

# ACCURACY OF 12 LEAD ECG FOR DIAGNOSIS OF POSTERIOR MYOCARDIAL INFARCTION

Iqtidarul Din<sup>1</sup>, Muhammad Adil<sup>2</sup>, Hameedullah<sup>3</sup>, Mohammad Faheem<sup>4</sup>, Farhat Abbas Shah<sup>5</sup>,  
Mohammad Hafizullah<sup>6</sup>

<sup>1-6</sup> Department of Cardiology,  
Lady Reading Hospital Peshawar - Pakistan.

**Address for correspondence:**  
**Dr. Muhammad Adil**

Senior Registrar, Department  
of Cardiology, Lady Reading  
Hospital Peshawar - Pakistan.  
E-mail: dradil\_2003@yahoo.  
com

Date Received:  
August 13, 2013  
Date Revised:  
March 28, 2014  
Date Accepted:  
March 31, 2014

## ABSTRACT

**Objective:** To determine the accuracy of 12 lead ECG for diagnosis of acute Posterior Myocardial Infarction (MI) after its confirmation by 15 leads ECG.

**Methodology:** This study was conducted in Cardiology Department, Lady Reading Hospital Peshawar from January to July, 2012. Patients presenting to CCU with typical chest pain, pain epigastrium, sweating, nausea or vomiting and with admitting diagnosis of acute coronary syndrome (ACS) were included. The diagnostic criteria for posterior MI on 12 leads ECG was when R:S was more than 1:1 in V2 or there was tall R wave in V1 or V2 (more than S in the same leads) or more than 2mm ST segment depression in anterior lead. Posterior MI was confirmed on 15 leads ECG taking it as a standard when ST segment elevation of >1mm was present in C7,8,9.

**Results:** Out of 176 randomly selected patients, 90(51.1%) were male and 86(48.9%) female; with mean age of 63 years. Out of these, 70 were in the age range of 51 to 60 years and 40 each in 41-50 and 61-70 years. Eighteen patients had changes of posterior MI on 12 leads ECG and amongst them 10 patients had true posterior MI on 15 leads ECG. We had 8 false positive cases on 12 leads ECG with no false negative cases after confirmation with 15 leads.

**Conclusion:** The accuracy of 12 leads ECG for detection of posterior MI was 55% after confirmation with 15 leads and there was no age and gender difference in its accuracy.

**Key Words:** Myocardial infarction (MI), 12 leads ECG, 15 leads ECG

This article may be cited as: Din I, Adil M, Hameedullah, Faheem M, Abbas F, Hafizullah M. Accuracy of 12 lead ECG for diagnosis of posterior myocardial infarction. *J Postgrad Med Inst* 2014; 28(2):145-8.

## INTRODUCTION

The incidence of posterior MI in the context of inferior myocardial infarction varies, depending on the diagnostic criteria used, with estimates ranging from 5% to 10%. Patients experiencing an inferior wall infarct may also have involvement of the posterior wall. Patients with inferior ST elevation myocardial (STEMI) generally have better outcomes than those with anterior infarction. However, the additional impact of posterior MI present in up to 5% of inferior STEMI<sup>1,2</sup>. Acute inferior wall myocardial infarction can be complicated by posterior MI leading to the excess mortality.

The acute in-hospital mortality rate of patients with inferoposterior MI or inferoposterolateral MI is much higher than in those with isolated inferior MI owing to arrhythmic and mechanical complications. The incidence of hypoten-

sion; bradycardia and heart blocks, requiring pacing support is much higher. Inferior MI with posterior MI and with or without shock has significantly higher mortality than anterior MI without shock, and is a predictor of mortality<sup>3</sup>.

Early recognition of isolated posterior wall infarction is essential because its management is different from acute coronary syndrome including unstable angina and non ST Elevation MI<sup>4</sup>. Therapy with only nitrates and morphine is associated with precipitation of complications as it deprives the patient from thrombolytic therapy and so increases the loss of myocardium<sup>5</sup>.

The rationale of this study is to find out the diagnostic accuracy of 12 leads ECG for detection of acute posterior infarction in reference to 15 leads ECG using it as a standard. 15 leads ECG is not difficult and is available commonly but it is not routinely practiced. The purpose of this study was to emphasize the importance of 15 leads ECG in the diagnosis of posterior MI.

