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Research Article

A COMPARATIVE STUDY OF PNEUMONIAS IN DIABETIC AND NON-DIABETIC PATIENTS

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ABSTRACT

It has been suggested that diabetes mellitus is associated with an increased susceptibility to infections, the risk of using more aggressive therapeutic agents and increased mortality and morbidity; however, current evidence supporting these events in the field of pneumonia is scarce. **Aim:** The aim of the present study is to evaluate the clinical features and microbiological characteristics and outcome of bacterial pneumonia in patients with type-2 diabetes mellitus, and to compare them with non-diabetics. **Materials and Methods:** A prospective study conducted in Santhiram medical college and general hospital, Nandyal, which included 60 patients of pneumonia with diabetes and 60 patients of pneumonia in non-diabetics. The clinical and radiological characteristics, the spectrum of causative agents, microbiological data and the outcome of diabetic patients were analysed and compared with data obtained from non diabetic patients. **Results:** Patients with diabetes were significantly associated with multilobar involvement ($P = 0.039$), prolonged duration of hospital stay ($P = 0.018$), more severe at presentation in form of increased PSI score ($P = 0.038$) and more ICU admissions. By contrast, there was no significant difference in age, sex, concomitant underlying illness, complications, mortality. In the sub group of patients with diabetes, mortality was associated with multilobar infiltrate, concomitant illness, high PSI score ($P < 0.001$) more complications ($P < 0.001$). **Conclusions:** In patients with pneumonia, diabetes is associated with poor prognosis, increased duration of hospital stay and poor outcome compared to non-diabetics. This study suggests that this outcome is more attributable to underlying circumstances of patients than to uncommon microbiological finding.

INTRODUCTION

Pneumonia is a common cause of Hospital admission, although a majority is treated in out patient settings. Moreover, serious coexisting illnesses have been identified in studies1 to 4 Unfortunately, the real impact of some of these underlying diseases on pneumonia has not been fully evaluated. Diabetes mellitus is a very prevalent chronic metabolic disorder that is present in about 5 to 10% of the elderly population. Several aspects of immunity, such as polymorphonuclear leukocyte function *(ie)* leukocyte adherence, chemotaxis, and phagocytes and bactericidal activity of serum are depressed in patients with diabetes.6,7 In consequence, some specific infections are very common in these patients, while others occur with more severity or are associated with an increased risk of complications. For patients with pneumonia, diabetes mellitus is also one of the most common underlying diseases1, 2, 8, however, it remains uncertain as to whether pneumonia shows particular clinical manifestations, increases morbidity or mortality or involves a predisposition for more aggressive agents in patients with diabetes. In this study, we propose to determine whether the clinical or radiological findings, the causative microorganisms, or the outcome of pneumonia are modified by the presence of diabetes mellitus as the underlying disease. Patients with diabetes have about twice the risk of infection related mortality compared with those without diabete[9]. Based on compilation of studies from different parts of the globe, the World Health Organization has projected that the maximum increase in diabetes would occur in India. Considering the large population and the high prevalence of diabetes, the burden of diabetes could be enormous. With an estimated 23 million today and the numbers set to increase to 57 million by 2025.[10] Studies conducted in India in the last decade have highlighted that not only is the prevalence of Type-2diabetes is high, but also that it is increasing rapidly in the urban population.[6]

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Aims & Objectives: To compare Peumonia in diabetics and non diabetics in the following aspects of Clinical presentation of pneumonia, Bacteriological etiology of pneumonia. Complications and Prognosis. Radiological patterns.

METHODOLOGY

60 Diabetic patients and 60 non diabetic patients with bacterial pneumonia admitted in medicine wards in Santhiram Medical College And General Hospital, Nandyal. The study was conducted for a period of 2 years, from September 2013 to September 2015. 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 of diabetes mellitus and/or treatment with oral antidiabetic agents or insulin. Alternatively, diagnosis could be established during this episode of pneumonia when the fasting plasma glucose concentration was ≥ 126 mg/dl (7.0mmol/l), and/or after ingestion it was ≥ 200mg/dl (11.1mmol/l) on two or more separate occasions.
A thorough clinical examination was carried out as per Performa.

In all the patients chest x-ray PA view was taken on admission and 7 days after the antibiotic therapy. In few patients chest x-ray lateral view was also taken. Ultrasound of chest was also done in some of the 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 hemoptysis. 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 was 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 3 consecutive days.

Sputum Culture: 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.

