Section: Cardiology

Original Research Article

A CLINICAL STUDY ON PROGNOSTIC SIGNIFICANCE OF LEFT ATRIAL VOLUME INDEX IN PATIENTS WITH ST-ELEVATION MYOCARDIAL INFARCTION

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Abstract

Background: Evaluating left atrium volume is a good way to estimate prognosis in acute myocardial infarction patients because it indicates to time and severity of diastolic dysfunction and long-term results of acute myocardial infarction. Left atrial (LA) volume is a prognostic predictor across a wide spectrum of cardiac and non-cardiac diseases. The aim is to assess the left atrial volume index in Myocardial Infarction & its Angiographic correlation and to assess any correlation between with left atrial volume index and outcomes of MI such as heart failure, arrhythmias and short-term mortality. **Materials and Methods:** A prospective analytical study was conducted at the Department of Cardiology, Coimbatore Medical College and Hospital, from October 2023 to September 2024. A total of 100 patients with ST elevation in ECG, with history and examination suggestive of Acute Myocardial infarction were included. The patients were studied considering risk factors, echocardiography indexes such as systolic and diastolic functions and left atrium volume and angiography. **Result:** Those patients who were admitted in Killip's class II, had a comparatively worser prognosis. Higher proportion of Hypertensive patients had LAVI > 34ml/$m^{2.}$ Patients with LAVI > 34ml/m^2 - had worsening heart failure and developed cardiogenic shock. 27 out of 36 patients with LAVI > 34 ml/m^2, had multivessel disease. 14 out of the 16 deceased patients had LAVI > 34 ml/m^2. 10 out of 12 patients who had both LAVI > 34 ml/m^2 & Severe LVD died. But 8 out of 10 who had Severe LVD but LAVI < 34 ml/m^2, survived. **Conclusion:** LA Volume index provides prognostic information incremental to clinical data and standard Echocardiographic predictors of outcome, including LV systolic function and Doppler assessment of Diastolic Function.

INTRODUCTION

Acute coronary syndrome (ACS) is one of the major causes of cardiovascular mortality in the modern world, left ventricular function is an important prognostic marker for patients with that syndrome. Acute myocardial infarction results in decrease in LV ejection fraction and left ventricular remodelling (LVR)- progressive dilatation of the left ventricle. Since, the left atrium is directly exposed to the LV filling pressures through the open mitral orifice during diastole, its size is influenced by the same factors that determine LV diastolic filling pressures. However, in contrast to the other doppler variables of LV diastolic function, which are affected by acute hemodynamic changes, LA volume is a more stable parameter, integrating the effects of LV filling pressures from preexisting cardiovascular conditions as well as acute disease. Thus, in this study, we assess the Left atrial volume index (LAVI) and its prognostic value in patients with acute myocardial infarction patients. Individuals with increased LAVI, i.e., with significant diastolic dysfunction, are at high risk for complications and could benefit from choosing the most appropriate treatment.[1-3]

Several clinical studies have reported the usefulness of left atrial volume (LAV) in the prognosis of several diseases.[5,6] Doppler indices of left ventricular (LV) diastolic function have been shown to predict cardiovascular events in a wide spectrum

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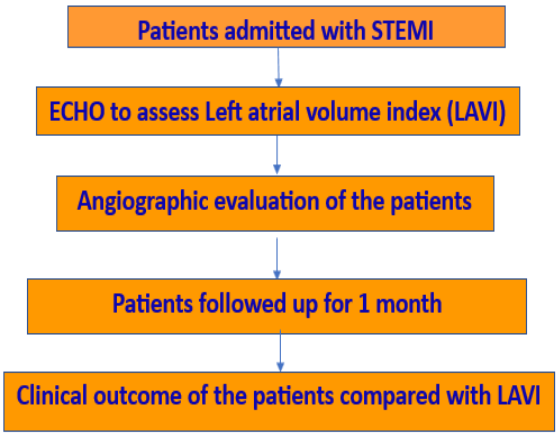
of individuals ranging from apparently healthy subjects to patients with end-stage dilative cardiomyopathy. In particular, a restrictive LV filling pattern has been identified as a strong predictor of morbidity and mortality in patients with acute myocardial infarction (MI). The close association between LV diastolic function and LA volume, which provides a sensitive morph physiologic expression of the severity of LV diastolic dysfunction and appears to be a useful index of cardiovascular risk. LA enlargement implies a poor prognosis in patients with acute MI.[7] Thus, the development and identification of early markers of left ventricular dysfunction are required to select ideal candidates for invasive therapy.[1,2]

Objectives: To assess the left atrial volume index in Myocardial Infarction & its Angiographic correlation and to assess any correlation between with left atrial volume index and outcomes of MI such as heart failure, arrhythmias and short-term mortality

MATERIALS AND METHODS

Study Design: The study employed a prospective analytical design to investigate 100 patients with ST elevation in ECG, with history and examination of Acute Myocardial infarction. The patients were studied considering risk factors, echocardiography indexes such as systolic and diastolic functions and left atrium volume and angiography.



