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STUDY OF SERUM NT- PRO BNP LEVELS IN COMMUNITY ACQUIRED PNEUMONIA AND ITS CORRELATION WITH SEVERITY

General Medicine

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ABSTRACT

Background: Community-acquired pneumonia (CAP) is a common respiratory infection associated with systemic inflammation, hypoxaemia, and cardiopulmonary stress. N-terminal pro-B-type natriuretic peptide (NT-proBNP), a marker of myocardial strain, may provide additional information regarding disease severity beyond routine clinical assessment. **Objectives:** To identify and quantify serum NT-proBNP levels in patients with CAP and to analyse its association with disease severity. **Materials and Methods:** This hospital-based comparative observational study included 70 participants: 35 CAP cases and 35 controls. Serum NT-proBNP levels and CURB-65 scores were assessed. Data were analysed using independent t-test, Welch's ANOVA, Pearson correlation, and ROC curve analysis. **Results:** Mean serum NT-proBNP levels were significantly higher among CAP cases than controls (1493 ± 972 pg/mL vs 113 ± 16.8 pg/mL; p<0.001). NT-proBNP levels increased progressively with severity, from 220 ± 201 pg/mL in mild disease to 1153 ± 306 pg/mL in moderate and 2688 ± 516 pg/mL in severe CAP (p<0.001). CURB-65 scores were significantly higher among cases than controls (2.63 ± 1.44 vs 0.00 ± 0.00; p<0.001) and increased with severity. A very strong positive correlation was observed between NT-proBNP and CURB-65 score (r=0.966; p<0.001). ROC analysis showed excellent predictive performance of NT-proBNP for severe CAP, with an AUC of 0.924 at a cutoff of 1480 pg/mL, sensitivity of 88.9%, and specificity of 85.7%.**Conclusion:** Serum NT-proBNP levels were significantly elevated in CAP and showed a strong association with disease severity. NT-proBNP may serve as a useful adjunct to CURB-65 for severity assessment and early risk stratification in hospitalized CAP patients.

KEYWORDS

Community-acquired Pneumonia; Nt-probnp; Curb-65; Severity; Biomarker; Roc Analysis.

INTRODUCTION

Community-acquired pneumonia (CAP) is a major infectious disease of the lower respiratory tract, characterized by acute pulmonary parenchymal inflammation with systemic clinical consequences. Beyond respiratory compromise, CAP may produce a measurable inflammatory, coagulative, and cardiovascular response. In older adults with CAP, inflammatory and cardiac markers such as neutrophil–lymphocyte ratio, BNP, procalcitonin, C-reactive protein, and D-dimer have been associated with disease severity, indicating that CAP severity is not determined by clinical symptoms alone.[1] NT-proBNP, a biomarker released in response to myocardial wall stress, has shown clinical relevance in hospitalized CAP patients, where elevated levels have been associated with poorer clinical outcomes.[2]

The clinical course of CAP is influenced by patient-related factors, including age, nutritional status, body mass index, comorbidities, and physiological reserve. Lee et al. reported that BMI modifies the prognostic interpretation of NT-proBNP in CAP, suggesting that biomarker values should be assessed in relation to patient characteristics.[3] Akpınar et al. demonstrated that NT-proBNP levels may help predict prognosis, ICU admission, and mortality in patients with community-acquired pneumonia, supporting its role as a severity-associated biomarker.[4] Similarly, cardiac biomarker elevation has been documented in severe CAP, where pro-BNP, troponin, and CK-MB may reflect cardiovascular strain during acute infection.[5]

Cardiovascular involvement in CAP is clinically important because cardiac biomarkers have been shown to identify patients at risk of early and long-term cardiovascular events after pneumonia.[6] In patients with community-acquired pulmonary infection, serum PCT, D-dimer, and NT-proBNP have also been evaluated for assessing illness condition, reinforcing the role of combined inflammatory and cardiac biomarker assessment.[7] Indian evidence has further examined serum NT-proBNP and D-dimer in relation to CURB-65, supporting their potential usefulness as prognostic markers in CAP.[8]

Although clinical scores such as CRB-65 and CURB-65 are practical tools for risk stratification, studies suggest that adding biomarkers may improve prognostic assessment.[9] NT-proBNP has been evaluated as a biological marker for mortality prediction in CAP,[10] and its prognostic utility has been observed in adult and elderly CAP patients.[11] BNP has also shown prognostic value in pneumonia when compared with procalcitonin and A-DROP score.[12] Therefore, in an Indian Tier II hospital population, assessing serum NT-proBNP alongside CAP severity may provide clinically relevant evidence to support early risk stratification and guide the present study aim.

