Anthracosis and anthracofibrosis

Naseh Sigari, MD, Shilan Mohammadi, MD.

ABSTRACT

Objectives: To define the clinical, radiographic, and bronchoscopic features, and to describe the occupations of the largest group of patients with anthracosis.

Methods: All patients who underwent flexible bronchoscopy at 2 Iranian hospitals (Imam Hospital [Tehran], and Tohid Hospital [Sanandaj]), Iran, between April 1982 and June 2006 were considered for inclusion in the study. The demographic data, clinical, and radiographic findings of anthracotic and anthracofibrotic patients were recorded.

Results: Of the 14300 patients, 487 cases of simple anthracosis, and 291 of anthracofibrosis were found. A total of 98.4% female patients were housewives, and 86.4% lived in rural areas. Of the male patients, 40.6% were farmers, 29.6% were manual workers, and 7.5% were miners. Of these, 96% of patients had abnormal chest radiography. On bronchoscopic examination, bilateral bronchial involvement was found in 62.5% of the patients. The condition was confined to the trachea in 0.38% of patients, the bronchi involved were the main bronchus in 37%, the lobar bronchi in 83.2%, and segmental bronchi in 35%. Bronchial narrowing and obstruction was observed in 37.4% of the patients.

Conclusion: Anthracosis and anthracofibrosis are neglected conditions that are a common finding on routine bronchoscopic examination. Given the demographic findings, and a review of other reports from developing countries, exposure to combustion of biomass fuel in rural areas is a possible risk factor.


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Anthracosis is used to describe a condition in which the bronchial mucosa is covered by black pigments, of which carbon is a major constituent. The term “anthracofibrosis” was coined to describe bronchial stenosis, and deformity combined with overlying anthracotic mucosa. The mechanisms that underlie the formation of these conditions are unclear. It has been shown that long term exposure to biomass...
is one of the most important risk factors. Bronchial tuberculosis is another likely cause of the development of anthracofibrosis. However, some investigators have found that there is no correlation of this condition with active tuberculosis. An association with domestic pollution has been reported. Other environmental factors such as cigarette smoke, air pollution, and mixed mineral dust are known to cause anthracosis. Only 3 published reports have described the clinical features of large numbers of patients with anthracofibrosis. Other reports described etiological factors, or are limited case reports, or described the findings of computed tomography scans performed on patients. The aims of this retrospective study were to define some demographic properties, and the findings of clinical, radiological, and bronchoscopic examinations of the largest group of patients with anthracosis and anthracofibrosis, and to present the occupation of the patients.

**Methods.** This study consisted of a retrospective review of the hospital records of all patients that underwent diagnostic flexible bronchoscopy at the Imam Hospital of the Tehran University of Medical Science, Tehran, and the Tohid Hospital of the Kurdistan University of Medical Science, Sanandaj, Iran between April 1982 and June 2006. Examination using fiberoptic bronchoscopy was performed by 7 pulmonologists (including the corresponding author) over a 24-year period. During this period, 14,300 bronchoscopies were performed. The indications for performance of diagnostic bronchoscopy were varied, they included hemoptysis, chronic cough, chronic pneumonia, and other pulmonary problems. We reviewed the records of the bronchoscopic examination of all 14,300 patients. A diagnosis of anthracosis or anthracofibrosis was made solely on the basis of the findings of the bronchial tree seen on bronchoscopic examination. Particular attention was paid to black pigmentation scattered throughout the airways (which indicates anthracosis), and narrowing, deformity, and obliteration of lobar or segmental bronchi by these black plaques (anthracofibrosis). In total, 778 cases of anthracosis and anthracofibrosis were identified on the basis of the bronchoscopic criteria. We extracted the recorded demographic data, and the findings of clinical, radiographic, and bronchoscopic examination of these patients.

The survey was a descriptive retrospective hospital records based study. The mean value of patients age and frequencies of other data were analyzed by Statistical Package for Social Science (SPSS Inc, Chicago, IL., USA ) version 10 statistic software.

**Results.** Among the 14,300 records, 778 cases of anthracofibrosis, or simple plaques of anthracosis were detected. Anthracosis that was manifested by simple plaques was found in 487 patients, and anthracofibrosis in 291 patients (37.4%). The patients comprised 399 men (51.3%), and 379 women. The age range from 25-80 years (mean of 63 years). Of the female patients, 373 (98.4%) were recorded as having been housewives throughout their lives with no history of other occupations. Of the male patients, 164 (40.6%) were farmers, and 118 (29.6%) were manual workers. Only 30 male patients had a history of working in mining, and therefore exposed to a risk of occupational anthracosis. Other occupations reported by male patients include: different kinds of office worker (n=33), well diggers (n=13), builders (n=11), bakers (n=8), and various others (n=220). Farmers and manual workers had no history of changing jobs. The majority of females reported that they were housewives (86.4%). All the male farmers lived in rural areas. More than 86% of the manual workers lived in rural areas, or had previously been rural dwellers who had migrated to urban areas. The most common presenting complaints of the patients in our series were productive cough (83.6%), and dyspnea (35.7%). Hemoptysis was seen in 20.1% of cases, and nonspecific chest pain in 5.5%. Twenty-seven patients (3.5%) had no symptoms, and bronchoscopy was performed for the evaluation of abnormal screening radiographs. Except for 31 patients, all had abnormal findings on chest radiography. Radiological findings were variable. They included focal consolidation, a diffuse reticular pattern, segmental or lobar atelectasis, a diffuse nodular pattern, and mass lesions (Table 1). The principal finding on bronchoscopic examination was anthracotic pigmentation of the bronchial mucosa with, or without narrowing of the bronchial lumen. The most common site of involvement in the disease process was the bronchus of the right middle lung lobe (Table 2).

