

Serum Immunoglobulin Levels and One-Year Mortality in Non-Cystic Fibrosis Bronchiectasis

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Abstract

Background

Bronchiectasis is a heterogeneous chronic airway disease associated with substantial morbidity and mortality. We investigated the associations of serum immunoglobulin levels with disease severity and one-year mortality and evaluated the incremental prognostic value of serum IgM beyond established prognostic models.

Methods

This retrospective single-center cohort study included 68 patients with non-cystic fibrosis bronchiectasis with available serum immunoglobulin measurements, sputum culture results, and at least one year of follow-up. Disease severity was assessed using the Bronchiectasis Severity Index (BSI), FACED, and E-FACED scores. Univariable and multivariable Cox proportional hazards regression analyses identified independent predictors of one-year mortality. Receiver operating characteristic (ROC) analysis evaluated the incremental predictive value of serum IgM when added to the E-FACED score.

Results

During one year of follow-up, 15 patients (22.1%) died. Reduced serum IgM levels (HR 0.14, 95% CI 0.02–0.79; $p = 0.02$) and chronic *Pseudomonas aeruginosa* colonization (HR 21.41, 95% CI 1.49–307.15; $p = 0.02$) were independently associated with mortality. The E-FACED score showed an AUC of 0.761, whereas the combined E-FACED–IgM model improved the AUC to 0.841, with higher sensitivity (78.6% vs. 53.3%), negative predictive value (92.8% vs. 86.0%), and overall accuracy (80.9% vs. 77.3%).

Conclusions

Reduced serum IgM independently predicted one-year mortality and improved the prognostic performance of the E-FACED score beyond established clinical risk factors. Incorporating serum IgM into the E-FACED score improved mortality prediction, suggesting that serum IgM may represent a readily available prognostic biomarker for risk stratification. Further multicenter prospective studies are warranted.

Introduction

Bronchiectasis is a heterogeneous chronic lung disease characterized by irreversible bronchial dilatation accompanied by chronic airway inflammation and recurrent infections (1). Although bronchiectasis was once considered a rare disease, its prevalence has been steadily increasing worldwide, largely due to the widespread use of high-resolution computed tomography, increased life expectancy, and greater awareness of the disease(1). Bronchiectasis imposes a substantial healthcare burden, as it is associated with frequent exacerbations, recurrent hospitalizations, impaired quality of life, and increased mortality(1–3). However, bronchiectasis is now recognized not as a single disease but as a

heterogeneous clinical syndrome characterized by diverse etiologies, inflammatory profiles, microbiological features, and clinical outcomes(4). The pathogenesis of bronchiectasis is driven by a self-perpetuating cycle involving infection, impaired mucociliary clearance, persistent airway inflammation, and progressive structural lung damage, with chronic bacterial colonization—particularly *Pseudomonas aeruginosa*—being associated with more frequent exacerbations, increased hospitalizations, poorer quality of life, and adverse clinical outcomes (1, 4, 5). This marked clinical and biological heterogeneity highlights the need for novel biomarkers and risk factors that may improve prognostic assessment in patients with bronchiectasis.

Primary and secondary immunodeficiencies represent important underlying causes of bronchiectasis, with disorders of humoral immunity being among the immunological conditions most strongly associated with the disease(5). Accordingly, current international guidelines recommend routine assessment of serum immunoglobulin levels in patients diagnosed with bronchiectasis(1, 6). Recurrent respiratory tract infections and the development of bronchiectasis are frequently reported in patients with common variable immunodeficiency (CVID), X-linked agammaglobulinemia, and other antibody deficiencies (5). Previous studies have also demonstrated that reduced serum immunoglobulin levels are associated with increased infection burden, greater disease severity, and chronic airway damage(5, 7, 8). However, the prognostic significance of serum immunoglobulins and their potential contribution to existing risk stratification models in bronchiectasis remain incompletely understood(4, 8).

