Original Article

A Comparative Study of Bacterial Pneumonia in Diabetic and Non-diabetic Patients From A Rural Tertiary Center

Prabhakar K, Moosa PE, Jayaram N, Yashwant AL

Department of General Medicine, Sri Devaraj Urs Medical College, Kolar

ABSTRACT

Objectives: *To study the clinical profile, radiological and microbiological characteristics and outcome of pneumonia in patients with diabetes mellitus.*

Materials and Methods: *A prospective study conducted in the hospital attached to Sri Devaraj Urs Medical College, Kolar, which included 50 patients of pneumonia with diabetes and 50 patients without diabetes. The clinical profile, radiological characteristics, the spectrum of causative agents, microbiological data and outcome of pneumonic patients with diabetes were analyzed and compared with data obtained from non-diabetic patients.*

Results: *Patients with diabetes were significantly associated with multilobar involvement (p=0.039), more severe at presentation in the form of pneumonia severity index(PSI score (p=0.020), more mortality(p=0.012) and more ICU admissions. In contrast, there is no significant difference in the age, sex, concomitant illness and complications. In subgroup of patients with diabetes, mortality was associated with multilobar involvement, high PSI score (p=0.01).*

Conclusion: *In patients with pneumonia, diabetes is associated with more severe presentation, poor prognosis and poor outcomes. This study showed that this outcome is more attributable to underlying circumstances of patients than uncommon microbiological findings.*

INTRODUCTION

Hospitalizations with pneumonia have increased by 20-50% in Western populations during the past 10 years.[1] Combined with influenza, pneumonia is the seventh leading cause of Death. [2] Immune function is compromised in people with diabetes. Therefore, infections are more common and infection related mortality is higher in this group. [3] Diabetic subjects may have increased susceptibility to pneumonia for several reasons. They are at increased risk of aspiration, hyperglycemia, decreased immunity, impaired lung function, pulmonary microangiopathy, and coexisting morbidity. [4]

In this article, we proposed to determine whether the clinical and radiologic findings, the causative

Corresponding author:

K. Prabhakar,

Professor of Medicine,

Sri Devaraj Urs Medical College,

Tamaka, Kolar - 563 101, Karnataka

Ph: 9448048308

Email: drprabhakark@yahoo.in

micro-organisms and the outcome of community-acquired pneumonia are modified by the presence of diabetes mellitus as the underlying disease.

MATERIALS AND METHODS

A prospective study conducted in hospital attached with Sri Devaraj Urs Medical college, Kolar, which included 50 patients of pneumonia with diabetes and 50 patients of pneumonia in non diabetes.

The Objectives of the study is to compare pneumonia in diabetics and non diabetics in their

1) Clinical presentation of pneumonia.

2) Bacteriological etiology of pneumonia, complications and prognosis.

3) Radiological patterns and Hematological changes in response to pneumonia.

Type 2 Diabetic patients and non diabetic patients who fulfill all the following criteria are included in this study

1) Fever, productive or non productive cough with or without chest pain or breathlessness.

2) X-ray chest showing homogenous or non homogenous opacities.

3) Sputum Gram staining and culture shows pathological organisms.

Patients diagnosed to have tuberculosis,HIV positive or with other immuno compromised state, upper respiratory tract infections are excluded from the study.

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

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

The clinical profile and radiological characteristics, the spectrum of causative agents, microbiological data and the outcome of diabetic patients were analyzed and compared with data obtained from non diabetic patients during hospital stay.

