

Original Research Article


# A study of clinical manifestations of right ventricular myocardial infarction

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## Abstract

**Introduction:** Myocardial Infarction is the term used when the myocardium is necrosed due to ischemia. It may be trans mural or subendocardial. Inferior wall infarction has got some special features like the association with Right ventricular infarction and Brady arrhythmias especially sinus bradycardia and heart blocks. Clinically Right Ventricular Myocardial Infarction can be suspected when a patient with Inferior Wall Myocardial Infarction presents with elevated JVP, positive Kussmaul's sign, hypotension, right-sided third or fourth heart sounds, tender hepatomegaly, and oliguria rarely TR and clear chest.

**Aim of the study:** To study the various clinical manifestation of Right Ventricular Myocardial Infarction. To study the Clinical profile, Risk factors, ECG features, Complications and Outcome of Right Ventricular Myocardial Infarction.

**Materials and methods:** This study was mainly conducted to find out the clinical manifestations of right ventricular myocardial infarction and its risk factors, ECG features, complications and outcome of RVM. All patients admitted to Intensive Coronary Care Unit with ST elevation in V4R were taken for study. Presence of an aneurysm, mitral regurgitation, left ventricular clot or pericardial effusion was noted. Ejection fraction was determined by-Mode and 2-D using Simpson's rule.

**Results:** During the study period 474 cases of acute myocardial infarction were admitted and. Out of 474 cases, 242 were acute inferior wall myocardial infarction. 106 cases showed evidence of right ventricular myocardial infarction in ECG. All the 106 cases were associated with inferior wall myocardial infarction. Angina was present in 73% of patient. Angina was equivalent to 27%. All patients with chest pain were associated with sweating. Nausea, vomiting, and Indigestion were the

common presenting angina equivalents in young. Dyspnea was the predominant symptom in elderly people. Most of the patients with angina equivalents were Diabetes.

**Conclusion:** All cases of Inferior Wall Myocardial Infarction should have Right sided chest leads recorded during ECG examination as more the ST elevation more the severity of Right Ventricular Myocardial Infarction and its complications and mortality rate. If the diagnosis of Right Ventricular Myocardial Infarction is correctly made earlier and thrombolysed the prognosis is usually good even in patients with complications.

## Key words

Right Ventricular Hypertrophy, Thrombolysis, Myocardial Infarction, ECG Simpson's Rule.

## Introduction

Myocardial Infarction is the term used when the myocardium is necrosed due to ischemia. It may be transmural or subendocardial. Inferior wall infarction has got some special features like the association with Right ventricular infarction and Brady arrhythmias especially sinus bradycardia and heart blocks [1]. Right, Ventricular Myocardial Infarction is different from that of the left ventricle in the acute presentation, therapy, and long term prognosis [2]. The early recognition of Right Ventricular Myocardial Infarction is important because the time of onset of its hemodynamic consequence is unpredictable and these may be prevented by the administration of intravenous fluid load. Isolated Right Ventricular Myocardial Infarction is very rare. It is usually associated with Inferior Wall Myocardial Infarction. It is less commonly associated with Anteroseptal Myocardial Infarction [3]. The incidence of Right Ventricular Myocardial Infarction in Inferior wall infarction varies from 25-52% in various studies [4]. Involvement of right ventricle is related to severe atherosclerotic occlusion of the right coronary artery and is associated with involvement of posteroinferior wall and posterior portion of the septum. Clinically Right Ventricular Myocardial Infarction can be suspected when a patient with Inferior Wall Myocardial Infarction presents with elevated JVP, positive Kussmaul's sign, hypotension, right-sided third or fourth heart sounds, tender hepatomegaly, oliguria rarely TR and clear chest. Introduction to hemodynamic studies, radionuclide ventriculography, pyrophosphate scintigraphy, phonocardiography

and 2D echocardiography have made the diagnosis of subclinical cases easier and earlier [5]. In this study, clinical manifestations of Right Ventricular Myocardial Infarction are studied based on electrocardiographic criteria [6].