Several multidimensional prognostic scores, including the Faced score, E-Faced score, and the Bronchiectasis Severity Index (BSI), have been developed to predict disease severity and mortality risk in patients with bronchiectasis(2, 9). A systematic review and meta-analysis demonstrated that the Faced score had superior discriminative ability for predicting all-cause mortality compared with the BSI (AUC: 0.87 vs. 0.75), whereas both scoring systems showed comparable performance in predicting hospitalization (Faced AUC: 0.82; BSI AUC: 0.80) (10). However, these scoring systems are primarily based on clinical, functional, radiological, and microbiological variables and do not incorporate biomarkers reflecting the host immune response (2, 9). As bronchiectasis is increasingly recognized as a heterogeneous disease with distinct biological endotypes, there is growing interest in identifying novel biomarkers that may complement existing prognostic models and improve risk stratification (4, 11, 12). In this context, serum immunoglobulins have emerged as potential prognostic biomarkers(8). Studies investigating the association between primary antibody deficiencies and bronchiectasis have demonstrated that reduced serum immunoglobulin levels are associated with increased susceptibility to respiratory infections, greater disease severity, and chronic airway damage (7, 8). Nevertheless, the prognostic significance of serum immunoglobulins and their potential contribution to existing risk prediction models in patients with bronchiectasis remain incompletely understood(11, 12).

The aim of this study was to investigate the associations of serum immunoglobulin levels with disease severity and one-year mortality in patients with non-cystic fibrosis bronchiectasis. We also explored the relationship between serum immunoglobulin levels and chronic bacterial colonization and evaluated their potential contribution to existing prognostic scoring systems.

Materials and Methods

Study Design and Study Population

This retrospective, single-center observational cohort study included patients with non-cystic fibrosis bronchiectasis who were followed at the Department of Chest Diseases, Yedikule Chest Diseases and Thoracic Surgery Training and Research Hospital between 2015 and 2025 and had at least one year of clinical follow-up. The diagnosis of bronchiectasis was confirmed by high-resolution computed tomography (HRCT) of the chest according to internationally accepted radiological criteria.

All consecutive eligible patients meeting the inclusion criteria during the study period were included. Eligible participants were aged ≥ 18 years, had available serum immunoglobulin measurements, at least one sputum culture result, and a minimum of one year of clinical follow-up. Patients with missing clinical or laboratory data, a diagnosis of cystic fibrosis, or insufficient follow-up data were excluded. In addition, patients with active hematologic malignancy, receiving immunosuppressive therapy, or with nephrotic syndrome, advanced liver disease, protein-losing enteropathy, or other known causes of secondary hypogammaglobulinemia were excluded.

Data Collection

Clinical, laboratory, radiological, and microbiological data were retrospectively retrieved from the electronic medical records and the hospital information system. Laboratory variables included complete blood count, routine biochemical parameters, C-reactive protein (CRP), serum immunoglobulin levels (IgG, IgA, and IgM), and IgG subclass levels. For the microbiological assessment, sputum culture results were reviewed, and the presence of chronic bacterial colonization was recorded.

Microbiological and Immunological Assessment

Serum immunoglobulin levels were assessed using the results obtained during routine clinical evaluation. Chronic colonization with *Pseudomonas aeruginosa* was defined in accordance with the recommendations of the European Respiratory Society as the isolation of *P. aeruginosa* from two separate sputum samples collected at least three months apart within a one-year period. Isolation of *P. aeruginosa* from a single sputum culture was not considered indicative of chronic colonization.

Assessment of Disease Severity

Disease severity was assessed using the Bronchiectasis Severity Index (BSI), the Faced score, and the E-Faced score. The BSI was calculated based on age, body mass index, FEV₁, dyspnea severity, previous hospitalizations, exacerbation frequency, radiological extent of disease, and chronic microbiological colonization. The Faced score comprises five variables: age, percent predicted FEV₁, dyspnea severity,

radiological extent, and chronic colonization with *Pseudomonas aeruginosa*. The E-FACED score was calculated by adding the annual exacerbation frequency to the FACED score.

Study Outcome

The primary study outcome was 1-year all-cause mortality. At the end of the follow-up period, patients were categorized into two groups according to survival status: survivors and non-survivors.

Statistical Analysis

Statistical analyses were performed using IBM SPSS Statistics version 31 (IBM Corp., Armonk, NY, USA). The distribution of continuous variables was assessed using both visual (histograms and probability plots) and analytical methods (Kolmogorov–Smirnov and Shapiro–Wilk tests). Continuous variables with a normal distribution were expressed as mean $\pm$ standard deviation (SD), whereas non-normally distributed variables were presented as median (interquartile range [IQR]). Categorical variables were expressed as numbers and percentages. Comparisons between groups were performed using the Student's t-test for normally distributed continuous variables, the Mann–Whitney U test for non-normally distributed continuous variables, and the chi-square test or Fisher's exact test for categorical variables.

