

Research Article

Prevalence of diabetes mellitus in tuberculosis patients: a hospital based study

Manoj D. Kottarath*, Rajani Mavila, Achuthan V., Smitha Nair

Department of Pulmonary Medicine, Academy Of Medical Sciences, Pariyaram, Kerala, India

Received: 10 September 2015

Accepted: 19 September 2015

***Correspondence:**

Dr. Manoj D. Kottarath,

E-mail: drdkmanoj@gmail.com

Copyright: © the author(s), publisher and licensee Medip Academy. This is an open-access article distributed under the terms of the Creative Commons Attribution Non-Commercial License, which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

ABSTRACT

Background: Screening of high risk individuals with weak immunity as in diabetics for active tuberculosis is of great public health importance. The prevalence of diabetes in tuberculosis is high and the data regarding the same is necessary for strengthening TB control activities.

Methods: This study was conducted to know the prevalence of diabetes mellitus in tuberculosis patients diagnosed from the hospital. This was a hospital based descriptive study conducted in Department of Respiratory medicine, Academy of Medical Sciences, Northern Kerala in association with DOTS center during a one year period from August 2014 to July 2015. All patients diagnosed as a case of tuberculosis from our institution were included for the study. All patients were screened for diabetes mellitus using Fasting Plasma Glucose value. Additional information regarding age, body mass index (BMI), sputum smear positivity and treatment category of tuberculosis were collected.

Results: There was a higher prevalence of diabetes in tuberculosis patients than in general population and the rate was found to be 19.6%. There was a statistically significant association of diabetes with older age, higher BMI and sputum positivity.

Conclusions: Routine screening for diabetes needs to be intensified in the community and more importantly in Tuberculosis patients.

Keywords: Tuberculosis, Diabetes mellitus, Fasting plasma glucose, Sputum positive pulmonary tuberculosis

INTRODUCTION

Tuberculosis (TB) remains one of the deadliest communicable disease in the world with the estimated 9.0 million new cases and 2 million deaths due to the disease in 2013.¹ 350 million people have diabetes mellitus (DM) globally and predicted global prevalence of diabetes will double by 2030. India has the maximum number of diabetics in the world.^{2,3} The prevalence of Diabetes Mellitus in adults in India is estimated to be ranging from 5.6 to 12.4% in urban area and still lesser in rural area.⁴

People with a weak immune system such as diabetes mellitus are at 2-3 times increased risk for developing active tuberculosis compared to people without diabetes. About 10% cases of Tuberculosis are linked to Diabetes Mellitus.¹

For a country like India where burden of tuberculosis is heavy along with the maximum number of diabetes warrants immediate attention to this twin health problem. The growing burden of diabetes is contributing the sustained high levels of TB in the community. India is facing the dual problem of being the highest TB-burden country having a large number of people with diabetes,

posing a serious challenge for the health system. A recent systematic review of the effect of DM on TB treatment outcomes showed that DM may delay sputum culture conversion, may increase the case fatality rate during treatment, and may increase relapse rates of TB after successful completion of treatment.⁵

In the above context, WHO has recommended routine screening for diabetes in all tuberculosis patients. Also, WHO has recommended considering screening for tuberculosis in diabetic patients, particularly in the settings of high TB prevalence.¹

Several studies conducted in India and abroad have shown higher prevalence rate of diabetes in tuberculosis than in general population.⁶ Similar study reports are available from Kerala also.⁷ We have conducted this study for knowing the prevalence of Diabetes mellitus in tuberculosis patients in our area. Our institution is catering two northern districts of Kerala State of India and similar studies and data are not available from this place to the best of our knowledge. Other objectives of this study include comparison of diabetes prevalence among tuberculosis patients across age, sex, Body Mass Index (BMI), sputum positive pulmonary tuberculosis and retreatment cases of tuberculosis.

