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Original Research Article

A CLINICO- ETIOLOGICAL PROFILE OF COMMUNITY ACQUIRED PNEUMONIA IN TYPE 2 DIABETES MELLITUS – A CROSS SECTIONAL STUDY

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Abstract

Background: Pneumonia is inflammation of lung parenchyma triggered by infectious agent. It is commonest disease with high prevalence in community, and causes the significant morbidity, and mortality. Respiratory infections are among the major infections associated with diabetes. The aim of this cross-sectional study was to study a clinico- etiological profile of community acquired pneumonia (CAP) in Type 2 Diabetes mellitus. **Materials and Methods:** This observational cross-sectional study was completed on 100 adult patients attending Medicine OPD/IPD in Department of General Medicine, Rohilkhand Medical College and Hospital, Bareilly, UP for duration of 1 year. Patients with presenting with CAP with type II Diabetes mellitus, age > 18 years and < 65 years and patients who had fever < 10 days were include in this study. **Result:** Mean age of study patients were 56.3±15.3 with male predominance (55.0%). In our study cases 46.0% patients were smokers and 48.0% were alcoholics. Blood Culture and Urine Routine and Microscopy findings were much more positive for HbA1c greater than 7% than having the level ≤7%. Chest X Ray and High-resolution computed tomography findings were also much more severe for HbA1c greater than 7 group patients than having the level ≤7. The pathogens not associated with glycaemic parameters. In COVID-19 positive cases S. aureus and E. coli was significantly lower. **Conclusion:** CAP in diabetic patients is more frequently due to Staphylococcus aureus and E. coli species. CAP incidence seems to be increasing at higher rate among the patients with T2DM than among non-diabetic patients.

INTRODUCTION

Community-Acquired Pneumonia (CAP) is defined as "an acute infection of the pulmonary parenchyma in a patient who has acquired the infection in the community." The clinical appearance of CAP diverges, oscillating from mild pneumonia considered by the fever and the creative cough to severe pneumonia categorized by the respiratory distress and the sepsis. Since of the extensive spectrum of accompanying the clinical features, CAP is a portion of differential analysis of approximately all the respiratory diseases. CAP is a common and potentially life-threatening disease. CAP is connected with the considerable morbidity and mortality, predominantly in elder adult persons and patients with notable comorbidities.[1] CAP is a important reason of the death worldwide. The incidence of CAP indicates whichever a burden in the host immunity, interaction with a infectious micro-organism or an devastating inoculum.[2]

In accumulation to above revealed factors, present comorbidities in host may be damage the pulmonary immunity function and can be led to amplified hazard of pneumonia. These include elder age, chronic lung diseases (CLD) and immunocompromising circumstances like diabetes mellitus (DM).[3]

Viral respiratory tract infections (RTI) can be led to primary level of viral pneumonias and also predispose to the secondary level of the bacterial pneumonia. This is greatest marked for the influenza virus contamination. Situations that intensification risk of the macro aspiration of stomach innards and / or the micro aspiration of upper airway excretions influence to CAP, such change in awareness (e.g. due to the stroke, seizure, anaesthesia, drug or alcohol habit) or dysphagia owing to the esophageal

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abrasions or the dysmotility. The smoking, alcohol overdoing (e.g. >80g/day), and the opioid habit are the important modifiable interactive risk factors for the CAP. Other reasons that have been connected with an amplified risk of the CAP comprise crowded living circumstances (e.g. the prisons, homeless accommodations), dwelling in low-income locations, and contact to the environmental toxins.[3]

The maximum frequently recognized reasons of the CAP can be gathered into three types. They are (1) the typical bacteria (eg, S. pneumoniae (most communal bacterial source), H. Influenza, Staphylococcus aureus, Group A streptococci, aerobic gram-negative bacteria like the Klebsiella spp or Escherichia coli). (2) The atypical bacteria (e.g. Legionella, Mycoplasma, Chlamydia). (3) The respiratory viruses (e.g. Influenza A and B viruses, Rhinoviruses, Parainfluenza viruses, Adenoviruses, Respiratory Syncytial virus, Corona virus). The comparative incidence of these micro-organisms fluctuates with the geography, the pneumococcal vaccination rates, the host risk factors (e.g. smoking, alcohol uses), season, and the pneumonia severity.[4]

