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Research Article

Echocardiographic predictors of early in- hospital heart failure during first ST-elevation myocardial infarction

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Abstract

Objective: To analyze the role of left atrial volume compared to other conventional parameters of systolic and diastolic left ventricular function in patients with first STEMI in predicting early congestive heart failure.
Methods: A total of 61 patients with ST elevation myocardial infarction were studied, a detailed history, general examination, routine investigations were performed and ECHO was performed within 72 hrs and EF,DT, E/A,LVEDVI,LVESVI and LAVI were estimated, patients were then divided according to Killip class> II and < II and analyzed.
Results: Of 61 patients25 developed in-hospital heart failure (killip>II), mean age of patient in our study was58.5yrs and mean age of patient who developed HF was64.12yrs.Diabetes was present in 28 patients, of which 18 developed HF which was significant(p 0.01).46 patients had involvement of anterior wall of which 24 patients developed HF (p 0.001).EF was significantly associated with HF with a mean of 36% compared to that of 45% without HF(p 0.001).LAVI showed a significant association with development of HF with a mean of 28.96 in those with HF compared to 22.58 in those without HF.
Conclusion: In our study of patients with STEMI, there was increase incidence of HF in elderly patients (>60yrs) and in diabetic individuals. There was significant increase in incidence of HF in patients with anterior wall infarction. Ejection fraction<35% was significantly associated with increased incidence of HF and a strong predictor of In-hospital HF. LAVI was also significant predictor of HF in our study and a LAVI>32ml/$m^2$was associated with a high incidence of HF.
Key words: Cigarette Smoking, CD4, CD3, Smokers, non smokers.

1. Introduction

Acute Myocardial infarction is a significant public health problem on increase in developing countries. Heart failure following AMI is a leading cause of cardiovascular mortality and morbidity and contributes to significantly to worldwide burden of CVS diseases[2]. The incidence of HF has dramatically increased due to increasing role of coronary artery disease and hence early detection of patients with AMI at risk of development of in hospital failure is necessary to limit myocardial injury and LV dysfunction[1]. Left ventricular systolic functions have been extensively studied in relation to heart failure, however it has now become apparent that left ventricular diastolic function contributes to signs and symptoms of clinical heart failure[3]. An increasing number of studies have reported the use of several indices like the ejection fraction, left atrial volume and diastolic indices like E/A ratio, deceleration time in predicting early in-hospital failure in patients with ST elevation myocardial infarction[3]. Some studies also showed the use Myocardial Performance Index and Left Atrial Volume comparison to conventional parameters like ejection fraction in predicting early in-hospital failure in patients with ST elevation myocardial infarction.

1.1 Objective of the Study

To analyze the role of left atrial volume compared to other conventional parameters of systolic and diastolic left ventricular function in patients with first time ST elevation myocardial infarction, in predicting early heart failure during in-hospital evolution by echocardiography.

2. Materials and Methods

2.1 Source of Data

The material for the present study was collected from patients who were admitted to BLDEU'S Shri B.M. Patil Medical College Hospital and Research centre, Bijapur and diagnosed with ST elevation acute Myocardial infarction according to inclusion criteria and period of study was from October 2011 to March 2013.

2.2 Method of collection of data

By detailed history and detailed clinical examination and examined for signs of heart failure, relevant investigations like ECG changes, lipid profile and CPK-MB enzyme levels and patients were subsequently subjected to Echocardiography within 72 hours of admission and various indices noted and analysis of various Echocardiographic indices was done in correlation to clinical signs .

2.3 Sample size

Time period of study from OCTOBER 2011 to MARCH 2013With prevelance rate of Acute Myocardial infarction – 7%[4] At confidence interval of 95% allowing 5% margin of error, the sample size is 100 ,

$$n = \frac{(1.96)^2 \times p \times q}{d^2}$$

Among cases of myocardial infarction 40% cases were ST elevation MI 40% of 100 cases will be 40 so minimum 40 cases were to be included in the study

2.4 Inclusion Criteria

Pateints age of Adult age>18 years, Characteristic chest pain>20 min, ST elevation> 1mm in atleast 2 contiguous leads and transient rise in CPKMB**.**

2.5 Exclusion Criteria

Non ST elevation MI, Early reinfarction, In- hospital Death, Previous Coronary Bypass Valvular heart disease, Congenital heart disease, Left bundle branch block and Chronic heart failure

2.6 Statistical Method

All results are expressed as Mean $\pm$ one SD and two samples were compared by Mann Whitney rank sum test or unpaired 't'test and for Qualitative data Chi square test or Fischer"s exact test was applied.

