



Correlation of Serum and Pericardial Fluid Amino Terminal Pro-B-type Natriuretic Peptide

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Authors' contributions

This work was carried out in collaboration between all authors. Author SS Conceived, designed, did editing for intellectual contents and final approval of manuscript. Author HRA designed, editing and final approval of manuscript. Author SA did manuscript writing, literature review, acquisition of data and statistical analysis. All authors read and approved the final manuscript.

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ABSTRACT

Objective: To investigate the correlation of pericardial fluid and serum NT-proBNP levels in patients during coronary artery bypass grafting (CABG).

Study Design: Crosssectional study.

Place and Duration of the Study: This study was conducted over a period of one year from March 2010 to March 2011 in Physiology Department Ziauddin University, Clifton Karachi.

Methodology: A crosssectional study was done on 50 patients, undergoing CABG. Both the samples of serum and pericardial fluid were collected during CABG and NT-proBNP levels were assessed by an electrochemiluminescence immunoassay. The log transformation of NT-proBNP concentrations was done. We investigated the correlation of the pericardial fluid and serum levels of log NT-proBNP.

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Results: Pericardial fluid log NT-proBNP was estimated to be 2.7 ± 0.54 pg/ml in contrast to a serum level of 2.2 ± 0.6 pg/ml in 50 CABG patients. It was found that pericardial fluid NT-proBNP levels were significantly correlated with its serum levels with an r value of 0.85 and a p -value of < 0.0001 . The pericardial fluid- serum ratio has been estimated to be 1.25.

Conclusion: Serum NT-proBNP levels have significant correlation with its pericardial fluid levels. It can be used alone in the clinical practice provided kidneys function normally.

Keywords: Amino terminal pro-B-type natriuretic peptide; natriuretic peptide; pericardial fluid- serum ratio; CABG.

1. INTRODUCTION

Cardiac dysfunction has been a global epidemic in health care and is a major cause of mortality and morbidity all over the world [1]. This most commonly seen cardiovascular condition is caused by coronary artery disease, hypertension, diabetes mellitus, cardiotoxic drugs, valvular heart disease and obesity [2,3]. After the development of ventricular dysfunction (VD) remodeling of the vascular tree occur by a number of hemodynamic and neurohormonal factors which include the adrenergic and renin-angiotensin-aldosterone systems (RAAS) [4]. One of the key neuroendocrine factors is the natriuretic peptide (NP) system.

The NP system consists of the three NPs, A-type natriuretic peptide (ANP), B-type natriuretic peptide (BNP), and C-type natriuretic peptide (CNP) respectively [4]. These NPs are involved in body fluid homeostasis and blood pressure control by causing vasodilatation, natriuresis, suppression of the renin-angiotensin system (RAS), and inhibition of both cardiomyocyte hypertrophy and cardiac fibroblast activation [5]. In these NPs most sensitive and specific marker of VD is BNP whereas ANP is less specific [6]. The precursor of this NP, PreproBNP (134 amino acid peptide) is released in the myocytes in response to increased cardiac ventricular wall stress and is broken down into ProBNP (a 108-amino-acid peptide) [4]. ProBNP is cleaved by a circulating endoprotease into inactive NT-pro-BNP and BNP (a 32-amino-acid peptide), a bioactive peptide [7]. NPs bind to two guanylyl cyclase coupled effector receptors (NP receptors A and B) and a clearance receptor (NP receptor C) [8].

It has been reported that the patients presenting to the emergency with dyspnoea should be evaluated by BNP and NT-pro-BNP to differentiate between cardiac and non-cardiac causes of dyspnea [9]. Thus both BNP and NT-proBNP are probable biomarkers for left VD [10].

Longer half life and more stability of NT-proBNP, makes it more suitable marker of cardiac dysfunction [11].

Pericardial fluid is more closely related with left ventricle than serum hence pericardial fluid NT-proBNP may be a good predictor of ventricular function [8]. Many studies have reported that pericardial fluid levels of cardiac peptides are higher than plasma but due to difficulty in getting pericardial fluid we cannot measure its level as a routine investigation [12,13]. However correlation of pericardial fluid NT-proBNP with the serum can predict that how good serum NT-proBNP is related to ventricular function. This study aimed to measure both pericardial and serum NT-proBNP in patients undergoing coronary artery bypass grafting (CABG) and correlate them.

2. METHODS

A crosssectional study was done on fifty consecutive patients undergoing CABG. Patients were recruited from South City Hospital, Karachi. The study was approved by the ethic committee of Ziauddin University. Consent was taken from all the patients. Samples of pericardial fluid and blood were taken in glass tubes during CABG, clarified by centrifugation at 3000 g for 10 min at room temperature, and rapidly frozen at -80°C in sterile plastic tubes until use. In both the samples of serum and pericardial fluid collected during CABG, NT-proBNP levels were assessed by proBNP electrochemiluminescence immunoassay (Roche Diagnostics, Mannheim, Germany cat # 04842464 190).

2.1 Data Analysis

Data was entered and statistically analysed by using Statistical Package for the Social Sciences (SPSS) version 17.0. For continuous variables descriptive statistics was used to calculate mean and standard deviation and for categorical variables frequencies and percentages were calculated. The log

transformation of NT-proBNP levels was done. The correlation of the pericardial fluid and serum levels of log NT-proBNP was done by Pearson correlation.