MATERIAL AND METHODS

Study Design: This was a hospital-based comparative observational study conducted among patients with community-acquired pneumonia and age- and sex-comparable controls without pneumonia.

Study Setting: The study was conducted in the Department of Medicine and associated CSSH, Meerut, Uttar Pradesh, India.

Study Population: Patients attending CSSH, Meerut, were enrolled. The case group included patients diagnosed with community-acquired pneumonia, while the control group included patients without pneumonia.

Sample Size: A total of 70 participants were included, comprising 35 cases and 35 controls.

Inclusion Criteria: Patients aged ≥18 years presenting with fever ≥37.3°C, recent-onset cough, sputum production or other symptoms of respiratory infection, with or without chest pain, leukocyte count >10 × 10/L or <4 × 10/L, and chest X-ray showing patchy infiltrative shadows or interstitial changes, with or without pleural effusion, were included.

Exclusion Criteria: Patients with active tuberculosis, lung cancer, pulmonary fibrosis, pulmonary embolism, pulmonary hypertension, nosocomial pneumonia, congestive heart failure, cirrhosis, acute coronary syndrome, end-stage renal disease, or acute kidney injury were excluded.

Data Collection and Investigations: Demographic details, clinical history, presenting symptoms, vital parameters, anthropometric measurements, personal habits, and relevant clinical findings were recorded. Laboratory investigations, chest X-ray findings, HRCT chest findings where available, culture sensitivity reports, serum NT-proBNP levels, and CURB-65 score were assessed and documented.

Ethical Consideration: The study was conducted after obtaining institutional ethical approval. Written informed consent was obtained from all participants before enrolment, and confidentiality of patient information was maintained.

Statistical Analysis: Data were compiled and analysed using appropriate statistical methods. Categorical variables were expressed as frequency and percentage, while continuous variables were expressed as mean ± standard deviation. Chi-square test, independent t-test, correlation analysis, and ROC curve analysis were applied where appropriate. A p-value <0.05 was considered statistically significant.

RESULTS

Table 1. Comparison of NT-proBNP Levels According to Study Group (N = 70).

Parameter	Case Mean ± SD	Control Mean ± SD	Mean Difference	t-value	df	p-value
NT-proBNP (pg/mL)	1493 ± 972	113 ± 16.8	1381	8.40	68	<0.001*

Student's independent t-test.

Table 1 shows that mean serum NT-proBNP levels were markedly higher among CAP cases (1493 ± 972 pg/mL) compared to controls (113 ± 16.8 pg/mL). The mean difference of 1381 pg/mL was statistically significant on independent t-test analysis (t=8.40, df=68, p<0.001), indicating a strong association between elevated NT-proBNP levels and community-acquired pneumonia.

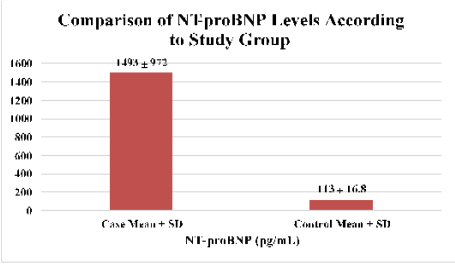

Figure 1: Comparison of NT-proBNP Levels According to Study Group

Table 2. Comparison of NT-proBNP Levels According to Severity Class (N = 70).