Univariate Cox proportional hazards regression analysis was performed to identify factors associated with one-year mortality. Variables with $p < 0.05$ in the univariate analysis, together with those considered clinically relevant, were included in the multivariable Cox proportional hazards regression model. Results were reported as hazard ratios (HRs) with 95% confidence intervals (CIs).

To evaluate the incremental value of serum IgM beyond the E-FACED score, a combined model was constructed using the predicted probabilities derived from a logistic regression model incorporating both the E-FACED score and serum IgM levels. The discriminative performance of the models was assessed using the area under the receiver operating characteristic curve (AUC). The optimal cut-off values were determined using the Youden index, and corresponding 2×2 contingency tables were used to calculate sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and overall accuracy.

All statistical tests were two-sided, and a p value < 0.05 was considered statistically significant.

Ethics Approval

The study was approved by the Ethics Committee of Yedikule Chest Diseases and Thoracic Surgery Training and Research Hospital (Approval No. 2026-22; Date: 09.04.2026). As this was a retrospective chart review, the requirement for informed consent was waived by the Ethics Committee. All data were anonymized before analysis, and the study was conducted in accordance with the principles of the Declaration of Helsinki.

Results

A total of 68 patients with bronchiectasis were included in the study, of whom 38 (55.9%) were male. The median age of the study population was 53 years (IQR, 44–69). During the one-year follow-up period, 15 patients (22.1%) died, whereas 53 patients (77.9%) survived. Baseline demographic, clinical, laboratory, microbiological, and radiological characteristics according to mortality status are presented in Table 1.

Compared with survivors, deceased patients were older and had a higher prevalence of hypertension and *Pseudomonas* colonization. Non-survivors also exhibited lower serum IgM levels, higher inflammatory markers, and higher disease severity scores, including FACED, E-FACED, BSI, and SII.

In univariable Cox regression analysis, older age (HR 1.04, 95% CI 1.01–1.08, $p=0.02$), hypertension (HR 6.90, 95% CI 2.35–20.25, $p<0.001$), higher IgG2 levels (HR 1.33, 95% CI 1.08–1.63, $p=0.006$), higher IgG4 levels (HR 1.19, 95% CI 1.07–1.32, $p=0.001$), lower IgM levels (HR 0.25, 95% CI 0.07–0.91, $p=0.03$), elevated CRP levels (HR 1.01, 95% CI 1.01–1.02, $p=0.004$), higher neutrophil counts ($p=0.01$), increased NLR values (HR 1.09, 95% CI 1.01–1.17, $p=0.02$), and a higher CRP-to-albumin ratio (HR 1.58, 95% CI 1.18–2.12, $p=0.002$) were associated with mortality. Higher FACED (HR 1.54, 95% CI 1.12–2.12, $p=0.007$), E-FACED (HR 1.65, 95% CI 1.18–2.31, $p=0.003$), and BSI scores (HR 1.21, 95% CI 1.06–1.37, $p=0.003$) were also significant predictors of mortality. In addition, *Pseudomonas* colonization was significantly associated with mortality (HR 9.00, 95% CI 1.18–68.47, $p=0.03$) (Table 2).

Based on the results of the univariable analysis and clinical relevance, age, IgM, NLR, CRP-to-albumin ratio, and *Pseudomonas* colonization were entered into the multivariable Cox regression model. In the adjusted analysis, lower serum IgM levels (HR 0.14, 95% CI 0.02–0.79, $p=0.02$) and *Pseudomonas* colonization (HR 21.41, 95% CI 1.49–307.15, $p=0.02$) remained independently associated with mortality, whereas age, NLR, and the CRP-to-albumin ratio were no longer significant predictors (Table 3).

