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THE CONJUNCTIVAL BACTERIAL CONTAMINATION IN PATIENTS UNDERGOING CATARACT SURGERY

DANIELA SIMINA SOARE (DOGARU)[1], LARISA ILIE[2], ANA CRISTINA GHIȚĂ [3], AURELIAN MIHAI GHIȚĂ[4]

[1]Smile Land SRL Bucharest, [2,4]University Emergency Hospital, Bucharest,[3,4]Ocularcare Eye Clinic, Bucharest, [4]"Carol Davila" University of Medicine and Pharmacy, Bucharest

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Abstract: *Endophthalmitis is a serious postoperative complication of cataract surgery. The patient's own ocular and periocular flora is the most common source of infection. A total of 605 patients undergoing cataract surgery were included in the study. The study ran for a one-year period, from June 2019 to August 2020. Conjunctival swabs were obtained from all the patients and Gram staining was performed. Staphylococcus was the most common isolate. The results were similar with those found in other studies. Despite of the rise in the incidence with age, we observed a higher rate of Gram-negative bacterial infection in younger patients and the incidence decreased gradually with age. In conclusion, younger patients have a lower rate of bacterial conjunctival contamination, but they have a higher proportion of contamination with Gram-negative bacteria. Older patients have a higher rate of ocular surface contamination, most commonly with Gram-positive bacteria.*

INTRODUCTION

Over the last decades, cataract surgery has become the most frequently performed surgical procedure worldwide.(1) With its high success rates and cost effectiveness, cataract surgery has been reported to improve the patient's quality life. Despite the low rate of complications (2-5), most of them being treated with success, endophthalmitis is a rare, but potentially sight-devastating complication (6,7) after cataract surgery in spite of adequate treatment. Studies show that ocular surface bacterial flora is the main cause of postoperative endophthalmitis.(8,9)

The prevalence of cataract surgery is higher in the older population. Given that contamination of the ocular surface is most common in the elderly, patients undergoing cataract surgery will be the most vulnerable group in the general population at risk of developing postoperative endophthalmitis.(7,10)

Bacterial contamination of the ocular surface is influenced by several factors such as population heterogeneity, comorbidities and lifestyle.(10-12) The main issues in the management of postoperative endophthalmitis is the lack of actualized data, the difficulty of obtaining vitreous or aqueous humour samples and the unreliable results of them due to a high incidence of false negative results.

This is the reason why targeted therapy is difficult to perform and patients with endophthalmitis are often treated with broad-spectrum antibiotics.(13,14)

Given the poor visual outcome of many cases of postoperative endophthalmitis, the main focus should be on prevention of this dreaded surgical complication.(7,15) The most common prophylactic methods used preoperatively in order to sterilize the conjunctival cultures and to reduce the risk of postoperative endophthalmitis are povidone iodine and levofloxacin drops.(16)

For a targeted therapy it is important to know the bacterial contamination flora of the ocular surface, its frequency in the general population, the types of bacteria involved and the risk groups.

AIM

Given the poor visual outcome of many cases of postoperative endophthalmitis, the main focus should be on prevention of this dreaded surgical complication.

MATERIALS AND METHODS

A total of 605 patients were included in the study. One week before surgery, conjunctival swab was taken from the eye undergoing cataract surgery. In case of a positive result, an antibiogram was also performed.

In order to identify the risk groups, all patients were asked to complete a comorbidity questionnaire. The subjects were divided into the following groups' patients with history of acute hepatitis, patients with diabetes mellitus, patients with dry eye syndrome, patients with chronic eye conditions on long-term topical therapy and patients with other conditions. We also followed the risk of bacterial conjunctival contamination in different age groups.

The samples were collected and analysed in several laboratories. Patients were able to choose the laboratory where they performed their tests. The major disadvantage of testing in several laboratories is that more people are involved in culture analysis and antibiotic sensitivity testing which can interfere with the results.

