The Egyptian Journal of Bronchology

RESEARCH Open Access

# Prevalence, causes, and chest sonographic findings of bronchiectasis among admitted patients in tertiary care hospital: 10 years' experience

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## Abstract

**Background:** Bronchiectasis may be associated and/or co-exist with respiratory diseases as bronchial asthma and chronic obstructive pulmonary disease (COPD) or non-respiratory diseases. However, data about this association and/or co-existence is little. The objectives of the study were to determine the prevalence of bronchiectasis among admitted patients in the Chest Department in 10 years' period (2008–2018) and to detect associated and/or co-existent respiratory diseases. In a retrospective cohort study, the diagnosis of bronchiectasis was based on chest HRCT. Data included the total number of hospitalized patients during this period, their final diagnosis, co-existing diagnosis associated with bronchiectasis, and sonographic and spirometric findings.

**Results:** The total number of patients admitted in 2008–2018 was 17,531 patients. The prevalence of bronchiectasis during this period was 9.04%. COPD was the commonest suspected cause (54.1%) followed by post-tuberculosis bronchiectasis (17.1%). On admission, 63.7% had acute type 2 respiratory failure, 21.1% had decompensated cor pulmonale, 3.8% required mechanical ventilation (MV), and 1.3% required non-invasive MV. On discharge, 9.9% required long-term oxygen therapy. The presence of B lines in chest ultrasonography was recorded in 68.2% and air bronchogram in 29.1%.

**Conclusions:** The prevalence of bronchiectasis among admitted patients was still increasing. COPD with bronchiectasis accounted for more than half of cases. More researches are needed to identify the impact of the COPD-bronchiectasis phenotype.

**Trial registration:** ClinicalTrials.gov, NCT04101448

**Keywords:** Bronchiectasis, Prevalence, Comorbidities, COPD

## Background

Bronchiectasis—permanent dilatation of the bronchi—is characterized clinically by cough, expectoration, and recurrent exacerbations [1, 2]. There is an increase in the prevalence of bronchiectasis worldwide and in the UK; 566 per 100,000 women versus 485 per 100,000 men had bronchiectasis [3–5]. Chest high-resolution computed tomography (HRCT) is the gold standard for the diagnosis of bronchiectasis if the broncho-arterial ratio is more than 1; however, this ratio may be high in healthy patients over 65 years [6–8].

Diverse varieties of conditions lead to bronchiectasis including idiopathic form in 40% of these conditions [9]. Bronchiectasis may be associated and/or co-exist with respiratory diseases including bronchial asthma and chronic obstructive pulmonary disease (COPD) or non-respiratory diseases including HIV and rheumatoid arthritis. However, data about this association

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and/or co-existence is little [5]. To the best of our knowledge, there is no published data about the prevalence of bronchiectasis among hospitalized patients in Egypt.

The primary goal of the study was to determine the prevalence of bronchiectasis among hospitalized patients in the Chest Department over 10 years' period from 2008 to 2018. The secondary goal was to detect associated and/or co-existing respiratory diseases.

## Methods

This study has a retrospective cohort design, and the data are delivered from the database of a tertiary hospital over a 10-year period from 2008 to 2018. The study included all hospitalized patients aged ≥ 18 years. The diagnosis of bronchiectasis was based on chest HRCT [6] using Aquilion 64, Toshiba Medical Systems, Otawara, Japan. HRCT was performed by standard protocol. Scans were obtained at full inspiration from the apex to the lung base with the patients in the supine position and examined by 3 specialists separately (a radiologist and 2 pulmonologists).

The collected data included the total number of hospitalized patients in the Chest Department during this period, their final diagnosis, baseline characteristics of bronchiectasis patients, co-existing diagnosis associated with bronchiectasis, and sonographic and spirometry findings.

Gray-scale ultrasound was done by an ultrasound scanner (Aloka Echo Camera SSD 3500; Aloka Prosound; Japan) equipped with a 3.5-MHz convex probe when indicated (suspicious pneumonia, pleural effusion, pulmonary infarction).

Standard spirometry was performed on admission by means of a fully equipped computerized system using Cosmed SrL, Quark PFTs ergo, P/N Co9035-12-99, Italy. The classification of the spirometry pattern of cases was based on GOLD [10]. A single breath (using D 97723; Zan 300, Oberthulba, Germany) was used to measure diffusing capacity for carbon monoxide (DLCO).

### Data availability

The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

### Ethical consideration

The ethical committee of the Faculty of Medicine, Assiut University, approved this study, and written informed consent was previously taken from the participants.

ClinicalTrials.gov registration ID: NCT04101448.

### Statistical analysis

Number and percent (*n*, %) were used to describe categorical variables while mean ± standard deviation (mean ± SD) was used to describe continuous variables.

The prevalence was calculated as follows: prevalence = number of cases/population size × 100.

