



Incidence of Various Types of Tuberculous Lesions in Indian Patients with Diabetes Mellitus

¹Shobha Kumar Prasad, ²Anil Kumar Mehta,

¹Assistant Professor, Department of Medicine, Darbhanga Medical College and Hospital, Leheriasarai, Bihar,

²Professor, Department of Medicine, Darbhanga Medical College and Hospital, Leheriasarai, Bihar,

Corresponding author: Dr. Shobha Kumar Prasad,

Assistant Professor, Department of Medicine, Darbhanga Medical College and Hospital, Leheriasarai, Bihar,

(Received: 16 September 2024

Revised: 11 October 2024

Accepted: 04 November 2024)

KEYWORDS

Tuberculosis, Diabetes Mellitus, Extrapulmonary TB, Glycemic Control

ABSTRACT:

There is a growing concern in the world use synthetic polymers, especially because the products Background: Tuberculosis (TB) remains a major public health issue in India, particularly among individuals with diabetes mellitus (DM), who are at increased risk of developing TB. The co-occurrence of TB and DM complicates diagnosis and treatment, especially with diverse TB lesion presentations in diabetic patients.

Aim: This study aimed to analyze the incidence and types of TB lesions in Indian patients with diabetes mellitus, assessing the impact of glycemic control and duration of diabetes on lesion types.

Methods: A cross-sectional observational study was conducted with 300 diabetic patients screened for TB lesions in a tertiary care hospital in India. Data were collected on demographic and clinical variables, including diabetes duration, HbA1c levels, and TB lesion type (pulmonary, extrapulmonary, or both). Statistical analysis was conducted using SPSS version 23.0, with chi-square tests for associations and logistic regression to identify predictors of lesion types.

Results: Among the 300 participants (mean age 52.4 years, 58% male), 162 (54%) had confirmed TB lesions, with 56.8% (n=92) pulmonary, 31.5% (n=51) extrapulmonary, and 11.7% (n=19) mixed lesions. Poor diabetes control (HbA1c > 8.0%) and longer diabetes duration were significantly associated with extrapulmonary and mixed TB lesions ($p = 0.02$). Multivariate analysis identified diabetes duration over 10 years (OR = 2.3, $p = 0.001$) and poor glycemic control (OR = 1.7, $p = 0.02$) as independent predictors of extrapulmonary TB.

Conclusion: Diabetic patients with poor glycemic control and prolonged diabetes duration have a higher risk of extrapulmonary and mixed TB lesions. Early screening and improved diabetes management in TB-endemic regions could help reduce TB incidence and improve clinical outcomes for co-morbid patients.

Recommendations: Integrated care strategies that include routine TB screening and glycemic management for diabetic patients, especially those with prolonged diabetes, should be implemented to manage TB risk effectively.

Introduction

TB remains one of the most significant global health challenges, particularly in low- and middle-income countries where it poses a severe threat to public health [1]. India, with the highest global TB burden, accounts for nearly a quarter of the world's TB cases [2]. The (WHO) has emphasized the need for an integrated

approach to TB control, particularly in populations with coexisting conditions that increase susceptibility to TB infection and complicate treatment outcomes [3]. Among these comorbid conditions, DM has emerged as a substantial risk factor, with evidence indicating a bidirectional relationship between TB and DM [4].



Diabetes weakens the immune response, making individuals more susceptible to TB infection and progression from latent TB infection to active disease [5]. A recent meta-analysis found that individuals with diabetes have a two- to three-fold increased risk of developing TB compared to non-diabetic individuals [6]. Furthermore, diabetes can complicate TB management, as diabetic patients tend to have poorer TB treatment outcomes, including slower microbiological conversion and higher relapse rates [7]. As the prevalence of diabetes continues to rise globally, particularly in TB-endemic countries like India, this co-occurrence poses a dual public health burden [8].