ROC curve analysis demonstrated that the E-FACED score alone yielded an AUC of 0.761 (95% CI 0.637–0.884) (Figure 1). Using an optimal cut-off value of ≥ 6.5 , the E-FACED score showed a sensitivity of 53.3%, specificity of 84.3%, positive predictive value of 50.0%, negative predictive value of 86.0%, and an overall accuracy of 77.3% (Table 4). The combined E-FACED–IgM model demonstrated superior discriminative performance, with an AUC of 0.841 (95% CI 0.731–0.951) (Figure 1).

At the optimal predicted probability cut-off value of ≥ 0.273 , the model achieved a sensitivity of 78.6%, specificity of 81.6%, positive predictive value of 55.7%, negative predictive value of 92.8%, and an overall accuracy of 80.9% (Table 4). The addition of serum IgM to the E-FACED score improved discrimination, sensitivity, negative predictive value, and overall diagnostic accuracy for mortality prediction.

Discussion

In this retrospective cohort study of patients with non-cystic fibrosis bronchiectasis, reduced serum IgM levels and chronic colonization with *Pseudomonas aeruginosa* were independently associated with 1-

year all-cause mortality. Furthermore, incorporating serum IgM levels into the E-FACED score improved its discriminative performance for predicting mortality.

Our study demonstrated that reduced serum IgM levels are an independent predictor of 1-year all-cause mortality in patients with non-cystic fibrosis bronchiectasis. To the best of our knowledge, studies specifically evaluating the association between serum IgM levels and mortality in bronchiectasis are scarce. Nevertheless, the available evidence suggests that reduced serum IgM levels may be associated with the development of bronchiectasis, recurrent respiratory tract infections, an increased infectious burden, and chronic bacterial colonization(7, 13). Sperlich and colleagues demonstrated that reduced serum IgM levels were associated with the presence of bronchiectasis, a higher frequency of respiratory tract infections, and a more severe clinical course in patients with Common variable immunodeficiency (7). Similarly, Lucuab-Fegurgur and Gupta reported a higher prevalence of recurrent respiratory tract infections and bronchiectasis among patients with Selective IgM deficiency(13). These findings support the notion that reduced IgM levels are associated with a greater infectious burden and increased disease severity, thereby providing a plausible biological basis for the observed association between reduced serum IgM levels and mortality in our study.

IgM is the first antibody produced during the humoral immune response and plays a pivotal role in complement activation, opsonization, and the early clearance of microorganisms. Impaired antibody-mediated immunity has been recognized as a key contributor to recurrent airway infections and disease progression in bronchiectasis, as highlighted by studies of primary humoral immunodeficiencies and recent review articles(5, 8). Accordingly, reduced serum IgM levels may contribute to impaired bacterial clearance, persistence of chronic infections, and sustained airway inflammation, thereby leading to adverse clinical outcomes. This biological mechanism provides a plausible explanation for the independent association between reduced serum IgM levels and mortality observed in our study.

Another important finding of our study was that chronic colonization with *Pseudomonas aeruginosa* was independently associated with 1-year all-cause mortality. This finding is consistent with previous studies demonstrating that chronic *P. aeruginosa* colonization is associated with poor prognosis in patients with bronchiectasis. Finch et al., in a cohort of 3,693 patients, reported that chronic *P. aeruginosa* colonization was associated with an approximately threefold increase in mortality risk, as well as higher rates of hospitalization and exacerbations (14). Chronic colonization is thought to contribute to persistent neutrophilic inflammation and progressive airway damage, thereby promoting adverse clinical outcomes(14, 15). Our findings further support the role of chronic *P. aeruginosa* colonization as an important marker of poor prognosis in bronchiectasis.

Notably, reduced serum IgM levels and chronic colonization with *Pseudomonas aeruginosa* retained their independent associations with mortality in the same multivariable model, suggesting that the prognostic impact of serum IgM cannot be explained solely by the burden of chronic infection. This finding raises the possibility that serum IgM reflects the host's immune competence against infection and may provide prognostic information beyond established clinical and microbiological risk factors.

Accordingly, serum IgM may capture not only the burden of infection but also broader immunological and biological processes that influence prognosis in bronchiectasis.

