Print ISSN: 2321-6379
Online ISSN: 2321-595X

Original Article

Cross-sectional Study on Comorbidities in Pulmonary Tuberculosis: Red Flags for Prognosis

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Abstract

Context: Comorbidity of tuberculosis (TB) with non-communicable diseases (e.g., diabetes mellitus, malnutrition, smoking, and alcohol-related diseases) and other communicable diseases (e.g., human immunodeficiency virus [HIV]/AIDS) is prevalent in regions of the world that are highly endemic for TB, thereby posing as important contributors to the TB burden.

Objective: The aims of the study were as follows: (1) To estimate the prevalence of major comorbidities in pulmonary TB patients and (2) to assess the sociodemographic profile of pulmonary TB patients.

Settings and Design: A cross-sectional study was conducted in tertiary care facility (TB and Chest Government Hospital, Erragadda) in Hyderabad district.

Materials and Methods: A total of 150 patients were recruited from August to September by consecutive sampling. All patients who met the inclusion criteria for the study were interviewed by a peer-reviewed questionnaire. Height and weight were measured by standardized techniques and body mass index (BMI) calculated.

Statistical Analysis Used: Descriptive analyses were done to estimate the prevalence of various comorbidities and Chi-square test was applied to test the significance with various comorbidities.

Results: The prevalence of diabetes was 20%, as determined by self-report and the HIV prevalence was found to be 10% among TB cases. In total, severe malnourished was 43% (BMI <16) and 31% were found to have a normal BMI (>18.4). Among males, 35% were smokers. Alcohol use was reported by 36% and hazardous alcohol use disorders identification test-C by 21%.

Conclusion: Alcohol abuse and malnutrition in the study population are key drivers of TB in the region. Alcohol treatment programs are few in this area and more may be needed. It is possible that malnutrition is secondary to TB itself accounting for the high prevalence.

Key words: Alcohol abuse, Comorbidities, Diabetes mellitus, Human immunodeficiency virus, Malnutrition, Pulmonary tuberculosis, Smoking

INTRODUCTION

Tuberculosis (TB) is one of the top 10 causes of death worldwide. In 2017, 10 million people fell ill with TB, and 1.6 million died from the disease (including 0.3 million among people with human immunodeficiency virus [HIV]).[1] Globally, the epidemic of TB is on a decline. In 2017, the proportion of people with TB who died from the disease was 16%, down from 23% in 2000, but in developing countries like India, the burden of TB still persists with the global TB report 2017 estimating the incidence of TB in India as approximately 2,800,000 accounting for about a quarter of the world's TB cases.[1] The reasons for the persistence of the epidemic in India are mainly the abundance of risk factors and coexistence with other comorbid conditions that on the rise in the country. Levels of unsuspected comorbidity are also high; patients with concurrent communicable or non-communicable diseases (NCDs) are frequently overlooked. People living

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www.ijss-sn.com

Month of Submission : 02-2021
Month of Peer Review : 03-2021
Month of Acceptance : 03-2021
Month of Publishing : 04-2021

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with chronic communicable diseases such as TB and HIV/AIDS are most likely to develop comorbidity with NCDs (diabetes mellitus [DM], malnutrition, smoking, and alcohol-related diseases).[2] Moreover, coexisting communicable and NCDs augment the risk or effect of the other. Active TB disease is linked with the breakdown in immune surveillance. This explicates the strong association between active TB disease and other communicable diseases or NCDs that exercise a toll on the immune system.[3] Common TB-NCD comorbidities include DM, smoking, alcohol use disorders, chronic lung diseases, cancer, and depression.[2,4,5] It is, therefore, important to identify these comorbidities in people diagnosed with TB, especially in a high burden country like India to ensure early diagnosis and improve comanagement. The aim of this study is to identify the prevalence of these comorbidities in relation to the local epidemiology and subsequently providing opportunities to investigate commonalities and potential synergies in prevention and control.[2]

MATERIALS AND METHODS

Sample and Procedure

A cross-sectional study was conducted in the tertiary care facility (Government Chest and TB Hospital, Erragadda) of Hyderabad district, which is the main referral center for TB patients in the district. In a cross-sectional survey, new TB patients were interviewed, and medical records assessed in consecutive sampling within 2 months of anti-TB treatment. Patients were recruited from the DOTS clinic of the facility. Written informed consent was obtained from all individuals meeting the study inclusion criteria.

