N-TERMINAL PRO-BRAIN NATRIURETICS PEPTIDE AS A PREDICTOR OF SHORT TERM OUTCOME IN ACUTE SEGMENT ELEVATION MYOCARDIAL INFARCTION

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ABSTRACT:

Background: N-terminal pro-brain natriuretic peptide (NT-proBNP) is a biomarker that reflects ventricular wall stress and has been associated with prognosis in patients with acute coronary syndromes. This study aimed to evaluate the relationship between NT-proBNP levels and short-term outcomes in patients with acute ST-segment elevation myocardial infarction (STEMI).

Methods: A total of 40 patients admitted with acute ST elevation myocardial infarction to :S Nijalingappa Medical College,Bagalkotewere included in this study. The patients were evaluated as per the history, general physical examination, systemic examination, ECG, cardiac troponin T, NT-pro BNP and Echocardiography. The included patients were followed up over a period of 7 days for development of various short term complications of acute MI.

Results: NT-proBNP levels in the full cohort ranged from 246 to 3000 pg/ml. The mean levels were 1585.65±999.133 pg/ml with the median NT-proBNP as 1483.50 pg/ml. Out of 40 patients studied, 13 patients (32.5%) had complications. Arrhythmias comprised the

majority with 22.5%(9 subjects). 5 patients succumbed to death (12.5%). There was a significantly higher incidence of arrhyhmias (p – 0.001), cardiac failure (p – 0.043), lower ejection fraction (p<0.001)

Conclusions: NT-pro BNP is a strong predictor of short term outcome in AMI, including death. NT-pro BNP is a better short term prognostic indicator than cardiac troponin T and LVEF. It can identify high risk patients who might benefit from an aggressive management strategy

Keywords: STEMI=ST elevation myocardial infarction ,NT-pro BNP=N-Terminal pro Brain Natriuretic peptide ,LVEF=Left Ventricular Ejection fraction

INTRODUCTION:

Acute ST-segment elevation myocardial infarction (STEMI) remains a significant cause of morbidity and mortality worldwide [1]. Early risk stratification in STEMI patients is crucial for guiding treatment strategies and improving outcomes [2]. While several biomarkers have been studied in this context, N-terminal pro-brain natriuretic peptide (NT-proBNP) has emerged as a promising prognostic indicator [3].

NT-proBNP is a neurohormone released by ventricular cardiomyocytes in response to increased wall stress [4]. Elevated levels of NT-proBNP have been associated with adverse outcomes in various cardiovascular conditions, including heart failure and acute coronary syndromes [5]. However, its specific role in predicting short-term outcomes in STEMI patients requires further investigation.

Previous studies have suggested that NT-proBNP levels correlate with infarct size, left ventricular dysfunction, and mortality in acute myocardial infarction [6]. However, the relationship between NT-proBNP and short-term complications in STEMI patients, particularly in comparison to established markers such as cardiac troponin T and left ventricular ejection fraction, remains unclear.

This study aims to evaluate the relationship between NT-proBNP levels and short-term outcomes in patients with acute STEMI. We hypothesize that higher NT-proBNP levels on admission will be associated with an increased risk of complications, including arrhythmias, cardiac failure, and death, within the first seven days post-infarction. Additionally, we seek to compare the prognostic value of NT-proBNP with that of cardiac troponin T and left ventricular ejection fraction.

By elucidating the prognostic significance of NT-proBNP in acute STEMI, this study aims to contribute to improved risk stratification and management strategies for these high-risk patients.

METHODOLOGY:

This study was conducted at S Nijalingappa Medical College, Bagalkote. A total of 40 patients admitted with acute ST-elevation myocardial infarction (STEMI) were included in the study. The diagnosis of STEMI was made based on the standard criteria of typical chest pain lasting for more than 30 minutes, ST-segment elevation of ≥1 mm in two or more contiguous leads on the electrocardiogram (ECG), and elevated cardiac biomarkers.

Upon admission, a comprehensive evaluation of each patient was performed. This included a detailed medical history, focusing on the onset and nature of symptoms, risk factors, and previous cardiovascular events. A thorough general physical examination was conducted, noting vital signs, presence of jugular venous distension, and signs of heart failure. Systematic examination of the cardiovascular, respiratory, and other relevant systems was also carried out.

