ORIGINAL RESEARCH PAPER

Cardiology

KEY WORDS:

CLINICAL PROFILE OF ACUTE RIGHT VENTRICULAR MYOCARDIAL INFARCTION IN RELATION TO INFERIOR WALL MYOCARDIAL INFARCTION IN A TERTIARY CARE CENTRE

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Introduction

Coronary artery disease is the commonest form of heart disease and the leading cause of morbidity and mortality throughout the world. Acute myocardial infarction (AMI) is the single most important cause of morbidity and mortality in India. There is increased incidence of acute myocardial infarction in developing countries because of multiple factors like unhealthy food habits, stress factors, increase in habits like smoking and alcohol and rapid urbanization[3,4]. There is an advent of newer diagnostic techniques for the disease, but still ECG remains the pillar as it is non-invasive and easily available. Right ventricular Myocardial infarction(RVMI) is diagnosed using right sided precordial leads (RPL) .With the introduction of RPL diagnosis of RVMI has become easy and economical. Isolated RVMI is not uncommon in acute MI and has its own therapeutic and prognostic implications. Management of RVMI differs from other MIs. The presence of RVMI is known to increase the chances of cardiogenic shock, arrhythmias and conduction blocks[1].

Objectives

1. To study the frequency and clinical profile of right ventricular MI in patient with inferior wall MI.
2. To study the prognosis in patients admitted with right ventricular MI along with inferior wall MI.

Methodology

This study is based on analysis of 50 consecutive patients of Inferior wall myocardial infarction (IWMI)as proved by E.C.G. admitted from June 2021 to December 2021 in the ICCU of Villupuram Medical College and Hospital, Tamilnadu. All the Patients were studied at the time of admission, during management in hospital and followed up in the hospital.

Criteria: Only patients with definite evidence of IWMI in 12 lead standard ECG were included in this study. For these patients additional Right Precordial leads were taken at the time of admission and repeated at 12 hours, 24 hours and 48 hours. A detailed case history was taken and a detailed physical examination was done at the time of admission. Right precordial leads were applied on the areas of chest which the leads corresponded on the left. Criteria for diagnosing RVMI is ST elevation in II, III, avF, V1 and ST elevation in all are any one of the right precordial leads i.e. RV3, RV4, RV5, RV6 and associated mirror changes in the anterior leads. As EchoCardiography and Coronary Angiography was not performed on all the patients in this study, so the reports of these investigations was not considered for the diagnosis of RVMI.

Inclusion Criteria

All the patients with definite evidence of acute inferior wall myocardial infarction as proved by 12 lead ECG along with right ventricular pericardial leads RV3, RV4, RV5, RV6

Exclusion Criteria

- ECG evidence of Left bundle branch block(LBBB)
- History of previous MI
- Cor pulmonale
- Suspected pulmonary embolism
- pericardial disease.

Clinical Examination was given to the examination of Jugular venous pulse, Kussumauls sign, blood pressure, S3 and S4 and systolic murmur of Tricuspid regurgitation. Continuous ECG monitoring was done to detect arrhythmias and conduction defects. Routine investigations like Random Blood Sugar, Urea, Creatinine, total Cholesterol and in most of the cases Creatinine phosphokinase, lactate dehydrogenase and SGOT were estimated. As Echo and Angiogram were done in very few patients, there were not considered for this study.Routine treatment for AMI was given.Complications were identified and treated accordingly.

Results

A total of 171 cases of acute MI were admitted in Villupuram medical college and hospital during the study period.

Table 1: Incidence in all groups

	Total No. of All AMI	No. of IWMI among AMI	Percentage
Incidence in all groups (n)	171	50	29.2%

The incidence of IWMI among all the cases of AMI was 29.2%

Table 2: Incidence of RVMI in IWMI

	Total No. of IWMI	No. of RVMI in IWMI	Percentage
Incidence of RVMI in IWMI (n)	50	16	32%

In our study group of RVMI incidence with inferior wall MI was 32%.So the incidence of RVMI in all cases of AMI was 9.3 %.

Table 3: Age Incidence

Age in years	IWMI without RVMI (n = 34)	RVMI (n = 16)	Total (n = 50)
21 – 30	2 (5.9%)	- -	2 (4%)
31 – 40	4 (11.7%)	1 (6.6%)	5 (10%)
41 – 50	7 (20.5%)	4 (26.6%)	12(24%)
51 – 60	10 (29.4%)	8 (53.3%)	18 (36%)
61 and above	11(32.3%)	2 (13.3%)	13 (26%)

Our study showed a peak incidence of RVMI in the age group of 51 – 60 years but the peak incidence of IWMI was in the age group of 61 years above.

