

**BJMHR**

British Journal of Medical and Health Research

Journal home page: [www.bjmhr.com](http://www.bjmhr.com)

## **Clinical Profile and outcome of Inferior wall myocardial infarction(IWMI) with special reference to Right ventricle involvement**

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### **ABSTRACT**

Inferior wall myocardial infarction (IWMI) is unique in its involvement of right ventricle. The incidence varies from 30 % to 50%. The aim of this study was to survey the clinical profile and prevalence of risk factors in a subgroup of patients with IWMI and incidence of right ventricle involvement who were admitted to the Cardiac ICU. The analysis involved 91 consecutive patients (pts) with inferior wall myocardial infarction hospitalized between 1 January 2003 and 1 December 2003. Ninety one patients were studied and the mean age was 58 years. There were 70 males and 21 females. 48% (43/91) of the patients had a stay of more than seven days. About 29% (26/91) of the patients presented with atypical symptoms. More than half of patient(51% -14/27) with RV involvement were with atypical symptoms. Eleven (11/91) patients were hemodynamically unstable at presentation, of which five (5/11-46%) of them had RV involvement. Forty one (45%) of them had other wall involvement along with IWMI. Forty three (48%) of patients had a stay more than seven days. In our study the number of deaths were only four (4/91) which was only 4%, Ten (11%) were discharged against medical advice and the rest of them recovered completely. Among deaths two of them had RV involvement and both of them had complete heart block on presentation and one of them presented with a cardiac arrest and was revived initially in emergency room. Right ventricular MI when seen with an IWMI was associated with unusually higher incidence of hypotension 22% (10/27) and 63% (17/27) arrhythmias in the form of atrioventricular (AV) blocks or complete heart blocks and sinus bradycardia.

**Keywords:** acute, arrhythmias, infarction, inferior wall, myocardial, right ventricle.

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Received 01 August 2016, Accepted 09 August 2016

Please cite this article as: Keshava C *et al.*, Clinical Profile and outcome of Inferior wall myocardial infarction(IWMI) with special reference to Right ventricle involvement. British Journal of Medical and Health Research 2016.

## INTRODUCTION

Acute myocardial infarction(MI) is one of the major public health problems and leading cause of death worldwide and in India. The actual prevalence of CAD is zooming in a linear fashion; it has increased from 4% in 1960 to 11% in 2001. In simple terms, from every 25th individual in 1960, to every 9th in 2001 can be confidently suspected of having CAD<sup>1</sup>. MI can affect the heart in its entirety or selected regions of the heart. The heart has an anterior wall, inferior wall, septal and lateral wall by electrocardiographists<sup>2</sup>. Anterior wall MI (AWMI) (55%) is the most common variant and IWMI (40-50%) the second most common<sup>3</sup>. The clinical presentation of each of them is unique with its own complexity and complications. IWMI by and large has a more favorable prognosis than an AWMI.

The inferior wall anatomically constitutes the lateral 2/3rd of the left ventricle and the medial 1/3rd of the right ventricle. Infarction involving this region of the heart causes ST elevation in Lead II, III and avF on a routine 12 lead ECG and is clinically associated with increased incidence of arrhythmias<sup>4,5</sup>. Right ventricle (RV) infarction is usually associated with left ventricle and does not exist in isolation. Right ventricle involvement is seen in nearly 30 to 50% of IWMI based on criteria used and occasional cases of AWMI<sup>6,7,8</sup>. The clinical sequelae of RV involvement vary widely, and range from no hemodynamic compromise to severe hypotension and cardiogenic shock. Overall literature reviews shows approximately 25% to 50% of them to be hemodynamically significant<sup>9</sup>.

### **Objectives of the study:**

The aim of this study was to survey the clinical profile and prevalence of risk factors in the sub-groups of patients with inferior wall MI, who were admitted to the Cardiac Intensive Care Unit(CICU) with acute onset of complaints and ECG changes suggestive of inferior wall MI (ST elevation in lead II, III and avF) with special emphasis on RV involvement at St. John's Medical College Hospital.

## MATERIALS AND METHOD

This was a retrospective study conducted at St. John's Medical College Hospital, which is a 1200 bedded tertiary care centre, catering to the patients of southern Karnataka as well as neighboring states of Tamilnadu and Andhra Pradesh. After obtaining clearance from the local ethical committee, the records were screened for all consecutive patients who were admitted to the CICU with a diagnosis of acute IWMI from January to December and included in this study. The inclusion criteria was all patients with ECG evidence of acute inferior wall STEMI. Patients with AWMI was excluded. A total of 91 patients were included in the study.