## METHODOLOGY

This study was conducted in Cardiology Department, Lady Reading Hospital, Peshawar from January 15, 2012 to July 14, 2012. Patients presenting to Coronary Care Unit, Lady Reading Hospital (CCU, LRH) with typical chest pain, pain epigastrium, sweating nausea or vomiting and with admitting diagnosis of acute coronary syndrome (ACS) were included. Patients having LBBB, pericardial effusion, anterior MI, and LVH were excluded. Posterior MI was diagnosed on 12 leads ECG when R: S was more than 1:1 in V2 or had tall R wave in V1 or V2 (more than S in the same leads) or more than 2mm ST segment depression in anterior lead. Posterior MI was confirmed on 15 leads ECG taking it as a standard when ST segment elevation of >1mm was present in C7, 8, 9. The study was approved by the Hospital Ethical Committee. Patients who visited Cardiology unit Lady Reading Hospital through OPD or ER meeting the inclusion criteria were included in the study. An informed consent was obtained. Sample size of 176 was calculated using 34% accuracy of 12 leads ECG for diagnosis of posterior MI with 95% confidence interval and 5% margin of error using WHO software for determination of sample size.

All the data collected with the help of proforma was entered and analyzed through SPSS version 10. Frequency and Percentages were calculated for categorical variables like gender and accuracy. Mean  $\pm$  standard deviation were calculated for quantitative variables like age. Accuracy was stratified among age and gender to see them as effect modifiers.

## RESULTS

A total of 176 patients fulfilling inclusion criteria were randomly selected and were included in this study. Out of 176 cases, there were 90 males (51.1%) and 86 female patients (48.9%); male to female ratio was 1 to 1.05.

The mean age of patients was  $58 \pm 0.5$  years ranged from 40 to 80 years, Majority of patients (n=70) were in the age range of 51 to 60 years (39%), followed by (n=40) in age group of 61-70 years (22%), and (n=40) patients were in the age range of 40-50 (22%) years,

14% (n=26) patients were in the age range of 71-80 years.

12 Leads ECG was performed on arrival and posterior leads ECG were also taken. 15 lead ECG was the diagnostic modality in 100 % of patients in this study.

Out of total of 176 patients, 18 patients (10.22%) had changes suggestive of posterior MI on 12 leads ECG. Amongst these 10 patients had posterior MI (5.6%) confirmed on 15 leads ECG.

Accuracy of 12 leads ECG for detection of posterior MI was thus calculated after confirmation by 15 leads ECG and was found to be 55% (Table 1). Seven patients in the age range of 51 to 60 years, 4 each in 41-50 and 61-70 years age range, 3 in the age range of 71-80 years were detected as having posterior MI on 12 leads ECG. On the other hand, four patients in the age range of 51-60 years, 2 each in age group of 41-50, 61-70, 71-80 (22%) years age range were confirmed as having posterior MI on 15 leads ECG.

Nine male and 9 female patients had posterior MI on 12 leads ECG. 5 male and 5 female patients had posterior MI on 15 leads ECG. Hence it shows that the accuracy of 12 leads ECG for detection of posterior MI has no age and gender differences as effect modifiers and is same for all age and gender groups.

## DISCUSSION

The ECG diagnosis of acute posterior infarction has traditionally been based on the presence of ST $\downarrow$  on the precordial chest leads<sup>6,7</sup>. However, such ST $\downarrow$  are neither specific nor sensitive for the diagnosis of a posterior infarction. These ECG changes might be caused by anterior ischemia and therefore do not constitute an indication for thrombolytic therapy. Prominent R-waves on leads V1 and V2, which might be the only manifestation of posterior myocardial infarction, do not enable the determination of the age of the infarction<sup>8-11</sup>.

