

Role of Early 2D Echocardiography in Patient with Acute Myocardial Infarction in Correlation with Electrocardiography and Clinical Presentation

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Abstract

Introduction: Echocardiography is noninvasive, most frequently used usually the initial imaging test to evaluate all cardiovascular disease related to structural, functional, or hemodynamic abnormality of the heart or great vessels. The major advantage of echocardiography is the ability to obtain instantaneous real time image even in emergency units. The present study was undertaken to evaluate left ventricular function, extent of myocardium involved and complications of acute myocardial infarction by 2D ECHO, to correlate these findings with ECG and clinical presentation, and to assess the role of 2D ECHO in management and prognosis of patients with acute myocardial infarction. **Materials and Methods:** The present study was conducted on patients visiting our tertiary health centre, Nasik over a period of 2 years. 55 patients were included in the study. Patients with prior history of acute myocardial infarction, valvular heart disease, cardiomyopathy, cardiac surgery, congenital heart disease and non ST elevation MI were not included in the study. Patients were classified as per Killip classification and 2D ECHO was performed on the patients within 24 hours of admission. The findings of which were correlated with clinical and ECG findings. **Results:** Of 55 patients studied it was found that MI had male preponderance with hypertension as major risk factor. Also, the severity of the infarction increased with the increase in the Killip class. Mean ejection fraction was also observed to be decreasing in patients with increase in severity of the infarction. **Conclusion:** 2D ECHO performed within 24 hours of admission helps the clinician to predict and diagnose complications in patients with acute MI and take proper steps in the management of the patient.

Keywords: Echocardiography, Killip Classification, Myocardial Infarction

1. Introduction

2D ECHO is used to examine patients with coronary artery disease and enables us to visualize the heart directly in real time using ultrasound. 2D ECHO done within 24 hour of admission, can predict patients at high risk, correlates well with clinical events and

electrocardiography, can diagnose mechanical complications and left ventricular dysfunction and aid in treatment and determining prognosis of patients with acute myocardial infarction.

The study was conducted to clinically evaluate patients with acute myocardial infarction by assessing left ventricular function, extent of myocardial infarction and its

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effect on cardiac function with the help of 2D ECHO and was correlated with the findings of the same with clinical events and ECG. The utility of 2D ECHO within 24 hours to predict/diagnose complications following AMI was determined. Also, the association of high risk factors for AMI was assessed.

2. Materials and Methods

2.1 Material

The current study was conducted on 55 patients in Dr. Vasantrao Pawar Medical College, Nasik over a period of two years from June 2010 to May 2012. Acute myocardial infarction was diagnosed by presence of ¹ typical angina pain for half hour, ECG changes consistent with acute ST segment elevation myocardial infarction and increase in cardiac enzymes.

2.1.1 Inclusion Criteria

All patients with first episode of acute myocardial infarction were included in the study.

2.1.2 Exclusion Criteria

- a) Prior history of acute myocardial infarction.
- b) Valvular heart disease.
- c) Cardiomyopathy.
- d) Cardiac surgery.
- e) Congenital heart disease.
- f) Non S T elevation MI.

2.2 Methods

On admission patients were classified according to the electrocardiographic changes as extensive anterior infarction, anteroseptal infarction, anterolateral infarction, inferior wall infarction and right ventricular infarct. The patients were classified on admission clinically according to Killip classification^{2,3}.

2D ECHO/ Doppler was performed on all patients to evaluate the overall performance within 24 hours of admission. The patients were studied with the help of MICROMAX model. 2D ECHO/ Doppler parameters used for examining the patient included Ejection Fraction (LVEF), Left ventricular internal dimensions at the end of systole (LVIDs) and at end of diastole (LVIDd).

Depending on the wall motion patients were classified as normokinetic, hypokinetic, akinetic and

dyskinetic. In patients with presence of more than one regional wall motion abnormality, predominant abnormality was assigned. The presence or absence of diastolic dysfunction, mitral regurgitation or other mechanical complications of acute myocardial infarction was evaluated with Doppler studies. The overall LV function was evaluated using LVEF, LV dimension and segmental wall motion study. Regional segmental wall motion score and index was calculated by dividing left ventricle into 16 segments and evaluating each segment. In patients experiencing cardiogenic shock, third degree heart block and sustained ventricular tachycardia or fibrillation cardiovascular complication was considered.

2.3 Ethical Consideration:

An Institutional Ethical Committee approval was obtained before beginning of the study.

3. Results

3.1 Age and Sex Distribution

Of the 55 patients, 34 were male and 21 were females. 6/55 were <40 years of age, 34/55 were between 40-60 and 15/55 were >60 years.

3.2 Risk Factors for AMI

Hypertension (35%), ischemic heart disease (21%), smoking (21%) and diabetes (13%) were the major risk factors. Out of 55 patients, 20% had no risk factors. 23/55 had inferior wall, 16/55 anteroseptal, 9/55 anterolateral, 7/55 extensive anterior wall involvement.

