Frequency of Diabetes Mellitus in Pulmonary Tuberculosis Patients

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Abstract

Background: Diabetes Mellitus is an important risk factor for Pulmonary Tuberculosis (PTB). Diabetes and Tuberculosis often present together and complicate each other at many levels. There is inadequate data on the frequency of diabetes mellitus in TB patients in Pakistan. Implementation of bidirectional screening for both diseases in patients with tuberculosis will not only ensure early case detection but also better management of diabetes at the same time. The study was conducted to assess the frequency of diabetes in patients presenting with pulmonary tuberculosis.

Material and Methods: In this cross-sectional study, 137 sputum positive TB patients were selected by non-probability (purposive) sampling technique and data was collected using a questionnaire. All cases of tuberculosis, more than 18 years of age, were screened for diabetes. Diabetes was confirmed by determining fasting blood sugar level using cut-off value of 126mg/dl.

Results: The frequency of diabetes among pulmonary T.B patients in this study is was found to be 34.3% of which 29.9% were known DM cases and 4.4% were newly diagnosed.

Conclusion: This study concludes high frequency of Diabetes mellitus in pulmonary tuberculosis. Diabetes is a common co-morbidity in people with TB, screening TB patients with fasting blood sugar estimation will help in early detection of diabetes.

Keywords: Diabetes mellitus, Pulmonary tuberculosis

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Introduction:

Tuberculosis or TB is an infectious bacterial disease caused by *Mycobacterium tuberculosis,* that most often affect the lungs (1). TB is the second greatest killer worldwide due to a single infectious agent (2). In 2014, an estimated 9 million people fell ill with Tuberculosis disease and 1.5 million died from the disease. Over 95% of TB deaths occur in low and middle-income countries (WHO).

Diabetes is a chronic disease, which occurs when the pancreas does not produce enough insulin, a hormone that regulates blood glucose, or when the body cannot effectively use insulin it produced. This leads to a persistent increase in the concentration of blood glucose (hyperglycemia) together with the disturbance in the carbohydrate, protein and fat metabolism (3). WHO projects that diabetes will be the 7th leading cause of death in 2030 (4). In 2012, an estimated 1.5 million deaths were directly caused by the diabetes and more than 80% of diabetes deaths occur in low and middle-income countries (WHO, 2015).

The global burden of diabetes mellitus and tuberculosis is huge. Diabetes mellitus is epidemically present in developing countries where the other disease under our study i.e. T.B is also highly endemic (5). This shows that both diseases are increasingly present together which make an interest in this topic (6). Globally 15% of

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tuberculosis cases are reported with diabetes mellitus (7). Diabetes was recognized as an important risk factor for pulmonary tuberculosis that may worsen the disease and affect the treatment response of tuberculosis (8, 9). Diabetics are four to five times more prone to contract tuberculosis than the non-diabetics (10).

Diabetes mellitus increases the risk of several infections by disturbing the defense system of body. So, the impaired innate and adaptive immune response facilitates the proliferation of tuberculosis (11). Hyperglycemia favors the growth of tubercle bacilli. So severity of tuberculosis goes directly with the hyperglycemia status and host defense activity of patient (12). Diabetes mellitus together with tuberculosis is a double trouble. This double burden is a serious and growing challenge, especially for developing countries. The effective control of one disease, control the effect of other(13).

Pakistan is a developing country having dual problem of being high burden of tuberculosis with many patients diagnosed with diabetes mellitus, facing serious health problems. Inadequate data is reported so far, on the frequency of diabetes mellitus among tuberculosis patients in Pakistan (14). Diabetes mellitus is often responsible for adverse effect on TB treatment outcomes by delaying the time for microbiological response, reducing the possibility of favorable outcomes and increasing the risk of relapse, death and drug resistance (15, 16). So, screening of DM in TB patients may improve the diabetes mellitus case detection and its early treatment and thus indirectly leads to better TB-specific treatment outcomes. Therefore, it is important to consider the frequency of diabetes mellitus among patients with pulmonary tuberculosis. The

rational of this study was to check the frequency of Diabetes mellitus among pulmonary Tuberculosis. Objective of the study was to assess the frequency of Diabetes mellitus in patients presenting with pulmonary tuberculosis.

Material and Methods:
Study design: This study was Cross-sectional study.
Setting: Samples were collected from Gulab Devi Chest Hospital, Lahore.
Target population: The target population were patients with pulmonary tuberculosis, already confirmed by AFB sputum smear or culture.
Duration of Research: Study was completed in 3 months.
Sampling technique: Purposive sampling was used.
Sample size: Sample size for this research was 137. Frequency of this research is 35% with 95% of confidence interval.
Sample size was drawn by using this formula

$$n = \frac{z_{1-\frac{\alpha}{2}}^2 \, \sigma^2}{d^2}$$

Sample selection criteria:
Inclusion criteria: Sputum positive pulmonary tuberculosis cases and patients with age 18 years and above
Data Collection Method: A cross sectional study was done on 137 pulmonary tuberculosis patients. A questionnaire was designed to collect the information from the patients regarding their clinical findings and laboratory results and an oral consent was taken from patients prior to sampling.
The fasting blood sample was taken from these patients and serum was separated. Glucose is then measured by enzymatic method (Glucose-oxidase method). 1ml of reagent (glucose-oxidase) is taken in a test

tube and 10µl of serum from patient's sample is added in it. After 5 minutes of incubation at 37º, glucose is the measured in the Spectrophotometer. The fasting plasma glucose above 126 mg/dl is considered as diabetic value.

