Original Article

To Determine the Diagnostic Accuracy of 12 Lead ECG For Detection of Posterior Myocardial Infarction Keeping 15 Lead ECG as Gold Standards

Mushtaq Ahmad, Noorul Hadi, Shah Wali, Abdul Wali, Tajender

ABSTRACT

Objective: Predictive value of 12 lead ECG in the diagnosis of posterior myocardial infarction keeping 15 lead ECG as a gold standard.

Study Design: Cross Sectional Study

Place and Duration of Study: This study was conducted at the Department of Cardiology MTI Mardan Medical Complex, Mardan from February 2016 to August 2016.

Materials and Methods: Study was conducted in patients presenting with ST Segment elevation Myocardial Infarction.All patients meeting the inclusion criteria were enrolled in the study through OPD/ER department and were admitted in the ward for further evaluation. Patients were quickly evaluated by history and clinical examination and then immediately subjected to 12 lead ECG to detect the posterior MI. Immediately after completing the 12 lead ECG, additional 3 posterior leads were applied to detect posterior MI on 15 lead ECG.Data was entered on a well prepared proforma and SPSS Version 21 was used for analysis of data.

Results: In this study, 165 patients were observed in which mean age was 62 years with standard deviation ± 1.33. 53% percent of the patients were male while 47% patients were female. Posterior myocardial infraction on 15 lead ECG among 165 patients was detected in 25(15%) patients and was not detected in 140(85%) patients.

Posterior myocardial infraction on 12 lead ECG among 165 patients was detected in 17(10%) patients and undetected in 148(90%) patients. Diagnostic accuracy of posterior myocardial infraction on 12 lead ECG, keeping 15 lead ECG as gold standard, had Sensitivity=60%, Specificity = 98.57%, Positive predictive value= 88.24%, Negative predictive value = 93.24%, and Diagnostic Accuracy 92.72%.

Conclusion: Our study concludes that the diagnostic accuracy of posterior myocardial infraction on 12 lead ECG was 92.72%. with sensitivity= 60.00%, specificity = 98.57%, positive predictive value= 88.24% and negative predictive value = 93.24%.

Key Words: Diagnostic Accuracy, 12 lead ECG, posterior myocardial infarction, 15 lead ECG

Citation of articles: Ahmad M, Hadi N, Wali S, Wali A, Tajender. To Determine the Diagnostic Accuracy of 12 Lead ECG For Detection of Posterior Myocardial Infarction Keeping 15 Lead ECG as Gold Standards. Med Forum 2018;29(11):48-51.

INTRODUCTION

CAD is as big a Problem in Pakistan as in the rest of the world.CAD is a growing health problem world wide. it has implications for both men and women. By 2021, it is postulated to be the number 1 killer world wide.[1] Those in the lower socioeconomic strata suffer a worst outcome as compared to the rich. This disease entity deserves the most in terms of resources as it has a very high mortality and morbidity associated with it.[2,3]

Department of Cardiology MTI MMC Mardan.

Correspondence: Dr Mushtaq Ahmad, Associate Professor and Incharge Cardiology, MTI MMC Mardan.
Contact No: 0300-9175470
Email: Mushtaq030091@gmail.com

Received by: April, 2018
Accepted by: August, 2018
Printed by: November 2018

Optimal care of these patients must be ensured. This would decrease the burden of the disease. We must adhere strictly to the standard guidelines in the care of these patients.[4]

According to the most careful estimates based on sound scientific studies nearly 100, 000 suffered an acute MI in Pakistan in the calendar year 2002[5]. MI has the different types like Anterior MI, Inferior MI, Right Ventricular MI and Posterior MI[6].

Anterior MI has grave prognosis as it damages larger part of myocardium while isolated inferior MI damages only a small portion. But Inferior MI should not be taken inferior as it carries poor prognosis if associated with Right ventricular (RV) MI, Lateral or Posterior MI because it is associated with large area of myocardium of LV[7].

Posterior Myocardial Infarction cannot be picked easily on 12 lead ECG because it has no direct relation with posterior wall, so has been phrased as dark side of moon[8]. ST segment depression in anterior leads has

been considered as mirror imaging of posterior wall (equivalent of ST segment elevation in posterior wall). But this doesn't trulyexist in every case because ST segment depression in anterior leads has been considered as only electrical phenomenon in reciprocal leads or ischemia in anterior leads. C[7,8,9] should be done in emergency to look for association of posterior myocardial infarction. Any change in ECG except posterior leads is neither sensitive nor specific for posterior MI[9]. Increasing the number of leads even up to 80 leads further increases the sensitivity[10].

