Scholars Journal of Applied Medical Sciences (SJAMS) **ISSN 2320-6691(Online)**
Sch. J. App. Med. Sci., 2013; 1(6):739-744 **ISSN 2347-954X (Print)**

(An International Publisher for Academic and Scientific Resources)
www.saspublishers.com DOI: 10.36347/sjams.2013.v01i06.0020

Research Article

A Study of Oral Glucose Tolerance in Pulmonary Tuberculosis

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Abstract: The present study was aimed to find the incidence of OGT and it's clinical profile in patients with pulmonary tuberculosis. Method: Study included 75 patients with positive sputum smear for acid fast bacilli and chest x-ray. Results: AFB findings showed positive in 73.33% in sample 1 and 76% in sample2.on chest x-ray almost half(49.33%) of the patients had infiltration. No statistically significant association of sex, age and chest x-ray findings was seen in patients with pulmonary tuberculosis and diabetes mellitus.
Keywords: Diabetes mellitus, Glucose tolerance test, impaired glucose tolerance, pulmonary tuberculosis.

INTRODUCTION

Tuberculosis (TB) is an infectious disease caused by the bacillus *Mycobacterium tuberculosis*. It typically affects the lungs (pulmonary TB) but can affect other sites as well (extra pulmonary TB). The disease spreads by droplet infection when people suffering from pulmonary TB expel bacteria, for example by coughing. In general, a relatively small proportion of people infected with *Mycobacterium tuberculosis* will go on to develop TB disease; however, the probability of developing TB is much higher among people infected with HIV. TB is also more common among men than women, and affects mostly adults in the economically productive age groups; around two-thirds of cases are estimated to occur among people aged 15–59 years [1].

Despite dramatic improvements in public health and medical care, Mycobacterium tuberculosis remains as much of a threat in the 21st century as it was when first identified as a pathogen by Koch in 1882. Tuberculosis (TB) is a major cause of morbidity and mortality throughout the world. One-third of the world's population is infected with the TB bacillus. The WHO cites TB as the single most important fatal infection, with around 8.8 million new cases and 1.4 million deaths per year, 95% in developing countries [2].

Tuberculosis is a major public health problem in India. In 2010, there were 2 to 2.5 million new cases accounting for one quarter of the total cases worldwide [1]. The impact of tuberculosis (TB) can be devastating, especially in developing countries suffering from high burdens of both TB and humanimmunodeficiency virus (HIV) infections. Tuberculosis, is a major barrier to economic development of the country costing India about Rs. 12,000 crore a year [3].

The issue of increasing drug resistant strains has lead to increase in TB incidence over the last decade, in both developing and developed countries. Drug resistance in tuberculosis (TB) is a matter of great concern for TB control programs since there is no cure for some multidrug-resistant strains of *M. tuberculosis*. There is concern that these strains could spread around the world, stressing the need for additional control measures, such as new diagnostic methods, better drugs for treatment, and a more effective vaccine. MDR-TB, defined as resistance to at least rifampicin (RIF) and isoniazid (INH), is a compounding factor for the control of the disease, since patients harboring MDR strains of *M. tuberculosis* need to be entered into alternative treatment regimens involving second-line drugs that are more costly, more toxic, and less effective. Moreover, the problem of extensively drug resistant (XDR) strains has recently been introduced [4].

Diabetes Mellitus is a metabolic disorder of multiple etiologies characterized by chronic hyperglycemia with disturbances of carbohydrate, fat and protein metabolism resulting from defects in insulin secretion, insulin action or both. Diabetes mellitus (DM) is a chronic and potentially disabling disease which is reaching an epidemic proportion in many parts of the world. It is a major and growing threat to global public health. The biggest impact of the disease is on adults of working age; particularly in developing countries. The vast majority of cases of the diabetes fall into two broad categories: those having little or no endogenous insulin secretory capacity (IDDM or type 1 DM) and those who retain endogenous insulin secretory capacity but have a combination of resistance to insulin action and an inadequate compensatory insulin secretory response (NIDDM, or Type 2 DM) [5, 6].

The evidence that diabetic patient have an increased risk of developing pulmonary tuberculosis is a well-known. Unlike patients of diabetes developing tuberculosis where the disease tends to be extensive and bilateral. What makes the diagnosis of the combination difficult is the fact that the symptoms of the complicating disease are masked by the co-existing disease [7].

