

CARDIO SPECIFIC TROPONIN-I IN PATIENTS WITH VALVULAR HEART DISEASE

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ABSTRACT

Valvular heart disease is a common cardiac disease in our country. The valvular heart disease which we face in our day to day hospital and private practice is due to chronic sequelae of rheumatic fever. In chronic rheumatic heart disease mitral valve is affected in more than 90% of cases and aortic valve is the next most frequently affected valve. This study was done to evaluate the association of Cardio specific Troponin I (cTnI) and valvular heart disease. Cross sectional study was conducted among 60 valvular heart disease patients and 30 control groups. A structured questioner and checklist was used to collect data through face to face interview, echocardiography findings and laboratory estimation of cTnI.

A total 60 patients and 30 healthy control subjects were investigated for cTnI. cTnI level was within normal physiological limits in all the control subjects. The mean value was 0.02 ± 0.00 . The mean cTnI level in aortic stenosis patients was 0.67 ± 0.81 . In mitral stenosis patients and in patients with both aortic and mitral stenosis cTnI level was also within normal physiological limits. The mean level was 0.02 ± 0.21 and 0.15 ± 0.50 respectively. Ejection fraction of all the patients were normal, indicating that cases yet not developed complication (eg; Heart failure). The cTnI in control group and aortic stenosis patients shows significant difference of mean (<0.001). But the cTnI in control group and other groups of patients shows no significant difference of mean (>0.05) cTnI level in aortic stenosis patients increases in absence of heart failure indicating that it can expose cardiomyocyte injury prior to the development of overt Left ventricular dysfunction. So that, serial monitoring of cTnI could help clinicians to give definitive treatment before development of complications.

Key words: *Cardiospecific Troponin I, Aortic stenosis.*

(Bangladesh J Physiol Pharmacol 2009; 25(1&2) : 4-6)

INTRODUCTION

Valvular heart disease is a common cardiac disease in our country. The valvular heart disease which we face in our day to day hospital and private practice is due to chronic sequelae of rheumatic fever. In chronic rheumatic heart disease mitral valve is affected in more than 90% of cases and aortic valve is the next most frequently affected valve¹.

In aortic stenosis there occurs obstruction to left ventricular out flow during systole. Pressure gradient across the aortic valve (pressure higher in left ventricle than aorta during systole) causes chronic Lt ventricular pressure overload and compensatory Lt ventricular hypertrophy. Increased wall thickness and decreased cavity size oppose the increased wall stress. The left ventricular hypertrophy initially leads to diastolic

dysfunction and later on systolic dysfunction. In the late state, left ventricular systolic function can be reduced as a result of myocardial fibrosis². The sequence of cardiac decompensation begins with ventricular dilatation, which further raises wall stress, leading to increased left ventricular hypertrophy and probably reduced blood flow to the hypertrophied myocardium, in turn leading to ischemia with reduced left ventricular ejection fraction. Furthermore, aortic stenosis is itself associated with 50% increased risk of cardiovascular mortality and myocardial infarction³.

In mitral stenosis obstruction of blood flow from Lt. atria to Lt. ventricle during diastole, causing increased pressure in the Lt. atrium, pulmonary capillaries and eventually pressure increases in the right side of the heart. As valve area gets smaller, conditions which increase valve flow from Lt. atria to Lt. ventricle (exercise, tachycardia) results in an increase in Lt. atrial pressure and worsen the condition.

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Increase Lt. atrial pressure!Pul. HTN!RV pressure overload!RV failure & tricuspid regurgitation⁴

Lt. ventricular systolic dysfunction and heart failure predict poor prognosis including a less favorable outcome after valve replacement in aortic stenosis. The onset of heart failure is preceded by structural and functional alterations in the heart muscle with degeneration and death of the cardiac myocyte⁵. Disease of the heart valves may progress with time and selected patients require regular review, usually every 1 or 2 years, to ensure that deterioration is detected before complication such as heart failure ensue¹. Detection of ongoing myocardial injury before the outbreak of overt Lt. ventricular dysfunction could help promote earlier surgery in patients without symptom or with vague symptom.

Troponin I, a protein molecule that plays an essential role in the contraction of the striated muscle. cTnI has been established as reliable and highly heart specific markers of myocyte injury. Their background concentrations in the circulation are normally undetectable or very low and they are therefore sensitive to even minor heart muscle damage. Measuring circulating cardiac TroponinI would help expose ongoing silent myocyte damage in aortic stenosis⁶. cTnI was elevated even in the absence of heart failure indicating that it can expose cardiomyocyte injury prior to the development of overt Lt. ventricular dysfunction. Serial monitoring of cTnI during follow up of asymptomatic aortic stenosis will show whether cTnI can assist in the timing of therapeutic interventions.

The aim of the study was to explore the relationship of serum cTnI and aortic stenosis. So that it will help in the detection of ongoing myocardial injury in aortic stenosis patient before the outbreak of overt Lt. ventricular dysfunction which will help to promote earlier surgery in patients without symptom or with vague symptom.

In MS no significant cardiac ischaemia develops that causes release of cTnI from cardiac myocytes. So, study of relationship between cTnI and aortic stenosis will be more significant and informative than study of relationship between cTnI and mitral stenosis.

