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Original Research Article

Surveillance of Respiratory Pathogens among Uncontrolled Type II Diabetes Mellitus Patients

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Abstract

Background and Aim: Diabetes mellitus is a standalone risk factor for lung infections, which present with severe clinical signs, frequent complications, and increased morbidity & mortality. It has been suggested that impaired lung function and insulin resistance, type 2 diabetes, glucose intolerance, and obesity are related. The goal of the current investigation was to ascertain the relationship between LRTI in DM patients.

Material and Methods: In order to research the connection between DM and lower respiratory tract infections, 200 instances of DM with lower respiratory tract infections were examined over the course of a year. Using a pre-designed organised proforma, information on each chosen patient was meticulously gathered. Based on FBS/PPBS, oral glucose tolerance, and HbA1c criteria (i.e., FBS>126 mg/dl, OGT>2oomg/dl), diabetes is diagnosed. All patients underwent Ziehl-Neelsen staining and culture-sensitivity testing. When necessary, imaging tests including computed tomography and ultrasonography were carried out.

Results: The age range most frequently impacted was 40 to 59 (n=114). Males were more impacted than females, with 38% of patients hailing from urban regions and 62% from rural ones. Patients' socioeconomic level ranged from lower socioeconomic status (48%), middle socioeconomic status (34%), to upper socioeconomic status (18%). Instances of Mycobacterium tuberculosis were most frequently isolated. Additionally, strains of Staphylococcus aureus, Klebsiella pneumonia, Pseudomonas aeruginosa, Escherichia coli, and Influenza A (H1N1) were isolated. In diabetic patients, Mycobacterium tuberculosis was the most isolated organism. Dry cough from early consolidation, prior antibiotic treatment, and incorrect sputum collection are the causes of inability to detect any organism in sputum in 35% of patients.

Conclusion: LRTI and other DM-related complications are more likely to develop in DM patients with age greater than 50, duration greater than 4, and uncontrolled DM status. According to radiological findings, lesions that were moderately to severely progressed and that involved both sides were more prevalent.

Keywords: Diabetes Mellitus, Influenza A, Mycobacterium Tuberculosis, Lower Respiratory tract Infection

Introduction

Due to inadequate insulin action or secretion, diabetes is a chronic illness that is characterised by consistently high levels of glucose in the blood. Insulin resistance, improper insulin production, and b-cell death are all symptoms of T2D, which is also characterised by inflammation and metabolic stress. It is brought on by a number of risk factors, including ageing, way of life, and genetic susceptibility [1]. Loss of glycemic homeostasis causes metabolic stress, which in turn causes harmful microvascular and macrovascular consequences as well as hepatic comorbidities [2]. Studies have also demonstrated that T2D makes patients more vulnerable to serious infections; this is because microenvironmental dysmetabolism impairs immune responses [3,4]. This is significant since it relates to a number of diseases, including those that cause higher hospitalisation and mortality rates, such as skin and soft tissue infections, urinary tract infections, and respiratory infections [5,6].

One of the most severe infections connected with diabetes is thought to be respiratory. Microangiopathic changes in the lungs of T2D patients were found to be correlated with hyperglycemia and elevated protein glycosylation [7,8]. According to the pneumonia severity index, diabetes people are more likely than non-diabetic patients to get severe respiratory infections. The majority of infections in diabetes individuals are caused by gram-positive cocci like S. pneumoniae, followed by pathogens like H. influenza [9,10]. Due to bacteria like S. pneumoniae, diabetes patients may have more severe disease development, increased rates of hospitalisation, and the emergence of complications like bacteremia. An increased incidence of recurrent bacterial pneumonia has been linked to diabetes [11]. Additionally, about 25% of nosocomial infections are multi-microbial [12]. When Klebsiella and Staphylococcus are involved in bacterial pneumonia in diabetics, the disease tends to progress more quickly and mechanical ventilator support is required more often [13]. Diabetes is frequently accompanied by lung tuberculosis, which also causes insulin resistance and "brittleness". Patients with severe diabetes who require high doses of insulin are more likely to develop lung tuberculosis than those whose diabetes is under control but not under control. Diabetes-related lung tuberculosis presents a number of challenges, including a severe form and more aggressive course of the disease, a higher propensity for cavitation and destruction, and a higher prevalence of anti-tuberculotic drug resistance [14].

