



Original Article

Study the risk of pulmonary tuberculosis among patients with bronchial anthracosis and non-anthracosis in rural Haryana: A case-control hospital-based study

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ABSTRACT

Anthracosis is caused by deposition of dark pigments in the tracheo-bronchial tree, which is inversely proportional to the amount of soot particle exposure in the prevailing atmosphere. Deposition is caused by iron, lead, cadmium, silica, phenol, hydrocarbon complexes. mainly exhibited the residents of coal miner and industrial areas. **Objectives:** 1. Study the prevalence of Pulmonary tuberculosis by analyzing BAL (Bronchoalveolar lavage) CBNAAT (Cartridge based nucleic acid amplification test) among cases with Bronchial anthracosis. 2. Study the risk of pulmonary tuberculosis among patients with bronchial anthracosis by estimating odd ratios. **Material & Method:** A case-control study was conducted in the Department of Respiratory Medicine, at BPS GMC (W), Delhi NCR region, where sputum negative suspected patients underwent bronchoalveolar lavage (BAL) and BAL was sent for CBNAAT for confirmation of tuberculosis. **Results:** Total of 1168 patients who were suspected of tuberculosis had undergone video bronchoscopy and BAL was taken. The average age of male/female in our study was 46.1 and 46.2 years. 14.5% among 96 anthracotic subjects and 7.3% among non anthracotic subjects were found to have tuberculosis through BAL Cbnaat, Odds ratio was 2.303 being CI 95% (1.246, 4.25) in our study. **Conclusion:** Anthracosis is a complication of Tobacco smoking as well as environmental pollution that have a deep impact on host immunity as per previous research and will increase the chance to develop chronic infection like tuberculosis in this part of the world. Present study will be helpful to execute the working guideline to control the triggering factor of pulmonary tuberculosis by taking measures in that direction.

Keywords: Anthracosis, Pneumoconiosis, Bronchial anthracofibrosis, Pulmonary Tuberculosis, Bronchoscope.

INTRODUCTION

Term anthracosis refers to the deposition of black pigments in the mucosal lung tissues (Fig 1), which is primarily derived from carbon, silica and other inhaled pollutants from the environment.¹ Grobbelaar et al coined the term “HUT-LUNG” in cases of chronic biomass fuel exposed patients.² Observation ranges from being simple deposition in the mucus to findings associated with tuberculosis and malignancy. Anthracosis damages the bronchial mucosa in turn leads to impaired / reduced ciliary clearance making the person more prone to infections viz. tuberculosis, malignancy, recurrent secondary infections.³ Many a times anthracosis is an incidental finding only to be observed during bronchoscopic procedures as mentioned in one of the study finding ranges from 3.4%-21% appearing as black plaques in mucosal tissues of diseased person.⁴

It is mainly caused due to the carbon silica and quartz particles and is predominantly found in coal miners.⁵ Deposition occurs mainly due to inhalation of air particles, direct exposure at work, indoor cooking, using fuels such as wood, charcoal, organic fertilizers, industrial workers and volcanic ash seen in people living near highly and frequently erupting volcanoes.⁶ as stated by the kim et al in their study the number of anthracotic patches & site varies from being single (48%) to multiple (52%) leading to bronchial narrowing in 6.67% of cases.⁷

Smoking is found to be the one of the most Important predisposing factor w.r.t increased frequency of anthracosis in patients as well as in rural population 55%-65% and in farmers specially ranging up to 40%.⁸ The term anthracosis was first described by Abraham et al in the year 1951 & as its progression leads to narrowing of the airway due to the deposition of particles leading to the development of anthracofibrosis, the term coined by Chung et al in the year 1988.^{9,10} various other terms have been proposed besides i.e. anthracotic bronchitis, anthracostenosis & bronchial anthracosis.¹¹ Overall prevalence of varies from population to population and depending upon the exposure which ranges from <1% to 22% in certain conditions in developing countries.¹² As the disease progress the patient presents with complains of cough, fever, breathlessness, lymphadenopathy and with hemoptysis at times.

