# TWO DIMENSIONAL ECHOCARDIOGRAPHY IN ACUTE MYOCARDIAL INFARCTION

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**SUMMARY**

**100 Patients with first episode of acute myocardial infarction were examined. 9 patients were excluded from study because of poor echgenicity and the study consisted of 91 patients (53 anterior, 31 inferior, 6 posterior and 1 lateral). Diagnostic admission electrocardiograph was possible in 31 (69 percent) of anterior and 14 (46 percent) of inferior infarcts. 6 patients of posterior and one of lateral wall infarct had the first electrocardiograph within normal limits. Adequate 2 dimensional echocardiography was possible in 91 patients, 71 (79 percent) had the typical wall motion abnormalities. 45 (84 percent) of anterior, 22 (70 percent) of inferior, 4 (60 percent) of posterior and one (50 percent) patient of lateral wall infarct had the diagnostic segmental dysfunction suggestive of myocardial infarction.**

**Keywords: -**

## INTRODUCTION

10-16 percent of patients of acute myocardial infarction presenting to the emergency room are incorrectly perceived as being at low risk and therefore send home 4 These are the patients at risk for sudden death then those admitted. When electrocardiography during acute chest pain does not show signs of myocardial ischemia, the diagnostic process will be optimized by a more scientific test. In echocardiographic studies during angioplasty it is noted that regional asynergy appears first before electrocardiography or even chest pain.

The use of echocardiography in acute myocardial infarction is based on the classic work of Tennant and Wigger1 and later on Herman2. Various non-invasive imaging techniques including fluoroscopy, radio nuclide imaging, left ventricular contrast angiography and echocardiography have been employed to evaluate the segmental wall motion abnormalities in clinical practice. Using 2 dimensional echocardiography within 12 hour after onset of the chest pain, regional wall motion abnormalities were adequately detected in 94 percent of the cases3. We used the most modern state of the art equipment to detect segmental abnormalities associated with acute myocardial infarction.

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## METHODS

Hundred patients with first episode of acute myocardial were included in the study. The age group was 30-70 years with a mean age of 55. The diagnosis of acute myocardial infarction was documented in each case by a typical history, serial electrocardiographic changes and creatine kinase MB elevation. The electrocardiographic criteria for diagnosis of acute myocardial infarction was appearance of Q waves greater then 0.04 seconds or tall R waves in V1 with an R/S ratio more then 1 and transient ST elevation. 12 lead ECG was repeated daily for first three days and at discharge from hospital. The electrocardiographic infarct localization was made according to the following criteria,

1. Anterior in leads V1-V4
2. Inferior in leads II, III and a VF.
3. Posterior R/S ratio more then 1 in lead V1
4. Lateral in leads 1, aVL and V5-V6.

2 dimensional echocardiographic studies were performed within 4-5 hours of admission using a phased array sector scanner of Toshiba SSH-140A. The scan probe contained a 3 and 2.5 MHz transducer that was driven through a 90 degrees sector arc. Studies were recorded on a Panasonic VHS recorder. Images were then available for redisplay in real time, slow motion or single fram format. The examination

was performed in supine or 30 degrees left lateral decubitus position. Left ventricle was divided in 20 segments 5 (Fig. 1). Cross sectional images of left ventricular endocardial surface were obtained by recording the short and long axis views through basal, midventricular and apical regions. Both the basal and midventricular portions were divided in eight segments each, and the apical region in four myocardial segments. Studies were considered adequate for analysis only when each of the 20 segments were adequately visualized. Each segment was visualized for the presence and degree of asynergy. Wall motion of each segment was characterized as normal, hypokinetic, akinetic or dyskinetic based on visual assessment .