## Results

The total number of patients admitted to the Chest Department in a tertiary hospital from the period 2008 to 2018 was 17,531 patients. The prevalence of bronchiectasis among these patients was 9.04%. However, COPD is the most common diagnosis during this period followed by interstitial lung diseases (ILD) (9.2%) as shown in Table 1. Among bronchiectasis, 25.2% of patients were nonsmokers and 11% were current smokers (Table 2).

As regards the prevalence of bronchiectasis stratified by year of diagnosis (per year), the highest prevalence was recorded in year 2018 where the number of cases was 356 giving 22.6% prevalence rate per year followed by year 2017 in which the prevalence rate was 9.5% compared to 7% in year 2008. Lower rates were recorded in years 2013 and 2014; the rates were 6.3% and 6.5%, respectively (Fig. 1).

Transthoracic ultrasonography was done for 223 bronchiectasis patients. The most common finding was B lines in 68.2% of patients followed by consolidation with air bronchogram in 29.1% (Table 3).

Table 4 shows that hypertension (10.4%) and diabetes (8.4%) were the most common associated comorbidities.

As regards the final diagnosis of bronchiectasis, COPD with bronchiectasis was the commonest (54.1%) followed by post-tuberculous bronchiectasis (17.1%). Bronchial asthma was reported in 2.2%, and alpha 1 antitrypsin deficiency was recorded in 2.6%. Systemic lupus erythematosus was noticed in 0.12%. As regards complications, chronic respiratory failure was recorded in 9.1%; hence, long-term oxygen therapy was needed in 9.1% of cases. Hemoptysis was recorded in 1.3% of cases (Table 5).

## Discussion

This study was a retrospective cohort design to determine the prevalence of bronchiectasis among patients admitted to the Chest Department in a tertiary care hospital over 10 years' period from 2008 to 2018 and to detect associated and/or co-existing respiratory diseases. The main results showed a 9.04% prevalence of bronchiectasis among admitted patients with an increasing rate of prevalence over the years, COPD with bronchiectasis was the commonest (54.1%) diagnosis, and chronic respiratory failure indicating long-term oxygen therapy was described in 9.1% of patients.

**Table 1** Final diagnosis of admitted patients in the Chest Department from 2007 to 2018 (*n* = 17,531)

| Study population (***n*** = 17,531) | Final diagnosis | Percentage |
|---|---|---|
| Chronic obstructive pulmonary disease (COPD) | 6679 | 38.1 |
| Interstitial lung diseases (ILD) | 1595 | 9.1 |
| Combined emphysema pulmonary fibrosis (CEPF) | 161 | 0.9 |
| Bronchiectasis | 1585 | 9.04 |
| Pneumonia | 1116 | 6.3 |
| Tuberculosis | 373 | 2.1 |
| Pleural effusion | 1435 | 8.1 |
| Empyema | 211 | 1.2 |
| Pneumothorax | 637 | 3.6 |
| Bronchogenic carcinoma | 547 | 3.1 |
| Mesothelioma | 92 | 0.52 |
| Pulmonary embolism | 889 | 5.07 |
| Obstructive sleep apnea syndrome (OSAS ) + obesity hypoventilation syndrome (OHS) | 362 | 2.06 |
| Overlap syndrome (COPD-OSAS) | 610 | 3.4 |
| Others | 1239 | 7.1 |

In the current study, the prevalence of bronchiectasis among admitted patients was 9.04%. As regards the prevalence of bronchiectasis stratified by year of diagnosis (per year), the highest prevalence was recorded in year 2018 (the number of cases was 356 giving 22.6% prevalence) followed by year 2017 in which the prevalence rate was 9.5% compared to 7% in year 2008. However, the lower rates were recorded in years 2013 and 2014; the rates were 6.3% and 6.5%, respectively. The reasons for the increasing prevalence of bronchiectasis are unknown; it may be explained by increased awareness of the disease leading to better surveillance using HRCT over time. It is agreed that the prevalence of bronchiectasis is common and has been growing since 2004. Quint et al. [5] reported that the prevalence of bronchiectasis increased from 350.5 per 100,000 in 2004 to 566.1 per 100,000 in 2013 in women and from 301.2 per 100,000 in 2004 to 485.5 per 100,000 in men [5]. Similarly, Kwak et al. [11] by using data from private healthcare claims found a higher prevalence of bronchiectasis than expected. Weycker et al. [12] reported that the prevalence of bronchiectasis was 52.3 per 100,000 among adults aged ≥ 18 years and was 110,000 among adults of all ages in the USA. Using outpatient data, Seitz et al. [13] reported that disease prevalence was increased from 2000 to 2007 (the annual growth rate is 8.7%). A similar increase of 8% in annual growth rate and in the prevalence of bronchiectasis from 52 per 100,000 in 2001 to 139 per 100,000 in 2013 was recorded among adults of all ages in the USA [14].