As pulmonary tuberculosis is found to be more common in patients with anthracosis, especially in old healed & active cases, various theories have been proposed so patient exposed to mycobacterium tuberculosis especially in cases of tubercular lymphadenopathy when lymph node ruptures near the adjoining tracheo bronchial leading to the black pigmentation of mucosa and appear as inflammation and fibrosis upon histopathologic examination, subsequent & recurrent insult to tissue leads to microscopic molecular alterations favoring where approximate percentage ranges up to 23% in malignant cases associated with anthracosis.^{13,14,15} besides this as our study aims to find out the correlation between anthracosis and tuberculosis it has been found that pulmonary tuberculosis was found to be higher in anthracosis/anthracotic patients i.e. 17.6% & 4% and pulmonary tuberculosis in turn increases the chances of anthracosis by five folds. The study emphasizes correlating the association between anthracosis/anthracofibrosis (Fig 2 & Fig 3).

Figures:



Fig 1 anthracotic patch **Fig 2** anthracotic patch **Fig 3** Anthracotic patch at carina

Aim:

To study the risk of Pulmonary Tuberculosis among patients with Bronchial Anthracosis.

Objectives:

1. Study the prevalence of Pulmonary tuberculosis by analyzing BAL (Bronchoalveolar lavage) CBNAAT (Cartridge based nucleic acid amplification test) among cases with Bronchial anthracosis.

Study the risk of pulmonary tuberculosis among patients with bronchial anthracosis by estimating odd ratios.

MATERIALS AND METHODS

A case control study was conducted in the Department of Respiratory Medicine, at BPS GMC (W) Delhi NCR region, where sputum AFB & Cbnaat negative suspected patients underwent bronchoalveolar lavage (BAL) and BAL was sent for CBNAAT for confirmation of tuberculosis.

Inclusion criteria:

All sputum negative suspected cases (Radiological or symptomatic) of Pulmonary tuberculosis were included and compared in two groups viz. Group 1 consisted of patients with sputum and Cbnaat with anthracosis and Group 2 consisted of sputum and Cbnaat without anthracosis.

Exclusion Criteria:

1. Age less than 18 years.
2. Pregnant Women.
3. Contraindicated for fiber optic bronchoscopy.
4. Non cooperative.

5. Suspected case of Lung cancer.
6. Not given consent for the procedure.
7. HIV and Pregnancy.

RESULTS

Total of 1168 patients were included in the study, among them 65% were males and 35% were female patients (Table 1). who were suspected of tuberculosis had undergone video bronchoscopy. Average age of males and females in our study was 46.1% and 46.2% years, (14.5%) among 96 anthracotic subjects and 7.3% among non anthracotic subjects were found to have tuberculosis through BAL Cbnaat, Odds ratio was 2.303 being CI 95% (1.246, 4.25). We also observed a higher percentage of patients after 40 years of age comprising almost 59% cases as compared to 39 % cases in less than 40 years of age (Table 2,3). Hence, we can say that incidence was seen with increasing age which is risk factor with advancing age as described in the study by Ahmed K et al. ¹⁶ Constitutional symptoms like cough (16.52%/10.45%), weight loss (15.06%/11.21%), fever (13.61%/4.88%), expectoration (11.4%/4.02%), chest pain (4.79%/1.54%), diabetes mellitus (3.93%/1.54%) were observed in our patients, Table (4), striking similar symptoms cough ranging from 29% to 83.6%, dyspnea 90% to 100% cases, and various other symptoms viz. chest pain, unexplained weight loss, hemoptysis, enlarged mediastinal lymph nodes range of symptom varies from one study to another With respect to biomass exposure it was found that patients 35 % of males and 14.89%, (Table 5), of females were found to have anthracosis on bronchoscopic study as compared to 30% males and 19.69 females had non exposure to biomass in our study (Table 6).

