ORIGINAL ARTICLE

PREVALENCE AND CLINICAL PROFILE OF RIGHT VENTRICULAR INFARCTION IN PATIENTS WITH ACUTE INFERIOR WALL MYOCARDIAL INFARCTION AT A TERTIARY CARE HOSPITAL

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Objectives: Coronary artery disease remains a prominent global cause of illness and mortality. A significant proportion of individuals experiencing acute inferior myocardial infarction (IWMI) develop right ventricular infarction (RVI), contributing substantially to clinical and hemodynamic instability. This study aims to assess the prevalence of RV infarction in patients presenting with IWMI.

Methodology: Consecutive IWMI patients visiting the Department of Cardiology at the National Institute of Cardiovascular Diseases between February 2021 and August 2021, of any gender and aged between 18 and 80 years, were recruited. Patients underwent a comprehensive assessment, including history, clinical examination, routine investigations, and electrocardiogram (ECG). Right ventricular infarction was evaluated based on a right-sided ECG.

Results: A total of 155 patients were included, with a mean age of 56.2±12.4 years; 40 (25.8%) were between 18 to 50 years old. In terms of gender distribution, 105 (67.7%) were male. Comorbid conditions included hypertension in 88 (56.8%) patients, diabetes mellitus in 58 (37.4%), 64 (41.3%) smokers, and 26 (16.8%) with a positive family history. RVI was observed in 41 (26.5%) patients. Notably, the prevalence of RVI differed significantly between diabetic and non-diabetic patients (13.8% vs. 34%, p=0.006) and between those with positive and negative family histories (7.7% vs. 30.2%, p=0.017), respectively. No significant impact of other parameters on RVI was observed.

Conclusion: Right ventricular infarction was prevalent in more than a quarter of patients with IWMI. It exhibited a negative association with the presence of diabetes and a positive family history.

Keywords: Coronary artery disease, Right ventricular infarction, Inferior wall myocardial infarction

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INTRODUCTION

Coronary artery disease (CAD) stands as one of the most prevalent cardiovascular diseases worldwide, significantly contributing to global mortality. According to the World Health Organization (WHO), CAD accounted for 18.6 million deaths in 2019, representing approximately 16% of all global fatalities.[1] This disease affects both developed and developing nations, with a higher burden observed in high-income countries, attributed to lifestyle factors such as sedentary behavior, unhealthy diets, and elevated rates of obesity. Multiple risk factors, including smoking, hypertension, increased LDL (low-density lipoprotein) levels, diabetes mellitus (DM), poor diets, physical inactivity, and a family history of CAD, are implicated in its development.[2] Notably, high-income regions like North America, Western Europe, and Australia exhibit a higher prevalence of CAD compared to low- and middle-income nations.[1]

Myocardial infarction, commonly referred to as a heart attack, is a frequently diagnosed condition among hospitalized individuals, particularly in developed

nations where it stands out as the leading cause of both illness and death.[3] The primary treatment for ST-segment elevation myocardial infarction (STEMI) is the timely performance of primary percutaneous coronary intervention (PCI).[4] The adoption of primary PCI has significantly improved clinical outcomes and prognosis for STEMI patients. However, the specific location of the coronary artery occlusion significantly influences the patient's journey and eventual outcome. Patients with right ventricular (RV) involvement during a heart attack, particularly in the right ventricle, face a more challenging immediate phase with a higher risk of severe complications.[5]

Approximately half of STEMI cases are associated with occlusion in the right coronary artery (RCA), leading to an inferior wall myocardial infarction (IWMI). Evidence suggests that the functioning of the right ventricle independently influences the prognosis in various diseases. Right ventricular infarction (RVI) is a complication that may occur after a specific type of heart attack called IWMI.[6,7] A recent meta-analysis found that RVI occurs in about 38% of cases of inferior STEMI.[6] Studies have consistently shown that individuals with RVI experience higher mortality compared to those with a heart attack not involving the right ventricle.[3,6,8,9]

However, much of this research predates the widespread use of primary PCI, and contemporary PCI methods have evolved significantly. Consequently, there is limited research on the outcomes of RVI in the context of modern primary PCI.[10] This study aims to address this gap by investigating the clinical outcomes of RVI in the current era of primary PCI.[9]

Considering the limited data on RV infarction in IWMI patients in our population, existing information is derived from single centers with small sample sizes. Our center, being the largest cardiac care center in Pakistan, is uniquely positioned to provide more representative results, given the diverse patient population from all regions of the country. This study seeks to explore the prevalence and extent of permanent damage in the right ventricle among patients experiencing IWMI. The specific objective was to assess the prevalence of RV infarction in patients presenting with IWMI.

