

Rapid Measurement of B-Type Natriuretic Peptide in the Emergency Diagnosis of Heart Failure

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Abstract: The present study was undertaken to identify the congestive heart failure patients by BNP test. To measure BNP levels in Patients with congestive heart disease, to use the BNP in the heart failure treatment and Routine use of BNP assays may help to more rapidly identify patients with heart failure, thereby saving money on unnecessary echocardiograms. In the present study observe the measurement of B-type natriuretic peptide in the heart failure patients.

Key words: BNP levels • Patients • Heart disease • B-type

INTRODUCTION

Heart failure, also called congestive heart failure, is a condition in which the heart cannot pump enough oxygenated blood to meet the needs of the body's other organs. The heart keeps pumping, but not as efficiently as a healthy heart. Usually, the loss in the heart's pumping action is a symptom of an underlying heart problem. Heart failure affects nearly 35 million adults in world total population [1]. It is on the rise with an estimated 4 to 7 millions new cases each year. More than 7.5 million Indian's suffer from CHF and nearly a million new cases arise each year. Congestive heart failure (CHF), congestive cardiac failure (CCF) or just heart failure is a condition that can result from any structural or functional cardiac disorder that impairs the ability of the heart to fill with or pump a sufficient amount of blood through the body [2]. It is not to be confused with "cessation of heartbeat", which is known as a systole, or with cardiac arrest, which is the cessation of normal cardiac function with subsequent hemodynamic collapse leading to death [3]. Heart failure may decompensate easily; this may occur as the result of any intercurrent illness (such as pneumonia), but specifically myocardial infarction (a heart attack), anemia, hyperthyroidism or arrhythmias. These place additional strain on the heart muscle, which may cause symptoms to rapidly worsen [4]. During the

last decade, brain natriuretic peptide (BNP) has emerged as powerful biochemical markers of cardiac function as automated rapid assays have been made available to hospital laboratories, an increasing number of studies that were performed by clinical investigators have documented the usefulness of these markers in the process of diagnosis, prognosis and treatment of cardiac disease [5].

The present study was undertaken to identify the congestive heart failure patients by BNP test. To measure BNP levels in Patients with congestive heart disease, to use the BNP in the heart failure treatment and Routine use of BNP assays may help to more rapidly identify patients with heart failure, thereby saving money on unnecessary echocardiograms.

MATERIALS AND METHODS

Population Studies: During the studies at K.G Institution, coimbatore. More than 100 peoples have analyzed, as a myocardial symptoms having cases. From this only 80 abnormal patients have taken out of more than 100 patients of both sexes. As these 80 abnormal total patients have been categorized into both males as well as females based on their various elevated blood BNP levels. According to these 35 female patients were finalized from out of 80 cases. As for the male 45 were identified.

Table 1: Protein stabilizers to yield

Bottle	BNP-concentration	
	Pg/ml	Pmol/l
Standard cal-A	0	0
Standard cal-B	100	29
Standard cal-C	400	116
Standard cal-D	1000	289
Standard cal-E	2000	578S
Tandard cal-F	4000	1156

Preservative, Sodium azide and proclin 300

Table 2: Protein stabilizers to yield

Bottle	BNP-concentration		Range	
	Pg/ml	Pmol/l	Pg/ml	Pmol/l
Control-L	100	29	50-150	14-43
Control-M	440	127	264-616	76-178
Control-N	1500	434	900-2100	260-607

Assay Methods for BNP: AxSYM-BNP is a microparticle enzyme immunoassay (MEIA) for the quantitative determination of human B-type natriuretic peptide in human EDTA plasma on the AxSYM system (Photo 1 and 2). BNP values are used as an aid in the diagnosis and assessment of severity of heart failure.

Explanation of the Test: Numerous studies have indicated that BNP can be used for patient diagnosis, prognosis and therapy monitoring. Levels of BNP have been shown to be elevated in patients with cardiac dysfunction. Plasma BNP levels provide clinically useful information concerning the diagnosis and management of left ventricular dysfunction and heart failure, which complements other diagnostic testing procedures, e.g, electrocardiograms, chest X-rays and echocardiograms. So that BNP is the testing for diagnosis or rule out of heart failure.

Plasma BNP levels also increase with decreasing physiological functional capacities, as measured by left ventricular ejection fraction (LVEF). BNP has demonstrated utility for prognostic stratification of patients with heart failure and acute coronary syndromes (ACS). Elevated levels of BNP in heart failure patients predict disease progression and increased morbidity and mortality. Increased BNP levels in ACS patients have a higher rate of cardiac complications and higher post myocardial infraction. Preliminary studies have reported the use of BNP measurements to optimize treatment for hearty failure. Measurements of BNP two hours or more post-treatment detect only the endogenous levels of BNP.

AxSYM BNP Standard Calibrators: Six bottles (4Ml each) of AxSYM BNP standard Calibrators. Calibrator A is Acetate buffer with protein (bovine) stabilizers. Calibrators B-F contain BNP in Acetate buffer with protein (bovine) stabilizers to yield the following concentration (Table 1).

Controls: Three bottles (8ml each) of AxSYM BNP controls containing BNP in Acetate buffer with protein (bovine) stabilizers to yield the following concentrations (Table 2).

Standardization: The AxSYM BNP standard Calibrators are traceable to an internal reference standard that has been prepared gravimetrically with synthetic BNP .the internal reference standard underwent a one-time value assignments to align with a commercially available BNP assay with a decision threshold of 100pg/ml.

