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An assessment of spectrum of different microorganism causing community acquired pneumonia in diabetic and non-diabetic

Dr MC Srivastava[1], Dr Amritesh Ranjan Mishra*[2], Mr Sultan Ahmed[3]

[1]*Assistant Professor, Department of Medicine, Prasad Institute of Medical Sciences, Sarai Shahzadi, Banthara, Lucknow-226401*
[2]*Assistant Professor, Department of TB and Chest, Prasad Institute of Medical Sciences, Sarai Shahzadi, Banthara, Lucknow-226401*
[3]*Tutor, Department of Microbiology, Prasad Institute of Medical Sciences, Sarai Shahzadi, Banthara, Lucknow-226401*

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ABSTRACT

Objective: To assess the spectrum of different microorganism causing community acquired pneumonia in diabetic and non-diabetic.

Methods: This was a cross-sectional study. A total of 275 patients were included in the study. Adults aged 20 years or older (<80 years), diabetic patients and non-diabetic patients with community acquired pneumonia were included in the study. Sputum and blood culture analysis was done.

Results: The prevalence of diabetes was found to be in 37.1% patients. AFB was positive among 71.1% diabetic patients and in 28.9% among non-diabetic patients. Culture was positive among 78.2% diabetic patients and in 21.9% among non-diabetic patients. Entero Aeroganes was among 85.7% diabetic patients and among 14.3% non-diabetic patients on sputum microscopy. Streptococci was in 81.8% diabetic patients and in 18.2% non-diabetic patients on sputum microscopy. Klebsiella pneumonia was in all the diabetic patients on blood culture. Haemophilus influenza was in 90% diabetic patients and in 10% non-diabetic patients on blood culture. Multilobe chest X-ray finding was in 37.5% diabetic patients and in 62.5% of non-diabetic patients.

Conclusion: In patients with pneumonia, diabetes mellitus is associated with microbial etiology and multilobe involvement. This study suggests that the adverse outcome is more attributable to the underlying circumstances of patients than to uncommon microbiological findings.

Key words: Diabetic–Pneumonia–Microorganism

1 INTRODUCTION

According to the World Health Organization (WHO), lower respiratory tract infections are the third leading cause of death in the world[1]. Specifically, CAP is ranked as the fifth cause of mortality global and in 2013, pneumococcal pneumonia accounted for more than 20% of these cases. Furthermore, in addition to pneumococcal pneumonia being an important cause of mortality, lower respiratory tract infections represent the third leading cause of lost years of life after adjusting for disability[2].

The probability of hospitalization in patients suffering from community-acquired pneumonia (CAP) with an underlying comorbidity such as a cardiac, respiratory or metabolic pathology is 73 times higher than in patients without a comorbidity[3]. The detection of these comorbidities is important for prevention, such as pneumococcal vaccination, and to prevent excessive hospitalization. Diabetes is one of these comorbidities. In Europe, the prevalence of diabetes is 8.8%, and this number is projected to increase[4].

Persons with diabetes mellitus, compared with nondiabetic persons, have higher rates of impaired immunity, decreased lung function and an increased risk for various types of infection, including pneumonia[5,6].

Patients with diabetes appear to be at increased risk for acquiring S. aureus pneumonia and patients requiring renal dialysis are at risk for hospital-acquired pneumonia, healthcare associated pneumonia and ventilator associated pneu-

* Corresponding author.

monia caused by multi-drug resistant pathogens[7]. A study by Haque and colleagues found that 28-day mortality rates were higher among ICU patients with MRSA pneumonia when they had comorbid diabetes[8].

Current guidelines for the management of adults with hospital-acquired, ventilator-associated and health care associated pneumonia issued jointly by the American Thoracic Society and the Infectious Diseases Society of America (IDSA) recommend either linezolid or vancomycin as appropriate antibiotic agents for the treatment of MRSA nosocomial pneumonia (NP)[7]. The guidelines do not, however, address the potential for worse outcomes of this infection in a patient with diabetes, nor how the presence of this comorbidity might affect selection of antibiotic therapy. Presumably, this is based on a lack of published data on these issues.

The present study was designed to assess the spectrum of different microorganism causing community acquired pneumonia in diabetic and non-diabetic.

2 MATERIAL AND METHODS

This was a cross-sectional study conducted in the Department of Medicine, Prasad Institute of Medical Sciences, Lucknow, UP. The study was approved by the Ethical Committee of the Institute and consent was taken from each participant before including in the study. Adults aged 20 years or older (<80 years), diabetic patients and non-diabetic patients with community acquired pneumonia were included in the study. Patients diagnosed to have tuberculosis, HIV positive or with other immunocompromised states, lung cancer and having upper respiratory tract infections were excluded from the study. A total of 275 patients were included in the study.

