

Association Between Blood Type Clinical Course and Sputum Microorganisms in Bronchiectasis

Bronşektazide Kan Grubu, Klinik Seyir ve Balgam Mikroorganizmaları Arasındaki İlişki

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ABSTRACT

Objective: ABO blood groups have been shown to be associated with susceptibility to various infections. Patients with bronchiectasis frequently experience recurrent infections, which may lead to a poor clinical course and adverse outcomes. This study aimed to evaluate the relationship between ABO blood groups, clinical course, and microorganisms isolated from sputum cultures in adult patients with non-cystic fibrosis (non-CF) bronchiectasis.

Materials and methods: Adult patients with bronchiectasis who were followed between January 2016 and October 2024 were retrospectively evaluated. Microorganisms isolated from sputum cultures, as well as demographic, clinical, and laboratory data, were obtained from hospital records. Patients were classified according to their ABO blood groups (O, A, B, and AB) and compared in terms of clinical course, including hospitalization, intensive care unit (ICU) admission, frequency of exacerbations and emergency department visits, mortality, and sputum culture results.

Results: A total of 102 patients (51 males and 51 females) were included in the study. *Pseudomonas aeruginosa* was isolated from sputum cultures in 26 patients, and colonization was detected in six patients. Twenty-five patients (25.5%) required ICU admission, and 19 patients (19.3%) died during follow-up. Among the ABO blood groups, all clinical and microbiological parameters were similar, except for the median number of emergency department visits per year, which was significantly higher in patients with blood group B ($p = 0.047$).

Conclusion: No significant differences were observed among ABO blood groups regarding exacerbation frequency, mortality, lung function parameters, or bacterial growth in sputum cultures in adult patients with non-CF bronchiectasis. However, emergency admissions due to lower respiratory tract infections were more frequent in patients with blood group B, suggesting a potentially increased risk of infection in this group. Due to the limited sample size, multicenter studies are required to further investigate the association between ABO blood groups, sputum microbiology, and clinical outcomes in bronchiectasis.

Keywords: ABO blood group; Bronchiectasis; Microorganisms; *Pseudomonas aeruginosa*

ÖZET

Amaç: ABO kan gruplarının çeşitli enfeksiyonlara yatkınlık ile ilişkili olduğu gösterilmiştir. Bronşektazi hastaları sık enfeksiyonlar geçirebilmekte ve bu durum kötü klinik seyir ve olumsuz sonuçlara yol açabilmektedir. Bu çalışmada, kistik fibrozis dışı bronşektazisi olan erişkin hastalarda ABO kan grubu ile klinik seyir ve balgam kültüründe üreyen mikroorganizmalar arasındaki ilişkinin değerlendirilmesi amaçlandı.

Materiyal ve metod: Ocak 2016 – Ekim 2024 tarihleri arasında izlenen bronşektazi hastalarının balgam kültürlerinde üreyen mikroorganizmalar retrospektif olarak değerlendirildi. Demografik, klinik ve laboratuvar verileri hastane kayıtlarından elde edildi. Hastalar ABO kan gruplarına göre O, A, B ve AB olmak üzere dört gruba ayrıldı ve klinik seyir (hastaneye yatış, yoğun bakım ihtiyacı, alevlenme varlığı ve sayısı, acil başvurular, mortalite) ile balgam kültür sonuçları açısından karşılaştırıldı.

Bulgular: Çalışmaya toplam 102 hasta (51 erkek, 51 kadın; her biri %50) dahil edildi. Yirmi altı hastada balgam kültüründe *Pseudomonas aeruginosa* üremesi saptanırken, 6 hastada kolonizasyon mevcuttu. Yirmi beş hasta (%25,5) yoğun bakım ünitesinde izlenmiş ve 19 hasta (%19,3) hayatını kaybetmişti. İncelenen tüm kan grupları arasında parametrelerin büyük çoğunluğu benzerdi; ancak yıllık medyan acil başvuru sayısının B kan grubunda daha yüksek olduğu saptandı ($p=0,047$).

