

Prevalence of tuberculosis and diabetes comorbidity in patients attending secondary healthcare hospital in south India: A retrospective study

Dillieswary Ragouraman¹, Raman P. Priyadharsini², Venkatesh C³

¹JIPMER, Karaikal, Puducherry, ²Department of Pharmacology, JIPMER, Karaikal, Puducherry, ³District TB Officer, Government Chest Clinic, Karaikal, Puducherry, India

ABSTRACT

Background and Objectives: Tuberculosis, a communicable disease and diabetes, a non-communicable disease together has a bidirectional relationship toward each other with significant morbidity and delayed treatment outcome. Therefore, there is a need to identify the prevalence of both these diseases in a community. A retrospective study was planned to identify the prevalence of both diseases among the patients attending secondary hospitals for 3 years. **Methods:** The study was conducted in the chest diseases department in a secondary care hospital after obtaining approval from the institute ethics committee and RNTCP. The retrospective data in the hospital register was used to identify various parameters. The data for basic demographic characteristics, number of new cases, previously treated cases, pulmonary/extrapulmonary cases, drug resistance cases, and DM/TB cases were entered in Microsoft excel and were analyzed. **Results:** The prevalence of TB among the patients attending the chest diseases department was 2.9%, 2.5%, and 3% for the years 2016, 2017, and 2018, respectively. The prevalence of DM/TB ranged between 8.5–11%, which is a lesser range when compared with many other studies. **Interpretations and Conclusion:** There was no significant difference in the prevalence between the years. The screening of one disease in the presence of the other can reduce the prevalence and improve the prognosis.

Keywords: Comorbidity, diabetes, drug resistance, prevalence, tuberculosis

Introduction

India is one of the highest tuberculosis (TB) burden countries among the eight countries, which contributes to two-thirds of TB cases.^[1] As per the World Health Organization (WHO), the incidence of TB has to be reduced to around 4–5% as a part of the end TB strategy.^[2] There is a bidirectional relationship between diabetes mellitus (DM) and TB as one increases the risk of the other. DM also affects the course of TB and its treatment.^[3,4] As per the WHO report, people who are immunocompromised are at higher risk of developing TB and

diabetes is one such risk factor. DM increases the risk for TB threefold, which urges the need for screening of TB among diabetic patients and vice versa.^[4-7] It was also estimated that DM is an important risk factor for 15% of TB cases worldwide, and among that 40% of cases were identified in Asian countries like India and China.^[8] The proportion of TB was higher among the DM carriers with a value of 13.6% when compared with controls.^[9]

On the other way, many studies have concluded that glucose tolerance is impaired in TB patients. The cause of glucose intolerance in TB patients is infection-related insulin resistance, which leads to hyperglycemia. TB also causes pancreatitis which may be evident after the screening of diabetes in TB patients. Diabetes reduces cellular immunity which makes the individuals more susceptible to TB. The pharmacokinetics of

Address for correspondence: Dr. Raman P. Priyadharsini, Department of Pharmacology, JIPMER, Karaikal, Puducherry, India. E-mail id: drpriya.rp@gmail.com

Received: 24-09-2020

Revised: 02-12-2020

Accepted: 21-12-2020

Published: 08-04-2021

Access this article online

Quick Response Code:



Website:
www.jfmpc.com

DOI:
10.4103/jfmpc.jfmpc_1984_20

This is an open access journal, and articles are distributed under the terms of the Creative Commons Attribution-NonCommercial-ShareAlike 4.0 License, which allows others to remix, tweak, and build upon the work non-commercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.

