Frequencies of Various Lower Respiratory Tract Infections in Type 2 Diabetes Mellitus Patients

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Author Contributions

AH MAM conceived idea, MAM KS MUB drafted the study, MAM IM collected data, NF MUB did statistical analysis and interpretation of data, MAM AH KS critical review manuscript, All approved final version to be published.

Declaration of conflicting interests

The authors declare that there is no conflict of interest.

Abstract

Respiratory Infections; DM; LRTI

Background: Chest infections are one of the factors for excessive morbidity and mortality of the people having diabetes mellitus. Defects conferred by diabetes in the immune system related to functioning of different cells including polymorphonuclear cells, monocytes and Lymphocytes are the reason for increased infections in diabetics.

Objective: To determine the frequency of various lower respiratory tract infections in patients with Type 2 diabetes mellitus.

Methodology: The present study was conducted at department of Pulmonology, Bahawal Victoria Hospital, Bahawalpur, Pakistan. A total of 139 patients with type 2 DM were included in this study. The age of the study cases were from 30 to 60 years. Patients of both genders were selected for this study. Patients with tuberculosis, chest trauma, asthma and sore throat were excluded.

Results: Mean age was 41.64 ± 8.49 years. Out of the 139 patients, 95 (68.35%) were male and 44 (31.65%) were females. Pneumonia was found in 33 (23.74%), acute bronchitis in 29 (20.86%), pleural effusion in 14 (10.07%), pleuritis in 23 (16.55%) and pulmonary tuberculosis in 52 (38.13%) patients of DM type 2.

Conclusion: The most common causes of lymphocytic exudative pleural effusion are tuberculosis and cancer. Tuberculosis is more common in children and adolescents, whereas cancer is more common in adults. In patients with unidentified exudative lymphocytic pleural effusion, pleural biopsy should be a regular diagnostic technique.

Key words: LRTI; Diabetes Mellitus; Punjab

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Introduction

One of the progressively increasing health problems faced throughout the globe is diabetes. DM causes serious health issues and poses numerous burdens on health facilities.[1] Its Prevalence increased within the previous couple of decades and as per World Health Organization (WHO), within the last 3 decades, approximately 346 million people are now living with DM worldwide. Infections play a major role in morbidity and mortality of diabetic patients. Studies revealed that defect within the function of various immune cells is reason for increased infections in diabetics.[2] Other possible

causes are low levels of thromboxane B2, various leukotriene, and prostaglandins.[3,4] Some studies also showed altered lymphocyte function and impaired monocytic phagocytosis in patients with diabetes.[5,6] Also, it has been shown in various studies that improving glycemic control improves the function of different immune cells.[7] Some micro-organisms have been found to have predilection for diabetic patients. For instance, in patients with streptococcal bacteremia, the prevalence of diabetes was found to be as high as 27.5 percent.[8] In several studies, incidence of tuberculosis among persons with diabetes was found to be three or fourfold high as compared to general population. In a study in England conducted on an immigrant Asian society showed a higher prevalence of cavitary tuberculous disease.[9] It remains uncertain whether diabetes is an independent risk factor for an increased incidence or severity of common respiratory infections.[7,8,9] In one of the largest meta-analysis of community-acquired pneumonia, the odds ratio for death related to diabetes was just 1.3.[10] A retrospective cohort study didn't identify diabetes as a significant risk factor for death at 30 days in elderly patients with pneumonia.[11] As the diabetes goes on increasing in our society and diabetic patients are more susceptible to different form of infections especially respiratory infections and our climate conditions are totally different from the foreign countries, so we intended to conduct this study to find out the frequency of different lower respiratory tract infections in Type 2 diabetes patients in our local population. This study will not only provide the local magnitude of the matter but also will help us emphasize on devising and implementing proper protocols for diagnosis as well as prevention of respiratory infections in diabetic patients.

