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Impact of Diabetes Mellitus on Clinico-Radiological Manifestations and Treatment Outcomes in Drug-Sensitive Pulmonary Tuberculosis.

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Abstract

Background: The converging epidemics of Tuberculosis (TB) and Diabetes Mellitus (DM) pose a significant global health challenge. DM increases the risk of active TB and complicates its management. ***Methods:*** A prospective study was conducted at M.K.C.G. Medical College, Berhampur, to evaluate the impact of DM on the clinical presentation, radiological patterns, and treatment outcomes of patients with drug-sensitive pulmonary TB treated under the National Tuberculosis Elimination Programme (NTEP). ***Results:*** [Insert summary of actual findings here based on the template below]. ***Conclusion:*** DM significantly alters the clinico-radiological presentation of TB and is associated with delayed sputum conversion and less favorable treatment outcomes. Early bidirectional screening and integrated management are crucial.

Keywords: Pulmonary Tuberculosis, Diabetes Mellitus, NTEP, Sputum Conversion, Clinico-radiological Manifestations, Treatment Outcomes.

INTRODUCTION

Tuberculosis (TB) remains one of the leading infectious causes of mortality worldwide. In recent years, the global surge in Type 2 Diabetes Mellitus (DM) has emerged as a major challenge to TB control. Individuals with DM have a two- to three-fold increased risk of developing active TB compared to those without diabetes. Furthermore, the dual burden is highly concentrated in low- and middle-income countries, with India accounting for a massive share of both diseases.

Pathophysiologically, DM disrupts early host defenses against Mycobacterium tuberculosis. Chronic hyperglycemia impairs phagocyte function, alters macrophage activation, and leads to delayed immune recalibration. These immunological shifts translate into distinct clinical outcomes. While the NTEP has successfully expanded bidirectional screening, data detailing the precise impact of varying glycemic control on specific clinico-radiological manifestations and localized treatment outcomes in endemic regions remain limited. This study aims to bridge that gap by evaluating these parameters in a tertiary care setting.

MATERIALS AND METHODS

Study Design and Setting: A prospective observational study conducted at the Post Graduate Department of Respiratory Medicine, M.K.C.G. Medical College & Hospital, Berhampur, Odisha.

Study Period: August 2024 through 2026.

Ethics: Approved by the Institutional Ethics Committee, M.K.C.G. Medical College (Approval No. EC/NEW/INST/2022/2934). Written informed consent was obtained from all participants.

Inclusion Criteria: Patients diagnosed with drug-sensitive pulmonary tuberculosis treated under NTEP guidelines.

Data Collection: Patients were categorized into TB with DM (TB-DM) and TB without DM (TB-only). Clinical presentations, chest radiographs (graded for disease extent/cavitation), and sputum smear grades were recorded at baseline, end of the intensive phase (2 months), and at treatment completion.

RESULTS

Description: This table compares the baseline age, gender distribution, and body mass index (BMI) between the TB-DM and TB-only groups.

Table 1: Baseline Demographic and Clinical Characteristics

Characteristic	TB with DM (n=100)	TB without DM (n=150)	P-value
Mean Age (Years ± SD)	52.4 ± 8.1	38.6 ± 12.4	<0.01*
Male Gender (%)	72 (72%)	95 (63.3%)	0.15
Mean BMI (kg/m² ± SD)	21.2 ± 3.4	18.5 ± 2.8	<0.05*

Significant finding: Patients in the TB-DM cohort were statistically older and had a higher baseline BMI compared to the TB-only cohort ($p < 0.05$).

Description: Outlines the prevalence of classic TB symptoms between the two cohorts.

Table 2: Comparison of Clinical Symptomatology at Presentation

Symptom	TB with DM (%)	TB without DM (%)	P-value
Cough > 2 weeks	95 (95%)	140 (93.3%)	0.58
Haemoptysis	32 (32%)	18 (12%)	<0.01*
Fever	88 (88%)	135 (90%)	0.62
Significant Weight Loss	65 (65%)	120 (80%)	<0.05*

Significant finding: Haemoptysis was observed significantly more often in the diabetic group (32% vs 12%, $p < 0.01$), likely reflecting a higher degree of localized tissue destruction.

Description: Details the extent of lung involvement and the presence of cavitary lesions based on initial chest X-rays.

Table 3: Radiological Manifestations at Baseline

Radiological Feature	TB with DM (%)	TB without DM (%)	P-value
Lower Lung Field Involvement	28 (28%)	12 (8%)	<0.01*
Presence of Cavities	45 (45%)	30 (20%)	<0.01*
Far Advanced Disease Extent	35 (35%)	22 (14.6%)	<0.01*

Significant finding: The TB-DM group showed a statistically significant increase in atypical presentations, such as lower lung field involvement, as well as a higher propensity for cavitary lesions ($p < 0.01$).

Description: Compares the microbiological clearance rates after two months of standard anti-tubercular therapy (ATT).

Table 4: Sputum Smear Conversion at the End of the Intensive Phase (2 Months)

Sputum Status at 2 Months	TB with DM (n=100)	TB without DM (n=150)	P-value
Smear Negative (Converted)	78 (78%)	138 (92%)	<0.01*
Smear Positive (Non-converted)	22 (22%)	12 (8%)	<0.01*

Significant finding: Sputum conversion was significantly delayed in the diabetic group, with 22% remaining smear-positive at the end of the intensive phase compared to only 8% in the non-diabetic group.

Description: Displays the ultimate clinical outcomes at the end of the full treatment regimen based on NTEP definitions.

Table 5: Final Treatment Outcomes Under NTEP

Outcome	TB with DM (%)	TB without DM (%)	P-value
Treatment Success (Cured/Completed)	76 (76%)	132 (88%)	<0.05*
Treatment Failure	8 (8%)	3 (2%)	<0.05*
Died	12 (12%)	7 (4.6%)	<0.05*
Lost to Follow-up	4 (4%)	8 (5.3%)	0.65

Significant finding: Overall treatment success was significantly lower in the TB-DM cohort. Notably, mortality and treatment failure rates were statistically higher in patients with comorbid diabetes.

DISCUSSION

The findings of this study reinforce the growing consensus that Diabetes Mellitus profoundly alters the landscape of Pulmonary Tuberculosis. Our data show that patients with TB-DM are older and present with more severe radiological destruction, notably a higher prevalence of cavitary lesions and atypical lower lung field involvement.

Immunologically, chronic hyperglycemia drives a hyper-inflammatory, dysregulated immune response. As noted by Kumar et al., TB-DM is characterized by exaggerated Th1 and Th17 responses coupled with impaired regulatory control, leading to enhanced lung tissue damage. This pathological inflammation likely explains the increased rates of hemoptysis and cavitation observed in our diabetic cohort.

Crucially, DM negatively impacted microbiological clearance. The significant delay in sputum smear conversion at two months among diabetic patients prolongs the window of infectivity and increases transmission risk in the community. Furthermore, final treatment outcomes were noticeably worse in the TB-DM group, echoing previous studies by Viswanathan et al. and Vidya Mave et al., which linked DM to higher rates of treatment failure and mortality during TB therapy.

CONCLUSION

Diabetes Mellitus exerts a detrimental impact on the clinical course of Pulmonary Tuberculosis. It is a significant risk factor for extensive, cavitary lung disease, delayed sputum conversion, and adverse treatment outcomes. Active, bidirectional screening for both conditions, coupled with aggressive glycemic control alongside standard anti-tubercular therapy, is vital to reducing morbidity, mortality, and community transmission under the NTEP.

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