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Prevalence of Diabetes Mellitus among Newly Diagnosed Tuberculosis Patients in Western UP

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Abstract: ***This study investigates the prevalence of diabetes mellitus among newly diagnosed tuberculosis patients in Western UP. The research is a hospital based prospective study involving 215 patients. The study found a higher prevalence of diabetes in females compared to males and in the age group of 3060 years. The results highlight the need for routine screening of tuberculosis patients for diabetes due to its high mortality rate.***

Keywords: Tuberculosis, Diabetes Mellitus, Prevalence, Western UP, Screening

1. Introduction

In the early 20th century, it was said that the patients who did not die in a diabetic coma were likely to die from TB, particularly if they were poor. Before the discovery of insulin, tuberculosis was considered as the main cause of death. Tuberculosis (TB) is a major contagious disease, that mostly affects lung but can also affect other sites, that is one of the top 10 causes of death worldwide which is caused by the bacillus Mycobacterium tuberculosis, and is spread when the bacteria is expelled in air [1].

Tuberculosis, a rare disease whose prevalence is measured in cases per 100, 000 population, is also considered a slow - moving disease – the time scale of epidemics is decades rather than weeks or years. Globally, in 2019, there were an estimated 10.0 million (8.9 - 11.0 million) people infected with TB, and 1.4 million (1.3 - 1.6 million) people died of TB (World Health Organization, 2020). Cell - mediated immunity is compromised leading to decreased defence against M. Tuberculosis, hence there is increased risk of reactivation. [2]

Risk factors for TB are often associated with conditions leading to impairments of immune function such as (HIV), diabetes mellitus (DM), malnutrition, chronic kidney disease (CKD), chronic lung disease, and immunosuppressant use etc. The above - mentioned factors increase the risk development of TB. [3]

India is a country with 1.2billion population which accounts for 17.5% of the world's population with urbanization happening at a fast pace. In current times, the social and economic development, is associated with less physical inactivity, unhealthy diet and obesity, hence playing role in increasing incidence of DM. In Oct 2014, The WHO identified and raised an alarm for some countries such as China, India, Pakistan, Brazil and Russia, as these countries are facing increasing DM epidemic with being the highly populated nations, adding to the risk of highcontagion [4].

The "Diabetes Capital" of the world - India is projected to account for 62–80 million DM patients by 2030. This along with under nutrition and HIV is the cause for concern with regard to increase in TB burden. Between 1998 and 2008, TB incidence has increased by 28%, attributed to increase in aging population, urbanization, and diabetes. In 2021, Approximately 537 million adults (20 - 79 years) are living with diabetes [5] According to ancient history, Egyptians documented diabetes. However, it was the Greek physician Aertaeus who coined the term diabetes mellitus (DM). In Greek, diabetes means "to pass through" and mellitus is the Latin word for honey.

It is seen that Diabetes leads to the faster progression of latent TB infection (LTBI) to active TB disease and poor TB treatment outcomes such as death during treatment, relapses and delayed sputum smear conversion. [6] There is a bidirectional relationship between TB and diabetes; the presence of long - term diabetes may trigger TB disease and affect the prognosis, while TB worsens the glycaemic control in TB - diabetes population.

Recently, the emphasis is being laid on reduction of diabetes and tuberculosis. The association between DM and TB was first described centuries ago by Avincenna, a Persian philosopher, and the co - morbidity was a frequently discussed topic in the medical literature from the first half of the XXth century. [7] [8]

This double burden of TB and DM has recently emerged as an important public health problem due increase in incidence in India thus highlighting the importance of screening TB patients for DM on a routine basis. The Central TB Division and the National non - communicable disease division jointly developed a framework called 'National Framework for joint TB - Diabetes collaborative activities' which acts as a directive tool for medical, healthcare professionals etc in executing TB–DM associative services. It recommends screening all registered TB patients for diabetes and ensures comprehensive diabetes care and management among diagnosed TB cases. [9] [10]

