



STUDY OF BRAIN-NATRIURETIC PEPTIDE, LACTATE LEVELS AND BLOOD PRESSURE IN PATIENTS WITH CONGESTIVE HEART FAILURE

Biochemistry

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ABSTRACT

INTRODUCTION: Congestive Heart Failure is a complex physiological syndrome caused from structural or functional alterations to the myocardium. Lactate is produced by anaerobic metabolism and Brain-Natriuretic peptide is secreted by the heart ventricles in response to left ventricular stretching or wall tension.

AIM: The aim of the study was to evaluate Brain-Natriuretic Peptide, Lactate levels and Blood pressure in Congestive Heart Failure patients and compared them with healthy individual.

MATERIALS AND METHODS: Total 80 participants who fulfilled the inclusion and exclusion criteria were enrolled in the study. They were divided into two group i.e., case and control group. Case group included 40 patients of Congestive Heart Failure, age between 18-65 years and control group comprised of 40 healthy individuals with similar age range. Blood sample were drawn and analyzed for the evaluation of Serum lactate and Brain-Natriuretic Peptide. Blood Pressure was also measured in both the groups.

RESULT: The present study has demonstrated that the level of Brain-Natriuretic Peptide and lactate were significantly high in Congestive heart failure patients when compared with control group. Systolic and Diastolic blood pressure were also higher among patients group.

CONCLUSION: The results of the study suggested that the levels of Lactate and Brain-Natriuretic Peptide were high in Congestive heart failure patients when compared with healthy individual. Systolic and Diastolic blood pressure were also higher among patients group. Elevated lactate and Brain-Natriuretic Peptide level can be recommended as useful indicator of poor prognosis and hence can be helpful in early identification of patients at risk.

KEYWORDS

Congestive Heart Failure, Systolic Blood Pressure, Diastolic Blood Pressure, Lactate

INTRODUCTION

Congestive Heart Failure (CHF) is a complex physiological syndrome caused from structural or functional alterations to the myocardium¹, in which the heart cannot pump enough blood to adequately supply the rest of the body². It is an irreversible condition that often causes symptoms that make everyday life very difficult. Patients with heart failure experience various emotional as well as physical symptoms such as dyspnea, sleeping difficulties, fatigue, edema, depression, and chest pain^{3,4}. These symptoms limit patient's daily physical and social activities and result in poor quality of life⁵⁻⁷.

The estimated prevalence of heart failure in India due to several causes is 1.3-4.6 million and its annual incidence is 0.4-1.8 million. The reasons for these higher figures appear to be the ill effects of industrialization, continuing prevalence of rheumatic heart disease, restricted access to health care facilities, and growing size of old age population⁸.

Lactate is produced by anaerobic metabolism and is the most important fuel of the heart under stress/ shock conditions. Lactate production can be increased in conditions that cause inadequate oxygen delivery as well as in conditions that have disproportionate oxygen demands⁹. It may reflect inadequate tissue perfusion in conditions such as Congestive heart failure¹⁰. Brain-Natriuretic Peptide (BNP) was isolated in porcine brains¹¹. It is secreted by the heart ventricles in response to left ventricular stretching or wall tension. It may be a backup hormone that is activated only after a prolonged period of volume overload¹².

Monitoring of Blood Pressure during screening in CHF patients is important for proper clinical management. Therefore, the aim of the study was to evaluate the lactate, BNP levels and Blood Pressure in patients with CHF and compared them with healthy individuals.

MATERIALS AND METHODS

The study was conducted in Department of Biochemistry in association with Department of Cardiology, Mahatma Gandhi Medical College & Hospital, Jaipur, after seeking approval from Institutional

Ethics Committee (IEC) and consent from enrolled participants. Total 80 participants including 40 CHF patients, age between 18-65 years and 40 controls with similar age range were included in the study and below the age of 18 years and patients with cardiopulmonary arrest on admission, acute coronary infection, Cardiogenic shock, acute and thyroid dysfunction were excluded from the study.

Blood samples were collected using the standard aseptic technique and analyzed for the estimation of Serum lactate by Colorimetric-Lactate oxidase method and BNP by ADVIA Centaur- Chemiluminescence (CLIA) assay. Blood pressure was also assessed in all enrolled participants.

Results obtained after analysis were presented as mean $\pm$ SD between two groups, i.e., CHF patients (n=40) and healthy individuals (n=40). The result of the patient group was compared with those of the healthy individuals group by applying the Student's t test. A p-value of ≤ 0.05 was considered significant for all statistical tests.

RESULTS

In the present study, the mean age in CHF patients (54.27 $\pm$ 9.31 years) and the healthy individuals group (53.60 $\pm$ 12.72 years) was comparable. The levels of BNP and lactate were significantly high in CHF patients when compared with healthy individuals group. Systolic and Diastolic blood pressure were also higher among patients group.

DISCUSSION

Heart failure is a major public health problem worldwide entailing high morbidity and mortality as well as high costs. The present study was planned to evaluate the levels of Serum Lactate & BNP and Blood Pressure in 40 CHF patients and compared them with 40 healthy individuals. Patients were selected on the basis of inclusion and exclusion criteria.

