FREQUENCY OF RIGHT VENTRICULAR INFARCTION AMONG PATIENTS PRESENTING WITH ACUTE INFERIOR WALL MYOCARDIAL INFARCTION

Ariz Samin, Nasir Ali*, Shaheer Farhan, Syed Hassan Mustafa, Mahnoor Javaid**, Saqib Malik**, Sajid Khan, Saamia Arshad**, Mahwish Touqeer**, Farhan Tuyyab**

Armed Forces Institute of Cardiology/National Institute of Heart Disease (AFIC/NIHD)/National University of Medical Sciences (NUMS) Rawalpindi Pakistan, *National Institute of Cardiovascular Diseases, Karachi Pakistan, **Ayub Teaching Hospital Abbottabad Pakistan

ABSTRACT

Objective: To determine the frequency of right ventricular infarction among patients with acute inferior wall myocardial infarction.

***Study Design*:** Descriptive cross sectional study.

Place and Duration of Study: Ayub Teaching Hospital, Abbottabad from, Jan 2017 to Sep 2017.

Methodology: A total of 163 patients aged 18-75 years and admitted to coronary care unit (CCU) with first attack of acute inferior wall myocardial infarction, were recruited through non probability purposive sampling. Electrocardiogram and Echo were performed of all patients and their findings were noted for the frequency of right ventricular infarction in acute inferior wall myocardial infarction.

Results: There were 117 (72%) males and 46 (28%) females. Patients were stratified according to their age in four groups i.e. 13 (8%) patients were less than 40 years of age, 26 (16%) patients were aged between 41 and 50 years, 46 (28%) patients were aged between 51 and 60 years of age and 78 (48%) patients were above 60 years of age. Mean ± SD was 60 ± 1.28. Out of 163 patients, 44 (27%) had right ventricular infarction while 119 (73%) did not have right ventricular infarction.

Conclusion: The frequency of right ventricular infraction among patients presenting with acute inferior wall myocardial infarction was 27%.

Keywords: Acute inferior wall myocardial infarction, Right ventricular infarction.

INTRODUCTION

Coronary artery disease (CAD) is a major health hazard around the globe and has now become the most common cause of death in the civilized word[1,2]. It is responsible for an approximately 7.2 million deaths per year or 12% of all deaths in the western countries and thus is a major cause of morbidity and mortality worldwide[3]. In 2014 alone, it caused 9.87% of all deaths in Pakistan, and the numbers are expected to increase in future[4]. Given the high disease burden, acute myocardial infarction has remained a principal focus of cardiovascular therapeutics.

Among CAD, Right ventricular infarction (RVI) was considered a less important and less common entity in the past. However, in recent year RVI has been increasingly demonstrated due to more advanced techniques and guidelines[1]. Also, right ventricular dysfunction after myocardial infarction is a poor prognostic marker, as it is associated with increased in-hospital mortality and morbidity[5,6].

Occlusion of left circumflex branch (LCX) or right coronary artery (RCA) is the major reason for acute inferior myocardial infarction (AIMI). The infarct-related artery (IRA) of acute inferior myocardial infarction can significantly influence the disease progression of AIMI patients. When RCA shown to be the IRA, patients often undergo right ventricular infarction, intermittent cardiac pacing, as well as severe hemodynamic complications, leading to shock, arrhythmias, and even death. However, the prognosis for those with LCX occlusion is much better. Unfortunately, the RCA shown to be the culprit artery in AIMI is much more common than the LCX[7].

An electrocardiogram (ECG) is the first diagnostic test performed in patients complaining

Correspondence: Dr Ariz Samin, Cardiology Department, AFIC/NIHD Rawalpindi Pakistan

of chest pain. If the left ventricle is involved, evidence of inferior lead ischemia/infarction in leads II, III, and AVF is likely to be present. Disproportionate ST-elevation in lead III>II is pathognomonic for RVMI and warrants further investigation. ST elevation in the V1 lead is also highly suspicious for RVMI and is even more specific when coupled with ST-depression in lead V2. Overall, conventional left sided electro-cardiography is a poor indicator of RV ischemia/infarction due to the position of the right side of the heart. If right side dysfunction is suspected, a right-sided ECG is the most sensitive and specific, as ST elevation in V4R >1.0 mm has 100% sensitivity, 87% specificity, and 92% predictive accuracy. Conduction abnormalities such as right bundle branch block, bradycardia, or complete heart block can also manifest themselves in the ECG but may also be non-specific[8-10].

