A Comparative Study of Bacteriological and Radiological Profile of Community Acquired and Ventilator Pneumonia with Special Reference to Type 2 Diabetes Mellitus Patients in a Tertiary Care Hospital

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Abstract: _Background: The present study was done to study pneumonia in Type 2 Diabetic patients with respect to clinical and bacteriological profile, laboratory parameters and prognosis. Methods: It is a prospective observational study. Patients aged >18 Years with Type 2 Diabetes mellitus and who met the diagnostic criteria for pneumoniaas per British Thoracic Society guidelines, VAP is diagnosed in patients presenting with development of new or progressive radiological infiltrates after 48 hrs of admission or after 48 hrs of mechanical ventilation & one of the following - Fever >38.3^{0}C, Leucocytosis>12000/cu. mm, or Leucopenia <4000/cu. mm, Purulent respiratory secretion, Quantitative endotracheal aspirate cultures with growth > 106cfu/ ml. A total of fifty patients with Type 2 Diabetes and pneumoniain this study. Data were analysed using SPSS 21. A probability value of <0.05 has been considered as statistically significant. Conclusion: In CAP group the most common comorbidity observed was hypertension (44%) followed by cardiac failure (24%). In VAP group, next to poisoning (36%), the most common primary diagnosis in VAP group was cerebrovascular accident (28%) followed by renal disease (20%). Substance abuse such as smoking and alcoholism was found in 30% and 20% of the patients respectively. Klebsiella was the most common organism isolated from sputum culture in CAP group (56%) whereas in VAP group both klebsiella and pseudomonas were equally predominant (32% each). Mortality in CAP group was 12% and it was 36% in VAP group. Significant association between HbA1C level and blood urea with mortality was observed, HbA1c and blood urea were significantly higher in death cases than in those who survived in both groups. Mean blood glucose levels were higher in non- survivors when comparedto the survivors in both groups._

Keywords: Diabetes Mellitus, Community Acquired Pneumonia, Ventilator Associated Pneumonia, Fasting Blood Sugar, Post Prandial Blood Sugar, HemoglobinA1C (HBA1C)

1. Background

Pneumonia is defined as a syndrome caused by acute infection of lung parenchyma characterised by clinical and radiographic features of consolidation of part or parts of single lung or both lungs. Abnormal lung function has been noted in diabetics such as decreased lung volume, impaired elastic recoil and impaired diffusion due to reduction inpulmonary capillary blood volume. Pulmonary microangiopathy and nonenzymatic glycosylation induced alteration of pulmonary connective tissue are the most common pathogenic mechanisms causing pulmonary dysfunction in diabetics. Enzymes important for oxygen dependent killing of micro organisms (antioxidants) such as super oxide dismutase, glutathione peroxidise, glutathione reductase are decreased leading to increased susceptibility to infections in diabetics. These abnormalties imply that lung is the "target organ" in diabetes. Incidence of pulmonary tuberculosis among the patients with diabetes is three to four times higher than in normal population.

Incidence of pulmonary tuberculosis among the patients with diabetes was three to four times higher than in normal population. Causes for increased frequency of TB in DM are impaired phagocytosis and impaired cellular immunity in persons with diabetes allowing spread of the disease over neutralising antibodies in bronchial secretions and hyperglycemia favouring the growth, viability and propagation of tubercle bacilli. Tuberculosis in diabetics is characterised by severe and more aggressive course of the disease, a higher tendency to destruction and more common resistance to ATT. There is extensive caseation of lung tissue and cavitary lesion with less pleural involvement.

Factors that affect host's ability to counteract infections are changes in function of capillary endothelium, erythrocyte rigidity and alteration in oxygen dissociation curve which occur due to chronic hyperglycemia. Longstanding diabetic

patients with associated complications are at higher risk of infections than non - diabetic patients or diabetic patients without any complications. Decreased oxygen supply to the tissues due to microvascular changes predispose to infections by anaerobic organisms that grow well in those conditions.

