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Study of Bacteriological and Clinical Profile of Community Acquired Pneumonia in Type 2 Diabetes Patients

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Abstract

Introduction: Community-acquired pneumonia (CAP) remains a common and serious illness despite the availability of potent new anti-microbials and effective vaccines. Since pneumonia is not a reportable illness, information about its incidence is based on crude estimates. However, it appears that as many as four million cases of community-acquired pneumonia occur annually and as much as 20% of these require hospitalization. Pneumonia is increasingly common among older patients and those with co-morbidity like COPD, DM, renal failure, congestive heart failure, CLD and other conditions. Two major variables that influence the spectrum of etiologic agent and initial approach to therapy are the severity of initial presentation and presence of either co-existing illness or advanced age.

Material And Methods: This is a Prospective study of cases was conducted among 30 diabetic patients and 30 non-diabetic patients with bacterial pneumonia admitted in Tertiary Care Teaching Hospital. A detailed history was taken in all the patients with respect to presenting complaints (like fever, new or increasing sputum production, dyspnoea and Chest Pain) predisposing factors and accompanying illness. Sputum was collected for bacteriological examination after rinsing the mouth with saline before institution of antibiotic therapy and subjected to following tests. Sputum was examined macroscopically with respect to quantity, colour, odour and evidence of haemoptysis.

Results: The average age in non-diabetic patients was 47.3 ± 5.37 years and in Diabetic patients were 48.43 ± 5.65 years. Most of the patients (80% in SG and 70% in CG) were between 40 to 60 years. Most of the patients in both groups were males (66.7% in CG and 80% in SG). The commonly associated co morbidities in CG and SG were Asthma (3.3% vs 6.7%), COPD (16.7% vs 23.3%) and IHD (10% vs 20%). There was no statistically significance difference of associated co morbidities in between two groups (p = 0.207). The complications in diabetic group were Pleural effusion (13.3%), septic shock (16.7%), Renal failure (3.3%) & MODS (3.3%) in comparison with Non – Diabetic group were Pleural effusion (6.7%), septic shock (10%). Patients in diabetic group were predominantly among PSI class IV and V (53.3%), in comparison with non – diabetic group who were predominantly in PSI Class I (53.3%).

Conclusion: The yield of causative organisms of Community Acquired pneumonia by routine sputum cultures is low. Among the organisms isolated gram-negative organisms predominated. Among the presenting symptoms breathlessness at presentation had significant association with mortality, whereas presence or absence of fever, cough or sputum production did not have any significant association with mortality.

Keywords: Community-acquired pneumonia, Type 2 Diabetes Patients, Pleural effusion

INTRODUCTION:

Community-acquired pneumonia (CAP) remains a common and serious illness despite the availability of potent new anti-microbials and effective vaccines. In the United States, pneumonia is the sixth leading cause of death from infectious diseases. [1] Since pneumonia is not a reportable illness, information about its incidence is based on crude estimates. However, it appears that as many as four million cases of community-acquired pneumonia occur annually and as much as 20% of these require hospitalization. [2] The mortality rate of pneumonia patients in out-patient settings is low, in the range of one to five per cent, but among patients who require admissions to ICU it approaches 25%.[3]

In recent years, both the epidemiology and treatment of pneumonia have undergone changes. Pneumonia is increasingly common among older patients and those with co-morbidity like COPD, DM, renal failure, congestive heart failure, CLD and other conditions. [4] Two major variables that influence the spectrum of etiologic agent and initial approach to therapy are the severity of initial presentation and presence of either co-existing illness or advanced age. Patients with severe community-acquired pneumonia have a distinct epidemiology and a somewhat different distribution of etiologic pathogens than patients with other forms of pneumonia. Similarly, the presence of co- morbidity or advanced age can determine the likely pathogens involved. [5]

Although an etiological diagnosis is optimal in the management of community acquired pneumonia the responsible pathogens are not identified in 50% of the patients even when extensive diagnostic tests are performed. [6]

The bacteriological profile of community-acquired pneumonia is different in different countries and changing with time within the same country, probably due to frequent use of antibiotics, changes in environmental pollution, increased awareness of the disease and changes in life expectancy. For instance *Streptococcus pneumoniae* remains the commonest

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organism leading to community acquired pneumonia in most parts of the Countries. [7] *Klebsiella pneumoniae* is the most common pathogen leading to admission to a medical intensive care unit in Singapore. [8] The problem is much greater in the developing countries where pneumonia is the most common cause of hospital attendance in adults. [9]

In India also the etiological agent of CAP varies with geographical distribution e.g. *Streptococcus pneumoniae* predominates as etiological agent of CAP in Shimla and Delhi whereas *Pseudomonas aeruginosa* predominates as an etiological agent in blood culture positive CAP in Ludhiana. [10]

MATERIAL AND METHODS

This is a Prospective study of cases was conducted among 30 diabetic patients and 30 non-diabetic patients with bacterial pneumonia admitted in Tertiary Care Teaching Hospital.

