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Research Article

Pulmonary Tuberculosis

Study of the prognostic effect of diabetes in patients of pulmonary tuberculosis

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Background: There is a synergistic effect between diabetes mellitus and pulmonary tuberculosis. India has the highest number of tuberculosis patients and India has also the second-highest number of patients with diabetes mellitus in the world. The dual curse of these two diseases may have an impact on both sides as an outcome of treatment and poor glycaemic control. There were many studies have been done about the relationship between diabetes and tuberculosis but still there is a large gap about its synergistic effect. **Methods:** In this study, we include 164 patients with pulmonary tuberculosis aged more than 18 years 72 out of 164 patients are diabetic and 92 patients are nondiabetic. Demographic details, physical and clinical examination, Blood sugar fasting and postprandial, Hba1c, x-rays chest, sputum for AFB and CBNAAT test have been done on all patients then ATT was given to patients and appropriate antidiabetic treatment given to diabetic patients. follow up done on all patients on the 2nd month and 6th months. **Results:** In this study, the commonest age group for tuberculosis infection is 45-54 but in diabetic patients common age group for tuberculosis infection is 55-64. Patients of diabetes and tuberculosis commonly have elevated Hba1c and relatively poor treatment outcome reflected by a sputum conversion rate of 77.7%, 16.7%has failed treatment and also diabetic patients has 3+ sputum positivity. **Conclusions:** In patients with tuberculosis screening of diabetes may improve treatment outcomes and prevent complications by appropriate management of diabetes and tuberculosis.

Keywords: Tuberculosis, Diabetes mellitus, Coinfection, Hba1c, CBNAAT

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Introduction

Tuberculosis (TB) is a communicable disease that is a major cause of ill health and one of the leading causes of death worldwide. Until the coronavirus (COVID-19) pandemic, TB was the leading cause of death from a single infectious agent, ranking above HIV/AIDS. An estimated 10.6 million people (95% UI: 9.9–11 million) fell ill with TB in 2021, an increase of 4.5% from 10.1 million in 2020. The TB incidence rate (new cases per 100 000 population per year) raise by 3.6% between 2020 and 2021, reversing declines of about 2% per year for most of the previous 2 decades. There is a strong and enduring relationship between TB incidence rates per capita and indicators of development such as average income and undernourishment. Economic and financial barriers can affect access to health care for TB diagnosis and completion of TB treatment; about half of TB patients and their households face catastrophic total costs due to TB disease.[1] Eight countries accounted for two-thirds of all new cases: India, Indonesia, China, the Philippines, Pakistan, Nigeria, Bangladesh, and South Africa. Of all cases, 57% occurred in male patients, 32% in female patients, and 11% in children.

The worldwide prevalence of Diabetes Mellitus (DM) has risen dramatically over the past two decades, from an estimated 30 million cases in 1985 to 463 million in 2019. In 2019, the prevalence of diabetes in individuals aged 20–79 years worldwide was 9.3%, ranging from 4.7–12.2%. The countries with the greatest number of individuals with diabetes in 2019 were China (116.4 million), India (77 million), the United States (31 million), Pakistan (19.4 million), Brazil (16.8 million), and Mexico (12.8 million). Diabetes is a major cause of mortality. In recent years, diabetes has been listed as the seventh leading cause of death in the United States, but several studies indicate that diabetes-related deaths are likely underreported.

Diabetes is an independent risk factor for tuberculosis in community-based studies in South India and multiple studies globally. It is suggested that diabetes accounts for 20 per cent of all tuberculosis and 10 per of smear-positive tuberculosis.[2] It is suggested that all people with tuberculosis should be screened for diabetes and screening of tuberculosis in diabetes should be Considered particularly in settings of high TB prevalence. People with TB and diabetes have a high risk of during treatment and TB relapse after treatment. As diabetes is also complicated by the presence of another infectious disease also, it is important to take care of diabetes in patients suffering from diabetes.[3]

India continues to highest TB burden country in the world Tuberculosis continues to be one of the most common health hazards in India. Around one-third of the world's population is estimated to be infected by Mycobacterium tuberculosis. India is experiencing an escalating epidemic of diabetes mellitus. Available data suggest that an estimated 11% of the urban population and 3% of the rural population above the age of 15 years have diabetes mellitus, about half of this rural population is unaware of diabetes mellitus. Most recent data suggest that people with diabetes mellitus are about 62 million with a further 77 million having impaired glucose tolerance.