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2. Methods

The present study was conducted in the department of General Medicine in PES Hospitals, Kuppam, from January 2020 to July 2021 after ethical committee approval was obtained.

Inclusion criteria:
1) Patients aged >18 Years with Type 2 Diabetes mellitus and who met the diagnostic criteria for pneumonia and
2) As per British Thoracic Society guidelines CAP is diagnosed in patients presenting with:
   - Symptoms suggestive of acute lower respiratory illness (cough with or without expectoration, shortness of breath, pleuritic chest pain) for < 1 week
   - Atleast one systemic feature - fever (>37.7 0 C), chills and rigors or severe malaise
   - New focal chest signs (bronchial breath sounds or crackles) with
   - No other explanation for the illness.
3) Chest X ray suggestive of consolidation of lung - unilateral or bilateral homogenous or non homogenous opacities.
4) Purulent respiratory secretions.
5) Quantitative endotracheal aspirate cultures with growth > 106cfu/ ml.

Exclusion criteria:
1) Age <18 years.
2) Patients who were not willing to give informed consent to participate in the study

A total of fifty patients of Type 2 Diabetes with pneumonia were included in this study.

Statistical analysis of data:
The data was entered into MS Excel 2007 version and further analyzed using SPSS 21. For descriptive analysis, the categorical variables were analyzed by using percentages and the continuous variables were analyzed by calculating mean ± Standard Deviation. A probability value of<0.05 was considered statistically significant.

3. Observations

Table 1: Laboratory Findings – FBS, PPBS, HBA1c

	CAP		VAP	
FBS	No of patients	Percentage	No of patients	Percentage
130 - 199	13	52%	5	20%
200 - 299	9	36%	16	64%
>300	3	12%	4	16%

PPBS	No of patients	Percentage	No of patients	Percentage
180 - 299	15	60%	9	36%
300 - 399	7	28%	13	52%
>400	3	12%	3	12%

HBA1C	No of patients	Percentage	No of patients	Percentage
<7	03	12%	02	8%
7 - 10	14	56%	09	36%
>10	8	32%	14	56%

Table 2: Radiological Findings of the Patients

Site of Pneumonia	CAP		VAP	
	No of patients	Percentage	No of patients	Percentage
Unilobar	08	32%	08	32%
Bilateral Basal	13	52%	12	48%
Multilobar	04	16%	05	20%

Table 3: Sputum Culture

Organism	CAP		VAP	
	No of patients	Percentage	No of patients	Percentage
Klebsiella pneumoniae	14	56%	8	32%
Non fermenting gram negative bacilli	4	16%	4	16%
Pseudomonas	5	20%	8	32%
E. Coli	-	-	2	8%
Others	2	8%	3	12%

Table 4: Clinical Features of the patients

Clinical features	CAP		VAP	
	No of patients	Percentage	No of patients	Percentage
Fever	22	88%	23	92%
Cough	25	100%	- -	-
Expectorations/ Respiratory secretions	25	100%	25	100%
Breathlessness	17	68%	-	-
Chest pain	5	20%	-	-

Table 5: Association of HBA1C with Mortality

HBA1C	CAP		VAP	
	Non Survivors	Survivors	Non Survivors	Survivors
	Number of patients (percentage)	Number of patients (percentage)	Number of patients (percentage)	Number of patients (percentage)
<7	-	3 (13.6%)	-	2 (12.5%)
7 - 10	-	14 (63.6%)	1 (11%)	8 (50%)

p - 0.027 p - 0.044

Table 6: Mortality

	CAP		VAP	
	No of patients	Percentage	No of patients	Percentage
Survivors	22	88%	16	64%
Non survivors	3	12%	9	36%

4. Results

- In the present study, males were more frequently affected than females in both CAP (64%) and VAP (72%). Females were less affected (36% in CAP and 28% in VAP).