Table 1

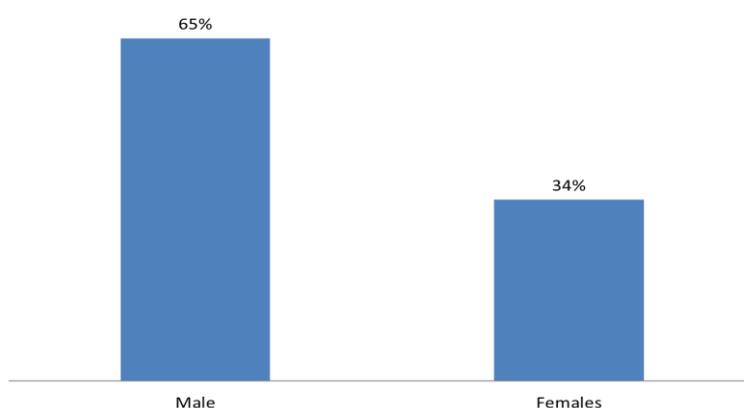


Table 2

Age Group Differentiation

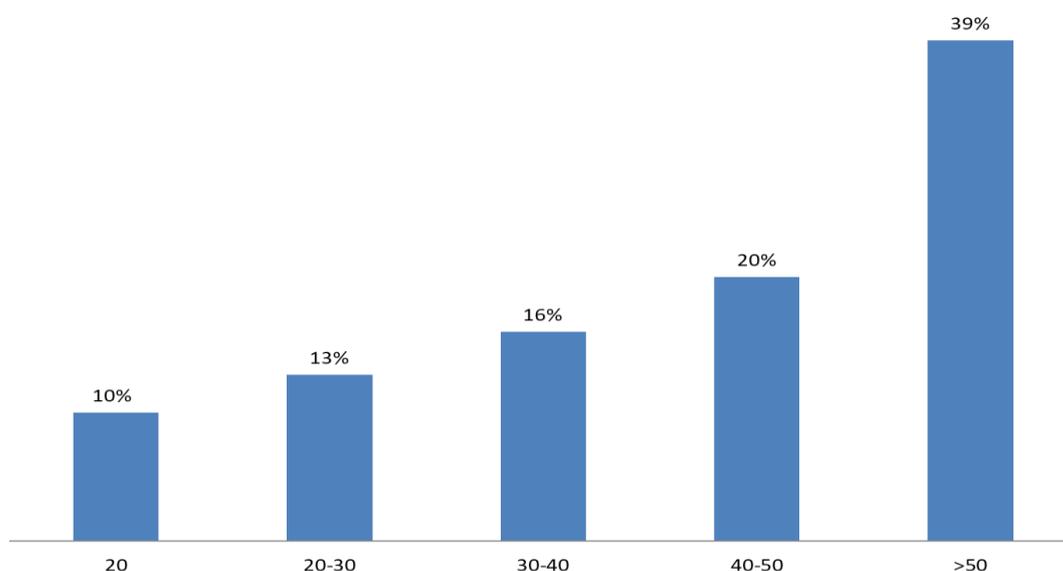


