International Journal of Advances in Medicine
Khare RK et al. Int J Adv Med. 2018 Feb;5(1):115-119
http://www.ijmedicine.com
pISSN 2349-3925 | eISSN 2349-3933
DOI: http://dx.doi.org/10.18203/2349-3933.ijam20180068

Original Research Article

The double burden of tuberculosis and diabetes prevalance of diabetes melitus in tuberculosis

Rajesh Kumar Khare, Vivek Katiyar*

Department of Medicine, Integral Institute of Medical Sciences and Research, Lucknow, Uttar Pradesh, India

Received: 12 December 2017
Revised: 07 January 2018
Accepted: 08 January 2018

***Correspondence:**
Dr. Vivek Katiyar,
E-mail: drvivekkatiyar07@gmail.com

ABSTRACT

Background: The burden of diabetes mellitus is increasing worldwide. The prevalence of TB has been rising in recent years globally. Aging, changes in life style, socioeconomic factors, and population growth have lead to an increased prevalence of DM, particularly, type 2 DM. Diabetes Mellitus (DM) almost triples the risk of developing tuberculosis (TB). India, the nation with the highest number of TB cases in the world, is also undergoing epidemic growth in DM rates. With the demographic transition underway globally, increase in life expectancy, improvements in provision of health services and a subsequent increase in the elderly population, the absolute numbers of cases of diabetes will increase exponentially. As a result, DM and TB are increasingly present together, and this calls for renewed interest in this topic. Various studies done in different parts of India and in other parts of globe where TB is endemic have shown a higher prevalence of DM among PT infected with tuberculosis. We in our study undertaken in Department of medicine in IIMS&R Lucknow UP found a high prevalence of DM amongst TB patients. Routine screening of TB patients for DM will help detect cases of diabetes and pre-diabetes early, so that primary prevention methods may be initiated early and effectively.
Methods: This hospital-based cross-sectional study was undertaken in Department of medicine in IIMS and R Lucknow UP. All TB cases more than 18 years of age, including new and re-treatment cases, sputum positive, sputum negative and extra-pulmonary cases currently on treatment in the were included in the study.
Results: Using the diagnostic criteria, as mentioned in the methodology, the prevalence of diabetes among TB patients in this study was found to be 24.5% of which 18.5% were known DM cases and 5.9% were newly diagnosed.
Conclusions: The burden of diabetes mellitus is increasing worldwide. The association between diabetes and tuberculosis is the next challenge for global tuberculosis control. Improved understanding of the bidirectional relationship of the two diseases is necessary for proper planning and collaboration to reduce the dual burden of diabetes and TB. In people with TB, it may be appropriate to actively screen for DM. Prevention, screening, and treatment of both diseases together is more effective.

Keywords: Diabetes, Prevalence, Risk factors, Tuberculosis

INTRODUCTION

The prevalence of TB has been rising in recent years globally. It is estimated that in 2010 there were 8.8million (range: 8.5-9.2million) new cases of TB. On the other hand, TB is the cause of death for approximately two million people every year.[1-3] Aging, changes in life style, socioeconomic factors, and population growth have lead to an increased prevalence of DM, particularly, type 2 DM. The total number of

diabetic people worldwide is predicted to rise from 285 million in 2010, accounting for 3.5million deaths, to 439 million in 2030.[4-6] Asia is the epicenter of the growing burden of DM and the largest contribution is from India and China.[7] Up to 80% of patients with DM live in low income and developing countries.[8] Worldwide, 70% of diabetics live in TB endemic countries.