- Most common symptom in the present study in CAP group was cough (100%) followed by fever (88%). Breathlessness and chest pain were less common symptoms. In VAP group, most common clinical feature observed were increase in respiratory secretions (100%) followed by fever (92%). Requirement of FiO2 >35% was seen in 60%of the patients in VAP group.
- In CAP group, hypertension (44%) was most common associated comorbidity followed by cardiac disease (24%). Most frequent comorbidity observed in VAP group were cerebrovascular accident (28%) followed by renal disease (20%).
- Poisoning was the most frequently observed primary diagnosis in VAP (36%) followed by cerebrovascular accident (28%) and renal disease (20%). Other less common primary diagnosis were cardiac disease, COPD, snake bite, sepsis and hypertension.
- Most common organism isolated from sputum in CAP group was Klebseilla pneumoniae (58%) followed by pseudomonas (20%). In VAP group both Klebsiella pneumonia and pseudomonas (32% each) were equally predominant.
- Klebsiella was sensitive to Meropenem, tigecyclin and colistin in all CAP patients and 90% sensitive to ceftriaxone and amikacin, relatively resistant to amoxycillin and clavulinic acid and ampicillin and sulbactam.
- Mean blood glucose in survivors in CAP group was 212mg% and it was 316mg% in nonsurvivors and it was statistically significant (p - 0.03). In VAP group, mean HBA1C in survivors was 257mg% and in nonsurvivors it was 328mg% with a statistically significant association (p - 0.02). Hyperglycemia was associated with mortality in both the groups.

5. Discussion

- In this study majority of the patients (60%) were in CAP group belonged to the age group of 51 - 70 years with the mean age of 58.4 years.
- Cough was the most frequent symptom seen in 92% patients in CAP group followed by fever in 88% of CAP group. most common features in VAP group fever and endotracheal secretions.
- In this study, substance abuse such as smoking was found in 30% of patients and 20% patients were alcoholics.
- The most common mode of distribution of radiological abnormalties in the present study was bilateral involvement seen in 48% of the patients followed by unilobar in 32% of the patients and multilobar in 20%.
- Most common organism isolated from sputum culture in CAP group was Klebsiella (56%) followed by Pseudomonas (20%).
- The mortality rate in CAP patients was 12%, mortality rate in VAP patients in the present study was 36%.
- Mean HbA1C in the present study in CAP group was 9.27% (8.84% in survivors and 12.4% in nonsurvivors) and it was 9.93% in VAP group (9.3% in survivors and 9.93% in nonsurvivors). HbA1C levels were higher in nonsurvivors than in survivors in both groups and it was statistically significant (p=0.027)

6. Conclusions

- 50 patients with Type 2 Diabetes mellitus and pneumonia were included in the study. Among them 25 patients had CAP and 25 patients had VAP.
- Mean age of the patients in CAP group was 58.4 years and it was 62.08 years in VAP group.
- In both groups males were predominantly affected (64% males in CAP and 72% in VAP)
- In CAP group most common comorbidities observed were hypertension (44%) followed by cardiac failure (24%). In VAP group, next to poisoning (36%), most common primary diagnosis in VAP group was cerebrovascular accident (28%) followed by renal disease (20%).
- Among the clinical features most common finding was fever followed by cough or respiratory secretions in both the groups
- Substance abuse such as smoking and alcoholism was found in 30% and 20% of the patients respectively
- Bilateral involvement of the lungs was the most common radiological involvement noticed in both groups.
- Klebsiella was the most common organism isolated from sputum culture in CAP group (56%) whereas in VAP group both Klebsiella and pseudomonas were equally predominant (32% each).
- Mortality in CAP group was 12% and it was 36% in VAP group.
- Significant association between HbA1C level and blood urea with mortality was observed i. e HbA1c and blood urea were significantly higher in nonsurvivors than in survivors in both groups.
- Mean blood glucose levels were higher in nonsurvivors when compared with the survivors in both groups.
- No significant association was noticed between vital signs and total counts with m1ortality in both groups.
- CURB 65 score correlated with mortality in patients with community acquired pneumonia.

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