## Materials and methods

The study was conducted in the Intensive Coronary Care Unit of Saveetha Medical College Hospital, Chennai. The study period was from November 2016 to November 2017. This study was mainly conducted to find out the clinical manifestations of right ventricular myocardial infarction and its risk factors, ECG features, complications and outcome of RVMI. All patients admitted to Intensive Coronary Care Unit with ST elevation in V4R were taken for study. Both male and female patients were included both young and old patients were included.

## Exclusion criteria

- Patients with other congenital and acquired valvular heart disease, COPD and right ventricular hypertrophy.
- Patients with previous myocardial infarction.
- Patients with other serious comorbid illnesses each case detailed history about age, sex, occupation, presenting symptoms, time of admission, previous history and habits were taken. comprehensive risk factor analysis was made with specific importance to Obesity, Diabetes Mellitus,

Hypertension, Hyperlipidemia, Non-smoker.

- Ex-smoker discontinued 10 years ago and current smokers, Family H/o premature coronary artery disease, defined as sudden cardiac death, acute myocardial infarction, coronary artery disease before the age of 40 years. The detailed physical examination was made including Vital signs, Blood pressure, JVP, Kussmaul sign, Cardiac examination for gallops, murmur, rub, rales, Clinical evidence of tricuspid regurgitation, Risk stratification with 'Killips' classification. All patients with acute myocardial infarction were given the following treatment. thrombolysis was done depending on the merits of the patient and therapeutic window, excluding contraindications. Thrombolysis was done with Streptokinase 1.5 Million units dissolved in 100 ml of Normal Saline administered over a period of 1 hour after cardiac monitoring. Adequacy of thrombolysis was assessed in 90 minutes after thrombolysis based on the following parameters: Control of chest pain, ST segment resolution, Reperfusion arrhythmias.

Patients were continuously monitored for complications like infarct extension, re-infarction, left ventricular dysfunction, cardiogenic shock, mitral regurgitation and ventricular septal rupture and managed accordingly. Electrical complications were continuously monitored and prompt measures were done to correct the same. Complete basic investigations were done in all patients. These included: Urine - albumin, sugar, deposits, Urine ketones (if diabetic), Blood - TC, DC, Hb%, ESR, Blood - Glucose, Urea, Creatinine, Serum Electrolytes, X ray Chest PA view, Serial CPK-MB estimation was done on admission and every 12 hours for first 48 hours, Lipid profile was done in all patients on the day of admission.

## Echocardiography

All patients were subjected to echocardiography after stabilization or at discharge. The following parameters were noted. Wall motion abnormalities in the form of Hypokinesia – reduced systolic movement, Akinesia - the absence of systolic movement, Dyskinesia - paradoxical motion. Presence of an aneurysm, mitral regurgitation, left ventricular clot or pericardial effusion was noted. Ejection fraction was determined by Mode and 2-D using Simpson's rule. This was done for patients benefit, but this data was not included in our study. The data were entered into a proforma and analysis of the data collected was done with simple statistical methods. The patient outcome at the end of the first week was assessed in relation to mortality, morbidity with respect to in-hospital complications like electrical, mechanical, left ventricular dysfunction, mitral regurgitation, etc.

## Results

During the study period, 474 cases of acute myocardial infarction were admitted and. Out of 474 cases, 242 were acute inferior wall myocardial infarction. 106 cases showed evidence of right ventricular myocardial infarction in ECG. All the 106 cases were associated with inferior wall myocardial infarction.

Ages of the patients taken for the study were ranging from 26 to 83 years. 31 patients were aged between 50-59 years. The youngest patient in this study was 26 years. Oldest patient was 83 years old. In our study highest incidence was in the 6<sup>th</sup> decade (**Table – 1**).

Admission time interval after the onset of initial symptoms was as per **Table – 2**. The day was divided into 4 quarters. A maximum number of patients (29) had their initial symptom in the second quarter between 6 A.M. and 12 noon. 27 patients had their initial symptoms between 12 midnight to 6 A.M. (**Table – 3**). Angina was present in 73% of patient. Angina equivalent to 27% as per **Table – 4**.