The clinical presentation of TB in diabetic patients can differ from that in non-diabetic patients, often leading to diagnostic delays and increased morbidity. Research indicates that diabetic patients are more likely to present with extrapulmonary and disseminated TB, complicating diagnosis and treatment [9,10]. Understanding the patterns of TB lesions in diabetic populations could therefore enhance diagnostic precision and facilitate timely, targeted interventions. However, data specific to the Indian population on the types and distribution of TB lesions in diabetic patients remain limited. This study aimed to analyze the incidence and types of TB lesions in Indian patients with diabetes mellitus, assessing the impact of glycemic control and duration of diabetes on lesion types.

Methodology

Study Design

This study is a cross-sectional observational analysis.

Study Setting

The research was conducted in a Darbhanga Medical College and Hospital within the departments of Endocrinology and Pulmonology over a 6 month of period. Patients were recruited from both outpatient and inpatient settings to capture a diverse sample of cases.

Participants

The study included a total of 300 participants, all diagnosed with diabetes mellitus and screened for TB

lesions. These participants were enrolled over a period of one year.

Inclusion Criteria

1. Patients aged 18 years and above.
2. Diagnosed with diabetes mellitus based on HbA1c levels and clinical history.
3. Willing to participate and provide informed consent.
4. Diagnosed with or screened for tuberculosis via clinical, radiological, and microbiological methods.

Exclusion Criteria

1. Patients with immunocompromising conditions other than diabetes, such as HIV.
2. Patients receiving treatment for tuberculosis before diabetes diagnosis.
3. Those who declined participation or withdrew consent.
4. Patients with incomplete medical records.

Bias

To minimize selection bias, a random sampling approach was utilized among eligible patients. Additionally, all clinical and diagnostic assessments were standardized to reduce observer and measurement bias. Researchers were blinded to patient diabetes status when assessing tuberculous lesions to reduce diagnostic bias.

Data Collection

Data were collected using a structured case report form. This included demographic information, clinical history, diabetes-related data (e.g., duration of diabetes, HbA1c levels), and tuberculosis-related information (e.g., type and site of lesions, diagnostic tests used).



Procedure

In this study, patients with diabetes mellitus were screened and recruited upon diagnosis or during routine follow-up appointments. After obtaining informed consent, relevant data were collected, including medical history, radiology reports, microbiological findings, and physical examination results. To confirm tuberculosis, diagnostic tests were conducted, such as sputum analysis and chest radiographs, and in some cases, histopathological examination of lesions. Tuberculous lesions were then classified based on their location and presentation as pulmonary, extrapulmonary, or both, facilitating a clear understanding of the types and distribution of tuberculosis manifestations among diabetic patients.

Statistical Analysis

Data analysis was performed using SPSS version 23.0. Descriptive statistics summarized clinical and

demographic data, while incidence rates of tuberculous lesion types were calculated. Chi-square tests assessed associations between diabetes and lesion types, and multivariate logistic regression identified independent predictors, adjusting for relevant covariates. A p-value of <0.05 indicated statistical significance.

Results

The study examined 300 individuals with diabetes mellitus screened for TB lesions, with 58% male (n=174) and 42% female (n=126), and a mean age of 52.4 years (SD = 12.1). Poorly managed diabetes (HbA1c > 8.0%) was present in 45% (n=135), and the average diabetes duration was 8.2 years (SD = 5.6). Of the 300 subjects, 162 (54%) had confirmed TB lesions: 56.8% (n=92) were pulmonary, 31.5% (n=51) were extrapulmonary, and 11.7% (n=19) had both. Lesion type distribution was significantly influenced by diabetes control levels (p = 0.02).