**Table 1** - Radiographic findings on plain radiography in 778 patients with anthracosis and anthracofibrosis.

<table>
<thead>
<tr>
<th>Radiologic findings</th>
<th>n</th>
<th>(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal radiograph</td>
<td>31</td>
<td>(4)</td>
</tr>
<tr>
<td>Focal consolidation</td>
<td>390</td>
<td>(50.1)</td>
</tr>
<tr>
<td>Diffuse reticular pattern</td>
<td>218</td>
<td>(28)</td>
</tr>
<tr>
<td>Atelectasis</td>
<td>64</td>
<td>(8.2)</td>
</tr>
<tr>
<td>Diffuse nodular pattern</td>
<td>37</td>
<td>(4.7)</td>
</tr>
<tr>
<td>Mass lesion</td>
<td>25</td>
<td>(3.2)</td>
</tr>
<tr>
<td>Bilateral involvement</td>
<td>223</td>
<td>(28.7)</td>
</tr>
</tbody>
</table>
Table 2 - Findings on bronchoscopic examination of patients.

<table>
<thead>
<tr>
<th>Bronchoscopic findings</th>
<th>n</th>
<th>(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lobar bronchus pigmentation</td>
<td>647</td>
<td>(83.2)</td>
</tr>
<tr>
<td>Main bronchus pigmentation</td>
<td>288</td>
<td>(37)</td>
</tr>
<tr>
<td>Segmental bronchus pigmentation</td>
<td>272</td>
<td>(35)</td>
</tr>
<tr>
<td>Tracheal involvement</td>
<td>3</td>
<td>(0.38)</td>
</tr>
<tr>
<td>Bronchial narrowing</td>
<td>227</td>
<td>(29.2)</td>
</tr>
<tr>
<td>Bronchial obstruction</td>
<td>64</td>
<td>(8.2)</td>
</tr>
<tr>
<td>Bilateral involvement</td>
<td>486</td>
<td>(62.5)</td>
</tr>
<tr>
<td>Unilateral lung involvement</td>
<td>289</td>
<td>(37.1)</td>
</tr>
</tbody>
</table>

Discussion. The terms anthracosis and anthracofibrosis are used to describe conditions seen in coal miners. The prevalence of these disease patterns was reduced in developed countries, but according to the experiences of many pulmonologists in developing countries, these conditions are widespread, and are not associated only with occupational exposure to coal. According to the findings of our study, anthracotic plaques had a prevalence of 5.4% in patients who underwent routine diagnostic bronchoscopy. Mirsadraee et al. found anthracosis in 21% of patients who underwent diagnostic bronchoscopy. Chung et al. reported anthracofibrosis in 3.1% of patients who had routine bronchoscopy, and Lee et al. described the clinical features of 114 patients with bronchial anthracofibrosis that was not associated with tuberculosis. All these reports were from Asia. Other reports from developing countries have also been published. In contrast, Wynn et al. found one case of anthracosis per 1000 bronchoscopy procedures performed. Other reports from North America and Europe are case reports.

We were unable to identify the risk factors for the conditions in our patients as the study comprised a retrospective review of the hospital records. However, comparison of our results with those from other reports may allow the development of causal hypotheses. More than 93% of all the female patients were housewives who lived in rural areas, and as many as 40% of males were farmers who inhabited rural areas. The vast majority of low paid manual workers in our region are poor people who live in the countryside, or are past rural dwellers who have migrated to the city.

Wood is the main fuel that is used for heating, cooking, and baking in Iranian villages, and almost all rural houses lack a ventilation system. As a result, inhalation of wood smoke and particles that are released from combustion of biomass fuel, may affect both men and women inside the house in rural areas. Other reports have discussed the correlation between the use of biomass fuel in rural areas and the prevalence of both anthracosis and anthracofibrosis. Amoli et al. described 10 Iranian female patients with anthracosis who had an apparent history of baking bread over wood fires. Torun et al. described 27 patients with anthracofibrosis who had a history of prolonged exposure to wood smoke, and no occupational history of exposure to coal. Finally, Sandoval et al. reported a correlation between exposure to biomass fuel and anthracosis. The preponderance of female patients with anthracosis in other reports explained the exposure of women to wood smoke. In some reports, this condition is known as a disease of elderly women that mainly involves those who are exposed to biomass fuel. The use of wood as a fuel is commonplace in other developing countries. Many publications have highlighted the adverse effects of combustion of wood on the respiratory systems of women who work in the home. It was not possible in our study to establish the origin of the anthracotic plaques, and a correlation between occupation and anthracofibrosis or anthracosis. However, the demographic properties of our patients, and the results of the previously mentioned studies allow us to surmise that combustion of biomass fuel is a risk factor for the development of these 2 diseases. Moreover, the finding of only 30 male patients that had an apparent history of working in mines, supports the hypothesis that factors other than occupation have a role in the pathogenesis of these conditions. Comparison with other patients who underwent bronchoscopy was not one of the aims of the study.

In conclusion, anthracosis and anthracofibrosis are neglected conditions common in patients who underwent routine bronchoscopy, particularly in developing countries. Given the demographic properties of our patients and a review of other reports from developing countries, exposure to biomass fuel combustion in rural areas is a possible risk factor for the conditions described herein. Epidemiological investigations, including case control studies are required to identify the main risk factors and mechanisms of these diseases.

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References


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