



Identification of characteristics of TB in patients with diabetes mellitus

Dr. Mahendran C S¹, Dr. Manish Kumar Sharma^{2*}, Dr. Eshutosh Chandra³

¹Assistant Professor, Department of Respiratory Medicine, Santosh Medical College & Hospital, Santosh Deemed to be University, Ghaziabad.

²Assistant Professor, Department of Respiratory Medicine, Santosh Medical College & Hospital, Santosh Deemed to be University, Ghaziabad.

³JR, Department of Respiratory Medicine, Santosh Medical College & Hospital, Santosh Deemed to be University, Ghaziabad.

*Dr. Manish Kumar Sharma - Corresponding Author

ABSTRACT

Background & Objective: A rising body of research shows that diabetes is a significant risk factor for tuberculosis and may have an impact on how the disease manifests. The goal of this study was to identify the characteristics of TB patients with diabetes mellitus in Ghaziabad.

Methods and Materials: A case-control study conducted during the period 2010-2011. Diabetic tuberculosis patients enrolled as cases and non diabetic patients as control.

Results: 156 non-diabetic patients and 84 diabetic patients with TB. Patients with diabetes who had tuberculosis were older (mean 49.23 years) and had less education than non-diabetic patients (mean 43.21 ys). Age 45–64, low levels of education, extra-pulmonary TB, and related medical conditions (especially hypertension) are all strongly linked to diabetes in TB patients.

Conclusions: Patients with diabetes who have TB in Iraq are older than 44, have extra-pulmonary TB disease, and are more likely to have concomitant medial disease (mostly hypertension). We anticipate that our study will contribute to bettering the management of tuberculosis in diabetic patients as there are no comparable studies in Iraq.

INTRODUCTION

There has long been understanding of the connection between diabetes mellitus and tuberculosis (TB) (1). Avicenna cited this connection as evidence (who lived from 980 through 1027). Early in the 20th century, it was believed that a diabetic patient who did not pass away in a diabetic coma was more likely to pass away from TB, especially if the patient was poor (2). Prior to the development of publicly accessible therapy for both diseases, diabetes mellitus was a well-known risk factor for TB. However, this was largely forgotten during the second half of the 20th century. The link between TB and

diabetes is now resurfacing due to the present global rise in type 2 diabetes occurrences. The highest rise in type 2 diabetes cases will be seen in poorer nations, where the disease is very prevalent (3,4). There is mounting evidence that diabetes mellitus is a significant risk factor for TB and may influence how the disease manifests and how well it responds to treatment. Additionally, TB may cause glucose intolerance and deteriorate glycemic control in diabetics. Recent research revealed that 10%–30% of TB patients may also have diabetes (4-6).

Considering the rising rates of obesity and diabetes worldwide as well as the sustained high rates of TB in low-income countries, it is predicted that the number of people with both TB and diabetes will rise drastically. TB and diabetes mellitus have been described as the "convergence of two epidemics" (1). According to the WHO, diabetes mellitus is a worldwide epidemic that mostly affects low- and middle-income nations, where 80% of all diabetes-related deaths occur (1). Despite the fact that the epidemic looks to be nearing an end, tuberculosis still ranks among the leading causes of death globally (7). In a world where almost one-third of people have latent Mycobacterium TB infection, the current pandemic of type 2 diabetes mellitus is escalating (1,2,7). The purpose of the research was to characterize TB patients with diabetes mellitus and to evaluate risk factors for diabetes in TB patients. The absence of a prior study in Ghaziabad is the impetus for conducting this one.

METHODS AND MATERIALS

In the specialized center for chest and respiratory disease, a case-control study was conducted. The national tuberculosis control program in Ghaziabad is centralized at this facility. TB patients were enrolled as cases and non-diabetic TB patients as control. Data were collected during the period 2010 to 2011.

Methodology

Patients older than 14 diagnosed with TB over the course of this study who are known instances of diabetes or who have been checked for diabetes and found to have diabetes were entered in this study as cases, and the two subsequent non-diabetic TB patients (also older than 14) were

enrolled as controls once diabetes had been ruled out with a blood sugar test.

