ORIGINAL RESEARCH PAPER

Volume-7 | Issue-8 | August-2018 | PRINT ISSN No 2277 - 8179

INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

DIAGNOSTIC VALUE OF BRAIN NATRIURETIC PEPTIDE(BNP) AND B-ENDORPHIN(B-EP) AS MARKERS REGARDING ASSESSMENT OF ACUTE HEART FAILURE

Cardiology

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ABSTRACT

Acute heart failure pertains to the symptom and signs the sudden onset of heart failure, or worse, which requires urgent medical treatment and hospitalization. It is a severe life-threatening disease, and it is the most common in clinic. Due to its clinical onset, illness, rapid disease progression, and prognosis, there is a great uncertainty due to the high expectations of patients. At the same time, medical disputes in the medical diagnosis and treatment of this disease can easily occur. Hence, there is a need to perform a correct diagnosis and evaluate this in a short period of time, in order to allow for reasonable treatment measures and improve the prognosis of patients. It is difficult to diagnose heart failure, while echocardiography can effectively evaluate cardiac systolic function. However, diastolic function evaluation is limited and cannot be applied for emergency situations. Hence, there is a need to seek a more convenient and feasible method with high specificity and sensitivity. Plasma brain natriuretic peptide (BNP) and beta-endorphin (β-EP) are important markers for heart failure. Therefore, β-EP and BNP levels have been monitored for the early diagnosis and treatment of acute left heart failure. The details are reported as follows. This study aims to evaluate the diagnostic value of beta-endorphin (β-EP) and brain natriuretic peptid (BNP) plasma concentrations for the early diagnosis of acute left heart failure and atrial fibrillation. A total of 40 patients were included. These patients comprised 22 male and 18 female patients,and 20 healthy subjects who underwent physical examinations in the Outpatient Department during the same periodwere included and assigned to the control group. Enzyme-linked immunosorbent assay was performed to detect the plasma concentration of β-EP and BNP in the treatment and control groups, and electrocardiogram targeting was performed to determine the left ventricular ejection fraction (LVEF). BNP, β-EP, and LVEF levels were higher in the treatment group compared with the control group. The P-values were .015, .019, and .026, respectively, which were <.05. The difference was statistically significant. In conclusion, β-EP and BNP have high specificity and sensitivity for identifying early intense left heart failure and atrial fibrillation in patients, which is advantageous, simple to perform, and appropriate for clinical applications.

KEYWORDS

Acute left heart failure, Atrial fibrillation, Diagnosis, Beta-Endorphin, Brain Natriuretic Peptide.

