

ORIGINAL ARTICLE

FREQUENCY OF RIGHT VENTRICULAR INFARCTION IN PATIENTS WITH ACUTE INFERIOR WALL MYOCARDIAL INFARCTION PRESENTING AT A TERTIARY CARE HOSPITAL, PESHAWAR

Rahid Ullah¹, Jabar Ali², Adil Bilal³, Daud Ahmad Jan⁴, Abdur Rahim⁵, Wasim Sajjad²

¹National Institute of Cardiovascular Diseases (NICVD), Karachi, Pakistan, ²Lady Reading hospital, Peshawar, Pakistan, ³THQ Tangi, Charsadda, Pakistan, ⁴DHQ Charsadda, Pakistan, ⁵Saidu Teaching hospital, Swat, Pakistan

Objectives: Right ventricular infarction has prognostic significance in the setting of acute “inferior wall myocardial infarction (IWMI)”, this research is intended to determine the frequency of “right ventricular infarction (RVI)” in patients with acute IWMI.

Methodology: This descriptive cross-sectional study took place at a tertiary care hospital in Peshawar, Pakistan. The study included consecutive patients who were diagnosed with acute IWMI. The presence of RVI was determined based on specific ECG findings showing >1.0mm ST segment elevation on right-sided chest leads.

Results: In a sample of 150 patients, 87 (58%) were male. The average age of the patients was 61 ± 10.7 years. Among the patients, 111 (74%) had hypertension, 64 (42.7%) were diabetic, and 45 (30%) were smokers. A body mass index (BMI) exceeding 25 kg/m² was observed in 83 (55.3%) patients. RVI was observed in 62 (41.3%) of the patients. The occurrence of RVI did not show statistically significant differences between males and females (41.4% vs. 41.3%; p=0.989), hypertensive and non-hypertensive individuals (41.4% vs. 41.0%; p=0.964), diabetics and non-diabetics (42.2% vs. 40.7%; p=0.855), smokers and non-smokers (42.2% vs. 41.0%; p=0.885), and patients with BMI ≤25 kg/m² and >25 kg/m² (41.8% vs. 41.0%; p=0.920), respectively.

Conclusion: Based on the research findings, it can be concluded that RVI is a relatively common occurrence in patients with acute IWMI, as it was observed in more than 40% of the patients studied. However, no statistically significant association exists between RVI and various demographic and clinical factors.

Keywords: Pakistan, right ventricular infarction, inferior wall myocardial infarction, acute myocardial infarction

Citation: Ullah R, Ali J, Bilal A, Jan DA, Rahim A, Sajjad W. Frequency of Right Ventricular Infarction in Patients with Acute Inferior Wall Myocardial Infarction Presenting At a Tertiary Care Hospital, Peshawar. Pak Heart J. 2023;56(02):163-166. DOI: <https://doi.org/10.47144/phj.v56i2.2372>

INTRODUCTION

Cardiovascular disease (CVD) significantly contributes to morbidity and mortality rates. It has been estimated that CVD alone accounts for over 18.6 million deaths annually.¹ Myocardial infarction (MI), commonly known as a heart attack, is caused by the interrupted blood supply to the heart muscle that causes necrosis and tissue damage.²

To diagnose “ST elevation myocardial infarction (STEMI)” on an electrocardiogram (ECG), specific criteria are used. For men, a 2 mm ST segment elevation is considered significant in the precordial leads, while for women (who typically have lower ST heights), a rise of 1.5 mm or more is regarded as significant. Furthermore, ST segment shifts or Q waves in leads II, III, and aVF indicate an inferior wall myocardial infarction. Notably, in more than one-third

of cases involving an inferior wall MI, there is also concomitant right ventricular infarction. Therefore, when evaluating a patient with an inferior wall MI, it is important to examine leads V3R and V4R specifically to assess right ventricular involvement.²

Recently, it has been observed that “right ventricular infarction (RVI)” is quite common in cases of “inferior wall myocardial infarction (IWMI)”. In the past, the function of the right ventricle was not well-defined in patients with a history of MI.³ Patients typically present with retrosternal chest pain accompanied by symptoms such as diaphoresis, raised jugular venous pressure (JVP), hypotension, and bradycardia.⁴

RVI leads to hemodynamic disturbances, including elevated jugular venous pressure and clear lung fields. In more severe cases, RVI can be followed by hypotension and cardiogenic shock. The term RVI is

generally used to describe acute right ventricular failure caused by abnormalities in the right ventricular free wall movement, as well as the enlargement of the right ventricle in the presence of ischemic but viable myocardium.⁵

The combination of RVI and inferior MI is associated with high mortality rates and frequent hospitalizations. Primary "percutaneous coronary intervention (PCI)" or thrombolysis is the preferred treatment option in these patients. These interventions improve right ventricular function and provide a mortality benefit.⁶ Therefore, considering the prognostic significance of RVI in the setting of acute (IWMI), this research is intended to determine the frequency of RVI in patients with acute IWMI presenting to the cardiac emergency department of a tertiary care hospital in Peshawar, Pakistan.