METHODS

The study was conducted at the department of Respiratory Medicine, Academy of Medical Sciences, Kannur, Kerala. Duration of the study was one year from August 2014 to July 2015. The study was done in association with DOTS centre of the institution. All the tuberculosis patients diagnosed from the institution, including pulmonary and extra pulmonary tuberculosis, were included in the study, after written informed consent. An ethical committee clearance of the institution was obtained for the study. Variables such as age, sex, height and weight were recorded for each patient. The body mass index was derived from the recorded height and weight values and categorised as per the recommended cut offs by WHO (underweight :< 18 kg/m². normal: 18.0-24.9 kg/m², overweight: >25kg/m²).⁸ The diagnostic criteria for Diabetes was fasting plasma glucose above 126mg/dl or already diagnosed as diabetic by a medical professional and on treatment.⁹

Tuberculosis patients were categorised in to sputum smear positive pulmonary tuberculosis, sputum negative pulmonary tuberculosis and extra pulmonary tuberculosis according to Revised National Tuberculosis Control Programme (RNTCP) diagnostic criteria.¹⁰ New and retreatment cases are noted separately.

The data was entered in Microsoft Excel sheet and analysed using Epi Info 7.1.1.14 (CDC Atlanta) software. The results were expressed in frequencies and proportions. The significance of association of different factors with Diabetes was tested using Chi-square test. A

P value of < 0.05 was considered statistically significant. Logistic regression was carried out to estimate adjusted Odds ratio.

RESULTS

Table 1: Characteristics of tuberculosis patients.

	Categories	Frequency	%
Age group (year)	<20	14	9.5
	21-30	21	14.3
	31-40	19	12.9
	41-50	29	19.7
	51-60	30	20.4
	>=61	34	23.1
sex	Male	105	71.4
	Female	42	28.6
BMI (kg/m ²)	<=18.5	48	32.7
	18.5-24.9	93	63.3
	>25	6	4.1
Type of TB	Sputum positive pulmonary	41	27.9
	Sputum negative pulmonary	30	20.4
	Extra pulmonary	76	51.7
Treatment category	New cases	134	91.2
	Retreatment cases	13	8.8
	Total	147	100.0

Out of the total 147 tuberculosis patients included in the study 29 patients were diabetics and the prevalence of diabetes was found to be 19.7%. The characteristics of the study participants are shown in Table 1.

The mean age of the tuberculosis patients was 45.39 years with a standard deviation of 18.57. More than 50% of the tuberculosis patients were aged less than 50 years. Males constituted 71% of the study participants. The proportion of the Tuberculosis patients with BMI <18.5 was 33%. The mean BMI of the whole study population was 20.13 kg/m² (standard deviation 2.66). More than half of the tuberculosis patients were having extra pulmonary tuberculosis.

The comparison of diabetes mellitus prevalence among tuberculosis patients across different groups is shown in Table 2.

Among the variables there was a statistically significant association with older age, higher BMI and sputum positivity in diabetic individuals. There were no statistically significant differences regarding sex distribution or number of ret-treatment cases of tuberculosis in diabetics. Variables found significant were assessed by logistic regression analysis and the odds ratio was calculated which is presented in Table 3.

The mean age of patients with diabetes was 57.69 years with a standard deviation of 11.48. There was a higher prevalence for diabetes in older population comparing with all tuberculosis patients which was statistically significant (P value = 0.001). The adjusted odds for

developing diabetes in the age group of 41-60 years was 26.20 (confidence interval 2.41-284.6) and in age group of over 61 years was 41.80 (Confidence Interval 4.1-426.9).

Table 2: Comparison of diabetes mellitus prevalence among tuberculosis patients across different groups.

