



EVALUATION OF BRAIN-NATRIURETIC PEPTIDE AND ITS ASSOCIATION WITH LACTATE LEVELS IN CONGESTIVE HEART FAILURE PATIENTS

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ABSTRACT

Introduction: Congestive Heart failure is a common cardiovascular condition and a major public health problem. Lactate is an end-product of anaerobic cell metabolism. Brain Natriuretic Peptide is a hormone secreted by the ventricles in the heart as a response to left ventricular stretching or wall tension.

Aim: To evaluate the association of Brain-Natriuretic peptide with Serum lactate levels in Congestive Heart Failure patients.

Materials and Methods: Total 100 diagnosed cases of Congestive Heart Failure, age between 18-65 years of either gender were included. Patients with cardiopulmonary arrest, cardiogenic shock, acute coronary syndrome or infection and other chronic disease were excluded. Total patients were divided into 2 groups on the basis of lactate levels. Group-1 included patients with lactate levels <2.0 mmol/L and Group-2 with lactate levels 2.0 mmol/L.

Results and Discussion: The levels of Brain-Natriuretic Peptide were significantly high among patients with lactate levels 2.0 mmol/L, when compared with patients had lactate levels <2.0 mmol/L.

Conclusion: Finding of the study suggested that there is a strong correlation between Serum Lactate level and Brain-Natriuretic Peptide level. Screening of Heart Failure patients for these parameters can be helpful in better management of such patients and in averting the risk of mortality.

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INTRODUCTION

Congestive Heart failure (CHF) is a common cardiovascular condition and a major public health problem having a prevalence of over 23 million worldwide (Nogueira PR *et al.*, 2010). It is a complex clinical syndrome that underlines the incapability of the heart to perform its circulatory function with the desired efficiency due to functional or structural (systolic or diastolic) alterations (Gelfman LP *et al.*, 2017). CHF is a leading cause of morbidity in adult population characterized by dyspnea, fatigue, and signs of volume overload, which may include peripheral edema and pulmonary rules (Sarhat E *et al.*, 2018).

Lactate is an end-product of anaerobic cell metabolism, signalling tissue hypoxia, most often due to impaired peripheral perfusion (Andersen LW *et al.*, 2014). The interpretation of systemic lactate level is far more complex and reflects tuned balance between lactate production and elimination. Lactate of 1,400–1,500 mmol/L per day is formed from the reduction of pyruvate which is generated largely by anaerobic glycolysis (Jeppesen JB *et al.*, 2013).

Brain Natriuretic Peptide (BNP) is a hormone secreted by the ventricles in the heart as a response to left ventricular stretching or wall tension (Doust J *et al.*, 2006). It is synthesized mainly in the heart, and to a lesser extent in other organs (Massimo Volpe *et al.*, 2004). It is synthesized as pre-hormones and subsequently cleaved to obtain a biological active -carboxy terminal peptide along with the amino-terminal end (Rubattu S *et al.*, 2001), (Tonne JM *et al.*, 2011), (Chauhan SD *et al.*, 2004)

Nowadays a number of different biochemical markers have been identified in heart failure patients that could indicate the patient's severity. Among them, probably the most useful is BNP and Lactate, because it is easily obtained and because of its diagnostic and prognostic information. Therefore the objective of the study was to evaluate the association between BNP and lactate in CHF patients.

MATERIALS AND METHODS

The study was conducted in Department of Biochemistry in collaboration with Department of Cardiology of Mahatma Gandhi Medical College & Hospital, Jaipur. Proper history and consent was taken before enrolling the patients for the study.

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Total 100 clinically diagnosed cases of CHF, age between 18-65 years of either gender were included. Patients with cardiopulmonary arrest, cardiogenic shock, concurrent acute coronary syndrome or infection and any other chronic disease were excluded from the study. Total patients were divided into 2 groups on the basis of lactate levels. Group-1 included Congestive Heart Failure patients with lactate levels <2.0 mmol/L and Group-2 with lactate levels ≥ 2.0 mmol/L.

