RESEARCH PAPER

A comparative analysis of conjunctival microbial flora and the impact of cataract surgery

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ABSTRACT:
Cataracts persist as the main cause of blindness around the world, and surgery is the only way to cure them and restore vision in patients who have them. This study seeks to compare the microbial flora in the conjunctival sac of pre-operative, post-operative, and non-operated eyes of the same cataract patients at a tertiary care hospital in Salem. This study is a prospective observational investigation carried out over six months involving 30 patients diagnosed with cataracts. Conjunctival swabs from non-operated, pre-operated, and post-operated cataract patients were obtained and cultured on blood agar to identify bacterial and fungal flora. The data were statistically analysed using SPSS software (version 28.0). Of the 90 conjunctival swabs, 70% were found to be from people who hadn't had surgery, 67% from people who had surgery, and 36% from people who had surgery. Among all isolated organisms, Coagulase-negative staphylococci were the most prevalent in preoperative (43%), postoperative (20%), and non-operated eyes (23%), followed by Diphtheroids. The reduction in microbial growth post-surgery (about 80%) was achieved with the administration of prophylactic antibiotic eye drops containing Moxifloxacin 0.5% with Dexamethasone 0.1%, compared to a 10% reduction with Ciprofloxacin 0.3% with Dexamethasone 0.1%, indicating that fourth-generation antibiotics have greater potency than second-generation agents. Demographic analysis showed that 60% of the individuals were women and 40% were men. Half of the patients were between the ages of 61 and 70. There were more people with diabetes and high blood pressure. The study provided evidence that post-operative use of antibiotics, particularly fourth-generation fluoroquinolones, can reduce colonisation of the conjunctival flora.

KEY WORDS: Cataract, Conjunctival flora, Microbial growth, Surgery, Infection, Endophthalmitis risk.

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INTRODUCTION:

A cataract is a condition in which the lens of the eye becomes cloudy, preventing light from properly reaching the retina and thereby affecting vision.[1-3] It is claimed that cataract is the leading cause of blindness around the world. While cataracts are typically thought of as an age-related condition, they can occur in any age group. However, they are more common as people become older. Typically, a person will develop cataracts in both eyes.[4] Among the different types, age-related

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cataract is the most frequently observed form.[5] In the early stage, they can be corrected by prescription glasses; however, as they progress, surgical intervention becomes necessary.[6,7] Common symptoms include reduced vision, myopic shift, photophobia, monocular diplopia, and altered colour perception.[3,8] Cataract is divided into different types according to the opacity and its location, and is divided into nuclear cataract, posterior subcapsular cataract, cortical cataract, etc.[8–10] The occurrence of cataracts is associated with various contributing factors such as ageing, congenital conditions, trauma, radiation exposure, systemic disorders such as diabetes and endocrine abnormalities, myotonic dystrophy, nutritional deficiencies, smoking, alcohol consumption, and prolonged use of corticosteroids.[3–5] [11–15] Epidemiological data of about 33 million people worldwide were vision-impaired (suffering from low vision or blindness) in the year 2020. According to the WHO statistics of 2021, about 54 million people will be blind at the age of 60 years and above in the developing world by 2025. Among the global causes of blindness, cataract accounts for about 45% and thus about 40 million people will have cataract and need cataract surgery by the year 2025.[16–18]

Surgery for cataracts is among the most common operations done in ophthalmology.[19–21] The chance of getting endophthalmitis is very rare (0.07% & 0.12%)[19], but sometimes the disease causes blindness and eye damage.[22–26] Most of the time, infections occur due to microorganisms present either on the patient's ocular surface or in the operating room.[27,28] The conjunctiva covers the eyelids' inner lining and the sclera. It carries microorganisms that act as a defence mechanism against pathogenic organisms. But during surgery, the protection gets disrupted, causing infection.[29–32] Studying bacteria in pre- and post-operative periods may help reduce post-operative endophthalmitis.[33,34] The organisms that have been reported as causing conjunctivitis include Coagulase-Negative Streptococci, Corynebacterium, Staphylococcus aureus, and Streptococcus spp.[35,37] The conjunctival flora may differ depending on the geographical location of the people, since climate, region, season, dietary/food habits, and patients' specific factors such as age, sex, co-morbid conditions, and exposure to drugs differ from person to person.[28] [38–41] In addition, studies conducted in regions such as China and Northern India have shown that environmental and seasonal variations can also influence conjunctival microbial patterns. [40,42] Numerous studies have explored conjunctival flora by comparing culture results from before and after surgical procedures. However, none of them has specifically studied or reported on the microbial growth in conjunctival sacs of non-operated, pre-operated, and post-operated eyes. Therefore, the present study was conducted in the Southern region of India, in Salem district, Tamil Nadu.

