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Correlation between Plasma B-Type Natriuretic Peptide and Haemoglobin Level in Acute Heart Failure

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Abstract: ***BNP (Brain natriuretic Peptide) is inversely related to Hb (Haemoglobin) in acute heart failurepatients. In this study also BNP is inversely proportionate to Hb. Aim: To assess the correlation between plasma B –type natriuretic peptide and haemoglobin level in acute heart failure patients. Method: Observational cross – sectional study was conducted in 86 patients those who are admitted with acute heart failure in Little flower hospital, Angamaly, Ernakulam, Kerala. Haemoglobin level and BNP level as clinical and demographic information were collected. Descriptive analysis was used to analyse the collected data by qualitative variables and quantitative variables. Mean and standerd according to the normality of the data they have an spearman correlation coefficient for the assessment of correlation between outcome variable. All data entered in Excel analysed using IBI sample size version 1.01. Results: In 86 patients both haemoglobin levels and BNP values were analysed to clarify the relationship of these markers. BNP level were significantly inversely related with haemoglobin concentration. (R = - 0.594, p<0.0001). Multiple variable analysis revealed that decreased Hb was one of independent predictors for the BNP. Conclusion: The combination of haemoglobin and high BNP level may deteriorate the prognosis of the first acute heart failure patients.***

Keywords: Brain natriuretic peptide, Acute heart failure, Hemoglobulin

1. Introduction

Anaemia due to chronic disease such as diabetes, cancer, renal and heart failure (HF), is the most important common cause of low haemoglobin (Hgb) in hospitalized patients. [1]

Brain natriuretic peptide (BNP) is a neurohormone produced from the left ventricles of the heart and is released into the blood in response to volume expansion and pressure overload. Plasma or whole blood testing for BNP has become the mainstay for diagnosis of heart failure. [2]

Acute heart failure is a syndrome defined as the new onset or worsening of symptoms and signs of HF. It is often a potentially life - threatening condition, requiring hospitalization and emergency treatment. [3]

In this view of the evidence, it is necessary to know if there is any correlation between the BNP and Hgb level in acute heart failure patients

To establish diagnostic, therapeutic, and prognostic strategies, the identification of reliable biomarkers for heart failure is necessary. [4, 5]. Although a number of biomarkers have been developed, the ideal biomarkers should meet certain criteria: 1) non - invasive sample collection, 2) a high degree of sensitivity and specificity, 3) able to detect the disease at an early stage, 4) sensitivity high enough to reflect relevant changes in disease conditions, 5) a long halflife within the sample, 6) rapid measurement system responding to clinical needs, and 7) low cost [6, 7].) In the failing heart, increased wall stress and neurohormonal activation facilitate BNP secretion chiefly from ventricular myocytes. BNP promotes diuresis, vasodilatation, and attenuation of renin and aldosterone secretion [8].

The plasma levels of BNP increased in proportion to the severity of heart failure. Plasma levels of BNP were 5 - fold higher in non - survivors than in survivors. . Plasma levels of BNP provided prognostic information independent of other variables previously associated with a poor prognosis. To date, a number of studies have reported the diagnostic and prognostic impacts of BNP in heart failure [8, 9]

Anemia is an important factor to deteriorate the prognosis of ischemic heart disease. B - type natriuretic peptide (BNP), a marker of heart failure, has also closely related with mortality in patients with acute heart failure. In the general elderly population, anemia is caused by nutritional deficiencies (primarily iron), chronic inflammation/CKD, or unexplained anemia of the elderly (a hypoproliferativeanemia with blunted erythropoietin response) in approximately one third each, with primary hematologic diseases or other conditions accounting for smaller proportions. Anaemia is an independent predictor of incident HF, and of adverse outcomes in patients with established HF. In the absence of clinical HF, patients with anaemia have elevated levels of natriuretic peptides, suggesting that anaemia may lead to subclinical ventricular dysfunction.

2. Methods and Materials

Observational cross – sectional study was conducted in 86 patients those who are admitted with acute heart failure in Little flower hospital, Angamaly, Ernakulam, Kerala.

Haemoglobin level and BNP level as clinical and demographic information were collected.

Inclusion Criteria:
Subjects diagnosed with acute heart failure.

Exclusion Criteria:
Patients receiving haemodialysis, Patients suffering with Severe chronic obstructive pulmonary disease (COPD), pneumonia, Adult respiratory distress syndrome., Any overt or covert bleeding manifestations. Any patient with secondary cause of anemia, Patients with cyanotic heart diaeses, Patients with low PCV (hematocrit) value.