Blood samples were collected by veni-puncture using standard techniques and analyzed for the estimation of serum Lactate by Colorimetric-Lactate oxidase method and Brain-Natriuretic Peptide by ADVIA Centaur- Chemiluminescence (CLIA) assay.

The results obtained were presented as mean±SD and subjected to statistical evaluation. BNP was analyzed and were compared between Lactate levels in Congestive Heart Failure by applying student t-test. A p-value of 0.05 shall be considered as statistically significant.

RESULTS

Among 100 CHF patients, highest number of cases were in the age group 56-65 years (60%), followed by 18.96% of the total cases in age group 46-55 years. The number of males was higher than females among the cases. When total cases were distributed on the basis of Lactate levels, then 62% patients had lactate level ≥ 2.0 mmol/L and remaining 38% patients had lactate level <2.0 mmol/L. The population mean of BNP was 501.68±777.60 and the mean of BNP in CHF patients with lactate level ≥ 2.0 mmol/L was significantly high when compared with patients with lactate level <2.0 mmol/L.

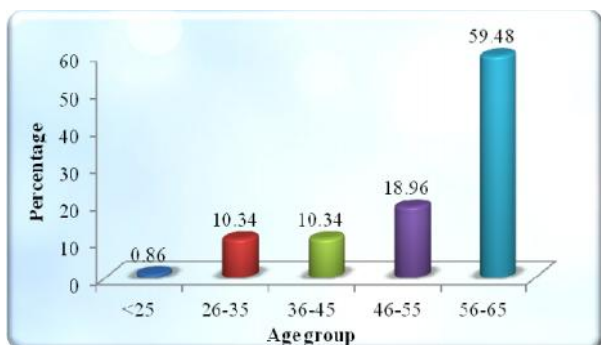


Fig 1 Distribution of CHF patients on the basis of Age

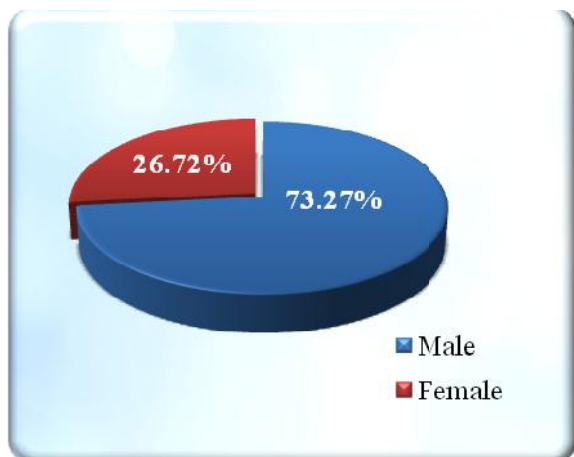


Fig 2 Distribution on the basis of Gender

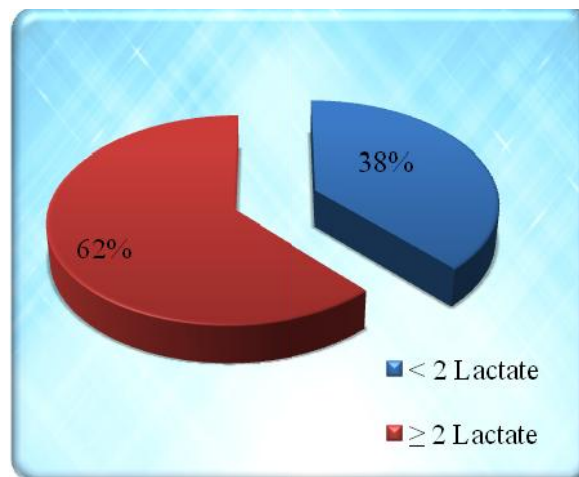


Fig 3 Distribution on the basis of Serum Lactate level

Table 1 Distribution of CHF patients on the basis of BNP

Parameter	Population mean (n=100)	Serum Lactate < 2.0 mmol/L	Serum Lactate ≥ 2.0 mmol/L	t-test	P-value
Brain-Natriuretic Peptide (BNP) pg/ml	501.68±777.60	116.90±153.34	899.96±948.64	-6.257	<0.0001