The following data was collected from the hospital records of these patients and analyzed

- a) Information regarding cardiovascular risk factors such as - age, sex, diabetes, hypertension, smoking, alcohol, dyslipidemia, family history, postmenopausal state.
- b) Clinical features at the time of arrival to the hospital.
- c) Electrocardiographic changes in the 12 lead and also the right precordial leads (V3R and V4R). The following table demonstrates the sensitivity and specificity of more than 1 mm of ST-segment elevation in V3R, and V4R.
- d) Treatment received in the hospital.
- e) Complications and duration of hospital stay and the final outcome.

**Table 1 Sensitivity and Specificity of >1 mm of ST-Segment Elevation in V<sub>3</sub>R and V<sub>4</sub>R.**

Leads	Sensitivity (%)	Specificity (%)
V <sub>3</sub> R	69	97
V <sub>4</sub> R	93	95

During in-hospital stay, mortality rate, and cardiogenic shock were evaluated. Cardiogenic shock was defined as persistent systolic blood pressure <90 mmHg with abnormal peripheral perfusion or decrease in the baseline systemic blood pressure by 30 mmHg lasting at least 30 minutes without administration of pressor agents and systolic blood pressure >90 mmHg but <110 mmHg while on pressor agents. Thrombolytic therapy (streptokinase) was administered in all patients without contraindications and with chest pain lasting <12 hours. Additional pharmacological therapy was given in accordance with currently accepted guidelines on treatment of MI. Arterial hypertension was diagnosed if arterial blood pressure exceeded 140/90 mmHg (according to 2013 ESH/ESC guidelines) or in patients taking anti-hypertensive agents prior to admission. Diabetes mellitus was diagnosed in patients previously treated with insulin or oral anti-diabetic agents or de novo during present hospitalization according to the accepted standard criteria. The diagnosis of hypercholesterolemia was based on increased total cholesterol concentration >200 mg% or LDL >130 mg% during hospitalization.

**Table 2**

			Total 91(100%)	Men 70(77%)	Women (21-33%)
1	AGE	<50yrs	17	15	2
		>50yrs	74	55	19
2	Hospital Stay	<7days	48 (52%)	37 (52%)	11(52%)
		>7days	43(48%)	33 (48%)	10(48%)
3	Co Morbids				
	DM		46	28	18
	HTN		51	40	11
	IHD		7	7	0
	Dyslipidemia		46	37	9
	Smoker		38	38	0

	Alcohol		22	22	0
	Post Menopausal		17	0	17
	Family H/O		17	14	3
4	Si/sy	Typical	66 (73%)	53	13
		Atypical	25	17	8
5	ST elevation		91	70	21
6	IWMI		23(27%)	18	5
	IWMI+RV		27(29%)	18	9
	IWMI+Other		41(45%)	34	7
7	LVDysfunctn		60	46	14
8	CAG ( 50/91)	Single	25	21	4
		TVD	20	14	6
		Atypica	5	3	2
9	Thrombolyse		43/91	34	9
10	Complication				
	Arrhythmia		29/91	23	6
	Hypotension		24/91	16	8
	Cardiac arres		3/91	1	2
	TPI(pacemak)		10/91	6	4
	Ventilation		6	5	1
11	Outcome	Dead	4	3	1
		Dischar	77	60	17
		DAMA	10	9	1
12	Co-morbids		75/91	57	18

## RESULTS AND DISCUSSION

Clinical characteristics of the study patients enlisted in Table-2. Among the 91 patients 48%(43/91) had a stay of more than seven days. Out of the 91 patients studied 70(77%) were males and 21(23%) were females. The mean age of the patients was 58.8 years. When it came to risk factors among male patients(N=70) the common risk factors noted were as follows diabetes in 40%(N=28/70), hypertension in 57.14%(N=40/70, dyslipidemia in 52.85%(N=37/70), smoking in 54.28%(N=38/70), alcohol abuse in 31.43%(N= 22/70), past history of coronary artery disease in 10%(N=7/70) and family history of coronary disease in 20%(N=14/70).

Among the female patients, risk factors revealed DM in 85.7%(N=18/21), HTN in 52.4% (N=11/21), Dyslipidemia in 42.8%(N=9/21) and 17 out of 21(80.9%) patients had attained menopause. None of them had the habit of smoking or alcohol consumption or previous history IHD.

