

Comparison of development of sputum positive pulmonary tuberculosis in controlled and uncontrolled 50 cases of diabetes mellitus

Jayant Chauhan, Bhavesh Patel, Jitendra Sisodia, Yagnang Vyas, Tehzeeb Faruqui, Pankaj Panchal

Department of TB and Respiratory Medicine, SSG Hospital, Medical College Baroda, Vadodara, Gujrat, India

Correspondence to: Jayant Chauhan, E-mail: jbcchauhan15@yahoo.com

Received: August 22, 2017; Accepted: September 17, 2017

ABSTRACT

Background: Tuberculosis (TB) is one of the prominent preventable and treatable causes of death in developed country. Diabetes mellitus (DM) is chronic metabolic disorder and have rising trend of incidence and prevalence in developed country. When both diseases present together, it greatly increases risk of death among patients. **Objective:** DM is one of the risk factors for development and relapse of TB which is also associated with development of multidrug-resistant TB or extended drug-resistance TB. Main purpose of this study is to quantify risk among DM patients by classifying into controlled and uncontrolled DM. By doing so, we can create awareness among DM patients for more sugar control to reduce risk for TB and help in global control of TB. **Materials and Methods:** This is prospective analytical study was done on 50 patient of DM presented with respiratory symptoms at department of TB and Respiratory Medicine Department, Baroda Medical College and S.S.G. Hospital, Vadodara, Gujarat, India. Analysis was done using Microsoft EXCEL 2007 software package. **Results:** A total 50 patient of DM presented with respiratory symptoms was studied. Out of 50 DM patients, 36 (72%) are male, and 14 (28%) are female. 20 (40%) have uncontrolled DM, and 30 (60%) have controlled DM. Age group of 36-50 and 51-65 have most number of DM patients, that is, 18 (36%) each and most number of uncontrolled DM, that is, 7 (14%) each. On chest X-ray examination, 12 patients (24%) having lesion of X-ray and lesions are more found in middle and lower lung. On sputum examination, after X-ray shows 9 (18%) were sputum positive patients and 41 (82%) were sputum negative. Uncontrolled DM patients have more sputum positive result than controlled DM patients. As per our study, out of 12 chest X-ray positive patients, 9 (75%) patients have sputum positive results, and in uncontrolled DM, 8 (75%) patients have chest X-ray positive of total chest X-ray positive patients. **Conclusion:** In our study, we found that DM is risk factor TB and if patient having uncontrolled DM than patients more prone to develop TB than controlled DM. More male DM patients in 36-50 years age group have uncontrolled DM with chest X-ray lesions and sputum positive results. It is important to screen patient with DM for TB for early diagnosis and treatment, particularly with uncontrolled DM.

KEY WORDS: Tuberculosis; Sputum Positive; Diabetes Mellitus

INTRODUCTION

Tuberculosis (TB) is communicable disease which mainly involves respiratory system and cause by mycobacterium

TB. The WHO recognized TB is one of the major causes of mortality that earned it position in top 10 causes of death in world.^[1] In 2015, 10.4 million people contracted TB and TB were accounted for 1.8 million deaths.^[1] 61% of newly detected TB patients are from Asia in 2015 and four countries, which are account for highest number of TB cases, are India, China, Indonesia, and Pakistan. TB is mainly found in low- and middle-income countries, and 95% of TB deaths occur in these countries.

Diabetes mellitus (DM) is noncommunicable disease which is characterized by insulin insufficiency or underutilization

Access this article online

Website: <http://www.ijmsph.com>

DOI: 10.5455/ijmsph.2017.0926019092017

Quick Response code



of insulin produced in body. According to International diabetes foundation, there are 415 million DM cases globally in 2015, and it is estimated that this figure will increase to 642 million by 2040.^[2] According to the WHO, DM resulted in 1.6 million deaths directly in 2015.^[3] Because of change in lifestyle and diet habits, rapid urbanization, industrialization, ageing population, there has been increasing prevalence of DM in low- and middle-income countries at a great rate. India having second largest number of DM cases in the world and 69.2 million cases of DM are in India.^[2] DM is more common in urban area than rural area due to factors as mention above and half of population is unaware of having DM.^[4]