Severity Class	N	NT-proBNP Mean ± SD (pg/mL)	SE	Fvalue	df1	df2	p-value
Mild	46	220 ± 201	29.7	166	2	16.8	<0.001*
Moderate	12	1153 ± 306	88.3				
Severe	12	2688 ± 516	149.0				

Welch's one-way ANOVA.

Table 2 demonstrates a progressive increase in mean NT-proBNP levels with advancing severity of community-acquired pneumonia. Mild cases showed a mean level of 220 ± 201 pg/mL, compared to 1153 ± 306 pg/mL in moderate and 2688 ± 516 pg/mL in severe cases. This difference was statistically significant on Welch's ANOVA (F=166, p<0.001).

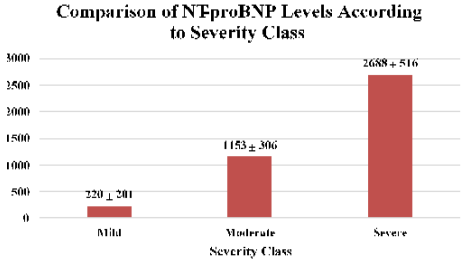

Figure 2: Comparison of NT-proBNP Levels According to Severity Class

Table 3. Comparison of CURB-65 Score According to Study Group (N = 70).

Parameter	Case Mean ± SD	Control Mean ± SD	Mean Difference	t-value	df	p-value
CURB-65 Score	2.63 ± 1.44	0.00 ± 0.00	2.63	10.8	68	<0.001 *

Student's independent t-test.

Table 3 shows that the mean CURB-65 score was significantly higher among CAP cases (2.63 ± 1.44) compared to controls (0.00 ± 0.00). The mean difference of 2.63 was statistically significant on independent t-test analysis (t=10.8, df=68, p<0.001), indicating greater clinical severity among patients with community-acquired pneumonia.

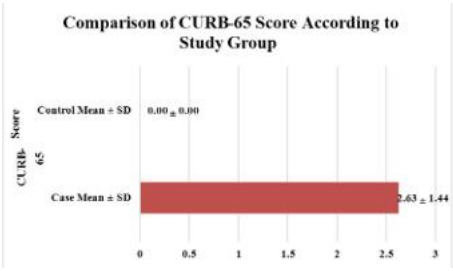

Figure 3: Comparison of CURB-65 Score According to Study Group

Table 4. Comparison of CURB-65 Score According to Severity Class (N = 70).

Severity Class	N	CURB-65 Score Mean ± SD	SE	Fvalue	df1	df2	p-value
Mild	46	0.239 ± 0.431	0.0636	377	2	19.5	<0.001*
Moderate	12	2.417 ± 0.515	0.1486				
Severe	12	4.333 ± 0.492	0.1421				

Welch's one-way ANOVA.

Table 4 demonstrates a progressive rise in CURB-65 score with increasing severity of community-acquired pneumonia. Mild cases had a mean score of 0.239 ± 0.431, while moderate and severe cases showed higher scores of 2.417 ± 0.515 and 4.333 ± 0.492, respectively. The difference was statistically significant on Welch's ANOVA (F=377, p<0.001).

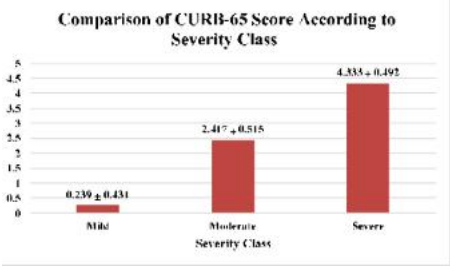

Figure 4: Comparison of CURB-65 Score According to Severity Class

Table 5. Correlation Between NT-proBNP Level and CURB-65 Score (N = 70).

	Correlation Matrix		
		NT-proBNP (pg/mL)	CURB-65 Score
NT-proBNP (pg/mL)	Pearson's r	—	
	df	—	
	p-value	—	
CURB-65 Score	Pearson's r	0.966	—
	df	68	—
	p-value	<.001	—

Table 5 shows a very strong positive correlation between serum NT-proBNP levels and CURB-65 score among the study participants. Pearson's correlation coefficient was 0.966, with statistical significance at p<0.001. This indicates that NT-proBNP levels increased proportionately with higher CURB-65 scores, supporting its association with increasing severity of community-acquired pneumonia.

