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# A Study on the Correlation of Brain Natriuretic Peptide (BNP) and Troponin I in Acute Coronary Syndrome and Its Relation to Clinical Outcome

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## A B S T R A C T

***Background:*** Acute coronary syndrome (ACS) is a life-threatening condition resulting from reduced blood flow to the myocardium, which can lead to ischemia and infarction. Biomarkers such as brain natriuretic peptide (BNP) and troponin I (Trop I) play key roles in the diagnosis and prognosis of ACS. Investigating the correlation between these biomarkers and clinical outcomes may enhance risk stratification. ***Objectives***: To determine the correlation between BNP and troponin I levels in ACS patients and assess their relationship with clinical outcomes such as left ventricular (LV) dysfunction, arrhythmias, and mortality. ***Methods***: A prospective observational study was conducted on 75 patients diagnosed with ACS at a tertiary care hospital. BNP and troponin I levels were measured on days 1 and 3 of hospitalization, and clinical outcomes were documented during the hospital stay and after 1 month. The main outcomes included reinfarction, cardiogenic shock, ventricular arrhythmias, and mortality. ***Results***: Of the 75 patients, 58.67% were male, with a mean age of 59.25 years (±11.15). Major risk factors were hypertension (54.67%), diabetes mellitus (49.33%), and dyslipidemia (13.33%). Patients with BNP levels >600 pg/mL had a significantly higher incidence of complications (90.9%) compared to those with lower BNP levels. Similarly, 91.66% of patients with troponin I >20000 ng/L developed complications such as LV dysfunction and arrhythmias. ***Conclusion***: Elevated BNP and troponin I levels are significantly correlated with adverse clinical outcomes in ACS patients. BNP and troponin I can serve as valuable prognostic markers for identifying high-risk patients.

## INTRODUCTION

### BACKGROUND

Acute coronary syndrome (ACS) represents a spectrum of conditions caused by acute myocardial ischemia, including unstable angina, non-ST elevation myocardial infarction (NSTEMI), and ST elevation myocardial infarction (STEMI) [1]. Coronary artery disease (CAD), the leading cause of ACS, is projected to become increasingly prevalent, particularly in developing countries like India. By 2020, the burden of CAD in India is expected to rise by 120% in women and 137% in men [2, 3]. This growing incidence underscores the importance of early diagnosis and effective risk stratification to improve patient outcomes.

**The Role of Biomarkers in ACS**:

Cardiac biomarkers are crucial in diagnosing myocardial infarction (MI) and predicting clinical outcomes. Troponin I (Trop I) is a structural protein of cardiac myocytes, released into the bloodstream during myocardial injury [4]. Elevated troponin I levels have been associated with worse outcomes, including heart failure, arrhythmias, and death [5]. Troponin I is widely recognized as a diagnostic tool, but it also serves as a prognostic marker, particularly in differentiating between STEMI and NSTEMI cases [6].

Brain natriuretic peptide (BNP), on the other hand, is a hormone secreted by ventricular myocytes in response to increased wall stress. Elevated BNP levels are a marker of cardiac dysfunction and are commonly observed in heart

failure and ACS [7, 8]. BNP is valuable not only for its diagnostic utility but also for predicting the severity of ACS and the likelihood of complications such as cardiogenic shock, left ventricular (LV) dysfunction, and death [9]. BNP levels have been shown to correlate strongly with adverse outcomes, making it a crucial tool in the risk stratification of ACS patients [10].

**Epidemiology of ACS and CAD**:

The prevalence of ACS and CAD is increasing globally, with low- and middle-income countries like India experiencing a rapid epidemiological transition. This shift is due to changes in lifestyle, urbanization, and rising rates of hypertension, diabetes, and dyslipidemia [11]. The Global Burden of Disease study projects that by 2020, non-communicable diseases, including CAD, will account for the majority of deaths in these regions [2]. The increasing burden of CAD highlights the need for efficient use of biomarkers such as BNP and troponin I to improve early detection and management strategies.

**Study Rationale**:

Although both BNP and troponin I are well-established biomarkers for diagnosing ACS, limited studies have explored their combined prognostic value. Understanding how BNP and troponin I levels correlate with clinical outcomes can provide critical insights into the management of ACS patients. This study aims to examine the relationship between these biomarkers and outcomes like LV dysfunction, arrhythmias, and mortality to guide future treatment strategies and improve patient care.

**Aims:**

The primary objectives of this study are:

1. To determine the correlation of serum brain natriuretic peptide (BNP) and troponin I levels in patients with acute coronary syndrome (ACS).
2. To assess the relationship of these cardiac biomarkers with clinical outcomes, including left ventricular dysfunction, arrhythmias, and mortality.