DM is chronic metabolic disorder which is associated with low immunity which makes it susceptible to various infections. In DM, Th1 cell function is depressed which plays vital role in TB. Furthermore, reduced production of interleukin-1 beta and tumor necrosis factor from peripheral blood monocytes found in patient with TB associated with DM.^[5] Few study also found that poorly controlled DM associated with low nonspecific interferon gamma and depressed bactericidal activity of leukocyte.^[5,6] In addition, function of neutrophils such as chemotaxis and oxidative killing of pathogen is reduced compare to non-diabetic patients.^[7] Taken together, DM responsible for reduction in both cellular and humoral immunity and tend to increase susceptibility to TB and increases risk of progression of latent TB to active TB.

In developing countries like India, as predicted by the WHO, there is constant rise in case of TB and DM. According to one of the study, DM is responsible for 14.8% of pulmonary TB and 20.2% of smear-positive pulmonary TB.^[8] Same study also point out that increasing in prevalence of DM in urban area is cause of 15.2% increased incidence of smear-positive TB in urban area compare to rural area. DM carries two to three times of risk for developing of TB compare to non-diabetic patients and DM associated with death of TB patients 2 times higher than non-diabetic patients, and after adjusting with age, HIV, weight and foreign birth, risk of death is 6.5 times higher in DM than non-diabetic patients.^[9]

MATERIALS AND METHODS

This is prospective analytical study was done on 50 patient of DM, controlled or uncontrolled, presented with respiratory symptoms as outdoor basis in hospital. Detail history and examination was carried out in all patients followed by sputum examination, X-ray chest PA view and routine blood work. We also send sputum CBNAAT in few patients when indicated.

Selection Criteria

Patients were selected using following parameters:

1. Patients with DM presented with respiratory symptoms.
2. Patient with age >12 years.
3. Patient should not diagnosed with HIV infection.

Statistical Analysis

Analysis was done using Microsoft EXCEL 2007 software package.

RESULTS

A total 50 patient of DM presented with respiratory symptoms was studied at the department of TB and Respiratory Medicine Department, Baroda Medical College and S.S.G. Hospital, Vadodara, Gujarat, India.

Age, Sex, and DM

Out of 50 DM patients, 36 (72%) are male, and 14 (28%) are female. Age group of 36-50 and 51-65 have most number of DM patients that is 18 (36%) each.

In male diabetic patients, 12 (33.33%) having uncontrolled DM, and 24 (66.67%) having controlled DM. In male, 36-50 age group have more number of DM patients 13 (26%), and uncontrolled DM patients 6 (12%) than other age groups. In Female diabetic patients, 8 (57.14%) of total have uncontrolled DM, and 6 (42.86%) of total have controlled DM. In female, 51-65 age group have more number of DM patients 6 (12%) and uncontrolled DM patients 5 (10%) than other age groups. Age group of 36-50 and 51-65 have most number of uncontrolled DM that is 7 (14%) each.

As presented in Tables 1 and 2, diabetes among male patients found more than female patients in this study. Picture of distribution of controlled and uncontrolled DM in female patients was different from male patients. Male patients have more uncontrolled DM than female patients. However, when we compare proportion; female patients have more uncontrolled DM than male patients. Overall, out of 50 DM patients, 30 (60%) have controlled DM, and 20 (40%) have uncontrolled DM.

DM and X-ray Examination

After selection of patients having DM with respiratory symptoms, we obtain chest X-ray PA view. Out of 50 DM patients, 12 patients (24%) having lesion of X-ray.