Blood samples were collected from all patients upon admission for laboratory analyses. Cardiac troponin T levels were measured using a high-sensitivity assay to confirm myocardial necrosis. NT-proBNP levels were quantified using a standardized immunoassay. The NT-proBNP assay had a measurable range from 5 to 3,500 pg/mL. Other routine blood tests, including complete blood count, renal function tests, and lipid profile, were also performed as part of the standard care protocol.

All patients underwent a 12-lead ECG at admission and at regular intervals thereafter as per the standard protocol for STEMI management. The ECGs were analyzed for the location and extent of ST-segment elevation, presence of Q waves, and any rhythm disturbances.

Transthoracic echocardiography was performed on all patients within 24 hours of admission. Left ventricular ejection fraction (LVEF) was calculated using the modified Simpson's method. Other parameters assessed included regional wall motion abnormalities, presence of mechanical complications, and any significant valvular pathologies.

The patients were followed up closely for a period of 7 days following admission. During this time, they were monitored for the development of various short-term complications of acute myocardial infarction. These complications included arrhythmias (such as ventricular tachycardia, ventricular fibrillation, or atrial fibrillation), acute heart

failure, cardiogenic shock, mechanical complications (such as ventricular septal rupture or acute mitral regurgitation), and death.

All patients received standard treatment for STEMI as per the current guidelines, including reperfusion therapy (either primary percutaneous coronary intervention or fibrinolysis), antiplatelet agents, anticoagulation, and other supportive measures as indicated. Data collection was performed using a standardized case report form. This included demographic information, clinical presentation, ECG findings, laboratory results (including NT-proBNP and troponin T levels), echocardiographic parameters, treatment received, and any complications that occurred during the 7-day follow-up period.

Statistical analysis was performed using appropriate software. Continuous variables were expressed as mean ± standard deviation or median with interquartile range, depending on the distribution of the data. Categorical variables were expressed as frequencies and percentages. The relationship between NT-proBNP levels and various outcomes was analyzed using appropriate statistical tests, including chi-square test for categorical variables and t-test or Mann-Whitney U test for continuous variables, depending on the data distribution. A p-value of <0.05 was considered statistically significant.

RESULTS:

Table 1 summarizes the demographic and clinical characteristics of the 40 patients included in the study. It provides information on age, gender distribution, prevalence of risk factors, type of STEMI, and key clinical parameters like LVEF, NT-proBNP, and Troponin T levels. This gives an overview of the study population.

Table 1: Baseline Characteristics of Study Participants (n=40)

Characteristic	**Value**
Age (years), mean ± SD	62.5±11.3
Male, n (%)	28 (70%)
Hypertension, n (%)	22 (55%)
Diabetes Mellitus, n (%)	16 (40%)
Smoking, n (%)	18 (45%)
Previous MI, n (%)	6 (15%)
Anterior STEMI, n (%)	24 (60%)
Time to presentation (hours), median (IQR)	4.5 (2.5-7)
LVEF (%), mean ± SD	45.3 ±9.7
NT-proBNP (pg/mL), median (IQR)	1483.5 (784-2156)

Troponin T (ng/L), median (IQR)	2450 (1200-4800)

Table 2 shows the incidence of various complications observed during the 7-day follow-up period. It highlights that 32.5% of patients experienced at least one complication, with arrhythmias being the most common (22.5%), followed by death (12.5%) and cardiac failure (10%).

Table 2: Complications during 7-day follow-up

Complications	**N (%)**
Any complication	13 (32.5%)
Arrhythmias	9 (22.5%)
Cardiac failure	4 (10%)
Cardiogenic shock	2 (5%)
Death	5 (12.5%)

Table 3 demonstrates the relationship between NT-proBNP levels and specific complications. Patients who experienced arrhythmias, cardiac failure, or death had significantly higher NT-proBNP levels compared to those who did not experience these complications. The p-values indicate that these differences are statistically significant.

Table 3: Comparison of NT-proBNP levels between patients with and without complications

Outcome		**NT-proBNP (pg/mL), median (IQR)**	**p-value**
Arrhythmias	**Yes (n=9)**	2340 (1890-2780)	**0.001**
	No (n=31)	1250 (680-1820)	
Cardiac failure	**Yes (n=4)**	2680 (2210-2950)	**0.043**
	No (n=36)	1380 (730-2050)	
Death	**Yes (n=5)**	2820 (2450-2980)	**<0.001**
	No (n=35)	1320 (710-1930)	

Table 4 shows the correlation of NT-proBNP with other important clinical parameters. There's a strong negative correlation with LVEF (r = -0.68), suggesting that higher NT-proBNP levels are associated with lower LVEF. There's also a moderate positive correlation with Troponin T levels (r = 0.54) and a weak positive correlation with age (r = 0.32).

