



ESTIMATE OF PRE-DIABETES AND DIABETES AMONG TB PATIENTS ATTENDING GOVERNMENT HOSPITALS IN HALDWANI OF DISTRICT NAINITAL, UTTARAKHAND.

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ABSTRACT Association between DM and Tuberculosis has been documented throughout history. From the ancient time until the beginning of the twentieth century, diabetes was considered a co-morbidity among tuberculosis patients. This study was conducted to know the prevalence of looming co-epidemic of TB-diabetes as there was lacking of such studies in Uttarakhand. The mean age of the study participants was 37.8±15.9 years. **400 tuberculosis patients** who were registered to DOTS center of Government Medical College, Haldwani and S. S. J. Base Hospital, Haldwani in the third quarter (July to September) of the year 2015 were included in the study by Systematic random sampling. Out of 400 patients, 49(12.3%) patients had Pre-Diabetes and 98(24.5%) had diabetes and prevalence of diabetes was significantly higher in men compared to women [(28.5% vs 18.2%); p=0.02]. As in the general population age, BMI, smoking, non-vegetarian diet and sedentary occupation were the common risk factors associated with diabetes among TB patients.

KEYWORDS : Diabetes, Tuberculosis, DOTS

INTRODUCTION:

Diabetes mellitus has the potential to fuel the epidemic of tuberculosis (TB). The world seems to face a looming co-epidemic of TB-diabetes, and that this is a serious public health issue we need to address urgently. Unaddressed, the consequences could prove catastrophic in areas where tuberculosis and diabetes are endemic. Tuberculosis primarily affects lungs, but can also affect all other extra-pulmonary compartments ex. the lymph nodes, bones, skin, visceral organs and central nervous system¹.

That an association exists between DM and Tuberculosis has also been documented throughout history. From the ancient time until the beginning of the twentieth century, diabetes was considered a co-morbidity among tuberculosis patients². Sushruta's work showed a relationship exists between the two diseases and Avicenna remarked in his *Canon of Medicine* that 'phthisis' is often complicated by DM.³

Now that the relationship between DM and TB has been widely accepted, there has been an influx of various recent studies and publications discussing or investigating the existence and magnitude of any such associations, and the relevance of any such associations but still there is a lacking of such studies in Uttarakhand, especially in Kumaun region. So this study was conducted to know the prevalence of looming co-epidemic of TB-diabetes.

MATERIAL AND METHODS

1. Study Area:

This study was carried out in Government Medical College & Dr. Sushila Tiwari Government Hospital in Haldwani block of district Nainital, Uttarakhand

2. Study design:

It is a hospital based Cross-sectional study.

3. Study population

Tuberculosis Patients who were registered to DOTS center of Government Medical College, Haldwani and S. S. J. Base Hospital, Haldwani in the third quarter (July to September) of the year 2015 were included in the study.

INCLUSION CRITERIA:

All diagnosed TB patients (both pulmonary and extrapulmonary) who gave consent were recruited into the study

EXCLUSION CRITERIA

- Those patients who refuse to participate.
- Patients who were transferred out

4. Sampling method

Systematic Random sampling

5. Sample size

The total sample size was estimated by using the formula: $n = 1.96^2 \frac{PQ}{D^2}$

Level of significance = 5%
Expected prevalence = 50%
Permissible level of error in the estimate = 5%

P = prevalence of morbidity (50%)
Q = (1-P) that is (50%)
D = permissible level of error in the estimate which is taken as 5%

Sample Size (n) = $(1.96)^2 (0.5)(0.5) / (0.05)^2$

= 384.16

= 385 ; so we took 400 TB patients as our sample

k = N/n

= 836/385

= 2.17 ≈ 2

: k is sample interval

: N is total TB patients in both TB unit in 3rd quarter of 2015

: n is sample size calculated.

So we selected every alternate TB patient in our study to complete our sample which was 400.

6. Data collection and interpretation

A pre-designed and pre-tested semi structured questionnaire was used. Fasting blood glucose was done in all patients with a glucometer. Pre diabetes and Diabetes were diagnosed as per WHO guidelines. The sputum smear result, HIV status, and the Tuberculin test were reviewed from the Case Folders.

7. Data analysis and presentation:

Analysis was done using SPSS version 22 and descriptive interpretation of data was done. The comparison of means was done using the student t-test while qualitative variables was compared using the Chi-square test. P value less than 0.05 were taken as significant.

8. Ethical clearance: Ethical clearance was obtained before conducting the study from the Institutional Ethical Committee of Government Medical College, Haldwani.

RESULTS:

The mean age of the study participants was 37.8±15.9 years. Among those male participants (42.5±15.3) years were significantly older than female participants (34.7±15.9) years. Mean BMI of the TB patients was 20.5±4.1 kg/m² with female participants (22.6±5.1 kg/m²) having significantly higher mean BMI than Male (19.8±3.2 kg/m²). Hinduism (73.8%) was the predominant religion among study participants.

