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Original Research Article

Estimation of Serum Levels of NTProBNP in Heart Failure Patients Treated in BGS MCH Hospital– A Facility Based Cross S0ectional Study

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ABSTRACT

Background
Heart failure is a prevalent medical state with a grim prognosis. Echocardiography is the gold standard for diagnosis; nevertheless, it is not always accessible, particularly in emergency situations. NT-pro-brain natriuretic peptide (NTproBNP) is an innovative biomarker for diagnosing heart failure & is utilised in standard testing procedures. The aim of present study is to estimate the serum NT proBNP levels in patients with heart failure & correlate them with different stages/severity of left ventricular dysfunction.

Methods
The present cross-sectional study was conducted at BGS MCH HOSPITAL among 36 patients of heart failure during the study period of one year. All the participants were interviewed using semi structured questionnaire. Semi structured questionnaire was used to collect the data regarding age, gender, comorbidities, coronary artery disease & ventricular dysfunction. Blood samples were drawn for measuring NTproBNP level .

Results
The median age of patients was 67 with range of (26-86). Female patients were 9 (28%) & male patients were 23 (72%). Patients having diabetes were 18 (57%) & with hypertension 27 (87%). Maximum patients were of moderate dysfunction 10 (30%) & severe dysfunction were 10 (30%). The high level of NTproBNP was found in severe dysfunction (12701). The diagnostic value of NT-proBNP alone showed a sensitivity of 72%, a specificity of 81%, a positive predictive value of 25%, & a negative predictive value of 97%.

Conclusion
Symptomatic patients should have B-type natriuretic peptide tested immediately to rule out heart failure. The effect of NT-proBNP-lowering treatment on prognosis needs additional study.

Keywords-BNP, Heart Failure, NT-Pro-Brain Natriuretic Peptide, prognosis

INTRODUCTION

Heart failure is recognised as a debilitating ailment with a dismal prognosis, particularly in its advanced stages, where patients experience reduced survival rates & mortality rates exceeding 50% within the 1st year of follow-up.[1-4] Timely recognition of patients at risk for severe progression or premature mortality is crucial, since it enables intervention to alter the natural trajectory of their disease.

Heart failure may arise from a fast decline in cardiac pump performance or may be induced by an elevation in SVR due to a quick reduction in cardiac output amongst preexisting cardiac dysfunction. It may also progress gradually & subtly, initiated by myocardial injury or a stressor, accompanied by certain abnormal haemodynamic & neurohormonal reactions. Neurohormonal stimulation can lead to water & salt retention, accompanied by heightened systemic vascular resistance.[5] While these haemodynamic & neurohormonal systems offer inotropic support, they result in prolonged elevations in load & risk. Theoretically, regulating elevated levels of neurohormones would constitute the foundation of the treatment.[6]

Natriuretic peptides are predominantly synthesised in the heart & released into the bloodstream in reaction to heightened wall tension.[7] BNP, unlike ANP, is secreted not only by the atria but also by the ventricles, particularly in individuals with heart failure.[8] Circulating levels of various cardiac natriuretic peptides—including ANP, BNP, & their NT-proANP & NT-proBNP—are elevated in both symptomatic & asymptomatic individuals with left ventricular dysfunction.[9,10]

Recent smaller studies indicate that BNP & NT-proBNP may outperform ANP & NT-proANP in identifying left ventricular dysfunction.[11,12] A consistent & efficient enzyme-linked immunosorbent assay (ELISA) method for analysing NT-proBNP has recently been developed, indicating that NT-proBNP may be an appropriate peptide for diagnostic assays.[13]

The aim of present study is to estimate the serum NT proBNP levels in patients with heart failure & correlate them with different stages/severity of left ventricular dysfunction.

MATERIAL & METHODS

The present cross-sectional study was conducted at BGS MCH HOSPITAL among patients of heart failure during the study period of one year. Before the study started, institutional ethics committee approval was obtained. The entire study process was explained to the patients before they were requested to sign an informed permission form.

Through convenient sampling a total of 36 patients of heart failure admitted to hospital were selected on the basis of inclusion & exclusion criteria.

Inclusion criteria

Patients having clinical symptoms, ECG changes, serum biochemical changes of heart failure.