Study Setting: The study was conducted at the Department of Cardiology, Coimbatore Medical College and Hospital, spanning from October 2023 to September 2024.

Sample Size: A total of 100 patients were included in the study based on the inclusion and exclusion criteria.

Sampling Technique: Purposive sampling was employed to select patients meeting the inclusion criteria and excluding those with predefined exclusion criteria.

Study Population

Inclusion Criteria

Patients with history, examination and ECG changes suggestive of STEMI.

Exclusion Criteria

- Patients with previous MI
- Patients with history of significant valvular lesions
- Patients with large shunt lesions
- Patients with documented history of Atrial flutter and fibrillation

Data Collection: A previously designed proforma will be used to collect the demographic and clinical details of the patients. A thorough clinical examination will be done. An ECG will be recorded in each case as soon as possible (within 15 minutes of admission). Serial ECGs will be obtained daily during the period of stay at the hospital. Echocardiogram at the time of admission and Coronary Angiogram in further days. Echocardiography was performed immediately after thrombolysis in patients with AMI using GE ECHO machine, 3 Sc-Rs transducer adult probe equipped with Tissue Doppler. After informed consent coronary angiogram was performed in the study population is a standard access site was either radial or femoral. The standard view of coronary angiogram study AP, RAO, LAO, caudal and cranial. The information collected regarding all the selected cases were recorded in a master chart.

Statistical Analysis: Descriptive statistics, such as mean, standard deviation, and frequency distributions, were used to summarize patient characteristics. Detailed analysis was done with the help of SPSS 16 software and Sigma Stat 3.5 version.

Ethical Consideration: The study protocol was approved by the Institutional Ethics Committee, ensuring adherence to ethical guidelines, patient confidentiality, and informed consent procedures.

RESULTS

Table 1: Baseline Characteristics.

Characteristics	LAVI <34 ml/m2 (64)	LAVI >34 ml/m2 (36)	P VALUE
Mean age	48	58	<0.001
Male gender	42 (66%)	21(59%)	0.15
Hypertension	31 (49%)	23 (64%)	0.007
Current smoker	34 (53%)	12 (33%)	0.033
Diabetes	10 (16%)	10 (28%)	0.03
Hyperlipidemia	21 (33%)	16 (44%)	0.08
KILIP CLASS > II on admission	8 (12.5%)	9 (25%)	<0.001
Echocardiographic characteristics:			
Characteristic	LAVI < 34 mL/m2	LAVI > 34 mL/m2	P VALUE
LV ejection fraction, %	45 (42–60)	35 (32–45)	0.001

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LV end-systolic dimension, mm	34 (30–38)	40 (38–46)	0.001
LV end-diastolic dimension, mm	50 (46–54)	56 (52–60)	0.001
Diastolic function			
Normal	27 (43%)	9 (25%)	<0.001
Grade I diastolic dysfunction	17 (26%)	10 (28%)	0.65
Grade II diastolic dysfunction	13 (20%)	9 (26%)	0.21
Grade III diastolic dysfunction	7(11%)	8 (22%)	0.001

Table 2: LA volume parameters

LA Volume parameters	LAVI < 34 mL/m2	LAVI > 34 mL/m2
LA dimension, mm	41 (38–45)	48 (43–53)
LA volume, ml	46 (38–55)	77 (67–93)
LA volume index, mL/m2	24 (20–27)	42 (36–49)
Moderate or severe MR	5 (8%)	10 (28%)

Table 3: Angiographic Findings.

	LAVI < 34 ml/m2	LAVI > 34 ml/m2
Single vessel disease	29 (45%)	7 (19.5%)
Double vessel disease	5 (8%)	15 (42%)
Triple vessel disease	14 (22%)	12 (33%)
Normal coronaries (recanalised)	9 (14%)	1 (2.75%)
Branch vessel disease	7 (11%)	1 (2.75%)
	64	36

Table 4: Hospital Complications.