India is said to be the diabetic capital of the world with the greatest number of cases. There is rising concern worldwide about the twin epidemics of these two chronic diseases, especially in low to middle-income countries such as India and China. The escalating epidemic of DM is also said to have a significant impact on global TB control.

Diabetes mellitus(DM) TB co-infection is associated with poor glycaemic control in DM patients. Reactive hyperglycaemia often accompanies chronic infections due to the associated pro-inflammatory state and release of counter-regulatory stress hormones such as epinephrine, cortisol and glucagon, all insulin antagonists.[4] The dual curse of these two diseases may have an impact on the outcome of treatment. This study was performed to assess the prognosis in patients with diabetes mellitus and tuberculosis and its treatment outcome.

Material and Method

This retrospective cross-sectional study was done in the Department of Medicine at Mednirai Medical College cases are selected from the outdoor patient department and indoor admitted patients from January 2022 to March 2023. Newly diagnosed patients with sputum-positive pulmonary tuberculosis above the age of 18 years

Were included in the study. MDR TB, pregnant women, Patients who were sputum negative, without any of the classic symptoms for TB, HIV positive, patients with chronic renal or chronic liver disease, and chronic alcoholics, are not included in the study. Patients who were previously treated for tuberculosis were also excluded from the study. In this study 164 sputum-positive pulmonary tuberculosis above the age of 18 years of patients included, 72 patients are diabetic and 92 are nondiabetic. Patients with chronic productive cough have been examined for sputum by CBNAAT and ZeihlNeelson method and a chest x-ray was also done. All patients with sputum-positive TB were screened for diabetes with blood sugar fasting and HBA1C, and a detailed clinical profile and physical examination were done and noted. All these positive samples were graded as per the RNTCP guidelines. General demographic details were taken for all the patients including their height and weight and the Body Mass Index was calculated. Chest X-rays were taken for all the patients for the presence and location of cavities, opacities, hilar enlargement, pleural effusion, fibrosis, pneumothorax etc. The x-rays were also graded as minimal, moderately advanced and far advanced as per the national tuberculosis association guidelines: Minimal: -Slight to moderate density, no cavities, a small part of one or both lungs, total extent the not greater volume of lung one side of the space above 2ndcostochondral junctions and T4/T5; Moderately advanced: -Slight to moderate density lesions one\both lungs. Total extent; far advanced, more extensive than moderate and involved more than two lobes of the lung. All the patients with tuberculosis were treated with first-line ATT. Patients with diabetes are treated by appropriate antidiabetic and ATT. The patients were followed up after 2 months and 6 months and in each follow-up, sputum smear, chest X-rays and other blood tests were performed. Sputum smear-positive patients were declared cured only if they had negative sputum results and complete symptomatic relief at the end of a full course of anti-tubercular treatment.

Results

In this study in Table -1, the total number of patients was 164 of which 72 patients has tuberculosis and diabetes mellitus and 92 were nondiabetic tuberculosis. Males are more affected than females in both diabetic and nondiabetic Groups similarly BMI was low in both groups. Most patients in the diabetic and nondiabetic groups have an addiction to alcohol or smoking or both. The most common age group in patients with tuberculosis is 45-54 years and in patients with diabetes age group is 55-64 years. In figure-1 most patients of diabetic have poor glycaemic control revealed by high Hba1c which was most prominent in the 35-64 years age group. In figure-2 most patients with diabetes have 3+ sputum positivity but nondiabetic patients were equally divided between 1+,2+, and 3+ sputum positivity. In the table-2 most of the patients with nondiabetic tuberculosis were cured by treatment with six-month ATT. There was one case of failed treatment in nondiabetic tuberculosis patients, 29% completed treatment successfully with clinical improvement but required extended treatment due to nonadherence or missing the regular treatment. the sputum conversion from positive to negative in patients with nondiabetic tuberculosis is 93.5%. The sputum conversion rate in the diabetic group is 77.7% and 16.7% of patients have failed treatment, 2 patients died during treatment patient who died had poor glycaemic control and 3+ sputum positivity. In patients with diabetic tuberculosis, 11.1% have minimal X-ray severity and 54.2 has far advanced severity. In patients with nondiabetic tuberculosis, 47.8% have moderate severity.