Methodology

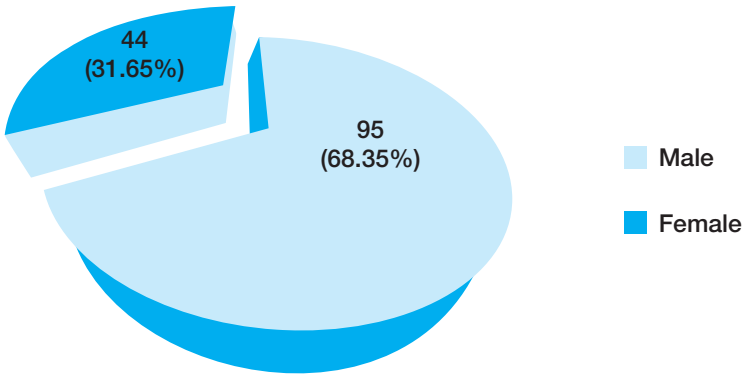
Approval of study was taken by the hospital ethical committee of faculty members at Bahawal Victoria hospital. This was a descriptive, cross-sectional type of study, conducted at Bahawal Victorial Hospital Bahawalpur. Our objective was to identify the frequency of various respiratory tract infections in Type 2 diabetes patients presenting in our outpatient department. Study included 139 consecutive patients attending the out patient department at Bahawal Victoria Hospital. All male and female patients with type 2 diabetes mellitus running in age from 30-60 years for >2 years and experiencing symptoms of chest infection were included in the study. Those patients with past history of tuberculosis, recent chest trauma and those with history of bronchial asthma were excluded from the study. All the patients were informed about the study and a written consent was taken from all the participants.

All patients were assessed for presence or absence of lower respiratory tract infections i.e. pneumonia, acute bronchitis, pulmonary tuberculosis, pleural effusion and pleuritis after a detailed history and physical examination and after confirming the diagnosis on chest x-rays, complete blood counts, sputum gram staining and culture and AFB smear. CT scans were used where needed to confirm the diagnosis. All the data including the demographic and outcome variables obtained from patients were recorded on the pre-designed proforma. Data was analyzed using SPSS version 16.

Results

There were 139 patients enrolled in the study. Mean age of the patients was 41.64 ± 8.49 years with range from 30 to 60 years. Out of the 139 patients, 95 (68.35%) were male and 44 (31.65%) were females with male to female ratio of 2.2:1 (Graph 1). Mean BMI was 28.68 ± 4.72 kg/m2. Mean duration of diabetes mellitus was 8.74 ± 1.19 years.

When frequencies of lower respiratory tract infections in diabetes patients was analyzed it was found that



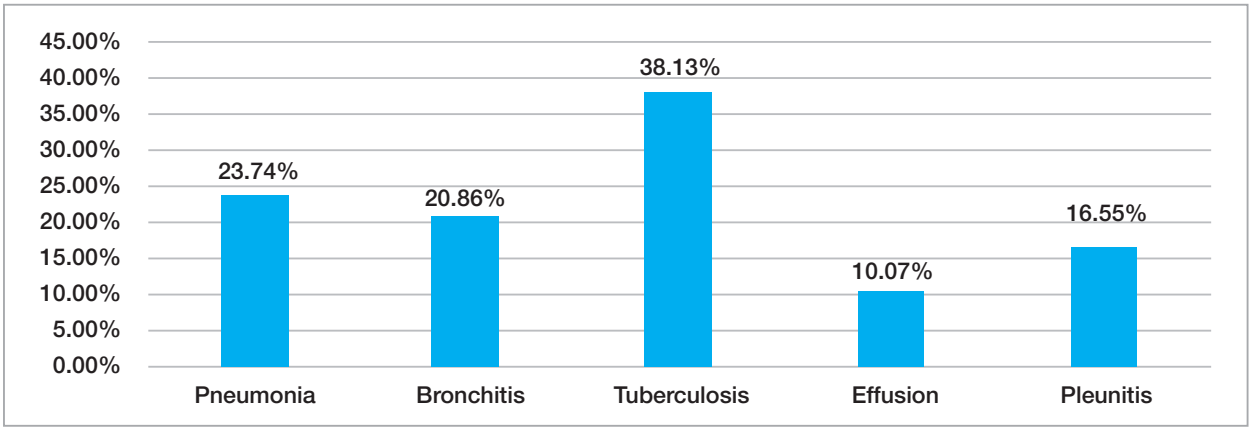
Graph 1: Distribution of patients according to gender (n=139).

