

## A Study of Respiratory Tract Infections in Diabetes Mellitus Patients Presenting to Tertiary Care Centre, Dhiraj Hospital, Vadodara, Gujarat

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### Dr. Bhavesh Patel,

Associate Professor, Department of Respiratory Medicine, SBKS MI & RC, Sumandeep Vidyapeeth Deemed To Be University, Vadodara, Gujarat, India.

### Dr. Mothiganesh G.,

Resident, Department of Respiratory Medicine, SBKS MI & RC, Sumandeep Vidyapeeth Deemed To Be University, Vadodara, Gujarat, India

### Dr. Rushikesh R. Yadav,

Resident, Department of Respiratory Medicine, SBKS MI & RC, Sumandeep Vidyapeeth Deemed To Be University, Vadodara, Gujarat, India.

### Dr. Ujwal Jain,

Senior Resident, Department of Respiratory Medicine, SBKS MI & RC, Sumandeep Vidyapeeth Deemed To Be University, Vadodara, Gujarat, India

### Dr. Sonal Goyal,

Senior Resident, Department of Respiratory Medicine, SBKS MI & RC, Sumandeep Vidyapeeth Deemed To Be University, Vadodara, Gujarat, India

### Corresponding Author: Dr. Ujwal Jain

#### Abstract:

**Introduction:** Diabetes mellitus refers to a group of disorders typified by persistent hyperglycemia caused by an absolute or relative shortage of insulin, which interferes with carbohydrate, protein, and fat metabolism. The degree of severity of hyperglycemia and the persistence of it is substantially linked with the severity of the microvascular, macrovascular, and neurological problems. These effects increase the chance of infection. Predisposition to infections brought on by changes in the host's defensive mechanisms and interaction with the respiratory epithelium's and cilia's regular functioning. Gastroparesis brought on by autonomic neuropathy, increased risk of aspiration due to reduced esophageal motility, pulmonary microangiopathy, impaired lung functions, and co-existing morbidity.

**Aim:** To determine respiratory tract infections in patients with diabetes mellitus.

**Methodology:** A prospective observational research design was used. Clinical assessments of the subjects were made using a case record design approach. In order to assess the incidence of respiratory infections in diabetic patients, all individuals with diabetes mellitus who had also experienced respiratory infections were collected and further analysed. The trial lasted for 1.5 years.

**Result:** With an average age of 52.70 years, the 50 patients in our research with DM and lung infections varied in age from 25 to 85. The majority (58%) of patients are in the 50 to 70 age range. We found a significant correlation between age, gender, and illness duration in those with DM associated with lung infections. Cough was the most prevalent symptom exhibited by the patient 50(100%), accompanied by mucoid expectoration 26 (52%), purulent 15 (30%) followed by mucopurulent expectoration 5(10%), blood tinged sputum 1(2%), and no expectoration 3 (6%). Mycobacterium tuberculosis was found in 21patients, the most prevalent organism in our study pulmonary infections in diabetic patients, accounted 42% of all infections, followed by Klebsiella pneumonia 8 (16%) and then by Pseudomonas aeruginosa 7 (14%) and next by Aspergillus fumigatus 5 (10%), then followed streptococcus pneumonia 4 (8%) and finally staphylococcus aureus & enterobacteriaceae 2 (4%) and E. coli (2%).

**Conclusion:** According to the study, there is a strong link between diabetes mellitus and pulmonary infections. All individuals with diabetes mellitus were found to have TB as their most prevalent pulmonary infection. In our investigation, individuals with DM associated with pulmonary infections showed a strong association between illness duration, age and gender. The

most frequent kind of expectoration in all of the patients that were included was cough with mucoid expectoration, which was followed by purulent and mucopurulent expectoration. The incidence of hemoptysis was particularly notable in diabetic individuals with pulmonary infections

## 1. Introduction:

Diabetes mellitus (DM) refers to a heterogeneous group of diseases defined by chronic hyperglycaemia because of absolute or relative deficiency of insulin moving metabolism of carbohydrate, protein and fat. There are certain environmental and genetic factors additionally contribute to developing DM. The magnitude and period of hyperglycaemia are powerfully related to the severity of microvascular, macrovascular and neurologic complication [1].

