

Impact of Smoking and Diabetes Mellitus on Clinico-Bacterio-Radiological Profile of Pulmonary Koch's Patients

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Abstract

Background: Both smoking and diabetes are attributed to be strongly linked with pulmonary tuberculosis. The significance of the study lies in assessing severity of manifestations in pulmonary tuberculosis patients due to smoking and diabetes. **Subjects and Methods:** This is a cross sectional observational study among patients presenting to Department of Tuberculosis and Chest Diseases, Government Medical College, Patiala. 200 Patients were enrolled in this study who are sputum smear positive pulmonary kochs patients already on ATT and admitted in this department were evaluated by clinical history, blood and radiological investigations and the data was statistically analyzed. **Results:** Non smoker non diabetic group had maximum of females, n=28 (56%), whereas purely diabetic study group has maximum of males, n=30 (60%). The total number of patients whose sputum showed bacterial culture was 19 (9.5%). In the patients having both diabetes and smoking as risk factor there was maximum culture positivity, n=6 (31.5%) and most common organism isolated was klebsiella pneumonia, n=3 (50%), Klebsiella was also the most common organism isolated overall, n=10 (62.5%). **Conclusion:** The combination of smoking and diabetes can lead to serious disease, sputum positivity and complications.

Keywords: Diabetes Mellitus, Smoking, Pulmonary Tuberculosis.

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Introduction

TB is one of the most important problems in India, with 1.98 million new cases per year, comprising over 20% of the global total for incident cases.^[1] Chronic exposure to tobacco, as well as to a number of environmental pollutants, impairs the normal clearance of secretion on the tracheo bronchial mucosal surface and may thus allow the causative organism *Mycobacterium tuberculosis*, to escape the first level of host defenses which prevent bacilli from reaching the alveoli.^[2]

Smoke also impairs the function of pulmonary alveolar surfactants.^[3] Nicotine is hypothesized to act directly on nicotine acetylcholine receptors on macrophages to decrease production of intracellular tumor necrosis factor and thus impair killing of *M. tuberculosis*.^[4] These effects of smoking on pulmonary host defense support a causal link between smoke exposure and either an increased risk of acquiring TB or progression of TB.

In a recently conducted study it was found that 'Ever smokers' were more likely to have experienced cough, dyspnea, cavity, milliary lung involvement, positive sputum culture and poor outcomes of TB. In both current smokers and ex-smokers TB was associated with more extensive lung disease, lung cavitations and positive sputum

bacteriology. Patients who continue to smoke, therefore, pose a risk not only to themselves, but also to every other person simultaneously exposed to their infection and cigarette smoke.^[5-9]

Diabetes mellitus (DM) is also associated with an increased risk of TB disease.^[10] According to a recent systematic review, among cohort studies, people with DM had approximately three times the risk of developing TB disease as people without. The global burden of DM is rising; the prevalence is estimated to reach 438 million by 2030, and more than 80% of the adult cases will be in newly developed or developing countries. The convergence of these two epidemics may lead to an increased incidence of TB disease, especially in low and middle income countries with increasing numbers of people with DM and prevalent TB disease. Diabetic TB patients have an increased risk of treatment failure, death and recurrent TB compared with non-diabetic TB patients.^[11,12] DM also influences the manifestations of TB. It has been reported that diabetic TB patients have more symptoms,^[13] are more likely to be smear-positive,^[14,15] and have an increased frequency of cavitary lesions compared with non-diabetic TB patients.^[16] In a recent study smokers had more than a 2-fold increased risk of pre-treatment positive smears in both non-diabetic and diabetic TB patients and diabetic smokers had more than a 5-fold increased risk of pre-treatment positive smears

than did non-diabetic non-smokers. Furthermore, the increased frequency in positive smears was mainly of a high positivity grade, indicating remarkable joint effects of diabetes and smoking that increased the risk of transmission of TB.^[17]

This study is an effort to investigate joint effects and interactions between the influences of smoking and diabetes on TB.

Subjects and Methods

This is a cross sectional and observational study where a total of 200 sputum smear positive pulmonary kochs patients already on ATT admitted in Department of chest and TB diseases, whose clinical history, sputum bacteriological investigation, smoking and diabetic status, blood investigations, radiological patterns analysed for the purpose of studying varying manifestations due to smoking and diabetes. 50 diabetic patients, 50 smokers, 50 patients who are both smoker and diabetics, 50 patients who are neither smoker or diabetic are compared on basis of clinical symptoms, sputum AFB grading and radiological severity.

Clinical symptoms include fever, cough-productive and nonproductive, haemoptysis, breathlessness, loss of weight and loss of appetite were assessed. Diabetic control assessed by fasting blood sugar and HbA1c levels.

An ever-smoker is defined as one who had smoked the equivalent of at least one cigarette a day for a period of 1 year. An ex-smoker is defined as an ever-smoker who had stopped smoking for at least 1 year before the current TB episode, and a current smoker as an ever-smoker who was still smoking or had stopped smoking for less than 1 year. Patients who did not fulfil the criterion of an ever-smoker are classified as never-smokers.

