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INTERSECTION OF HYPERGLYCEMIA AND INFECTION - CLINICAL PROFILING OF CAP IN PATIENTS OF T2DM VISITING TERTIARY CARE HOSPITAL OF SOUTHERN BIHAR

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Abstract

Background: Community-acquired pneumonia (CAP) is a major cause of morbidity and mortality worldwide, particularly among patients with chronic comorbidities such as type 2 diabetes mellitus (T2DM). Diabetes is known to impair immune function and is associated with increased susceptibility, severity, and adverse outcomes of respiratory infections. Data on the clinical profile and outcomes of CAP in diabetic patients from eastern India, especially southern Bihar, remain limited. ***Objectives:*** To study the clinical profile, severity, radiological patterns, glycaemic status, and in-hospital outcomes of community-acquired pneumonia in patients with type 2 diabetes mellitus attending a Narayan Medical College & Hospital, Bihar. ***Materials and Methods:*** This prospective observational study included adult patients with T2DM diagnosed with CAP. Detailed demographic data, clinical presentation, laboratory parameters including glycaemic indices, and radiological findings were recorded. Severity of pneumonia was assessed using standard scoring systems. Patients were followed throughout hospitalization, and outcomes such as ICU admission, need for mechanical ventilation, duration of hospital stay, and mortality were documented. Data were analysed using appropriate statistical methods. ***Results:*** A total of 100 patients were studied. The mean age was 58.4 ± 10.2 years, with male predominance. Fever, cough with expectoration, and dyspnoea were the most common presenting symptoms. Poor glycaemic control was evident, with a mean HbA1c of 8.9 ± 1.6%. Lobar consolidation was the most frequent radiological finding. Poor glycaemic control was significantly associated with increased severity of pneumonia ($p = 0.002$) and adverse outcomes including ICU admission, mechanical ventilation, and mortality. ***Conclusion:*** Community-acquired pneumonia in patients with type 2 diabetes mellitus is associated with severe disease and unfavourable outcomes, particularly in those with poor glycaemic control. Early diagnosis, prompt management, and optimal glycaemic control are essential to improve clinical outcomes in this high-risk population.

Keywords: Community-acquired pneumonia, Type 2 diabetes mellitus, Glycaemic control, Clinical profile, Disease severity.

INTRODUCTION

Community-acquired pneumonia (CAP) remains a major cause of morbidity and mortality worldwide and continues to place a heavy burden on health systems, particularly in low- and middle-income regions where access to preventive care and early treatment is uneven [1]. CAP affects all age groups but carries greatest risk for the elderly and for people with chronic comorbidities; it is a leading infectious cause of hospital admission and accounts for substantial in-hospital mortality even with modern supportive care [1]. Diabetes mellitus — overwhelmingly type 2 diabetes in adult populations — is increasingly prevalent across India and contributes to susceptibility to infections through multiple mechanisms including hyperglycaemia-associated impairments in innate and adaptive immunity, altered pulmonary host defences and microangiopathic changes that can compromise tissue perfusion and healing [2,3,9]. Observational evidence consistently indicates that patients with type 2 diabetes have a higher incidence of CAP and are more likely to require hospitalization for lower respiratory tract infection than people without diabetes; pooled estimates from recent meta-analyses and systematic reviews suggest an approximately 1.5–1.7-fold increased risk, although heterogeneity and residual confounding in the literature warrant cautious interpretation [3,2]. Beyond increased incidence,

