Original article:

A study of pulmonary tuberculosis in diabetes mellitus and its clinicoradiological correlation

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Abstract:

Introduction: India being Diabetic Capital with largest number of tuberculosis patients. Several studies have highlighted that Diabetes as a risk factor for TB. TB in Diabetic patients tend to have more cavitatory, less sputum positive with paucity in symptoms and signs. Hence We would like to highlight the varied pulmonary manifestations through our study.

Methodology: Cross sectional study conducted in BH and CGH, Davangere with 50 patients. Pulmonary TB was diagnosed through history, examination, Sputum Microscopy and Chest X ray.

Results and Discussion: Out of 50,36(72%) males & 14(28%). Maximum incidence of TB was seen in >50 years with peak incidence in 51-60 & 61-70.Mean age for males was 52.8 and females was 55.6 years. Symptoms noted were cough(92%), Fever(80%), Anorexia(58%), Loss of weight(56%), Dyspnea(42%), Hemoptysis(20%), Chest pain(20%),night sweats(20%). Duration of Diabetes were <1y(22%),2-5y(42%),6-10y(32%),>10y(4%). Mean FBS was 241 mg/dl and PPBS was 316 mg/dl. Sputum positive cases <50y(16/20) and >50y(21/30) with P=0.182. Cavitatory lesions were noted in 38% followed by non homogenous opacities in 22% of patients.

Conclusions: There was a linear relationship between duration of DM & TB incidence. Majority of our patients had poorly controlled sugars, suggesting that severe hyperglycemia is associated with development of pulmonary TB. Sputum positivity was more in patients aged > 50 yrs. Cavitation and non homogeneous opacity were more common in patients aged > 50 yrs. Lower lung field TB was more common in aged >50 yrs and females. Early diagnosis and properly monitored treatment regimen is the only time proven answer.

Introduction:

Over two billion people in the world are infected with M.tuberculosis, of whom more than 11 million have active TB, and the total number of yearly incident cases and attributable deaths is rising globally.[1,2]The impact of an increasingly globalised world on disease burden goes beyond infections to non-communicable diseases (NCDs), which are rising in prevalence in middle and low income countries due to ageing populations and changing lifestyles and diets[1].

90% of the infected persons do not develop the disease in their life time because of the immunity that they develop against it or immunization with BCG vaccination. Even with this situation, there are more than 9 million active TB cases in the world and 85% of the burden of TB cases is in the poor developing countries and of this, India bears 50% of the cases. According to the WHO, an estimate of 1.5 million people die due to tuberculosis each year.[3]

The number of people with diabetes, which was 171 million in 2000, is expected to grow to 366 million – 440 million by 2030.[4]Historically, the incidence of tuberculosis in patients with diabetes has been high.[4,5,6] In 1934, a treatise on the association between diabtes and tuberculosis

each year.[3]

The number of people with diabetes, which was 171 million in 2000, is expected to grow to 366 million – 440 million by 2030.[4]Historically, the incidence of tuberculosis in patients with diabetes has been high.[4,5,6] In 1934, a treatise on the association between diabtes and tuberculosis was written by Howard Root (a physician at the Deacones Hospital, Boston, MA, USA), before the availability of antimycobacterial drugs.[4,6] Diabetes is a risk factor for developing active TB. There is strong evidence for this association, with studies examining the incidence of TB showing it to be two to five times higher in diabetic patients than in non-diabetic patients. [1,7-9] Calculations from an epidemiological model in India suggest that DM accounts for 14.8% of pulmonary TB and 20.2% of smear-positive TB.[10] It is estimated that an increased prevalence of DM in urban areas is associated with a 15.2% increased incidence of smear-positive pulmonary TB in urban, compared to rural, populations.[1,10]

DM has been found to be independently associated with an unfavo-urable outcome of pulmonary TB.[1,14] TB in diabetic patients has been reported to have more cavitatory lesions, less sputum positivity and a paucity of symptoms and signs compared to TB in non-diabetic patients.[8] DM has been found to be a risk factor for death in TB patients: one study showed the risk to be twofold higher than in those without DM.[15] The only way to counter dreadful combination is to insist on a routine blood sugar screening test in tuberculosis patients of 40 and over and carryout sputum and X-ray examination in diabetics once a year or on any occasion when cough persists for a month or the insulin requirement suddenly goes up.