The identification of reliable biomarkers in bronchiectasis is currently regarded as one of the major priorities in the field. In a recent position statement by the European Multicentre Bronchiectasis Audit and Research Collaboration study group, the identification of robust and clinically applicable biomarkers was highlighted as one of the highest research priorities(12). Similarly, it has been emphasized that phenotype- and endotype-based approaches rely on the identification of biomarkers that reflect the underlying biological mechanisms of disease and that these biomarkers will play a pivotal role in future prognostic assessment and the development of targeted therapeutic strategies(11). In addition, the *treatable traits* approach advocates the assessment of not only clinical characteristics but also biologically identifiable and modifiable traits, and proposes that reliable biomarkers will become a cornerstone of personalized patient management(16). In this context, the independent association between serum IgM levels and mortality, together with the incremental prognostic value observed beyond the existing risk model, suggests that serum IgM may represent a clinically useful prognostic biomarker in patients with bronchiectasis.

In our study, the addition of serum IgM levels to the E-FACED score improved its discriminative performance for predicting mortality. Notably, the improvements in sensitivity, negative predictive value, and overall diagnostic accuracy suggest that incorporating serum IgM may facilitate more reliable identification of patients at low risk of mortality. At present, the FACED score, the E-FACED score, and the Bronchiectasis Severity Index (BSI) are widely used to assess the risks of mortality, exacerbations, and hospitalization in patients with bronchiectasis(2, 9, 10). However, these scoring systems are primarily based on clinical, functional, radiological, and microbiological variables and do not incorporate immunological biomarkers(4, 17). Therefore, the incorporation of serum IgM, a readily available and routinely measured biomarker, into existing prognostic scoring systems may improve risk stratification in patients with bronchiectasis. However, these findings should be validated in larger, multicenter, prospective studies before serum IgM can be considered for routine use in prognostic assessment.

Our study has several limitations. First, its retrospective, single-center design and the relatively limited number of patients and mortality events may restrict the generalizability of the findings. In addition, serum immunoglobulin levels were assessed only at baseline, and changes over time during follow-up could not be evaluated.

Despite these limitations, our study also has several important strengths. To the best of our knowledge, this is among the few studies to evaluate the prognostic value of serum IgM levels for 1-year all-cause mortality in patients with non-cystic fibrosis bronchiectasis. Furthermore, the comprehensive assessment of clinical, microbiological, radiological, and immunological characteristics, together with the evaluation of the incremental prognostic value of serum IgM beyond established risk scores and its independent association with mortality, represents the major strengths of our study.

If validated in future prospective studies, serum IgM may represent a readily available biomarker that could complement existing prognostic tools and facilitate individualized risk stratification in patients with bronchiectasis.

Conclusion

In conclusion, reduced serum IgM levels and chronic colonization with *Pseudomonas aeruginosa* were independently associated with 1-year all-cause mortality in patients with non-cystic fibrosis bronchiectasis. The addition of serum IgM levels to the E-FACED score improved its predictive performance for mortality, particularly by increasing sensitivity and negative predictive value. These findings suggest that serum IgM may represent a readily available and promising prognostic biomarker in bronchiectasis. Nevertheless, further validation in larger, multicenter, prospective studies is warranted before its incorporation into routine clinical practice.

Declarations

Ethics approval and consent to participate

The study was approved by the Ethics Committee of Yedikule Chest Diseases and Thoracic Surgery Training and Research Hospital (Approval No. 2026-22; Date: 09 April 2026). The requirement for informed consent was waived because of the retrospective nature of the study. The study was conducted in accordance with the Declaration of Helsinki.

Consent for publication

Not applicable.

Availability of data and materials

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Competing interests

The authors declare that they have no competing interests.

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The authors received no specific funding for this study.

Authors' contributions

NB conceived and designed the study, collected the data, interpreted the findings, and drafted the manuscript. **CS** performed the statistical analyses, contributed to data interpretation, and critically

revised the manuscript. **KK, EÖB, BK, GK, SNS, and ST** contributed to study design, data collection, interpretation of the findings, and critical revision of the manuscript. All authors read and approved the final manuscript.

