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Relationship between Bronchial Anthracofibrosis and Pulmonary Tuberculosis: Autopsy Findings

MOHAMMADALI EMAMHADI[1], BABAK MOSTAFAZADEH[1*], MOHAMMADREZA MASJEDI[2], MOSLEM BAHADORI[3], and GITA SHAFIEE[4]

1Department of Forensic Medicine & Toxicology, Shahid Beheshti University of Medical Sciences, Tehran-Iran; [2]Masih Daneshvari Hospital, National Research Institute of Tuberculosis and Lung Diseases (NITLD), Shahid Beheshti University of Medical Sciences, Tehran-Iran; [3]Masih Daneshvari Hospital, National Research Institute of Tuberculosis and Lung Diseases (NITLD), Shahid Beheshti University of Medical Sciences, Tehran-Iran; [4]Farzan Clinical Research Institute, Tehran, Iran.

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ABSTRACT

The purpose of this study was to evaluate the characteristics of anthracofibrosis and the relationship between bronchial anthracofibrosis (BAF) and tuberculosis during autopsy in the Iranian Legal Medicine Organization (LMO). In this cross-sectional study, 385 subjects who had died from 2007 to 2010 were examined. A questionnaire having information such as the deceased's age, sex, ethnicity, smoking status and occupation was filled out for each subject. Subjects in whom autopsied lungs revealed definite obligation, edema, bronchial stricture and dark pigmentation within mucosa were considered to have anthracofibrosis. Pulmonary tuberculosis was considered with typical granulomatous in bronchial biopsy or smear positive. During the 4-year period, we evaluated 385 cases, 48(12.5%) of whom had BAF. Of these, 60.4% were female. Mean age of subjects with anthracofibrosis was 67.08±8.4 yr. Pulmonary tuberculosis was demonstrated in 24 (50%) of cases with BAF. According to bronchi features, the anatomical distribution of BAF in 60.4% cases was multiple. Anthracofibrosis more commonly occurred in right middle lobe bronchus (47.92%). This study revealed a significant correlation between BAF and pulmonary tuberculosis (*P*=0.001). So, BAF is one of the infrequent symptoms of pulmonary tuberculosis. In patients with anthracofibrosis and pulmonary symptoms, TB would be taken into consideration.

Keywords: *Anthracofibrosis, Pulmonary tuberculosis, Autopsy*

INTRODUCTION

Bronchial anthracofibrosis (BAF) is a clinical entity characterized by proximal airway narrowing or obliteration and development of dark pigmentation (anthracosis) on airways and bronchial [1-2]. These damages appear in patients with or without a history of occupational dust exposure [3-4]. Most patients with BAF have had no exposure to the industry and no history of smoking; however, several studies reported the association between BAF and pulmonary tuberculosis (PTB) during autopsy and bronchoscopy, especially in women possibly exposed to wood smoke [5-6]. It seems, biomass combustion products can impair innate immune defense mechanisms [7-8]. The risk of TB in coal miners with anthracosis, was greater than that in the general population [6]. While, no association was found between BAF and PTB [9]. So, this relationship between anthracosis and tuberculosis has been inconsistent.

As pulmonary tuberculosis is one of the most important health problems in developing countries

*** Corresponding author:** Babak Mostafazadeh, E-mail: swt_f@yahoo.com

Table 1. Characteristics of subjects with anthracofibrosis and without anthracofibrosis

Subjects	With anthracofibrosis n (%)	Without anthracofibrosis n (%)	*p* value
Number (%)	48(12.5)	337(87.5)	0.2
Age (yr)	67.08±8.40	48.69±4.23	0.002
Sex			
Male	19(39.6)	197(58.5)	0.01
Female	29(60.4)	140(41.5)	
Smoker	10(20.8)	117(34.7)	0.07
Ethnicity			
Iranian	40(83.3)	249(73.9)	0.2
Others	8(16.7)	88(26.1)	
Occupation			
Housekeeper	26(54.2)	158(46.9)	0.09
Employee	8(16.7)	0(0)	
Baker	4(8.3)	92(27.3)	
Others	10(20.8)	87(25.8)	

especially in Asia, so, knowing the risk factors and conditions associated with the disease, is important. Anthracofibrosis has been reported in Asia as a complication of TB. So, in patients with anthracofibrosis and pulmonary symptoms, pulmonary TB should be considered [10].