Inclusion Criteria

Type 2 diabetic patients and non diabetic patients who fulfill all the following criteria of Fever, productive or non productive cough with or without chest pain or breathlessness. X-ray chest showing homogenous or non homogenous opacities. Sputum gram staining and culture showing pathological organisms.

Diabetics were confirmed on the basis of past history of diabetes, history of taking oral hypoglycemic drugs or insulin, previous medical records suggestive of diabetes or previous reports of blood sugar or HbA1c confirming the diagnosis of diabetes according to WHO criteria.

Exclusion Criteria

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

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 test and Mann Whitney U test have been used to find the significance of mean values of study parameters between Non-diabetic and diabetic group. Odds ratio has been used to find the strength of oral manifestation between non-diabetic and diabetic.

OBSERVATIONS & RESULTS

The present study was conducted at Santhiram Medical College and General Hospital, Nandyal from September 2013 to September 2015. A total no. of 120 pneumonia cases were studied, out of which 60 cases were pneumonia in diabetics (Study group SG) and 60 cases were pneumonia in non diabetics (control group CG).

Table 1 Comparison of age in years between two groups

Age in years	Non-diabetic		Diabetic	
	No	%	No	%
40-50	22	36.7	22	36.7
51-60	18	30.0	20	33.3
61-70	12	20.0	14	23.3
>70	8	13.3	4	6.7
Total	60	100.0	60	100.0
Mean ± SD	56.90±11.83		57.93±9.71	

Samples are age matched with P=0.713

The average age in SG was 57.93±9.71 yrs and in CG were 56.90±11.83 yrs (no significance). The age span of the patients was between 40 and 75 yrs in both groups, while most of the patients (66.7% in CG and 70% in SG) were between 40 to 60 yrs.

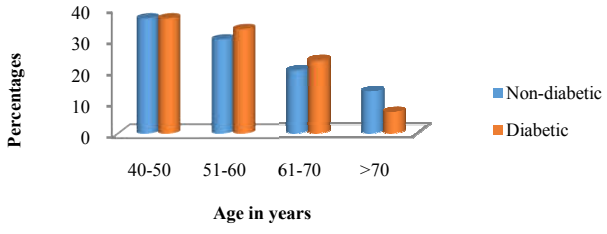
Table 2 Comparison of sex between two groups

Sex	Non-diabetic		Diabetic	
	No	%	No	%
Male	46	76.7	40	66.7
Female	14	23.3	20	33.3
Total	60	100.0	60	100.0

Patients between two groups are sex matched with P=0.390

Most of the patients in both groups were males (76.7% in CG and 66.7% in SG). There was no statistically significant difference regarding sex in both the groups.

Figure 1 : Comparison of age between two groups



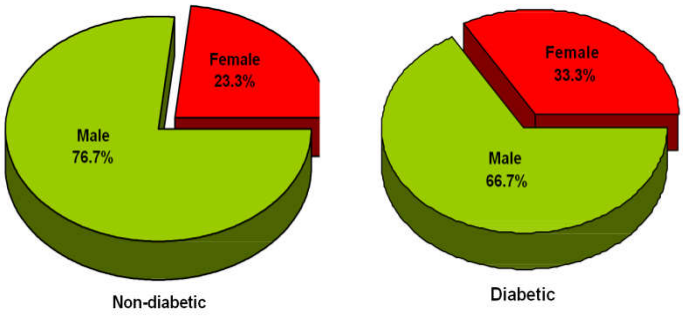


Figure 2 Comparison of sex between two groups.

Table 3 Comparison of Typical Clinical signs between two groups

Typical presentation	Non-diabetic		Diabetic	
	No	%	No	%
No Consolidation	34	56.7	38	63.3
Consolidation	26	43.3	22	36.7
Total	60	100.0	60	100.0
Inference	Consolidation is equally distributed b/w groups with P=0.598			

There was no statistically significant difference in typical presentation (ie) signs of consolidation and respiratory signs other than consolidation between the two groups. Table 4: Comparison of Concomitant Underlying illness between two groups.