Sonuç: Bu çalışmada, kistik fibrozis dışı bronşektazisi olan erişkin hastalarda kan grupları arasında alevlenme sıklığı, mortalite oranı, akciğer fonksiyonları ve balgam kültüründe üreyen bakteri türleri açısından anlamlı bir fark saptanmadı. Bununla birlikte, alt solunum yolu enfeksiyonu nedeniyle acil başvuruların B kan grubunda daha fazla olması, bu grupta enfeksiyon riskinin daha yüksek olabileceğini düşündürmektedir. Ancak hasta sayısının sınırlı olması nedeniyle, bronşektazide kan grubu ile balgam kültürü ve klinik seyir arasındaki ilişkinin daha iyi değerlendirilmesi için çok merkezli çalışmalara ihtiyaç vardır.

Anahtar Kelimeler: ABO kan grubu, Bronşektazi, Mikroorganizma, *Pseudomonas aeruginosa*.

INTRODUCTION

ABO blood groups are classified according to the antigens present on the surface of erythrocytes. These antigens are not limited to erythrocytes but are also expressed on epithelial cells and mucosal surfaces, where they may facilitate certain infections while providing protection against others. Recent studies have demonstrated a significant association between ABO blood groups and susceptibility to various infectious diseases (1–6). This relationship gained particular attention during the COVID-19 pandemic, during which an increased risk of infection was observed in individuals with blood group A, whereas a relatively protective effect was reported in those with blood group O (7,8). In addition, an association between *Helicobacter pylori* infection and blood group A has been established (1).

Bronchiectasis is a chronic and progressive disease characterized by irreversible bronchial dilatation, impaired mucociliary clearance, mucus accumulation, and recurrent infections. Infections play a central role in both the initiation and progression of the disease. Permanent airway damage leads to defective mucociliary clearance and mucus retention, creating a favorable environment for microbial colonization. Consequently, patients may experience frequent infections that trigger acute exacerbations and result in further bronchial damage (9–12). Moreover, infections are known to be important contributors to disease progression and mortality in bronchiectasis (13).

In pediatric populations, blood group B has been reported to be highly associated with *Pseudomonas aeruginosa* sepsis (14). In contrast, no association has been found between ABO blood group gene polymorphisms and lung disease severity or age at onset of *P. aeruginosa* infection (15), nor between ABO blood group type and *Pseudomonas* colonization in cystic fibrosis–related bronchiectasis (16). To the best of our knowledge, the relationship between ABO blood groups, bacterial infections, and clinical course has not been investigated in adult patients with non–cystic fibrosis bronchiectasis.

Therefore, this study aimed to evaluate the association between ABO blood groups, clinical course, and microorganisms isolated from sputum cultures in adult patients with non–cystic fibrosis bronchiectasis.

METHODS

Study Design and Population; This retrospective study included adult patients diagnosed with bronchiectasis who were followed at Sultan 2. Abdulhamid Han Training and Research Hospital between January 2016 and October 2024. Patients with a confirmed diagnosis of bronchiectasis, a documented ABO blood group, and available sputum culture results were eligible for inclusion. Patients with cystic fibrosis–related bronchiectasis and those with missing clinical or microbiological data were excluded from the analysis.

Inclusion and Exclusion Criteria; Adult patients (≥ 18 years) with a confirmed diagnosis of bronchiectasis who were followed between January 2016 and October 2024, had a documented ABO blood group, and had available sputum culture results were included in the study. Patients with cystic fibrosis–related bronchiectasis, those younger than 18 years, and patients with missing or incomplete clinical, microbiological, or laboratory data were excluded from the analysis.

Data Collection; Demographic, clinical, and laboratory data were obtained retrospectively from the hospital's electronic medical records. Recorded variables included age, sex, ABO blood group, comorbidities, disease duration, inhaled corticosteroid use, nebulizer use, long-term oxygen therapy (LTOT), use of noninvasive ventilation, and laboratory parameters. Clinical outcomes such as number of exacerbations, emergency department visits, hospitalization, intensive care unit (ICU) admission, and mortality during follow-up were also documented.