Researchers decided to double the size of the control group to boost the study's power because they anticipated just a limited number of diabetic TB patients. Comprehensive selection of diabetic TB cases was made (all detected cases were enrolled). The selection of non-diabetic TB cases was random and methodical; after each diabetic TB patient was found, the next two cases of non-diabetic TB that met the selection criteria (recently detected PTB, age greater than 14 years) were asked to take part in the study.

Each patient underwent a complete physical examination and medical history. All patients who were recruited underwent blood sugar testing, and diabetes was either diagnosed or ruled out using the American Diabetes Association 2010 criteria.

Statistical analysis

Data entry and analysis were performed using version 20 of the Statistical Package for Social Sciences. Continuous variables are provided as means and standard deviation while discrete variables are displayed as numbers and percentages. The significance of an association between discrete variables is evaluated using the chi-square test for independence, and the difference in the means of two continuous variables is evaluated using the t-test for two independent samples. The association between study variables and the presence of diabetes in the TB patient population was assessed using multivariate analysis using multivariate binary logistic regression, using entry approach. The baseline levels for categorical variable comparisons were age 15–44 years for age group, female for sex, married for marital status, illiterate for education level, normal

body weight for BMI, pulmonary TB for site of TB, no associated medical disease for associated medical disease, and negative history for history of contact with an index TB case. Each estimate was then adjusted for age and sex. Results with a P value under 0.05 were deemed significant.

RESULTS

The correlation between TB and diabetes is resurfacing because to the present rise in type 2 diabetes cases worldwide (4,5). On the other side, diabetes patients with tuberculosis may experience deteriorating glucose control (4-6).

In order to better manage these patients, we attempt to evaluate the features of diabetic patients who contract tuberculosis

in this study. 240 tuberculosis patients in total were enrolled in this study. Participants were 156 non-diabetic and 84 diabetic TB cases.

80 cases of type II diabetes mellitus and 4 cases of type I diabetes were considered diabetic patients. Only 4 (5%) of the 80 type II diabetic patients were identified through screening TB patients for diabetes; the remaining type II patients were already known to have the disease. The 4 type I diabetic individuals had a history of having this condition. Due to missing blood sugar readings in three control (non diabetic) tuberculosis cases' documented data, those cases were removed from the analysis.

Table 1: Characteristics of sampled TB patients

	Diabetic	Not Diabetic	Total	P- value
Variables	N=84(%)	N=156(%)	N=240(%)	
Age Group (year)				0.001
15-44	28	92	120	
45-64	40	43	83	
≥ 65	16	21	37	
Gender			0	0.423
Male	49	85	134	
Female	35	71	106	
Marital Status			0	0.526*
Married	42	89	131	
Single	34	54	88	
Divorced/Separated	3	9	12	
Widow	5	4	9	
Education			0	0.001
Illiterate	5	4	9	
Read & write/primary	39	37	76	
Intermediate/preparatory	17	73	90	
> Preparatory	23	42	65	
BMI Category			0	0.924
Underweight	8	21	29	
Normal	53	87	140	

Overweight	16	23	39	
Obese	7	25	32	
Site of TB			0	0.071
PTB	66	103	169	
EPTB	18	53	71	
Current smoking Status			0	0.724
Current Smoker	15	31	46	
Not smoker	69	125	194	
History of Contact			0	0.529
Positive	6	12	18	
Negative	78	144	222	

*after merging divorced/separated with widow

Table 2: Distribution of sampled TB patients according to presence of diabetes

Presence of associated medical illness	Diabetic	Not Diabetic	Total	P-value
	N=84(%)	N=156(%)	N=240(%)	
Any				0.002
Yes	18(21.42%)	9(5.76%)	27	
No	66(78.57%)	147(94.23%)	213	
Type				0.004*
Hypertension	15(17.85%)	7(4.48%)	22	
Asthma	1(1.19%)	3(1.92%)	4	
COPD	2(2.38%)	2(1.28%)	4	
Malabsorption	1(1.19%)	1(0.64%)	2	
None	65(77.38%)	143(91.66%)	208	

*after merging asthma, COPD and malabsorption

Table 3: Results of logistic regression analyses

	Wald Statistic	P-value	OR	Lower	Upper
Age Group	1.439	0.482			
45-65	0.556	0.462	1.213	0.729	2.009
≥ 65	1.182	0.293	1.520	0.697	3.317
Male Sex	7.8723	0.004	0.542	0.344	0.850
Marital Status	0.521	0.925			
Single	0.431	0.514	0.851	0.508	10.410
Divorced/Separated	0.000	0.99	0.000	0.000	---

