



## CLINICO-RADIOLOGICAL PATTERNS OF PULMONARY TUBERCULOSIS IN PATIENTS WITH TYPE 2 DIABETES: INSIGHTS FROM A TERTIARY CARE CENTER IN CHENNAI

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### ABSTRACT

Pulmonary Tuberculosis (PTB) and Type 2 Diabetes Mellitus (T2DM) are two significant public health issues, particularly in countries like India. This study evaluates the clinico-radiological profile of patients with PTB coexisting with T2DM in a tertiary care hospital in Chennai. A cross-sectional study of 212 patients was conducted to analyze clinical symptoms, radiological findings, and their correlation with diabetic parameters such as fasting blood sugar (FBS), postprandial blood sugar (PPBS), and HbA1C levels. The study revealed a significant correlation between uncontrolled diabetic parameters and the severity of tuberculosis. Cavitory lesions were the most common radiological finding in PTB-T2DM patients. The findings suggest that careful management of blood sugar levels in PTB patients can potentially improve clinical outcomes.

**KEYWORDS :** Pulmonary Tuberculosis, Type 2 Diabetes Mellitus, Radiological Findings, Glycemic Control, Cross-Sectional Study

### INTRODUCTION

Pulmonary Tuberculosis (PTB) and Type 2 Diabetes Mellitus (T2DM) are two major global health concerns that often coexist, particularly in countries like India, where the burden of both diseases is high. The prevalence of PTB is significant, with India accounting for 2.6 million cases, and T2DM affecting approximately 8.7% of the adult population [1, 2]. The co-occurrence of these diseases can complicate clinical management and outcomes. PTB affects glycemic control in diabetic patients, leading to challenges in managing both conditions [3, 4]. Diabetes has been shown to alter the clinical presentation, radiological manifestations, and treatment outcomes of PTB [5].

The link between T2DM and PTB has been well established in the literature, highlighting the need for a comprehensive understanding of how diabetes affects the clinical and radiological presentation of PTB. This study aims to assess the clinico-radiological findings in PTB patients with T2DM in a tertiary care setting in Chennai.

### Methodology

This cross-sectional study was conducted at the Department of Respiratory Medicine, Sree Balaji Medical College, Chromepet, Chennai, from August 2022 to December 2023. A total of 212 patients diagnosed with PTB and T2DM, both sputum AFB-positive and AFB-negative, were included in the study.

### Inclusion Criteria

- Patients with microbiologically confirmed PTB and T2DM.
- Patients aged 18 years and above.

### Exclusion Criteria

- Patients with extra-pulmonary tuberculosis.
- Pregnant women and children.
- Patients with PTB without T2DM.

### Data Collection

Clinical data, including demographic details, duration of diabetes, smoking history, and clinical symptoms, were collected. Radiological findings were assessed using chest X-rays and computed tomography (CT). Blood tests, including fasting blood sugar (FBS), postprandial blood sugar (PPBS), and HbA1C, were performed to assess glycemic control.

### Statistical Analysis

Descriptive statistics were used to summarize the clinical and demographic data. Chi-square tests were used to evaluate the association between categorical variables. A p-value of less

than 0.05 was considered statistically significant.

### RESULTS

The study sample included 150 males (70.7%) and 62 females (29.3%), with a mean age of 50-59 years.

**Table 1: Age Distribution of Study Sample (n=212)**

Age Group (years)	Frequency (n)	Percentage (%)
18 – 29	17	8.0
30 – 39	28	13.2
40 – 49	50	23.6
50 – 59	53	25.0
60 – 69	38	18.0
>70	26	12.2
Total	212	100.0

### Clinical Findings

The most common presenting symptoms were cough (95%), fever (82%), dyspnea (65%), and anorexia (72%). Hemoptysis was observed in 20% of the patients, and 29% had clubbing.

### Radiological Findings

Chest X-ray showed cavitory lesions in 69% of the patients, non-homogeneous opacities in 45%, and fibrosis in 25%.

**Table 2: Radiological Findings in PTB-T2DM Patients (n=212)**

Radiology Findings	Frequency (n)	Percentage (%)
Cavitory Lesions	146	69.0
Non-Homogeneous Opacities	95	45.0
Fibrosis	53	25.0
Pleural Involvement	34	16.0
Bronchiectasis	17	8.0

### Correlation with Diabetic Parameters

A significant correlation was found between high HbA1C levels and positive sputum AFB results, indicating that uncontrolled diabetes is associated with more severe forms of PTB.

**Table 3: Correlation Between HbA1C Levels and Sputum AFB Results**

HbA1C Range	Total Cases (n)	Sputum Positive (n)	Sputum Negative (n)
<7	24	2	22
7-10	21	15	6
10-13	137	133	4
>13	30	30	0

Total	212	180	32
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## DISCUSSION

The coexistence of Pulmonary Tuberculosis (PTB) and Type 2 Diabetes Mellitus (T2DM) presents unique clinical challenges due to the interplay between these two conditions. This study demonstrates that poor glycemic control in diabetic patients with PTB is associated with more severe clinical and radiological manifestations of tuberculosis. Specifically, our findings indicate a significant correlation between elevated HbA1C levels and severe forms of PTB, characterized by extensive cavitory lesions and higher sputum AFB positivity rates. These results align with previous studies that have reported a similar trend, suggesting that diabetes exacerbates the clinical course of PTB [6, 7].