People with DM are three times at risk of developing TB disease compared to non - diabetics. Glucose intolerance or transient hyperglycaemia has been observed in up to 49% of patients with active TB. Patients with DM have high predisposition to Tuberculosis due to weakened cellular immunity and ciliary function that predisposes them to TB. On the contrary, stress response to TB may result in insulin resistance. Tuberculosis of the pancreas can lead to endocrine hypofunction resulting in diabetes. In addition,

Diabetes is also considered as a independent risk factor for poor response to tuberculosis treatment and death. [11] [12]

The study on routine screening of TB patients for DM using HbA1c in India was done by Balakrishnan [13] and it was found that over 40% patients had diabetes. However, routine DM screening using HbA1c was not mandatorily followed but further research was recommended so as to determine the most cost - effective way of diabetes screening. There is need for the awareness of diabetes mellitus screening among tuberculosis patients due to its high mortality rate which is neglected during the diagnosis of tuberculosis and its management.

In this study we mainly aim to study the prevalence of diabetes in newly diagnosed tuberculosis in western up.

Objective
To study the prevalence of diabetes mellitus in newly diagnosed patients of Tuberculosis in WESTERN UP.

Study Design
Hospital based Prospective study

2. Material and Method

This is a hospital based prospective study involving 215 patients with newly diagnosed tuberculosis in Department of respiratory medicine in MMC from 1 Jan 2021 to 1 Jan 2022.

Inclusion Criteria
1) Age > 18 yrs.
2) Newly diagnosed pulmonary Tb patients who were not given ATT.
3) Patients giving informed and written consent.
4) Patients with pre - existing diabetes mellitus and newly diagnosed Dm
5) Patient with extrapulmonary tuberculosis [pleural effusion and pneumothoraxonly]
6) Pregnant women

Exclusion Criteria
1) Patient not giving consent.
2) Patients already diagnosed as a case of Pulmonary tuberculosis and MDR TB.
3) Patients taking ATT.
4) Recurrent Tb.
5) Age < 18 years.
6) Tuberculosis Patients with other co - morbid conditions like HIV, chronic liver and kidney disease, malignancies and patients on long term steroid therapy were excluded from the study.
7) Extrapulmonary tuberculosis [other sites]

An informed and written consent was taken from all the selected participants. History in detail about symptoms of tuberculosis, compliance with medicine, including any relevant complication, any drug intake, any other illness. Routine blood investigations were sent for all shortlisted patients including Chest X Ray, Cect thorax and Sputum for afb and trunaat (depending on the clinical finding and history). All the patients were registered under Antituberculosis treatment therapy after being positive either clinically or radiologically or microbiologically. Newly diagnosed diabetes patients were started on Oral hypoglycaemic or insulin therapy and pre - existing diabetes patients' treatment was revised according to their fasting rbs/ hba1c levels and rest were advised to continue previous treatment. Patients were then divided into groups and subgroups under various variables and Performa was made to study the prevalence

Blood samples for FBG in all patients after an overnight fast of at least 10 hours. For every newly diagnosed and registered TB patient, first blood sample for FBG was taken immediately after the TB diagnosis; and was followed by regular monitoring.

Patients reporting current use of medication to lower glucose levels or a self - reported physician diagnosis at enrolment were classified as having known diabetes (KDM), irrespective of their HbA1c level.

Newly diagnosed diabetes (NDM) was classified as HbA1c $\geqslant$ 6.5% in participants without KDM at enrolment.

Pre - DM was classified as having a HbA1c level between 5.7% and 6.5% in participants without KDM at enrolment

