The Demographic, Clinical, Radiographic and Bronchoscopic Evaluation of Anthracosis and Anthracofibrosis Cases

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Abstract

**Background:** The aim of the study was to evaluate the demographic features, clinical findings, radiological and bronchoscopic findings of patients with bronchial anthracosis.

**Methods:** Among 1541 patients who underwent bronchoscopy in our bronchoscopy unit between 2006-2008, 104 patients with anthracosis were included in this prospective study. The patient's geographical location, occupation, type of fuel used for cooking in the kitchen and for heating in their house, admission complaints, chest x-ray and thorax computed tomography (CT) findings, bronchoscopic images and the accompanying pathological diagnosis were recorded and evaluated.

**Results:** A total of 104 (6.7%) patients with a mean age of 61.35±13.34 years were included in this study: 49 (47.1%) of which were female, 55 (52.9%) male. The most common complaints were cough, dyspnea and sputum production in 71.2%, 57.7% and 49.0% patients, respectively. In 48 (46.1%) patients history of cigarette smoking was found. While in 31 (38.3%) patients exposure to mineral dust or biomass in their job was observed, 37 (45.7%) patients were housewives. In all of the patients biomass exposure was found because of the fuel used for heating or in kitchens. Regarding geographical location, we found that the majority of the patients (38.5%) were from Black Sea region located in northern Anatolia. While the most common chest x-ray findings were consolidation (51.9%) and fibrosis (18.3%), consolidation (38.5%) and fibrosis (36.5%) were also found to be the leading thorax CT findings. The most common bronchoscopic findings were bilateral anthracosis, stenosis and bronchial torsion 67.3%, 40.4% and 23.1% patients, respectively. Among the anthracosis patients, with bronchoscopy 11 of them were found to have malignancy and 7 of them tuberculosis.

**Conclusion:** Large scale, country-wide studies should be conducted for the determination of epidemiological data of bronchial anthracosis and anthracofibrosis in our country in which a high rate of biomass exposure is found.

**Keywords:** Anthracosis; Anthracofibrosis; Bronchoscopy; Biomass exposure

**Abbreviations:** CT: Computerised Tomography; TB: Tuberculosis

Introduction

Anthracosis, a form of pneumoconiosis, is most commonly seen in coal workers. Air pollution, biomass smoke and cigarette smoke are also known as the other environmental factors for anthracosis [1-5]. The term “anthracotic” is usually used to describe coal and other black pigments of which carbon is a major constituent. Characteristically, coal deposits are present as black plaques in the bronchi [6]. The term “bronchial anthracosis” is of fairly recent origin and has come to define a clinical entity with bronchial lumen narrowing and anthracotic pigmentation visible on bronchoscopy. First reported from Korea, it was predominantly seen in non-smoking ladies with a longstanding history of exposure to wood smoke used either for food cooking or heating. The luminal narrowing and anthracotic pigmentation was most commonly observed in the right middle lobe [6-9]. The CT findings have been reported to include smooth bronchostenosis and peribronchial lymph nodes along with peripheral atelectasis [6,8,9,11]. Bronchogenic carcinoma and endobronchial tuberculosis (TB) are two main causes of bronchostenosis that can be accompanied by peribronchial nodes and atelectasis [12,13].

Recently, an increasing number of patients in whom dark anthracotic pigmentation in conjunction with bronchial narrowing or obliteration was not associated with environmental exposure to coal dust or smoking, was demonstrated in bronchoscoppy patients. This bronchoscopic finding is called “anthracofibrosis”. This report is a summary of demographic, clinical, radiographic and bronchoscopic findings of these patient.

**Materials and Methods**

Among a total of 1541 patients who underwent bronchoscopy at Dr. Lutfi Kirdar Kartal Research and Training Hospital Pulmonary Diseases Department's Bronchoscopy Unit between 2006-2008, anthracosis and anthracofibrosis were diagnosed in 104 patients. Diagnosis of anthracosis and anthracofibrosis were made solely on the basis of bronchoscopic findings. Patients in whom bronchoscopy revealed definite narrowing or obliteration of lobar or segmental bronchi with anthracotic pigmentation in the surrounding mucosa were considered to have anthracosis and in whom bronchoscopy revealed black plaques were considered to have anthracosis and were included in this analysis. Geographical location and profession of the patients, type of fuel used for heating and cooking in the kitchen, admission complaints, chest x-ray and chest tomography findings, bronchoscopic features and the accompanying diagnosis were evaluated.

