

Cytokine-Based Diagnostic Accuracy for Postoperative Endophthalmitis: Implications for Bacterial–Fungal Differentiation

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Research Article

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Abstract

Background

Vitreous cytokines have been proposed as diagnostic biomarkers for acute post-cataract endophthalmitis, but their diagnostic accuracy has not been quantified. We reanalyzed a previously described cohort to determine the diagnostic accuracy of vitreous cytokines for distinguishing infectious endophthalmitis from non-infectious controls and for predicting culture positivity, and explored optical coherence tomography (OCT) central macular thickness as an additional biomarker correlate.

Methods

Individual-level vitreous concentrations of 25 cytokines, chemokines and growth factors — originally measured by multiplex immunoassay in 18 patients with acute infectious endophthalmitis after cataract extraction and 39 non-infectious vitrectomy controls — were reanalyzed. ROC analysis estimated the area under the curve (AUC), optimal Youden cut-off, sensitivity and specificity for each cytokine. Leave-one-out cross-validation (LOOCV) assessed a combined biomarker panel. Multivariable regression evaluated TNF- α versus initial visual acuity (logMAR), adjusting for age and diabetes. In patients with interpretable OCT imaging, central macular thickness was compared between affected and fellow eyes (Wilcoxon signed-rank test) and correlated with vitreous cytokines (Spearman).

Results

IL-6, G-CSF, IL-8, IL-1 α and TNF- α showed excellent discrimination between endophthalmitis and controls (AUC 0.97–1.00). A combined IL-6 + G-CSF panel achieved LOOCV AUC = 0.999, with no gain over IL-6 (AUC = 1.000). Within endophthalmitis cases, IL-8 predicted positive culture with moderate accuracy (AUC = 0.753; cut-off 1264 pg/mL; sensitivity 81.8%, specificity 71.4%), outperforming TNF- α (AUC = 0.675) and IL-17 (AUC = 0.597). TNF- α correlated with initial visual acuity ($r = 0.51$, $p = 0.032$), attenuated after adjusting for age and diabetes ($p = 0.117$). Central macular thickness was greater in affected than fellow eyes (323.5 vs 246.1 μm , $p = 0.004$), but no cytokine correlated with affected-eye thickness or the affected–fellow difference (maximum $r = 0.41$, $p \geq 0.12$).

Conclusions

Vitreous IL-6, G-CSF and IL-8 show potential as rapid diagnostic biomarkers for bacterial post-cataract endophthalmitis, and IL-8 shows moderate value in predicting culture positivity. Together with published data on fungal endophthalmitis, these findings support a hypothesis-generating role for cytokine profiling in etiological triage, pending prospective, multicenter validation. Affected eyes showed greater central

macular thickness than fellow eyes, a structural correlate not explained by the cytokine panel measured here.

Background

Acute infectious endophthalmitis following cataract surgery is a rare but potentially blinding complication, with an incidence between 0.087% and 0.265%.[1] Clinical diagnosis is often made before microbiological confirmation, since culture results take several days to return and yield variable sensitivity.[2] This diagnostic delay is clinically important because early treatment decisions — particularly the choice between intravitreal antibiotic injection alone and combined pars plana vitrectomy — are guided largely by clinical severity rather than by microbiological or molecular data.[3]

Vitreous cytokines are known to rise sharply during infectious endophthalmitis and have been proposed as adjunctive diagnostic and prognostic tools.[4, 5] We have previously described, in a cohort of 18 patients with presumed acute post-cataract endophthalmitis and 39 non-infectious vitrectomy controls, that levels of multiple cytokines — including IL-6, IL-8, TNF- α , G-CSF and IL-1 α , among others — were significantly higher in infected eyes, that TNF- α correlated with initial visual acuity, and that IL-8 was higher among culture-positive patients.[6] However, that analysis was restricted to between-group comparisons of central tendency (Mann-Whitney and Kruskal-Wallis tests) and did not address a question of direct clinical relevance: the accuracy with which individual cytokine levels can discriminate infectious from non-infectious eyes, or predict a positive culture, at the single-patient level.