Sputum investigations include sputum AFB smear by fluorescent microscopy, gram stain and pyogenic culture.

For this study sputum grading done by fluorescent microscopy with 0.1% auramine stain and grading is as follows.^[18]

Grade	No of AFB seen
SCANTY	1-19/40 fields
1+	20-199/40 fields
2+	5-50/1 field
3+	>50/1 field

Blood investigations include haematological profile-Hb, TLC, DLC, Platelet count along with FBS, HbA1C for diabetic status. Radiological severity was assessed by Chest X-Ray. The radiological severity of the disease was assessed based on the guidelines of National TB Association of USA.^[19] Recordings of abnormal opacity of the lung parenchyma included location (right-upper, right-lower, left-upper, or left-lower) and the extent of disease (minimal, moderately-advanced, or far advanced).

The extent of disease was estimated based on the sum of all areas of abnormality in which a boundary of abnormal opacity could be drawn.

- Minimal lesions were defined as an area less than that above a horizontal line across the 2nd chondro sternal

conjunction of one lung.

- Moderately advanced lesions were defined as an area greater in size than the minimal lesions but smaller than that of one entire lung.
- Far advanced lesions were defined as an area equivalent to or greater than one lung

The data was collected at end of study period and statistically analysed.

Inclusion Criteria

- All pulmonary kochs patients already on ATT diagnosed by smear positive report.
- Patients included in this study are selected from four groups-smoker, diabetic, both smoker and diabetic, non-smoker and non-diabetic.

Exclusion Criteria

- Pulmonary kochs patients clinico-radiologically diagnosed.
- Pulmonary kochs patients diagnosed by molecular techniques CBNAAT, Line probe assay and culture.

Aims & Objectives

- To study association of TB manifestations severity in pulmonary kochs patients due to smoking and diabetes
- To study the joint effect of diabetes and smoking status on clinico-bacterio-radiological manifestations of pulmonary kochs
- To study the various radiological patterns in chest x ray in pulmonary kochs patients due to impact of diabetes
- To identify the main micro-organisms co-infecting a pulmonary kochs patient with smoking and diabetes
- To identify the association of blood sugar control in diabetic pulmonary kochs patients with severity of TB manifestations

Results

Out of total 200 patients the most common presentation of tuberculosis was fever which accounted for 80 percentage of patients (n=160) followed by cough, 76.5 percentage (n=153) [Table 1]

Table 1: Symptom Profile of Patients Enrolled

Symptom	No of patients having symptom	Percentage
Fever	160	80
Cough	153	76.5
Haemoptysis	15	7.5
Breathlessness	57	28.5
Loss of appetite	144	72
Loss of weight	144	72
Total	200	100

Haemoptysis which is a dreaded complication of pulmonary kochs had its maximum prevalence in diabetic smoker group, 4 percentage (n=8)

In the study conducted it was found out that there was only one female smoker after including both smoking groups under study (smoker non diabetic and smoker diabetic)

Non smoker non diabetic group had maximum of females,

n=28(56%), whereas purely diabetic study group has maximum of males, n=30(60%). [Table 2]

Table 2: Gender Distribution in Diabetic Study Group

Group	Males	Females	Total
Number of patients	30	20	50
Percentage	60	40	100

On comparison of social background for patients having atleast one risk factor (smoker, diabetic, smoker and diabetic) it was found that maximum population was from rural background, n=92(61.33%) [Table 3]

Table 3: Social Background Distribution Among Study Population

Group	Rural	Urban	Total
Number of patients	92	58	150
Percentage	61.33	31.87	100

Across the two groups who smoked it was found that there was a majority of ex-smokers, n=59(59%). Average smoking index of smoking non diabetic group was found to be 194.8 and average pack years was found to be 14.15. Average smoking index of smoker diabetic group was found to be 300 and average pack years found to be 20.

In the smoker diabetic group of patients majority of the patients had a sputum AFB grading of 3+, n=27(54%) followed by 2+, n=13(26%) [Table 4]

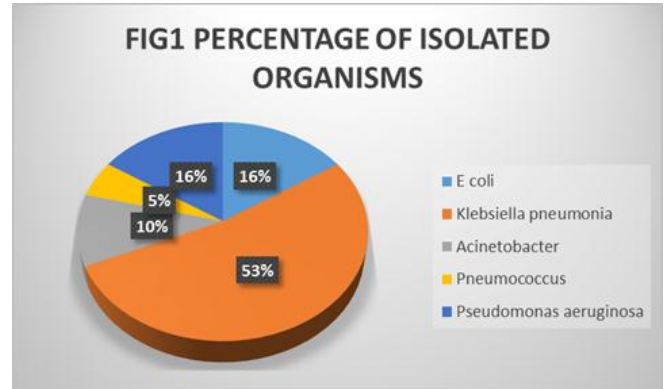
Table 4: Distribution Of Patients In Diabetic Smoker Group By Sputum Grading

Sputum grading	Number of patients	Percentage
Scanty	3	6
1+	7	14
2+	13	26
3+	27	54
Total	50	100