The aim of this study was to evaluate the characteristics of anthracofibrosis and the relationship between BAF and pulmonary tuberculosis during autopsy in the Iranian Legal Medicine Organization.

MATERIALS AND METHODS

The Ethics Committee at Massih Daneshvari Hospital and Iranian Legal Medicine Organization (LMO) Tehran, Iran conducted this study to assess the characteristics of anthracofibrosis and the relationship between BAF and tuberculosis during autopsy.

Given an, α level 0.05 and a power of 90 percent, the sample size required was estimated to be 385 subjects. The rotten corpses, unknown corpses, and cadavers without aware family that leads to less information were excluded. Basic demographic data such as the deceased's age, sex, ethnicity, smoking status, and occupation were recorded from relatives. Both gross and histological findings at autopsy were recorded. Subjects in whom autopsied lungs revealed definite obligation, edema, bronchial stricture and dark pigmentation within mucosa were considered to have anthracofibrosis.

The samples were fixed with 10% formalin and sent to LMO Pathology ward. Most typical granulomas in the lung are caused by mycobacterial or fungal infection. The noninfectious causes of granulomatous lung disease are sarcoidosis, Wegener granulomatosis, hypersensitivity pneumonitis, aspiration pneumonia, and talc granulomatosis [11]. Pulmonary tuberculosis was considered with typical granulomatous in bronchial biopsy or smear positive. So, samples were sent to the LMO laboratory for acid fast staining. In case of observing acid fast bacilli in the high power field, it was considered as smear positive.

Statistical analysis

All data are presented as mean±SD, and frequency, where appropriate. Significant differences in general characteristics determined by Chi-square and student *t* test. SPSS for Windows (version 16; SPSS Inc., Chicago, ILL.) was used for data analyses and *p*-values < 0.05 were considered statistically significant.

RESULTS

Three hundred and eighty five subjects ≥ 20 years who had died from 2007 to 2010 enrolled in the study, out of which, 48(12.5%) showed anthracofibrosis. The mean age was 67.08±8.4 years. As shown in Table 1 there was no significant difference between subjects with anthracofibrosis and without anthracofibrosis in mean age, smoking, ethnicity and occupation. However, the prevalence of anthracofibrosis in women was more than those in men (60.4% vs. 39.6%, p=0.01). Table 2 shows pulmonary findings in two groups. In regard to pulmonary findings, involvements of mediastinal lymph nodes (43.75%), hilar lymph nodes (18.75%) and both mediastinal as well as hilar lymph nodes (29.17%) were the common findings in subjects with anthracofibrosis (p<0.001). In addition, the prevalence of pulmonary tuberculosis in cases with bronchial anthracofibrosis was 50%. While, this rate was 34.42% in subjects without anthracofibrosis. This difference was statistically significant (p=0.002).

As for bronchi features, anthracofibrosis was more commonly occurred in right middle lobebronchus (47.92%), right upper lobar bronchus (18.75%), and left upper lobe bronchus (14.58%), respectively. Moreover, the anatomical distribution of anthracofibrosis in 60.4% cases was multiple and 39.58% cases were single (Table 3).

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Table 2. Pulmonary findings in subjects with anthracofibrosis and without anthracofibrosis

Lung functions	With anthracofibrosis n (%)	Without anthracofibrosis, n (%)	*p* value
Pulmonary fibrosis	33(68.75)	190(56.38)	0.2
Pleural adhesion	43(89.58)	232(68.84)	0.09
Lymph nodes involvement			
Mediastinal lymph nodes	21(43.75)	35(10.38)	<0.001
Hilar lymph nodes	9(18.75)	21(6.23)	
Mediastinal & Hilar lymph nodes	14(29.17)	22(6.53)	
Without lymph nodes involvement	4(8.33)	259(76.85)	
Pulmonary tuberculosis	24(50)	116(34.42)	0.002

Data was shown as n (%) with *p* value according to chi-square

DISCUSSION

This study showed that the rate of anthracofibrosis was high in subjects during autopsy (12.5%), and this disease is one of the most common pulmonary diseases occurring in Iran.

Anthracofibrosis is a condition of bronchial luminal narrowing or obligation with dark pigmentation of the overlying mucosa [1-2].

