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General Medicine

STUDY OF N TERMINAL PRO BNP (NT-proB-NP) LEVELS IN PATIENTS OF CONGESTIVE HEART FAILURE AT AL AMEEN MEDICAL COLLEGE AND HOSPITAL VIJAYAPURA.

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ABSTRACT **Background:** Heart failure is a multi-factorial ailment with considerable variation in its pathogenesis. A hormonally active peptide called serum B-type natriuretic peptide (BNP) is released from the left ventricular wall in response to myocyte stretching. **Objectives:** The purpose of the current study was to examine N-Terminal Pro-BNP levels in congestive heart failure patients in a tertiary hospital. **Material and Methods:** The current investigation was a prospective, hospital-based observational study that included patients of either gender, 20–70 years old, with clinical signs of cardiac failure and 2D echocardiography suggesting a reduced left ventricular ejection fraction. Levels of NT-proBNP were measured. **Results:** Among the 70 patients, the majorities (52.86%) were between the ages of 50 and 59, and the majorities (62.86%) were male. The patients' average age was 54.7 ± 14.5 years. The majority of patients (58.57%) had NYHA class IV symptoms, and 72.86 % of them had heart failure with dilated etiology. NT-proBNP (pg/ml) levels were more in females (3223.4 ± 928.7) as compared to Males (2862.5 ± 839.4), in patients with systolic dysfunction (3168.3 ± 849.1) as compared to diastolic dysfunction (2156.5 ± 812.6), in patients with ejection fraction ≤ 40% (4684.1 ± 1203.6) as compared to ejection fraction > 40% (2923.3 ± 792.5). According to onset of heart failure, NT-proBNP (pg/ml) levels were more acute on chronic failure (4147.5 ± 1371.9) as compared to chronic heart failure (3236.1 ± 738.2) & acute heart failure (2346.2 ± 637.3).We observed that, as per progress in NYHA classification of heart failure, there was increase in NT-proBNP level, reduced EF % & increased hospital stay, and difference was statistically significant ($p<0.001$). **Conclusion:** In conclusion, the measurement of NT-proBNP is a valuable biochemical tool for the accurate diagnosis of congestive heart failure (CHF) severity. The levels of NT-proBNP in the blood can provide insight into the severity of cardiac dysfunction, as well as predict outcomes such as hospital stay and mortality. Furthermore, measuring NT-proBNP levels can also help to assess ejection fraction and guide treatment decisions. Overall, NT-proBNP is a reliable and important tool in the diagnosis and management of CHF.

KEYWORDS : NT-proBNP, congestive heart failure, cardiac dysfunction, ejection fraction

INTRODUCTION

Heart failure is a complex condition that has varying causes in different parts of the world. Over the past decade, it has become a major health problem due to an aging population and better survival rates in patients with cardiovascular conditions. Diagnosing heart failure can be challenging, with both over-diagnosis and under-diagnosis being common, especially in elderly, obese individuals, and those with underlying lung disease.

The symptoms and signs of heart failure can overlap with those of pulmonary disease, which can make it difficult for clinicians to make an accurate diagnosis based on symptoms, physical examination, ECG, and chest radiography. This can lead to misdiagnosis and delays in starting appropriate treatment, which can cause significant morbidity. Misdiagnosis of heart failure can be dangerous, as using a treatment strategy for other conditions such as Chronic Obstructive Pulmonary Disease (COPD) can be hazardous to patients with heart failure and vice versa.

The hormone B-type Natriuretic Peptide (BNP) is produced by the left ventricular wall when the myocytes are stretched. This hormone is released as a prohormone called Pro BNP, which then breaks down into two forms: N Terminal –pro BNP (NT-ProBNP) and the active BNP. BNP helps to protect the body from plasma overload by promoting natriuresis, diuresis, inhibiting the sympathetic nervous system, and widening blood vessels. This study aimed to investigate the levels of NT-ProBNP in patients with congestive heart failure at a tertiary hospital.

OBJECTIVES

The purpose of the current study was to examine N-Terminal Pro-BNP levels in congestive heart failure patients in a tertiary hospital.

MATERIAL AND METHODS

Present study was hospital-based, prospective, observational study, conducted in department of general medicine, at Al Ameen Medical college & hospital, Vijayapura, Karnataka, India. Study duration was of 1 year (June 2021 to May 2022). Study approval was obtained from institutional ethical committee.

