Right Ventricular Myocardial Infarction As An Independent Predictor Of Prognosis In Acute Inferior Wall Myocardial Infarction

[1]Dr. M. Nataraj, M.D., [2]Dr. G. Vinoth Khanna, M.D., [3]Dr. A. Salma Hanam, M.D., [4]Dr. K. Dhananjayan, M.D.,* [5]Dr. R. Ranjiv

[1,2,4] Associate Professor, Department of General Medicine, Government Thiruvarur Medical college, Thiruvarur, Tamil Nadu, India

[3] Assistant Professor, Department of General Medicine, Government Thiruvarur Medical college, Thiruvarur, Tamil Nadu, India

[5] Junior Resident, Department of General Medicine, Government Thiruvarur Medical college, Thiruvarur, Tamil Nadu, India

*Corresponding Author:
Dr. K. Dhananjayan, M.D.

Associate Professor, Department of General Medicine, Government Thiruvarur Medical college, Thiruvarur, Tamil Nadu, India

Type of Publication: Original Research Paper
Conflicts of Interest: Nil

Abstract

Background: Right ventricular myocardial infarction (RVMI) is frequently associated with inferior wall myocardial infarction (IWMI). In this study the incidence, presentation, risk factors, prognosis and complications of IWMI with and without right ventricular involvement analysed, as RVMI may affect the prognosis of patients with inferior wall myocardial infarction[1].

Methods: Presence of RVMI in patients presenting with IWMI (n=50) is identified by electrocardiogram, 12-lead and right precordial leads (RPL). ST elevation of greater than 1 mm in right precordial leads suggestive of RVMI, further confirmed by cardiac enzymes and echocardiogram

Results: Their mean age was 55.56 years; there were 42 males. RVMI was evident in 24 (48%) cases. Risk of bradycardia and hypotension is high with patients in RVMI group than with non RVMI. There were two deaths in our study, both were among the RVMI group

Conclusions: RVMI occurs in more than one-third of patients with acute IWMI. All the patients with IWMI should have RPL electrocardiogram recorded as early as possible for evidence of RVMI, of which V4R have the highest sensitivity. Early diagnosis of RVMI in patients with IWMI will guide in appropriate management and better outcome.

Keyword: Right ventricular myocardial infarction, Electrocardiogram, Right precordial leads, Inferior wall myocardial infarction

Introduction:

Right ventricular myocardial infarction (RVMI) is recognized first in a sub-group of patients with inferior wall myocardial infarction (IWMI) in whom right ventricle failure and elevated right ventricular filling pressure observed despite relatively normal left ventricular filling pressure[4]. In Post-mortem studies right ventricular involvement was 19% to 51% of patients with acute IWMI. RVMI contributes significantly to haemodynamic instability, atrioventricular block, bradycardia requiring pacing support and in-hospital mortality and morbidity[10].

Though RVMI can be diagnosed from echocardiography, first pass/equilibrium radionuclide ventriculography, technetium pyrophosphate myocardial scintigram, haemodynamic measurements

and angiography, right precordial lead (RPL) electrocardiogram is most readily available and easily performed. Identification of RVMI in patients with IWMI is important because, management of RVMI differs substantially from the management of left ventricular myocardial infarction[3]. The present study was done to identify RVMI among IWMI patients using RPL electrocardiogram and to evaluate it's prognostic value in patient with IWMI.

Material And Methods:

Inclusion Criteria

The study was done on fifty patients presenting with IWMI diagnosed on the basis of history, physical examination, electrocardiogram (12 lead and RPL), cardiac enzyme estimation and echocardiography admitted to intensive care unit (ICU) of Government Thiruvarur Medical College and Hospital, Thiruvarur, during the period May 2021 to January 2022, who were above 20 years of age and gave consent to participate in the study.

Exclusion Criteria

Patients with associated anterior and lateral wall MI, history of previous myocardial infarction, ECG evidence of left bundle branch block (LBBB), cor-pulmonale, suspected pulmonary embolism, associated pericardial disease and patients not consenting to participate were excluded from the study.

In all patients, a detailed history and careful physical examination was done with emphasis on haemodynamic parameters like jugular venous pulse (JVP), hypotension, presence of third and fourth heart sounds and cardiac murmur. Associated cardiovascular risk factors like smoking, hypertension, diabetes mellitus, alcohol and betal nut chewing were recorded.

ECG (12-lead and RPL), cardiac enzyme assay and echocardiogram were carried out in all patients. Right precordial leads (RPL) were applied on the right side of chest on the areas to which the leads corresponded on the left. ECG monitoring was done during the stay in ICU for identification of arrhythmias and conduction blocks [5].