INCLUSION CRITERIA :

Type 2 diabetic patients and non diabetic patients who fulfill all the following criteria

1. Fever, productive or non productive cough with or without chest pain orbreathlessness.
2. X-ray chest PA view showing homogenous or non homogenous opacities.
3. Sputum gram staining and culture showing pathological organisms.

EXCLUSION CRITERIA :

1. Features suggestive of viral and fungal pneumonia and culture showing fungalgrowth.
2. Patients diagnosed to have tuberculosis.
3. Patients who are HIV positive or with other immunocompromised states.
4. Patients with upper respiratory tract infections.

A detailed history was taken in all the patients with respect to presenting complaints (like fever, new or increasing sputum production, dyspnoea and Chest Pain) predisposing factors and accompanying illness.

A diagnosis of diabetes mellitus was based on previous clinical and /or biochemical diagnosis and /or treatment with oral anti-diabetic agents or insulin. Alternatively, diagnosis could be established during this episode of pneumonia when the fasting plasma glucose concentration was ≥126mg/dl and/or after ingestion it was ≥200mg/dl on two or more separate occasions.

In all the patients, chest x-ray PA view was taken on admission and 7 days after antibiotic therapy. In few patients chest x-ray lateral view was also taken. Ultrasound chest was also done in few cases.

Sputum was collected for bacteriological examination after rinsing the mouth with saline before institution of antibiotic therapy and subjected to following tests. Sputum was examined macroscopically with respect to quantity, colour, odour and evidence of haemoptysis.

All the sputum smears were stained with gram's stain. Those smears which showed morethan 25 polymorphs per low power field and less than 10 squamous epithelial cells per low power field was considered as appropriate sample and others as inappropriate. Sputum was also examined for AFB by Ziehl neelson(ZN) stain. The purulent portion of the sputum was inoculated on blood agar, Mac conkey's medium and heat blood agar. These were read after over night incubation.

STATISTICAL METHODS :

Chi-square test and fisher exact test have been used to find the significance of frequency distribution of study parameters between Non-diabetic and diabetic groups. Student t testand Mann whitney U test have been used to find the significance of mean values of studyparameters between Non-diabetics and diabetics group. Odds ratio has been used to findthe strength of oral manifestation between non-diabetic and diabetic.

RESULTS

Table 1: Comparison of age in years between two groups

Age in years	Non-diabetic		Diabetic	
	Number	Percent	Number	Percent
21-30	6	10	2	3.3
31-40	12	20	10	16.7
41-50	22	36.7	26	43.3
51-60	20	33.3	22	36.7
Total	60	100	60	100
Mean ± SD	47.3 ± 5.37		48.43 ±5.65	

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The average age in non-diabetic patients was 47.3 ± 5.37 years and in Diabetic patients were 48.43 ± 5.65 years. Most of the patients (80% in SG and 70% in CG) were between 40 to 60 years.

Table 2: Comparison of sex between two groups

Sex	Non-diabetic		Diabetic	
	Number	Percent	Number	Percent
Male	40	66.7	48	80
Female	20	33.3	12	20
Total	60	100	60	100

Most of the patiens in both groups were males (66.7% in CG and 80% in SG). There wasno statistically significant difference regarding sex in both the groups.

Table 3: Comparison of concomitant underlying illness between two groups

Concomitant underlying illness	Non diabetic		Diabetic	
	Number	%	Number	%
Asthma	2	3.3	4	6.7
COPD	10	16.7	14	23.3
IHD	6	10	12	20

The commonly associated co morbidities in CG and SG were Asthma (3.3% vs 6.7%), COPD (16.7% vs 23.3%) and IHD (10% vs 20%). There was no statistically significance difference of associated co morbidities in between two groups (p = 0.207).

Table 4: Comparison of chest x-ray findings

Chest X- ray findings	Non - diabetic		Diabetic	
	Number	%	Number	%
Unilobe	42	70	24	40
Multi lobe	18	30	36	60
Total	60	100	60	100
Inference	P = 0.019*. Multi lobe involvement is more in Diabetic group (60%) than in Non — diabetic group and the difference is found to be statistically significant.			

Table 5: comparison of Sputum culture between Non – diabetic and diabetic groups

Sputum culture	Non diabetic	Diabetic	P value
Staphylococcus	4 (6.7%)	6 (10%)	0.640
Streptococcuspneumonia	22 (36.7%)	18 (30%)	0.784
Pseudomonas	2 (3.3%)	10 (16.7%)	0.196
Enterococcus	4 (6.7%)	2 (3.3%)	0.553
E.coli	8 (13.3%)	4 (6.7%)	0.667
Klebsiella	8 (13.3%)	6 (10%)	0.687
Enterobacter	2 (3.3%)	-	
Polymicrobial	8 (13.4%)	10 (16.7%)	0.717
H. influenza	2 (3.3%)	-	
Acinobacter	-	2 (3.3%)	
Proteus mirabilis	-	2 (3.3%)	

Table 6: Comparison of type of complications between Non-diabetic and Diabeticgroups

Type of complications	Non – diabetic (n=60) Number (%)	Diabetic (n = 60)Number (%)
MODS	-	2 (3.3%)
Pleural effusion	4 (6.7%)	8 (13.3%)
Renal failure	-	2 (3.3%)
Septic Shock	6 (10%)	10 (16.7%)

The complications in diabetic group were Pleural effusion (13.3%), septic shock (16.7%),Renal failure (3.3%) & MODS (3.3%) in comparison with Non — Diabetic group were Pleural effusion (6.7%), septic shock (10%).