Table 1. Stratification groups of various clinical and demographic features in the study population

Variable	Groups	Number of patients (n = 139)	Percentage of the patients
Age (years)	30-45	100	71.94%
BMI	46-60	39	28.06%
	≤ 30	102	73.38%
	> 30	37	26.62%
	Urban	56	40.29%
	Rural	83	59.8%
Smoking status	Yes	43	30.9%
	No	96	69.06%
Duration of DM (years)	=10	64	73.38%
	>10	75	26.62%
	>3	45	32.37%

Tuberculosis was the most common infection and was found in 52/139 (38.13%) of the patients followed by pneumonia which was present in 33/139 (23.74%), acute bronchitis in 29/139 (20.86%), pleural effusion in 14/139 (10.07%) and pleuritis was diagnosed in 23 (16.55%) (Graph 2).

When the effect of age was noted on frequencies of respiratory tract infections it was found that in age



Graph 2: Frequencies of various lower respiratory tract infections in type 2 diabetes mellitus patients

group 30-45 years there were 100/139 patients and pneumonia was present in 25/100 (25%) while in age group 46-60 years pneumonia was present in 8/39 (20.51%) with a p-value of 0.57. Acute bronchitis was present in 17/100 (17%) in age group 30-45 years in comparison to 12/39 (30.77%) patients in age group 46-60 years with a p-value of 0.073. Pulmonary tuberculosis was present in 41/100 (41%) in age group 30-45 years in comparison to 11/39 (28.2%) patients in age group 46-60 years with a p-value of 0.161. Pleural effusion was diagnosed in 8/100 (8%) patients in age group 30-45 years in comparison to 6/39 (15.3%) in age group 46-60 years with a p-value of 0.194. Pleuritis was diagnosed in 20/100 (20%) in age group 30-45 years in comparison to 3/39 (7.69%) patients in age group 46-60 years with a p-value of 0.079 (Table 2).

When the effect of gender was noted on frequencies of respiratory tract infections it was found that among male patients, pneumonia was present in 25/95 (26.72%) while in females it was present in 8/44 (18.18%) with a p-value of 0.294. Acute bronchitis was present in 21/95 (22.11%) among male patients in comparison to 8/44 (30.77%) females with a p-value of 0.294. Pulmonary tuberculosis was present in 35/95 (36.84%) in comparison to 17/44 (38.64%) with a p-value of 0.839. Pleural effusion was diagnosed in 10/95 (10.53%) male patients in comparison to 04/44 (9.09%) in females with a p-value of 0.794. Pleuritis was diagnosed in 17/95 (17.89%) male patients in comparison to 6/44 (13.64%) patients in age group 46-60 years with a p-value of 0.530 (Table 3).

Table 3. Effect of gender on frequencies of respiratory tract infections in diabetic patients.

		Male (n=95)	Female (n=44)	P-Value
Pneumonia	Present	25 (26.72%)	08 (18.18%)	0.294
	Absent	70 (73.68%)	36 (81.82%)	
Acute bronchitis	Present	21 (22.11%)	08 (18.18%)	0.596
	Absent	74 (77.89%)	36 (81.82%)	
Pulmonary tuberculosis	Present	35 (36.84%)	17 (38.64%)	0.839
	Absent	60 (63.16%)	27 (61.36%)	
Pleural effusion	Present	10 (10.53%)	04 (9.09%)	0.794
	Absent	85 (89.47%)	40 (90.91%)	
Pleuritis	Present	17 (17.89%)	06 (13.64%)	0.530
	Absent	78 (82.11%)	38 (86.36%)	

When the effect of BMI was noted on frequencies of respiratory tract infections it was found that among patients with BMI < 30 there were 102 patients and pneumonia was present in 26/102 (25.49%) while in patients with BMI > 30 it was present in 7/37 (18.92%) with a p-value of 0.421. Acute bronchitis was present in 21/102 (20.59%) among patients with BMI < 30 in comparison to 8/37 (21.62%) patients with BMI > 30 with a p-value of 0.895. Pulmonary tuberculosis was present in 39/102 (38.24%) in BMI < 30 in comparison to 13/37 (35.14%) with a p-value of 0.739. Pleural effusion was diagnosed in 10/102 (9.80%) in patients with BMI < 30 in comparison to 04/44 (10.81%) in patients with BMI > 30 with a p-value of 0.862. Pleuritis was diagnosed in 20/102 (19.61%) in those with BMI < 30 in comparison to 34/37 (91.89%) among patients with BMI > 30 with p-value of 0.001 (Table 4).