The chest CT was performed before bronchoscopy to evaluate lung lesions such as consolidation, atelectasis, mediastinal enlargement or masslike opacities seen on chest radiographs. CT scans were obtained.
The principal finding of bronchoscopy was anthracotic pigmentation of bronchial mucosa and bronchial luminal narrowing. While both anthracosis and anthracofibrosis were observed in 60 (57.7%) of these patients, only bronchial anthracotic pigmentation (plaques) were established in 44 (42.3%) of them. Bilateral anthracosis, stenosis and torsion were the leading bronchoscopic findings (Figure 1, Figure 2).

The severity of bronchial narrowing was variable in each bronchus and had no correlation with the degree of anthracotic pigmentation. On bronchoscopy, the left upper lobe bronchus was the most commonly involved site. Single site involvement was noted in 32 (30.8%) of anthracofibrosis and in 33 (31.7%) of anthracosis patients. Bronchial stenosis or torsion was most commonly in segmental bronchi (n=46, 44.2%) and the most common bronchial sites were the segment bronchi of left upper lobe, right middle lobe and right upper lobe, respectively.

On chest X-ray, consolidation was observed in 51.9% and fibrosis in 18.3% (Figure 3). In thorax CT findings, consolidation (38.5%) and fibrosis (36.5%) were also seen most commonly (Figure 4).

Among these 104 patients 11 of them were found to have malignancy. Active tuberculosis was found in 7 patients. Bronchial washing fluid was positive for acid-fast bacilli in these patients.

Discussion

Anthracofibrosis is a bronchoscopic finding showing dark anthracotic pigmentation on the bronchial mucosa in conjunction with bronchial narrowing or obliteration [8]. Most patients are presented with cough, dyspnea and sputum. Because of their age and chest radiographic findings, chest CT and bronchoscopy are usually performed to exclude bronchogenic carcinoma.

Anthracofibrosis has been reported mostly from developing countries mainly from Asia and some case reports are rarely described from North America and Europe [9,14]. The prevalence of anthracosis differ widely in studies. Per 1000 bronchoscopy procedures performed, Wynn et al. [15] reported one case of anthracosis. In contrast to Wynn et al, Mirsadraee et al. [14] found anthracosis in 21% of patients who...
underwent diagnostic bronchoscopy and Chung et al. [6] reported anthracofibrosis in 3.1% of patients. According to the findings of our study, among patients who underwent routine diagnostic bronchoscopy the prevalence of anthracosis and anthracofibrosis were 2.8 and 3.8% respectively.

Although the mechanisms that underlie the formation of anthracofibrosis are unclear, it has been shown that long term exposure to biomass is one of the most important risk factors [16-19]. Cigarette smoke, air pollution, and mixed mineral dust are described among the other environmental factors known to cause anthracosis [3,4,20,21]. Torun et al. [18] described 27 patients with anthracofibrosis who had a history of prolonged exposure to wood smoke, and no occupational history of exposure to coal. A correlation between exposure to biomass fuel and anthracosis is reported by Sandoval et al. [4]. In our study, 53% of the patients with anthracosis were non-smokers whereas only 38% had occupational mineral dust exposure. In our study, the left upper lobe was the most commonly involved lobe (51%). Among our patients may support the hypothesis that factors other than occupational history of exposure to coal. A correlation between exposure to biomass fuel and anthracosis is reported by Sandoval et al. [4]. In our study, 53% of the patients with anthracosis were non-smokers whereas only 38% had occupational mineral dust exposure. In our study we found that the affected females were housewives who lived in rural areas, and as many as 40% of males were farmers who inhabited rural areas. In some reports, anthracofibrosis is known as a disease of elderly women who are exposed to biomass fuel. The preponderance of female patients with anthracosis in other reports may be explained by the exposure of women to wood smoke. The finding of only 38% of mineral dust exposure among our patients may support the hypothesis that factors other than occupation have a role in the pathogenesis of these conditions.

In the study of Sigiari et al. [22], bilateral bronchial involvement was found in 62.5% of the patients on bronchoscopic examination and bronchial narrowing and obstruction was observed in 37.4% of the patients. Young KH et al. [8] reported that among 54 bronchial anthracofibrosis cases, the right middle lobe bronchus was the most commonly involved site (63%) on bronchoscopy. In the same study while single-site involvement was noted in 48% of patients multiple site involvement was seen in 52%. In our study, the left upper lobe bronchus was the most commonly involved site on bronchoscopy. Single site involvement was noted in 32 (30.8%) of anthracofibrosis and in 33 (31.7%) of anthracosis patients. Torun et al. [18] showed that the most common bronchoscopic findings were anthracosis and bronchial narrowing among their patients noted mostly at right upper lobe followed by right middle lobe. Wynn et al. [15] reported that there was a predilection for right middle lobe bronchus leading to lobar collapse mimicking cancer.

