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STUDY OF PREVALENCE AND FACTORS ASSOCIATED WITH THE TUBERCULOSIS (TB) AND DIABETES (DM) CO-OCCURRENCE: A CROSS SECTIONAL STUDY.

Community Medicine

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ABSTRACT

Background: Type 2 diabetes mellitus represents more than 90% of total prevalence of diabetes in the world and is responsible for 9% of the global mortality corresponding to four million deaths per year. Both diabetes mellitus (DM) and tuberculosis (TB) are among the leading causes of morbidity and mortality.

Aims And Objective: The objective of the current study was to determine the prevalence and analyze associated factors of TB and DM comorbidity.

Methods And Materials: A cross-sectional study was carried out over a period of 6 months at designated TB Centre's in Muzaffarpur district of Bihar. A total of 112 adults newly diagnosed with pulmonary TB were examined for Fasting Blood Sugar (FBS) level. Diagnosis of DM and Impaired Fasting Glucose (IFG) were based on cut-off value of FBS recommended by the WHO.

Result: The prevalence of diabetes and IFG are found to be 13.9% and 8.0%, respectively. A significant difference ($p<0.05$) was observed between the mean ages of the TB only (45.9 years) and TB-DM co-morbidity patients (53.8 years). No significant association was found between gender and diabetes. Clinical characteristics of TB were similar in TB and TB-DM co-morbidity patients.

Conclusion: The prevalence of DM among TB cases observed in this study is high and may indicate an emerging threat of TBDM comorbidity Furthermore, age and BMI were identified as independent risk factors for DM in TB cases, pointing to the need to pay attention to age and BMI status when managing this co-morbidity. Patients with DM were at a higher risk of sputum smear positivity therefore higher infectivity.

KEYWORDS

TB-DM prevalence, transient hyperglycemia, fasting blood glucose, prediabetes.

INTRODUCTION:

The association between Diabetes Mellitus (DM) and Tuberculosis (TB) poses a strong public health challenge. The dual burden of tuberculosis (TB) and diabetes mellitus (DM) has become a major global public health concern. Tuberculosis (TB) is still a cause of public fear and stigma in many parts of the world accounting for millions of morbidity and mortality figures each year.1 The burden of this global epidemic is borne not by the developed countries where this disease is regarded as a disease of the past, but by low- and middle-income countries where ending TB is a distant reality [1–5]. Currently, the association between DM and TB is re-emerging worldwide. Cases of DM are increasing in resource poor countries where TB is of a high burden [6–7]. In 2013, there were an estimated 9.0 million incident cases, and 1.5 million TB deaths globally [8]. In the same year, DM affected 382 million people and killed 5.1 million persons. It is projected that the number of people affected by DM will increase to 592 million by 2035 [9] and about 80% of these people live in low and middle income countries where TB is endemic [8–9]. DM triples the risk of developing active TB among infected individuals [10]. It also increases susceptibility to Mycobacterium tuberculosis infection and development of diseases. DM directly impairs innate and adaptive immune responses that are necessary to counter the progression from infection to clinical diseases [11]. The association between DM and TB is supported by the fact that patients with DM have impaired cell-mediated immunity, renal failure, micronutrient deficiency and pulmonary microangiopathy, all of which increase their susceptibility to develop TB disease [12, 11, and 13]. Studies conducted in different parts of the world have shown that 12%-44% of TB diseases were associated with DM [14–19].

AIMS AND OBJECTIVE:

The objective of this systematic review was to summarize the existing evidence on prevalence and associated risk factors of TB-DM comorbidity at global and regional levels.

MATERIAL AND METHODS:

Study Setting

The region was the first to carry out DM screening among TB patients and has relatively better quality of routine TB and DM data. Patients with non-conclusive blood glucose test results for DM diagnosis were excluded from the analysis. The main outcome variables were proportions of patients with a diagnosis of TBDM and TBNDM. The study subjects were all TB patients who were diagnosed with TB from 1st October 2020 to 31st March 2021in all TB diagnostic. Ethical clearance was obtained from Institutional Ethical Committee. TB diagnosis was made based on the standard diagnostic procedures as defined in the National TB Control Program and WHO Guidelines.

Thus, TB patients diagnosed, both bacteriologically confirmed by smear microscopy and clinically diagnosed (abnormalities by X-ray, extra-pulmonary cases without laboratory confirmation and physicians' decision) were included in this study. As part of the integrate TB-DM services, TB patients are routinely screened for DM by collecting blood for fasting blood glucose test (overnight fasting) at the TB clinic. Those with fasting blood glucose level ≥ 126 mg/dl are referred to DM clinic for confirmation of DM diagnosis, follow-ups and appropriate management. On the other hand, DM patients are offered TB screening on every visit by the physician or clinician in the DM clinic. Consequently, presumptive TB is examined by the initial TB diagnostics (Acid Fast Bacilli Microscopy (AFB). Those who were found to have TB are linked to the TB services and treated according to the standard TB management.

Study Population

The study has been conducted in catchment area of Sri Krishna Medical College, Muzaffarpur, Bihar. All TB cases that were diagnosed and registered in the national tuberculosis treatment register during the period of 1st October 2020 to 31st March 2021 were included in the study., However, paediatric TB cases (<15 years old) and those with unknown or undocumented diabetic status were excluded from the final analysis. A total of 124 TB patients were diagnosed and treated for TB from 1st October 2020 to 31st March 2021 in all the TB diagnostic. Of these, TB cases who met the inclusion criteria were included in the study. Thus, the final sample size of the study was 112 after excluding 12 TB patients with unknown or undocumented status of diabetes mellitus and paediatric TB patients.