It has been suggested that impaired lung function and insulin resistance, type 2 diabetes, glucose intolerance, and obesity are related. The goal of the current investigation was to ascertain the relationship between LRTI in DM patients.

Material and Methods

In order to research the connection between DM and lower respiratory tract infections, 200 instances of DM with lower respiratory tract infections were examined over the course of a year. All 200 patients randomly chosen from all ages and both sexes are admitted to Indian tertiary care hospitals. In this cross sectional investigation, patients with DM who had LRTI based on clinical and radiological evidence were either known cases or had just been diagnosed. Every patient's data contained information on their typical clinical exams as well as their typical biochemical and haematological tests. Using a pre-designed organised proforma, information on each chosen patient was meticulously gathered. Data about the performer's current age, onset age, place of residence, personal and family history, seasonal variance, and religion were all. development, socioeconomic status of the parents, history of relapse, included in this performa etc. Based on FBS/PPBS, oral

glucose tolerance, and HbA1c criteria (i.e., FBS>126 mg/dl, OGT>2oomg/dl), diabetes is diagnosed. All patients underwent Ziehl-Neelsen staining and culture-sensitivity testing. When necessary, imaging tests including computed tomography and ultrasonography were carried out. On the basis of clinical, radiographic, and laboratory results, a diagnosis was reached.

Statistical Analysis

The collected data was organised, inputted, and exported to the data editor page of SPSS version 15 (SPSS Inc., Chicago, Illinois, USA) after being combined and entered into a spreadsheet programme (Microsoft Excel 2007). The level of significance and confidence level for each test were set at 5% and 95%, respectively.

Results

The age range most frequently impacted was 40 to 59 (n=114). Males were more impacted than females, with 38% of patients hailing from urban regions and 62% from rural ones. Patients' socioeconomic level ranged from lower socioeconomic status (48%), middle socioeconomic status (34%), to upper socioeconomic status (18%). (Table 1) The two most typical symptoms were a cough and a fever. Other symptoms were anorexia, weight loss, shortness of breath, chest pain, and hemoptysis. Mycobacterium tuberculosis was the most often isolated organism among all the pathogens causing LRTI. Additionally, strains of Staphylococcus aureus, Klebsiella pneumonia, Pseudomonas aeruginosa, Escherichia coli, and Influenza A (H1N1) were isolated. No organism was isolated in 34% patients (Table 2).

DM has a higher degree of genetic predisposition than TB, and patients with DM have a higher risk of getting TB due to their immunological impaired status, as evidenced by the fact that 27% of the patients had a family history of DM and 10% of the patients had a family history of TB. At the time the pulmonary infection was diagnosed, the average age of DM patients was 4.80 years.

A rigorous diabetes management is critical to preventing such infections because 70% of the patients did not have their DM under control at the time of LRTI discovery. In diabetic patients, Mycobacterium tuberculosis was the most isolated organism. Dry cough from early consolidation, prior antibiotic treatment, and incorrect sputum collection are the causes of inability to detect any organism in sputum in 35% of patients.

Radiographs appeared to show that unilateral or bilateral isolated lower lobe involvement was more typical. Nodular lesions were less frequent than exudative and cavitatory lesions. Most patients had bilateral involvement and a mild to far-advancing lesion.

Table 1: Demographic Distribution of study participants

Variable	Number	Percentage (%)
Age group (years)		
< 19	6	3
20-39	48	24
40-59	114	57
60 and more than 60	32	16
Gender		
Male	136	68
female	64	32
Socio economic status		

Lower	96	48
Middle	68	34
upper	36	18
Residence		
Urban	76	38
Rural	124	62

Table 2: Clinical profile of 50 patients of DM with LRTI in present study

Variables	Number	Percentage (%)
Symptoms		
Cough	192	96
Fever	180	90
Breathlessness	52	26
Anorexia	96	48
Chest pain	58	29
Hemoptysis	48	24
weight loss	34	17
Duration of DM		
First time detected-	20	10
< 1 year	22	11
1 to 5 year	88	44
> 5 year	52	26
Status of DM		
First time detected	40	20
Controlled	22	11
Isolated organism		
Mycobacterium tuberculosis	44	22
Streptococcus pneumonia	34	17
Klebsiella pneumonia	16	8
Staphylococcus aureus	8	4
Pseudomonas aeruginosa	12	6
Escherichia coli	4	2
Influenza A (H1N1)	12	6
% No pathogen isolated	68	34

Discussion

According to our study's findings, there is currently conflicting evidence showing that lower respiratory tract infections are more likely to occur and that upper respiratory tract infections are less likely to occur. Patients with diabetes were shown to have an increased risk of an unidentified upper respiratory tract infection in a previous investigation [15]. Diabetes was not linked to pneumonia in previous case-control and cohort studies [16-18]. Because elderly or patients with chronic illnesses were included in these research, it is possible that the findings do not apply to the diabetes population as a whole.