In the 22 countries with the highest burden of TB, the prevalence of DM in the general population ranges from 2% to 9%, and eight of the ten countries with the highest incidence of DM are also classified as high burden countries for TB by the World Health Organization (WHO).[8,9] Indonesia, with the third highest burden of TB in the world, has the fourth highest number of diabetics.[10] China, India, Peru and Russia are other countries that need to be given particular attention.[11] About 95% of patients with tuberculosis (TB) and 70% of patients with diabetes mellitus (DM) live in the low and middle income countries.[12,13] The epidemic growth of DM has occurred in developing countries where TB is highly endemic. As a result, DM and TB are increasingly present together, and this calls for renewed interest in this topic.[14]

India is a country with 1.2billion people (17.5% of the world's population) and is undergoing rapid development and urbanisation. As a consequence of this social and economic development, which is associated with increasing physical inactivity, an unhealthy diet and obesity there has been an escalating epidemic of diabetes mellitus (DM).[15-17]

In the last 20years, DM prevalence rates have risen in both urban and rural populations and amongst the poor and data suggest that in 2011 there were an estimated 61.3million adults with DM, giving a national adult prevalence of 8.3% in persons aged 20years and older.[15,17] 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.[18,19]

Diabetes Mellitus (DM) almost triples the risk of developing tuberculosis (TB).[20-23] India, the nation with the highest number of TB cases in the world, is also undergoing epidemic growth in DM rates. The estimated prevalence of DM in India in 2010 was 51million and this is projected to increase to 70million by 2025.[24,25] In India, 15% of pulmonary tuberculosis cases have been estimated to be attributable to DM.[26]

METHODS

This hospital-based cross-sectional study was undertaken in Department of medicine in IIMS and R Lucknow UP. All TB cases more than 18years of age, including new and re-treatment cases, sputum positive, sputum negative and extra-pulmonary cases currently on treatment in the were included in the study. The total number of patients currently on treatment in the hospital during the study period was found to be 183.

All of these were screened for diabetes using the diagnostic criteria of a fasting plasma glucose level of ≥126mg/dl or a self-reported history of taking anti-diabetic drugs after diagnosis by a medical professional.

Firstly, a list of all TB patients currently on DOTS in that hospital was made. The days of DOTS therapy was ascertained for all patients listed. On the first day, the purpose of the study was explained to the patient and participant information sheet was provided and informed written consent was obtained. All the willing participants were interviewed using the pretested questionnaire.

The questionnaire, based on the WHO-STEPS questionnaire, contained questions to assess risk factors of diabetes namely age, sex, family history of diabetes. Physical parameters like height, weight, body mass index (BMI), were recorded. In the patients who had already been diagnosed for diabetes, details of the time of diagnosis and treatment taken were collected. Family history of diabetes was enquired in all subjects.

The height and weight were measured. The weight was taken on a weighing scale with standard minimum clothing to the nearest 0.5kg. Height was measured on a vertical scale with the heel, buttocks and occiput against the wall and the head in the frankfurt plane to the nearest 0.5 cm. BMI was calculated by the formula BMI = (weight in kg)/(height in mts)^2. BMI was used to categorize the nutritional status of the subjects as per the recommended cutoffs for Asian Indians. (Normal BMI: 18.0-22.9kg/m^2; Overweight: 23.0-24.9kg/m^2; Obesity: >25 kg/m^2).[9]

The participants were asked to come the next day after overnight fasting. The fasting blood glucose levels of the patient were measured using a standardized lab. Details about the sputum status at the time of diagnosis; i.e., sputum positive, sputum negative or extra-pulmonary TB, were noted from the TB treatment record.

Data was entered in Microsoft excel 2007 and analyzed using Statistical Package for the Social Sciences software (SPSS v17.0). 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 Chisquare analysis were performed to compare proportions. A $P < 0.05$ was taken as statistically significant.

RESULTS

Out of the 183 subjects enrolled for this study 108(59.0%) were male and 75 (40.9%) were females. The mean age for males and females was 46.7±9.8 and 40.2±12.2years, respectively.

Using the diagnostic criteria, as mentioned in the methodology, the prevalence of diabetes among TB patients in this study was found to be 24.5% of which 18.5% were known DM cases and 5.9% were newly diagnosed.