Exclusion criteria

Patients with no history of cardiac & renal failure.

Patients who experienced at least one of the following symptoms or indicators of chronic heart failure were deemed to have them: neck vein distension, orthopnea, peripheral fluid retention, weight loss from diuretic treatment, auscultatory rales, or dyspnoea when walking at a regular pace. A semi-structured questionnaire was used to interview each participant. Data on

age, gender, comorbidities, coronary artery disease, and ventricular dysfunction were gathered using a semi-structured questionnaire. All patients had blood samples taken, either during hospitalisation or at the outpatient clinic, so that commercially accessible immunoassays could measure the levels of NT-proBNP.

Statistical Analysis

Data gathered was incorporated in MS excel.The data were analysed using SPSS version 22 (Statistical package for social sciences).Continuous variables were summarised as median with range & Categorical variables were summarised using percentages. Kruskal – Wallis test(KWT) was used to assess the difference in NTproBNP level between various levels of heart failure. KWT is a non parametric method for testing whether samples originate from same distribution. A ROC ("Receiver Operating Characteristic") curve was drawn to estimate the cut-off point for the natriuretic peptide value (NT-proBNP) as a predictor of mortality.

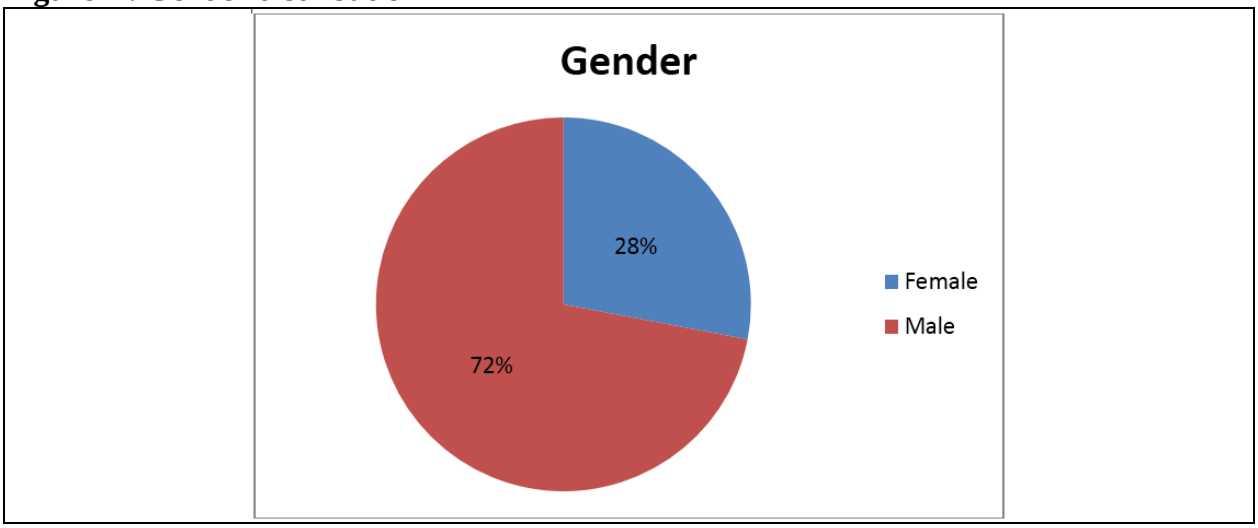
RESULTS

The median age of patients was 67 with range of (26-86). Total number of female patients were 9 (28%) & male patients were 23 (72%) (figure 1). Patients having comorbidity like diabetes were 18 (57%) & with hypertension 27 (87%) as shown in table 1.

Table 1: Description of patients

Variables	Frequency	Proportion (%)
Age (median with range)	67 (26 – 86)	
Gender		
Female	9	28
Male	23	72
With diabetes	18	57
With hypertension	27	87

Figure 1 : Gender distribution



The number of patients with good stage were 2 (6%), fair dysfunction were 3 (9%), mild dysfunction were 5 (15%), moderate dysfunction were 10 (30%), severe dysfunction were 10 (30%) & various severe dysfunction was a 1 (3%) as shown in table 2.

