

# Bacterial pneumonias: Etiology and demographical profile in patients with diabetes mellitus

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## Abstract

**Introduction:** Diabetes Mellitus (DM) is the main cause of illness and mortality in both developed and developing nations. Patients with DM are more likely to get skin and soft tissue infections, urinary tract infections and pneumonia. The organisms that cause pneumonia are generally like those found in the general population; however, gram negative organisms are predominant in DM. The present study was thus planned to study the demographical and etiological profile in diabetics and non-diabetics with respect to clinical presentation.

**Materials & Methods:** This was a Prospective study of 60 patients in a territory care centre; complete clinical history was taken followed by a thorough clinical examination. The relevant recorded as per the proforma.

**Results:** Majority of the study subjects were in the age group of 40-60 years in the current study with no significant difference in the age group between the two groups. Of the total study population males were predominant with no statistical difference between the two groups. Polymicrobial followed by gram negative were found more among the diabetics than in non-diabetics in gram staining. Sputum culture showed that streptococcal pneumonia is the common organism in both DM and non-DM. Polymicrobial infection was found more predominant in diabetics than in non-diabetics

**Conclusion:** In view of predominant polymicrobial and gram negative bacilli etiology, choice of empirical antibiotic regimens for treatment of pneumonia in DM should cover these wide range of organisms.

**Keywords:** Diabetes mellitus, pneumonia, infection

## Introduction

In both developing and developed countries, diabetes is the leading cause of morbidity and mortality. Pneumonia, urinary tract infection, skin and soft tissue infection all occur more frequently in diabetics. The organisms that cause pneumonia are generally similar to those found in the general population; however, gram positive organisms such as *S. aureus* and *Mycobacterium tuberculosis* are more prevalent <sup>[1]</sup>. Diabetes mellitus is one the most frequent underlying diseases in people with community-acquired pneumonia <sup>[2]</sup>.

The severity of micro-vascular complications is strongly related to the magnitude and duration of hyperglycaemia. These complications increase the risk of infection. Predisposition to infection may also be influenced by conditions that impair normal clearance mechanisms and by disturbances in the function of pulmonary immune cells<sup>[3, 4]</sup>.

Hyperglycaemia impairs a broad range of neutrophil and monocyte functions, which is critical for limiting pyogenic and other bacterial infection invasion. Both adhesion and phagocytosis are dependent on the recognition of specific molecules on the bacterial surface, such as bacterial glycoproteins, as well as attached complement and IgG produced in response to the infection. Phagocytic cell migration to infection sites is generally impaired in diabetics, but improves with glycaemic control<sup>[5]</sup>.

Mortality in adults hospitalized with community-acquired pneumonia (CAP) ranges from 6 to 14%<sup>[6]</sup>. In these patients, advanced age and comorbidities such as diabetes are associated with an increased risk of death<sup>[7-9]</sup>. Given the hyperglycaemia, decreased immunity, impaired lung function and chronic complications, such as renal failure, heart disease and pulmonary microangiopathy, associated with diabetes<sup>[10]</sup>, it is plausible that diabetes may predict increased severity of pneumonia. Recent observational studies and a meta-analysis of pneumonia-related mortality, however, produced inconsistent findings.

As prevalence of diabetes<sup>[16]</sup> and pneumonia-related hospitalizations increase in the aging populations<sup>[17]</sup>, accurate data is required to understand the clinical course and to potentially prevent pneumonia-related deaths in diabetics.

The present study was thus planned to study the demographical profile in diabetics and non-diabetics with respect to clinical presentation.

## Materials & Methods

This was a Prospective study with 60 patients, carried out in patients admitted in the department of General Medicine, NRI General Hospital, during the period of May 2019 to May 2022.

### 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 or breathlessness.
2. X ray chest showing homogeneous or non-homogeneous opacities.
3. Sputum gram staining and culture showing pathological organisms.

### Exclusion criteria

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

After approval from institutional ethics committee and obtaining written informed consent, patients admitted in the general medicine department at NRIGH, who satisfy the inclusion and exclusion criteria were recruited in the study.

Complete clinical history was taken followed by a thorough clinical examination. The relevant details of symptoms and signs along with laboratory data are recorded as per the proforma.

