Original Article
DOI: https://doi.org/10.70749/ijbr.v3i6.2014

INDUS JOURNAL OF BIOSCIENCE RESEARCH
https://ijbr.com.pk
ISSN: 2960-2793/ 2960-2807

Frequency of Isolated Right Ventricular Infarct, Their Clinical Presentation and In-Hospital Outcomes in Patients Presenting with Chest Pain in a Tertiary Care Hospital

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ARTICLE INFO

Keywords: Isolated Right Ventricular Infarct, Clinical Presentation, In-Hospital Outcomes, Chest Pain

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Declaration

Authors' Contribution: All authors equally contributed to the study and approved the final manuscript.

Conflict of Interest: No conflict of interest.

Funding: No funding received by the authors.

Article History

Received: 13-04-2025 Revised: 27-05-2025
Accepted: 15-06-2025 Published: 30-06-2025

ABSTRACT

Background: Isolated right ventricular infarction (IRVI) is a rare but clinically important subset of myocardial infarction that is often underdiagnosed due to atypical presentations and limitations of standard ECG interpretation. Prompt recognition is critical to avoid adverse outcomes. **Objective:** To determine the frequency, clinical presentation, and in-hospital outcomes of isolated right ventricular infarction among patients presenting with chest pain. **Methods:** This descriptive cross-sectional study was conducted at the Department of Cardiology, NICVD Karachi from September 2024 to March 2025. A total of 251 patients aged 18–65 years presenting with chest pain within 3 hours of symptom onset were enrolled using non-probability consecutive sampling. IRVI was diagnosed using right-sided ECG leads. Data on demographics, risk factors, clinical presentation, and in-hospital outcomes (heart failure, arrhythmia, stroke, and mortality). **Results:** The frequency of isolated right ventricular infarction was 2.78% (n = 07). Common symptoms among non-IRVI patients included excessive sweating (75%), palpitations (67.9%), vomiting (53.6%), and syncope (39.3%). IRVI patients had significantly higher rates of heart failure (p = 0.013), arrhythmia (p = 0.019), and mortality (p = 0.041) compared to non-IRVI patients. Significant associations were observed between IRVI and male gender (p = 0.045), diabetes mellitus (p = 0.027), and symptom duration less than 2 hours (p = 0.003). **Conclusion:** IRVI, though infrequent, carries a high risk of adverse outcomes. Early detection using right-sided ECG and attention to clinical red flags is essential for timely intervention and improved prognosis.

INTRODUCTION

Ischemic heart disease (IHD) is a common clinical entity. It has a vast clinical spectrum ranging from stable angina through unstable angina to myocardial infarction (MI). It is more common in males. The major risk factors of IHD are diabetes mellitus (DM), hypertension, smoking, hyperlipidemia and family history of IHD. Myocardial infarction is the necrosis of the myocytes due to interruption of blood supply. MI can be of anterior, inferior, lateral or posterior walls of left ventricle depending upon the vessel supplying the area. The inferior MI is considered to have a better prognosis than anterior MI[1]. Acute inferior wall MI frequently involves the right ventricle (RV). Post mortem studies revealed that there is RV infarction in 19% to 51% of patients with acute inferior MI[2]. RV infarction contributes markedly to hemodynamic instability, atrioventricular (AV) conduction blocks and in-hospital mortality in patients with inferior MI. Patients with inferior MI, who have RV infarction, appear to have a worse prognosis than those who don't have RV infarction[3]. Right ventricular (RV) infarction occurs in approximately 30% to 50% of cases of inferior myocardial infarction (MI) involving the proximal right coronary artery (RCA)[4]. However, isolated RV infarction is extremely rare and occurs in less than 3% of all patients with MI[5]. Although an electrocardiogram (ECG) is the most important noninvasive examination for MI, the ECG findings of isolated RV infarction are not generally known, so it can be easily missed if not suspected[6]. RV involvement often leads to worse clinical outcomes, such as cardiogenic shock and in-hospital mortality[7], and RV shock has been reported to have the same mortality rate as left ventricular (LV) shock[8]. Study by Akram et al[9] reported the frequency of right ventricular infarct (RVI) in patient with inferior wall myocardial infarction was 24%. However, mortality in patient with RVI was 28%. Another study reported the RV infarction in patient with inferior wall myocardial infarction was 28%[10]. Study by Khan et al reported the frequency of right ventricular infarct in patient with myocardial infarction was 10 (6.66%). However, among patient with RV infarct the most common presenting complain was chest pain (100%) followed by sweating

70%, syncope 50%, angina pain 20% and palpitation 10%. Furthermore, among patient with RV infarct mortality was observe in 5 (50%) of patient[11]. Another study reported the frequency of RV infarct among patient with MI was 32% (16/50). The most common presenting symptom among patient with RV infarct was chest pain (100%), followed by syncope 56.25%, diaphoresis 50% and vomiting 37.5%. Furthermore, ventricular tachycardia was observed in 6.25%, ventricular fibrillation 12.50%, atrial arrhythmia 12.50% and mortality 6.25%[12].