2.7 Echocardiography variables

A Comprehensive 2D Color Doppler Echo was performed in all patients with above inclusion criteria within 72 hours of admission, the various indices used to predict early in hospital failure on Echo was determined by a single observer throughout the study. The various indices were calculated on Echo using the M mode to determine the various indices. The following parameters were done to establish the HF

LVEF: The ejection fraction was calculated using the simpson method

EDV-ESV/EDV*100 On M mode

LA volume: The Left Atrial volume was calculated by the 2 Dimensional 4 chamber view by simpson's method

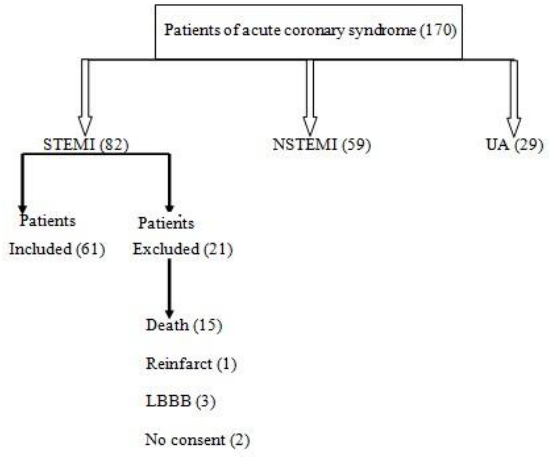
E/A RATIO and Deceleration time (DT): Mitral diastolic inflow velocities at the tip of leaflets and LV systolic outflow curves obtained just below aortic valve. Using these following were calculated a) E/A ratio diastolic velocities b) Deceleration time of early diastolic filling (DT).
Left ventricular end diastolic volume (LVEDV)
Left ventricular end systolic volume (LVESV)
Patients were also clinically defined as per KILLIP classification

KILLIP CLASSIFICATION

- No clinical signs of heart failure.
- Rales or crackles in lungs,S3, raised JVP
- Frank pulmonary edema
- Cardiogenic shock or hypotension(peripheral vasoconstriction, BP<90mmhg, oliguria)

2. Observation and Results

A total of 61 patients were included in the study, who were admitted in Shri B.M. Patil Medical College, Hospital and research centre, bijapur, during the study period..A total of 170 acute coronary syndrome patients were admitted, 82 patients presented as ST elevation myocardial infarction (STEMI), 59 patients were Non ST elevation myocardial infarction (NSTEMI) and 29 patients presented as unstable angina (UA). 82 patients presented as STEMI, out of which 61 patients were included in our study, 21 were excluded. Of the 21 excluded patients, 15 patients died in hospital, one patient had reinfarction, 3 patients had a left bundle branch block and 2 patients did not undergo echocardiography.



Of the 61 patients included 45 patients (73.7%) were male and 16 were female (26.2%) The average age of the patients included in study was 56.4years and no of patients with diabetes mellitus was 24(39.3%) and patients and those with hypertension were 13(21.3%) and 18(29.5%) were smokers the number of patients who were thrombolysed was 55(90.1%), and the number of patients with infarction of anterior wall were 46(75.4%) and those with infarction of inferior wall were 15(24.5%) and 39(63.9%) patients developed heart failure within first week of hospitalization

The number of patients who developed heart failure with Killip class>II were 25(40.9%), all of them being in class III and none in class IV.

Table No 1: Clinical variables according to absence or presence of HF

		Heart Failure Present (25)		Heart Failure Absent (36)		P-Value
		Patients	(%)	Patients	(%)	
HTN	Present	05	62.5	03	37.5	0.254
	Absent	20	37.7	33	62.3	
Location	Anterior	24	52.5	22	47.8	0.001*
	Inferior	01	6.7	14	93.3	
Diabetes Mellitus	Present	18	64.2	10	35.8	<0.0001*
	Absent	07	21.2	26	78.8	
		Mean	Standard deviation	Mean	Standard deviation	
Age (years)		64.12	9.3	52.97	11.00	<0.0001
CKMB		72.12	15.08	52.802	12.92	<0.0001*