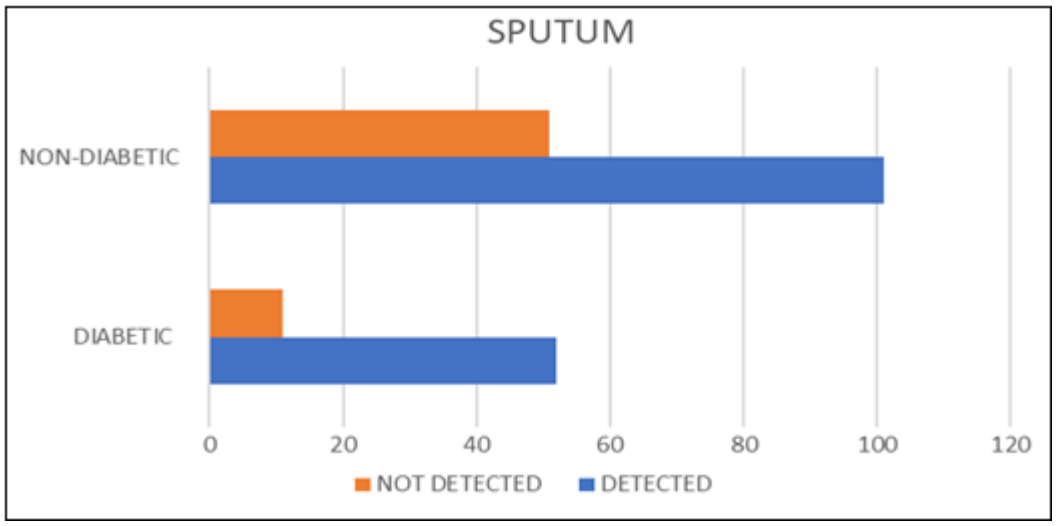
The data was entered into Microsoft Excel 2007 and analysed using SPSS (SPSS v17.0). Continuous variables were summarised using the mean with standard deviation (SD), and means were compared using the t - test. Counts (proportions) were given for categorical variables, and proportions were compared using Chi - square analysis. P 0.05 was used to identify a statistically significant value.

