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Study Of Cardiac Troponin T Level In Subjects With Acute Coronary Syndrome And Its Correlation With Left Ventricular Dysfunction Admitted In Tertiary Care Hospital Mysore

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ABSTRACT

Background

Acute coronary syndrome is defined as presence of acute myocardial injury detected by abnormal cardiac biomarker values in setting of signs of ischemia. Certain protein referred to as cardiac biomarkers are released from necrotic heart muscle after MI.Major predictor of long term survival after recovery from acute MI is the functional status of the left ventricle, it is described in terms of ejection fraction . Cardiac troponin T is a very reliable biomarker for detection of myocardial damage and left ventricular ejection fraction.Therefore the present study plans to analyse the relationship between peak troponin T level after ACS and left ventriculardysfunction determined by 2d echocardiography

Objectives

1.To assess cardiac troponin t levels in patients of acute coronary syndrome and to correlate cardiac troponin t level with left ventricular ejection fraction as assessed by echocardiography after first acute myocardialinfarction.

Method Of Study

This cross sectional study included 80 patients with first attack of Acute myocardial infarction were selected and observed. Troponin T levels are measured 12 to 48 hoursafter admission so as to obtain its peak value. Two dimensional Echocardiography was also done and ejectionfraction was measured. The relationship between left ventricular ejectionfraction and troponinT concentration was studied using spearman's correlation Coefficient.

Observation And Results

There was a strong negative correlation between the left ventricular ejection fraction and Troponin T levels.Pearsons correlation coeffecient was –0.838 with $p<0.0001$.Troponin T value of 2.64ng/ml predicted LV Ejection fraction of <40% with high sensitivity(97.30%) and specificity(93.02%).

Conclusion

Troponin T shows a strong negative correlation with left ventricular ejection after a first episode of myocardial infarction. Its measurement is a quick, cheap, sensitive andhighly specific method in identifying cardiac injury and to determine low ejection fraction <40 percent which is associatedwith complications.

INTRODUCTION

Acute coronary syndrome is defined as presence of acute myocardial injury detected by abnormal cardiac biomarker values in setting of evidence of acute myocardial ischemia.Certain protein referred to as cardiac biomarkers are released from necrotic heart muscle after STEMI and these are obtained to distinguish unstable angina from NSTEMI and to assess magnitude of STEMI.Cardiac troponins are tissue specific for the myocardium and it has been shown to be a very sensitive and specific marker of acute myocardial infarction. [1] According to international consensus and task force definition of MI it is based mainly on elevated cardiac troponins level exceeding 99th percentile and demonstrating increase or decrease over timeIt is now recognised that the major predictor of long term survival after recovery from acute MI is the functional status of the left ventricle. Left ventricular function has usually been described in terms of ejection fraction. [2]

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If a sufficient quantity of myocardium undergoes ischemic injury, left ventricular pump function becomes depressed; cardiac output, stroke volume, blood pressure are reduced and ESV is Increased. The degree to which ESV is increased perhaps is the most powerful predictor of mortality following MI.[3]Cardiac troponin is a very reliable biomarker for detection of myocardial damage and left ventricular ejection fraction.
Therefore the present study plans to analyse the relationship between peak troponin T level after ACS and left ventricularsystolic dysfunction determined by 2d echocardiography
DEMOGAPHY: Every year 1.1 million people experience myocardial infarction in United States. Six million people were admitted for consideration of the disease and 46,000 people die of coronary artery related deaths. [4]

In UK, coronary artery disease is the most common cause of death. The average incidence of myocardial infarction in UK in the age group of 30 to 69 years is 600 perone lakh in males and 200 per one lakh in females. [5]

India is the country where most people with cardiac diseases reside. In India around 6.5% people experience a new acute myocardial infarction every year with the global burden of disease study estimate of age-standardized CVD death rate of 272per 100 000 population in India is higher than the global average of 235 per 100000 population.[6]