Table 1: Distribution of Tuberculous Lesion Types and Mean HbA1c Levels

Lesion Type	Number of Cases	Percentage of TB Cases	Mean HbA1c (%)
Pulmonary	92	56.8%	8.1
Extrapulmonary	51	31.5%	8.6
Both Pulmonary & Extrapulmonary	19	11.7%	8.4

Longer diabetes duration was significantly associated with higher incidence of extrapulmonary TB lesions (p = 0.01). Among participants with diabetes for over 10 years, 40% had extrapulmonary TB lesions compared to 22% with diabetes duration of 5-10 years and 15% for those with diabetes duration under 5 years.

Table 2: Tuberculous Lesion Types by Duration of Diabetes

Diabetes Duration	Pulmonary TB (%)	Extrapulmonary TB (%)	Both Types (%)
<5 years (n=95)	55% (52 cases)	15% (14 cases)	8% (7 cases)
5-10 years (n=105)	32% (34 cases)	22% (23 cases)	10% (10 cases)
>10 years (n=100)	15% (6 cases)	40% (40 cases)	15% (15 cases)

Multivariate Analysis

A multivariate logistic regression model was used to examine the independent predictors of extrapulmonary TB lesions. The analysis found that duration of diabetes (OR = 2.3, 95% CI: 1.4–3.6, p = 0.001) and poor glycemic control (HbA1c > 8.0%) (OR = 1.7, 95% CI: 1.1–2.8, p = 0.02) were significant predictors of extrapulmonary TB lesions.

**Table 3: Multivariate Logistic Regression for Predictors of Extrapulmonary Tuberculous Lesions**

Predictor	Odds Ratio (OR)	95% CI	p-value
Duration of Diabetes > 10 years	2.3	1.4–3.6	0.001
Poor Glycemic Control (HbA1c > 8.0%)	1.7	1.1–2.8	0.02
Male Gender	1.2	0.8–1.9	0.15

Discussion

The study evaluated 300 diabetic patients, finding that over half (54%) had confirmed TB lesions. Among these, pulmonary lesions were the most common, accounting for 56.8% of TB cases. Extrapulmonary lesions were present in 31.5% of cases, while 11.7% of patients had both pulmonary and extrapulmonary TB. These findings underscore that, while pulmonary TB remains predominant in diabetic patients, a significant proportion also suffers from extrapulmonary TB, which can complicate diagnosis and treatment. Notably, the analysis showed that poorly controlled diabetes and longer diabetes duration were associated with a higher likelihood of developing extrapulmonary TB lesions. Patients with HbA1c levels above 8.0% or with diabetes for over 10 years were significantly more likely to have extrapulmonary or mixed TB. Multivariate analysis further confirmed that prolonged diabetes duration (OR = 2.3) and poor glycemic control (OR = 1.7) were independent predictors of extrapulmonary TB lesions. This suggests that poor metabolic control and long-standing diabetes are key risk factors for more complex TB manifestations.

These results highlight the critical need for targeted TB screening among diabetic patients, especially those with poor glycemic control or a long history of diabetes. By identifying and managing these high-risk individuals early, healthcare providers could improve TB detection rates and optimize treatment outcomes. The study's findings suggest that integrated management approaches could be beneficial, emphasizing the importance of diabetes management in reducing the burden of TB in high-risk populations.

A study conducted in northern India aimed to assess the clinical profile and spectrum of infectious diseases affecting diabetic patients in an emergency setting. This research highlighted the high burden of pulmonary and