There is an overall 30.2% exaggerated probability of pulmonary infections in diabetic patients than nondiabetics. Hospitalization with pulmonary infection has exaggerated by 20-50% in last ten years in Western countries. Diabetes > 10 years combined with HbA1c > 9% is associated with 60% increased risk of pneumonia related hospitalization because of microangiopathic changes within the basement membrane of the pulmonary blood vessels and respiratory epithelium in diabetic patients [2].

There is definite co-relation between the prevalence of tuberculosis and diabetes in comparison to general population because [1, 3, 4]

1. Chronic hyperglycemia favours growth, viability and propagation of tubercle bacilli.
2. Decreased cell mediated immunity (CMI) and phagocytosis in diabetes allow spread of disease.
3. Micro vascular insufficiency.
4. Disturbances in electrolyte balance and local tissue acidosis favours

### Aim

To find out pulmonary infections in diabetic patients.

### Objectives

1. To find out organisms causing pulmonary infections among diabetic patients.
2. To find the most common organism isolated from the diabetic patients with pulmonary infection.

3. To find the incidence of tubercular vs non tubercular pulmonary infections in diabetic patients.

## 2. Materials and Methods

### Study Design

- **Type of Study:** Prospective observational study.
- **Study site:** Department of respiratory medicine, Dhiraj Hospital, Piparia, Vadodara, Gujarat.
- **Study population:** Indoor & outdoor patients of diabetes with pulmonary diseases in the Dept. of Respiratory Medicine.
- **Study period:** 1.5 year from the date of approval of thesis synopsis.
- **Sample size:** All the patients coming to the Department of respiratory medicine with pulmonary infections with diabetes mellitus more than 18yrs of age.

Total number of patients (N) = 50

$$n = NZ2P(1-P)/(N-1) + Z^2P(1-P)$$

Where:

n= Sample Size

N= Population Size (N=150)

Z= Z statistic for level confidence

P= Expected Prevalence or Proportion (P = 0.38)

d= Precision (d = 0.05)

Sample Size n = 50

### Inclusion Criteria

- Patients having diabetes.
- Patients having Symptoms of pulmonary infections.
- Age group > 18 year all the patients.
- Patients who are ready to give written consent.

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## Exclusion Criteria

- Co-morbid conditions like chronic kidney disease and malignancy.
- Non diabetic patients.
- Patients who are not ready to give written consent.

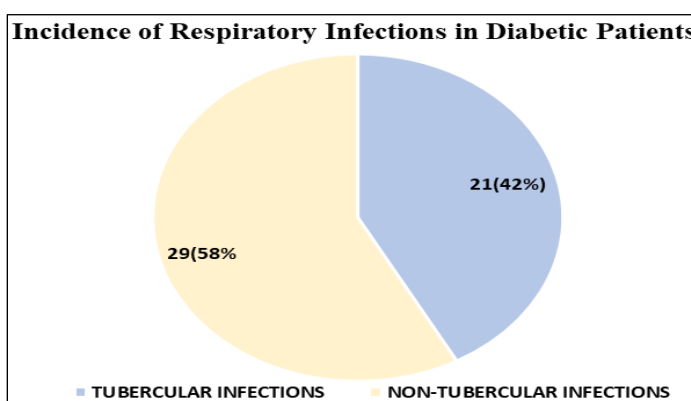
## 3. Methodology

Subjects were clinically evaluated by a designed case record format. Clinical evaluation by detailed history and examination of the respiratory system and other systems including chief complaints.

## 4. Results

From clinical findings and investigations it was found that among 50 diabetic patients, 21 cases were having tubercular and 29 cases were having Non tubercular infections.

So, the incidence of tubercular pulmonary infection among diabetic patens 42% in this study with a relative risk of 1.32.



