Original Research Article

Diagnostic evaluation of right ventricular myocardial infarction

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Abstract

Background: The right ventricle (RV) has been defined as the "forgotten chamber", as its role in cardiac physiopathology has long been underestimated. Nevertheless, the RV is involved in a wide range of pathological conditions and its altered function may significantly affect the patient's clinical status.

Objectives: To study the incidence of Right ventricular myocardial infarction (RVMI) in today's clinical setting, to analyze the various methods to diagnose RVMI quickly and correctly, to understand the clinical spectra of RVMI, to assess the complications of Right ventricular infarction.

Materials and methods: It was single centre prospective study carried out in all patients of acute myocardial infarction admitted to Smt. NHLMMC Hospital, Ahmedabad from the period of July 2013 to August 2013. They were thoroughly followed up for first 7-10 days. 50 patients were enrolled for the study based on purposive sampling technique. Demographic details and clinical signs were recorded. The demographic and quantitative data were statistically analyzed.

Results: The study showed male preponderance which shows that the incidence of RVMI was more common in males (82%). Around 32% of patient belonged to 5th decade followed by 4th decade (22%). This further concludes that RVI was more common from 40-60 years. Majority cases of RVMI belonged to Inferior wall (70%) which was significant, followed by anterior wall infarction in 14%. Global infarction which involves both inferior and anterior wall was least common. The most common clinical sign was found to be bradycardia in 66% cases, followed by hypotension (64%). Inter-ventricular septum was most common affected Echocardiographic finding (100%), followed by RV inferior wall (70%). Apical anterolateral and RV free wall were the least common ECG findings. The most common site of occlusion was RCA (94%) which was statistically significant (p<0.05), followed by LAD in 80%. Least common site of occlusion was LCX in 20% cases. This concluded

that right coronary artery was the most common site of occlusion for RVMI. The most common complication of RVMI was left bundle branch block (LBBB) in 12% of cases, followed by 2nd degree AV block (10%). Complete heart block was seen in 6% of cases while least common were ventricular tachycardia/ fibrillation.

Conclusion: The present study concluded that ruling out RV involvement in any case of ST-elevation myocardial infarction is necessary, in order to identify the specific high-risk group of patients with increased chances of in-hospital morbidity and mortality. Early diagnosis in this situation is important to ensure not only appropriate treatment but also to ensure that potentially dangerous therapies, such as vasodilators, nitrates, morphine, are avoided.

Key words

Infarction, Hypotension, Bradycardia, Electrocardiography, Angiography.

Introduction

The right ventricle (RV) has been defined as the "forgotten chamber", as its role in cardiac physiopathology has long been underestimated. Nevertheless, the RV is involved in a wide range of pathological conditions and its altered function may significantly affect the patient's clinical status [1]. Over 75 years ago, Saunders described the clinical trial of arterial hypotension, elevated jugular venous pressure, and clear lung fields in a patient with extensive necrosis of the right ventricle and minimal involvement of the left ventricle [2]. Since then RVI has been recognized more frequently and continues to be a diagnostic and therapeutic challenge [3]. Acute myocardial infarction (MI) involving only the right ventricle is a rare event. Right ventricular involvement in the setting of an acute inferior wall myocardial infarction is much more common [4]. Recognizing the syndrome of RVI is important as it identifies a significant clinical entity, which is associated with considerable immediate morbidity and mortality and has a well-delineated set of priorities for its management. Its presence defines a high-risk subgroup of patients with acute inferior left ventricular infarction [5]. The best management of right ventricular involvement in acute myocardial infarction requires early recognition [6]. Early diagnosis in this situation is important to ensure not only appropriate treatment but also to ensure that potentially dangerous therapies, such as vasodilators, nitrates, morphine, are avoided[7]. Since there are lacunae in literature on this topic, we conducted this study to determine the incidence of Right ventricular infarction (RVI), methods to diagnose, understand the clinical spectra of Right ventricular infarction.

Materials and methods

This study was carried out in all patients of acute myocardial infarction admitted to Smt. NHLMMC Hospital, Ahmedabad from the period of July 2013 to August 2013. They were thoroughly followed up for first 7-10 days. In each of the 50 cases, detailed history was taken, and emphasis was given to symptoms on admission and development of complications. In clinical examination special emphasis was given on vital data, JVP, Kussmaul's sign, Hepatojugular reflex and presence of RV S_3/S_4. The examination of respiratory and other systems was carried out. Hypotension was defined as Systolic Blood Pressure less than or equal to 90 mmHg. Bradycardia was defined as heart rate less than or equal to 60. Preliminary investigations such as cardiac enzymes like cardiac troponin T or I, serum lipid profile, blood sugar for associated diabetes were carried out. X-ray chest was done in all patients at the time of admission.

A standard 12 lead ECG with additional right pre-cordial leads V3R to V6R were recorded on admission, at 6 hours and then daily, and as and when required. ST segment elevation of at least l mm in lead VI and/or right pre-cordial leads was and indicative of the presence of RVI. The

proforma consists of questions related to demographic details of the patient, physical examination, treatment.

Statistical analysis

The recorded observation was entered in epi data software and further transferred to epi info 7. Frequency tables in the form of proportion were developed. Chi square test was used to determine the test of significance. A p value of <0.05 was considered statistically significant.

Results

As per **Table – 1**, the study showed male preponderance which shows that the incidence of RVMI was more common in males (82%). Around 32% of patient belonged to 5th decade followed by 4th decade (22%). This further concluded that RVI was more common from 40-60 years. And it was statistically significant.

