

Radiological Pattern of Pulmonary Tuberculosis in Diabetes Mellitus

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Background: Tuberculosis is one of the most serious public health problem globally. About one third of the population has been infected with mycobacterium tuberculosis. Post primary tuberculosis has been classically considered as a disease causing patchy opacity or with cavitary or calcified lesion, in one or both upper lung lobes. On the other hand, diabetes mellitus is also a major public health problem. Worldwide prevalence of diabetes is 4%, while in Pakistan prevalence of diabetes is 4.5 - 11% making Pakistan 6th in world ranking of diabetes mellitus prevalence. When two diseases are common, these can effect each other in terms of clinical presentation and course of the disease. In pulmonary tuberculosis with diabetes mellitus radiological pattern of may be different from patients without diabetes mellitus.

Objective: To determine the radiological pattern of pulmonary tuberculosis in diabetes mellitus.

Study Design: A prospective-observational study.

Place of Study: The study was conducted in B.V. Hospital, Bahawalpur.

Duration of Study: The study was conducted from January 2004 to December 2006.

Material and Methods: One hundred and fifty patients with diabetes mellitus (both type 1 and type 2) and pulmonary tuberculosis were included in the study. Pulmonary tuberculosis was diagnosed on the basis of AFB positive sputum, history and radiological findings suggestive of pulmonary tuberculosis. Two physicians (including one chest physician) and a radiologist reviewed the chest radiographs. Those x-rays were selected in which there was no difference of opinion. Diabetic patients were either known diabetics or they were newly diagnosed based on WHO criteria.

Results: A total of 150 patients were analyzed in which there was 105 were male and 45 females. The age range was 18 years to 75 years. The mean age was 49.81 and standard deviation was +12.28. Out of 150 films 69 (46%) showed the typical pattern (patchy infiltration / nodular pattern with or without cavitation) involving upper zone. While 81 (54%) pts showed the atypical pattern with lower lung field involvement. Out of 150 films, in 84 right lung was involved, in left lung about 39 and bilateral lesion found in 27 films. In 75 films x-rays showed non homogeneous opacity, cavity in 31 and homogeneous shadows in 22 and multiple shadows in 22 films. Among lower lung field involvement with pulmonary tuberculosis 50.6% were above the age of 50 years.

Conclusion: Atypical pattern of pulmonary tuberculosis is the common mode of presentation in elderly and diabetic patients.

Keywords: Pulmonary tuberculosis, Diabetes Mellitus, Typical pattern, Atypical pattern.

Introduction

Tuberculosis is one of the most serious public health problem. About one third of the global population has been infected with mycobacterium tuberculosis (TB). Even the developed countries are not protected from epidemic of pulmonary TB¹. In 2005 there were an estimated 8.8 million new cases of tuberculosis worldwide².

In Pakistan the WHO estimated an incidence of 79/100000 sputum smear positive cases and 177/100000 of all forms of TB³. Pulmonary TB is generally classified into primary and post primary TB, both have distinct radiological involvement of lungs). Post primary TB typically causes lesions in one or both upper lung lobes, which may be patchy or homogenous opacities, cavity or calcified lesions.⁴ While in diabetics and elderly people, pulmonary TB causes atypical radiological involvement like lower lung field

involvement.^{5,6} The lower lung field involvement of pulmonary TB in elderly and diabetic patients is important because delay in interpretation of these images might delay timely diagnosis and treatment of pulmonary tuberculosis.⁵

On the other hand, DM is also a major public health problem. Worldwide prevalence of diabetes is 4%, while in Pakistan prevalence of diabetes is 4.5 - 11% making Pakistan 6th in world ranking.⁷

When two diseases are common in a community, these can effect each other in terms of clinical presentation , course ,diagnosis and response to treatment.⁸⁻¹² The peculiar relationship of DM and TB has been observed for more than 2000 years. "Before the discovery of insulin, a diagnosis of diabetes was a death sentence within 5 years," said Lawrence Broxmeyer, "and the usual cause of that death was

tuberculosis".¹³ DM causes more pronounced/atypical radiological findings in pulmonary TB.¹⁴

The aim of the study was to determine the radiological pattern of PTB in patients with DM.

Material and Methods

This study was conducted in Bahawal Victoria Hospital affiliated with Quaid-e-Azam Medical College in patients attending medical outdoors and admitted in Medical Unit-I and Medical Unit-II. The study was conducted from January 2004 to December 2006.

In this prospective and observational study, we collected 150 patients were selected by convenient sampling technique who were fulfilling the following criteria:

1. Sputum smear positive for AFB.
2. History / clinical examination suggest PTB.
3. X-ray findings suggestive of PTB. (Localization of the radiological interpreted using two different classifications. First, commonly upper-mid and lower zones are separated by a horizontal line passing at the level of second and fourth ribs respectively. The lower lung field (LLF) was separately defined as the area below an imaginary line traced across the hila and including the parahilar regions on a standard posteroanterior chest roentgenogram. This was to allow comparisons to be made with previous reports that used the same definition. The lower lung field included middle lobe and the lingual in addition to the lower lobes).¹⁵
4. Known diabetics (with or without treatment) or newly diagnosed diabetic patients (1. Symptoms of diabetes and a casual plasma glucose 200 mg/dl (11.1 mmol/l) or 2. FPG 126 mg/dl (7.0 mmol/l) or 3. 2-h plasma glucose 200mg/dl (11.1 mmol/l) during an OGTT).¹⁶

Results

One hundred and fifty patients were included. There were 105 males and 45 females. The age range was 18 to 75 years. The mean age was and standard deviation was.