STATISTICAL METHODS

Descriptive statistical analysis has been carried out in the present study. Results on continuous measurements are presented on Mean SD (Min-Max) and results on categorical measurements are presented in Number (%). Significance is assessed at 5 % level of significance. Student t test (two tailed, independent) has been used to find the significance of study parameters on continuous scale between two groups Inter group analysis) on metric parameters, Chi-square/ Fisher Exact test has been used to find the significance of study parameters on categorical scale between two or more groups.(standard value of 0.05)

Significant figures

+ Suggestive significance (P value: $0.05<P<0.10$)

* Moderately significant (P value:$0.01<P$ 0.05)

** Strongly significant (P value : P0.01)

Statistical software: The Statistical software namely SAS 9.2, SPSS 15.0, Stata 10.1, MedCalc 9.0.1 ,Systat 12.0 and R environment ver.2.11.1 were used for the analysis of the data and Microsoft word and Excel have been used to generate graphs, tables etc.

RESULTS

A total of one hundred subjects were included in the study. Of this 50 were diabetics and the rest had no diabetes mellitus. The age ranged from 16 to 76 years (yrs) with a mean age of 49yrs in non-diabetic and 55yrs in diabetic group (Figure -1). Most of the patients in both groups were males with 68% in non diabetic and 62% in diabetic group. There was no statistically significant difference regarding the sex in either groups (Table -1).

There was no statistically significant difference in typical presentation i.e. signs of consolidation and respiratory signs other than consolidation in both groups. 54% of non-diabetic patients with pneumonia had presented with typical features of consolidation, whereas 62% of other group presented with non-typical features of consolidation. (Table-2)

Duration of hospital stay in days were statistically similar in both the groups (p-0.098).Habits like smoking and alcoholism, the vital signs like respiratory rate, BP and SpO_2 were statistically similar in both the groups. This study showed the distribution of total count statistically similar in both the groups.(Table- 3).

92% of pneumonic in the diabetic group had low hemoglobin concentration where as 74% in the non-diabetic group had low hemoglobin concentration. Low Hemoglobin was statistically significant finding for diabetic patients with pneumonia (p=0.421) (Figure- 2).

Elevated blood urea nitrogen (BUN) was statistically significant in patients with pneumonia in diabetes group with a p value of 0.022 (Table -4). Renal failure in this group was either a consequence of sepsis or diabetic nephropathy.

Multi-lobe involvement (>2 zone involvement in chest x-ray) was more common in the diabetic group (46% in diabetic and 38%non-diabetic) which is statistically significant p-0.418 (Figure 3).

On gram staining, gram positive cocci were significantly more (p-0.013) in non diabetic in comparison with diabetes group(50% vs 26%) (Table 5).

A combination of gram positive coccii (GPC) / gram negative bacilli (GNB) (GPC/GNB) was significantly more in diabetes group with p value of <0.001 (Table 5).Gram negative cocci(GNC) were noticed in 4 non diabetic-pneumonic patients. One patient without diabetes had combination gram negative cocci (GNC) and gram negative baciili (GNB).

The most common organisms on sputum culture in non diabetics were streptococcus pneumonia(35%),Klebsiella and Enterococcus (10%).In diabetic group pseudomonas and polymicrobial accounted 12% and 26% respectively .

Intensive care unit (ICU) admission and complications were statistically equal in both the groups with p- value of 0.260 (Figure 4).

Incidence of mortality was significantly more in the diabetic group with pneumonia with p-0.012 (Table 6).There were 12 deaths in pneumonic patients with diabetic whereas non-diabetic group had only 3 deaths (Table-6).

Complications like acute respiratory distress syndrome (ARDS) were found in 10% of diabetics with pneumonia (Figure 5). Cardiac arrest and multi-organ dysfunction(MODS) were noticed in 6% and 2% respectively in

diabetes patients with pneumonia (Figure 5). Incidence of complications is statistically similar in both the groups of pneumonia.

Thirteen and nine patients with Pneumonia in diabetic group had pneumonia severity score (PSI) of grade 1V and V respectively. Only 5 patients had grade 1V score in non diabetic groups. Four out of 50 patients in non diabetic group had grade 5 PSI score. Diabetics with pneumonia had significantly higher Pneumonia severity score (PSI) i.e. class 1V and V (P-0.027) in comparison to non diabetic group (Table 7).