Table 4 Comparison of Concomitant Underlying illness between two groups

Concomitant Underlying illness	Non-diabetic (n=60)		Diabetic (n=60)	
	No	%	No	%
Neoplasm	2	3.3	0	-
CCF	2	3.3	2	3.3
Asthma	4	6.7	4	6.7
IHD	8	13.3	12	20.0
COPD	10	16.7	16	26.7
Altered sensorium	4	6.7	10	16.7
CVA	0	-	2	3.3
Others	8	13.3	8	13.3

The commonly associated co morbidities in CG and SG were IHD (20% vs 13.3%), COPD (26.7% vs 16.7%) and Asthma (6.7% vs 6.7%). There was no statistically significant difference of associated co morbidities in between two groups

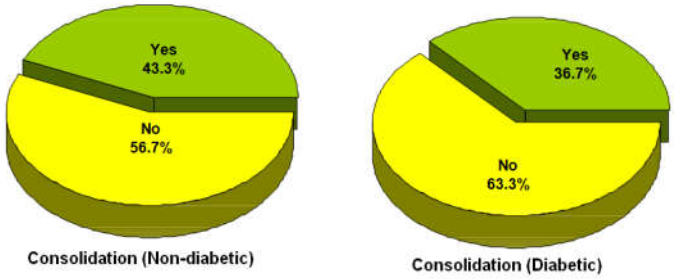


Figure 3 Comparison of Typical Clinical signs between two groups

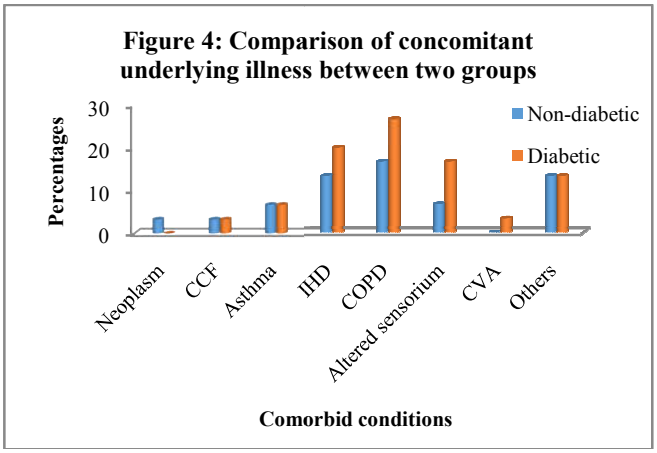


Table 5 Comparison of Chest x-ray findings

Chest x-ray findings	Non-diabetic		Diabetic	
	No	%	No	%
Unilobe	36	60.0	20	33.3
Multi lobe	24	40.0	40	66.7
Total	60	100.0	60	100.0
Inference	Multilobe involvement is 3.0 times more likely in Diabetic with P=0.039*			

Multilobe involvement (> 2 zones involvement in chest x- ray) was more common in SG (40% in CG vs. 66.7% in SG) which is statistically significant (P = 0.039). Multilobe involvement is 3 times more likely in diabetics.

Table 6 Comparison of Sputum gram staining between Non-diabetic and Diabetic groups

Sputum gram staining	Non-diabetic (n=60)	Diabetic (n=60)	P value
GNB	10 (16.7%)	16 (26.7%)	0.347
GPC	28 (46.7%)	10 (16.7%)	0.012*
GNC	6 (10.0%)	-	0.237
GBC/GNB	2 (3.3%)	-	0.999
GPC/GNB	4 (6.7%)	18 (30.0%)	0.020*
GPC/GPB	2 (3.3%)	6 (10.0%)	0.612

On Gram staining, Gram positive cocci were significantly more (P = 0.012) in CG in comparison with SG (46.7% vs. 16.7%)

A combination of GPC/GNB was significantly more in SG than CG (30% vs. 67%).

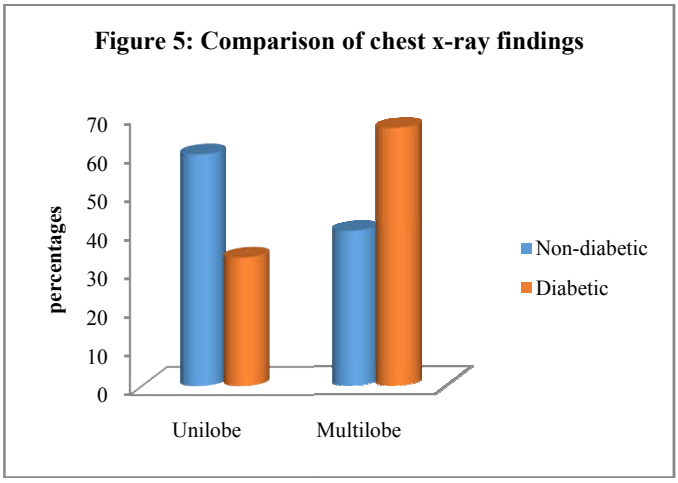


Figure 6: comparison of sputum gram staining between Non-diabetic and diabetic groups

