Clinical profile and in-hospital outcomes of patients hospitalised for bronchiectasis exacerbation

Received: 20 June 2025
Accepted: 7 Oct 2025

To the Editor:

Exacerbations play a pivotal role in the natural history of bronchiectasis, driving symptom worsening, accelerating lung function decline and increasing mortality risk [1, 2]. Exacerbations requiring hospitalisation have particularly severe consequences – not only for individual patients but also for healthcare systems, due to prolonged admissions, the need for intensive care, and post-discharge complications [3]. These events are frequently associated with complex clinical presentations involving respiratory failure, cardiovascular instability and the need for ventilatory support [1]. Yet, despite their impact, hospitalised bronchiectasis exacerbations remain poorly characterised. Most existing evidence derives from outpatient cohorts or retrospective administrative datasets, which lack the clinical granularity necessary to inform risk stratification and guide therapeutic decisions in acute care settings [1]. Identifying factors that predict poor in-hospital outcomes is essential to improve acute management, guide resource allocation, and ultimately prevent long-term sequelae in this vulnerable population.

We conducted a multicentre, retrospective, observational study across four Italian hospitals to characterise adults with bronchiectasis who were hospitalised between January 2013 and August 2023 for an exacerbation, and to identify clinical factors associated with adverse in-hospital outcomes. Adults (⩾18 years) with clinically and radiologically confirmed bronchiectasis and an acute exacerbation were included [4]. Cases were first identified *via* ICD-9-CM codes 494.0 (bronchiectasis) and 494.1 (bronchiectasis with exacerbation), and then manually verified by investigators at each site to confirm the diagnosis according to international consensus recommendations for radiological and clinical criteria [4]. Exacerbations were defined according to established criteria: a deterioration in three or more key symptoms (such as cough, sputum volume or purulence, dyspnoea, fatigue, or haemoptysis) lasting at least 48 h and requiring a change in treatment [5]. Data were collected using a standardised case report form and included demographics, comorbidities, presenting symptoms, imaging findings, spirometry (forced expiratory volume % predicted (FEV% pred)), microbiology, arterial blood gases, and clinical outcomes. More precisely, pulmonary function was captured as the most recent FEV% pred measured in clinical stability prior to the index admission; no predefined time-window relative to hospitalisation was applied. Patients with COPD or asthma were not excluded to be closer to a what a real life clinic might dela with (although still a stratified analysis as planned) and were recorded as comorbidities together with cardiovascular disease, connective tissue disease, malignancy and others. No additional exclusion criteria were applied, in order to maximise the accurate representation of real-world patients admitted for bronchiectasis exacerbation. The primary endpoint was a composite adverse outcome occurring during hospitalisation, defined as any of the following: all-cause mortality, need for non-invasive ventilation (NIV), or endotracheal intubation and invasive mechanical ventilation. Independent predictors were identified using multivariate logistic regression (ENTER method). Analyses were conducted with SPSS v29.0.1.0. Ethics approval was obtained from the IRCCS Humanitas Ethics Committee (protocol 59/23), with a waiver of informed consent due to data anonymisation.

A total of 318 patients – median (interquartile range (IQR)) age: 72.0 (61.0–78.0) years; 54.7% female – were included, see table 1. 50.3% were current or former smokers. The median (IQR) FEV% pred was 55.5% (41.3–76.0%), and chronic *Pseudomonas aeruginosa* infection was present in 29.2%. The most frequent comorbidities were cardiovascular disease (43.4%), COPD (41.5%) and pulmonary hypertension

Shareable abstract (@ERSpublications)
Patients hospitalised for bronchiectasis exacerbations face significant in-hospital risks. Cardiovascular disease, pulmonary hypertension and low FEV_1 % pred are key predictors of short-term complications and should guide early risk assessment. https://bit.ly/42UOpJ3

Cite this article as: Bindo F, Simonetta E, Gramegna A, *et al*. Clinical profile and in-hospital outcomes of patients hospitalised for bronchiectasis exacerbation. *ERJ Open Res* 2026; 12: 00837-2025 [DOI: 10.1183/23120541.00837-2025].

