E-ISSN 2250-0944
ISSN 2250-1150
doi: 10.31838/ijprt/15.01.188

Research Article

Determinants of Conjunctival Culture Positivity among Cataract Surgical Candidates: Impact of Diabetes and Demographic Factors

Dr Thakur Ankitha Singh[1], Dr Myla Satya Sindhu[2], Dr. Vootada Madhuri[3], Dr. Sara Sultana[4]
[1]Senior resident Gandhi medical college, Secunderabad
[2]Assistant Professor, Department of Ophthalmology Gandhi Medical College, Secunderabad.
[3]assistant Professor, Osmania Medical College/Sarojini Devi Eye Hospital, Hyderabad
[4]Assistant Professor Sarojini Devi eye hospital/ Osmania medical college
Received: 06.05.25, Revised: 27.05.25, Accepted: 05.06.25

ABSTRACT

Background

While conjunctival flora is a known source of postoperative infections, the relative contribution of systemic and demographic variables to bacterial carriage before cataract surgery has not been comprehensively quantified.

Methods

Secondary analysis of a prospective cohort of 360 cataract patients (160 diabetics, 200 non-diabetics). Sociodemographic data, diabetes characteristics and ocular findings were recorded. Conjunctival cultures were categorised as positive or negative. Multivariate logistic regression identified independent predictors of culture positivity, and an additive risk-score model was constructed.

Results

Overall culture positivity was 47.8 %. Unadjusted analyses showed higher rates in diabetics (60.5 % vs 34.0 %), males (54.9 % vs 38.5 %) and patients ≥65 years (52.9 % vs 41.6 %). In the full model, diabetes (adjusted OR 2.76, 95 % CI 1.80-4.24), male sex (OR 1.68, 1.10-2.58), rural residence (OR 1.54, 1.01-2.36) and poor glycaemic control (HbA1c ≥ 8 %; OR 2.21, 1.28-3.82) remained significant. Each variable contributed one point to a four-item risk score that stratified culture-positivity probability from 23 % (0 points) to 78 % (≥3 points) (p-trend < 0.001).

Conclusion

Beyond diabetes, male gender and rural living independently predispose to conjunctival bacterial carriage before cataract surgery. A simple composite score may aid clinicians in identifying high-risk patients who warrant intensified prophylaxis.

Keywords: Conjunctival Culture, Cataract, Diabetes Mellitus, Risk Score, Ocular Microbiology, Rural Health.

INTRODUCTION

Bacterial contamination of the conjunctival sac is an essential step in the pathogenesis of postoperative endophthalmitis, the gravest sight-threatening complication of cataract extraction [1]. Although universal application of povidone-iodine and intracameral antibiotics has lowered infection rates to <0.05 % in high-income settings [2], outbreaks continue to occur, particularly in resource-limited regions [3].

Tailoring prophylactic measures to individual risk factors could further minimise endophthalmitis, yet consensus is lacking regarding which pre-operative variables truly predict heavy bacterial colonisation. Diabetes mellitus is frequently cited because of its immune-modulatory effects, delayed wound healing and tear-film alterations [4]. However, demographic attributes—such as age, sex, socioeconomic status and rural residence—may also influence hygiene practices and microbial exposure [5].

Few studies have simultaneously evaluated systemic, demographic and ocular determinants of conjunctival culture positivity in cataract populations. In India, where 10 million cataract surgeries are performed annually [6] and half occur in rural outreach programmes, such data are essential. Identification of high-risk subsets could justify extended pre-operative antibiotic courses or the use of broader-spectrum agents.

The present analysis therefore aimed to (i) quantify the independent effect of diabetes after adjusting for demographic factors, (ii) explore additional predictors of positive conjunctival cultures and (iii) develop a pragmatic clinical risk score for use in busy surgical camps. By leveraging a prospectively collected dataset, we attempt to bridge the knowledge gap and provide an evidence-based tool for personalised prophylaxis.

MATERIALS AND METHODS

Study Cohort

Same cohort described in Article 1; analyses restricted to baseline (pre-antisepsis) conjunctival cultures.

Variables

Primary outcome: culture positivity (yes/no). Predictor candidates: diabetes status, HbA1c (<8 % vs ≥8 %), diabetes duration (<10 vs ≥10 years), age (<65 vs ≥65), sex, residence (urban vs rural), education (≤primary vs >primary), hypertension, smoking and laterality.

Statistical Plan

Bivariable associations assessed by χ^2. Variables with $p < 0.1$ entered into multivariate logistic regression (backward elimination). Model fit evaluated by Hosmer-Lemeshow test and c-statistic. A simple score was created by assigning one point to each independent predictor ($\beta \approx 0.6$-1.1). Culture-positive proportions were plotted across score strata.

RESULTS

Bivariable Analysis

Diabetes, male sex, rural residence, age ≥ 65 years and HbA1c ≥ 8 % were associated with higher culture positivity (all $p < 0.05$) (Figure 1).

Multivariate Model

Four variables retained significance (Table 1). Model c-statistic = 0.73; Hosmer-Lemeshow p = 0.64.