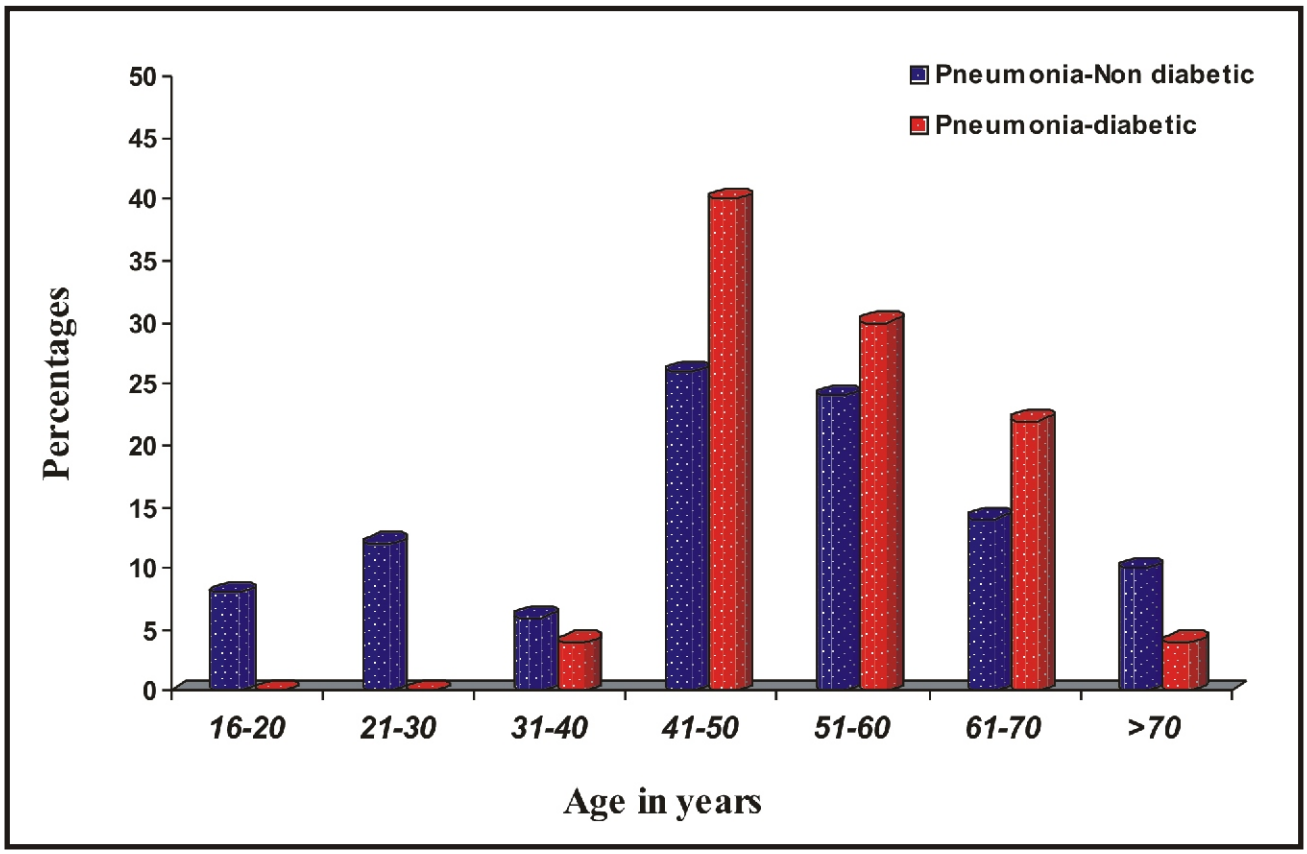

Figure 1: Age distribution of patients studied

Table 1: Showing the gender distribution of patients studied

Gender	Pneumonia-Non Diabetic		Pneumonia- Diabetic	
	No	%	No	%
Male	34	68.00	31	62.00
Female	16	32.00	19	38.00
Total	50	100.00	50	100.00

Samples are gender matched with p=0.529

Table 2: Showing pneumonic presentation of both the groups

Typical features	Pneumonia-Non Diabetic		Pneumonia- Diabetic	
	No	%	No	%
Nil	23	46.00	31	62.00
Consolidation	27	54.00	19	38.00
Total	50	100.00	50	100.00

Distribution of typical features was statistically similar in two groups of patients with P=0.108.