As per **Table – 2**, majority cases of RVMI belonged to Inferior wall (70%) which was significant, followed by anterior wall infarction in 14%. Global infarction which involves both inferior and anterior wall was least common.

Table – 1: Age and Sex wise distribution of study participants.

Age in Years	No. of cases	Sex		Percentage		p-value
		Male	Female	Male	Female	
31-40	7	7	0	14	0	0.21
41-50	12	11	1	22	2	0.01*
51-60	19	16	3	32	6	0.01*
61-70	8	4	4	8	8	0.11
71-80	3	2	1	4	2	0.21
>80	1	1	0	2	0	0.43
Total	50	41	9	82	18	

Table – 2: Type of Infarction according to ECG.

Type of RV +LV	No. of cases	Percentage	p-value
Only Inferior	35	70	0.001*
Inferior + Posterior wall	5	10	0.22
Global (Inferior + anterior wall)	3	6	0.45
Anterior wall infarction only	7	14	0.31

Table – 3: Clinical signs of Right Ventricular Myocardial Infarction.

Signs	No. of cases	%
Hypotension	32	64
Bradycardia	33	66
Increased JVP	30	60
Kussmaul's sign	30	60
Presence of lung Congestion	3	6
Presence of S3/S4	3	6
Presence of Murmur	1	2

As per **Table – 3**, the most common clinical sign was found to be bradycardia in 66% cases, followed by hypotension (64%). The least

common clinical sign was murmur (2%) but this was not statistically significant (p>0.05).

Table – 4: Echocardiographic findings of RVMI.

Site of RVMI	No. of cases	%
RV Free wall	4	8
RV inferior wall	35	70
IVS (inter-ventricular septum)	50	100
Apical Anterior wall	7	14
Apical anterolateral wall	3	6

According to **Table – 4**, inter-ventricular septum was most common affected Echocardiographic finding (100%), followed by RV inferior wall

(70%). Apical anterolateral and RV free wall involvement were the least common echocardiographic findings.

As per **Table – 5**, the most common site of occlusion was RCA (94%) which was statistically significant (p<0.05), followed by LAD in 80%. Least common site of occlusion was LCX in 20% cases. This concludes that right coronary artery is the most common site for RVMI.

Table – 5: Site of Occlusion as per Coronary Angiography.

Site of occlusion	No. of cases	Percentage
RCA	47	94
LAD	40	80
LCX	10	20

Table – 6: Complications of RVMI.

Arrhythmia	No. of cases	%
2nd Degree AV Block	5	10
Complete Heart Block	3	6
LBBB (left bundle branch blocks)	6	12
RBBB (right bundle branch block)	2	4
Ventricular tachycardia (VT)/ ventricular fibrillation (VF)	1	2

As per **Table – 6**, the most common complication of RVMI was left bundle branch block (LBBB) in 12% of cases, followed by 2nd degree AV block (10%). Complete heart block was seen in 6% of cases while least common were ventricular tachycardia/ fibrillation.

Discussion

Over the years, many studies have confirmed the following facts: Incidence of RVI as a sole entity is rare. RVI commonly is associated with Inferior Wall Infarction (IMI), and complicates around 30-50% of IMI cases. Presence of RV involvement in ST-elevation myocardial infarction is an independent risk factor for increased morbidity and mortality. RVI is commonly complicated by hypotension and bradycardia while it is uncommonly complicated by severe cardiogenic shock and life-threatening arrhythmia. Mainstay of managing RVI depends on early diagnosis and prompt volume loading followed by urgent reperfusion [7-15].

Our present study confirms the above facts with evidence: RVI was found to be present in association with inferior wall infarction in total 86% cases showing proximal RCA obstruction as the most common culprit. Incidence of RVI was found to be more in males, especially at the extremes of our age distribution, that is age 31-40 years and >60 years. Among the risk factors, smoking, tobacco and alcohol were the most common culprits in more than 70% cases, while sedentary lifestyle and hypertension were associated in more than 60% cases. Hypotension accompanied RVI in about 60% cases while atypical symptoms like syncope occurred in 8% patients. Bradycardia complicated 64% cases and signs of mild to moderated RV dysfunction were present in up to 60% cases. ST elevation in lead aVR was present in 16% cases, confirming Left Main Coronary Artery (LMCA) obstruction in such cases. Although RCA block was the most common cause of RVI, associated Left Anterior Descending (LAD) block in 80% cases and Left circumflex (LCX) block in 20% cases was also seen. Basal posterior inter ventricular septum (IVS) hypokinesia was seen in 100% cases, confirming echocardiographically the role of interventricular dependence in RV function. Severe cardiogenic shock was seen only in 6% cases while life-threatening arrhythmias (VT/VF) were seen in 2% cases. Prompt volume loading of 500 ml in initial 15-30 minutes followed by urgent reperfusion proved to be a successful approach with no mortality with only 6% cases needing inotropic support. These results are also supported by studies based on RVMI and Cardiac perfusion [16-22].

Conclusion

The present study concluded that ruling out RV involvement in any case of ST-elevation

myocardial infarction is necessary, in order to identify the specific high-risk group of patients with increased chances of in-hospital morbidity and mortality. Careful Bedside clinical examination is the starting point in diagnostic evaluation of RVI while Electrocardiography is the simplest mainstay for diagnosis. Echocardiography is an indispensable tool in evaluating RV dysfunction in any setup while if facilities permit, cardiac MRI is the gold standard for complete evaluation of RV.

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