Any clue for posterior MI on 12 lead ECG is an indication for posterior leads (15 lead ECG)[7]. This double practice ECG wastes golden time of thrombolytic therapy. An idea to cumulate all the clues of posterior MI and compare it with 15 leads ECG. Ten of 12 patients who has ECG changes on 12 lead ECG were confirmed to have posterior MI on 15 lead ECG[11]. In another study, for diagnosis of posterior myocardial infarction, 43.3% sensitivity and 95.1% specificity was found in 12 lead ECG with an overall prevalence of posterior MI was 49%[12],

Very limited data is available on this scenario so the aim of this study is to determine the diagnostic accuracy of posterior MI on 12 lead ECG keeping 15 lead ECG as gold standard. In our settings, the burden of MI patients is very high and our staff is very busy. More than 1000 ECGs are performed in casualty and almost 500 ECGs inside Cardiology department. If we find the sensitivity and specificity of 12 lead ECG for detection of posterior MI to be significantly high as compared to available literature, we can use it as a routine in the detection of Posterior MI and the patient can be thrombolysed on early basis by saving the golden time for thrombolysis as saving minutes means saving muscles of myocardium.

MATERIALS AND METHODS

This study was performed at Department of Cardiology, Mardan Medical Complex, Mardan. It was a Cross Sectional(Validation) Study with a duration of 6 months from 29/02/2016 to 29/8/2016. The Sample size was 165 keeping 43% sensitivity, 95% specificity, 40% proportion of posterior myocardial infarction, 95% confidence interval and precision for sensitivity 10% and precision for specificity 4.5%. (n=165)

Data Collection Procedure: The study was initiated after due approval was accorded to it by the Research and Ethical Committee. The patients fulfilling the inclusion criteria were recruited. (i.e. those with characteristic ischemic chest pain, pain epigastrium, sweating, nausea and vomiting) were enrolled in the study. Patients in the OPD/ER who had changes on 12 lead ECG underwent further scrutiny in the ward. The purpose and benefits of the study was explained to all patients and they were assured that the study is done purely for research and data publication and if agreed a written informed consent was obtained.

All patients were quickly evaluated for history and clinical examination. All patients were immediately subjected to 12 lead ECG to detect the posterior MI on the basis of criteria mentioned in operational definitions. Immediately after completing the 12 lead ECG, additional 3 posterior leads were applied to detect posterior MI on 15 lead ECG keeping in view the criteria mentioned in operational definitions.

All the patients were immediately managed as per ward protocols. All ECG recordings and reports were done under supervision of an expert cardiologist. The results of the study were compiled in the form of Graphs and Charts. All data were entered into a proforma.

Data Analysis: SPSS version 21 was used for data analysis. Mean + standard deviation was calculated for age while Frequency and percentage were calculated for gender. Sensitivity, Specificity, positive predictive value (PPV), negative predictive value (NPV) and accuracy was determined by taking 15 lead ECG as gold standard. Effect modifiersincluding age and gender were controlled though stratification. Statistical Analysis was done by usinig chi square test .All the results were presented in the form of tables or charts.

RESULTS

In this study a total of 165 patients, attending Department of Cardiology Mardan Medical Complex, Mardan were observed to determine the predictive value of 12 lead ECG in the diagnosis of Posterior Myocardial infarction, keeping 15 lead ECG as gold standard. The results obtained as:

For the different age groups, 165 patients was analyzed as 36(22%) patients were in age range 41-50 years, 63(38%) patients were in age range 51-60 years and 66(40%) patients were above 61-70 years of age. Mean age was 62 years with standard deviation ± 1.33.

Gender distribution among 165 patients was analyzed as 87(53%) patients were male while 78(47%) patients were female.

Detection posterior myocardial infraction on 15 lead ECG among 165 patients was detected in 25(15%) patients and was not detected in 140(85%) patients. (as shown in Table 1)

Detection posterior myocardial infraction on 12 lead ECG among 165 patients was detected in 17(10%) patients and was not detected in 148(90%) patients. (as shown in Table 2)

Diagnostic accuracy of posterior myocardial infraction on 12 lead ECG keeping 15 lead ECG as gold standard was analyzed as 12 lead ECG had Sensitivity= 60.00%, Specificity = 98.57%, Positive predictive value= 88.24%, Negative predictive value = 93.24%, Diagnostic Accuracy = 92.72%. (as shown in Table 3)