		9			
Widow	0.072	0.78 7	0.782	0.132	41.99 1
BMI Category	3.413	0.33 6			
Overweight	0.902	0.34 1	0.728	0.374	1.414
Obese	2.759	0.09 7	0.492	0.212	1.138
Underweight	0.087	0.74 8	0.836	0.265	2.661
EPTB	9.852	0.00 3	0.357	0.186	0.678
Current Smoker	1.559	0.21 4	0.632	0.305	1.306
Positive for medical history	4.116	0.04 5	2.751	1.029	7.335
History of Contact to TB patient	0.488	0.48 6	0.438	0.053	4.191

Reference categories are: age 15-44 for age group, female for sex, married for marital status, normal weight for BMI category, PTB for EPTB, not current smoker for current smoker, negative medical history for positive medical history, and negative history for history of contact to TB patient.

Participants' ages ranged from 15 to 65 years, with a mean age of 49.23 years, while those of the non-diabetic patients ranged from 15 to 68 years, with a mean age of 43.21 years. This difference in means was found to be significant ($P < 0.05$), indicating that the mean age of diabetic TB patients is significantly higher than that of non-diabetic TB patients. Age and education, which showed that diabetic TB patients were more likely to be in the age range of 45 to 64 years than non-diabetic TB patients ($P < 0.05$, table 1), were factors that were substantially connected with diabetes in TB disease.

Low education level: According to this study, diabetic patients are more likely to have low education than non-diabetic patients (primary school completion rate for diabetic patients is 49.4% against 25.5%, table 1). When compared to non-diabetic TB patients, diabetic TB patients were substantially more likely to have another medical condition present (21.42% vs. 5.76%, table 2) ($P < 0.05$). Hypertension was the most common related medical condition, and diabetic TB patients were more likely to have it than non-diabetic TB patients—13 out of 77 diabetic TB patients (17.84%) and 5 out of 141 (4.48%).

A diabetic patient had a case of chronic obstructive pulmonary disease, a non-diabetic patient with asthma had tuberculosis, and a patient without diabetes had a malabsorption issue. The presence of diabetes was not significantly correlated with other characteristics (sex, marital status, BMI category, site of TB, smoking

status, and history of interaction with index TB patients) among recruited TB patients ($P > 0.05$, table 1).

According to a logistic regression study, diabetic TB patients are more likely to have a second medical condition (comorbidity) than non-diabetic TB patients (OR = 2.7, table 3), and they are less likely to present with Extrapulmonary TB (OR 0.35 table 3). There were no significant connections between other factors and diabetes discovered (table 3).

DISCUSSION

Public health is affected by a link between diabetes mellitus and TB that combines communicable and non-communicable diseases (8).

The age range of diabetics that predominated in our study was 45–64 years old. This result was in line with that of Jai Kishan (9), who discovered that diabetics who contracted TB mostly belonged to the 40–60 age range. Additionally, a research published by indicated that diabetic TB patients were older than non-diabetic TB patients (10,11)

Although this study concluded that there is no connection between the sex of TB patients and diabetes, other investigations have shown contradictory results (9,11). However, Pérez-Guzmán et al., (12) discovered that there is a female majority after the age of 50. Between diabetic and non-diabetic TB patients, the mean BMI did not significantly differ. The results of (Alisjahbana et al., 2006; Babu et al., 2013) (4,13) who discovered that malnutrition was more prevalent among TB patients are different from this one.

This study shows that diabetic TB patients are more likely than non-diabetic TB patients to have an associated medical

ailment, and this disease is more likely to be hypertension. This result is consistent with that of (Weng et al., 2009) (14), who discovered that diabetic patients also had higher rates of hypertension. According to our research, diabetic TB patients are more likely to present with pulmonary T B than non-diabetic TB patients and less likely to have extra-pulmonary TB. This outcome was found to be similar to that reached by (MiF et al, 2013; India Diabetes Mellitus-Tuberculosis Study Group, 2013). (11,15)

CONCLUSION

Patients with diabetes who have TB in Ghaziabad are older than 44, have extra-pulmonary TB disease, and are more likely to have concomitant medial disease (mostly hypertension). We think that our study will contribute to bettering the management of tuberculosis in diabetic patients as there are no studies of this kind in Ghaziabad.

