RESEARCH PAPER

Clinical Pattern of Tuberculosis in Diabetic Patients-An Observational Study

Mohammad Syedul Islam[1*], Farzana Ahmed[2], Ruhus Safa Noor[3], Ariful Islam[4], Fahmida Faizha Shama[5], Sifat Sharmin[6]

1. Associate Professor, Department of Internal Medicine, Bangladesh Medical University, Shahbag, Dhaka, Bangladesh. Email Id: dr.syedul@bsmmu.edu.bd. Orcid Id: 0009-0001-1390-0628.
2. Associate Professor, Department of Paediatrics, Marks Medical College, Dhaka, Bangladesh. Email Id: farzanaahmedpaed@gmail.com.
3. Assistant Registrar Department of Dermatology & venereology, Mugda Medical College Hospital, Mugda, Dhaka, Bangladesh. Email Id: safanoor048@gmail.com. Orcid Id: 0009-0008-3370-2806.
4. Associate Professor(cc) & Head, Department of ENT & HNS, Dhaka Community Medical College, Boro-Mogbazar, Dhaka, Bangladesh. Email Id: ariftushar99@gmail.com. Orcid Id: 0009-0008-9936-0941.
5. BDS, MPH, MPhil (on course), National Institute of Preventive and Social Medicine, Dhaka, Bangladesh. Email Id: fahmidafaizha72@gmail.com. Orcid Id: 0009-0009-3087-2399.
6. Research Coordinator, International Network of Doctors Journal, Dhaka, Bangladesh. Email Id: limutanvir7889@gmail.com. Orcid Id: 0000-0003-0364-6010.

Corresponding author: Dr. Mohammad Syedul Islam, Associate professor, Department of Internal Medicine, Bangladesh Medical University, Shahbag, Dhaka, Bangladesh.

ABSTRACT:

Background: *Tuberculosis (TB) and diabetes mellitus (DM) pose significant global health challenges and have a reciprocal relationship. Diabetes heightens the risk of TB due to weakened immune responses, leading to more severe illness, slower treatment response, and worse outcomes. This study sought to assess the clinical features and disease trends of TB in diabetic individuals visiting a tertiary care facility in Bangladesh.* ***Methods:*** *An observational study based in a hospital was carried out at tertiary care hospital, Bangladesh, from September 2025 to February 2026, involving 75 adult patients with diabetes mellitus and recent tuberculosis diagnosis. Clinical, laboratory, glycemic, and radiological information was gathered and examined using SPSS version 26. Relationships between glycemic management, duration of diabetes, and characteristics of TB were evaluated, with $p<0.05$ deemed statistically significant. Approval for ethical considerations and informed consent were secured.* ***Results:*** *In a group of 75 TB–DM patients, the average age was 51.6 ± 11.8 years, showing a male majority (64.0%) and predominantly type 2 diabetes (93.3%). Poor glycemic control was identified in 53.3%. Chronic cough was the most prevalent symptom (93.3%), whereas GeneXpert positivity stood at 82.7% and pulmonary TB was the most common type (77.3%). Inadequate glycemic management and prolonged duration of diabetes were notably linked to increased sputum positivity and bilateral lung involvement, respectively.* ***Conclusion:*** *Tuberculosis in individuals with diabetes is linked to considerable clinical severity, elevated bacteriological positivity, and widespread pulmonary involvement. Ineffective glycemic regulation and extended diabetes duration elevate disease burden, emphasizing the necessity for combined TB–diabetes management and prompt intervention.*

Keywords: Tuberculosis, Diabetes mellitus, GeneXpert positive, Sputum Smear Positivity

How to cite this article: Mohammad Syedul Islam1* Farzana Ahmed2 Ruhus Safa Noor3 Ariful Islam4 Fahmida Faizha Shama5 Sifat Sharmin6. Clinical Pattern of Tuberculosis in Diabetic Patients-An Observational Study. Int J Drug Deliv Technol. 2026;16(89s):1619-1624. DOI: 10.25258/ijddt.16.89s.168.