The total number of patients whose sputum showed bacterial culture was 19 (9.5%). In the patients having both diabetes and smoking as risk factor there was maximum culture positivity, n=6 (31.5%) and most common organism isolated was klebsiella pneumonia, n=3 (50%), Klebsiella was also the most common organism isolated overall, n=10 (62.5%). [Table 5 & Figure 1]

Table 5: Percentage of Organisms Isolated By Culture

Organism	Number	Percentage of isolated organisms
E coli	3	15.7
Klebsiella pneumonia	10	52.7
Acinetobacter	2	10.6
Pneumococcus	1	5.3
Pseudomonas aeruginosa	3	15.7
Total	19	100



On comparison of total leukocyte count among patients it was found that raised count (>15000) was found maximum among patients of pure smoker group n=10(20%). [Table 6]

Table 6: Distribution Of Patients Based On Leukocyte Count

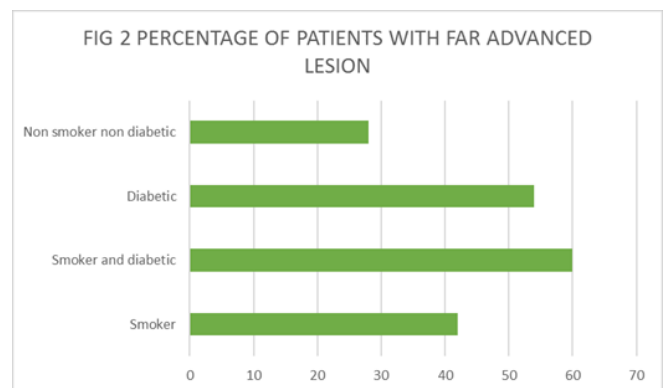
Total leukocyte count	Number of patients	Percentage
<11000	25	50
11000-15000	15	30
>15000	10	20
total	50	100

Out of total 200 patients only 2 subjects were HIV positive both were from smoker diabetic population (1%)

When data of radiological involvement was analysed it was found that more radiological involvement was found in groups having atleast one risk factor and maximum patients with far advanced radiological lesion was found to be from group having both smoking and diabetes, n=30 (60%) followed by diabetic group, n=27(54%) and smoker group, n=21(42%). [Table 7]

Table 7: Percentage of Patients With Far Advanced Lesion

Group	Number of patients with far advanced lesion	Percentage
Smoker	21	42
Smoker and diabetic	30	60
Diabetic	27	54
Non smoker non diabetic	14	28
Total	50	100



Out of radiological lesions consolidation was the common radiological lesion, n=101(50.5%), followed by cavity with

consolidation, n=80(40%). Out of 2 HIV positive patients one had cavity with consolidation and one presented with miliary disease. [Table 8]

Table 8: Distribution of Types of Radiological Lesion among Study Population

Radiological lesion	Number of patients	Percentage
Pneumothorax	5	2.5
Hydropneumothorax	3	1.5
Consolidation	101	50.5
Cavity and consolidation	80	40
Pleural effusion	8	4
Miliary pattern	3	1.5
Total	200	100

Out of the total diabetic population only 20 percentage (n=20) afforded HbA1C and out of these patients 15 patients had good diabetic control. [Table 9]

Table 9: Diabetic Control Among Patients Enrolled

Criteria	Number of patients	Percentage
HbA1C performed	20	20
Diabetic control	15	15
Total	100	100

Discussion

It was observed during our study that the maximum reported symptom of pulmonary Kochs was fever and not cough, which may highlight the limitation of our current screening symptom of cough more than 2 weeks as cough seem to be frequently overlooked by patients especially from rural areas with poor access to healthcare facilities. Haemoptysis observed mostly in group with both diabetes and smoking which may imply the rapid progression of disease in presence of these risk factors.

Rural population constituted majority of the study population, mainly due to the urban population unwillingness to disclose information about disease status and unwillingness to do the required investigations for this study. This highlights to need for greater awareness about the among urban population even though they are having higher literacy levels.

The finding that majority were ex smokers in the smoking group denoted that tobacco smoking leaves a long term residual impact on lung health and leave a person predisposed to pulmonary Kochs

Both the HIV patients had far advanced lesion on X ray which depicts the advanced disease that occurs in patients with TB HIV coinfections independent of any other risk factors

The high proportion of sputum 3 + patients ,maximum culture positivity and maximum proportion of far advanced lesions on Chest X ray in the diabetic smoker group denotes the additive synergy of these two risk factors but our study failed to demonstrate the increased risk factor association of diabetes or smoking.^[17]

One limitation of this study was that in the smoker group there was only one female leading to gender bias and poor results. Another limitation was that only 20 percentage of

the patients enrolled underwent HbA1C investigation due to poor affordability and hence poor assessment of glycemic control of the patients. The main strength of this study is the presence of a good control group.

Conclusion

Even though many studies have been conducted on the impact of smoking and diabetes on TB causation and disease progression but not on the joint effect of both these factors. The conclusion is that combination of smoking and diabetes can lead to serious disease, sputum positivity and complications.

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