**Figure 1:** Incidence of respiratory infections in diabetic patients

**Table 1:** Incidence of respiratory infection in diabetic patients

	Total Cases	Tubercular Infections	Non-Tubercular Infections
Diabetic	50(100%)	21(42%)	29(58%)

**Table 2:** Age incidence of respiratory infections in diabetic infections

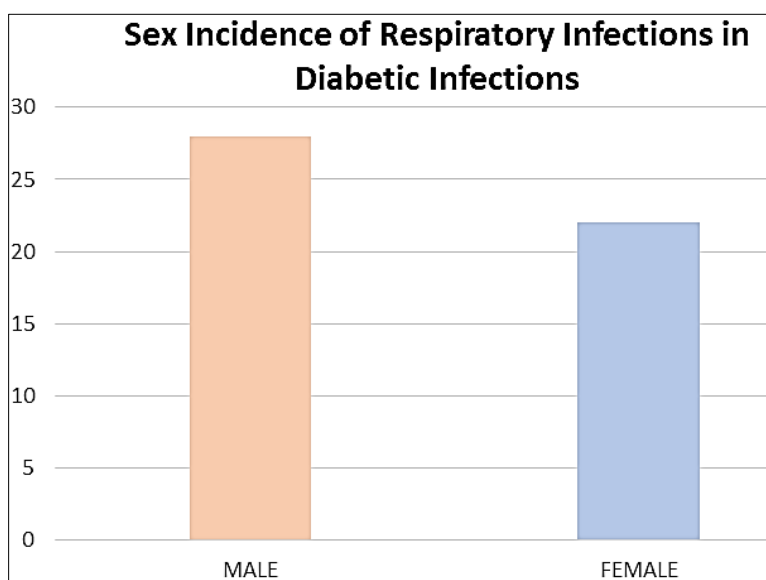
Age Incidence of Respiratory Infections in Diabetic Infections	
Age Group	No. of Cases
<30	1(2%)
30-50	17(34%)
50-70	29(58%)
>70	3(6%)
	Mean Age (Yrs.)
Diabetic (N=50)	52.70

The mean age of 52.70 years in diabetic patients with a standard deviation of 11.28.

**TABLE 3:** Sex incidence of respiratory infections in diabetic infections

Sex Incidence of Respiratory Infections in Diabetic Infections		
Sex	Male	Female
Diabetics	28(56%)	22(44%)

The association between sex incidence among diabetic patients with pulmonary infections in this study was observed that pulmonary infection was more prevalent among male patients 28(56%).



**Figure 2:** Sex incidence of respiratory infections in diabetic infections

**Table 4:** Correlation of Respiratory Infections with Duration of Diabetes Mellitus

Correlation of Respiratory Infections with Duration of Diabetes Mellitus (N=50)		
Duration (Year)	No. of Cases	Percentage (%)
<=5	4	8
6-10	13	26
11-15	12	24
>15	21	42

In this study out of 50 diabetic patients duration of diabetes of >15 years in 21 (42%).

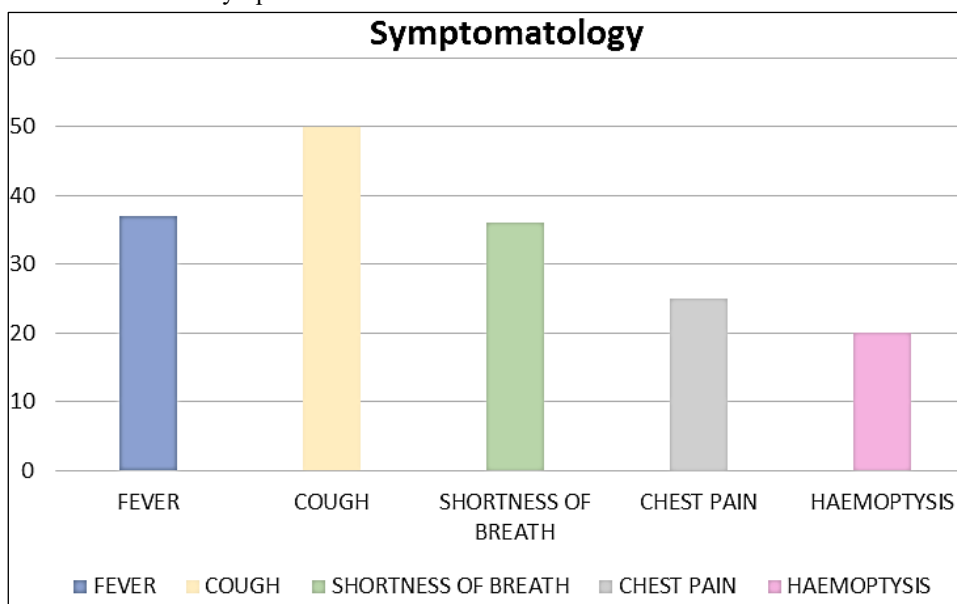
Cases, 6-10 years in 13 (26%) cases, 11-15 years in 12(24%) cases, and <5 years 4(8%) cases. So it was observed that the incidence of both tubercular and non-tubercular infection increases with increased duration of diabetes.