**Table 2** Baseline characteristics of bronchiectasis in the study group

| Study population (1585) | Frequency, ***n*** | Percentage |
|---|---|---|
| Gender, male/female | 1055/530 | 66.5/33.5 |
| **Smoking** | | |
| Nonsmokers | 400 | 25.2 |
| Ex-smokers | 1012 | 63.8 |
| Current smokers | 173 | 11 |

The present study revealed that COPD with bronchiectasis was the commonest (54.1%) followed by post-tuberculous bronchiectasis (17.1%). Bronchial asthma

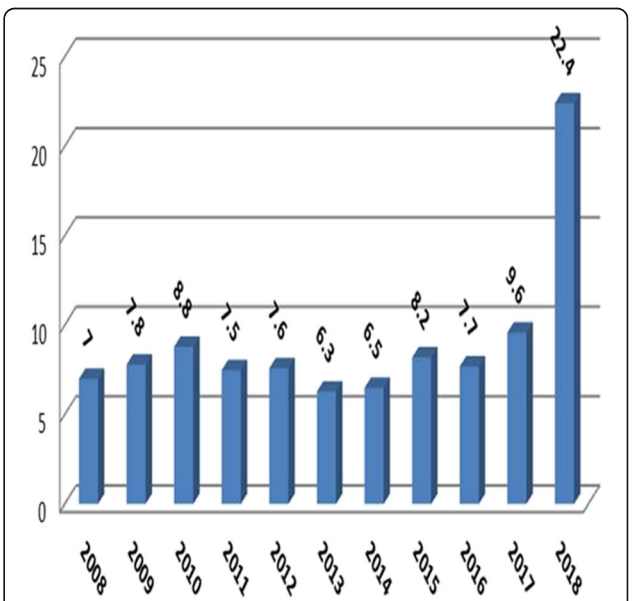


**Fig. 1** Prevalence of bronchiectasis in patients admitted in the Chest Department from 2008 to 2018 stratified by year of diagnosis (*n* = 1585)

**Table 3** Transthoracic ultrasonography findings in the study bronchiectasis patients admitted to the Chest Department from 2008 to 2018 ($n$ = 223)

| Chest sonar findings | Frequency | Percentage |
|---|---|---|
| Pleural effusion | 40 | 17.9 |
| Consolidation, air bronchogram | 65 | 29.1 |
| Pleural thickening | 7 | 3.1 |
| B lines | 152 | 68.2 |
| Normal | 15 | 6.7 |
| Mass | 6 | 2.7 |

More than one finding was reported in the same patient; transthoracic ultrasonography was done if indicated

was reported in 2.2% of patients. Systemic lupus erythematosus was noticed in 0.12%.

Bronchiectasis is recognized as a complication of COPD and asthma [15–17]. In contrast to the current study, Quint et al. [5] demonstrated that bronchial asthma was more commonly associated with bronchiectasis (43%) than COPD (36%). HIV was reported in 7% and rheumatoid arthritis in 6%, while other connective tissue diseases in 5%. They explain this difference by the misclassification of COPD as asthma in the database. Also, some studies had bronchiectasis as an exclusion criterion leading to under-diagnosis of bronchiectasis in COPD. Moreover, most of these studies excluded patients with previously known bronchiectasis and those with bronchiectasis in only one pulmonary segment, as this circumstance can be found in a significant percentage of elderly people in the general population or in smokers with no airway obstruction [11].

Patients with rheumatoid arthritis and bronchiectasis may have increase complications due to immunosuppressive treatments. Bronchiectasis has been recorded in other connective tissue diseases including Marfans syndrome, systemic sclerosis, primary Sjogren syndrome, ankylosing spondylitis, and systemic lupus erythematosus [18]. Fenlon et al. [19] demonstrated that bronchiectasis was observed in 7 of 34 patients with systemic lupus erythematosus (SLE).

**Table 4** Co-existing diagnosis associated with bronchiectasis in the study group ($n$ = 1585)

| Study population (1585) | Number | Percentage |
|---|---|---|
| Hypertension | 165 | 10.4 |
| Diabetes mellitus | 134 | 8.4 |
| Pulmonary embolism | 16 | 1.1 |
| Rhinitis | 13 | 0.8 |
| Liver cirrhosis | 69 | 4.3 |
| Renal impairment | 10 | 0.6 |
| Lobectomy | 13 | 0.8 |
| Fungal ball | 3 | 0.1 |