**Table – 1:** The age and gender variations among myocardial infarction patients.

Age (Years)	Male	Male (%)	Female	Female (%)	Total	Total (%)
20-29	1	0.9	-	-	1	0.9
30-39	10	9.4	1	0.9	11	10.5
40-49	15	14.2	3	2.8	18	17.0
50-59	31	29.2	8	7.5	39	36.7
60-69	21	19.8	4	3.8	25	23.6
70-79	7	6.6	2	1.9	9	8.5
80-89	3	2.8	-	-	3	2.8
Total	88	83.0	18	17	106	100

**Table – 2:** Admission time interval after the onset of initial symptoms.

Time window	Male	Female	Total	Percentage (%)
<3 hour	23	5	28	26.41
3-6 hour	35	7	42	39.62
6-12 hour	20	4	24	22.64
12-24 hour	10	2	12	11.32

**Table – 3:** Diurnal variation of initial symptoms among patients.

Time	Male	Female	Total	Total (%)
12 midnight to 6.00 A.M	27	5	32	30
6 A.M. to 12 noon	29	6	35	33
12 noon to 6 P.M.	25	4	29	27.4
6 P.M. to 12 midnight	7	3	10	9.4

**Table – 4:** Analysis of clinical features (Presenting Symptom).

Presenting Symptoms	Male	Female	Total	Total %
Angina	65	12	77	73
Angina Equivalent	23	6	29	27

**Table – 5:** Analysis of presenting symptoms of myocardial infarction among patients.

Gender	Pt with angina equivalents	Dyspnoea	Syncope	Giddiness	Nausea/ Vomiting	Palpitation	Indigestion
M	23	22	8	16	18	10	6
F	6	5	4	4	5	3	3
Total	29	27	12	20	23	13	9

**Table – 6:** Clinical signs suggestive of right ventricular myocardial infarction.

Clinical signs	No. of Cases	%
Hypotension SBP < 90	53	50
Bradycardia	68	64.25
Elevated JVP	55	51.4
Kussmaul's Sign	21	19.8
Basal Rales	44	41.5
Cardiogenic shock	14	13.2

All patients with chest pain were associated with sweating, Nausea, Vomiting, and Indigestion were the common presenting symptoms in young. Dyspnoea was the predominant symptom in elderly people. Most of the patients with angina equivalents were Diabetes (Table –

5). Clinical signs suggestive of right ventricular myocardial infarction were as per **Table - 6**. Risk stratification by Killip classification was as per **Table – 7**. ECG Analysis of ST elevation was as per **Table – 8**. Analysis of arrhythmias was as per **Table – 9**.

44% patients developed I degree heart block. 21% patients developed II degree heart

block.13.2% patients developed complete heart block. 3.7% patients developed Atrial Fibrillation (**Table – 9**).

Chest pain, syncope, nausea, and vomiting improved dramatically with thrombolysis.48.1% patients with dyspnoea were also improved with thrombolysis (**Table – 10**).

**Table – 7:** Risk stratification by Killip classification.

Killip class	No of Cases	Total %	Death
1	51	48.1	
2	28	26.4	
3	16	15.1	
4	11	10.4	7

**Table – 8:** ECG Analysis of ST elevation.

ST elevation in V4R	No of patients	Percentage (%)	No of Death
1mm	91	85.8	1
>1mm	15	14.2	6
Total	106	100	7

**Table – 9:** Analysis of arrhythmias.

Type	No of cases	Percentage (%)
I degree heart block	46	44
II degree heart block	22	21
Complete heart block	14	13.2
RBBB	3	2.8
LAHB	3	2.8
AF	4	3.7
VF	5	4.7

**Table – 10:** The improvement of clinical symptoms after thrombolysis.

Presenting Symptom	No of patients	Symptoms improved in no of patients after thrombolysis	%
Chest pain	77	69	89.6
Nausea/ vomiting	23	23	100
Syncope	12	12	100
Dyspnoea	27	13	48.1