Microbiological Assessment; Sputum culture results obtained during routine clinical follow-up were reviewed. Bacterial growth was categorized as *Pseudomonas aeruginosa*, other gram-negative bacteria, gram-positive bacteria, or polymicrobial growth. Colonization was defined as repeated isolation of the same microorganism in sputum cultures without signs of acute infection, according to standard clinical criteria.

Grouping and Outcomes; Patients were classified into four groups based on their ABO blood type (O, A, B, and AB). The groups were compared in terms of clinical course, including frequency of exacerbations, emergency department visits, hospitalization, ICU admission, and mortality, as well as sputum microbiological findings.

Ethical Considerations; Ethical approval for the study was obtained from the Clinical Research Ethics Committee of Ümraniye Training and Research Hospital (Approval Date: December 12, 2023; Approval Number: B.10.1.TKH.4.34.H.GP.0.01/454). The study was conducted in accordance with the principles of the Declaration of Helsinki.

Statistical Analysis; Statistical analyses were performed using IBM SPSS Statistics for MacOS, version 29.0 (IBM Corp., Armonk, NY, USA). Categorical variables were presented as frequencies and percentages, while continuous variables were expressed as median values with minimum and maximum ranges. Normality of data distribution was assessed using the Kolmogorov–Smirnov test. Comparisons between two groups were performed using the Mann–Whitney U test for non-normally distributed variables, while comparisons among more than two groups were conducted using the Kruskal–Wallis H test. The Chi-square test or Fisher's exact test was used for categorical variables. Logistic regression analysis was performed to identify

independent risk factors associated with bacterial growth in sputum. A p-value <0.05 was considered statistically significant.

RESULTS

A total of 102 patients were included in the study, comprising 51 males and 51 females (50% each). The demographic characteristics and baseline clinical features of the patients according to ABO blood group are summarized in *Table 1*. The median age and sex distribution were similar across all blood groups, and no significant differences were observed regarding comorbidities, disease duration, use of inhaled corticosteroids, nebulizer therapy, noninvasive ventilation, or long-term oxygen therapy.

Clinical outcomes according to ABO blood group are presented in *Table 2*. There were no statistically

significant differences among the blood groups in terms of hospitalization, intensive care unit (ICU) admission, frequency of exacerbations, or mortality. However, the median number of emergency department visits per year was significantly higher in patients with blood group B compared with the other blood groups ($p = 0.047$).

Microbiological and laboratory findings are shown in *Table 3*. *Pseudomonas aeruginosa* was isolated from sputum cultures in 26 patients (25.5%), and colonization was identified in six patients. The rates of *P. aeruginosa* isolation, other gram-negative and gram-positive bacterial growth, and polymicrobial growth did not differ significantly among the ABO blood groups. Similarly, median values of white blood cell count, neutrophils, lymphocytes, eosinophils, and platelet counts were comparable across the groups.

Table 1. Demographic and baseline clinical characteristics of patients according to ABO blood group

Variable	O (n=37)	A (n=42)	B (n=12)	AB (n=11)	p-value
Age, years	61 (26–81)	59 (26–86)	65 (24–85)	67 (29–85)	0.691
Male sex, n (%)	20 (54.1)	19 (45.2)	6 (50.0)	6 (54.5)	0.870
Disease duration, years	6 (1–8)	4 (1–7)	3.5 (2–12)	5 (1–12)	0.462
Comorbidities (any), n (%)	23 (62.2)	25 (59.5)	5 (41.7)	5 (45.5)	0.521
Nebulizer use, n (%)	13 (35.1)	20 (47.6)	6 (50.0)	2 (18.2)	0.256
BiPAP use, n (%)	6 (16.2)	8 (19.0)	1 (8.3)	1 (9.1)	0.748
LTOT use, n (%)	9 (24.3)	13 (31.0)	4 (33.3)	1 (9.1)	0.472
FEV ₁ , % predicted	47.5 (22–94)	57 (27–87)	62.5 (38–81)	78.5 (59–98)	0.313
FVC, % predicted	56 (27–84)	59 (38–83)	73 (63–90)	94.5 (82–107)	0.110
FEV ₁ /FVC ratio	64.9 (42–87)	66.6 (40–114)	63 (57–84.4)	64.5 (55–74)	0.945

Abbreviations: BiPAP, bilevel positive airway pressure; LTOT, long-term oxygen therapy; FEV₁, forced expiratory volume in 1 second; FVC, forced vital capacity.