### Presentation:

About one third of the patients 29% (N=26/91) presented with atypical clinical features which were as described in the Table-3. Patients with RVI had significantly higher mortality, cardiogenic shock rate and third degree AV block. The remaining patients presented with typical features suggestive of acute MI such as retrosternal chest pain and pain radiating to

the left arm. ECG done at the time of arrival in the ED revealed an ST elevation in all patients. Twenty three(25.2%) patient had an IWMI alone, twenty seven(30%) patients had IWMI with RV involvement and forty one(45%) patients had inferior wall MI along with other wall(anterior or lateral) involvement.

**Table 3: List of Atypical Symptoms**

Atypical symptoms	Total	Infr.+RVMI	Infr.+alone	Infr+Others
		14	4	8
Giddiness & Vomiting	4	3	0	1
Breathlessness	8	1	3	4
Vomiting	2	2	0	0
Abdominal pain	2	2	0	0
Back ache and tired ness	2	2	0	0
Jaw and neck pain	1	1	0	0
Sudden onset of weakness and altered mental status	4	1	1	2
Fever and breathlessness	1	1	0	0
Bilateral arm pain	2	1	0	1

**Infr** – Inferior, **RVMI** – Right ventricular myocardial infarction

Eleven patients(12.08%) were unstable at the time of admission requiring stabilization in the ER before transferring to the CICU and were in cardiogenic shock and had arrhythmias (complete heart block CHB). The majority (45%) of them (N=5/11) had RV involvement.

In our study it was noted that a greater percentage (45% -5/11) of patients with RVMI were hemodynamically unstable compared to isolated inferior wall (27%-3/11) involvement and Inferior wall + Others (27% - 3/11).

### **Investigations:**

All 91 patients underwent echocardiography. Left ventricular dysfunction was detected in 34% of patients(N=31/91). Of the 91 patients, fifty(55%) patients were subjected to coronary angiography which revealed single vessel disease(SVD) in 50% patients(N=25/50), TVD(Triple vessel disease) in 40% patients(N=20/50) and 10% (N=5/50) of them had atypical features (found to have coronary aneurysms - two had only inferior wall and three had Inferior wall with others).

### **Treatment:**

a). Out of the 91 patients 43 patients received thrombolytic therapy with streptokinase and 4 patients were subjected to primary PTCA. Others (44/91) patients were managed conservatively with anti-platelet agents, heparin and NTG(Nitroglycerin drip). Six patients needed mechanical ventilation and 10 of them required insertion of a temporary pacemaker.

### **Outcome:**

The primary outcome in our study was mortality. Out of the ninety one patients, four(4/91)

died, ten (10/91) were discharged against medical advice and the rest of them recovered completely. Among the two(2/11) deaths with RVMI both of them had complete heart block on presentation and one of them who presented with a cardiac arrest was revived initially.

The peculiarity of our study was that there were only four deaths reported over the entire period of one year among all the IWMI patients, which further supports the fact that inferior wall MI has a fewer deaths than an anterior wall MI.

Of the 27 patients with RV involvement, two(7.5%) died and three(11.25%) were discharged against medical advice and the final outcome was not known in them. Of the 21 patients with IWMI, one (4.7%) died, and in the forty three IWMI patients with other wall involvement, one (2.3%) death was reported. Three out of four(75%) were not thrombolysed and one(25%) patient who underwent thrombolysis had a RVMI, suggesting a poor outcome in those who were not thrombolysed.

**Complications (Table 4 & 5)** and major therapeutic interventions such as ventilation, inotropic support and pacing were considered in secondary outcome. Six needed ventilatory support and ten required artificial pacing as shown in Table - 5.

#### **Arrhythmias:**

Among the 63% (17/27) patients of RVMI involvement four(23.5%) had sinus bradycardia, three had ventricular premature complexes(17.6%), three junctional rhythm and seven(41.17%) had complete heart blocks. Heart block (first, second and complete heart blocks) were more common in patients with RVMI. Of the seven patients who had complete heart block all of them underwent temporary pacing immediately on admission.

**Table 4:**

	<b>Infr. Alone</b>	<b>Infr. + RVMI</b>	<b>Infr. + Other walls</b>
Arrhythmias	4	17	8
Hypotension/C. shock	3	10	11
Cardiac arrest	0	3	0
Pacing	1	7	2
Ventilator support	2	1	3

**Infr** – Inferior, **RVMI** – Right ventricular myocardial infarction

Right ventricular MI though less harmful by itself, when seen with an IWMI was associated with unusually higher incidence of hypotension and arrhythmias in the form of AV blocks / complete heart blocks and sinus bradycardia.