Data Analysis: The data was analyzed by using Statistical Package for social sciences (SPSS version 16.0), the original raw data for all of the clinical trials and these data were combined to perform the analysis. Categorical data was presented to percentages and in the form of graphs while Descriptive and Frequency distribution were used for the quantitative data.

Operational Definition:

Diabetes Mellitus: Diabetes mellitus is a group of metabolic disorders characterized by hyperglycemia resulting from defects in insulin secretion, insulin action or both. The current WHO diagnostic criteria for the diabetes is fasting blood glucose level ≥ 7.0mmol/l (126mg/dl) or 2-h plasma glucose ≥ 11.1mmol/l (200mg/dl). The decision diagnostic criteria of this study wes fasting blood glucose level ≥ 7.0mmol/l (126mg/dl).

Results:

Data of 137 patients was taken for this study. Out of which 58 (42.34%) were male and 79 (57.66%) were females. The mean age was 44.75 years with standard deviation ± 16.874 and the minimum age involved in the study was 18 years while maximum age was 80 years. The majority of patients taken in the study were from low class (84.7%), 10.2% from middle class and 5.1% from upper class. About 85.40% patients were married and 14.60% were single.

Using the diagnostic criteria, the frequency of diabetes among pulmonary T.B patients in this study was found to be 34.3% (47 out of 137 patients were diabetic) of which 29.9% (41 out of 47) were known DM cases and 4.4% (6 out 47) were newly diagnosed. Impaired fasting glucose was seen in 2.2% (3 out of 137) while rest of 63.5% patients (87 out of 137) had normal fasting blood glucose value.

The minimum value of fasting blood glucose was 70 while maximum value was 261. The mean fasting blood glucose value was 111.55 with standard deviation ±50.111 (table. 1). On analyzing the risk factors of diabetes in TB patients, 25 patients, of which 16 are diabetics, had a family history of diabetes and detail is revealed in *Table* 1.

Discussion:

Diabetes Mellitus and Tuberculosis are serious and life-threatening co-morbidities. A lot of work has been done on the frequency of diabetes mellitus in TB patients. But the issue didn't get considerable attention in our country and thus inadequate is reported so far on this topic. It is the time that the "unhealthy partnership" of TB and DM receives the attention it deserves. Being forewarned and prepared gives a better chance of reducing the dual burden of disease.

This study was conducted to determine the frequency of diabetes mellitus in pulmonary tuberculosis patients. As per results in this study, the frequency of diabetes mellitus in pulmonary tuberculosis patients was found to be 34.3% of which 29.9% were known DM cases and 4.4% were new DM cases.

In 2014, a study conducted in a tertiary hospital of Lahore estimated a frequency of diabetes to 25.9% (out of which 20.21% were known diabetic and 5.69% were newly diagnosed with diabetes (Usmani, 2014 #64). A study in India showed that the

frequency of diabetes in TB patients was found to be 29% (known diabetics-20.7%, new diabetes cases-8.3%) (5). Another study in India, estimated the frequency of diabetes mellitus among TB patients to be 25.3% (known diabetics-15.96%, new diabetes cases 9.3%) (16).

A study conducted in Orizaba, Veracruz state and Mexico, estimated the frequency of DM with TB patients was 29.63% (17). In a study in Saudia Arabia, the co-existence of diabetes mellitus and TB was found to be 29% (18). These studies support the increase frequency of diabetes in TB patients. Further researches are needed to ascertain, the best time for screening, identify a valid and cost-effective method for screening and subsequent changes needed, if any, in the standard management guidelines in patients with both diseases. This converging for two epidemics should be a wake-up call for all clinicians and researchers to gear-up to meet the challenge of patients afflicted by tuberculosis as well as diabetes.

Conclusion:

This study concluded increased frequency of Diabetes mellitus in pulmonary tuberculosis. Diabetes is a common co-morbidity in people with TB, screening TB patients with fasting blood sugar estimation will help in early detection of diabetes. Strategies are needed to ensure that optimal care is provided to patients with both diseases.

References:

1.   Fogel N. Tuberculosis: a disease without boundaries. Tuberculosis. 2015;95(5):527-31.

2.   Sandhu GK. Tuberculosis: current situation, challenges and overview of its control programs in India. Journal of global infectious diseases. 2011;3(2):143.