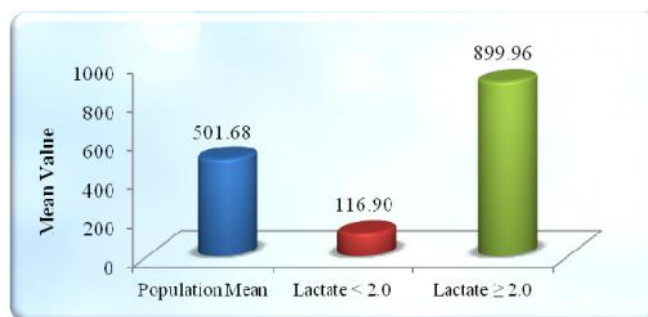


Fig 4 Distribution of CHF patients on the basis of BNP pg/ml

DISCUSSION

The present study was planned to evaluate the correlation of BNP and Lactate among 100 CHF patients. Patients were selected on the basis of predefined exclusion and inclusion criteria and after obtaining informed consent.

Fig.1 exhibits the distribution of cases on the basis of age. The number of case was observed to be higher in the age group 56 years to 65 years. Almost 60% of the cases belonged to this age group followed by 18.96% of the total cases in age group 46-55 years. A study by Zymlinski R *et al* 2018, reported a mean age of 67±12 years in heart failure patients (Zymlinski R *et al.*, 2018).

Fig.2 demonstrated the distribution of cases on the basis of Gender. The number of males was higher (73.27%) than females among total CHF patients. Higher percentage of male patients as compared to female among heart failure patients were reported by Zymlinski R *et al* 2018. Mehta *et al* 2006 concluded in their study that the incidence and prevalence of heart failure is lower in woman than in men at all ages or larger number of elderly women in the populations of the developed country (Mehta *et al.*, 2006). Another study by Adamo L at al 2017 reported in their study that 81% patients were males as compared to only 19% female patients (Adamo L at al., 2017).

When total cases were distributed on the basis of Lactate levels, then 62% patients had lactate level ≥ 2.0 mmol/L and remaining 38% patients had lactate level <2.0 mmol/L as

shown in Fig:3.

Previously, there was lack of any simple biochemical marker of blood which could diagnose heart failure and monitor progression. BNP has gained recognition as a reliable cardiac marker. Its role in detecting and monitoring heart failure is being extensively studied now day (Callender T *et al.*, 2014). Table:1 & Fig:4 represented the mean BNP of total population and further the level in lactate level <2.0 group and in lactate level 2.0 group. On applying student t-test between these two group, it was found to be statically highly significant with p-value <0.0001. Although, the mechanism of secretion of BNP and that of production of lactic acid are not directly associated but both involve cardiac muscle stretching and are influenced by Congestive heart failure events. Increase BNP level are indicate of poor prognosis and is a recommended test for patient who are at high risk of level Heart Failure.

A study by Ishak S *et al* 2012, reported that there is strong and convincing evidence that BNP is a reliable and useful biomarker in acute dyspnea due to CHF and has a diagnostic as well as prognostic value. They further concluded that due to its prognostic implication it is recommended that BNP should be measured in all the patients with clinical signs of CHF even if the diagnosis is apparent (Ishak S *et al.*, 2012).

Another study by Osca J *et al* 2002, demonstrated that BNP increased in proportion to the left ventricular dysfunction and severity of the heart failure and concluded that BNP determinations would complement the information provided by other variables used in the diagnosis of Heart Failure (Osca J *et al.*, 2002).

CONCLUSION

The present study was planned to evaluate the association of Serum Lactate level and BNP level in patients of CHF. Finding of the study suggest that there is a strong association between Serum Lactate level and BNP level. Screening of Heart Failure patients for these parameters (Serum Lactate level and BNP) can be helpful in better management of such patients and in averting the risk of mortality.

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