Pulmonary congestion was seen in 8/55 in Killip Class 1, 14/55 in Killip Class 2 and 7/55 in Killip class 3 whereas normal chest x-ray was seen in 26/55 cases.

In the present study, the overall mortality was 15% of which 1.81% belonged to Killip class II, 3.63% to Killip Class III and 10.9% to Killip Class IV. 71% (5/7) of patients who belonged to Killip class IV, 12.5% (2/16) of Killip class III and 4.76% (1/21) of Killip class II, died while still hospitalized. There was no in hospital mortality in Killip Class I (Table 1).

3.3 Severity of Disease and Complications

Also, severity of clinical presentation increased from Killip class I to Killip class III with subsequent decrease in ejection fraction. The mean ejection fraction in Killip

Table 1. Killip class and morality

Killip class	Number of patients	Mortality	Percentage
I	11	0	-
II	21	1	4.76%
III	16	2	12.5%
IV	7	5	71 %
Total	55	8	

Class I was 54.09 %, Killip Class II was 42.12 %, Killip class III was 38.06 % and Killip class IV was 33.57 (Table 2) The mean EF in patients who died of AMI was 34.63 % & in rest of the patients who survived was 43.63 % (Table 4). The mean ejection fraction in patients who had complications was 34.64% (SD 5.92) as compared to 42.15 % (SD 9.35) in others without major complications.

3.4 Regional Wall Motion Abnormality

Of 55 patients, regional wall motion abnormality was noted in the form of hypokinesia in 30/55, akinesia in 19/55 and dyskinesia in 6/55.

3.5 Regional Wall Motion Score

The mean RWMS in patients who died was 31.87 (SD. 3.125), in patients with complications was 27.52 (SD 4.37) while in rest of the patients without major complications it was 23.91 (SD 4.16) (Figure 1).

3.6 Regional Wall Motion Index

The mean RWMI in patients who died was 1.85 (SD 0.3737), in patients with complicated AMI was 1.84 (SD 0.27) while in others it was 1.49 (SD 0.26) (Table 3).

3.7 Severity of Wall Motion Abnormality Related to Formation of Thrombus

3.3 % of patients with hypokinesia, 26.3 % with akinesia and 66.7 % with dyskinesia had LV thrombus. In the present study, only one (i.e. 2 %) LV thrombus was detected in inferior wall AMI. Rest eight (i.e.16 %) were found in anterior wall AMI. The incidence of LV thrombi in extensive anterior infarct was 57 % as compared to 18.75 % in anteroseptal and 11 % in anterolateral AMI. Clinically apparent thromboembolism is seen in only 1/9 cases cases who had clinically apparent thromboembolic phenomenon.

Table 2. Mean ejection fraction and Killip Class

Killip Class	No. of Patients	Mean ejection fraction	Standard Deviation
I	11	54.09	2.99
II	21	42.12	3.97
III	16	38.06	2.86
IV	7	33.57	5.35
Total	55		

Table 3. Regional wall motion score in death and others

	Number	Mean Regional wall motion score	Standard Deviation	95% CI
Death	8	31.81	3.125	25.56 ---38.06
Others	47	25	3.1	18.8 --- 31.2

Table 4. Ejection fraction and mortality

	Number of Patients	Mean ejection fraction	Standard Deviation	95% CL
Death	8	34.63	7.39	19.85—49.41
Others	47	43.63	9.62	24.39—62.87

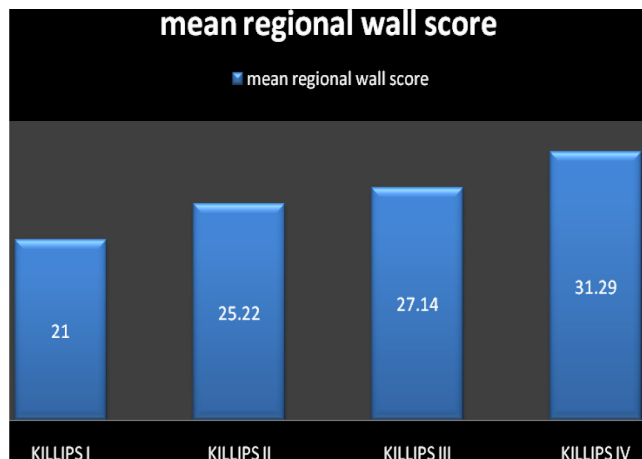


Figure 1. Mean regional wall motion score and Killip Class.

8/23 inferior wall infarction were diagnosed as RV infarction on 2D ECHO of which only 5 cases had ECG evidence.

3.8 Complication Detection in Study

34/55 patients had evidence of diastolic dysfunction.

Complications seen in patients included mitral regurgitation(11/55),complete heart block (3/55),sustained ventricular tachycardia (3/55) block (3/55), pericardial effusion (2/55),ventricular septal defect(1/55) and death (8/55). 22/55 patients had no complications (Figure 2).

4. Discussion

4.1 Age and Sex Distribution

In the present study, 60% were males and 40% were females.

This is in accordance with numerous studies that have shown a male preponderance for coronary heart disease^{4,5}.