Table 3

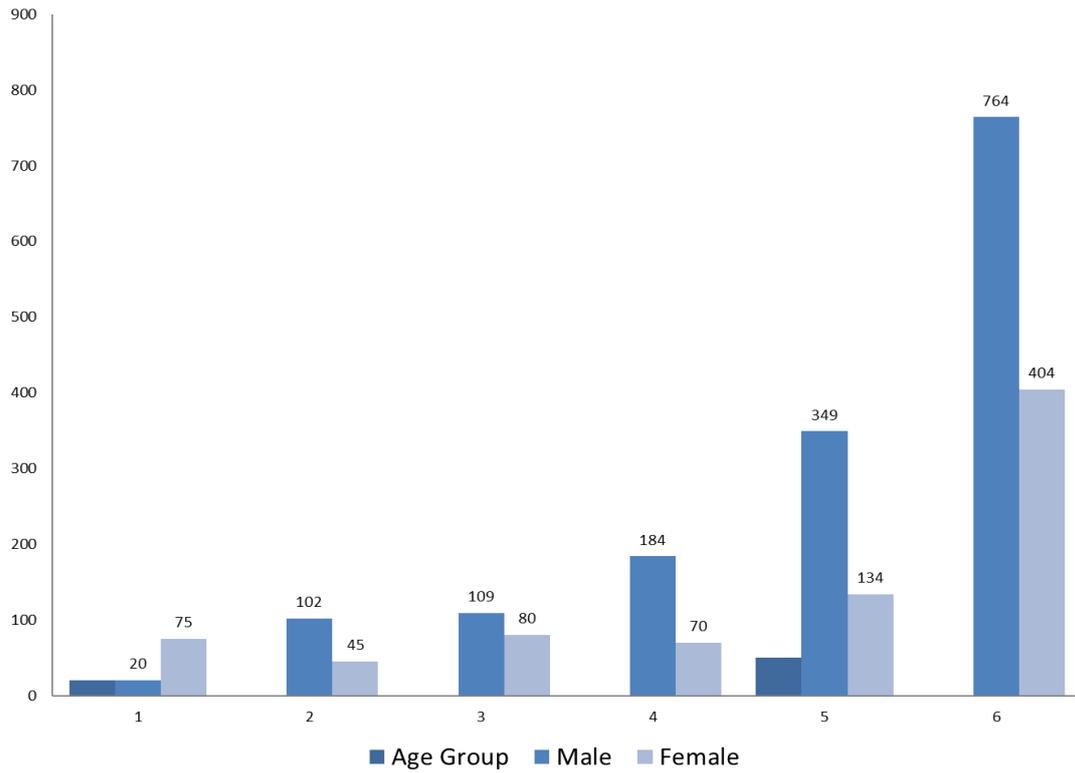


Table 4

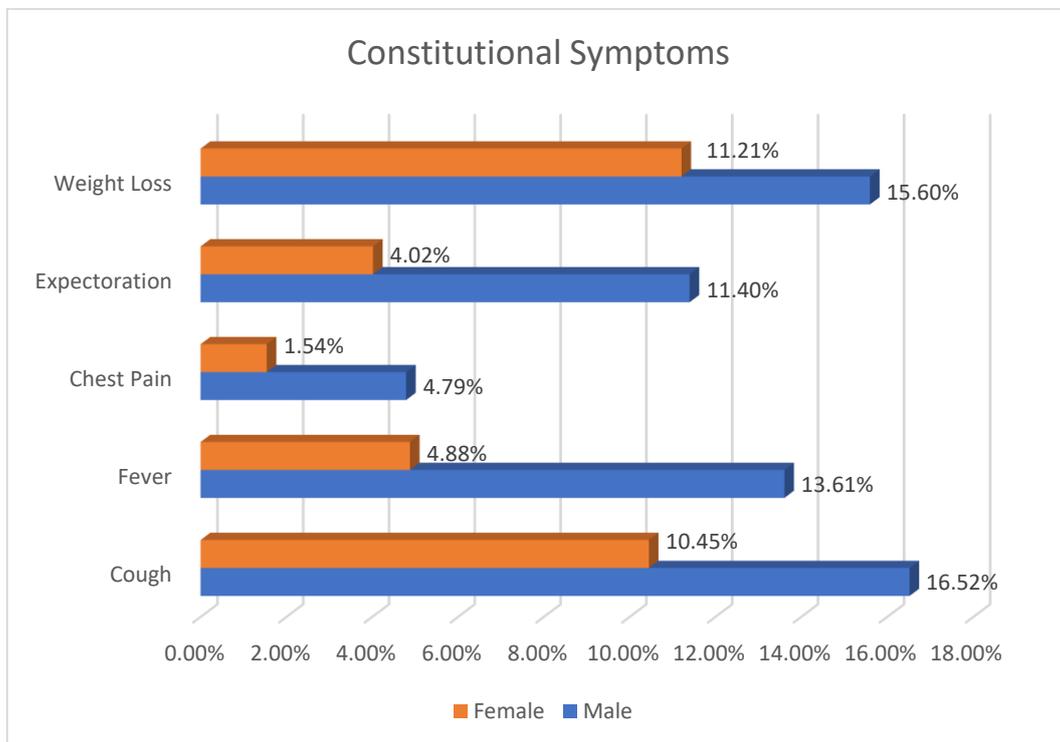