Criteria for diagnosing RVMI [6]:

In a patient with acute IWMI,

1. ST segment elevation of 1mm or more in lead V1 or any one of the right precordial leads(V4R-V6R)

2. ST segment elevation in V1, with ST segment depression in lead V2 also indicates the presence of right ventricular infarction

3. Lead V4R was found to be the most sensitive of all precordial leads

Echocardiography and laboratory investigations included random plasma glucose, fasting lipid profile, blood urea nitrogen, along with serum lactate dehydrogenase (LDH), Creatine phosphokinase(CPK), CK-MB and Troponin I was done in all patients.

All patients with inferior wall MI were divided into RVMI and non RVMI group based on right precordial ECG findings and confirmed with echocardiogram.

Statistical Analysis

Descriptive statistical analysis for continuous measurements was presented on mean ± standard deviation (SD). Results on categorical measurements was presented in number (%). The Chi-Square test was used to compare the categorical variables. Two-sided p-value of <0.05 was accepted for statistical significance.

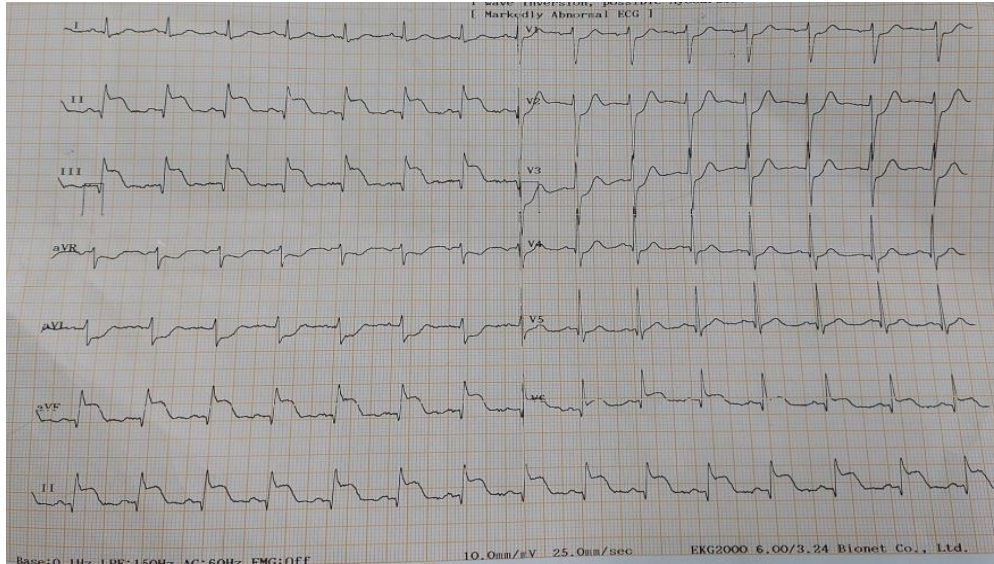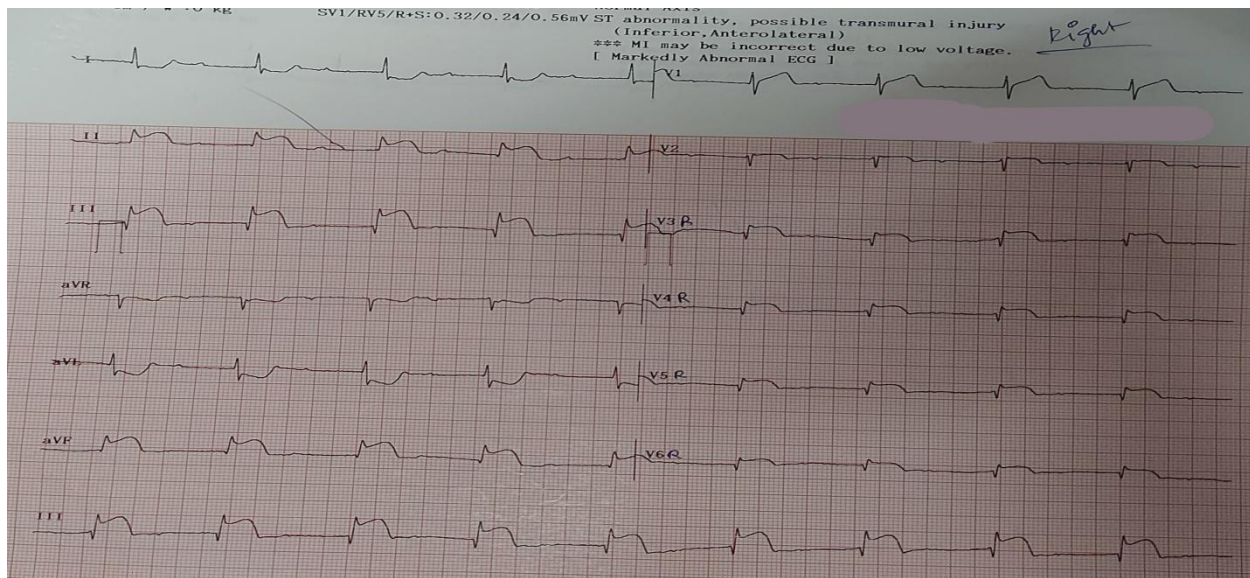**Fig.1 Acute inferior wall myocardial infarction**