**Table 5:** Symptomatology

Symptomatology	
Symptoms	Diabetic (N=50)
Fever	37(74%)
Cough with	50(100%)
Mucoid	26(52%)
Mucopurulent	5(10%)
Purulent	15(30%)
Blood Stained	1(2%)
Dry Cough	3(6%)
SOB	36(72%)
Chest Pain	25(50%)
Haemoptysis	20(40%)

The most common symptoms of presentation was cough 50 (100%) with mucoid 26(52%), purulent 15(30%) & mucopurulent 5(10%) expectoration in diabetic patients. Other common symptoms were fever

37(74%), SOB 36(72%), chest pain 25 (50%), haemoptysis 20(40%) among diabetics in this study. No statistical significance was found.



**Figure 3:** Symptomatology



**Table 6:** Blood SUG

Blood Sugar		
	Mean FBS (MG/DL)	Mean PPBS (MG/DL)
Diabetic (N=50)	190	419.5

**Table 7:** Zonal Involvement of Pulmonary Infections in Diabetic Patients

Zonal Involvement of Pulmonary Infections in Diabetic Patients	
Lower Zone	12(24%)
Upper Zone	9(18%)
Mid Zone	5(10%)
Lower and Mid Zone	5(10%)

**Table 8:** Organisms Isolated in Sputum, BAL Fluid & Urine Culture

Organisms Isolated In Sputum, BAL Fluid & Urine Culture				
Organisms	Sputum	BAL Fluid	Urine	Total
<i>Streptococcus pneumoniae</i>	4(8%)	-	-	4(8%)
<i>Klebsiella pneumoniae</i>	5(10%)	3(6%)	-	8(16%)
<i>P. Aeruginosa</i>	5(10%)	2(4%)	-	7(14%)
<i>Staph. aureus</i>	2(4%)	-	-	2(4%)
<i>E. coli</i>	-	-	1(2%)	1(2%)
Enterobacteriaceae	2(4%)	-	-	2(4%)
<i>H. Influenzae</i>	-	-	-	-
Aspergillus	-	5(10%)	-	5(10%)

The most common symptoms of presentation was cough 50 (100%) with mucoid 26(52%), purulent 15(30%) & mucopurulent 5(10%) expectoration in diabetic patients. Other common symptoms were fever 37(74%), SOB 36(72%), chest pain 25 (50%), haemoptysis 20(40%) among diabetics in this study. No statistical significance was found.

**Table 9:** Incidence of Smear Positive AFB in Diabetic Patients

Incidence of Smear Positive AFB in Diabetic Patients			
Category	No. of Cases	Sputum AFB Positive	Sputum AFB Negative
Diabetic	50	21(42%)	29(60%)

## 5. Discussion

### Age Incidence

Deshmukh *et al.*'s case series from 1984, which included 138 patients with TB-DM, showed that 82.6% of the population was over 45 and mostly male. 56.6% of TB patients had DM, which was later discovered via a urine examination and confirmed by a blood sugar test in 43.4% of TB patients [5]. According to J Kishan *et al.*'s analysis of 100 cases of TB-DM in 2010, the majority of patients were men (61/100), and the 40–60 age range was the most often affected (76/100) [6]. In our study, diabetes patients had a mean age of 52.70 years and a standard deviation of 11.287. In this study, it was shown that there was a stronger correlation between sex incidence and lung infections, with male patients having a 28(56%) higher prevalence of pulmonary infections.