Table 3: Showing the Comparison of Total count in two groups of patients

Total count	Pneumonia-Non Diabetic (n=50)	Pneumonia- Diabetic (n=50)
<3500	1(2.0%)	3(6.0%)
3500-11000	18(36.0%)	16(32.0%)
>11000	31(62.0%)	31(62.0%)
Inference	Distribution of Total count is statistically similar in two groups with P=0.643	

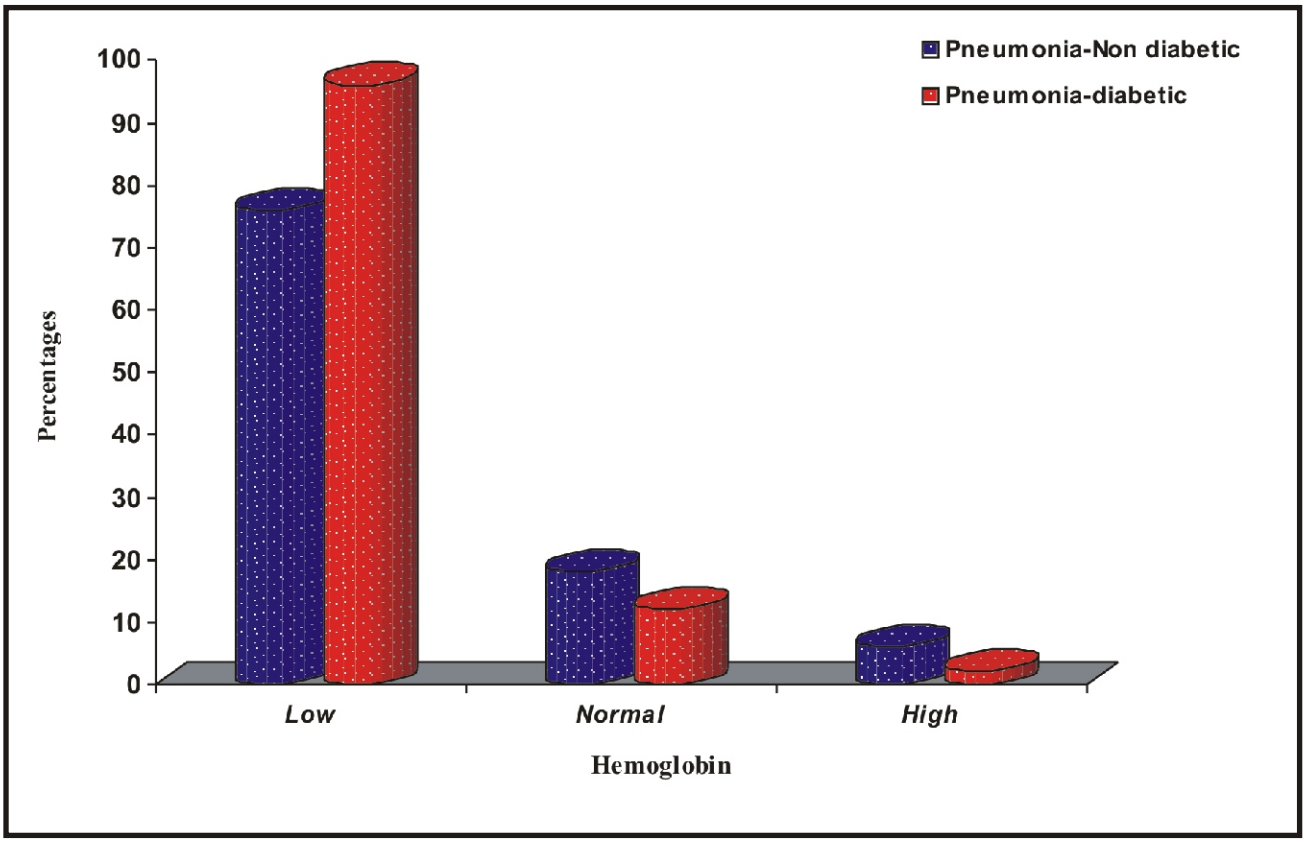

Figure 2 : Showing the hemoglobin concentration in both the groups