	Categories	Number of tuberculosis patients	Number of tuberculosis patient with diabetes	Percent	P value
Age group(years)	<20	14	0	0	0.001
	21-30	21	0	0	
	31-40	19	1	5.3	
	41-50	29	8	27.6	
	51-60	30	9	30.0	
	>=61	34	11	32.4	
sex	Male	105	25	23.8	0.07
	Female	42	4	9.5	
BMI	<=18.5kg/m ²	48	3	6.3	0.001
	18.5-24.9 kg/m ²	93	22	23.7	
	>25 kg/m ²	6	4	66.7	
Type of TB	Sputum positive pulmonary	41	15	36.6	0.003
	Sputum negative pulmonary	30	6	20.0	
	Extra pulmonary	76	8	10.5	
Treatment category	New cases	134	25	18.7	0.5
	Re-treatment	13	4	30.8	
Total		147	29	19.7	

Table 3: Logistic regression analysis of risk factors for Diabetes in Tuberculosis patients.

Categories	crude odds ratio	95% confidence interval	Adjusted odds ratio	95% confidence interval	
age(year)	<= 40				
	41-60	20.19	18.0-22.4	26.2	2.41-284.6 ^a
	>=61	24.09	22.0-26.2	41.8	4.1-426.9 ^a
BMI(kg/m ²)	<18.5				
	18.5-24.9	4.65	3.4-5.9	6.1	1.6-22.5 ^b
	>25	30	27.9-32.1	97	5.3-100 ^b
type of TB	Sputum positive	4.9	3.9-5.9	11.2	2.7-47.1 ^c
	sputum negative	2.13	0.9-3.3	8.9	1.7-46.9 ^c
	extra pulmonary				

a - Adjusted for sex and BMI, b - Adjusted for age and sex, c- Adjusted for age, sex and BMI

The mean BMI of diabetic patients was 22.94 kg/m² (standard deviation 2.97). The higher BMI in diabetic individuals was found to be statistically significant. (P value = 0.001). The adjusted Odds ratio for developing diabetes in the BMI group of 18.5-24.9 kg/m² was 6.1 (Confidence Interval 1.6-22.5) and >25 kg/m² group was 97 (Confidence Interval 5.3-100).

In 29 diabetic patients, the majority of them were sputum positive pulmonary tuberculosis (15 patients-51.7%). The higher incidence of sputum positive pulmonary tuberculosis in diabetics was statistically significant (P value = 0.003). The adjusted Odds ratio for sputum positivity for diabetes was 11.2 (Confidence Interval 2.7-46.9).

25 diabetic cases were new TB (18.7% of the total new cases) and only 4 cases were in retreatment category (30.8% of total retreatment cases). There was no statistically significant relation in the treatment category with diabetics.

Out of the 29 diabetic patients 16 patients were newly detected diabetics (55%) and the remaining 13 (45%) were already on treatment for diabetes.

DISCUSSION

The prevalence of diabetes mellitus in India is estimated to range from 5.6 to 12.4 percent in urban area and 2.4 to 2.7 percent in rural area.⁴ A crude prevalence of 12.7% was reported by a study from south Kerala in 2000.¹¹ In the current study the prevalence of diabetes in tuberculosis was found to be 19.6%. Hence the prevalence of diabetes mellitus in tuberculosis is high in this study, comparing with general population.

Similar higher prevalence of diabetes in tuberculosis patients was reported in studies from Tamil Nadu (25%), Pondicherry (29%) and Saudi Arabia.¹²⁻¹⁴ The study from Saudi Arabia was a retrospective one among inpatient cohort and only sputum positive individuals were included. Our study included smear negative and extra pulmonary tuberculosis cases also. The other two studies were community based cross sectional studies. We have included the substantial number of extra pulmonary tuberculosis and smear negative pulmonary tuberculosis diagnosed from our tertiary care institution for the study. Considering the positive correlation between sputum positivity and diabetes mellitus, this may be the reason why the prevalence rate of diabetes is slightly on the lower side in the present study comparing with other studies. Prevalence of impaired glucose tolerance in tuberculosis patients was reported to be 16.98% in a study by Jain et al.¹⁵ A study from Kerala reported a very high Diabetes prevalence in tuberculosis of 44% but the diagnostic criteria for diabetes was based on HbA1c > 6.5%.⁷

Our study has shown a significantly higher prevalence of diabetes in older population. Similar study reports are there from India and other Asian countries.¹⁵⁻¹⁸ Globally, with increased health care facilities, better living conditions and changing life styles the prevalence of diabetes is increasing. Routine screening and detecting pre-diabetic stage might decrease the incidence of tuberculosis in diabetics.