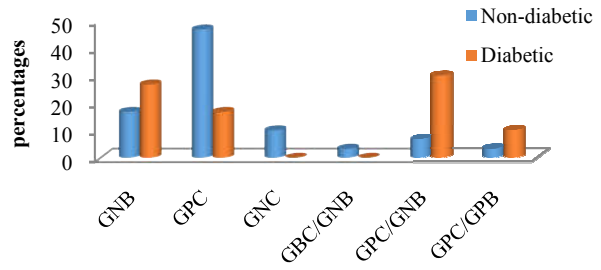


Table 7 Comparison of Sputum culture between Non-diabetic and Diabetic groups n (%)

Sputum culture	Non-diabetic (n=60)	Diabetic (n=60)	P value
1.E coli	2 (3.3%)	4 (6.7%)	0.999
2.Strep pneu	24 (40.0%)	14 (23.3%)	0.592
3.Klebsiella	4 (6.7%)	10 (16.7%)	0.424
4.Stap auerus (MRSA/MSSA)	12 (20.0%)	4 (6.7%)	0.129
5.H.Influenza	2 (3.3%)		0.999
6.Acinectobacter	-	6 (10.0%)	0.237
7.Pseu aeruginosa	4 (6.7%)	6 (10.0%)	0.999
8.Proteus mirabalis	2 (3.3%)	-	0.999
9.Enterobacter	2 (3.3%)	4 (6.7%)	0.999
10.Poly microbial	4 (6.7%)	12 (20.0%)	0.254
11.Entrococcus	4 (6.7%)	-	0.492

The common organisms on sputum culture in non diabetics were Strep pneumonia (40%), Stap Auerus (20.0%), Pseudomonas (6.7%) and Enterococcus (6.7%).

In diabetics Strep pneumonia (23.3%), Klebsiella (16.7%), Acinectobacter (10%), Polymicrobial (20%). But there was no statistical significance between the two groups

Table 8 Comparison of Outcome between Non-diabetic and Diabetic groups

Outcome	Non-diabetic (n=60)	Diabetic (n=60)	P value
ICU admission, n (%)	10 (16.7%)	18 (30.0%)	0.222
Complications, n (%)	12 (20.0%)	20 (33.3%)	0.243
Mortality, n (%)	6 (10.0%)	14 (23.3%)	0.166
Duration Hospital stay Mean ± SD	9.10±5.24	12.30±4.98	0.018*

There was no difference between two groups in ICU admission (or) complications.

More no. of mortalities were in SG (23.3%) in comparison with CG (10%). The duration of hospital stay was significantly more (P < 0.018) in SG (12.30±4.98) in comparison with CG (9.10±5.24).

Figure 7: comparison of sputum culture

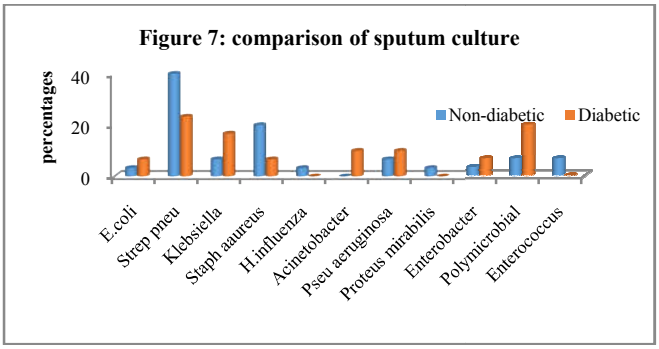
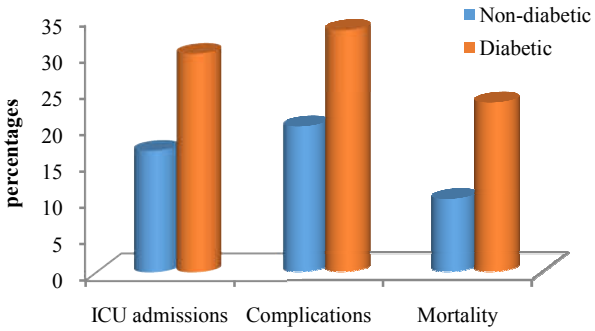


Figure 8: comparison of outcome between Non-diabetic and diabetic groups



There was no difference between two groups in ICU admission (or) complications.

More no. of mortalities were in SG (23.3%) in comparison with CG (10%). The duration of hospital stay was significantly more (P < 0.018) in SG (12.30±4.98) in comparison with CG (9.10±5.24).