Table 2: Ventricular dysfunction among study patients

Ventricular function	Frequency	Proportion (%)
good	2	6
Fair dysfunction	3	9
mild dysfunction	5	15
moderate dysfunction	10	30
severe dysfunction	10	30
Very severe dysfunction	1	3

Serum level (median value) of NTproBNP in heart failure patients at different stages is shown in figure 2 & table 3 repsectively. 6,000 pg/ml threshold was determined as the optimal cut-off point for stratifying the population for mortality risk.

Figure 2: Serum level of NTproBNP in heart failure patients

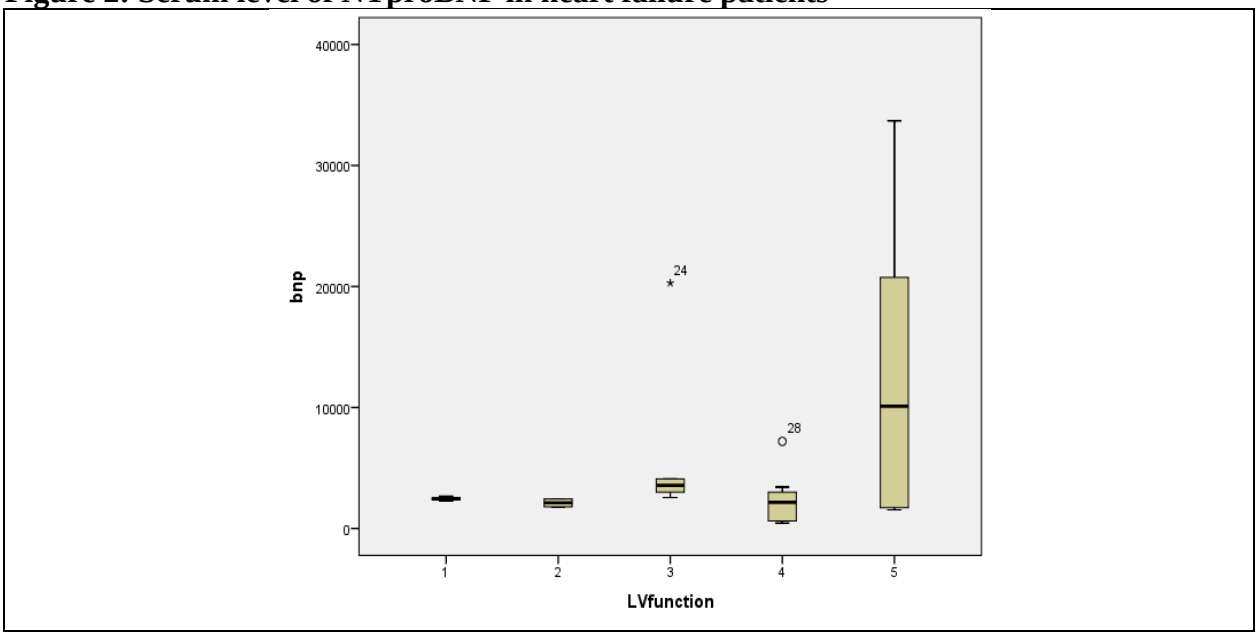


Table 3: Serum level of NTproBNP in heart failure patients

Sl. no	Ventricular function	NTProBNP (median)
1	good	2121
2	Fair dysfunction	2442
3	mild dysfunction	3560
4	moderate dysfunction	2158
5	severe dysfunction	12701

The diagnostic value of NT-proBNP alone showed a sensitivity of 72%, a specificity of 81%, a positive predictive value of 25%, & a negative predictive value of 97% as shown in table 4.

Table 4 Diagnostic value of NT-proBNP for the detection of heart failure

Diagnostic value	Percentage
Sensitivity	72%
Specificity	81%
Positive predictive value	25%
Negative predictive value	97%

DISCUSSION

Making a differential diagnosis in patients presenting with chest pain upon admission to the department is frequently challenging. Echocardiography is the definitive diagnostic modality for heart failure, despite its limitations regarding cost & accessibility.[14,15] Consequently, BNP & NT-proBNP have emerged as standard assays in recent years because to their reliability, ease of use, & cost-effectiveness.[16] The American College of Emergency Physicians & the European Society of Cardiology have endorsed the clinical application of natriuretic peptide readings to assist in the diagnosis or exclusion of heart failure.[17]

