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Bidirectional Screening of Tuberculosis Patients for Diabetes Mellitus and Diabetes Patients for Tuberculosis

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To assess the feasibility and results of screening diabetes mellitus (DM) patients for tuberculosis (TB) and TB patients for DM within the routine health care setting. Prospective observational study carried out within the Diabetes Centre and Pulmonary Medicine Department from February 2012 to September 2012. The screening for active TB in DM and DM in TB patients is followed as per the guidelines of the Revised National Tuberculosis Control Programme and national programmes in India. Total of 307 patients diagnosed with TB during the study period. Among the TB patients 9.77% were smokers, 19.54% were known cases diabetes, and 15.96% were newly diagnosed cases of diabetes. Total of 4,118 diabetes patients were screened for TB in which 111 patients found to have TB. The strengths of this study are that we implemented screening within the routine health system. It is feasible to screen DM patients for TB resulting in high rates of TB detection.

Keywords: Diabetes mellitus; India; Prevalence; Tuberculosis

INTRODUCTION

India accounts for one-fifth of the global burden of tuberculosis (TB) [1] and ranks second in the top 10 countries, next to China with a higher burden of diabetes too [2]. Case detection rates for all forms of TB are 59%, but in those patients detected treatment success rates are high at 88%. Given the large absolute numbers of patients with TB, the numbers of patients with multidrug resistant TB (MDR-TB; resistance to both isoniazid and rifampicin) are high, with 2% of new cases and 15% of retreatment cases estimated to have MDR-TB [1]. Diabetes is a chronic metabolic disorder known for its progressive nature and associated with wide range of complications. Apart from this, impairment in immune system is very common among diabetic subjects, which makes them more prone to acquire infections and persistence of the same. World Health Organization (WHO) has recognised diabetes mellitus (DM) as a global epidemic, mostly affecting low, and middle income counties, where 80% of all deaths from DM occur [3]. Several epidemiological studies demonstrated that subjects with diabetes are three times at higher risk of getting active TB disease compared to those without diabetes [4]. India is a country with 1.2 billion population (17.5% of the world's population). Country is undergoing rapid social and economic expansion which is associated with increasing physical inactivity, an unhealthy diet and obesity. Consequences of which, there has been an escalating epidemic of DM [5,6]. In the last 20 years, DM prevalence rates have risen in both urban and rural populations and also amongst the poor [5]. Available data suggest that in 2011 there were an estimated 61.3 million adults with DM, giving a national adult prevalence of 8.3% in persons aged 20 years and above. A further 77 million people were estimated to have had impaired glucose tolerance. In terms of absolute numbers and given the size of the population, this makes India one of the

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highest DM and TB burden countries.

The idea that TB and DM share synergetic relationship has been creating growing concern around the world. Recently, WHO and the International Union Against Tuberculosis and Lung Disease (Union) have acknowledged the need for international guidelines on the joint management and control of TB and DM and have published a provisional collaborative framework for the care and control of both diseases [7]. This paper describes single centre experience in the bidirectional screening procedures, implementation, monitoring, results and challenges of screening TB patients for DM and DM patients for TB within routine health care settings in the country.

METHODS

Design

This was a prospective observational pilot study carried out in our hospital within the routine health services. The study design was similar to that used in China [8,9].

Patients

Patients included all persons aged 15 years and above who were consecutively diagnosed and registered with TB between February to September 30th, 2012. Every patient with confirmed TB started anti-TB treatment immediately. Treatment regimens and anti-TB drug formulations were in accordance with those recommended by WHO and Revised National Tuberculosis Control Programme (RNTCP) of India [10].

The random blood glucose (RBG) of diagnosed and registered cases of TB were done on the first visit. If RBG was less than 110 mg/dL, the subject were considered to be non-DM and no further evaluation was done. If RBG was more than 110 mg/dL, the patients were called next day fasting for fasting blood sugar. If fasting blood glucose (FBG) ≥126 mg/dL, patient were considered as cases of DM and enrolled in the study as new DM. On the day first visit, if patient were already known cases of DM, then no further investigations were carried out and included in study as known DM cases. The screening for DM followed national guidelines which stipulate that a FBG is used with cutoff thresholds in line with those recommended by the WHO. In brief, FBG ≥126 mg/dL indicates DM; FBG from 110 mg/dL to less than 126 mg/dL indicate impaired fasting glucose; FBG <110 mg/dL is normal. The screening for DM in TB patients followed the guidelines stipulated by the National Programme for Prevention and Control of Cancer, Diabetes, Cardiovascular Diseases and Stoke in India [11].

Similarly screening was carried out every time the patient visited the DM clinic and was based on asking about cough for longer than 2 weeks, fever, weight loss, hemoptysis, and or any suspicion of active TB to account for extrapulmonary TB. Patients with a positive symptom screen were referred to TB services for investigation in accordance with the Operational Guidelines stipulated by the RNTCP.

In both, screening protocols patients with other risk factors for TB like HIV infection, connective tissue disorders, chronic renal failure, chronic liver disease, malignancies, on long term steroid, or cytotoxic drug therapy, chronic alcoholics and pregnant women were excluded after careful evaluation of present and past histories along with the reports.