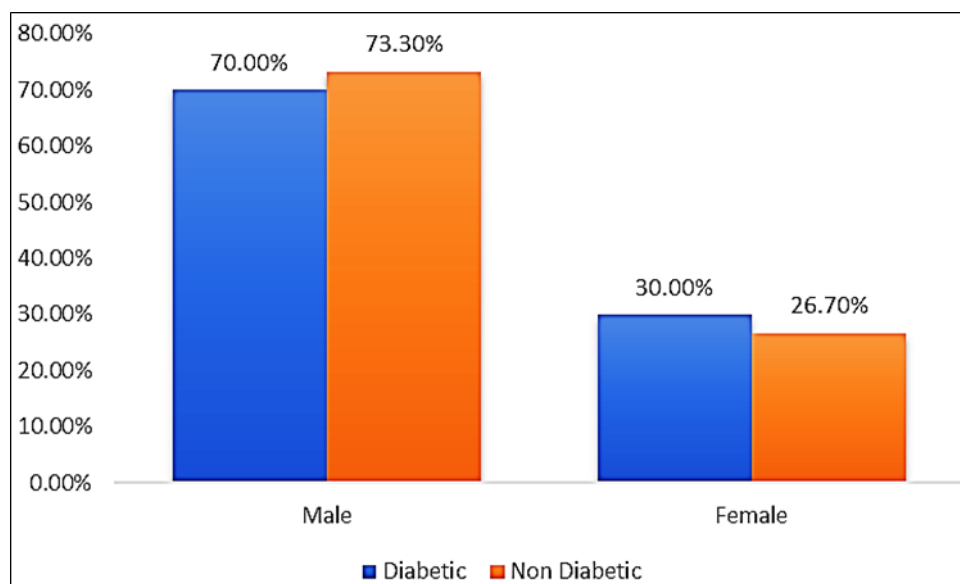
**Statistical analysis:** The data collected will be expressed as percentage and statistical analysis will be done using paired t test. 5% Level of significance is considered as statistically significant

## Results

**Table 1:** Age distribution in diabetics and non-diabetics

	Diabetic		Non-Diabetic		Total	
	N	%	N	%	N	%
40 - 50	10	33.3%	11	36.7%	21	35.0%
51 - 60	11	36.7%	9	30.0%	20	33.3%
61 - 70	7	23.3%	5	16.7%	12	20.0%
71 - 80	2	6.7%	5	16.7%	7	11.7%
Total	30	100%	30	100%	60	100%
Mean $\pm$ SD	55.93 $\pm$ 8.05		57.36 $\pm$ 11.54			
T test = 0.55, p=0.57, Not statistically significant						

In the current study age range is found to be 40-80 years with a mean age of  $55.93 \pm 8.05$  years among diabetics and  $57.36 \pm 11.54$  years among non-diabetics. 36.7% of the study subjects in the non-diabetic group are aged 40-50 years compared to 33.3% in the diabetic group. Among the study subjects aged 51-60 years 36.7% are diabetics compared to 30% non-diabetics. Majority of the study subjects are in the age group of 40-60 years in the current study. There is no significant difference in the age group between the two groups (Table 1).



**Fig 1:** Bar graph representation of gender in diabetics and non-diabetics

In the current study 71.7% are males compared to 28.3% females. Males were found to be more than females as 70% in diabetic group and 73.3% in non-diabetic group were males. There seems to be no statistical difference regarding gender between the two groups (Figure 1).

**Table 2:** Sputum gram staining in diabetic and non-diabetics

	Diabetic		Non-Diabetic		Total	
	N	%	N	%	N	%
Gram Negative bacilli	8	26.7%	5	16.7%	13	21.7%
Gram Positive cocci	7	16.7%	14	46.7%	19	31.7%
Gram negative cocci	0	0.0%	3	10.0%	3	5.0%
GNB/GPC/GNC	11	36.7%	2	6.7%	13	21.7%

Gram Negative bacilli was observed among 26.7% of diabetics compared to 16.7% non-diabetics. Gram Positive cocci was found in 16.47% diabetics and 46.7% non-diabetics compared to Gram negative cocci 10% among non-diabetics was observed contrastingly none of the diabetics was found to have Gram negative cocci. GNB/GPC/GNC was observed among 36.7% diabetics and 6.7% non-diabetics. IN the current study 31.7% were found to be gram positive cocci compared to 21.7% Gram Negative bacilli and GNB/GPC/GNC whereas Gram negative cocci was observed among 5% study subjects that too only among non-diabetics.

**Table 3:** Sputum culture in diabetic and non-diabetics

	Diabetic		Non-Diabetic		Total	
	N	%	N	%	N	%
E Coli	2	6.7%	1	3.3%	3	5.0%
Strep pneumonia	7	23.3%	12	40.0%	19	31.7%
Klebsiella	4	13.3%	2	6.7%	6	10.0%
Staph Aureus	2	6.7%	6	20.0%	8	13.3%
H Influenza	0	0.0%	1	3.3%	1	1.7%
Acinetobacter	3	10.0%	0	0.0%	3	5.0%
Pseudomonas	4	13.3%	2	6.7%	6	10.0%
Proteus	0	0.0%	1	3.3%	1	1.7%
Enterobacter	2	6.7%	1	3.3%	3	5.0%
Polymicrobial	6	20.0%	2	6.7%	8	13.3%
Enterococcus	0	0.0%	2	6.7%	2	3.3%