Table 2. clinical outcomes of patients according to ABO blood group

Variable	O (n=37)	A (n=42)	B (n=12)	AB (n=11)	p-value
Hospitalization, n (%)	37 (100)	42 (100)	12 (100)	11 (100)	—
Length of hospital stay, days	8.3 (4–37)	9 (2–16.3)	8.5 (3–19)	8 (6–13)	0.996
Intensive care unit admission, n (%)	9 (24.3)	13 (31.0)	2 (16.7)	1 (9.1)	0.431
Exacerbations since diagnosis	4 (1–29)	3 (1–35)	4 (1–36)	2.5 (1–20)	0.531
Emergency department visits per year	2 (1–11)	2 (1–5)	9 (7–10)	3 (1–5)	0.047
Hemoptysis, n (%)	15 (40.5)	12 (28.6)	3 (25.0)	1 (9.1)	0.222
Mortality, n (%)	7 (18.9)	10 (24.4)	2 (16.7)	0 (0)	0.331

Abbreviations: ICU, intensive care unit.

Table 3. Microbiological and laboratory findings of patients according to ABO blood group

Variable	O (n=37)	A (n=42)	B (n=12)	AB (n=11)	p-value
Microbiological findings					
<i>Pseudomonas aeruginosa</i> isolated, n (%)	9 (24.3)	14 (33.3)	2 (16.7)	1 (9.1)	0.329
Colonization, n (%)	1 (11.1)	4 (28.6)	0 (0)	1 (9.1)	0.179
Gram-positive bacterial growth, n (%)	6 (16.2)	5 (11.9)	3 (25.0)	1 (9.1)	0.655
Gram-negative bacterial growth, n (%)	11 (29.7)	13 (31.0)	3 (25.0)	1 (9.1)	0.522
Non- <i>Pseudomonas</i> growth, n (%)	15 (40.5)	17 (40.5)	6 (50.0)	3 (27.3)	0.742
Polymicrobial growth, n (%)	3 (23.1)	4 (23.5)	2 (40.0)	0 (0)	—
Specific microorganisms isolated					
<i>Streptococcus</i> spp., n (%)	1 (7.7)	1 (5.9)	2 (40.0)	1 (9.1)	—
<i>Acinetobacter</i> spp., n (%)	0 (0)	0 (0)	0 (0)	1 (9.1)	—
<i>Escherichia coli</i> , n (%)	2 (15.4)	3 (17.6)	0 (0)	0 (0)	—
<i>Candida</i> spp., n (%)	5 (38.5)	1 (5.9)	1 (20.0)	0 (0)	—
<i>Staphylococcus</i> spp., n (%)	1 (7.7)	1 (5.9)	0 (0)	0 (0)	—
<i>Klebsiella</i> spp., n (%)	0 (0)	2 (11.8)	0 (0)	0 (0)	—
Laboratory parameters					
WBC ($10^3/\mu\text{L}$)	9.5 (1–22)	9.1 (5.2–67.7)	11.4 (4.9–20.6)	7.8 (5.1–16.5)	0.469
NEU ($10^3/\mu\text{L}$)	6.6 (0.1–17.7)	6.7 (2.1–61.8)	9.0 (3–17)	5.1 (2.7–15.1)	0.277
LYM ($10^3/\mu\text{L}$)	1.7 (0.4–9.2)	1.9 (0.3–4.0)	1.9 (0.6–2.5)	1.8 (0.6–3.5)	0.878
EOS ($10^3/\mu\text{L}$)	0.1 (0–2.6)	0.1 (0–0.6)	0.1 (0–0.4)	0.2 (0–0.5)	0.127
PLT ($10^3/\mu\text{L}$)	282.1 (134–587)	290.5 (166–769)	287 (263–362)	269 (191–397)	0.630

Abbreviations: WBC, white blood cell count; NEU, neutrophil count; LYM, lymphocyte count; EOS, eosinophil count; PLT, platelet count.