Diagnostic accuracy metrics — sensitivity, specificity, and area under the receiver operating characteristic curve (AUC) — answer a fundamentally different question than a group-comparison p-value, and are the metrics that determine whether a biomarker could plausibly be translated into a point-of-care or rapid-turnaround clinical test. In addition, although fungal endophthalmitis is far less common than bacterial disease after cataract surgery, published cytokine data suggest that the two entities may generate quantitatively distinct inflammatory responses, raising the possibility that cytokine profiling could eventually assist etiological triage while microbiological confirmation is pending.[8, 9]

The purpose of this study was to reanalyze the individual-level vitreous cytokine data from our previously described cohort using receiver operating characteristic analysis, to quantify the diagnostic accuracy of the most discriminative cytokines, to determine whether cytokine levels can predict culture positivity, and to place these findings in the context of published bacterial and fungal endophthalmitis cytokine data.

Methods

Study design and population

This is a secondary, hypothesis-generating reanalysis of a previously described, single-center cohort.[6] Briefly, patients with a clinical diagnosis of acute endophthalmitis following cataract surgery (Endophthalmitis Vitrectomy Study criteria) were recruited from the Emergency Department of the Altino

Ventura Foundation between March 2011 and October 2012. Non-infectious controls underwent posterior vitrectomy for retinal detachment, epiretinal membrane/macular hole, or proliferative diabetic retinopathy on the same day that case samples were collected. Vitreous humor was analyzed for 25 cytokines, chemokines and growth factors using the Bio-Plex Pro Human Cytokine multiplex assay (Bio-Rad, Hercules, CA). Full details of sample collection, inclusion/exclusion criteria and the multiplex protocol were reported previously.[6] The original study was approved by the Ethics Committee of the Federal University of Pernambuco and adhered to the Declaration of Helsinki; all patients provided written informed consent covering future analyses of the collected data. No new patients, samples, or measurements were generated for the present analysis; individual-level, de-identified concentration data were reused.

Statistical analysis

For each cytokine, discrimination between endophthalmitis cases and non-infectious controls was quantified using the area under the receiver operating characteristic curve (AUC). The optimal cut-off was defined by the Youden index (maximum of sensitivity + specificity – 1), with corresponding sensitivity and specificity reported. A combined biomarker panel (logistic regression on log-transformed IL-6 and G-CSF concentrations) was evaluated using leave-one-out cross-validation (LOOCV) to limit overfitting and yield an optimism-corrected estimate of performance, given the limited sample size, and compared with LOOCV performance of each marker individually. Within the endophthalmitis group only, ROC analysis was used to evaluate IL-8, TNF- α and IL-17 as predictors of positive microbial culture. The association between TNF- α and initial visual acuity (logMAR) was assessed with Spearman correlation and, secondarily, with multivariable linear regression adjusting for age and diabetes status. Analyses were performed in Python (pandas, scikit-learn, statsmodels, scipy). Given the exploratory nature of this reanalysis and the limited sample size, results should be interpreted as hypothesis-generating rather than confirmatory; no correction for multiple comparisons was applied, consistent with the exploratory framing of this study. Statistical computations for this reanalysis (including the optical coherence tomography sub-analysis described below) were performed with the assistance of an AI-based analytic tool (Claude, Anthropic); all outputs were independently reviewed and verified by the authors.

Optical coherence tomography sub-analysis

As an additional exploratory sub-analysis, spectral-domain OCT central macular thickness was compared between the affected eye and the fellow, uninfected eye of each patient with endophthalmitis, where imaging was available and interpretable; eyes with media opacity precluding image acquisition were excluded from this sub-analysis. Paired comparison was performed using the Wilcoxon signed-rank test. The association between vitreous cytokine concentrations and affected-eye central macular thickness, and between cytokine concentrations and the affected–fellow eye thickness difference, was assessed using Spearman correlation for the five cytokines with the strongest diagnostic performance in the primary analysis (IL-6, G-CSF, IL-8, IL-1 α and TNF- α), together with IL-17 and IFN- γ . This sub-analysis

was not part of the original cohort's pre-specified analysis plan and is presented as hypothesis-generating.