Echocardiography has a high threshold for detecting right-sided myocardial dysfunction, and its increasing availability and fidelity has made it a rising diagnostic modality in a variety of settings such as the emergency department and the operating room. Findings on echo suggestive of RVI include studying right ventricular size, function and contractility[11].

Early reperfusion is the mainstay of treatment in these patients. Reperfusion not only promotes right ventricular function recovery, but also prevents the development of complications and improves survival[12].

The recent study was designed to determine the frequency of RVI among patients with acute inferior wall myocardial infarction. Firstly, no similar study was performed locally, and this study provided data for the local guideline making. Secondly, there is limited data available about the adverse outcome of AIMIin terms of RVI.

METHODOLOGY

It was a descriptive cross sectional study conducted from January 2017 to September 2017 in the department of cardiology, Ayub Teaching Hospital, Abbottabad. A total of 163 patients aged 18- 75 years and admitted to CCU with first attack of acute inferior wall myocardial infarction, were recruited through non probability purposive sampling. Patients with any previous history of heart failure or ischemic heart disease or myocardial infarction, patients with acute pericarditis and/or acute myocarditis were excluded from the study to control confounding. Sample size was calculated using 27% percentage of right ventricular infarct post IWMI, and with 95% confidence interval and 5% margin of error.

The diagnosis of Acute Inferior Wall MI was made on the basis of characteristic retrosternal chest pain radiating to left shoulder or jaw and not relieved by intake of nitrates and elevated serum troponin levels of more than 0.1 ng/dl measured in the laboratory and ECG showing an ST segment elevation of >1.0 mm in limb leads II, III, aVF. Right ventricular infraction (RVI) was diagnosed on echocardiography findings i.e. evidence of right ventricular akinesia/ hypokinesia/ dilatation or development of new tricuspid regurgitation. Patients with any of these findings were considered to have RVI.

After obtaining the approval from hospital's ethics and research committee, an informed written consent was taken from the patients and the details of the study were explained to them. Then, a complete history and physical examination was performed on all patients included in the study. Next, ECG and Echocardiographic studies were performed on all patients and their findings were recorded on a pro forma. All investigations were done by the same cardiologist having atleast 5 years' experience.

Data collected was analyzed using SPSS version-22. Frequency and percentage were calculated for categorical variables like gender and RVI. Means and SD was calculated for numerical variable like age. RVI was stratified among age and gender to see the effect modifications. All results were presented in the form of tables and graphs.

RESULTS

A total of 163 patients were observed in this study conducted at the department of cardiology

Ayub Teaching Hospital Abbottabad. There were 117 (72%) males and 46 (28%) females. Patients were stratified according to their age in four groups i.e. 13 (8%) patients were less than 40 years of age, 26 (16%) patients were aged between 41 and 50 years, 46 (28%) patients were aged between 51 and 60 years of age and 78 (48%) patients were above 60 years of age. Mean ± SD was 60 ± 1.28.

Table-I: Freqeuncy of right ventricular infarction in acute inferior wall myocardial infarction (n=163).

Right Ventricular Infarct	n (%)
Yes	44 (27)
No	119 (73)
Total	163 (100)

Out of 163 patients, 44 (27%) had right ventricular infarction while 119 (73%) did not have RVI. Some of the results are shown in the tables. When the frequency of RVI in IWMI was stratified by age groups (*p*-value = 0.997) or gender (*p*-value=0.873), the results were found to be statistically insignificant.

Table-II: Stratification of right ventricular infarction in acute inferior wall myocardial infarction with age (n=163).