## Discussion

A steady decline in the mortality rate from acute myocardial infarction has been observed since 1970. In recent decades, thrombolytic therapy has dramatically reduced the mortality from acute myocardial infarction [7]. Right ventricular myocardial infarction, usually associated with inferior wall myocardial infarction, with the

occurrence of complications similar to that in patients with anterior wall myocardial infarction. So, during the early period of right ventricular myocardial infarction, we have to carefully watch for the early complications. The value of conventional ECG as a simple noninvasive bedside method for diagnosing right ventricular myocardial infarction has increased

recently [8]. Many cases of right ventricular myocardial infarction which were missed during bedside clinical examination were identified by electrocardiography. In this study, males were affected more than females. This observation usually correlates well with many studies regarding acute right ventricular myocardial infarction [9]. This may be due to the risk factors like hypertension, smoking, alcoholism and type A personality which were common in males than females. In right ventricular myocardial infarction nausea, with or without vomiting was the presenting symptom irrespective of angina. Angina equivalents were more in females [10]. It was around 40%. According to Harrison's Principles of Internal Medicine, a minimum 15-20% of Myocardial Infarction are painless. The silent infarcts are greater in patients with diabetes. Presenting symptoms observed did not vary from various other published studies [11]. As with previous studies prevalence of angina equivalents was 23% and a higher proportion has been reported in patients with diabetes. Similar observations were made in other studies [12]. Nausea and vomiting were found to be a common association as given in published observations. 40% of patients admitted with inferior wall and right ventricular myocardial infarction were found to be hypertensive, equal incidence in males and females. Smoking was exclusively prevalent among males with a frequency of 50% [13]. Central abdominal obesity, a particular risk factor in India, was found in 36% of patients with myocardial infarction, more often with females than males in whom it was 60%. Systemic venous congestion and raised jugular venous pressure were present in 50% of the patients. And also a significant number of patients had Kussmaul's sign, oliguria and right ventricular S<sub>3</sub> [14]. The features of right ventricular failure noted in right ventricular myocardial infarction patients in this study are marginally lower. So the clinical features of right ventricular failure need not be present in all cases and are present only in cases with severe right ventricular involvement. Though hypotension with clear lung fields suggestive of right ventricular myocardial infarction, a

significant number of patients with right ventricular myocardial infarction had basal rales [15]. This probably was due to the coexistent left ventricular inferior wall myocardial infarction in all these patients. ST elevation in right precordial leads indicates right ventricular myocardial damage exceeding 25% or damage reaching the lateral margins of the right ventricle. So, ST elevation in V4R also indicates extent of the right ventricular damage. In this study, the lesser the magnitude of ST elevation, lesser the complication was noted [16]. Death rate was observed in patients who had ST elevation more than 1 mm. This shows that the severity of the infarction can be assessed by the amount of ST elevation. The serious complications like cardiogenic shock, arrhythmias were observed in patients with ST-elevation more than 1 mm in this study. In this study also a statistically significant higher incidence of bradycardia was observed. Most of the patients improved with thrombolytic therapy. In this study the incidence of atrioventricular conduction disturbances was 78.3%. Looking into specific conduction disturbances a lower incidence of complete atrioventricular block was observed in this study [17]. Of the 14 cases with complete heart block, 5 patients expired during a hospital stay. Atrial Fibrillation which was transient was noticed in 4 patients (3.7%). This might be due to left ventricular dysfunction or atrial ischemia. The reported incidence of atrial fibrillation in AMI is 10-15%, but it is only one third of those with IWMI, as compared to anterior wall MI [18]. The incidence of intraventricular conduction defects in this study was 5.6%, i.e., 3 cases had complete RBBB and another 3 cases had left anterior hemiblock. The reported incidence of RBBB in AMI is 2-4% with pure IWMI and 7-10% with RV extension and that of LAHB is 3.5% in various studies [19, 20].

## **Conclusion**

The incidence of Right Ventricular Myocardial Infarction is fairly common (38%) and its more common in males than females and the difference being less as the age advances. In the

majority of patients, retrosternal chest pain and anginal equivalents like syncope had its onset between 6 A.M. and 12 noon. Smoking and Hypertension were the most prevalent risk factors. All cases of Inferior Wall Myocardial Infarction should have Right sided chest leads recorded during ECG examination as more the ST elevation more the severity of Right Ventricular Myocardial Infarction and its complications and mortality rate. If the diagnosis of Right Ventricular Myocardial Infarction is correctly made earlier and thrombolysed the prognosis is usually good even in patients with complications. Mortality is higher in patients with Inferior wall Myocardial Infarction with Right Ventricular Myocardial Infarction is because of a higher incidence of conduction disturbances and pump failure.

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