METHODOLOGY

Study Design: his descriptive cross-sectional study aimed to assess the prevalence of RV infarction in patients presenting with IWMI.

Setting: The study was conducted at the National Institute of Cardiovascular Diseases (NICVD), Karachi, spanning from February 22, 2021, to August 21, 2021.

Participants: The inclusion criteria encompassed consecutive patients of either gender presenting with acute IWMI, aged between 18 and 80 years. Exclusion criteria involved patients with a history of prior transmural MI and associated anterior or lateral wall myocardial infarction. Additionally, individuals with MI following invasive coronary artery procedures like PCI or coronary artery bypass grafting (CABG), as well as those with severe chronic obstructive pulmonary disease (COPD), end-stage renal or liver disease, and those who declined participation consent, were excluded.

Ethics: Prior approval was obtained from the hospital ethical committee, and verbal informed consent was secured from patients after explaining the study's purpose and benefits.

Diagnosis and Assessments: Diagnosis of acute IWMI was based on the presence of typical retrosternal chest pain radiating to the left shoulder or jaw for more than 20 minutes, unrelieved by nitrates (0.5 mg sublingually, repeated after 15 to 20 minutes), elevated serum troponin-I levels exceeding the upper limit of normal (more than 0.4ng/dl measured in the hospital clinical laboratory), and an electrocardiogram (ECG) indicating ST-segment elevation of > 1.0mm in two of the three inferior limb leads II, III, aVF.

Right ventricular infarction was diagnosed using right-sided ECG, characterized by an inferior STEMI with ST elevation in lead III > lead II. V1 showed isoelectricity while V2 was significantly depressed, and ST elevation was observed throughout the right-sided leads V3R-V6R

Variables: All patients underwent a comprehensive evaluation, including history, clinical examination, routine investigations, and ECG. Demographic characteristics such as age, gender, and risk factors like hypertension (using antihypertensive medications for the last six months), diabetes (patients on diabetogenic medications over the previous six months), smoking (ten cigarettes per day for two years), and family history were documented. Family history assessed the presence of ischemic heart diseases, i.e., angina, MI, or history of myocardial revascularization in a first-degree male or female relative before age 55 or 65, respectively.

Study Size: A sample size of 155 was determined at a 95% confidence interval and a margin of error of 7%, based on the assumed prevalence of 27% for RV infarction in patients with acute IWMI.[11]

Statistical Methods: All collected data, including age, gender, hypertension, diabetes, smoking, family history, and right ventricular infarction, were entered into the statistical software SPSS 22, and descriptive analysis was applied. Numerical variables like age were expressed as mean and standard deviation (SD) or median (IQR), while categorical variables such as gender, age group, hypertension, diabetes, smoking, family history, and RVI were presented as frequencies and percentages. Stratification addressed effect modifiers such as age group, gender, hypertension, diabetes, smoking, and family history. The Chi-square test or Fisher's exact test was appropriately applied, considering a p-value <0.05 as significant.

RESULTS

Participants: A total of 155 patients were included, with a mean age of 56.2±12.4 years. Among them, 40 (25.8%) were between 18 and 50 years old, while 115 (74.2%) were over 50 years old. Regarding gender distribution, 105 (67.7%) were male, and 50 (32.3%) were female.

Descriptive Data: The most commonly documented comorbid condition was hypertension, observed in 88 (56.8%) patients, followed by diabetes mellitus in 58 (37.4%) patients. Out of the 155 patients, 64 (41.3%) were smokers, whereas 91 (58.7%) were non-smokers. Additionally, 26 (16.8%) had a positive family history, while 129 (83.2%) had a negative family history. Right ventricular infarction was diagnosed in 41 (26.5%) patients, as presented in Table 1.

Table 1: Descriptive, demographics, and clinical characteristics of the patients

Characteristics	Total
Total	**155**
Mean age (years)	56.2 ± 12.4
Age groups	
18-50 Years	40 (25.8%)
>50 Years	115 (74.2%)
Gender distribution	
Male	105 (67.7%)
Female	50 (32.3%)
Comorbid condition	
Diabetes mellitus	58 (37.4%)
Hypertension	88 (56.8%)
Positive family history	26 (16.8%)
Smoking status	
Smoker	64 (41.3%)
Non-Smoker	91 (58.7%)
Right ventricular infarction	
Positive	41 (26.5%)
Negative	114 (73.5%)

Outcome Data: The prevalence of RVI was 13.8% (8/58) among diabetic patients and 34% (33/97) among non-diabetic patients, with a significant difference noted (p=0.006). Similarly, the prevalence of RVI was 7.7% (2/26) among patients with a positive family history and 30.2% (39/129) among those with a negative family history, also showing a significant difference (p=0.017). No significant impact of other parameters on RVI was observed (see Table 2).

