

## The appearance of tuberculosis in diabetic patients.

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### Abstract

**Introduction:** Tuberculosis is one of the greatest causes of death caused by infectious diseases. Almost one third of the world population (meant 2 billion) are infected by tuberculosis and vulnerable to tuberculosis. Diabetes is one of the most common non contagious diseases in the world. This disease is the fourth or fifth cause of death in the most of developed countries. The relationship between tuberculosis and diabetes had been introduced years ago and diabetes is considered as a threatening factor in tuberculosis in the research history. Not only tuberculosis is prevalent among diabetic persons, but also diabetic can affect the appearances of imaging of tuberculosis.

**Material and methods:** This is a kind of analytic study, a case control study, which was carried out between years 93-94 in Zabol. In this study, the radiographic findings from the patients suffering from pulmonary tuberculosis in diabetic patients and not diabetic patients are compared. These radiographies handed in to a radiologist and the radiologic findings of these graphs from the anatomic location (upper and lower half of the right and left bellows), Presence or absence of cavities, nodules, density and pleural involvement were recoded and compared with diabetic and non-diabetic group. After gathering of the data using SPSS software, descriptive statistics was presented in the form of (frequency, percent) graphs and a chi-square test ( $p < 0/05$ ) was used to analysing and comparing of the results of diabetic and un-diabetic patients.

**Result:** The population of the study was consisted of Chest radiograph for 124 TB patients which 61 (49/19%) were suffering from diabetics. In this study, 45 (71/43%) non-diabetic and 42 (65/85%) diabetic patients were women ( $p=0/7$ ). There were 12 (19/67%) diabetic TB patients and 3 (4/76%) non-diabetic- TB patients with the consolidation of middle part of left lung ( $p=0/01$ ) and 8 (13/11%) diabetic TB and 1 (1/59%) non-diabetic TB with reticulonodular infiltration of lower part of left lung ( $p=0/02$ ). There was no significant deference in rest of the radiographic results.

**Discussion and conclusion:** The findings of this study indicate that reticulonodular infiltration and consolidation of lower and middle part of lung in TB diabetic patients is more than TB non-diabetic patients and diabetes can affect findings of pulmonary tuberculosis radiography.

**Keywords:** Chest radiography, Diabetes mellitus, Tuberculosis.

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### Introduction

Tuberculosis is a kind of Microbial diseases that is caused by *Mycobacterium tuberculosis* [1]. Tuberculosis appears in 85% of the cases as pulmonary and in 15% of the cases as out pulmonary [2]. Almost one third of the world population (meant 2 billion) is infected by tuberculosis microbe and they are vulnerable to tuberculosis.

And every year, 9 million people are infected to tuberculosis and 1.5 to 2 million of them dies [3]. More than 90% of the disease and death caused by tuberculosis occur in the developing countries, which 75% of the cases are in economically active age (15 to 54 years old) [4]. Diabetes is one of the most common not-contagious diseases in the world. This disease is the fourth or fifth cause of death in developed countries [3]. The relationship between tuberculosis and diabetes has been introduced by Abu Ali Sina hundreds of

years ago [5]. And in 1950 and again in 1992 diabetes was proposed as a threatening factor in causing active tuberculosis in literature reviews [6]. The mechanism of cooperation is not much known but researchers believe that diabetes, through repressing immune responses and affecting bacteria killing activities of white blood cells, activates the hidden infections of *Mycobacterium* and progress of the disease [7]. Tuberculosis is very prevalent among diabetic people [8].

There are contradictory results in the case of the effects of diabetes mellitus on radiologic features of pulmonary tuberculosis [9]. In some studies about distribution of pulmonary involvement in TB, no differences between diabetic people and non-diabetic people is observed [10]. However, some other studies indicated that, in diabetic people lower lobe involvement is more prevalent [11]. Cavitory lesions especially nodular cavity lesions in diabetic patients are more prevalent

[12]. Furthermore, there is a relationship between lower lobe involvement and the female gender and age above 40 years old [13]. Even, in a study, diabetes mellitus was reported as the only cause of cavitation or other decrements at the base of the lungs [14]. However, paying attention to change of radiographic finding of tuberculosis in diabetic patients can contribute to its diagnosis [15]. According to the high prevalence of pulmonary tuberculosis in Sistan region and high potential of diabetic patient to catch tuberculosis due to weakness of their immune system and also according to different findings on the effects of diabetes mellitus on radiological features of the tuberculosis, this study was carried out to compare the findings of the chest radiography of pulmonary tuberculosis among diabetic and non-diabetic patients of the Zabol city.

