

## Risk Factors for Conjunctival Bacteria Flora in Pre-Operative Cataract Patients, South-East Nigeria

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### Abstract

#### Purpose

To determine the risk factors for conjunctival bacteria flora in pre-operative cataract patients.

#### Methods

This was a descriptive, cross-sectional, hospital-based, prospective study involving 104 consecutive,

consented patients scheduled for cataract surgery at University of Nigeria Teaching Hospital Enugu in 2017. Patients using any form of antibiotics, with previous intraocular surgery or ocular inflammation were excluded from the study. The participants' socio-demographic profile, medical and social histories were obtained through interviewer-administered questionnaire. Conjunctival swab was obtained from the inferior fornix of the eye scheduled for surgery. Data was analysed using Statistical Package for Social Science version 23. Logistic regression analysis was done to identify the factors. The level of significance was at  $p < 0.05$ .

## Result

The participants were mainly females 67(64.4%), with a mean age of  $64 \pm 2SD$  years. The conjunctival swab bacteria isolation rate was 36.5%. Advanced age, male gender, illiteracy, residency in rural areas and tobacco use were associated with increased bacterial isolation but only age was statistically significant,  $p = 0.02$ . Use of topical medications (anti-glaucoma and artificial tear) significantly reduced bacteria growth,  $p = 0.03$ . However, in the multiple regression models, only age remained statistically significant.

## Conclusion

Strict precautionary measures should be directed to illiterate male patients on tobacco use residing in rural areas especially, the elderly ones, to avert the menace of post-operative endophthalmitis.

## Introduction

Worldwide, cataract surgery is a highly cost-effective treatment for the leading cause of avoidable blindness, usually with good visual outcome, barring devastating complications by endophthalmitis. Studies have shown that greater proportion of post-operative endophthalmitis are caused by the contamination of microorganism from the conjunctiva and eyelid during surgical manipulation and peri-operative period [1-4].

Endophthalmitis is a severe and dreaded complication of cataract surgery. It could cause permanent loss of vision as well as the eye ball, if not identified and managed appropriately. The collateral damage caused by this devastating complication could be a source of discouragement and barrier to uptake of cataract surgery.

Several factors such as advanced age [5-9], male gender [5,10], climatic and geographical locations [11,12], use of topical medications [8,13,14], and immunosuppressive conditions [8,15,16] have been documented to influence conjunctival bacteria. Understanding the epidemiological characteristics of conjunctival bacteria flora is important to avert the menace of post-operative endophthalmitis. It offers the Ophthalmologist a high index of suspicion and informed decision on early detection of disease and intervention to restore vision.

No previous study has been done in south-east Nigeria. Hence the decision to conduct this study in UNTH, a major hospital in the region aimed at generating data for an evidence-based policy and protocol on the management of patients scheduled for cataract surgery.

## Methods

### Study Area

University of Nigeria Teaching Hospital (UNTH) Ituku-Ozalla, Enugu was established in 1960. It is located along Enugu-Port Harcourt expressway, 15 Kilometers from Enugu Metropolis, the capital of old eastern Nigeria. Enugu State is one of the 36 States of the Federal Republic of Nigeria. It is located in the South-Eastern geo-political region of Nigeria. It falls within the transitional forest- savannah region with a mean annual rainfall of 1,200-2,000mm, and has two main seasons: rainy and dry seasons. UNTH provides health care and functions as a referral centre for the entire Southeast, South-south, North-central and occasionally other parts of Nigeria. The Ophthalmology department runs daily weekday clinics, theatres and 24 hours emergency services. It maintains eye centre in one of the outposts of the teaching hospital where residents are sent for rural posting. The department runs regular outreach program where eye care is provided and patients requiring further management referred to the centre. Cataract cases are brought to the hospital complex for surgery. Every category of patients are seen and treated. The Medical Microbiology department is within the hospital complex and is about five minutes walking distance apart from Ophthalmology clinic and ward. It has excellent synergy with Ophthalmology department.

### Study Design

This was a descriptive, cross-sectional, hospital-based, prospective study involving 104 consecutive patients scheduled for cataract surgery from June to September 2017 at UNTH that meet the eligibility criteria, and voluntarily consented to participation.

### Inclusion Criteria

Consenting patients (consent from patients' caregiver for children) booked for cataract surgery, irrespective of age.