The aim of this study includes detection and comparison of the kind of microorganism flora (bacteria and fungi) present in the conjunctiva of operated or non-operated eyes of patients with cataract; assessment of any changes in the kind of microorganism flora resulting from surgery, medicines, and hospitalization; assessment of any presence of microorganisms in the conjunctiva of operated and non-operated eyes of patients with cataract; and recommending practices that would avoid infections in such patients.

Fig. No. 1 Immature cataract

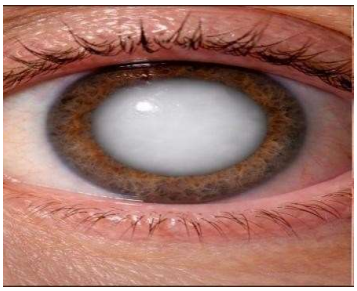

Fig. No. 2 Mature cataract

MATERIALS AND METHODS:

An observational study was conducted prospectively for six months at a tertiary care hospital on 30 patients of both sexes diagnosed with cataracts. There was a total of 90 swabs taken from the conjunctiva: 30 swabs from the non-operated eye, 30 swabs from pre-operative eyes, and 30 swabs from post-operative eyes of the same subjects. The experiment was conducted to determine the presence of microbial flora in the conjunctival sac of non-operated, pre-operated, and post-operative cataract

patients. The study protocol was approved by the Ethical Committee of the Institutional Review Board of Vinayaka Mission's Kirupananda Variyar Medical College & Hospital (Approval No: VMKVMC&H/IEC/25/237). Informed consent was obtained from all participants or their legally authorised representatives. Conjunctival swabs were collected using sterile techniques from patients undergoing cataract surgery and from individuals with normal vision. The swabs were immediately taken to the microbiology laboratory at Vinayaka Mission's Kirupananda Variyar Medical College & Hospital for analysis. Swabs were used aseptically to collect material from the inferior conjunctival sac and inoculated into sterile culture media. Bacterial cultures were grown on blood agar plates, and growth was evaluated after 24-72 hours, while that of fungi was evaluated after 5-6 days. The data were analysed using SPSS software (version 28.0)

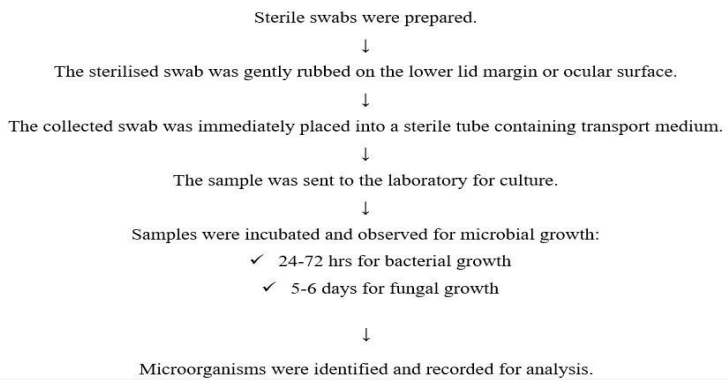

Fig. No. 3 Procedure for conjunctival swab collection and microbial culture analysis

PATIENT SELECTION CRITERIA:

The study will be conducted on patients diagnosed with age-related cataracts and who are over 40 years of age and capable of giving informed consent. The study will exclude patients with active ocular infections, such as conjunctivitis; previous ocular surgery that affects the conjunctival flora; those receiving antibiotics; those with ocular trauma or inflammatory diseases, or who are pregnant or lactating.

RESULTS:

A study was conducted involving 30 patients, from whom a total of 90 conjunctival swabs were collected. This included 30 swabs from preoperative eyes, 30 from postoperative eyes, and 30 from the non-operated eyes of the same patients.

Among the study population, 60% were women, and 40% were men. The 61–70-year age group showed the highest incidence of cataract, accounting for 50% of cases. According to the occupational analysis, daily wage workers were the most affected group, accounting for 33% ($\chi^2 = 8$). A considerable proportion of patients had comorbid conditions, with 46% ($\chi^2 = 7$) presenting with both diabetes mellitus and hypertension. Alcohol consumption was the most common habit observed (39%, $\chi^2 = 0.03$).