INTRODUCTION:

Tuberculosis (TB) is a contagious illness caused by Mycobacterium tuberculosis, mainly impacting the lungs but also other body parts. It transmits via airborne droplets and typically manifests with a persistent cough, fever, weight loss, and night sweats in those with active TB disease [1,2]. Diabetes mellitus (DM) is a long-term metabolic condition impacting almost 500 million individuals globally, mainly in low- and middle-income nations. It is a significant factor in illness and death and disrupts metabolism by causing chronic inflammation and immune system issues [3,4].

Diabetes mellitus (DM) compromises both innate and adaptive immune responses, elevating the risk of developing active tuberculosis (TB) by two to three times. On the other hand, active TB can deteriorate glycemic control due to systemic inflammation and treatment effects, establishing a bidirectional relationship that leads to increased disease severity, slower sputum conversion and treatment response, higher rates of treatment failure and relapse, and

elevated mortality [5-7]. Numerous studies demonstrate that diabetes greatly impacts the clinical manifestation of tuberculosis. In contrast to non-diabetic patients, those with diabetes frequently exhibit more intense symptoms, greater lung involvement, elevated bacillary counts, slower sputum conversion, and a higher likelihood of a late diagnosis [8,9]. Patients with diabetes who have pulmonary tuberculosis frequently exhibit unusual radiological characteristics, more extensive lung damage, increased bacillary loads, and extended sputum positivity, indicating heightened disease severity [10,11]. Diabetes negatively influences tuberculosis treatment results, heightening the chances of delayed sputum conversion, failure of treatment, relapse, drug resistance, and increased mortality. These risks are amplified with inadequate glycemic control, underscoring the importance of combined TB-diabetes management and mutual screening [12,13].

Recent worldwide research has indicated that diabetes correlates with more severe clinical presentations of tuberculosis, such as extensive lung involvement, increased bacillary loads, slower sputum conversion, and worse treatment results, highlighting the necessity for integrated management of TB and diabetes [14,15]. Bangladesh endures a dual challenge of tuberculosis (TB) and diabetes mellitus (DM), experiencing a high rate of TB cases alongside an increasing prevalence of diabetes. The simultaneous presence of these conditions presents significant clinical and public health obstacles. A recent study from Bangladesh revealed that diabetic patients with pulmonary tuberculosis often displayed less lung field involvement, emphasizing the unusual radiological features of TB in individuals with diabetes [16].

Despite the significant prevalence of tuberculosis (TB) and diabetes mellitus (DM) in Bangladesh, information regarding the clinical characteristics of TB in diabetic individuals is still scarce. This study sought to assess the clinical characteristics of tuberculosis in diabetic patients visiting a tertiary care hospital to facilitate early diagnosis and enhance patient management.

METHODOLOGY:

This hospital-based observational study was conducted in the Department of Respiratory Medicine at tertiary care hospital, Bangladesh, over a six-month period from September 2025 to February 2026. The study aimed to evaluate the clinical pattern of tuberculosis among patients with diabetes mellitus and to explore the association between glycemic control, duration of diabetes, and selected clinical and radiological characteristics of tuberculosis.

A total of 75 consecutive adult patients with diabetes mellitus and newly diagnosed tuberculosis were enrolled using a consecutive sampling technique. Eligible participants were aged 18 years or older, had a confirmed diagnosis of diabetes mellitus (type 1 or type 2), and were newly diagnosed with pulmonary or extrapulmonary tuberculosis during the study period. Tuberculosis was diagnosed based on clinical presentation, microbiological evidence (sputum smear microscopy for acid-fast bacilli and/or GeneXpert MTB/RIF assay), radiological findings, and relevant investigations for extrapulmonary tuberculosis in accordance with the National Tuberculosis Control Programme (NTP) guidelines. Patients who had already initiated anti-tuberculosis treatment before enrollment, those with incomplete clinical or laboratory data, pregnant women, and patients who declined to participate were excluded from the study.

