

## **Research Article**

# **Risk of Severe Pulmonary Tuberculosis in Smokers and in Patients with COPD**

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**Abstract:** Tuberculosis is a major public health problem. Some patients present with minimal lesions where as others present with advanced lesions. This is a Case control study to identify the strength of associations between smoking and COPD and severity of disease. There were 80 cases and 80 controls. The study was done over a period of 18 months. In severe disease group 63.75% were smokers, but in patients with minimal lesions, 46.25% were smokers. COPD was present in 28.75% of the former group, whereas it was only 6.25% in patients with minimal lesions. Both univariate and multivariate analysis were done. Univariate analysis showed that both smoking and COPD were risk factors for the development of severe pulmonary tuberculosis. When these factors were analysed along with age by multivariate method, only COPD was found to be significant. COPD was found to be an independent risk factor for the development of severe forms of pulmonary tuberculosis.

**Keywords:** Pulmonary Tuberculosis, Advanced lesions, Minimal lesions, Smoking, COPD, Risk factors

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## **INTRODUCTION**

Tuberculosis is a significant cause of morbidity and mortality especially of the developing countries [1]. Most commonly, in about 90% of cases [2], the disease involves the lungs. The development of pulmonary tuberculosis from its onset to its various clinical manifestations may be pictured as a series of battles between host and invader. The inhaled bacillus may continue to multiply or it may be destroyed by alveolar macrophages before any lesion is produced. The interplay between the bacillary multiplication and the response of the host to their components determine whether the infection will progress or regress, and if it does progress, what form will it take [3]. Tuberculosis is a local disease in that each lesion is handled by the host almost as if other lesions do not exist. Thus lesions in one area may progress, while those in other areas may stabilize or even regress [4]. The liquefaction of caseous foci perpetuates pulmonary tuberculosis because it results in cavity formation. A cavity is formed when a caseous focus ruptures through the wall of a nearby bronchus and discharges its contents into the air passages. The extent of the disease is determined by the number of bacilli and their viability in addition to the amount of aspiration of liquefied caseous material through the bronchial tree [5]. Tuberculosis is a granulomatous disease. Granuloma formation is due to delayed type hypersensitivity. Thus the host could overcome the reinfection/reactivation much more

rapidly than it overcame the primary infection. But the delayed type hypersensitivity is like a double edged sword. It is responsible for the tissue injury that occurs when the concentrations of bacilli and their products are high [6]. Lowe suggested that smoking might predispose to tuberculosis [7] although opinions differ in this regard. COPD can co-exist with pulmonary tuberculosis as its prevalence is also high. Symptoms of tuberculosis may become aggravated when COPD gets superadded [8]. Although these studies point to increased risk of pulmonary tuberculosis in smokers and in patients with COPD, there is scope for studies to identify smoking and COPD as risk factors for severe forms of pulmonary tuberculosis. Severe pulmonary tuberculosis is associated with increased morbidity and mortality of the host [9]. This study was undertaken to find out whether smoking or COPD are risk factors for the development of severe forms of pulmonary tuberculosis.

## **MATERIALS AND METHODS**

Patients admitted in the wards of the Department of Pulmonary Medicine, Medical College, Trivandrum as well as in the wards of the Health services department, Pulayanarkottah Hospital, Trivandrum, who satisfied the inclusion and exclusion criteria were selected as cases. Controls were selected from patients attending the state TB centre, Trivandrum, satisfying the inclusion and exclusion criteria.

**Inclusion criteria for cases**

- Sputum AFB positivity
- "Far advanced lesions" in the chest x-ray as per ATS criteria

**Inclusion criteria for controls**

- Sputum AFB positivity
- "Minimal lesions" in the chest x-ray as per ATS criteria

**Exclusion criteria**

- History of Anti TB treatment for more than 10 days
- Presence of radiological lesions in a previous radiograph, if available

The sample size was estimated to be 72. Assuming an attrition rate of 10%, 80 patients were included in the study as cases and 80 patients as controls.

The study was completed by 18 months.

**RESULTS****Table 1: Smoking history of study population**

Sl. No.	Smoking history	Cases	% of total	Controls	% of total
1	Smokers	51	63.75	37	46.25
2	Non smokers	29	36.75	43	53.75
	Total	80	100	80	100

**Table 2: Presence of COPD in study population**

Sl. No.	COPD	Cases	% of total	Controls	% of total
1	Present	23	28.75	05	6.25
2	Not present	57	71.25	75	93.75
	Total	80	100	80	100

**Table 3: Univariate Analysis - Relative Risk of Smoking and COPD in severe disease compared to minimal disease**

Ref. categ.	Coeff.	S.E.	Z score	p-value	O.R.	Lower	Upper
Smoking	.7148	.3231	2.2126	.0269	2.044	1.085	3.850
COPD	1.8005	.5238	3.4374	.0006	6.053	2.168	16.897

**Table 4: Multivariate Analysis - Relative Risk of Age, Smoking and COPD, when these three variables are considered together**

Term	Coeff.	S.E.	Z score	p-value	O.R.	Lower	Upper
Age	.0238	.0126	1.8841	.0596	1.024	.999	1.050
Smoking	.1612	.3629	.4443	.6568	1.175	.577	2.393
COPD	1.3396	.5670	2.3625	.0182	3.818	1.256	11.60

The data was analysed and multiple logistic regression was performed by unconditional and conditional methods. Univariate analysis was done first and Z-score as well as Odds Ratio were calculated for each variable. In the multivariate analysis, two or more variables were analysed together. The confounding effect of one variable over another was also looked for.