The incidence of myocardial infarction in India among young ison the rise in the last three years.The huge load of patients with coronary artery disease in oursubcontinent is probably due to the large population and due to the presence of cardiovascular risk factors in a large scale. [10]INTERHEART study which was conducted in around 52 countries tell that the coronary risk factors like diabetes, hypertension, smoking, obesity, hyperlipidemia are moreprevalent in India than any other countries.[7] In 1990, there were 1.7 million deaths in India and it doubled by the year 2010.[8]

Studies tell that coronary artery disease manifests ten years earlier in India than any part of the world. In rural India, the percentage of people with heart disease has increased from 1-2 to 3-5 percent. In urban India, it has gone up from 2-3 to 10-11 percent. [9] This increased prevalence in urban population is probably due to increase in stress, decreased physical activity,increased intake of high calorie diets and increased prevalence of risk factors. Studies among asian Indian people tell that almost half of the patients with myocardial infarction are in agegroup less than 50 years of age and 25 percent occur less than 40 years of age.

MATERIALS AND METHODOLOGY

Source of data:
In Patients and Out patients attending Medicine Department in Tertiary Care Hospital, Mysuru.
Method of collection of data:

- Study Design- Cross Sectional study.
- Study Period- a period of one and a half year between Jan 2020 to July 2021.
- Sample Size: 80
- Sampling method:The sampling technique used in this study was purposive sampling.

- Inclusion Criteria:

Patients of age above 18 years diagnosed and admitted with first acute coronary syndrome.

- Exclusion Criteria:
  1.Patients with history of MI in the past
  2.Patient having preexisting ECG changes s/o old MI
  3.Valvular heart disease
  4.Congenital heart disease
  5.Myocarditis, Pericarditis
  6.Renal Impairment
  7.Sepsis
  8.Acute congestive heart failure
  9.Acute pulmonary embolism
  10.Prolonged tachyarrhythmias.
  11.Acute exacerbation of COPD.

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Institutional ethics committee approval was obtained.
All subjects included in the study will be explained of the procedure and valid informed written consent will be taken.
Type of study - A Hospital based cross sectional observation study.

- Study subjects will be selected as per inclusion and exclusion criteria
- Diagnosis of Acute coronary syndrome is made on the basis of clinical examination and ECG changes and Biochemical markers.
- History and examination was done including basic parameter of subjects like age, sex, weight, height and body mass index
- Troponin T levels are measured 12 to 48 hours after admission so as to obtain its peak value. All patients received standard therapy like anti platelets, anti lipidemics, anti coagulation with heparin, fibrinolytics (if the criteria for administering these drugs are met) and supportive care.

Two dimensional Echocardiography was done and ejection fraction was measured.
The relationship between left ventricular ejection fraction and troponinT concentration was studied using spearman's correlation coefficient. The relation between Troponin T concentration and ejection fraction was examined by constructing a receiver operator characteristic (ROC) curve.
Patients were initially categorised in to two groups; those with ejection fraction of less than 40 percent and those with ejection fraction more than 40 percent. Then sensitivity andspecificity of Troponin was determined. Sensitivity was plotted against 1- specificity and ROC curve was produced.
The test is better if the curve is near the top left corner. The point of inflection of the ROC curve allows selection of the best trade off between sensitivity and specificity.

RESULTS

A total of 80 people were involved in thestudy .Out of 80 people who had ACS 62 were male(78%) and 18 were females (22%).The mean age of the patients was 55.98 years (SD- 13.47) with a minimum age of 26 years and maximum of 85 years.Most of the patients were in the age group of 51-60 years (31.25%)
Out of 80 patients 15 patients were only diabetic (18.75%), 14 were only hypertension((17.50%) and 33 patients were both diabetic and hypertensive(41.25%).18 patients were neither diabetic or hypertensive(22.50%).This shows that both diabetes and hypertension are important risk factors for development of ACS and having both together doubles the risk of ACS.