Table 4: Sex Incidence

Sex	Total Incidence in IWMI n=50	IWMI withoutRVMI n=34	RVMI n=16
Male	43 (86%)	30 (88.2%)	13 (81.2%)
Female	7 (14%)	4 (11.8%)	3 (18.8%)

Our study showed a very high incidence of IWMI and as well as RVMI in males compared to females. This may be due to association of many risk factors which is more common in males.

Table 5: Incidence of Risk Factors

Risk Factors	IWMIwithout RVMI (n = 34)	RVMI (n = 16)	Total (n = 50)
Diabetes	10 (29.4%)	2 (12.5%)	13(26%)
Hypertension	16 (47%)	6 (37.5%)	22 (44%)
Smoking	28 (82.35%)	11 (68.7%)	39 (78%)
Family History	13 (38.2%)	7 (43.8%)	20 (40%)
Alcohol	8(23.5%)	5 (31.25%)	13 (26%)

Our study shows percentage of various risk factors associated with MI. In most of cases multiple risk factors co-existed.

Table 6: Symptomatology at Presentation

Symptoms	RVMI (n = 16)	IWMI without RVI (n=34)	IWMI (n = 50)
Chest Pain	15 (93.7%)	33(97%)	48 (96%)
Syncope	7 (43.7%)	2 (5.8%)	9 (18%)
Palpitation	1 (6.2%)	2 (5.8%)	3 (6%)
Sweating	10 (62.5%)	28 (82.3%)	38 (76%)
Angina Pain within 24 hrs.	4 (25%)	6 (17.6%)	10 (20%)

In our study chest pain was the commonest symptom followed by sweating. Syncope was essentially an important presenting symptom in RVMI. Palpitation was the least presenting symptom in IWMI.

Table 7: Physical findings at presentation

Physical Finding	IWMI (n = 50)	RVMI (n = 16)	IWMI without RVMI (n=34)
Pulse:			
Normal(60 –100)	39 (78%)	6 (37.5%)	33 (97%)
Bradycardia (< 60)	8 (16%)	7 (43.7%)	1 (2.9%)
Tachycardia (>100)	3 (6%)	2 (12.5%)	1 (2.9%)
Blood Pressure Normotensive (100-140/60-90) Hypotensive (<100/<60) Hypertensive (>140/>90)	22 (44%) 14 (28%) 14 (28%)	2 (12.5%) 10 (62.5%) 3 (18.7%)	20 (58.8%) 4 (11.7%) 11 (32.3%)
JVP Normal Elevated	12 (24%) 7 (14%)	10 (62.5%) 6 (37.5%)	2 (5.8%) 1 (2.9%)
Heart Sounds S3/S4	4 (8%)	2 (12.5%)	2 (5.8%)
Tricuspid regurgitation murmur	7 (14%)	2 (12.5%)	5 (14.7%)

Hypotension, elevated JVP, Bradycardia and Kussumauls sign were increasingly associated with RVMI when compared to IWMI without RVMI.

Table 8: Showing Clinical Course

		RVMI (n = 16)	IWMI without RVMI (n = 34)	Total (n = 50)
1.	Complicated	11 (68.75%)	18 (52.9%)	29 (58%)
2.	Uncomplicated	5(31.25%)	16 (47.1%)	21 (42%)

Complications were significantly higher in RVMI than in IWMI without RVMI in our study. This clearly indicated that patients with RVMI were prone to develop some complication.

Table 9: Showing Arrhythmia's

	Type of Arrhythmias	RVMI (n=16)	IWMI without RVMI (n=34)	Total (n =50)
1.	SVT/AF	0	0	0
2.	Ventricular	2 (12.5%)	4 (11.76%)	6 (12%)
3.	Ventricular Tachycardia	1 (6.25%)	1 (2.9%)	2 (4%)
4.	Ventricular fibrillation	4 (25%)	1 (2.9%)	5 (10%)

The incidence of VF was significantly high in cases of RVMI and it was a major cause for mortality. However, the incidence of it was very low in IWMI without RVMI.

Table 10: Showing conduction blocks

	Conduction Block	RVMI (n=16)	IWMI without RVMI (n=34)	Total (n =50)
1.	First Degree AV Block	0	3 (8.8%)	3 (6%)
2.	Second Degree AV Block	1 (6.25%)	1 (2.9%)	2 (4%)
3.	Complete Heart Block	7 (43.75%)	2 (5.8%)	9 (18%)

Complete Heart Block was commonly seen in the RVMI and few of them it became normal that too after medication.

Table 11: Showing total incidence of Mortality after thrombolysis

Thombolysis	No. of Patients who	Mortality (n = 8)	P value
With Streptokinase	30	2 (25%)	0.0105
Not done	12	6(75%)	

Our study shows a high incidence of mortality in non thrombolysed patients which proves the benefit of thrombolysis. (p=0.0105)

Table 12: Showing incidence of Mortality Total death in the study = 8

Death in RVMI group = 6

Death in IWMI without RVMI group = 2

	FATAL	NON FATAL	P VALUE
RVMI	6(37.5%)	10	0.004
IWMI without RVMI	2(5.9%)	32	

Mortality is significantly high in RVMI were as it is lower in IWMI without RVMI(p=0.004).