Inclusion Criteria Include

1. Newly diagnosed pulmonary TB
2. Having taken at least 2 months of anti-TB medication
3. Age group of 15–45 years.

Exclusion Criteria Include

1. Patients with extra-pulmonary TB
2. Those who did not consent and were in the age group of <15 and >45 years of age.

Study Procedures

The sample size was calculated to be 150 from the formula $4pq/l^2$, taking an absolute error of 5% and considering the prevalence of HIV comorbidity which was lowest among all the studied comorbidities (6%) so that the sample size was adequate for all the comorbidities studied.

Consecutive sampling was followed and patients were recruited from the OPD of the DOTS clinic, patients were interviewed consecutively, and a maximum of 20 samples was taken in a day. The study was conducted over a period of 2 months from August to September.

Measures

Diabetes was defined as random blood sugar >200 mg/dL or self-report; severe malnutrition was defined as body mass index (BMI) <16 kg/m^2 and malnutrition as BMI ≤18.5 kg/m^2. Hazardous alcohol use was defined as per alcohol use disorders identification test-C (AUDIT-C).

On enrollment, all patients were interviewed by a peer-reviewed questionnaire, the first part included sociodemographic characteristics including age, gender, marital status, religion, and education. In the second part, participants were asked about alcohol use and smoking. Alcohol use was assessed using the AUDIT-C questionnaire[6] (a modified version of AUDIT) which assessed hazardous alcohol use among the alcohol users. HIV status was assessed from the reports. Baseline anthropometric measurements included height and weight measured by standardized techniques and BMI calculated.

Data Analysis

Data were entered and analyzed into Microsoft excel. Data were checked for normality distribution and outliers. Chi-square tests were used to test for differences in proportions. Probability below 0.05 was regarded as statistically significant.

RESULTS

A total of 150 subjects were interviewed for identifying comorbidities associated with TB. The mean age of the study population was 32 years.

Males constituted 59% (n = 89) and females constituted 40.6% (n = 61) of the study. Total 76% (n = 115) were married and 23.3% (n = 35) were unmarried. Occupation wise highest were semiskilled workers 54.6% (n = 82), and least were professional 1.5% (n = 2) [Table 1].

Education wise, the proportion of illiterates was highest at 35% (n = 53) and proportion of middle school education was lowest. In terms of socioeconomic status classified according to BG Prasad's classification 2018, highest was lower middle class 31.3% (n = 47) status followed by upper middle class status 24.6% (n = 37) and least were of lower status 10.6% (n = 16) [Table 1].

Prevalence of Risk Factors Stratified by Patient Characteristics

The distribution of risk factors as classified by patient characteristics is shown in Table 1. Compared with TB patients without risk factors, those with one risk factor (comorbidity) or more were likely to be males, married,

semiskilled by occupation and belonging to the Hindu religion [Table 2].

When stratified by education, illiterates showed the highest prevalence and those belonging to the lower middle class (100%) followed by lower class (68.7%) by socioeconomic status.

Prevalence of Risk Factors

The prevalence of individual comorbidities, of frequency, included. Malnutrition 68% (n = 45) and alcohol abuse 36% (n = 54) in the study population are key drivers of TB in the region, followed by smoking 34.6%, diabetes 20%, and least were HIV 10%. P value came to be significant for alcohol use between males and females and insignificant for HIV positivity. The prevalence of all comorbidities was higher in males compared to females. Diabetes, Smoking and Hazardous alcohol use were exclusively found in males [Figure 1].