RESULTS

Aggregate data of the study, the Tuberculosis Unit and Diabetes Centre are shown in Tables 1 and 2. Total of 307 patients diagnosed with TB during the study period. Among the TB patients 9.77% were smokers, 19.54% were known cases of diabetes, and 15.96% were newly diagnosed cases of diabetes. Total of 4,118 diabetes patients were screened for TB in which

Table 1. Screening patients with tuberculosis for diabetes mellitus

Indicator	Value
No. of patients with TB registered over the three quarters	307 (100.0)
Male	197 (64.2)
Female	110 (35.8)
Mean age of the patients	50.7±14.8
No. of current smokers (smoked in last 3 months)	30 (9.77)
No. with known diagnosis of DM	60 (19.54)
No. needing to be screened with RBG	247 (80.46)
No. actually screened with RBG	247 (80.46)
No. with RBG ≥110 mg/dL	133 (43.32)
No. screened with FBG	133 (43.32)
No. with FBG ≥126 mg/dL (newly diagnosed with DM)	49 (15.96)
No. with known or newly diagnosed DM	109 (35.50)
No. with known and newly diagnosed DM referred to diabetes care	109 (35.50)
No. of patients with known or newly diagnosed DM reached to DM care	109 (35.50)

Values are presented as number (%) or mean±standard deviation.
TB, tuberculosis; DM, diabetes mellitus; RBG, random blood glucose; FBG, fasting blood glucose.

Table 2. Tuberculosis screening in diabetes patients

Patients with diabetes who were screened and diagnosed with tuberculosis	Value
No. of DM patients seen in the clinic during the study period	4,118 (100.0)
Male	2,348 (57.0)
Female	1,770 (43.0)
Mean age of the patients	46.8±15.2
No. of DM patients screened at least once for TB symptoms in each quarter	2,072 (50.32)
No. of DM patients with a positive TB symptom screen	45 (1.09)
No. of DM patients referred for TB investigations	45 (1.09)
No. diagnosed with TB after referral for investigations	2 (0.05)
No. of DM patients already diagnosed with TB from elsewhere	109 (2.65)
Total no. identified and registered with TB (known and new)	111 (2.70)
New smear positive	52 (1.6)
New smear negative	29 (0.70)
New extrapulmonary	30 (0.73)
New others	-
Relapse	-
Failure	-
Treatment after default	-
RT-others	-
MDR-TB	-
No. on TB treatment	111 (2.7)

Values are presented as number (%) or mean±standard deviation.
DM, diabetes mellitus; TB, tuberculosis; RT, retreatment; MDR, multi drug resistant.

111 patients (52 new smear positive, 29 new smear negative, 30 new extrapulmonary). The key findings of the study are nearly half of the TB patients had either diabetes or prediabetic status. Following are the challenges in bidirectional screening of tuberculosis and diabetes. If the blood tests are required to be done after the diagnosis of TB, the patients will have to make additional visits to the health facility and many time patients do not come after repeated phone calls. After patients are referred for diabetes care, getting feedback from the diabetes clinic was a challenge as many patients do ignore. Standardized TB treatment under RNTCP is available at all levels of health care facilities whereas standardised DM treatment is not guaranteed if patients have to be referred to a health facility near to their place of residence. Additional manpower is required if records and reports have to be maintained at primary and secondary health care facilities.

DISCUSSION

The major risk factors associated with TB burden are HIV/AIDS, malnutrition, air pollution, smoking, alcohol consumption, and diabetes as well [12]. Despite a good national TB programme in India, the diabetes epidemic is hampering TB control efforts. Recently published clinical research studies in South India in about 1,500 TB patients found a high prevalence of DM, that was about 25% in the state of Tamil Nadu and about 44% in the state of Kerala [13,14]. The observations of our study are similar to many other studies in India, Brazil, and the US-Mexico border [15,16]. The study by Jimenez-Corona et al. [17] has several observations worth noting. They followed a large sample size totaling 1,262 patients with pulmonary TB (PTB), and found a high prevalence of DM of 29.63%. They were also able to demonstrate that dual disease (DM+PTB) was more likely to be associated with increased morbidity: pulmonary cavities, delayed sputum conversion >60 days, higher probability of treatment failure, and higher recurrence and relapse rates [17].

In the present study number of TB patients diagnosed after screening DM patients is very small (2.7%). In a systematic review of literature Jeon et al. [18], demonstrated that screening of diabetics yielded active TB prevalence rates ranging from 1.7% in Sweden to 36% in Korea. Screening would have higher yield in a country like India where TB prevalence is estimated at 283/100,000 with high DM prevalence estimated to be 8.3% of all adults. In this high-prevalence setting, screening 100,000 people with DM would yield around 2,000 to 3,000 cases of TB. Although routine screening for diabetes takes place in some hospitals, if it is done in all health care facilities, it will lead to better and earlier detection of DM, earlier and better treatment of DM and improved clinical outcomes of anti-TB treatment [19]. The strengths of this study are that we implemented screening within the routine system with no special budget allocated to support these activities. We think that because of their higher risk for TB and the fact that patients with DM are anyway more likely to attend health facilities, the marginal costs for TB screening using a symptom-base approach are likely to be small and to prove cost effective. The association of two diseases from two different categories, i.e., infectious diseases and noncommunicable diseases indicate the need for the bidirectional screening. Similarly, in the patients

diagnosed with any form of active TB, the presence of history of diabetes must be confirmed, if they are not previously diagnosed with diabetes then subject them to diabetes screening.

Diabetic patients are at higher risk of developing new as well as reactivation of old TB disease. Uncontrolled and undiagnosed diabetes may lead to poor TB treatment outcome. Diabetes management during TB treatment is individailzed, through monitoring the blood glucose and adjusting the diabetic medications keeping the details of diabetes related complications and comorbidities in mind. Screening for active TB in DM clinics should lead to earlier detection of TB and earlier and better treatment of TB. Screening of TB patients for DM also leads to earlier detection of DM and better treatment and favourable outcome for TB as well as DM. Hence we conclude, "Bidirectional screening of tuberculosis patients for diabetes and diabetes patients for tuberculosis is feasible and imperative in routine health care settings."

CONFLICTS OF INTEREST

No potential conflict of interest relevant to this article was reported.

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