

Original Research Article

Clinical profiling of right ventricular infarction in patients with acute inferior wall myocardial infarction

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ABSTRACT

Background: Incidence of Right Ventricular Myocardial Infarction (RVMI) associated with Inferior Wall Myocardial Infarction (IWMI) is reported to be quite high (30%-50%). To diagnose coexisting RVMI is important, since its early recognition and proper treatment reduces overall morbidity and mortality in IWMI. Author assessed the incidence and clinically profiled patients with right ventricular infarction in acute inferior wall myocardial infarction and analysed the effects of RVMI on clinical outcome of IWMI.

Methods: A total of 150 patients of IWMI were evaluated in the present hospital based prospective observational study over duration of two years. They were evaluated for coronary risk factors like diabetes mellitus, hypertension, smoking, obesity, alcohol and dyslipidemia. Twelve-lead ECG, cardiac enzyme assay and echocardiography were undertaken in all the participants.

Results: Of the total 150 patients, 45 (30%) patients had right ventricular myocardial infarction (RVMI). Complications were significantly lower in patients with isolated IWMI as compared to patients with IWMI and associated RVMI except pulmonary edema ($p < 0.05$). Of the total 22 (14.67%) deaths in the present study, 18 (12%) had associated RVMI and 4 (2.66%) isolated IWMI, the difference being statistically significant.

Conclusions: Involvement of right ventricle increases rate of complications as well as the mortality rate in patients with inferior wall myocardial infarction.

Keywords: Inferior wall myocardial infarction, Right ventricular myocardial infarction

INTRODUCTION

With the turn of the century, cardiovascular diseases (CVDs) have become the leading cause of mortality in India.¹ The epidemiological transition in India in the past 2 decades has been dramatic; in a short timeframe, the predominant epidemiological characteristics have transitioned from infectious diseases, diseases of undernutrition, and maternal and childhood diseases to non-communicable diseases (NCDs).² In comparison with the people of European ancestry, CVD affects Indians at least a decade earlier and in their most productive midlife years.^{3,4} The World Health

Organization (WHO) has estimated that, with the current burden of CVD, India would lose \$237 billion from the loss of productivity and spending on health care over a 10 years of period (2005-2015).⁵ Ischemic heart disease (IHD) and stroke constitute the majority of CVD mortality in India (83%), with IHD being predominant.⁶ The prevalence of IHD in urban India was 2%, and increased 7-fold to $\approx 14\%$ by 2013.^{7,8} Similarly, it more than quadrupled in rural areas, from 1.7% to 7.4% between 1970 and 2013.⁹

Myocardial infarction was previously thought to be a disease of mainly the left ventricle. Right ventricular

infarction (RVMI) was just a pathological entity. The incidence of RVMI associated with inferior wall myocardial infarction (IWMI) has been shown to be as high as 30%-50%, with isolated RVMI occurring in less than 3% of cases.¹⁰ It has also been postulated that RVMI occurs exclusively in association with inferior/inferoposterior myocardial infarction.¹¹ It is imperative that author diagnose the condition, since its early recognition and proper treatment reduces the morbidity and mortality.¹² Prompt fluid therapy may abort the vicious cycle set to motion by right ventricular infarction, which if treated in conventional way or neglected tends to lead to true cardiogenic shock.

With the present study, author assessed the incidence and clinically profiled patients with right ventricular infarction in acute inferior wall myocardial infarction and analysed the effects of RVMI on clinical outcome of IWMI.

METHODS

The study was hospital based prospective observational study conducted in Intensive Cardiac Care Unit (ICCU), tertiary care government institute for two years (November 2015 to October 2017) with 150 patients.

Operational definitions

Diagnostic criteria for acute myocardial infarction

Detection of rise and/or fall of cardiac biomarker values (preferably cardiac troponin) with at least one value above 99 percentile upper reference limit (URL); with at least one of the following:

- Symptoms of ischaemia,
- New or presumed new significant ST segment-T wave (ST-T) changes or new left bundle branch block (LBBB),
- Development of new pathological Q waves in the electrocardiogram (ECG),
- Imaging evidence of new loss of viable myocardium or new regional wall motion abnormality,
- Identification of an intracoronary thrombus by angiography or autopsy.¹³

Diagnostic criteria for inferior wall myocardial infarction

- ST segment elevation in the inferior leads (II, III, aVF),
- Reciprocal ST segment depression in lateral and/or high lateral leads (I, aVL, V5, V6).

Diagnostic criteria for right ventricular infarction

- ST segment elevation >1mm in at least one of the right precordial leads.^{14,15}

All cases with acute inferior wall myocardial infarction were included. Patients with previous myocardial infarction (documented on ECG), ECG evidence of left bundle branch block (LBBB), clinical evidence of cor-pulmonale, suspected pulmonary embolism, associated pericardial disease, patients with congenital heart disease and Left ventricular hypertrophy, patients with associated anterior and lateral wall myocardial infarction and patients not consenting to participate were excluded.