On the other hand, this situation reflects the daily medical practice where the clinician treats patients whose tests were performed in different laboratories. The most important and primary test to perform directly on positive cultures is Gram testing which represents the most rapid and simplest test to characterize microorganisms. The Gram stain divides bacteria into two groups, Gram-positive and Gram-negative. An

[3]Corresponding author: Aurelian Mihai Ghiță, B-dul. Ion Mihalache, Nr. 128, Sector 1, București, România, E-mail:ghita.amg@gmail.com Phone: +40723 863438
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additional Giemsa staining may be performed to help characterize the conjunctival inflammatory response.

All cultures were inoculated onto blood agar and agar chocolate plates and were incubated in a 5% CO2 atmosphere for 24 hours at 35- 37 degrees Celsius. Bacteria were identified according to the conventional methods used for each microorganism class.

The data were analysed using IBM SPSS Statistics 2 and also using the general elements of descriptive statistics for the analysed variables (graphic representation).

The statistic tests used were: t-student for independent samples and the One Way Anova Test. A level of $p<0,05$ was accepted as statistically significant.

RESULTS

The study included 605 patients aged between 45 and 98 years (median age, 69.65, st dev 9.25). 38,5% of the patients were males and 61,54% were females. 46,28% of patients studied presented no other associated condition, while the rest of them had several conditions, the most common of which were dry eye, diabetes mellitus and chronic eye conditions on long-term topical therapy (table no. 1).

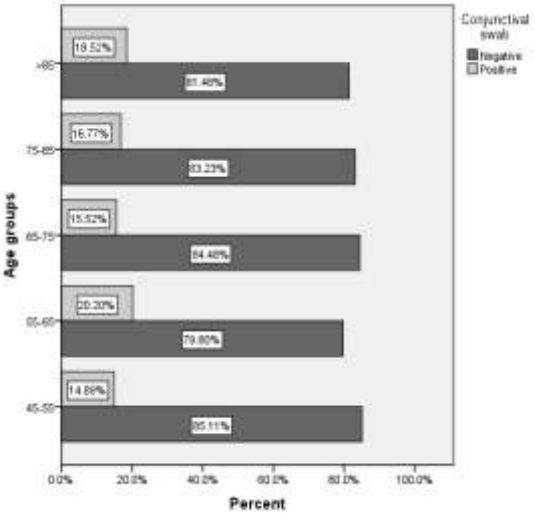
Table no. 1. Patient distribution by risk groups (count, percentage and st dev)

Study group	Sum	proc	Std. Deviation
control	280.00	46.28%	0.49
diabetes mellitus	63.00	10.41%	0.31
topic treatment	130.00	21.49%	0.41
dry eye	32.00	5.29%	0.22
infections	13.00	2.15%	0.15
oncological diseases	9.00	1.49%	0.12
hepatitis	19.00	3.14%	0.17
other conditions	90.00	14.88%	0.36
Valid N (listwise)	605	100.00%	

In our study we found that the conjunctival swabs were positive in 101 patients (16,7%). Among these, 85 patients (14%) were with Gram-positive bacteria and 16 (2.6%) were with Gram-negative bacteria.

The positive conjunctival secretion rate increases with advancing age except in the 55-65 years group (incidence 20,20%). Patients younger than 45 years have a low incidence of bacterial conjunctival contamination. Without taking into account the age group 55-65 years, there is an incidence increase proportional to age with a maximum for patients older than 85 years (figure no. 1).

Figure no. 1. Contamination rate by age groups



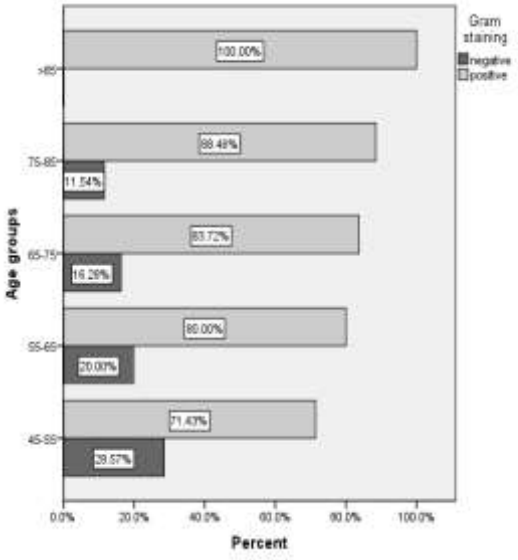
Among risk groups, diabetic patients had the highest rate of bacterial contamination (53,66%). Except patients with hepatitis and patients with oncological diseases, all the study groups had statistically significant higher rates of bacterial contamination and the rate of contamination with gram positive and negative is showed in table no. 2. A higher rate of Gram-negative bacterial infection is observed in the group with diabetes (9,76%) and in the one with chronic infections (22,22%)- compared to the control group, with statistically significant results (table no. 2).