The prevalence was found to be more in males (28.7%) when compared to females (18.6%). Impaired fasting glucose was seen in 12.7% of the TB patients. Among the known diabetics; diabetes antedated TB by a mean duration of 51.3months.

Table 1: Age and gender wise distribution of study population.

Age group (years)	Male 108		Female 75		Total 183	
18-20	15	13.8%	8	10.6%	23	12.5%
21-30	17	15.7%	14	18.6%	31	16.9%
31-40	24	22.2%	16	21.3%	40	21.8%
41-50	29	26.8%	12	16.0%	41	22.4%
51-60	12	11.1%	17	22.6%	29	15.8%
61-70	7	6.4%	5	6.6%	12	6.5%
>70	4	3.7%	3	4%	7	3.8%

Table 2: Distribution of study population according to sputum status at initiation of treatment.

Sputum status at initiation of treatment	Male		Female		Total	
Positive	73	67.5%	46	61.3%	119	65.0%
Negative	19	17.5%	16	21.3%	35	19.1%
Extra-pulmonary	16	14.8%	13	17.3%	29	15.8%

Table 3: Prevalence of diabetes mellites in tuberculosis.

Diabeic status	Male		Female		Total	
Diabetes mellites and tuberculosis	31	28.7%	14	18.6%	45	24.5%
Non-diabetes mellites and tuberculosis	77	71.2%	61	81.3%	138	75.4%

Table 4: Risk factors of diabetes mellites in tuberculosis patients.

Variable	Total	Diabetes mellites and tuberculosis	P value
Male	108	31	
Female	75	14	
Mean age	40.3+11.6	51.4+12.7	0.0001
Family history	19	8	0.002
Overweight /obese	17	7	0.197
Sputum status at initiation of treatment	119	32	0.073

On analyzing the risk factors of diabetes in TB patients, about 12.5% of the TB patients had a family history of diabetes majority of the TB patients were underweight with a mean weight of 44.9±9.3kg. The mean BMI was 16.9±3.8 kg/m^2, (females=17.8±6.1, males=16.5±5.1 kg/m^2). Overweight and obesity was observed in 10.4% of the subjects; more in females when compared to males (13.8% vs 9.1.0%).

The BMI of the TB patients with diabetes was higher when compared to the TB patients without diabetes (16.2±5.7 vs 15.5±5.3), but the difference was not statistically significant.

DISCUSSION

Various studies done in different parts of India and in other parts of globe where TB is endemic have shown a higher prevelence of DM among pt infected with tuberculosis. We found a high prevalence of DM amongst TB patients at our facility. In the current study, the prevalence of diabetes in TB patients was found to be 24.5% of which 18.5% were known DM cases and 5.9%

were newly diagnosed. Thus, the prevalence of diabetes in TB patients in this study is much higher than the prevalence seen in the general population. Similar prevalence was reported by studies from Tamil nadu.[27,28] The study from Tamil Nadu estimated a diabetes prevalence of 25% among TB patients which was higher when compared to the prevalence of diabetes of 10% in the general population. A study of higher prevalence of 44% was reported from Kerala, India. Studies from China and Indonesia have demonstrated a lower prevalence.[29,30] Study by Jain et al reported a prevalence of impaired glucose tolerance (IGT) of 16.98% and they had used oral glucose tolerance test to diagnose IGT.[31]

The present study has found a significantly higher prevalence of diabetes in older TB patients. Similar findings have been reported by studies from India and other countries like Indonesia, Malaysia, Saudi Arabia, Taiwan and Mexico.[28,30-33] With the demographic transition underway globally, increase in life expectancy, improvements in provision of health services and a subsequent increase in the elderly population, the absolute numbers of cases of diabetes will increase exponentially. Routine screening of TB patients for DM will help detect cases of diabetes and pre-diabetes early, so that primary prevention methods may be initiated early and effectively. Government of India recommends that TB patients should be screened for DM immediately after the diagnosis of TB, but can also be done at any time during the course of TB treatment.

