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A STUDY OF CLINICO-BACTERIOLOGICAL-RADIOLOGICAL PROFILE OF PULMONARY TUBERCULOSIS IN DIABETIC PATIENTS WITH SPECIAL REFERENCE TO RIFAMPICIN RESISTANCE

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ABSTRACT

Background: It was observed that patients who have DM complicated with TB often experience delayed sputum culture conversion, increased risk of death and recurrence. The emergence of MDR-TB makes the adverse anti-TB treatment outcomes in TB-DM comorbidity even worse, which may increase treatment related economic burden, promote the transmission of MDR-TB, and even accelerate the generation of extensively drug-resistant-TB (XDR-TB). **Aim and Objectives:** With the above background, the current study was planned to study the clinical profile, radiological presentation and the pattern of drug resistance of pulmonary tuberculosis in diabetics. **Materials and Methods:** The present prospective-observational study was conducted amongst the patients attending OPD and in the ward of Department of Pulmonary Medicine, SRMS IMS, Bareilly. A total of 60 patients of tuberculosis including both old and newly detected cases of diabetes were included in the study excluding extra-pulmonary tuberculosis, patients who developed transient hyperglycaemia on starting anti TB treatment and those who were not willing to participate. **Result:** Using the GenExpert kit, we found rifampicin resistance to be 8.33% in present study. Productive cough (73.3%), breathlessness (96.7%), chest pain (58.3%) and fever (71.7%) were the major presenting clinical features. On Chest X-ray, majority had unilateral involvement (81.7%). Infiltration (41.8%) and consolidation (31.7%) were the most common X-ray abnormalities. **Conclusion:** Present study and other contemporary studies from different parts of India indicate a high rifampicin resistance rate, thus indicating the need to address this problem.

KEYWORD: Tuberculosis, Diabetes, Rifampicin Resistance, GenExpert

INTRODUCTION

The Global Tuberculosis Report 2017 reveals that an estimated 10.4 million people fell ill with TB in 2016: 90% were adults, 65% were male, 10% were people living with HIV (74% in Africa) and 1.67 million died from the disease. India accounted for 26% of global TB deaths.[1]

TB remains a major public health problem in India with incidence of 211 per lakh, accounting for 25% of all TB cases reported globally.[1,2] In 2011, out of the estimated global annual incidence of 9 million TB cases, nearly 2.3 million were estimated to have occurred in India (**GOI, 2013**).[3]

The global prevalence (age-standardized) of diabetes has nearly doubled since 1980, rising from 4.7% to 8.5% in the adult population.[4] According to the Diabetes country profiles 2016 published by the World Health Organization, the prevalence of diabetes in India was 7.8% being slightly higher in males (7.9%) than in females (7.5%).[5]

The growing prevalence of TB-DM comorbidity worldwide has provided a new challenge to clinical management and health systems control strategy.[6] It was observed that patients who have DM complicated with TB often experience delayed sputum culture conversion, increased risk of death and recurrence.[7-10]

A number of systematic reviews and meta-analyses show that not only people with DM have a 2–3 times higher risk of developing active TB but also experience more adverse TB treatment outcomes: with delayed sputum

culture conversion, an increased risk of death during anti-TB treatment and an increased risk of recurrent disease after successful completion of treatment.[11]

The emergence of MDR-TB makes the adverse anti-TB treatment outcomes in TB-DM comorbidity even worse, which may increase treatment related economic burden, promote the transmission of MDR-TB, and even accelerate the generation of extensively drug-resistant-TB (XDR-TB). Many studies indicate significant. association between DM and MDR-TB, i.e., patients with DM were more likely to have MDR-TB. DM is also found to be independent risk factor for primary MDR-TB.[12]

AIM AND OBJECTIVES

With the above background, the current study was planned to

1. Study the clinical profile of pulmonary tuberculosis in diabetics.
2. Study the radiological presentation of pulmonary tuberculosis patients with diabetes.
3. Study the pattern of drug resistance in diabetes.

