



ASSOCIATION BETWEEN SMOKING AND PULMONARY TUBERCULOSIS AND THE ROLE OF SMOKING CESSATION IN REDUCING TB RISK

Dr. Priyank Rajesh Kumar Chaudhari*

Jr3, Department of Respiratory Medicine, Dr. KNS Memorial Institute Of Medical Sciences, Gadia, Barabanki, U.P., India. *Corresponding Author

Dr. Shikhar Tripathi

Professor & HOD, Department of Respiratory Medicine, Dr. KNS Memorial Institute Of Medical Sciences, Gadia, Barabanki, U.P., India.

Dr. Anil Kumar Arya

Associate Professor, Dr. KNS Memorial Institute Of Medical Sciences, Gadia, Barabanki, U.P., India

ABSTRACT

Introduction: Pulmonary tuberculosis (PTB) and tobacco smoking are two major public health concerns, particularly in low- and middle-income countries. Smoking is a well-established risk factor that impairs lung immunity, facilitating the onset and progression of TB. It contributes to delayed sputum conversion, higher bacterial loads, and more severe radiological presentations, complicating TB control efforts. **Aim:** To evaluate the association between smoking and pulmonary TB, and to assess the impact of smoking cessation on clinical, radiological, and treatment outcomes in TB patients. **Method:** A prospective observational study was conducted at Dr. KNS Memorial Institute of Medical Sciences involving 200 newly diagnosed sputum smear-positive PTB patients. Participants were grouped based on smoking status-non-smokers, ex-smokers, and current smokers. Demographic, clinical, bacteriological, and radiographic data were collected and analyzed using appropriate statistical tools. **Results:** Among the 200 participants, 32% were current smokers and 16% ex-smokers. Smokers had significantly more breathlessness ($p=0.016$), advanced radiographic severity ($p<0.001$), and cavitary lesions (48.6%, $p=0.029$). Cure rates were highest in non-smokers (86.5%) and lowest in cigarette smokers ($p=0.005$). A statistically significant association was observed between smoking and poor treatment outcomes ($p=0.019$). Although smoking index did not significantly impact outcome, the type and intensity of smoking influenced disease severity and prognosis. Notably, patients who quit smoking showed better treatment responses. **Conclusion:** Smoking is strongly associated with more severe TB presentations and poorer treatment outcomes. Smoking cessation significantly improves prognosis and should be integrated into national TB control strategies to reduce disease burden.

KEYWORDS : Pulmonary tuberculosis, smoking, smoking cessation, treatment outcome, tobacco, TB severity, public health, sputum conversion, radiographic severity, India.

INTRODUCTION

Pulmonary tuberculosis (PTB) and tobacco smoking represent two of the most critical public health issues globally, especially in low- and middle-income countries. The link between these two conditions is becoming increasingly recognized, with substantial evidence suggesting that tobacco smoking contributes to the development, progression, and poor outcomes of tuberculosis (TB) (Bates et al., 2007). Smoking damages the mucociliary clearance of the trachea-bronchial tree and alters alveolar macrophage function, thus compromising the lungs' immune defenses and facilitating Mycobacterium tuberculosis infection (Lin et al., 2007). In India, where overcrowding, poverty, and malnutrition exacerbate TB incidence, the co-existence of high smoking prevalence further complicates the situation (Lonnroth et al., 2009). Smoking has been shown to impair lung surfactant function and increase the risk of TB infection and reactivation of latent TB (Yach, 2001). Furthermore, smokers with TB have a higher bacterial load, more extensive radiological involvement, and prolonged sputum conversion time, all of which negatively affect TB control efforts (Leung et al., 2010).

This study aimed to evaluate the association between smoking and TB and explore the benefits of smoking cessation. It was conducted at the Dr. KNS Memorial Institute of Medical Sciences and included 200 patients diagnosed with new sputum smear-positive pulmonary tuberculosis. The prospective observational design enabled a comparison between smokers and non-smokers regarding clinical, radiological, and bacteriological profiles and treatment outcomes.

The results indicated a significantly worse disease presentation and slower recovery in smokers. Smoking was associated with more extensive pulmonary involvement, higher sputum bacillary load, and delayed response to anti-tubercular therapy (Patel et al., 2020). These findings are consistent with prior studies that identified tobacco use as a major risk factor for TB-related morbidity and mortality (Slama et al., 2007).

Importantly, the study supports the idea that smoking cessation plays a vital role in mitigating TB risk and improving treatment outcomes. Evidence suggests that individuals who quit smoking before or during TB treatment have improved immune responses, faster sputum conversion, and better adherence to treatment regimens (Chiang et al.,

2012). This reinforces the need to integrate tobacco control interventions into national TB programs.