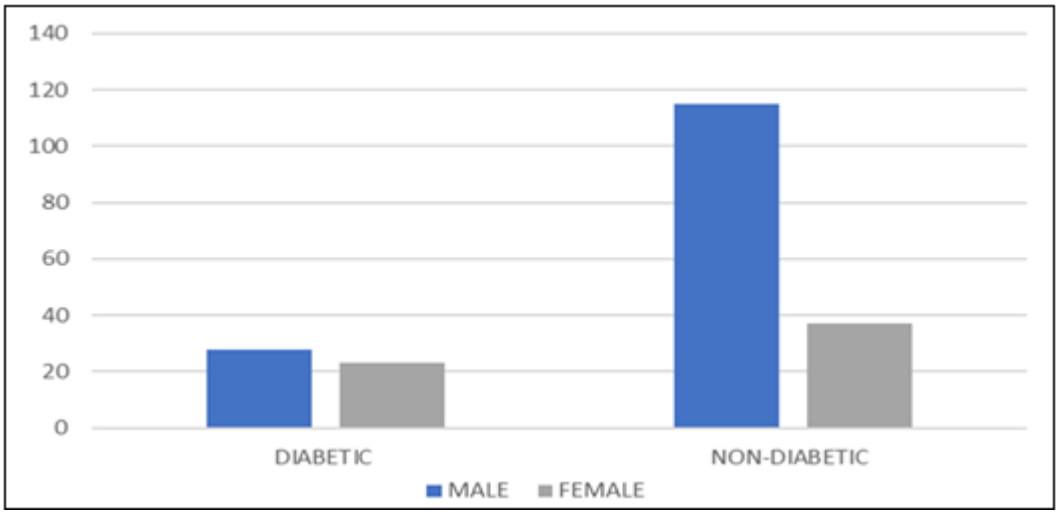
3. Result

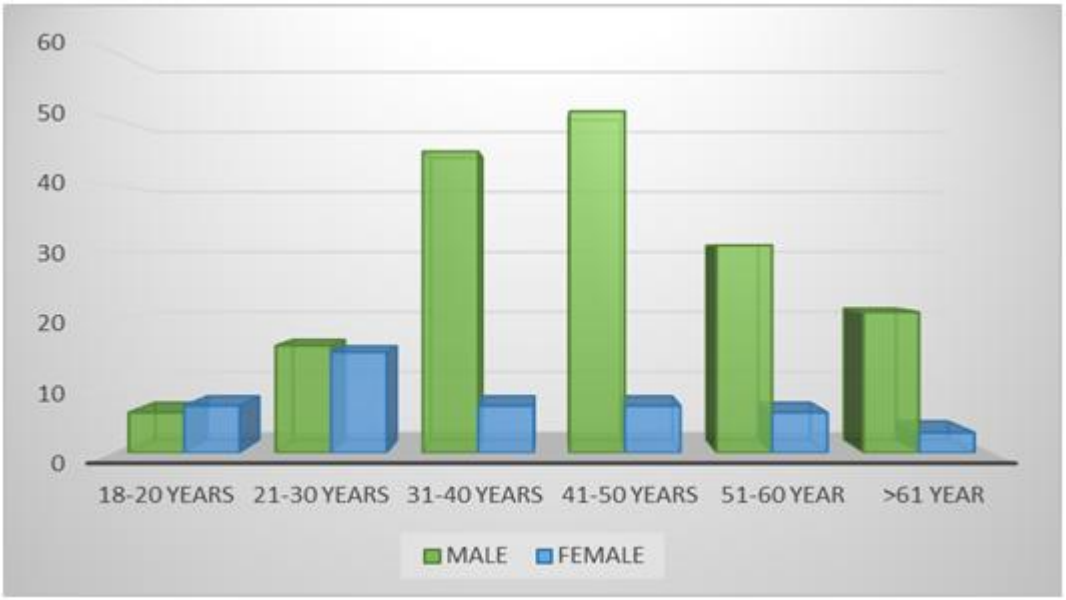
Our study enrolled 215 patients who were studied under different variables as shown in table 1with and mean age as of 44.9 ± 12.9 year in males and 36.2 ± 16.2 year in females. The prevalence of diabetes among TB patients in this study was determined to be 16.4%in males and 77.7% in females. Age group 30 - 60 years showed higher prevalence of diabetes. Prevalence of diabetes was higher in case of smoking 82% followed by tobacco use and alcohol.
Following tables show the frequency of the patients in each category.

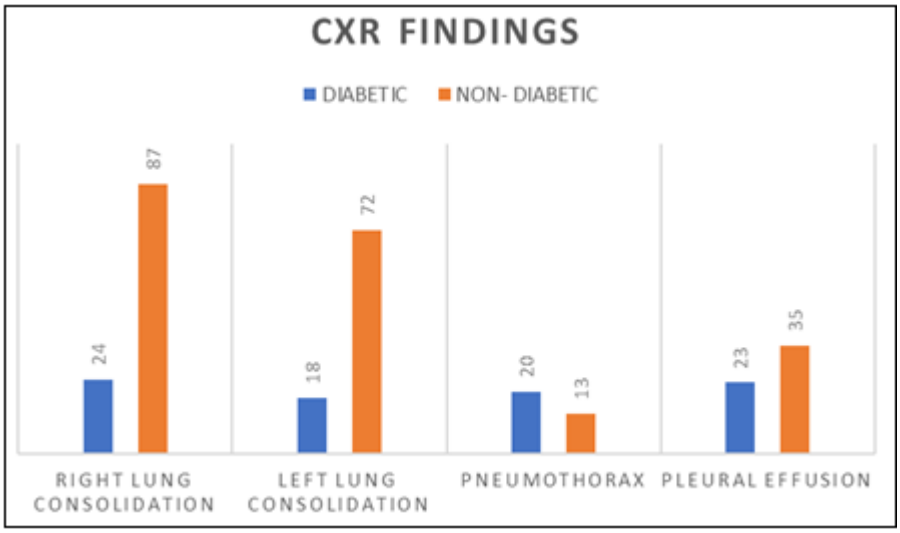
Variable		Male (170)	Female (45)
Age	18 - 20 Years	6 (3.5%)	7 (15.5%)
	21 - 30 Years	16 (9.4%)	15 (33.3%)
	31 - 40 Years	45 (26.4%)	7 (15.5%)
	41 - 50 Years	51 (30%)	7 (15.5%)
	51 - 60 Year	31 (18.2%)	6 (13.3%)
	>61 Year	21 (12.3%)	3 (6.66%)