Results

Diagnostic accuracy for endophthalmitis versus non-infectious controls

Five cytokines showed excellent discrimination between endophthalmitis and control eyes: IL-6 (AUC = 1.000), G-CSF (AUC = 0.999), IL-8 (AUC = 0.980), IL-1ra (AUC = 0.976) and TNF- α (AUC = 0.972) (Table 1, Figure 1A). At their Youden-optimal cut-offs, IL-6 (≥ 2827.5 pg/mL) achieved 100% sensitivity and 100% specificity; G-CSF, IL-8, IL-1ra and TNF- α achieved sensitivity of 94.4–100% with specificity of 97.4–100%.

Cytokine	AUC	Cut-off (pg/mL)	Sensitivity (%)	Specificity (%)	n
IL-6	1.000	2827.5	100.0	100.0	57
G-CSF	0.999	78.9	100.0	97.4	56
IL-8	0.980	345.1	94.4	100.0	57
IL-1ra	0.976	42.9	94.4	100.0	57
TNF- α	0.972	23.7	94.4	100.0	57

Table 1. Diagnostic accuracy of the five most discriminative vitreous cytokines for endophthalmitis versus non-infectious vitrectomy controls. AUC: area under the receiver operating characteristic curve; cut-offs correspond to the Youden index.

A combined panel (IL-6 + G-CSF, logistic regression) evaluated by leave-one-out cross-validation achieved AUC = 0.999, essentially unchanged from IL-6 alone under the same cross-validation procedure (AUC = 1.000), indicating no incremental diagnostic value from combining these two markers (Table 2).

Model	LOOCV AUC	n
IL-6 alone	1.000	57
G-CSF alone	0.996	56
IL-8 alone	0.963	57
IL-6 + G-CSF (combined panel)	0.999	56

Table 2. Leave-one-out cross-validated (LOOCV) diagnostic performance of single cytokines versus a combined IL-6 + G-CSF panel.

Prediction of positive microbial culture

Within the endophthalmitis group (n = 18; 11 culture-positive, 7 culture-negative), IL-8 showed moderate accuracy for predicting a positive culture (AUC = 0.753), with a cut-off of 1264 pg/mL yielding 81.8% sensitivity and 71.4% specificity. TNF- α showed weaker discrimination (AUC = 0.675), and IL-17 performed close to chance (AUC = 0.597) (Table 3, Figure 1B).

Cytokine	AUC	Cut-off (pg/mL)	Sensitivity (%)	Specificity (%)
IL-8	0.753	1264.0	81.8	71.4
TNF- α	0.675	34.9	81.8	57.1
IL-17	0.597	35.0	54.5	85.7

Table 3. Accuracy of IL-8, TNF- α and IL-17 in predicting positive microbial culture among patients with clinically diagnosed endophthalmitis (n = 18).

Visual acuity

TNF- α correlated with initial visual acuity expressed in logMAR (Spearman r = 0.51, p = 0.032, n = 18), confirming the direction of the association reported in the original univariate analysis. In a multivariable linear model adjusting for age and diabetes status, the association between log-transformed TNF- α and initial logMAR visual acuity was attenuated and no longer statistically significant (β = 0.18, p = 0.117), while age showed a borderline independent association with worse initial visual acuity (p = 0.057). This exploratory model (R² = 0.43, n = 18) suggests that part of the crude TNF- α –visual acuity association may be confounded by patient age, a nuance not identifiable in the original bivariate analysis.

Optical coherence tomography: affected versus fellow eye

Central macular thickness was evaluable in 16 of 18 affected eyes (excluded: media opacity in 1, bulbar atrophy in 1) and in the paired fellow eye for 15 patients. Structural OCT findings in the affected eye were heterogeneous: normal in 6, epiretinal membrane in 7, cystoid macular edema in 2, and macular atrophy in 1 (2 eyes not gradable). Affected eyes had significantly greater central macular thickness than fellow eyes (mean 323.5 μ m vs 246.1 μ m; Wilcoxon signed-rank p = 0.004; Table 4).

Eye	n	Mean central macular thickness (μ m)
Affected eye	15	323.5
Fellow (uninfected) eye	15	246.1

Table 4. Central macular thickness (μm) in the affected eye versus the fellow, uninfected eye of patients with endophthalmitis (paired comparison, $n = 15$).