Previous studies of anthracofibrosis have been in Asians, mostly in elderly women with no history of smoking [1-3]. According to a study by Chung et al. in Korea, most patients with anthracofibrosis were non-smokers with a history of wood smoke exposure. Carbon, asbestos and sedimentation of silica particles were reported in lung tissue from patients with anthracofibrosis [1]. Rivera et al. reported that biomass smoke produces more fibrosis and pigmentation than cigarette smoke, possibly due to mineral particles [12]. High levels of biomass burning or environmental exposure were responsible for airway pigmentation and at times narrowing, particularly in poorly ventilated conditions [3, 13, 14]. Although, we could find no correlation between occupation and anthracofibrosis, pulmonary fibrosis in the same involved bronchi was seen in about 70% cases.

Several studies have demonstrated a strong association between BAF and pulmonary tuberculosis [10, 15, 16], suggesting a causal role of TB for development of bronchial anthracofibrosis. Our results show that a large proportion (50%) of cases of anthracofibrosis with tuberculosis found at autopsy are unexpected, and have not been diagnosed during life. It is still unclear that people with BAF are more susceptible to pulmonary TB or tuberculosis is one of the causes in development of anthracofibrosis.

Stenotic in bronchial anthracofibrosis are secondary to an exaggerated immunological response to tuberculosis antigens in the lymphatic or lung parenchyma [1, 2, 17]. In addition, anthracotic pigmentation has been observed to develop in the process of healing bronchoglandular TB and fibrotic reaction [18]. Chronic biomass exposure can impair immune and cellular defense mechanism of respiratory system and reduce the activity of macrophages, which might increase the risk for TB [19-22].

Prevalence of BAF was significantly higher in elderly women [3, 17]. This finding was consistent with our study. It might be due to high levels of biomass burning particles are presents in homes [23], and although endobronchial tuberculosis is common in young people [24], a fibrotic response is mostly elderly patients [1].

Because bronchial narrowing with distal obliteration and involved mediastinal lymph nodes suggest the possibility of a tumor, the recognition of anthracofibrosis is important to avoid invasive therapy [1]. In our study, multifocal involvement was common and supported the diagnosis of anthracofibrosis over malignancy. In addition, our results confirm previous studies [1, 25] the most commonly involved area was the right middle lobe bronchus. Kala et al. reported that the right middle lobe was predominantly involved in patient with anthracofibrosis and was frequently associated with TB. This patient had the history of prolonged wood smoke exposure [25].

To the best of our knowledge, this is the first study

Table 3. Bronchi features of subjects with anthracofibrosis

Bronchi features	Number	Percent
Type of involvement	19	39.58
Single	29	60.42
Multiple		
Involved bronchi	23	47.92
Right middle lobar bronchus	9	18.75
Right upper lobar bronchus	1	2.08
Right lower lobar bronchus	7	14.58
Left upper lobar bronchus	3	6.25
Left lower lobar bronchus	5	10.42

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in Iran, conducted to determine the characteristics of anthracofibrosis and the relationship between BAF and tuberculosis at autopsy.

In conclusion, our findings showed a significant correlation between BAF and pulmonary tuberculosis. So, BAF is one of the infrequent symptoms of pulmonary tuberculosis. The necessary evaluations of TB in all patients with anthracofibrosis and pulmonary symptoms should be performed. On the other hand, regarding that pulmonary tuberculosis is still one of the health problems of developing countries; information about its risk factors and co-existing conditions including anthracofibrosis in patients having pulmonary symptoms is suggested.