Among X-ray positive patients, distribution pattern of lesions displayed in Table 3. As seen in Table 3, lesion in upper lung found in 3 (25%), middle lung found in 5 (41.67%),

Table 1: Age-wise distribution of DM among male and female

Age	20-35	36-50	51-65	>65	Total
Male	4	13	12	7	36
Female	2	5	6	1	14
Total	6	18	18	8	50

DM: Diabetes mellitus

Table 2: Age- and sex-wise distribution of controlled and uncontrolled DM

Age	Male			Female			Total
	Controlled DM	Uncontrolled DM	Total	Controlled DM	Uncontrolled DM	Total	
20-35	1	3	4	1	1	2	6
36-50	7	6	13	4	1	5	18
51-65	10	2	12	1	5	6	18
>65	6	1	7	0	1	1	8
Total	24	12	36	6	8	14	50

DM: Diabetes mellitus

Table 3: Location of X-ray lesions in patient with controlled and uncontrolled DM

Parameters	X-ray lesion location among DM patients			Total
	Upper	Middle	Lower	
Controlled DM	2	2	0	4
Uncontrolled DM	1	3	4	8
Total	3	5	4	12

DM: Diabetes mellitus

and lower lung found in 4 (33.33%) of total X-ray positive patients. Uncontrolled DM have more X-ray positive patient 8 (66.67%) than controlled DM 4 (33.33%).

DM and Sputum Examination

After X-ray examination, all patients are subjected for sputum examination. Out of total 50 patients, 41 (82%) were sputum negative, and 9 (18%) were sputum positive patients.

Table 4 represents distribution of sputum negative and positive patients among controlled and uncontrolled DM. Sputum grading was done according to RNTCP guideline. In controlled DM, 29 (58%) of total patients were sputum negative, and 3 (6%) were sputum positive. In uncontrolled DM, 12 (24%) were sputum negative and 6 (12%) were sputum positive.

In controlled sputum positive DM patients, all 3 (33.33%) sputum positive patients have grade 3 result as per RNTCP guidelines. In uncontrolled sputum positive patients, 1 (11.11%) have grade 1, 3 (33.33%) have grade 2, and 2 (22.22%) have grade 3 report as per RNTCP guidelines.

Table 5 represents age- and sex-wise distribution of sputum positivity among DM patients. As per above data, 7 (77.78%) male patients have sputum positive result and out of which 6 (66.67%) have uncontrolled DM. In females, 2 (22.22%) patients have sputum positive result and both patients have controlled DM. Age group of 36-50 have more sputum positive patients 4 (44.44%) than other age groups while >65 age group have no sputum positive DM patients. In male of same age group, all of them have with uncontrolled DM.

Chest X-ray Lesions in Sputum Positive and Negative DM Patients

In this study, we compare the chest X-ray lesion in sputum positive and negative DM patients. Results are displayed in Table 6.

All 50 DM patients were subjected for chest X-ray examination and 12 (24%) patients have chest x-ray with lesions and 38 (76%) patients have no lesion on chest X-ray. As per our study, out of 12 chest X-ray positive patients, 9 (75%) patients have sputum positive results, and 3 (25%) patients have sputum negative results. In controlled DM, 4 (25%) patients have chest X-ray positive out of 12 chest X-ray positive patient and 3 (33.33%) patients have sputum positive result in same group.

In uncontrolled DM, 8 (75%) patients have chest X-ray positive of total chest X-ray positive patients and 6 (66.66%) patient have sputum positive result in same group.

DISCUSSION

According to analysis of data collected during this study found that DM found to more common among male (72%) than female (28%) as well as more male DM patients have uncontrolled DM (24%) than female DM patients (16%). As shown in Tables 1 and 2, age groups of 36-50 and 51-65 have highest number of DM (36% each) patients than other age group under study, and 20-35 age groups have least number of DM patients (12%). Further analysis show that age group of 36-50 have more male uncontrolled DM patients (12%) and 51-65 age group have more female uncontrolled DM patients (10%), and >65 age group have least number of uncontrolled DM in both sex groups (2% each). We found in over study that male patient have more uncontrolled DM in middle age and female patients have in later age. After initial assessment of DM patients with respiratory symptoms, we get done chest X-ray and results are presented in Table 3 which shows location of X-ray lesion in DM. Out of 50 patients, 12 (24%) patients have lesion on chest X-ray examination. During study, we noted that 9 (75%) patients having more lesion in middle and lower lung than right upper lung. Patient with uncontrolled DM have more lesion in middle and lower lung compared to controlled DM patients. After X-ray examination,

