

Clinico-Radiological Profile Of Pulmonary Tuberculosis In Patients With Type -2 Diabetes Mellitus — An Observational Case Series In A Tertiary Care Center.

Dr. Christy Singla, Dr. Rehbar Khan, Dr. Aravind Raj K

Junior Resident, Department Of Respiratory Medicine, Muzaffarnagar Medical College, Muzaffarnagar, Uttar Pradesh, India

Professor And Head, Department Of Respiratory Medicine, Muzaffarnagar Medical College, Muzaffarnagar, Uttar Pradesh, India

Assistant Professor, Department Of Respiratory Medicine, Muzaffarnagar Medical College, Muzaffarnagar, Uttar Pradesh, India

Abstract

Type 2 diabetes mellitus (T2DM) is a recognized risk factor for active tuberculosis (TB) and is reported to alter its clinical and radiological presentation, often producing atypical lower-zone, multizonal, or more extensively cavitary disease compared with non-diabetic patients. As per India TB Report 2023, 2025 marks a milestone year for TB surveillance efforts in India, with a record high notification of 24.2 Lakh cases, this is an increase of over 13% as compared to 2021. It translates to a case notification rate of approximately 172 cases per lakh population

Diabetes mellitus (DM) is considered to be a significant risk factor for TB with a prevalence rate between 6% and 25%. The effect of diabetes on the development and severity of TB, and the complex interrelations between nutrition, obesity, diabetes, and TB remain provocative issues in public health and clinical medicine

This paper describes a hospital-based, descriptive observational case series that will enroll 50 consecutive patients with pulmonary TB and coexisting T2DM over a 16-month period, to document their demographic, clinical, glycemic, and chest-radiographic profile, and to explore the relationship between glycemic control (HbA1c) and radiological disease pattern.

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I. Introduction

Tuberculosis (TB) remains one of the leading infectious causes of death worldwide, with an estimated 8.2 million new cases notified globally in the most recent reporting year — the highest annual figure recorded since WHO surveillance began.¹ Diabetes mellitus (DM) is one of five major health-related risk factors that collectively account for a substantial proportion of the global TB burden, alongside HIV, undernutrition, smoking, and alcohol use disorder; diabetes alone is estimated to underlie roughly 400,000 incident TB episodes each year.^{2,3} The relationship between TB and DM is bidirectional. Diabetes impairs innate and adaptive immune responses — including alveolar macrophage function, neutrophil chemotaxis, and antigen-specific T-lymphocyte responses — increasing susceptibility to Mycobacterium tuberculosis infection and progression to active disease; conversely, active TB can worsen glycemic control and unmask latent or new-onset diabetes through the metabolic stress of chronic infection.^{11,12} Systematic reviews estimate a two- to three-fold higher risk of active TB in diabetics compared with non-diabetics.^{11,12}

Several Indian and international observational and case-control studies have reported that diabetics with PTB more often show atypical lower-zone involvement, multilobar or bilateral disease, and cavitary lesions compared with non-diabetics, along with a higher bacillary load and delayed sputum conversion.^{4–10} Recognizing this atypical pattern at the bedside has practical value: it can prompt earlier diabetes screening in TB patients and closer TB surveillance in diabetics, particularly those with poor glycemic control.

Given the rising prevalence of type 2 diabetes in India and other high-TB-burden countries, we plan this observational case series to systematically document the demographic, clinical, and radiological profile of pulmonary TB in patients with known T2DM at our institution, and to examine whether glycemic control correlates with radiological disease severity.

II. Aim And Objectives

1. To study the demographic and clinical profile of pulmonary tuberculosis in patients with type 2 diabetes mellitus.

2. To describe the radiological pattern of pulmonary tuberculosis in this population.
3. To correlate glycemic control (HbA1c) with pattern of radiological involvement.

III. Study Design

Hospital-based, descriptive, observational case series, conducted in the Department of Respiratory Medicine, at Muzaffarnagar Medical College, Muzaffarnagar, Uttar Pradesh, India, over a planned period of 16 months from MARCH 2025 to JULY 2026, following approval from the Institutional Ethics Committee.

IV. Study Population

Fifty consecutive patients satisfying the eligibility criteria below will be enrolled after written informed consent, using consecutive sampling of patients presenting to the department during the study period.