Our study is showing higher BMI for Tuberculosis with Diabetes patients which are statistically significant. An Indonesian study have reported similar result with a significantly higher median BMI in TB with DM patients than non-diabetic TB patients.¹⁶ On the contrary, few other studies has shown a lower BMI in diabetics.¹⁷ Tuberculosis is a diseases causing decrease in body fat. But diabetes has well known association with obesity.¹⁹

It is interesting to note that the coexistent disease is associated with higher BMI. Our study report suggests that screening for tuberculosis is necessary in diabetics even if they are having higher BMI. Further studies with larger sample size are required to confirm this association.

The higher number of extra pulmonary tuberculosis in our study is as expected because this was a hospital based study and more number of extra-pulmonary cases is diagnosed in the hospital settings than periphery. Still number of sputum positive pulmonary tuberculosis was high in diabetics as 15 out of 29 diabetics were sputum positive. The higher number of sputum positives in diabetic individuals indicates the public health importance of screening and identifying pulmonary tuberculosis sufficiently early so that the spread of the tuberculosis in the community can be contained. Increased incidence of sputum positive pulmonary tuberculosis in Diabetes is reported in a study from China.²⁰ Our study shows number of retreatment cases in diabetic group was 4 out of the 13 total retreatment tuberculosis cases (30.8%). New cases of tuberculosis in diabetic individuals was 25 (18.7 %) out of total 134 new cases. The difference was not statistically significant to show any relation with diabetes. Several studies have shown the incidence of retreatment cases is high in diabetics.^{5,20} The sample size in our study is small and that may be the reason, the significant association if any, is not detected.

More than half of the diabetics (55%) were unaware of their diabetic status at the time of tuberculosis diagnosis. This means that many of the diabetic patients are ignorant about their diabetic status. Earlier detection might prevent them from getting tuberculosis.

The importance of this study is our sample represents the 2 northern districts of Kerala from where similar data is not available. The higher prevalence of sputum positivity and newly detected diabetes mellitus in tuberculosis patients in this study needs further evaluation with larger sample size as this is of public health importance. The drawbacks of this study includes it was a hospital based study and so the number of extra pulmonary tuberculosis was on the higher side.

The prevalence of diabetes mellitus in tuberculosis is high in our community. To conclude, considering the bidirectional linkage of both diseases screening for diabetes needs to be intensified in the community especially in Tuberculosis patients.

ACKNOWLEDGEMENTS

We express our gratitude to Dr. Padmanabhan .P.T, DOTS Medical Officer, Academy of Medical Sciences for his help in data collection. We also acknowledge our thanks to Dr. Aslesh, Department Of Community

Medicine, Academy of Medical Sciences for helping us to do the Statistical analysis.

