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A Study on the impact of Diabetes Mellitus on treatment outcome of Pulmonary Tuberculosis

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Introduction

Tuberculosis (TB) remains a critical public health challenge in India, which accounts for 27% of the global TB burden, with 2.8 million new cases reported in 2023[1]. Andhra Pradesh, a high-burden state in southern India, reported 124,000 TB cases in 2023, reflecting a12% increase from 2020, driven by gaps in early diagnosis and treatment adherence[2]. Concurrently, diabetes mellitus (DM) has reached epidemic proportions in India, with 101 million adults living with diabetes in 2023, the second-highest national burden globally[3]. Andhra Pradesh mirrors this trend, where 15.6% of its adult population has DM-exceeding the national average of 11.4%-due to urbanization, sedentary lifestyles, and high prevalence of obesity[4].

The TB-DM syndemic is particularly acute in Andhra Pradesh. Recent studies indicate that 25-30% of TB patients in the state have comorbid DM, nearly double the national average (12-18%)[5]. This overlap is fueled by poor glycemic control, delayed TB diagnosis, and fragmented healthcare delivery in rural and tribal regions, which constitute 40% of Andhra Pradesh's population[6,7]. Diabetic TB patients in the state face 3.5-fold higher odds of cavitary lung lesions, 2.8-fold higher relapse rates, and 40% lowertreatment success rates compared to non-diabetic TB patients[8]. Mechanistically, chronic hyperglycemia in DM impairs macrophage function and Th1-mediated immunity, accelerating Mycobacterium tuberculosis proliferation and drug resistance[8]. Conversely, TB-induced systemic inflammation exacerbates insulin resistance, worsening glycemic control and increasing DM-related complications, such as neuropathy and renal disease[9,10,16]. Furthermore nearly 52% of DM cases in TB patients are newly diagnosed during TB treatment, highlighting systemic gaps in bidirectional screening[17].

In Andhra Pradesh robust Mukhyamantri Aarogyasri health insurance scheme and the National TB Elimination Programme (NTEP), integration of TB-DM care remains suboptimal. Only 28% of primary health centers in the state offer simultaneous glucose monitoring and TB diagnostics, while <15% of diabetic patients receive routine TB preventive therapy (TPT)[13]. Cultural stigma around chronic diseases and reliance on private healthcare-which manages 60% of TB cases further hinder coordinated care[8,9].

Aims and Objectives

1.To assess the sociodemographic profile of study population

2.To determine the impact of diabetes mellitus on treatment outcome of pulmonary tuberculosis

Methodology

Study Design
This study is a hospital-based study conducted at the Department of Pulmonary Medicine, Viswabharathi Medical College and General Hospital, [City/Location], Andhra Pradesh.

Sample Size
A total of 60 consecutive cases of pulmonary tuberculosis were enrolled according to the specified inclusion and exclusion criteria.

Inclusion Criteria
Patients meeting the following criteria were included in the study:
1. Diagnosed cases of pulmonary tuberculosis of age greater than 18 years.
2. Patients who provided informed consent and were willing to participate in the study.

Exclusion Criteria
Patients were excluded from the study if they met any of the following criteria:
1.Age less than 18 years.
3.Patients with type 1 diabetes mellitus.
4.Patients co-infected with HIV and the patients with other infectious diseases of the lungs.

Data Collection: The study participants were explained the scope of the study and after taking the informed consent, data were collected from them using a structured questionnaire .Sputum smear examination was done for all the study participants and OGTT was performed for the study subjects except for known diabetics to know their Glycemic status

Data entry and analysis
Data were entered in MS excel 2013 and analyzed using appropriate statistical methods

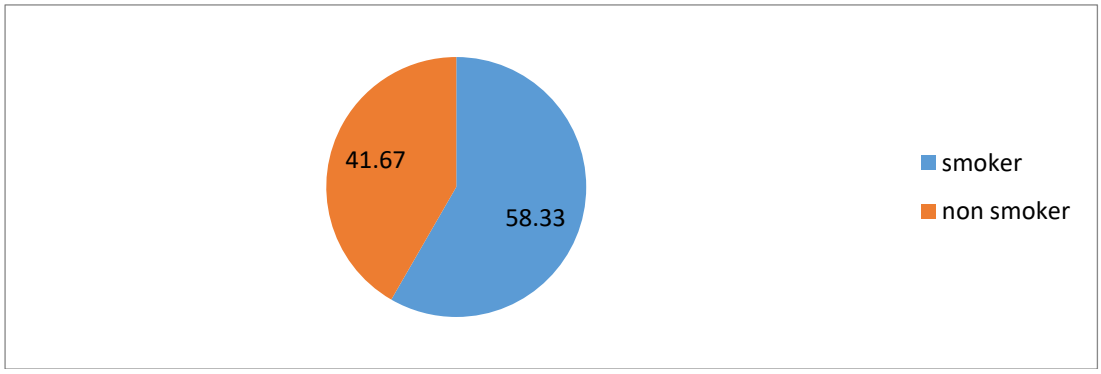
Results

Table1: Sociodemographic profile of the study population

		No. of patients
Age distribution	<40	10
	41-50	18
	51-60	12
	>60	20
Sex	Male	45
	Female	15

In the current study, majority of the study participants were in the age group of above 60 followed by those in the age group of 41-50. Males were more among the study participants compared to females.