Despite this structural difference, no vitreous cytokine correlated significantly with affected-eye central macular thickness or with the affected–fellow eye thickness difference (Table 5). TNF- α showed the strongest, non-significant association with affected-eye thickness (Spearman $r = 0.35$, $p = 0.190$, $n = 16$); IL-6 showed a similar non-significant trend ($r = 0.41$, $p = 0.119$). No cytokine reached nominal significance for either outcome.

Cytokine	r (affected-eye thickness)	p	r (affected–fellow difference)	p
IL-1ra	0.08	0.778	-0.12	0.675
IL-6	0.41	0.119	0.38	0.163
IL-8	0.00	0.991	-0.18	0.511
G-CSF	0.33	0.212	0.33	0.234
TNF- α	0.35	0.190	0.27	0.327
IL-17	0.12	0.656	0.00	1.000
IFN- γ	0.21	0.437	0.08	0.778

Table 5. Spearman correlation between vitreous cytokine concentrations and OCT central macular thickness in the affected eye, and the affected-fellow eye thickness difference.

Discussion

This reanalysis reframes a previously reported group-comparison dataset[6] in terms of diagnostic accuracy, the metric most relevant to clinical translation. Five cytokines — IL-6, G-CSF, IL-8, IL-1ra and TNF- α — discriminated endophthalmitis from non-infectious controls with AUCs at or near 1.0. Such near-perfect discrimination should be interpreted cautiously: it may partly reflect genuine, substantial biological differences between an acute bacterial infectious process and chronic or degenerative vitreoretinal conditions (the composition of the control group), rather than a universally generalizable property of these biomarkers. Complete or near-complete separation between groups is more easily achieved in small, single-center samples and warrants confirmation in larger, multicenter cohorts with harmonized control groups before any diagnostic cut-off is proposed for clinical use.

The combined IL-6 + G-CSF panel did not outperform IL-6 alone, consistent with IL-6 already approaching ceiling discrimination in this dataset; combining biomarkers is more likely to add value in settings where no single marker achieves near-complete separation.

A more clinically actionable finding is the moderate accuracy of IL-8 (AUC = 0.753) for predicting positive microbial culture among patients already diagnosed with endophthalmitis. Unlike the case-versus-

control comparison, this is a within-disease discrimination task with direct relevance to antimicrobial stewardship and to interpreting culture-negative presumed endophthalmitis, which likely includes both true sterile inflammation and false-negative cultures. IL-8 has previously been proposed as an early marker of bacterial infection in other clinical contexts,[10] and the present cut-off (1264 pg/mL) may serve as a starting point for prospective evaluation, though it requires external validation before any clinical application.

The attenuation of the TNF- α –visual acuity association after adjustment for age is a new observation not identifiable in the original univariate analysis, and illustrates a broader point: with $n = 18$, multivariable estimates are imprecise and this finding should be treated as hypothesis-generating rather than as evidence against a TNF- α –severity relationship, which remains biologically plausible and has experimental support.[11]

The OCT sub-analysis adds a structural dimension to these cytokine findings. Affected eyes showed significantly greater central macular thickness than the fellow, uninfected eye, confirming an objective structural correlate of the acute inflammatory process independent of clinical grading. However, none of the vitreous cytokines measured — including TNF- α and IL-6, the markers most strongly associated with disease severity in this cohort — correlated with the magnitude of this structural change. This dissociation may reflect the small number of evaluable eyes ($n = 15–16$), the fact that central macular thickness integrates mechanisms beyond the cytokines assayed here (e.g., VEGF-mediated vascular permeability, which showed no group-level difference in the original cohort,[6] or direct toxin-mediated tissue injury), or simply insufficient power to detect a true but modest association. This sub-analysis should be regarded as hypothesis-generating and does not support using the present cytokine panel as a surrogate for structural macular involvement.