Fig.2 Acute inferior wall MI with right ventricular MI

Results:

Of the 50 cases with inferior wall MI, 24(48%) cases had evidence of RVMI. Their mean age was 55.56 years; there were 42(84%) males. Most of IWMI patients (30%) were in the age group of 61-70 years. RVMI was seen maximum in 41-50 years age group. IWMI is associated with alcoholism as major risk factor in 21 (42%) patients followed by diabetes mellitus in 20 patients(40%). In patients in RVMI group, same association was seen i.e., alcoholism was the major risk factor.

The common presentation was chest pain (95.83%), excessive sweating and giddiness (33.33%) in RVMI group. Ten patients presented with Bradycardia among which 7 were in RVMI group. Out of 5 patients with hypotension, 4 were in RVMI group and Jugular Venous Pulse was elevated among 3 patients with RVMI group, both were statistically significant. Sinus bradycardia, 1st and 2nd degree heart blocks were more common among RVMI group. Two deaths occurred, both were in RVMI group which was statistically significant.
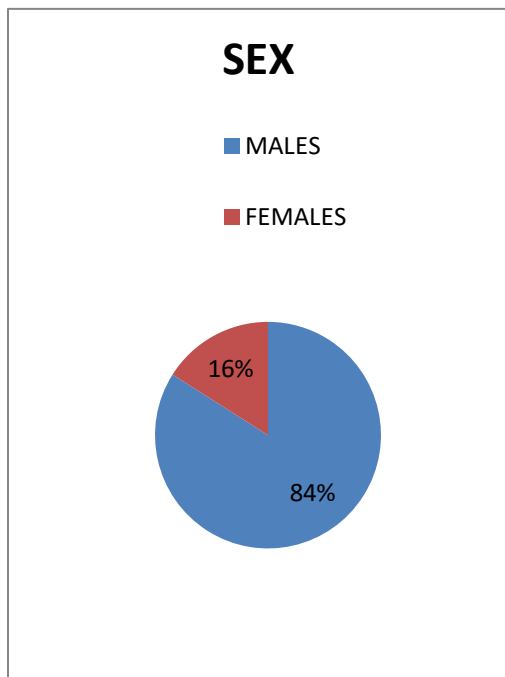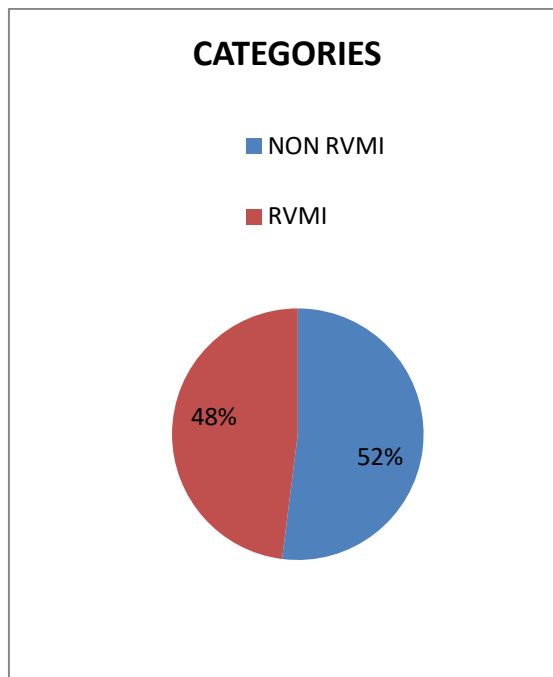
Chart 1 Sex distribution