Table No. 1: Analysis of study population according to demographic and clinical variables

Characteristic	Category	Percentage (%)	Chi- Square (χ^2)
Gender	Male	40	-
	Female	60	-
Age Distribution	61-70 years	50	-
Occupation	Daily wage workers	33	8
Comorbidities	DM + HTN	46	7
Habits	Alcohol consumption	39	0.03

Out of 90 swabs, 20 (67%) pre-operative samples showed microbial growth, whereas only 11 (37%) post-operative samples were positive. In non-operated eyes, 21 (70%) samples showed microbial growth.

Table No. 2: Comparison of microbial growth (total samples) in Pre and Post-cataract surgery and the normal eye in the study population

	Positive Samples Microbial Growth	Percentage of Microbial Growth Found (%)	Chi-square (χ^2)	*P* value
Preoperative eyes	20	67	1.8	0.17
Postoperative eyes	11	37	0.0909	0.76
Non-operated eyes	21	70	0.904	0.82

Coagulase-negative Staphylococci (CNS) were the most commonly isolated organisms, which accounted for 43% (χ^2 = 0.9), 20% (χ^2 = 0.04), and 23% (χ^2 = 0.58) in pre-operative, post-operative, and normal eyes, respectively. The second most frequently isolated organism was Diphtheroid, which accounted for 23% (χ^2 = 0.9), 17% (χ^2= 0.04), and 17% (χ^2 = 0.01) in pre-operative, post-operative, and normal eyes, respectively. Other organisms isolated in normal eyes included *Streptococcus species* (17%, χ^2 = 0.01) and *Cutibacterium species* (13%, χ^2 = 0.03).

Table No. 3: Distribution of isolated microbes in pre-operative, post-operative, and Non-operated eyes

Bacterial growth	Preoperative (%)	Chi-Square Value (χ^2) (preoperative)	Postoperative (%)	Chi-Square Value (χ^2) (postoperative)	Non-operated Eyes (%)	Chi-Square Value (χ^2) (non-operated eyes)
Coagulase-negative staphylococci CNS	43	0.9	20	0.04	23	0.58
Diphtheroids	23	0.9	17	0.04	17	0.01
Streptococcus species	-	-	-	-	17	0.01
Cutibacterium species	-	-	-	-	13	0.03

The study revealed that maximum microbial growth was observed in preoperative eyes (67%) and non-operated eyes (70%), whereas in postoperative eyes, it was 37%, which is a reduction. The absolute difference in the reduction in microbial growth from pre- to post-operative is 30%, whereas the reduction in microbial growth from the preoperative to the postoperative period is 45%. The relative reduction in microbial growth in the postoperative period compared to the preoperative period following cataract surgery with antibiotics.

Table No. 4: Comparative analysis of microbial growth with absolute and relative risk reduction in pre- and post-operative eyes

Study group	Bacterial and Fungal Growth	Percentage for Microbial Growth (%)	Absolute difference	Relative reduction
Pre-operative	20	67	-	-
Post-operative	11	37	30%	45%

A significant reduction in microbial growth was observed post-operatively (37%) compared to pre-operative levels (67%). The absolute reduction was 30%, while the relative reduction reached 45%.

Patients treated with moxifloxacin 0.5% combined with dexamethasone 0.1% showed an 80% reduction in microbial growth, whereas those treated with ciprofloxacin 0.3% with dexamethasone 0.1% showed only a 10% reduction. However, no statistically significant difference was observed (p = 0.067).

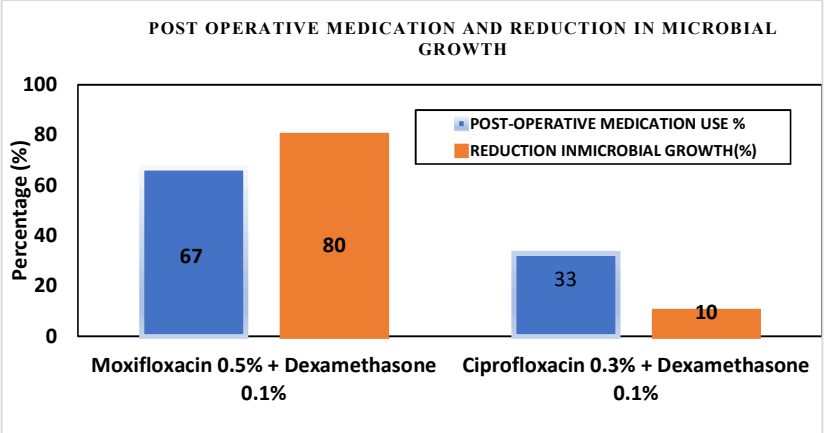

Fig. No.4 Comparison of post-operative medications and reduction of microbial growth after the use of post-operative medication

DISCUSSION:

The present study showed that microbial growth was highly prevalent among both pre-operative (67) and the unoperated eyes (70), which implies the existence of normal conjunctival flora. In all the groups, the most common isolate was coagulase-negative Staphylococcus (CNS). Such results support the perception that native conjunctival flora may serve as a possible cause of postoperative infections, especially endophthalmitis.