Diabetes mellitus was diagnosed using the national diabetes data group and WHO diagnostic criteria:

1. Symptoms of diabetes plus random blood sugar >200mg/dl.
2. Fasting plasma glucose >126mg/dl.
3. Two hour plasma glucose >200mg/dl during an oral glucose tolerance test.

Diagnostic criteria for CAP

I. **In the absence of chest radiograph**

(a) Symptoms of an acute lower respiratory tract illness (cough with or without expectoration, shortness of breath, pleuritic chest pain) for less than 1 week, (b) At least one systemic feature (temperature >37.7°C, chills, and rigors, and/or severe malaise), (c) New focal chest signs on examination (bronchial breath sounds and/or crackles), (d) No other explanation for the illness.

II. **When a chest radiograph is available**

Symptoms and signs as above with new radiographic shadowing for which there is no other explanation. Radiographic shadowing may be seen in the form of a lobar or patchy consolidation, loss of a normal diaphragmatic, cardiac or mediastinal silhouette, interstitial infiltrates, or bilateral perihilar opacities, with no other obvious cause.

Sputum collection and examination

Sputum was collected for the bacteriological examination. Sputum was examined macroscopically with respect to quantity, colour, odour and evidence of haemoptysis. All sputum smears were stained with gram's stain. Based on the results of gram staining, each sample was labelled as appropriate or inappropriate. Those smears which showed more than 25 polymorphs per low power field and less than 10 squamous epithelial cells per low power field were considered as appropriate sample and others as inappropriate. Sputum was also examined for AFB by Ziehl Nelson (Z.N.) stain by direct and concentration method for 2 consecutive days.

Blood sampling

For blood culture, a minimum of 10 ml of blood was taken through venipuncture and injected into two or more "blood culture bottles" with specific media for aerobic and anaerobic organisms. The blood was collected using aseptic technique. This required that both the tops of the culture bottles and the venipuncture site of the patient were cleaned prior to collection by swabbing with 70% isopropyl alcohol (povidone and left to dry before venipuncture).

Statistical analysis

The results are presented in frequencies and percentages. The Chi-square test was used for comparisons. The p-value<0.05 was considered significant. All the analysis was carried out on SPSS 16.0 version (Chicago, Inc., USA).

3 RESULTS

The prevalence of diabetes was found to be in 37.1% patients (Fig.1).

About one fourth of patients were between 31-40 years (24.4%) followed by 20-30 (21.8%), 51-60 (21.1%), 41-50 (18.9%) and >60 (13.8%). More than half of patients were males (56%). The percentage of diabetic patients was highest in age 41-50 years (34.6%) and was lowest in age 20-30 years (26.7%). Females (38%) were more diabetic than males (36.4%) (Table-1).

Fever was the most common clinical symptom among the patients (33.5%) and Plueritic chest pain was the least common clinical symptom among the patients (21.1%). Fever was present among 78.3% diabetic patients and among 21.7% among non-diabetic patients. Expectoration was present among 76.7% diabetic patients and among 23.3% among non-diabetic patients. There was significant (p=0.001) difference in clinical symptoms between diabetic and non-diabetic patients (Table-2).

AFB was positive in 27.6% and blood culture was positive in 31.6% patients. AFB was positive among 71.1% diabetic patients and in 28.9% among non-diabetic patients. Culture was positive among 78.2% diabetic patients and in 21.9% among non-diabetic patients. There was significant (p=0.001) difference in AFB and blood culture between diabetic and non-diabetic patients (Table-3).

Streptococci was the most common organism isolated on sputum microscopy (14.5%). Klebsiella pneumonia and Acinetobacter was the second most common organism isolated in sputum microscopy each constituted 13.2%. E.coli was third the most common organism isolated on sputum microscopy (11.8%). Entero Aeroganes was among 85.7% diabetic patients and among 14.3% non-diabetic patients on sputum microscopy. Streptococci was in 81.8% diabetic patients and in 18.2% non-diabetic patients on sputum microscopy. There was significant (p=0.0001) difference in organisms isolated on sputum microscopy between diabetic and non-diabetic patients (Table-4).

Pseudomonas aeruginosa was most common organism isolated on blood culture (12.6%). Streptococcus pneumonia and Haemophilus influenza was the second most common organism isolated on blood culture each constituted 11.5%. Klebsiella pneumonia was in all the diabetic patients on blood culture. Haemophilus influenza was in 90% diabetic patients and in 10% non-diabetic patients on blood culture. There was significant (p=0.0001) difference in organisms isolated blood culture between diabetic and non-diabetic patients (Table-5).

Unilobe chest X-ray finding was in 53.5% patients. Multilobe chest X-ray finding was in 37.5% diabetic patients and in 62.5% of non-diabetic patients. There was significant (p=0.0001) difference in chest X-ray finding between diabetic and non-diabetic patients (Table-6).