Table 4. Stratification of lower respiratory tract infections with respect to BMI.

		≤ 30 (n=102)	≥ 30 (n=37)	P-Value
Pneumonia	Present	26 (25.49%)	07 (18.92%)	**0.421**
	Absent	76 (74.51%)	30 (81.08%)	
Acute bronchitis	Present	21 (20.59%)	08 (21.62%)	**0.895**
	Absent	81 (79.41%)	29 (78.38%)	
Pulmonary tuberculosis	Present	39 (38.24%)	13 (35.14%)	**0.739**
	Absent	63 (61.76%)	24 (64.86%)	
Pleural effusion	Present	10 (9.80%)	04 (10.81%)	**0.862**
	Absent	92 (90.20%)	33 (89.19%)	
Pleuritis	Present	20 (19.61%)	03 (8.18%)	**0.001**
	Absent	82 (80.39%)	34 (91.89%)	

When the effect of smoking was noted on frequencies of respiratory tract infections it was found that among smoker patients pneumonia was present in 09/43 (20.93%) while among non-smokers it was present in 24/96 (25%) with a p-value of 0.602. Acute bronchitis was present in 04/43 (9.30%) among smokers in comparison to 25/96 (26.04%) females with a p-value of 0.025. Pulmonary tuberculosis was present in 16/43 (37.25%) in smokers in comparison to 36/96 (37.50%) patients who are non-smokers with a p-value of 0.974. Pleural effusion was diagnosed in 5/43 (11.63%) smokers in comparison to 09/96 (10.71%) in non-smokers with a p-value of 0.955. Pleuritis was diagnosed in 7/43 (9.38%) smokers in comparison to 16/96 (16.67%) non-smoker patients with a p-value of 0.955 (Table 5).

Table 5. Effect of smoking on frequencies of respiratory tract infections

		Yes (n=43)	No (n=96)	P-Value
Pneumonia	Present	09 (20.93%)	24 (25.0%)	0.602
	Absent	34 (79.07%)	72 (75.0%)	
Acute bronchitis	Present	04 (9.30%)	25 (26.04%)	0.025
	Absent	39 (90.70%)	71 (73.96%)	
Pulmonary tuberculosis	Present	16 (37.21%)	36 (37.50%)	0.974
	Absent	27 (62.79%)	60 (62.50%)	
Pleural effusion	Present	05 (11.63%)	09 (10.71%)	0.683
	Absent	38 (88.37%)	87 (89.29%)	
Pleuritis	Present	07 (9.38%)	16 (16.67%)	0.955
	Absent	36 (90.62%)	80 (83.33%)	

When the effect of duration of diabetes was noted on frequencies of respiratory tract infections it was found that among patients with duration < 10 pneumonia was present in 14/64 (21.88%) while in patients with duration > 10 years it was present in 19/75 (25.33%) with a p-value of 0.633. Acute bronchitis was present in 13/64 (20.31%) among patients with duration < 10 years in comparison to 16/75 (21.33%) patients with duration > 10 with a p-value of 0.883. Pulmonary tuberculosis was present in 21/64 (32.81%) in those with duration < 10 years in comparison to 31/75 (41.33%) with duration > 10 years with a p-value of 0.301. Pleural effusion was diagnosed in 04/64 (6.25%) in patients with duration < 10 in comparison to 10/75 (13.33%) in patients with duration > 10 years with a p-value of 0.467. Pleuritis was diagnosed in 09/64 (14.06%) in those with duration < 10 years in comparison to 14/75 (18.67%) among patients with duration > 10 years with p-value of 0.467 (Table 6).