A significant reduction in microbial growth was observed in the eyes after surgery (37%). This may have been because antibiotics were given before the surgery to prevent infection. The mixture of moxifloxacin 0.5% and dexamethasone 0.1% in the current research yielded a significant reduction in microbial colonisation (about 80%). Formulations with ciprofloxacin showed relatively less efficacy, in contrast. This difference may be attributed to increased antimicrobial activity and a broader spectrum of fourth-generation fluoroquinolones, including moxifloxacin, which has effective coverage of both Gram-positive and Gram-negative microorganisms.

The present findings are in agreement with earlier research reports. For example, a recent investigation by Ranjan et al. (2024) found that microbial colonisation of the conjunctiva is prevalent among patients with cataracts, with the most commonly cultured bacteria being coagulase-negative staphylococci [43]. Another important aspect highlighted by the study was that, although antibiotic prophylaxis greatly reduces the number of microbes present, it is very unlikely that total eradication would occur.

Similarly, Suto et al. reported that Coagulase-negative staphylococci and Diphtheroids constitute the predominant normal flora of the conjunctival sac before cataract surgery.[24] The finding correlates with that of this study. They found that endogenous microbial flora in the eye plays an important role in postoperative infections. They also stressed the importance of microbial evaluation before operation as well as antibiotic prophylaxis.

From the current study, there is an obvious decrease in the number of microbes after administration of postoperative antibiotics, with better results with moxifloxacin 0.5% and dexamethasone 0.1% than with ciprofloxacin. The superior reduction in microbial colonisation achieved by moxifloxacin in this study indicates its wider and more consistent spectrum against microorganisms existing in the conjunctival sac, especially Coagulase-negative Staphylococci and Diphtheroids.

Similar findings have been cited by Ratnumnoi et al. (2017), who established that fluoroquinolones are very effective against both Gram-positive and Gram-negative bacteria found in the conjunctival flora of cataract patients [19]. These results justify the application of fluoroquinolones as prophylaxis agents and are in line with the positive results in the current study.

Moreover, it was also seen that newer generations of fluoroquinolones have excellent antimicrobial efficacy and higher activity against resistant organisms compared to older generation agents like ciprofloxacin, as reported in Gentile et al.'s (2014) study [35]. This correlates with the present findings, which indicate that ciprofloxacin-based regimens had a comparatively low effectiveness. The enhanced effect of moxifloxacin could also be connected with its high tissue penetration and pharmacodynamics.

Furthermore, because of the prevalence of these disorders among the patients, there could be an additional factor where the existence of systemic disorders may affect the colonisation of the conjunctiva with microorganisms. This is supported by the results of Gupta et al. (2024), who stated that the observed differences were due to demographic factors and systemic disorders as well as differences in geographical location, yet Staphylococcus remained the most common isolate.[28]

Though the number of microbes decreased following the surgery, it did not decrease to zero, which implies that there is still some risk of infection. The findings underscore the importance of maintaining stringent aseptic conditions during surgery, in addition to the administration of antibiotics. Although no statistical significance was found between the two antibiotics, the results point towards the use of fourth-generation fluoroquinolones.

Overall findings highlight the importance of recognising conjunctival microbial flora and selecting suitable preventive strategies to minimise the risk of postoperative complications following cataract surgery.

CONCLUSION:

In summary, the findings of this study indicate that conjunctival microbial colonisation is common among cataract patients and shows a significant reduction following cataract surgery with appropriate post-operative antibiotic therapy. The predominance of coagulase-negative Staphylococci in non-operated, pre-operative, and post-operative eyes highlights their role as normal ocular flora as well as potential pathogens in post-operative infections.

The study findings indicate that the use of fourth-generation fluoroquinolones, particularly moxifloxacin, is more effective in reducing microbial load compared to ciprofloxacin-based regimens. Although a substantial decrease in microbial growth was observed after surgery, complete eradication was not achieved, suggesting a persistent risk of infection. In addition, certain demographics such as old age and comorbid diseases such as diabetes mellitus and hypertension can play a role in bacterial colonisation.