Table No. 1. Posterior myocardial infraction on 15 lead ECG (n=165)

15 Lead ECG	Frequency	Percentage
Detected	25	15%
Not detected	140	85%
Total	165	100%

Table No. 2: Posterior myocardial infraction on 12 lead ECG (n=165)

12 lead ECG	Frequency	Percentage
Detected	17	10%
Not detected	148	90%
Total	165	100%

Table No. 3: Posterior myocardial infraction on 12 lead ECG vs 12 lead ECG (n=165)

		Posterior MI on 15 Lead ECG		
		Detected	**Not Detected**	**Total**
Posterior MI on 12 Lead ECG	**Detected**	(A) 15 TP	(B) 2 FN	17
	Not Detected	(C) 10 FP	(D) 138 TN	148
	Total	25	140	165

Sensitivity= 60.00%
Specificity = 98.57%
Positive predictive value= 88.24%
Negative predictive value = 93.24%
Diagnostic Accuracy = 92.72%

DISCUSSION

Posterior Myocardial Infarction cannot be picked easily on 12 lead ECG because it has no direct relation with posterior wall, so has been phrased as dark side of moon[8]. ST segment depression in anterior leads has been considered as mirror imaging of posterior wall (equivalent of ST segment elevation in posterior wall). But this doesn't truly exist in every case because ST segment depression in anterior leads has been considered as only electrical phenomenon in reciprocal leads or ischemia in anterior leads. C7, 8 ,9 should be done in emergency to look for association of posterior myocardial infarction. Any change in ECG except posterior leads is neither sensitive nor specific for posterior MI[9]. Increasing the number of leads even up to 80 leads further increases the sensitivity[10,11].

In this study 165 patients were observed and categorized as follows; 22% patients were in age group 41-50 years; 38% in age group 51-60 years and 40% were above 61-70 years of age. Mean age was 62 years with standard deviation ± 1.33. Fifty three percent patients were male while 47%) patients were female. Diagnostic accuracy of posterior myocardial infraction on 12 lead ECG keeping 15 lead ECG as gold standard was analyzed as 12 lead ECG had Sensitivity= 60.00%, Specificity = 98.57%, Positive predictive value= 88.24%, Negative predictive value = 93.24%, and Diagnostic Accuracy = 15+138/165 *100 = 153/165* 100=92.72%.

Similar results were observed in another study conducted by Din I et al[11]in which a total of 176 patients were observed. The predicted value of 12 lead ECG was found to be 55, using 15lead ECG as gold standard for Posterior MI. 12 Lead ECG has an accuracy for all age groups , as well as men and women alike.

A previous study using 15-lead ECG in comparison with 12-lead ECG showed equivalent results. The sensitivity and positive predictive value of 12-lead ECG for the diagnosis of MI was around 90%. Similarly, the specificity for MI was also around 90%. A 15 lead ECG added only very little to the findings on 12 lead ECG.[12-16]Our study showed similar results.

A 12 lead ECG is a cheaper modality for the diagnosis of Posterior Myocardial infarction.V789 are valuable leads in case of a 15 lead ECG. Its sensitivity and specificity is around 90%.[17,18,19] Wall motion abnormalities for the diagnosis of Posterior Myocardial Infarction have been used in earlier studies. However sensitivity and specificity is less than that of ECG. [20,21,22] Nevertheless, wall motion abnormality on Echocardiography can have a collaborative evidence in the diagnosis of infarction.

CONCLUSION

Our study concludes that the diagnostic accuracy of posterior myocardial infraction on 12 lead ECG was 92.72%. with sensitivity= 60.00%, specificity = 98.57%, positive predictive value= 88.24% and negative predictive value = 93.24%.

Author's Contribution:

Concept & Design of Study:	Mushtaq Ahmad
Drafting:	Noorul Hadi
Data Analysis:	Shah Wali, Abdul Wali, Tajender
Revisiting Critically:	Mushtaq Ahmad, Noorul Hadi
Final Approval of version:	Mushtaq Ahmad

Conflict of Interest: The study has no conflict of interest to declare by any author.