METHODOLOGY

This study was conducted at the Cardiology Emergency Department of Lady Reading Hospital in Peshawar, Pakistan, from 13 May 2019 to 13 November 2019. The hospital's ethical and research committee approved the study protocol, ensuring adherence to ethical guidelines.

The research included male and female patients aged between 30 and 75 years who presented with acute inferior wall myocardial infarction (IWMI). Patients with a prior history of heart failure, cardiovascular disease (CVD), acute pericarditis, acute myocarditis, and unstable angina were excluded from the study. Informed consent was obtained from patients admitted to the cardiology department, ensuring their voluntary participation in the study.

Comprehensive assessments were performed on all included patients to confirm the diagnosis of acute IWMI. This involved obtaining a detailed medical history, conducting thorough clinical examinations, and performing routine investigations such as electrocardiogram (ECG) and echocardiography. Right ventricular involvement (RVI) was identified by analyzing the ECG, specifically looking for >1.0mm ST segment elevation on right-sided chest leads (e.g., V3R and V4R). Additionally, evidence of right ventricular akinesia, hypokinesia, dilatation, or new tricuspid regurgitation on echocardiography further confirmed the presence of RVI.

A data collection form was utilized to record all relevant information, including age, gender, height, weight, body mass index (BMI), hypertension, diabetes mellitus, and smoking history. Strict adherence to the exclusion criteria was followed to ensure the collected data was unbiased and reliable.

Data analysis was performed using SPSS 22 software. Descriptive statistics, such as mean and standard deviation, were calculated for numerical variables (e.g., age, height, weight, BMI). Categorical variables, including gender, hypertension, diabetes mellitus, smoking, and RVI, were analyzed by calculating frequency and percentage distributions.

To assess the association of various factors with RVI, the incidence of RVI was stratified based on age, gender, BMI, hypertension, diabetes mellitus, and smoking. Post-stratification chi-square tests were employed to examine potential associations. A significance level of $p \leq 0.05$ was used to determine statistical significance, indicating a meaningful association between the variables under investigation.

Please note that this revision aims to improve the clarity and organization of the methods section. Additional details specific to the study design and data collection methods may need to be included, depending on the requirements of the intended audience or journal guidelines.

RESULTS

The study included a total of 150 patients, of whom 87 (58%) were male. The mean age of the participants was 61 ± 10.7 years. Among the assessed co-morbid conditions, 111 (74%) patients had hypertension, 64 (42.7%) had diabetes, and 45 (30%) were smokers. A body mass index (BMI) exceeding 25 kg/m² was observed in 83 (55.3%) patients. Detailed baseline characteristics of the study participants can be found in Table 1.

Table 1: Distribution of baseline characteristics of the study participants

	Summary
Total (N)	150
Gender	
Male	87 (58%)
Female	63 (42%)
Age (years)	
30-40	18 (12%)
41-50	34 (22.7%)
51-60	48 (32%)
61-75	50 (33.3%)
Co-morbid conditions	
Hypertension	111 (74%)
Diabetes mellitus	64 (42.7%)
Smoking	45 (30%)
Body mass index (kg/m²)	
≤25	67 (44.7%)
>25	83 (55.3%)

Among the study population, 62 (41.3%) patients were diagnosed with right ventricular infarction (RVI). The distribution of baseline characteristics between

patients with and without RVI is presented in Table 2. The analysis revealed no statistically significant association between RVI and gender (p=0.989), age (p=0.996), hypertension (p=0.964), diabetes (p=0.855), smoking (p=0.885), and BMI (p=0.920).

Table 2: Frequency of right ventricular infarction by baseline characteristics of patients

	Base (N)	Right ventricular infarction		P-value
		Yes	No	
Total (N)	150	62 (41.3%)	88 (58.7%)	
Gender				
Male	87	36 (41.4%)	51 (58.6%)	0.989
Female	63	26 (41.3%)	37 (58.7%)	
Age group				
30-40 years	18	7 (38.9%)	11 (61.1%)	0.996
41-50 years	34	14 (41.2%)	20 (58.8%)	
51-60 years	48	20 (41.7%)	28 (58.3%)	
61-75 years	50	21 (42%)	29 (58%)	
Hypertension				
Hypertensive	111	46 (41.4%)	65 (58.6%)	0.964
Non-hypertensive	39	16 (41%)	23 (59%)	
Diabetes mellitus				
Diabetic	64	27 (42.2%)	37 (57.8%)	0.855
Non-diabetic	86	35 (40.7%)	51 (59.3%)	
Smoking				
Smoker	45	19 (42.2%)	26 (57.8%)	0.885
Non-smoker	105	43 (41%)	62 (59%)	
Body mass index (kg/m²)				
≤25	67	28 (41.8%)	39 (58.2%)	0.920
>25	83	34 (41%)	49 (59%)	