The maximum studies advocate an improved risk of the infection amongst patients with DM associated with the general populace, though the greatness of this danger is indeterminate.[5] Host- and organism-specific problems that may be inform why DM patients are more susceptible to certain infections. Numerous facets of resistance, such as the specific neutrophil roles like the chemotaxis, endothelial adherence, phagocytosis, intracellular bactericidal action and the cell-mediated insusceptibility are all depressed in uncontrolled DM.[6]

Numerous studies have verified that the DM patients access healthcare facility for the contagions more recurrently than non-DM.[7] The chance of contagion in DM is directly associated to severity of hyperglycemia.[8] However it is still uncertain as to whether pneumonia in DM has the exact clinical appearances, high mortality or comprises more virulent pathogens. The current learning is consequently started to study of the clinico-etiological profile of community acquired pneumonia in Type 2 Diabetes mellitus.

MATERIALS AND METHODS

This observational cross-sectional study was completed in Department of General Medicine, Rohilkhand Medical College and Hospital, Bareilly, UP for duration of 1 year (November 2020 to October 2021) on 100 adult patients attending Medicine OPD/IPD with presenting with community acquired pneumonia, & type II Diabetes mellitus and fit to the inclusion criteria were recruited for this study.

Inclusion Criteria

1. New cases present with CAP with type II Diabetes mellitus.
2. Age > 18 years and < 65 years.
3. Patients who had fever < 10 days.

Exclusion Criteria

1. Known case of COPD and Asthma.
2. Known case of interstitial lung disease.
3. Hospital acquired pneumonia cases.
4. Patients having malignancy- primary/secondary.
5. Patients previously had similar complain and treated for pneumonia.

Procedure methodology

A hospital based cross sectional study was carried out in a tertiary health care centre Rohilkhand Medical College & Hospital, Bareilly. Ethical clearance was taken from Institutional ethics committee (IEC). Informed consent was taken & explained to the patients. Patients fulfilling the case definition of CAP, an infection in a community setting was screened for diabetes mellitus.[9,10] All the pneumonia confirmed cases along with diabetes mellitus were selected as study population fulfilling inclusion criteria. In the selected cases, investigation was carried out & the pattern of the disease was observed.[9]

Schedule was prepared before undertaking the study. A pretested semi structured interview schedule consisting both open & closed ended questions was admitted for collecting information related to clinico-etiological profile of CAP in type-II diabetes mellitus.

Statistical Analysis

Data was entered on a Microsoft Excel spreadsheet and then it was imported into Statistical Package for Social Sciences (SPSS) version 23.0 for Statistical analysis. Data was analysed by applying frequency, percentage, mean, standard deviation. Discrete (categorical) groups were compared by chi-square ($\chi 2$) test was used to correlate diabetes mellitus with clinical profile of pneumonia. P- value of <0.05 was considered statistically significant.

RESULTS

Majority of the studied patients were above 60 years of age (46.0%) with mean age 56.3±15.3 years and male predominance (55.0%). Patients' personal history was found that 46.0% patients were smokers and 48.0% were alcoholics.

Table 1: Demographic details.

Parameters		No. of patients (n=100)	Percentage
Age in years	≤30	9	9.0
	31-45	15	15.0
	46-60	30	30.0
	>60	46	46.0
Mean Age		56.3±15.3 years	

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Gender	Male	55	55.0
	Female	45	45.0
Patients' personal History	Smoking	46	46.0
	Alcohol	48	48.0

The association between Blood Culture and Urine Routine and Microscopy findings were much more positive for HbA1c greater than 7 than having the level ≤7 but the difference was statistically insignificant (p>0.05).

Table 2: Microbial Findings

Microbiological parameters		**HbA1c**		**P value***
		≤7 (n=19)	**>7 (n=81)**	
Blood Culture	Positive	3 (15.8%)	28 (34.6%)	0.111
	Negative	16 (84.2%)	53 (65.4%)	
Urine Routine and Microscopy	Positive	5 (26.3%)	29 (35.8%)	0.432
	Negative	14 (73.7%)	52 (64.2%)	

*Chi Square test

The association between Chest X Ray and High-resolution computed tomography findings were much more severe for HbA1c greater than 7 group patients than having the level ≤7 but the difference was statistically insignificant (p>0.05).

Table 3: Radiological Findings.