Table 1: General characteristics of the pulmonary tuberculosis patients with and without diabetes.

		PTB with DM	PTB without DM
Sex (Male/Female)		51/21	69/23
Age group	<35	1 (1.4%)	15 (16.3%)
	35-44	6 (8.3%)	14 (15.2%)
	45-54	17 (23.6%)	16 (17.4%)
	55-64	19 (26.4%)	7 (7.6%)
	65-74	16 (22.2%)	21 (22.8%)
	>75	13 (18.1%)	19 (20.8%)
BMI		22.7 ± .2	18.3 ± 2.9
Hb		12.9 ± 1.2	12.5 ± 1.9
ESR		50.3 ± 19.7	59.3 ± 21.2
Smokers		33 (45.8%)	41 (44.6%)
Alcoholics		39 (54.2%)	45 (48.9%)

Table 2: Outcome of treatment at the end of 6 months

	With DM	Without DM
Cured	24 (33.3%)	59 (64.1%)
Completed	32 (44.4%)	27 (29.%)
Failure	12 (16.7%)	1 (1.1%)
Default	2 (2.8%)	4 (4.3%)
Death	2 (2.8%)	1 (1.1%)

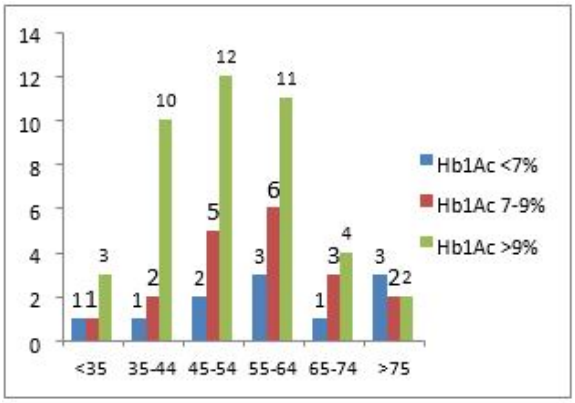

Figure 1 : Relation between Hb1Ac and age among the diabetic patients with PTB.

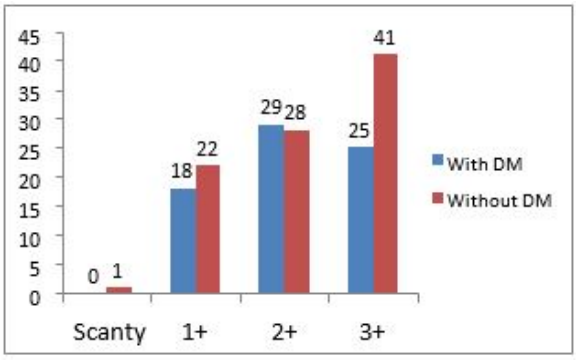

Figure 2 : Sputum positivity among the diabetic and nondiabetic.

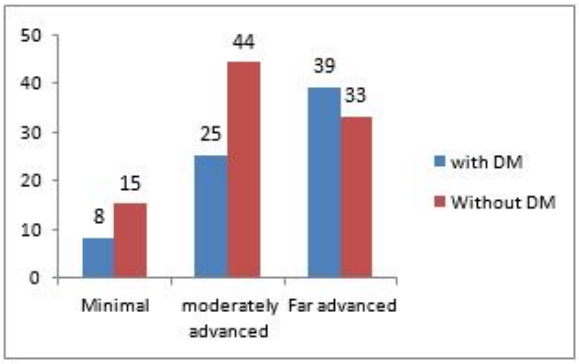

Figure 3: Chest X-ray severity among the patients.