It is therefore important to adhere strictly to asepsis in surgical procedures and the appropriate utilisation of antibiotics after surgery. This will help avoid infections and enhance surgery outcomes among patients with cataracts. More studies are required for validation purposes.

CONFLICT OF INTEREST:

The authors declare there is no conflict of interest

SOURCE OF FUNDING:

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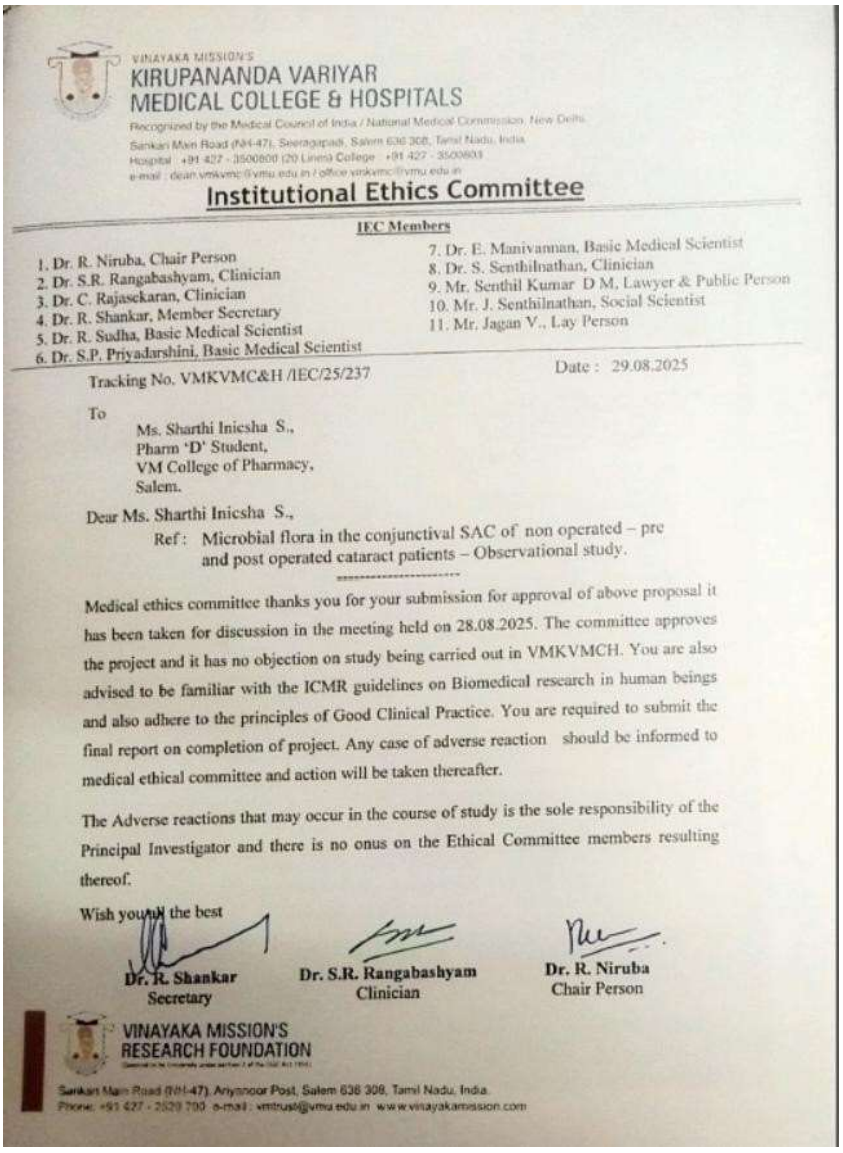
REFERENCES:

1. Shiels A, Hejtmancik JF. Biology of Inherited Cataracts and Opportunities for Treatment. Annu Rev Vis Sci. 2019 Sep 15;5(1):123–49. doi:10.1146/annurev-vision-091517-034346 PubMed PMID: 31525139.
2. Institue NE. National Eye Institute [Internet]. 2011 [cited 2026 Mar 31]. cataract what you should know. Available from: https://www.nei.nih.gov/eye-health-information/eye-conditions-and-diseases/cataracts
3. Lixi F, Corda C, Coco G, Carnovale-Scalzo G, Mancini A, Romeo MA, et al. Light discomfort thresholds in patients with senile cataract versus pseudophakic subjects. Graefes Arch Clin Exp Ophthalmol. 2025 Nov;263(11):3147–54. doi:10.1007/s00417-025-06941-3 PubMed PMID: 40794177.
4. Kiziltoprak H, Tekin K, Inanc M, Goker YS. Cataract in diabetes mellitus. World J Diabetes. 2019 Mar 15;10(3):140–53. doi:10.4239/wjd.v10.i3.140
5. Hashemi H, Pakzad R, Yekta A, Aghamirsalim M, Pakbin M, Ramin S, et al. Global and regional prevalence of age-related cataract: a comprehensive systematic review and meta-analysis. Eye. 2020 Aug 13;34(8):1357–70. doi:10.1038/s41433-020-0806-3
6. Allen D, Vasavada A. Cataract and surgery for cataract. BMJ. 2006 Jul 15;333(7559):128–32. doi:10.1136/bmj.333.7559.128
7. Heus P, Verbeek JH, Tikka C. Optical correction of refractive error for preventing and treating eye symptoms in computer users. Cochrane Database of Systematic Reviews. 2018 Apr 10;2018(4):CD009877. doi:10.1002/14651858.CD009877.pub2
8. Jolly JK, Pratt L, More AK, Kwan J, Jones RL, MacLaren RE, et al. The Effect of Cataract on Color Vision Measurement with the Low-Vision Cambridge Colour Test. Ophthalmology Science. 2022 Jun;2(2):100153. doi:10.1016/j.xops.2022.100153
9. Richter GM, Torres M, Choudhury F, Azen SP, Varma R, Los Angeles Latino Eye Study Group. Risk factors for cortical, nuclear, posterior subcapsular, and mixed lens opacities: the Los Angeles Latino Eye Study. Ophthalmology. 2012 Mar;119(3):547–54. doi:10.1016/j.ophtha.2011.09.005 PubMed PMID: 22197433.
10. Jansone-Langina Z, Solomatin A, Solomatins M, Krumina G. Quality of life assessment for nuclear, cortical, posterior subcapsular patients before and after cataract surgery. J Optom. 2024 Apr 27;17(2):100489. doi:10.1016/j.optom.2023.100489
11. Khokhar S, Pillay G, Dhull C, Agarwal E, Mahabir M, Aggarwal P. Pediatric cataract. Indian J Ophthalmol. 2017 Dec;65(12):1340. doi:10.4103/ijo.IJO_1023_17
12. Rong X, Rao J, Li D, Jing Q, Lu Y, Ji Y. TRIM69 inhibits cataractogenesis by negatively regulating p53. Redox Biol. 2019 Apr;22:101157. doi:10.1016/j.redox.2019.101157
13. Sugawa H, Matsuda S, Shirakawa JI, Kabata K, Nagai R. [Preventive Effects of Aphanothece sacrum on Diabetic Cataracts]. Yakugaku Zasshi. 2019 Mar 1;139(3):381–4. doi:10.1248/yakushi.18-00177-4 PubMed PMID: 30828014.