Table 4: Showing the blood urea nitrogen (BUN) levels in the both group

BUN	Pneumonia-Non Diabetic (n=50)	Pneumonia- Diabetic (n=50)
<40	45(90.0%)	36(72.0%)
>40	5(10.0%)	14(28.0%)
Inference	Elevated BUN was significantly associated with patients with Pneumonia in diabetics with P=0.022*	

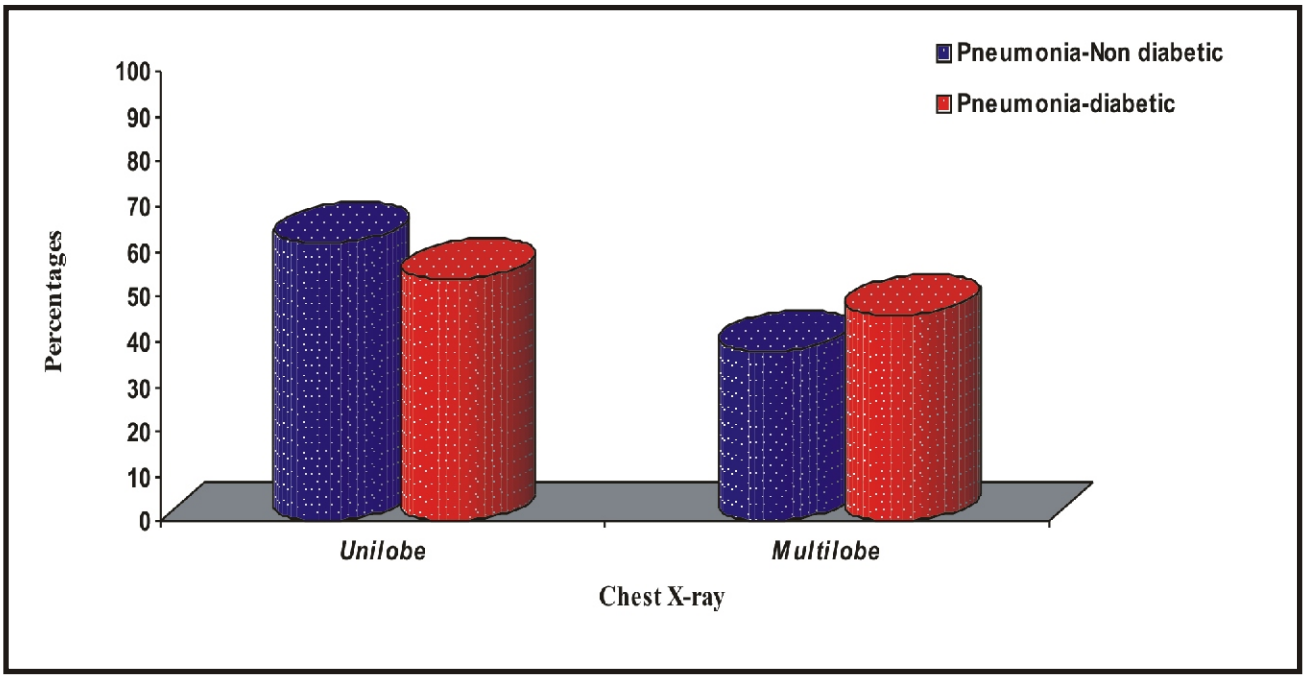

Figure 3: C-XRay :Unilobe Vs Multilobe Involvement in the Diabetic and Non-diabetic group with pneumonia