Figure 5: Correlation Between NT-proBNP Level and CURB-65 Score

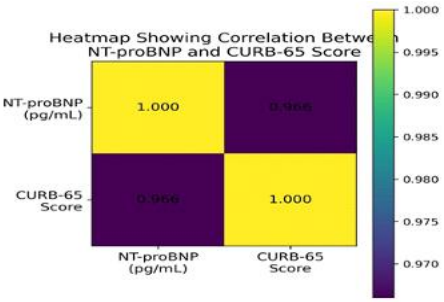

Table 6. ROC Curve Analysis of NT-proBNP for Prediction of Severe CAP (N = 70).

Parameter	Value
Area Under Curve (AUC)	0.924
Optimal Cutoff (pg/mL)	1480
Sensitivity (%)	88.9
Specificity (%)	85.7
p-value	<0.001*

Table 6 shows that NT-proBNP had excellent diagnostic performance for predicting severe community-acquired pneumonia, with an AUC of 0.924. At an optimal cutoff value of 1480 pg/mL, NT-proBNP demonstrated 88.9% sensitivity and 85.7% specificity. The association was statistically significant (p<0.001), supporting its utility as a severity marker.

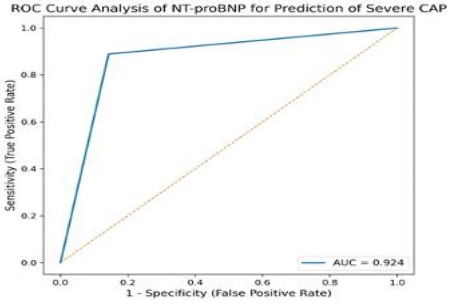

Figure 6: ROC Curve Analysis of NT-proBNP for Prediction of Severe CAP

DISCUSSION

Mean serum NT-proBNP was substantially higher in CAP cases than controls, with values of 1493 ± 972 pg/mL versus 113 ± 16.8 pg/mL, showing a significant mean difference of 1381 pg/mL (t=8.40, df=68, p<0.001). Similar biomarker elevation was reported by Xu et al. (2016)[7], who observed significantly higher NT-proBNP levels in 126 CAP patients than in 120 healthy controls. Seo et al. (2020)[2] also found that NT-proBNP above 942.5 pg/mL independently predicted 30-day mortality among 1,821 hospitalized CAP patients. Akpınar et al. (2019)[4] reported a prognostic cutoff of 1,434.5 pg/mL for ICU admission and mortality, closely approximating the mean case value here. In contrast, Lee et al. (2021)[3] emphasized that BMI modifies NT-proBNP interpretation, suggesting patient profile may influence absolute biomarker levels.

NT-proBNP increased progressively across severity categories, from 220 ± 201 pg/mL in mild illness to 1153 ± 306 pg/mL in moderate and 2688 ± 516 pg/mL in severe CAP, with a highly significant difference on Welch's ANOVA (F=166, p<0.001). This graded rise is consistent with Liu et al. (2023)[1], who found BNP to be an independent predictor of severe CAP among 158 older adults, including 85 mild-moderate and 73 severe cases. Xu et al. (2016)[7] similarly reported increasing NT-proBNP levels across low-, moderate-, and high-risk PSI groups. Dinesh et al. (2025)[8] observed higher NT-proBNP among nonsurvivors in 96 CAP patients, supporting its relationship with poor prognosis. Farhat et al. (2024)[9] also linked elevated biomarkers to death or ICU admission, although troponin T and procalcitonin outperformed NT-proBNP in their model.