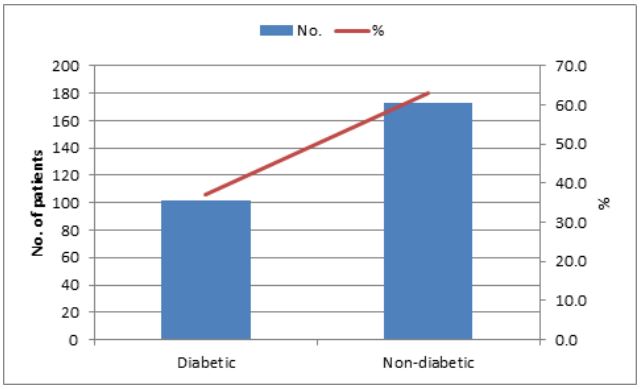

Figure 1. Distribution of diabetic and non-diabeticpatients

4 DISCUSSION

In the present study, about one fourth of patients were between 31-40 years (24.4%) followed by 20-30 (21.8%), 51-60 (21.1%), 41-50 (18.9%) and >60 (13.8%). More than half of patients were males (56%). The percentage of diabetic patients was highest in age 41-50 years (34.6%) and was lowest in age 20-30 years (26.7%). Females (38%) were more diabetic than males (36.4%). Falguera et al[9] in their study shows that 61.41% of the patients were in age group between 40 to 60 years. Bhambar et al[10] reported that the average age in diabetics was 57.93±9.71 years and majority of them were between 40-60 years of age. Studies have reported male predominance in diabetics [11,12].

In this study, fever was the most common clinical symptom among the patients (33.5%) and Plueritic chest pain was the least common clinical symptom among the patients (21.1%). Fever was present among 78.3% diabetic patients and among 21.7% among non-diabetic patients. Miquel et al[12] reported that typical clinical features like signs of consolidation were seen in 58% of the patients and other 42% of patients presented with signs other than consolidation in diabetics. Bhambar et al[10] reported 63.3% with signs of consolidation and 36.7% signs other than consolidation in diabetics.

In the present study, AFB was positive in 27.6% and blood culture was positive in 31.6% patients. AFB was positive among 71.1% diabetic patients and in 28.9% among

Table 1. Age and gender distribution of diabetic and non-diabetic patients

Age and gender	No. of patients (n=275)		Diabetic		Non-diabetic	
	No.	%	No.	%	No.	%
Age in years						
20-30	60	21.8	16	26.7	44	73.3
31-40	67	24.4	21	31.3	46	68.7
41-50	52	18.9	18	34.6	34	65.4
51-60	58	21.1	19	32.8	39	67.2
>60	38	13.8	12	31.6	26	68.4
Gender						
Male	154	56.0	56	36.4	98	63.6
Female	121	44.0	46	38.0	75	62.0

[1]Chi-squaretest

Table 2. Comparison of clinical symptoms between diabetic and non-diabetic patients

Clinical symptoms#	No. of patients (n=275)		Diabetic		Non-diabetic		p-value1
	No.	%	No.	%	No.	%	
Cough	67	24.4	44	65.7	23	34.3	0.001*
Expectoration	73	26.5	56	76.7	17	23.3	0.001*
Breathlessness	71	25.8	49	69.0	22	31.0	0.001*
Plueritic chest pain	58	21.1	39	67.2	19	32.8	0.001*
Fever	92	33.5	72	78.3	20	21.7	0.001*

[1]Chi-squaretest, #Multiple response *Significant

Table 3. Comparison of sputum AFB and blood culture between diabetic and non-diabetic patients

Sputum AFB/Blood culture	No. of patients (n=275)		Diabetic		Non-diabetic		p-value1
	No.	%	No.	%	No.	%	
Sputum AFB							
Positive	76	27.6	54	71.1	22	28.9	0.0001*
Negative	199	72.4	48	24.1	151	75.9	
Blood culture							
Positive	87	31.6	68	78.2	19	21.8	0.0001*
Negative	188	68.4	34	18.1	154	81.9	

[1]Chi-squaretest, *Significant

Table 4. Comparison of sputum microscopy between diabetic and non-diabetic patients