Table no. 2. Gram-positive and Gram-negative bacterial contamination- count and percentage in control and risk groups

Study groups	Count Row N %	No colonization	Gram staining		Total
			negative	positive	
Control	Count	250.00	4.00	26.00	280.00
	Row N %	89.29%	1.43%	9.29%	100.00%
Diabetes_ mellitus	Count	41.00	4.00	18.00	63.00
	Row N %	65.08%	6.35%	28.57%	100.00%
Topic treatment	Count	110.00	3.00	17.00	130.00
	Row N %	84.62%	2.31%	13.08%	100.00%
Dry eye	Count	23.00	1.00	8.00	32.00
	Row N %	71.88%	3.13%	25.00%	100.00%
Infections	Count	9.00	2.00	2.00	13.00
	Row N %	69.23%	15.38%	15.38%	100.00%
Oncological diseases	Count	7.00	0.00	2.00	9.00
	Row N %	77.78%	0.00%	22.22%	100.00%
Hepatitis	Count	16.00	0.00	3.00	19.00
	Row N %	84.21%	0.00%	15.79%	100.00%
Other conditions	Count	56.00	8.00	26.00	90.00
	Row N %	62.22%	8.89%	28.89%	100.00%

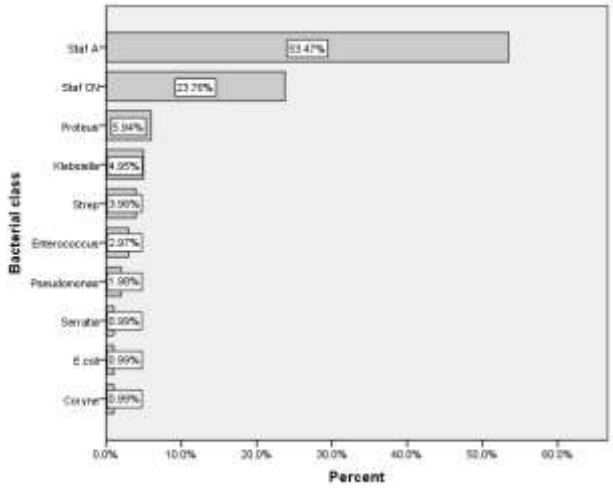
An unequal distribution of Gram-positive/Gram-negative bacterial contamination is observed (figure no. 2). The Gram-negative bacterial contamination rate is lower in the 45-55 years group and the incidence gradually decreases with age, so that the Gram-negative contamination incidence is equal to zero in patients older than 80 years.

Figure no. 2. Percentage of gram positive and negative contamination in each age decade from the total positive tests



Staphylococcus Aureus and Staphylococcus Coagulase-negative are the most common etiological agents. Streptococcus, Proteus, Klebsiella, Enterococcus and Pseudomonas are less frequently involved. Other types of bacteria are found in less than 1% of all patients with positive conjunctival swab (figure no. 3).

Figure no. 3. Percentage of each bacterium type from the total positive conjunctival swabs



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DISCUSSIONS

Older patients are more frequently candidates for cataract surgery.(17) These patients often have other comorbidities that can also increase the risk of bacterial contamination. Similar to other studies, we found a higher rate of bacterial conjunctival contamination in elderly patients with a peak incidence in the 55-65 years group. A higher incidence of conjunctival bacterial infection was reported in diabetic patients, in patients with chronic eye conditions on long-term topic therapy, in patients with other associated infections.(18-20) Rubio et al showed that diabetics have a conjunctival flora pattern that serves as a predominant cause of many diabetic infections, including conjunctival contamination.(6,21) Kawata and Matsuo revealed that a higher rate of positive conjunctival bacterial culture prior to cataract surgery was found in elderly patients with diabetes or previous hospital-based surgeries at other specialties.(22)