The current study indicated that the median age of patients was 67 years, with a range of 26 to 86 years. The research conducted by Mrinal et al. indicated that the average age was 58.73 years. In our study, 28% of patients were female, whereas 72% were male. Mrinal demonstrated that 70% of the subjects were male & 30% were female.[18]

In our study patients having comorbidity like diabetes were 18 (57%) & with hypertension 27 (87%). In a study done by Jadhav N et al [19] majority 66% had DM, 50% were smokers, 40% had hypertension & only 16% had history of IHD. Study by Hossain Z [20] et al. showed that 53% were smokers, 54% were hypertensive, 46% had DM & 20% had positive Family history.

In our study the high value of NTproBNP was found in sever dysfunction. In a study done by Corteville DC et al NT-proBNP levels exceeding 500 pg/mL demonstrated 89% specificity for ventricular dysfunction, accompanied by a positive likelihood ratio of 4.1 & a 47% posterior probability of illness presence. NT-proBNP levels ranging from 100 to 500 pg/mL did not influence the chance of ventricular dysfunction (likelihood ratio, 0.95).[21] Maisel et al. authored a review of the application of natriuretic peptide levels in clinical practice, proposing specific cut lines for BNP & NT-proBNP in the diagnosis of heart failure. According to their findings, a BNP level of less than 100 pg/ml renders cardiac failure unlikely. Levels ranging from 100 to 400 pg/ml, accompanied by clinical suspicion or a history of heart failure, suggest likely heart failure. Levels exceeding 400 pg/ml indicate a significant likelihood of cardiac failure. Elevated amounts of NT-proBNP were observed.[22]

This finding aligns with previous research from Dao & colleagues, who demonstrated that BNP measures effectively identified heart failure with notable sensitivity & negative predictive value in a smaller cohort of patients. [23] In less critical environments, both BNP & ANP have demonstrated diagnostic utility in patients sent to heart failure clinics.[24,25]

This study included certain drawbacks. The primary limitation was the quantity of eligible cases. The restricted population may have influenced our findings. Weight & body mass index were not assessed in our study. Recent publications indicate that obesity may affect NT-proBNP levels. This may represent the most vulnerable facet of this investigation.

CONCLUSION

The prompt assessment of B-type natriuretic peptide is beneficial for confirming or ruling out heart failure in patients experiencing symptoms. The impact of therapy interventions designed to reduce NT-proBNP levels on prognosis requires further exploration.

REFERENCES

1. McMurray JJV, Stewart S. The burden of heart failure. Eur Heart J. 2002; 4 (suppl D): 50-8.
2. Fonarow GC, Adams KF, Abraham WT, et al. Risk stratification for inhospital mortality in acutely decompensated heart failure. Classification & regression tree analysis. JAMA. 2005; 293: 572-80.
3. Shahar E, Lee S, Kim J, et al. Hospitalized heart failure: rates & long-term mortality. J Cardiac Fail. 2004; 10: 374-8.
4. Wong PS, DavidssonGK, Timeyin J, et al. Heart failure in patients admittd to hospital: mortality is still high. Eur J Intern Med. 2002; 13: 304-10.
5. Peacock WF. Congestive heart failure & acute pulmonary edema. In. In: Tintinalli JE, StapczynskiJS, Ma OJ, Cline DM, Cydulka RK, Meckler GD, editors. Tintinalli's Emergency Medicine: A Comprehensive Study Guide. 7 th ed. New York: McGrawHill.2011;405-15.
6. Gheorghiade M, Pang PS. Acute heart failure syndromes. J Am CollCardiol. 2009; 53(7): 557-73.
7. Kinnunen P, Vuolteenaho O, Ruskoaho H. Mechanisms of atrial & brain natriuretic peptide release from rat ventricular myocardium: effect of stretching. Endocrinology 1993;132:1961–70.
8. Yasue H, Yoshimura M, Sumida H, et al. Localization & mechanism of secretion of B-type natriuretic peptide in comparison with those of A-type natriuretic peptide in normal subjects & patients with heart failure. Circulation 1994;90:195–203.
9. Cowie MR, Struthers AD, Wood DA, et al. Value of natriuretic peptides in assessment of patients with possible new heart failure in primary care. Lancet 1997;350:1349–53.
10. McDonagh TA, Robb SD, Murdoch DR, et al. Biochemical detection of left-ventricular systolic dysfunction. Lancet 1998;351:9–13.
11. Hunt PJ, Richards AM, Nicholls MG, et al. Immunoreactive amino-terminal pro-brain natriuretic peptide (NT-PROBNP): a new marker of cardiac impairment. ClinEndocrinol (Oxf) 1997;47:287–96.
12. Yamamoto K, Burnett JC, Jougasaki M, et al. Superiority of brain natriuretic peptide as a hormonal marker of ventricular systolic & diastolic dysfunction & ventricular hypertrophy. Hypertension 1996;28:988–94.
13. Karl J, Borgya A, Gallusser A, et al. Development of a novel, N-terminal-proBNP (NT-proBNP) assay with a low detection limit. Scand J Clin Lab Invest Suppl 1999;230:177–81
14. Hunt SA, Abraham WT, Chin MH, Feldman AM, Francis GS, Ganiats TG, et al. ACC/AHA 2005 Guideline Update for the Diagnosis & Management of Chronic Heart

