



NT-PRO BNP AS AN EARLY BIOMARKER IN ACUTE MYOCARDIAL INFARCTION AND HEART FAILURE DIAGNOSIS

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ABSTRACT Acute myocardial infarction (AMI) is a leading cause of mortality worldwide, often resulting in heart failure and left ventricular (LV) dysfunction. N-terminal pro-brain natriuretic peptide (NT-pro BNP) has emerged as a reliable biomarker for assessing cardiac stress and is increasingly used to aid in the diagnosis and prognosis of heart failure, particularly when echocardiography is not available. This study aimed to evaluate the levels of NT-pro BNP in patients with AMI and to investigate its correlation with LV dysfunction, reduced left ventricular ejection fraction (LVEF), and heart failure. A total of 52 patients diagnosed with AMI, including both STEMI and NSTEMI cases, were analyzed. NT-pro BNP levels were measured within 48 hours of symptom. Results demonstrated that 88.46% of patients had elevated NT-pro BNP levels, with mean values reaching 1818.79 pg/ml. Statistically significant associations were found between elevated NT-pro BNP levels and reduced LVEF ($p < 0.05$), LV dysfunction (23.08%), and heart failure (38.85%). This study underscores the potential of NT-pro BNP as an early diagnostic marker in AMI patients for identifying and managing heart failure and LV dysfunction. Early identification and intervention based on NT-pro BNP levels could improve patient outcomes by facilitating timely and targeted treatment.

KEYWORDS : NT-pro BNP, Acute Myocardial Infarction, Heart Failure, Left Ventricular Dysfunction, STEMI, NSTEMI

INTRODUCTION

Acute myocardial infarction is the leading cause of death from coronary artery disease, accounting for about 2.4 million fatalities in the US, 4 million in Europe and northern Asia, and over a third of deaths in industrialized countries each year¹.

Over the last three to four decades, the epidemiology of acute myocardial infarction has dramatically transformed. Approximately 550,000 new cases and 200,000 recurring cases of acute myocardial infarction occur each year. Acute myocardial infarction with or without ST-segment elevation (STEMI or non-STEMI) is a common cardiac emergency that can cause significant morbidity and mortality².

Acute myocardial infarction is a catastrophic medical illness defined by the acute blockage of a coronary artery and subsequent destruction of the heart muscle due to inadequate blood supply. Current clinical investigations have shown that coronary atherosclerosis is the leading cause of AMI, with smoking history, diabetes, dyslipidemia and other independent risk factors all playing a substantial role. These causes can impede the heart's blood flow, resulting in myocardial necrosis. The damaged myocardium continues to function with increased oxygen consumption resulting in an imbalance between oxygen supply and demand and eventually myocardial necrosis³.

N-terminal pro brain natriuretic peptide (NT pro BNP) is a biomarker that is secreted by the myocardium in response to increasing cardiac stress. It has been demonstrated that the ischemic myocardium secretes NT pro BNP, and high levels of NT pro BNP are associated with a poor prognosis in myocardial infarction⁴.

Despite the more powerful treatments available in the acute phase of myocardial infarction, post infarction heart failure is a growing medical and epidemiological concern. Heart failure is a frequent medical condition with a dismal prognosis. The gold standard for diagnosis is echocardiography although it is not always available particularly in emergency situations. NT pro brain natriuretic peptide (NT pro BNP) is a new biomarker for the diagnosis of heart failure that is being employed in standard emergency room diagnostics⁵.

Hence present study is undertaken to show the importance of NT pro BNP in acute myocardial infarction and Heart Failure.

MATERIALS AND METHOD

The present study was carried out on 52 patients diagnosed with ST segment elevation myocardial infarction and Non-ST segment elevation myocardial infarction following approval of ethical committee

Inclusion Criteria:

1. Adults > 18 years
2. All the patients in which symptoms of Acute Myocardial Infarction.
3. ECG changes Suggestive of Acute Myocardial Infarction.