Discussion

Our study consisted of 50 consecutive patients of IWMI. . Our study shows 9.3% (only ECG proven) of RVMI in all cases of MI. Cabin and Setaro J. reported an incidence of RVMI in 13% of all cases of MI studied in 1992Our reported incidence of RVMI is comparable to that of Cabin and Setarostudy[5]

Our study based on ECG shows an RVMI in IWMI incidence of 32% and Gertz et al reported necropsy analysis of IWMI as a part of TIMI study to have had RVMI in 30% of patients. So our report tallied with that of Gertz et al study.[6]

In Dittrich et al study the maximum incidence of MI was below 60 years (75.26%) and 24.26% in the patients aged above 60 years. Here the study was done in 820 patients MI. In Isreli Heart Study the peak age incidence was seen in age group of 45 – 54 years. Our study of IWMI had a peak incidence of IWMI in 32.3% in the age group of 51 –60 years and RVMI of 53.3% in the same age group. So our report is similar and compared with these two groups with respect to age.[7]

Chinnaiah et al reported an incidence of 72% in males and Kannel W.B. et al in a 26 years follow up of a group of males and females aged between 35 – 84 years found the incidence to be 66%. Our study shows a higher incidence i.e., 86% in males. This clearly indicates a male predominance and it might be due to higher associated risk factors like smoking stress factors and alcoholism.

Masaharu Ishihara et al showed an incidence of Cigarette Smoking to be present in 90% of patients with MI and Framingham Study shows 86%. Our study showed 82.35% of IWMI patients to be smokers and none of the females in this study group were smokers.[10]So this high incidence of smoking associated with MI clearly proves that tobacco smoking is a very important risk factor for the development of MI.

In Dittrich Study IWMI and alcoholism correlation was 17.5%. Our study shows an incidence of 23.5%, which matches with that of Dittrich study.[11]

There is little difference between our study and Framingham study with that of North Karella Project and this difference is not very significant.The high incidence of hypertension in our study may be because we had a very limited study group over a short period.[12]Usually these risk factors are not present singly. Multiple risk factors present together and this increases the risk.

Chest pain is the commonest symptom in AMI and it was present in 93.7% of our study group and in 97% of patients of RVMI. Syncope was a very prominent symptom to be present with RVMI that is in 43.7%. It was also present in 18% of IWMI without RVMI.This indicates a higher incidence of conduction defects in cases of RVMI, which is the cause of syncope.

Braat reported an incidence of bradycardia in 48% patients of RVMI and Mohan et al in 66%. While out study shows 43.7% incidence. Whereas bradycardia in IWMI without RVMI in our study was 2.9%. Our study correlates with the reported incidences of other two groups. This mainly due to the involvement of the A.V.Node.[13]

Shah et al reported hypotension in 52% and Mohan et al in 55% and our study shown 62.5% in cases of RVMI. This is comparatively high when compared with 11.7% of hypotension in IWMI without RVMI. This proves that RVMI causes significant hemodynamic derangements.[13]

Dell' Italia showed that raised JVP was present in 88% of the cases and 62.5% in our study. Dell' Italia et al reported the specificity of raised JVP to the 69% in cases RVMI. This shows that JVP is an important clinical indicator for RVMI and it also proves RV is an important part of circulation.In our study ECG was the only (12 lead standard ECg + RPLs) investigative device used to prove RVMI .In our study in patients with RVMI, ST elevation in only one RPL was not found. But RV4 was elevated in all the 15 cases of RVMI. Croft et al in 1982 was the first to report that ST elevation of 1 mm or more in one or more of RV4 to RV6 was 90% sensitive and 91% specific for RVMI. It is now generally agreed that 1 mm ST elevation in RV3 to RV6 or only in RV4 in highly specific and sensitive for diagnosing RVMI.[14,15]

Chou et al in 1981 had proposed that ST elevation in V1 might suggest RVMI and our study of RVMI in 15 patients showed that there was STS elevation in V1 in 9 cases (60%). This is significant finding.[14]

Lloyd et al have reported completed Heart Block in 31% of the cases where as our study showed 43.75%. in our study of complete heart block in IWMI without RVMI was 5.8%. This shows a significant risk in patients of RVMI to develop complete heart block than in patients of IWMI without RVMI. This is because of the involvement of the AVnode.[14]The incidence of VF in RVMI was 25% where as in IWMI without RVMI was 2.9% in our study.