Table 9 Comparison of type of complications Non-diabetic and Diabetic groups

Type of complications	Non-diabetic (n=60)	Diabetic (n=60)
Pleural effusion	4 (6.7%)	4 (6.7%)
Septic shock	8 (13.3%)	12 (20.0%)
Renal failure	-	2 (3.3%)
MODS	-	2 (3.3%)
VF	-	2 (3.3%)
Cardiac arrest	-	4 (6.7%)

The complications in diabetic group were pleural effusion (6.7%), septic shock (20%), renal failure, MODS (3.3%), ventricular tachycardia (3.3%), and cardiac arrest (6.7%). In comparison with CG were pleural effusion (6.7 %), septic shock (13.3%).

Table 10 Comparison of study characteristics in Alive and death in Diabetic patients

Study characteristics	Alive	Death	P value
Age in years, Mean ±SD	56.61±7.57	62.29±14.72	0.180
Sex; male : female	14:9	6:1	0.222
Hospital stay , Mean ± SD(days)	10.30±4.51	5.14±5.87	0.020*
RR, Mean ±SD	25.39±3.92	35.43±3.21	<0.001**
SBP, Mean ±SD	140.30±41.16	111.14±34.49	0.101
DBP, Mean ±SD	83.56±12.76	72.86±22.15	0.105
TC, Mean ±SD	12821.0 (6119.59)	11694.29 (7094.7)	0.684
Hb, Mean ±SD	9.70±2.26	9.11±3.12	0.584
BUN, Mean ±SD	20.61±9.09	40.71±26.32	0.004**
Na, Mean ±SD	139.75±5.91	131.28±8.62	0.012*
Glucose, Mean ±SD	171.45±39.18	190.00±36.50	0.343
PSI, Mean ±SD	76.83±21.85	148.00±34.46	<0.001**
ICU admission, n (%)	2 (8.7%)	7 (100.0%)	<0.001**
Complications, n (%)	3 (13.1%)	7(100.0%)	<0.001**

In comparison of Alive and dead in diabetic group showed the following

1. Duration of hospital stay was significantly more in Alive (10.30±4.51) than dead (5.14±5.87) with P = 0.020.
2. Dead patients were tachypnic (RR = 35.3±3.21) compared to Alive (25.39±3.92) with P <0.001.
3. Renal impairment was significantly more in dead (BUN

= 40.71±4.51) than in Alive (20.61±9.09) with P <0.004.
4. Sodium levels were comparatively low in dead patients.
5. PSI scoring was significantly more in dead (148.80±34.46) than in Alive (76.83±21.85) with P < 0.001.
6. All dead patients were admitted to ICU (100%) in comparison to Alive patients (8.7%) with P < 0.001.
7. All dead patients had complications (100%) compared to Alive patients (13.1%) with P < 0.001.

DISCUSSION

The present study included 60 non-diabetic and 60 diabetic patients with pneumonia. In this study, I have compared the following parameters like age, sex, clinical features, concomitant underlying diseases, X ray investigations of sputumculture in particular, ICU admissions, mortality, complications between Diabetics and non Diabetic patients with pneumonia.

Miquel *et al* has reported that patients with diabetes were significantly older with average age of 62 yrs[12]. Akbar DH has also reported a higher age incidence.[13]

In the present study the average age in SG was 57.93±9.71 yrs and in CG were 56.90±11.83 yrs (no significance). The age span of the patients was between 40 and 75 yrs in both groups, while most of the patients (66.7% in CG and 70% in SG) were between 40 to 60 yrs.

Miqel *et al* reported that patients with diabetes were predominantly males (60%).[12]

Akbar DH also reported male predominance in diabetics.[13] In the present study most of the patients in both groups were males (76.7% in CG and 66.7% in SG). There was no statistically significant difference regarding sex in both the groups.

Miquel *et al* reported that 56% of patients with diabetes had concomitant underlying disease along with diabetes.[12] The present study showed that about 27% patients had concomitant underlying disease in the form of CCF (3.3%), Asthma (6.7%), IHD (20%), COPD (26.7%), and CVA (3.3%).The commonly associated co morbidities in CG and SG were IHD (20% vs 13.3%), COPD (26.7% vs 16.7%) and Asthma (6.7% vs 6.7%). There was no statistically significant difference of associated co morbidities in between two groups.