Fig 1 Smoking status of study participants



From the above figure, it is clear that 58.33% of the study participants were smokers and 41.67% were non smokers

Table 2: Sputum smear microscopy with ZNstain

	No. of patients
A	50
B	10

Above Table shows the Sputum smear microscopy using Ziehl-Neelsen (ZN) stain was performed on 60 patients, with 50 patients showing result positive and 10 patients showing result negative and CBNAAT positive

Table 3: Classification of PTB with sputum smear microscopy

	No. of patients	Smear positive	Smear negative
New	36	30 (83%)	6 (17%)
Relapse	14	11(79%)	3 (21%)
Treatment after loss to follow up	10	9 (90%)	1(10%)

In the current study, overall, 83% (50/60) of all PTB cases were smear-positive, underscoring the high prevalence of detectable bacillary load. Smear positivity rates were highest in the treatment-after-loss group (90%), followed by new (83%) and relapse (79%) categories.

Table 4: Diabetes mellitus among study population at the initiation of treatment

Diabetes mellitus	Frequency
Present	22(36.67%)
Absent	38(63.33%)

It is clear from the above table that among the study participants 36.67% were

diabetic and 63.33% were non diabetic at the time of initiation of treatment

Table5: sputum smear conversion at the end of intensive phase

Sputum conversion (n=50)		**No. of patients**
	GroupA(n=30)	26 (86.66%)
	GroupB (n=20)	16 (80%)
	Total	**42 (84%)**

Among 50 patients studied, 42 (84%) achieved sputum conversion. In Group A (30 patients), 26 (86.66%) showed successful conversion, while in Group B (20 patients), 16 (80%) achieved conversion

Table 6: Treatment outcomes

Treatment outcome	Group1	Group2	Total
Cured	25 (69.4%)	20 (83.3%)	**45 (75%)**
Completed	04 (11.1%)	02 (8.3%)	**06 (10%)**
Defaulted	05 (13.9%)	01 (4.2%)	**06 (10%)**
Failure	01 (2.8%)	0 (0%)	**01 (1.7%)**
Death	01 (2.8%)	01 (4.2%)	**02 (3.3%)**
Total	**36 (100%)**	**24 (100%)**	**60 (100%)**

Among 60 patients, Group 1 (36 patients) and Group 2 (24 patients) showed distinct outcomes. In Group 1, 25 patients (69.4%) were cured, while Group 2 reported a higher cure rate of 83.3% (20 patients). Overall, 45 patients (75%) achieved cure across both groups.

Table 8. Diabetes mellitus and other clinical characters associated with poor treatment outcome in study participants.

Variables		**Treatment outcome**		**X^2 & P value**
		Satisfactory	**Poor**	
Age	**<40**	9	1	X2=3.05
	41-50	17	1	P =0.3839
	51-60	10	2	
	>60	15	5	
Gender	**Male**	38	7	X2=0.0436
	Female	13	2	P =0.8346
Diabetes mellitus	**present**	14	8	**X2=12.4346**
	absent	37	1	**P=0.000421***
Smoking status	**Smoker**	35	7	X2=1.2423
	Non smoker	25	2	P=0.2650
Sputum smear microscopy	**Positive**	42	8	X2=0.2353
	Negative	9	1	P=0.6276

From the above table, it is clear that a significant association was found between diabetes mellitus and treatment outcome of tuberculosis with satisfactory treatment outcome among nondiabetic compared to diabetic patients .

Discussion

Our study found that the majority of TB patients (20%) were aged >60 years, followed by those aged 41-50 years (18%), consistent with previous studies showing older adults are at higher risk of developing TB. A pronounced predominance of male patients (75%) was also observed, aligning with existing literature showing males are more likely to be affected by TB. These demographic trends highlight the importance of considering age and sex factors in TB research and control efforts. Further analysis will explore trends related to these demographic characteristics, providing insights into the complex interplay between age, sex, and TB outcomes.

The study's treatment outcomes demonstrate a satisfactory cure rate of 75% across both groups, with a higher cure rate observed in Group 2 (83.3%) compared to Group 1 (69.4%). These findings are consistent with previous studies, which have reported cure rates ranging from 70% to 90% for tuberculosis (TB) treatment (World Health Organization, 2020). However, the default rates (10%) and mortality rates (3.3%) observed in this study highlight the need for improved treatment adherence and patient support [14].

The study's findings demonstrate a significant association between diabetes and treatment outcomes in tuberculosis (TB) patients. Patients with diabetes exhibited higher rates of treatment failure and mortality, highlighting the importance of diabetes management in TB treatment (World Health Organization, 2020.These findings emphasize the need for regular monitoring of glycemic status to optimize TB treatment outcomes [15].

Conclusion: To conclude, diabetes is relatively a common morbidity among TB affected population and it has a negative impact on treatment outcome. Mortality is higher in TB patients with diabetes compared with TB patients without diabetes. TB patients should be queried about diabetes which should be attentively managed if present. Enhanced medical vigilance especially during early part of treatment is very much important.

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