MATERIALS AND METHODS

The present prospective-observational study was conducted over a period of one year amongst the patients attending the outpatient department and in the ward patients of Department of Pulmonary Medicine, Shri Ram Murti Smarak Institute of Medical Sciences (SRMS IMS) at Bareilly, Uttar Pradesh. A total of 60 patients of tuberculosis attending the outpatient department and, in the ward, including both old and newly detected cases of diabetes were included in the study excluding extra-pulmonary tuberculosis, patients who developed transient hyperglycaemia on starting anti TB treatment and those who were not willing to participate.

Face-to-face interview in the presence of one family member, preferably care-taker of the patient or closely related were conducted. Information about the purpose of study was given to all study subjects, rapport was developed and voluntary informed consent was taken before filling the pre-designed, pre-tested semi-structured questionnaire.

A detailed history was taken with particular reference to demographic information, socioeconomic status and family history of tuberculosis. A thorough general physical and systemic examination was carried out. All cases were subjected to haemogram, hepatic and renal function tests, blood sugar, and chest X-ray (PA view).

Apart from known cases of diabetes, patients of pulmonary tuberculosis were screened for diabetes mellitus according to the criteria laid in the Classification and Diagnosis of Diabetes: Standards of Medical Care in Diabetes 2018 by the American Diabetes Association (ADA).

All patients were directed to collect the early morning sputum specimen in a sterilized wide-mouthed bottle with a tightly fitting cork stopper. Sputum was sent for smear for Acid-Fast Bacilli (AFB) on three consecutive days. Drug resistance pattern was studied using GENEXPERT test.

Data were entered using Microsoft Excel 2013 and statistical analysis was done using IBM SPSS v 20.0.0. Categorical variables were analysed using proportions and percentages. Association between categorical variables was established by Chi square and odds ratio (OR) with 95% confidence intervals (CI) where applicable. Continuous variables were summarized by mean and standard deviation (SD), and association tested by parametric tests.

RESULTS

Table. 1: Distribution of study subjects according to age and sex.

AGE (Yrs)	Female		Male		Total	
	N	%	N	%	N	%
≤ 30	2	16.7	4	8.3	6	10.0
31 - 40	0	0.0	15	31.3	15	25.0
41 - 50	3	25.0	8	16.7	11	18.3
51 - 60	5	41.7	10	20.8	15	25.0
> 60	2	16.7	11	22.9	13	21.7
Total	12	100.0	48	100.0	60	100.0
Mean ± SD	52.00 ± 12.41		49.23 ± 15.32		49.78 ± 14.73	

Majority of the subjects (48, 80%) were males. Most of the study subjects fell in the age group of 31-40 years (15, 25%) and 51-60 years of age (15, 25%). The mean age of the study subjects was 49.78 ± 14.73 years. Cough was the most common presenting complaint present for more than two weeks' period in majority of subjects (37, 61.7%). Second most common presenting complaint was fever, present in most of the study subjects for less than two weeks' period (38, 63.4%) followed by loss of appetite (46, 76.7%), breathlessness (38, 63.3%), chest pain (23, 38.3%) and lastly haemoptysis (15, 25.0%).

Table. 2: Distribution of study subjects based on clinical profile.

			Frequency	Percent
Presenting Complaints	Cough	< 2 weeks	23	38.3
		> 2 weeks	37	61.7
	Haemoptysis	Absent	45	75.0
		Present	15	25.0
	Breathlessness	Absent	22	36.7
		Present	38	63.3
	Fever	Absent	3	5.0
		< 2 weeks	38	63.4
		> 2 weeks	19	31.7
	Chest pain	Absent	37	61.7
		< 2 weeks	16	26.7
		> 2 weeks	7	11.6
	Loss Appetite	Absent	14	23.3
		Present	46	76.7
AFB		Negative	2	3.3
		Positive	58	96.7
Treatment status		New case	45	75.0
		Recurrent	12	20.0
		TALTFU[@]	3	5.0
Total			60	100.0

[@] Treatment After Loss To Follow-Up

It was evident that majority of the patients (58, 96.7%) were positive for acid-fast bacilli (AFB positive). A high proportion of the patients (45, 75.0%) enrolled in this study were newly diagnosed cases of pulmonary tuberculosis, followed by relapse (12, 20.0%) and the smallest proportion of patients were TALTFU.