TABLE 1 Characteristics of the study population and according to the composite adverse outcome occurring during hospitalisation (any of the following: all-cause mortality, need for non-invasive ventilation, or endotracheal intubation and invasive mechanical ventilation)

Variable	Overall (N=318)	No negative outcome (N=254)	Negative outcome (N=64)	p-value
Age, years	72 (61–78)	72 (62–78)	71 (56–77)	0.251
Male sex	144 (45.3)	108 (42.5)	36 (56.3)	0.049
BMI, kg·m^{-2}	21.5 (18.4–24)	21.5 (18.7–24)	21 (16.7–24)	0.653
Either current or former smoker	160 (50.3)	133 (64.6)	27 (56.3)	0.283
Hospitalisations in the previous year	0 (0–1)	0 (0–1)	1 (0–1)	0.002
Chronic *P. aeruginosa* infection	93 (29.2)	71 (30.5)	22 (37.3)	0.315
Other chronic bacterial infection	69 (21.7)	55 (24.8)	14 (26.4)	0.805
FEV_1% pred	55.5 (41.25–76)	59.5 (43.3–82.5)	47 (35–61.3)	0.002
Comorbidity				
COPD	132 (41.5)	100 (39.4)	32 (50)	0.123
Cardiovascular diseases	138 (43.4)	103 (40.6)	35 (54.7)	0.041
Connective tissue diseases	14 (4.4)	12 (4.7)	2 (3.1)	0.744
Active malignancy	26 (8.2)	21 (8.3)	5 (7.8)	0.905
Inflammatory bowel disease	5 (1.6)	5 (2)	0 (0)	0.587
Diabetes mellitus	45 (14.2)	31 (12.2)	14 (21.9)	0.047
Pulmonary hypertension	35 (11.0)	21 (8.3)	14 (21.9)	0.002
Cognitive impairment	19 (6.0)	15 (5.9)	4 (6.3)	0.917
Chronic liver disease	18 (5.7)	14 (5.5)	4 (6.3)	0.819
Chronic anaemia	31 (9.7)	24 (9.4)	7 (10.9)	0.813
Asthma	38 (11.9)	30 (11.8)	8 (12.5)	0.879
Peripheral vascular disease	62 (19.5)	51 (20.1)	11 (17.2)	0.602
Chronic macrolide therapy	32 (10.1)	20 (7.9)	12 (18.8)	0.010
LAMA	148 (46.5)	109 (42.9)	39 (60.9)	0.010
LABA	158 (49.7)	118 (46.5)	40 (62.5)	0.022
ICS	128 (40.3)	98 (38.6)	30 (46.9)	0.227
Long-term oxygen therapy	76 (23.9)	43 (16.9)	33 (51.6)	<0.001
Home non-invasive ventilation	20 (6.3)	3 (1.2)	17 (26.6)	<0.001
Signs and symptoms of exacerbation on admission				
Dyspnoea	235 (73.9)	177 (69.7)	58 (90.6)	<0.001
Cough	202 (63.5)	162 (63.8)	40 (62.5)	0.849
Increased sputum volume	144 (45.3)	114 (44.9)	30 (46.9)	0.775
Increased sputum purulence	105 (33.0)	81 (31.9)	24 (37.5)	0.394
Bronchospasm	95 (29.9)	76 (29.9)	19 (29.7)	0.971
Haemoptysis	39 (12.3)	34 (13.4)	5 (7.8)	0.288
Chest pain	41 (12.9)	32 (12.6)	9 (14.1)	0.755
Fatigue	115 (36.2)	92 (36.2)	23 (35.9)	0.966
Vital signs on admission				
Heart rate, bpm	88 (78–100)	87 (77–100)	90 (80–100)	0.120
Systolic blood pressure, mmHg	130 (116–144)	130 (119–144)	130 (110–142)	0.395
Diastolic blood pressure, mmHg	75 (65–83)	75 (65–83)	75 (60–84)	0.753
Respiratory rate, breaths·min^{-1}	19 (17–24)	18 (16–22)	22 (18–26)	0.013
Temperature, °C	36.5 (36–37.3)	36.5 (36–37.3)	36.4 (36–37.2)	0.252
Arterial blood gas				
F_{IO_2}, %	21 (21–21)	21 (21–21)	21 (21–32)	<0.001
pH	7.45 (7.41–7.47)	7.45 (7.42–7.47)	7.41 (7.37–7.47)	<0.001
P_{O_2}, mmHg	65 (56–77)	65 (57–77)	60 (51–79)	0.093
P_{CO_2}, mmHg	39 (35–46)	38 (35–43)	47 (36–61)	<0.001
Blood tests				
Haemoglobin, g·dL^{-1}	12.5 (11.12–13.6)	12.6 (11.3–13.6)	12 (10.9–13.3)	0.142
WBC count, 10^3·mm^{-3}	10.09 (7.51–13.02)	9.92 (7.46–13.08)	10.41 (7.96–12.72)	0.426
Eosinophils, 10^3·mm^{-3}	0.1 (0–0.2)	0.1 (0–0.2)	0.1 (0–0.2)	0.945
Creatinine, mg·dL^{-1}	0.83 (0.66–1.07)	0.83 (0.67–1.07)	0.81 (0.63–1.05)	0.661
BNP, pg·mL^{-1}	166 (79–361)	147 (71–300)	216 (97–432)	0.181
C-reactive protein, mg·dL^{-1}	3.54 (0.93–12.30)	3.4 (0.83–12.57)	3.73 (1.33–11.79)	0.415
Procalcitonin, ng·mL^{-1}	0.11 (0.05–0.29)	0.1 (0.05–0.22)	0.22 (0.05–0.47)	0.208
Complications at hospital admission				
Atrial fibrillation	24 (7.5)	16 (6.3)	8 (12.5)	0.093
Confusion	27 (8.5)	13 (5.1)	14 (21.9)	<0.001