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REFERENCES

1. Chung MP, Lee KS, Han J, Kim H, Rhee CH, Han YC, Kwon OJ. Bronchial stenosis due to anthracofibrosis. *Chest* 1998; 113(2): 344–50.
2. Kim HY, Im JG, Goo JM, Kim JY, Han SK, Lee JK, Song JW. Bronchial anthracofibrosis (inflammatory bronchial stenosis with anthracotic pigmentation). *Am J Radiol* 2000; 174(2):523–7.
3. Kim Y J, Jung C Y, Shin H W, Lee B K. Biomass smoke induced bronchial anthracofi brosis: presenting features and clinical course. *Respir Med* 2009; 103(5): 757–65.
4. Ohshima S. Studies on pulmonary anthracosis. With special reference to the mineral constitution of intrapulmonary particulate pollutants in the human lung. *Acta Pathol Jpn* 1990; 40: 41- 9.
5. Aslani J, Ghanei J, Khosravi L. Association of Tuberculosis with Anthracosis, Baqiyatallah Hospital. *Tehran University Medical Journal* 2002; 60:460-4. (Persian)
6. Mosquera JA, Rodrigo L, Gonzálvez F. The evolution of pulmonary tuberculosis in coal miners in Asturias, northern Spain. An attempt to reduce the rate over a 15-year period, 1971-1985. *Eur J Epidemiol* 1994; 10(3): 291- 7.
7. Houtmeyers E, Gosselink R, Gayan-Ramires G, Decramer M. Regulation of mucociliary clearance in health and disease. *Eur Resp J* 1999; 13(5): 1177–88.
8. Fick R B Jr, Paul E S, Merrill W W, Reynolds H Y, Loke J S O. Alterations in the antibacterial properties of rabbit pulmonary macrophages exposed to wood smoke. *Am Rev Respir Dis* 1984; 129(1): 76–81.
9. Saeedi P, Mirsadraee M. Anthracosis of lung: evaluation of potential underlying causes. *J Bronchol* 2005; 12(2):84-7.
10. Najafizadeh K, Zahirifard S, Mohammadi F, Shah Ghasempour SH, Hasan Zadeh N, Dehnad A, Halvani A, Moezi HR, Kazempour Dizaji M, Masjedi MR, Farnia P. Bronchial Anthracofibrosis or Anthracotic Bronchitis. *Tanaffos* 2003; 2(8): 7-11.
11. Mukhopadhyay S, Gal AA. Granulomatous lung disease: an approach to the differential diagnosis. *Arch Pathol Lab Med* 2010; 134(5):667-90.
12. Rivera R M, Cosio M G, Ghezzo H, Salazar M, Pérez-Padilla R. Comparison of lung morphology in COPD secondary to cigarette and biomass smoke. *Int J Tuberc Lung Dis* 2008; 12(8):972–9.
13. Kulkarni N S, Prudon B, Panditi S L, Abebe Y, Grigg J. Carbon loading of alveolar macrophages in adults and children exposed to biomass smoke particles. *Sci Total Environ* 2005; 345(1-3): 23–30.
14. Pinkerton KE, Green FH, Saiki C, Vallyathan V, Plopper CG, Gopal V, Hung D, Bahne EB, Lin SS, Ménache MG, Schenker MB. Distribution of particulate matter and tissue remodeling in the human lung. *Environ Health Perspect* 2000; 108(11): 1063–9.
15. Kim J Y, Park J S, Kang M J, Yu CG, *Kim* YH, Han SG, et al. Endobronchial anthracofibrosis is causally associated with tuberculosis. *Korean J Intern Med* 1996; 51:351–7.
16. Mirsadraee M, Saeedi P. Anthracosis of lung: evaluation of potential underlying causes. *J Bronchol* 2005; 12(2): 84–7.
17. Long R, Wong E, Barrie J. Bronchial anthracofibrosis and tuberculosis: CT features before and after treatment. *Am J Radiol* 2005; 184:S33-S6.
18. Chung HS, Lee JH. Bronchoscopic assessment of the evolution of endobronchial tuberculosis. *Chest* 2000; 117(2):385–92.
19. Smith KR, Samet JM, Romieu I, Bruce N. Indoor air pollution in developing countries and acute lower respiratory infections in children. *Thorax* 2000; 55(6): 518- 32.
20. Delgado L, Parra E R, Capelozzi V L. Apoptosis and extracellular matrix remodeling in human silicosis. *Histopathology* 2006; 49(3): 283–9.
21. Thibodeau M, Giardina C, Hubbard A K. Silica-induced caspase activation in mouse alveolar macrophages is dependent upon mitochondrial integrity and aspartic proteolysis. *Toxicol Sci* 2003; 76(1): 91–101.
22. Shen H M, Zhang Z, Zhang Q F, Ong C N. Reactive oxygen species and caspase activation mediate silica-induced apoptosis in alveolar macrophages. *Am J Physiol Lung Cell Mol Physiol* 2001; 280(1): L10–L7.
23. International Institute for Population Sciences. National family health survey (MCH and Family Planning): India 1992–93. Bombay, India: IIPS, 1995.
24. Im JG, Song KS, Kang HS, Park JH, Yeon KM, Han MC, Kim CW. Mediastinal tuberculous lymphadenitis: CT manifestations. *Radiology* 1987; 164(1):115–9.
25. Kala J, Sahay S, Shah A. Bronchial anthracofibrosis and tuberculosis presenting as a middle lobe syndrome. *Prim Care Resp J* 2008; 17(1):51-5.

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