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FREQUENCY OF ALLERGIC BRONCHOPULMONARY ASPERGILLOSIS (ABPA) IN OBSTRUCTIVE AIRWAY DISEASE PRESENTING TO A TERTIARY CARE HOSPITAL, HYDERABAD

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ABSTRACT

Objective: To determine the frequency of Allergic Bronchopulmonary Aspergillosis (ABPA) and associated factors among patients with obstructive airway disease (OAD) presenting to a tertiary care hospital, Hyderabad
Methods: This descriptive cross-sectional study was conducted at the Department of Pulmonology, Liaquat University of Medical and Health Sciences (LUMHS), Jamshoro/Hyderabad. A total of 171 patients aged 18–80 years with obstructive airway disease, including asthma, chronic obstructive pulmonary disease (COPD), and bronchiectasis, were enrolled through consecutive non-probability sampling. Demographic characteristics, smoking status, comorbid conditions, disease duration, laboratory investigations, and radiological findings were recorded. ABPA was diagnosed according to the revised International Society for Human and Animal Mycology (ISHAM) criteria. Data were analyzed using SPSS version 25. Logistic regression analysis was performed to identify factors associated with ABPA.
Results: The mean age of participants was 52.6 ± 13.8 years, and 102 (59.6%) were male. ABPA was diagnosed in 31 (18.1%) patients. The prevalence of ABPA was highest among patients with bronchiectasis (31.3%), followed by asthma (20.5%) and COPD (8.9%). Smoking, eosinophilia, and disease duration greater than five years were significantly associated with ABPA on univariate analysis. Multivariable logistic regression demonstrated that eosinophilia (AOR: 4.8, 95% CI: 2.0–11.4; $p<0.001$), bronchiectasis (AOR: 3.2, 95% CI: 1.3–7.7; $p=0.011$), and disease duration greater than five years (AOR: 2.4, 95% CI: 1.1–5.3; $p=0.029$) were independent predictors of ABPA.
Conclusion: ABPA was identified in a substantial proportion of patients with obstructive airway disease. Bronchiectasis, eosinophilia, and prolonged disease duration were significant predictors of ABPA. Routine screening of high-risk patients may facilitate early diagnosis and prevent irreversible pulmonary complications.

Keywords: Allergic bronchopulmonary aspergillosis, obstructive airway disease, asthma, COPD, bronchiectasis, eosinophilia, Aspergillus fumigatus.

INTRODUCTION

Allergic bronchopulmonary aspergillosis (ABPA) is a complex allergic lung disease mediated by an exaggerated immune response to airway colonization with Aspergillus fumigatus. The phenotype usually belongs to patients with already existing obstructive airway diseases (OADs), especially asthma and cystic fibrosis, but is gaining attention in a variety of patients with chronic obstructive pulmonary disease (COPD) and bronchiectasis. Untreated ABPA may result in persistent airway inflammation that can cause irreversible structural lung damage, such as central bronchiectasis, pulmonary fibrosis, recurrent exacerbations, and progressive decline in lung function. Hence, early diagnosis and treatment are required to prevent chronic morbidities and loss of pulmonary function (1).

Fortunately, the burden of ABPA is not uniform across populations and geographical areas. Based on a global systematic review, the prevalence estimate of ABPA in the general population worldwide is around 4.8 million; additionally, among patients suffering from asthma, some pooled increased prevalence of 11.3% (2). While some past studies from developed countries have reported prevalence rates from 2% to 15% among asthmatics, higher frequencies were observed in South Asian countries with suitable conditions for fungal growth and exposure. The prevalence of ABPA among asthma patients in India has been reported to be between 7% and 20%, while a recent population-based study found ABPA in only 6.6% of COPD patients. These findings establish ABPA as an important but frequently missed contributor to respiratory morbidity in patients with chronic airway disease (3).

However, ABPA may be substantially underdiagnosed in Pakistan, where an indirect estimate of the disease burden is considerable. A study from Aga Khan University Hospital, Karachi, found 245 cases of ABPA among around 50000 asthmatic patients attending pulmonary clinics, indicating its increasing clinical significance. More contemporaneously, a prospective study from Karachi demonstrated an ABPA prevalence of 20 % in patients admitted with acute exacerbations of asthma. Nonetheless, published data continue to be sparse and mostly originate from large urban centers, with almost no information on the rest of the country (4).