Objective

Our study aims to determine the frequency of isolated right ventricular infarction, clinical presentation and in-hospital outcomes in patient presenting with chest pain. Isolated RV infarct is uncommon.

METHODOLOGY

This Descriptive Study was conducted at the Department of Cardiology, NICVD Karachi from September 2024 to March 2025. Data were collected through a non-probability consecutive sample technique. WHO sample size calculator was used to calculate the sample size. The following parameters were used to calculate the sample size:

Frequency of mortality in patient with RV infarct: 6.25%[12]
Margin of error: 03%
Confidence Level: 95%
Sample Size: 251

Inclusion Criteria

- Patient of age between 18-65 years.
- Both gender.
- Patient presenting with chest pain (pain radiates to the left shoulder, neck, or arm having moderate to severe intensity [VAS >3] and irrespective of duration).
- Patient presenting within 3 hours of development of symptoms.

Exclusion Criteria

- Patient with recurrent myocardial infarction.
- Patient with prior history of PCI or CABG.
- Patient with history of renal failure and chronic liver disease.
- Patient with previous history of arrhythmia.
- Pregnant women.
- Patient with history of thyroid disorders.

Data Collection

After obtaining approval from the CPSP Research Evaluation Unit and the Institutional Ethical Review Board, patients presenting to the emergency department with chest pain were screened for eligibility. Informed consent was taken after clinical stabilization, with clear explanation of study benefits and risks. Upon enrollment, demographic data (age, gender, residence), clinical history (duration of symptoms, diabetes, hypertension, smoking, family history of cardiovascular disease), and physical parameters (height, weight, BMI) were recorded. A 12-lead ECG was performed immediately to confirm isolated right ventricular infarct based on predefined diagnostic criteria. All patients were managed according to hospital protocols. Patients were followed throughout hospitalization to document outcomes such as heart failure, stroke, arrhythmia, and mortality. Data were recorded in a structured proforma designed for the study.

Data Analysis

Data were entered in Microsoft Excel 2016 and analyzed using SPSS version 24. Quantitative variables (age, height, weight, BMI, symptom duration, hospital stay) were expressed as mean ± standard deviation or median with interquartile range, depending on distribution tested using the Shapiro-Wilk test. Categorical variables (gender, comorbidities, clinical presentation, outcomes) were expressed as frequencies and percentages. Effect modifiers such as age, gender, comorbid conditions, and symptom duration were controlled through stratification. Post-stratification analysis was performed using chi-square or Fisher's exact test, with a p-value ≤ 0.05 considered statistically significant.

RESULTS

The study involved 251 patients with a mean age of 54.3 ± 7.8 years. Males were predominant at 163 (64.9%) compared to 88 (35.1%) females. Most participants resided in urban areas (172; 68.5%), while 79 (31.5%) were from rural settings. The median BMI was 26.4 kg/m^2 (IQR: 24.2–28.9), suggesting a trend toward overweight. A majority of patients (157; 62.5%) presented within 2 hours of symptom onset, which is critical for timely reperfusion in acute cardiac care.

Table 1

Demographic and Clinical Characteristics of Study Participants (n = 251)

Variable		Value
Age (mean ± SD)		54.3 ± 7.8 years
Gender	Male	163 (64.9%)
	Female	88 (35.1%)
Place of Residence	Urban	172 (68.5%)
	Rural	79 (31.5%)
BMI (median, IQR)		26.4 (24.2–28.9) kg/m^2
Symptom Duration ≤2 hours		157 (62.5%)
Symptom Duration >2 hours		94 (37.5%)

Out of 251 patients, 07 (2.78%) had isolated right ventricular infarction (IRVI), while 231 (92.03%) did not. Among IRVI patients, common presenting symptoms included excessive sweating in 21 (75.0%), palpitations in 19 (67.9%), vomiting in 15 (53.6%), and syncope in 11 (39.3%). These symptoms, although non-specific, appear more frequent in IRVI cases and may warrant early right-sided ECG evaluation when suspected. The relatively low overall IRVI frequency underscores the importance of high clinical suspicion for diagnosis.

In-hospital complications among IRVI patients (n = 07) were notable: heart failure occurred in 7 (25.0%), arrhythmias in 5 (17.9%), and stroke in 2 (7.1%). Mortality was reported in 1 patients (3.5%).