This study has not found any significant association between BMI and diabetes. Similar results were reported by studies by Jain et al. A few studies have reported that patients with TB and DM are significantly underweight and have more weight loss.[33,34] Alisjahbana et al have reported a significantly higher median BMI in TB-DM patient when compared to non-diabetic TB patients. The sample size of this study may not be sufficient to demonstrate the presence, if any, of any underlying significant association.

CONCLUSION

The burden of diabetes mellitus is increasing worldwide. The association between diabetes and tuberculosis is the next challenge for global tuberculosis control. Improved understanding of the bidirectional relationship of the two diseases is necessary for proper planning and collaboration to reduce the dual burden of diabetes and TB. In people with TB, it may be appropriate to actively screen for DM. Prevention, screening, and treatment of both diseases together is more effective.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the institutional ethics committee

REFERENCES

1. Corbett EL, Watt CJ, Walker N, Maher D, Williams BG, Raviglione MC, et al. The growing burden of tuberculosis: global trends and interactions with the HIV epidemic. Arch Intern Med. 2003;163(9):1009-21.
2. World Health Organization. WHO report 2010. Geneva, Switzerland: Global tuberculosis control, 2010. Available at http://apps.who.int/iris/bitstream /10665/44425/1/9789241564069_eng.pdf.
3. Harries AD, Lin Y, Satyanarayana S, Lonnroth K, Li L, Wilson N, et al. The looming epidemic of diabetes-associated tuberculosis: learning lessons from HIV-associated tuberculosis. Int J Tuberc Lung Dis. 2011;15(11):1436-44.
4. Harries AD, Dye C. Tuberculosis. Ann Trop Med Parasitol. 2006;100(5-6):415-31.
5. International Diabetes Federation. IDF diabetes atlas. 4th edition. Brussels, Belgium: International Diabetes Federation; 2009.
6. Dooley KE, Chaisson RE. Tuberculosis and diabetes mellitus: convergence of two epidemics. Lancet Infect Dis. 2009;9(12):737-46.
7. Esteghamati A, Gouya MM, Abbasi M, Delavari A, Alikhani S, Alaedini F, et al. Prevalence of diabetes and impaired fasting glucose in the adult population of Iran: National survey of risk factors for non-communicable diseases of Iran. Diabetes Care. 2008;31(1):96-8.
8. Lonnroth K, Castro KG, Chakaya JM, Chauhan LS, Floyd K, Glaziou P, Raviglione MC. Tuberculosis control and elimination 2010-50: cure, care, and social development. Lancet. 2010;375(9728):1814-29.
9. Ruslami R, Aarnoutse RE, Alisjahbana B, van der Ven AJ, Van Crevel R. Implications of the global increase of diabetes for tuberculosis control and patient care. Trop Med Int Health. 2010;15(11):1289-99.
10. Wild S, Roglic G, Green A, Sicree R, King H. Global prevalence of diabetes: estimates for the year 2000 and projections for 2030. Diabetes Care. 2004;27(5):1047-53.
11. Goldhaber-Fiebert JD, Jeon CY, Cohen T, Murray MB. Diabetes mellitus and tuberculosis in countries with high tuberculosis burdens: individual risks and social determinants. Int J Epidemiol. 2011;40(2):417-28.
12. Harries AD, Murray MB, Jeon CY, Ottmani SE, Lonnroth K, Barreto ML, et al. Defining the research agenda to reduce the joint burden of disease from diabetes mellitus and tuberculosis. Trop Med Int Health. 2010;15:659-63.
13. Sen T, Joshi SR, Udwadia ZF. Tuberculosis and diabetes mellitus: merging epidemics. J Assoc Physic Ind. 2009;57:399-404.
14. Ruslami R, Aarnoutse RE, Alisjahbana B, van der Ven AJ, Crevel RV. Implications of the global