Failure in the Adult: a report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines: developed in collaboration with the American College of Chest Physicians & the International Society for Heart & Lung Transplantation: endorsed by the Heart Rhythm Society. Circulation 2005; 112(12): e154-e235.

15. Oh JK. Echocardiography in heart failure: beyond diagnosis. Eur J Echocardiogr 2007; 8(1): 4-14.
16. Mueller C, Laule-Kilian K, Schindler C, Klima T, Frana B, Rodriguez D, et al. Cost-effectiveness of B-type natriuretic peptide testing in patients with acute dyspnea. Arch Intern Med 2006; 166(10): 1081-7.
17. Peacock WF. Congestive heart failure & acute pulmonary edema. In. In: Tintinalli JE, StapczynskiJS, Ma OJ, Cline DM, Cydulka RK, Meckler GD, editors. Tintinalli's Emergency Medicine: A Comprehensive Study Guide. 7 th ed. New York: McGraw Hill; 2011;405-15.
18. Kunj M, Kumar B, Kumar A. N-Terminal Pro-Brain Natriuretic Peptide as a Predictor of Complication & Mortality in Acute ST Segment Elevation Myocardial Infarction. International Journal of Contemporary Medical Research. 2017;4(5):1100-3.
19. Jadhav N, Pavan Patel DS, Pundkar RD. Assessment of Serum NT-Probnp Level in Acute Decompensated & Chronic Heart Failure Patients in a Tertiary Care Hospital. Sch J App Med Sci. 2017; 5(11F):4746-4749.
20. Hossain MZ, Siddique MA, Parveen T, Mahmood M, Siddika KA, Mahmud S, Osmany D, Bari N. A Study of N-terminal pro-Brain Natriuretic Peptide as a Predictor of Adverse Outcome of STEMI. University Heart Journal. 2015;11(1):13-7.
21. Dao Q, Krishnaswamy P, Kazanegra R, et al. Utility of B-type natriuretic peptide in the diagnosis of congestive heart failure in an urgent-care setting. J Am CollCardiol 2001;37:379–85.
22. Corteville DC, Bibbins-Domingo K, Wu AH, Ali S, Schiller NB, Whooley MA. N-terminal pro-B-type natriuretic peptide as a diagnostic test for ventricular dysfunction in patients with coronary disease: data from the heart & soul study. Arch Intern Med. 2007 Mar 12;167(5):483-9.
23. Maisel A, Hollander JE, Guss D, McCullough P, Nowak R, Green G, et al. Primary results of the Rapid Emergency Department Heart Failure Outpatient Trial (REDHOT). A multicenter study of B-type natriuretic peptide levels emergency department decision making, & outcomes in patients presenting with shortness of breath. J Am CollCardiol 2004; 44(6): 1328-33.
24. Cowie MR, Struthers AD, Wood DA, et al. Value of natriuretic peptides in assessment of patients with possible new heart failure in primary care. Lancet 1997;350:1349–53.
25. Bettencourt P, Ferreira A, Dias P, et al. Evaluation of brain natriuretic peptide in the diagnosis of heart failure. Cardiology 2000;93:19–25