RVI	<40 years	41–50 years	51–60 years	60 years	Total	*p*-value
Yes	4	7	12	21	44	0.997
No	9	19	34	57	119	
Total	13	26	46	78	163	

Table-III: Stratification of right ventricular infarction in acute inferior wall myocardial infarction with gender (n=163).

RVI	Male	Female	Total	*p*-value
Yes	32	12	44	0.873
No	85	34	119	
Total	117	46	163	

DISCUSSION

Acute right ventricular myocardial infaraction (RVMI) is a common complication affecting 30 (50%) of patients after inferior wall myocardial infarction (IWMI)[13].

We investigated the frequency of right ventricular infarct in patients with acute inferior wall myocardial infarction, and it was found to be 27%. A similar study was performed by Jensen *et al*[14], who reported a higher frequency of RVMI i.e. 47%. One reason for their higher frequency may be due to the fact that they used cardiac MRI which is more advanced compare to echo in diagnosing RVI. They also observed that gender had no effect on RVMI frequency which is in accordance with our study.

Iqbal *et al*[15], observed that the frequency of RVMi was 48.5% among patients presenting with IWMI. They enrolled 198 patients with acute inferior wall MI in their study, and used ECG criteria for diagnosing RVI. In addition, they also reported that right ventricular infarct in IWMI patients results in two folds higher mortality.

Pfisterer *et al*[16], had shown that the frequency of RVI in the inferior wall myocardial infarction (IWMI) was 33.2%. His study concluded that among patients with IWMI, highest mortality was found in those patients who were complicated by either complete heart block or bundle branch block. Another similar study conducted by Holman *et al*[17], they reported that complete heart block was the most significant factor in defining poor outcome though reperfusion therapy tend to improve this.

A study conducted in Karachi Pakistan had shown that 23.6% of the patients with inferior wall MI had high degree AV block while 37.7% had right ventricular infarction[18]. They had concluded that advancing age and late presentations were significant risk factors for high degree AV block with resultant worse mortality.

Right ventricles are mostly supplied by the right coronary artery (RCA), and it is when its proximal portion is occluded that the right

ventricular infarct develops. RVI, when develop, leads to reduced RV contractility, leading to hemodynamic compromise. The overall situation can further be complicated by bradyarrythmias. Treatment involves reperfusion therapies and volume resuscitations. However, even in the absence of reperfusion therapies, right ventricles may still recover with spontaneous recovery of RV function, though recovery is usually slow and has a higher in-hospital mortality[19,20].

This study is not without certain limitations. Firstly, we did not obverse the frequency of in-hospital mortality of RVI. Secondly, other associations like diabetes, hypertension and cigarette smoking were not looked into and their relationship with the RVI was not studied. Finally, RVI with inferior wall MI is known to cause complications like complete heart block and cardiogenic shock. We neither documented these complications nor observed their correlation with age or gender.

CONCLUSION

The frequency of right ventricular infraction among patients presenting with acute inferior wall myocardial infarction was 27%.

CONFLICT OF INTEREST

This study has no conflict of interest to be declared by any author.