Data were collected using a structured case record form through face-to-face interviews, physical examination, review of medical records, and laboratory reports. Sociodemographic information including age, sex, and place of residence was recorded. Diabetes-related variables included type of diabetes, duration of diabetes, and glycemic status. Glycemic control was assessed using glycated hemoglobin (HbA1c), with poor glycemic control defined as HbA1c ≥8.0%. Clinical information included presenting symptoms such as chronic cough, fever, weight loss, night sweats, loss of appetite, and hemoptysis, as well as physical examination findings including pallor, bilateral crepitations, and peripheral lymphadenopathy.

Laboratory investigations included sputum smear microscopy for acid-fast bacilli, GeneXpert MTB/RIF assay, erythrocyte sedimentation rate (ESR), and HbA1c estimation. Chest radiography was performed for all patients with pulmonary tuberculosis to evaluate radiological characteristics including upper lobe involvement, cavitary lesions, bilateral pulmonary involvement, and pleural effusion. Tuberculosis was classified as pulmonary or extrapulmonary, and extrapulmonary cases were further categorized according to the anatomical site involved. Treatment category was classified as new or previously treated according to the National Tuberculosis Control Programme guidelines.

Data were entered, cleaned, and analyzed using Statistical Package for the Social Sciences (SPSS) version 26. Continuous variables were expressed as mean ± standard deviation (SD) and range, whereas categorical variables were presented as frequencies and percentages. Associations between categorical variables, including HbA1c category and sputum smear positivity, as well as duration of diabetes and bilateral pulmonary involvement, were assessed using the Chi-square test or Fisher's exact test where appropriate. A two-tailed p-value of less than 0.05 was considered statistically significant.

Ethical approval for the study was obtained from the Institutional Review Board (IRB) of tertiary care hospital, Bangladesh, before commencement of the study. Written informed consent was obtained from all participants prior to enrollment. Confidentiality and anonymity of participants were maintained throughout the study, and all procedures were conducted in accordance with the ethical principles outlined in the Declaration of Helsinki.

RESULTS:

A total of 75 patients with diabetes mellitus and newly diagnosed tuberculosis were enrolled in the study. The mean age of the participants was 51.6 ± 11.8 years (range: 24–76 years). Table 1 shows the largest proportion of patients (34.7%) belonged to the 51–60 years age group, followed by 41–50 years (25.3%). Males constituted 48 (64.0%) of the study population, giving a male-to-female ratio of 1.8:1. Type 2 diabetes mellitus was present in 93.3% of patients, and 42.7% had diabetes for more than five years. Poor glycemic control (HbA1c ≥8.0%) was observed in 53.3% of the participants.

Table 1. Sociodemographic Characteristics and Diabetic Profile of the Patients (N = 75)

Variable	Frequency (n)	Percentage (%)
Age group (years)		
18–30	5	6.7
31–40	10	13.3
41–50	19	25.3
51–60	26	34.7
>60	15	20.0
Mean ± SD	51.6 ± 11.8	–
Range	24–76	–
Sex		
Male	48	64.0
Female	27	36.0
Residence		
Urban	42	56.0
Rural	33	44.0
Type of diabetes		
Type 1	5	6.7
Type 2	70	93.3
Duration of diabetes		
<5 years	43	57.3
≥5 years	32	42.7
HbA1c		
<8.0%	35	46.7
≥8.0%	40	53.3

Figure I present chronic cough was the most frequent presenting symptom, reported by 70 (93.3%) patients, followed by fever (76.0%), weight loss (68.0%), night sweats (52.0%), loss of appetite (49.3%), and hemoptysis (22.7%).

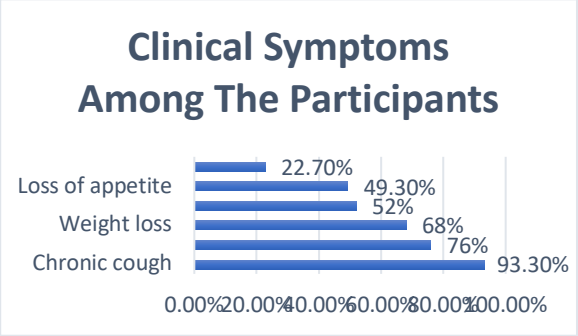


Figure legend: *Distribution of presenting clinical symptoms among diabetic patients with tuberculosis. Multiple responses were allowed; therefore, percentages do not total 100%.*