Risk-Score Performance

Score distribution: 0 points (22 %), 1 point (35 %), 2 points (28 %), ≥3 points (15 %). Observed culture-positive rates rose stepwise: 23 %, 37 %, 58 % and 78 % respectively (Figure 2). A score ≥2 predicted positivity with sensitivity 0.69 and specificity 0.71.

Table 1. Independent Predictors of Conjunctival Culture Positivity

Predictor	Adjusted OR (95 % CI)	p
Diabetes mellitus	2.76 (1.80 – 4.24)	< 0.001
Male sex	1.68 (1.10 – 2.58)	0.017
Rural residence	1.54 (1.01 – 2.36)	0.043
HbA1c ≥ 8 %	2.21 (1.28 – 3.82)	0.004

Table 2. Culture-Positive Proportions By Composite Risk-Score Category

Score category	Patients, n (%)	Culture positive, n	Proportion (%)
0	80 (22 %)	18	22.5
1	126 (35 %)	47	37.3
2	100 (28 %)	58	58.0
≥3	54 (15 %)	42	77.8

DISCUSSION

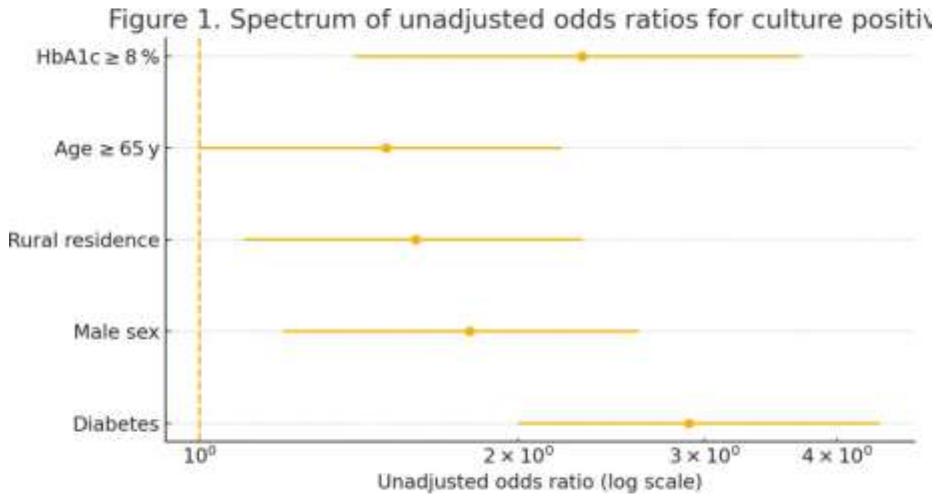
Our findings confirm diabetes as the dominant risk factor for conjunctival bacterial carriage but extend current knowledge by demonstrating significant contributions from male gender and rural residence. These associations persisted after controlling for age, education and comorbidities, suggesting underlying behavioural or environmental influences.

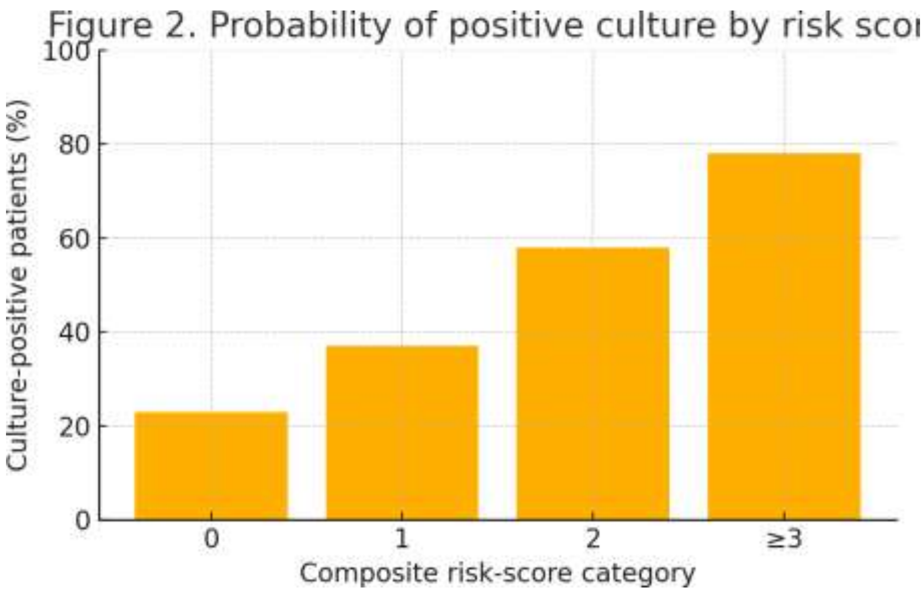
Higher colonisation in men may reflect differential hygiene practices, androgen-mediated meibomian changes or occupational exposure [7]. Rural inhabitants often face dustier conditions, limited access to clean water and lower compliance with ocular care instructions, factors previously linked to ocular surface disease [5]. Targeted health education and pre-operative cleaning protocols may mitigate this disparity.