3. Methods

Data base were collected for 86 patients those who are admitted with acute heart failure. Patients haemoglobin value and B - type Natriuretic peptide value are collected from the department. Demographic data of the patient will be collected using proforma

Statistical Analysis:
Descriptive statistics were used to assess baseline characteristics of the data. Quantitative outcomes presented as means and standard deviation and qualitative items in counts and percentages. Diagrams or graphs used accordingly. As the data doesn't follow normality, we have used Spearman Rank correlation for the assessment of correlation between the study variables. A $p<0.05$ shows statistical significance. All the data entered in Microsoft excel and analyzed using SPSS version 20.00.

4. Results

This study consists of 86 patients who has acute heart failure to assess the correlation between plasma B –type natriuretic peptide (BNP) and hemoglobin level (Hb) in acute heart failure patients.

Table 1: Baseline characteristics of the study population

Variables		Frequency	Percentage
Age	Range, Mean±SD	38 - 94, 66.53±11.312	
	38 - 52	10	11.60%
	53 - 66	36	41.90%
	67 - 80	32	37.20%
	81 - 94	8	9.30%
Gender	Male	39	45.30%
	Female	47	54.70%

In this study population, the range of age varies from 38 - 94 years with an average of 66.53±11.312 years. Out of the 86 patients 10 (11.6%) belongs to the age groups of 38 - 52 years, Majority were 53 – 66 and between 67 - 80 (79.1%) years. We have observed that more than half of the population were females (55%) and nearly half of them were males (45%) (Table 1).

Table 2: Descriptive assessment of BNP And Hb

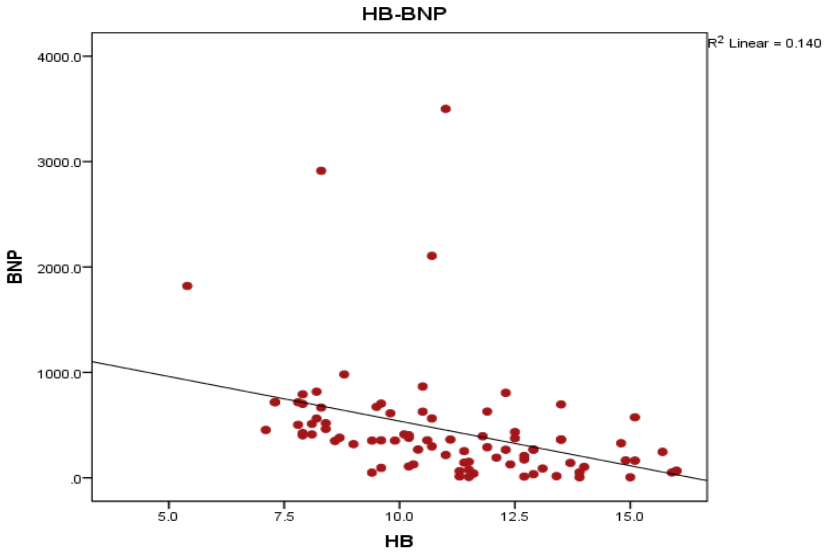
Variables	Range	Mean	Standard Deviation
BNP	5 - 3500	449.34	551.17
HB	5.4 - 16	11.04	2.43

Descriptive assessment of BNP and HB. The range of BNP varies from 5 to 3500 with an average of 449.34± 551.17. Also, Hb ranges from 5.4 to 16 with an average of 11.04 ± 2.43 respectively (Table 2).

Table 3: Correlation of BNP and Hb among the population

	HB	
BNP	R Value	Significance
	0.402	<0.0001

Spearman Rank, **p<0.0001 Shows Significant



Graph 1: Scatter diagram for correlation between BNP and HB

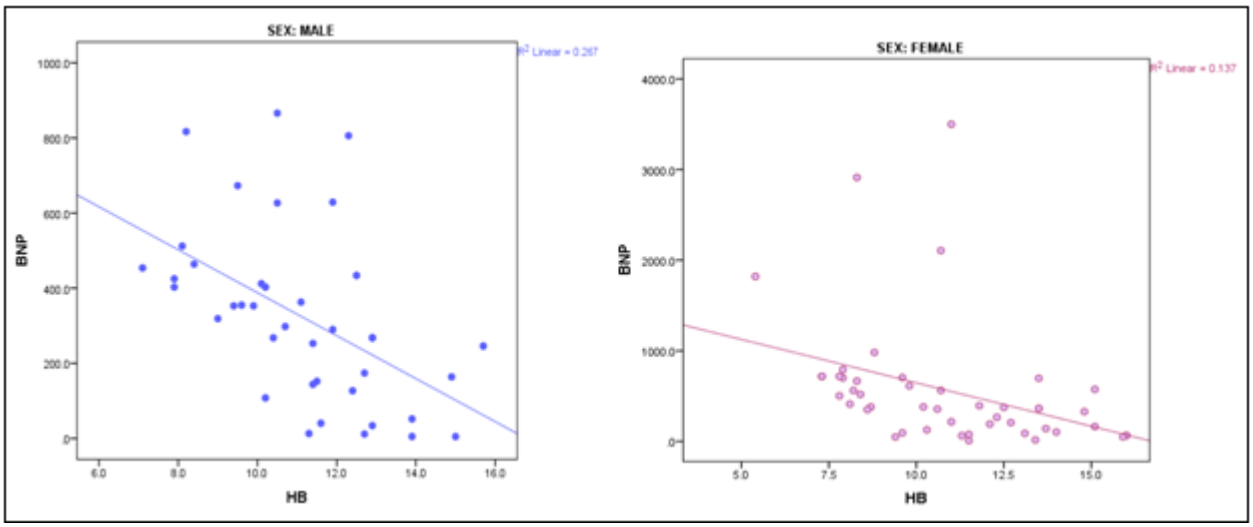
Table 3 and scatter diagram (Graph 1) shows correlation of BNP & Hb level among the study population. As the parameter BNP doesn't showed normality we have used Spearman rank correlation method. In this study we have seen that there is a good negative correlation between BNP