In a study conducted by Chikako et al, it has been reported that patients with diabetes mellitus have a higher bacterial detection rate, compared to those with dry eye syndrome and those who used other topical ocular medication who were associated with significantly lower detection bacterial rates.(23) Geyer et al suggested that topical medication used to treat glaucoma frequently became contaminated with bacteria and the contamination rate was related to the duration of use, therefore leading to conjunctival bacterial contamination.(20)

Studies have shown that conjunctival bacterial contamination increases with age due to reduced local and general immunity and higher incidence of associated diseases. Rubio showed that patients older than 64 years had a higher conjunctival contamination rate than those younger than 64 years.(24) Norregaard et al found that older age increases the risk of postoperative endophthalmitis due to conjunctival bacterial contamination.(10) Due to the small number of cancer patients included in the study, it cannot be established if they have a higher rate of bacterial contamination than the control group.

We also found that patients with viral hepatitis do not have an increased risk of ocular surface contamination.

The distribution of bacteria found in conjunctival swabs in our study group is quite similar to the distribution found in other studies in elderly Caucasian patients. In a study conducted by L D Ormerod, Coagulase-negative Staphylococcus was the most common cause of postoperative endophthalmitis.(25) Ronald C Gentile et al showed that the most prevalent pathogen responsible for culture-positive endophthalmitis was Coagulase-negative Staphylococcus followed by Staphylococcus aureus. A low contamination rate was found for Gram-negative organisms.(26)

Diabetic patients and patients with other associated infections have an increased risk of contamination with Gram-negative bacteria compared to the control group or other studied groups such as patients with topic therapy, patients with dry eye syndrome or patients with viral hepatitis. Also, we found that the incidence of gram negative was highest (28.57%) in the 45-55 years group and decreased slowly with each decade until was absent in patients older than 80 years.

Mehmet et al conducted a study in which they evaluated the conjunctival bacterial flora in diabetic and nondiabetic patients and they found that the rates for bacterial isolations were higher in diabetic patients compared to nondiabetic controls and Gram-negative bacterial colonization was significantly higher in diabetic patients.(19) Sarma S.S and Chandra T.J studied the conjunctival bacterial contamination among diabetic and nondiabetic individuals and found that Gram-negative bacteria were more common in diabetic patients compared to controls.(27) There are no other studies in the literature that evaluate conjunctival contamination with Gram-negative bacteria in patients with cardiovascular diseases or other associated infections. Also, we didn't find previous studies identifying a higher incidence of Gram-negative bacterial conjunctival contamination in younger patients. Our study is the first to demonstrate that the incidence of Gram-negative bacterial contamination decreases with each decade until is absent in patients older than 80 years and also the fact that is highest in the 45-55 years group.

Staphylococcus aureus was the most prevalent microorganism. Therefore, perioperative prophylaxis with a broad-spectrum antibiotic targeting mainly staphylococcal species is important.

A reasonable option seems to be the topical use of chloramphenicol, aminoglycosides such as netilmicin and fluoroquinolones such as moxifloxacin and levofloxacin. According to the literature, these antibiotics have a broad-spectrum activity and a superior efficiency on staphylococcal species. Compared to Ciprofloxacin and Ofloxacin, bacteria have high susceptibility rates to last generation fluoroquinolones.(28) Levofloxacin is a third generation fluoroquinolone that can penetrate the cornea and achieve high intraocular concentrations.(29) Moxifloxacin was significantly more potent than Levofloxacin against fluoroquinolone-resistant Coagulase-negative Staphylococcus.(30,31,3,5) Moxifloxacin is more effective in preventing postoperative endophthalmitis than the non-fluoroquinolones antibacterial agents, such as chloramphenicol, gentamycin and trimethoprim.(32)

CONCLUSIONS

In conclusion, it is important to assess the risk of bacterial contamination in patients undergoing cataract surgery. This risk increases by 50% if the patient has other associated conditions such as diabetes mellitus. Other risk groups are considered patients with dry eye, topical treatment or other associated infections. The most prevalent etiological agent is Staphylococcus, while Streptococcus and Gram-negative bacteria are less common.

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