DISCUSSION

In this study, no significant differences were observed among ABO blood groups with regard to exacerbation frequency, mortality, lung function parameters, or the growth of *Pseudomonas aeruginosa* and other bacterial species in sputum cultures of adult patients with non-cystic fibrosis bronchiectasis. However, emergency department admissions due to lower respiratory tract infections were significantly more frequent in patients with blood group B, suggesting a potentially increased susceptibility to infection in this group.

Previous studies have demonstrated that the risk of urinary tract, upper respiratory tract, gastrointestinal, and skin infections—as well as infections caused by *Escherichia coli*, *Pseudomonas*, and *Staphylococcus* species—is generally lower in individuals with blood group O compared with other blood groups (1). Conversely, blood group O has been associated with a

higher incidence of certain infections such as cholera, plague, tuberculosis, and mumps, while blood group A has been linked to an increased risk of smallpox and *Pseudomonas aeruginosa* infection. Blood group B has been associated with gonorrhea, tuberculosis, *Streptococcus pneumoniae*, *E. coli*, and *Salmonella* infections, whereas blood group AB has been linked to smallpox and *E. coli* and *Salmonella* infections (2).

The association between ABO blood groups and susceptibility to infectious diseases has been explained by several biological mechanisms (1). First, certain microorganisms may directly bind to ABO antigens expressed on host cells, facilitating microbial adhesion and cellular entry, as observed with norovirus, *Helicobacter pylori*, and *Plasmodium falciparum*. Second, naturally occurring anti-A and/or anti-B antibodies in plasma may exert a protective effect by neutralizing pathogens and preventing their attachment to host cells, as suggested for SARS-CoV-2.

Third, ABO blood groups may influence immune responses; for example, individuals with blood group A have been reported to exhibit exaggerated inflammatory responses during infections, potentially affecting disease severity. Finally, ABO antigens expressed in mucosal secretions may alter the composition of the microbiota in the gastrointestinal and respiratory tracts, thereby modulating mucosal immunity.

Bacterial growth in sputum is a well-established determinant of morbidity and mortality in bronchiectasis. Previous studies have shown that lower respiratory tract infections and chronic bacterial colonization are associated with more severe symptoms, reduced quality of life, increased exacerbation frequency, higher hospitalization rates, accelerated lung function decline, and increased mortality, particularly in the presence of *Pseudomonas aeruginosa*, which is the most common pathogen and is associated with the poorest prognosis in bronchiectasis (3-6).

In the present study, *Pseudomonas aeruginosa* was isolated in 25.5% of patients, which is higher than the rate of 19.8% reported by Wang et al. (3). This difference may be explained by the selection of patients with documented microbial growth in sputum cultures in our cohort. Although emergency department admissions were more frequent among patients with blood group B, other indicators of disease severity—including lung function parameters, hospitalization duration, ICU admission, and mortality—were similar across blood groups. This finding may be related to comparable exacerbation rates among the groups.

Limitations

This study has several limitations. First, its retrospective and single-center design limits the generalizability of the findings. Second, the relatively small sample size, particularly in some blood group subcategories, may have reduced the statistical power to detect subtle differences between groups. Third, sputum cultures were evaluated based on routine clinical sampling rather than standardized prospective protocols. Finally, potential confounding factors such as treatment adherence and environmental exposures could not be fully controlled.

CONCLUSION

In conclusion, ABO blood group was not associated with exacerbation frequency, lung function impairment, mortality, or sputum bacterial growth in adult patients with non-cystic fibrosis bronchiectasis. However, the higher frequency of emergency department admissions observed in patients with blood group B suggests that this group may have an increased susceptibility to lower respiratory tract infections. Larger, multicenter prospective studies are warranted to further clarify the relationship between ABO blood groups, sputum microbiology, and clinical outcomes in bronchiectasis.

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