and Hb which was found to be statistically significant (r= - 0.594, p<0.0001).

Table 4: Correlation between BNP and HB with demographic parameters

Variables		BNP		Hb	
		R Value	Significance	R Value	Significance
Age		0.402	<0.0001	- 0.371	<0.0001
Gender	Male	- 0.600 (<0.0001)			
	Female	- 0.617 (<0.0001)			

Spearman Rank correlation, p<0.05 shows significance



Graph 2: Scatter Diagram for correlation between Hb and BNP with age and gender.

Correlation results among the study population showed significant positive correlation between age and BNP (r = 0.402, p < 0.001) and observed a negative correlation with Hb (r = 0.371, p<0.0001). Assessment of correlation between the BNP and hb among males and females showed a negative correlation between BNP and Hb on both gender.

5. Discussion

This study was undertaken to analyse the correlation between the BNP level and Hb level in acute heart failure patients. *Wilkerson DKetal.* states that there was an independent association between blood hemoglobin and plasma BNP concentrations in healthy subjects. These findings indicate anemia is a main contributor that elevates plasma BNP concentration. The degree of anemia was not severe enough in our patients to support the idea that anemia initiated myocardial lactate production and hence myocardial ischemia. [11, 12]*Joffy Set al* states that However, increased cardiac output may well increase transmural wall stress even in the absence of myocardial ischemia, and hence facilitating the synthesis and release of BNP in the ventricle. Alternatively, natriuretic peptides may be involved in the regulation of volume homeostasis. [13] *Ezekowitz JA et al* states anemia may modulate neurohumoral activation. This is a reason why anemia is likely a risk factor of HF [14, 15]. *Manolis AS et al* statesAnemia deteriorates cardiac function, because it causes cardiac stress through tachycardia and increased cardiac output. It may reduce renal blood flow and fluid retention, addingfurther stress to the heart. . These are the reasons why the normalization of blood hemoglobin levels using erythropoietin and/or iron supplements improves the symptoms of HF, exercise tolerance, and quality of life in patients with HF. [16, 17].

Weidemann et al states that the plasma BNP level is a suitable marker of the degree of ischaemic damage to the heart,. Hypoxia - inducible factor (HIF) - 1 is a dimeric protein complex that plays an integral role in the body's response to low oxygen concentrations or hypoxia. HIF - 1 is among the primary genes involved in the homoeostatic process, which can increase vascularisation in hypoxic areas, such as localised ischaemia and tumours. The production of BNP has been shown to sensitively react to the activation of HIF - 1α in cardiomyocytes. Thus, plasma BNP could be capable of serving as a marker of cardiac overload induced by anaemia. [18, 19, 20]

NT - proBNP and BNP differ also for half - life (120 versus 20 minutes) thus resulting in higher levels of circulating NT - proBNP; they are both cleared by the kidney [21]. BNP levels rise primarily in the presence of left ventricular dysfunction: the most recent clinical guidelines on heart failure (HF) management suggest its measurement to support clinical decision regarding the diagnosis and to establish prognosis or disease severity in ambulatory patients with dyspnea [22], in chronic HF

In this study we figure out and validate the fact that there is an inverse relationship between the Hb and BNP level in acute heart failure Patients, Patients with Acute heart failure with a low Hb have a higher risk of recurrent cardiac events and the Hb is an effective predictor of outcomes for patients with Acute heart failure.

6. Conclusion

The combination of haemoglobin and high BNP level may deteriorate the prognosis of the first acute heart failure patients. We conclude that haemoglobin levels are independently predictive of plasma BNP levels in patients

with suspected heart failure. Patients with AcuteHeartFailure with a low Hb have a higher risk of recurrent cardiac events and the Hb is an effective predictor of outcomes for patients with AcuteHeartFailure. We found a positive correlation between age and BNP in this study.

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