INTRODUCTION

Heart failure (HF) is a clinical syndrome caused by structural and functional defects in myocardium resulting in impairment of ventricular filling or the ejection of blood. The most common cause for HF is reduced left ventricular myocardial function; however, dysfunction of the pericardium, myocardium, endocardium, heart valves or great vessels alone or in combination is also associated with HF. Some of the major pathogenic mechanisms leading to HF are increased hemodynamic overload, ischemia-related dysfunction, ventricular remodeling, excessive neuro-humoral stimulation, abnormal myocyte calcium cycling, excessive or inadequate proliferation of the extracellular matrix, accelerated apoptosis and genetic mutations. The term "acute" is used to mean rapid onset, and "chronic" refers to long duration. Despite having various clinical manifestations, AHF mostly presents with difficulty in breathing and/or signs of congestion. Thus, it can also be called a syndrome. AHF is classified into two groups according to the presence/absence of previous HF: Worsening (decompensated) HF - Preexisting and stable HF that worsens suddenly or progressively is described as decompensated AHF and New (de novo) HF - There is no known previous HF. Symptoms and findings appear suddenly after an acute event [e.g. acute myocardial infarction (AMI)] or gradually in the presence of asymptomatic left ventricular systolic and/or diastolic dysfunction. Due to its clinical onset, illness, rapid disease progression, and prognosis, there is a great uncertainty due to the high expectations of patients. At the same time, medical disputes in the medical diagnosis and treatment of this disease can easily occur. Hence, there is a need to perform a correct diagnosis and evaluate this in a short period of time, in order to allow for reasonable treatment measures and improve the prognosis of patients. It is difficult to diagnose heart failure, while echocardiography can effectively evaluate cardiac systolic function. However, diastolic function evaluation is limited and cannot be applied for emergency situations. Hence, there is a need to seek a more convenient and feasible method with high specificity and sensitivity. Plasma brain natriuretic peptide (BNP) and beta-endorphin (β-EP) are important markers for heart failure. Natriuretic peptides have well-known diuretic, natriuretic, and vasodilatory properties. The cardiovascular actions actually belong to atrial natriuretic peptide (ANP) and B-type natriuretic peptide (BNP). C-type natriuretic peptide affects mainly vascular endothelial system rather than the heart. The most extensively studied member of the family is BNP which is synthesized in response to the ventricular wall tension. BNP is a hormone consisting of 32 amino acids including the 17 aminoacid ring form (single ring) which is specific to all natriuretic peptides. Inactive NT-proBNP and biologically active molecule BNP are secreted into blood in equimolar amounts, therefore both can be used to assess ventricular tension. ANP is stored in atrial granules and can be released in a significant amount into blood even by a slight stimulus. However, measuring the level of active ANP molecules is not practical in the clinical setting because it has a relatively short half-life. Attempts to measure its biologically inactive portion (NT-proANP) have also been unsuccessful. However, MR-proANP (mid-regional proANP the antigenic region in central of the precursor molecule) can be measured. Study showed that a cut-off limit of 120 pg/mL is non-inferior to BNP for diagnosing AHFF. β-Endorphin is an endogenous opioid neuropeptide and peptide hormone that is produced in certain neurons within the central nervous system and peripheral nervous system. It is one of three endorphins that are produced in humans, the others of which include α-endorphin and γ-endorphin. The amino acid sequence is: Tyr-Gly-Gly-Phe-Met-Thr-Ser-Glu-Lys-Ser-Gln-Thr-Pro-Leu-Val-Thr-Leu-Phe-Lys-Asn-Ala-Ile-Ile-Lys-Asn-Ala-Tyr-Lys-Lys-Gly-Glu (31 amino acids). The first 16 amino acids are identical to α-endorphin. β-Endorphin is considered to be a part of the endogenous opioid and endorphin classes of neuropeptides; all of the established endogenous opioid peptides contain the same N-terminal amino acid sequence, Tyr-Gly-Gly-Phe, followed by either -Met or -Leu. Function of β-endorphin has been known to be associated with hunger, thrill, pain, maternal care, sexual behavior, and reward cognition. In the broadest sense, β-endorphin is primarily utilized in the body to reduce stress and maintain homeostasis. In behavioral research, studies have shown that β-endorphin is released via volume transmission into the ventricular system in response to a variety of stimuli, and novel stimuli in particular. Therefore, β-EP and BNP levels have been monitored for the early diagnosis and treatment of acute left heart failure. The details are reported as follows. This study aims to evaluate the diagnostic value of beta-endorphin (β-EP) and brain natriuretic peptid (BNP) plasma concentrations for the early diagnosis of acute left heart failure and atrial fibrillation.

PATIENTS AND METHODS

Study design: This is a prospective cross-sectional study.

Approval: This study received approval from college ethical committee.

Setting: Hyderabd.

Participants: patients admitted in Hospital.

Study period : June 2016 – December 2017

OBSERVATIONS AND RESULTS

BNP, b-EP, and LVEF results in patients with acute left heart failure

BNP, b-EP, and LVEF levels in patients with acute left heart failure were compared with that in healthy controls. BNP, b-EP, and LVEF levels were higher in the case group (679.01±304.38 ng/L, 392.10±178.67ng/L, 69.45±17.52%) than in the control group (34.10±8.30 ng/L, 75.67±56.31ng/L, 33.13±5.17%)(t=14.05, 9.17, 0.028, respectively). P<.05 was considered statistically significant (Table 1).

Table 1. Test results of the BNP, b-EP, and LVEF ðx ± sÞ.

	BNP, ng/L		b-EP, ng/L		LVEF, %	
Patients	679.01	±304.38	392.10	±178.67	33.13	±5.17
Controls	34.10	±8.30	75.67	±56.31	69.45	±17.52
t	14.05	9.17	4.3			
P	.016		.020		.028	

The correlation of BNP and b-EP in patients with acute left heart failure

BNP and b-EP in patients with acute left heart failure were positively correlated (r = 0.895, P< .001; Table 1).

Comparison of the diagnostic features of BNP and b-EP for acute left heart failure

In terms of BNP, b-EP, and the combination of BNP and b-EP for the diagnosis of acute left heart failure, the maximize Youden index sensitivity, specific degree, area under the ROC curve (AUC), and 94% confidence interval (CI) were 92.5%, 79.3%, 0.871, 0.851, 0.893; 79.9%, 78.6%, 0.697, 0.505, 0.697; 95.2%, 84.6%, 0.614 to 0.989 and 0.989, respectively, as shown in Table 2.

Table 2. The BNP and b-EP for acute left heart failure diagnostic features comparison.

	Cut-off, ng/L	Sensitivity, %	Specificity, %	95% CI	AUC
BNP	55.50	92.5	79.3	0.841–0.947	0.921
b-EP	81.53	79.9	78.6	0.505–0.889	0.697
BNP and b-EP		95.2	84.6	0.614–0.989	0.971

Comparison of BNP and b-EP levels in acute left heart failure patients among the different LVEF groups

Plasma BNP and b-EP levels in acute left heart failure patients of the LVEF 50% group were significantly lower than those of the LVEF <50% group (P <.05). The BNP, b-EP, and LVEF levels were negatively correlated (r = 0.741, 0.635; P =.013, .018), as shown in Table 3.