However, the converse relationship that the patients with tuberculosis have higher incidence of impaired Oral Glucose Tolerance (OGT) was less widely accepted till 1950. Despite, it is now accepted that altered OGT is observed in pulmonary tuberculosis patients, the relation of pulmonary tuberculosis and development of altered OGT are not well documented and very few studies have reported that the incidence of diabetes mellitus is predated in pulmonary tuberculosis. With this hypothesis the present study was undertaken to assess the OGT and its clinical profile in patients with pulmonary tuberculosis.

MATERIALS AND METHODS

The present study was conducted in the Department of Medicine, B. R. Ambedkar Medical College, Bangalore on patients with pulmonary tuberculosis. The study design was one year cross sectional study**.** The present one year study was conducted during the period of January 2011 to December 2011. Patients with pulmonary tuberculosis attending the out patient department and those admitted in the general and chest wards under Department of Medicine, Dr. B. R. Ambedkar Medical College and Hospital, Bangalore were selected for the study. The study was approved by the Ethical and Research Committee, Dr. B. R. Ambedkar Medical College, Bangalore. Patients fulfilling selection criteria were explained about the purpose of study and a written informed consent was obtained before enrollment.

A total of 75 patients with pulmonary tuberculosis were selected for the study. Patients with positive sputum smear for acid fast bacilli, patients with chest x-ray features suggestive of pulmonary tuberculosis and patients aged more than 30 years and less than 65 years were included in the study. Patients with diabetes mellitus and previously diagnosed and treated patients of pulmonary TB were excluded from the study. Simple random sampling was employed where every third patient who fulfilled the selection criteria was included in the study.

Sampling procedure

The sample size was calculated based on the formula as mentioned below.

$$n = 4 \times p \times q / d^2$$

Where p = Prevalence (Prevalence of the disease which wastaken as 25% as no records were available regarding the study), q = 100 – p, d = Absolute error taken as 10%, $n = 4 \times 25 \times 75 / 10^2$, n = 100.

Method of collection of data

Demographic data like gender and age were collected along with relevant history and recorded on predesigned and pretested proforma. A thorough clinical examination was conducted and the findings were also recorded. Body mass index was calculated based on formula;

$$\textit{Body Mass Index} = \frac{\textit{Weight (Kg)}}{\textit{Height}^2\ \textit{(m)}}$$

Body mass index in the range of less than 18.5 kg/m^2 were considered as underweight, 18.5 to 24.9 kg/m^2 were considered as normal, 25.0 to 29.9 kg/m^2 were considered as overweight and more than 30 kg/m^2 were considered as obese.

RESULTS

In the present study 88% patients were males and 12% were female with male to female ratio of 7.33:1. In this study the most common age group was 51 to 60 years (33.33%) followed by 41 to 50 years (32%). However 21.33% and 13.33% patients had age between 31 to 40 years and more than 60 years respectively.

Table 1: Symptoms of presentation

History	Distribution (n=75)	
	Number	Percent
Cough	50	66.67
Sputum	50	66.67
Fever	54	72.00
Loss of appetite	32	42.67
Loss of weight	32	42.67
Weakness/Fatigue	32	42.67

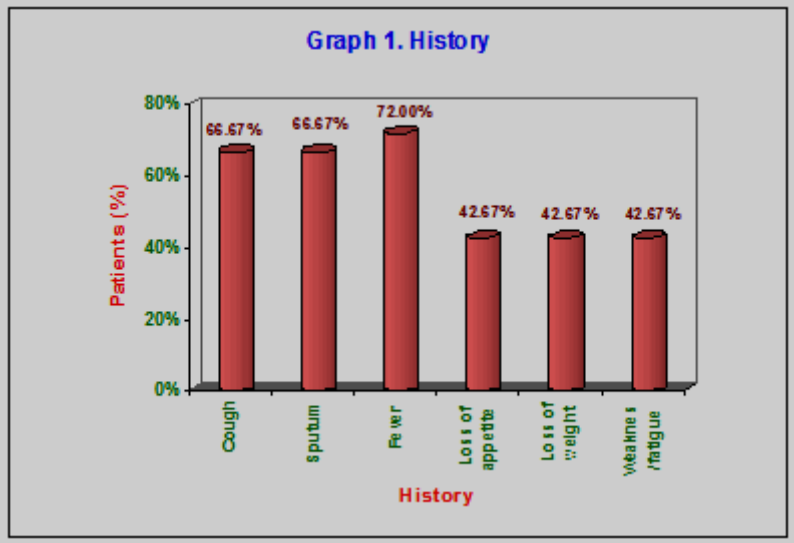

Fig. 1: History versus Patients (%)