Table 2: Comparison of right ventricular infarction among demographics and clinical characteristics of the study subjects

Characteristics	Total (N)	Right Ventricular Infarction	P-value
Total	**155**	**41**	**-**
Age groups			
18-50 Years	40	11 (27.5%)	0.861
>50 Years	115	30 (26.1%)	
Gender distribution			
Male	105	27 (25.7%)	0.763
Female	50	14 (28%)	
Hypertension			
Hypertensive	88	23 (26.1%)	0.919
Non-Hypertensive	67	18 (26.9%)	
Diabetes mellitus			
Diabetes	58	8 (13.8%)	0.006
Non-Diabetes	97	33 (34%)	
Smoking status			
Smoker	64	15 (23.4%)	0.476
Non-Smoker	91	26 (28.6%)	
Family history			
Positive	26	2 (7.7%)	0.017
Negative	129	39 (30.2%)	

DISCUSSION

In our investigation, we systematically examined a consecutive sample of patients to gain insights into the frequency of RVI and its clinical characteristics in individuals with acute IWMI. Among the 151 patients diagnosed with IWMI, 41 individuals (26.5%) experienced right ventricular MI. Numerous previous studies have delved into the prevalence and characteristics of RVI in individuals with IWMI.[2,4,5,7,8]

The reported occurrence of RVI in IWMI spans a range of 27% to 48.5% in the existing literature. For instance, Ravikeerthy M and colleagues,[12] observed a 40% incidence, Memon AG and team,[13] found that among 198 cases with IWMI, 48.5% had evidence of RVMI, and Ali H et al.[14] identified right ventricular involvement in 32% of 16 cases with IWMI. Therefore, our findings align with existing evidence regarding the incidence of RVMI in IWMI. The relative infrequency of right ventricular involvement is attributed to the right ventricle's lower susceptibility to ischemia, owing to its smaller muscle mass and continuous coronary perfusion in both systole and diastole.[14]

In a study conducted by Samin A et al., the occurrence of RVI in patients with acute inferior wall myocardial infarction was reported to be 27%, consistent with our

findings. Importantly, no statistically significant associations were observed between the incidence of RVI and the patients' gender or age, emphasizing the multifactorial nature of the factors influencing this cardiac complication.[15]

An additional investigation by Saif M et al., focusing on the local population, further explored the incidence of RVI in acute IWMI patients. The prevalence of RV infarction varied across studies, ranging from 24% to 50% in different series.[2] The vulnerability of right ventricular infarct patients to factors such as decreased preload, lack of atrioventricular synchronization, and potential hemodynamic disturbances underscored the clinical significance of understanding and managing RVI.[2]

In our current study involving 155 patients, we examined the prevalence and clinical profile of RVI in acute IWMI patients. A notable 26.5% (41 individuals) experienced right ventricular myocardial infarction. These findings align with Iqbal MA et al., who reported a majority of RVI in 27% of their patient cohort.[11] Conversely, a study by Ali H et al. indicated gender-based differences, with 35% of males and 38% of females experiencing RV infarction.[14]

In a broader context, diverse studies presented varying incidences of RVI among IWMI patients. Khandait V et al.[16] found right ventricular involvement in 30% of cases, while Ravikeerthy M et al.[12] reported an incidence of 40%. Memon AG et al. observed RVMI indications in 48.5% of their cases.[13] Similarly, Gulati R et al.[17] documented an anticipated 21.6% incidence of RVI in inferior MI cases, and Akram et al.[18] reported 24% RVI.

LIMITATION

It is essential to note certain limitations in our study. The cross-sectional nature of the investigation precludes the establishment of causal links between risk factors and RVI. Furthermore, being conducted at a single center with a relatively small participant pool limits the generalizability of the findings to a broader population. Additionally, the study did not assess patient outcomes, preventing conclusive statements about the impact of RVI on the outcomes of IWMI. Larger-scale research endeavors are warranted to validate and build upon the results of this study.

CONCLUSION

RVI was observed in more than a quarter of the patients with IWMI. It was found to be negatively associated with the presence of diabetes and a positive family history.

AUTHORS' CONTRIBUTION

SZ and MNK: Concept and design, data acquisition, interpretation, drafting, final approval, and agree to be accountable for all aspects of the work NAS, KN, HS, IJB, and SR: Data acquisition, interpretation, drafting, final approval and agree to be accountable for all aspects of the work.

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