Figure I: Distribution of Presenting Clinical Symptoms Among Tuberculosis Patients with Diabetes (N = 75)

Table 2 shows the clinical examination findings, laboratory investigations, and radiological characteristics. Pallor was observed in 36.0% of patients, while bilateral crepitations were detected in 28.0%. Sputum smear positivity for acid-fast bacilli was documented in 58.7% of patients, and GeneXpert detected Mycobacterium tuberculosis in 82.7%. Chest radiography demonstrated upper lobe involvement in 61.3%, cavitary lesions in 37.3%, and bilateral pulmonary disease in 26.7%.

Table 2. Clinical Examination, Laboratory and Radiological Findings (N = 75)

Variable	Frequency (n)	Percentage (%)
Clinical findings*		
Pallor	27	36.0
Bilateral crepitations	21	28.0
Peripheral lymphadenopathy	8	10.7
Laboratory findings*		
Sputum smear positive	44	58.7
GeneXpert positive	62	82.7
Elevated ESR	56	74.7
Chest X-ray findings*		
Upper lobe involvement	46	61.3
Cavitary lesion	28	37.3
Bilateral involvement	20	26.7

Pleural effusion	7	9.3

**Multiple responses were allowed; therefore, percentages do not total 100%.*

Table 3 shows the pattern of tuberculosis and treatment category. Pulmonary tuberculosis (PTB) was the predominant form of the disease, diagnosed in 58 (77.3%) patients, while 17 (22.7%) had extrapulmonary tuberculosis (EPTB). Among patients with EPTB, pleural tuberculosis was the most common site (7, 9.3%), followed by lymph node tuberculosis (5, 6.7%), abdominal tuberculosis (3, 4.0%), and skeletal tuberculosis (2, 2.7%). According to the National Tuberculosis Control Programme (NTP) guidelines, 66 (88.0%) patients were categorized as new cases, whereas 9 (12.0%) had previously received anti-tuberculosis treatment.

Table 3. Pattern of Tuberculosis and Treatment Category (N = 75)

Variable	Frequency (n)	Percentage (%)
Pattern of tuberculosis		
Pulmonary tuberculosis	58	77.3
Extrapulmonary tuberculosis	17	22.7
Site of extrapulmonary tuberculosis		
Pleural	7	9.3
Lymph node	5	6.7
Abdominal	3	4.0
Skeletal	2	2.7
Treatment category		
New case	66	88.0
Previously treated	9	12.0

Table 4 presents sputum smear positivity was significantly higher among patients with poor glycemic control (HbA1c ≥8.0%) than among those with HbA1c <8.0% (72.5% vs. 42.9%, p = 0.010).

Table 4. Association Between Glycemic Control and Sputum Smear Positivity (N = 75)

HbA1c	Sputum smear positive n (%)	Sputum smear negative n (%)	Total	p-value
<8.0% (n = 35)	15 (42.9)	20 (57.1)	35	
≥8.0% (n = 40)	29 (72.5)	11 (27.5)	40	**0.010**

Chi-square test. Bold values indicate statistical significance (p <0.05).

Table 5 shows the association between the duration of diabetes mellitus and radiological extent of pulmonary tuberculosis. Patients with diabetes of five years or longer had a significantly higher frequency of bilateral pulmonary involvement than those with a shorter duration of diabetes (40.6% vs. 16.3%, p = 0.020).

Table 5. Association Between Duration of Diabetes and Bilateral Pulmonary Involvement Among Patients with Pulmonary Tuberculosis (n = 58)

Duration of diabetes	Bilateral involvement n (%)	Unilateral involvement n (%)	Total	p-value
<5 years (n = 32)	5 (15.6)	27 (84.4)	32	
≥5 years (n = 26)	10 (38.5)	16 (61.5)	26	**0.049**

Chi-square test. Bold values indicate statistical significance (p <0.05).

