

The Prevalence and Risk Factors of Bronchiectasis among Adults Based on CT Scan Findings: A Retrospective Single-Center Study

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Abstract

Background: Bronchiectasis, characterized by irreversible bronchial dilation, often affects patients' long-term health. This study assessed the prevalence and risk factors of bronchiectasis in adults based on CT scan-finding department (OPD) patients in a single center. **Methods:** We retrospectively reviewed the medical records of 301 adult OPD patients examined between 2021 and 2022. We diagnosed bronchiectasis based on high-resolution chest CT scans. We analyzed demographic characteristics, tuberculosis (TB) history, and the presence of comorbid conditions using electronic medical records. We conducted univariate and multivariate analyses to identify potential risk factors for bronchiectasis. **Results:** Among 301 patients who had high-resolution chest CT scans, 139 (46.1%) received a diagnosis of bronchiectasis. Multivariable analysis revealed significant associations between bronchiectasis and the following factors: age greater than 50 years and history of tuberculosis. We found no significant correlation between gender and smoking history. **Conclusion:** This study found a high prevalence of bronchiectasis (46.1%) among OPD patients in our single center, with older age and a history of tuberculosis identified as independent risk factors.

Keywords

Bronchiectasis, Tuberculosis, Prevalence, Risk Factors

1. Introduction

Bronchiectasis is a long-term lung condition that causes the airways to widen. This

condition can result in a mucus-producing cough and frequent lung infections [1] [2]. Breathing problems, a decline in lung function, a worsening quality of life, and an increased risk of early death are often associated with this lung disease [3] [4]. Bronchiectasis has a significant impact on both healthcare systems and society, with frequent hospitalizations and deaths being the main contributors to this burden [5].

According to global data, bronchiectasis diagnoses have increased in recent years [6]. In Europe, between 2005 and 2011, the number of hospitalized patients for bronchiectasis in Germany increased by 2.9% annually. The United States has reported similar findings [7]. In the United States, the estimated prevalence of bronchiectasis among adult patients was 139 per 100,000 [8]. China has the highest prevalence of bronchiectasis, with over 1,200 per 100,000 people over 40 years old affected by the disease [2]. About 7.4% of people in Africa have post-TB bronchiectasis [9]. A large study of over 1,200 people with bronchiectasis found that the most common cause was unknown (idiopathic), accounting for 40% of cases. Following this were post-infective bronchiectasis (20%), chronic obstructive pulmonary disease (COPD) (15%), connective tissue disease (CTD) (10%), immunodeficiency (5.8%), and asthma (3.3%). In India, previous lung tuberculosis (pulmonary TB) was the leading cause of bronchiectasis [10].

This study aims to provide much-needed data on the prevalence and risk factors of this disease in this underserved population. This study's findings will have significant implications for the prevention and treatment of bronchiectasis in Somalia. The identification of risk factors will help target interventions for high-risk populations. Additionally, the data on prevalence will help to advocate for increased resources for the diagnosis and management of bronchiectasis in Somalia.

2. Methods and Materials

2.1. Study Design

The Türkiye Training and Research Hospital in Mogadishu, Somalia, conducted this retrospective, single-center study.

2.2. Patient Selection

The study included all patients with high-resolution CT scan findings treated at the outpatient unit of Mogadishu Somalia Türkiye Training and Research Hospital between January 1, 2021, and December 31, 2022.

Patients with high-resolution CT scan findings were eligible for inclusion. Patients who did not have chest CT scans were excluded.

2.3. Data Collection

We collected data from the medical records of eligible patients. The following information was collected: We gathered data on demographic characteristics such as age and sex, smoking history, medical history such as pneumonia, tuberculosis, asthma, and other chronic lung diseases, clinical features, and HRCT results.

2.4. Data Analysis

We analyzed the data using SPSS software (version 26.0). We used descriptive statistics to characterize the study population. We used univariate and multivariate analyses to identify the risk factors associated with bronchiectasis.