Out of 80 patients 41 were smokers(51.25%) and 16 were alcoholic(20%), 8 (10%)patients were both smoker and alcoholic.15(18.75%) patients were neither smoker or alcoholicIn my study both smoking and excess alcohol consumption increased the risk of development of ACS But effect of smoking in deveopment of ACS was higher compared to alcohol.

Out of 80 patients under study all of them had presented with chest pain as their chief complaint(100%). 15 patients had associated history of dyspnea(18%), 13 patients had associated history of fatigue(16.25%) and 1 patient had associated history of palpitations(1.25%)

Out of 80 patients the mean value of Total cholesterol was 175+/-62.48, HDL cholesterol mean level was 42.14+/-8.05,Triglyceride mean value was 168.85+/-75.63,LDL mean value was 109.53 +/-35.67There were 19 patients with total cholesterol level >240mg/dl(24%),37patients with HDL<40(46%),17 Patients with Triglyceride level >200(21%),15 patients with LDL of>160mg/dl(19%).This study shows that atherogenic lipid profile is most commonly found in patient with low HDL.

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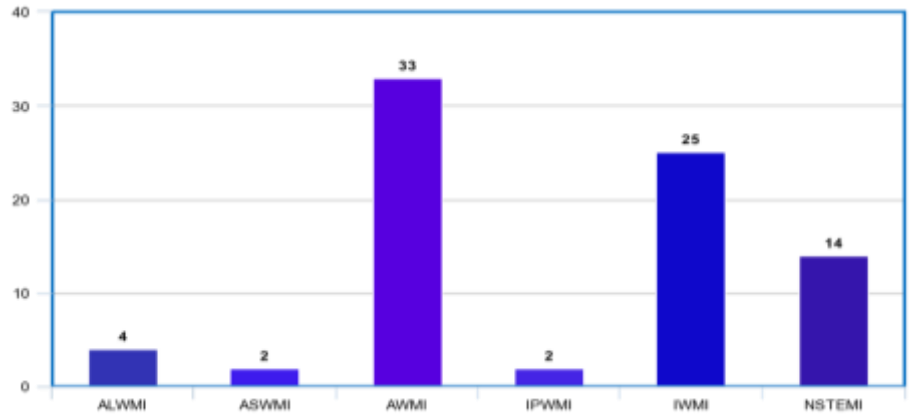

Figure 1- Distribution of type of MI

Out of 80 patients under study most common type of myocardial infarction was AWMI (n=33)(41.25%), followed by Inferior wall MI (n=25) (31.25%),NSTEMI (n=14) (17.5%),antero lateral wall MI(n=4)(5%),Anterio septal and Inferoposterior wall MI were 2 each (2.5%).