REFERENCES

1. Mozaffarian D, Benjamin EJ, Alan S, Donna K, Michael J, Heather J, et al. Executive summary: heart disease and stroke statistics–2016 update: a report from the American Heart Association. Circulation 2016; 133(4): 447–54.
2. Yaylak B, Ede H, Baysal E, Baysal E, Altıntas B, Akyuz S, et al. Neutrophil/lymphocyte ratio is associated with right ventricular dysfunction in patients with acute inferior ST elevation myocardial infarction. Cardiol J 2016; 23(1): 100-06.
3. Sanchis-Gomar F, Perez-Quilis C, Leischik R, Lucia A. Epidemiology of coronary heart disease and acute coronary syndrome. Ann Transl Med 2016; 4(13): 256-60.
4. World Health Rankings. Pakistan: Coronary heart disease. [cited 2017 February 3] Available from URL: http://www.worldlifeexpectancy.com/pakistan-coronary-heart-disease.
5. Daanish AC, Sanket KM, Sanjay TT. A study of the clinical profile of right ventricular infarction in context to inferior wall myocardial infarction in a tertiary care centre. J Cardiovasc Dis Res 2013; 4(3): 170–76.
6. Gorter TM, Hummel YM. Right ventricular function after acute myocardial infarction treated with primary percutaneous coronary intervention (from the glycometabolic intervention as adjunct to primary percutaneous coronary intervention in ST-segment elevation myocardial infarction iii trial) Am J Cardiol 2016; 118(3): 338–44.
7. Li Q, Wang DZ, Chen BX. Electrocardiogram in patients with acute inferior myocardial infarction due to occlusion of circumflex artery. Medicine (Baltimore) 2017; 96(42): e6095-00.
8. Albaghdadi A, Teleb M, Porres-Aguilar M, Porres-Munoz M, Marmol-Velez A. The dilemma of refractory hypoxemia after inferior wall myocardial infarction. Proc (BaylUniv Med Cent) 2018; 31(1): 67-69.
9. Ashida T, Tani S, Nagao K, Yagi T, Matsumoto N, Hirayama A. Usefulness of synthesized 18-lead electrocardiography in the diagnosis of ST-elevation myocardial infarction: A pilot study. Am J Emerg Med 2017; 35(3): 448-57.
10. Konstam MA, Kiernan MS, Bernstein D, Bozkurt B, Jacob M, Kapur NK, et al. American Heart Association Council on clinical cardiology; council on cardiovascular disease in the young; and council on cardiovascular surgery and anesthesia. Evaluation and Management of Right-Sided Heart Failure: A Scientific Statement From the American Heart Association. Circulation 2018; 137(20): e578-22.
11. Apostolakis S, Konstantinides S. The right ventricle in health and disease: insights into physiology. Pathophysiol Diagn Manage Cardiol 2012; 121(1): 263–73.
12. Malla RR, Sayami A. In hospital complications and mortality of patients of inferior wall myocardial infarction with right ventricular infarction. JNMA J Nepal Med Assoc 2007; 46(167): 99-02.
13. Albulushia A, Giannopoulosb A, Kafkasc N, Dragasisc S, Pavlidesa G, Chatzizisis SY. Acute right ventricular myocardial infarction. Expert review of cardiovascular therapy 2018: 16(7); 455–64.
14. Jensen CJ, Jochims M, Hunold P, Sabin GV, Schlosser T, Bruder O. Right ventricular involvement in acute left ventricular myocardial infarction: prognostic implications of MRI findings. AJR Am J Roentgenol 2010; 194(1): 592-98.
15. Iqbal MA, Shah I, Rauf MA, Khan N. Frequency of acute right ventricular myocardial infarction in patients with acute inferior myocardial infarction. Pak Heart J 2012; 45(1): 81-85.
16. Pfisterer M. Right ventricular involvement in myocardial infarction and cardiogenic shock. Lancet 2003; 362(1): 392-94.
17. Holman BL, Wynne J, Colucci WS. Right ventricular ejection fraction: an indicator of increased mortality in patients with congestive heart failure associated with coronary artery disease. J Am Coll Cardiol 1983; 2(1): 217-24.
18. Pirzada AM, Zaman KS, Mahmood K, Sagheer T, Mahar SA, Jafri MH. High degree Atrioventricular block in patients with acute inferior Myocardial Infarction with and without Right Ventricular involvement. J Coll Physicians Surg Pak 2009; 19(5): 269-74.
19. Goldstein JA. Pathophysiology and management of right heart ischemia. Journal of the American College of Cardiology. J Am Coll Cardiol 2002; 40(5): 841-53.
20. Eulo LH, Héctor GP, Úrsulo JH, Nilda EZ, Eduardo CV, Ramón VF, Marco AP, et al. Primary reperfusion in acute right ventricular infarction: An observational study. World J Cardiol 2014; 6(1): 14–22.