**Figure 1**
**Cross sectional views of left ventricle and division of myocardial segments at the level of mitral valve, papillary muscle and apex.**

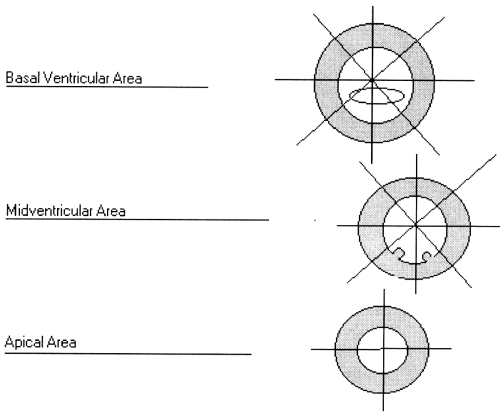


**Table 1.**
**First Electrocardiograph in myocardial infarction**

| Infarct | No. of Pts. | Diagnostic | Nonspecific | Normal |
|---|---|---|---|---|
| Anterior | 53 | 31(69%) | 11(21%) | 5(10%) |
| Inferior | 31 | 14(46%) | 12(40%) | 5(14%) |
| Posterior | 6 | 0 | 2(33%) | 4(67%) |
| Lateral | 1 | 0 | 0 | 1 |

## RESULTS

Hundred patients with first episode of acute myocardial infarction were included in the study out of which adequate 2 dimensional echocardiographic recordings were possible in 91 patients. The electrocardiographic infarct site in 91 patients was as follows,

1. Anterior 53 (58 percent).
2. Inferior 31 (34 percent).
3. Posterior 6 (7 percent).
4. Lateral 1 (1 percent).

**Figure 2**
**Admission Electrocardiograph in acute myocardial infarction**

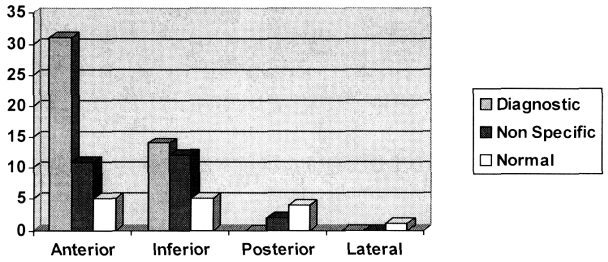


**Table 2.**
**Serial electrocardiographs in acute myocardial infarction**

| Infarct | No. of Pts. | Diagnostic | Nonspecific | Normal |
|---|---|---|---|---|
| Anterior | 53 | 50 | 3 | 0 |
| Inferior | 31 | 25 | 6 | 0 |
| Posterior | 6 | 4 | 1 | 1 |
| Lateral | 1 | 1 | 0 | 0 |

In 53 patients of anterior myocardial infarction the admission electrocardiograph was diagnostic in 37 (69 percent), nonspecific in 11 (21 percent and normal in 5 (10 percent). Fig. 2 and table 1. During serial studies in coronary care unit for three days the electrocardiograph became diagnostic in 50 (94 percent) and nonspecific in three of anterior infarctrs, fig. 3 and table 2.

9 (9 percent) patients could not adequately examined on echocardiography because of poor echogenicity. In 89 of 91 patients the site of the infarction was same on 2 dimensional echocardiography and electrocardiography Among 100 patients who suffered a clinical myocardial infarction wall motion abnormality was detected in 91 patients in at least two myocardial segments (91 percent) table 3. Diagnostic wall motion abnormality was detected in 45 (84 percent) of anterior, 22 (70 percent) of inferior, 4 (60 percent) of posterior and one (50 percent) of lateral wall infarct patients. 9 cases of extensive anterior infarction on electorcardiography had a more extensive area of wall motion abnormality involving part of the lateral wall on echocardiography. All the six patients of posterior infarction were associated with asynergy of the posteriobasal segments of the myocardium i.e. segment No. 18 and 19.

**Figure 3**
**Serial electrocardigraphs in acute myocardial infarction.**

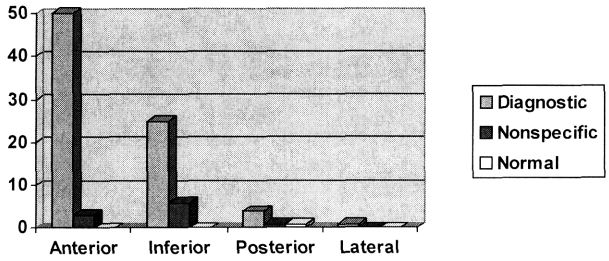


**Table 3.**
**2 dimensional echocardiography early in acute myocardial**

| | Anterior | Inferior | Posterior | Lateral |
|---|---|---|---|---|
| Diagnotic Echo. | 45(84) | 22(70) | 4(60) | 1(50) |
| Technically poor study | 3 | 3 | 1 | 0 |
| Non conclusive | 5 | 6 | 1 | 0 |