diabetes has been associated with more complicated clinical courses in pneumonia — higher complication rates, increased need for intensive care support, and a signal towards greater mortality in several cohorts — effects that are magnified by poor glycaemic control and by concurrent diabetes-related end-organ complications [4,10]. The predominant pathogens causing CAP remain bacterial organisms such as Streptococcus pneumoniae, Haemophilus influenzae and, increasingly in certain settings, gram-negative bacilli; infections due to pneumococcus are of particular concern in people with diabetes, who experience higher rates of invasive disease and complicated pneumococcal pneumonia [1,4]. International management guidelines emphasise early recognition, appropriate risk stratification, prompt empiric antimicrobial therapy guided by severity and local microbiology, and prevention through vaccination (influenza and pneumococcal) — interventions that are especially relevant for patients with diabetes [1]. In India, the burden of lower respiratory infections continues to be substantial according to global burden estimates, and regional studies highlight high incidence and hospitalization rates for CAP in northern and eastern states including Bihar, pointing to the public-health importance of local epidemiological data to inform prevention and care pathways [7,8]. Despite this, there is limited contemporary, hospital-based data from South Bihar describing the clinical profile, microbiological spectrum, severity indices, glycaemic status at presentation, and short-term outcomes of CAP among patients with type 2 diabetes; such data are essential to tailor empiric antibiotic choices, identify high-risk subgroups for early escalation, and target vaccination and glycaemic-optimization strategies [8]. The present study therefore aims to characterise the clinical, microbiological and outcome profile of community-acquired pneumonia in adults with type 2 diabetes attending a Narayan Medical College & Hospital, Bihar, providing locally relevant evidence to inform clinical practice and preventive strategies in a region where diabetes prevalence and respiratory infection burden converge.The aim of the present study is to evaluate the clinical profile of community-acquired pneumonia in patients with type 2 diabetes mellitus attending a Narayan Medical College & Hospital, Bihar. The objectives are to assess demographic characteristics, presenting clinical features, severity, microbiological patterns, glycaemic status at admission, associated comorbidities, treatment outcomes, and in-hospital complications in this patient population. [8]

MATERIALS AND METHODS

Study design: Hospital-based prospective observational study.

Study setting: Department of Medicine, Narayan Medical College & Hospital, Bihar.

Study duration:1 years

Study population: Adult patients with type 2 diabetes mellitus presenting with community-acquired pneumonia.

Inclusion criteria:

- Age ≥18 years.
- Known or newly diagnosed type 2 diabetes mellitus.
- Clinical features suggestive of pneumonia with radiological confirmation on chest X-ray.
- Pneumonia acquired outside the hospital or within 48 hours of hospital admission.

Exclusion criteria:

- Hospital-acquired or ventilator-associated pneumonia.
- Patients with active pulmonary tuberculosis.
- HIV infection, malignancy, or immunosuppressive therapy (including long-term steroids).
- Pregnant women.

Sample size: A total of 100 patients fulfilling inclusion criteria were enrolled consecutively during the study period.

Statistical Analysis: Data were entered into Microsoft Excel and analysed using SPSS software version 27.0 (SPSS Inc., Chicago, IL, USA) and GraphPad Prism version 5. Continuous variables were expressed as mean ± standard deviation, while categorical variables were presented as frequencies and percentages. The unpaired t-test was used to compare continuous variables between independent groups, and the paired t-test was applied for within-group comparisons. Categorical variables were analysed using the Chi-square test or Fisher's exact test as appropriate. A p-value of <0.05 was considered statistically significant.

RESULTS

Table 1: Demographic Characteristics of Study Participants (n = 100)

Variable	Number (n)	Percentage (%)
Age (years, mean ± SD)	58.4 ± 10.2	—
Male	62	62
Female	38	38
Duration of diabetes ≥5 years	64	64
Smokers	41	41

Table 2: Clinical Presentation of CAP in Type 2 Diabetes Mellitus

Symptom	Present (n)	Percentage (%)
Fever	88	88
Cough with expectoration	81	81
Dyspnoea	69	69
Chest pain	34	34
Altered sensorium	18	18

Table 3: Laboratory Parameters at Admission

Parameter	Mean ± SD
Total leukocyte count (cells/mm³)	14,200 ± 4,100
Random blood sugar (mg/dL)	262 ± 68
HbA1c (%)	8.9 ± 1.6
Serum creatinine (mg/dL)	1.4 ± 0.6