Complications	LAVI < 34 ml/m2	LAVI > 34 ml/m2	P Value
VT / VF	4 (6.25%)	3 (8%)	0.38
Paroxysmal AF	13 (20%)	9 (25%)	0.64
Worsening HF	8 (12.5%)	24 (67%)	<0.001
Cardiogenic shock	10 (16%)	12 (33%)	0.001
Complete heart block	2 (3.12%)	1 (3%)	0.92

Table 5: Predictors of mortality

Characteristic	Surviving patients (84)	Deceased patients (16)	P value
Mean age	44	60	0.001
Male gender	54 (64%)	9 (56%)	0.40
AWMI	36 (43%)	10 (62.5%)	0.08
Multivessel disease	36 (43%)	10 (62.5%)	0.08
KILLIP CLASS > II on Admission	11 (13%)	6 (38%)	0.001
Diabetes	16 (19%)	4 (25%)	0.26
Hypertension	44 (52%)	10 (62.5%)	0.15
Mean LVEF %	45	35	0.001
LV Systolic Function	**LAVI < 34mL/m2 (64)**	**LAVI > 34mL/m2 (36)**	**Mortality**
MILD LVD (49)	40 (62.5%)	9 (25%)	0
MODERATE LVD (29)	14 (22%)	15 (42%)	4 (0 + 4)
SEVERE LVD (22)	10 (15.5%)	12 (33%)	12 (2 + 10)

DISCUSSION

This study has been conducted to assess the prognostic significance of left atrial volume index in acute myocardial infarction and its angiographic correlation to assess the relationship between LA volume index and In-hospital events after Acute Myocardial Infarction (STEMI). Furthermore, the LA volume index provides prognostic information in addition to the available clinical data and standard echocardiographic predictors of outcome like LV systolic function, doppler assessment of LV diastolic function.

Age Group and LA volume index, in this study of 100 patients, there is a positive correlation between age of the patient and LA volume index. This is in accordance with various previous studies, which had shown that there is a correlation between old age and increased LA volume index.[8]

In this study among 100 patients 46 patients are smokers and 54 were non-smokers. In similar articles by Teresa S M Sang MD et al Left atrial volume there was found to correlate positively with age, history of systemic hypertension, diabetes mellitus, hyperlipidemia, and smoking.[9] In our study, there is a significant positive Co-relation between LA volume index and patients with systemic hypertension.

In our study, 25% of the patients who were admitted in killip's Class II and above had a LA volume index of > 34 ml/m^2, whereas only 12.5% of the patients who were admitted in killip's Class II and above had a LA volume index of <34 ml/m^2 which was statistically significant. Also, LA volume index >34 ml/m^2 was associated with an increased incidence of CHF, independent of age, myocardial infarction, diabetes mellitus, hypertension, LV hypertrophy, and mitral inflow velocities.[10]

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LV dysfunction is more common with larger LA volumes. LAVI and dimensions progressively increased with DD grade increase. There was a relative decrease of the E-wave and E/A ratio, and an increase of the mitral deceleration time in the grade I DD groups (altered relaxation) in comparison to the group with normal diastolic function; the opposite was observed in the group with grade III DD (restrictive pattern).

Among the LAVI > 34ml/m^2 groups, 7 patients had Single Vessel Disease. 15 patients had Double vessel Disease; 12 patients had Triple Vessel Disease.

33% of the patients in the group of LAVI >34ml/m^2 had an arrhythmic episode, 67 % of the patients in the group of LAVI > 34ml/m^2 had heart failure during hospital stay and 1 patient expired during the 30- day follow up. These results signify more morbidity in the form of raised incidence of heart failure and arrhythmia.

14 out of the 16 deceased patients had LAVI > 34 ml/m^2. 10 out of 12 patients who had both LAVI > 34 ml/m^2 & Severe LVD died. But 8 out of 10 who had Severe LVD but LAVI < 34 ml/m^2, survived.

CONCLUSION

This study demonstrates that LA enlargement implies a poor prognosis in patients with Acute MI. It has proved as a predictor of In-hospital events in patients with acute myocardial infarction. LA Volume index provides prognostic information incremental to clinical data and standard Echocardiographic predictors of outcome, including LV systolic function and Doppler assessment of Diastolic Function. Measurement of LA volume is a simple and important tool which can be easily done and reproducible and may be incorporated in routine assessment of diastolic function. Measurement of the LA volume index could emerge as a simple and important tool for Risk stratification and as a guide for future surveillance and therapy in patients with Acute myocardial infarction.

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