Original Article

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Diabetes Mellitus among Newly Diagnosed Tuberculosis Patients in Tribal Odisha: An Exploratory Study

Community Medicine Section

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ABSTRACT

Introduction: The association between Diabetes Mellitus (DM) and Tuberculosis (TB) poses a strong public health challenge. Tribal ethnics possess a different propensity towards infectious and haematological diseases which may influence the inter-relationship of DM and TB and thus merit separate attention.

Aim: To investigate the prevalence of diabetes in newly diagnosed pulmonary TB patients of tribal ethnicity in Odisha.

Materials and Methods: A cross-sectional study was carried out over a period of 9 months at four designated TB microscopic centres in a tribal district (Malkangiri) of Odisha. A total of 110 tribal 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. Data was entered and analysed using SPSS version 22.0.

Results: The prevalence of diabetes and IFG are found to be 13.9% and 8.9%, 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 high FBS was found to be higher in newly diagnosed pulmonary TB patients of tribal ethnicity thus indicating the need for intensified bidirectional screening. Further studies should be undertaken towards the risk profiling of diabetes and other lifestyle diseases in this population.

Keywords: Co-morbidity, Inter-relationship, Newly diagnosed tuberculosis, Screening

INTRODUCTION

Tuberculosis (TB) remains a leading cause of disability-adjusted life years in many regions of the world, particularly in low and middle income countries [1]. According to the World Health Organization (WHO), in 2013, an estimated 9.0 million people were with TB and of which 2 million cases were from India [2,3]. Further, recent scientific evidence has highlighted the increasing incidence of diabetes in LMIC. More than 371 million people all over the world had Diabetes Mellitus (DM) in 2012 as reported by International Diabetes Federation (IDF) [4]. The WHO has projected that deaths attributable to diabetes may double between 2005 and 2030 [5].

Multiple studies globally present diabetes to be an independent risk factor for TB in the community. The risk of TB infection not only rises in diabetes patients, but is also associated with a higher risk of an increased number of diabetes complications [6]. Diabetics not only require longer treatment, but are also more likely to develop multi-drug resistant TB [7]. TB treatment results are influenced by DM, mainly by delaying sputum culture conversion, increasing patient fatality and treatment failure and increasing the risk of recurrent TB after completion of anti-TB treatment [8,9]. Understanding the interaction between the two diseases is important since they have implications for achieving the 2035 WHO targets for TB incidence and mortality. Accordingly, several studies [5,7,9-12] have been initiated to investigate the coexistence of diabetes with TB. In India, various community and hospital based studies have noted a varied prevalence of glucose intolerance among TB patients [13-17].

Tribal population, constitute an integral component of Indian society sharing 8.6% according to 2011 census [18]. Tribal ethnics have been recognized for their different propensity towards infectious and haematological diseases and thus merit separate attention; the inter-relationship of DM and TB may be influenced by ethnicity [19]. Especially, the identification of hyperglycaemia at the time of first diagnosis of TB can inform the clinician and appropriate decisions could be made. It is therefore important to understand the level of diabetes among those with TB and compare the findings with mainstream populace. One study in South India has observed the prevalence of DM in TB patients among the tribes to be 5% [20]. However, in Odisha, to date no study has explored this dimension especially in the indigenous tribal population. This is an important knowledge gap since tribals constitute 22.8% of the whole state's population [18]. Against this backdrop, we undertook this study that investigated the prevalence of glucose intolerance and DM among tribal patients with newly diagnosed TB.

MATERIALS AND METHODS

This cross-sectional study was carried out in a tribal district of Odisha (Malkangiri) from January to September 2014. Ethical clearance was obtained from Institutional Ethical Committee of IIPH, Bhubaneswar, Public Health Foundation of India. Study participants included patients voluntarily attending all the four designated TB microscopic centers with symptoms of TB such as cough, weight loss and haemoptysis. The sample size for this study was determined by using the prevalence of DM among the TB cases from a study done in a tertiary health center where the researchers have found the prevalence to be 5% [20]. The sample size was calculated by using the formula $n = Z^2pq/d^2$, where n is the desired sample size, z is the standard estimate = 1.96, p = prevalence of DM among the TB cases, q = 1-p and d is the precision of the study = 0.05. By using the formula, the sample size was estimated to be 73. Considering a non-response rate of 20%, it was decided to include 110 numbers of patients attending the microscopic center during the study period. Depending upon the patient inflow to the individual TB center (which was assessed from previous records) the number of patients recruited from each center was calculated. Of the four TB centers, 28 participants were from the two centers

each and 21 and 24 participants were included from the other two centers. Finally, total 101 participants consented and were included in the study.

Adult patients who were diagnosed for the first time with pulmonary TB by the treating clinicians either by clinical correlation with digital radiographical findings or sputum microscopy or both, patients with tribal ethnicity and patients with no past history of smoking and alcohol used disorders (self reported) were included in the study. Patients with any haematological disease like sickle cell diseases/ Thalassaemia, smokers and alcoholics, patients with self-reported known diabetic, patients with extra-pulmonary TB and severely ill/ comatose patients and relapse cases or those patients having past history of TB were excluded from the study.

All adult patients (>18 years) who were diagnosed positive for pulmonary TB were further screened for diabetes. Fasting Blood Sugar (FBS) level estimation was done after 8 hours of fasting using Glucose Oxidase method. All the participants were explained about the purpose of the study and were free to decide whether to participate or not. They were also told that they could withdraw themselves from the study at any point of time. From those who volunteered to participate, informed and written consent were obtained from them prior to conducting the study.