In the present study most of the patients (72%) presented with fever followed by cough and sputum (66.67% each). The other presentations are as shown in Table 1 and Fig. 1.

In the present study 24% patients were smokers and 14.67% consumed alcohol. Personal history of both smoking and alcohol consumption was noted in 26.67%. However, in 34.67% of patients no significant personal history was recorded.

Table 2: Distribution of patients according to BMI

BMI (Kg/m^2)	Distribution (n=75)	
	Number	Percent
<18.50	3	4.00
18.50 to 24.99	43	57.33
25.00 to 30.00	27	36.00
>30.00	2	2.67
Total	**75**	**100.00**

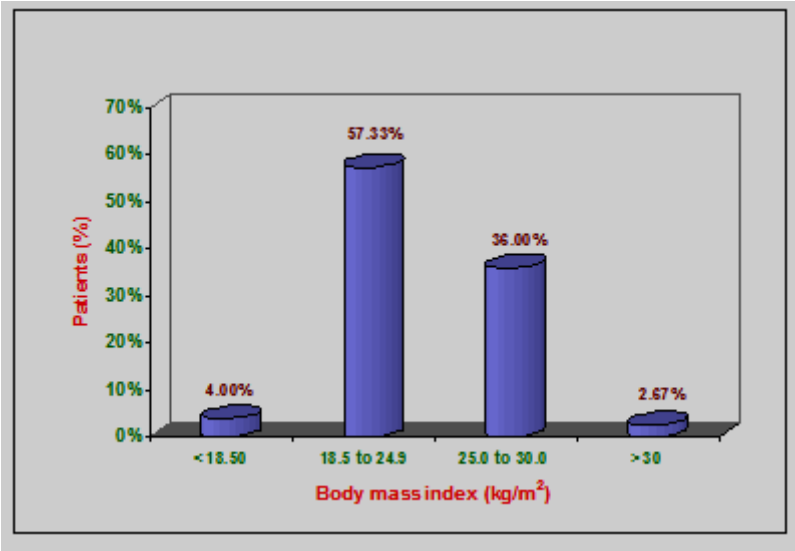

Fig. 2: Body Mass Index

In this study, among 57.33% of patients had normal BMI (18.5 to 24.9 kg/m^2) whereas 36% were overweight (25.0 to 30.0 kg/m^2).

Table 3: Sputum for acid fast bacilli

AFB findings	Sample 1 (n=75)		Sample 2 (n=75)	
	Number	Percent	Number	Percent
Normal	15	20.00	13	17.33
+	55	73.33	57	76.00
++	5	6.67	5	6.67
+++	0	0.00	0	0.00
Total	**75**	**100.00**	**75**	**100.00**