**Table 5**

	<b>Infr + RVMI</b>	<b>Infr</b>	<b>Others</b>
S. bradycardia	4	0	0
S. tachycardia	0	0	0
VPB's	3	2	2
Junctional rhythm	2	1	2



Heart Blocks			
First degree	1	1	0
Second degree	2	0	0
LBBB	0	0	0
Bi-fascicular	0	0	0
RBBB	0	0	1
Complete HB	7	0	3

**Infr** – Inferior, **RVMI** – Right ventricular myocardial infarction

The majority of the problems arise due to a missed diagnosis rather than specific errors in treating the condition.. The problem with right ventricular infarction is not that it is difficult to diagnose but that it is usually not looked for. ST elevation in chest lead V4R, or a lead VI (though less sensitive) ST elevation in a patient with elevated JVP, and clear lung fields and hypotension should alert the emergency medicine physician to a RVMI. (the classical triad of right ventricular involvement).

This should forewarn the emergency physician to be careful with nitrates, morphine and diuretics. In a patient who is having a volume depleted left ventricle all these drugs would further impair venous return (vasodilatation) and worsen the fluid deficit: fluid replacement would be a better a choice once RVMI is confirmed.

Right ventricular infarction should be suspected in any patient with ECG changes suggestive of MI and with an elevated JVP and clear lung fields.

Noninvasive studies demonstrate RV dysfunction characterized by RV dilatation and RV regional motion abnormalities in 40% to 50% of patients with acute IWMI, although hemodynamic compromise develops in fewer than one-half of such cases. The incidence of right ventricular infarction observed in this study was in conformity of other published reports<sup>10,11,12,13,14</sup>. The reason for this infrequent involvement of the right ventricle is that the wall of the right ventricle is very thin and has both a systolic and diastolic coronary flow.

Patients with acute ischemic RV dysfunction may result in poor hemodynamics associated with higher in-hospital morbidity and mortality<sup>15,16</sup>. It is usual to see patients with RVMI manifest with spontaneous early hemodynamic improvement and later recovery of RV function, even in the absence of reperfusion of the infarct-related artery<sup>17,18</sup>. Due to this chronic right heart failure attributable to RVI is rare. In our study patients with RVMI had a higher incidence of complications in the form of arrhythmias 62%(17/27) and hypotension 33%(10/27). In the present study the incidence of complete AV blocks in patients with inferior myocardial infarction with right ventricular infarction was found to be 41.17% versus zero% in patients with inferior infarction without right ventricular infarction. This came in accordance with the previously mentioned studies<sup>19</sup>. Topol et al, suggested that the mechanism by which complete AVB contribute to increased in-hospital mortality is still

controversial, It is possible that complete AVB is a marker of a large inferior myocardial infarction with concomitant involvement of the right ventricle. Loss of contribution to ventricular filling in complete AVB, even when paced by ventricular stimulation contributed to further compromise of the hemodynamic status of these patients.

RV involvement patients had a much higher incidence(16%) of sinus bradycardia and AV blocks (first and second degree - 3/19 cases) and complete heart blocks 36%(7/19 cases) compared to cases with no right ventricular involvement. Other published reports (10,11) revealed the same. This is due to the involvement of right coronary artery (60% right dominant heart-of the cases) in right ventricular involvement which supplies the AV node in the majority of the population.

Zehender et al found that pacing were required in about 11 % of patients with inferior infarction associated with right ventricular infarction who did not receive thrombolytic therapy. In the present study, pacing was required in a higher incidence(41.17%) than the above mentioned study. This higher incidence of pacing may be due to the less than 50% of patients being thrombolysed with streptokinase.

Although the risk factors encountered in this study were in conformity with other studies we encountered a greater number of female patients with diabetes(85.7%). In our study the number of primary PTCA was very minimal which was related to financial affordability of the patients we get. The drawbacks of our study was it was a retrospective study and data was collected from pre-existing records of the hospital and so the information bias could not be ruled out. The degree of ST elevation could not be looked from the ECG strips as they were not stored in records and as per policy were handed over to relatives at time of discharge or death,

## CONCLUSION:

Though RVMI associated with IWMI is a dreaded problem, a high index of suspicion and a prompt early detection based on symptoms and signs, with a right sided ECG can help in effective management and reduction in morbidity and mortality.

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