2.5. Ethical Considerations

We obtained an approval letter from the review board of Mogadishu-Somali Türkiye Recep Tayyip Erdogan Training and Research Hospital (MSTH: 10621, Ref. No. 625). We followed the relevant guidelines of the Helsinki Declaration for all methods. We informed the participants about the study's purpose and obtained their written informed consent.

3. Results

Among 301 patients, 139 (46.1%) received a diagnosis of bronchiectasis.

The mean age in the bronchiectasis group was 58.42 years (SD \pm 18.94), while in the non-bronchiectasis group, it was 54.55 years (SD \pm 20.58). The odds ratio (OR) for age, with a 95% confidence interval (CI), was 0.513 to 0.920, and the p-value was 0.092, indicating a non-significant difference. The age distribution showed a significant association, with 26.6% of patients aged 50 years or younger in the bronchiectasis group compared to 41.4% in the non-bronchiectasis group (OR = 0.514, 95% CI: 0.315 to 0.839, p = 0.007). For patients older than 50, the bronchiectasis group had 73.4%, while the non-bronchiectasis group had 58.6%. The gender distribution did not show a significant difference, with 49.6% of males in the bronchiectasis group and 53.7% in the non-bronchiectasis group (OR = 0.850, 95% CI: 0.540 to 1.338, p = 0.482) (Table 1).

Table 1. Baseline characteristics of patients with & without bronchiectasis.

Patient characteristic	Bronchiectasis (n = 139)	Non-bronchiectasis (n = 162)	OR** (95% CI*)	P-Value	
Age (years), mean \pm SD	58.42 \pm 18.94	54.55 \pm 20.58	(0.513 - 0.920)	0.092	
Age group	\leq 50 Years	37 (26.6%)	67 (41.4%)	0.514	0.007
	>50 Years	102 (73.4%)	95 (58.6%)	(0.315 - 0.839)	
Gender	Male	69 (49.6%)	87 (53.7%)	0.850	0.482
	Female	70 (50.4%)	75 (46.3%)	(0.540 - 1.338)	
Smoking status	Yes	25 (18.0%)	29 (17.9%)	1.006	0.985
	No	114 (82.0%)	133 (82.1%)	(0.557 - 1.815)	
Comorbidities	DM***	10 (7.2%)	13 (8.0%)		0.895
	HTN****	17 (12.2%)	22 (13.6%)	1.104	
	DM/HTN	5 (3.6%)	8 (4.9%)	(0.851 - 1.434)	
	No	107 (77.0%)	119 (73.5%)		

*CI (Confidence Interval), **OR (Odd Ratio), ***DM (Diabetes Mellitus), ****HTN (Hypertension).

The results highlight significant differences in CT scan findings and echocardiogram results. Cystic bronchiectasis is notably present in 56.8% of cases, compared to none in the non-bronchiectasis group (p-value = 0.000). Traction bronchiectasis is also significantly more prevalent in cases (43.2%) compared to non-bronchiectasis (0.0%). A higher percentage of people with emphysema, multiple tree-in-bud nodular infiltrates, fibrotic changes, ground glass, and septic pulmonary emboli show up on CT scans than people who don't have these conditions. Echocardiogram findings show a higher percentage of normal results in controls (15.1%) compared to cases (10.5%), with a statistically significant p-value of 0.008. Other types of echocardiograms, like R-H DILATED/PHTN, PHTN, R-H DILATED, and EF 40-45, show different percentages between the two groups (**Table 2**).

Table 2. Comparison of laboratory parameters in patients with and without bronchiectasis.