Gender difference was significantly noted in sociodemographic

characters like marital status (76% vs 56.5%) with majority of male being married, education (83.3% vs 74%) with majority of male being literate, and occupation (72% vs 39.6%) with majority of male being employed.

Gender difference was not noted in the dwelling areas, i.e., urban vs rural.

Smoking habit in any form (50.8% vs 9.7%) and consumption of alcohol (43.1% vs 3.9%) was significantly higher among male. There was no significant difference in systolic blood pressure whereas diastolic blood pressure was higher in men compared to women (79.4±7.1 vs. 77.8±6.1 mmHg). The proportion of subjects with positive family history of TB was more among men (25.2% vs 14.3%).

Out of 400 patients, 49(12.3%) patients had Pre-Diabetes and 98(24.5%) had diabetes and prevalence of diabetes was significantly higher in men compared to women [(28.5% vs 18.2%); p=0.02].

Table 1: Socio-demographic Characteristic of Study Participants

S no.	Characteristic	Total	Male	Female	P value	
1.	Age (years)	37.8±15.9	42.5±15.3	34.7±15.9	<0.001	
2.	BMI (kg/m ²)	20.5±4.1	19.8±3.2	22.6±5.1	<0.001	
3.	Religion	Hindu	295(73.8)	184(74.8)	111(72.1)	0.08
		Muslim	92(23.0)	56(22.8)	36(23.4)	
		others	13(3.3)	6(2.4)	7(4.5)	
4.	Marital Status	Married	274(68.5)	187(76.0)	87(56.5)	<0.001
		Unmarried	102(25.5)	43(17.5)	59(38.3)	
		Widowed	24(6.0)	16(6.5)	08(5.2)	
5.	Location	Urban	149(37.3)	87(35.4)	62(40.3)	0.32
		Rural	251(62.7)	159(64.6)	92(59.7)	
6.	Education	Illiterate	81(20.3)	41(16.7)	40(26.0)	0.024
		Literate	319(79.7)	205(83.3)	114(74.0)	
7.	Occupation	Unemployed/housewife/student	162(40.5)	69(28.0)	93(60.4)	<0.001
		Employed	238(59.5)	177(72.0)	61(39.6)	
8.	Smoking	Present	140(35.0)	125(50.8)	15(9.7)	<0.001
		Absent	260(65.0)	121(49.2)	139(90.3)	
9.	Alcohol	Present	112(28.0)	106(43.1)	6(3.9)	<0.001
		Absent	288(72.0)	140(56.9)	148(96.1)	
10.	Blood Pressure	SBP	121.8±12.2	121.9±12.9	121.6±11.1	0.73
		DBP	78.8±6.7	79.4±7.1	77.8±6.1	
11.	Family H/O TB	Present	84(21.0)	62(25.2)	22(14.3)	0.009
		Absent	316(79.0)	184(74.8)	132(85.7)	
12.	Pre-Diabetic	Present	49(12.3)	33(13.4)	16(10.4)	0.37
		Absent	351(87.7)	213(86.6)	138(89.6)	
13.	Diabetes	Present	98(24.5)	70(28.5)	28(18.2)	0.02
		Absent	302(75.5)	176(71.5)	126(81.8)	

Comparison of the study characteristics among patients with normoglycemia, prediabetes, and diabetes is shown in Table 2. TB patients with diabetes were older than the subjects with pre-diabetes and non-diabetic (48.2±15.1 vs. 39.8±14.9 vs. 31.7±15.9 years, p<0.001). Mean BMI of patients with diabetes was significantly higher when compared to patients with pre-diabetes and non-diabetic (22.9±4.8 vs 20.6±4.1 vs 19.6±5.2 (p <0.001)). It was also seen that a higher proportion of TB cases with normoglycemia (27.5%) were vegetarian while Smoking habit was significantly higher in Diabetics. There was no significant difference in Diastolic BP while Systolic BP was significantly higher in Diabetics (p=0.01). As expected HbA1c (p<0.001) and Total cholesterol (p<0.001) was significantly higher among Diabetics. Among type of TB case Pulmonary TB was significantly higher among TB patients with Diabetes (p<0.001).