Inclusion criteria:

- a) Age $\geq$ 18 years.
- b) Newly diagnosed pulmonary TB, confirmed bacteriologically (sputum AFB smear) or clinico-radiologically as per NTEP criteria.
- c) Pre-existing, previously diagnosed type 2 diabetes mellitus

Exclusion criteria:

- a) Type 1 diabetes mellitus or secondary/steroid-induced diabetes.
- b) HIV co-infection or other immunosuppressive states/medication.
- c) Drug-resistant TB (MDR/XDR) at diagnosis.
- d) Extrapulmonary TB without pulmonary involvement.
- e) Patients not willing to give informed consent

V. Results-

Table 1. Age of Patients

Age Group	Involvement (n=number)
18-30	12
31-49	14
50-65	24

Table 2. Sex of Patients

Sex	Involvement (n= Number)
Male	32
Female	18

Table 3 Zone of lesions

Zone	Involvement (n= number)
Upper	16
Middle	14
Lower	20

Table 4. Poor HbA1c control >8 and pattern of lesion

Radiological Pattern	Involvement of Pattern
Infiltrates	28
Upper Zone involvement	16
Cavitatory lesion	22
Bilateral Disease	24
Lower lobe Involvement	14

TABLE 5 – Type of lesions

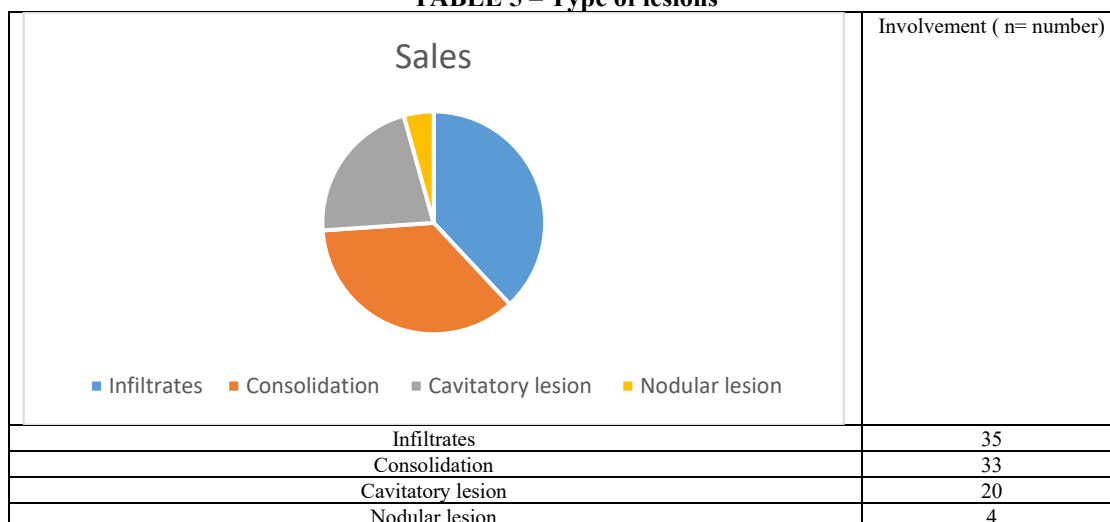
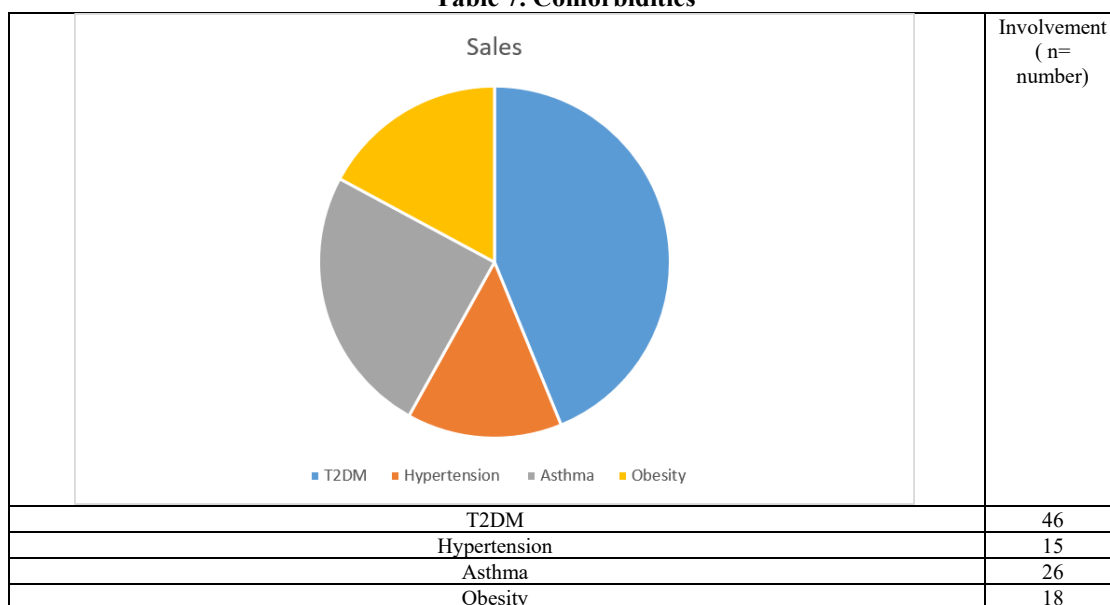