Table 5: Comparison of Sputum Gram in two groups of patients

Sputum Gram	Pneumonia-Non Diabetic (n=50)	Pneumonia- Diabetic (n=50)	P value
GNB	16(32.0%)	18(36.0%)	0.673
GPC	25(50.0%)	13(26.0%)	0.013*
GNB/GPC	2(4.0%)	16(32.0%)	<0.001**
GNC	4(8.0%)	0	0.117
GNC/GNB	1(2.0%)	0	1.000

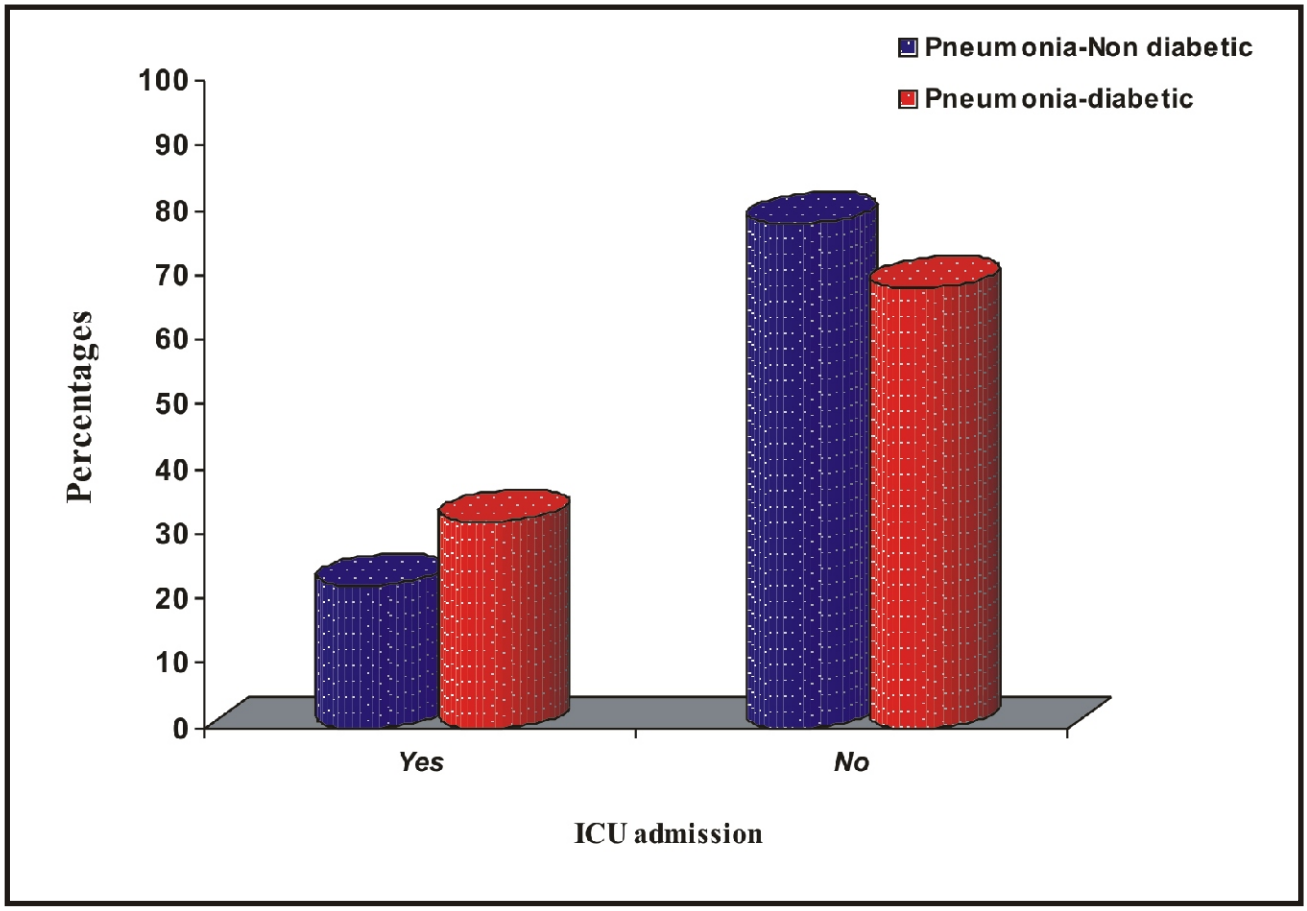

Figure 4: ICU statistics of both the groups

Table 6 : Comparison of Mortality in two groups of patients

Mortality	Pneumonia-Non Diabetic (n=50)	Pneumonia- Diabetic (n=50)
Yes	3(6.0%)	12(24.0%)
No	47(94.0%)	38(72.0%)
Inference	Incidence of mortality was significantly more in Pneumonia with Diabetes group with P= 0.012*	