Majority of the patients (49, 81.7%) had a unilateral lesion. On dissevering the lesions on a zonal basis, it was evident that maximum lesions were found in the upper zone (36, 60.0%) followed by lower zone (15, 25.0%) and least in the middle zone (3, 5.0%). A small proportion of lesions (6, 10.0%) were distributed over more than one zones. It was also observed that the highest proportion of study subjects had cavity only (24, 40.0%) followed by infiltrates only (16, 26.7%), followed by those who had cavity and infiltrates (12, 20.0%), followed by fibrocavitatory lesions (7, 11.7%). Only one subject had miliary appearance (1.7%).

Table 4 shows that resistance to Rifampicin was found only in a small proportion (8, 13.3%). Majority of the study subjects (37, 61.7%) were known old cases of diabetes and in this subgroup resistance to rifampicin was observed in (5, 13.5%) patients. A similar pattern of sensitivity and resistance was also observed amongst the newly diagnosed cases of diabetes (20; 86.9% and 3; 13.1% respectively). The difference in proportions was found to be insignificant statistically (z = -0.0521; p-value = 0.9601).

Table. 3: Distribution of diabetic tuberculosis patients according to radiographic findings.

Chest X-Ray		Frequency	Percent
CXR	Bilateral involvement	11	18.3
	Unilateral involvement	49	81.7
Zone	Upper zone	36	60.0
	Middle zone	3	5.0
	Lower zone	15	25.0
	>1 zones	6	10.0
Lesion	Cavity	24	40.0
	Infiltrates	16	26.7
	Fibrocavity	7	11.7
	Cavity + Infiltrates	12	20.0
	Miliary	1	1.7
	Total	60	100.0

Table. 4: Distribution of drug sensitivity pattern in diabetes.

Diabetes mellitus	**Newly diagnosed**			**Known cases**		
Resistant	3(13.3%)			5(13.5%)		
Sensitive	20(86.9%)			32(86.5%)		
Total	23(100.0%)			37(100.0%)		
p-value = 0.9601						
HbA_{1c}	**< 6.5**	**6.5 - 7.5**	**7.5 - 8.5**	**8.5 - 9.5**	**≥ 9.5**	**Mean ± SD**
Resistant	0(0.0%)	3(15.8%)	0(0.0%)	3(42.9%)	2(7.7%)	8.83 ± 2.17
Sensitive	1(100.0%)	16(84.2%)	7(100.0%)	4(57.1%)	24(92.3%)	9.27 ± 2.36
Total	1(100.0%)	19(100.0%)	7(100.0%)	7(100.0%)	26(100.0%)	9.21 ± 2.32
p-value 0.616						
Fasting	**< 126**	**126 - 199**		**≥ 200**		**Mean ± SD**
Resistant	0(0.0%)	5(16.1%)		3(12.0%)		199.00 ± 18.52
Sensitive	4(100.0%)	26(83.9%)		22(88.0%)		201.27 ± 56.49
Total	4(100.0%)	31(100.0%)		25(100.0%)		200.97 ± 52.91
p-value 0.911						
Post-Prandial	**< 200**	**200 - 299**		**≥ 300**		**Mean ± SD**
Resistant	1(8.3%)	5(14.7%)		2(14.3%)		276.50 ± 79.34
Sensitive	11(91.7%)	29(85.3%)		12(85.7%)		244.73 ± 59.51
Total	12(100.0%)	34(100.0%)		14(100.0%)		248.97 ± 62.66
p-value 0.184						

Only one subject had HbA_{1c} below 6.5%. Highest proportion of subjects (26, 43.3%) had a very poor glycaemic control with HbA_{1c} of 9.5% or above, followed by those subjects (19, 31.7%) who had maintained near normal glycaemic control with HbA_{1c} between 6.5%-7.5%. Mean HbA_{1c} levels of the study population came out to be 9.21 ± 2.32. All groups exhibited higher proportions of mycobacterium sensitive rather than resistant to Rifampicin. The differences in the means of HbA_{1c} levels of the two groups were not significant statistically (p-value 0.616).

