



Original Article

Right Ventricular Myocardial Infarction : Presentation and Acute Outcomes

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Abstract

Right Ventricular Infarction (RVI) complicating inferior wall myocardial infarction (MI) is common and associated with significant morbidity and mortality. We try to systematically assess the incidence, clinical presentation and in hospital outcomes of right ventricular myocardial infarction in a tertiary-care set up. This study was a descriptive, cross sectional observational series of consecutive patients with RVMI. All patients with acute inferior myocardial infarction (n=100) were enlisted. RVMI was diagnosed by ≥ 1 mm ST elevation in lead V4R in right sided electrocardiogram. RVI occurred in 31% (n=31) of patients of acute inferior infarctions. Patients with isolated inferior myocardial infarction served as controls (n=69). Echocardiography was performed within 24 hours of admission. From both groups, 51% were qualified for thrombolysis. The incidence of hypotension (96.7%), cardiogenic shock (64.5%), bradycardia and heart block were much higher in RVI than in inferior myocardial infarction. Clinically manifest RV dysfunction (raised jugular venous pulse, hypotension and tricuspid regurgitation) and right ventricular dilatation detected by echocardiography was seen in a variable number of patients. In hospital mortality rate was significantly higher (n=13, 41.9%) in right ventricular infarction group than in inferior myocardial infarction group (n=2, 2.9%).

TAJ 2012; 25: 42-46

Introduction

The description of right ventricular infarction appeared more than 70 years ago,¹ yet for decades it was not considered an important clinical entity. In 1974, Cohn and coworkers² published their classic report on right ventricular infarction as a distinct clinical entity.

Clinical studies demonstrated that right ventricular involvement occurs almost exclusively in patients with inferior wall infarction and postmortem studies revealed that it was 19 to 51 percent of patients with acute inferior myocardial infarctions.³

Clinically, RVMI may be missed; for the classical triad of hypotension, clear lung fields and elevated

jugular venous pressure does not always occur.⁴ Although quite specific, this triad has a sensitivity of less than 25 percent, but distended neck veins alone have been shown to be 88 percent sensitive and 69 percent specific.⁴ Kussmaul's sign is highly sensitive and specific for right ventricular infarction.⁵

The diagnosis of right ventricular infarction 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,⁶ at the time of presentation is

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the most readily available, simplest, inexpensive and currently gold standard of these techniques. ST-segment elevation ≥ 1 mm in right chest lead V_{4R} is 70% sensitive and nearly 100% specific for RVMI.⁷

We looked at the presentation and in hospital outcomes of noninvasive management of RVMI complicating IMI in the setting of a tertiary medical college hospital.

Material and Methods

The study design was a prospective observational series. It was carried out on 100 consecutive patients of acute inferior myocardial infarction admitted in coronary care unit of department of medicine between July 2007 and June 2009. Patients underwent therapy according to established guidelines. Informed consent was obtained from all patients and ethical review was done by institutional review board. Right sided ECG was routinely done in all patients presenting with acute IMI within 10 hrs of symptoms of onset at the time of admission. RVMI was diagnosed based on 1-mm ST-segment elevation in V_{4R} lead.⁷ Patients with RVMI constituted group A (n=31) and without RVI constituted group B (n=69) and served as controls.

Real time, two-dimensional echocardiographic examination was performed in 87 patients within 24 hrs of hospital admission. 13 patients were excluded from echocardiography due to death.

Data were analyzed by SPSS V-15 software. Significant test were done by Chi-square test. All tests of significance were two tailed and a p value of ≤ 0.05 was considered to indicate statistical significance.

Results

Incidence of right ventricular infarction was 31% among the acute inferior myocardial infarction. Table 1 shows the patient characteristics of both groups. Mean (\pm SD) age of group A was 55.26 ± 10.61 yrs and group B was 51.25 ± 9.95 and it revealed no significant difference ($p=0.08$). Male and female ratio in group A was 5.2:1 and in group B was 6.6:1. Smoking incidence was relatively greater in group A (83.8% vs 65.2%, $p=0.04$). Hypertension was more common in group A

($p=0.02$). But diabetes and dyslipaemia were more common in group B patients.

Mean duration of chest pain was 5.95 ± 1.46 hrs. in group A patients and 6.06 ± 1.87 hrs in group B patients ($p=0.78$) and systolic blood pressure was 72.58 ± 15.65 mm of Hg in group A patients and 118.62 ± 22.77 mm of Hg in group B patients ($p=0.01$) at the time of hospitalization. Breathlessness were present in 93.5% patients of group A and 84.05 % patients of group B. Clinically shock was found in 71% patients of group A and only 2.8% of group B ($p=.00$). Thirty seven (37%) patients were found to be hypotensive in which thirty (96.7%) patients belong to group A and only seven (10.1%) in group B ($p=.00$). Kussmaul's sign was present only in thirteen (42%) patients of group A ($p=0.00$). Engorged neck vein was predominant in group A (32.2% vs 1.4%, $p=0.00$) Reduced urinary output was observed in twenty four (77.4%) patients of group A and twenty (29%) patients of group B. Palpitation was prominent presenting complains of both groups and presented by 80.6% patients of group A and 65.2% patients of group B. Pulsus paradoxus was only present in three (9.6%) patients of group A ($p=0.03$).

Early 2D echocardiography revealed right ventricular dilatation in four (22.2%) patients and tricuspid regurgitation in two (11.1%) patients of group A.

Frequency of sinus bradycardia and first degree heart block was relatively more in group A patients but high degree AV block (second degree and complete heart block) were more in group B (11.6% vs 6.4%). Three patients (4.3%) of group B had required temporary pacing for complete heart block.