Miquel *et al* reported that typical clinical features like signs of consolidation were seen in 42% of the patients and other 58% of patients presented with signs other than consolidation in diabetics.[3] The present study reported 36.7% with signs of consolidation and 63.3% signs other than consolidation in diabetics.

Miquel *et al* has reported that there was no significant difference in microbiological results in patients with diabetes and non diabetes.[12] Present study has also shown that there is no significant difference in microbiological results in between both the groups. Spomenka *et al* reported that Staph auerus and Gram negative organisms such as Klebsiell, E coli, Enterobacter, Pseudomonas and Acinectobacter are common organisms in diabetes. [11]

Palmar DL reported that Gram positive cocci such as Strep pneu are responsible for majority of infections in diabetic patients, followed by agents such as H influenza.[14]

The present study has shown that among diabetes the common organisms are Strep pneu (23.3%), polymicrobial (20%), Klebsiella (16.7%), Acinectobacter (10.0%). Miquel *et al* reported 9% of patients had polymicrobial infections[12] Present study showed 20% patients had poly microbial in comparison to 6.7% in non diabetics.

Miquel *et al* reported that there was no significant difference in no. of ICU admissions in between the two groups.[12] Potgieter *et al* reported that bacterial pneumonias in diabetic individuals, especially when caused by Klebsiella and Staphlococcus is associated with more severe course of disease and more frequently need mechanical ventilation.[15]

The present study also showed that there is no significant difference in no. of ICU admissions in between both the groups and frequent ventilatory support was required in patients with polymicrobial etiology.

Koziel H *et al* reported that the most common complications of pneumonia in diabetics were pleural effusion, empyema and bacteremia.[13]

Miquel *et al* reported that pleural effusion was significantly more in diabetic patients and there was difference between other risk factors.[12]

Present study showed that there was no significant difference in complications between the two groups. Miquel *et al* reported that duration of stay was more in diabetics in comparison with non diabetics.[12] Present study has also shown that duration of stay is more in diabetics in comparison with non diabetics.

Miquel *et al* reported that mortality was more common in diabetic patients which was statistically significant.[12] Akbar DH reported that there was no significant difference in mortality between both the groups.[12] The present study has also reported that there is no difference in mortality between the two groups. Miquel *et al* reported that multilobar infiltrate (P = 0.003) and the simultaneous presence of co morbidities (P = 0.029) were found to be independently associated with mortality.[12] The present study has reported that multilobar involvement, elderly (>60yrs), associated co morbidities were associated with mortality independently.

Miquel *et al* has shown that there was no relation found with sex, length of disease, bacteremia, empyema, pleural effusion with mortality. [12]

Present study has also shown no relation between sex, length of disease, bacteremia, empyema, pleural effusion with mortality. Koziel *et al* reported that Acinectobacter pneumonia has been associated with a mortality rate exceeding 60% in diabetics.[13] Present study showed that there is no mortality in diabetic patients with Acinectobacter pneumonia. Miquel *et al* has reported that in diabetic group mortality was significantly associated with underlying concomitant illness, multilobe involvement and no significant difference in age, sex and glucose level at entry.[13] The present study also showed that in diabetic group mortality was significantly associated

with concomitant illness, multilobe involvement, renal impairment and no significant difference in age, sex and glucose level at entry.

CONCLUSIONS

In patients with pneumonia, Diabetes Mellitus is associated with poor prognosis, polymicrobial etiology, multilobe involvement, increased ICU admissions, increased severity in the form of high PSI score and mortality. This study suggests that this adverse outcome is more attributable to the underlying circumstances of patients than to uncommon microbiological findings. Certainly, age, prior co morbidities, as well as multilobe infiltrates have already been related to poor prognosis; however, in this study, diabetes also remained a significant prognostic factor of mortality in patients with pneumonia.

1. Complications were more common in diabetic group like pleural effusion (6.7%), Septic shock (20%), renal failure, MODS, VF (3.3% each) and Cardiac arrest (6.7%).
2. Duration of hospital stay was more in diabetics (12.30±4, 98) when compared to non diabetics (9.10±5.24).
3. Majority of non diabetics presented under PSI class I (50%) when compared to diabetics who majority of them were under PSI class IV (33.3%) and class V (26.7%).
4. There was not statistically significant difference in mortality between diabetics (23.3%) and non diabetics (10%). Mortality in diabetics was more common in patients with age > 60yrs; associated concomitant illness, multilobe involvement and poly microbial etiology and high PSI score.
5. No relation was found with sex, duration of hospital stay, bacteremia, pleural effusion, signs of consolidation with mortality.

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