### Impact of Diabetes on Tuberculosis Manifestations

Diabetes mellitus, particularly when poorly controlled, has been recognized as a risk factor for the development and progression of PTB. The hyperglycemic environment impairs immune responses, leading to diminished macrophage activation and delayed recruitment of immune cells to the site of infection [8]. Consequently, diabetic patients are more susceptible to primary infection, reactivation of latent tuberculosis, and more severe forms of PTB, as evidenced by the high prevalence of cavitory lesions found in our study. Cavitory lesions are often associated with high bacterial loads and increased transmission risk, indicating that diabetic patients with PTB could be more infectious than non-diabetic PTB patients [9].

The presence of cavitory lesions in 69% of the study population is notably higher compared to the general PTB population without diabetes, where cavitory lesions are reported less frequently. These findings suggest that poorly controlled diabetes alters the pathophysiology of PTB, leading to more aggressive disease manifestations. This correlation is further supported by Singla et al. [4], who observed a higher frequency of severe radiological presentations, such as cavitation and extensive lung involvement, among diabetic patients compared to non-diabetic controls. Additionally, the association of HbA1C levels with sputum AFB positivity, as observed in this study, highlights the role of chronic hyperglycemia in impairing the host's ability to mount an effective immune response against *Mycobacterium tuberculosis*.

### Implications for Clinical Management

The significant association between high HbA1C levels and more severe TB manifestations underscores the importance of optimizing glycemic control in patients with concurrent T2DM and PTB. Effective glycemic management is essential not only for controlling diabetes but also for enhancing the immune response against tuberculosis. Studies have shown that improved glycemic control can reduce the risk of TB complications and enhance the efficacy of anti-tubercular therapy [7]. Therefore, integrating diabetes management with TB care protocols, including regular monitoring of blood glucose levels and HbA1C, could lead to better clinical outcomes.

Furthermore, the high prevalence of comorbid conditions such as hypertension and dyslipidemia among the study cohort suggests that a multidisciplinary approach is needed to address these overlapping health issues. Incorporating diabetes education, nutritional counselling, and regular physical activity as part of the comprehensive care for PTB-T2DM patients may help in achieving better glycemic control and reducing TB-related morbidity and mortality [5]. Additionally, our findings support the need for routine screening for diabetes in TB patients, especially in high TB burden settings like India, where a significant proportion of undiagnosed diabetes cases could exacerbate TB outcomes.

## Comparative Radiological Analysis and Its Clinical Relevance

The radiological findings from this study reveal a higher prevalence of cavitory lesions, non-homogeneous opacities, and pleural involvement among PTB-T2DM patients. These patterns differ significantly from those observed in non-diabetic TB patients, who tend to present with less severe radiological features. The study by Pérez-Guzmán et al. [3] corroborates these findings, highlighting that diabetic patients are more likely to present with atypical radiological findings, such as lower lung field involvement and cavitations. The radiological variability observed in diabetic patients can complicate the diagnosis and management of TB, particularly in resource-limited settings where advanced imaging modalities may not be readily available.

The high rate of pleural involvement (16%) in this study is also noteworthy, as pleural TB is typically considered a manifestation of primary infection. This suggests that in diabetic patients, TB may not only present more aggressively but may also manifest in forms typically associated with a different pathophysiology. Clinicians should therefore maintain a high index of suspicion for atypical presentations in diabetic TB patients and consider early, aggressive diagnostic and therapeutic interventions.

### Public Health Implications and Future Directions

The dual burden of PTB and T2DM has significant public health implications, particularly in low- and middle-income countries like India, where both diseases are highly prevalent. The intersection of these two diseases necessitates an integrated approach to disease management and control. Public health strategies should focus on strengthening TB and diabetes screening programs, enhancing the capacity of healthcare systems to manage comorbid conditions, and improving access to multidisciplinary care.

Furthermore, future research should aim to explore the molecular mechanisms underlying the interplay between TB and diabetes, focusing on immune dysfunction and the role of chronic hyperglycemia in TB pathogenesis. Large-scale, multicenter studies could provide more robust evidence to inform clinical guidelines and public health policies. Additionally, the potential benefits of adjunctive therapies, such as metformin, which has been shown to have immunomodulatory effects in diabetic TB patients, warrant further investigation [9].

In conclusion, this study highlights the complex relationship between PTB and T2DM and underscores the importance of integrated care approaches that address both conditions concurrently. Improved glycemic control, routine diabetes screening in TB patients, and personalized treatment plans are critical to mitigating the adverse outcomes associated with this dual burden.

## CONCLUSION

Clinico-radiological findings in PTB patients with T2DM reveal a strong correlation between uncontrolled blood sugar levels and the severity of tuberculosis. Early diagnosis and effective glycemic control are critical in managing these patients to improve clinical outcomes and reduce complications.

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