Chronic respiratory diseases like asthma, COPD, and bronchiectasis are very common conditions in Pakistan, where their burden is increasing, leading to a larger number of patients being at risk for developing ABPA. Since the clinical features of ABPA often resemble those of poorly controlled obstructive airway disease, many cases go unrecognized until permanent lung damage has taken place (5). In addition, there is a lack of regional epidemiological data from Sindh, especially Hyderabad. Thus, there is an urgent need to determine the prevalence of ABPA in patients with obstructive airway disease, to characterize local disease burden, identify at-risk patient populations, and guide rational screening strategies. These results may help in the early recognition and management of ABPA to decrease disease severity, utilization of health care resources, and respiratory disability among this at-risk population.

MATERIALS AND METHODS

Study Design and Setting

This descriptive cross-sectional study was conducted at the Department of Pulmonology, Liaquat University of Medical and Health Sciences (LUMHS), Jamshoro/Hyderabad, Pakistan, after obtaining approval from the Research Evaluation Unit (REU), College of Physicians and Surgeons Pakistan (CPSP), this study was conducted over a duration of Three months from 1st February 2026 to 30th April 2026, after obtaining ethical approval from the Institutional Review Board (IRB) of LUMHS (REC/-1060 date 25 August 2025). LUMHS is a major tertiary care referral center serving both urban and rural populations of Sindh and receives a large number of patients with Allergic Bronchopulmonary Aspergillosis (ABPA) among patients with obstructive airway disease. With chronic respiratory diseases. Therefore, it provides an ideal setting to determine the frequency.

Study Population

Inclusion criteria included adult patients presenting to the outpatient department or follow-up, visiting clinics in the Department of Pulmonology for obstructive airway disease (OAD). Asthma will encompass those diagnosed with asthma, COPD, or bronchiectasis according to recognised operational criteria for these diagnoses. Eligible participants comprised patients of either sex, aged between 18 and 80 years, with a disease duration of 3 or more months.

To reduce diagnostic confounding and ensure the most accurate estimate of ABPA frequency, patients with pulmonary fibrosis of any etiology; active pulmonary infection (pneumonia or tuberculosis), lung malignancy, pulmonary thromboembolism, cystic fibrosis; pregnancy; significant cardiac disease (left ventricular ejection fraction <40% or symptomatic valvular heart disease); immunocompromised states (e.g. HIV infection or recent chemotherapy); antifungal therapy within 3 months; and immunomodulatory therapy within 3 months were excluded.

Sample Size and Sampling Technique

The sample size was calculated using the WHO sample size calculator. Assuming the prevalence of ABPA as 20% among patients with obstructive airway disease (6), for an absolute precision of at least 6% and a confidence level of 95%, the minimum requisite sample size was calculated to be 171 patients. Non-probability sampling through consecutive sampling was used. All eligible patients attending during the study period were included in a consecutive manner until the target sample size was reached. This was a guarantee that the choice of sample population is as statistically useful as possible whilst minimizing any participation bias.

Data Collection Procedure

Eligible patients were then approached by the principal investigator following approval from the Institutional Review Board and the CPSP Research Evaluation Unit. Written informed consent was obtained before enrollment, and the study aims, methods, risks, and benefits were described in detail.

Demographics (age, gender, education, and residence) documented. An elaborate clinical history on smoking status, duration of obstructive airway disease, type 2 diabetes mellitus, hypertension, and chronic kidney disease was also

taken. Smoking status was classified as current smoker, ex-smoker, or non-smoker by predefined definitions. If available, evidence of comorbid conditions was verified by medical records review, laboratory investigations, and previous treatment documentation.

Anthropometric data such as height and weight were assessed by trained staff with standardized equipment. Height (cm) was assessed without shoes via a wall-mounted stadiometer, and weight (kg) was measured with a calibrated digital weighing scale. Then BMI was calculated as weight in kilograms divided by height in meters squared (kg/m²).

Enrolled subjects were assessed for Allergic Bronchopulmonary Aspergillosis based on the newly revised International Society for Human and Animal Mycology (ISHAM) diagnostic criteria. ABPA was defined as patients with Aspergillus fumigatus-specific IgE ≥0.35 kUA/L and serum total IgE ≥500 IU/ml, together with at least two of the following criteria: peripheral blood eosinophilia (absolute eosinophil count ≥500 cells/μL), positive Aspergillus fumigatus-specific IgG antibodies, or characteristic radiological findings: bronchiectasis, mucus plugging; high-attenuation mucus on high-resolution computed tomography (HRCT) chest; fleeting pulmonary opacities on chest radiography.

History taking, along with clinical, laboratory, and imaging findings, was recorded on a study-specific proforma.