Most of the study subjects had raised levels of fasting blood sugar with majority (31, 51.7%) having fasting blood sugar between 126 mg/dL and 199 mg/dL followed by those (25, 41.7%) having fasting blood sugar of 200 mg/dL or above. A similar pattern of sensitivity and resistance was present among all subgroups. The mean fasting blood sugar of the study population came out to be 200.97 ± 52.91. The means of fasting blood sugar of the study population for sensitive and resistant patients were 201.27 ± 56.49 and 199.00 ± 18.52 respectively and this difference in the means of the two groups was not significant statistically (p-value 0.911).

Most of the study subjects had raised levels of post-prandial blood sugar with majority (34, 56.7%) having post-prandial blood sugar between 200 mg/dL and 299 mg/dL followed by those (14, 23.3%) having post-prandial blood sugar of 300 mg/dL or above. A similar pattern of sensitivity and resistance was present seen amongst all subgroups. The mean post-prandial blood sugar of the study population came out to be 248.97 ± 62.66. The means of post-prandial blood sugar of the study population for sensitive and resistant patients were 244.73 ± 59.51 and 276.50 ± 79.34 respectively and this difference in the means of the two groups was not significant statistically (p-value 0.184).

DISCUSSION

In the present study majority of the subjects (48, 80%) were males similar to the study conducted by **Singla R *et al*[7]** (75.9% males, 24.1% females) and **Viswanathan AA *et al*[13]** (males 80.9% and females 19.1%) while in contrast to **Baghaei P *et al*[14]** (42.6% males, 57.4% females) perhaps due to different social settings in a different geographical area.

The mean age of the study subjects was 49.78 ± 14.73 years which was similar to **Kang YA *et al*[15]** but less than **Farrag MA *et al*[16]** who reported mean age of diabetic tuberculosis patients as 49.9±11.3 years and 53.36 years respectively probably owing to a different study design in a varying socio-cultural population as the **Farrag MA *et al*[16]** study was carried out at a DOTS Centre in Egypt retro-prospectively.

It was observed that cough was the most common presenting complaint present in all the study subjects with variation only in duration of cough at the time of presentation. At the time of presentation, cough was present for more than two weeks' period in majority of subjects (37, 61.7%) and for less than 2 weeks in all the remaining subjects (23, 38.3%). These findings were consistent with the findings of **Hashim KPA *et al*[17]** and **Farrag MA *et al*[16]** who also reported all diabetic tuberculosis patients as having cough at the time of presentation. Whereas cough at the time of presentation was reported as 97.9% by **Baghaei P *et al*[14]** and 85% by **Singla R *et al*[7]** perhaps owing to a different study design and also because they have excluded more severe cases with military tuberculosis.

Second most common presenting complaint was fever, present in 57 (95%) of the patients. Alike cough, fever was present in most of the study subjects for less than two weeks' period (38, 63.4%) and for more than two weeks' period in the remaining subjects (19, 31.7%). Proportion of febrile patients was higher but similar to other studies in which **Hashim KPA *et al*[17]** reported fever as 83.8%, **Singla R *et al*[7]** reported as 80.7% and **Baghaei P *et al*[14]** reported 76.6% possibly because of mostly urban patients with better educational status and awareness of healthcare services and their utilization with even trivial health problems like cough even before development of fever.

The presenting complaint next in order of being commonly shared by the subjects was loss of appetite (46, 76.7%), followed by breathlessness (38, 63.3%), chest pain (23, 38.3%) amongst which it was present for less than two weeks in majority of subjects (16, 26.7%) and lastly haemoptysis (15, 25.0%). Dyspnoea was reported higher in the study conducted by **Hashim KPA *et al*[17]** as 82.2% feasibly due to exclusion of patients taking steroids which could have led to suppression of cough whereas lower reports were given by **Baghaei P *et al*[14]** (48.9%) who studied only newly diagnosed cases and **Farrag MA *et al*[16]** (41%) who did their study at a DOTS centre in retrospect which could be a source of recall bias and incompleteness of records.