For reprints contact: WKHLRPMedknow_reprints@wolterskluwer.com

How to cite this article: Ragouraman D, Priyadharsini RP, Venkatesh C. Prevalence of tuberculosis and diabetes comorbidity in patients attending secondary healthcare hospital in south India: A retrospective study. J Family Med Prim Care 2021;10:1241-5.

anti-TB drugs is also affected by the DM and there are also drug interactions like rifampicin inducing the metabolism of antidiabetic drugs.^[4,10,11]

Drug resistance is another major issue of concern in treating TB and in India, 23% of the new cases have multidrug-resistant tuberculosis (MDR TB).^[12] The chances of drug resistance in DM/TB patients increases because the plasma levels of the anti-TB drugs are reduced. The drug isoniazid is prone to induce diabetes by affecting the Krebs cycle and increasing the glucagon secretion.^[13] The most commonly treated diseases at the community level include diabetes, hypertension, infections like TB, etc., Owing to high prevalence at the primary care level, it would be desirable and rationale for the primary care physicians to know the deleterious effects of one disease on other's pathogenesis and treatment. There is a high need to identify the prevalence and treat the patients presenting with both DM and TB and to focus on the morbidity imposed by one disease on the other. Thus, the present study aimed to study the prevalence of TB and diabetes comorbidity in patients attending secondary healthcare hospitals and to identify the influence of one disease on the other among the TBDM patients.

Materials and Methods

This study was conducted in a government hospital to identify the prevalence of TB, TB with diabetes, and antituberculosis drug resistance among patients attending the outpatient department for chest diseases. The study was conducted after obtaining approval from the Indian Council of Medical research and the institutional ethics committee 1/8/2019 JIP/IEC/2019/082. The permissions were obtained from the department of chest diseases and the Revised National TB Control Program (RNTCP), Government hospital. The hospital register was studied in a detailed manner and the data was entered in an excel sheet. The retrospective data of the patients with the diagnosis of pulmonary TB, extra pulmonary TB, newly treated, previously treated, relapse, default, failure, and antituberculosis drug resistance, were collected from the register for 3 years from January, 2016 to December, 2018. The patient details (basic demographic characteristics), diagnosis, treatment history, drug susceptibility results, and comorbidities were noted from the records. The difference in the prevalence between the years 2016, 2017, and 2018 was also compared. The impact of diabetes on the course of the disease and treatment outcome was assessed.

Parameters measured

- % of patients with TB (new cases)
- % of patients with TB (previously treated cases)
- % of patients with pulmonary TB
- % of patients with extrapulmonary TB
- % of TB patients with DM
- % of patients with resistance to drug isoniazid or rifampicin
- % of patients with resistance to both isoniazid and rifampicin

- % of patients who discontinued treatment due to the comorbidity of both diseases.

Data analysis

All the data are expressed as percentage. The data are entered in the excel sheet and the percentage of all the parameters is calculated. The statistical analysis of the data was done using statistical package for the social sciences (SPSS) software. The comparison of the percentage of prevalence of TB and DM among the patients between the years was compared using the Chi-square test. A P value < 0.05 was considered statistically significant.

Observation and Results

The basic demographic characteristics of the patient population is listed in Table 1. Around 2.5 to 3 % of the patients were TB patients among those who attended the chest diseases department [Table 2]. The percentage of new cases were decreasing every year [Table 3]. The prevalence of diabetes mellitus and tuberculosis in all three consecutive years ranged between 8.5-10.6%.

Discussion

The present study shows that the prevalence of the DM among TB patients is 8.5%, 10.6%, and 8.9% for the years 2016, 2017, and 2018, respectively [Figure 1]. Our study results are comparable with the study reported by Gil *et al.* in which the prevalence of diabetes among tuberculosis patients in TB endemic countries like South Africa, Peru, Romania, and Indonesia was 12.5%.^[14] The study also reported that patients with dual diseases had a higher incidence of cardiovascular diseases and increased morbidity. The prevalence is less when compared with other studies reported by Nagar *et al.* in Bhopal, Mansuri *et al.* in Ahmedabad, and Jiménez-Corona, *et al.* in Mexico^[15-17] The global prevalence of diabetes among TB patients is identified to be 15.3% from a systematic review of 200 studies and our study shows a lesser value compared to that study.^[18] The prevalence in our study increased to 10.6% in the year 2017 and decreased