Exclusion Criteria:

1. Pregnant Ladies
2. Pericardial Effusion
3. Cardiomyopathies
4. Hyperthyroidism

A detailed history and thorough clinical examination were done with emphasis on the acute myocardial infarction. Evidence of myocardial ischemia with ECG changes indicative of new ischemia i.e. new ST, T changes together with detection of rise and/or fall of cardiac biomarkers with at least one value above the 99th percentile of the upper reference limit.

Blood samples were collected at admission for NT pro BNP and other routine blood tests. The blood samples for NT pro BNP analysis in AMI group were taken within first 48 hours from the beginning of the symptoms. NT pro BNP was determined with from venous blood collected in EDTA plastic tubes (Ethylenediaminetetraacetic acid). NT pro BNP measurements were made with a COBAS e 411 Roche device. Cobas e 411 analyzer is fully automated and uses patented electrochemiluminescence (ECL) technology to perform immunoassay analysis.

Statistical Analysis

Descriptive and inferential statistical analysis has been carried out in the present study. The statistical software namely STATISTICAL PACKAGE FOR THE SOCIAL SCIENCES 20 (SPSS 21.0) was used for the analysis of the data. Analysis of variance (ANOVA) has been used to find the significance of mean difference of parameters between three or more groups of patients.

RESULTS

In our study of 52 patients of AMI, there were (9.62%) patients whose NT Pro BNP level was <125 pg/ml and in (28.85%) patients it was found between 125 -449 pg/ml. There were (21.15%) patients in whom NT Pro BNP level was between 450-899 pg/ml and (5.77%) between 900 -1799 pg/ml. 34.62% patients had level ≥ 1800 found.

Table 1: Status of NT Pro BNP in AMI Patients.

AMI	NT Pro BNP Code					Total
	<125	125-449	450-899	900-1799	≥ 1800	
		449	899	1799		

NSTEMI	5.77	13.46	9.62	1.92	9.62	40.38
STEMI	3.85	15.38	11.54	3.85	25.00	59.62
Total	9.62	28.85	21.15	5.77	34.62	100.00

In this study of 52 patients of AMI , (61.54%) patients had Anterior wall AMI out of which (23.08%) has value more than equal to 1800 pg/ml, (1.92%) between 900-1799 pg/ml, (13.64%) between 450-899 pg/ml , (21.15%) between 125-449 pg/ml and (1.92 %) had value less than 125 pg/ml. (23.08%) of Inferior wall AMI out of which (5.77 %) has value more than equal to 1800 pg/ml, (1.92%) between 900-1799 pg/ml, (7.69%) between 450-899 pg/ml , (1.92%) between 125-449 pg/ml and (5.77%) had value less than 125 pg/ml. (15.38%) patients had Lateral wall AMI out of which (5.77%) has value more than equal to 1800 pg/ml, (1.92%) between 900-1799 pg/ml, (5.77%) between 125-449 pg/ml and (1.92%) had value less than 125 pg/ml.

Table 2: Status of NT Pro BNP and Type of STEMI and NSTEMI

NTPBNP	Type of STEMI and NSTEMI			Total	Type of STEMI and NSTEMI (%)			Total
	Anterior	Inferior	Lateral		Anterior	Inferior	Lateral	
<125	1	3	1	5	1.92	5.77	1.92	9.62
125-449	11	1	3	15	21.15	1.92	5.77	28.85
450-899	7	4	0	11	13.46	7.69	0.00	21.15
900-1799	1	1	1	3	1.92	1.92	1.92	5.77
>=1800	12	3	3	18	23.08	5.77	5.77	34.62
Total	32	12	8	52	61.54	23.08	15.38	100.00

In present study of 52 AMI patients , (65.38%) had reduced ejection fraction out of which (34.62%) had NT Pro BNP level more than 1800 pg/ml , (5.77%) had level between 900 -1799 pg/ml ,(11.54%) between 450-899 pg/ml and (13.46%) had value between 125-449 pg/ml. (25%) had mild reduced ejection fraction out of which ,(9.62%) between 450-899 pg/ml and (15.38%) had value between 125-449 pg/ml. Statistical significant difference was found i.e p value(<0.05).