Anthracofibrosis is a bronchoscopic finding showing dark anthracotic pigmentation on the bronchial mucosa in conjunction with bronchial narrowing or obliteration. Most patients are elderly women who usually are present with cough, sputum and dyspnea. Because of their age and segmental or lobar atelectasis on chest radiographs, bronchoscopy and chest CT are usually performed to exclude bronchogenic carcinoma. On CT a segmental collapse distal to the involved bronchi was the most common finding. The right middle lobe was the most frequently involved lobe (51%). Bronchial narrowing was noted in 80% of patients. In our study, consolidation was the most common finding on CT scan. Consolidation was seen in 52%. In our study, the left upper lobe was the most commonly involved site (63%) on bronchoscopy. In the same study while single-site involvement was noted in 48% of patients multiple site involvement was seen in 52%. In our study, the left upper lobe bronchus was the most commonly involved site on bronchoscopy. Single site involvement was noted in 32 (30.8%) of anthracofibrosis and in 33 (31.7%) of anthracosis patients. Torun et al. [18] showed that the most common bronchoscopic findings were anthracosis and bronchial narrowing among their patients noted mostly at right upper lobe followed by right middle lobe. Wynn et al. [15] reported that there was a predilection for right middle lobe bronchus leading to lobar collapse mimicking cancer.

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The finding in our study that majority of anthracofibrosis patients were from Kastamonu; a city in northern part of Turkey having costal borders with Black Sea was striking. The heavily forested geographical feature of Black Sea region and widespread use of wood for heating or as fuel in the kitchen may be the explanations for high rates of biomass exposure living in this part of Turkey.

Table 1: Demographic properties of patients.

<table>
<thead>
<tr>
<th></th>
<th>Female</th>
<th>Male</th>
</tr>
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<tbody>
<tr>
<td>Age (mean±SD)</td>
<td>61.35±13.34</td>
<td>70.29±14.4</td>
</tr>
<tr>
<td>Biomass exposure</td>
<td>104 (100%)</td>
<td>63 (100%)</td>
</tr>
<tr>
<td>Occupational biomass exposure</td>
<td>31 (38.3%)</td>
<td>17 (27.5%)</td>
</tr>
<tr>
<td>Being housewife</td>
<td>37 (45.7%)</td>
<td>26 (41.2%)</td>
</tr>
<tr>
<td>Cigarette smoking</td>
<td>48 (46.1%)</td>
<td>34 (53.1%)</td>
</tr>
<tr>
<td></td>
<td>55 (52.9%)</td>
<td>49 (78.1%)</td>
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</table>

Table 2: Bronchoscopic findings of bronchial anthracofibrosis (n=104).

<table>
<thead>
<tr>
<th></th>
<th>RM</th>
<th>RUL</th>
<th>RML</th>
<th>RLL</th>
<th>LM</th>
<th>LUL</th>
<th>LLL</th>
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</thead>
<tbody>
<tr>
<td>Plaque</td>
<td>13</td>
<td>22</td>
<td>12</td>
<td>14</td>
<td>15</td>
<td>12</td>
<td>15</td>
</tr>
<tr>
<td>Torsion or stenosis</td>
<td>3</td>
<td>25</td>
<td>24</td>
<td>23</td>
<td>15</td>
<td>14</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>16</td>
<td>15.4</td>
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Values given as number (%)
We could not find any literature data about the geographical distribution of anthracofibrosis cases from Turkey. We propose that these patients with anthracosis from that region of Turkey should be evaluated in another prospective trial.

In conclusion, among patients who undergo routine bronchoscopy, anthracosis and anthracofibrosis are diagnosis that may easily be missed or findings may be attributed to other causes. Thorough clinical evaluation and close follow-up of patients are required, since tuberculosis, pneumonia and malignancy may be associated with bronchial anthracofibrosis. Large scale, country-wide studies should be conducted for the determination of epidemiological data of bronchial anthracosis and anthracofibrosis in our country in which a high rate of biomass exposure is found.

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