SEX

■ MALES

■ FEMALES

16%

84%

Chart 2 Category wise distribution

CATEGORIES

■ NON RVMI

■ RVMI

48%

52%

Table 1   Sex distribution

MALES	42
FEMALES	8
TOTAL	50

Table 2   Category wise distribution

NON RVMI	26
RVMI	24
TOTAL	50

Chart 3   Distribution of age group among NON RVMI & RVMI Group

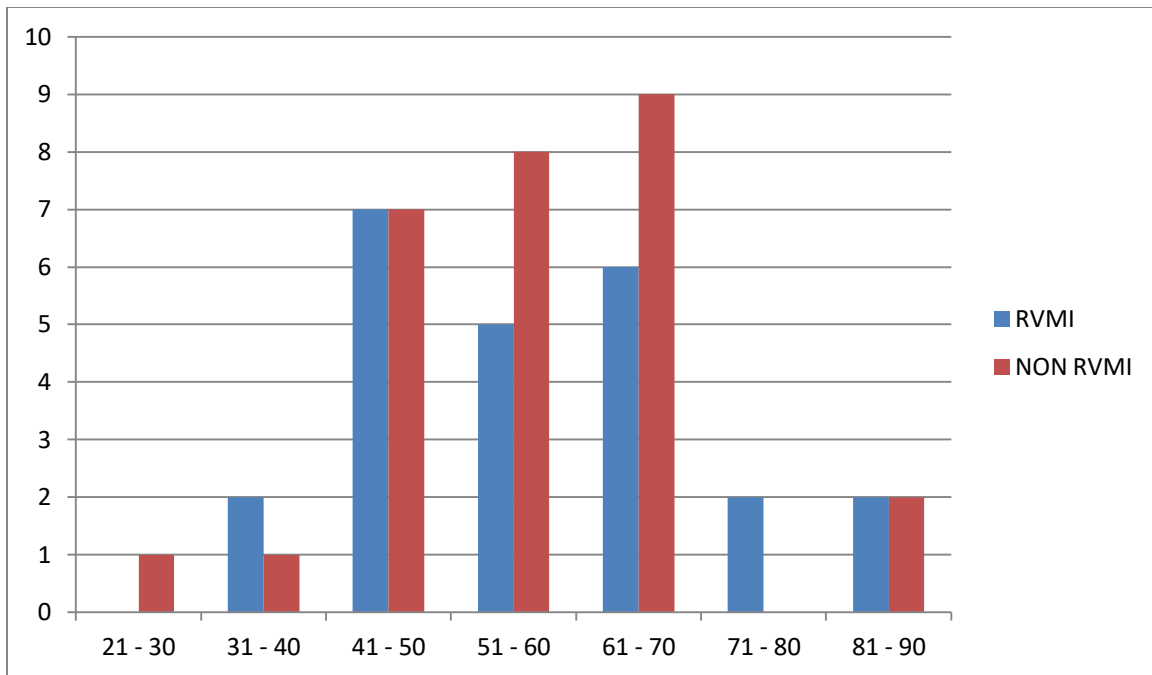**Table 3   Distribution of age group among NON RVMI & RVMI Group**

AGE GROUP	NON RVMI	RVMI
21 – 30	1	0
31 – 40	1	2
41 – 50	7	7
51 – 60	8	5
61 – 70	9	6
71 – 80	0	2
81 - 90	0	2

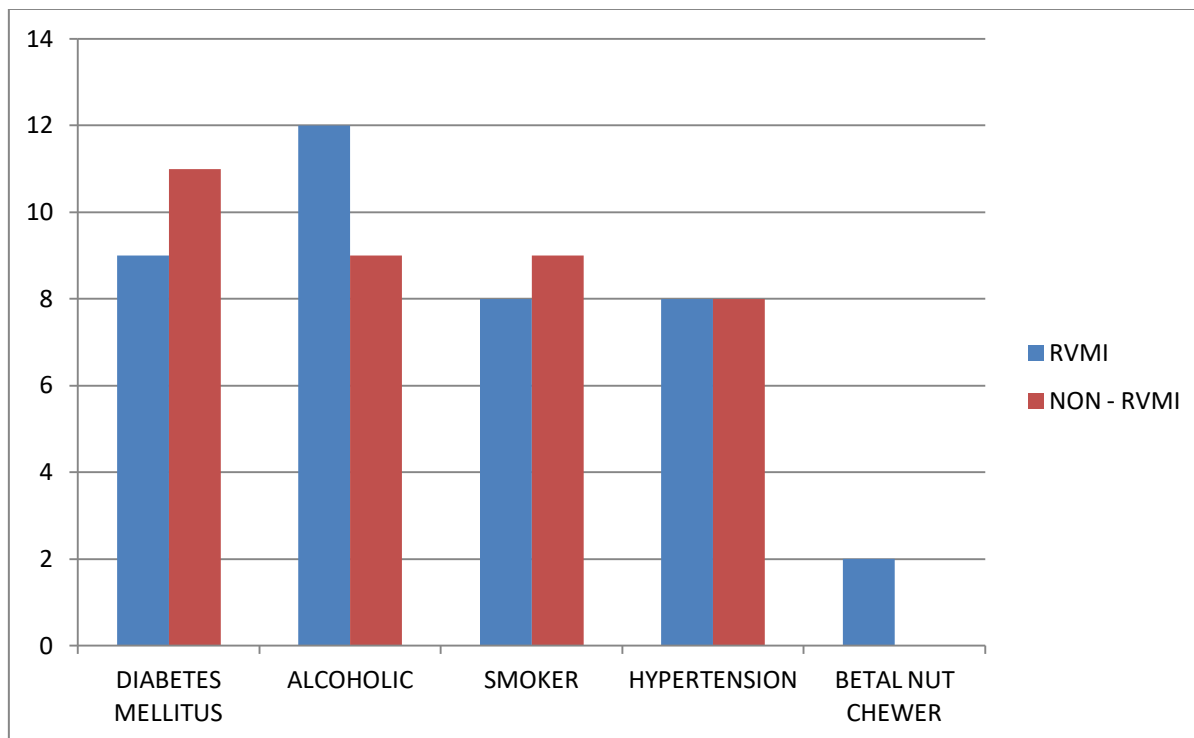**Chart 4   Distribution of risk factors among NON RVMI & RVMI Group**