Data regarding the socio-demographic information, symptoms and complaints, drug and diet history, family history of diabetes, alcohol and smoking habits, were collected from the participants using a structured questionnaire. All the participants were assessed for clinical characteristics such as cough, haemoptysis, weight loss, fever, breathlessness, night sweats, loss or decrease of appetite, lymphadenopathy from the history and clinical examination. Sputum smear microscopy using Ziehl – Neelsen stain was done after two samples (one morning and the other on the same day) of sputum were collected from each participant as per the RNTCP guidelines. Presence of Acid Fast Bacilli as per RNTCP guidelines was denoted as AFB positive and absence of acid fast bacilli in at least hundred oil immersion fields (when 1000 oil immersion fields are screened) was considered AFB negative. Screening and diagnosis of DM was done following national guidelines as recommended by the WHO; FBG 126 mg/dl indicates DM; FBG 110–125 mg/dl indicates impaired fasting glucose (IFG). FBS<110 mg/dL were considered normal [21].

STATISTICAL ANALYSIS

Statistical analysis was done using Statistical Package for the Social Sciences software (SPSS v 22.0, Chicago, USA). Continuous variables were summarized as mean with Standard Deviation (SD) and t-test was used to compare means. Categorical variables were expressed as counts (proportions) and Chi-square analysis were performed to compare proportions. The p<0.05 was taken as statistically significant.

RESULTS

One hundred ten patients were approached, out of which 101 (91.8%) agreed to participate in the study. All the 101 participants (76 males and 25 females) were newly diagnosed cases of TB. The socio-demographic variables are depicted in [Table/Fig-1]. Among the participants, 13.9% (12 males and 2 females) were diagnosed to be diabetic as per the WHO criteria. Additionally 9 (8.9%) patients were found to have impaired fasting glucose.

The average age of the participants was 46.7 years and average duration of the present symptoms suggestive of TB was 18 days. Among the patients having both TB and DM (n = 14) 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 = 87) 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/Fig-2]. 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 haemoptysis (10.9%). Clinical characteristics of TB were similar in TB only and TB-DM co-morbidity patients.

Variables	TB only (%)**	TB-DM co-morbidity (%)**	p-value
Age			
≥ 55 years	28 (27.7)	09 (8.9)	
<55 years	55 (54.5)	05 (5.0)	0.034*
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

[Table/Fig-1]: Socio demographic variables in TB only and TB-DM co-morbidity groups.
TB - Tuberculosis, DM - Diabetes, AFB – Acid Fast Bacilli, *statistically significant, ** n = 101

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	10.1	0.007*	2.8

[Table/Fig-2]: Relationship between age and blood sugar: a comparison between the two groups
TB - Tuberculosis, DM - Diabetes, FBS – Fasting Blood Sugar, *statistically significant.

DISCUSSION

A growing body of research has highlighted the interplay of TB and DM as an emerging health care challenge in low and middle income countries. In India, recent studies have demonstrated similar inter-relationship between TB and DM in mainstream population. In view of limited available information, our study attempted to explore the prevalence of diabetes in newly diagnosed pulmonary TB patients of tribal ethnicity of Odisha.

The prevalence of DM in this study is 13.9%, which is lower than reports from India [22] and other neighboring countries [10,12]. However, a South Indian study on tribal had observed a lower prevalence of DM (5%) compared to our study [20]. This is worrisome since traditionally tribal populations in India have exhibited lower prevalence of diabetes compared to the mainstream populace. This also indicates the changing nature of lifestyle among the tribal population in Odisha with growing urbanization [23].

We found the prevalence of IFG to be similar to the findings of the south Indian tribal study. TB, being a chronic infectious disease with compromised immunity can temporarily increase the blood glucose levels and thus co-existence of TB could be responsible for stress-induced hyperglycaemia in some of these patients [8,24]. However, this is also probably an early indicator of a future risk of DM [25]. At the same time, this interaction, and the rise in blood glucose levels, can contribute to false positive diagnoses of DM if blood glucose levels are measured at the time of diagnosis of TB patients.

In relation to the effect of gender on diabetes in TB, mixed results have been reported. Similar to our results few studies did not mark any difference, however some studies reported a higher frequency among men [5,22,26]. The dis-similarity among the studies can be because of the unique ethnic characteristics of tribal community. In tribal communities, most of the families are matriarchal with females performing similar activities as that of male members. Further, the increasing consumption of alcohol and tobacco among the tribal women could be another plausible reason [20]. In the present study, diabetic TB patients are older than those without DM. [5,10,22]

which may be due to an association of type 2 DM with older age.

The results varied regarding the rate of positive smears at the time of diagnosis of DM. There are studies which reported DM as an independent risk factor for positive sputum smear [27,28] while others have found a higher frequency of negative sputum smears among TB-DM cases [29]. Some authors have reported no association between DM and patients' bacteriology results [30] similar to our findings.

LIMITATION

The present study has few major limitations. First, the sample size was small and limited to one district. Thus, it is difficult to generalize the findings to other tribal communities. Second, we did not estimate the post prandial blood glucose and glycated haemoglobin levels. Third, we did not follow the patients and re-analyse their blood sugar levels after they completed the DOTS therapy. Further, since we included patients based on self-reports a selection bias cannot be excluded. Future research need to include more tribes in a larger sample with follow up.

Despite the limitations, our study is first to explore the blood sugar level among newly diagnosed TB patients in a tribal community provides novel insights into the coexistence of TB and DM in this special population group.

CONCLUSION

The prevalence of fasting blood sugar was found to be higher in newly diagnosed pulmonary TB patients belonging to tribal ethnicity thus indicating the need for intensified bidirectional screening. Further studies should be undertaken towards the risk profiling of diabetes and other lifestyle diseases in these population.

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