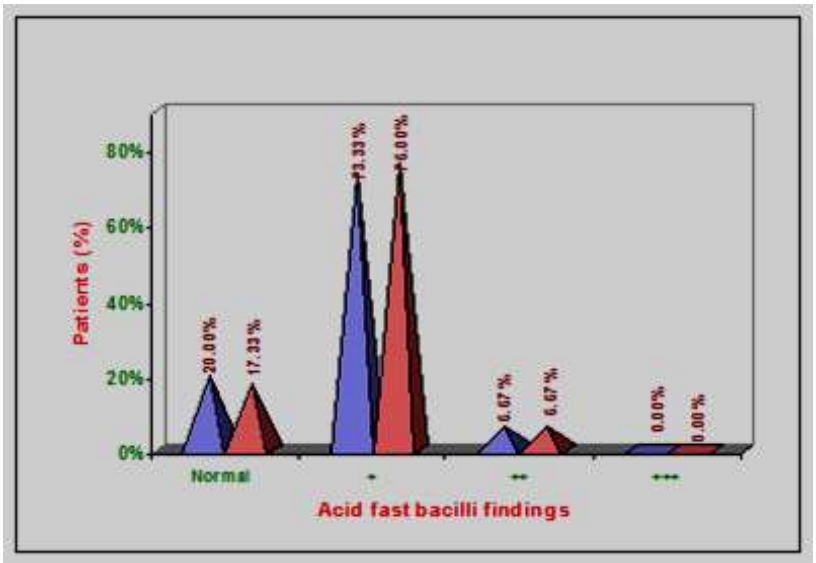

Fig. 3: Sputum for acid fast bacilli

In this study AFB findings showed + in 73.33% patients on sample and 76% patients on sample 2. However 6.67% each showed ++ on sample 1 and 2.

Table 4: Glucose Tolerance Test

Glucose tolerance (mg/dL)	Distribution (n=75)	
	Number	Percent
Normal	61	81.33
Impaired fasting glycemia	0	0.00
Impaired glucose tolerance	11	14.67
Diabetes mellitus	3	4.00
Total	**75**	**100.00**

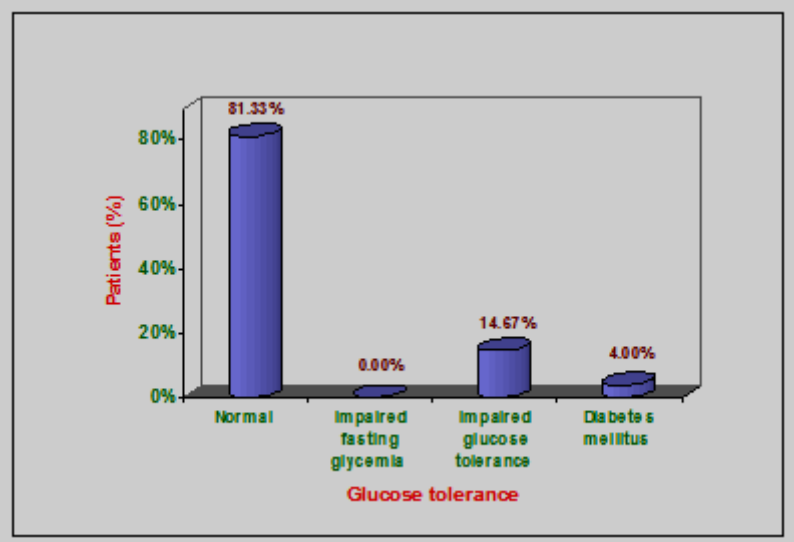

Fig. 4: Glucose Tolerance Test

In the present study among 81.33% patients GTT was normal (Fasting < 110 mg/dL and 2 hours < 140 mg/dL). In 14.67% of patients impaired glucose tolerance (Fasting < 126 mg/dL and 2 hours > 140 mg/dL) was recorded and among 4% patients diabetes mellitus (Fasting > 126 mg/dL and 2 hours > 200 mg/dL) was diagnosed. However, no patient had impaired fasting glycemia.

Table 5: Final diagnosis of DM based on FBS and PPBS

Diagnosis	FBS >110 mg/dL (n=3)		PPBS >200 mg/dL (n=3)	
	Number	Percent	Number	Percent
Confirmed	3	100.00	3	100.00
Not confirmed	0	0.00	0	0.00
Total	**3**	**100.00**	**3**	**100.00**

In the present study 4% patients with diabetes mellitus (Fasting > 126 mg/dL and 2 hours > 200 mg/dL) based on glucose tolerance test were subjected to FBS and PPBS. These test confirmed diagnosis of diabetes mellitus among all the (100%) patients.