Continued

TABLE 1 Continued

Variable	Overall (N=318)	No negative outcome (N=254)	Negative outcome (N=64)	p-value
Respiratory distress	85 (26.7)	45 (17.7)	40 (62.5)	<0.001
Pneumonia (consolidation)	123 (38.7)	96 (37.8)	27 (42.2)	0.519
Pulmonary embolism	5 (1.6)	4 (1.6)	1 (1.6)	1.000
Treatment during hospitalisation				
Systemic corticosteroids	121 (38.1)	93 (63.4)	29 (43.8)	0.293
Antibiotic therapy	300 (94.3)	239 (94.1)	61 (95.3)	1.000
Vasopressors	1 (0.3)		1 (100)	
Clinical outcomes during hospitalisation				
Non-invasive ventilation	51 (16.0)		51 (100)	
Intubation	7 (2.2)		7 (100)	
In-hospital death	10 (3.1)		10 (100)	
Length of stay, days	13 (9–16)	13 (9–15)	17 (13–21)	<0.001

Data are presented as median (interquartile range) or n (%). Systemic corticosteroids include intravenous and/or oral administration during hospitalisation. BMI: body mass index; FEV_1: forced expiratory volume in 1 s; BNP: brain natriuretic peptide; F_{IO_2}: fraction of inspired oxygen; ICS: inhaled corticosteroids; LABA: long-acting β-agonists; LAMA: long-acting muscarinic antagonists; P_{CO_2}: partial pressure of carbon dioxide; P_{O_2}: partial pressure of oxygen; WBC: white blood cell count.

(11%). Chronic respiratory therapies included inhaled agents (long-acting muscarinic agonists: 46.5%; long-acting beta-agonists: 49.7%; inhaled corticosteroids: 40.3%), long-term oxygen therapy (23.9%), and home NIV (6.3%). Chronic macrolide therapy was prescribed in 10.1%. At admission, the most common symptoms were dyspnoea (73.9%), cough (63.5%), increased sputum volume (45.3%) and purulence (33.0%). Concomitant pneumonia was present in 38.7% of cases, and 26.7% had respiratory acidosis. During hospitalisation, 94.3% received antibiotics, 38.1% (≈121/318) received systemic corticosteroids (either intravenous or oral), 16% required NIV and 2.2% required endotracheal intubation and invasive mechanical ventilation. In-hospital mortality was 3.1%, with a median (IQR) time to death of 15.3 (4.6–24.0) days. The composite adverse outcome occurred in 64 patients (20.1%). Compared to those without complications, patients who experienced the composite outcome had significantly lower FEV% pred (median 47% *versus* 59.5%, p=0.002), and higher prevalence of cardiovascular disease (54.7% *versus* 40.6%, p=0.041), pulmonary hypertension (21.9% *versus* 8.3%, p=0.002), and diabetes (21.9% *versus* 12.2%, p=0.047). They also more frequently presented with respiratory acidosis (62.5% *versus* 17.7%, p<0.001) and were more likely to be on domiciliary NIV prior to admission (26.6% *versus* 1.2%, p<0.001). Multivariate analysis identified cardiovascular disease (OR 3.89, 95% CI 1.39–10.90, p=0.010), pulmonary hypertension (OR 3.88, 95% CI 1.16–12.97, p=0.028), and low FEV% (OR 1.022 per % decrease, 95% CI 1.001–1.044, p=0.036) as independent predictors of the composite outcome. Median (IQR) hospital stay was 13 (9–16) days, and significantly longer among those with adverse outcomes (17 *versus* 13 days, p<0.001). In a subgroup analysis excluding COPD, the direction and magnitude of the associations were preserved; cardiovascular disease and pulmonary hypertension remained significantly associated with the composite outcome, whereas FEV% showed a similar inverse trend but was not statistically significant.