When classified according to BMI, overall 68% has malnourishment with a BMI <18.4, of these 64 (43.3%) had a BMI <16 and were severely malnourished followed by 23 (15.3%) with a BMI between 16 and 16.9 and at least 15 (10%) with a BMI of 17–18.4. The majority of the males were malnourished (75%) with BMI <18.4 and females accounting for 25% of those with malnutrition [Figure 2].

Table 1: Sociodemographic characteristics of study population

Variable	*n* (%)	Prevalence of comorbidities, *n* (%)
Sex		
Male	89 (59.4)	65 (73)
Female	61 (40.6	27 (44.2)
Marital status		
Married	115 (76)	74 (64.3)
Unmarried	35 (23.3)	17 (48.5)
Religion		
Hindu	81 (54)	52 (64.1)
Muslim	66 (44)	41 (62.1)
Christian	3 (2)	0 (0)
Occupation		
Professional	2 (1.5)	0 (0)
Skilled	22 (14.6)	12 (54.5)
Semiskilled	82 (54.6)	58 (70.7)
Unskilled	44 (29.3)	29 (65.9)
Education		
Illiterate	53 (35.4)	35 (66)
Primary	20 (13.4)	20 (100)
Middle	15 (10)	7 (46.6)
High	25 (16.6)	19 (25)
Intermediate	37 (24.6)	0 (0)
Socioeconomic status		
Upper	24 (16)	12 (50)
Upper middle	37 (24.6)	12 (32.4)
Middle	26 (17.3)	0 (0)
Lower middle	47 (31.3)	47 (100)
Lower	16 (10.6)	11 (68.7)

Table 2: Genderwise distribution of risk factors

Risk factor	*n* (%) total	Male	Female	*P*-value
Diabetes	30 (20)	30 (100)	0 (0)	–
HIV	15 (10)	11 (73.3)	4 (26.7)	0.09982
BMI (malnourishment≤18.4)	102 (67.5)	76 (75.5)	26 (24.5)	–
Smoking	52 (34.6)	52 (100)	0 (0)	–
Alcohol use	54 (36)	53 (99)	1 (1)	<0.0000001
Hazardous alcohol use (AUDIT-C)	31 (20.6)	31 (100)	0 (0)	–

DISCUSSION

The study population had a majority of males with a percentage of 59% (n = 89), the majority of whom were married 76% (n = 115) and were semiskilled 58% (n = 82) in occupation. When prevalence was assessed according to patient characteristics, compared with TB patients without risk factors, those with one risk factor (comorbidity) or more were likely to be males, married, semiskilled by occupation and belonging to lower middle and lower class. This is similar to a study conducted by Peltzer *et al.*, where the study population was mostly composed of married males and had lower education.[7] The higher prevalence of comorbidity among men in this sample may be because alcohol and tobacco use were included and that the two substance use disorders were much more common in men than women in this study and in the general population.