Cinca et al reported an incidence of 4% of patients developing VF during thrombolysis. His study included all cases of MI. Our study has only IWMI and RVMI. So incidence of VF in our study is very high.[16]

The incidence of VT in RVMI was 6.25% and 2.9% in IWMI without RVMI in our study.. [17] Mortality rates, particularly, in RVMI, is higher than compared to IWMI without RVMI. In our study the mortality in RVMI was 37.5%. Whereas it was only 5.9% in IWMI without RVMI. In thrombolysed patients the mortality was significantly low (25%) compared with non thrombolysed patients (75%). Most of the cases of RVMI were not suited for thrombolysis of the associated complications. In these patients the death was high. Castaigne et al in their study of mortality after thrombolysis reported an incidence of 4% where as in our study it was 25%.

Conclusion

The incidence of mortality and complications can be reduced only when we are fully aware of the diagnosis and the complications that can occur in RVMI.

In all cases of IWMI, RVMI should be looked for by using simple and specific investigation like RPLs of ECG.

Clinically RVMI can be suspected when there is bradycardia, irregular pulse, hypotension and elevated JVP with clear lungs in a setting of Acute MI.

ECG is a very simple investigative tool. The Advantage of ECG is it is easily available, noninvasive, cost effective, specific and sensitive.

The incidence of complications like hypotension, conduction defects and arrhythmias are very high in RVMI. Hypotension occurs because of mechanical pump failure and can be corrected just by volume loading and occasionally drug may be required to raise the BP.

Conduction defects like I degree, II degree and complete heart block are commonly seen. They are usually transient resolving with a short period of time but may be prolonged causing serious hemodynamic derangements and can cause death. Atropine should be given initially, if it not responded, injection Isoprenaline and cardiac pacing may be useful.

Arrhythmias occurs commonly in RVMI. Ventricular ectopic are the commonest and they usually do not cause problem and treatment. If they are recurring regularly. Injection Lidocaine is given. Ventricular Tachycardia and Ventricular Fibrillation are seen commonly in RVMI. VF is life threatening and should be reverted by DC cardioversion. The mortality rate in RVMI is very high due to its association with complications. So RVMI should be carefully searched for and the complications should be anticipated and necessary interventions should be undertaken as early as possible.

References

1. Kakouros N, Cokkinos DV. Right ventricular myocardial infarction: pathophysiology, diagnosis, and management. Postgrad Med J 2010;86:719.
2. Leo Schamaroth. A text book of electrocardiography. 1995.
3. Fisch Charles. Electrocardiography. Braunwalds a text book of Cardiovascular medicine. New York McGraw Hill, 5th edition: 108.
4. John A Farmer, Antonio M Gottojr. Text book of Cardiovascular Medicine, 5th edn. 1148.
5. Gazino JM et al. Relation between systemic hypertension and blood lipids on risk of MI. Am J Cardiol 1999; 84(7): 768-773.
6. Kinch and Hyan. RVI. NEJM 1994; 330: 1211 to 1217.
7. GISSI study. Effectiveness of IV thrombolytic therapy treatment in AMI. Lanct 1986; 1:397-401.
8. Ferguson JJ, Diver DJ, Boldt M Et al. Significance of nitroglycerine induced hypotension with IMI. Am J Cardiol 1989; 68:311.
9. Castagine AD, Herve C, Duval A et al. Pre hospital versus hospital use of thrombolytics. Am J of Cardiol 64: 628-636.

10. Michael J Davis. Pathology of coronary atherosclerosis. Hurst's. The Heart, 9th edition. New York McGraw Hill: 1161-1189.
11. Erhardt CR, Sjogren A Wahlberg. Single Rt precordial lead in Diagnosis of RVI in IMI. Am Heart J 1976; 191: 571.
12. Berger PG, Rucco NA, Timon TC et al. The impact of thrombolytic therapy on RVI complicating IMI, Results from thrombolysis in IMI. Circulation 1989; 80: 311-313.
13. Goto, Yamamoto J, Saito M Et al. Effects of RV ischemia on LV geometry and the end diastolic pressure volume relationship in dog. Circulation 1985; 72: 1104.
14. Kneiakes BJ, Ports TA, Botvinic EH et al. RVMI with ventricular septal rupture. Am Heart J 1984; 107: 1257.
15. Kakouros N, Kakouros S, Lekakis J, et al. Tissue Doppler imaging of the tricuspid annulus and myocardial performance index in the evaluation of right ventricular involvement in the acute and late phase of a first inferior myocardial infarction. Echocardiography 2011; 28:311.
16. Adam JE, Sicard JM, Allen BT et al. Diagnosis of perioperative MI with management of cardiac Tropon in I. NEJM 1994; 330: 670.
17. Braat SH, Brugada P, de Zwaan C Et al. Value of ECG in diagnosing RV involvement in patients with Acute IMI. Br Heart J 1983; 49: 368.