Variables	Bronchiectasis (n = 139)	Non-bronchiectasis (n = 162)	P-Value
CT scan findings*			
Cystic bronchiectasis	79 (56.8%)	0 (0.0%)	0.000
Traction bronchiectasis	60 (43.2%)	0 (0.0%)	
Consolidation	0 (0.0%)	30 (18.5%)	
Cavitary Lesion	0 (0.0%)	28 (17.3%)	
Lung metastasis	0 (0.0%)	20 (12.3%)	
Ground glass	0 (0.0%)	18 (11.1%)	
Fibrotic changes	0 (0.0%)	19 (11.7%)	
Filling defect segmental arteries	0 (0.0%)	12 (7.4%)	
Emphysema	0 (0.0%)	14 (8.6%)	
Multiple tree-in-bud nodular infiltrates	0 (0.0%)	10 (6.2%)	
Septic pulmonary emboli	0 (0.0%)	11 (6.8%)	
Echo findings			
Normal	21 (15.1%)	17 (10.5%)	0.008
R-H DILATED /PHTN	20 (14.4%)	15 (9.3%)	
PHTN**	24 (17.3%)	27 (16.7%)	
R-H DILATED	9 (6.5%)	22 (13.6%)	
EF 40-45***	19 (13.7%)	8 (4.9%)	
No Echo	46 (33.1%)	73 (45.1%)	

*CT (Computed Tomography), **PH or PHTN (Pulmonary Hypertension), ***EF (Ejection Fraction).

People who had bronchiectasis (case) had higher hemoglobin levels (12.31 ± 2.53 vs. 11.39 ± 2.80 , $p = 0.003$) and lower C-reactive protein (CRP) levels (35.86 ± 39.74 vs. 50.66 ± 49.75 , $p = 0.005$) than people who did not have bronchiectasis. (**Table 3**)

Table 3. Comparison of laboratory parameters in patients with and without bronchiectasis.

Laboratory parameters	Bronchiectasis (n = 139)	Non-bronchiectasis (n = 162)	P-Value
HGB	12.31 ± 2.53	11.39 ± 2.80	0.003
PLT	346.99 ± 142.62	323.75 ± 167.87	0.201
WBC	9.05 ± 6.90	9.40 ± 8.81	0.705

Continued

Neutrophil	7.26 ± 8.26	7.74 ± 9.39	0.642
Lymphocyte	2.26 ± 2.55	2.22 ± 2.78	0.899
Monocyte	1.29 ± 2.60	1.72 ± 3.23	0.208
Eosinophils	1.45 ± 5.40	4.05 ± 16.71	0.080
Sedimentation	33.32 ± 51.43	38.97 ± 57.08	0.371
CRP	35.86 ± 39.74	50.66 ± 49.75	0.005

*HGB (Hemoglobin), **PLT (Platelet), ***WBC (White Blood Count), ****CRP (C-reactive protein).

The analysis of risk factors associated with bronchiectasis revealed significant findings. People with bronchiectasis were more likely to cough up mucus (91.4% vs. 78.4%, OR = 2.917, $p = 0.002$) and experienced less air entering their lungs during listening (25.9% vs. 39.5%, OR = 0.809, $p = 0.046$). The history of tuberculosis was significantly more common in bronchiectasis than non-bronchiectasis (66.2% vs. 37.7%, OR = 3.241, $p = 0.000$) (**Table 4**).

Table 4. Risk Factors Associated with and Without Bronchiectasis.