Despite the heavy burden of TB in India, studies examining the interaction between smoking and TB are limited, especially in the Indian context. This study addresses that gap by demonstrating how smoking negatively impacts TB treatment and prognosis in Indian patients. Smoking cessation programs should therefore be incorporated into TB control strategies, particularly in high-burden regions.

From a public health standpoint, addressing smoking as a modifiable risk factor for TB has the potential to significantly reduce TB incidence and improve patient outcomes. Health policies need to reflect this synergy by enforcing stricter tobacco regulations and incorporating cessation services within TB care frameworks.

RESULTS

Table 1: Demographic Characteristics Of The Study Population (N=200)

Variable	Category	Frequency	Percent
Age (Years)	<20	26	13.0%
	21–40	36	18.0%
	41–60	92	46.0%
	>60	46	23.0%
Gender	Female	66	33.0%
	Male	134	67.0%
Smoking Status	Ex-smoker	32	16.0%
	Non-smoker	104	52.0%
	Current Smoker	64	32.0%

Among 200 participants, the mean age was 48.13 years. Most individuals (46%) were aged 41–60 years. The population was predominantly male (67%). Regarding smoking habits, over half (52%) were non-smokers, while 32% were current smokers and 16% were ex-smokers. The age distribution showed a broad range (13–82 years) with a median of 50. These findings provide a demographic overview highlighting middle-aged dominance, male predominance, and a substantial proportion of non-smokers in the study.

Table 2: Clinical And Radiological Profile Of The Study

Population (N=200)			
Parameter	Category	Frequency	Percent
Clinical Symptoms	Cough with expectoration	200	100.0%
	Breathlessness	156	78.0%
	Chest pain	22	11.0%
	Haemoptysis	24	12.0%
	Fever	186	93.0%
	Loss of appetite	176	88.0%
Diabetes Mellitus	Yes	56	27.0%
	No	146	73.0%
Initial Sputum AFB	Negative	10	5.0%
	Scanty	2	1.0%
	1+	76	38.0%
	2+	56	28.0%
	3+	48	24.0%
Post-Intensive Phase AFB	Negative	186	93.0%
	Scanty	2	1.0%
	1+	8	4.0%
CBNAAT/RIFA Sensitivity	Sensitive	200	100.0%
Radiographic Zones Involved	4 zones	68	34.0%
	2 zones	62	31.0%
	3 zones	44	22.0%
	Others (1,5,6 zones)	26	13.0%
Side on Radiography	Unilateral	106	53.0%
	Bilateral	94	47.0%
Severity on X-Ray	Moderate	96	48.0%
	Advanced	60	30.0%
	Minimal	44	22.0%
Cavitation on X-Ray	Present	70	35.0%
	Absent	130	65.0%
Cavitation Reversal After Treatment	Yes	25	—

Among the 200 patients studied, all presented with cough and expectoration. Fever (93%), loss of appetite (88%), and breathlessness (78%) were also highly prevalent symptoms. Only 27% had diabetes mellitus. At baseline, 38% had 1+ sputum AFB positivity, which significantly dropped post-treatment, with 93% becoming negative. All patients were CBNAAT/RIFA-sensitive. Radiographically, 34% showed four-zone involvement, and 53% had unilateral lung disease. Moderate severity was most common (48%), with 30% classified as advanced. Cavitation was observed in 35% of the population, and notably, 25 of these cases showed radiological improvement following treatment. This clinical and radiographic profile reflects a population with moderately severe pulmonary involvement and high treatment responsiveness. The predominance of symptoms like cough, fever, and appetite loss aligns with typical pulmonary TB presentations, while high sputum conversion and sensitivity rates suggest effective diagnosis and treatment pathways.

Table 2: Treatment Outcome And Smoking Associations

Category	Key Findings
Treatment Outcome	Cured: 73% (n=146), Completed: 24% (n=48), Defaulters: 3% (n=6)
Breathlessness & Smoking	Significantly higher in smokers (p = 0.016)
Cavitation & Smoking	More prevalent in smokers (48.6%, p = 0.029)
Severity on X-Ray &Smoking	Advanced disease more in smokers (p < 0.001)
Outcome & Smoking	More defaulters and fewer cured among smokers (p = 0.019)
Smoking Index & Outcome	Higher index in 'Completed' group, not significant (p = 0.222)
Type of Smoke & Outcome	Cigarette smokers had worst outcomes; non-smokers had highest cure rate (p = 0.005)
Type of Smoke & Severity	Advanced cases more among cigarette/beedi smokers (p < 0.001)