Table 5

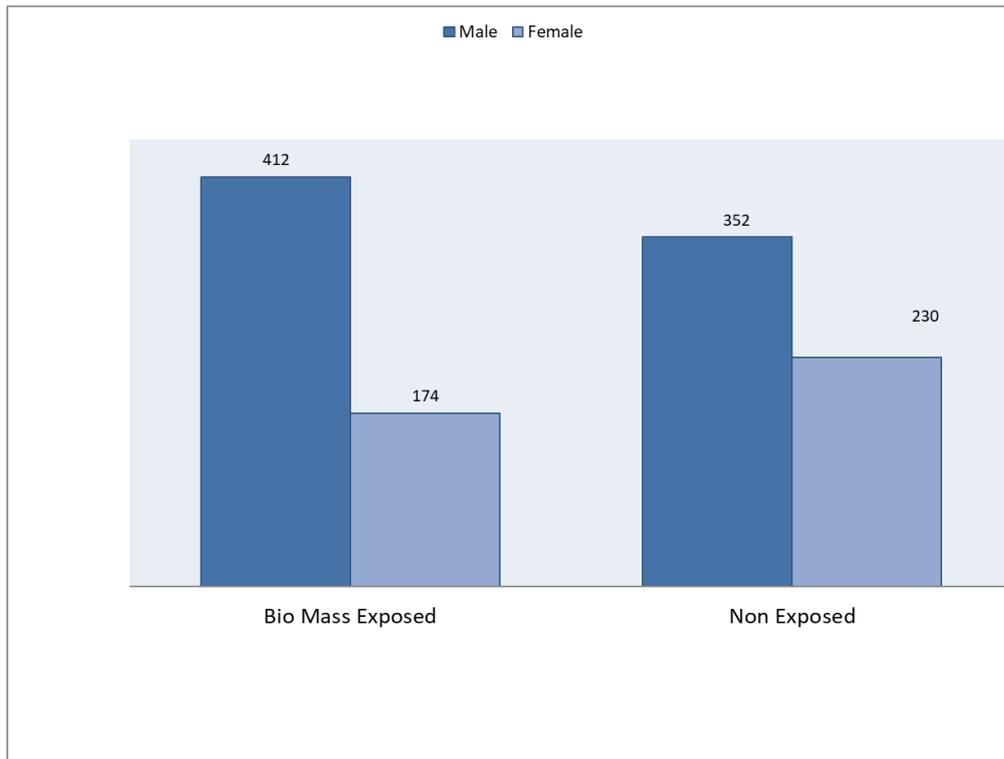
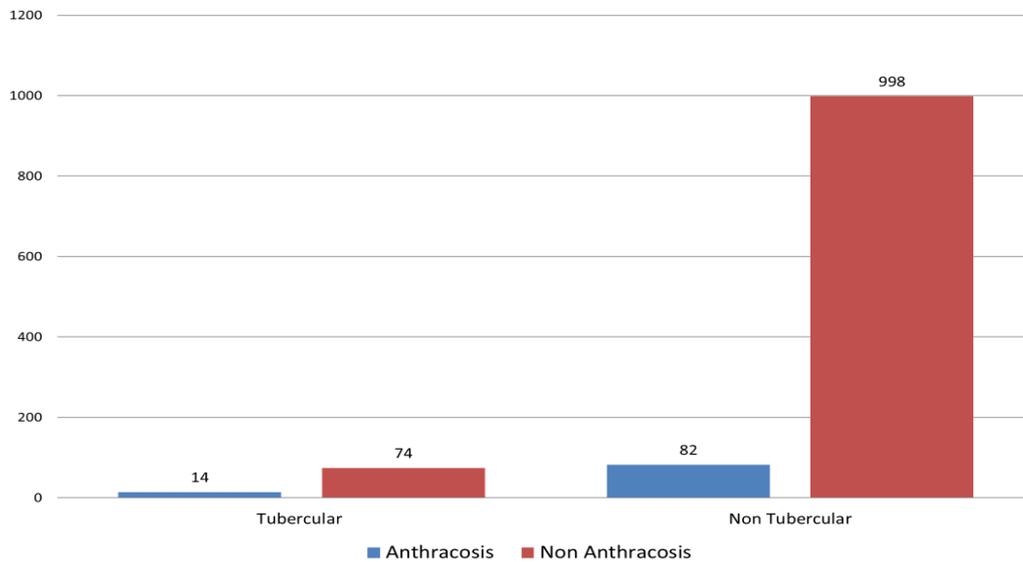