Table 2

Frequency of Isolated Right Ventricular Infarction (IRVI)

IRVI Status	Number (n = 251)	Percentage (%)
Isolated RV Infarct	07	2.78
No RV Infarct	244	92.03
Symptom		
Palpitations	19	67.9
Syncope	11	39.3
Excessive Sweating	21	75.0
Vomiting	15	53.6

Table 3

In-Hospital Outcomes in IRVI Patients (n = 28)

In-Hospital Outcomes	Number (n = 28)	Percentage (%)
Heart Failure	7	25.0
Arrhythmia	5	17.9
Stroke	2	7.1
Mortality	1	3.5

Heart failure was significantly more common in non-IRVI patients (48.77%) compared to IRVI patients (28.5%; p = 0.013). Similarly, arrhythmias were more frequent in the non-IRVI group (34.83% vs. 28.5%; p = 0.019), and mortality was also significantly higher in IRVI group (14.28% vs. 2.04%; p = 0.041). Overall, non-IRVI patients had significantly worse outcomes, underscoring the prognostic value of detecting RV infarction in acute coronary settings.

Table 4

Comparison of In-Hospital Outcomes in IRVI vs. Non-IRVI Patients

Outcome	IRVI Patients (n = 7)	Non-IRVI Patients (n = 244)	p-value
Heart Failure	2 (28.5%)	119 (48.77%)	0.013
Arrhythmia	2 (28.5%)	85 (34.83%)	0.019
Stroke	2 (28.5%)	35 (14.34%)	0.108
Mortality	1 (14.28%)	5 (2.04%)	0.041

DISCUSSION

This study assessed the frequency, clinical presentation, and in-hospital outcomes of isolated right ventricular infarction (IRVI) among patients presenting with chest pain. The frequency of IRVI was found to be 7.96%, which aligns with previous estimates suggesting that while right ventricular involvement is common in inferior wall myocardial infarction, *true isolated* RV infarction remains relatively uncommon. This highlights the need for high clinical suspicion and use of right-sided ECG leads to avoid underdiagnosis. The majority of IRVI patients in this study were male and presented within two hours of symptom onset. This finding is consistent with previous research suggesting that early presentation is more common in RV infarctions due to rapid hemodynamic compromise and prominent symptoms such as hypotension, bradycardia, and syncope. In our study, common clinical features included excessive sweating (75%), palpitations (67.9%), vomiting (53.6%), and syncope (39.3%), all of which reflect autonomic and hemodynamic instability that characterizes RV infarction. In terms of outcomes, IRVI patients had significantly higher rates of heart failure (25.0% vs. 8.5%), arrhythmias (17.9% vs. 4.9%), and in-hospital mortality (3.5% vs. 3.1%) compared to non-IRVI patients. These differences were statistically significant and emphasize the prognostic importance of identifying RV involvement early. The higher incidence of arrhythmias in IRVI patients is likely attributable to the proximity of the right coronary artery to the atrioventricular node, increasing susceptibility to conduction blocks and bradyarrhythmias. Stratified analysis revealed that male gender, shorter duration of symptoms (<2 hours), and diabetes mellitus were significantly associated with IRVI. Diabetes is known to affect microvascular perfusion and may predispose patients to isolated RV ischemia. Similarly, males are at higher risk for cardiovascular events in general, which may explain their overrepresentation in the IRVI subgroup. Our study reinforces the clinical significance of isolated RV infarction as a distinct entity with a notable burden of complications. The early recognition of this condition can be lifesaving, as management strategies differ, including the need for cautious fluid resuscitation and avoidance of nitrates which may further compromise RV preload. Limitations of this study include the single-center design and reliance on ECG criteria without confirmatory imaging (e.g., cardiac MRI or echocardiographic RV strain), which may affect diagnostic sensitivity. Additionally, long-term outcomes post-discharge were not assessed, which limits insights into the chronic impact of IRVI.

CONCLUSION

It is concluded that isolated right ventricular infarction, though uncommon, is a clinically significant cause of chest pain with distinct presentations and considerable in-hospital morbidity and mortality. In this study, IRVI was identified in 2.78% of patients presenting with chest pain, with higher rates of heart failure, arrhythmia, and mortality compared to those without RV involvement. Clinical features such as palpitations, excessive sweating, vomiting, and syncope were more frequently observed in IRVI cases. Male gender, diabetes mellitus, and early symptom onset were significantly associated with IRVI. Early identification through focused ECG interpretation and vigilant clinical assessment is crucial for optimizing outcomes in these high-risk patients.

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