Table 4   Distribution of risk factors among NON RVMI & RVMI Group

RISK FACTORS	NON RVMI	RVMI
DIABETES MELLITUS	11	9
ALCOHOLIC	9	12
SMOKER	9	8
HYPERTENSION	8	8
BETEL NUT CHEWER	0	2

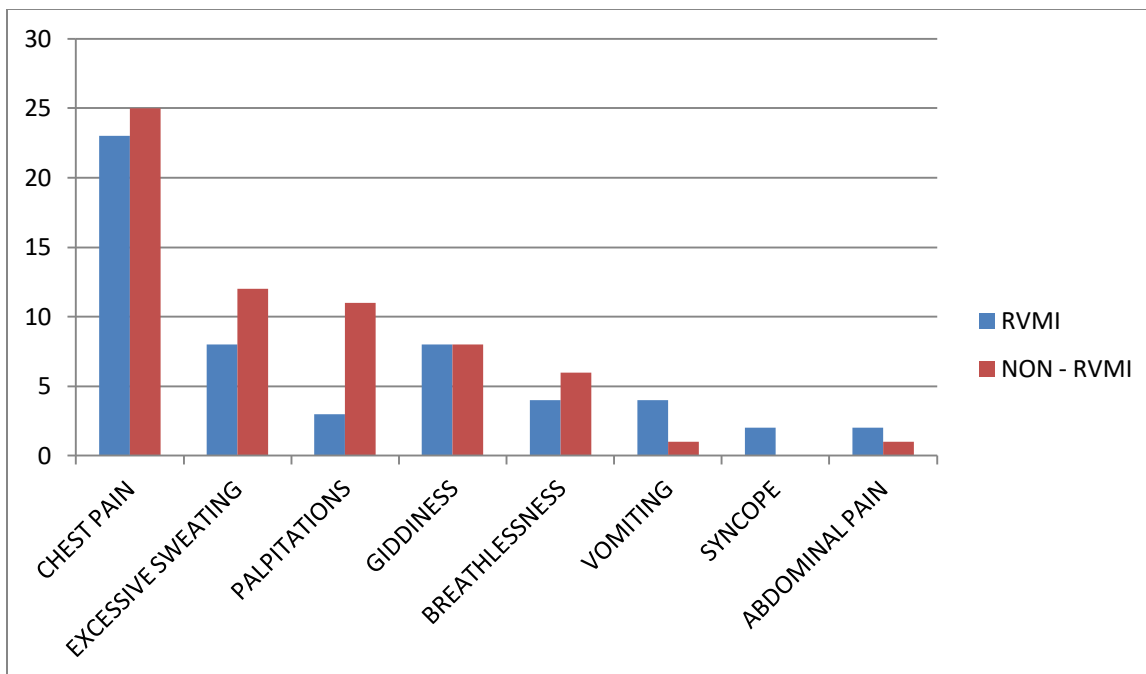## Chart 5   Distribution of symptoms among NON RVMI & RVMI Group

Table 5   Distribution of symptoms among NON RVMI & RVMI Group

SYMPTOMS	NON RVMI	RVMI
CHEST PAIN	25	23
EXCESSIVE SWEATING	12	8
PALPITATIONS	11	3
GIDDINESS	8	8
BREATHLESSNESS	6	4
VOMITING	1	4
SYNCOPE	0	2
ABDOMINAL PAIN	1	2

