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## Bronchial Anthracosis and Pulmonary Tuberculosis

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### ABSTRACT

**Background:** Bronchial anthracosis is defined as appearance of multiple dark anthracotic pigmentations on large airway mucosa with or without airway narrowing or obliteration. Since there has been vague and controversy regarding the relationship between bronchial anthracosis and pulmonary tuberculosis, we conducted this study to shed light on this matter.

**Materials and Methods:** In this cross-sectional study, data was obtained from reviewing the files of 1,594 patients who underwent bronchoscopy in Afzalipour Hospital during 2003 to 2007. Those with dark pigmentation on their airways mucosa were considered as having bronchial anthracosis. During bronchoscopy, samples were collected from the airways in the form of bronchoalveolar lavage and then the smear and culture of these samples were examined for acid fast bacilli. Patients with both positive culture and smear and those with positive culture alone for acid fast bacilli were considered as having pulmonary tuberculosis.

**Results:** Of 1,594 cases studied in this research, 333 (20.8%) had bronchial anthracosis, out of which 158 (55.5%) were women. Risk of bronchial anthracosis was 0.4 times less in men (CI 95%=0.32-0.52) ( $p<0.001$ ). In other words, bronchial anthracosis had a significantly less prevalence among men. Also, risk of tuberculosis in people with bronchial anthracosis was 2.6 times more than that of healthy people (CI 95%= 1.48-4.75) ( $p<0.001$ ).

**Conclusion:** This research revealed a significant correlation between bronchial anthracosis and pulmonary tuberculosis. Therefore, performing necessary tests and follow-ups for pulmonary tuberculosis is necessary in cases that undergo bronchoscopy for any reason and those with bronchial anthracosis. (*Tanaffos* 2010; 9(2): 21-25)

**Key words:** Bronchial anthracosis, Pulmonary tuberculosis, Bronchoscopy

### INTRODUCTION

Anthracosis is a bronchoscopic finding characterized by development of dark pigments on airways and bronchial mucosa. They can result in

bronchial damage, metamorphosis and obliteration. Pathologically, these damages appear as a result of sedimentation of silica, carbon and asbestos particles in cytoplasm of mucosal and sub-mucosal cells as well as macrophages (1-3).

Ongoing trend of industrialization in recent years and presence of industrial pollutants like carbon, asbestos and silica in the air have resulted in changes

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in the pattern of occupational diseases. At present, anthracosis is considered as one of the most important occupational diseases, and in spite of its decreased prevalence in recent years especially in advanced countries like Japan and Netherlands, it is still the second most important occupational disease. Although in Netherlands, prevalence of this disease has decreased from 8.1 in 100,000 people to 7 in every 100,000 from 2004 to 2006(4,5), it still ranks second following the chronic diseases related to acoustic organs.

On the other hand, pulmonary tuberculosis is one of the most important health problems in developing countries, and has been introduced as a health hazard to these communities along with the incidence of AIDS. Since this disease is chronic and has a special treatment protocol, it imposes huge costs and expenses on the health systems every year.

Several researches have been carried out evaluating the relationship between anthracosis and tuberculosis during autopsy and bronchoscopy; however, in some cases the results have been inconsistent. A study performed by Aslani et al. revealed a strong correlation between anthracosis and pulmonary tuberculosis (6). In another study performed by Mosquera et al., it was shown that risk of tuberculosis in coal miners, who are more likely to have anthracosis, was 3 times greater than that in general population (7) while in another prospective study, no relationship was found between anthracosis and tuberculosis (8). In another study, risk of tuberculosis and non-tuberculosis pneumonia was reported to be higher in people with anthracosis (9). This makes the relationship between anthracosis and risk of tuberculosis more complex.

Considering the aforementioned controversies, we decided to carry out a research on the relationship between bronchial anthracosis and pulmonary tuberculosis.

## **MATERIALS AND METHODS**

In this cross-sectional study data was obtained from reviewing the files of 1,594 patients who underwent bronchoscopy in Afzalipour Hospital during 2003-2007.

These patients had various conditions ranging from chronic cough to abnormal findings on chest x-ray and hemoptysis and all underwent bronchoscopy due to the doctors' orders. All cases consented to this study. Their bronchoscopy was done by experts who were skillful at diagnosing bronchial anthracosis.

Bronchial anthracosis was characterized by dark pigmentations within airway mucosa found during bronchoscopy. Therefore, those with these dark pigmentations were considered as having bronchial anthracosis. All patients were anesthetized for bronchoscopy, and had oxygen support according to the related protocols.

Moreover, heart electric activity and arterial oxygen saturation were monitored and recorded continuously in patients using a pulse oximeter during bronchoscopy. The result of laboratory tests was also extracted from patients' files to help us examine them for pulmonary tuberculosis. All patients underwent BAL sampling during bronchoscopy. Then, samples were sent to the laboratory for culture and acid fast staining. Smears of these samples were examined for acid fast bacilli; in case of observing acid fast bacilli on the high power field, the case was considered as smear positive. Afterwards, the samples were cultured in Lowenstein - Jensen medium for at least two months. After that, the colonies resulted from bacterial growth in this medium were examined for acid fast bacilli using optical microscope and high power field and the result was recorded in patient's file. People with both positive culture and smear or with positive culture alone for acid fast bacilli were placed in the

group of pulmonary tuberculosis patients. During these studies, the laboratory supervisor was completely unaware of the bronchoscopy results related to the samples and presence or absence of dark pigmentations on the airways mucosa.