Validated bronchiectasis severity scores (*e.g.* BSI, FACED, BRICS) could not be computed in most patients because several components were missing. As a pragmatic proxy of radiological extent, we report the binary Reiff variable (positive if ⩾3 lobes involved or cystic bronchiectasis; negative otherwise); however, radiological severity was not independently associated with the composite outcome in our cohort.

Our findings underscore: 1) the clinical vulnerability of patients hospitalised for bronchiectasis exacerbations, with one in five experiencing significant deterioration during admission; 2) a low overall in-hospital mortality despite a high comorbidity burden, yet frequent need for ventilatory support; and 3) cardiovascular disease, pulmonary hypertension, and impaired lung function as independent predictors of in-hospital complications [6]. While FEV% is a well-established marker of long-term prognosis, our results confirm its relevance in predicting short-term deterioration during hospitalisation. Notably, age, radiological severity and concomitant pneumonia were not independently associated with poor outcomes. Currently, no validated risk stratification tools exist for patients hospitalised with bronchiectasis exacerbations [1]. Our study has important implications. From a clinical point of view, our findings support the adoption of multidimensional risk assessment tools upon admission to promptly identify high-risk patients who may benefit from intensified monitoring or early escalation of care. The strong

prognostic role of cardiovascular comorbidities highlights the need for systematic screening, risk modification strategies, and cardiology involvement during bronchiectasis exacerbations. From a research point of view, while this study identifies key predictors of adverse outcomes, prospective, multicentre validation is required to develop hospitalisation-specific risk models. Moreover, the association between respiratory acidosis, prior home NIV use, and complications suggests that future interventional trials should evaluate the timing of NIV initiation in this population. Finally, as this study focused exclusively on in-hospital outcomes, longitudinal studies are needed to assess post-discharge mortality, readmission rates, functional recovery, and quality of life, thereby informing integrated care models.

This study has several limitations, including its retrospective design, potential underreporting of non-standardised variables (*e.g.* pneumonia definition), and absence of a formal sample size calculation. Moreover, although all cases were manually validated, initial screening *via* ICD–9–CM codes may have underdetected exacerbations among patients without coded bronchiectasis, particularly in high-risk groups such as haematological malignancies or post–transplant recipients [7]. The aetiology of bronchiectasis – which can influence outcomes during exacerbations – was not captured in our case report form. We could not compute validated severity scores because of missing components, relying instead on a simplified Reiff-based extent variable. Finally, background immunosuppression and exacerbation-specific microbiology (sputum and blood cultures) were not systematically collected and the coexistence of COPD/asthma – recorded as comorbidities – may confound attribution of the exacerbation driver in individual cases, which we recognise as an interpretative limitation. Nevertheless, its multicentre nature, large sample size, manual case validation, and real-world focus on hospitalised patients enhance its validity and generalisability. In contrast to prior studies – mostly based on administrative data or small single-centre cohorts lacking outcome analysis [1] – this work provides one of the most detailed clinical profiles of bronchiectasis exacerbations requiring hospitalisation and identifies early predictors of short-term adverse outcomes.

In conclusion, patients admitted for bronchiectasis exacerbations are at substantial risk of in-hospital deterioration. Cardiovascular disease, pulmonary hypertension, and reduced FEV% are key early predictors of adverse outcomes. Recognising these factors at admission may improve risk stratification, optimise resource allocation, and ultimately enhance short-term outcomes in this fragile patient population.