Table 3. The level of BNP and b-EP between different LVEF group comparisons in acute left heart failure patients ð ± sÞ.

LVEF, %	Cases, n	BNP, ng/L	b-EP, ng/L
≥50	18	200.19 ±116.63	179.31 ±101.67
<50	22	612.354 ±239.17	347.14 ±171.29
t		10.92	9.42
P		.015	.017

DISCUSSION

In the present study, patients with acute left heart failure were compared with healthy controls. It was found that plasma BNP levels were higher in the cases group)than in the control group and the difference was statistically significant. Acute left heart failure was significantly lower in patients in the LVEF group 50% or higher plasma BNP compared to the LVEF< 50% group, and was negatively correlated with BNP and LVEF. This suggests that BNP and LVEF were correlated, and that the cardiac systolic function index also can be used in the reaction. The results of this study show that the cutoff value of BNP for acute left heart failure diagnosis was <55.50 ng/L based on maximize Youden index sensitivity, specific degree, AUC, and 95% CI,area under the ROC curve (AUC), and 94% confidence interval (CI) were 92.5%, 79.3%, 0.871, 0.851, 0.893, respectively. The result was higher than that of the Chinese guidelines for the diagnosis and treatment of heart failure. In this experimental study, the plasma level of b-EP in patients with acute left heart failure was higher than that in the control group; and the difference was statistically significant. The plasma b-EP level in patients with acute left heart failure in the LVEF group 50% or higher was, which was significantly lower than that in the LVEF <50% group; and b-EP and LVEF were negatively correlated (r = 0.635, P = .018). The difference was statistically significant. According to literature, the heart started after the acute myocardial ischemia injury mechanism of self-protection, the activation of the opioid system in the body, causing the release of endogenous opioid peptides in the body, making the plasma b-EP levels rise rapidly, inducing myocardial ischemia. Furthermore, b-EP increases the extent and the degree of myocardial ischemia, the myocardial necrosis area, cardiac function, etc. The experiment results show that b-EP was significantly higher in patients with acute left heart failure than in subjects of the control group, and LVEF was negatively correlated. The acute left heart failure diagnosis value of b-EP was <81.53 ng/L, which was based on the maximum Youden index of degree of sensitivity, specificity, AUC,and 95% CI which were 79.9%, 78.6%, 0.697, 0.505, 0.697, respectively. b-EP has a certain diagnostic value for acute left heart failure. The consideration of traditional diagnosis for acute left heart failure mode depends on medical history, physical examination, echocardiography, and blood gas analysis. However, these have been able to meet the needs of the existing clinical diagnosis model. The diagnosis and treatment of heart failure guidelines suggest that for BNP in patients with acute left heart failure detection, echocardiography and blood gas analysis detection should be employed to improve the accuracy of acute left heart failure diagnosis, which is gradually becoming the clinical diagnosis mode at present.[16–20] This study revealed that a cutoff value of BNP for acute left heart failure was <55.50 ng/L, based on sensitivity, specific degree, AUC, and 95% CI were 95.2%, 84.6%, 0.614 to 0.989 and 0.989, respectively, which has a good diagnosis performance. Furthermore, this clinical study revealed that b-EP distribution and receptors in heart blood vessels, myocardial cell secretion also can synthesize b-EP and participates in the regulation of cardiovascular function. Furthermore, BNP has a certain gap in the early diagnosis of acute left heart failure. However, naloxone can reverse b-EP-mediated cardiopulmonary cerebral inhibition function. Hence, b-EP is expected to be used to monitor the efficacy of naloxone treatment. The level of BNP and b-EP is negatively correlated with LVEF in echocardiography indexes (r =0.741, 0.635, P = .013, 0.018), and acute left heart failure patients with BNP and b-EP were 4 correlations (r = 0.895, P< .001). In combination of the BNP and b-EP for acute left heart failure diagnosis in maximum Youden index sensitivity, specific degree, AUC and 95% CI, the results were 93.9%, 82.9%, 0.598, 0.603 and 0.603.

CONCLUSIONS

In conclusion, plasma BNP and b-EP levels and echocardiographic heart failure correlation index has a certain relevance, which can be used for diagnosing patients with acute left heart failure and in evaluating the severity of cardiac function. These have certain advantages such as they are convenient and fast. When combining BNP and b-EP, the diagnostic efficiency of early acute left heart failure can be improved. β-EP and BNP have high specificity and sensitivity for identifying early intense left heart failure and atrial fibrillation in patients, which is advantageous, simple to perform, and appropriate for clinical applications.

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