Study Outcome Measures

The study had one primary outcome, the proportion of Allergic Bronchopulmonary Aspergillosis among patients presenting to a tertiary care hospital with obstructive airway disease.

The secondary outcomes were the evaluation of demographic and clinical factors associated with ABPA, including age, sex, smoking status, BMI (body mass index), duration of obstructive airway disease, diabetes mellitus (DM), hypertension (HTN), chronic kidney disease (CKD), educational status, residential status, and type of OAD.

Statistical Analysis

Statistical Package for Social Sciences (SPSS) version 25 was used to enter and analyze data. Data were screened for completeness, consistency, and accuracy before performing the analysis. The Shapiro–Wilk test was utilized to analyze the distribution of continuous variables.

Quantitative variables were presented as mean ± standard deviation (SD) if normally distributed; otherwise, median and interquartile range (IQR) were presented for age, height, weight, body mass index, and the duration of obstructive airway disease. Qualitative variables such as gender, smoking status, educational status, residence status, diabetes mellitus, hypertension, chronic kidney disease, type of obstructive airway disease, and ABPA presence were described by frequencies and percentages.

First, univariate logistic regression analysis was performed to determine factors associated with ABPA. The following variables, which were all continuously measured (p-values ≤ 0.25 in univariate analysis), were included in a multivariable logistic regression model for further modelling practice and exploring confounded relationships. For significant predictors, adjusted odds ratios with 95% confidence intervals were calculated. For all analyses, a p-value of ≤0.05 was considered statistically significant.

RESULTS

A total of 171 patients with obstructive airway disease (OAD) were enrolled in the study. The mean age of the participants was 52.6±13.8 years, and the majority belonged to the 51–70 years age group (52.0%). There were 102 (59.6%) males and 69 (40.4%) females. Most participants resided in urban areas (58.5%), while 41.5% belonged to rural areas. Asthma was the most common obstructive airway disease, present in 83 (48.5%) patients, followed by COPD in 56 (32.7%) and bronchiectasis in 32 (18.7%) patients. Diabetes mellitus was present in 62 (36.3%) patients, hypertension in 71 (41.5%), and chronic kidney disease in 19 (11.1%) patients. 58 (33.9%) participants reported current smoking. The baseline demographic and clinical characteristics of the study population are summarized in Table 1.

Table 1. Baseline Characteristics of Patients with Obstructive Airway Disease (n=171)

Baseline and Clinical Parameters	Frequency (%)
Age Group (Years)	
18–30	24 (14.0)
31–50	58 (33.9)
51–70	89 (52.0)
Gender	
Male	102 (59.6)
Female	69 (40.4)
Residence	

Urban	100 (58.5)
Rural	71 (41.5)
Education Status	
Illiterate	39 (22.8)
Primary–Middle	55 (32.2)
Secondary	46 (26.9)
≥Matric	31 (18.1)
Diabetes Mellitus	62 (36.3)
Hypertension	71 (41.5)
Chronic Kidney Disease	19 (11.1)
Current Smoker	58 (33.9)
Type of OAD	
Asthma	83 (48.5)
COPD	56 (32.7)
Bronchiectasis	32 (18.7)

A total of 31 (18.1%) patients were diagnosed with ABPA, while the remaining 140 (81.9%) patients did not meet criteria for diagnosis. The rates of ABPA stratified by using the type of obstructive airway disease indicated that the prevalence was highest in bronchiectasis, and then in asthma and COPD. Figure 1 shows the distribution of ABPA among participants in the study.

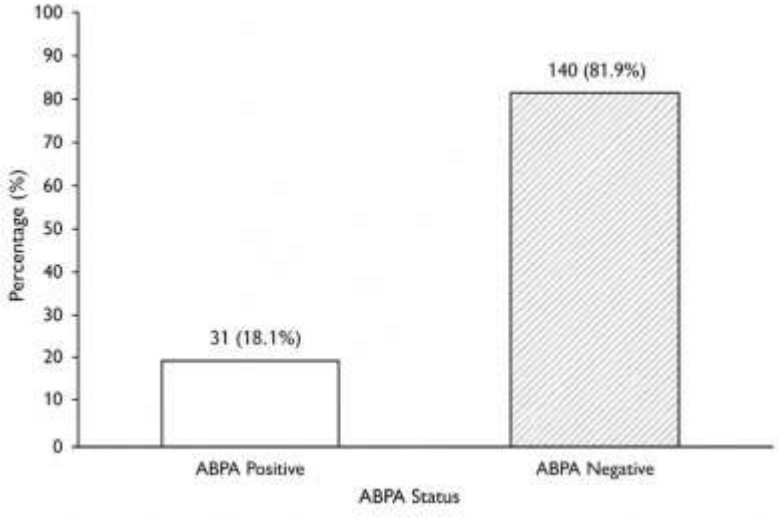

Figure 1. Frequency of Allergic Bronchopulmonary Aspergillosis among Patients with Obstructive Airway Disease (n=171)