Risk factors		Bronchiectasis (n = 139)	Non-bronchiectasis (n = 162)	OR* (95% CI)**	P-Value
Cough	Productive	127 (91.4%)	127 (78.4%)	2.917	0.002
	Dry	12 (8.6%)	35 (21.6%)	(1.448 - 5.875)	
Dyspnea	Yes	132 (95.0%)	157 (96.9%)	0.601	0.285
	No	7 (5.0%)	5 (3.1%)	(0.186 - 1.936)	
Hemoptysis	Yes	38 (27.3%)	37 (22.8%)	1.271	0.368
	No	101 (72.7%)	125 (77.2%)	(0.753 - 2.145)	
Recurrent fever	Yes	111 (79.9%)	121 (74.7%)	1.343	0.288
	No	28 (20.1%)	41 (25.3%)	(0.779 - 2.317)	
Lung auscultation	Decrease air entry	36 (25.9%)	64 (39.5%)		0.046
	Crepitation	13 (9.4%)	7 (4.3%)	0.809	
	Crackles	68 (48.9%)	70 (43.2%)	(0.656 - 0.998)	
History of tuberculosis	Wheezing	22 (15.8%)	21 (13.0%)		0.000
	Yes	92 (66.2%)	61 (37.7%)	3.241	
	No	47 (33.8%)	101 (62.3%)	(2.018 - 5.205)	
Asthma	Yes	11 (7.9%)	18 (11.1%)	0.688	0.349
	No	128 (92.1%)	144 (88.9%)	(0.313 - 1.510)	
COPD***	Yes	7 (5.0%)	10 (6.2%)	0.806	0.670
	No	132 (95.0%)	152 (93.8%)	(0.298 - 2.177)	

CI (Confidence Interval), *OR (Odd Ratio), *COPD (Chronic obstructive pulmonary disease).

4. Discussion

This study addresses this critical public health problem by providing Somalia's first comprehensive assessment of bronchiectasis. It also assessed various potential risk factors for bronchiectasis, including demographic characteristics and medical history. This comprehensive assessment provides valuable insights into the risk factors for bronchiectasis in Somalia.

The prevalence of bronchiectasis in Somalia is still unknown. However, based

on our clinical observations and the prevalence of tuberculosis in Somalia, it remains high. Only 80.6% of tuberculosis (TB) patients in Benadir received a cure, according to research in Somalia. This is significantly lower than the World Health Organization's (WHO) target of at least a 90% success rate for TB treatment. This shortfall may increase the risk of developing bronchiectasis [11].

A study in South Africa looked at 175 patients and tested them for HIV. More than a third (61, or 34.9%) were HIV-positive. Interestingly, a significant proportion (86.9%, or 53 patients) of these HIV-positive patients identified tuberculosis (TB) as the cause of their bronchiectasis (TB) identified as the reason behind their bronchiectasis [12].

In Somalia, although there is no population-based study about HIV prevalence, there is a study about the prevalence of HIV among HIV patients in Benadir, Somalia, which showed that the prevalence was very low, around 1.5% [13]. This study presents the first prevalence report on bronchiectasis in Somalia, estimating a rate of 46.1%, compared to estimates of 7.4% in Sudan and 4.9% in Ethiopia (10). At 67 per 100,000, Germany has a lower rate than the UK, where new cases reach 566 and 485 per 100,000 in women and men, respectively [14]. The most notable finding of this study was that of bronchiectasis, which is a factor that is comprised of comorbid pulmonary conditions such as a previous pulmonary TB history. In a similar study, alongside other severe infections, the high prevalence of tuberculosis in the Indian subcontinent made it the dominant underlying cause of bronchiectasis [15]. In contrast, in a study in Germany, most bronchiectasis patients had COPD [6]. Our study revealed a high prevalence of bronchitis among individuals older than 50 years. Similar to our research, one study revealed the prevalence of bronchiectasis in individuals exceeding 75 years of age in Italy [16]. The reason that our subjects are younger than the Italian group may be related to the high pulmonary TB in younger adults.

Our findings regarding the relationship between asthma and COPD did not reach statistical significance, unlike the results reported in another study. Among bronchiectasis patients, 36% had COPD, and a significant portion (43%) had asthma diagnoses.

The reason for the lack of relationship between asthma/copd and bronchiectasis may relate to the high prevalence of post-TB bronchiectasis and the low prevalence of COPD in our country due to low smoking habits in the population. This suggests a high prevalence of these co-existing conditions [17]. Productive cough was a common symptom among our patients, similar to another study from Australia, which showed chronic cough was the most common symptom [18].