3.   Ozougwu J, Obimba K, Belonwu C, Unakalamba C. The pathogenesis and pathophysiology of type 1 and type 2 diabetes mellitus. Journal of Physiology and Pathophysiology. 2013;4(4):46-57.

4.   Mathers CD, Loncar D. Projections of global mortality and burden of disease from 2002 to 2030. PLoS medicine. 2006;3(11):e442.

5.   Raghuraman S, Vasudevan KP, Govindarajan S, Chinnakali P, Panigrahi KC. Prevalence of diabetes mellitus among tuberculosis patients in urban Puducherry. North American journal of medical sciences. 2014;6(1):30.

6.   Mi F, Jiang G, Du J, Li L, Yue W, Harries AD, et al. Is resistance to anti-tuberculosis drugs associated with type 2 diabetes mellitus? A register review in Beijing, China. Global health action. 2014;7(1):24022.

7.   Riza AL, Pearson F, Ugarte-Gil C, Alisjahbana B, van de Vijver S, Panduru NM, et al. Clinical management of concurrent diabetes and tuberculosis and the implications for patient services. The lancet Diabetes & endocrinology. 2014;2(9):740-53.

8.   Wang C, Yang C, Chen H, Chuang S, Chong I, Hwang J, et al. Impact of type 2 diabetes on manifestations and treatment outcome of pulmonary tuberculosis. Epidemiology & Infection. 2009;137(2):203-10.

9.   Alisjahbana B, Sahiratmadja E, Nelwan EJ, Purwa AM, Ahmad Y, Ottenhoff TH, et al. The effect of type 2 diabetes mellitus on the presentation and treatment response of pulmonary tuberculosis. Clinical Infectious Diseases. 2007;45(4):428-35.

10.   Jawad F, Shem A, Memon R, Ansari G. Glucose intolerance in pulmonary tuberculosis. JOURNAL-PAKISTAN MEDICAL ASSOCIATION. 1995;45:237-8.

11.   Restrepo BI, Camerlin AJ, Rahbar MH, Wang W, Restrepo MA, Zarate I, et al. Cross-sectional assessment reveals high diabetes prevalence among newly-

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diagnosed tuberculosis cases. Bulletin of the World Health Organization. 2011;89:352-9.

12. Kant S, Lata H, Natu S, Mishra A, Verma N. Diabetes mellitus with pulmonary tuberculosis--a double trouble. Journal of the Indian Medical Association. 2013;111(3):187-91.

13. Chachra V, Arora V. Study on prevalance of diabetes mellitus in patients with TB under DOTS strategy. The Indian journal of tuberculosis. 2014;61(1):65-71.

14. Usmani RA, Nasir MI, Wazir S, Pervaiz Z, Zahra T, Akhtar M. Diabetes mellitus among tuberculosis patients in a tertiary care hospital of Lahore. Journal of Ayub Medical College Abbottabad. 2014;26(1):61-3.

15. Jeon CY, Murray MB. Diabetes mellitus increases the risk of active tuberculosis: a systematic review of 13 observational studies. PLoS medicine. 2008;5(7):e152.

16. Viswanathan V, Kumpatla S, Aravindalochanan V, Rajan R, Chinnasamy C, Srinivasan R, et al. Prevalence of diabetes and pre-diabetes and associated risk factors among tuberculosis patients in India. PloS one. 2012;7(7):e41367.

17. Jiménez-Corona ME, Cruz-Hervert LP, García-García L, Ferreyra-Reyes L, Delgado-Sánchez G, Bobadilla-del-Valle M, et al. Association of diabetes and tuberculosis: impact on treatment and post-treatment outcomes. Thorax. 2012:thoraxjnl-2012-201756.

18. Singla R, Khan N, Al-Sharif N, Al-Sayegh M, Shaikh M, Osman M. Influence of diabetes on manifestations and treatment outcome of pulmonary TB patients. The International Journal of Tuberculosis and Lung Disease. 2006;10(1):74-9.

Table 1. Family History of DM * Blood fasting glucose

		Blood fasting glucose			
		Normal (70 to 110)	IFG (from 111 to 126)	Diabetic (above 126)	Total
Family History of DM	Yes	9	0	16	25
	no	78	3	31	112
Total		87	3	47	137

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Supplementary File 1:

QUESTIONNAIRE

Frequency of Diabetes Mellitus in Pulmonary Tuberculosis Patients

Demographical Study:

Name_____   Age/Sex_____

Socioeconomic status _____   Marital status_____

Ward_____   Reg#_____

Clinical Findings:

Known diabetic: Yes_____ No_____

New DM case: Yes_____ No_____

Family history of diabetes _____

Smoking _____

Symptoms:

P o l y d i p s i a	
P o l y p h a g i a	
P o l y u r i a	

Laboratory Findings:

Test	Result
BSF	

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