Table 3: Status of NT Pro BNP and LVEF

NTPBNP	LVEF Code			Total	LVEF Code (%)			Total
	Mild Reduce	Preserved	Reduce		Mild Reduce	Preserved	Reduce	
<125	0	5	0	5	0.00	9.62	0.00	9.62
125-449	8	0	7	15	15.38	0.00	13.46	28.85
450-899	5	0	6	11	9.62	0.00	11.54	21.15
900-1799	0	0	3	3	0.00	0.00	5.77	5.77
>=1800	0	0	18	18	0.00	0.00	34.62	34.62
Total	13	5	34	52	25.00	9.62	65.38	100.00

In our study of 52 patients of AMI, (23.08%) patients were found in whom LV dysfunction present. Out of which in (15.38%) NT Pro BNP was found more than equal to 1800 pg/ml, (7.69%) had value between 450-899 pg/ml. It was found that there was statistically significant difference between NT Pro BNP and LV dysfunction, p value (<0.05).

Table 4: Status of NT Pro BNP and LV Dysfunction.

NTPBNP	LV Dysfunction		Total	LV Dysfunction (%)		Total
	N	Y		N	Y	
<125	5	0	5	9.62	0.00	9.62
125-449	15	0	15	28.85	0.00	28.85
450-899	7	4	11	13.46	7.69	21.15
900-1799	3	0	3	5.77	0.00	5.77
>=1800	10	8	18	19.23	15.38	34.62
Total	40	12	52	76.92	23.08	100.00

In our study of 52 patients of AMI, (38.85%) patients were found in whom Heart failure present. Out of which in (28.85%) NT Pro BNP was found more than equal to 1800 pg/ml, (5.77%) had value between 900-1799 pg/ml and (3.85%) had value between 450-899 pg/ml. It was found that there was statistically significant difference between NT Pro BNP and Heart Failure, p value (<0.05).

Table 5: Status of NT Pro BNP and Heart Failure.

NTPBNP	Heart Failure		Total	Heart Failure (%)		Total
	N	Y		N	Y	
<125	5	0	5	9.62	0.00	9.62
125-449	15	0	15	28.85	0.00	28.85

450-899	9	2	11	17.31	3.85	21.15
900-1799	0	3	3	0.00	5.77	5.77
>=1800	3	15	18	5.77	28.85	34.62
Total	32	20	52	61.54	38.46	100.00

DISCUSSION

In our study of 52 patients of AMI, there were 88.46 % patients found whose NT Pro BNP level were raised. Mean NT Pro BNP was 1818.79 pg/ml. It was in concordance with the following studies, Senthivelan et al 2018⁶. In his study found out that NT Pro BNP were raised in 87.88 % of AMI.

In present study of 52 AMI patients, (65.38%) had reduced ejection fraction. It was in concordance with the following studies. It was in concordance with the following studies Luchner A et al 2005⁷ NT-pro BNP grew gradually and inversely to LVEF.

In our study of 52 patients of AMI, (23.08%) patients were found in whom LV dysfunction present. Out of 12 patients NT pro BNP >= 1800 pg/ml was found in 8 patients which means 66.66% patients. It was in concordance with the following studies Senthilvelan P et al 2018⁶ In severe LV dysfunction 66.7 % had NT Pro BNP more than cut off value.

In our study of 52 patients of AMI, (38.85%) patients were found in whom Heart failure present. NT pro BNP ≥ 1800 pg/ml, this range shows the highest percentage of heart failure cases (28.85%). It indicates a strong association between high NT pro BNP levels and heart failure. It was in concordance with the following studies Brady et al 2022.⁸ In his study he showed that 31% of Heart failure patients have NT pro BNP >= 2000 pg/ml.

CONCLUSION

There was positive correlation found between NT Pro BNP level on admission and heart failure (38.85%), LV dysfunction (23.08%), reduced LVEF in the present study with statistically significant (p<0.05) difference. Thus, we conclude that NT Pro BNP can be used as an early marker in the diagnosis and management of heart failure.

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Conflicts Of Interest: There are no conflicts of interest.

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