Prior to the study, patients were informed regarding the research and their consent was obtained while completing the files. They were divided into two positive and negative groups in terms of having anthracosis and two positive and negative groups concerning pulmonary tuberculosis. Finally, Crude Odds Ratio (OR) was calculated using single-variable Logistic Regression test.  $P < 0.05$  was considered significant.

## RESULTS

In this research, files of 1,594 patients who underwent bronchoscopy in Afzalipour Hospital during 2003 to 2007 were studied out of which, 981 were men (61%) and 613 were women (49%). Patients were in the age range of 27 to 87 years. Among these patients, 333 had bronchial anthracosis including 158 women (55.5%) and 148 men (44.4%); that is, the prevalence of bronchial anthracosis in this study was 20.8 %. Risk and prevalence of bronchial anthracosis in men were 0.4 times less than those in women (CI95%=0.32-0.52) ( $P < 0.001$ ). This difference was statistically significant. Also, risk of tuberculosis in people with bronchial anthracosis was 2.6 times greater than that of healthy individuals (CI95%= 1.48-4.75).

Prevalence of tuberculosis in cases with bronchial anthracosis was 6.9%. This rate was 2.7% in cases without bronchial. Risk of tuberculosis in people with bronchial anthracosis was 2.6 times more than that in subjects without bronchial anthracosis (CI95%= 1.48-4.75). The correlation between bronchial anthracosis and pulmonary tuberculosis was statistically significant ( $P < 0.001$ ).

## DISCUSSION

This study showed a significant correlation between sex and anthracosis and also a meaningful relationship between anthracosis and tuberculosis. Prevalence of anthracosis was higher among women (more than 50%). Also, 6.9% of people with bronchial anthracosis had pulmonary tuberculosis, while only 2.7% of those without bronchial anthracosis had pulmonary tuberculosis. Logistic Regression test showed that risk of pulmonary tuberculosis in those with bronchial anthracosis was 2.6 times greater than in those without this condition.

According to a study by Kim et al., in Korea in 1996, most patients with bronchial anthracosis were old women with no history of smoking. These women usually lived in rural houses where kitchens were used as a place for cooking and heating. They used fuels like wood sticks, leaves and agricultural leftovers. These houses did not have good ventilation (10). Smoke resulted from burning of wood sticks consisted of a combination of gases and particles of different sizes. The reason why dark pigmentations appeared on bronchial mucosa was that these particles were trapped by epithelial cells and macrophages beneath the airway mucosa (11, 12).

In some studies, tuberculous lymphadenitis and intra-bronchial tuberculosis were considered as the cause of dark pigmentations; In other words, perforation of a tuberculous lymph node into the adjacent bronchi happens automatically and silently, and anthracotic dark materials trapped in lymph nodes next to bronchi find their way out to the bronchi. Following the process of healing and fibrotic reaction in the bronchi, anthracotic pigments appear and narrowing of the airways occurs (1,2,13).

Although bronchial tuberculosis in some patients is due to perforation of the lymph node into the adjacent bronchi and ingress of anthracotic materials into the bronchi, this pathologic manifestation is usually limited to one bronchus and is inconsistent as

several dark plaques appear in the airways of people with this disease; high prevalence of pulmonary tuberculosis in these patients is due to aging (old women) and changes in immune defense mechanisms as a result of inhalation of poisonous materials of wood smoke (11, 14).

Whether or not *Mycobacterium tuberculosis* is one of the main causes in development of bronchial anthracosis or that people with bronchial anthracosis are more susceptible to pulmonary tuberculosis are still unclear and further studies are required in this regard.

Study of Kim et al., on 54 patients with bronchial anthracosis showed that 33.9% of them had pulmonary tuberculosis (15). In their study, prevalence of bronchial anthracosis was significantly higher in women. This finding was consistent with that of our study. Higher prevalence of bronchial anthracosis in women might be due to some special activities they do like baking bread, cooking food with biomass fuel or carpet weaving.

Chung and his colleagues performed a study on 28 patients with bronchial anthracosis and reported that 39 to 61% of them had pulmonary tuberculosis as well (8 men and 20 women)(1).

In a study carried out on two female Indian immigrants in Canada with bronchial anthracosis, Long reported that both women had active pulmonary tuberculosis as well (16). Another study by Aslani et al. on 96 patients with bronchial anthracosis showed that 52 women (54.2%) and 44 men (45.8%) had TB and prevalence of pulmonary tuberculosis in this population was 27% (6).

Since this was a retrospective study and information related to patients including, history of smoking, occupation, history of exposure to natural pollutants like coal dust, and their life style had not been recorded, this study could not evaluate the effect of these factors on bronchial anthracosis and further studies are required in this field. Thus, single

variable tests were used in this study. It is recommended that the effect of other variables be considered in future studies. In this study, we used adjusted statistical tests and the effects of confounding variables were excluded.

This study had two strength points. Firstly, it had a larger sample size than other studies. Thus, the results are more reliable. Secondly, it compared pulmonary tuberculosis in both healthy individuals and those with bronchial anthracosis. To our knowledge, this comparison has not been performed by other studies.

In conclusion, bronchial anthracosis is mainly observed in old women complaining of cough, phlegm and dyspnea who mainly undergo bronchoscopy due to an old age and changes observed on their radiography and chest CT-scan in order to rule out bronchogenic carcinoma. Abnormal manifestation of pulmonary tuberculosis in these patients usually results in late diagnosis. This study found a significant correlation between bronchial anthracosis and pulmonary tuberculosis. Considering all the above, we recommend performing necessary tests and follow-ups for early diagnosis of pulmonary tuberculosis in these patients.

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