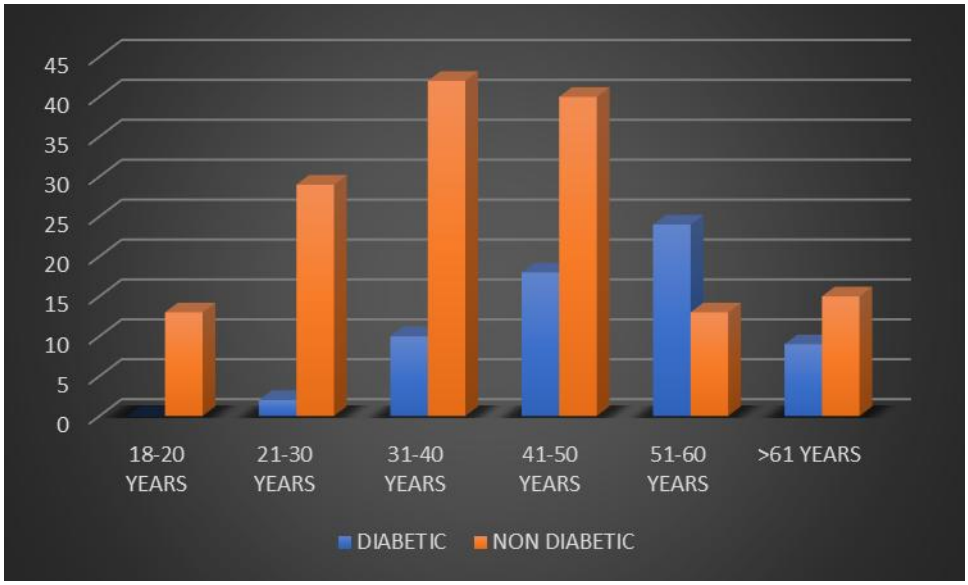
Sputum	Detected	129 (75.8%)	24 (53.3%)
	Not Detected	42 (24.7%)	20 (44.4%)
Diabetes	HBA1C 7 - 8%	12 (7.05%)	20 (44.4%)
	HBA1C > 8%	16 (7.1%)	15 (33.3%)
	Non - Diabetic	115 (67.6%)	37 (82.2%)
Family History of Diabetes	Yes	15 (8.8%)	15 (33.3%)
	No	155 (91.1%)	30 (66.6%)
Risk Factor	Smoking	100 (58.8%)	18 (40%)
	Alcohol	146 (85.5%)	2 (4.44%)
	Tobacco Chewer	154 (90.5%)	16 (35.5%)
	Biomass Fuel Exposure	46 (27%)	34 (75.5%)
Symptoms	Evening Rise of Temperature	152 (89.4%)	37 (82.2%)
	Loss of Weight {Significant}	134 (78%)	34 (75.5%)
	Night Sweats	143 (84%)	40 (88.8%)
	Cough With Sputum	120 (70.5%)	32 (71.1%)
	Shortness Of Breath	86 (50.3%)	20 (44.4%)
	Chest Heaviness	105 (61.7%)	32 (71.1%)
	Blood In Cough	40 (23.5%)	12 (26.6%)
CXR Findings	Right Lung Consolidation	88 (51.7%)	23 (51.1%)
	Left Lung Consolidation	72 (42%)	18 (40%)
	Pneumothorax	25 (14.7%)	8 (17.7%)
	Pleural Effusion	42 (24.7%)	16 (35.5%)