Objectives:

1. To study the clinical profile of pulmonary tuberculosis in Diabetic patients.

2. To study the radiographic pattern of pulmonary tuberculosis in Diabetic patients.

3. To study the difference in manifestations between well controlled diabetic from uncontrolled diabetic.

Methodology :

Cross sectional study conducted in BH and CGH, Davangere with 50 patients.

Study period : December 2012 to January 2014.

Inclusion criteria :

- Adult patients with diabetes mellitus with pulmonary tuberculosis.

Exclusion criteria :

- Diabetic patients with extra pulmonary tuberculosis.

- Pulmonary tuberculosis patients not having diabetes.

The following investigations were used in the present study :

- Hemoglobin
- Total leukocyte count
- Lymphocyte percentage
- Erythrocyte sedimentation rate
- Fasting blood sugar
- Post prandial blood sugar
- Sputum AFB
- Chest x-ray

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- HbA1C

Method of collection of data :

Pulmonary tuberculosis was diagnosed by detailed history, clinical examination, sputum examination for acid fast bacilli, chest radiography.

Diabetes mellitus was diagnosed using the national diabetes data group and WHO diagnostic criteria:

1. Symptom of diabetes plus random blood sugar > 11.1 mmol/L (200 mg/dl) or
2. Fasting plasma glucose > 7.0 mmol/L (126 mg/dl) or
3. Two hour plasma glucose > 11.1 mmol/L (200 mg/dl) during an oral glucose tolerance test.

Adult patients who fulfilled the above criteria were included in the study. The clinical profile which was evaluated in this study include age and sex distribution, symptom of presentation, past history of tuberculosis, duration of diabetes mellitus, incidence of smoking, incidence of clubbing, hemoglobin level, erythrocyte sedimentation rate, total leukocyte count, blood sugar values, sputum AFB results and radiological pattern.

Results:

First group : Age less than or equal to 50 yrs - 20 patients (40%).

Second group : Age more than 50 yrs - 30 patients (60%)

Table 1: Symptoms

Symptom	Males	Females	<50, n =20	>50, n=30	Total
Cough	32	14	17	29	46
Fever	30	10	23	23	40
Hemoptysis	6	4	3	7	10
Dyspnea	15	6	7	14	21
Anorexia	18	11	10	19	29
Loss of Weight	18	10	9	19	28
Chest Pain	7	3	5	5	10
Night Sweats	7	3	3	7	10

As shown in table, the predominant symptoms noted were cough (92%), fever(80%), anorexia (58%),loss of weight(56%), dyspnea(42%) in the age group > 50 yrs. Other symptoms noted were hemoptysis (20%), chest-pain (20%), night sweats (20%).

Table 2: duration of diabetes

Duration (years)	Number of patients	Percentage
<1	11	22%
2– 5	21	42%
6 – 10	16	32%
>10	2	4%
Total	50	100%
Mean ± SD (years)	4.79 ± 4.71	
Range	1 month to 25 years	

As shown in table, 42% of the patients had a duration of diabetes between 2-5 yrs and 32% of the patients had a duration of diabetes between 6-10yrs and in 22% of the patients, duration of the diabetes below 1 yr. 4% of the patients had diabetes more than 10yrs.