14. Moshirfar M, Webster CR, Seitz TS, Ronquillo YC, Hoopes PC. Ocular Features and Clinical Approach to Cataract and Corneal Refractive Surgery in Patients with Myotonic Dystrophy. Clinical Ophthalmology. 2022 Aug;Volume 16:2837–42. doi:10.2147/OPTH.S372633
15. Yanshole V V., Yanshole L V., Snytnikova OA, Tsentalovich YP. Quantitative metabolomic analysis of changes in the lens and aqueous humor under development of age-related nuclear cataract. Metabolomics. 2019 Mar 26;15(3):29. doi:10.1007/s11306-019-1495-4
16. Razzaghi S, Khalili AF, Faramarzi E, Motlagh BF, Zeinalzadeh AH. A Population-based Study of the Prevalence of Cataract and Its Relationship with Smoking in the Northwest of Iran: The Azar Cohort Eye Study. Middle East Afr J Ophthalmol. 2023 Jul;30(3):156–63. doi:10.4103/meajo.meajo_79_23
17. Steinmetz JD, Bourne RRA, Briant PS, Flaxman SR, Taylor HRB, Jonas JB, et al. Causes of blindness and vision impairment in 2020 and trends over 30 years, and prevalence of avoidable blindness in relation to VISION 2020: the Right to Sight: an analysis for the Global Burden of Disease Study. Lancet Glob Health. 2021 Feb;9(2):e144–60. doi:10.1016/S2214-109X(20)30489-7
18. Brian G, Taylor H. Cataract blindness--challenges for the 21st century. Bull World Health Organ. 2001;79(3):249–56. PubMed PMID: 11285671.
19. Ratnumnoi R, Keorochana N, Sonthisombat C. Normal flora of conjunctiva and lid margin, as well as its antibiotic sensitivity, in patients undergoing cataract surgery at Phramongkutklao Hospital. Clinical Ophthalmology. 2017 Jan;Volume 11:237–41. doi:10.2147/OPTH.S109247
20. Davis G. The Evolution of Cataract Surgery. Mo Med. 2016;113(1):58–62. PubMed PMID: 27039493.
21. Rossi T, Romano MR, Iannetta D, Romano V, Gualdi L, D'Agostino I, et al. Cataract surgery practice patterns worldwide: a survey. BMJ Open Ophthalmol. 2021 Jan 13;6(1):e000464. doi:10.1136/bmjophth-2020-000464
22. Wadbudhe AM, Tidke SC, Tidake PK. Endophthalmitis After Cataract Surgery: A Postoperative Complication. Cureus. 2022 Oct 9;14(10):e30110. doi:10.7759/cureus.30110
23. Khanna RC, Ray VP, Latha M, Cassard SD, Mathai A, Sekhar GC. Risk factors for endophthalmitis following cataract surgery-our experience at a tertiary eye care centre in India. Int J Ophthalmol. 2015;8(6):1184–9. doi:10.3980/j.issn.2222-3959.2015.06.19 PubMed PMID: 26682170.
24. Toshida H, Suto. Conjunctival sac bacterial flora isolated prior to cataract surgery. Infect Drug Resist. 2012 Jan;5:37. doi:10.2147/IDR.S27937
25. Cheraqpour K, Ahmadraji A, Tabatabaei SA, Bohrani Sefidan B, Soleimani M, Shahriari M, et al. Outbreak of postoperative endophthalmitis caused by *Pseudomonas aeruginosa* : a case report and brief literature review. Journal of International Medical Research. 2021 Nov 1;49(11):3000605211055394. doi:10.1177/03000605211055394
26. Durand ML. Endophthalmitis. Clin Microbiol Infect. 2013 Mar;19(3):227–34. doi:10.1111/1469-0691.12118 PubMed PMID: 23438028.
27. Soare SD, Ilie L, Costeliu O, Ghiță AC, Voinea LM, Ghiță AM. The ocular surface bacterial contamination and its management in the prophylaxis of post cataract surgery endophthalmitis. Rom J Ophthalmol. 2021 Apr 15;65(1):2–9. doi:10.22336/rjo.2021.2
28. Gupta V, Naharwal A, Mood M, Kumar S, Shrestha S, Chand S. Bacterial and fungal flora of conjunctiva of patients presenting with cataract and their seasonal variation in Northern India. J Lab Physicians. 2024 Mar 2;16:260. doi:10.25259/JLP-2023-1-11-(1541)
29. Ke R, Zhang M, Zhou Q, Yang Y, Shen R, Huang H, et al. Bacteriological profiles and drug susceptibility of Streptococcus isolated from conjunctival sac of healthy children. BMC Pediatr. 2020 Dec 22;20(1):306. doi:10.1186/s12887-020-02203-9
30. Azari AA, Barney NP. Conjunctivitis: a systematic review of diagnosis and treatment. JAMA. 2013 Oct 23;310(16):1721–9. doi:10.1001/jama.2013.280318 PubMed PMID: 24150468.
31. O'Callaghan R. The Pathogenesis of Staphylococcus aureus Eye Infections. Pathogens. 2018 Jan 10;7(1):9. doi:10.3390/pathogens7010009
32. Shumway CL, Motlagh M, Wade M. Anatomy, Head and Neck, Eye Conjunctiva. StatPearls [Internet]. 2026 [cited 2026 Apr 1]. Available from: https://www.ncbi.nlm.nih.gov/books/NBK519502/ PubMed PMID: 30137787.
33. Fenjan MA, Hamied FM, Al Sakini AS, Khorsheed H, Al-Aish ST. Preoperative conjunctival flora and antibiotic susceptibility in cataract surgery patients at Ibn Al-Haitham teaching eye hospital in Baghdad, Iraq. J Ophthalmic Inflamm Infect. 2025 Feb 27;15(1):15. doi:10.1186/s12348-025-00471-z PubMed PMID: 40014159.
34. Armstrong RA. The microbiology of the eye. Ophthalmic Physiol Opt. 2000 Nov;20(6):429–41. PubMed PMID: 11127123.
35. Gentile RC, Shukla S, Shah M, Ritterband DC, Engelbert M, Davis A, et al. Microbiological spectrum and antibiotic sensitivity in endophthalmitis: a 25-year review. Ophthalmology. 2014 Aug;121(8):1634–42. doi:10.1016/j.ophtha.2014.02.001 PubMed PMID: 24702755.
36. Relhan N, Albini TA, Pathengay A, Kuriyan AE, Miller D, Flynn HW. Endophthalmitis caused by Gram-positive organisms with reduced vancomycin susceptibility: literature review and options for treatment. Br J Ophthalmol. 2016 Apr;100(4):446–52. doi:10.1136/bjophthalmol-2015-307722 PubMed PMID: 26701686.