The acid-fast positivity for mycobacterium as seen on Zeil-Nelson staining in sputum samples collected from diabetic tuberculosis patients showed that majority of the patients (58, 96.7%) were positive for acid-fast bacilli (AFB positive). AFB positivity in the sputum samples of diabetic tuberculosis patients was reported similar by **Hashim KPA *et al*[17]** at 91.8% and much lower by **Kang YA *et al*[15]** at 69% probably because our study was conducted in our department of pulmonary medicine increasing the propensity of pulmonary tuberculosis patients whereas **Kang YA *et al*[15]** included culture proven MDR-TB patients from all national TB hospitals , all Korean National Tuberculosis Association (KNTA) chest clinics and eight randomly selected university hospitals near Seoul thereby increasing the proportion of sputum negative cases as well as extrapulmonary tuberculosis cases in their study.

Newly diagnosed cases of pulmonary tuberculosis constituted a high proportion of the study patients (45, 75.0%), followed by those patients who had completed their course of treatment in the past and had had a relapse of the disease (12, 20.0%) and the smallest proportion of patients were those who had initiated their treatment for pulmonary tuberculosis in the past but had discontinued treatment after one month of initiating it (3, 5.0%), now known as Treatment After Loss To Follow-Up (TALTFU) patients. Proportion of newly diagnosed cases in our study was much higher as compared to studies conducted by **Kang YA *et al*[15]** in a different geographical area with lower incidence and **Vishwanathan AA *et al*[13]** in a district achieving global targets of cure rates including only tuberculosis patients registered with RNTCP who reported new cases of smear positive pulmonary tuberculosis in diabetic patients as 33.8% and 44.9% respectively. **Vishwanathan AA *et al*[13]** reported an additional new smear negative pulmonary and new extrapulmonary tuberculosis cases in diabetic patients as 40.4% making a total of new cases of tuberculosis in diabetic patients in their study as 85.3% which is higher than the proportions in our study.

In our study unilateral lesion was present in majority of the chest radiographs of pulmonary tuberculosis patients with diabetes (49, 81.7%) while the remaining (11, 18.3%) patients had a bilateral lesion. Our results were similar to the study conducted by **Baghaei P *et al*[14]** who reported unilateral lesion in 82.2% of the subjects and bilateral lesion in 17.8% of the study subjects. But these proportions were in contrast to the studies conducted by **Farrag MA *et al*[16]** (52%) including only sputum positive pulmonary tuberculosis patients from a DOTS centre excluding patients with chronic liver disease, renal failure and HIV comorbidities and **Kang YA *et al*[15]** (29.9%) who included patients from all national TB hospitals , all Korean National Tuberculosis Association (KNTA) chest clinics and eight randomly selected university hospitals near Seoul who were culture proven MDR-TB thereby increasing the proportion of extrapulmonary tuberculosis cases in their study.

When we dissevered the lesions on a zonal basis, it was evident in our study that maximum lesions were found in the upper zone (36, 60.0%) followed by lower zone (15, 25.0%) and least in the middle zone (3, 5.0%). A small proportion of lesions (6, 10.0%) were distributed over more than one zones. Higher proportions were reported in the study conducted by **Hashim KPA *et al*[17]**, upto 87.7% in the upper zone, 82.2% in the middle zone and 28.8% in the lower zone which was due to overlap and non-contingency in reported zonal percentages. Contrasting zonal division of lesions was reported by **Farrag MA *et al*[16]** as upper zone lesions 36%, lower zone lesions 18% and multizonal lesions 46% possibly because the study design was different and the study was conducted in a different geographical region restricted to sputum positive pulmonary tuberculosis patients from a DOTS centre excluding patients with chronic liver disease, renal failure and HIV comorbidities.