**Univariate analysis**

Smoking and COPD were found to be significant risk factors for the development of far advanced lesions by univariate analysis (both with p-value less than 0.05).

**Multivariate analysis**

Analysis was done considering more than one variable in each step. This also helped to identify the confounding factors. When age, smoking and COPD were analysed by multivariate method, smoking was not found to be significant. It was because of the confounding variables (Age and COPD) that smoking was apparently showing increased risk in univariate analysis. However, COPD was a significant risk factor independent of Age or smoking.

**DISCUSSION**

Pulmonary tuberculosis is characterised by cavity formation especially in its severe forms of the disease [9]. If extensive and bilateral, these increase the mortality and morbidity of the host. In addition the disease also becomes more infectious and hence severe form of pulmonary tuberculosis is serious both to the individual and to the community. The gold standard of diagnosis of pulmonary tuberculosis is sputum examination for acid fast bacilli [2, 9]. The severity was assessed by radiological criteria as per ATS recommendation [10]. Why some patients present with severe forms of pulmonary tuberculosis has not clearly been answered. Studies have found the relation between tuberculosis and smoking [11,12] as well as tuberculosis and COPD [13]. The present study finds out whether smoking and COPD increase the risk of development of severe disease. COPD is found to be a significant risk factor independent of age. When age, smoking and COPD were analysed together, it was seen that COPD and not smoking is a significant risk factor for the development of severe pulmonary tuberculosis.

## CONCLUSIONS

Pulmonary tuberculosis presents with minimal lesions in some patients and with advanced lesions in other patients. Severe pulmonary tuberculosis is associated with increased mortality and morbidity. Smoking is a common habit and COPD occurs in 30% of smokers. The present study is designed to find out the association between smoking, COPD and severe pulmonary tuberculosis. Severe forms of pulmonary tuberculosis were more common in both smokers and COPD. But a multivariate analysis was also done to study the confounding effect of age, smoking and COPD. It was found that COPD and not smoking was an independent risk factor for the development of severe pulmonary tuberculosis.

## REFERENCES

1. World Health Organization; Epidemiology, Global tuberculosis control: epidemiology, strategy, financing. 2009: 6–33.
2. Behera D; Textbook of Pulmonary Medicine. 2<sup>nd</sup> edition, Jaypee Brothers Medical Pub., New Delhi, 2010: 457.
3. Dannenberg AM Jr., Pathogenesis of Tuberculosis Microbiology. 1984: 344-354
4. Salvin SB, Neta R; Relation between Delayed Hypersensitivity and Immunity in Tuberculosis. Am Rev Respir Dis., 1975; 111: 373-377.
5. Kumar V, Abbas AK, Fausto N, Mitchell RN; Robbins Basic Pathology. 8<sup>th</sup> edition, Saunders Elsevier. 2007: 516–522.
6. Grosset J; Mycobacterium tuberculosis in the Extracellular Compartment: an Underestimated Adversary. Antimicrob Agents Chemother., 2003; 47(3): 833–836.
7. Lowe CR; An association between smoking and respiratory tuberculosis. Br Med J., 1956; 2(5001):1081–1086.
8. Guleria JS, Pande JN, Gupta RG; Chronic obstructive lung disease in Northern India. Am Rev Resp Dis., 1969; 100(4): 490-498.
9. Jindal SK; Textbook of pulmonary and critical care medicine. Jaypee Brothers Medical Publishers, New Delhi, 2011: 544
10. American Thoracic Society; Diagnostic Standards and Classification of Tuberculosis. American Review of Respiratory, 1990; 142(3): 725-735.
11. Maurya V, Vijayan VK, Shah A; Smoking and tuberculosis: an association overlooked. Int J Tuberc Lung Dis., 2002; 6(11): 942-951.
12. Kolappan C, Gopi PG; Tobacco smoking and pulmonary tuberculosis. Thorax, 2002; 57(11): 964–966.
13. Lee CH, Lee MC, Shu CC, Lim CS, Wang JY, Lee LN *et al*.; Risk factors for pulmonary tuberculosis in patients with chronic obstructive airway disease in Taiwan: a nationwide cohort study. BMC Infectious Diseases, 2013; 13:194.