The current study findings regarding the sputum culture is that 31.7% of the study subjects were positive for strep. Pneumonia compared to 13.3% each Staph aureus and polymicrobial. Pseudomonas was 10% and klebsiella was also 10%. E. coli was identified among 5% and Enterobacter also 5% whereas 3.3% enterococcus and 1.7% *H. influenza* and proteus 1.7%. Among diabetics and non-diabetics strep pneumonia contributed highest with 23.3% in diabetics and 40% in non-diabetics. Polymicrobial infection was found more among the diabetics than non-diabetics (20% vs. 6.7%). In the current study E. coli, Klebsiella, Acinetobacter, pseudomonas and Enterobacter was more prevalent among diabetics whereas strep. Pneumonia, staph. Aureus, *H. influenzae*, proteus was more prevalent among non-diabetic study subjects.

## Discussion

### Age

In the current study the mean age of  $55.93 \pm 8.05$  years among diabetics and  $57.36 \pm 11.54$  years among non-diabetics. Majority of the study subjects are in the age group of 40 - 60 years in the current study. There is no significant difference in the age group between the two groups. In a study conducted by Sammaiah and co-workers<sup>[18]</sup> the mean age of diabetics was  $46.43 \pm 8.65$  years compared to  $44.3 \pm 9.37$  years among non-diabetics and 43.3% of the

diabetics were in the age group of 41-50 years compared to 36.7% among non-diabetics. Most of the study subjects were in the age group of 40 to 60 years which is similar finding to the current study.

In another study conducted by Miquel and his group<sup>[19]</sup> diabetic study subjects were found to be elder when compared to non-diabetics with a mean age of 62 years whereas similar observation were shown by several authors<sup>[20]</sup>.

## Gender

In the current study males were found to be more than females as 70% in diabetic group and 73.3% in non-diabetic group were males. There seems to be no statistical difference regarding gender between the two groups, similar observation was done by study conducted by Sammaiah group<sup>[18]</sup> distribution of males were higher than females in both the diabetics and non-diabetics 66.7% in diabetics and 80% among non-diabetics were males. Miquel<sup>[19]</sup> and also Akbar team<sup>[20]</sup> has also reported a male preponderance in their studies.

## Sputum gram staining

Gram Negative bacilli was observed among 26.7% of diabetics compared to 16.7% non-diabetics. Gram Positive cocci was found in 16.47% diabetics and 46.7% non-diabetics compared to Gram negative cocci 10% among non-diabetics was observed contrastingly none of the diabetics was found to have Gram negative cocci. GNB/GPC/GNC was observed among 36.7% diabetics and 6.7% non-diabetics. In the current study 31.7% were found to be gram positive cocci compared to 21.7% Gram Negative bacilli and GNB/GPC/GNC whereas Gram negative cocci was observed among 5% study subjects that too only among non-diabetics. Sammaiah *et al.*<sup>[18]</sup> study reported that sputum gram staining revealed that GPC were significantly more detected in non-diabetic (36.7%) compared to diabetics. polymicrobial were observed at a increased rate among diabetics compared to non-diabetics. Shetty GV *et al.*<sup>[24]</sup> reported that GNB was identified among 21 (42%) diabetics and 15 (30%) non-diabetics whereas GPC was found among 18 (36%) diabetics compared to 31 (62%) non-diabetics compared to GPC/GNB 12 (24%) vs. 4 (8%) among diabetics and non-diabetics respectively.

## Sputum culture

The current study findings regarding the sputum culture is that 31.7% of the study subjects were positive for strep. Pneumonia compared to 13.3% each Staph aureus and polymicrobial. Pseudomonas was 10% and klebsiella was also 10%. E. coli was identified among 5% and Enterobacter also 5% whereas 3.3% enterococcus and 1.7% *H. influenza* and proteus 1.7%. Among diabetics and non-diabetics strep pneumonia contributed highest with 23.3% in diabetics and 40% in non-diabetics. Polymicrobial infection was found more among the diabetics than non-diabetics (20% vs. 6.7%). In the current study E. coli, klebsiella, Acinetobacter, pseudomonas and Enterobacter was more prevalent among diabetics whereas strep. Pneumonia, staph. Aureus, *H. influenza*, proteus was more prevalent among non-diabetic study subjects. A study conducted by Sammaiah *et al.*<sup>[18]</sup> reported that common organisms are strep pneumonia (30%) pseudomonas (16%) and polymicrobial (16%). Miquel *et al.*<sup>[19]</sup> reported that microbiological results had no variations among diabetics and non-diabetics and 9% of diabetics had polymicrobial infections. Saibal *et al.*<sup>[25]</sup> reported that Klebsiella pneumoniae was the most frequent causative pathogen for CAP in diabetic patients, whereas Streptococcus pneumoniae was the most frequent causative agent for non-diabetic patients.

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