In our study the most common type of lesion present on chest x-ray of the diabetic tuberculosis patients enrolled in the study was observed to be cavity only (24, 40.0%) followed by infiltrates only (16, 26.7%), followed by those who had cavity and infiltrates (12, 20.0%), followed by fibrocavitatory lesions (7, 11.7%). Only one subject had miliary appearance (1.7%). Similar patterns were observed on dividing the study subjects into groups resistant and sensitive to rifampicin on GeneXpert. None of the study subjects in the resistant group showed infiltrates or miliary shadows on chest x-ray. These

results were more or less similar to the studies conducted by **Kang YA *et al*[15], Hashim KPA *et al*[17]** and **Farrag MA *et al*[16]** who reported proportions of cavitatory lesions as 45.2%, 39.7% and 26.0% respectively.

In the present study it was seen that majority of diabetic tuberculosis patients (52, 86.7%) had mycobacterium sensitive to Rifampicin as seen by Gene Xpert and resistance to Rifampicin was found only in a small proportion (8, 13.3%). This proportion was higher than reported by **Leung CC *et al*[18]** (0.8%) in their Chinese study where incidence of MDR-TB is lower than that in India and **Sanchez GD *et al*[19]** (9.97%) in their Mexican study where both prevalence and incidence of MDR-TB are lower than that in India but lower than that reported by **Mehta S *et al*[20]** (27.3%) from the OPD of a rural hospital in Andhra Pradesh which is even higher than the National anti-TB drug resistance survey report for Andhra Pradesh (0.55% in new cases and 7.89% in previously treated cases).

In the present study it was observed that only one subject had maintained good glycaemic control as evident by HbA_{1c} levels below 6.5% and all other 59 (98.3%) subjects had HbA_{1c} levels above 6.5%. Highest proportion of subjects (26, 43.3%) had a very poor glycaemic control with HbA_{1c} of 9.5% or above, followed by those subjects (19, 31.7%) who had maintained near normal glycaemic control with HbA_{1c} between 6.5%-7.5% and smallest proportion of subjects (7; 11.7% and 7; 11.7% respectively) had bad glycaemic control with HbA_{1c} between 7.5%-8.5% and 8.5%-9.5%. The mean HbA_{1c} of the study population came out to be 9.21 ± 2.32which was much higher than the proportion and means reported by **Ginandjar P *et al*[21]** in their study (29% subjects had HbA_{1c} levels above 7% and mean was 7.25 ± 2.7) because their study included diabetic as well as non-diabetic tuberculosis patients.The means of HbA_{1c} of the study population for sensitive and resistant patients were found to be 9.27 ± 2.36 and 8.83 ± 2.17 respectively. The differences in the means of the two groups were not significant statistically (p-value 0.616).

On observing the pattern of sensitivity of mycobacterium to Rifampicin as seen by Gene Xpert according to glycaemic control of the studied diabetic tuberculosis patients, it was observed that 8 (13.6%) patients with HbA_{1c} levels above 6.5% were resistant to Rifampicin and a similar pattern of sensitive and resistant mycobacterium was present among all subgroups of HbA_{1c}. All groups exhibited higher proportions of mycobacterium sensitive rather than resistant to Rifampicin. These proportions were less than 29.7% resistant proportions reported in patients with HbA_{1c} levels above 6.5% by **Magee MJ *et al*[22]** in their study possibly because the studywas conducted at the National Center for TB and Lung Disease (NCTLD) in Tbilisi which is the largest TB treatment and referral facility in Georgia thereby having proclivity of receiving referred patients with more severe disease just like Berksonian bias.

In our study it was observed that most of the study subjects had raised levels of fasting blood sugar with majority (31, 51.7%) having fasting blood sugar between 126 mg/dL and 119 mg/dL followed by those (25, 41.7%) having fasting blood sugar of 200 mg/dL or above. A very small proportion (4, 6.7%) had normal range fasting blood sugar below 126 mg/dLwhich was much lower than 38.1% diabetic tuberculosis patients having normal range fasting blood sugar below 126 mg/dL in the study conducted by **Lina Y *et al*[23]** probably due to a smaller sample size and varying prevalence in their geographic area.