Inclusion criteria:

- Patients of either gender, age 20-70 years, with clinical features of cardiac failure, with 2D echocardiography suggestive of reduced left ventricular ejection fraction, willing to participate,

Exclusion criteria:

- Patients with abnormal renal function tests,
- Patients with BMI > 30 kg/m2,
- Patients with haemoglobin< 9 gm %,
- Patients not willing to participate

Study was explained to all participants in local language & written consent was taken for participation & study. A detailed clinical history was recorded regarding age, medical history (duration of symptoms, ischemic heart disorders, rheumatic heart disorders, hypertension, diabetes, dyslipidaemia, smoking, alcoholism), followed by clinical examination (pulse, blood pressure, respiratory, cardiovascular and central nervous systems). Routine laboratory tests (fasting blood glucose, blood urea, complete blood picture, serum creatinine and electrolytes), ECG & radiological investigations (chest x-ray, 2D echocardiogram and ultrasound abdomen) were done for every patient. 3 ml blood was collected into EDTA tubes. In ED, point of care testing of NT-proBNP was done using a standard commercially available assay - Triage Assay, AlereNT-proBNP test, and Bio-site Triple meter Pro.

Data was collected and compiled using Microsoft Excel, analyzed using SPSS 23.0 version. Frequency, percentage, means and standard deviations (SD) was calculated for the continuous variables, while ratios and proportions were calculated for the categorical variables. Difference of proportions between qualitative variables was tested using chi- square test or Fisher exact test as applicable. P value less than 0.5 was considered as statistically significant.

RESULTS

In present study, 70 patients were studied. Majority was of 50-59 year's age group (52.86 %), were male (62.86 %). Mean age of patients was 54.7 ± 14.5 years. Majority patients had NYHA class IV symptoms (58.57 %), had heart failure due to dilated aetiology (72.86

%). Hypertension was noted in majority (38.57 %), followed by diabetes (21.43 %), hypothyroidism (15.71 %) & paroxysmal AF (10 %) as medical co-morbidity. As per NYHA class of heart failure, majority belonged to Class IV (44.29 %) followed by Class III (31.43 %), class II (20 %) & class I (4.29 %).

Table 1- General characteristics

Characteristics	No. of patients/ Mean ± SD	Percentage
Age groups (in years)		
20-39	3	4.29%
40-49	13	18.57%
50-59	37	52.86%
60-70	17	24.29%
Mean age	54.7 ± 14.5	
Gender		
Male	44	62.86%
Female	26	37.14%
NYHA class (symptoms)		
II	9	12.86%
III	20	28.57%
IV	41	58.57%
Heart failure etiology		
Dilated	51	72.86%
Ischemic	19	27.14%
Medical history		
HTN	27	38.57%
Diabetes	15	21.43%
Hypothyroidism	11	15.71%
AF (paroxysmal)	7	10.00%
VT/VF	4	5.71%
NYHA Class of heart failure		
I	3	4.29%
II	14	20.00%
III	22	31.43%
IV	31	44.29%

NT-proBNP (pg/ml) levels were more in females (3223.4 ± 928.7) as compared to Males (2862.5 ± 839.4), in patients with systolic dysfunction (3168.3 ± 849.1) as compared to diastolic dysfunction (2156.5 ± 812.6), in patients with ejection fraction ≤ 40% (4684.1 ± 1203.6) as compared to ejection fraction > 40% (2923.3 ± 792.5). According to onset of heart failure, NT-proBNP (pg/ml) levels were more acute on chronic failure (4147.5 ± 1371.9) as compared to chronic heart failure (3236.1 ± 738.2) & acute heart failure (2346.2 ± 637.3).

Table 2. NT-proBNP levels according to various variables

Variables	Mean ± SD level (pg/mL)
Gender	
Males	2862.5 ± 839.4
Females	3223.4 ± 928.7
According to type of failure	
Systolic dysfunction	3168.3 ± 849.1
Diastolic dysfunction	2156.5 ± 812.6
According to ejection fraction	
≤ 40%	4684.1 ± 1203.6
> 40%	2923.3 ± 792.5
Onset of heart failure	
Acute heart failure	2346.2 ± 637.3
Chronic heart Failure	3236.1 ± 738.2
Acute on chronic failure	4147.5 ± 1371.9

We observed that, as per progress in New York Heart Association classification of heart failure, there was increase in NT-proBNP level, reduced EF % & increased hospital stay, and difference was statistically significant ($p<0.001$).

Table 3- NT-proBNP Levels According to New York Heart Association classification

NYHA Class	Avg. NT-proBNP (pg/dl)	Avg. EF %	Average hospital stay (days)
I	837.2 ± 213.4	61.23 ± 5.35	4.1 ± 2.8
II	1984.4 ±`489.7	50.29 ± 4.92	5.3 ± 2.4
III	2934.2 ± 592.3	40.32 ± 6.55	7.9 ± 3.1
IV	4153.4 ± 728.5	34.58 ± 5.78	11.3 ± 4.2

DISCUSSION

In the setting of acute dyspnea, uncertainty in diagnosis can result in longer hospital stays, increased healthcare costs, and higher rates of repeat hospitalization or death.[7] However, testing for brain natriuretic peptide (BNP) or N-terminal pro-brain natriuretic peptide (NT-proBNP) can improve diagnostic accuracy and predict prognosis, leading to better clinical outcomes.[8,9] Notably, NT-proBNP is a superior predictor of mortality compared to BNP and is equally effective in predicting heart failure in patients with all levels of renal function. [10]