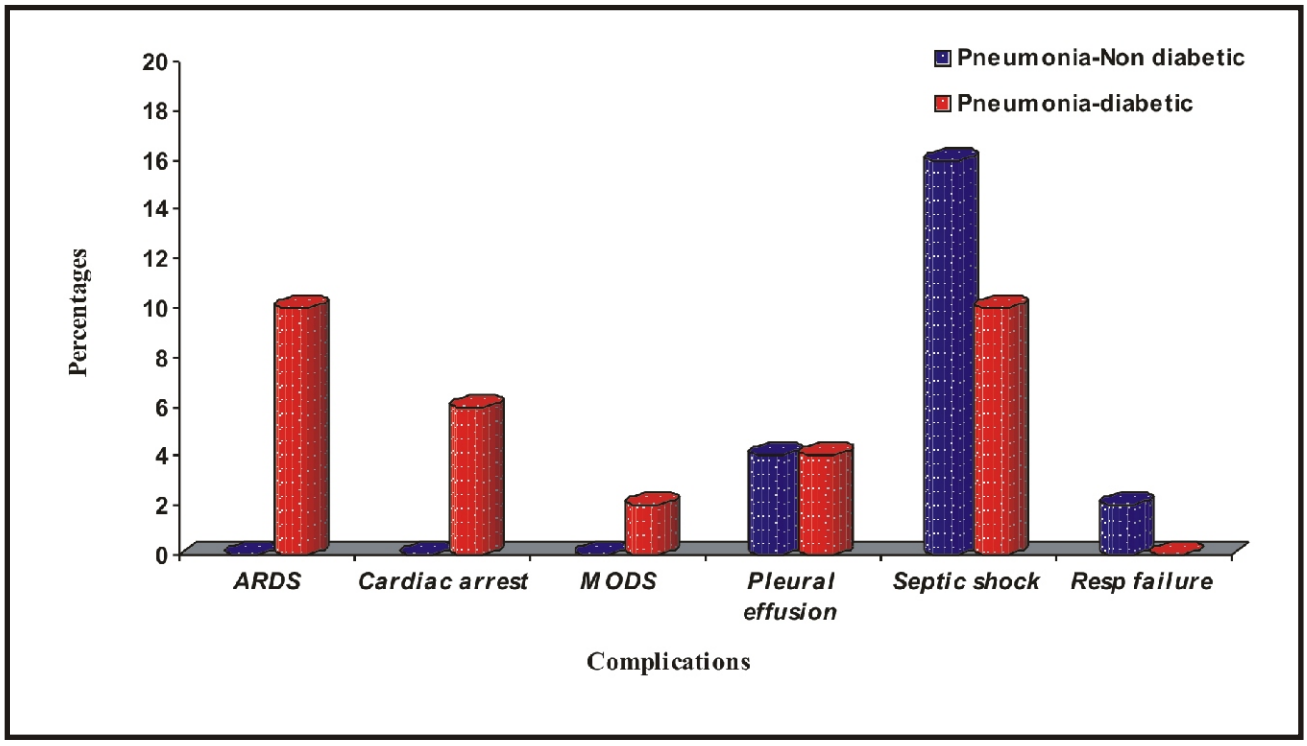

Figure 5: Incidence of complications in both the groups

Table 7: Comparison of PSI score in two groups of patients

Complications	Pneumonia-Non Diabetic (n=50)	Pneumonia- Diabetic (n=50)
Absent	39(78.0%)	34(68.0%)
Present	11(22.0%)	16(32.0%)
• ARDS	0	5(10.0%)
• Septic shock	8(16.0%)	5(10.0%)
• Cardiac arrest	0	3(6.0%)
• Pleural Effusion	2(4.0%)	2(4.0%)
• MODS	0	1(2.0%)
• Resp failure	1(2.0%)	1(2%)
Inference	Incidence of complications were statistically similar in two groups of patients with p=0.260	

DISCUSSION

In the present study we have compared parameters like age, sex, clinical features, vitals, investigation, ICU admissions, mortality, complication and PSI score between diabetes and non diabetes patients with pneumonia.

Hyperglycemia is an independent predictor of morbidity and/or mortality in patients admitted for acute coronary syndromes, ischemic stroke, heart failure, trauma, and a variety of surgical procedures.[5]

Five cohort studies [6,7,8,9] found that diabetes is a risk factor for pneumonia, with relative risks (RRs) ranging from 1.30 to1.75, while three studies [10,11,12] failed to find an association. Given the rising incidence of pneumonia-related hospitalizations and the increasing prevalence of diabetes [13], it is important to clarify whether diabetes and poor long-term glycemic control is a risk factor for pneumonia.

Miquel et al has reported that patients with diabetes were significantly older with average age of 62[14] which is similar with our study with an average age of 55 in diabetic group. Akbar DH had reported male predominance in diabetics (60%).[15] In our present study also showed male predominance in diabetic group (62%). Miquel et al[14] also reported that typical clinical features like signs of consolidation were seen in 58% of patients and other 42% of patients presented with signs other than consolidation. But our study reported 38% with signs of consolidation and 62% signs other than consolidation.