### Exclusion Criteria

Patients who were on topical or systemic antibiotics or had used same within two weeks of presentation, history of contact lens wear, previous intraocular surgery or active ocular inflammation. Patients who did not give consent and those due to age or other peculiarities were not cooperative.

**Ethical** clearance was obtained from the Health Research and Ethics Committee (institutional review board) of the University of Nigeria Teaching Hospital, Ituku-Ozalla, Enugu according to the tenets of the Declaration of Helsinki. Written informed consent was obtained from each participant (from patients' caregiver for children). Participation in the study was voluntary and at no cost to the patients. Patients were informed that quality of care in the hospital did not depend on decision to participate or not.

### Sample Size Determination

Minimal sample size (N) was determined using formula below for calculating cross sectional study sample size

$$\frac{Z_{1-\alpha/2}^2 p(1-p)}{d^2}$$

$Z_{1-\alpha/2}$  at 95% confidence index is 1.96

p: is estimate positive result from previous research. A positive result of 41.9% was recorded in a research done in south-west, Nigeria [12].

d: is the precision (allowable error) which will be 10%

$$N = \frac{1.96^2 \times 0.419(1 - 0.419)}{0.1^2} = \frac{3.8416 \times 0.419 \times 0.581}{0.01}$$

= 93.519  $\approx$  94 eyes.

Attrition of 10% will give 9.4 eyes.

N  $\approx$  104 eyes.

### Sampling Technique

All consecutive consenting patients irrespective of age scheduled for cataract operation were recruited into the study until the estimated sample size was obtained. Only the eye scheduled for the operation was included even in patients with bilateral operable cataract.

### Study Procedure

Existing and new patients seen, diagnosed and booked for cataract surgery were evaluated for eligibility and recruited into the study. After obtaining consent, the structured and pre-tested questionnaire comprising of three sections: - socio-demographic, clinical and laboratory sections was administered by the researchers.

### Collection of Swab Sample

Having explained the procedure to each participant, a pair of sterile surgical gloves was worn by the principal researcher; the lower lid manually retracted by gentle downward pull to expose the inferior conjunctival fornix. Participants were requested to gaze up to avoid irritating or injuring the cornea, then, conjunctival swab was obtained from the inferior conjunctiva fornix by swabbing from the lateral end to the medial end using a sterile swab stick without touching the eye lashes or lid skin. Each swab stick specimen was taken within 30 minutes to Medical Microbiology and Parasitology Laboratory, unit for immediate inoculation.

## Isolation

In the laboratory, following standard method, swab was promptly inoculated onto three culture media:- blood agar, nutrient agar and MacConkey agar aimed at optimal isolation and was incubated at 37°C overnight according to the CLSI standard guidelines [17].

## Data Management

The statistical package used to analyze the data collected was IBM SPSS version 23. Chi-square tests were used to identify the factors associated with the conjunctival bacteria growth in the univariate analysis. The level of significance considered was  $P < 0.05$ . Multiple logistic regression analysis was carried out to confirm the significant associations established using Chi-Square tests.

## Results

The participants comprised of 37 (35.6%) males and 67 (64.4%) females with a mean age of  $64 \pm 2SD$  years. Other characteristics were as shown in tables 1 and 2.

**Table 1:** Socio-demographic characteristics of participants,  $N=104$

| Variable                  | Frequency | Percentage | Mean          |
|---------------------------|-----------|------------|---------------|
| <b>Gender</b>             |           |            |               |
| Male                      | 37        | 35.6       |               |
| Female                    | 67        | 64.4       |               |
| <b>Age (years)</b>        |           |            | $64 \pm 16.7$ |
| ≤ 20                      | 4         | 3.8        |               |
| 21 – 30                   | 2         | 1.9        |               |
| 31 – 40                   | 1         | 1.0        |               |
| 41 – 50                   | 9         | 8.7        |               |
| 51 – 60                   | 11        | 10.6       |               |
| ≥ 61                      | 77        | 74.0       |               |
| <b>Marital Status</b>     |           |            |               |
| Single                    | 9         | 8.7        |               |
| Married                   | 63        | 60.6       |               |
| Widowed                   | 32        | 30.8       |               |
| <b>Educational Status</b> |           |            |               |
| No formal education       | 21        | 20.2       |               |
| Primary                   | 44        | 42.3       |               |
| Secondary                 | 17        | 16.3       |               |
| Tertiary                  | 22        | 21.2       |               |

| <b>Residence</b> |    |      |  |
|------------------|----|------|--|
| Urban            | 47 | 45.2 |  |
| Semi-urban       | 19 | 18.3 |  |
| Rural            | 38 | 36.5 |  |

