

Anthracosis and anthracofibrosis

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ABSTRACT

الأهداف: تحديد السمات الإشعاعية السريرية والتنظير الشعبي و لوصف إصابات المجموعة الكبرى من المرضى بالفحام الذي تم رفع تقارير بالإصابة به من قبل.

الطريقة: تم اعتبار جميع المرضى الذين خضعوا لتنظير الشعب المرين بالمستشفيات الإيرانية - مستشفى إمام - طهران، و مستشفى توحيد - سنندج - طهران - إيران، خلال الفترة ما بين أبريل 1982 إلى يونيو 2006م مشمولين في هذه الدراسة. تم تسجيل البيانات الجغرافية السكانية والسريرية والنتائج الإشعاعية للمرضى المصابين بالفحام والتليف الفحمي.

النتائج: من بين 14300 مريض تبين وجود 487 حالة مصابة بالفحام و 291 حالة مصابة بالتليف الفحمي. من بين النساء بلغت نسبة 98.4% من ربات المنازل و 86.4% عشن في مناطق ريفية، من بين الذكور بلغت نسبة 40.6% كانوا مزارعين، و 29.6% كانوا عمال يدويين و 7.5% كانوا عمال مناجم. خضع 96% من المرضى لأشعة الصدر والبطن. عند الفحص بتنظير الشعب، تبين وجود إصابة شعبية على الجانبين لدى 62.5% من المرضى. تم تقييد الحالة إلى الرغامي لدى 0.38% من المرضى. كانت القصبة الهوائية الرئيسية من الشعب الرئيسية المصابة لدى 37% و الشعب الفصي لدى 83.2% والقصبات القطعية 35%. تمت ملاحظة الضيق الشعبي لدى 37.4% من المرضى.

خاتمة: تعتبر حالات الفحام والتليف الفحمي حالات مهمة والتي ليست من النتائج غير الشائعة في فحص التنظير الشعبي الروتيني. يعتبر إعطاء نتائج عن السكان ومراجعة تقارير الدول النامية والتعرض لاحتراق الوقود الحيوي في المناطق الريفية كعامل خطر محتمل.

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.¹ The term "anthracofibrosis" was coined to describe bronchial stenosis, and deformity combined with overlying anthracotic mucosa.² 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.³⁻⁶ Bronchial tuberculosis is another likely cause of the development of anthracofibrosis.^{2,7,8} However, some investigators have found that there is no correlation of this condition with active tuberculosis.⁹⁻¹¹ An association with domestic pollution has been reported.¹² Other environmental factors such as cigarette smoke, air pollution, and mixed mineral dust are known to cause anthracosis.¹³⁻¹⁶ Only 3 published reports have described the clinical features of large numbers of patients with anthracofibrosis.^{2,6,8} Other reports described etiological factors,^{3,5,10} or are limited case reports,^{11,17-19} or described the findings of computed tomography scans performed on patients.^{8,20,21} 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 features 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.

Radiologic findings	n	(%)
Normal radiograph	31	(4)
Focal consolidation	390	(50.1)
Diffuse reticular pattern	218	(28)
Atelectasis	64	(8.2)
Diffuse nodular pattern	37	(4.7)
Mass lesion	25	(3.2)
Bilateral involvement	223	(28.7)

Table 2 - Findings on bronchoscopic examination of patients.

Bronchoscopic findings	n	(%)
Lobar bronchus pigmentation	647	(83.2)
Main bronchus pigmentation	288	(37)
Segmental bronchus pigmentation	272	(35)
Tracheal involvement	3	(0.38)
Bronchial narrowing	227	(29.2)
Bronchial obstruction	64	(8.2)
Bilateral involvement	486	(62.5)
Unilateral lung involvement	289	(37.1)

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 al¹⁰ found anthracosis in 21% of patients who underwent diagnostic bronchoscopy. Chung et al² reported anthracofibrosis in 3.1% of patients who had routine bronchoscopy, and Lee et al⁹ 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.^{3,5} In contrast, Wynn et al¹¹ found one case of anthracosis per 1000 bronchoscopy procedures performed. Other reports from North America and Europe are case reports.^{8,10}

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. Amoli³ described 10 Iranian female patients with anthracosis who had an apparent history of baking bread over wood fires. Torun et al⁵ 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 al⁴ 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.²²⁻²⁵ 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

1. Naeye RL. The pneumoconiosis: coal worker pneumoconiosis. In: Saldana MJ, editor. Pathology of pulmonary disease. Philadelphia (PA): JB Lippincott; 1994. p. 369-385.
2. Chung MP, Lee KS, Han J, Kim H, Rhee CH, Han YC, et al. Bronchial stenosis due to anthracostenosis. *Chest* 1998; 113: 344-350.