Table 3 : fasting blood sugar in tuberculous diabetics

FBS (mg/dl)	No. of patients	Percentage
< 126	1	2%
126 – 150	6	6%
151 – 200	12	24%
201 – 300	22	44%
>300	9	18%
Mean ± SD	241 ± 95.8	
Range	120 – 510	

As shown is table, the fasting blood sugar values showed a definite correlation with pulmonary tuberculosis. 44% of the patients had fasting blood sugar values between 201 to 300 mg/dl and 24% had values between 151 - 200 mg/dl and 18% of the patients had values above 300 mg/dl. Mean fasting blood sugar value was 241mg/dl.

Table 4 : post prandial blood sugar values in tuberculous patients

PPBS (mg/dl)	No. of patients	Percentage
<200	1	2%
200 – 250	9	18%
251 – 350	27	54%
>350	13	26%
Mean ± SD	316 ± 91.5	
Range	182 – 590	

As shown in table, 54% of the patients had post prandial blood sugar values between 251- 350 mg/dl, 18% had values between 200-250mg/dl and 26% of the patients had values above 350 mg/dl. Mean post prandial blood sugar value in the study group was 316mg/dl.

Table 5 : Hba1c in tuberculous diabetics

HbA1c	No. of patients	Percentage
<7	5	10%
7-9	24	48%
9-12	19	38%
>12	2	4%
Mean ± SD	8.9 ± 1.6	
Range	6.2 – 13.1	

Table 6: lower lung field tuberculosis

	<50(n=20)	>50(n=30)	P value
No of patients	04	18	0.005(sig.)

Table 7 : radiological results

Type of Lesion	Male	Female	<50, n =	>50, n=	Total	P Value
Cavitatory Lesions	13	6	8	11	19	0.04
Non homogenous Opacities	9	2	3	8	11	0.31
Infiltrates	9	1	5	5	10	0.43
Miliary shadows	2	2	0	4	4	0.43
Pleural Effusion	2	3	3	2	5	0.96

As shown in table, chest x-ray showed cavitatory lesions in 38% of the patients ,non-homogeneous opacities in 22% of the patients and infiltrates in 20% of the patients. Other lesions noted were pleural effusion 10% of the patients and miliary shadows in 8% of the patients .

Discussion:

A clinical and radiological evaluation of 50 cases of pulmonary tuberculosis with diabetes mellitus was done.The high incidence of tuberculosis in diabetic patients, reported by western and Indian workers suggests a significant association between these two diseases.[16,17] In our study the total number of males were 72% and females were 28%. The male to female ratio was 2.5:1.

Patel JC showed a similar ratio of male : female. In the 179 cases he studied, 76% were males and 24% were females.[18] Morris and others also in their study observed that male population out numbered the females.[19] Tripathy and Kar reported that 78% of their patients were males.[20]

The high incidence of disease in males is possibly due to the fact that both tuberculosis and diabetes are more common in males. Another reason could be attributed to the increase in the smoking and occupational exposure to dust among males, and also the number of male patients getting admitted to the hospital are more than females. In the present study, the number of patients above the age of 50 were 60% and peak incidence was in the age groups of 51-60yrs and 61-70yrs.

The predominant symptoms noted in our study was cough (92%), fever (80%) and anorexia (58%) in both patients less than 50 yrs and more than 50 yrs. Loss of weight was also noted in both the age group of patients. In a study done in Ethiopian diabetic patients with tuberculosis, the three most common symptoms of tuberculosis were fever (80.5%), sweating (80.4%) and cough (70.5%).[21]

Our study showed that 69.4% of the males were smokers and smoking may be a contributing factor for developing tuberculosis in these patients. Clubbing was noted in 20% of the patients in our study. Of these 85% had far advanced tuberculosis as evidenced by clinical and radiological examination. The prevalence of clubbing noted by different workers showed wide variations. It was as low as 1% (Weirman) to 90% (Neufeld).[22] Macfarlane showed an incidence of 21%. He also reported that finger clubbing was associated with more severe pulmonary damage. Gross clubbing occurs with long standing tuberculosis.[23] Finger clubbing is of value in assessing patients with pulmonary tuberculosis because it helps to identify those with severe destructive disease.