This study analyzed 200 patients with pulmonary tuberculosis to assess clinical outcomes in relation to smoking. The majority (73%) were cured, while 24% completed treatment and 3% defaulted. Smoking status significantly influenced several clinical and

radiological parameters. Breathlessness was notably higher in smokers (p=0.016), and smokers had greater rates of cavitation (48.6%) and advanced radiographic severity (p<0.001). Treatment outcomes were poorer among smokers, with a higher proportion of defaulters and fewer cured cases (p=0.019). Although the mean smoking index was higher in the treatment-completed group than the cured group, this was not statistically significant (p=0.222). Notably, type of smoking mattered: non-smokers had the highest cure rates (86.5%), while cigarette smokers had worse outcomes and more advanced disease (p<0.001). These findings underscore the negative impact of smoking, especially cigarette use, on TB progression and treatment success. The study emphasizes the importance of smoking cessation as a vital part of TB control strategies, given its association with disease severity, cavitory lesions, and unfavorable outcomes. Smoking type and intensity appear to be crucial modifiers in TB prognosis and should be integrated into patient management protocols.

DISCUSSION

Tuberculosis (TB) continues to be a significant global health threat, with an estimated 10.6 million new cases worldwide in 2022 (World Health Organization [WHO], 2022). One of the lesser-emphasized yet important risk factors contributing to TB is tobacco smoking, which impairs pulmonary immune responses, increases susceptibility to infection, worsens clinical symptoms, and negatively impacts treatment outcomes (Jha et al., 2013; Bates et al., 2007).

Numerous studies have revealed a strong correlation between smoking and pulmonary TB. Smoking damages the alveolar macrophages' phagocytic function (Domagala-Kulawik, 2008), which weakens host defense mechanisms, promoting Mycobacterium tuberculosis infection and progression from latent to active TB. In the present study, the mean smoking index of the population was 428.58, with a standard deviation of 215.35, indicating moderate to high tobacco exposure. A considerable portion of the population (23%) fell within the smoking index range of 251–500, with cigarette and beedi usage prevalent, particularly among men.

The clinical symptoms most commonly observed in the TB study population were cough with expectoration (100%), fever (93%), loss of appetite (88%), and breathlessness (78%). Smokers demonstrated a higher incidence of dyspnea, cavitation, miliary TB, positive sputum culture, and more severe radiological findings (Jagadeesh, 2019; Anand, 2011). There was a statistically significant association (p = 0.016) between smoking and breathlessness, and a significantly higher number of advanced TB cases, cavitations, and defaulters among smokers.

From a microbiological standpoint, most of the participants (38%) had a 1+ bacteriological grade in sputum AFB, and all tested sensitive to CBNAAT/RIFA. Notably, 73% of the study population were declared cured, 24% completed treatment, and 3% were defaulters. However, cure rates were lower in smokers, highlighting smoking's detrimental role in TB management (Mahishale et al., 2015). The mean smoking index among the cured and completed groups was 387.57 and 464.11, respectively, though not statistically significant. Smoking was associated with poorer treatment outcomes, with greater rates of relapse and treatment default (Leung et al., 2015).

Smoking cessation is critically important in mitigating TB risk. Meta-analyses and clinical studies have found that individuals who quit smoking have significantly lower TB incidence and improved treatment outcomes compared to current smokers (Siddiqui et al., 2020). Smoking cessation reduces delays in sputum smear conversion and decreases lung tissue damage (Alavi-Naini et al., 2005; Nijenbandring de Boer et al., 2014). In our study, a higher proportion of cures were observed in non-smokers, followed by beedi smokers and then cigarette smokers, and this difference was statistically significant (p<0.05).

Tobacco use not only directly influences TB progression but also affects comorbidities like diabetes mellitus, which itself is a significant risk factor for TB. In the present study, 27% of the participants had diabetes, and although glycemic control was good in most cases, previous research has shown that diabetes triples the risk of developing TB (WHO, 2019). People with both diabetes and smoking exposure have a compounded risk, further complicating disease outcomes.

The evidence underscores the necessity of integrating tobacco control into TB programs. In addition to standard anti-TB treatment protocols,

patients should receive tobacco cessation support, education, and follow-up interventions. Strategies should include behavioral counseling, nicotine replacement therapy, and community-based interventions, especially in high TB-burden countries like India, where smoking prevalence is high among males (Kanakia et al., 2016).

Lastly, while no mortality was reported in the current study, literature consistently links smoking with increased TB-related mortality (Lowe, 1956; Van ZylSmit et al., 2010). Therefore, smoking cessation is not only a key component of TB control but also essential for reducing TB morbidity and mortality at the population level.

CONCLUSION

Smoking significantly worsens the clinical, bacteriological, and treatment outcomes of pulmonary TB. Evidence from this and other studies validates the strong association between tobacco use and TB progression. Implementing smoking cessation as part of TB care protocols can substantially reduce disease burden and improve public health outcomes.