3. RESULTS

Fifty, predominantly male subjects with a mean age of 58 years were enrolled (Table 1). Regarding clinical characteristics for the study cohort the patients represent with diabetes mellitus (52%), hypertension (78%), and dyslipidaemia (52%) (Table 2).

Table 1. Patient characteristics

Patient characteristics	Mean \pm SD
Age (years)	58 \pm 6.61
Male# (%)	43(86%)
Weight(Kg)	76.21 \pm 16.09
Height(cm)	165 \pm 9.95
BMI	27.89 \pm 4.83
Smokers	8 (16%)

Table 2. Clinical characteristics of the patients

Disease state	No. of patients
Hypertensive	39(78%)
Diabetics	26 (52%)
Dyslipidaemia	26 (52%)

Mean pericardial fluid log NT-proBNP was estimated to be 2.7 \pm 0.54 pg/ml and serum log NT-proBNP was 2.2 \pm 0.6 pg/ml in 50 CABG patients (Table 3). The pericardial fluid and serum NT-proBNP levels were found to be positively and significantly correlated with an r value of 0.85 and a p-value of < 0.001 (Fig. 1).

The results have also shown the ratio of the pericardial fluid- serum as 1.25 (Table 3).

Table 3. NT-proBNP levels in serum and pericardial fluid and their ratio

NT-proBNP levels	Mean \pm SD
Log Serum NT-proBNP (pg/ml)	2.20 \pm 0.60
Serum NT-proBNP (pg/ml)	667.67 \pm 862.66
Log pericardial NT-proBNP (pg/ml)	2.73 \pm 0.54
Pericardial NT-proBNP (pg/ml)	2667.82 \pm 4435.02
Pericardial –serum ratio	1.25

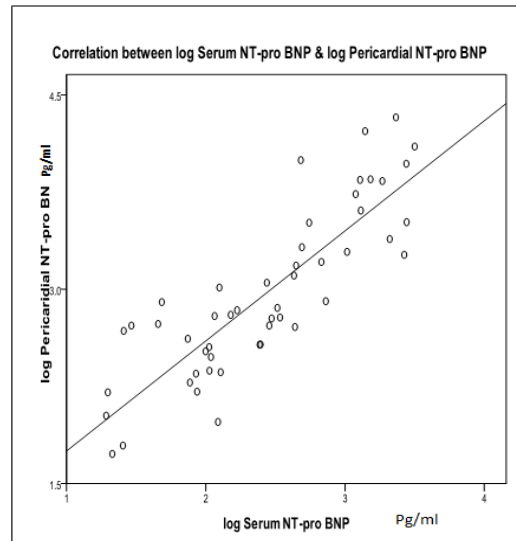


Fig. 1. Correlation of serum and pericardial fluid NT-proBNP

4. DISCUSSION

NPs have been used as biomarkers of cardiac stress and heart failure (HF) [14]. This is due to the involvement of these NPs in regulation of body fluid homeostasis and blood pressure [5]. Hence the extent of left ventricular (LV) dysfunction and the severity of HF can be assessed by the quantitative measurement of NPs [15]. Natriuretic peptides are used both as diagnostic and prognostic marker of cardiac dysfunction [16]. Of the natriuretic peptides, NT-proBNP has been reported to be a more appropriate marker of cardiac dysfunction [17].

Although studies have been done on serum and pericardial fluid levels of NT-proBNP and their correlation have been seen to be associated with the parameters of ventricular function [8]. This study investigated the correlation of pericardial fluid and serum levels of NT-proBNP. Many studies have reported that NPs in pericardial fluid give more sensitive, stable, and accurate information about left ventricular dysfunction than its plasma levels [12,13]. This may be due to the fact that NPs were secreted primarily from the ventricle into the pericardial space [12]. However a study done by Amjad et al. [8] concluded that diagnostic value of serum NT-proBNP levels, for left ventricular systolic dysfunction, has comparable results with its pericardial fluid levels.

This study has shown that serum NT-proBNP levels have significant correlation with its pericardial fluid levels in patients undergoing CABG. Hence by measuring merely serum levels, pericardial fluid levels and cardiac function can be assessed by using pericardial fluid -serum ratio. The pericardial fluid analysis has been used to study the local paracrine release of NPs from the myocardium [12,13]. But due to difficulty in getting pericardial fluid we cannot measure its level as a routine investigation. The findings of significant correlation in this study indicate that serum NT-proBNP levels provide accurate information about its pericardial fluid levels and left ventricular dysfunction in CABG patients.

The prognostic value of serum NT-proBNP levels has already been established with cardiac failure by a number of studies [12,13]. The serum NT-proBNP levels can be used to estimate both cardiac function as well as the pericardial fluid levels of NT-proBNP.

5. CONCLUSION

Since serum NT-proBNP levels have significant correlation with its pericardial fluid levels in CABG patients, the serum levels alone can be used to gauge cardiac function during different stages of heart failure provided kidneys function normally. This study shows first, the measurement of NT-proBNP in the pericardial fluid as a cardiac biomarker in CABG patients. Secondly it is well correlated with serum levels. Hence this enables serum levels of NT-proBNP alone to be used in the clinical practice, provided kidneys function normally.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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