Funding: No funding sources

Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee

REFERENCES

1. WHO: Global Tuberculosis Report-2014. www.who.int/tb/publications/global_report/gtbr14_executive_summary.pdf Accessed on 10, September 2015.
2. Joshi SR, Parikh RM. India - diabetes capital of the world: now heading towards hypertension. *J Assoc Physicians India.* 2007;55:323-4.
3. Kumar A, Goel MK, Jain RB, Khanna P, Chaudhary V. India towards diabetes control: Key issues. *Australas Med J.* 2013;6(10):524-31.
4. Ramachandran A. Epidemiology of diabetes in India: three decades of research. *J Assoc Physicians India.* 2005;53:34-8.
5. Baker MA, Harries AD, Jeon CY, Hart JE, Kapur A, et al. The impact of diabetes on tuberculosis treatment outcomes: A systematic review. *BMC Med.* 2011;9:81.
6. IUATLD & WHO: Collaborative Framework for Care & Control of Tuberculosis and Diabetes. <http://www.who.int/tb/publications/2011/en/index.html2>. Accessed on September 10, 2015.
7. Balakrishnan S, Vijayan S, Nair S, Subramoniapillai J, Mrithyunjayan S, Wilson N, et al. High diabetes prevalence among tuberculosis cases in Kerala, India. *PLoS One.* 2012;7:e46502.
8. Global Database on Body Mass Index. World Health Organization, 2006. www.who.int/bmi/index.jsp?introPage=intro_3.html. Accessed on September 10, 2015.
9. Definition and diagnosis of diabetes mellitus and intermediate hyperglycaemia: Report of a WHO/IDF consultation. Geneva: WHO. http://www.who.int/diabetes/publications/diagnosis_diabetes2006/en/index.html Accessed September 10, 2015.
10. Central TB Division, GOI-WHO Collaboration Programme (2008-09), Revised National Tuberculosis Control Programme-Training Course for Program Manager (Modules 1-4). 2011:22-29.
11. Kutty VR, Soman CR, Joseph A, Pisharody R, Vijayakumar K. Type 2 diabetes in southern Kerala: variation in prevalence among geographic divisions within a region. *Natl med J Ind.* 2000;13:287-92.
12. Screening of Tuberculosis Patients for Diabetes Mellitus: Pilot Project-Module for RNTCP staff 2009. Central TB Division, MOH & FW, New Delhi
13. Raghuraman S, Vasudevan KP, Govindarajan S, Chinnakali P, Krishna Chandra Panigrahi. Prevalence of Diabetes Mellitus among Tuberculosis Patients in Urban Pudukcherry N Am J Med Sci. 2014;6(1):30-4.
14. Singla R, Khan N, Al-Sharif N, Al-Sayegh MO, Shaikh MA, Osman MM. Influence of diabetes on manifestations and treatment outcome of pulmonary TB patients. *Int J Tuberc Lung Dis.* 2006;10:74-9.
15. Jain MK, Baghel PK, Agrawal R. Study of impaired glucose tolerance in pulmonary tuberculosis. *Indian J Community Med.* 2006;31(3):137-9
16. Alisjahbana B, Sahiratmadja E, Nelwan EJ, Purwa AM, Ahmad Y, Ottenhoff TH, et al. The effect of type 2 diabetes mellitus on the presentation and treatment response of pulmonary tuberculosis. *Clin Infect Dis.* 2007;45:428-35.
17. Chang JT, Dou HY, Yen CL, Wu YH, Huang RM, Lin HJ, et al. Effect of type 2 diabetes mellitus on clinical severity and treatment outcome in patients with pulmonary tuberculosis: A potential role in the emergence of multi-drug resistance. *J Formos Med Assoc.* 2011;110:372-81.
18. Guptan A, Shah A. Tuberculosis and Diabetes: An Appraisal. *Ind J Tub.* 2000;47(3):2-8.
19. World Health Organization. Obesity and Overweight Facts. Available at <http://www.who.int/hpr/NPH/docs/gsobesity.pdf> Accessed on 10 September 2015.
20. Mi F, Tan S, Liang L, Harries AD, Hinderaker SG, Lin Y, et al. Diabetes mellitus and tuberculosis: pattern of tuberculosis, two-month smear conversion and treatment outcomes in Guangzhou, China. *Tropical Medicine & International Health.* 2013;18:1379-85.

Cite this article as: Kottarath MD, Mavila R, Achuthan V, Nair S. Prevalence of diabetes mellitus in tuberculosis patients-a hospital based study. *Int J Res Med Sci* 2015;3:2810-4.