The mean age in CHF patients (54.27 $\pm$ 9.31 years) and the healthy individuals group (53.60 $\pm$ 12.72 years) was comparable. A study by Adamo L et al 2017¹³, reported almost similar mean age (57 $\pm$ 11.46

years). Table.1 and Fig. 1: exhibits that, when serum lactate levels were compared between CHF patients and healthy individuals, then a statistically significant increased was found in patients group. Lactate is produced in the most of the human tissue with a very high production in skeletal muscle. It is the end product of anabolic glycolysis. Plasma lactate levels indicate and tolerance between the process of lactate production and its clearance.

A study by Sauser K et al 2016¹⁴, reported that elevated lactate levels are most commonly associated with shock states, given their rise due to ischemia from hypoperfusion. They further concluded that more aggressive management initially or during hospitalization, or reflect a unique pathophysiology of worsening perfusion despite appropriate treatment.

Table:1 & Fig:2 represented that, when BNP levels were compared between CHF patients and healthy individuals, then a statistically significant increased was found in patients group. A study by Maisel et al study¹⁵, reported that the mean BNP value among those diagnosed with Heart Failure was 675 pg/mL. Another study by Ishak S et al 2012¹⁶, concluded in their study that BNP should be measured in all the patients with clinical signs of CHF. They further concluded that, rapid measurement of BNP may reduce the total treatment cost of patients

Tables and Figures:

Table 1: Comparison of Serum Lactate, BNP levels, Systolic Pressure and Diastolic Pressure between Cases and Control group

	Cases (n=40)	Control (n=40)	t-value	p-value
Lactate (mmol/L)	2.62 ± 0.61	0.90 ± 0.48	14.01	<0.0001
BNP (pg/ml)	365.85 ± 166.98	52.51 ± 20.23	11.78	0.0001
Systolic Pressure (mmHg)	137.25 ± 18.52	119.92 ± 3.38	5.82	<0.0001
Diastolic Pressure (mmHg)	87.50 ± 6.09	77.92 ± 5.70	7.26	0.0001

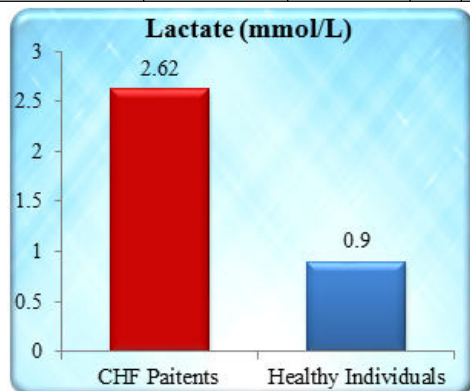


Fig.1: Comparison of Serum Lactate levels between CHF Patients and Healthy Individuals

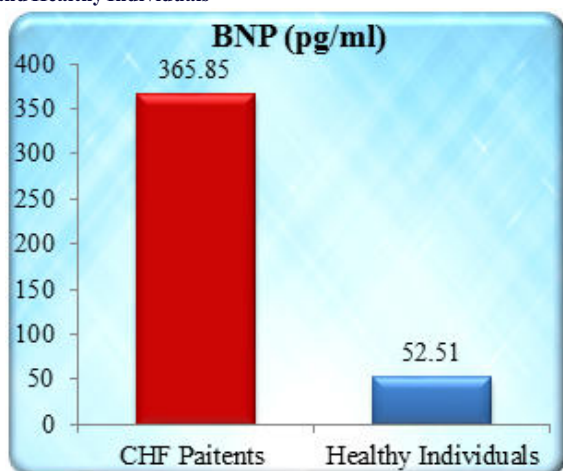


Fig.2: Comparison of BNP levels between CHF Patients and Healthy Individuals

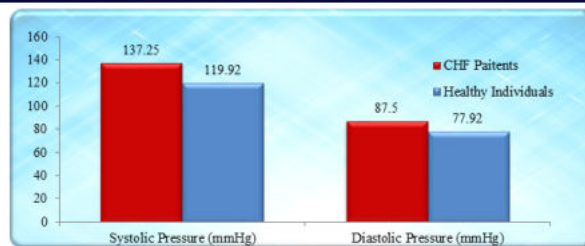


Fig.3: Comparison of Systolic and Diastolic Blood Pressure between CHF Patients and Healthy Individuals

In the present study, when Blood Pressure were measured among total participants, then a significantly increased in Systolic as well as Diastolic blood pressure were found among CHF patients, when compared with healthy individuals as shown in Table.1 & Fig.3. High lactate level as indicative of hypoxic and anabolic glycolysis which probably affects heart functions and lead to high blood pressure. A study by Oh G et al 2020¹⁷, reported in their study that, among chronic hypertension patients, functional as well as structural changes in the heart can lead to Heart Failure. They further concluded in their study that, Blood Pressure management can also prevent further disease progression.

CONCLUSION

The present study was planned to evaluate Serum Lactate, BNP levels and blood pressure in CHF Patients. Finding of the study suggest that the levels of Lactate and BNP were high in CHF patients when compared with healthy individual. Systolic and Diastolic blood pressure were also higher among patients group. Elevated lactate and BNP level can be recommended as useful indicator of poor prognosis and hence can be helpful in early identification of patients at risk. Monitoring of Blood pressure during screening as well as follow up among CHF patients is recommended for proper clinical management.

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