**Table 5** Final diagnosis, clinical complications, and pulmonary function of the study bronchiectasis population ($n$ = 1585)

| Study population | Number | Percentage |
|---|---|---|
| **Final diagnosis** | | |
| COPD with bronchiectasis | 858 | 54.1 |
| Post-tuberculous bronchiectasis | 271 | 17.1 |
| Idiopathic pulmonary fibrosis | 54 | 3.4 |
| Bronchial asthma | 36 | 2.2 |
| OHS, overlap syndrome | 12 | 0.7 |
| Kartagner syndrome | 11 | 0.6 |
| Systemic lupus erythematosus | 2 | 0.12 |
| **Clinical complications** | | |
| Respiratory failure | 1012 | 63.7 |
| Mechanical ventilation | 61 | 3.8 |
| Non-invasive ventilation | 29 | 1.8 |
| Decompensated cor pulmonale | 335 | 21.1 |
| Hemoptysis | 21 | 1.3 |
| Long-term oxygen therapy | 158 | 9.9 |
| **Pulmonary function** | | |
| Obstructive | 693 | 43.7 |
| Mixed | 8 | 0.5 |
| Restrictive | 58 | 3.7 |
| Diffusion defect | 28 | 1.8 |
| Cannot be done | 166 | 10.5 |

*OHS* obesity hypoventilation syndrome

McDonnell et al. [20] reported that 81 different comorbidities were recorded during the 5-year follow-up of patients with bronchiectasis including COPD, asthma, diabetes, inflammatory bowel disease, connective tissue diseases, peripheral vascular disease, and cardiovascular disease. In their study, COPD, asthma, connective tissue diseases, and inflammatory bowel disease as comorbidities are associated with a higher mortality. Du et al. [21] in their meta-analysis demonstrated that bronchiectasis detected by chest CT was common among COPD patients. The relationship between COPD and bronchiectasis is still controversial. It may be due to chronic infection in COPD resulting in structural damage, loss of integrity of epithelial cell, mucociliary clearance impairment, hyper-secretion of mucus, and persistent inflammation of airway with tissue injury leading to bronchiectasis [22–24].

The current study revealed that alpha 1 antitrypsin deficiency was recorded in 2.6%. Other studies reported that PiZZ deficiency had radiological bronchiectasis in 94.5% of cases during the period from 1995 and 2002 [25]. In 28 Irish patients with A1AT deficiency, 14 of them had bronchiectasis [26]. Chronic respiratory failure is considered as an important complication of bronchiectasis.

The finding in this study showed that chronic respiratory failure was recorded in 9.1%, and hence, long-term oxygen therapy was described in 9.1% of patients. Hemoptysis was recorded in 1.3% of cases. In Europe, bronchiectasis database demonstrated that 86 of 1145 (7.5%) patients were using long-term oxygen therapy for chronic respiratory failure [27]: a use of long-term oxygen therapy if $PaO_2 \leq 55$ mmHg in stable patients or 56–59 mmHg in those with hypoxic organ damage [28, 29].

In Mayo Clinic during the period from 1976 to 1993, hemoptysis was found in 63 of the lung resection group [30]. In Korea, it has been suggested that the use of inhalers may increase the risk of hemoptysis [31].

### Limitations of the study

First, this a retrospective study and there is a need for a prospective study to address the current situation. Second, not all patients were following the current guidelines for the diagnosis of bronchiectasis (the diagnosis was based on the guideline on the same year). Finally, different radiology specialists were blindly recording their findings.

## Conclusions

The prevalence of bronchiectasis among admitted patients was not uncommon with increasing rate of prevalence over the years due to increase awareness. COPD was the commonest cause in the study group followed by post-tuberculous bronchiectasis. Chronic respiratory failure was recorded in 9.1%, and hence, long-term oxygen therapy was described in 9.1% of patients.

### Recommendation

To follow-up patients with COPD to try to explain if the associated bronchiectasis is due to repeated bacterial infections or the patients are having de novo bronchiectasis with obstructive pulmonary function.

#### Abbreviations

COPD: Chronic obstructive pulmonary disease; TB: Tuberculosis; IPF: Interstitial pulmonary fibrosis; SLE: Systemic lupus erythematosus; HRCT: High-resolution computed tomography

#### Acknowledgements

The authors want to thank all colleagues in the Chest Department of Assiut University Hospital for their contribution in the data entry throughout the past years.

#### Authors' contributions

Prof. AMH was responsible for the conception and design, acquisition of data, drafting of the submitted protocol, and writing and editing of the final version of the manuscript. Prof. HM participated in the conception and design; she was responsible for the analysis and interpretation of the data, critical revision of the submitted protocol, and final draft of the manuscript. All authors have read and approved the manuscript.

#### Funding

No fund was needed for the study.

#### Availability of data and materials

Available.

#### Ethics approval and consent to participate

The manuscript was approved by the ethical committee of the Faculty of Medicine, Assiut University. Written consent was previously given by all participants.

#### Consent for publication

All authors revised and approved the submission.

#### Competing interests

The authors declare they have no conflict of interest.

Received: 23 April 2020 Accepted: 21 May 2020
Published online: 16 July 2020

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