On observing the pattern of sensitivity of mycobacterium to Rifampicin as seen by Gene Xpert amongst the studied diabetic tuberculosis patients according to levels of fasting blood sugar, it was seen that that a similarly pattern of sensitive and resistant mycobacterium was present among all subgroups. All groups exhibited higher proportions of mycobacterium (>83% in all groups) sensitive rather than resistant to Rifampicin.

The means of fasting blood sugar of the study population for sensitive and resistant patients were 201.27 ± 56.49 and 199.00 ± 18.52 respectively. The differences in the means of the two groups were not significant statistically (p-value 0.911).The mean fasting blood sugar of the study population came out to be 200.97 ± 52.91 which was much higher than the means reported by **Ogbera AO *et al*[24]** in their study (165.77 ± 115.32 in known cases of diabetes mellitus and 169.37 ± 79.28 in new cases of diabetes mellitus) because their study included diabetic as well as non-diabetic tuberculosis patients.

In the present study it was seen that most of the study subjects had raised levels of post-prandial blood sugar with majority (34, 56.7%) having post-prandial blood sugar between 200 mg/dL and 299 mg/dL followed by those (14, 23.3%) having post-prandial blood sugar of 300 mg/dL or above. A very small proportion (4, 6.7%) had normal range post-prandial blood sugar below 200 mg/dL which was much lower than 82.79% diabetic tuberculosis patients having normal range post-prandial blood sugar below 200 mg/dL in the study conducted by

Ushanagadevi CS *et al*[25] probably because they included patients of newly diagnosed young sputum positive tuberculosis patients attending the outpatient clinic of Department of Thoracic Medicine GRH, Madurai excluding known cases of diabetes mellitus.

On observing the pattern of sensitivity of mycobacterium to Rifampicin as seen by Gene Xpert amongst the studied diabetic tuberculosis patients according to levels of post-prandial blood sugar, it was seen that that a similarly pattern of sensitive and resistant mycobacterium was present among all subgroups. All groups exhibited higher

proportions of mycobacterium (>85% in all groups) sensitive rather than resistant to Rifampicin.

The mean post-prandial blood sugar of the study population came out to be 248.97 ± 62.66. The means of post-prandial blood sugar of the study population for sensitive and resistant patients were 244.73 ± 59.51 and 276.50 ± 79.34 respectively. The differences in the means of the two groups were not significant statistically (p-value 0.184).

CONCLUSION

Cough and fever were the most common presenting symptom followed by loss of appetite, breathlessness, chest pain and hemoptysis in descending order. Unilateral lesions were much plebeian than bilateral lesions with predilection for upper zone, followed by lower zone and then middle zone. Cavitatory lesions are the commonest finding on radiograph followed by infiltrates. Rifampicin resistance by Gene Xpert was seen in 8 (13.3%) cases with similar proportion in newly diagnosed and known cases of diabetes. The difference in proportions of rifampicin resistance in short term and long term glycemic control was similar and not found significant statistically.