Comparison with fungal endophthalmitis: a hypothesis for etiological triage

Because fungal endophthalmitis is uncommon after cataract surgery, our cohort did not include fungal cases, precluding a direct within-study comparison. Published human data are limited: in the largest available multiplex study of infectious endophthalmitis (46 patients, of whom only 3 were fungal), the cytokine profile of fungal cases was reported to be closer to non-infectious controls than to bacterial cases, with the authors explicitly noting they could not identify a biomarker signature with sufficient discriminatory power for microorganism type, given the very small fungal subgroup.[8] Experimental murine models of *Aspergillus flavus* endophthalmitis have reported elevated vitreous IL-6, TNF- α and IL-8, but at magnitudes and using assay platforms not directly comparable to human Bio-Plex data.[9] Taken together, these sources are consistent with a plausible — but currently unproven — hypothesis that bacterial post-cataract endophthalmitis, particularly when driven by *Staphylococcus epidermidis* as in the present cohort, generates a more intense innate cytokine response than fungal disease. This hypothesis cannot be tested with the present dataset and should not be over-interpreted; it is presented here to motivate future prospective studies that include fungal cases and a harmonized multiplex

platform, which would be needed before cytokine profiling could plausibly assist bacterial–fungal triage in practice.

Limitations

This is a secondary analysis of a small ($n = 18$ cases), single-center cohort, without an independent validation set; LOOCV reduces but does not eliminate optimism bias. The control group combined three heterogeneous non-infectious diagnoses, which may inflate discrimination relative to a real-world comparator such as post-surgical eyes without inflammation. No fungal endophthalmitis cases were available for direct comparison, and the bacterial-versus-fungal discussion relies on indirect, cross-platform literature comparisons that cannot be statistically tested. Absolute cytokine concentrations are also sensitive to pre-analytical and analytical factors — sample handling, storage, and assay platform — which can limit direct comparability across studies and should be borne in mind when interpreting the cut-offs proposed here.[7] Finally, as an exploratory reanalysis, no correction was made for multiple comparisons, and all cut-offs require prospective validation before clinical use. The OCT sub-analysis further reduces the effective sample size to 15–16 evaluable eyes and involved multiple correlation tests without adjustment for multiplicity; these findings should likewise be treated as preliminary and hypothesis-generating rather than confirmatory.

Conclusions

Vitreous IL-6, G-CSF, IL-8, IL-1ra and TNF- α show excellent diagnostic accuracy for distinguishing post-cataract endophthalmitis from non-infectious controls in this cohort, and IL-8 shows moderate accuracy for predicting positive microbial culture. These findings support further prospective evaluation of cytokine-based diagnostic panels and generate a testable hypothesis — grounded in limited published data — that bacterial and fungal post-cataract endophthalmitis may produce quantitatively distinct cytokine responses, warranting dedicated multicenter studies that include fungal cases.

Abbreviations

AUC

area under the curve

G-CSF

granulocyte colony-stimulating factor

IFN- γ

interferon gamma

IL-1ra

interleukin-1 receptor antagonist

IL-6

interleukin-6

IL-8

interleukin-8

IL-17
interleukin-17
LOOCV
leave-one-out cross-validation
logMAR
logarithm of the minimum angle of resolution
OCT
optical coherence tomography
ROC
receiver operating characteristic
TNF- α
tumor necrosis factor alpha
VEGF
vascular endothelial growth factor.

Declarations

Declaration of generative AI and AI-assisted technologies in the writing process

During the preparation of this work, the corresponding author (P.E.) used Claude (Anthropic) in order to assist with statistical reanalysis of the vitreous cytokine and optical coherence tomography data, and to assist with drafting portions of the manuscript text, including the optical coherence tomography sub-analysis section. All AI-assisted statistical outputs were subsequently reproduced independently, without AI assistance, by the second author (H.S.L.E.). After using this tool, the authors reviewed and edited the content as needed and take full responsibility for the content of the publication. The AI tool was not used to generate, alter, or fabricate any underlying data and is not listed as an author, consistent with ICMJE and COPE guidance.

Ethics approval and consent to participate

The original cohort study was approved by the Research Ethics Committee of the Centro de Ciências da Saúde, Universidade Federal de Pernambuco (CEP/CCS/UFPE; CAAE 0028.0.172.000–10; protocol registration CEP/CCS/UFPE No. 032/10) and adhered to the tenets of the Declaration of Helsinki. All patients provided written informed consent, including consent covering future analyses of the collected data; no new patients, samples, or measurements were generated for the present secondary analysis. The original ethics protocol covered a broader panel of vitreous cytokines and growth factors collected from this cohort; the present manuscript and the prior publication[6] each analyze different, non-overlapping subsets of that panel, and no results are duplicated between them.