PATIENTS AND METHODS

20 patients (2 male and 18 female) between the age ranges of 5-60 years were selected having aortic stenosis, 20 patients (3male & 17 female) between the age ranges of 18-60 years were selected having mitral stenosis, &20 patients (1male and 19 female) between the age ranges of 16-65 years were selected having both aortic and mitral stenosis, that were confirmed by echocardiography. All the patients came to the out patient department of NICVD with mild symptoms such as palpitation, chest pain, and exertional dyspnoea. Ischemic heart disease was excluded by

Echocardiography. 30 control subjects (5 male and 25 female) between the age ranges of 5-60 years were selected randomly. A blood sample for determination of cTnI was obtained by vein puncture. Micro particle enzyme immune assay was done for the quantitative determination of cTnI.

Data are presented as mean ±SD. Mann Whitney U test was done as the test of significance. A probability value of p< 0.05 was considered significant. All calculations were done with SPSS system 10.0.

RESULTS

cTnI level was within normal physiological limits in all the control subjects. The mean value was 0.02±0.00. Among the patients of aortic stenosis cTnI was undetectable in two patients, in two patients there was detectable cTnI but it was within normal physiological limits, and another sixteen patients had elevated levels of cTnI. The mean cTnI level in aortic stenosis patient was 0.67±0.81, having significant difference with control subjects (p<0.001). The mean conc of cTnI in mitral stenosis patients and in patients with both aortic and mitral stenosis were 0.02±0.21ng/ml and 0.15±0.50ng/ml respectively, both having no significant difference with the control subjects (p>0.05).

The normal ejection fraction is e"55%. The ejection fraction of cases and control subjects shows no significant difference of mean.. This indicates that cases yet not develop complications, such as heart failure (as shown by lowered ejection fraction).

Table I
Ejection fraction and cTnI in study subject.

Groups	cTnI(ng/ml)	Ejection fraction
	Mean ± SD	Mean ± SD
Control subjects	0.02±0.00	65.25±3.25
Aortic stenosis patients	0.67±0.81	63.10±6.33
Mitral stenosis patients	0.02±0.21	60.70±7.96

Table-II
Comparison of cTnI between case and control.

Groups	cTnI(ng/ml)	Mean ±SD
Level of significance	(P value)	
AS patient vs control	0.67±0.81 vs 0.02±0.00	0.001
MS patient vs control	0.02±0.21 vs 0.02±0.00	0.448
AS with MS patient vs control	0.15±0.50 vs 0.02±0.00	0.067

Data are presented as mean±SD. Mann Whitney U test was done as the test of significance.

DISCUSSION

It is evident from the findings of present study that there is a significant higher level of serum cTnI in aortic stenosis patients with normal ejection fraction. The survival rates of the patients with asymptomatic aortic stenosis patients are nearly normal, until the symptoms of angina, syncope or heart failure develops. The presence of symptoms of heart failure in patients of aortic stenosis causes a bad prognosis within a short period of time (mean survival < 2 years)⁷. We found that cTnI elevated in the absence of heart failure indicating that it can expose cardiomyocyte injury prior to the development of overt Lt. ventricular dysfunction. So that, serial monitoring of cTnI could help clinicians to give definitive treatment before development of complications.

Cardiac Troponin I have been established as reliable and highly heart specific markers of myocyte injury. Their background conc. in the circulation are normally undetectable or very low (normal level is 0.00-0.05ng/ml) and they are therefore sensitive to even minor heart muscle damage⁶. The triggers of myocyte death in aortic stenosis have not been detailed, the possible path physiology is that in aortic stenosis there occur narrowing of aortic valve which causes decreased blood flow from the left ventricle to the aorta. This increases workload of the workload of the Lt. Ventricle. This forces the left ventricle to squeeze harder, as a result the walls become thicker in time and left ventricular hypertrophy develops. The hypertrophied Lt. ventricular muscle mass elevates myocardial oxygen requirements. Even in the absence of obstructive coronary artery disease there may be interference with coronary blood flow. This is because of the compression of the coronary arteries by the hypertrophied myocardium. The coronary arteries that give nutrition to the heart muscle with blood and oxygen arise just valve may not get enough blood to adequately supply the heart muscle⁸. This in turn, results in the relative ischemia of the Lt. ventricular myocardium and consequently death of the cardiac myocyte ultimately leads to the development of depressed systolic function and heart failure⁶. However, it is noted that circulating cTnI was undetectable in two of our patients with severe aortic stenosis. This suggests that myocytes injury can be intermittent and may therefore escape detection.

In mitral stenosis there occurs decreased blood flow from the Lt. atrium to the Lt. ventricle, which causes increased workload of the Lt. atrium. Lt. atrium squeezes harder to deliver blood to the Lt. ventricle. As a result Lt. atrial hypertrophy develops. But the Lt. atrium is a small structure and its blood and oxygen requirement is very small. So that although Lt. atrial hypertrophy develops in mitral stenosis cardiac ischaemia does not develop.

In patients suffering from both aortic and mitral stenosis blood flow from the Lt. atrium to the Lt. ventricle

is reduced. As a result, although the patient has co existing aortic stenosis left ventricle can deliver its content blood through the stenosed aortic valve without increasing its workload. So that, in patients with both aortic and mitral stenosis left ventricular hypertrophy does not develops which prevents the development of cardiac ischemia.

An important limitation of work this have financial constrain in serial measurement of cTnI and left ventricular functions. Therefore, the true predictive value of circulating cTnI could not be studied. Only serial monitoring of cTnI during follow up of asymptomatic aortic stenosis will show whether cTnI can assist in the timing of therapeutic interventions.

From present study findings we can conclude that circulating cTnI concentrations are frequently detectable and elevated in patients with severe aortic stenosis even in the absence of heart failure. Circulating cTnI deserves a potential warning signal in patients with severe but still asymptomatic aortic stenosis.

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