82% of the patients in our study were found to be anemic. Of these, 40% had mild anemia, 40% had moderate anemia and 02% had severe anemia. In a study done in Jammu region by PavanMalhotra, it was found that 88.76% of tuberculosis patients were anemic. 13.26% had mild anemia, 17.34% had moderate and 58.16% had severe anemia.

Anemia was normocytic normochromic and normocytic hypochromic type.[24]The total white cell count in our study showed an average value of 8696. Few patients who had far advanced tuberculosis showed a normal blood count, and certain others with mild to moderately advanced tuberculosis had a higher white cell count. So there was no correlation noticed between the severity of tuberculosis and total white cell count. Knelle has proved that leukocyte picture is of no help in diagnosis of tuberculosis and our study also shows the same. In general, a normal total WBC count in the presence of extensive pulmonary shadowing on a chest radiograph favours a diagnosis of tuberculosis rather than acute pneumonia or lung abscess.[23]

41% patients had duration of diabetes between 2-5yrs, 22% of the patients had duration of diabetes less than 1 yr and 33% of the patients between 6-10yrs. The average duration of diabetes in this study was *4.83* yrs with standard deviation ± 4.75.44% of patients in our study had lower lung field involvement. It was more common in the age group >50 yrs. (18 out of 30 cases). The p value was <0.005 which is significant. In a study done by Bacakoglu F and others, it was reported that in tuberculous diabetics lower lung field tuberculosis was significantly associated with female gender, and in patients older than 40 yrs.[25,26]In a study done by Ravindran P and others, the incidence of lower lung field tuberculosis among diabetic patients was 13.8 1%.[27]

In our study too, lower lung field involvement was more in patients aged >50 yrs and in females ; the results being comparable to other studies.Non homogeneous opacities (22%) and Cavitatory lesions (38%) were the most common type of lesions noted followed by homogeneous opacities (20%) in the age group above 50 yrs.As reported in many studies, tuberculosis in diabetic patients is associated with extensive caseation of lung tissue and cavitatory lesions with little pleural involvement.[28,29]

In our study also, cavities and non homogeneous opacities were more common compared to other lesions. Multiple cavitations were seen in many patients. Cavitations and infiltrations were more compared to pleural involvement.Our study correlates with most of the above radiological studies with regards to the side of lesion, site of lesion, extent of lesion as well as nature of radiological pattern.

Conclusion:

- The current diabetes epidemic may thus lead to a resurgence of Tuberculosis in endemic regions like India.

- This has potoentially serious implications for tuberculosis control and it must become a priority to initiate focused and and co-ordinated action like case finding, treatment of latent tuberculosis and efforts to diagnose, detect and treat DM may have a beneficial impact on TB control.

References:

1. Sarah Lou Bailey and Paul Grant. The tubercular diabetic : the impact of diabetes mellitus on tuberculosis and its threat to global tuberculosis control. 2011;11(4) : 344-7.
2. Sarah Lou Bailey and Paul Grant. World Health Organization. Global tuberculosis control : a short update to the 2009 report Geneva : WHO, 2009.
3. Crammer and Perachon; 1700
4. Lancet Infect Dis. Tuberculosis and diabetes mellitus: convergence of two epidemics. 2009 December;9(12);737-746.
5. Barach J. Historical facts in diabetes mellitus. Ann Med Hist 1928;10:387.
6. Root H. The association of diabetes and tuberculosis. N Engl J Med 1934;210:1, 78,127.
7. Banerjee S, Banerjee M. Diabetes and tuberculosis interface. J Indian Med Assoc 2005;103:318,320,322 passim.
8.   Bashar M, Alcabes P, Rom WN, Condos R. Increased incidence of multidrug-resistant tuberculosis in diabetic patients on the Bellevue Chest Service, 1987 to 1997. Chest 2001;120:1514–9.
9. Jeon CY,Murray MB. Diabetes mellitus increases the risk of active tuberculosis: a systematic review of 13 observational studies. PLoS Med 2008;5:e152.
10. Stevenson CR, Forouhi NG, Roglic G et al. Diabetes and tuberculosis: the impact of the diabetes epidemic on tuberculosis incidence. BMC Public Health 2007;7:234.
11. Mugusi F, Swai AB, Alberti KG, McLarty DG. Increased prevalence of diabetes mellitus in patients with pulmonary tuberculosis in Tanzania. Tubercle 1990;71:271–6.
12. Restrepo BI, Fisher-Hoch SP, Crespo JG et al. Type 2 diabetes and tuberculosis in a dynamic bi-national border population. Epidemiol Infect 2007;135:483–91.
13. LindosoAA,Waldman EA, Komatsu NK et al. Profile of tuberculosis patients progressing to death, city of Sao Paulo, Brazil, 2002. Rev SaudePublica 2008;42:805–12.
14. Wang CS, Yang CJ, Chen HC et al. Impact of type 2 diabetes on manifestations and treatment outcome of pulmonary tuberculosis. Epidemiol Infect 2009;137:203–10.
15. Dooley KE, Tang T, Golub JE, Dorman SE, Cronin W. Impact of diabetes mellitus on treatment outcomes of patients with active tuberculosis. Am J Trop Med Hyg 2009;80:634–9.
16. Wallace O Fenn,HermannRahn.Hand book of Physiology.3rd edn;45-48.33
17. Harrison's Principles of Internal Medicine,18th Edition,vol-2
18. Sentochnik DE, Eliopoulos GM. Infection and diabetes. In : Kahn CR, Weir GC, editors. Joslin's diabetes mellitus. 13th edition. Vol. 1. New Delhi: BI Waverly Pvt. Ltd; 1996.p.868-873, 881-882.
19. Hoddinott S, Dornan J, Bear JC, Farid NR. Immunoglobulin levels, immunodeficiency and HLA in type 1 diabetes mellitus. Diabetologia1 982;23 :326-29.
20. Vishwanath R. History of tuberculosis. In :Rao KN, Vishwanath R, 78 Deshmukh MD, editors. Textbook of tuberculosis. 2ndedition Vikas publishing house; 1981.p.2-3.

21. Feza B, Ozen KB, Gursel C, Abdullah S, Mahmut A. Pulmonary tuberculosis in patients with diabetes mellitus. Respiration 2001 ;68:595-600.

22. Morris JT, Seaworth BJ, McAllister CK. Pulmonary tuberculosis in diabetics. Chest 1992;102:539-41.

23. King H, Aubert RE, Herman WH. Global burden of diabetes 1995-2005:Prevalence, numerical estimates and projections. Diabetes care 1 998;2 1:14I4.

24. Mona B. Increased incidence of multidrug resistant tuberculosis in diabetic patients on the Bellevue chest service; 1987-1997: clinical investigations. Chest 2001;120:1514-19

25. Tripathy SR, Kar KP, Chakraborthy DC, Majumdar AK. Diabetes mellitus and pulmonary tuberculosis - A prospective study. Ind J Tub 1 984;3 1:122.

26. Iseman MD. Tuberculosis down through the centuries.In :Iseman MD, editor. A clinician's guide to tuberculosis.Philadelphia : Lippincott Williams and Wilkins; 2000.p.9-10.

27. Khanna BK, Khare KS. Clubbing in pulmonary tuberculosis.Ind J Tub 1986;33:11.

28. Kishan J, Garg K, ;tuberculosis and diabetes , department of tuberculosis and chest diseases, Govt medical college, Patiala.SAARC J TUBER.LUNG DIS .HIV/AIDS 2010 VII (2) 34-38.

29. Ezung T, Devi N T, Singh T.B. Pulmonary tuberculosis and diabetes mellitus a study; Department of Medicine, Regional Institute of Medical Sciences, Imphal. J IndianMed Assoc.2002 Jun;100(6):376,378-9.