

# RIGHT VENTRICULAR INFARCTION IN ASSOCIATION WITH INFERIOR MYOCARDIAL INFARCTION

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## ABSTRACT

**Objectives:** To assess the frequency of right ventricular infarction (RVI) in patients with inferior myocardial infarction (MI).

**Material and Methods:** This is a single centre descriptive study carried out at AFIC/NIHD Rawalpindi, Pakistan. One hundred patients with acute inferior MI were selected excluding those with preinfarction arrhythmias. Specific clinical findings of hypotension, raised jugular venous pulse (JVP), clear lung fields, Kussmaul's venous sign and tricuspid regurgitation (TR) were noted for each patient. A 12-lead ECG followed by additional leads of RV4, RV5 and RV6 were done along with 2-D echocardiography for ventricular dilatation, wall asynergy and abnormal inter-ventricular septum (IVS) motion.

**Results:** RVI was present in 29 (29%) patients. There is no impact of age, gender and risk factors on the incidence of RVI in inferior MI. Out of these 29, the classic triad of hypotension, raised Jugular Venous Pressure (JVP) and clear lung fields was present in 9 (31%) cases, raised JVP with clear lung fields was present in 23 (80%) patients. Kussmaul's venous sign and Tricuspid Regurgitation (TR) were present in 11 (38%) and 17 (59%) patients respectively. RVI was confirmed by 2D Echocardiography.

**Conclusion:** RVI is not uncommon in patients with inferior MI.

**Key Words:** Acute Myocardial Infarction, Acute Inferior Myocardial Infarction, Right Ventricular Infarction.

## INTRODUCTION

Acute MI usually occurs when thrombotic occlusion of a coronary artery, previously narrowed by atherosclerosis, leads to necrosis of the heart muscle<sup>1</sup>. Inferior AMI previously thought of as a relatively benign entity is now recognized to cause significant morbidity and mortality due to its complications such as arrhythmias and RVI<sup>2</sup>. The right ventricle has the same cardiac output as the left ventricle, yet it has one sixth as much muscle mass and performs one fourth of the stroke work because the pulmonary vascular resistance is one tenth of the systemic resistance<sup>3,4</sup>.

The right coronary artery provides the predominant blood flow, supplying the lateral wall through the marginal branches; in the majority of patients, it also supplies the posterior wall and posterior interventricular septum through the posterior descending artery. The anterior wall of the right ventricle is supplied by the conus artery and by branches of the left anterior descending artery<sup>5</sup>.

RVI occurs when there is an occlusion of the right coronary artery proximal to the marginal coronary arteries or less commonly due to occlusion of the left anterior descending artery<sup>6</sup>.

RVI was initially described approximately 70 years ago. However, it was not until 1974 when Cohn et al described the clinical and haemodynamic features of RVI that led to the recognition of this abnormality as a distinct clinical entity and was taken as a diagnostic and therapeutic challenge<sup>7</sup>. RVI complicates 30-50% of inferior MI and 10% of anterior MI<sup>3,8</sup>. Isolated RVI is rare and present in 2% of autopsies<sup>3,8</sup>. Inferior MI complicated by RVI may have in hospital mortality as high as 31% as compared to 6% for patients with inferior MI without RVI<sup>9</sup>. 2D echocardiography provides important information regarding right ventricular end-diastolic volume/diameter<sup>10,11</sup>, interventricular/interatrial septal motion<sup>12</sup> and tricuspid regurgitation.<sup>13</sup>

The difference in the management of LVF and RVF makes it more important for prompt diagnosis and intervention to reduce mortality.

The objective of this study was to determine the frequency of RVI in patients of inferior MI.

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## MATERIAL AND METHODS

The study was carried out from May 2006 to March 2007 at AFIC/NIHD Rawalpindi which serves as a tertiary care referral hospital for armed forces personnel and also provides health services to civil and private organisations in Rawalpindi and the adjoining areas. A total of 100 consecutive adult patients of both genders, with acute inferior MI diagnosed by history of typical chest pain lasting for more than 30 minutes, ST-segment elevation equal to or more than 1 mm (0.1 mV) in two or more of leads II, III, and aVF and an increase in the serum CK MB levels to more than twice the normal value within 24 hours after admission were included in the study after informed consent. However patients with known history of arrhythmias, taking anti-arrhythmic drugs, confounding variables like pretreatment ECG showing bundle branch block and patients unwilling to take part in this study were excluded. A detailed clinical history including risk factors like smoking, diabetes mellitus hypertension, and dyslipidemia followed by systemic examination was done. Specific findings of hypotension, raised jugular venous pulse, clear lung fields, Kussmaul's venous sign (distention of the jugular vein on inspiration) and tricuspid regurgitation were noted for each patient. A 12-lead ECG followed by additional leads of RV4, RV5 and RV6 were done along with 2-D echocardiography.

Informed consent was taken and confidentiality was maintained. The relevant information was entered into a pre-designed proforma and entered in SPSS version 11 and statistical analysis was done in terms of frequency, percentages for age, gender, risk factors, RVI in inferior MI, clinical findings and 2-D echo findings.

