Factors affecting readmitted patients with acute exacerbation of bronchiectasis

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Background
Bronchiectasis is an important cause of morbidity and mortality all over the world. Determining the frequency of actual occurrence is particularly misleading and difficult to determine, especially in patients with multiple respiratory disorders, because it can be a result of any primary pulmonary disease. The objective of this study was to evaluate the effect of readmission with acute exacerbation of bronchiectasis (AEB) on the admissions later on, need of long-term O_2 and mechanical ventilation, and mortality.

Patients and methods
This is an observational cohort and prospective study. It was conducted on patients admitted with AEB who achieved modified O'Donnell criteria, and their high-resolution computed tomography showed bronchiectasis on admission at Aleppo University Hospital between September 2017 and January 2019. They were divided into three groups by age. Patients with bronchial asthma, chronic obstructive pulmonary disease, and cystic fibrosis were excluded.

Results
The study included 90 patients (57 males and 33 females) with a mean age of 52.93 ±20.437 years. AEB showed a peak of incidence in the age group 41–65 years. Dyspnea is the most common symptom in exacerbations (88.23%) followed by hemoptysis (80.88%). Wheezing had the least frequency on admission (60.29%). Median survival age was 14±0.214 months. We collected information on 136 exacerbations in 90 patients. A total of 31 (34.44%) patients had at least one readmission and 19 (21%) patients died within 12 months of admission to the hospital. Age, smoking, and need of long-term O_2 were statistically significant between the two groups of study (P=0.013, <0.0001, and 0.04, respectively). Sex, radiological changes, mortality, and mechanical ventilation have no significance.

Conclusion
AEB is a common reason for hospitalization, and it correlates with age, smoking, readmission, and need of long-term O_2 treatment.

Keywords:
bronchiectasis, exacerbation, mortality

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Introduction

Bronchiectasis is a chronic respiratory disease that was described by Laennec in 1819 [1,2]. The name is derived from the Greek words Bronckos, which means airway, and ectasia which means dilatation [3]. It is defined as an abnormal, irreversible dilatation with thickened walls of bronchi [4]. It can be focal or diffused [5,6]. Recent reports suggest that bronchiectasis is more frequent in advanced ages, and it is not only the disease of children but also of adults [7].

It has a high prevalence in poor countries, where health conditions are poor, and there is no enough supporting care; in contrast, the prevalence in advanced countries has decreased. The diagnostic procedure plays an important role in providing more reliable data on case counts. Studies have shown that the probability of diagnosis increases 10 fold with the use of high-resolution computed tomography (HRCT) [8]. Frequent admissions are associated with high mortality [9]. A study in the United States in 2005 estimated the incidence of 4.2 cases per 100 000 in the 18–34 age group, compared with 272 cases per 100 000 among patients who are older than 75 years [10]. A study performed in the United Kingdom investigating changes in the incidence and prevalence of bronchiectasis in the United Kingdom from 2003 to 2014 and found that it was higher in women than in men, with higher prevalence in patients older than 60 years [11]. Prevalence of bronchiectasis has recently declined for many reasons such as improvement in health conditions, advanced diagnostic procedures that help in early diagnosis, and availability of antibiotics. It

remains a real challenge in areas lacking proper health care and is still an important cause of morbidity and mortality.

There are many definitions of acute exacerbation of bronchiectasis (AEB). We chose O'Donnell criteria in this study. The study aims to highlights the role of admission to a hospital for an exacerbation with respect to high readmission and mortality rates.

Patients and methods

Patient population

A prospective single-center observational cohort study was done at Aleppo University Hospital for all patients with diagnosis of bronchiectasis admitted for AEB between September 1, 2017, and January 31, 2019. Patients were required to fulfill the following factors to be included in the study: a radiographic diagnosis of bronchiectasis by HRCT, age greater than 15 years, and meeting the criteria for an AEB as defined by O'Donnell modified criteria. Patients with history of cystic fibrosis, bronchial asthma, or chronic obstructive pulmonary disease (COPD) were excluded.

Criteria for acute exacerbation of bronchiectasis

A modified criteria for an AEB was used. It was based on O'Donnell's criteria which requires having four of the following nine criteria: change in sputum production, increased dyspnea, increased cough, fever (temperature $>38.0^{\circ}$ C), increased wheezing, fatigue, or malaise, radiographic evidence of new infiltrate, change in breath sounds, and reduction of FEV1.0 or FVC by 10% in comparison with a previously recorded pulmonary function test [12]. Pulmonary function tests were omitted because our cohort did not have them performed at the onset or during the exacerbation. Therefore, the O'Donnell's modified criteria used in this study required four of eight criteria to be considered an AEB.

Data collection

We reviewed and followed the patients' profiles and collected the following variables: demographics, smoking history, diagnosis of asthma, COPD or CF by a physician, sputum, or tracheal cultures on admission, hemoptysis, need of long-term O_2, and need for mechanical ventilation.