Table 4: Association Between Glycaemic Control and Severity of Pneumonia

HbA1c Level	Mild CAP (n=38)	Moderate–Severe CAP (n=62)	p-value
<7%	18	9	0.002
≥7%	20	53	

Table 5: Radiological Findings on Chest X-ray

Finding	Number (n)	Percentage (%)
Lobar consolidation	56	56
Bronchopneumonia	29	29
Bilateral involvement	15	15

Table 6: Outcome and Complications

Outcome	Number (n)	Percentage (%)	p-value
ICU admission	27	27	0.01
Mechanical ventilation	14	14	0.03
In-hospital mortality	8	8	0.04

Figure: 1. Clinical Presentation of CAP in Type 2 Diabetes Mellitus

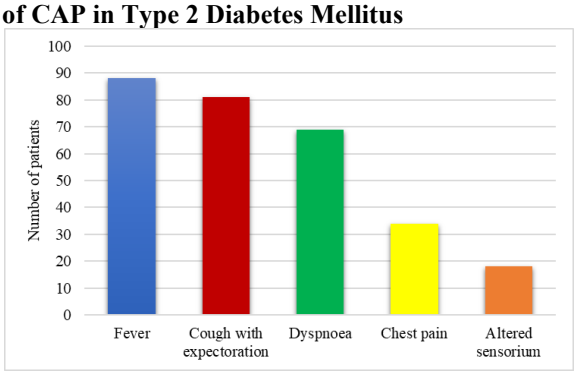

Figure: 2. Outcome and Complications

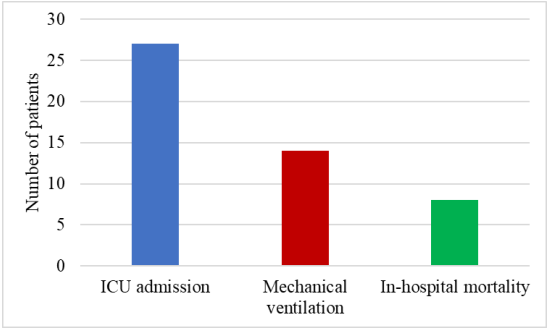

Table 1 depicts the demographic profile of the study participants. The mean age of patients was 58.4 ± 10.2 years, with a predominance of males (62%). A majority of patients (64%) had a duration of diabetes of five years or more, and 41% were smokers.

Table 2 summarizes the clinical presentation of community-acquired pneumonia in patients with type 2 diabetes mellitus. Fever was the most common symptom (88%), followed by cough with expectoration (81%) and dyspnoea (69%). Chest pain and altered sensorium were observed in 34% and 18% of patients, respectively.

Table 3 shows the laboratory parameters at admission. The mean total leukocyte count was 14,200 ± 4,100 cells/mm³, indicating an inflammatory response. Poor glycaemic control was evident, with a mean random blood sugar level of 262 ± 68 mg/dL and a mean HbA1c of 8.9 ± 1.6%. The mean serum creatinine level was 1.4 ± 0.6 mg/dL.

Table 4 illustrates the association between glycaemic control and severity of pneumonia. Patients with HbA1c ≥7% were more likely to have moderate to severe pneumonia compared to those with HbA1c <7%. This association was found to be statistically significant ($p = 0.002$).

Table 5 presents the radiological findings on chest X-ray. Lobar consolidation was the most common pattern observed (56%), followed by bronchopneumonia (29%). Bilateral lung involvement was seen in 15% of patients.

Table 6 describes the outcomes and complications among the study population. ICU admission was required in 27% of patients, 14% required mechanical ventilation, and in-hospital mortality was observed in 8% of cases. Poor glycaemic control was significantly associated with adverse outcomes, including ICU admission ($p = 0.01$), need for mechanical ventilation ($p = 0.03$), and mortality ($p = 0.04$).