## Materials and Methods

This is an analytic case control study. Radiography of the patients suffering from pulmonary tuberculosis whose diabetes was proven and the same number of radiographies of the patients suffering from just tuberculosis without diabetes (as approved and recorded in the profile of the patients) was collected from tuberculosis centre of Zabol city and will be delivered to the radiologists with no information about patients and she report chest radiography and finally the bellows findings of diabetic and non-diabetic TB patients from the anatomic position (upper and lower zone of the right and left bellows) existence or not existence of cavitation, nodules, consolidation and pleural involvement are compared to each other. After gathering of the data, using Spss software, descriptive statistics are presented in the form of (frequency, percent) graphs. For the analysis and comparison of the results in diabetic and non-diabetic people,  $\chi^2$  test with 0/05 level of significance is operated.

## Results and Discussion

The sample population of this study was consisted of 124 chest radiography of TB patients that 61 of them (49/19%) were suffering from diabetics.

45 persons were (71/43%) non-diabetic and 42 persons (65/85%) of diabetic people were women. 7 persons (11/48%) of the TB diabetic patients and 10 persons (15/87%) of non-diabetic TB patients had upper parts consolidation in their chest radiography ( $p=0/5$ ). 3 persons (4/92%) of diabetic TB patients and 4 persons (6/35%) of non-diabetic TB had right upper zone cavitory lesion in their chest graph ( $p=1$ ). 6 persons (9/84%) of the diabetic-TB patients and 5 persons (7/94%) of non-diabetic TB patients had right upper zone nodular infiltration in their chest graph ( $p=0/5$ ). 4 persons (6/56%) of non-diabetic TB patients had right upper zone reticulonodular infiltration in their chest graph ( $p=0/2$ ). 3 persons (4/92%) of

diabetic TB patients and 1 (1/59%) of non-diabetic TB patients had Right upper zone fibrosis in their chest graph ( $p=0/3$ ). 12 persons (19/67%) of diabetic- TB patients and 7 (11/11%) of non-diabetic TB patients had consolidation of right middle zone in their chest graph ( $p=0/1$ ). 7 persons (11/48%) of diabetic TB patients and 6 persons (9/52%) of non-diabetic TB patients had middle zone nodular infiltration in their chest graph ( $p=0/5$ ). 6 persons (9/84%) of the diabetic TB patients and 5 persons (7/94%) of non-diabetic TB patients had right middle zone reticulonodular infiltration in their chest graph ( $p=0/5$ ). 9 persons (14/75%) of the diabetic TB patients and 8 persons (12/7%) of non-diabetic TB patients had left upper and lower consolidation in their chest graph ( $p=0/5$ ). 5 persons (8/2%) of the diabetic TB patients and 2 persons (3/17%) of non-diabetic TB patients had left upper and lower cavitation in their chest graph ( $p=0/3$ ). 5 persons (8/2%) of the diabetic TB patients and 5 persons (7/94%) of non-diabetic TB patients had left upper and lower nodular infiltration in their CXR ( $p=0/1$ ). 3 persons (4/92%) of the diabetic TB patients and 1 person (1/59%) of non-diabetic TB patients had upper lower left part reticulonodular infiltration in their chest graph ( $p=0/4$ ). 1 person (1/64%) of the diabetic TB patients had left upper and lower zone fibrosis in their chest radiography and none of the non-diabetic TB patients had left upper and lower zone fibrosis ( $p=0/5$ ).