Francesco Bindo [1], Edoardo Simonetta [2], Andrea Gramegna [1,3], Paola Faverio [4,5], Paola Scarano [2], Veronica Polelli [2], Anna Stainer [2,6], Francesco Amati [2,6], Mattia Nigro [2,6], Angela Tramontano [2], Sara Mirijaj [3], Pietro Curci [4,5], Manuel Mancuso [7], Claudia Crimi [7,8], Fabrizio Luppi [4,5], Francesco Blasi [1,3] and Stefano Aliberti [2,6]

[1]Respiratory Unit and Cystic Fibrosis Adult Center, Fondazione IRCCS Ca' Granda Ospedale Maggiore Policlinico, Milan, Italy. [2]IRCCS Humanitas Research Hospital, Respiratory Unit, Rozzano, Italy. [3]Department of Pathophysiology and Transplantation, University of Milan, Milan, Italy. [4]Respiratory Disease Unit, Fondazione IRCCS San Gerardo dei Tintori, Monza, Italy. [5]School of Medicine and Surgery, University of Milano-Bicocca, Milan, Italy. [6]Humanitas University, Department of Biomedical Sciences, Pieve Emanuele, Italy. [7]Department of Clinical and Experimental Medicine, University of Catania, Catania, Italy. [8]Respiratory Medicine Unit, Policlinico "G. Rodolico-San Marco", Catania, Italy.

Corresponding author: Stefano Aliberti (stefano.aliberti@hunimed.eu)

Provenance: Submitted article, peer reviewed.

Ethics statement: This study was approved by the Ethics Committee of IRCCS Humanitas Research Hospital (Rozzano, Milan, Italy), protocol number 59/23, approved on 10 May 2023. Informed consent was waived due to the retrospective design and anonymisation of patient data.

Conflict of interest: F. Bindo, E. Simonetta, P. Faverio, P. Scarano, V. Polelli, A. Stainer, F. Amati, M. Nigro, A. Tramontano, S. Mirajaj, P. Curci, M. Mancuso and F. Luppi declare no conflict of interest. A. Gramegna has received honoraria from Chiesi, Vertex, and Insmed for lectures outside the submitted work. C. Crimi has received lecture fees from F&P, ResMed, Philips, Vital Aire, GSK, AstraZeneca and Sanofi; and has participated on an advisory board for Vital Aire, outside the submitted work. F. Blasi reports grants from AstraZeneca, Chiesi and Insmed; and honoraria for lectures or advisory boards from AstraZeneca, Chiesi, Boehringer Ingelheim, GSK, Guidotti, Grifols, Insmed, Menarini, Novartis, OM Pharma, Pfizer, Sanofi, Vertex and Zambon, outside the submitted

work. S. Aliberti has received personal fees for consulting and lectures from Insmed (multiple branches), Zambon, AstraZeneca, Menarini, CSL Behring, Pfizer, Fondazione Internazionale Menarini, Moderna, Boehringer Ingelheim, Chiesi, MSD, Vertex, BRAHMS, Physioassist, AN2 Therapeutics, GSK and Verona Pharma; grants from GSK; and participated on advisory boards for Insmed, AstraZeneca, MSD and Verona Pharma, outside the submitted work.

Support statement: No funding declared.

References

1 De Angelis A, Johnson ED, Sutharsan S, *et al.* Exacerbations of bronchiectasis. *Eur Respir Rev* 2024; 33: 240085.
2 Choi H, McShane PJ, Aliberti S, *et al.* Bronchiectasis management in adults: state of the art and future directions. *Eur Respir J* 2024; 63: 2400518.
3 Goeminne PC, Hernandez F, Diel R, *et al.* The economic burden of bronchiectasis – known and unknown: a systematic review. *BMC Pulm Med* 2019; 19: 54.
4 Aliberti S, Goeminne PC, O'Donnell AE, *et al.* Criteria and definitions for the radiological and clinical diagnosis of bronchiectasis in adults for use in clinical trials: international consensus recommendations. *Lancet Respir Med* 2022; 10: 298–306.
5 Hill AT, Haworth CS, Aliberti S, *et al.* Pulmonary exacerbation in adults with bronchiectasis: a consensus definition for clinical research. *Eur Respir J* 2017; 49: 1700051.
6 McDonnell MJ, Aliberti S, Goeminne PC, *et al.* Comorbidities and the risk of mortality in patients with bronchiectasis: an international multicentre cohort study. *Lancet Respir Med* 2016; 4: 969–979.
7 Freund O, Wand O, Hadad Y, *et al.* Respiratory burden in hematology-related bronchiectasis: clinical characteristics and treatable traits. *Respiration* 2025; 104: 791–799.