Specimen Collection and Preparation for Analysis: EDTA plasma must be used for The AxSYM BNP assay. Other sample types including serum, citrate plasma and heparin plasma arte not recommended. If samples cannot be tested within the given times for room temperature or 2-8°C storage they may be separated by centrifugation and frozen for upto 3 months at -20°C or below in plastic tubes. Multiple freeze / thaw cycles should be avoided. Samples may undergo upto 3 freeze /thaw cycles. Specimens must be mixed thoroughly after thawing, by LOW speed vortexing or by gently inverting and centrifuged prior to use, to remove particulate matter and ensure consistency in the results.

Sample Storage: Whole blood samples, stored at 2-8°C, must be tested within 24 hours of collection. When blood samples, stored at room temperature, must be tested within 4 hours of collection. Plasma samples, stored at 2-8 °C, must be tested within 24 hours of collection. Plasma samples, stored at room temperature, must be tested within 4 hours of collection.

Quality Control: The minimum control requirement for an AxSYM BNP assay is a single sample of all three controls tested every 24 hours. Each day of use for each reagent for controls may be placed in any position in the sample carousel. If the quality controls procedure in the laboratory require more frequent use of controls to verify test results. En sure that assay controls are within the concentration ranges specified in the package insert.

RESULTS

During this project studies, 80 patients were taken as congestive heart failure having cases. From this affected percentage in both sexes have been calculated. This is represented in following Table 3. From these 45 males and 35 females marked as congestive heart failure having cases in out of total 80 patients. All these 80 patients' blood BNP levels were measured by the instrument of AxSYS with Microparticle Enzyme Immuno Assay (MEIA) test procedure. Based on these MEIA test procedure, elevated cardiac patients BNP in blood had been analyzed in patients at various age groups and the levels of BNP mentioned in the unit of pictogram per milliliter. The BNP levels in both sexes are noted separately given in the Table 4.

Elevation levels of BNP in above aged groups in both sexes are indicates severity of heart failure. The elevation of blood BNP is not only the myocardial failure but also with condition that are considered, even which can be one of reason for patients to have congestive heart failure with increased BNP level in the blood. The conditions included are such as cigarette smoking, alcohol intake, hypertension and high intakes of non-veg items. These are marked in the percentage order given in the Table 5.

Table 3:

Total patients	Males	Females	Affected%	
			Male	Females
80	45	35	56.25	43.75

Table 4:

S.No	Age of males	BNP level pg/ml	Age of females	BNP level pg/ml
1	>30	142.10	>30	244.5
2	44-55	338.60	44-55	424.4
3	56-65	1080.62	56-65	965.5
4	66-75	2501.6	66 -75	1960.23
5	>76	3567	>76	3442.8

Table 5:

S.NO	Risk Factors	No. of Patients in 80		Affected %	
		Male	Female	Male	Female
1	Age	12	12	26.66%	34.28%
2	Food based obesity	5	11	11.11%	31.42%
3	Smoking	15	-	33.33%	-
4	Hyper tension	10	9	22.22%	25.71%
5	Other conditions	3	3	6.66%	8.57%

According to the MEIA test procedure, the normal levels of BNP in heart failure patient's blood would be upto 100pg/ml. If the value has been measured above this normal level, which would indicate that patient under the risk of congestive heart failure. But in these total 80 cardiac patients various abnormal blood BNP levels were found.

Based on these studies any biochemical marker like BNP has never been found even at under the normal values. In case if peoples were diagnosed with little levels of blood BNP at any age, such a little BNP level would have been taken as a good prognostic tool to treat patient before affecting with severe conditions of various cardiac diseases. Extensively BNP can also be used to identify diabetic patients with cardiac arrest.

DISCUSSION

The plasma levels of either brain natriuretic peptide (BNP) has recently gained extreme importance as markers of myocardial dysfunction [6]. The patient has normal systolic function but symptoms consistent with cardiac failure and a clearly raised brain natriuretic peptide level, diastolic heart failure is likely to be present. If our pilot findings are corroborated both in systolic and diastolic dysfunction, it is probable that a set of target levels of plasma BNP can be established to guide treatment of systolic and diastolic dysfunction within both sexes (plasma BNP is higher in females) and in different age groups (brain natriuretic peptide rises with age) [7].

A BNP level of 80 pg/ml is useful in diagnosing heart failure in symptomatic patients without a history of heart failure. BNP levels are potentially more useful when a baseline concentration is known for a patient, because BNP levels are proportional to the severity of heart failure. Maintaining a BNP concentration of less than 100 pg/ml has shown to correlate with functional improvement in patients with heart failure and has tended to decrease clinical endpoints, such as cardiovascular death. Consequently, using BNP concentrations to monitor patients with heart failure and manage their medical therapy accordingly might improve overall morbidity and mortality [8].

The Measurements of B-type natriuretic peptide added significant independent predictive power to other clinical variables in models predicting which patients had congestive heart failure. Rapid measurement of B-type natriuretic peptide is useful in establishing or excluding the diagnosis of congestive heart failure in patients [9].

The Brain natriuretic peptide (BNP) is promising drugs for a clinical use in the prevention of cardiac remodeling and the treatment of cardiac diseases such as heart failure and myocardial infarction, in the study of "The role of natriuretic peptides in cardio protection [10].

To conclude that from the present findings is, Plasma levels of ANP and BNP have been found to be increased in patients with various heart diseases, but the elevation in circulatory BNP correlates better than ANP with the severity of CHF. Therefore, plasma BNP has been suggested (and lately used) to aid in the accurate diagnosis of heart failure in patients admitted to the emergency room with symptoms of decompensate heart failure. Furthermore, circulatory BNP has been utilized as a prognostic marker in CHF as well as a hormone guide in the evaluation of the efficacy of the conventional treatment of this disease state.

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