In our study acute posterior infarction was present in 18 patients on 12 leads ECG and 10 patients on 15 leads ECG out of total 176 patients of ACS. Results of our study are consistent with other local and international studies. Overall the incidence of posterior MI is

**Table 1: Accuracy of 12 leads ECG (n=176)**

Characteristic	15 Leads ECG (n=176)	12 Lead ECG (n=176)
Posterior Infarction detected	10 (5.68%)	18 (10.22%)
Posterior Infarction not detected	166 (94.32%)	158 (89.78%)

Accuracy of 12 leads ECG was calculated as 10 cases by 15 leads and 18 cases by 12 leads =  $0.55 \times 100 = 55\%$

4 to 7 % among all MI patients<sup>12, 13</sup>. Studies have shown that posterior chest leads improved the diagnostic accuracy of the ECG for the detection of posterior myocardial infarction (MI)<sup>14, 15</sup>. Other studies<sup>12, 16</sup> have shown that in 2% to 12% of patients with enzymatically confirmed AMI, ST $\uparrow$  occurred only on posterior chest leads. In these studies ST $\uparrow$  in leads V7 through V9 is indeed associated with acute posterior MI. In addition, in these studies the clinical course and the echocardiographic and angiographic findings in patients with such infarcts were also taken into consideration. In our study we did not include echo and angiographic findings.

A study investigating the use of 15-lead ECG in comparison with 12-lead ECG in every emergency chest pain patient showed no alterations in diagnosis and management<sup>17</sup>. The sensitivity and positive predictive value of 12-lead ECG for the diagnosis of MI was 88.4 to 96.8%, respectively, but the specificity for MI was from 91 to 84%. The overall accuracy of the additional lead ECG is only modestly improved. This study is almost comparable to our study in which sensitivity was 100%.

ECG is valuable, noninvasive, easily available and inexpensive modality of diagnosing posterior infarction. V789 are considered the most sensitive leads for the diagnosis of posterior infarction on 15 leads ECG. Its sensitivity is 76% and specificity is 96%<sup>12, 18</sup>. Echocardiographic evidence of akinesia or hypokinesia of posterior wall has also been used as diagnostic criteria for posterior MI in previous studies<sup>12, 19, 20</sup>. However echocardiography is less specific and sensitive than ECG. Nevertheless echocardiographic measurements and wall motion abnormalities is routinely obtained in patient of inferior MI at the time of admission in order to diagnose posterior MI.

## LIMITATIONS

In our study posterior MI diagnosis was not confirmed by echocardiography and elevation of cardiac enzymes. Cardiac biomarkers were also not measured routinely as were measured in previous studies because of early presentation of patients in window period in which cardiac biomarkers are not raised. Secondly cardiac biomarkers can not differentiate between ST elevation and non ST elevation MI. Also in our study angiographic findings and in-hospital complications were not studied.

## CLINICAL IMPLICATIONS

The presence of ST $\uparrow$  in leads V7 through V9 may contribute to the triage of patients with chest pain and help in the early differentiation between patients with acute posterior infarction and those with anterior wall isch-

emia. This distinction may influence the decision-making process regarding the treatment of patients with acute coronary syndrome. The identification of the ST elevation on ECG pattern will enable this subgroup of AMI patients to benefit from thrombolysis or direct percutaneous transluminal coronary angioplasty. In contrast, patients without ST $\uparrow$  in the posterior chest leads (V7 through V9) who present with anterior ischemia manifested by ST-segment depression on precordial anterior chest leads might be candidates for other antithrombotic forms of therapy; for example, glycoprotein IIb/IIIa receptor inhibitors or low molecular weight heparin.

## CONCLUSION

It is noted that the accuracy of 12 leads ECG for detection of posterior MI is only 55% after confirmation with 15 leads ECG and is same for all age and gender groups.