Table 6. Addictions and Habits

Smoking	50%
Alcohol	40%
Drugs	10%

Table 7. Comorbidities



A total of 50 patients with pulmonary tuberculosis, and Type 2 DM were included. Most patients were aged 50-65 years. Followed by 34-49 years. There were 32 males and 18 females. 60% were from urban areas and 40% from rural areas. Smoking was reported in 50% and 40% had use of alcohol. Type 2 DM accounted for 92% of cases while 8% had other comorbidities other than type 2 DM. Diabetes preceded TB was reported in 68% of patients. Cough being the most common presentation followed by expectoration and polyuria.

Radiologically lower lung field involvement was present in 58% and Infiltrates in lower zone 70%, consolidation in 66%, cavitory lesions 40%. And nodular lesion in 8%

Poorly controlled hba1c >8.0 has shown the infiltrate pattern to dominate which correlates with the study done by N. Ranjan et al 2026¹⁷ This shows that poor glycemic control is a risk factor for developing pulmonary tuberculosis.

VI. Discussion-

Older [mean age 52.5 ($\pm$ 8.76)] it could be explained by the summation of accumulative effects of age and DM on decreasing the function of Immune system, this corresponds to research findings reported by Liu, 1989; Yamagishi et al, 1996; Tamura et al, 2001). [5,6,7] the disease 60% was predominantly from urban background may be because spread of PTB is faster in crowded living conditions in urban districts However, the increased prevalence of diabetes in urban areas may also play a role. This is in line with research finding by Stevenson (2007) [8]

50% were smokers. This is supported by findings from study by Lin et al (2009) [9] who theorized that chronic exposure to cigarette smoke tends to reduce expression of surface proteins related to antigen presentation by pulmonary macrophages.

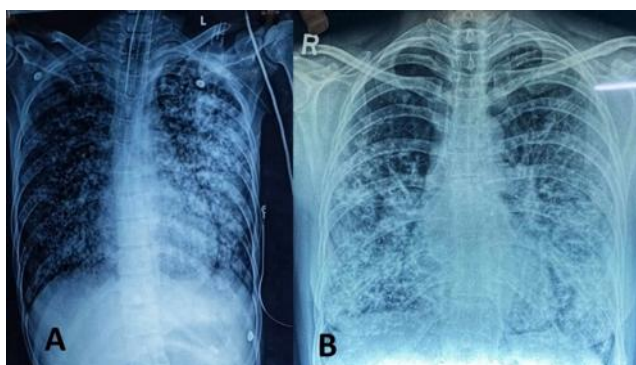
64% were males. This is backed by research findings from some previous research (Singla et al, 2006; Tatar et al, 2009; Nissapatorn et al, 2005) [10, 11, 12]

Research conducted to compare PTB- DM patients with only PTB patients (Mood et al 2021, Rania Abd El-Hamid El-Kady et al, 2021) have shown that the profile of the 02 groups is different, with TB-DM patients being older. [13,14]

40% patients had Sputum AFB grading+++ which suggests that there are more chances of high degree of infectivity in case of diabetic patients. Finding supported by results of study by Jiyani et al, 2015

Some previous studies show that compared to non-DM patients, PTB in patients with DM may progress faster, higher grade smear and culture positivity and have a higher body weight. (Mood et al, 2021; Busaroung et al 2022) [13, 16].

A large proportion of patients in our study had lower lung involvement. Clinically, this is important because lower lobe tuberculosis might be misdiagnosed as community-acquired pneumonia, abscess or cancer. Another atypical radiographic pattern was presence of multi lobar cavities. This is expected due to the deficient immune system in diabetics. These findings are supported by results obtained from studies conducted by Patel et al (2011); Sen et al (2009); Bacakoğlu et al (2001). Studies by Perez-Guzman (2001), Dooley et al (2009) comparing and analysis radiological images in PTB- DM & PTB- No DM patients concluded that the former group had a decreased frequency of upper and an increased frequency of lower lung field lesions. More PTB-DM patients developed cavitation more often in the lower lung fields



A.CXR-cavitory lesion in lower lobe



B. CXR indicating infiltrates in lower lung

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