## RESULTS

From May 2006 through March 2007, 100 consenting patients (70 men and 30 women; mean [ $\pm$ SD] age,  $57 \pm 8$  years), through non probability convenient sampling were prospectively studied who were admitted to AFIC Rawalpindi with acute inferior MI (Table 1). RVI was present in 29 (29%) patients which is statistically very significant ( $< 0.01$ ). There was no statistically significant impact of age, gender and risk factors like smoking, obesity, hypertension, diabetes mellitus and dyslipidemia on the incidence of RVI in inferior MI. Out of these 29, the classic triad of hypotension, raised JVP and clear lung fields was present in 9(31%) cases, raised JVP with clear lung fields was present in 23(80%) patients. Kussmaul's venous sign and clinically documented TR were present in 11(38%) and 17(59%) patients respectively. Two (7%) patients went into shock and 3(10.34%) patients died during hospitalization. RVI was confirmed by 2 D echocardiography which revealed RV dilatation manifested by increased RV end diastolic

diameter ( $3.2 \pm 1.3$ cm), RV end diastolic area ( $24.8 \pm 9.9$  cm<sup>2</sup>) and RV end systolic area ( $18.8 \pm 8.4$  cm<sup>2</sup>), wall asynergy, abnormal IVS deviation, TR and increased PAP.

**Table 1: Comparison of statistical data of inferior MI with and without RVI**

Variables	Inferior MI without RVI	Inferior MI with RVI	p Value
No. of patients	71	29	< 0.01
Age, yrs	57 $\pm$ 8	57 $\pm$ 8	NS
Male/Female	49/22	21/8	NS
Cigarette Smoking	27(38%)	10(34%)	NS
Hypertension	15(21%)	7(24.1%)	NS
Diabetes Mellitus	21(30%)	8(27.6%)	NS
Dyslipidemia	16(22%)	7(25%)	NS
BMI	26 $\pm$ 3	28 $\pm$ 4	NS
Heart rate/min	72 $\pm$ 11	70 $\pm$ 8	NS
Hypotension	12(17%)	9(31%)	< 0.01
Raised JVP	18(25%)	23(79.3%)	< 0.01
Kussmaul's sign	0(0%)	11(38%)	<0.001
Creatine kinase MB	115 $\pm$ 42	157 $\pm$ 41	NS
RV end diastolic diameter (cm)	2.6 $\pm$ 2.4	3.2 $\pm$ 1.3	< 0.01
RV end diastolic area (cm <sup>2</sup> )	15.1 $\pm$ 6.8	24.8 $\pm$ 9.9	< 0.01
RV end systolic area (cm <sup>2</sup> )	7.7 $\pm$ 3.8	18.8 $\pm$ 8.4	< 0.01
Septal deviation (%)	21%	89%	< 0.01
Tricuspid regurgitation	37(52.1%)	25(86.2%)	< 0.01
PAP, mm Hg	26 $\pm$ 7	30 $\pm$ 11	< 0.01

NS = Non-significant.

## DISCUSSION

Right ventricular infarction complicates about 30-50%<sup>3,8</sup> of inferior MI. The term represents a spectrum of disease from mild, asymptomatic right ventricular dysfunction to cardiogenic shock, and it includes transient ischemic myocardial dysfunction as well as myocardial necrosis. Right ventricular infarction is associated with considerable morbidity and mortality. Diagnosis of this condition requires a high degree of suspicion based on clinical findings and the early recording of the electrocardiogram through right precordial leads, as well as 2 D echo findings. The proper management of right ventricular infarction requires sustaining adequate right ventricular preload with volume loading and maintenance of atrioventricular synchrony, reduction of right ventricular afterload (particularly when left ventricular dysfunction is present), and inotropic support of the right ventricle. Inferior MI complicated by RVI may have in hospital mortality as high as 31% as compared to 6% for patients with inferior MI without RVI<sup>9</sup>. In our study mortality was 10.34%. Chronic lung disease and right ventricular hypertrophy are considered significant risk factors for RVI<sup>14</sup>. This study demonstrated that RVI was present in 29% of the patients with inferior MI which is reasonably high. Hypotension, raised JVP with clear lung fields, Kussmaul's venous sign and clinically documented TR which were present in different combinations with different percentages in our study. Two patients went into shock and 3 patients died during hospitalization. The diagnosis of RVI can be made from the physical examination, echocardiography, first-pass or equilibrium radionuclide ventriculography, technetium pyrophosphate myocardial scanning, and hemodynamic measurements, but right precordial electrocardiography is the most readily available, simplest, and most objective of these techniques. A 1-mm ST-segment elevation in RV4 lead is 70 percent sensitive and 100 percent specific for right ventricular infarction<sup>15</sup>. We used ECG recorded with right ventricular leads and to the echocardiography for diagnosing RVI.

Several aspects and limitations of this study should be considered. Firstly, our study represents a small portion of the diseased population, the frequencies and the clinical patterns thus noted may be studied on a large scale before applying the data to the community.

## CONCLUSIONS

Significant proportion of patients with inferior MI have RVI. High degree of suspicion is essential so as not to miss the diagnosis as management is quite different. Timely diagnosis and consequent appropriate management would reduced mortality.

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