DISCUSSION

In this hospital-based cohort of 100 adults with type 2 diabetes and community-acquired pneumonia (CAP) we observed an older patient profile (mean age 58.4 years), male predominance, high prevalence of poor glycaemic control (mean HbA1c 8.9%), frequent lobar consolidation on chest X-ray (56%), and substantial resource use — 27% ICU admission, 14% mechanical ventilation and 8% in-hospital mortality. These findings broadly mirror the pattern reported in several prior observational and hospital series, while also showing some important differences that likely reflect case-mix, local referral practice, and study methodology.

Population-level and large cohort analyses have consistently shown that patients with type 2 diabetes are at higher risk of severe CAP and excess mortality compared with non-diabetic patients. Kornum et al. found increased 30- and 90-day mortality among diabetic pneumonia patients in a population-based Danish cohort, and noted that hyperglycaemia attenuated but did not fully explain the excess risk [11]. Similarly, multicentre hospital analyses reported higher in-hospital mortality and prolonged length of stay among diabetics with CAP compared with non-diabetics [12,17]. Our observed mortality (8%) is lower than some of the larger series (which report rates up to ~15–20% in selected inpatient cohorts) [12,11,18], but is comparable to several Indian tertiary-centre reports where in-hospital mortality ranged between 6% and 12% depending on severity distribution and presence of comorbidities [13,14,15]. Differences in mortality are plausibly explained by variable proportions of severe/ICU cases, differing age distributions, and thresholds for ICU transfer.

Glycaemic control in our cohort was poor (mean HbA1c 8.9%) and, as in multiple prior studies, was associated with higher pneumonia severity and worse outcomes. Several hospital series from India and elsewhere demonstrated similar associations between elevated admission glucose or raised HbA1c and increased need for ICU care, mechanical ventilation and mortality [13,16,19]. A recent analysis emphasises that in-hospital hyperglycaemia — not diabetes per se — may be the dominant proximate driver of adverse outcomes, suggesting aggressive glycaemic optimisation as an actionable target in admitted CAP patients [16].

Microbiological and radiologic patterns in our study (predominance of lobar consolidation) agree with other Indian hospital studies that reported high rates of pneumococcal and gram-negative pathogens, and frequent lobar or multilobar involvement in diabetics [13,15,18]. However, pathogen distribution can be highly local — antimicrobial resistance, frequency of gram-negative etiologies, and emerging organisms differ regionally — so local culture data remain crucial for empiric antibiotic policies [12,20].

Finally, our rates of ICU admission and mechanical ventilation are consistent with tertiary referral practice in resource-limited settings where patients often present later and with greater severity [14,17]. Taken together, our findings support prior evidence that diabetes (and especially poor glycaemic control) identifies a subgroup of CAP patients at increased risk for severe disease and adverse outcomes, underscoring the importance of prompt risk stratification, early glycaemic management and adherence to vaccination and antimicrobial

stewardship strategies that are tailored to local microbiology. Future prospective studies with contemporaneous non-diabetic controls and detailed pathogen/resistance profiling would further clarify causal pathways and inform context-specific interventions.

CONCLUSION

The present study highlights that community-acquired pneumonia in patients with type 2 diabetes mellitus is associated with significant morbidity and adverse in-hospital outcomes. Most patients presented with poor glycaemic control, which was strongly linked to increased disease severity, higher rates of ICU admission, need for mechanical ventilation, and mortality. Lobar consolidation was the most common radiological pattern, and a substantial proportion of patients required advanced supportive care, reflecting late presentation and severe disease at admission. These findings underscore the importance of early recognition of pneumonia in diabetic patients, prompt initiation of appropriate antimicrobial therapy, and aggressive optimization of glycaemic control during hospitalization. Risk stratification using standard severity scores and close monitoring of high-risk patients can help improve outcomes. Preventive strategies, including strict long-term glycaemic control, smoking cessation, and adherence to recommended pneumococcal and influenza vaccination, are crucial in reducing the burden of community-acquired pneumonia in this vulnerable population. Overall, targeted clinical and preventive interventions may substantially reduce complications, healthcare utilization, and mortality among diabetic patients with community-acquired pneumonia.