3. Amoli K. Bronchopulmonary disease in Iranian housewives chronically exposed to indoor smoke. *Eur Respir J* 1998; 11: 659-663.
4. Sandoval J, Salas J, Martinez-Guerra ML, Gómez A, Martinez C, Portales A. Pulmonary arterial hypertension and corpulmonale associated with chronic domestic woodsmoke inhalation. *Chest* 1993; 103: 12-20.
5. Torun T, Gungor G, Ozmen I, Maden E, Bolukbasi Y, Tahaoglu K. Bronchial anthracostenosis in patients exposed to biomass smoke. *Turkish Respiratory Journal* 2007; 8: 48-51.
6. Kim YJ, Jung CY, Shin HW, Lee BK. Biomass smoke induced bronchial anthracofibrosis: presenting features and clinical course. *Respir Med* 2009; 103: 757-765.
7. Kim JY, Park JS, Kang MJ, Kim HY, Han SA, Lee J, et al. Endobronchial anthracofibrosis is causally associated with tuberculosis. *Korean Journal of Internal Medicine* 1996; 51: 351-357.
8. Long R, Wong E, Barrie J. Bronchial anthracofibrosis and tuberculosis: CT features before and after treatment. *AJR Am J Roentgenol* 2005; 184 (Suppl 3): S33-S36.
9. Lee HS, Maeng JH, Park PG, Jang GJ, Park W, Ryu DS, et al. Clinical features of simple bronchial anthracofibrosis which is not associated with tuberculosis. *Tuberc Respir Dis* 2002; 53: 510-518.
10. Mirsadraee M, Saeedi P. Anthracosis of lung: evaluation of potential underlying causes. *Journal of Bronchology & Interventional Pulmonology* 2005; 12: 84-87.
11. Wynn GJ, Turkington PM, O'Driscoll BR. Anthracofibrosis, bronchial stenosis with overlying anthracotic mucosa: possibly a new occupational lung disorder: a series of seven cases from one UK hospital. *Chest* 2008; 134: 1069-1073.
12. Mulliez P, Billon-Galland MA, Dansin E, Janson X, Plisson JP. [Bronchial anthracosis and pulmonary mica overload] *Rev Mal Respir* 2003; 20: 267-271. French.
13. Boespflug MD, Bourlière-Najean B, Panuel M, Petit P, Doucet V, Gentet JC, et al. Pulmonary anthracosis in children. *Eur Radiol* 1999; 9: 485-486.
14. Castranova V, Vallyathan V. Silicosis and coal workers' pneumoconiosis. *Environ Health Perspect* 2000; 108 (Suppl 4): 675-684.
15. Grobbelaar JP, Bateman ED. Hut lung: a domestically acquired pneumoconiosis of mixed aetiology in rural women. *Thorax* 1991; 46: 334-340.
16. Naccache JM, Monnet I, Nunes H, Billon-Galland MA, Paireon JC, Guillon F, et al. Anthracofibrosis attributed to mixed mineral dust exposure: report of three cases. *Thorax* 2008; 63: 655-657.
17. Bilici A, Erdem T, Boysan SN, Acbay O, Oz B, Besirli K, et al. A case of anthracosis presenting with mediastinal lymph nodes mimicking tuberculous lymphadenitis or malignancy. *Eur J Intern Med* 2003; 14: 444-446.
18. Kala J, Sahay S, Shah A. Bronchial anthracofibrosis and tuberculosis presenting as a middle lobe syndrome. *Prim Care Respir J* 2008; 17: 51-55.
19. Bircan HA, Bircan S, Oztürk O, Ozyurt S, Sahin U, Akkaya A. Mediastinal tuberculous lymphadenitis with anthracosis as a cause of vocal cord paralysis. *Tuberk Toraks* 2007; 55: 409-413.
20. Kim HY, Im JG, Goo JM, Kim JY, Han SK, Lee JK, et al. Bronchial anthracofibrosis (inflammatory bronchial stenosis with anthracotic pigmentation): CT findings. *AJR Am J Roentgenol* 2000; 174: 523-527.
21. Park HJ, Park SH, Kim YK, Lee KY. CT differentiation of anthracofibrosis from endobronchial tuberculosis. *AJR Am J Roentgenol* 2008; 191: 247-251.
22. Ekici A, Ekici M, Kurtipek E, Akin A, Arslan M, Kara T, et al. Obstructive airway diseases in women exposed to biomass smoke. *Environ Res* 2005; 99: 93-98.
23. Sezer H, Akkurt I, Guler N, Marakoglu A, Berk S. A case-control study on the effect of exposure to different substances on the development of COPD. *Ann Epidemiol* 2006; 16: 59-62.
24. Albalak R, Frisnacho AR, Keeler GJ. Domestic biomass fuel combustion and chronic bronchitis in two rural Bolivian villages. *Thorax* 1999; 54: 1004-1008.
25. Orozco-Levi M, Garcia-Aymerich J, Villar J, Ramirez-Sarmiento A, Antó JM, Gea J. Wood smoke exposure and risk of chronic obstructive pulmonary disease. *Eur Respir J* 2006; 27: 542-546.

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