cellular density and the increase of mean cellular area were not statistically different between the two groups of patients treated with and without vancomycin. The variation of these parameters demonstrated by specular microscopy can not be attributed to the use of vancomycin. The surgical manipulation and the modification of aqueous humor circulation and metabolism in pseudophakic eyes may be involved in the decrease of cell density with enlargement of the cellular area.

The limited use of vancomycin in ophthalmology still maintains its antibiotic efficacy towards a broad spectrum of bacteria. Probably this will be a problem in the future, but at the moment the safe prophylaxis and the drastic decrease of post operative endophthalmitis obtained by vancomycin represents a good weapon against infections.

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