Sputum microscopy#	No. of patients (n=76)		Diabetic		Non-diabetic		p-value1
	No.	%	No.	%	No.	%	
Streptococci	11	14.5	9	81.8	2	18.2	0.0001*
Staphylococcus aureus	5	6.6	4	80.0	1	20.0	0.0001*
Pseudomonas	5	6.6	4	80.0	1	20.0	0.0001*
Pseudomonas aeruginosa	7	9.2	5	71.4	2	28.6	0.0001*
Klebsiella pneumoniae	10	13.2	8	80.0	2	20.0	0.0001*
Entero Aeroganes	7	9.2	6	85.7	1	14.3	0.0001*
E. Coli	9	11.8	7	77.8	2	22.2	0.0001*
Candida albicans	6	7.9	4	66.7	2	33.3	0.0001*
Acinetobacter	10	13.2	7	70.0	3	30.0	0.0001*
Sterile	15	19.7	6	40.0	9	60.0	0.0001*

[1]Chi-squaretest, #Multiple response *Significant

Table 5. Comparison of organism isolated from blood culture between diabetic and non-diabetic patients

Organisms	No. of patients (n=87)		Diabetic		Non-diabetic		p-value1
	No.	%	No.	%	No.	%	
Streptococcus pneumoniae	10	11.5	8	80.0	2	20.0	0.0001*
Staphylococcus aureus	9	10.3	8	88.9	1	11.1	0.0001*
Streptococcus pyogenes	9	10.3	6	66.7	3	33.3	0.0001*
Klebsiella pneumoniae	8	9.2	8	100.0	0	0.0	0.0001*
E. coli	7	8.0	6	85.7	1	14.3	0.0001*
Pseudomonas aeruginosa	11	12.6	9	81.8	2	18.2	0.0001*
Haemophilus influenzae	10	11.5	9	90.0	1	10.0	0.0001*
Mycobacterium tuberculosis	7	8.0	6	85.7	1	14.3	0.0001*
Candida albicans	8	9.2	6	75.0	2	25.0	0.0001*
Mycoplasma pneumoniae	8	9.2	7	87.5	1	12.5	0.0001*
Sterile	13	14.9	4	30.8	9	69.2	0.0001*

[1]Chi-squaretest, #Multiple response *Significant

Table 6. Comparison of chest X-ray between diabetic and non-diabetic patients

Chest X-ray	No. of patients (n=87)		Diabetic		Non-diabetic		p-value1
	No.	%	No.	%	No.	%	
Unilobe	147	53.5	54	36.7	93	63.3	0.0001*
Multi lobe	128	46.5	48	37.5	80	62.5	

[1]Chi-squaretest, #Multiple response *Significant

non-diabetic patients. Culture was positive among 78.2% diabetic patients and in 21.9% among non-diabetic patients.

In contrast to the present study, Miquel et al[12] has reported that there was no significant difference in microbiological results in patients with diabetes and non-diabetes. Bhambar et al[10] had also shown that there is no significant difference in microbiological results in between both the groups.

In this study, Entero Aeroganes was among 85.7% diabetic patients and among 14.3% non-diabetic patients on sputum microscopy. Streptococci was in 81.8% diabetic patients and in 18.2% non-diabetic patients on sputum microscopy. Klebsiella pneumonia was in all the diabetic patients on blood culture in this study. Haemophilus influenza was in 90% diabetic patients and in 10% non-diabetic patients on blood culture in the present study. Spomenka et al[13] reported that Staph auerus and Gram negative organisms such as Klebsiell, E coli, Enterobacter, Pseudomonas and Acinectobacter are common organisms in diabetes. Palmar[14] reported that Gram positive cocci such as Strep pneumonia are responsible for majority of infections in diabetic patients, followed by agents such as H influenza. Bhambar et al[10] had shown that among diabetes the common organisms are Strep pneumonia (22%), polymicrobial (20%), Klebsiella (16%), Acinectobacter (10.0%). Miquel et al[12] reported 19% of patients had polymicrobial infections in comparison to 9% in non-diabetics. Bhambar et al[10] showed 20% patients had poly microbial in comparison to 6% in non-diabetics.

In the present study, Unilobe chest X-ray finding was in 53.5% patients. Multilobe chest X-ray finding was in 37.5% diabetic patients and in 62.5% of non-diabetic patients. Sammaiah et al[15] found that multilobe involvement in diabetics was in 60% patients.

5 CONCLUSION

In patients with pneumonia, diabetes mellitus is associated with microbial etiology and multilobe involvement. This study suggests that the adverse outcome is more attributable to the underlying circumstances of patients than to uncommon microbiological findings. [1–15]

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AUTHOR BIOGRAPHY

Dr MC Srivastava Assistant Professor, Department of Medicine, Prasad Institute of Medical Sciences, Sarai Shahzadi, Banthara, Lucknow-226401

Dr Amritesh Ranjan Mishra Assistant Professor, Department of TB and Chest,
Prasad Institute of Medical Sciences, Sarai Shahzadi, Banthara, Lucknow-226401

Mr Sultan Ahmed Tutor, Department of Microbiology, Prasad Institute of Medical Sciences, Sarai Shahzadi, Banthara, Lucknow-226401