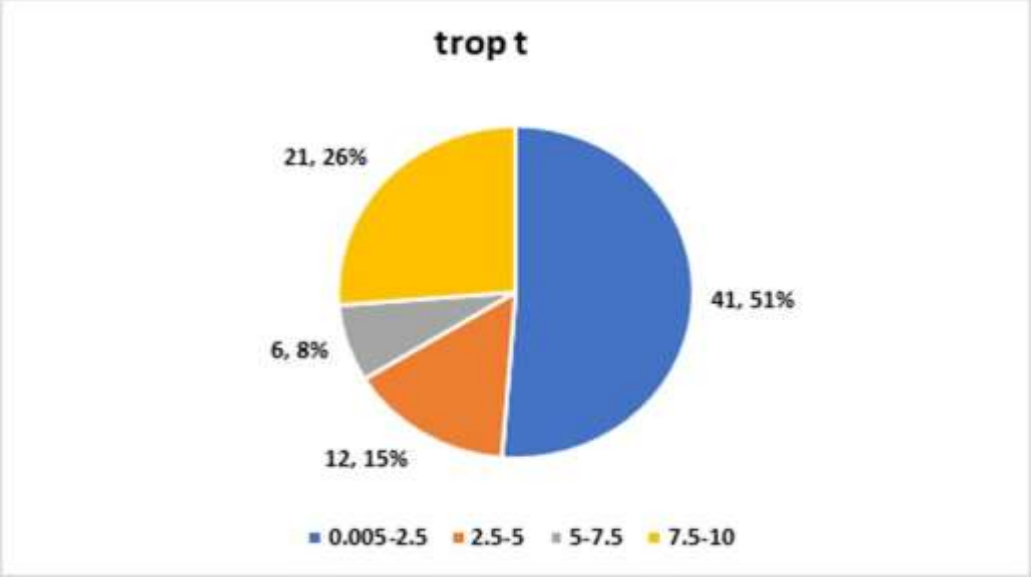

Fig 2: Pie chart showing Trop T value distribution

Out of 80 ACS patients under study mean value of Trop T measured was 3.77 ng/ml with standard deviation of +/-3.69ng/ml. Lowest value being 0.005ng/ml and highest being 10ng/ml. 41 patients(51%) had Trop T values between 0.005-2.5ng/ml, 12 patients (15%) had Trop T values between 2.5-5ng/ml, 6 patients (8%) had Trop T values between 5-7.5ng/ml, 21 patients (26%) had Trop t values between 7.5-10ng/ml.

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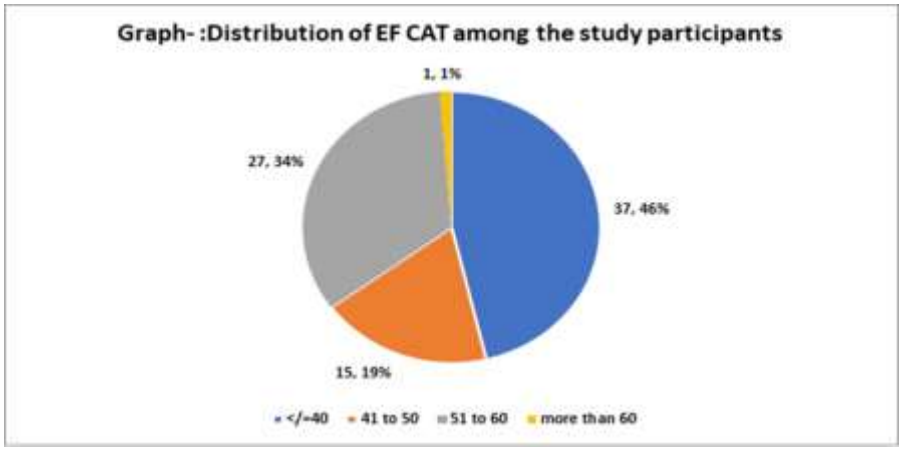

Fig 3: Pie chart showing distribution of EF

Out of 80 ACS patient under study Ejection fraction measured after MI was found to be of mean value of 45.64% with standard deviation of 8.93% . With highest value of EF being 65% and minimum being 30%.