The mean CURB-65 score was significantly higher in CAP cases than controls, with values of 2.63 ± 1.44 versus 0.00 ± 0.00, yielding a mean difference of 2.63 (t=10.8, df=68, p<0.001). This confirms marked clinical severity among cases and aligns with Akpınar et al. (2019)[4], who evaluated CURB-65 alongside NT-proBNP and found NT-proBNP more predictive of 30-day mortality than CURB-65. Seo et al. (2020)[2] similarly reported that NT-proBNP improved the predictive accuracy of CURB-65 and PSI in 1,821 hospitalized CAP patients. Dinesh et al. (2025)[8] assessed CAP severity using CURB-65 and PSI in 96 patients and found NT-proBNP useful for prognostication. In contrast, Farhat et al. (2024)[9] used CRB-65 rather than CURB-65 and showed improved prediction when biomarkers were added to clinical scoring.

The CURB-65 score increased stepwise with clinical severity, from 0.239 ± 0.431 in mild cases to 2.417 ± 0.515 in moderate cases and 4.333 ± 0.492 in severe cases, with a highly significant difference on Welch's ANOVA (F=377, df1=2, df2=19.5, p<0.001). This pattern is consistent with Akpınar et al. (2019)[4], who used CURB-65 with NT-proBNP for risk stratification and found NT-proBNP to be a strong predictor of 30-day mortality. Dinesh et al. (2025)[8] similarly assessed CAP severity using CURB-65 and PSI in 96 patients and reported higher NT-proBNP and D-dimer levels among nonsurvivors. Seo et al. (2020)[2] found that NT-proBNP improved CURB-65 prediction in 1,821 CAP patients. In contrast, Farhat et al. (2024)[9] used CRB-65 rather than CURB-65, showing improved prediction after biomarker addition.

A very strong positive correlation was observed between serum NT-proBNP and CURB-65 score, with Pearson's r=0.966, df=68, and p<0.001, indicating that NT-proBNP increased proportionately with clinical severity. This finding is aligned with Dinesh et al. (2025)[8], who evaluated NT-proBNP and D-dimer in relation to CURB-65 among 96 CAP patients and found higher biomarker levels among nonsurvivors. Seo et al. (2020)[2] also reported that NT-proBNP above 942.5 pg/mL independently predicted 30-day mortality and improved CURB-65 performance. Akpınar et al. (2019)[4] observed that NT-proBNP, with a cutoff of 1,434.5 pg/mL, predicted ICU admission and mortality better than CURB-65. Dumanlı and Karadağ (2025)[5] reported correlation of CK-MB, rather than Pro-BNP, with CURB-65 and PSI, providing a differing biomarker-specific observation.

ROC analysis showed excellent predictive performance of NT-proBNP for severe CAP, with an AUC of 0.924, optimal cutoff of 1480 pg/mL, sensitivity of 88.9%, specificity of 85.7%, and p<0.001. This is closely comparable to Akpınar et al. (2019)[4], who reported an NT-proBNP cutoff of 1,434.5 pg/mL for ICU admission and 30-day mortality, although their AUC was 0.735. Xu et al. (2016)[7] also found NT-proBNP to have the strongest diagnostic performance for high-risk CAP among PCT, D-dimer, and NT-proBNP. Seo et al. (2020)[2] identified NT-proBNP above 942.5 pg/mL as an independent mortality predictor. Tazón Varela et al. (2016)[10] reported good predictive accuracy for 30-day mortality. In contrast, Farhat et al. (2024)[9] found troponin T and procalcitonin to outperform NT-proBNP in combined risk modeling.

CONCLUSION

Overall, the findings support the proposed hypothesis that serum NT-proBNP is closely associated with the severity of community-acquired pneumonia. CAP cases showed markedly higher NT-proBNP levels than controls, and the biomarker demonstrated a graded rise from mild to severe disease, paralleling the increase in CURB-65 score. The strong positive correlation between NT-proBNP and CURB-65, along with excellent ROC performance for identifying severe CAP, indicates that NT-proBNP reflects both cardiopulmonary stress and clinical severity in this cohort. These observations are consistent with the reported prognostic value of natriuretic peptides in CAP and suggest that NT-proBNP may serve as a useful adjunct to conventional severity assessment. Its use may help identify patients requiring closer monitoring, early escalation of care, and more structured risk stratification in Indian hospital practice.

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