Consent for publication

Not applicable. This manuscript does not contain any individual person's identifiable data, images, or videos.

Competing interests

The authors declare no competing interests.

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Data availability / prior publication statement: This manuscript reports a secondary, hypothesis-generating reanalysis of a previously described cohort. The original cohort, clinical characterization and univariate cytokine comparisons were first reported in Escarião P, Commodaro AG, Arantes T, de Castro CMMB, Diniz MdeFA, Brandt CT. Analysis of Cytokines in Presumed Acute Infectious Endophthalmitis Following Cataract Extraction. J Clin Exp Ophthalmol. 2014;5:335. doi:10.4172/2155-9570.1000335 (Ref. 6). No results, tables, or conclusions from that publication are reproduced here; the diagnostic-accuracy analyses (ROC/AUC, optimal cut-offs, multivariable modelling, internal cross-validation) presented in this manuscript are novel and were not part of the original report.

Author Contribution

P.E. conceived the original cohort study and the present secondary analysis, performed the initial statistical reanalysis (with AI-assisted computation as detailed in Methods and in the AI-use declaration below), and drafted the manuscript. H.S.L.E. independently reproduced and verified the statistical reanalysis (ROC/AUC estimation, cross-validation, correlation and Wilcoxon signed-rank testing), without AI assistance, and critically revised the manuscript for important intellectual content. Both authors approved the final version and agree to be accountable for all aspects of the work. All co-investigators of the original cohort study[6] are acknowledged for their contribution to the underlying data but are not authors of this manuscript. The diagnostic-accuracy reanalysis (ROC/AUC, cut-off determination, cross-validation, multivariable modelling of visual acuity, and the comparative bacterial-fungal discussion) and the optical coherence tomography sub-analysis (affected-versus-fellow-eye comparison and its correlation with vitreous cytokine levels) are original to this manuscript and have not been previously published or submitted elsewhere in whole or in part.

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References

1. Taban M, Behrens A, Newcomb RL et al (2005) Acute endophthalmitis following cataract surgery: a systematic review of the literature. *Arch Ophthalmol* 123:613–620
2. Anand AR, Madhavan HN, Therese KL (2000) Use of polymerase chain reaction (PCR) and DNA probe hybridization to determine the Gram reaction of the infecting bacterium in the intraocular fluids of patients with endophthalmitis. *J Infect* 41:221–226
3. Results of the Endophthalmitis Vitrectomy Study (1995) A randomized trial of immediate vitrectomy and of intravenous antibiotics for the treatment of postoperative bacterial endophthalmitis. Endophthalmitis Vitrectomy Study Group. *Arch Ophthalmol* 113:1479–1496
4. Petropoulos IK, Vantzou CV, Lamari FN et al (2006) Expression of TNF-alpha, IL-1beta, and IFN-gamma in *Staphylococcus epidermidis* slime-positive experimental endophthalmitis is closely related to clinical inflammatory scores. *Graefes Arch Clin Exp Ophthalmol* 244:1322–1328
5. Ooi KG-J, Galatowicz G, Calder VL, Lightman SL (2006) Cytokines and chemokines in uveitis: is there a correlation with clinical phenotype? *Clin Med Res* 4:294–309
6. Escarião P, Commodaro AG, Arantes T, de Castro CMMB, Diniz MFA, Brandt CT (2014) Analysis of Cytokines in Presumed Acute Infectious Endophthalmitis Following Cataract Extraction. *J Clin Exp Ophthalmol* 5:335. 10.4172/2155-9570.1000335
7. Zhou X, Fragala MS, McElhaney JE, Kuchel GA (2010) Conceptual and methodological issues relevant to cytokine and inflammatory marker measurements in clinical research. *Curr Opin Clin Nutr Metab Care* 13:541–547
8. Deshmukh D, Chakrabarti M, Jayasudha R, Hasnat Ali M, Tyagi M, Sharma S, Joseph J (2018) Elevated cytokine levels in vitreous as biomarkers of disease severity in infectious endophthalmitis. *PLoS ONE* 13(10):e0205292
9. Khapuinamai A, Rudraprasad D, Pandey S, Gandhi J, Mishra DK, Joseph J (2024) Global transcriptomic profiling of innate and adaptive immunity during *Aspergillus flavus* endophthalmitis in a murine model. *Invest Ophthalmol Vis Sci* 65(4):44. 10.1167/iovs.65.4.44
10. Miedema KGE, de Bont ESJM, Elferink RFMO et al (2011) The diagnostic value of CRP, IL-8, PCT, and sTREM-1 in the detection of bacterial infections in pediatric oncology patients with febrile neutropenia. *Support Care Cancer* 19:1593–1600
11. Ramadan RT, Moyer AL, Callegan MC (2008) A role for tumor necrosis factor-alpha in experimental *Bacillus cereus* endophthalmitis pathogenesis. *Invest Ophthalmol Vis Sci* 49:4482–4489