In their study, Bi et al[11]. examined 55 stable CHF patients on treatment and 35 control subjects. The study found that the mean BNP level in patients with stable CHF was significantly higher than that of the control group, with values of 60.46 ± 16.13 pg/mL and 20.94 ± 5.81 pg/mL, respectively ($p = 0.001$). As age increased, an increasing trend in plasma BNP values was observed in both groups. The study also found a strong negative linear relationship ($r = -0.798$) between left ventricular ejection fraction (LVEF) and BNP levels in the study population. The researchers established that a plasma BNP level of 30.2 pg/mL had a 100% sensitivity and specificity to predict CHF.

In a study by Athavale et al[12], 50 patients presenting with acute onset dyspnea were examined. Ischemic heart disease (IHD) was found to be the most common cause (44%), followed by dilated cardiomyopathy (DCM) (32%) and chronic obstructive pulmonary disease (COPD) (10%). Anemia had the lowest median NT-proBNP value (850 pg/mL), while the highest values were observed in IHD patients (9485 pg/mL), followed by DCM patients (8969 pg/mL), and then COPD patients (2846 pg/mL). The study found a significant positive correlation between NT-proBNP and age (coefficient of correlation $r = 0.4007$, significance level $p = 0.0389$, and class interval = 0.137–0.61), and a significant negative correlation between creatinine clearance and NT-proBNP (coefficient of correlation $r = –0.372$, significance level $p = 0.007$, and class interval = –0.58 to –0.105). Additionally, the study found a significant negative correlation between left ventricular ejection fraction (LVEF) and NT-proBNP (coefficient of correlation $r = –0.36$, significance level $p = 0.009$, and class interval = –0.58 to –0.09), with higher LVEF values associated with lower NT-proBNP values. However, there was marked heterogeneity in the NT-proBNP values.

In a study by Anjankar AP et al.,[13] the cases group consisted of 28 males and 22 females with a mean age of 50.80 (13.11) years, while the control group consisted of 28 males and 22 females with a mean age of 50.86 (12.7) years. The study found a statistically significant difference in Mean N-T pro BNP between the case and control groups, as well as in NYHA Class and age group. The Mean N-T pro-BNP was not significantly different at discharge and on the 2nd follow-up. However, for the rest of the diagnoses, there was a notable difference in Mean N-T pro BNP at discharge and on the 2nd follow-up.

In a study conducted by Arun B et al.,[14] the mean age of patients was found to be 58.9 years. The median level of NT-proBNP was significantly higher in patients with HF than those with respiratory failure and Hyperventilation Syndrome (HVS). For patients under 50 years of age, the sensitivity and specificity of an NT-proBNP level >450 pg/mL was 76.9% and 90.0%, respectively. For patients aged 50-75 years, the sensitivity and specificity of an NT-proBNP level >900 pg/mL was 82.9% and 92.3%, respectively. For patients over 75 years of age, the sensitivity and specificity of an NT-proBNP level >1800 pg/mL was 61.5% and 100.0%, respectively.

In the study by Chaudhari ST et al.,[16] the average N-T pro BNP in cases was 3179 pg/mL and in controls was 103 pg/mL. The majority of the patients had long-standing hypertension and ischemic cardiomyopathy was the commonest cause of HF in the patient population. Mean N-T pro BNP was higher in females (3481 pg/mL) compared to males (2934 pg/mL). Systolic dysfunction (3316 pg/mL) raised the N-T pro BNP more than diastolic dysfunction. A higher degree of HF according to the New York Heart Association

classification was associated with a higher N-T pro BNP using competitive enzyme immunoassay technique.

Sane Rohit[16] studied 723 patients, the majority were males [n = 453 (62.64%)] with a mean age of 60.29 ± 10.91 years. Age, CAD, DCM, CKD and MI showed a significant positive correlation while LVEF (>40) showed a significant negative correlation with logarithm of NT-proBNP levels ($p < 0.05$). The ProBNP Investigation of Dyspnea in the Emergency Department (PRIDE) study6 demonstrated that elevated NT-proBNP concentrations were the strongest predictor of HF compared with traditional assessment.17 Periodic assessment of BNP in patients with CHF gives an objective data which provides clues for anticipating cardiac decompensation and facilitating therapeutic adjustment in advance.[18]

CONCLUSION

In addition to the diagnosis and severity of congestive heart failure, NT-proBNP measurements have been shown to have prognostic value as well. Higher levels of NT-proBNP have been associated with increased mortality and hospitalization rates in patients with heart failure. Regular monitoring of NT-proBNP levels in heart failure patients can provide early detection of worsening symptoms and allow for timely interventions, such as adjusting medication or initiating more aggressive therapies, to prevent adverse outcomes. Overall, NT-proBNP measurement is a valuable tool in the management of heart failure patients.

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