Page294

Table 6   Comparison of physical examination findings at presentation in patients with and without RVMI

Physical findings	With RVMI (n = 24)	Without RVMI (n = 26)	P-value*
Pulse(/min)			
< 60	7	3	>0.05
60– 100	14	21	>0.05
>100	3	2	>0.05
Systolic Blood Pressure (mmHg) Low (< 90)	4	1	**<0.05**
Normal (90 – 120)	13	10	>0.05
High (>120)	9	13	>0.05
Jugular Venous Pulse Elevated	3	0	**<0.05**
Basal crepitations	0	0	>0.05

*p value <0.05 significant by applying Chi square test

Chart 6   Distribution of pulse rate among NON RVMI & RVMI Group
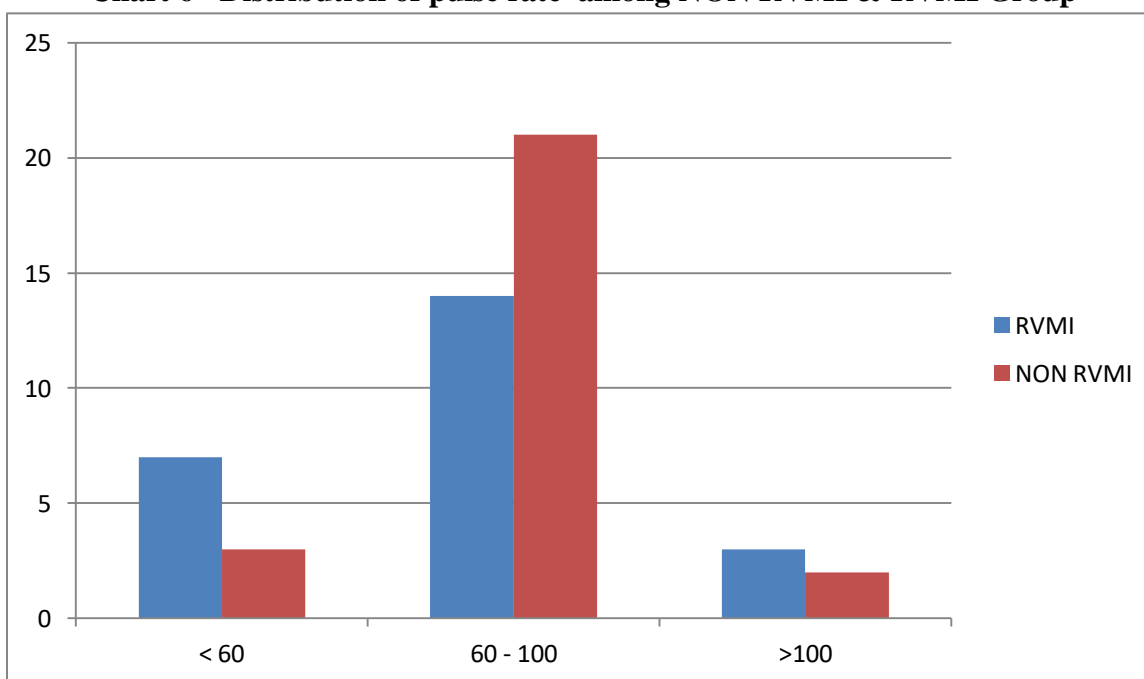
Page295