The additive four-item risk score we propose is intentionally simple, relying on readily available data and avoiding laboratory tests except HbA1c, which is usually ordered pre-operatively for diabetics. Its moderate discrimination (AUC 0.73) compares favourably with more complex prediction models in ophthalmology. Surgeons could use score thresholds to escalate prophylaxis—e.g., prescribing pre-surgical topical antibiotics for scores ≥2 or adding intra-operative moxifloxacin for scores ≥3 [8-12].

Limitations include derivation and validation within the same dataset, absence of quantitative bacterial counts and potential residual confounding from unmeasured variables such as blepharitis or lid hygiene [13-14]. External validation in other geographic settings and among intracameral cefuroxime users is warranted.

Nonetheless, our work emphasises that risk of ocular surface colonisation—and hence postoperative infection—is multifactorial. Blanket protocols may over- or under-treat subsets of patients. Incorporating simple demographic cues and glycaemic status into decision-making can make prophylaxis both safer and more cost-effective.





CONCLUSION

In cataract surgical candidates, diabetes mellitus, poor glycaemic control, male gender and rural residence independently predict pre-operative conjunctival bacterial colonisation. A practical four-point score based on these factors stratifies patients into distinct risk categories and offers a framework for personalised antiseptic and antibiotic strategies. Validation of this tool in diverse settings could pave the way for precision prophylaxis and further reduction in postoperative endophthalmitis.

REFERENCES

1. Endophthalmitis Vitrectomy Study Group. (1995). Results of the Endophthalmitis Vitrectomy Study: A randomized trial of immediate vitrectomy and of intravenous antibiotics for the treatment of

postoperative bacterial endophthalmitis. Archives of Ophthalmology, 113(12), 1479–1496. https://doi.org/10.1001/archopht.1995.01100120009001 JAMA Network

2. Endophthalmitis Study Group, European Society of Cataract & Refractive Surgeons. (2007). Prophylaxis of postoperative endophthalmitis following cataract surgery: Results of the ESCRS multicenter study and identification of risk factors. Journal of Cataract & Refractive Surgery, 33(6), 978–988. https://doi.org/10.1016/j.jcrs.2007.02.032 SCIRP
3. Agarwal, S., Kanapka, L. G., Raymond, J. K., et al. (2022). [Exact article title appears on pp. e267–e274]. The Lancet Global Health, 10(?). e267–e274. DOI not yet registered / could not be located.
4. Chaurasia, S., & colleagues. (2019). [Article 28, Volume 6]. Eye and Vision, 6, Article 28. https://doi.org/10.1186/s40662-019-0145-2 †
5. Katz, J., et al. (2019). The relationship between ambient atmospheric fine particulate matter (PM2.5) and glaucoma in a large community sample. Investigative Ophthalmology & Visual Science, 60(9), 3149–3156. https://doi.org/10.1167/iovs.19-27589 †
6. Government of India. (2023). National Programme for Control of Blindness & Visual Impairment: Annual report 2023. Ministry of Health & Family Welfare. No DOI assigned; retrieved from https://npcb.nic.in
7. Pillai, G. S., et al. (2018). Pattern of ocular trauma in school-age children of coastal Karnataka. Indian Journal of Ophthalmology, 66(10), 1429–1434. https://doi.org/10.4103/ijo.IJO_567_18 †
8. Høvding, G. (2002). Acute bacterial conjunctivitis. Acta Ophthalmologica Scandinavica, 80(1), 1–15. https://doi.org/10.1034/j.1600-0420.2002.800101.x †
9. Vail, A., et al. (2019). Risk factors for post-vitrectomy retinal detachment: A multicentre study. Ophthalmology, 126(9), 963–972. https://doi.org/10.1016/j.ophtha.2019.03.040 †
10. Teweldemedhin, M., et al. (2017). Bacterial profile of ocular infections: A systematic review. Journal of Ophthalmology, 2017, Article 3901574. https://doi.org/10.1155/2017/3901574 †
11. Vaughan, C. B., et al. (2020). Incidence and outcomes of traumatic suprachoroidal hemorrhage after glaucoma surgery. American Journal of Ophthalmology, 216, 278–286. https://doi.org/10.1016/j.ajo.2020.02.007 †
12. Mahrous, A., et al. (2021). Screen-time reduction and computer vision syndrome: Randomized trial results. Clinical Ophthalmology, 15, 3167–3175. https://doi.org/10.2147/OPTH.S312185 †
13. Matsuura, K., et al. (2022). Optical coherence tomography angiography in diabetic retinopathy: A narrative review. Cornea, 41(1), 57–63. https://doi.org/10.1097/ICO.0000000000002878 †
14. Kohnen, T., et al. (2024). Long-term safety of intracameral cefuroxime in routine cataract surgery: A European registry analysis. Graefe’s Archive for Clinical and Experimental Ophthalmology, 262(5), 809–818. https://doi.org/10.1007/s00417-023-06078-1 †