Table 4: Correlation between NT-proBNP and other parameters

Parameter	Correlation coefficient (r)	p-value
LVEF	-0.68	**<0.001**
Troponin T	0.54	**<0.001**
Age	0.32	**0.044**

Table 5 presents the results of a multivariate analysis, which helps identify independent predictors of complications. It shows that NT-proBNP is a strong independent predictor of complications (OR 1.15 per 100 pg/mL increase, p<0.001), even after adjusting for other factors like age, LVEF, and Troponin T levels. LVEF is also an independent predictor, while age and Troponin T are not statistically significant in this model.

Table 5: Multivariate logistic regression analysis for prediction of complications

Variable	Odds Ratio (95% CI)	p-value
NT-proBNP (per 100 pg/mL increase)	1.15 (1.08-1.23)	**<0.001**
Age (per year)	1.03 (099-1.07)	0.156
LVEF (per 1% decrease)	1.06 (1.01-1.11)	**0.018**
Troponin T (per 100 ng/L increase)	1.02 (0.99-1.05)	0.245

DISCUSSION:

The findings of our study demonstrate that NT-proBNP is a strong predictor of short-term outcomes in patients with acute ST-elevation myocardial infarction (STEMI). Our results show that higher levels of NT-proBNP are significantly associated with an increased risk of complications, including arrhythmias, cardiac failure, and death, within the first seven days post-infarction.

The median NT-proBNP level in our study population was 1483.5 pg/mL, which is comparable to the levels reported by Grabowski etal.[10] in their study of STEMI patients (median 1341 pg/mL). However, our study focused specifically on short-term outcomes within 7 days, whereas Grabowski et al. examined outcomes over a longer follow-up period.

We found that patients who experienced complications had significantly higher NT-proBNP levels compared to those who did not. This is consistent with the findings of Galvani et al.[11], who reported that elevated NT-proBNP levels were associated with an increased risk of death and heart failure in patients with acute coronary syndromes. However, our study extends these findings specifically to the STEMI population and to a shorter time frame.

The strong negative correlation between NT-proBNP and LVEF (r = -0.68) in our study aligns with the results of Richards et al.[8], who also found an inverse relationship between these parameters. This supports the notion that NT-proBNP reflects the degree of left ventricular dysfunction in the acute phase of myocardial infarction.

Interestingly, our multivariate analysis showed that NT-proBNP was a stronger independent predictor of complications than troponin T. This finding is particularly noteworthy and is supported by the work of Omlandet al.[7], who demonstrated that NT-proBNP provided prognostic information beyond that of troponin T in patients with acute coronary syndromes.

The incidence of complications in our study (32.5%) is slightly higher than that reported by Ezekowitzet al.[12] (25.1% in-hospital complications). This difference might be attributed to variations in patient populations or definitions of complications. However, both studies highlight the significant morbidity associated with STEMI in the acute phase.

Our finding that NT-proBNP is an independent predictor of complications (OR 1.15 per 100 pg/mL increase) is particularly important. It suggests that NT-proBNP could be a valuable tool for risk stratification in the acute phase of STEMI, potentially allowing for more targeted management strategies. This is in line with the conclusions of Mega et al.[9], who proposed incorporating NT-proBNP into risk assessment models for patients with STEMI.

The limitations of our study include its relatively small sample size and single-center design. Additionally, we did not assess the impact of treatment strategies on NT-proBNP levels or outcomes. Future larger, multicenter studies with longer follow-up periods could help to further validate our findings and explore the potential role of NT-proBNP in guiding treatment decisions in STEMI patients.

In conclusion, our study demonstrates that NT-proBNP is a strong predictor of short-term outcomes in patients with acute STEMI, providing prognostic information beyond traditional markers such as troponin T and LVEF. These findings suggest that routine measurement of NT-proBNP in STEMI patients could improve risk stratification and potentially guide management strategies in the acute phase.

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