Palmer DL[16] reported that gram positive cocci such has strep pneumonia are responsible for majority of infections in diabetics. Miquel et al[14] reported 9% of patients had polymicrobial infection in diabetics. our study showed 12% of infections by pseudomonas and 26% of infections by polymicrobials in diabetics group.

Potgiester et al[17] reported that diabetics patients are associated with more severe course and icu admissions. But our study showed no difference in number of admission to icu in both the groups.

Moquel et al[14] study and present study showed that majority of non diabetics patients presented with PSI class I in comparison with diabetes who in majority presented with class IV which statistically significant.

Akbar DL[15] reported that there was no significant difference in mortality between two groups, but our study showed significant mortality in diabetics group with p-0.012.

The estimation of HbA1c level and treatment protocols are not compared in diabetic and non diabetic patients with pneumonia which can be considered as the limitation of this study.

The present study also showed that diabetic group mortality was significantly associated with multilobe involvement, renal impairement, and high PSI score. Hyperglycemia and impaired immunity in diabetic patients might explain the reason for high mortality rate and complications in diabetic patients with pneumonia.

CONCLUSION

In patients with pneumonia, diabetes mellitus is associated with poor prognosis, polymicrobial etiology, multi-lobe involvement and increased severity in the form of high PSI and mortality. This study suggests that this adverse outcome is more attributable to underlying circumstances of patients than uncommon microbiological

findings. However, in this study, diabetics also remained a significant prognostic factor of mortality in patients with pneumonia.

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