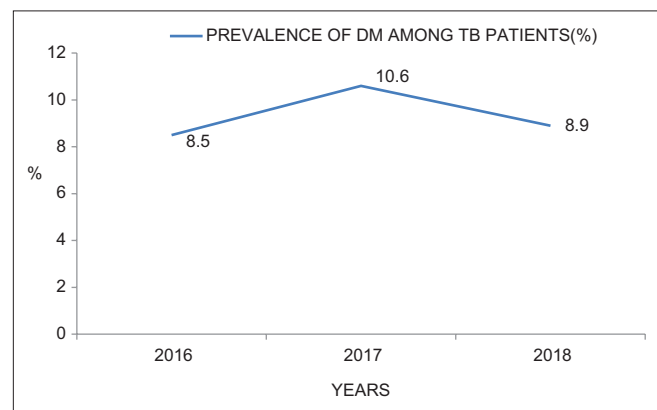


Figure 1: Difference in the prevalence of DM among TB patients in the years 2016, 2017, and 2018: The Chi-square test is used. P value = 0.74 P value > 0.05 indicates no significant difference in the prevalence among 3 years

in the subsequent year. The reason for this trend of rise and fall of prevalence cannot be well explained but there exists a range of 8–11% over 3 years and there is no significant difference in the prevalence when all 3 years are compared.

In contrast to the literature, most of the TB patients with diabetes were cured and completed the treatment. The percentages of the cured patients among DM/TB patients are 52.6%, 80.9%,

and 56.25% in the years 2016, 2017, and 2018, respectively. A systematic review of 59 studies conducted in the Middle East showed that there is no or little difference in the clinical presentation between DM/TB and nondiabetic TB patients whereas the microbiological response to drugs is delayed in DM/TB patients.^[19] However, the result of the present study differs from the concept as more than 50% of patients are cured. Our study indicates that diabetes did not have much impact on the cure following anti-TB treatment since more than 50% had attained cure. The other valid point is that since the data is analyzed from the hospital register, certain information about the time of diagnosis of diabetes, the drugs used for diabetic treatment, the severity of diabetes, the impact of diabetes on tuberculosis is lacking and so there is a difficulty to explain completely.

Our study shows that the number of deaths among diabetes and TB patients is two out of 19 and one out of 16 in the years 2016 and 2018, respectively. The cause of death is not mentioned in the register and this is one limitation of the study. The mortality due to diabetes among tuberculosis patients is also not established in the study conducted in Mexico by Jimenez-Corona *et al.*^[20]

In the year 2017, out of five patients with isoniazid and rifampicin resistance, three patients were diabetic. In the other 2 years, there is no association of drug resistance with diabetes [Table 4]. The risk of rifampicin resistance is increased threefold when there is diabetes comorbidity.^[21] The role of drug resistance due to diabetes is not much appreciated in the present study.

Table 1: Basic demographic characteristics of the patient population

	2016	2017	2018
Age			
<20	36	21	24
20-40	80	73	67
41-60	89	84	66
61-80	18	20	21
>80	0	0	1
Sex			
Male	135	127	112
Female	88	71	67
Total	223	198	182

Table 2: Prevalence of TB among the patients attending the hospital in the years 2016, 2017, and 2018

	2016	2017	2018
Total number of patient who attended chest diseases department	7519	7911	6054
Total TB cases	223	198	182
Prevalence of TB among the population who attend the chest diseases department.	2.96%	2.50%	3%

Table 3: Comparison of the percentages of various parameters between the years 2016, 2017, and 2018

Parameter	2016	2017	2018
Number of new cases (% of new cases)	196 (87.90%)	178 (89.90%)	154 (86.00%)
Number of previously treated (% of previously treated)	27 (12.10%)	20 (10.10%)	25 (14.00%)
Number of pulmonary TB (% of pulmonary TB)	159 (71.30%)	139 (70.20%)	128 (71.50%)
Number of extra pulmonary TB (% of extra pulmonary TB)	64 (28.70%)	59 (29.80%)	51 (28.50%)
Number of TB patients with DM (% of TB patients with DM)	19 (8.50%)	21 (10.60%)	16 (8.90%)
Number of patients with H or R resistance (% of resistance to H or R)	4 (1.80%)	5 (2.50%)	1 (0.55%)
% of resistance to H and R	4 (1.80%)	1 (0.50%)	4 (2.20%)
% of patients who discontinued treatment due to the comorbidity of both diseases	1 (0.4%)	-	-