Table No 2: Echo Cardiographic variables according to presence or absence of HF

	Heart Failure Present (25)		Heart Failure Absent (36)		P-Value
	Mean	Standard deviation	Mean	Standard deviation	
DT(ms)	198.0(25)	27.53	169.75(36)	27.81	0.01
LAVI (ml/m$^{2)}$	28.96(25)	3.30	22.58(36)	2.94	0.001*
E/A RATIO	0.844	0.15	1.0892	0.21	ns
LVESI(ml/m^2)	35.34	3.94	32.78	3.27	0.08
LVEDI(ml/m^2)	78.81	7.61	68.18	7.63	0.072
EF (%)	36.20	4.15	45.00	6.54	<0.001*

Table No 3: Odds ratios for left arterial volume index (LAVI) and EF predicting heart failure

Variables	Odds ratio	p-value
LAVI ≥28ml/m^2	37.91	0.009
EF ≤ 45%	2.7	0.0140

3. Discussion

In our study, we analyzed the role of echocardiographic indices to predict in hospital heart failure in patients with first ST elevation myocardial infarction. 61 patients included in our study were analyzed to compare various echocardiographic indices to predict in hospital heart failure. Out of 61 patients, 25 patients developed in hospital heart failure (killip>II) associated risk factors were also analyzed in correlation with development of in hospital heart failure

Deceleration time (DT) in our study showed a significant association with a presence of heart failure (p value 0.04). Souza *et al*[3] observed no significant association between DT and heart failure (killip >II) whereas Poulsen *et al*[5], a DT of <130ms identified a risk of developing HF, where as in our study only two patients had DT<130ms. E/A ratio were analyzed, a mean of 0.844 was observed in patients with CHF killip>II and a mean 1.08 in those with absent which was not statistically significant. Similar result were observed in study by Lilian P Souza *et al*[3], where as Poulsen *et al*[4], they observed a significant association between E/A >1.5 and HF. LVESVI and LVEDVI were also analyzed no significant association was obsereved, similar conclusion was made by Souza *et al*[3] and Poulsen *et al*[5] in their studies. Left atrial volume index (LAVI) was also analyzed, the mean LAVI in patients with HF killip>II was 28.96 and those without HF was 22.55 which was statistically significant (p 0.01). Souza *et al*[3] did not observe any significant result between HF and LAVI, Maheshwari *et al*[6] found a strong correlation between LAVI and increasing LV dysfunction in elderly patients and those with anterior wall infarction.

Moller *et al*[7] also analyzed the role of LAVI and other indices of diastolic and systolic function after AMI in 314 patients, patients were also analyzed according to LAVI>32 and LAVI<32, they concluded that LAVI is powerful predictor of mortality after AMI and provides significant information incremental to clinical data and conventional measures of LV systolic and diastolic function. In the same study they observed a significant association between LAVI and killip class with a p value<0.001. Ejection fraction(EF) was also analyzed and the mean in patients with HF present was 36% and in those with CHF absent was 45%, which was statistically significant p <0.001.EF has been established as a powerful index of systolic function and also its role in predicting in hospital heart failure has been well established

Souza *et al*[3] in their study concluded that EF<40% was powerful strongest and independent variable associated with development of CHF killip>II, it was superior to other indices of systolic and diastolic function, Poulsen *et al*[5] also observed that EF<45% was significant prognostic parameter in assessing LV function and predicting in hospital heart failure.

The frequency and distribution of LAVI was studied in patients with and without CHF. A LAVI of 32-39ml/m^2 predicted a 100% chance of developing in hospital heart failure, a value between 25-32 predicted a 75% chance of developing in hospital heart failure. The odds ratio for LAVI to predict heart failure was used, the cut off value of 32ml/m^2 was derived, out of 14 patients with LAVI>28, 13 had CHF(killip>II) with a odds ratio of 37.91 which was highly significant(p 0.009).

4. Conclusion

In our study of patients with STEMI, there was increase in incidence of Heart failure in elderly patients (>60yrs) and in diabetic individuals and in patients with infarction of anterior involvement. Ejection fraction<35% was significantly associated with increased incidence of Heart failure and a strong predictor of In-hospital Heart failure. Left atrial volume index was also significant predictor of in-hospital Heart failure in our study and a Left atrial volume index>32ml/m^2 was associated with a high incidence of In-hospital Heart failure.

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