Table 6



DISCUSSION

Though anthracosis is said to be the disease of elderly but recent trends have shown the early predisposition owing to atmospheric pollution, wood smoke, smoke at workplace, biomass exposure, and leading to approx 1.07% fold risk of increase in anthracosis in developing countries,¹⁶ risk of tuberculosis in anthracotic subjects ranges from 5.9% to 57.8% which lies in accordance with 14.5% in or study where anthracotic subjects were found to have pulmonary tuberculosis.

anthracosis involves black pigmentation deposition in mucosal, sub mucosal layers and in parenchyma of the lung which not stays with deposition but further escalate to narrowing of the airway leading to anthracostenosis, the term first used by Torun et al. Hence as it causes widespread clinical manifestations, radiological signs, bronchoscopy and histopathological findings the term “ANTHRACOSIS SYNDROME” considered to be more appropriate, he also found that anthracofibrosis was more common in elderly patients than patient with endobronchial tuberculosis which causes luminal narrowing in the main and lobar bronchi.¹⁷ Two hypotheses have been proposed w.r.t anthracosis development, firstly a typical strain associated with East African Indian Family & central asian superfamily is evident, and these strains are even evident in middle eastern countries like Iran. The second hypothesis states that the hypoxic environment leads the bacteria to grow slowly in the bronchial wall mucosa owing to decreased protective mechanism by the body due to falling immunity, and fails to recognise the bacteria leading to its development. and in advanced stages it doesn't limits itself pulmonary system but involves other organs later exhibiting as malignancy in hepatic nodules, renal and esophageal cancers, spindle cell pseudotumor which can occur anywhere in the body.¹⁸

In our study the average age of male and female patients was found to be 46.1 % and 46.2% as compared to their study by saeid hoseinina et al where the average age was around 60.1 for both genders.¹⁹ 14 (14.5%) among 96 anthracotic subjects were found positive in BAL CBNAAT almost closing onto the study done by Majid M et al where the cumulative incidence was around 16% and in another study in south korea where 28 Of 17 i.e 61% of anthracotic patients were found to be positive for tuberculosis.^{20,21} In another theory of anthracofibrosis states that biomass fuels generates carbon monoxide, nitrogen oxide, organic hydrocarbons, and various other toxic composites ranging from size 5mm to 10mm in size, their deposition occur in two ways firstly they are being taken and engulfed by the macrophages and they remain there & secondly decreased, delayed and deficit mucociliary clearance, defective macrophage activity preventing clearance leads to their deposition in the bronchial epithelial cells mostly at branching portion of the bronchus leading to decreased clearance which over the time leads to further fibrosis the bronchial wall and the surrounding mediastinum causing the hypertrophy and narrowing of the lumen which hampers the decreased activity of antibacterial capability of macrophages contributing the development of pneumonia in these patients.²² Presence of silica particles in wood smoke significantly makes the patient more prone for tuberculosis due to the increased sensitivity of *M.tuberculosis* risk of which increases with the age and exposure to biomass smoke. Although various pathological activities take place in the patients but main pathological changes were intra- and extracellular deposition of black particles in stroma and epithelial cells.²³

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