The study is approved by the local ethical committee, and every patient agreed to continue participation in our study in Aleppo University Hospital. Each patient gave his or her written consent for the collection and use of their clinical data.

Statistical analysis

Demographic characteristics and variables of interest were summarized by readmissions in one year (none vs. one or more) using descriptive statistics: mean (SD) for continuous variables and frequency (proportion) for categorical variables. To assess the association between demographic characteristics and mortality at 12 months, logistic regression was used, and the results are reported as an odds ratio, with a 95% confidence interval. A P value of less than 0.05 was used to detect the statistical significance. χ^2 is used as a test for statistical significance. Analysis was performed using IBM SPSS statistical software 23.

Results

Clinical coding identified 228 patients with a diagnosis of bronchiectasis admitted from a total of 415 admissions. A total of 28 patients had bronchial asthma, 69 had COPD, 13 had cystic fibrosis, and 28 left hospital without any connections later on; all of these 138 were excluded. Overall, we identified 90 patients with bronchiectasis who had a total of 137 exacerbations. Ninety patients met the criteria for an AEB and had a radiographic diagnosis (HRCT).

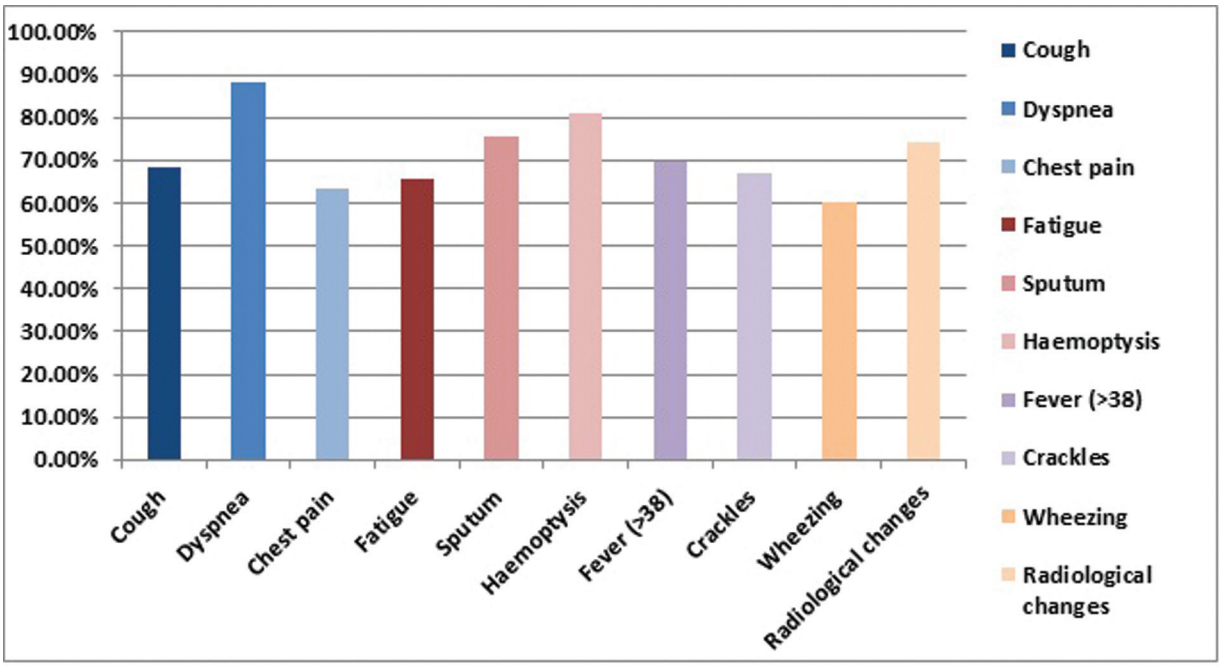
The presenting clinical features and medications are shown in Fig. 1. There was a predominance of men (63.3%). The mean age was 52.93±20.437 years, and 48.88% of them were in the age group between 41 and 65 years old. Moreover, 52 (57.8%) patients smoked or were actively smoking. Nineteen (21%) patients died, and in-hospital mortality was 11 patients. Dyspnea was the most common symptom (88.23%), followed by hemoptysis (80.88%), whereas the lowest frequency was for wheezing (60.29%). The average score of O'Donnell was 6.19. Mortality rate per 1 year was 15.83%. The median survival age was 14±0.214 months, and the mean hospitalization stay was 7.94±4.826 days.

Age, smoking, and need of long-term O_2 have a significant difference between the two groups of study (P=0.013, $P<0.0001$, and P=0.04, respectively). Sex, radiological changes, mortality, and mechanical ventilation have no significance, as shown in Table 1. For all the patients in the study, we found a significance for age, smoking, and need of long-term O_2 (0.021, <0.0001, and 0.04, respectively).

