
ASSOCIATION OF ELEVATED SERUM CARDIAC TROPONIN-I LEVEL
AND COMPLICATIONS IN ACUTE HEART FAILURE CASES

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Abstract

Acute heart failure is one of the major causes of morbidity and mortality all over the world. Available published data has suggested that patients of acute heart failure with elevated level of serum cardiac troponin-I (cTn-I) have more adverse outcomes than that of acute heart failure with normal cTn-I level. Elevated level of serum cTn-I is a potential risk factor for acute heart failure. This study was carried out in the department of Biochemistry, Dhaka Medical College and National Institute of Cardiovascular Disease (NICVD) during the period from January 2010 to December 2010. In this study, 100 patients with acute heart failure were enrolled. Out of 100 cases, 50 had elevated serum cTn-I (cTn-I \geq 1.0 ng/ml) and 50 had normal serum cTn-I (cTn-I $<$ 1.0 ng/ml). The adverse outcome of the two groups were recorded and compared. Patients with high and normal serum cTn-I had mean age of 52.40 ± 8.10 years and 54.64 ± 7.26 years respectively while male and female cases were equally distributed. Left ventricular systolic dysfunction (lower ejection fraction) was significantly ($p < 0.05$) higher among cases with elevated cTn-I level compared to those with normal level. The rate of renal failure (raised serum creatinine), impaired liver functions (raised ALT and AST) and abnormal serum electrolytes were significantly higher among the patients with elevated cTn-I compared to those with normal level. The study showed that elevated serum cTn-I level was a good biomarker to indicate adverse complications in acute heart failure cases.

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Key word: cardiac troponin-I, acute heart failure

Introduction

Heart failure is a term used to describe the state that develops when the heart cannot maintain an adequate cardiac output or can do so only at the expense of an elevated filling pressure.¹ It may occur with or without previous cardiac disease. The cardiac dysfunction can be due to systolic or diastolic dysfunction, abnormalities in cardiac rhythm or pre-load and after-load mismatch.² The adverse outcomes of the acute heart failure patients are - death, renal failure, impaired liver function, electrolyte imbalance and impaired left ventricular systolic function.¹

The predictors of adverse outcomes in acute heart failure are - older age, male gender, increased serum cardiac troponin-I (cTn-I), lower systolic blood pressure, increased serum cystatin - C, renal failure.³

Cardiac troponin-I is the inhibitory protein of the troponin-tropomyosin complex. It exists in three isoforms, one for slow-twitch and one for fast-twitch skeletal muscle, and one for cardiac muscle.⁴ cTn-I is a regulatory protein for cardiac muscle that control the calcium-mediated interaction of actin and myosin. cTn-I has been shown to be found only in cardiac muscle and studies have failed to identify any cTn-I outside of the heart. So, cTn-I is a specific marker for cardiac muscle.⁵

Recently cTn-I has also been proposed as a diagnostic and prognostic marker of acute heart failure. Increased cTn-I appears to be a sensitive and specific risk factor of complications in acute heart failure.⁶ Patients with an elevated cTn-I (\geq 1.0 ng/ml) had lower systolic

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blood pressure and a lower ejection fraction than those who had normal cTn-I.⁷ Researchers also suggested that early risk stratification of positive cTn-I patients could result in better management in terms of treatment and follow-up monitoring.

Therefore, the present study was undertaken to find out the complications of acute heart failure cases with elevated serum cTn-I level compared to those with normal levels.

Material and Methods

A total of 100 acute heart failures cases were selected purposively from the patients admitted in Cardiac Coronary Care Unit of Dhaka Medical College Hospital and National Institute of Cardiovascular Diseases (NICVD), Dhaka, from January 2010 to December 2010. The acute heart failure was diagnosed by physical examination, ECG and echocardiography. Detail clinical history and all information were recorded in a pre-designed data collection sheet. Serum cTn-I level was estimated in all study population. Based on the serum CTn-I level, the study population was divided into two groups. Group A consisted of patients having serum cTn-I level of ≥ 1.0 ng/ml while group B had cTn-I level < 1.0 ng/ml. Both the study groups were followed during the hospital stay to observe the outcomes.

Adverse outcomes namely renal failure, impaired liver function, electrolyte imbalance and left ventricular systolic dysfunction (lower ejection fraction) of both groups were observed during the hospital stay. Renal failure was diagnosed by raised serum creatinine (> 2 mg/dl), impaired liver function by elevated serum AST (> 37 IU/l) & ALT (> 40 IU/l) levels. Serum cTn-I was estimated by solid-phase enzyme-labeled chemiluminescent immunometric assay.

Values of different parameters were compared to see the difference between two groups by using student's t test, chi-square test & Fisher exact test. Written informed consents were obtained from all patients.

Results

A total of 100 patients with acute heart failure were enrolled in the study. The mean age of Group A and Group B patients were 52.40 ± 8.10 years and 54.64 ± 7.26 years respectively. Males and females

were nearly equally distributed between the groups (96% vs 92%).

Table-1 shows that significantly high ($P < 0.05$) number of group A (28%) patients in comparison to group B (10%) suffered from left ventricular systolic dysfunction (lower ejection fraction) as diagnosed by echocardiography during their hospital stay time. Renal failure was observed in 10 (20%) group A and 2 (4%) group B study subjects ($P < 0.05$). Similarly, impaired liver function was higher in group A (22%) compared to group B (8%) patients but was not statistically significant ($P > 0.05$). During the hospital stay, electrolyte imbalance was observed in 26.0% of group A compared to 4% of group B cases ($P < 0.004$).

Discussion

There are different predictors of adverse outcomes in acute heart failure cases. Cardiac troponin-I has been found to be a better marker of adverse outcomes by many workers.^{8,9} Recently, cardiac troponin- I was also proposed as a diagnostic and prognostic marker in acute heart failure.⁶ So, the present study was aimed to evaluate cTn-I as a predictor of outcomes of acute heart failure.

In the present study, acute heart failure cases with elevated serum cTn-I level compared to those with normal cTn-I level had significantly higher rate of adverse outcomes namely ventricular systolic

Table-1: The rate of complications in acute heart failure cases having elevated and normal serum cTn-I level (n=50)

Outcome	Group A n (%)	Group B n (%)	p value
Left ventricular systolic dysfunction	14 (28.0)	05 (10.0)	< 0.05
Renal failure	10 (20.0)	02 (4.0)	< 0.05
Electrolyte imbalance Na ⁺ < 135 mmol/L K ⁺ > 5.5 or < 3.5 mmol/L	13 (26.0)	2 (4.0)	< 0.004
Impaired liver function ALT > 40 IU/L AST > 37 IU/L	11 (22.0)	4 (8.0)	$> 0.05^{ns}$

Group A: Cases with elevated serum CTn-I (≥ 1.0 ng/ml), Group B: Cases with normal CTn-I level (< 1.0 ng/ml); Fisher's Exact test; ns = Not significant

dysfunction (28% vs 10%, $p < 0.05$), renal failure (20% vs 4%, $p < 0.05$) and electrolyte imbalance (26% vs 4%). Impaired liver function showed higher rate (22% vs 8%) though not statistically significant ($p > 0.05$). Similar observations were earlier reported by others.^{3,4,7,9,10}

Acute heart failure is a clinical emergency that might be fatal in some instances. Prognosis depends on many associated clinical conditions and institution of prompt treatment. A single specific easily measurable biochemical marker like serum cTn-I could play a role in the better management of the patients. Therefore, estimation of serum cTn-I in acute heart failure cases may be recommended to categorize patients for their proper management.

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