Table 4: Prevalence of DM among TB patients

	2016	2017	2018
Number of cases of DM + TB	19 (100%)	21 (100%)	16 (100%)
% of cases of DM and TB	8.5%	10.6%	8.9%
Distribution of DM + TB cases			
Cured	10 (52.6%)	17 (80.9%) (including 2 resistance cases)	9 (56.25%)
Default	1 (5.26%)	-	-
Failure	1 (5.26%)	1	3 (18.7%)
Resistance	-	3	-
Death	2 (10.5%)	-	1
Completed the treatment	5 (26.3%)	2 (9.5%)	3 (18.7%)

The prevalence of TB among the patients attending the chest diseases department is 2.9%, 2.5%, and 3% for the years 2016, 2017, and 2018, respectively. The number of TB cases (both new cases and previously treated) is decreasing year by year with values of 223, 198, and 182 in the years 2016, 2017, and 2018, respectively. Males were mostly affected compared to females [Table 1]. The new cases and the pulmonary cases are higher in number compared to the previously treated and the extra pulmonary cases, respectively.

It is a known fact that diabetes contributes to the risk of TB mortality and morbidity through many mechanisms such as progression from latent TB to active TB, late sputum conversion during treatment, treatment failure, etc., The major proposed mechanism for the deterioration is diabetic immunopathy with fewer levels of IL-10, an anti-inflammatory cytokine in TBDM patients.^[22,23]

Strength

The study compares the prevalence of TB, TB, and DM over three subsequent years, which gives an idea about the trend in the prevalence of both diseases.

Limitation

The retrospective data from the hospital register is used for analysis and certain information such as the history, lab investigations, and the disease status could not be identified. The reason for the death of the patients could not be identified in this study.

Conclusion

The prevalence of TB among the patients attending the chest diseases department is 2.9%, 2.5%, and 3% for the years 2016, 2017, and 2018, respectively. In the present study, we found that the prevalence of DM among TB patients over 3 years ranged between 8.5–11% and it is less when compared with many other studies. There was a decrease in the total number of TB cases every year but there was an increase in the percentage of new cases every year. The increased efforts in screening and treatment of both diseases can further reduce the prevalence in a community and good knowledge about the bidirectional relationship between the communicable and noncommunicable diseases can encourage the physicians at the primary care level to manage both efficiently.

Acknowledgments

The study is approved as ICMR STS project 2019 (Reference Number 2019-06251) and the authors are thankful to ICMR, New Delhi. The authors are thankful to Dr. Venkatesh C, District TB Officer, Govt Chest clinic, Karaikal, and State TB office Pondicherry for their support and encouragement in doing the study.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