**Table 2:** Medical / social history of participants (n=104)

| <b>Variable</b>                            | <b>Frequency</b> | <b>Percentage</b> |
|--|------------------|-------------------|
| <b>Medical and surgical condition</b>      |                  |                   |
| None                                       | 57               | 54.8              |
| Hypertension                               | 23               | 22.1              |
| Diabetes mellitus                          | 6                | 5.8               |
| Asthma                                     | 5                | 4.8               |
| Osteoarthritis                             | 1                | 1.0               |
| Benign prostate hypertrophy                | 1                | 1.0               |
| Diabetics and Hypertension                 | 9                | 8.6               |
| Hypertension and HIV                       | 1                | 1.0               |
| Diabetics, Hypertension and Osteoarthritis | 1                | 1.0               |
| <b>Topical medication</b>                  |                  |                   |
| Yes  | 30               | 28.8              |
| No   | 74               | 71.2              |
| <b>Use of alcohol</b>                      |                  |                   |
| No   | 51               | 49                |
| Yes  | 18               | 17.3              |
| Stopped                                    | 35               | 13.7              |
| <b>Use of tobacco</b>                      |                  |                   |
| No   | 84               | 80.8              |
| Yes  | 8                | 7.7               |
| Stopped                                    | 12               | 11.5              |

Thirty-eight participants had conjunctival bacteria growth. The conjunctival swab bacteria isolation rate was 36.5%.

In the univariate analysis, age  $p=0.02$  and use of topic medications  $p=0.03$  (anti-glaucoma and artificial tear) significantly increased and reduced conjunctival bacteria growth respectively, table 3.

**Table 3:** Factors associated with conjunctival bacterial growth ( $n = 38$ )

| Variables          |               | Positive   | Negative   | Chi. Sq | P value      |
|--------------------|---------------|------------|------------|---------|--------------|
| Gender             | Male          | 15 (40.5%) | 22 (59.5%) | 0.40    | 0.53         |
|                    | Female        | 23 (34.3%) | 44 (65.7%) |         |              |
| Age                | ≤ 20 years    | 0 (0%)     | 4 (100%)   | 13.58   | <b>0.02*</b> |
|                    | 21-30         | 0 (0%)     | 2 (100%)   |         |              |
|                    | 31-40         | 0 (0%)     | 1(100%)    |         |              |
|                    | 41-50         | 1 (11.1%)  | 8 (88.9%)  |         |              |
|                    | 51-60         | 1 (9.1%)   | 10 (90.9%) |         |              |
|                    | ≥ 61          | 36 (46.8%) | 41 (53.2%) |         |              |
| Education          | None          | 11 (52.5%) | 10 (46.7%) | 2.85    | 0.09         |
|                    | Formal        | 27 (32.5%) | 56 (67.5%) |         |              |
| Occupation         | Farmer        | 14 (41.2%) | 20 (58.8%) | 3.66    | 0.60         |
|                    | Trader        | 9 (34.6%)  | 17 (65.4%) |         |              |
|                    | Civil servant | 2 (28.6%)  | 5 (71.4%)  |         |              |
|                    | Retired       | 9 (45%)    | 11 (55%)   |         |              |
| Residency          | Urban         | 16 (34%)   | 31 (66%)   | 0.23    | 0.63         |
|                    | Rural         | 22 (38.6%) | 35 (61.4%) |         |              |
| DM                 | Yes           | 6 (37.5%)  | 10 (62.5%) | 0.01    | 0.93         |
|                    | No            | 32 (36.4%) | 56 (63.6%) |         |              |
| Topical medication | Yes           | 6 (20%)    | 24 (80%)   | 4.97    | <b>0.03*</b> |
|                    | No            | 32 (43.2%) | 42 (56.8%) |         |              |
| Alcohol use        | Yes           | 7 (38.9%)  | 11 (61.1%) | 0.05    | 0.82         |
|                    | No            | 31 (36%)   | 55 (64%)   |         |              |
| Tobacco use        | Yes           | 10 (50%)   | 10 (50%)   | 1.94    | 0.16         |
|                    | No            | 28 (33.3%) | 56 (66.7%) |         |              |

But when they were subjected to the multiple logistic regression analysis, only age remained statistically significant, table 4.