Overall, the goal of this study is to fill in a major knowledge gap about the prevalence and risk factors of bronchiectasis in low-income countries where infectious diseases like tuberculosis are common. This could lead to better clinical outcomes and a lower disease burden in this high-risk population. The reason for the high sedimentation rate may be related to the infectious process at the time of presentation, although it was not specific for bronchiectasis.

5. Limitations

This study has some limitations. Firstly, the accuracy and completeness of the data recorded in the medical records limit a retrospective design. Secondly, a single hospital in Somalia conducted the study. This limits the findings' generalizability to the entire Somali population. Third, the study had a relatively small sample size, which may limit its statistical power. Fourth, some of the data in the study, such as smoking history, was self-reported. This type of data is subject to recall bias, which can limit the accuracy of the findings. Finally, the absence of information on treatment strategies and management outcomes for bronchiectasis was also a limitation of our study.

6. Conclusion

In conclusion, the study found that bronchiectasis is a common disease in Somalia, with an estimated prevalence of 46.1%. The study also identified a number of risk factors for bronchiectasis, including a history of tuberculosis. This study's findings have important implications for the prevention and treatment of bronchiectasis in Somalia. Public health interventions aimed at improving access to tuberculosis prevention and treatment strategies could help reduce the burden of bronchiectasis in this population. Future research can use the findings of this study to develop targeted prevention and treatment strategies for this disease.

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Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

References

- [1] Chalmers, J.D., Aliberti, S. and Blasi, F. (2015) Management of Bronchiectasis in Adults. *European Respiratory Journal*, **45**, 1446-1462. <https://doi.org/10.1183/09031936.00119114>
- [2] Lin, J., Xu, J. and Qu, J. (2016) Bronchiectasis in China. *Annals of the American Thoracic Society*, **13**, 609-616. <https://doi.org/10.1513/annalsats.201511-740ps>
- [3] Sanchez-Carpintero Abad, M., Sanchez-Salcedo, P., de-Torres, J.P., Alcaide, A.B., Seijo, L.M., Pueyo, J., *et al.* (2020) Prevalence and Burden of Bronchiectasis in a Lung Cancer Screening Program. *PLOS ONE*, **15**, e0231204. <https://doi.org/10.1371/journal.pone.0231204>
- [4] Martin, C., Thevenot, G., Danel, S., Chapron, J., Tazi, A., Macey, J., *et al.* (2011) *Pseudomonas Aeruginosa* Induces Vascular Endothelial Growth Factor Synthesis in Airway Epithelium *in Vitro* and *in Vivo*. *European Respiratory Journal*, **38**, 939-946. <https://doi.org/10.1183/09031936.00134910>
- [5] De la Rosa, D., Martínez-García, M., Oliveira, C., Girón, R., Máiz, L. and Prados, C.

