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Original Research Article

Radiological and Clinical Patterns of Pulmonary Tuberculosis in Patients with and without Diabetes Mellitus: An Observational Study

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Abstract:

Background: Diabetes mellitus (DM) alters the immune response to Mycobacterium tuberculosis, leading to atypical and more extensive disease. Objective: To compare the radiological and clinical patterns of pulmonary TB among patients with and without DM.

Methods: A cross-sectional study was conducted at the Institute of Respiratory Diseases, SMS Medical College, Jaipur, from July 2023 to September 2024. A total of 210 newly diagnosed pulmonary TB patients were enrolled and grouped as non-diabetic, previously diagnosed DM, or newly diagnosed DM. All underwent chest radiography and sputum/CBNAAT testing.

Results: Of 210 TB patients, 80 (38.1%) had DM. Lower-lung-field involvement was more common among diabetics (60% vs 8%, p = 0.001). Cavitary lesions (70% vs 30%), miliary patterns (44% vs 20%), and pleural effusion (40% vs 29%) were more frequent in diabetics.

Conclusion: Diabetic TB patients present with atypical radiological patterns—particularly lower-lobe and diffuse involvement—which may mimic bacterial pneumonia. Routine DM screening and awareness of these atypical patterns are essential for early diagnosis and improved outcomes.

Introduction

Tuberculosis (TB) is one of the world's leading infectious causes of death, with India contributing the largest share globally [1,2]. At the same time, the prevalence of Diabetes Mellitus (DM) is increasing rapidly, creating a dangerous intersection between these two epidemics [3]. Diabetes compromises host immunity through impaired macrophage activity, reduced cytokine production, and delayed granuloma formation [4,5]. Consequently, diabetic patients are more susceptible to TB and often present with atypical radiological findings [6,7]. The association between DM and TB has long been recognized. Sosman and Steidl (1927) first described atypical lower-lung involvement in diabetic tuberculosis [8]. Subsequent studies have demonstrated that hyperglycemia triples the risk of developing active TB and worsens treatment outcomes [9,10]. Indian and Southeast Asian data reveal a predominance of lower-lobe and multiple cavitary lesions among diabetic TB patients [11,12]. Despite such evidence, information from North India remains limited, prompting this study to evaluate the clinical and radiological patterns of pulmonary TB in diabetics compared with non-diabetics.

Results

Table 1: Demographic and Clinical Profile

Parameter	Non-Diabetic (n = 130)	Diabetic (n = 80)	P value
Mean Age (years)	43.2 ± 10.7	54.6 ± 9.4	< 0.05
Male (%)	58.4	64.5	NS
BMI (kg/m²)	21.3 ± 3.4	23.1 ± 4.2	< 0.05
AFB Positive (%)	62	70	NS
CBNAAT Positive (%)	63	39	< 0.05

Table 2: Radiological Distribution

Radiological Finding	Non-Diabetic n (%)	Diabetic n (%)	P value
Upper Lung Field	72 (55)	2 (2)	0.1
Lower Lung Field	10 (8)	48 (60)	0.001
Cavitary Lesion	39 (30)	56 (70)	< 0.01
Miliary Pattern	26 (20)	35 (44)	< 0.05
Pleural Effusion	38 (29)	32 (40)	0.07

Table 3: Glycemic Control vs Radiological Severity

HbA1c (%)	Patients	Cavitary Lesions (%)	Bilateral Involvement (%)
< 7.0	16	31	12
7.0–8.9	34	65	42
≥ 9.0	30	80	70

Table 4: Treatment Outcomes

Outcome	Non-Diabetic	Diabetic	P value
Sputum Conversion (2 mo)	87.7%	72.5%	0.01
Sputum Conversion (6 mo)	98.5%	90.0%	0.04
Treatment Success	93.1%	82.5%	0.02
Relapse	3.1%	8.8%	0.03
Mortality	1.5%	5.0%	0.06

Discussion

The coexistence of tuberculosis and diabetes constitutes a major public-health challenge [1,3,5]. Our study demonstrated a 38.1% prevalence of diabetes among newly diagnosed PTB patients, similar to previous Indian data [7,11]. Diabetic patients were older, had higher BMI, and exhibited lower-lung-field involvement in 60% of cases, multiple cavities in 75%, and miliary spread in 44%. These findings are consistent with Perez-Guzman et al. (2001), Bacakoglu et al. (2001), and Vijayan et al. (2020) [9,11,13]. Pathophysiologically, chronic hyperglycemia impairs macrophage activation, reduces IL-12 and IFN-γ secretion, and causes microangiopathy, predisposing to atypical and lower-lobe lesions [14–16]. Restrepo et al. (2007) and Buasroung et al. (2022) reported similar associations between high HbA1c and radiological severity [15,17]. Treatment outcomes in our cohort were poorer among diabetics—reflected by slower sputum conversion and higher relapse. Dooley and Chaisson (2009) and Faurholt-Jepsen et al. (2012) made similar observations [18,19]. From a public-health standpoint, nearly half of our diabetic TB patients were newly diagnosed, emphasizing the value of bidirectional screening advocated by WHO (2011) and the India TB Report (2024) [21,22]. Our findings confirm that diabetes significantly modifies the clinical and radiological spectrum of pulmonary TB.

Conclusion

Diabetes Mellitus profoundly affects tuberculosis presentation, radiology, and treatment outcomes. Routine glucose screening at TB diagnosis, glycemic optimization, and integrated management are crucial to meet India's End TB targets.

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