DISCUSSION:

In the current research, participants with TB–DM were largely middle-aged, male, and had type 2 diabetes, with over half exhibiting inadequate glycemic control. A study in Bangladesh similarly revealed that the majority of TB patients with hyperglycemia in the diabetic range were middle-aged men, and that ongoing hyperglycemia continued to be prevalent post-TB treatment, emphasizing the necessity for regular diabetes screening and glycemic monitoring. These results align with the demographic and diabetic characteristics noted in the current study [17].

In the current research, chronic cough emerged as the most prevalent symptom, succeeded by fever, weight loss, night sweats, and decreased appetite. A study from Bangladesh also found that fever (88%), loss of appetite (81%), cough (70%), weight loss (65%), and night sweats (41%) were the main clinical symptoms in TB patients, corroborating the results of the current study [18].

In this study, the prevalence of GeneXpert positivity was 82.7%, sputum smear positivity was 58.7%, upper lobe involvement was 61.3%, and cavitary lesions were found in 37.3% of diabetic TB patients. Recent research has also indicated that patients with diabetes and pulmonary tuberculosis often exhibit elevated bacteriological positivity, involvement of the upper lobes, cavitary lesions, and widespread pulmonary abnormalities, indicating greater disease severity and bacillary load [6,9].

In the current research, pulmonary tuberculosis was the most prevalent type, followed by extrapulmonary tuberculosis, with pleural and lymph node involvement being the primary sites for EPTB. The majority of patients were newly diagnosed with TB.

Recent research has also indicated that pulmonary TB is the main presentation among TB-diabetes patients, with diabetes adding to the complexity of the disease and making treatment more challenging [12,14].

In this study, sputum smear positivity was notably greater in patients with inadequate glycemic control, suggesting a higher bacillary load. A recent meta-analysis indicated that achieving optimal glycemic control enhances TB treatment results, highlighting the significance of diabetes management in the course of TB therapy [19].

In the current research, patients with diabetes lasting ≥5 years exhibited considerably greater bilateral pulmonary involvement compared to individuals with shorter durations, suggesting that long-term diabetes might correlate with more widespread TB disease. Comparable results have been observed, indicating more severe radiological irregularities in diabetic individuals suffering from pulmonary infections [20].

Overall**,** Patients with TB–DM typically exhibit significant clinical and radiological symptoms, and poor glycemic control along with prolonged diabetes duration correlates with increased disease burden, highlighting the necessity for coordinated TB–diabetes care.

CONCLUSION:

In diabetic individuals, tuberculosis often manifests with notable clinical and imaging anomalies, featuring elevated bacteriological positivity, widespread lung involvement, and a greater disease burden. Inadequate glycemic control and prolonged diabetes duration correlate with more severe TB symptoms, highlighting the necessity for combined TB–diabetes screening, effective glycemic management, and prompt clinical intervention to enhance outcomes.

REFERENCES:

1. Bagcchi S. WHO's global tuberculosis report 2022. The Lancet Microbe. 2023 Jan 1;4(1):e20.
2. Suárez I, Fünger SM, Kröger S, Rademacher J, Fätkenheuer G, Rybniker J. The diagnosis and treatment of tuberculosis. Deutsches Aerzteblatt International. 2019 Oct 25;116(43).
3. Kumar R, Saha P, Kumar Y, Sahana S, Dubey A, Prakash O. A review on diabetes mellitus: type1 & Type2. World Journal of Pharmacy and Pharmaceutical Sciences. 2020 Aug 2;9(10):838-50.
4. Kaul K, Tarr JM, Ahmad SI, Kohner EM, Chibber R. Introduction to diabetes mellitus. InDiabetes: an old disease, a new insight 2012 Dec 30 (pp. 1-11). New York, NY: Springer New York.
5. Workneh MH, Bjune GA, Yimer SA. Prevalence and associated factors of tuberculosis and diabetes mellitus comorbidity: a systematic review. PloS one. 2017 Apr 21;12(4):e0175925.
6. Boadu AA, Yeboah-Manu M, Osei-Wusu S, Yeboah-Manu D. Tuberculosis and diabetes mellitus: The complexity of the comorbid interactions. International Journal of Infectious Diseases. 2024 Sep 1;146:107140.
7. Workneh MH, Bjune GA, Yimer SA. Prevalence and associated factors of tuberculosis and diabetes mellitus comorbidity: a systematic review. PloS one. 2017 Apr 21;12(4):e0175925.
8. Krishna S, Jacob JJ. Diabetes mellitus and tuberculosis. Endotext [Internet]. 2021 Apr 18.
9. Shi H, Yuan Y, Li X, Li YF, Fan L, Yang XM. Analysis of the influencing factors and clinical related characteristics of pulmonary tuberculosis in patients with type 2 diabetes mellitus. World journal of diabetes. 2024 Feb 15;15(2):196.
10. Zhan S, Juan X, Ren T, Wang Y, Fu L, Deng G, Zhang P. Extensive radiological manifestation in patients with diabetes and pulmonary tuberculosis: a cross-sectional study. Therapeutics and clinical risk management. 2022 May 23:595-602.
11. Pavlović JM, Pavlovic AD, Bulajić MV, Pešut DP. Prevalence of diabetes mellitus (DM) in tuberculosis (TB) patients: clinical and radiologic features in the TB-DM association based on a five-year hospital study. Infez Med. 2018 Mar 1;26(1):22-7.
12. Khattak M, Rehman AU, Muqaddas T, Hussain R, Rasool MF, Saleem Z, Almalki MS, Alturkistani SA, Firash SZ, Alzahrani OM, Bahauddin AA. Tuberculosis (TB) treatment challenges in TB-diabetes comorbid patients: a systematic review and meta-analysis. Annals of medicine. 2024 Dec 31;56(1):2313683.
13. Li M, Chen T, Hua Z, Yan H, Wang D, Li Z, Kang Y, Zhu N, Li C. Global, regional, and national prevalence of diabetes mellitus in patients with pulmonary tuberculosis: a systematic review and meta-analysis. Diabetology & Metabolic Syndrome. 2021 Oct 30;13(1):127.
14. Munir MA, Khan S, Rehman S, Ahmed D, Jabbar A. Tuberculosis among diabetes patients: a review of epidemiology,

pathophysiology, clinical manifestations, and management. Chronicles of Biomedical Sciences. 2024 Sep 2;1(3):PID26-.

15. Dhamotharaswamy K, Selvaraj H, Lakshmanaperumal P, R H, Sasankan AS, Thangavelu P, K M, Thangavel S. Diabetes and TB: confluence of two epidemic and its effect on clinical presentation. Current Diabetes Reviews. 2024 Jan 1;20(1):59-66.
16. Galib RK, Paul SK, Akter K, Musa MI, Sarker DJ, Choudhury SA, Paul SC, Chakrabortty R. Frequency of Lower Lung Field Tuberculosis in Diabetes Mellitus Patients Attending Tertiary Care Hospital in Bangladesh: A Cross-Sectional Study. Health Science Reports. 2025 Jan;8(1):e70413.
17. Alkabab YM, Biswas S, Ahmed S, Paul K, Nagajyothi J, Banu S, Heysell S. Differentiating transient from persistent diabetic range hyperglycemia in a cohort of people completing tuberculosis treatment in Dhaka, Bangladesh. PLoS One. 2021 Nov 23;16(11):e0260389.
18. Paul KK, Alkabab YM, Rahman MM, Ahmed S, Amin MJ, Hossain MD, Heysell SK, Banu S. A public-private model to scale up diabetes mellitus screening among people accessing tuberculosis diagnostics in Dhaka, Bangladesh. International Journal of Infectious Diseases. 2020 Mar 1;92:56-61.
19. Zhao L, Gao F, Zheng C, Sun X. The impact of optimal glycemic control on tuberculosis treatment outcomes in patients with diabetes mellitus: systematic review and meta-analysis. JMIR public health and surveillance. 2024 Apr 2;10:e53948.
20. Vishwakarma P, Usman K, Garg R, Bajpai J, Sethi R, Pradhan A. Clinical and Radiological Presentations of Various Pulmonary Infections in Hospitalized Diabetes Mellitus Patients: A Prospective, Hospital-Based, Comparative, Case Series Study. Pulmonary Medicine. 2021;2021(1):8878746.