REFERENCES

1. Global tuberculosis report 2017. Geneva: World Health Organization; 2017.
2. World Health Organization: WHO Report on Global Tuberculosis Control: Epidemiology, Strategy, Financing. Geneva: World Health Organization; 2011.
3. Government of India. TB India-2013. Revised National TB Control Programme, Annual Status Report. Central TB Division, Directorate General of Health Services, Ministry of Health and Family Welfare, Government of India. 2013.
4. Global report on Diabetes 2016. Geneva: World Health Organization; 2016.
5. World Health Organization – Diabetes country profiles, 2016. Geneva: World Health Organization; 2016.
6. Ugarte-Gil C, Moore DA. Tuberculosis and diabetes co-morbidity: an unresolved problem. Revista peruana de medicina experimental y salud publica, 2014; 31: 137–142.
7. 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. The international journal of tuberculosis and lung disease: the official journal of the International Union against Tuberculosis and Lung Disease, 2006; 10: 74–79.
8. Baker MA, Harries AD, Jeon CY, Hart JE, Kapur A, Lönnroth K et al. The impact of diabetes on tuberculosis treatment outcomes: a systematic review. BMC medicine, 2011; 9: 81.
9. Leung, C. C. et al. Lower risk of tuberculosis in obesity. Archives of internal medicine, 2007; 167: 1297–1304.
10. Mi, F. et al. Diabetes mellitus and tuberculosis: pattern of tuberculosis, two-month smear conversion and treatment outcomes in Guangzhou, China. Tropical medicine & international health, 2013; 18: 1379–1385.
11. Kumar A, Jain DC, Gupta D, Satyanarayana S, Kumar AMV, Chadha SS et al. Screening of patients with tuberculosis for diabetes mellitus in India. Tropical Medicine and International Health 2013 May; 18(5): 636–645.
12. Liu Q, Li W, Xue M, Chen Y, Du X, Wang C et al. Diabetes mellitus and the risk of multidrug resistant tuberculosis: a meta-analysis. Scientific Reports 2017; 7: 1090.
13. Viswanathan AA, Gawde NC. Effect of type II diabetes mellitus on treatment outcomes of tuberculosis. Lung India 2014; 31(3): 244-48.
14. Baghaei P, Tabarsi P, Abrishami Z, Mirsaeidi M, Faghani YA, Mansouri SD. Comparison of Pulmonary TB Patients with and without Diabetes Mellitus Type II. Tanaffos 2010; 9(2): 13-20.
15. Kang YA, Kim SY, Jo KW, Kim HJ, Park SK, Kim TH. Impact of Diabetes on Treatment Outcomes and Long-Term Survival in Multidrug-Resistant Tuberculosis. Respiration 2013; 86: 472–478.
16. Farrag MA, Dwedar IA, Samy NM. Study of pulmonary tuberculosis in type 2 diabetes in reference to clinical, radiological presentation and response to treatment. Egy J Chest Dis and Tb, 2017; 66: 745–749.
17. Hashim KPA, Muhammed Anas Ayoob MA. Impact of diabetes mellitus on clinical presentation and treatment response of smear positive pulmonary tuberculosis patients. Int J Res Med Sci. 2017 Apr; 5(4): 1245-1251.
18. Leung CC, Yew WW, Mok TYW, Lau KS, Wong CF, Chau CH et al. Effects of diabetes mellitus on the clinical presentation and treatment response in tuberculosis. Respirology, 2017; 22: 1225–1232.
19. Sánchez GD, García LG, Joya MC, Hervert PC, Reyes LF, Guerrero EF, et al. Association of Pulmonary Tuberculosis and Diabetes in Mexico: Analysis of the National Tuberculosis Registry 2000– 2012. PLoS ONE, 2015; 10(6): e0129312.
20. 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 Infectious Diseases, 2015; 15: 451-55.
21. Ginandjar P, Saraswati LD, Widjanarko B. Profile of glycated-hemoglobin, antioxidant vitamin and cytokine levels in pulmonary tuberculosis patients: A cross sectional study at Pulmonary Diseases Center Semarang City, Indonesia. Biomed J 2016; 39(5): 354-360.
22. Magee MJ, Kempker RR, Kipiani M, Gandhi NR, Darchia L, Tukvadze N et al. Diabetes mellitus is associated with cavities, smear grade, and multidrug

resistant tuberculosis in Georgia. Int J Tuberc Lung Dis., 2015; 19(6): 685–692.
23. Lina Y, Yuanb Y, Zhaoc X, Liud J, Qiue L, Hef X et al. The change in blood glucose levels in tuberculosis patients before and during anti-tuberculosis treatment in China. Global Health Action, 2017; 10: e1289737.
24. Ogbera AO, Kapur A, Abdur-Razzaq H, Harries AD, Ramaiya K, Adeleye O et al. Clinical profile of diabetes mellitus in tuberculosis. BMJ Open Diabetes Research and Care, 2015; 3: e000112.
25. Ushanagadevi CS. A study on glucose tolerance test in young sputum positive tuberculosis patients [MD thesis]. Chennai, Tamil Nadu: Madurai Medical College, The Tamil Nadu Dr.M.G.R. Medical University, 2007.