Information was collected through pre-set proforma from each participant. Careful physical examination was done with special reference to hemodynamic parameters like jugular venous pulse (JVP) and blood pressure. They were also evaluated for coronary risk factors like diabetes mellitus, hypertension, smoking, obesity, alcohol and dyslipidemia. In all of them 12-lead ECG, cardiac enzyme assay and echocardiography were done. The 12-lead ECG recordings were made at 25mm/sec speed and 1mV=10mm setting. Right Precordial Leads (RPL) were applied on the right side of chest on the areas to which the leads corresponded on the left. Lead II ECG monitoring was done throughout the stay in ICCU for identification of arrhythmias and conduction blocks. Informed written consent was elicited from each participant.

RESULTS

This hospital based cross sectional observational study was conducted with 150 patients to assess the incidence and clinical profile of right ventricular infarction in acute inferior wall myocardial infarction patients and to study the effects of right ventricular myocardial infarction (RVMI) on clinical outcome of Inferior wall myocardial infarction (IWMI). Mean age of participants was 56.07±10.91years and 60% of them were male. The mean BMI of participants was 23.9±3.74kg/m². Of the total 150 patients, 45 (30%) patients had right ventricular myocardial infarction (RVMI) while it was absent in 105 (70%) patients.

The mean SBP and DBP in male patients were 116.00±26.39mmHg and 74.55±14.47mmHg respectively while the mean SBP and DBP in female patients were 122.33±26.45mmHg and 77.50±15.14mmHg respectively. The mean SBP and DBP in patients with isolated IWMI were 118.09±26.35mmHg and 75.90±14.85mmHg respectively and it was comparable to the mean SBP and DBP in patients with IWMI and RVMI (119.56±27.13mmHg and 75.33±14.71mmHg respectively). Thirty (20%) and 37 (24.7%) male patients were diabetic and hypertensive respectively while 38 (25.3%) and 50 (33.3%) female patients were diabetic and hypertensive respectively. The female patients had significantly higher percentage of diabetes mellitus and hypertension.

Fifty-five (36.7%) and 26 (17.3%) male patients were smokers and consumed alcohol respectively; while 3

(5%) and 2 (3.3%) female patients were smokers and consumed alcohol respectively. There was significant difference between male and female patients. It was observed that there was no significant difference among males and females regarding lipid profile levels (TG, TC, HDL and LDL).

The mean ejection fraction levels in male and female patients were 45.88±6.21% and 46.08±5.99% respectively while the mean CKMB levels in male and female patients were 91.31±12.21 and 84.48±14.06 respectively. There was no significant difference in ejection fraction and CKMB values between male and female patients.

The mean ejection fraction levels and mean CKMB levels were comparable in patients with isolated IWMI and patients with IWMI and RVMI (p>0.05) (Table 1).

Table 1: Association of RVMI and ejection fraction and CKMB levels of patients.

| Parameters | IWMI | | IWMI with RVMI | | P-Value |
|-------------------|-------|-------|----------------|-------|---------|
| | Mean | SD | Mean | SD | |
| Ejection Fraction | 46.64 | 6.13 | 46.11 | 5.05 | >0.05 |
| CKMB | 66.12 | 13.94 | 64.31 | 11.97 | >0.05 |

Table 2: Association of RVMI and rate of complications.

| Complications | IWMI | | IWMI with RVMI | | Total | | p Value |
|-----------------|------|-------|----------------|-------|-------|-------|---------|
| | N | % | N | % | N | % | |
| Hypotension | 16 | 10.7% | 24 | 16% | 40 | 26.7% | <0.05 |
| Shock | 20 | 13.3% | 15 | 10% | 35 | 23.3% | <0.05 |
| Arrhythmia | 10 | 6.7% | 17 | 11.3% | 27 | 18% | <0.05 |
| Cardiac Arrest | 8 | 5.3% | 13 | 8.7% | 21 | 14% | <0.05 |
| AV Block | 7 | 4.7% | 11 | 7.3% | 18 | 12% | <0.05 |
| Cardiac Failure | 4 | 2.7% | 8 | 5.3% | 12 | 8% | <0.05 |
| Pulmonary Edema | 7 | 4.7% | 3 | 2% | 10 | 6.7% | >0.05 |

Table 3: Association of RVMI and Mortality of patients.

| Mortality | IWMI | | IWMI with RVMI | | Total | | p Value |
|-----------|------|--------|----------------|-----|-------|--------|---------|
| | N | % | N | % | N | % | |
| Died | 4 | 2.67% | 18 | 12% | 22 | 14.67% | <0.05 |
| Alive | 101 | 67.33% | 27 | 18% | 128 | 85.33% | |
| Total | 105 | 70% | 45 | 30% | 150 | 100% | |

Hypotension (40, 26.7%) and shock (35, 23.3%) were the commonest complications among study participants. The rate of complications was compared among both the mentioned groups.