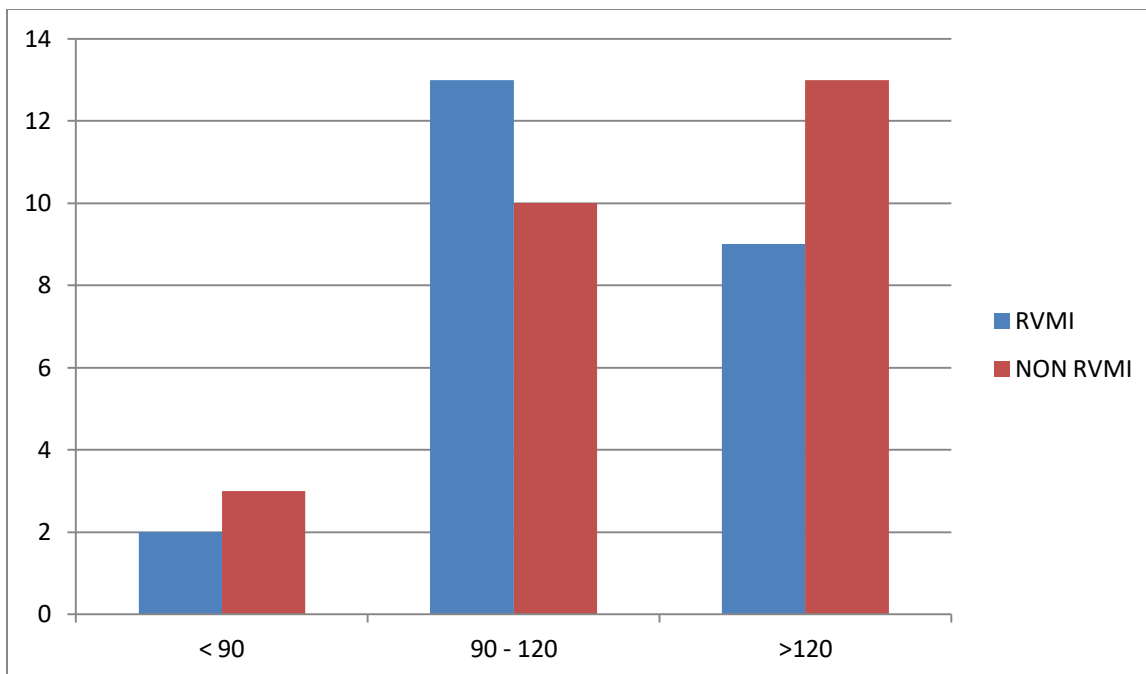## Chart 7   Distribution of blood pressure among NON RVMI & RVMI Group

Table 7 Comparison of complications among RVMI and NON RVMI

COMPLICATION	RVMI	NON RVMI	P- value
Multiple VPC*	1	4	>0.05
1st degree heart block	2	2	>0.05
2nd degree heart block	2	0	>0.05
Complete heart block	0	2	>0.05
Sinus tachycardia	4	4	>0.05
Sinus bradycardia	10	8	>0.05
Ventricular tachycardia	0	1	>0.05
Atrial fibrillation	0	1	>0.05

*VPC ventricular premature contractions

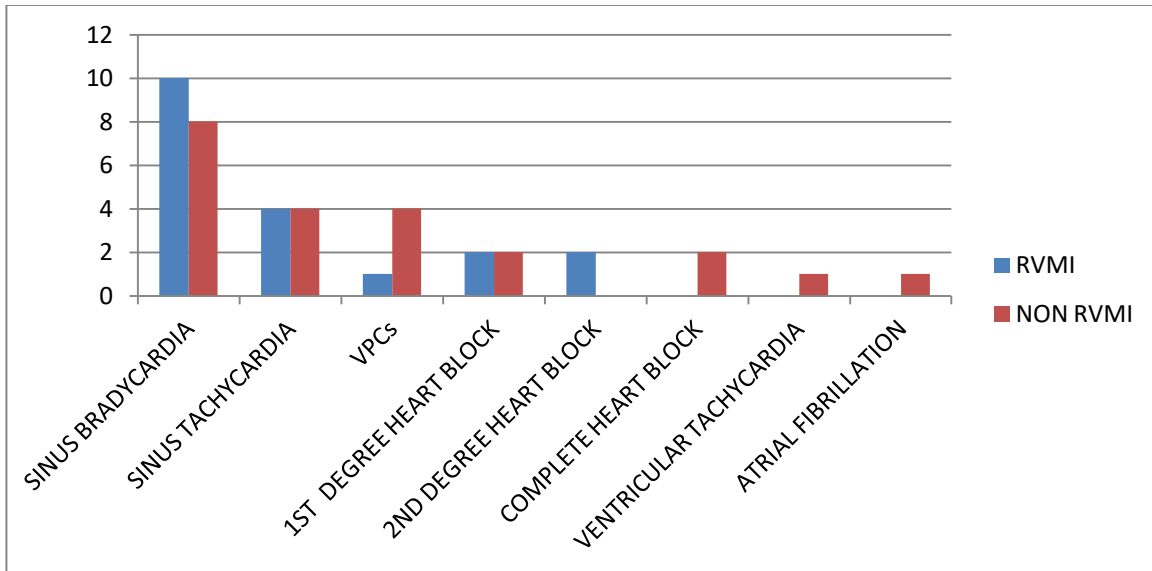**Chart 8   Distribution of complications among Non RVMI & RVMI Group**

Table 8   Outcome among RVMI and NON RVMI

OUTCOME	ADMITTED	DISCHARGED	DEATH
RVMI	24	22	**2**
NON RVMI	26	26	0
TOTAL	50	48	2

Discussion:

In the present study, RVMI was evident in 48% of cases with inferior wall MI. Most of the cases(39.2%) of RVMI occurred in the age group of 41-50 years in the RVMI group compared to non-RVMI, which was commonly (34.6%) seen in the age group of 61-70 years. In the study done by Ferguson et al[9], it was observed that prevalence of RVMI increased as the age advanced which was not evident in our study.