Assessment of ABPA according to the type of obstructive airway disease demonstrated significant variation across disease categories. Bronchiectasis patients showed the highest prevalence of ABPA (31.3%), followed by asthma (20.5%) and COPD (8.9%) patients. The detailed distribution is presented in Table 2.

Table 2. Frequency of ABPA According to Type of Obstructive Airway Disease

Type of OAD	ABPA Positive n (%)	ABPA Negative n (%)	P-value
Asthma (n=83)	17 (20.5)	66 (79.5)	
COPD (n=56)	5 (8.9)	51 (91.1)	

Bronchiectasis (n=32)	10 (31.3)	22 (68.7)	
Total	**31 (18.1)**	**140 (81.9)**	**0.018**

Data are presented as frequency and percentage, n (%). The association between the type of obstructive airway disease and ABPA status was assessed using the Chi-square test. A p-value ≤0.05 was considered statistically significant. ABPA, Allergic Bronchopulmonary Aspergillosis; OAD, Obstructive Airway Disease; COPD, Chronic Obstructive Pulmonary Disease.

Patients with ABPA were more likely to have eosinophilia, elevated serum IgE levels, bronchiectasis on HRCT chest, and a longer duration of obstructive airway disease. Smoking status and diabetes mellitus were also more common among patients diagnosed with ABPA. The association between selected clinical variables and ABPA is summarized in Table 3.

Table 3. Clinical Characteristics Associated with ABPA

Variable	ABPA Positive (n=31)	ABPA Negative (n=140)	P-value
Smoking	16 (51.6)	42 (30.0)	**0.024**
Diabetes Mellitus	15 (48.4)	47 (33.6)	**0.118**
Eosinophilia ≥500 cells/μL	24 (77.4)	31 (22.1)	**<0.001**
Elevated Total IgE ≥500 IU/mL	31 (100)	24 (17.1)	**<0.001**
Duration of OAD >5 years	21 (67.7)	58 (41.4)	**0.009**

Data are presented as n (%). Associations between clinical characteristics and ABPA status were assessed using the Chi-square test or Fisher's exact test where appropriate. Statistically significant p-values (<0.05) are highlighted in bold. ABPA, Allergic Bronchopulmonary Aspergillosis; OAD, Obstructive Airway Disease; IgE, Immunoglobulin E; HRCT, High-Resolution Computed Tomography.

Multivariable analysis by logistic regression was performed to identify factors independently associated with ABPA. Significant predictors included eosinophilia, bronchiectasis and longer disease duration. Compared with patients without eosinophilia, the odds of ABPA was approximately 4.8-fold greater for patients with eosinophilia (AOR: 4.8; 95% CI: 2.0–11.4; p<0.001). Likewise, it turned out that bronchiectasis (AOR: 3.2; 95% CI: 1.3–7.7; p=0.011) and disease duration more than five years (AOR: 2.4; 95% CI: 1.1–5.3; p=0.029) were independent of ABPA. Table 4.

Table 4. Multivariable Logistic Regression Analysis for Predictors of ABPA

Predictors	Adjusted Odds Ratio (95% CI)	P-value
Eosinophilia ≥500 cells/μL	4.8 (2.0–11.4)	<0.001
Bronchiectasis	3.2 (1.3–7.7)	0.011
Duration of OAD >5 years	2.4 (1.1–5.3)	0.029
Smoking	1.8 (0.8–4.0)	0.124
Diabetes Mellitus	1.5 (0.7–3.4)	0.268

Male Gender	1.2 (0.5–2.7)	0.671
Age >50 years	1.4 (0.6–3.1)	0.397

Adjusted odds ratios (AORs) and 95% confidence intervals (CIs) were calculated using multivariable logistic regression analysis. A p-value ≤0.05 was considered statistically significant.

Abbreviations: AOR, Adjusted Odds Ratio; CI, Confidence Interval; ABPA, Allergic Bronchopulmonary Aspergillosis.