37. Wong TY. Effect of increasing age on cataract surgery outcomes in very elderly patients. BMJ. 2001 May 5;322(7294):1104–6. doi:10.1136/bmj.322.7294.1104 PubMed PMID: 11337443.
38. Balbaba M, Canleblebici M, Güven O, Toraman ZA, Yıldırım H, Erdağ M. Evaluation of conjunctival flora in congenital ptosis. Int J Ophthalmol. 2025 Oct 18;18(10):1846–50. doi:10.18240/ijo.2025.10.04
39. Liu Q, Xu ZY, Wang XL, Huang XM, Zheng WL, Li MJ, et al. Changes in Conjunctival Microbiota Associated With HIV Infection and Antiretroviral Therapy. Investigative Opthalmology & Visual Science. 2021 Sep 2;62(12):1. doi:10.1167/iovs.62.12.1
40. Xu S, Zhang H. Bacteriological profile of conjunctiva bacterial Flora in Northeast China: a hospital-based study. BMC Ophthalmol. 2022 Dec 16;22(1):223. doi:10.1186/s12886-022-02441-8
41. Petrillo F, Pignataro D, Lavano MA, Santella B, Folliero V, Zannella C, et al. Current Evidence on the Ocular Surface Microbiota and Related Diseases. Microorganisms. 2020 Jul 13;8(7):907–25. doi:10.3390/microorganisms8071033 PubMed PMID: 32668575.
42. Deng Y, Wen X, Hu X, Zou Y, Zhao C, Chen X, et al. Geographic Difference Shaped Human Ocular Surface Metagenome of Young Han Chinese From Beijing, Wenzhou, and Guangzhou Cities. Investigative Opthalmology & Visual Science. 2020 Feb 27;61(2):47. doi:10.1167/iovs.61.2.47
43. Ranjan S, Aggarwal S, Sinha A, Bhatnagar N. A cross-sectional study to evaluate the conjunctival bacterial flora in patients undergoing cataract surgery. Santosh University Journal of Health Sciences. 2024 Jul;10(2):225–33. doi:10.4103/sujhs.sujhs_66_24



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Institutional Ethics Committee

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1. Dr. R. Niruba, Chair Person
2. Dr. S.R. Rangabashyam, Clinician
3. Dr. C. Rajasekaran, Clinician
4. Dr. R. Shankar, Member Secretary
5. Dr. R. Sudha, Basic Medical Scientist
6. Dr. S.P. Priyadarshini, Basic Medical Scientist
7. Dr. E. Manivannan, Basic Medical Scientist
8. Dr. S. Senthilnathan, Clinician
9. Mr. Senthil Kumar D M, Lawyer & Public Person
10. Mr. J. Senthilnathan, Social Scientist
11. Mr. Jagan V., Lay Person

Tracking No. VMKVMC&H /IEC/25/237 Date : 29.08.2025

To
Ms. Sharthi Inicsha S.,
Pharm 'D' Student,
VM College of Pharmacy,
Salem.

Dear Ms. Sharthi Inicsha S.,

Ref : Microbial flora in the conjunctival SAC of non operated – pre and post operated cataract patients – Observational study.

Medical ethics committee thanks you for your submission for approval of above proposal it has been taken for discussion in the meeting held on 28.08.2025. The committee approves the project and it has no objection on study being carried out in VMKVMCH. You are also advised to be familiar with the ICMR guidelines on Biomedical research in human beings and also adhere to the principles of Good Clinical Practice. You are required to submit the final report on completion of project. Any case of adverse reaction should be informed to medical ethical committee and action will be taken thereafter.

The Adverse reactions that may occur in the course of study is the sole responsibility of the Principal Investigator and there is no onus on the Ethical Committee members resulting thereof.

Wish you all the best

Dr. R. Shankar Secretary
Dr. S.R. Rangabashyam Clinician
Dr. R. Niruba Chair Person

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