Radiological parameters		**HbA1c**		**P value***
		≤7 (n=19)	**>7 (n=81)**	
Chest X Ray	Consolidation	6 (31.6%)	34 (42.0%)	0.279
	Ground glass and patchy opacities	4 (21.1%)	24 (29.6%)	
	Infiltrates Present	9 (47.4%)	23 (28.4%)	
High-resolution computed tomography (HRCT)	Pneumonia	0 (0.0%)	15 (18.5%)	0.348
	UIP	2 (10.5%)	12 (14.8%)	
	Acute respiratory distress syndrome	0 (0.0%)	1 (1.2%)	
	Chronic sequelae of COVID 19	8 (42.1%)	28 (34.6%)	
	Pathy Area of Consolidation	1 (5.3%)	4 (4.9%)	
	NA	8 (42.1%)	21 (25.9%)	

*Chi Square test

The below table shows the association of sputum positive findings (pathogens) with diabetes parameters and the difference was found statistically insignificant (p>0.05).

Table 4: Association of pathogens with diabetes parameters

Diabetes parameters		**Pathogens**		**p-value**
		Staphalo Coccus Aureus (n=22)	**E. coli (n=9)**	
HbA1c	≤7	3 (13.6%)	0 (0.0%)	0.244
	>7	19 (86.4%)	9 (100.0%)	
FBS	≤150	7 (31.8%)	4 (44.4%)	0.505
	>150	15 (68.2%)	5 (55.6%)	
PPBS	≤200	7 (31.8%)	5 (55.6%)	0.218
	>200	15 (68.2%)	4 (44.4%)	
Duration of DM	≤20	14 (63.6%)	4 (44.4%)	0.326
	>20	8 (36.4%)	5 (55.6%)	

The following table shows the association of COVID-19 findings with pathogens and the difference was found statistically significant (p<0.05).

Table 5: Association of COVID-19 positive patients with pathogens.

Pathogens	**COVID-19**		**p-value**
	Positive (n=64)	**Negative (n=36)**	
Staphalo Coccus Aureus (n=22)	2 (3.1)	20 (55.6)	<0.001
E. coli (n=9)	1 (1.6)	8 (22.2)	<0.001
Negative (n=69)	61 (95.3)	8 (22.2)	<0.001

DISCUSSION

In this study the majority of the studied patients were in the age group over 60 years followed by age group ranging from 46 to 60 years and the mean age was 54.5±13.9 years with male predominance this could be due to the fact that the males are much more involved in the outer environment activities and older people have low immunity and strength to fight infection. Smoking and alcohol were the major risk-factors associated with diabetes and infection as observed in present study. Our findings were in accordance with Sammaiah P et al,[11] who reported the mean age as 46.43±8.65 and males were 73.03%

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and smoking and alcohol as the major risk factors. Shetty GV et al,[4] reported average age in the diabetic group was 57.72±8.25 yr. In both the groups male patients (58.0% in CG and 54.0% in SG) were slightly more than female patients. In personal habits smoking and alcohol consumption were common. Acharya VK et al,[12] depicted that among 100 patients 64.0% were males, and only 36.0% were females. Majority of patients were above 40 years of age. Ahmed JU et al,[13] in their study found that of 120 subjects, 867% were male, 33% were female. Mean age of patients was 55.69 ±10.5 years.

In our study according to blood culture reports 22.0% were due to Staphalo Coccus Aureus and 9.0% were infected due to E. coli Whereas 69.0% shows negative results. Our findings were comparable with Acharya VK et al,[12] reported that the most frequent pathogen was Streptococcus pneumonia (31.0%) followed by Streptococcus aureus (8.0%) and E coli (8.0%). Ahmed JU et al,[13] Streptococcus pneumonia in 44.2% followed by Streptococcus Aureus (15.0%) and E coli (7.5%). S. aureus, E. coli, and P. aeruginosa were bacteria found in study by Saibal MA et al.[14] Sammaiah P et al,[11] reported that staph aureus and gram-negative organisms such as klebsiella, E. coli, enterobacter, pseudomonas and acinetobacter are common organisms in diabetes.

In present study based on chest X ray consolidations in 40.0% cases followed by infiltrates were present in 32.0% and Ground glass and patchy opacities in 28.0%. HRCT shows pneumonia in 15.0% followed by UIP pattern in 14.0%, Chronic sequelae of COVID 19 in 36.0%, Pathy Area of Consolidation in 5.0%. Similar to the present study Khwaja A et al,[15] reported that chest radiography revealed bilateral lung involvement in 47%, isolated right lung involvement in 34%, isolated left lung involvement in 19% and mediastinal involvement in one patient. The most common finding was consolidation; 63% followed by pleural effusion in 37% and interstitial infiltrates in 28% patients.