DISCUSSION

Considering the prognostic significance of the combination of acute IWMI and RVI, this research aims to determine the frequency of RVI in patients with acute IWMI who presented to the cardiac emergency department of a tertiary care hospital in Peshawar, Pakistan. In the study of 150 patients with acute IWMI, 58% were male, and the average age was

61 ± 10.7 years. RVI was observed in 41.3% of the patients. The occurrence of RVI did not show statistically significant differences based on gender, hypertension, diabetes, smoking, or BMI.

Several previous studies have also investigated the prevalence and impact of RVI in IWMI. The reported frequency of RVI in IWMI in the literature is 27% to 48.5%.⁷⁻¹³ A by Samin A et al.¹⁴ reported RVI in 27% of the patients with IWMI, and similar to our findings, no statistically significant association was observed between the RVI incidence and the gender and age of the patients. Another study in our local population by Saif M et al.¹⁵ observed 28.0% RVI in patients with acute IWMI. Barrillon et al.¹⁶ highlighted the increased risk of conduction problems in patients with RV involvement, while a study conducted by Zehender et al.¹⁷ reported a higher incidence of ventricular fibrillation and sustained ventricular tachycardia in patients with RV involvement as indicated by ECG. Mehta et al.¹⁸ conducted a large-scale study that compared clinical manifestations and outcomes of patients with acute myocardial infarction based on right ventricular involvement. It has been observed that in-hospital mortality rates were higher for patients with anterior wall MI, while IWMI with RV involvement had a higher rate of arrhythmias, including sustained ventricular tachycardia, ventricular fibrillation, and high-degree AV blockage.

It has been observed that, among patients with IWMI caused by the right coronary artery (RCA), approximately 20% exhibited evidence of permanent RVI as detected by cardiac magnetic resonance imaging (CMR). The patients with permanent RVI are found to have more severe dysfunction in both left and right ventricular and have larger LV infarct sizes.¹⁹ Larger infarct size is a well-established prognostic factor associated with an increased risk of adverse outcomes after primary PCI.²⁰ In a study by Stiermaier T et al.²¹, RV involvement is commonly seen in patients with IWMI when the culprit lesion is in the right coronary artery. Timely reperfusion using primary PCI can help save a significant portion of the at-risk RV myocardium. Although structural involvement of the RV did not independently predict outcomes, RV global longitudinal strain (GLS) emerged as a predictor of adverse events in addition to clinical parameters and LV function. A study by Noguchi M et al.²² reported a significantly higher in-hospital mortality rate (9.4% vs. 3.0%; p=0.018) among STEMI patients of RVI as compared to STEMI patients without RVI, respectively.

One of the main limitations of this study was the small sample size. Conducting further investigations on a larger sample size and focusing on a population with

sex and age normalization, along with a long-term follow-up, would provide a more comprehensive understanding of the prognostic role of RVI in patients with IWMI.

CONCLUSION

Based on the research findings, it can be concluded that RVI is a relatively common occurrence in patients with acute IWMI, as it was observed in more than 40% of the patients studied. However, no statistically significant association exists between RVI and various demographic and clinical factors.

These findings indicate that right ventricular infarction may be a relatively independent complication of acute inferior wall myocardial infarction, and its occurrence is not strongly influenced by the demographic and clinical factors examined in this study. Further research may be needed to explore other potential risk factors or underlying mechanisms contributing to the development of right ventricular infarction in this patient population.

AUTHORS' CONTRIBUTION

RU and JA: Concept and design, data acquisition, interpretation, drafting, final approval, and agree to be accountable for all aspects of the work. AB, DAJ, AR, and WS: Data acquisition, interpretation, drafting, final approval and agree to be accountable for all aspects of the work.

Conflict of interest: Authors declared no conflict of interest.