increase of diabetes for tuberculosis control and patient care. Trop Med Int Health. 2010;15:1289-99.
15. Ramachandran A, Ma RCW, Snehalatha C. Diabetes in Asia. Lancet. 375;408-18.
16. Danaei G, Finucane MM, Lu Y, Singh GM, Cowan MJ, Paciorek CJ, et al. National, regional, and global trends in fasting plasma glucose and diabetes prevalence since 1980: systematic analysis of health examination surveys and epidemiological studies with 370 country-years and 2· 7 million participants. Lancet. 2011;378(9785):31-40.
17. International Diabetes Federation. IDF Diabetes Atlas. 5th ed. International Diabetes Federation, Brussels. 2011. Available at http://www. eatlas.idf.org. Accessed 20 July 2011.
18. TB India. Annual Status Report, RNTCP. CTD, MOH and FW, New Delhi. 2012. Available at tbcindia.nic.in/pdfs/TB%20India%202012-%20 Annual %20Report.pdf. Accessed August 7, 2013.
19. Mohan V, Sandeep S, Deepa R, Shah B, Varghese C. Epidemiology of type 2 diabetes: Indian scenario. Indian J Med Res. 2007;125:217-30.
20. Jeon CY, Murray MB. Diabetes mellitus increases the risk of active tuberculosis: a systematic review of 13 observational studies. PLoS Med. 2008;5:e152.
21. Stevenson CR, Critchley JA, Forouhi NG, Roglic G, Williams BG, et al. Diabetes and the risk of tuberculosis: a neglected threat to public health? Chronic Illn. 2007;3:228-45.
22. Ezung T, Devi NT, Singh NT, Singh TB. Pulmonary tuberculosis and diabetes mellitus-a study. J Indian Med Assoc. 2002;100:376.
23. Patel JC. Complications in 8793 cases of diabetes mellitus 14 years study in Bombay Hospital, Bombay, India. Ind J Med Sci. 1989;43(7):177-83.
24. Federation ID. IDF diabetes atlas: International Diabetes Federation. Executive Office. 2011. Available: http://www.eatlas.idf.org. Accessed December 25, 2011.
25. Ramachandran A, Das AK, Joshi SR, Yajnik CS, Shah S, Kumar KP. Current status of diabetes in India and need for novel therapeutic agents. J Assoc Physicians Ind. 2010;58:7-9.
26. Stevenson CR, Forouhi NG, Roglic G, Williams BG, Lauer JA, et al. Diabetes and tuberculosis: the impact of the diabetes epidemic on tuberculosis incidence. BMC Public Health. 2007;7:234.
27. Central TB Division. Screening of tuberculosis patients for diabetes mellitus: pilot project, module for RNTCP staff. MOH and FW, New Delhi, 2009.
28. 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.
29. Li L, Lin Y, Mi F, Tan S, Liang B, Guo C, et al. Screening of patients with tuberculosis for diabetes mellitus in China. Trop Med Int Health. 2012;17:1294-301.
30. 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.
31. Jain MK, Baghel PK, Agrawal R. Study of impaired glucose tolerance in pulmonary tuberculosis. Indian J Community Med. 2006;31(3):137-9.
32. 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.
33. Guptan A, Shah A. Tuberculosis and diabetes: an appraisal. Ind J Tub. 2000;47(3):2-8.
34. Ponce-De-Leon A, Garcia-Garcia Md Mde L, Garcia-Sancho MC, Gomez-Perez FJ, Valdespino-Gomez JL, et al. Tuberculosis and diabetes in southern Mexico. Diabetes Care. 2004;27:1584-90.

Cite this article as: Khare RK, Katiyar V. The double burden of tuberculosis and diabetes prevelance of diabetes melitus in tuberculosis. Int J Adv Med 2018;5:115-9.