REFERENCES

1. Dooley K.E., Chaisson R.E., 2009. Tuberculosis and diabetes mellitus: convergence of two epidemics. *Lancet Infect Dis Dec*; 9(12), 737-746.
2. Oscarsson P., Silwer H., 2009. Incidence of pulmonary tuberculosis among diabetics. *Acta Med Scand Apr*;161(Suppl s335):23-48. Accessed on 12 Nov 2015 at <http://onlinelibrary.wiley.com/doi/10.1111/j.0954-6820.1958.tb04605.x/pdf>
3. Alisjahbana B., Sahiratmadja E., Nelwan E.J., Purwa A.M., Ahmad Y, Ottenhoff T.H, et al., 2007. The Effect of Type 2 Diabetes Mellitus on Presentation and Treatment Response of Pulmonary. Tuberculosis. *Clin Infect Dis. Aug*, 45(4), 428-35.

4. Alisjahbana B., van Crevel R., Sahiratmadja E., den Heijer M., Maya A., Istriana E, et al., 2006. Diabetes mellitus is strongly associated with tuberculosis in Indonesia. *Int J Tuberc Lung Dis* Jun;10 (6), 696-700.
5. Wild S., Roglic G., Green A., Sicree R., King H. Global prevalence of diabetes: estimates for the year 2000projections for 2030. *Diabetes Care* 2004 May; 27(5), 1047-53.
6. Restrepo B.I., Fisher-Hoch S.P., Crespo J.G., Whitney E., Perez A., Smith B., et al., 2007. Type 2 diabetes and tuberculosis in a dynamic binational border population. *Epidemiol Infect* Apr;135(3), 483-91.
7. Jiménez-Corona M.E., Cruz-Hervert L.P., Garcia-Garcia L., Ferreyra-Reyes, Delgado-Sánchez G., Bobadilla-Del- Valle M., 2013. Association of diabetes and tuberculosis: impact on treatment and post-treatment outcomes. *Thorax*;68(3):214-220.doi:10.1136/thoraxjnl-2012-201756.
8. Harries A.D., Murry M.B., Jeon C.Y., Ottmani S.E., Lonnroth K., Barreto M.L., et al. 2010. Defining the Research Agenda to Reduce the Joint Burden of Disease from Diabetes Mellitus and Tuberculosis. *Trop med Intl Health*. Jun; 15(6), 659-63
9. Kishan J., Grag K., 2010. Tuberculosis and Diabetes Mellitus: A case Series of 100 patients. *saarc j.tuber. lung dis. hiv/aids.*; VII(2):34-38. DOI: 10.3126/saarctb.v7i2.4404
10. Raghuraman S,Vasudevan K.P., S Govindarajan S., Chinnakali P., Panigrahi K.C., 2014. Prevalence of Diabetes Mellitus among Tuberculosis Patients in Urban Puducherry. *N Am J Med Sci*. Jan;6(1), 30–4.
11. Mi F., Tan S., Liang L., Harries A.D., Hideraker S.G., Lin Y., et al., 2013. Diabetes mellitus and tuberculosis:pattern of tuberculosis, two-month smear conversion andtreatment outcomes in Guangzhou, China. *Trop Med IntHealth*. Nov;18 (11), 1379-85.
12. Pérez-Guzmán C., Vargaas M.H., Torres-Cruz A., Perez-Padilla J.R., Furuya M.E., Villarreal-Velarde H.,2003. Diabetes modifies the male:female ratio in pulmonary tuberculosis. *Int J Tuberc Lung Dis*. Apr, 7(4), 354-8.
13. Babu R.V., Manju R., Kumar S.V., Das A.K., 2013. A Comparative Study of Diabetes Mellitus in Pulmonary Tuberculosis Patients .*World J.Med Sci.*, 9(2), 93-96.
14. Weng S.F., Hsu C.H., Lirn M.L., Huang C.L., 2009. Extrapulmonary tuberculosis: a study comparing diabetic and nondiabetic patients. *ExpClinEndocrinol Diabetes*.Jun;117 (6)
15. India Diabetes Mellitus-Tuberculosis Study Group.Screening of patients with diabetes mellitus for tuberculosis in India. *Trop Med Int Health*. 2013 May;18(5), 646-54.