Variables, Instruments And Data Collection

In this study, DM was the outcome variable and the socio demographic and clinical variables were the risk factors for DM among TB patients. A pre-tested structured data abstraction tool was used to collect the following clinical and socio-demographic variables from registers (TB treatment register, TB laboratory register, TB treatment card) and surveillance reports (quarterly TB patients' nutritional assessment and diabetes report, and quarterly TB notification and outcome report): age, sex, residence, height (in meter), weight (in kilogram), type of TB patient, TB site, TB treatment group, body mass index, fasting blood sugar (FBS) test results, HIV status, ART and CPT, and sputum smear results.

BMI results were classified as underweight (<18.5), normal weight (18.5–24.9), overweight (25–29.9) and obese (>30).18 The DM screening result which was collected from the TB patients' medical record (TB treatment card and quarterly TB patients' nutritional assessment and diabetes report) was classified using the WHO diagnostic criteria for DM. Hence, fasting blood glucose level ≥ 126mg/dl was considered as DM and fasting blood glucose levels of 110–125 mg/dl as pre-diabetes.

Statistical Analysis:

Data entry, cleaning and analysis were performed using Statistical Package for Social Science (SPSS) version. Categorical variables were expressed as proportions and chi-square analysis was performed to compare proportions.

RESULT:

One hundred twenty four (124) patients were approached, out of which 112 (90.3%) agreed to participate in the study. All the 112 participants (81 males and 31 females) were newly diagnosed cases of TB. The socio-demographic variables are depicted in.

Table-1: Socio Demographic Variables In TB Only And TB-DM Co-morbidity Groups

Variables	TB only (%)	TB-DM comorbidity (%)	P value
Age			
>55 years	28 (27.7)	09 (8.0)	
<55 years	55 (54.5)	05 (5.0)	0.0348
Gender			
Males	64 (63.4)	12 (11.9)	
Females	23 (22.8)	02 (2.0)	0.507
Sputum AFB Positive	69 (63.3)	12 (11.9)	
Sputum AFB Negative	18 (17.8)	02 (2.0)	0.730

TB=Tuberculosis, DM=Diabetes, AFB=Acid Fast Bacilli.

Among the participants, 12.5% (12 males and 2 females) were diagnosed to be diabetic as per the WHO criteria. Additionally 9 (8.0%) patients were found to have impaired fasting glucose. The average age of the participants was 46.5 years and average duration of the present symptoms suggestive of TB was 18 days. Among the patients having both TB and DM (n = 20) at the time of diagnosis, 85.7% were sputum smear positive and 14.3% were sputum smear negative while 79.3% of isolated TB patients (n = 91) were sputum smear positive. No statistically significant difference was observed for sputum smear positivity between the two groups. The mean age (53.8 years) of TB-DM patients was higher than that of isolated TB (45.9 years) with a statistically significant difference. The older age group had a significantly higher prevalence of diabetes compared to younger age group.

Table-2: Relationship Between Age And Blood Sugar: A Comparison Between The Two Groups.

Variables	Only TB Mean± SD	SEM	TB-DM Co-morbidity Mean± SD	SEM	p-value	t-value
Age (Years)	45.9 ± 12.6	1.35	53.8 ± 10.3	2.8	0.028	2.2
FBS (mg/dl)	108.5 ± 28.9	3.1	132.4 ± 37.7	132.4 ± 37.7	132.4 ± 37.7	132.4 ± 37.7

TB=Tuberculosis, DM=Diabetes, FBS= Fasting blood sugar.

No significant association was found between gender and diabetes. The predominant symptoms reported were cough (87.1%), weight loss (80.2%), digestion related problems (60.4%), night sweat (46.5%) and hemoptysis (10.9%). Clinical characteristics of TB were similar in TB only and TB-DM co-morbidity patients.

Prevalence Of DM Among Study Subjects.

The overall prevalence of DM in this study was 109 (8.3%). Of which 45 (3.4%) were known DM patients and 64 (4.9%) were newly diagnosed DM cases. The prevalence of DM was higher among patients in the younger age group, urban residents and married individuals.

DISCUSSION:

The highest prevalence of DM among TB patients is observed in many countries of Asia, North America and Oceania. On the contrary, the prevalence of TB among DM patients is low globally, but relatively higher in the studied countries of Asia and the African continents. Factors associated with TBDM comorbidity included sex, older age, urban residence, illicit drug use, alcoholism, cigarette smoking, sedentary lifestyle, obesity, HIV coinfection, hypertension, long duration of pre-existing DM, poor glycemic control, being a PTB patient, and family history of DM. The implementation of the WHO recommended TBDM integrated services is important to address the impact of TBDM comorbidity [6]. However, as implementing such a strategy is resource intensive, countries may benefit by first assessing the magnitude and risk/associated factors of TBDM comorbidity before making decisions to undertake such a big initiative.

CONCLUSION:

The prevalence of DM among TB patients observed in our study is high and may indicate an emerging threat of TBDM comorbidity. This systematic review revealed that there is a high burden of DM among TB patients at Global level. On the contrary, the global prevalence of TB among DM patients is low. Assessing the magnitude and risk/associated factors of TBDM comorbidity at country/local level is crucial before making decisions to undertake TBDM integrated services.

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