Table 4: Sputum positivity in DM patients

Parameters	Sputum negative	Sputum positive				Subtotal	Total
		Scanty	1+	2+	3+		
Controlled DM	29	0	0	0	3	3	32
Uncontrolled DM	12	0	1	3	2	6	18
Total	41	0	1	3	5	9	50

DM: Diabetes mellitus

Table 5: Age- and sex-wise distribution of sputum positivity in DM patients

Age	Male			Female			Total
	Sputum positive result			Sputum positive result			
	Controlled DM	Uncontrolled DM	Total	Controlled DM	Uncontrolled DM	Total	
20-35	0	2	2	0	0	0	2
36-50	0	3	3	1	0	1	4
51-65	1	1	2	1	0	1	3
>65	0	0	0	0	0	0	0
Total	1	6	7	2	0	2	9

DM: Diabetes mellitus

Table 6: Chest X-ray lesions in DM patients

Parameters	Chest X-ray lesions						Total
	Positive			Negative			
	Sputum positive	Sputum negative	Total	Sputum positive	Sputum negative	Total	
Controlled DM	3	1	4	0	28	28	32
Uncontrolled DM	6	2	8	0	10	10	18
Total	9	3	12	0	38	38	50

DM: Diabetes mellitus

we examine sputum of DM patients in this study. We used RNTCP guideline to grade sputum positivity in this study. Results of examination are summarized in Tables 4 and 5. 9 (18%) of patients have sputum positive result out of 50 DM patients. Among sputum positive DM patients, 6 (66.67%) DM patients have uncontrolled DM, and 3 (33.33%) DM patients have controlled DM. We also analyzed data in respect to age- and sex-wise distribution which is present in Table 5. As mention in table, male DM patients have more sputum positive result 7 (7.78%) than female DM patients 2 (22.22%). In male sputum, positive DM patients, 6 patients have uncontrolled DM. 36-50 years age group DM patients have high number of sputum positive result than any other age group and same group have most number of uncontrolled DM with sputum positivity. On evaluation of data presented in Table 6 show that out of 12 X-ray lesion positive patients, 9 (75%) DM patients have sputum positive results.

We found that DM with TB is more common among middle age male patient that is consistent with finding of one of study in India.^[10] In that study, they found male predominance of middle age group patients having TB with DM. Case-control study done in Kerala in India for outcome of TB patients with DM show that patients with poor glycemic control identified by HBA1C and fasting blood sugar level at initial point of

study had more severe form of pulmonary TB and better glycemic control is needed for optimal control of TB.^[11] This finding confirms our observation of uncontrolled DM having high probability of developing TB and controlled DM reduced risk of developing TB.

This study was done on 50 DM patients with respiratory symptoms only. To select patients with controlled DM or uncontrolled DM, capillary blood glucose was used due to its rapidity, easy to use without any technical knowledge, and safe results. As DM may alter clinical presentation of TB, we did not take account of it and included only those patients having respiratory symptoms. Hence, it is possible that we may miss DM with TB cases without any symptoms during screening. Due to certain limitation of our study, we did not follow-up patients after diagnosis and putting patients on treatment after diagnosis. That is main reason we are unable to comment about sputum conversion rate of DM with TB patients, glycemic control during treatment, and follow-up results of sputum negative DM patients.

In summary to analysis of data collected during in study, more male DM patients have uncontrolled DM with chest X-ray lesions and sputum positive results. DM patients in 35-50 years age group have more uncontrolled DM and

more likely to developed pulmonary TB than other age group patients. Few question still we need to find like risk of DM patient for developing multidrug-resistant or extended drug-resistance TB and risk of relapse in DM patients.

CONCLUSION

There is rising trend of DM and TB in developing country like India. In our study, we found that DM is risk factor for TB and if patient having uncontrolled DM than patients are more prone to develop TB than controlled DM. The data presented in this prospective analytical study shows that patients with uncontrolled DM in middle age group males are at higher risk for development of sputum positive pulmonary TB than controlled DM.