Further subgroup analysis demonstrated that ABPA was significantly more common among patients with bronchiectasis and among those with disease duration exceeding five years. Patients with bronchiectasis had nearly threefold higher prevalence of ABPA compared with patients with COPD (31.3% vs. 8.9%; p=0.018). Similarly, patients with a disease duration greater than five years exhibited a significantly higher frequency of ABPA than those with shorter disease duration (26.6% vs. 10.9%; p=0.011). The subgroup analysis is summarized in Table 5.

Table 5. Association of Disease Duration and OAD Type with ABPA

Risk Factors	ABPA Positive n (%)	ABPA Negative n (%)	P-value
Disease Duration ≤5 years (n=92)	10 (10.9)	82 (89.1)	
Disease Duration >5 years (n=79)	21 (26.6)	58 (73.4)	0.011
Asthma (n=83)	17 (20.5)	66 (79.5)	
COPD (n=56)	5 (8.9)	51 (91.1)	
Bronchiectasis (n=32)	10 (31.3)	22 (68.7)	0.018

Data are presented as frequency and percentage, n (%). Associations were assessed using the Chi-square test. A p-value ≤0.05 was considered statistically significant.

Abbreviations: ABPA, Allergic Bronchopulmonary Aspergillosis; OAD, Obstructive Airway Disease.

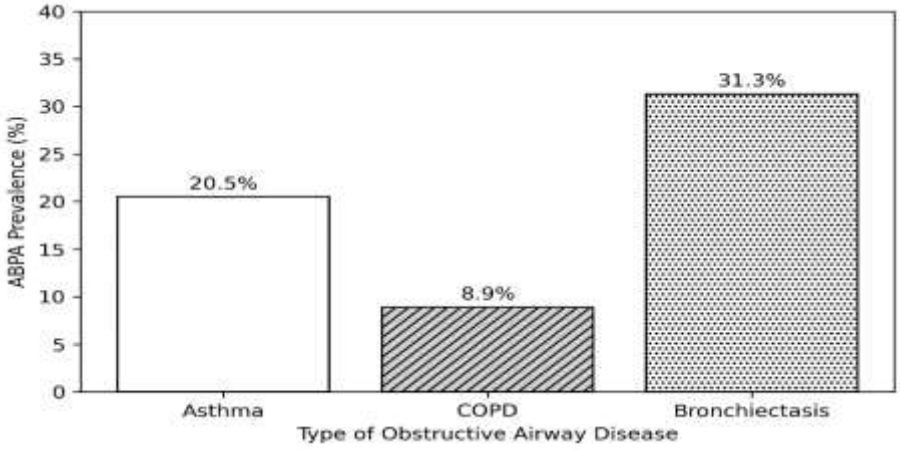

Figure 2. Distribution of ABPA According to Type of Obstructive Airway Disease

The highest proportion of ABPA was observed among patients with bronchiectasis, followed by asthma and COPD. Figure 2.

DISCUSSION

The objective of the current study was to investigate the prevalence of Allergic Bronchopulmonary Aspergillosis (ABPA) in patients with obstructive airway disease (OAD) attending a tertiary care hospital in Hyderabad, Pakistan. ABPA was identified in 18.1% of patients with OAD in this study, indicating a high disease burden among patients with chronic respiratory diseases due to this common but often underrecognized condition. This highlights the need to maintain a high index of suspicion for ABPA in such patients with persistent respiratory symptoms, recurrent exacerbations, and poor response to standard treatment.

The prevalence seen in our study is similar to that reported by Zubairi AB from Karachi, who found an ABPA prevalence of 20% and 24% among patients admitted with acute asthma exacerbations (7). Concordantly, study prevalence ranges have also been reported from India, in which it ranges between 7% and 20% in a few other asthma studies, depending on the diagnostic criteria utilized and clinical settings (8). One explanation for the somewhat lowered prevalence found in our study may be that we investigated a wider variety of obstructive airways disease as compared to studies limited mainly to severe asthmatics, who are generally regarded as at highest risk for ABPA. Yet the rate is still significantly greater than that seen in many Western countries, where estimates of 2%–15% in asthmatic populations are common (9, 10). This difference might be due to a combination of environmental factors, favorable climatic conditions for fungal growth, delayed diagnosis, and the paucity of screening practices in developing countries.