Figures

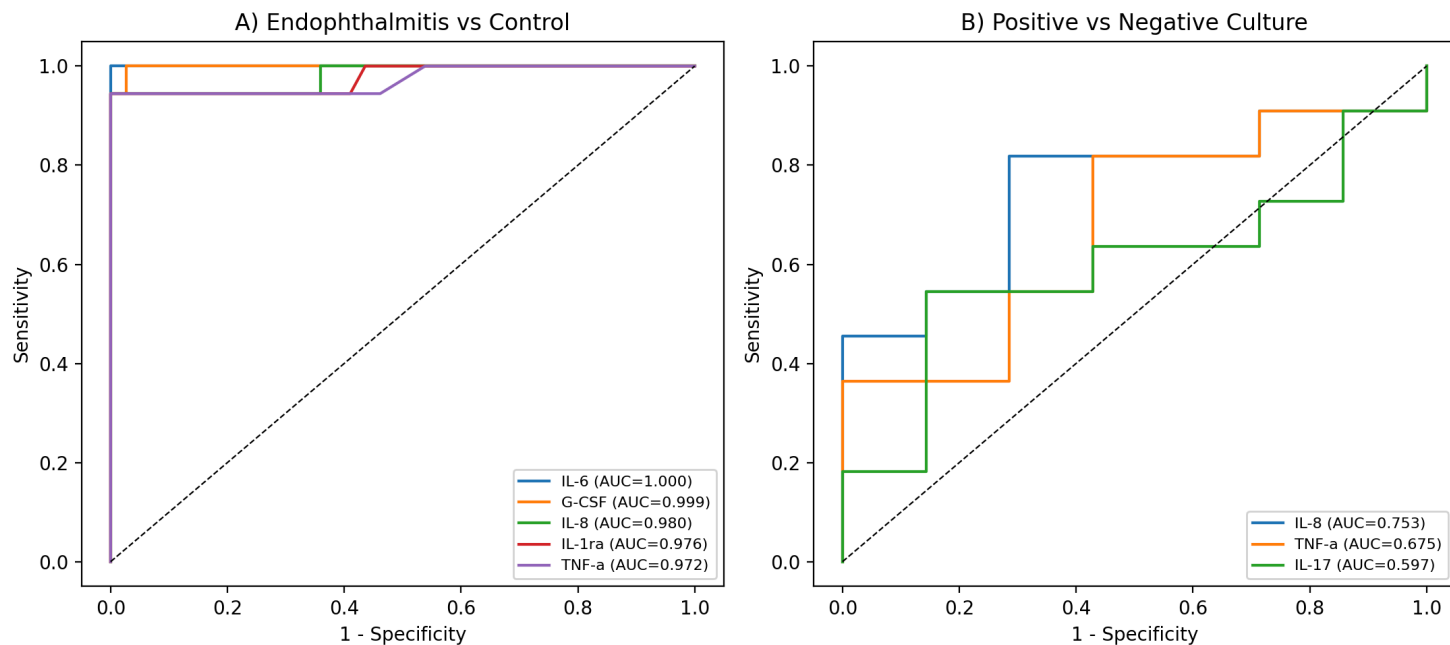


Figure 1

Receiver operating characteristic (ROC) curves. (A) Discrimination between endophthalmitis and non-infectious controls for the five most accurate cytokines (IL-6, G-CSF, IL-8, IL-1ra, TNF-α). (B) Prediction of positive microbial culture among patients with endophthalmitis, for IL-8, TNF-α and IL-17. AUC: area under the curve.