

Original Article

A Neglected Etiology of Bronchiectasis: External Compression Due to Hiatal Hernia

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ABSTRACT

Aim: To investigate the incidence of bronchiectasis supposed to be made by the external compression of hiatal hernia (HH) to bronchi. **Materials and Methods:** The thorax computed tomography (CT) scans of patients which were carried out in Duzce University Hospital between February 2014 and August 2015 were retrospectively evaluated. The repeated scans in the same patient were excluded. **Results:** A total of 4388 patients were included in the study. A total of 98 HH cases were detected of which 58 (59.2%) were female. The mean age was 73.30 ± 9.14 (45–90). The rate of HH according to small, moderate and large size was 45 (45.9%), 9 (9.2%), 44 (44.9%), respectively. The rate of hiatal hernia accompanied by bronchiectasis were similar in both males and females ($P = 0.078$). The prevalence of bronchiectasis was significantly high in large hernias with 81.4% rate ($P = 0.009$). Bronchiectasis rate was 12.343 times (OR: 12.343, 95% CI: 1.479–103.027, $P = 0.009$) higher in the large HH group compared to small and moderate HH groups. Hiatal hernia accompanied by bronchiectasis was 88.1% anatomically near to HH. **Conclusions:** Thus, hiatal hernia may cause bronchiectasis due to external compression rather than lymphadenopathy or the tumor as an etiology of bronchiectasis and should be considered in the differential diagnosis.

KEYWORDS: Bronchiectasis, hiatal hernia, thorax computed tomography

INTRODUCTION

Bronchiectasis is the abnormal and permanent distortion of one or more of the conducting bronchi or airways. This can be the result of an infection or another condition, but sometimes the cause is not known. In general, the pathogenesis of bronchiectasis is based on two basic mechanisms. First is airflow obstruction or abnormal dilatation of the bronchi.^[1] The second mechanism is chronic infection of the airways.^[2] Airway obstruction is typically followed by mucus accumulation and atelectasis in distal airway lumen. Both increased luminal pressure and retraction of adjacent parenchyma cause bronchial dilation. Secondary infection due to the bacteria localized to the bronchial wall contributes to bronchial damage and dilatation.^[3]

Obstruction can occur because of tumor, foreign body, impacted mucus caused by poor mucociliary clearance, external compression from tumor or lymphadenopathy

as in right middle lobe syndrome (chronic extrinsic compression of right middle lobe bronchus by hilar lymph nodes).^[4]

Although gastroesophageal reflux (GOR) due to hiatal hernia (HH) was suggested to be a possible etiology and risk factor associated with bronchiectasis, its role in the external compression of HH on bronchiectasis, especially the ones just adjacent to HH, has not been reported yet. Among patients with late stages of lung diseases, the opportunity of treating GOR is only shown in limited studies for chronic obstructive pulmonary disease and idiopathic pulmonary fibrosis, and in even fewer studies for bronchiectasis.^[5]

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In this study, we aimed to investigate the incidence of bronchiectasis supposed to be made by the external compression of HH on bronchi other than tumors or lymphadenopathies.

MATERIALS AND METHODS

Study design

The thorax computed tomography (CT) scans of patients which were carried out in Duzce University Hospital between February 2014 and August 2015 were retrospectively evaluated. The repeated scans in the same patient were excluded. A total of 4388 patients were included in the study.

Imaging protocol

All CT was performed on a MDCT scanner (16-slice Toshiba Medical Systems Activion). All patients were placed in supine position and inspiratory scans were obtained with or without intravenous contrast administration. Thorax CT was obtained with the following technical parameters: 120 kV peak, automatic exposure control (AEC) (max, 160 mAs), and slice thickness 1 mm, an X-ray tube rotation time of 0.75 second, collimation 16 × 1 mm, and a pitch factor of 0.938 mm) within one breath-holding period. Reconstruction slice thickness was 1 mm, and the slice interval was 1 mm with a CT reconstruction algorithm. The images transferred to a picture archiving and communication system (PACS) and a workstation. All images were processed with standard mediastinal (width, 400 HU; level, 40 HU) and lung (width, 1200; level, -600 HU) window settings. Axial images and multiplanar reconstruction reformatted images were evaluated together. The measurements were made in the axial plane; however, coronal and sagittal planes were used if necessary.

Evaluation of the presence of a HH

The presence of HH was determined by the evaluation of the esophageal junction in relation to the diaphragm using recognized anatomical definitions.^[6] Where “present,” each HH was classified according to gastric fundus size as small (<2 cm), moderate (2–5 cm) and large (>5 cm).

Statistical analysis

The descriptive statistics of all variables in the study (mean, standard deviation, median, minimum, maximum, and percent) were calculated. In comparison to proportions, Chi-square and Binomial tests were used. Relationships between the categorical variables were investigated by Pearson Chi-square and Fisher’ Exact tests. Logistic regression analysis was used to obtain Odds ratios for variables effecting bronchiectasis. All

statistical analyses were performed by IBM SPSS 20 and the $P < 0.05$ was considered statistically significant.