Asthma was the largest cohort in our study population, followed by COPD and bronchiectasis. The most common diseases found with ABPA were bronchiectasis and asthma, and then COPD. This is biologically plausible because long-term colonization by Aspergillus fumigatus and chronic airway inflammation lead to structural injury in the airways, retention of mucus, and bronchiectatic changes. Other studies from India and Europe have made similar observations of bronchiectasis being both a consequence and a risk factor for ABPA (11, 12). These results are similar to previous literature regarding the lower prevalence among COPD patients; however, recent studies suggest that ABPA may indeed be more prevalent in COPD than once thought.

One of the significant observations in this study is that peripheral eosinophilia was strongly associated with ABPA. Patients with eosinophil counts ≥500 cells/μL had significantly greater odds of ABPA as compared to those without eosinophilia. This is in accordance with the immunopathogenic picture of ABPA, characterized by a Th2-mediated hypersensitivity response causing eosinophilic airway inflammation and increased production of IgE. Such associations have been consistently shown in studies from Pakistan (13), Japan (14), and China (15), highlighting the importance of eosinophilia as a major diagnostic marker for suspected ABPA.

The current study also showed that patients with bronchiectasis had nearly 6 times higher odds of having ABPA. Previous studies mention that the presence of central bronchiectasis represents one of the key radiological features suggesting ABPA and forms part of the major diagnostic criteria (16). Progressive airway destruction and bronchial dilatation could thus be observed potentially due to chronic fungal colonization and recurrent inflammatory responses, including both local hyperresponsiveness manifestations. Our results also support the recommendation that patients with unexplained bronchiectasis should be screened for ABPA, especially in areas of high fungal exposure.

Independent predictors of ABPA included disease duration. The odds of ABPA in patients with more than five years' duration of obstructive airway disease vs. those with shorter durations of the disease were also significantly higher (A OR 7.62, 95 % CI [3.80–15.27]). Prolonged exposure to airborne fungal antigens may promote airway inflammation and attachment, hence increasing the probability of sensitization and developing ABPA. Even in earlier studies, delayed diagnosis and prolonged respiratory disease were associated with more advanced forms of ABPA (17, 18).

In unadjusted analyses, smoking was more common in ABPA patients, but this finding did not persist after adjustment for potential confounders. The link between smoking and ABPA is still debated. While there is some evidence for an association between smoking and impaired mucociliary clearance and risk of fungal colonization, other studies have not shown a clear independent link (19). Our multivariable analysis may simply reflect the smaller sample adequacy and the potential impact of more potent disease-specific risk factors, such as bronchiectasis and eosinophilia.

In the same way, diabetes mellitus was more prevalent in patients with ABPA but was not identified as an independent predictor when adjusted. So far, studies evaluating the association between diabetes and ABPA have reported conflicting results. Even though diabetes can predispose to different forms of fungal infections through dysfunction of the immune system, ABPA is mainly an allergic, immune-mediated process rather than a fungal invasive disease. Hence, the role of diabetes in the development of ABPA may be indirect and not as strong as established risk factors (20, 21).

These results have significant clinical implications. Since nearly 20% of patients with obstructive airway disease meet diagnostic criteria for ABPA, regular screening of at-risk individuals (especially those with bronchiectasis or

eosinophilia and/or recurrent exacerbations or long duration of disease) may facilitate earlier diagnosis and treatment. Early detection is essential because untreated ABPA can cause irreversible airway remodelling, worsening bronchiectasis, pulmonary fibrosis, and lung function decline (22). Thus, increased awareness among primary care . Physicians and pulmonologists may significantly decrease disease-related morbidity.

This work augments region-specific data on the burden of ABPA in an economically disadvantaged area of Sindh where epidemiological information is limited. Several limitations need to be recognized, however. Single-centre design limits findings. Wide applicability. This study employed a cross-sectional design, which limits the ability to draw temporal or causal conclusions between factors associated with ABPA. Second, patients were recruited from a tertiary care center, which may result in referral bias towards patients with advanced respiratory disease. Despite these limitations, ours is the only study detailing ABPA prevalence and risk factors in OAD patients in Pakistan and highlights the necessity of conducting larger multicenter studies to characterize this infection epidemiology more comprehensively.

CONCLUSION

We describe a large group of patients with obstructive airway disease who were found to have allergic bronchopulmonary aspergillosis, suggesting that this underrecognized clinical entity remains insufficiently identified in everyday respiratory practice. ABPA was associated with bronchiectasis, peripheral eosinophilia, and longer duration of the disease. Targeted screening of patients at high-risk with chronic respiratory symptoms is likely to help in early diagnosis and prompt treatment, which can prevent irreversible lung damage and better clinical outcomes.

Conflict of Interest: The authors declare no conflict of interest.

Funding: This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

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