REFERENCES

- Roth GA, Mensah GA, Johnson CO, Addolorato G, Ammirati E, Baddour LM, et al. Global burden of cardiovascular diseases and risk factors, 1990–2019: update from the GBD 2019 study. *J Am Coll Cardiol.* 2020;76(25):2982-3021.
- Choudhury T, West NE, El-Omar M. ST elevation myocardial infarction. *Clin Med (Lond).* 2016;16(3):277-82.
- El Amrawy AM, Zaghoul SA, El Sharkawy EM, Sobhy MA. Prognostic value of right ventricular diastolic dysfunction in patients with inferior ST-elevated myocardial infarction. *Egypt Heart J.* 2023;75(1):1-8.
- Haque SI, Zahid SA, Tuyyab F, Sayed TM, Ahmed I, Tahir A, et al. Clinical manifestations of right ventricular infarct in patients of inferior wall myocardial infarction. *Pak Armed Forces Med J.* 2019;69(Suppl 1):S78-81.
- Jeffers JL, Boyd KL, Parks LJ. Right ventricular myocardial infarction. In: *StatPearls [Internet]*. 2022 May 8. StatPearls Publishing.
- Santangelo S, Fabris E, Stolfo D, Merlo M, Vitrella G, Rakar S, et al. Right ventricular dysfunction in right coronary artery infarction: a primary PCI registry analysis. *Cardiovasc Revasc Med.* 2020;21(2):189-94.
- Iqbal MA, Shah I, Rauf MA, Khan N, Khan SB, Hafizullah M. Frequency of acute right ventricular myocardial infarction in patients with acute inferior myocardial infarction. *Pak Heart J.* 2012;45:81-85.
- Jensen CJ, Jochims M, Hunold P, Sabin GV, Schlosser T, Bruder O. Right ventricular involvement in acute left ventricular myocardial infarction: prognostic implications of MRI findings. *AJR Am J Roentgenol.* 2010;194:592-8.
- Memon AG, Shah MI, Devrajani BR, Baloch S. Incidence of right ventricular infarction in patients with acute inferior wall infarction. *J Postgrad Med Inst.* 2015;29(3):189-92.
- Ravikeerthy M, Yogi SR. A study of right ventricular infarction in inferior wall myocardial infarction. *Int J Sci Res.* 2015;5(4):1-3.
- Khan S, Kundi A, Sharieff S. Prevalence of right ventricular myocardial infarction in patients with acute inferior wall myocardial infarction. *Int J Clin Pract.* 2004 Apr;58(4):354-7.
- Memon AG, Shah MI, Devrajani BR, Baloch S. Incidence of right ventricular infarction in patients with acute inferior wall infarction. *J Postgrad Med Inst.* 2015;29(3): 189-92.
- Ondrus T, Kanovsky J, Novotny T, Andrsova I, Spinar J. Right ventricular myocardial infarction: From pathophysiology to prognosis. *Exp Clin Cardiol.* 2013 Winter; 18(1):27-30.
- Samin A, Ali N, Farhan S, Mustafa SH, Javaid M, Malik S, et al. Frequency of right ventricular infarction among patients presenting with acute inferior wall myocardial infarction. *Pak Armed Forces Med J.* 2020;70(Suppl-4):S741-4.
- Saif M, Safi SI, Samin A, Bukhari J, Khan S. Frequency of right ventricular infarction and in-hospital outcome after primary percutaneous coronary intervention (PPCI) in acute inferior myocardial infarction (MI). *Pak Armed Forces Med J.* 2020;70(Suppl-4):S855-9.
- Barrillon A, Chaignon M, Guize L, Gerbaux A. Premonitory sign of heart block in acute posterior myocardial infarction. *Br Heart J.* 1975;37:2-8.
- Zehender M, Kasper W, Kauder E, et al. Right ventricular infarction as an independent predictor of prognosis after acute inferior myocardial infarction. *N Engl J Med.* 1993;328:981-8.
- Mehta SR, Eikelboom JW, Natarajan MK, et al. Impact of right ventricular involvement on mortality and morbidity in patients with inferior myocardial infarction. *J Am Coll Cardiol.* 2001;37:37-43.
- Juul AS, Kyhl K, Ekström K, Madsen JM, Sabbah M, Ahtarovski KA, et al. The Incidence and Impact of Permanent Right Ventricular Infarction on Left Ventricular Infarct Size in Patients With Inferior ST-Segment Elevation Myocardial Infarction. *Am J Cardiol.* 2023;186:43-9.
- Stone GW, Selker HP, Thiele H, Patel MR, Udelson JE, Ohman EM, et al. Relationship between infarct size and outcomes following primary PCI: patient-level analysis from 10 randomized trials. *J Am Coll Cardiol.* 2016;67(14):1674-83.
- Stiermaier T, Backhaus SJ, Matz J, Koschalka A, Kowallick J, de Waha-Thiele S, et al. Frequency and prognostic impact of right ventricular involvement in acute myocardial infarction. *Heart.* 2021;107(7):563-70.
- Noguchi M, Sakakura K, Akashi N, Adachi Y, Watanabe Y, Taniguchi Y, et al. The comparison of clinical outcomes between inferior ST-elevation myocardial infarction with right ventricular infarction versus without right ventricular infarction. *Int Heart J.* 2019;60:560-8.

Address for Correspondence:

Dr. Jabar Ali, Assistant Professor at Lady Reading hospital, Peshawar, Pakistan.

Email: dr.jabarali78@gmail.com