### Duration of Diabetes

A classic study in 1934, Root" reported that the occurrence of pulmonary tuberculosis increased with the duration of diabetes [7]. In our study out of 50 diabetic patients duration of diabetes of 315 years in 21 (42% cases, 6-10 years in 13 (26%) cases, 11-15 years in 12(24%) cases and <5 years 4(8%) cases. So it was observed that the incidence of both tubercular and non-tubercular infection increases with increased duration of diabetes.

### Symptomatology

In a case report by Deshmukh *et al.* involving 138 TB-DM patients, the population of subjects was 82.6% older than 45 and mostly male. Diabetes was reported by 93.4% of TB patients and 56.6% of those cases were later identified by a urine check and confirmed by blood sugar tests. The authors of this study pointed out that when a known case of diabetes displays symptoms of general illness, such as fever, weakness, lethargy, cough, hemoptysis and chest pains [8], investigations may be able to detect TB. In our study, expectoration with cough in 50 (100%) diabetic patients, mucoid in 26 (52%) and mucopurulent in 5 (10%) patients, was the most frequent complaint of presentations. NO statistical significance was found.

### Pyogenic Etiology

Muzafar Ahmed Naik *et al.* in 2010 conducted a study which was comprised of 100 consecutive samples of blood and sputum of patients over 12 years of age admitted with the diagnosis of CAP to the ward of General medicine SKIMS Soura, Srinagar.

*Pseudomonas aeruginosa* [10] was the most frequently isolated organism, followed by *Staphylococcus aureus* [7] *Staphylococcus pneumoniae* [1], *E. coli* [6], *Klebsiella* [3], *Streptococcus pyogenes* [1] and *Acinetobacter* [1]. The overall rate of identification of microbial aetiology was 29%, which is exceedingly low compared to other parts of India (75.6% in Shimla, 47.7% in Chandigarh, or 62% in the UK, 68% in Singapore, and 56% in the Philippines). This can be explained by the fact that serology for viral and atypical infections was not conducted at the time of the inquiry. The mortality rate was 14% [9].

In our study it was observed that *Klebsiella pneumoniae* 8(16%), *P. aeruginosa* 7(14%), *Aspergillus* 5(10%) & *Streptococcus pneumoniae* 4(8%) infections were more Prevalent among diabetic patients whereas *Streptococcus pneumoniae* & *Klebsiella pneumoniae* were less common.

### Bronchoscopy

In their study from 2010, Arshad Altaf Bachh *et al.* looked at 75 instances of bronchoscopy for the diagnosis of pulmonary TB in which the sputum smear test was negative. In 48.33% of cases, bronchial washings were the sole treatment employed, whereas bronchoscopy was the only treatment in 66% of cases (40/60). In 48.33% of patients (29/60), bronchial washings swabs for AFB and histological evidence of caseating granuloma allowed for a quick diagnosis to be made [10]. In our study Out of 50 diabetic patients with cavitory lesion and non-resolving pneumonia and smear negative pulmonary tuberculosis FOB was done in 15 cases respectively and BAL fluid for Gram stain and culture and Zn stain and BACTEC culture for mycobacterium tuberculosis was done. Bronchoscopy yield for Pyogenic organisms among the 15 diabetic patients with pulmonary infection who underwent bronchoscopy was 9 i.e. 60%. No tubercular infection was found.

## 6. Conclusion

According to the findings of the research, there is a strong link between lung infections as well as diabetes mellitus. TB was found most common pulmonary infection among all the patients diagnosed with diabetes mellitus. In our study we found significant correlation, of duration of disease, age & gender in patients with DM associated with pulmonary infections. Cough with mucoid expectoration was found most common in all enrolled patients followed by purulent & mucopurulent expectoration, prevalence of hemoptysis was also significant in diabetic patients with pulmonary infections.

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