- (2016) Annual Direct Medical Costs of Bronchiectasis Treatment. *Chronic Respiratory Disease*, **13**, 361-371. <https://doi.org/10.1177/1479972316643698>
- [6] Ringshausen, F.C., de Roux, A., Pletz, M.W., Hämäläinen, N., Welte, T. and Rademacher, J. (2013) Bronchiectasis-Associated Hospitalizations in Germany, 2005-2011: A Population-Based Study of Disease Burden and Trends. *PLOS ONE*, **8**, e71109. <https://doi.org/10.1371/journal.pone.0071109>
- [7] Seitz, A.E., Olivier, K.N., Adjemian, J., Holland, S.M. and Prevots, D.R. (2012) Trends in Bronchiectasis among Medicare Beneficiaries in the United States, 2000 to 2007. *Chest*, **142**, 432-439. <https://doi.org/10.1378/chest.11-2209>
- [8] Goolam-Mahomed, A., Maasdorp, S.D., Barnes, R., Van Aswegen, H., Lupton-Smith, A., Allwood, B., *et al.* (2023) South African Thoracic Society Position Statement on the Management of Non-Cystic Fibrosis Bronchiectasis in Adults: 2023. *African Journal of Thoracic and Critical Care Medicine*, **29**, 71-80. <https://doi.org/10.7196/ajtccm.2023.v29i2.647>
- [9] Binegdie, A.B., Brenac, S., Devereux, G., Meme, H., El Sony, A., Gebremariam, T.H., *et al.* (2022) Post-Tb Lung Disease in Three African Countries. *The International Journal of Tuberculosis and Lung Disease*, **26**, 891-893. <https://doi.org/10.5588/ijtld.22.0261>
- [10] Dhar, R., Singh, S., Talwar, D., Murali Mohan, B.V., Tripathi, S.K., Swarnakar, R., *et al.* (2023) Clinical Outcomes of Bronchiectasis in India: Data from the EMBARC/Respiratory Research Network of India Registry. *European Respiratory Journal*, **61**, Article 2200611.
- [11] Karataş, M., Dirie, A., Çolakoğlu, S., Hussein, A. and Ali, A. (2024) Tuberculosis Treatment Outcomes and Associated Factors in Benadir Somalia. A Multicenter Cohort Study. *International Journal of General Medicine*, **17**, 2711-2718. <https://doi.org/10.2147/ijgm.s463237>
- [12] Titus, G., Hassanali, S. and Feldman, C. (2023) Non-Cystic Fibrosis Bronchiectasis: A Single-Centre Retrospective Study in Johannesburg, South Africa. *African Journal of Thoracic and Critical Care Medicine*, **29**, e1017. <https://doi.org/10.7196/ajtccm.2023.v29i4.1017>
- [13] Dirie, A.M.H., Çolakoğlu, S., Abdi, B.M., Shire, A.M. and Abdinur, A.H. (2022) The Prevalence of HIV among Tuberculosis Patients in Benadir, Somalia. Retrospective Multi-Center Study. *Annals of Medicine & Surgery*, **78**. <https://doi.org/10.1016/j.amsu.2022.103793>
- [14] Quint, J.K., Millett, E.R.C., Joshi, M., Navaratnam, V., Thomas, S.L., Hurst, J.R., *et al.* (2015) Changes in the Incidence, Prevalence and Mortality of Bronchiectasis in the UK from 2004 to 2013: A Population-Based Cohort Study. *European Respiratory Journal*, **47**, 186-193. <https://doi.org/10.1183/13993003.01033-2015>
- [15] Dhar, R., Singh, S., Talwar, D., Mohan, M., Tripathi, S.K., Swarnakar, R., *et al.* (2019) Bronchiectasis in India: Results from the European Multicentre Bronchiectasis Audit and Research Collaboration (EMBARC) and Respiratory Research Network of India Registry. *Lancet Glob Health*, **7**, e1269-e1279.
- [16] Monteagudo, M., Rodríguez-Blanco, T., Barrecheguren, M., Simonet, P. and Miravittles, M. (2016) Prevalence and Incidence of Bronchiectasis in Catalonia, Spain: A Population-Based Study. *Respiratory Medicine*, **121**, 26-31. <https://doi.org/10.1016/j.rmed.2016.10.014>
- [17] Martínez-García, M.Á., Soler-Cataluña, J.J., Donat Sanz, Y., Catalán Serra, P., Agramunt Lerma, M., Ballestín Vicente, J., *et al.* (2011) Factors Associated with Bronchiectasis in Patients with COPD. *Chest*, **140**, 1130-1137.

<https://doi.org/10.1378/chest.10-1758>

- [18] King, P.T., Holdsworth, S.R., Freezer, N.J., Villanueva, E. and Holmes, P.W. (2006) Characterisation of the Onset and Presenting Clinical Features of Adult Bronchiec-tasis. *Respiratory Medicine*, **100**, 2183-2189.

<https://doi.org/10.1016/j.rmed.2006.03.012>