**Table 4:** Result from Logistic Regression Analysis

|                    | B      | S.E   | Wald  | Df | P-value | Exp (B) |
|--------------------|--------|-------|-------|----|---------|---------|
| Age                | 1.275  | 0.537 | 5.637 | 1  | 0.018*  | 3.578   |
| Topical medication | -0.813 | 0.544 | 2.235 | 1  | 0.135   | 0.443   |
| Constant           | -8.037 | 3.154 | 6.492 | 1  | 0.01    | 0.000   |

However, male gender, illiteracy, retirees, residency in rural areas, diabetes mellitus, alcohol and tobacco use were associated with increased bacterial isolation, though not statistically significant, table 3.

## Discussion

The participants comprised of more females than males with a mean age of  $64 \pm 2SD$  years. This demographic profile is similar to findings in other studies [18,19]. This is not surprising because cataract is known to be age-related, increasing with advancing age [1].

In this study, age significantly increased conjunctival bacteria growth. This finding has been documented elsewhere in several studies [5-9,13,18]. It is believed that the visual challenges cataract imposes on patients could negatively affect their personal hygiene, coupled with decreasing immunity associated with normal aging process. Strict precautionary measures should therefore be directed to the elderly patients, in order to avert the complications of post-operative endophthalmitis.

Use of topical medications (anti-glaucoma and artificial tear) significantly reduced conjunctival bacteria growth, in this study. Similar report was made in other studies [8,13,14]. The wash out effect of the topical medications and the antiseptic properties of benzalkonium, the preservative in most topical medications may explain this finding.

The male gender has been associated with increased conjunctival bacteria growth [5,10,18,19]. However, similar observation was made in this study, though not statistically significant. In contrast, other studies [8,20] did not find any association with gender. The observed gender differences in adherence to use of medications [21] and conjunctival bacterial flora [22] may possibly explain this report.

Elsewhere, diabetes mellitus [8,16], alcohol [23] and tobacco [24] use have been associated with increased bacterial isolation. In the present study, these factors were weakly associated with increased conjunctival bacteria growth. The immunosuppressive effect of these factors may account for this finding. More robust studies with large sample size of populations with these factors to investigate this association is therefore advised.

Illiteracy and residency in rural areas were also found to be weakly associated with increased conjunctival bacteria growth in this study. Therefore, it is suggested that future studies should be designed to explore the influence of these socio-economic factors on conjunctival bacterial growth.

## Limitations of the Study are as Follows

The hospital-based nature of the study may limit generalisation of the results to the larger population. Beside that, the bacterial isolates were characterized based on their colonial morphology, Gram reaction and biochemical activities. Molecular techniques were not deployed in the characterization of the isolates. Also molecular techniques were not used to specifically identify the DNA sequence with mutations responsible for the observed resistance.

## Conclusion

Advanced age has remained the single most important risk factor for conjunctival bacterial growth in patients scheduled for cataract surgery in the study area. However, strict precautionary measures should be directed to illiterate male patients on alcohol and tobacco use residing in rural areas especially, the elderly ones, to avert the menace of post-operative endophthalmitis.

## Key Messages

- Understanding the epidemiological characteristics of conjunctival bacteria flora is important to avert the menace of post-operative endophthalmitis.
- Advanced age, male gender, illiteracy, residency in rural areas and tobacco use were associated with increased bacterial isolation.
- Use of topical medications (anti-glaucoma and artificial tear) significantly reduced bacteria growth.

## Declarations / Compliance with Ethical Standards

**Funding:** nil

**Conflicts of Interest/Competing Interests:** The authors declare that they have no conflict of interest.

**Ethics Approval:** This was obtained from the ethics committee of University of Nigeria Teaching Hospital Enugu. The procedures used in this study adhere to the tenets of the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

**Consent:** Written informed consent was obtained from all individual participants included in the study.

**Data Availability:** Available.

**Authors' Contribution Statements:** All authors contributed to the study conception and design. Material preparation, data collection and analysis were performed by [Cyril Mamah], [Samuel Ebede] and [Stella Ngozi Onwubiko]. The first draft of the manuscript was written by [Stella Ngozi Onwubiko] and all authors commented on previous versions of the manuscript. All authors read and approved the final manuscript.

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