Discussion

The important findings in this study were admission to the hospital with AEB was associated with significant hospital mortality (11%), with a median survival of 14 months. The rate of admission to hospital for acute

Figure 1



Signs and symptoms.

Table 1 Study population characteristics

	Readmission in 1 year		
	None (*N*=59) 65.56%	One or more (*N*=31) 34.44%	*P* value
Age (years)	66.84±20.743	49.21±18.81	**0.013**
Age groups			
15–40	10 (16.94)	14 (54.16)	**0.01**
41–65	32 (54.23)	12 (38.70)	
More 65	17 (28.81)	5 (16.12)	
Sex			
Female	19 (32.20)	17 (54.83)	0.23
Male	40 (67.79)	14 (45.16)	
Smoking	42 (71.18)	10 (32.25)	<**0.0001**
Need of long-term O_2	16 (27.11)	15 (48.38)	**0.044**
Radiology changes	45 (76.27)	26 (83.87)	0.407
Mechanical ventilation	7 (11.86)	3 (9.67)	0.575
Mortality	14 (23.72)	5 (16.12)	0.588

P value of less than 0.05 was used to detect the statistical significance, and c^2 is used as a test for statistical significance.

exacerbations was high (54.9%) from all admissions. Of the 90 patients included in the study, 31 (34.44%) patients were readmitted with at least once for further exacerbation within 12 months. This percentage is close to the results reported by Roberts *et al.* [9], who reported 46%. The percentage was less in our study, which may be owing to the important of COPD and asthma, which were excluded from our study. In our study, 19 (21.1%) patients died. It was close to the mortality rate reported by Goeminne *et al.* [13] (20.4%), and it is was close to half the percentage recorded by Machado *et al.* [14] (38.57%), owing to difference in exclusion criteria. The difference in percentages of mortality, which was higher in studies that included patients with COPD, confirms the role of COPD of mortality in AEB. In our study, the incidence of AEB was more common in men, which is in contrast to Machado *et al.* [14], Goeminne *et al.* [13], and Sadigov [15]. This might suggest the role of geographical region and demographics. It needs more studies to confirm that.

Smoking history was available for 52 (57.77%) of 90 patients. There is a high significance for smoking in our study ($P \leq 0.0001$), and it correlates well with readmission.

Age had a significant relation with readmission ($P=0.013$), and this was significantly different between

Table 2 Mortality within 12 months by age, sex, smoking, radiological changes, need of long-term O_2, and mechanical ventilation

All cases	OR	95% CI	*P* value
Age (years) (less or more 60 years old)	2.182	1.157, 8.291	**0.021**
Sex (male)	0.089	0.562, 1.165	0.232
Female	1.402	0.820, 2.397	
Smoking	0.453	0.265, 0.774	**<0.0001**
Radiological changes	1.1	0.891, 1.357	0.401
Needing of long-term O_2	1.784	1.025, 3.106	**0.044**
Mechanical ventilation	0.816	0.227, 2.936	0.75

P value of less than 0.05 was used to detect the statistical significance, and χ^2 is used as a test for statistical significance.

the age groups, with the highest percentage of readmission being in the group 15–40 years. This is similar to the results recorded by Machado *et al.*. [14], but contradicts Zaibi *et al.* [16], who found no significance of age with mortality.Needing long-term O_2 was significantly correlated with admission in our study (P=0.044), and the number of admissions correlated with readmissions of once or more within 12 months (P≤0.0001), which is in acceptance with Roberts *et al.* [9]. In our study, there are 31 patients who needed long-term O_2 (34.44%), and this is closely related to the result recorded by Hamdi *et al.* [17], representing 27.5%.

In our study, three (9.67%) patients from the group with one or more readmissions needed mechanical ventilation, but there is no statical significant of it on other admissions.

Dyspnea is the most common symptom (88.23%), which is in acceptance with Hamdi *et al.* [17].

Sex, mechanical ventilation, mortality, and radiology changes on admission do not have any significance on later admissions and mortality (Table 2).

Strengths and limitations

Our study confirms the effect of admission with an exacerbation of bronchiectasis on morbidity and mortality later.

The most important limitations of this study are its nature, as not all the patients attended the follow-up or were on call all the time; therefore, we found it difficult to follow-up the patients. We excluded patients with whom were never able to connect later, and the 90 patients were the final population after all exclusions.

Conclusion

AEB is a common reason for hospitalization, and it correlates with age, smoking, readmission, and need of long-term O_2 treatment. It has a high prevalence in the age group 41–65 years. AEB carries a high mortality rate associated with hospitalization and readmissions within 12 months. Obstructive respiratory disease is still a challenge and raises the mortality rate. More studies are needed in this field. Smoking is still a problem and a reason for respiratory disorders.

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Conflicts of interest

There are no conflicts of interest.

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