Table 6. Effect of duration of diabetes on frequencies of various respiratory tract infections in diabetes patients.

		Duration =10yrs (n=64)	Duration >10yrs (n=75)	P-Value
Pneumonia	Present	14 (21.88%)	19 (25.33%)	0.633
	Absent	50 (78.12%)	56 (74.67%)	
Acute bronchitis	Present	13 (20.31%)	16 (21.33%)	0.883
	Absent	51 (79.69%)	59 (78.67%)	
Pulmonary tuberculosis	Present	21 (32.81%)	31 (41.33%)	0.301
	Absent	43 (67.19%)	44 (58.67%)	
Pleural effusion	Present	04 (6.25%)	10 (13.33%)	0.167
	Absent	60 (93.75%)	65 (86.67%)	
Pleuritis	Present	09 (14.06%)	14 (18.67%)	0.467
	Absent	55 (85.94%)	61 (81.33%)	

Discussion

Lower respiratory tract infections (LRTIs) are a common reason for people to seek medical attention.[12] Patients with diabetes mellitus have an elevated risk of developing a complicated course of LRTI.[13] For example, infections may lead to serious acute hyperglycemia, which may cause adverse clinical outcomes.[14] Age range in my study was from 30 to 60 years with mean age of 41.64 ± 8.49 years. Out of the 139 patients, 95 (68.35%) were male and 44 (31.65%) were females with male to female ratio of 2.2:1. In our study we found that pulmonary tuberculosis was the most common respiratory infection seen in 52 diagnosed followed by pneumonia in 33 (23.74%), acute bronchitis in 29 (20.86%), pleural effusion in 14 (10.07%), pleuritis in 23 (16.55%). and pulmonary tuberculosis in 52 (38.13%) patients of type 2 diabetes mellitus. These results are similar to those seen in another study which showed that lower respiratory tract infections in type 2 diabetes mellitus were pneumonia (27.50%), acute bronchitis (22.50%), pleural effusion was seen in 15%, pleuritis in 10% and pulmonary tuberculosis was diagnosed in 40%.[15] In another study conducted in 2009, around 9 million patients were diagnosed with tuberculosis and almost 1.7 million persons died with tuberculosis. Patients

with diabetes are at higher risk of contracting tuberculosis than individuals without DM.[16] Some studies have reported that persons with DM are more likely to develop multi-resistant tuberculosis.

In another study which included 445 diabetic patients, mean age was 76 years and acute exacerbation of chronic bronchitis was present in 43.4% of episodes while acute bronchitis and pneumonia were present in 36.6% and 20.0% of episodes. Another study showed that the risk for LRTI is increased by 46% in type 1 diabetes, and 30% in type 2 diabetes.[16] The risk of recurrent LRTI in patients with diabetes mellitus was reported to be around 57%.[16]

Streptococcus pneumoniae has been responsible for causing community acquired pneumonia in general population and it has a predilection for infection in patients with diabetes mellitus.[11] Patients with diabetes mellitus have a significant change in respiratory immune system with an increased propensity to develop respiratory infections which can further cause changes in the ciliary function and mobility resulting in even higher chance of developing infection. Loss of antigen presenting ability due to altered immune system in diabetic patients has been the reason proposed for a higher risk of development of tuberculosis in patients with diabetes.[10] Similary, the development of viral pneumonia, bacterial pneumonia and even death has been reported higher in diabetics as compared to general population.[11] We need a higher scale study in south Punjab to further probe the exact pravelence, patterns and microbiology in diabetic patients with type 2 diabetes mellitus.

Conclusion

This study concluded that the frequency of various lower respiratory tract infections especially pulmonary tuberculosis is quite high in Type 2 diabetes mellitus patients. Therefore, it is imperative to use proper screening tests to timely diagnose these infections and implement aggressive management protocols to effectively treat them to avoid complications. It also highlights that diabetic patients should use preventive measures including various available vaccinations to prevent the development of these infections which in turn will not only improve the quality of life of these patients but also reduce the risk of spread of communicable diseases.

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