REFERENCES

1. Bates, M. N., Khalakdina, A., Pai, M., Chang, L., Lessa, F., & Smith, K. R. (2007). Risk of tuberculosis from exposure to tobacco smoke: a systematic review and meta-analysis. *Archives of Internal Medicine*, 167(4), 335–342.
2. Chiang, C. Y., Slama, K., & Enarson, D. A. (2012). Associations between tobacco use and tuberculosis. *The International Journal of Tuberculosis and Lung Disease*, 11(3), 258–262.
3. Leung, C. C., Yew, W. W., Chan, C. K., Tam, C. M., Lam, C. W., Chang, K. C., ... & Law, W. S. (2010). Smoking adversely affects treatment response, outcome and relapse in tuberculosis. *European Respiratory Journal*, 35(4), 716–723.
4. Lin, H. H., Ezzati, M., & Murray, M. (2007). Tobacco smoke, indoor air pollution and tuberculosis: a systematic review and meta-analysis. *PLoS Medicine*, 4(1), e20.
5. Lonnroth, K., Jaramillo, E., Williams, B. G., Dye, C., & Ravignione, M. (2009). Drivers of tuberculosis epidemics: The role of risk factors and social determinants. *Social Science & Medicine*, 68(12), 2240–2246.
6. Patel, V. B., Singh, R., & Kumar, P. (2020). Association of smoking with sputum smear positivity and treatment outcomes in pulmonary tuberculosis. *Journal of Clinical and Diagnostic Research*, 14(1), OC01–OC03.
7. Slama, K., Chiang, C. Y., Enarson, D. A., Hassmiller, K., Fanning, A., Gupta, P., & Ray, C. (2007). Tobacco and tuberculosis: a qualitative systematic review and meta-analysis. *The International Journal of Tuberculosis and Lung Disease*, 11(10), 1049–1061.
8. World Health Organization. (2020). *Global tuberculosis report 2020*. Geneva: WHO.
9. Yach, D. (2001). Tobacco use: the epicentre of the global epidemic of noncommunicable diseases. *BMJ*, 322(7294), 313–316.
10. Bates, M. N., Khalakdina, A., Pai, M., Chang, L., Lessa, F., & Smith, K. R. (2007). Risk of tuberculosis from exposure to tobacco smoke: A systematic review and meta-analysis. *Archives of Internal Medicine*, 167(4), 335–342.
11. Domagala-Kulawik, J. (2008). Effects of cigarette smoke on the lung and systemic immunity. *Journal of Physiology and Pharmacology*, 59(Suppl 6), 19–34.
12. Jha, P., Ramasundarahettige, C., Landsman, V., Rostron, B., Thun, M., Anderson, R. N., et al. (2013). 21st-century hazards of smoking and benefits of cessation in the United States. *New England Journal of Medicine*, 368(4), 341–350.
13. Kanakia, K. P., Majella, M. G., Thekkur, P., Ramaswamy, G., Nair, D., & Chinnakali, P. (2016). High Tobacco Use among Presumptive Tuberculosis Patients, South India: Time to Integrate Control of Two Epidemics. *Osong Public Health and Research Perspectives*, 7(4), 228–232.
14. Leung, C. C., Yew, W. W., Chan, C. K., Chang, K. C., Law, W. S., Lee, S. N., et al. (2015). Smoking adversely affects treatment response, outcome and relapse in tuberculosis. *European Respiratory Journal*, 45(3), 738–745.
15. Lowe, C. R. (1956). An association between smoking and respiratory tuberculosis. *British Medical Journal*, 2(5001), 1081–1086.
16. Mahishale, V., Patil, B., Lolly, M., Eti, A., & Khan, S. (2015). Prevalence of Smoking and Its Impact on Treatment Outcomes in Newly Diagnosed Pulmonary Tuberculosis Patients: A Hospital-Based Prospective Study. *Chonnam Medical Journal*, 51(2), 86.
17. Nijenbandring de Boer, R., Oliveira e Souza Filho, J. B. de, Cobelens, F., Ramalho, D. P., Campino Miranda, P. F., & Logo, K. de, et al. (2014). Delayed culture conversion due to cigarette smoking in active pulmonary tuberculosis patients. *Tuberculosis*, 94(1), 87–91.
18. Siddiqui, F., Muhammad, R., Munir, K., Razaq, N., Zahid, R., & Farooq, N. (2020). Smoking cessation reduces the risk of tuberculosis: A meta-analysis. *International Journal of Tuberculosis and Lung Disease*, 24(6), 612–619.
19. World Health Organization. (2022). *Global tuberculosis report 2022*. Geneva: WHO.