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References

1. Chalmers JD, Haworth CS, Flume P, Long MB, Burgel PR, Dimakou K, et al. European Respiratory Society clinical practice guideline for the management of adult bronchiectasis. *Eur Respir J*. 2025 Dec 1;66(6). doi:10.1183/13993003.01126-2025 PubMed PMID: 41016738.
2. Chalmers JD, Goeminne P, Aliberti S, McDonnell MJ, Lonni S, Davidson J, et al. The bronchiectasis severity index an international derivation and validation study. *Am J Respir Crit Care Med*. 2014 Mar 1;189(5):576–85. doi:10.1164/rccm.201309-1575OC PubMed PMID: 24328736.
3. Nigro M, Laska IF, Traversi L, Simonetta E, Polverino E, Chalmers JD, et al. Epidemiology of Bronchiectasis,2024. doi:10.1183/16000617.0091-2024
4. Raboso B, Pou C, Abril R, Erro M, Sánchez C, Manzano C, et al. Bronchiectasis. *Open Respiratory Archives*. Elsevier Espana S.L.U; 2024. doi:10.1016/j.opresp.2024.100339
5. Brown JS, Baxendale H, Floto RA. Immunodeficiencies associated with bronchiectasis. In: *Bronchiectasis*. European Respiratory Society; 2011. doi:10.1183/1025448x.10004210
6. Aytekin G, Yildiz E, Çölkesen F, Arslan Ş, Zamani A, Çalışkaner AZ. Reverse Angle: Immunological Evaluation of Patients with Bronchiectasis. *Asthma Allergy Immunol*. 2020;18:91–7. doi:10.21911/aai.503
7. Sperlich JM, Grimbacher B, Soetedjo V, Workman S, Burns SO, Lowe DM, et al. Predictive Factors for and Complications of Bronchiectasis in Common Variable Immunodeficiency Disorders. *J Clin Immunol*. 2022 Apr 1;42(3):572–81. doi:10.1007/S10875-022-01206-8 PubMed PMID: 35015197.
8. Suárez-Cuartín G, Lores C, Gomez-Olivas JD, Oscullo G, Martínez-García MÁ. Primary Humoral Immunodeficiencies and Bronchiectasis in Adults. *Journal of Clinical Medicine*. Multidisciplinary Digital Publishing Institute (MDPI); 2026. doi:10.3390/jcm15010179
9. Martínez-García MA, De Gracia J, Relat MV, Girón RM, Carro LM, De La Rosa Carrillo D, et al. Multidimensional approach to non-cystic fibrosis bronchiectasis: The FACED score. *European Respiratory Journal*. 2014 May 1;43(5):1357–67. doi:10.1183/09031936.00026313 PubMed PMID: 24232697.
10. He M, Zhu M, Wang C, Wu Z, Xiong X, Wu H, et al. Prognostic performance of the FACED score and bronchiectasis severity index in bronchiectasis: A systematic review and meta-analysis. *Bioscience Reports*. Portland Press Ltd; 2020. doi:10.1042/BSR20194514 PubMed PMID: 33057706.

11. Choi H, Gao YH. Phenotypes and endotypes in bronchiectasis: a narrative review of progress toward precision medicine. *Journal of Thoracic Disease*. AME Publishing Company; 2025. p. 2640–54. doi:10.21037/jtd-2024-1945
12. Chalmers JD, Goeminne PC, Ringshausen FC. EMBARcing on a new era for bronchiectasis: a review series for the Seventh World Bronchiectasis Conference. *European Respiratory Review*. European Respiratory Society; 2024. doi:10.1183/16000617.0124-2024 PubMed PMID: 38960616.
13. Lucuab-Fegurgur D, Gupta S. comprehensive clinical and immunological features of adult selective primary igm deficiency: response to immunoglobulin therapy. *Annals of Allergy, Asthma & Immunology*. 2018 Nov 1;121(5):S10. doi:10.1016/j.anai.2018.09.027
14. Finch S, McDonnell MJ, Abo-Leyah H, Aliberti S, Chalmers JD. A Comprehensive Analysis of the Impact of *Pseudomonas aeruginosa* Colonization on Prognosis in Adult Bronchiectasis. *Ann Am Thorac Soc*. 2015 Nov 1;12(11):1602–11. doi:10.1513/ANNALSATS.201506-333OC PubMed PMID: 26356317.
15. Xiao Y, Zhang J, Nie F, Peng T, Li P, Li K, et al. Genomic diversity and adaptive resistance mechanisms in *Pseudomonas aeruginosa* from bronchiectasis . *mSystems*. 2026 Jan 20;11(1). doi:10.1128/msystems.01514-25 PubMed PMID: 41347780.
16. Boaventura R, Sibila O, Agusti A, Chalmers JD. Treatable traits in bronchiectasis. *European Respiratory Journal*. European Respiratory Society; 2018. doi:10.1183/13993003.01269-2018 PubMed PMID: 30190263.
17. Einarsson GG, Sherrard LJ, Lee AJ, Carson J, Marshall A, Alkhatib A, et al. Molecular endotyping in people with bronchiectasis based on response to antibiotic treatment: iBEST study. *ERJ Open Res*. 2025 Nov;11(6):00389–2025. doi:10.1183/23120541.00389-2025