It was observed that significantly lesser complications occurred in patients with isolated IWMI as compared to patients with IWMI and RVMI; except in case of pulmonary edema. The difference was statistically significant as per Student t-test (p<0.05) (Table 2).

The mortality rates were deemed to be the most important outcome measures in the study. Overall, 22 out of 150 participants died during study period (mortality rate-14.67%). The rate of mortality was observed to be significantly lower in patients with isolated IWMI (4 out of 105 deaths) as compared to patients with IWMI and RVMI (18 out of 45 deaths). The difference was statistically significant as per Student t-test (p<0.05) (Table 3).

DISCUSSION

Based on early experiments of right ventricular performance, it was felt for many years that right ventricular contraction was unimportant in the circulation and that, despite loss of right ventricular contraction, pulmonary flow could be generated by a passive gradient from a distended venous system and active right atrial contraction.¹⁴

However, recognition of the profound hemodynamic effects of right ventricular systolic dysfunction slowly became evident with the description of severe RVMI, resulting in severe right heart failure, clear lungs, and low-output hypotension despite intact global left ventricular systolic function. Because of its simplicity and its high sensitivity and specificity, recording of V4R is all set to be an intrinsic part of the early evaluation and electrocardiographic examination of acute IWMI.¹⁵

With the present study, 150 patients were studied to assess the incidence and clinical profile of right ventricular infarction in acute inferior wall myocardial infarction patients and the effects of Right ventricular myocardial infarction (RVMI) on clinical outcome of Inferior wall myocardial infarction (IWMI) were also analysed. In present study 45 (30%) patients had right ventricular myocardial infarction (RVMI) out of total 150 IWMI patients. Chockalingam A et al, had found 50 (37%) out of 135 cases of IWMI to be having right ventricular involvement.¹⁶ Iqbal A et al, observed that out of total 50 cases with inferior wall MI, 16 (32%) cases had evidence of RVMI while Ravikeerthy M et al, observed the incidence at 30%.^{17,18} Thus author's findings with respect to incidence of RVMI in IWMI is largely corroborative of the available evidence.

The mean age of patients was 56.07±10.91 years with 3:2 male preponderance which is in line with findings of previous similar studies.^{11,17-19} It was observed in the present study that of total 150 participants, 58 (38.7%) were smokers and 28 (18.7%) were alcoholic, with significant difference between male and female patients. This was similar to observations made by Khan IS et al and Iqbal A et al.^{11,17}

The mean Systolic BP (SBP) and Diastolic BP (DBP) in patients with isolated IWMI were 118.09±26.35mmHg and 75.90±14.85mmHg respectively and it was comparable to the mean SBP and DBP in patients with IWMI and RVMI (119.56±27.13mmHg and 75.33±14.71mmHg respectively). Khan IS et al, had studied 50 cases of acute IWMI and reported that systolic blood pressure was stable in majority of patients and mean SBP was 113±35mmHg while mean diastolic blood pressure was 73±17mmHg similar to author's observation.¹¹ El Sebaie MH et al, included 76 patients with significant RCA lesions, divided into those with proximal RCA stenosis (43 patients) and distal RCA stenosis (33 patients) and found no significant difference in systolic blood pressure and diastolic blood pressure between groups.²⁰ So, blood pressure does not seem to affect the incidence of RVMI in IWMI.

In this study, the mean ejection fraction levels and mean CKMB levels were comparable in patients with isolated IWMI and IWMI with RVMI. Similar pattern was observed by Khan IS et al, who reported raised CKMB levels in all participants, with a mean of 178.16±88.9 and majority of patients having low left ventricular ejection fraction with a mean of 39.02±4.2% with insignificant difference between isolated IWMI patients and patients with IWMI with RVMI.¹¹

Complications such as hypotension, shock, arrhythmia, cardiac arrest, AV block and cardiac failure were observed to be significantly lower in patients with isolated IWMI as compared to patients associated with RVMI except pulmonary edema. This is in concordance with the observations by Khan IS et al, Memon et al.^{11,19}

But it was found not in line with findings of Iqbal A et al, of the total 22 (14.67%) deaths in the present study (12%) had associated RVMI and 4 (2.66%) isolated IWMI, the difference being statistically significant.^{17,18} Ravikeerthy M et al, studied a total of 50 cases of acute IWMI and found mortality rate to be 15% in patients with associated RV infarction (RVMI) and 3.33% in isolated inferior wall MI (IWMI).¹⁸ George et al, found mortality rate to be 12% in patients with inferior wall myocardial infarction and significantly higher at 28% in patients having right ventricular involvement in inferior wall myocardial infarction cases.²¹ Memon AG et al, reported more than double in-hospital mortality in RVMI Group as compared to without RVMI.¹⁹

CONCLUSION

Thus, it can be concluded that involvement of right ventricle increases rate of complications as well as the mortality rate in patients with inferior wall myocardial infarction.

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Ethical approval: The study was approved by the Institutional Ethics Committee

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