RESULTS

A total of 98 HH cases were detected. The rate of HH according to small, moderate, and large size was 45 (45.9%), 9 (9.2%), 44 (44.9%), respectively. A total of 58 cases (59.2%) were female. The mean age was 73.30 ± 9.14 (45-90). Nine (9.1%) patients (8 females 88.8%) were found to have confirmed bronchiectasis on thorax CT. The rate of hiatal hernia accompanied by bronchiectasis was similar in male and female gender ($P = 0.078$). The prevalence of bronchiectasis was significantly high in large hernias with 81.4% rate ($P = 0.009$). Demographic parameters and comparisons between bronchiectasis + and bronchiectasis- subgroups are shown in Table 1. The rate of bronchiectasis was 12.343 times (OR: 12.343, 95% CI: 1.479–103.027, $P = 0.009$) higher in the large HH group when compared to the small and moderate HH groups. Hiatal hernia accompanied by bronchiectasis was 88.1% anatomically close to HH. Axial chest CT images of different patients are shown in Figure 1.

DISCUSSION

To the best of our knowledge, our study is the first study which investigates the association between HH and bronchiectasis regarding the role of the external

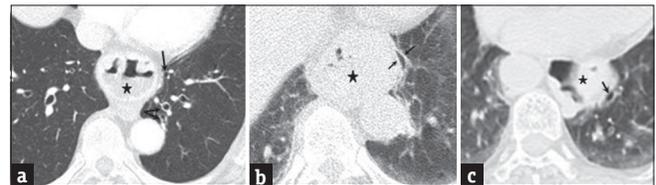


Figure 1: Axial chest CT images of different patients in lung window (a-c) show hiatal hernias (stars) with adjacent bronchiectasis (arrows)

Table 1: Demographic parameters and comparisons between Bronchiectasis+ and Bronchiectasis- subgroups

PARAMETERS	Bronchiectasis + n=9	Bronchiectasis - n=89	p
Demographic data			
Age, y, (mean±SD)	77.5±8.5	72.8±9.1	0.143
Female/Male, n (%)	8 (13.8)/1 (2.5)	50 (86.2)/39 (97)	0.078
Hernia size, n (%)			
Small	0 (0)	45 (100)	
Moderate	1 (10)	9 (90)	
Large	8 (18.6)	35 (81.4)	
Hernia size, n (%)			
Small-moderate	1 (1.8)	54 (98.2)	0.009
Large	8 (18.6)	35 (81.4)	

SD, standard deviation; y, year. The size of hiatal hernias. Small (<2 cm), moderate (2–5 cm) and large (>5 cm)

compression of hiatal hernia on bronchiectasis. However, we have already reported a rare case about association between HH and bronchiectasis which is also the first report on this topic.^[7] We found the prevalence of bronchiectasis as 9.8% in patients with HH. In the US, the prevalence of bronchiectasis has been reported as 272/100,000.^[8] McDonnell *et al.* evaluated the prevalence of HH among stable noncystic fibrosis bronchiectasis (NCFB) patients and determined associations with disease severity. They found a prevalence of HH in over a third of NCFB patients (36%). They also observed a significant statistical association between the presence of HH and increased GOR symptoms and increased composite bronchiectasis severity scores. They speculated that HH is associated with GOR and may contribute to lung disease severity.^[9]

The clinical course of bronchiectasis is generally punctuated by infectious exacerbations and the clinical presentation of bronchiectasis may be complicated by the coexistence of other medical conditions or comorbidities, including GOR. The role of GOR in the etiology of bronchiectasis has also been discussed in some reports. Hiatal hernia can cause bronchiectasis when the stomach acid that is aspirated into the lungs causes tissue damage. Recurrent microaspiration can cause irritation in the airways, lung damage, remodeling in respiratory system and may result in bronchiectasis in the end.^[9-11] In a study performed by Lomansey, respiratory complaints were detected in 43% of 300 patients with applied GOR surgery and bronchiectasis was diagnosed in 10 patients.^[12]

Moreover, it is reported that GOR potentially plays an important role in some patients with bronchiectasis and its progression and active anti-reflux treatments can be beneficial.^[5,13-15]

Bronchiectasis is more common in women than in men and is more common in middle age and elderly.^[6] Bronchiectasis was also detected more frequently in female patients in our study, although it was not statistically significant. Patients with bronchiectasis were older than the ones without bronchiectasis but the difference was not statistically significant. In the present study, bronchiectasis was frequently detected adjacent to HH.

So, external compression due to hiatal hernia might play a role in the etiology of bronchiectasis. As known, obstruction due to endobronchial lesions or external compression can lead to the development of bronchiectasis. Bronchial obstruction can result from extrinsic compression as in hilar lymphadenopathy

in middle lobe syndrome or tumor of neoplastic origin.^[16]

In a recent study, the etiology of bronchiectasis across European cohorts and according to different levels of disease severity has been identified. Among the 1,258 patients enrolled, an etiology of bronchiectasis was determined in 60%, including postinfective (20%), chronic obstructive pulmonary disease (15%), connective tissue disease (10%), immunodeficiency (5.8%), and asthma (3.3%). There might be some patients with bronchiectasis with an etiology of external compression of HH in the undetermined group.^[17] In a recent excellent review of Chalmers, there was no report about the possible role of external compression of HH in the etiology of bronchiectasis.^[18]

CONCLUSION

To conclude, it is thought that hiatal hernia may cause bronchiectasis due to external compression other than lymphadenopathy or the tumor as an etiology of bronchiectasis and should be considered in the differential diagnosis.

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Conflicts of interest

There are no conflicts of interest.

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