REFERENCES

1. Metlay JP, Waterer GW, Long AC, Anzueto A, Brozek J, Crothers K, et al. Diagnosis and Management of Adults with Community-Acquired Pneumonia. Am J Respir Crit Care Med. 2019;200(7): e45–e67.
2. Kornum JB, Thomsen RW, Riis A, Lervang HH, Schonheyder HC, Sorensen HT. Diabetes, glycaemic control, and risk of hospitalization with pneumonia. Diabetes Care. 2008;31(8):1541–1546.
3. Brunetti VC, Lee G, Hensgens M, et al. Type 2 diabetes mellitus and risk of community-acquired pneumonia: a systematic review and meta-analysis of observational studies. CMAJ Open. 2021;9(1): E62–E (open access).
4. Cilloniz C, Torres A, et al. Diabetes Mellitus and Pneumococcal Pneumonia: clinical features and outcomes. Diagnostics (Basel). 2024;14(8):859.
5. Almirall J, Gonzalez CA, et al. Risk factors for community-acquired pneumonia in adults: a systematic review of observational studies. Clin Microbiol Infect. 2017;23(4):253–261.
6. World Health Organization. Pneumonia — WHO fact sheet. 2022 (updated). Available from: WHO health topics: pneumonia.
7. Global Burden of Disease/Lancet Infectious Diseases: Lower respiratory infections summaries (GBD 2019 / 2024 synthesis). Lancet Infect Dis. 2024; (GBD LRI collaborators).
8. Awasthi S, et al. Incidence of community-acquired pneumonia in children aged 2–59 months and hospitalization patterns in Uttar Pradesh and Bihar: a population-based study. PLoS One. 2019;14(5):e0214086.
9. Holt RI, et al. Diabetes and infection: review of the epidemiology and pathophysiology. Diabetologia. 2024;67(5).
10. Silverii GA, et al. Diabetes, pneumococcal disease, and vaccination efficacy: clinical implications. Diagnostics (Basel). 2024;14(1).
11. Kornum JB, Thomsen RW, Riis A, Lervang HH, Schonheyder HC, Sorensen HT. Type 2 diabetes and pneumonia outcomes: a population-based cohort study. Diabetes Care. 2007;30(9):2251–2257.
12. Martins M, et al. Diabetes hinders community-acquired pneumonia outcomes in hospitalized patients. BMC Infect Dis. 2016. Available from: PMC article.
13. Community-acquired pneumonia in type 2 diabetes mellitus — clinical and bacteriological profile. J Eval Clin Pract / JEBMH. 2016. (Hospital-based observational study).
14. Sharath P, et al. Clinical profile of community acquired pneumonia (CAP) in diabetic patients: a comparative observational study. JEMDS. 2020 Oct.
15. A study on the clinical profile of patients with community acquired pneumonia admitted to a tertiary care centre in rural South Kerala. JMSCR. 2019 Mar.
16. Barmanray R D, et al. In-hospital hyperglycemia but not diabetes mellitus alone is associated with increased adverse outcomes in adults hospitalized with CAP. BMJ Open Diabetes Research & Care. 2022.
17. Outcome of community acquired pneumonia in diabetes mellitus and predictors of in-hospital mortality in a tertiary care hospital. (Single-centre outcome study). 2021.
18. Pneumonia in diabetics: clinico-bacteriological profile and outcomes — Medical Science Journal. 2017. (Indian tertiary-centre series).
19. A study of the clinical profile of CAP in diabetes mellitus. Statperson / regional journal. 2016.
20. Community-acquired pneumonia in individuals with diabetes — demographic, clinical and bacteriological characteristics. IJCPR / ImpactFactor PDF. (Hospital observational study).