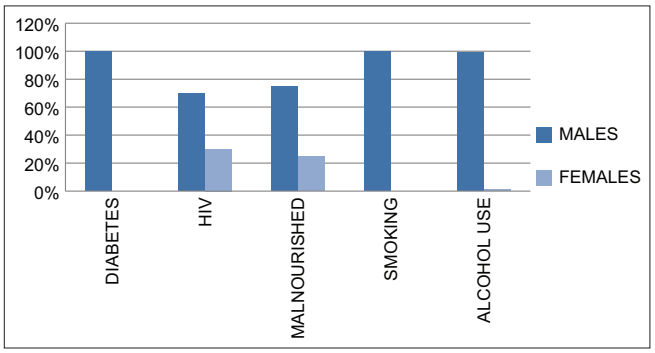

Figure 1: Prevalence of risk factors in sample population

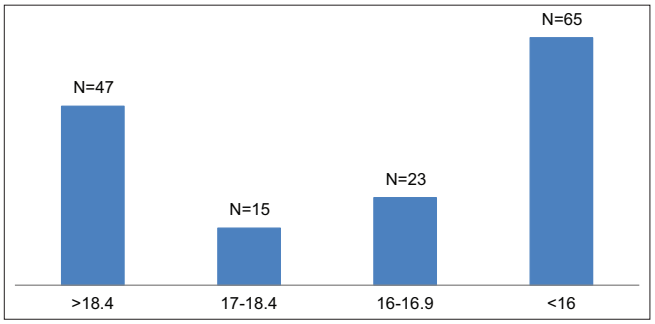

Figure 2: Classification of body mass index

The likelihood of TB risk factors was higher in TB patients with lower education and poorer socioeconomic status (poverty) than those with better socioeconomic status, which is in agreement with the previous studies and reviews.[8,9] The present study showed that the prevalence of diabetes in TB subjects was 20%, all of whom were male. The higher prevalence of DM among men than women might be a cumulative effect of other risk factors which are also in a higher percentage in males. The prevalence of DM in similar studies conducted in the area shows prevalence from 10% to 25%[10,11] and on a higher percentage in males which is in line with the present study. According to Gupta *et al*.,[12] the prevalence of HIV in TB patients was found to be 8.4%. Similarly, according to national statistics, the % of HIV positive among TB cases −6%, in our study, the prevalence has come out as 10%. In this study, undernutrition was the most prevalent comorbidity, present in 68% of men and women with pulmonary TB of which more than two-thirds were moderate to severely underweight according to BMI-based criteria. These results were similar to a study by Bhargava *et al*.[13] and Shetty *et al*.,[14] in which the prevalence of malnourishment was found to be 85% and 72% of these majority being severely malnourished. No women smoked (100% in males) or drank (99% in males), so the results are largely related to men. In a reference study conducted in South India,[15] among males, 55% had smoked and 49% had used alcohol which is similar to our study where the prevalence was 36% and 35%, respectively.

Study Limitations

The study was limited to only one tertiary hospital and the inclusion of more DOTS centers can provide a different profile with the inclusion of more study participants and thereby increasing the sample size and power. As this was a cross-sectional study, causality between the compared variables cannot be concluded. In addition, the study assessed individual comorbidities, the effect of multimorbidities cannot be ignored as disease severity, the specific combination of comorbidities and access to health care may affect each other.

CONCLUSION

Diagnosis and treatment of harmful drinking and alcohol misuse disorders should be part of basic clinical care for people with TB. Control measures for tobacco, alcohol, are an obvious priority for improving public health in the study area. The fact that malnutrition is very common in India, with regard to adults, one-third of both adult men and women were found to have evidence of chronic undernutrition, with a BMI <18.5 kg/m^2 in the National Family Health Survey of 2005–2006 may account for its large contribution to the TB burden.

TB is commonly accompanied by comorbidities such as HIV, DM, smoking, and alcohol or substance abuse which have their own nutritional implications, and these should be fully considered during nutrition screening, assessment, and counseling. Reducing the burden of TB in the study area will depend to a great extent on dealing with the factors that drive the TB burden in these areas. The current end TB strategy needs to be complemented with efforts to address comorbidities and social determinants. In principle, reducing the prevalence of the comorbidities will reduce TB incidence. This may be achieved by tackling these risk factors directly or the social determinants – on the individual, community, national, and international level – that lay behind them. The National TB Program could strengthen collaboration with other public health programs to contribute to the prevention, treatment, and management of HIV, malnutrition, smoking-related conditions, diabetes, and alcohol abuse. Frameworks for such work are already well established for HIV (WHO, 2006) and on the way to smoking.[16]

Several medical conditions are risk factors for TB and for poor TB treatment results, while TB can complicate the disease course of some diseases. It is, therefore, important to identify these comorbidities in people diagnosed with TB to ensure early diagnosis and improve comanagement.

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How to cite this article: Rani U, Roohen S, Khan AA, Sivasubramaniyam MK, Anjum S, Arundhati B. Cross-sectional Study on Comorbidities in Pulmonary Tuberculosis: Red Flags for Prognosis. Int J Sci Stud 2021;9(1):77-81.

Source of Support: Nil, **Conflicts of Interest:** None declared.