In the present study 84% were males. Similar male preponderance (84%) was reported in the study done by Iqbal et al[3]. Among the 42 male patients in our study 22 (38%) had RVMI while only 2 of the 8 women (25%) had evidence of RVMI, however, this difference did not attain statistical significance. Two patients with RVMI with second degree heart block presented with syncope. Patients with RVMI and complete heart block have been observed to present

with episodes of syncope classically described as Stokes-Adams attack.

In our study among the 50 patients with IWMI, five patients presented with hypotension, four among RVMI group and one in non RVMI group. The IWMI patients associated with RVMI frequently present with hemodynamic instability which is evident in our study. RVMI results in right ventricular failure, clinically can be seen with raised JVP and can be confirmed by echocardiogram.

Totally there were two deaths,, both were among RVMI group resulting from cardiogenic shock. It has been observed that inferior wall MI patients who also have right ventricular myocardial involvement are at increased risk of death, cardiogenic shock and arrhythmia. Patients with RVMI who are haemodynamically unstable should be managed with volume loading to maintain adequate RV preload, as preload determines RV output. Any interventions that

Page 297

reduce the preload, like diuretics, nitrates and vasodilators should be avoided even in the absence of hypotension as this will lead to worsening of symptoms and result in poor outcome. Hence treatment strategy is different from therapy for pump failure caused by acute left ventricular infarction due to need for maintaining the RV preload in acute RV infarction[4].

All IWMI patients should have right sided precordial leads recorded as early as possible for evidence of RVMI, of which V4R has the highest sensitivity[8]. The diagnosis can be confirmed by echocardiography for RV dilatation thus helping in preventing the complications and mortality associated with it.

The limitations in this study is small sample size and gender specific analysis could not be done. Long term prognosis could not be analysed as this is not a prospective study.

Conclusion:

In patients with myocardial infarction, especially those with IWMI, right ventricle involvement is an important contributor of shock, which significantly increases the risk of mortality. Our observations suggest that RVMI occurs in more than one-third of patients with acute inferior wall MI. Volume loading has long been considered the cornerstone of management in these cases. Early successful reperfusion using revascularization along with volume replacement aids in recovery from shock associated with RVMI, resulting in improved prognosis.

This article has demonstrated the importance of identifying RVMI in patients presenting with inferior wall MI based on clinical findings and early ECG recording through right precordial leads, to adopt appropriate management strategy and reduce morbidity as well as mortality in inferior wall MI associated with RVMI.

References:

1. Anderson HR, Falk E, Nielsen D. Right ventricular infarction diagnostic accuracy of electrocardiographic right chest leads V3R to V7R investigated prospectively in 43 consecutive fatal cases from a coronary care unit. Br Heart J 1989;61:514-20.
2. Khan S, Kundi A and Sharieff S. Prevalence of right ventricular myocardial infarction in patients with acute inferior wall myocardial infarction. Int J ClinPract 2004; 58: 354–357.
3. Iqbal A, Muddarangappa R, Shah SKD, Vidhyasagar S. A study of right ventricular infarction in inferior wall myocardial infarction. J ClinSci Res 2013;2:66-71
4. Haji SA, Movahed A. Right ventricular infarction- diagnosis and treatment. ClinCardiol2000;23:473-82
5. Chou TC, Van der Bel-Kahn J, Allen J, et al. Electrocardiographic diagnosis of right ventricular infarction. Am J Med 1981; 70:1175–1180.
6. Leo Schamroth. An introduction to Electrocardiography. Eighth Adapted Edition:2013
7. Moye S, Carney MF, Holstege C, Mattu A, Brady WJ. The electrocardiogram in right ventricular myocardial infarction. Am J Emerg Med 2005;23:793-9.
8. Robalino BD, Whitlow PL, Underwood DA, Salcedo EE. Electrocardiographic manifestations of right ventricular infarction. Am Heart J 1989;118:138-44.
9. Ferguson JJ, Driver DJ, Boldt M, Pasternak RC. Significance of nitroglycerine- induced hypotension with inferior wall myocardial infarction. Am J Cardiol1989;64:311-4
10. Zehender M, Kasper W, Kauder E, Schonthaler M, Geibel A, Olschewiski M et.al. Right ventricular infarction as an independent predictor of prognosis after acute inferior myocardial infarction N Engl J Med1993; 328:981-8.