In our study sputum findings were positive in 29.0% cases. Bjarnason A et al,[16] reported that sputum culture was found positive in 53% of available samples; however, only 33% could provide an adequate sample. In comparison, blood culture yielded relevant results in 7% of 231 cases. Assefa M et al,[17] in their study reported that overall culture positive sputum for the bacterial isolates from the clinically diagnosed adult patients of CAP was 39.4%. Both gram positive, and gram-negative bacterial isolates were improved with 46.8% and 53.2% prevalence, respectively. The mixed infections were detected among (0.9%) patients; E. coli and S. aureus, K. pneumoniae and H. influenzae, and K. pneumoniae and S. aureus were isolated from those 3 patients. In present study, K. pneumoniae (31.0%) was frequently isolated bacteria followed by S. pneumoniae (26.2%), S. aureus (20.6%), and E. coli (12.7%). Diabetic patients with S aureus had 1.22-fold higher probability of dying during their stay than those without that pathogen.

In a study by Ahmed JU et al,[13] the majority of patients had growth of Klebsiella pneumoniae in sputum, followed by S. aureus and then other gram-negative bacteria like Pseudomonas and E. coli. This finding is similar to other studies conducted in Bangladesh,[2] but somehow different from another study in India where the majority of growth was Pseudomonas followed by S. aureus.[18] It has been suggested that DM patients have increased rate of colonization and adherence of gram-negative bacteria to the upper respiratory epithelium. From there aspiration of these bacteria to the lung may be facilitated by the use of anti-ulcerants and diabetic gastroparesis.[19] Diabetic patients are also at increased risk of staphylococcal pneumonia as because the rate of nasal carriage of Staphylococcus in diabetic patients is 30% compared to 11% in non-diabetic individuals.[20] Regarding glycemic status, most of the bacterial growth was isolated in patients with uncontrolled DM as evidenced by HbA1c ≥7.0%. This is because uncontrolled DM causes immunosuppression leading to increased chance of any infection including pneumonia.

In this study the COVID-19 positive patients i.e., 64.0%, 4.7% had bacteremia of which 3.1% had S. aureus and 1.6% had E. coli and our findings were consistent with Sepulveda J et al,[21] stated that from March 31, 1.60% of COVID-19 patients had bacteraemia, with S. aureus as second commonest pathogen accounting for 13.0% of bacteraemias. Nori P et al,[22] reported comparable findings, with 1.90% of COVID-19 patients with bacteraemia with S. aureus as commonest etiology, accounting for 44.0% of bacteremias. In comparison with above studies, Cusumano JA et al,[23] case series found greater percentage of the patients who precisely had S. aureus bacteremias, which might be explained by the longer observation time which included entire admission of patient.

Pneumonia is defined as an inflammation and consolidation of the lung because of infection.[24] Due to lung location, anatomy, and function, this organ is more susceptible to oxidative damage.[25] On other hand, diabetes induces lung oxidative stress and inflammation and increases susceptibility to viral pneumonia. Not surprisingly, the COVID-19 infected diabetic patients have much more severe outcome than non-diabetes.[26] Rueda AM et al,[27] reported that in the non-diabetic cases who had bacterial pneumonia, high blood glucose related with more severity and a worse outcome, predominantly when plasma glucose (APG) levels were equal or more than 180 mg/dl at the admission. Consequently, this assumption can be haggard that controlling of blood glucose is of the necessary in several COVID-19 infected cases.[28]

Limitations of the study

The limitation of present study was smaller sample size and we were not able to follow up the patients

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after discharge as well as to find out 30- day mortality/90-day mortality.

CONCLUSION

CAP in DM patients is more commonly due to Staphylococcus aureus and E. coli species. CAP incidence seems to be increasing at higher rate among patients with T2DM than among non-diabetic patients. Diabetic patients have high susceptibility to viral infection due to several causes. Mortality among diabetic subjects with COVID-19 is multiple associated with non-DM subjects. S. aureus bacteraemia was found uncommon but related with high mortality-rates in the patients hospitalized with COVID-19. Risk-factors associated with the higher mortality included the hospital-onset bacteraemia, older age, and diabetes. Further investigation is necessary on relationship between COVID-19, and secondary S. aureus bacteraemia and other pathogens.

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