Tables

Tables 1 to 4 are available in the supplementary files section

Figures

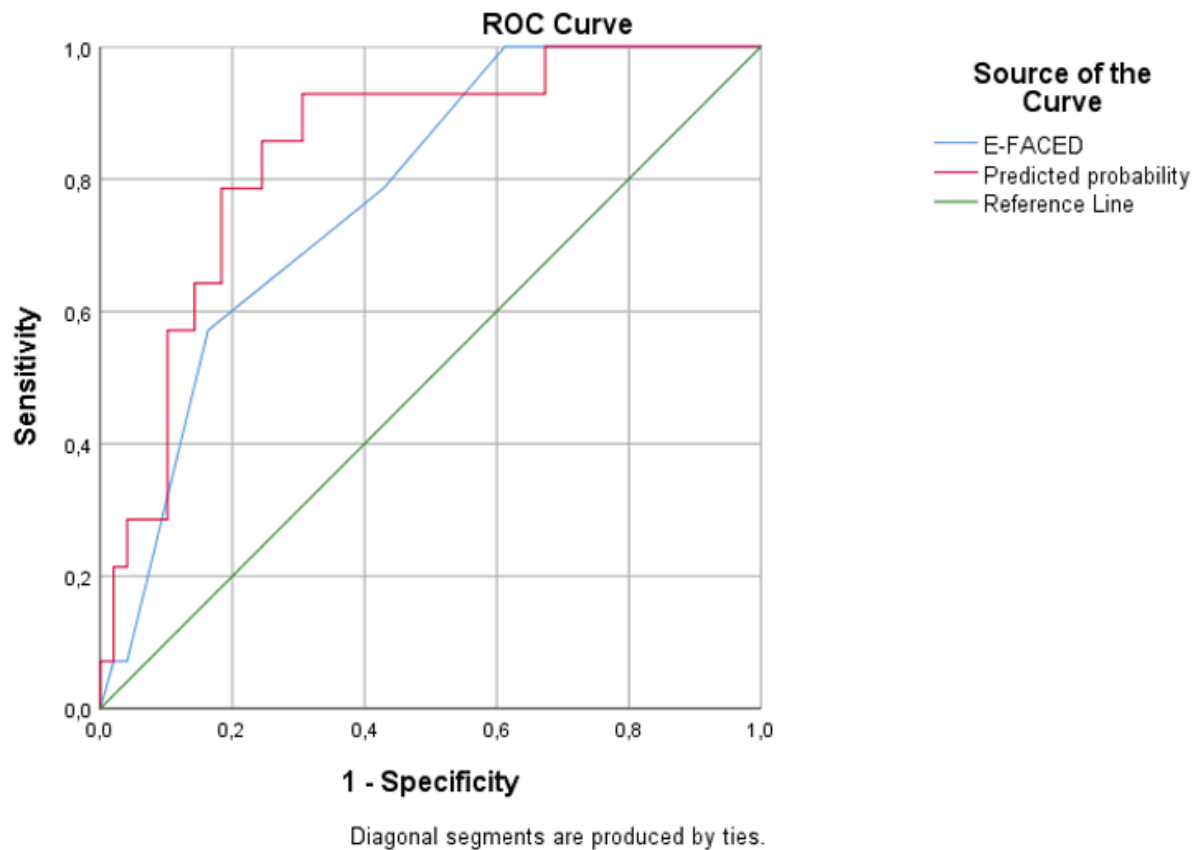


Figure 1

Comparison of ROC curves for the E-FACED score and the combined E-FACED + IgM model in predicting mortality.

Supplementary Files

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