12 persons (19/67%) of the diabetic TB patients and 3 persons (4/76%) of non-diabetic TB patients had left middle zone consolidation in their chest radiography ( $p=0/01$ ). One person (1/64%) of the diabetic TB patients had left middle zone cavitation in his chest radiography and none of the non-diabetic TB patients had left middle zone cavitation ( $p=0/5$ ). 6 persons (9/84%) of diabetic- TB patients and 5 persons (7/94%) of non-diabetic TB patients had left middle zone Nodular infiltration in their chest radiography ( $p=0/8$ ). 5 persons (8/2%) of the diabetic TB patients and 1 person (7/94%) of non-diabetic TB patient had left middle zone reticonodular infiltration in their chest radiography ( $p=0/1$ ). 16 persons (26/23%) of diabetic TB patients and 15 persons (23/81%) of non-diabetic TB patients had left middle zone consolidation in their chest radiography ( $p=0/7$ ). 1 person (1/64%) of the diabetic TB patients and 3 persons (7/94%) of non-diabetic TB patients had left lower zone cavitation in their chest radiography ( $p=0/6$ ). 6 persons (9/84%) of diabetic TB patients and 5 persons (9/52%) of non-diabetic TB patients had lower zone Nodular infiltration in their chest radiography ( $p=0/8$ ). 8 persons (13/11%) of the diabetic TB patients and 1 person (1/59%) of non-diabetic TB patients had left lower zone reticonodular infiltration in their chest radiography ( $p=0/02$ ).

In the Table 1 below, first, in general and based on the anatomic location and then in detail, radiographic findings were reviewed.

**Table 1.** Distribution of lung involvement.

Having diabetics	Involved lung	p-value
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	Without conflict	Right lung	Left lung	Left right lung	
Diabetic	2 (3.3%)	20 (32.8%)	15 (24.6%)	24 (39.3%)	0/4
Non-diabetic	1 (1.6%)	25 (39.7%)	9 (14.3%)	28 (44.4%)	

Pulmonary tuberculosis is one of the most important medical issues of the world and it has been incontrollable in some part of the world. The danger of this disease is very high among vulnerable groups such as diabetic people, HIV infected patients, and smokers [16]. A study by Jabbar has indicated that the prevalence of tuberculosis among diabetic people is ten times more than non-diabetic people [17]. Although the results of many studies point to the coincidence of diabetics and tuberculosis, but they could not determine the sequence of their happening. In another words, they are unable to determine whether diabetics cause tuberculosis or vice versa. But, 40 years of studies by the researchers confirm the effects of diabetics on increasing the danger of tuberculosis. The results of study by Jeon and Murray on 17 empirical studies from 1983-2007 over more than 700000 people that 18000 of them

had tuberculosis showed that diabetics increases the danger of tuberculosis up to three times and researchers reported this amount of danger in different studies 0/99-7/83 [18] that can be due to deteriorating immune system by diabetics and consequently widely spreading of tuberculosis and other diseases in these people.

In this study, in diabetic patients, the involvement of upper parts were 7%, middle parts were 7%, lower parts were 14%, and upper and middle parts were 6%, upper and lower parts were 5%, and middle and lower parts were 9%, and upper lower middle parts were 6% and in non-diabetic patients also the involvement of lower parts was more than other parts but there was no significant relationship ( $p > 0/05$ ) (Table 2).

Table 2. Distribution of the involvement of zone of lung.

Having diabetics	Involved parts								p-value
	N*	U*	M*	L*	U-M*	U-L*	M-L*	U-M-L*	
Diabetic	2 (3.3%)	7 (11.5%)	7 (11.5%)	14 (23%)	6 (9.8%)	5 (8.2%)	9 (14.8%)	11 (18%)	0/1
Non-diabetic	1 (1.6%)	8 (12.7%)	10 (15.9%)	24 (38.1%)	5 (7.9%)	7 (11.1%)	2 (3.2%)	6 (9.5%)	

N\*: lack involvement of the lung; U\*: Upper zone (region); M\*: Middle zone; L\*: Lower zone; U-M\*: Upper and Middle zone; U-L\*: upper and lower zone; M-L\*: Middle and Lower zone.