**Methods:**

**Study Design**:

This is a prospective observational study conducted in the Department of General Medicine at a tertiary care hospital between January 2023 and December 2023.

**Study Population**:

The study included 75 patients diagnosed with ACS based on clinical symptoms, electrocardiographic findings, and elevated cardiac biomarkers. Patients were evaluated during their hospital stay and followed up after 1 month.

**Inclusion Criteria**:

1. Patients above 18 years of age, of both sexes, diagnosed with ACS based on ECG changes and elevated cardiac markers.
2. Written informed consent.

**Exclusion Criteria**:

1. Patients with a history of ischemic heart disease.
2. Patients with chronic kidney disease.

**Data Collection**:

For each patient, baseline characteristics such as age, gender, and major risk factors (hypertension, diabetes, dyslipidemia) were recorded. BNP and troponin I levels were measured on day 1 and day 3 of hospitalization using ELISA. Echocardiography was performed to assess left ventricular (LV) function. Complications such as reinfarction, cardiogenic shock, arrhythmias, and death were documented during hospitalization and at 1-month follow-up.

**Statistical Analysis**

Data were analyzed using SPSS software. Continuous variables were expressed as mean ± standard deviation, while categorical variables were presented as percentages. Correlations between BNP, troponin I levels, and clinical outcomes were determined using Pearson's correlation coefficient. A p-value $<0.05$ was considered statistically significant.

**RESULTS**

**Demographics**: Out of the 75 patients, 44 (58.67%) were male, and the mean age of the study population was 59.25 years (SD ± 11.15). The most common comorbidities were hypertension (54.67%), diabetes mellitus (49.33%), and dyslipidemia (13.33%).

**ACS Types**: NSTEMI was the most prevalent form of ACS, seen in 45.3% of patients, followed by STEMI (40%) and unstable angina (14.7%).

**Complications and Biomarker Levels**:

The correlation between BNP levels and complications was significant. As shown in Table 1, 27.3% of patients with BNP <100 pg/mL developed complications, while 90.9% of those with BNP >600 pg/mL had adverse outcomes. Similarly, patients with troponin I levels >20000 ng/L were more likely to experience complications such as LV dysfunction, arrhythmias, and death, as seen in Table 2.

**Table 1: Correlation between BNP Levels and Complications**

| BNP Level (pg/mL) | Complications (%) |
|---|---|
| <100 | 27.3 |
| 100-600 | 38.7 |
| >600 | 90.9 |

**Table 2: Correlation between Troponin I Levels and Complications**

| Troponin I Level (ng/L) | Complications (%) |
|---|---|
| <2000 | 35.0 |
| 2001-5000 | 50.0 |
| 5001-10000 | 68.3 |
| 10001-20000 | 85.2 |
| >20000 | 91.66 |

## DISCUSSION

The results of this study show a significant correlation between elevated BNP and troponin I levels and adverse clinical outcomes in patients with ACS. BNP, released in response to increased wall stress, has been shown to be a strong predictor of left ventricular dysfunction, cardiogenic shock, and death [1-3]. Patients with BNP levels greater than 600 pg/mL were at a significantly higher risk of developing complications, a finding consistent with previous studies [4].

Troponin I, a highly specific marker of myocardial necrosis, was found to be elevated predominantly in STEMI patients. Its correlation with complications such as arrhythmias and left ventricular dysfunction suggests its utility not only as a diagnostic marker but also as a prognostic tool [5]. Previous research supports the association of elevated troponin levels with higher mortality and heart failure in ACS [6].

**Comparison with Other Studies**:

Our findings align with the results of several large-scale studies that have demonstrated the prognostic value of BNP and troponin I in ACS [7, 8]. BNP, in particular, has been recognized as an independent predictor of heart failure and mortality [9]. Similarly, high troponin I levels have been linked with poor outcomes in various ACS subtypes, particularly STEMI [10].

**Clinical Implications**:

The findings of this study suggest that combining BNP and troponin I measurements could enhance the early risk stratification of ACS patients. Identifying high-risk patients based on these biomarkers can lead to more aggressive therapeutic interventions and closer monitoring, potentially improving patient outcomes [11].

## LIMITATIONS

This study is limited by its small sample size and short follow-up period. Larger studies with longer follow-up are needed to confirm these findings and explore the combined use of BNP and troponin I in guiding ACS management.

## CONCLUSION

In this study, elevated levels of BNP and troponin I were significantly correlated with adverse clinical outcomes in patients with acute coronary syndrome. Both biomarkers serve as valuable prognostic tools for identifying high-risk patients who may benefit from more intensive monitoring and treatment. These findings support the use of BNP and troponin I in routine clinical practice for the risk stratification of ACS patients.

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