Lerner et al.⁴ had reported 60% of all coronary events were in male patients.

Glover et al.⁶ found that in young patients with AMI (age < 36 years) 95% were male. In the present study, patients with age < 40 years, 83.33% patients were male.

4.2 Risk Factors

In the present study, hypertension (35%) was found to be the major risk factor for AMI.

Birnbaum et al.⁷ had found hypertension as a risk factor in 28% and diabetes as a risk factor in 11% of their patients.

In the present study diabetes was present in 7 patients i.e. 13%.

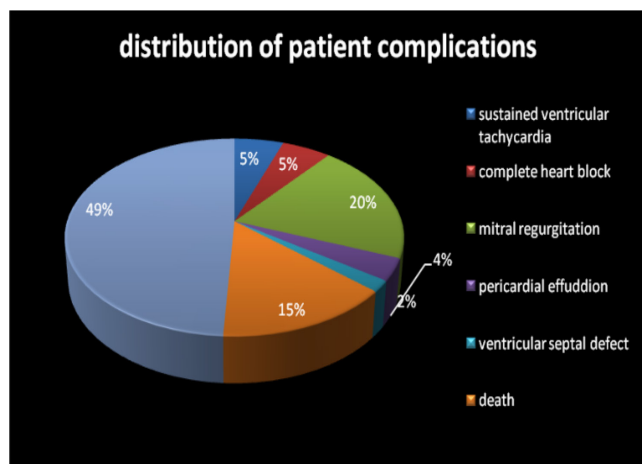


Figure 2. Complication of AMI noted in the patients during their hospital stay.

4.3 Site of Infarction and Killip Classification

Patients with extensive anterior AMI had a more severe clinical presentation (Killip III / IV) as compared to those with anterolateral, anteroseptal or inferior wall AMI.

4.4 Killip class and ejection fraction:

The severity of clinical presentation increases from Killip class I to Killip class IV with subsequent decrease in ejection fraction.

Gottlieb et al.⁸ observed that Killip class I(81.9%) had ejection fraction >40% whereas Killip class IV(85.7%) had ejection fraction < 40%.

Toth et al.⁹ showed in their study, that ejection fraction of less than 40 were associated with increased mortality.

In the present study, the mean ejection fraction in patients who had complications was 34.64% (SD 5.92) as compared to 42.15 % (SD 9.35) in others without major complications which was statistically significant.

4.5 Myocardial Wall Motion Abnormality

Weiss et al.¹⁰ found that acute myocardial infarction was almost always associated with regional wall motion abnormality. In the present study 2D ECHO regional wall motion abnormality correlated well with the site of infarct shown by electrocardiography.

Regional wall motion score (RWMS) is directly related to the extent of myocardium involved and risk of complications¹⁶. Gonson et al.¹¹ showed that early 2D ECHO is very useful to detect high risk of patient with AMI by calculating RWMS. In the present study, the mean RWMS in patients who died was 31.87 (SD. 3.125), while in rest of the patients who survived, it was 25 (SD 3.19) which is statistically significant.

Toth et al.⁹ showed that in patients with AMI, left ventricular regional wall motion index (RWMI) higher than 2 was associated with increased risk of death. In the present study, the mean RWMI in patients who died was 1.85 (SD 0.3737), while in patients who survived, it was 1.56 (SD 0.27) which is statistically significant.

Horowitz et al.¹² concluded that high RWMI was associated with higher complications. In the present study, the mean RWMI in patients with complicated AMI was 1.84 (SD 0.27) while in others it was 1.49 (SD 0.26) which is statistically significant.

4.6 Severity of Wall Motion Abnormality Related to Formation of Thrombus

Lamas et al.¹³ found that frequency of LV thrombus increased with increasing wall motion abnormality.

Visser et al.¹⁴ found that LV thrombus was present in no less than 86 % of patients with segmental dyskinesia.

In the present study, LV thrombus was found in 3.3 % of patients with hypokinesia, 26.3 % with akinesia and 66.7 % patient with dyskinesia which is similar to these studies.

4.7 Complication Detection in Study

Complications seen were mainly arrhythmias following reperfusion with streptokinase. AV blocks, sinus tachycardia, sinus bradycardia, and ventricular tachycardia were also seen.

Various studies have shown that mitral regurgitation develop in about 14-26 % in acute myocardial infarction¹⁵. In present study 22% patients developed mitral regurgitation.

5. Conclusion

Hypertension, smoking, diabetes mellitus and ischemic heart disease were the major risk factors with male preponderance.

Killip Classification of the patients on admission helps in assessing severity of infarction.

Patients with severe wall motion abnormalities and/or extensive anterior AMI are more prone to mural thrombus formation.

Mean ejection fraction, Mean regional wall motion score and Regional wall motion index predicts patients at high risk.

Thus early 2D ECHO done within 24 hour of admission, can predict patients at high risk, correlates well with clinical events and electrocardiography. It can diagnose complications and aid in treatment and determining prognosis of patients with acute myocardial infarction.

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