Table 2:

S No.	Characteristic	Pre-Diabetes	Diabetes	Non-Diabetes	P value
1.	Age (years)	39.8±14.9	48.2±15.1	31.7±15.9	<0.001
2.	BMI (kg/m ²)	20.6±4.1	22.9±4.8	19.6±5.2	<0.001

3.	Occupation	Unemployed/housewife/student	14(28.6)	40(40.8)	108(42.7)	0.18
		Employed	35(71.4)	58(59.2)	145(57.3)	
4.	Diet	Vegetarian	5(10.2)	18(18.4)	72(28.5)	0.008
		Non-Veg	44(89.8)	80(81.6)	181(71.5)	
5.	Smoking	Present	9(35.0)	31(50.8)	100(33.1)	0.01
		Absent	28(65.0)	30(49.2)	202(66.9)	
6.	Alcohol	Present	13(37.1)	23(36.5)	76(25.2)	0.08
		Absent	22(62.9)	40(64.5)	226(74.8)	
7.	Blood Pressure	SBP	123.8±12.1	126.9±11.9	121.6±11.3	0.01
		DBP	79.8±7.1	81.4±6.7	78.8±6.4	
8.	HbA1c		6.2±0.5	8.8±2.1	5.7±0.08	<0.001
9.	Total Cholesterol	mg/dl	176.7±10.3	188.3±12.2	164.2±9.9	<0.001
10.	Urea	mg/dl	27.8±5.6	28.1±8.7	27.6±6.2	0.12
11.	Creatinine	mg/dl	0.7±0.21	0.7±0.27	0.6±0.13	0.09
12.	H/O TB	Present	12(24.5)	24(24.5)	48(18.9)	0.42
		Absent	37(75.5)	74(75.5)	205(81.1)	
13.	Type of TB	Pulmonary	39(79.6)	91(92.8)	206(81.0)	<0.001
		Extrapulmonary	10(20.4)	7(7.2)	47(19.0)	

Multivariate analysis showed (Table3) that increasing Age (Age>30 years) was significantly associated with Diabetes among TB patients [8.35(4.11-19.49) p<0.001].

Raised Blood Pressure [2.46(1.25-4.82) p<0.001] was also associated with increased risk of Diabetes. PTB compared to non-PTB was associated with a higher risk of diabetes with an odds ratio of [2.99(1.64-5.45, p<0.001)]

Table 3: Multivariate analysis (Diabetes vs Non-Diabetes)

Explanatory variable	Odds ratio	95% CI	P value
Age	<30	1.00	
	>30	8.35	4.11-19.49 <0.001
BMI	Normal	1.00	
	Abnormal	1.36	0.51-3.74 0.67
Type of TB	Extrapulmonary	1.00	
	Pulmonary	2.99	1.64-5.45 <0.001
History of HTN	Absent	1.00	
	Present	2.46	1.25-4.82 <0.001
Diet	Vegetarian	1.00	
	Non-Vegetarian	1.02	0.54-1.94 0.82
Smoking	Absent	1.00	
	Present	1.05	0.49-1.72 0.32

DISCUSSION:

The present work was conducted to estimate Pre-Diabetes and Diabetes among Tuberculosis patients in Haldwani block of Nainital District. With diabetes on the rise in TB-endemic areas, our findings highlight the impact of diabetes, now type 2, on TB control in regions where both diseases are prevalent.

The present study showed that prevalence rates of DM and pre-diabetes were 24.5% and 12.3% respectively among TB patients registered under RNTCP. Diabetes was more prevalent among men than women (28.5% vs. 18.2%) while there was no gender difference in the prevalence of pre-diabetes. Male predominance can be explained in a way that males are more exposed to risk factors like smoking, tobacco use and alcohol consumption which impact both TB and DM. A case control study conducted in Bangalore, South India, during 2001-2003 reported that chronic disease particularly diabetes was a significant risk factor for developing TB. The prevalence rates of diabetes in TB and non-TB subjects were 22.2% and 15.9% respectively.

A nationwide INDIAB study⁵ conducted in the general population of Tamil Nadu, South India, showed that the prevalence rates of diabetes and pre-diabetes were 10.4% and 8.3% respectively, substantially lower in comparison with the estimated prevalence of DM and pre-diabetes in the current study among TB patients.

As in the general population age, BMI, smoking, non-vegetarian diet

and sedentary occupation were the common risk factors associated with diabetes among TB patients, in the present study.

Multivariate analysis showed that increasing Age was significantly associated with Diabetes among TB patients. The odds were greatly increased with age >30 years. Raised Blood Pressure was also associated with increased risk of Diabetes. TB patients with raised BP were having twice the risk of developing DM. Association of DM with PTB particularly for smear positive cases in this study was similar to that of the findings of Stevenson et al.⁶ This higher association was not seen with extrapulmonary TB.

Several recent reports indicate the need to consider the increasing trend in prevalence of diabetes in countries like India, which will impact the TB burden as well⁷. Considering the growing trend in prevalence of diabetes and huge burden of latent TB infection amongst Indian population, it is necessary to focus on diagnosis of latent TB infection and screening for DM and ensuring good metabolic control amongst those diagnosed with DM.

Moreover, there is a need for greater collaboration between RNTCP and National Program for Prevention and Control for Cancer, Diabetes, Cardiovascular Diseases and Stroke (NPCDCS) in India to ensure that protocols and guidelines are in place to address the dual burden.

This converging of two epidemics should be a wakeup call for all clinicians and researchers to gearup to meet the challenge of patients afflicted by tuberculosis as well as diabetes.

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