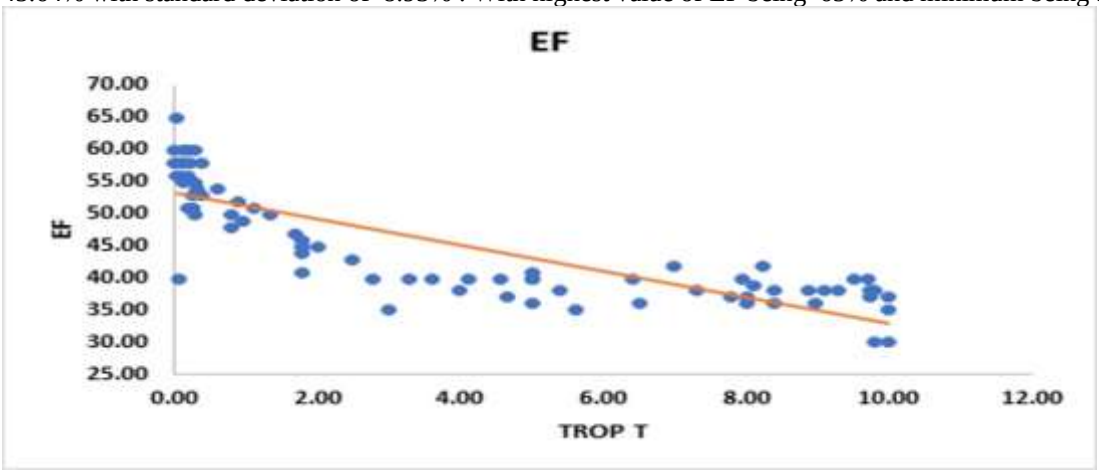

Fig 4 : Graph showing Ejection fraction and Trop T correlation

		Trop T	EF
Trop T	Pearson Correlation	1	-.838**
	Sig. (2-tailed)		.000
	N	80	80
EF	Pearson Correlation	-.838**	1
	Sig. (2-tailed)	.000	
	N	80	80

Table 1 : Table showing Pearsons correlation

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• In the present study there was strong negative correlation between left ventricular ejection fraction and Troponin T levels.Pearsons correlation coefficient was –0.838 .(P <0.0001)

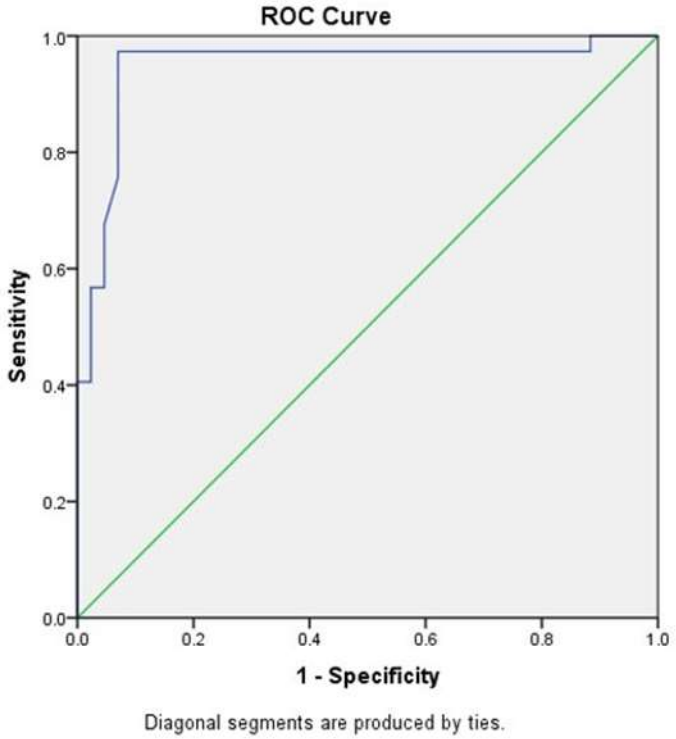

Figure 5 : ROC curve

• Analysis of ROC curve produced Area under curve of 0.948 (95% confidence interval 0.000 to 1.000)
• Troponin T value of more than 2.64ng/ml predicted LV ejection fraction of <40% with a high sensitivity(97.30%) and specificity(93.02%).

Positive If Greater Than or Equal To[a]	Sensitivity	1 - Specificity	Youden index	Specificity
2.640000	97.30%	.070	0.903	93.02%
Best cutoff of trop				
Area	Std. Error[a]	Asymptotic Sig.[b]	Asymptotic 95% Confidence Interval	
			Lower Bound	Upper Bound
.948	.029	.000	.891	1.000
AUC		p value		

Table 2: Table showing Interpretation of ROC curve

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DISCUSSION

Troponin is a highly reliable marker in the detection of cardiac injury. Its use is increasing in modern era in the diagnosis of acute myocardial infarction. Studies tell that the cardiac troponin T measured correlates well with the infarct size and thus indirectly denote left ventricular ejection fraction.