Table 1: Patients characteristics

Age (years)	IMI + RVI (Group-A) (n=31)	IMI (Group-B) (n=69)	p value
Total patients, N	31	69	-
Male:female	5.2:1	6.6:1	-
Age (mean \pm SD) yrs	55.26 ± 10.61	51.25 ± 9.95	0.08
Smoking, n (%)	26 (83.8)	45 (65.2)	0.04
Hypertension, n (%)	15 (48.3)	17 (24.6)	0.02
Diabetes, n (%)	05 (16.1)	18 (26.1)	0.07
Dyslipaemia, n (%)	03 (9.6)	17 (24.6)	0.07
Family history, n (%)	01 (3.2)	03 (4.3)	0.09
Obesity, n (%)	06 (19.3)	16 (23.1)	0.07

Table 2: Clinical features of right ventricular infarction

No	Clinical features	IMI+ RVI (Group-A) (n=31)		IMI (Group-B) (n=69)		Total	
		N	%	N	%	N	%
1	Chest Pain (mean \pm SD) hrs	5.95 \pm 1.46	-	6.06 \pm 1.87	-	-	-
2	SBP	72.58 \pm 15.65	-	118.62 \pm 22.7	-	-	-
3	Breathlessness	29	93.5	58	84.0	87	87
4	Shock	22	71.0	02	20	24	24
5	Hypotension	30	96.7	07	10.1	37	37
6	Kussmauls sign	13	42.0	0	0	13	13
7	Raised JVP	10	32.2	01	1.4	11	11
8	Reduced urinary output	24	77.4	20	29.0	44	44
9	Palpitation	25	80.6	45	65.2	70	70
10	Pulsus paradoxus	03	9.6	0	0	03	03
11	High degree AV block	02	6.4	08	11.6	10	10
12	Death	13	41.9	02	2.8	15	15

Only two (2.8%) patients of group B had developed short runs of ventricular tachycardia. Twenty patients (64.5%) of group A had developed cardiogenic shock and it became irreversible in thirteen (65%) of them and ultimately death ensued. Incidence of cardiogenic shock was highly significant in between two groups (group A: 64.5% vs group B 2.8%; $p=0.00$). During hospitalization, higher death rate was observed in 2nd day. Thirteen patients (41.9%) of group A and two patients (2.8%) of group B had died (41.9% vs 2.8%; $p=0.00$).

Discussion

The classic report of Cohn and coworkers² in 1974 for the first time established right ventricular infarction as a separate entity. Sharpe et al,⁸ Garty et al,⁹ Croft et al¹⁰ and Rodrigues¹¹ EA observed the incidence of right ventricular infarction 40%, 52.7%, 47.6 and 50% respectively. Recently, Chockalingram A¹² had showed 37% in India, Akbar MA et al¹³ showed 30% in Pakistan and Hossain M¹⁴ documented 40% incidence RV infarction among inferior MI patients in Bangladesh. Electrocardiographic criterion used by this study documented 31% RV involvement in patients with acute inferior myocardial infarction. This finding is consistent with the previous studies.

Clinical features those help in bed side recognition of RVI like systemic venous engorgement,

positive Kussmal's sign, hypotension and shock, all were more prevalent in group A patients. These findings are consistent with previous studies.

AV block(second degree and complete heart block) has been reported to occur as many as 48% of RVI patients.¹⁵ Incidence of high grade AV block was found in 20% patients of RVI by Chockalingram A.¹² Hossain¹⁴ also reported a higher frequency (50%) of AV block in RVI patients. Unexpectedly this study documented a low incidence (6.4%) of AV block in group A and a relatively high incidence (11.6%) in group B patients. Mehta SR¹⁶ also observed such a low incidence of AV block in his study. An explanation could therefore, be that dual or collateral blood supply to the AV node is functionally common.

Cardiogenic shock is relatively infrequent but leading cause of mortality in RVMI patients.¹⁷ Zehender et al¹⁸ found 11% cardiogenic shock in his observation. We had a higher incidence (64.5%) of cardiogenic shock in group B patients in comparison to group A patients without RVI and mortality was higher in group B than group A, (64.5% vs 2.8%; $p=0.00$). Akbar et al¹³ also observed a similar significant difference of cardiogenic shock between two groups of patients ($p<.004$).

It has been reported that the characteristic clinical presentation of RVI is usually much less frequent

than the actual presence of RVI^{4,5,19}. The incidence of cardiogenic shock in these studies ranges from 8% to 49%, depending on the criteria used to diagnose RVI.^{16,20}

The most striking finding was that while RVI has been described as a reversible cause of cardiogenic shock,^{2,19} study patients who developed cardiogenic shock due to RVI died as a consequence. Although most patients (96.7%) received volume expansion and inotropic supports (41.9%), most (80%) of them were non-responding to therapy and thirteen patients (41.9%) had died from irreversible cardiogenic shock. This outcome support the emerging evidence of early percutaneous intervention in this high risk subset of patients of IMI.²¹

This is an observational study of a relatively small group of patients. Echocardiogram and haemodynamic assessment could not be done to find out the cause of cardiogenic shock in expired patients. Another limitation is the absence of primary percutaneous coronary intervention (PCI), which is increasing employed in these settings.

Conclusion

Right ventricular infarction is a distinct, easily diagnosable entity occurring frequently in the setting of IMI. This diagnosis entails the use of specific therapy. The in-hospital mortality rate was significantly high (41%). Early reorganization, close monitoring and early PCI may be beneficial and reverse the vicious cycle leading to cardiogenic shock and death.

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