Table 6: Incidence of impaired glucose tolerance in patients with pulmonary tuberculosis

Glucose tolerance	Distribution (n=75)	
	Number	Percent
Normal	61	81.33
Impaired	14	18.77
Total	**75**	**100.00**

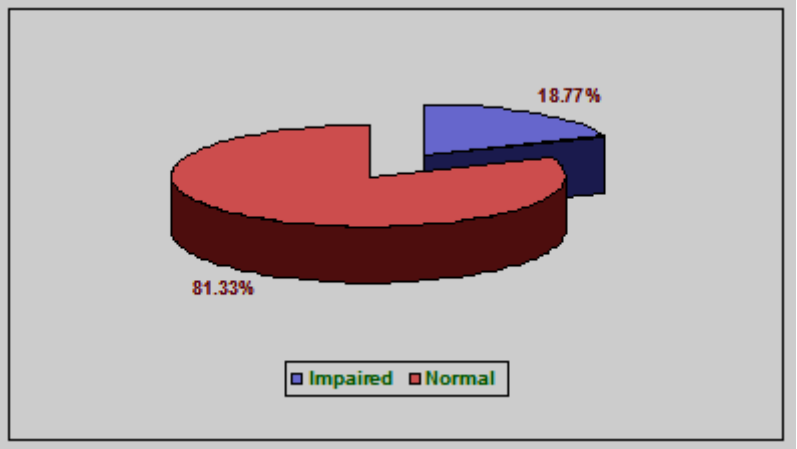

Fig. 5: Incidence of impaired glucose tolerance in patients with pulmonary tuberculosis

In the present study overall incidence of impaired glucose tolerance was 18.77% (including three cases of confirmed diabetes mellitus)

In this study 29.73% of patients showing infiltration on chest X-ray findings had impaired glucose tolerance followed by 18.18% with those having fibrotic changes. No statistically significant difference was noted between patients with different chest X-ray findings.

DISCUSSION

A study by Jain MK *et al.* [7], reported that out of the 106 patients of pulmonary tuberculosis (all aged 30 years and above) 18 (16.98 %) had abnormal Glucose Tolerance Test (GTT) of which 2 (1.88%) had impaired fasting glycemia, 11 (10.34 %) had impaired glucose tolerance and 5 (4.7 %) were frankly diabetic. Yamagishi *et al.* [8], reported 14.1% patients diagnosed pulmonary tuberculosis had impaired glucoce tolerance test. Firsova *et al.* [9], reported 10.8% patients of pulmonary tuberculosis had impaired glucoce tolerance test. Gupta *et al.* [10], reported 9.7% patients of pulmonary tuberculosis had impaired glucoce tolerance test. Roy Choudary *et al.* [11], reported 27.25% patients of pulmonary uberculosis had impaired glucoce tolerance test. These findings were comparable with present study except the study done by Choudary Roy et al. A case series by Deshmukh *et al.* [12] with 138 TB-DM patients revealed that 82.6% of the study population was above 45 years of age38 and there was a male preponderance. 43.4% of TB patients gave history of DM and 56.6% were detected subsequently on the

examination of urine, confirmed by blood sugar examination.

In another study by Tripathi *et al.* [13], 39 the authors observed 55% of TB-DM group were underweight and this group was mostly more than 40 years of age. In this study the commonest presentation of pulmonary tuberculosis was fever (72%) followed by cough and sputum (66.67% each). The diabetic signs in 8% of patients each were polyuria and polydipsia and other diabetic signs were polyphagia, blurred vision, parasthesia (5.33% each). Several studies have observed that patients with both diabetes and tuberculosis usually have a prolonged duration of fever and more significant weight loss with co-existent disease than with diabetes or pulmonary tuberculosis alone. The increasing rates of obesity and diabetes worldwide and continued high rates of tuberculosis in low-income countries, the number of individuals who have both tuberculosis and diabetes mellitus will increase markedly in the coming decades.

The limitations of the present study were smaller sample size and HbA1c was not confirmed. More research with large sample and other variables such as HbA1c, lipid profile and presence of diabetic complications in this largely neglected area would therefore be beneficial.

SUMMARY

The relation of pulmonary tuberculosis and development of altered OGT are not well documented and very few studies have reported that the incidence of diabetes mellitus in patients with pulmonary tuberculosis.The results showed majority of the patients were males (88%) with male to female ratio of 7.33:1. The most commonest age group was 51 to 60 years (33.33%) followed by 41 to 50 years (32%). The mean age of the patients was 49.93 ± 8.94 years. The commonest presentation of pulmonary tuberculosis was fever (72%) followed by cough and sputum (66.67% each) and diabetic symptoms and signs in 8% of patients each were polyuria and polydipsia. AFB findings showed + in 73.33% patients on sample and 76% patients on sample 2. On chest x-ray almost half (49.33%) of the patients had infiltration.

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