It is important to control DM epidemic as increase in number of such cases will leads to increase in number of TB patients and represents one of the biggest challenge in control of global TB. Hence, it is important to screen patient with DM for TB for early diagnosis and treatment particularly with uncontrolled DM. All TB patients should continue to screen for DM at the time of diagnosis as per RNTCP guidelines. If patient has TB with DM than management of both the diseases are challenging. Few studies found that rifampicin can cause hyperglycemia by direct or indirect interaction with oral hypoglycemic drugs.^[12,13] Level of rifampicin found two times lower in TB with DM patients than patients with only TB.^[14] Hence, it is important to focus on proper management of DM among TB patient for better outcome.

REFERENCES

1. WHO. World Health Organization Fact Sheet of Tuberculosis Reviewed March; 2017.
2. International Diabetes Federation. IDF Diabetes Atlas. 7th ed. Brussels: International Diabetes Federation; 2015.
3. WHO. World Health Organization Fact Sheet of Diabetes Mellitus Updated July; 2017.
4. Indian Council of Medical Research. Assessment of Burden of NCDs in India. New Delhi: Indian Council of Medical Research; 2005.
5. Rayfield EJ, Ault MJ, Keusch GT, Brothers MJ, Nechemias C, Smith H. Infection and diabetes: The case for glucose control. *Am J Med.* 1982;72(3):439-50.
6. Tsukaguchi K, Okamura H, Ikuno M, Kobayashi A, Fukuoka A, Takenaka H, et al. The relation between diabetes mellitus and IFN-gamma, IL-12 and IL-10 productions by CD4 alpha beta T cells and monocytes in patients with pulmonary tuberculosis. *Kekkaku.* 1997;72(11):617-22.
7. Delamaire M, Maugeudre D, Moreno M, Le Goff MC, Allannic H, Genetet B. Impaired leucocyte functions in diabetic patients. *Diabet Med.* 1997;14(1):29-34.
8. Stevenson CR, Forouhi NG, Roglic G, Williams BG, Lauer JA, Dye C, et al. Diabetes and tuberculosis: The impact of the diabetes epidemic on tuberculosis incidence. *BMC Public Health.* 2007;7:234.
9. Revised National Tuberculosis Control Programme Policy and Framework.
10. Anand KP, Kiran CR, Feroz G. Clinical profile of sputum positive pulmonary tuberculosis patients with diabetes mellitus in a teaching hospital at Jamnagar, Gujarat. *Natl J Med Res.* 2012;3-2:309-12.
11. Adiody S, Gopinath VP, Menon SK, Thomas T, Varghese PR. Outcome of tuberculosis in patients with diabetes mellitus treated with the revised national tuberculosis control programme regimen-a study from Kerala, South India. *Int J Contemp Med Res.* 2016;3(4):1123-6.
12. Takasu N, Yamada T, Miura H, Sakamoto S, Korenaga M, Nakajima K, et al. Rifampicin-induced early phase hyperglycemia in humans. *Am Rev Respir Dis.* 1982;125(1):23-7.
13. Niemi M, Backman JT, Fromm MF, Neuvonen PJ, Kivistö KT. Pharmacokinetic interactions with rifampicin: Clinical relevance. *Clin Pharmacokinet.* 2003;42(9):819-50.
14. Nijland HM, Ruslami R, Stalenhoef JE, Nelwan EJ, Alisjahbana B, Nelwan RH, et al. Exposure to rifampicin is strongly reduced in patients with tuberculosis and Type 2 diabetes. *Clin Infect Dis.* 2006;43(7):848-54.

How to cite this article: Chauhan J, Patel B, Sisodia J, Vyas Y, Faruqui T, Panchal P. Comparison of development of sputum positive pulmonary tuberculosis in controlled and uncontrolled 50 cases of diabetes mellitus. *Int J Med Sci Public Health* 2017;6(11):1598-1602.

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