Variable		Diabetic N=63	Non - Diabetic N=152	P - Value
Male		28 (44.4%)	115 (75.6%)	0.004*
Female		35 (55.5%)	37 (24.3%)	
Age Group	18 - 20 YEARS	0	13 (8.5%)	
	21 - 30 YEARS	2 (3.1%)	29 (19%)	0.06
	31 - 40 YEARS	10 (15.8%)	42 (26.3%)	0.003*
	41 - 50 YEARS	18 (28.5%)	40 (26.3%)	0.02*
	51 - 60 YEARS	24 (38%)	13 (8.5%)	0.006*
	>61 YEARS	9 (14.2%)	15 (9.8%)	0.3
Sputum	Detected	52 (82.5%)	101 (66.4%)	0.017*
	Not Detected	11 (17.4%)	51 (33.5%)	
CXR Findings	Right Lung Consolidation	24 (38%)	87 (57.2%)	0.01*
	Left Lung Consolidation	18 (28.5%)	72 (47.3%)	0.01*
	Pneumothorax	20 (28.5%)	13 (8.5%)	0.00018*
	Pleural Effusion	23 (36.5%)	35 (23%)	0.04*
Risk Factor	Smoking	52 (82.5%)	66 (43.4%)	0.0001*
	Alcohol	36 (57.1%)	112 (75.6%)	0.017*
	Tobacco Chewer	38 (60.3%)	132 (86.8%)	0.0001*

*Denotes significant p value

4. Discussion

There has been increasing trend of coexistence of diabetes and tuberculosis in India, hence WHO has laid the foundation for epidemiological research so as determine the associated burden of TB due to diabetes. Despite all efforts taken globally, pulmonary tuberculosis being an infectious disease remains a global threat. Besides, Diabetes mellitus infection is among the emerging cases complicating tuberculosis which has been recognized for its wide range of clinical spectrum and chronically [11] [12]

Our study included newly diagnosed cases of pulmonary tuberculosis in order to study the prevalence of diabetes which was found to be higher in females as compared to male. If age group is taken into consideration, our studied showed higher prevalence in 30–60 – year age group, with highest population at risk of age 50 - 60 year. Risk factor such as smoking shows higher prevalence of Diabetes as compared to tobacco consumption and alcohol.

Our study results are supported by the following other studies conducted in different parts of the world.

A population - based study conducted in six major cities throughout India in 200 discovered a 12.1 percentage - standardized prevalence of type 2 diabetes. Various studies done in different parts of India and in other parts of globe where TB is endemic have shown a higher prevalence of DM among patients infected with tuberculosis [13]

The study from Tamil Nadu estimated a diabetes prevalence of 25% among TB patients which was higher when compared to the prevalence of diabetes of 10% in the general population. A study of higher prevalence of44% was reported from Kerala, India [14].

Study by Jain et al reported a prevalence of impaired glucose tolerance (IGT) of 16.98% and they had used oral glucose tolerance test to diagnose IGT [15].

In 2015, Thapa, Barsha et al conducted study on prevalence of diabetes among tuberculosis patients in Kathmandu Valley where older age was found linked to diabetes [16].

In a retrospective study done in India by Kumar NP et al, found DM as a negative effect on the immune response but enhanced TB morbidity. A state wide cross sectional study concluded that half of the TB patients had Diabetes [17].

Zambia is another country with high TB burden has evaluated in a prospective study that TB is significantly associated with DM Bates et al. [18].

Another land mark systematic review in2014 results showed that both diseases interaction constitutes worldwide health threat. Among study participants' malnutrition was more common with womenbeing more vulnerable and undernourished in the study [19].

A cross sectional study conducted in Nigeria also found undernourished and weight loss the predominant symptoms in most of the patients [19].

TB and DM are interrelated with each other on a number of different levels. . Smoking leads an individual susceptible to TB because there is a strong link and association as smoking damages lungs and decreases body's immune system as a resultof which, smokers cannot combat TB infection; moreover, smoking is also known to reduce TB treatment effectiveness which in turn leads to longer period of infection and thus eventually leading to more severe form of disease. Certain occupational exposures predispose the patient to risk of developing TB. It is seen, age is linked with both diseases, as increasing age leads to type 2 diabetes and low immunity leading to in active TB. In Locality, the rural dwellers are more prone to develop TB while urban dwellers are more susceptible to develop type 2 diabetes due to sedentary life style and highly dense food intake. Socio - economic status also plays a important role. High socio – economic class has more Diabetes while low socio - class is more prone to develop TB. In today's time, with increasing urbanization, humans are more prone to such diseases and

diabetes and tuberculosis among them prove to be a major threat.

5. Conclusion

It can be inferred that prevalence of diabetes in higher in patients with tuberculosis.

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