## DISCUSSION

The commonly used criteria for clinical diagnosis of acute myocardial infarction consists of typical chest pain, classical electrocardiographic abnormalities and elevation of cardiac enzymes . In case when the admission electrocardiograph is diagnostic an immediate and confirmed diagnosis of infarction is made. However the classically diagnostic electrocardiographic abnormalities on admission are frequently not evident. The diagnostic accuracy of admission electrocardiograph by various author is,

1. Behar et al8 70 percent
2. MeGuinness et al9 51 percent
3. Horowitz et al16 54 percent

In this study the diagnostic sensitivity of admission electrocardiogram was different for different infarct sites (table 1) being highest (70 %) for anterior and lowest for posterior and lateral infarcts. The over all sensitivity in all patients was 55 percent. The diagnostic accuracy of serial electrocardiogram is 83 percent9 Other abnormalities like left bundle branch block, cardiomyopathies etc. also mimic the infarct pattern. The admission electrocardiogram has only 0.77 percent predictive value in ruling out myocardial infarction10.

SGOT and LDH are of no value in immediate diagnosis of acute myocardial infarction. The CPK enzyme determination specifically the MB isoenzyme although occasionally increased in other disease states is more sensitive and specific for the diagnosis of acute myocardial infarction. In a typical patient with acute chest pain CPK- activity exceed the normal range within 3 to 8 hours. The radioimmunoassay determination of MB fraction is almost 100 percent specific and sensitive in diagnosing infarction but the assay takes more then 12 hours to complete". Elevation of CPK-MB even with normal total CM is suggestive of small infarct 12, however the physiologic time delay of 3 to 8 hours for elevation of MB isoenzyme after onset on myocardial infarction, the time required to complete the test and availability of the test particularly in our circumstances are the potential limitations of CPK-MB determination as a diagnostic tool in the earliest hours of the onset of acute myocardial infarction.

Myocardial scintigraphy has also been used in diagnosing acute myocardial infarction with thallium 201 and technetium phrophasphate 13, but radioisotope scan are practically not possible to diagnose acute infarction in the emergency room settings and most of the scans require more then 24 hours before a positive result is obtained14.

Two dimensional echocardiography has been used as a noninvasive diagnostic aid in the diagnosis of acute myocardial infarction. With echocardiography in the earliest days M-mode tracings were used to detect wall motion abnormalities with significant success 15. Two dimensional echocardiography with its expanded view enhanced our ability to detect segmental abnormalities. The sensitivity of 2-dimensional echocardiography in detecting wall motion abnormalities reported is as below,

1. Horowitz 16 94 percent
2. Heger 17 90 percent
3. Gibson 18 97 percent

The results of this study also substantiate the ability of echocardiography to immediately diagnose acute myocardial infarction in patients who have not sustained a prior infarction. Cross sectional echocardiography was used to locate abnormally contracting myocardial segments associated with myocardial infarction. An other technical improvement on instrument used by Heger 17 was a

more wider sector arc (90 degrees), which provided a wider field of vision and permitted direct imaging of entire left ventricle. It is also an effective tool to identify high and low risk subsets of patients. All patients with clinically documented transmural infarction showed an immediate regional dysfunction. No patient of acute myocardial infarction confirmed by serum enzymes and electorcardiography was unrecognized by echocardiography.

From the data in this study it became evident that 2 dimensional echocardiography performed early in acute myocardial infarction is not only feasible but also offers important diagnostic information. It can be used to assess the extent of left ventricular dysfunction and patients can be stratified into high and low risk subsets prone to inhospital mortality.

**LIMITATIONS**

Difficulty arises to distinguish reversible ischemia from infarction by 2 dimensional echocardiography because segmental dysfunction have been found in areas without electorcardiographic evidence of infarction 18,19. Patients with previous history of myocardial infarction were not included in this study. Such patients are more difficult to assess because regional asynergy from prior infarction persists. However in case of multiple infarcts the diagnostic accuracy for a new infarct falls for all diagnostic procedures including electrocardiography Obesity, patients of COPD and chest wall deformities,
because of poor echogenicity could not be properly assessed echocardiographically.

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