## REFERENCES

1. Chockalingam A, Gnanavelu G, Alagesan R, Subramaniam T. Myocardial performance index in evaluation of acute right ventricular myocardial infarction. *Echocardiography* 2004;21:515-21.
2. Chockalingam A, Gnanavelu G, Subramaniam T, Dorairajan S, Chockalingam V. Right ventricular myocardial infarction: presentation and acute outcomes. *Angiology* 2005;56:371-6.
3. Yeo KK, Low RI, Parsons L, French WJ. Right ventricular infarction with inferior ST-elevation myocardial infarction has higher hospital mortality than anterior myocardial infarction. *Circulation* 2008;118:1050-8.
4. Thygesen K1, Alpert JS, White HD. Redefinition of myocardial infarction universal definition of myocardial infarction. *J Am Coll Cardiol* 2007;50:2173-95.
5. Jacobs AS, Leopold JA, Bates E, Mendes LA, Sleeper LA, White H, et al. Cardiogenic shock caused by right ventricular infarction. *J Am Coll Cardiol* 2003;41:1273-9.
6. Lew AS, Weiss AT, Shah PK, Maddahi J, Peter T, Ganz W, et al. Precordial ST segment depression during acute inferior myocardial infarction: early thallium-201 scintigraphy evidence of adjacent posterolateral or inferoseptal involvement. *J Am Coll Cardiol* 1985;5:203-9.
7. Boden WE, Kleiger RE, Gibson RS. Electrocardiographic evolution of posterior acute myocardial infarction importance of early precordial ST segment depression. *Am J Cardiol* 1987;59:782-7.
8. Khan S, Kundi A, Sharieff S. Prevalence of right ventricular myocardial infarction in patients with acute inferior wall

- myocardial infarction. *Int J Clin Pract* 2004;58:354-7.
9. Samad A. Coronary artery disease in Pakistan: preventive aspect. *Pak J Cardiol* 2003;14:59-60.
  10. Tipoo FA, Quraishi AR, Najaf SM, Kazmi KA, Jafary F, Dhakam S, et al. Outcome of cardiogenic shock complicating acute myocardial infarction. *J Coll Physicians Surg Pak* 2004;14:6-9.
  11. Ali M, Rana SI, Shafi S, Nazeer M. In hospital outcome of acute inferior wall myocardial infarction with or without right ventricular infarction. *Ann King Edward Med Coll* 2004;10:420-2.
  12. Matetzky S, Freimark D, Feinberg MS, Novikov I, Rath S, Rabinowitz B, et al. Acute myocardial infarction with isolated ST-segment elevation in posterior chest leads V7-9 "hidden" ST-segment elevations revealing acute posterior infarction. *J Am Coll Cardiol* 1999;34:748-53.
  13. Oraii S, Maleki I, Tavakolian AA, Eftekhazadeh M, Kaman-gar F, Mirhaji P. Prevalence and outcome of ST-segment elevation in posterior electrocardiographic leads during acute myocardial infarction. *J Electrocardiol* 1999;32:275-8.
  14. van Gorselen EO, Verheugt FW, Meursing BT, Oude Ophuis AJ. Posterior myocardial infarction: the dark side of the moon. *Neth Heart J* 2007;15:16-21.
  15. Wung S, Drew B. New electrocardiographic criteria for posterior wall acute myocardial ischemia validated by a percutaneous transluminal coronary angioplasty model of acute myocardial infarction. *Am J Cardiol* 2001;87:970-4.
  16. Zalenski RJ, Cooke D, Rydman R, Sloan EP, Murphy DG. Assessing the value of an ECG containing leads V4R, V8, and V9: the 15-lead ECG. *Ann Emerg Med* 1993;22:786-93.
  17. Brady W, Hwang V, Sullivan R, Chang N, Beagle C, Carter CT, et al. A comparison of 12- and 15-lead ECGs in ED chest pain patients: impact on diagnosis, therapy and disposition. *Am J Emerg Med* 2000;18:239-43.
  18. Agarwal J, Khaw K, Aurignac F, LoCurto A. Importance of posterior chest leads in patients with suspected myocardial infarction, but nondiagnostic, routine 12-lead electrocardiogram. *Am J Cardiol* 1999;83:323-6.
  19. Mehilli J, Kastrati A, Schulz S, Fröngel S, Nekolla SG, Moshage W, et al. (BRAVE-3) Study Investigators. Ab-ciximab in Patients With Acute ST-Segment-Elevation Myocardial Infarction Undergoing Primary Percutaneous Coronary Intervention After Clopidogrel Loading A Randomized Double-Blind Trial. *Circulation* 2009;119:1933-40.
  20. Khan AN, Ambreen F, Qureshi IZ. Hyperglycemia and in-hospital infarction: Application outcomes after first myocardial infarction. *Rawal Med J* 2006; 31: 55-7.

#### CONTRIBUTORS

ID and MA planned the study, did data analysis and wrote manuscript. H, MF, FA helped in manuscript writing. MH supervised the study. All authors contributed significantly to the final manuscript.