One hundred and thirty (86.7%) patients were from rural area while 20 patients were resident of urban areas. There were 17 patients with type 1 diabetes while 133 patients were having type 2 diabetes mellitus. Family history of pulmonary tuberculosis was in 60 () patients. The age distribution was following: 18-29 years 9, 30-39 years 21, 40-49 years 45, >50 years 75. The frequency of different symptoms were as follows: fever 150(100%), cough 150 (100%), productive cough 71 (47.3%), dry cough 79 (52.7%), weight loss 105 (70%), hemoptesis 29 (19.3%), breathlessness 22 (14.7%). Montoux test was positive 110 patients. Diagnosis on the basis of AFB staining was in 90% patients. Out of 150 films, in 84 right lung was involved, in left lung about 39 and bilateral lesion found in 27 films. In 75 films, x-rays showed non homogeneous opacity, cavity in 31 and homogeneous shadows in 22 and multiple shadows in 22 films.

On the basis of upper lung field and lower lung field

Table 1: *Demographic and Clinical Characteristics.*

Sex	No. of Patients
Male	105 (70%)
Female	45 (30%)
Age (yrs)	
18 – 29	09 (06%)
30 – 39	21 (14%)
40 – 49	45 (30%)
> 50	75 (50%)
Mean = 49.81 , Std. Dev = + 12.28	
Area of Residence	
Urban	20 (13.3%)
Rural	130 (86.7%)
DM Type	
Type – I	17 (11.3%)
Type – II	133 (88.7%)

Table 2: *Radiological Features.*

Lung Side Affected	No. of Patients
Right	84 (56%)
Left	39 (26%)
Bilateral	27 (18%)
Type of Lesions	
Non-Homogenous Opacities	75 (50%)
Cavity	31 (20%)
Homogenous Opacities	22 (15%)
Multiple Opacities	22 (15%)
Lung Field Affected	
Upper Lung Field	69 (46%)
Lower Lung Field	81 (54%)
Lung Zone Affected	
Upper Zone	50 (33.3%)
Middle Zone	13 (8.7%)
Lower Zone	87 (58%)

distribution 69 films showed upper lung field involvement and in 81 films lower lung field were involved. And in zone system distribution of lesion, 60 films showed upper zone involvement, 77 in lower zone and 13 in mid zone.

Discussion

The relationship between PTB and DM is very old.¹³ Either diabetes mellitus (DM) is predisposing the reactivation of PTB or DM may be caused by PTB due to insulin resistance.¹⁷ The diagnosis of PTB is confirmed either by sputum smear for AFB, culture for AFB, DNA/RNA probe or high-pressure liquid chromatography (HPLC).¹⁸ In minority of the cases expectoration of sputum is less due to minimal disease or because of inability to cough out the sputum. In such cases we rely on good clinical history, clinical examination and radiological features.¹⁹ It has also been realized that DM particularly uncontrolled, is more susceptible to the development of PTB.²⁰ The majority of our patients who developed tuberculosis were 30-75 years of age, similar to other studies, where most of the patients were above 40 years of age.²¹⁻²³

In the present study, majority of the patients were of type 2 DM, 133 (88.7%).

The reason for increased susceptibility of DM to PTB may be multifactorial though the exact mechanism is not known. It may be due to either altered macrophage function, alteration in connective tissues due to non-enzymatic glycosylation or due to diabetic neuropathy leading to reduced bronchial reactivity and broncho-dilatation.^{17,24,25} Though the presenting symptoms of PTB does not seem to be modified with DM yet DM can affect the radiological features of both location and the type of lesion.^{26,27} Fever, cough and loss of weight were the major symptoms in our study.

In our study most of the patients were males 105 (70%) which is also observed by Perez-Guzman et al.²⁸ It is commonly seen that PTB is having high frequency in males as compared to females and this may be because of higher exposure of males or under diagnosis of tuberculosis in females. But this male to female predominance in tuberculous patients is reversed as age progressed.²⁸ In our study majority of the patients were above the age of 50 which was also seen in a Chinese study.¹² In our study most of the patients were belonging to rural area 86.7% because most of the population is residing in villages while in most of the studies it is seen that PTB is more common in urban area because of crowded population.^{12,29}

Radiological signs of PTB are more pronounced in diabetics,³⁰ In patients with PTB alone, cavitation is less common with increasing age, while in diabetics of all ages, frequency of cavitation/LLF is high, whereas lower lobe/lung field involvement was the frequent change.³¹

In our study, right lung was affected in majority of the patients (56%) as opposed to left lung which was seen in 26%, whereas bilateral involvement was seen in 18% patients. These findings were consistent with those of Zuber et al.³²

According to lung field involvement, Hernandez et al³³ observed 48% patients affected with lower lung fields whereas Shaikh et al³⁴ and Jabbar et al³⁵ found 36% and 23.5% respectively. In our study, majority of the patients had non-homogenous opacities while 20% patients had cavitary lung involvement. These findings were similar to Shaikh et al³⁴ while Saulat et al³⁶ and Bacakoglu et al²⁷ found higher number of patients affected with cavitary lung involvement, 50% and 59% respectively, this may be explained on the type of DM in these studies.²⁷ In zonal involvement, 58% patients had lower zone involvement. These results are comparable to another study conducted by Perez et al³⁷ while Jabbar et al noticed 36% patients had involvement of lower zone in their study.³⁸

Conclusion

In conclusion, pulmonary tuberculosis may occur more often among patients with diabetes mellitus than those without it. Mostly between 35-75 years of age fever, cough and loss of weight was the most common presenting symptoms. Lower lung with non homogenous and cavitary lesion is a common finding.

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