Table 7: Comparison of PSI class between Non – diabetic and Diabetic groups

PSI Class	Non – diabeticNumber (%)	Diabetic Number (%)	P value
Class I	32 (53.3%)	18 (30%)	0.116

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Class II	10 (16.7%)	4 (6.7%)	0.421
Class III	8 (13.3%)	6 (10%)	0.687
Class IV	6 (10%)	18 (30%)	0.006
Class V	4 (6.7%)	14 (23.3%)	
Inference	Class IV and V are significantly more in diabetic patients with p <0.05		

Patients in diabetic group were predominantly among PSI class IV and V (53.3%), in comparison with non – diabetic group who were predominantly in PSI Class I (53.3%).

In the present study I have compared following parameters like age, sex, clinical features, concomitant underlying diseases, vital data, investigations, complications and PSI class between diabetic and non diabetic patients with pneumonia.

Pradeep *et al* reported that diabetic patients with pneumonia were significantly older than 57yrs.in a study conducted in a group of 60 people of which 30 were diabetics and 30 nondiabetics. with maximum people between 40-75yrs.[11]

Miquel *et al* also observed that most patients were older than 62yrs.in a study conducted on 106 diabetic patients with pneumonia and 554 non diabetic patients with pneumonia.[12] Akbar DH has also reported a higher age incidence.[13]

In the present study average age of presentation was 46yrs with maximum people between 40-60yrs (80%). Miquel *et al* reported that patients were predominantly males.[14] Pradeep *et al* also reported male predominance.[15] In the present study also males were predominant.

Miquel *et al* reported that 56%of the patients with diabetes had concomitant underlying disease along with diabetes.[16] Pradeep *et al* showed that 27% of patients had concomitant underlying disease.[17]

Present study had 25% of patients with concomitant disease in the form of COPD, asthma and CVA. Miquel *et al*., Pradeep *et al* have reported that there was no significant difference in microbiological results in patients with diabetes and non diabetes.[18] The present study also showed no statistically significant difference in microbiologicalresults in two groups.

Spomenka *et al* reported that staph aureus and gram negative organisms such as klebsiella, E. coli, enterobacter, pseudomonas and acinetobacter are common organisms in diabetes.[19] Palmar DL reported that gram positive cocci such as strep pneumoniae are responsible for majority of infections in diabetic patients followed by agents such as Hinfluenza.[20] The present study has shown that common organisms are strep pneumonia (30%) pseudomonas (16%) and polymicrobial (16%).

Koziel H *et al* reported that the most common complications of pneumonia in diabeticswere pleural effusion, empyema and bacteremia.[21]

Miquel *et al* reported that pleural effusion was significantly more in diabetic patients and there was difference between other risk factors.[22]

Sayali bhambar *et al* in a study conducted in pneumonia patients of which 50 were diabetics and 50 were non diabetics observed pleural effusion (6% vs 6%) and septicshock (20% vs 14%).[23]

In the present study patients had complications in the form of septic shock (16%), pleural effusion (13%), renal failure (3%) and MODS (3%) which was more compared to non diabetics.

In a study by Pratik ranjan *et al*,in Kolhapur,D.Y. Patil medical college conducted on 50 CAP patients of which 25 were diabetic and 25 non-diabetic,it was observed that 64% of diabetics had multilobar involvement.[24]

Saibal *et al* showed that on comparision of chest X-Ray,unilateral lobe infiltration wasmore in non-diabetic patients.[25] In the present study patients showed statistically significant multilobar involvement indiabetics.
Miquel *et al* reported that majority of non diabetics presented with PSI class 1 in comparison with diabetics who in majority presented with class 4 which was statistically significant.
Pradeep *et al* reported that majority of non diabetics presented with PSI class 1 in comparison with diabetics who in majority presented with class 4 and 5 which was statistically significant.

In the present study, majority of diabetics presented in class 4 and 5 which was significant. Diabetes mellitus has been associated with many alterations of the immune system. In a review of the subject by Joshi *et al*,[26] the most significant changeswere identified within humoral-mediated immunity, particularly related to the polymorphonuclear function.

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CONCLUSION

The yield of causative organisms of Community Acquired pneumonia by routine sputum cultures is low. Among the organisms isolated gram-negative organisms predominated. Among the presenting symptoms breathlessness at presentation had significant association with mortality, whereas presence or absence of fever, cough or sputum production did not have any significant association with mortality. Among physical signs at examination tachycardia, tachypnoea, hypotension and altered sensorium had significant association with mortality. A low platelet counts and impaired renal function was also associated with mortality. However, a high blood sugar value at presentation did not have any significant association with mortality.

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