REFERENCES

1. Gerward S, Tyden P, Hansen O, Engstrom G, Janzon L, Hedblad B. Survival rate 28 days after with first myocardial infarction. Inverse relationship with socio-economic circumstances. J Int Med 2009;154-72.
2. Jacobs AK, Antman EM, Faxon DP, Gregory T, Solis P. Development of systems of care for ST-

elevation myocardial infarction patients: executive summary Circulation 2009;116:217-30
3. Jollis JG, Roettig ML, Aluko AO, Anstrom KJ, Applegate RJ, Babb JD, et al. Implementation of a statewide system for coronary reperfusion for ST-segment elevation myocardial infarction. JAMA 2010;298:2371-80.
4. Masood A, Akhthar N. Review and guidelines for the management of patients with chronic therapeutically refractory angina. Pak J Cardiol 2010;7:6-15.
5. Hasan W, Hameed S, Akbar AM, Kanwal A, Ishaq I, Raza A. Comparison of in-hospital outcome of patients having first acute myocardial infarction with or without pre-infarct angina. The Journal 2012;10(3):79.
6. Saaby L, Poulsen TS, Hosbond S, Larsen TB, Diederichsen ACP, Hallas J, et al. Classification of myocardial infarction: frequency and features of type 2 myocardial infarction. Am J Med 2013; 126(9):789-797.
7. Chung SC, Gedeborg R, Nicholas O, James S, Jeppsson A, Wolfe C, et al. Acute myocardial infarction: a comparison of short-term survival in national outcome registries in Sweden and the UK. The Lancet 2014;383(9925):1305-1312.
8. Metaxa S, Koulouris S, Stalikas D, Velissariou G, Manolis AS. Concealed myocardial infarction revealed by high lateral and posterior electrocardiographic leads. Hospital Chronicles 2011;6(2):91-95.
9. Shemirani H, Nayeri-Torshizi E. Electro-cardiographic characteristics of posterior myocardial infarction in comparison to angiographic findings. ARYA Atheroscler 2015;11(1):30-35.
10. Rezaie S. Posterior Myocardial Infarction: How Accurate is the Flipped ECG Trick? Critical Care 2013;30:7.
11. Adil M, Faheem M, Shah FA. Hafizullah M. Accuracy of 12 lead ECG for diagnosis of posterior myocardial infarction. JPMI 2014;28(2):145-148.
12. Wahib SMA, Islam AEMM, Haque MM, Hossain SMD, Kamal MM, Ali SY, et al. Comparative Study between 12 and 15 Lead Electrocardiograms for Evaluation of Acute Posterior Myocardial Infarction. Cardiovascular J 2012;4(2):153-163.
13. 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.
14. Garwal J, Khaw K, Aurignac F, LoCurto A. Importance of posterior chest leads in patients with suspected myocar dial infarction, but nondiagnostic, routine 12-lead electrocardiogram. Am J Cardiol 1999;83:323-6
15. Mehilli J, Kastrati A, Schulz S, Früngel S, Nekolla SG, Moshage W, et al. (BRAVE-3) Study Investigators. Abciximab in Patients With Acute ST-Segment–Elevation Myocardial Infarction Undergoing Primary Percutaneous Coronary Intervention After Clopidogrel Loading A Ran domized Double-Blind Trial. Circulation 2009; 119:1933-40.
16. Khan AN, Ambreen F, Qureshi IZ. Hyperglycemia and in-hospital Infarction: Application outcomes after first myocardial infarction. Rawal Med J 2006; 31: 55-7.
17. Eckel RH, Jakicic JM, Ard JD, et al, for the American College of Cardiology/American Heart Association Task Force on Practice Guidelines. 2013 AHA/ACC guideline on lifestyle management to reduce cardiovascular risk: a report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines. J Am Coll Cardiol 2014 ;63(25 Pt B):2960-84.
18. David TE. Operative management of post infarction ventricular septal defect. Semin Thorac Cardiovasc Surg 1995;7(4):208-13.
19. Gaudiani VA, Miller DG, Stinson EB, Oyer PE, Reitz BA, Moreno-Cabral RJ, et al. Postinfarction ventricular septal defect: an argument for early operation. Surg 1981;89(1):48-55.
20. Daggett WM, Buckley MJ, Akins CW, Leinbach RC, Gold HK, Block PC, et al. Improved results of surgical management of post infarction ventricular septal rupture. Ann Surg 1982;196(3):269-77.
21. Schachinger V, Erbs S, Elsasser A, et al, for the REPAIR-AMI Investigators. Intracoronary bone marrow-derived progenitor cells in acute myocardial infarction. N Engl J Med 2006;355 (12):1210-21.
22. Traverse JH, Henry TD, Ellis SG, et al. Effect of intracoronary delivery of autologous bone marrow mononuclear cells 2 to 3 weeks following acute myocardial infarction on left ventricular function: the Late TIME randomized trial. JAMA 2011; 306(19):2110-9.