In our study, the radiographic changes of chest in lower parts of bellows, only based the Reticolondolar decrement of lower left part, there was a significant difference ( $p < 0/05$ ) (Tables 3 and 4) which is consistent with the studies of Moriss [19] and Janmeja form the Reticolondolar decrement of lower left part [20]. In a study which was carried out on 4430 people suffering from pulmonary tuberculosis in India during years 1998-2001, tuberculosis of lower lobes was observed in 10/5 percent of the case which was more obvious among diabetic patients (18/49%) and HIV infected patients (58/71%) [21]. That the involvement of lower lobes can be due to weakness of immune system.

In diabetic and non-diabetic patients no significant relationship was observed between involvement of left and right bellows. And in the study by Ayat alla et al. a little difference was observed between them [22].

In this study 2 persons, (2/1%) of diabetic patients and one person of the non-diabetic persons the type of the chest was completely normal which can be attributed to the issue of the involvement of Sagman khalphi of the middle lobe of the right bellows which is a blind spot in the chest radiography and spreading of the tuberculosis and it must be taken into account that the normality of the type does not reject tuberculosis.

In the case of clinical doubt, performing torackcell CT scan for discovering tree pattern which is the indicator of tuberculosis Indobronical or discovering other hasty changes can be helpful [23].

Table 3. Distribution frequency left middle zone consolidation in chest radiography.

Consolidation of left middle zone	Non-diabetic	Diabetic	p-value
Yes	3 (4.76%)	12 (19.67%)	0/01
No	60 (95.24%)	49 (80.33%)	

Table 4. Distribution frequency left lower zone reticulonudoler infiltration.

Reticulonudolar infiltration lower zone	Non-diabetic number (%)	Diabetic number (%)	p-value
yes	1 (1.59%)	8 (13.11%)	0/02
No	62 (98.41%)	53 (86.89%)	

In this study, 6 persons (6/2%) of the diabetic patients and 7 persons (3/9%) of the non-diabetic patients had fibotic changes. In this study diabetic patients, 47/4% congestion, 13/4% hole, 17/5% nodularity, 13/4% reticolonodolar, 6/2%

fibroz was observed that in comparison to diabetic patients no meaningful relationship was observed (Table 5).

**Table 5.** Distribution of the patterns of involvement of zone of lung.

Having diabetics	Involvement pattern						p-value
	Not involved	Congestion	Cavitation	Nedolarity	Reticolonodoler	Fibrosis	
Diabetic	2 (2.1%)	46 (47.4%)	13 (13.4%)	17 (17.5%)	13 (13.4%)	6 (6.2%)	0/3
Non-diabetic	1 (1.2%)	48 (59.3%)	25 (14%)	30 (16.19%)	19 (10.7%)	7 (3.9%)	

In the case of radiologic changes in middle parts of bellows in diabetic and non-diabetic patients, there was significant relationship from congestion of middle left part ( $p < 0/05$ ). No significant relationship was observed, between diabetic and non-diabetic patients Form the radiography features of chest in upper part of the bellows ( $p > 0/05$ ) (Tables 1-3 and 5).

In total, most of the radiological findings of the TB patients, are like that of TB non-diabetic patients which is consistent with the studies of Al Tawfiq [9], Jahbana [6], Wang [7], Bashar [8], but it is not consistent with the findings of the study by Bgaee et al. [16] and Ikezoe [24] who said that various fragmented and pitted distribution in bellows radiography in diabetic patients is more which its cause can be a good control of diabetics in the patients and lack of much effects on the process of tuberculosis [20].

## Conclusion

The findings of this study, indicates that the most of the radiological findings of the TB patients, is like non-diabetic TB patients. Distribution frequency of congestion of middle left part (Left middle zone consolidation) and left lower zone reticolonodular based on having diabetics had meaningful relationship with each other.

## Proposing Suggestions

In the future studies, to investigate the radiographic findings of the TB diabetic patients, based on diabetics type (type 1 and 2), the length of illness and type of treatment of the diabetics and anatomic location of it CT scan is suggested.

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