This study shows a strong negative correlation between troponin T measured post MI and the ejection fraction measured by 2D echocardiography. Relation between cTroponin T and ejection fraction by ROC curve show that troponin T concentration of >2.64 is highly sensitive and specific indicator of depressed LV function (LVEF<40 percent) after a first attack of STEMI.[11,12]

	PRESENT STUDY	ACR RAO ET AL	JENU SANTOSH ET AL
N	80	50	50
MEAN TROP T	3.77	5.2	5.644
MEAN EF	45	41	43
CORRELATION	NEGATIVE(-0.838)	NEGATIVE(-0.850)	NEGATIVE(-0.860)
ROC AOC	0.948	0.97	0.94
BEST CUTOFF TROP T FOR PREDICTING EF </>40	2.64ng/ml	2.8ng/ml	2.94ng/ml
sn	97.3%	97%	98%
sp	93.02%	94%	93%

Table 3 : Table showing comparision between my study and two other studies in relation to EF and Trop T

Regarding the risk factors studies tells that incidence of myocardial infarction increases with age.Incidence of MI rises after 45yrs in males and 55years in females and our study too showed a similar results with more number of cases between 41 to 50 years followed by 51-60years.

Atherogenic lipid profile is more common risk factor in ACS patients than in other non-lipid risk factors. This study also demonstrated that the atherogenic lipid is most commonly found in patient with low HDL cholesterol level which was also similar to study done by daulatmanuranget al.[10]

Of the 80 people, 52 percent were smokers. Smoking has got influence on blood pressure and sympathetic tone. It also causes reduced myocardial oxygen supply. Long duration of smoking increases the oxidation of Low density lipoprotein cholesterol and impairs endothelium dependent coronary artery vasodilation. It also promotes spontaneous platelet aggregation. This is responsible for the increased incidence of MI among smokers. Critchley JA et al in an article published in JAMA 2003, concluded that smoking cessation as an effective way to reduce CAD mortality by 36percent as compared to those who continue to smoke [13]

Although it has been told that mild alcohol consumption has been cardio protective, heavy drinking has got adverse effects on the heart. Although most of the people in our study had multiple risk factors, 20 percent of the people were alcoholics who consume in large amounts and for long duration.In a study published by I Biyik et al in journal of international medical research in 2007, they found increased coronary disease incidence in those who consumed alcohol in large quantities. This is probably due to reduction in prostaglandin F 1α and cyclic GMP leading on to coronary vasospasm.[14]

In our study 59 percent of the people were diabetics.In a study done by Booth GK et al (lancet 2006;368:29), insulin resistance and diabetes are one of the leading risk factors for Coronary Artery Disease. The presence of diabetes conferred an equivalent risk to aging 15 years, an impact higher than that of smoking.[15] A number of studies have assessed the role of BP levels in the prognosis of patients with acute coronary syndromes. Pathophysiologic links of hypertension to acute myocardial infarction (MI) include endothelial dysfunction, autonomic nervous system dysregulation, impaired vasoreactivity, and a genetic substrate. A history of hypertension is highly prevalent among patients presenting with MI, and some, but not all, studies have associated it with a worse prognosis. Some data support that low levels of admission and in-hospital BP may indicate an increased risk for subsequent events. Risk scores used in patients with MI have, therefore, included BP levels and a history of hypertension in their variables. Of note, good long-term BP control, ideally initiated prior to discharge, should be pursued in order to improve secondary prevention.

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CONCLUSION

Troponin T show a strong negative correlation with left ventricular ejection after a first episode of myocardial infarction. Its measurement is a quick, cheap, sensitive and highly specific method in identifying cardiac injury and to determine low ejection fraction <40 percent which is associated with complications.Thus its measurement helps in identifying patients who are at higher risk from MI and guide in starting the drugs like ACE inhibitors earlier which provide survival benefit. Multiple measurements are not necessary in determining its peak value as it has got a large time window unlike the other cardiac biomarkers which necessitate multiple measurements to determine their peak level.

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