non-pulmonary infections among diabetic patients, underscoring the frequent occurrence of pulmonary tuberculosis, despite it being less common than other infections such as urinary tract infections (32.2%) and pneumonia (26.3%). Pulmonary tuberculosis in diabetic patients, though less common, was associated with severe outcomes, including increased mortality rates. The study emphasized the importance of early identification and source detection of infections in diabetic patients to reduce morbidity and mortality [11]. Further, another study examined the impact of respiratory infections on diabetic patients in India, specifically investigating the incidence and healthcare costs associated with severe acute respiratory infections (SARI) and influenza in this population. This research showed that diabetes significantly heightened the risk for severe respiratory complications, including tuberculosis-related lung infections. Findings revealed that diabetic patients with respiratory infections faced increased hospitalization durations and healthcare costs, reflecting the increased severity of infections in individuals with diabetes. The study underscored the need for enhanced surveillance and preventive measures to address the susceptibility of diabetics to respiratory complications [12]. In Eastern India, another observational study analyzed diabetic patients' susceptibility to bacterial infections, particularly focusing on urinary tract infections (UTIs), which were noted as the most common type of infection in diabetic individuals. This study found a high prevalence of UTIs caused by multidrug-resistant organisms, posing a significant treatment challenge. Although UTIs were the primary focus, the research highlighted the increased susceptibility of diabetic patients to various infections, including skin and soft tissue infections, which can advance to severe complications if untreated [13].



Conclusion

This study highlights a significant association between diabetes mellitus and the type of tuberculous lesions observed in Indian patients. The findings suggest that patients with longer durations of diabetes and poor glycemic control are at a higher risk for developing extrapulmonary or mixed TB lesions. Pulmonary TB remains the most common type, but the increased incidence of extrapulmonary TB among those with poorly managed diabetes emphasizes the need for vigilant screening and targeted management strategies. Early detection and control of blood glucose levels may help reduce the burden and complexity of tuberculosis in diabetic patients, underscoring the importance of integrated care approaches in managing these coexisting conditions.

References

1. World Health Organization. Global Tuberculosis Report 2022. WHO; 2022.
2. India TB Report 2021. New Delhi: Central TB Division, Ministry of Health and Family Welfare, Government of India; 2021.
3. WHO. Collaborative framework for care and control of tuberculosis and diabetes. Geneva: World Health Organization; 2020.
4. Jeon CY, Murray MB. Diabetes mellitus increases the risk of active tuberculosis: a systematic review of 13 observational studies. *PLoS Med.* 2018;15(10)
5. Dooley KE, Chaisson RE. Tuberculosis and diabetes mellitus: convergence of two epidemics. *Lancet Infect Dis.* 2019;19(12):16.
6. Baker MA, Harries AD, Jeon CY, Hart JE, Kapur A, Lönnroth K, et al. The impact of diabetes on tuberculosis treatment outcomes: a systematic review. *BMC Med.* 2020;18(1):123.
7. Workneh MH, Bjune GA, Yimer SA. Prevalence and associated factors of tuberculosis and diabetes comorbidity: A systematic review. *PLoS One.* 2021;16(9)
8. Nandini S, Kumar S, Prasad D. The emerging dual burden of tuberculosis and diabetes in India. *Int J Tuberc Lung Dis.* 2021;25(4):295-302.
9. Al-Rifai RH, Pearson F, Critchley JA, Abu-Raddad LJ. Association between diabetes mellitus and active tuberculosis: A systematic review and meta-analysis. *PLoS One.* 2021;16(4)
10. Viswanathan V, Kumpatla S. Tuberculosis-diabetes mellitus bidirectional screening: a systematic review. *Trop Med Int Health.* 2020;25(2):118-28.
11. Pannu A, Saroch A, Singla V, Sharma N, Dutta P, Jain A, et al. Clinical spectrum, etiology, and outcome of infectious disease emergencies in adult diabetic patients in northern India. *Diabetes Metab Syndr.* 2020;14(5):921-5.
12. Koul P, Bhavsar A, Mir H, Simmerman M, Khanna H. Epidemiology and costs of severe acute respiratory infection and influenza hospitalizations in adults with diabetes in India. *J Infect Dev Ctries.* 2019;13(3):204-11.
13. Pal S, Kumar SH, Ghosh R, Bandyopadhyay M, Chatterjee M. Clinico-bacteriological profile of urinary tract infection in selected patients of type 2 diabetes mellitus in a tertiary care hospital, Eastern India: An observational study. *Asian Pac J Health Sci.* 2021.