References

1. TB statistics | Incidence, prevalence, high burden [Internet]. TB Facts TB Tests Drugs Stat. [cited 2019 Jan 23]. Available from: <https://www.tbfacts.org/tb-statistics/>.
2. Tuberculosis (TB) [Internet]. [cited 2018 Dec 22]. Available from: <https://www.who.int/news-room/fact-sheets/detail/tuberculosis>.
3. Dooley KE, Chaisson RE. Tuberculosis and diabetes mellitus: Convergence of two epidemics. *Lancet Infect Dis* 2009;9:737-46.
4. The Bidirectional Relationship between Tuberculosis and Diabetes [Internet]. [cited 2019 Jan 08]. Available from: <https://www.hindawi.com/journals/trt/2017/1702578/>.
5. Lee M-R, Huang Y-P, Kuo Y-T, Luo C-H, Shih Y-J, Shu C-C, *et al.* Diabetes mellitus and latent tuberculosis infection: A systematic review and metaanalysis. *Clin Infect Dis* 2017;64:719-27.
6. Cordeiro da Costa J, Oliveira O, Baía L, Gaio R, Correia-Neves M, Duarte R. Prevalence and factors associated with diabetes mellitus among tuberculosis patients: A nationwide cohort. *Eur Respir J* 2016;48:264-8.
7. WHO | Collaborative framework for care and control of tuberculosis and diabetes [Internet]. WHO [cited 2019 Jan 05]. Available from: <https://www.who.int/tb/publications/tb-diabetes-framework/en/>.
8. Zheng C, Hu M, Gao F. Diabetes and pulmonary tuberculosis: A global overview with special focus on the situation in Asian countries with high TB-DM burden. *Glob Health Action* 2017;10:1-11.
9. Pereira SM, Araújo GS, Santos CA, Oliveira MG, Barreto ML. Association between diabetes and tuberculosis: Case-control study. *Rev Saude Publica* 2016;50:82.
10. Niazi AK, Kalra S. Diabetes and tuberculosis: A review of the role of optimal glycemic control. *J Diabetes Metab Disord* 2012;11:28.
11. Martinez N, Kornfeld H. Diabetes and immunity to tuberculosis. *Eur J Immunol* 2014;44:617-26.
12. Chatterjee S, Poonawala H, Jain Y. Drug-resistant tuberculosis: Is India ready for the challenge? *BMJ Glob Health* 2018;3:e000971.
13. Manish G, Keshav GK, Syed RM, Sukriti K, Abhinav G. Isoniazid induced childhood diabetes: A rare phenomenon. *J Basic Clin Pharm* 2015;6:74-6.
14. Diabetes Mellitus Among Pulmonary Tuberculosis Patients From 4 Tuberculosis-endemic Countries: The TANDEM Study | Clinical Infectious Diseases | Oxford Academic [Internet]. [cited 2020 Dec 03]. Available from: <https://academic.oup.com/cid/article-abstract/70/5/780/5431210>.
15. Nagar V, Gour D, Pal DK, Singh AR, Joshi A, Dave L. A study on prevalence of diabetes and associated risk factors among diagnosed tuberculosis patients registered under Revised National Tuberculosis Control Programme in Bhopal District. *J Fam Med Prim Care* 2018;7:130-6.
16. Mansuri S, Chaudhari A, Singh A, Malek R, Viradhaya R. Prevalence of diabetes among tuberculosis patients at urban health centre, Ahmedabad. *Int J Sci Study* 2015;3:115-8.

17. Jiménez-Corona ME, Cruz-Hervert LP, García-García L, Ferreyra-Reyes L, Delgado-Sánchez G, Bobadilla-del-Valle M, *et al.* Association of diabetes and tuberculosis: Impact on treatment and post-treatment outcomes. *Thorax* 2013;68:214-20.
18. Noubiap JJ, Nansseu JR, Nyaga UF, Nkeck JR, Endomba FT, Kaze AD, *et al.* Global prevalence of diabetes in active tuberculosis: A systematic review and meta-analysis of data from 2.3 million patients with tuberculosis. *Lancet Glob Health* 2019;7:e448-60.
19. Alkabab YM, Al-Abdely HM, Heysell SK. Diabetes-related tuberculosis in the Middle East: An urgent need for regional research. *Int J Infect Dis* 2015;40:64-70.
20. Sanghani RN, Udwardia ZF. The association of diabetes and tuberculosis: Impact on treatment and post-treatment outcomes. *Thorax* 2013;68:202-3.
21. Mehta S, Yu EA, Ahamed SF, Bonam W, Kenneth J. Rifampin resistance and diabetes mellitus in a cross-sectional study of adult patients in rural South India. *BMC Infect Dis* 2015;15:451.
22. Kumar NP, Fukutani KF, Shruthi BS, Alves T, Silveira-Mattos PS, Rocha MS, *et al.* Persistent inflammation during anti-tuberculosis treatment with diabetes comorbidity. *eLife* 2019;8:e46477.
23. Martinez N, Kornfeld H. Tuberculosis and diabetes: From bench to bedside and back. *Int J Tuberc Lung Dis* 2019;23:669-77.