Discussion

In the present study, the number of diabetics was 43.9% of the total patients included. The prevalence of DM in TB patients in Kerala is reported to be 44%while it was reported to be 15.2% in a study in Tamil Nadu.[5]

The most common age group to be affected was 55-64 years among the diabetic group and 45-54 among the non-diabetic group in the present study. Similar findings were reported by Perez-Guzman et al who also found that TB-DM patients to be older. [6]HbA1c was elevated to >9% in the 45-54 age group although it was high even in the 35-44 and 55-64 age groups. Similar results were observed in studies by Adhami et al and Patel et al.[7,8]We have also observed that 16.7% of the cases among diabetics and only 1.1% of cases among non-diabetics failed to convert from sputum positive to sputum negative. Compared to the non-diabetics, the conversion was poor in the diabetics. This was observed in a few other studies. Alisjahbana et al study showed a significant number of positive sputum culture results at the end of 6 months in the DM group (22.2%), compared to patients without DM (9.6%) with a P value of <0.05% diabetes remained a significant risk factor for sputum conversion.[9]

Among the Chest X-ray findings, far advanced severity was more common among the diabetics than the non-diabetics. Most of the diabetic patients either have far advanced severity or moderately advanced severity with very only 11.1% showing minimally advanced stages. This was concurrent with studies by Chiang et al and Avuthu et al, where it was reported that multiple cavities and lesions in the lungs were more among the patients with poor glycemic control than otherwise.[10,11]

Sathish Rajaa et.al showed that 39% of newly diagnosed smear-positive pulmonary TB patients had DM. We had an additional yield of nearly 15% by screening the cases with random blood glucose testing. The NNS to diagnose a DM case was 12. We also found that obese TB patients and those patients who were separated/divorced/widowed had a significantly higher risk of having DM compared with those with normal BMI and unmarried patients. [12]

Surinder Pal et.al retrospectively analyzed 1000 consecutively admitted cases to a leading Tuberculosis and chest hospital in north India for the coexistence of Tuberculosis and Diabetes Mellitus. These cases constituted 11.6% of the total admitted cases during the study period. The present study observed that males were the main victims in a majority of cases.[13]

Our study found a prevalence of DM amongst TB patients of 25.3% (22.2%, 28.6%), which is higher than that of the general population of India. This could be because all patients were hospitalized in an urban, tertiary hospital, representing a highly selected group. [14]

As shown by Li et al. hospitalized TB patients have a significantly higher prevalence of DM compared to patients receiving outpatient care [15]

Omamah Alfariset. al, conducted among Indian patients with pulmonary TB, we found that rifampin concentrations were universally low and that the concentrations of isoniazid and pyrazinamide were reduced in patients with DM compared to those in patients without DM. Surprisingly, however, high pyrazinamide concentrations were associated with a longer time to sputum culture conversion.

In subgroup analyses, in patients without DM, drug concentrations did not have an impact on microbiologic outcomes, but in patients with DM, the time to culture conversion was positively associated with isoniazid and rifampin concentrations and negatively associated with pyrazinamide levels. To our knowledge, this is the first study to show differences in PK-PD relationships in patients DM with versus patients without DM.[16]

Conclusion

Diabetes and TB mutually affect each other poor glycemic control leads to the worst outcome of ATT treatment and chronic TB also leads to poor glycaemic control.

Usually, hyperglycemia/diabetes has no symptoms or is unaware of the disease therefore it is necessary for all newly diagnosed TB patients must be screened for diabetes and if diagnosed with diabetes they must be treated with either OHA or insulin and known patients of diabetes also treated for better glycaemic control which leads to better outcome of ATT treatment.

Hence screening for DM in patients with TB could improve case detection, early treatment, and prevention of DM complications. Maintenance of blood sugar levels at normal or near normal levels is one of the primary goals in patient care. Tuberculosis worsens glycaemic control and makes the control of DM difficult.

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