Males were more impacted by males than females. According to the results of the majority of the current research, all diabetic women had a higher risk of infection than

control patients [19-22]. However, previous research primarily focused on diabetic female patients, and no connections for male patients were noted.

Other symptoms were anorexia, weight loss, shortness of breath, chest pain, and hemoptysis. Mycobacterium tuberculosis was the most often isolated organism among all the pathogens causing LRTI. Additionally, strains of Staphylococcus aureus, Klebsiella pneumonia, Pseudomonas aeruginosa, Escherichia coli, and Influenza A (H1N1) were isolated. The primary pathogen causing nosocomial and community acquired pneumonia is staphylococcus. Streptococcus, Pneumococcus, Legionella, and viral infections are all possible causes of infections that may have higher morbidity and fatality rates. Diabetics who have pulmonary tuberculosis often have a severe type and a more aggressive course of the disease, as well as higher damage, cavitations, greater treatment resistance, unusual x-ray findings, and more effusions. Mucormycosis, aspergillus species, coccidioides immitis, and cryptococcus neoformans can all cause primary pneumonia in diabetics. According to a study [23] that looked at patients hospitalised for tuberculosis over a 6-year period and discovered that 13.2% of them had diabetes, the number continuously rose with time [24]. Nearly 50 percent of the sample in a smaller but comparable Pakistani research exhibited impaired glucose tolerance [25]. Studies that were either not controlled or in which control participants were chosen at random from the general community provide the majority of the current evidence on the link between infections and diabetes. Due to the frequent doctor visits required for diabetes management, both study designs run the danger of having a significant selection bias. For instance, it has been demonstrated that having a history of frequent visits to a primary care physician raises the chance of developing significant respiratory tract infections when the flu is widespread.

The frequency of future infections showed only a slight connection with mean fasting plasma glucose levels, according to Rayfield *et al*., who monitored 241 diabetic patients at outpatient clinics in New York [26]. The evidence from more recent trials, which is covered in more depth above, implies that highly dysregulated diabetes increases a number of certain infections more than well-regulated diabetes does. Randomised studies have demonstrated that postoperative patients who get parenteral nourishment encounter higher infections than those who receive enteral feeding, which may be linked to the emergence of severe hyperglycemia [27,28]. In some subgroups of diabetic and non-diabetic patients, rigorous hyperglycemic control and intense insulin therapy have been proven to minimise the incidence of recurring wound infections and sepsis in randomised studies in surgical patients [29,30]. It is unclear if the observed impact is the result of insulin's advantageous anti-inflammatory properties or a reduction in the harm caused by hyperglycemia.

In our investigation, lung infections caused by staphylococcus, candida species, gram-negative bacteria like klebsiella, and pseudomonas were much more common in diabetes individuals. Compared to non-diabetics, diabetics had a significantly greater incidence of pulmonary tuberculosis and higher rates of cavitation. These results agree with those of the earlier research [31-33].

Conclusion

LRTI and other DM-related complications are more likely to develop in DM patients with age greater than 50, duration greater than 4, and uncontrolled DM status. The most prevalent isolated pathogen among DM with LRTI patients is Mycobacterium tuberculosis. According to radiological findings, lesions that were moderately to

severely progressed and that involved both sides were more prevalent. Diabetes increases mortality from influenza A (H1N1) pneumonia compared to non-diabetics. Study revealed that lack of education, poor life style, poor nutrition and absence of follow-up visits led to development of serious respiratory infections among diabetics. So there is a great need of health counseling regarding strict diabetic control and follow-up visits to improve their quality of life. To better understand the immunopathogenic processes linking DM and infections and to devise plans to increase diabetes patients' vaccine coverage, more study is required.

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