Section: General Medicine

Original Research Article

PREVALENCE OF RIGHT VENTRICULAR AND POSTERIOR WALL INFARCTION AMONG PATIENTS WITH ACUTE INFERIOR WALL MYOCARDIAL INFARCTION

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Abstract

Background: Cardiologists face a major issue with ischaemic heart disease, particularly inferior wall myocardial infarction (IWMI). It can increase morbidity and mortality when paired with right ventricular and posterior wall infarction. The present study aimed to investigate the prevalence of right ventricular (RVI) and posterior wall infarction (PWI) among patients with acute inferior wall myocardial infarction (IMI). **Materials and Methods:** A hospital-based cross-sectional study performed at Sri Manakula Vinayagar Medical College in Kalitheerthalkuppam, Pondicherry, on 50 patients presenting with acute IWMI was investigated for 18 months. Appropriate questionnaires were employed to gather data from the patients. A total of 4ml of blood were collected for tests such as the Troponin-I, CK-MB, liver function test, renal function test, fasting lipid profile, and random blood sugar test to confirm and determine risk factors. **Result:** Most of the patients were male, between 60 and 69. Breathlessness and chest pain were consistently seen in participants as primary symptoms. RVI and PWI in 46% and 52% of cases. Drinking and smoking are significant risk factors for RVI and PWI. The patients' ECG study revealed 14 LCX and 36 instances of RCA. Analysis of the mean difference between all clinical measurements in individuals with RVI and PWI revealed that, except for ECHO-EF, there was no statistically significant difference between posterior wall violations. **Conclusion:** The ability to diagnose RWI and PWI in patients with acute IWMI is improved by adding right-sided and posterior chest leads and the standard 12-lead ECG. RVI therapy requires maintaining a healthy right ventricular preload and providing inotropic support.

INTRODUCTION

Coronary artery disease (CAD) is a major cause of morbidity and mortality, illness, and disability in developing countries. According to the Global Burden of Disease Study, CAD became India's leading cause of mortality between 1990 and 2013.[1] In India, CAD is linked to an increasing trend, geographical variability, early onset, poor management, and greater mortality.[2] Nine risk factors were found to be responsible for more than 90% of the risk of an initial acute myocardial infarction (MI) in a case-control study conducted across 52 countries (INTER HEART).[3] The results were universal because these risk factors affected both men and women equally in all geographic and racial contexts.[4]

According to the INTERHEART study, the cause of premature coronary artery disease in the South Asian region was the premature onset of the biological risk factors mentioned above.[4,5] Asian Indians develop coronary artery disease 5–10 years earlier than the general population worldwide. Indians first have an acute myocardial infarction, on average around 53. Not only is coronary artery disease on the rise in India, but it is also harming the working population between the ages of 35 and 65. The inferior wall of the heart experiences less perfusion due to coronary artery occlusion, leading to myocardial infarction (MI). If not treated promptly, this results in myocardial ischemia, followed by an infarction. The right coronary artery typically nourishes the inferior myocardium. Due to left dominance, the left

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circumflex will feed the posterior descending coronary artery in about 6–10% of the population.[3,5] A right ventricular myocardial infarction is associated with inferior wall myocardial infarction in 25% to 50% of cases. The septum is forced towards the volume-depleted left ventricle by the increased right ventricular volume and end-diastolic pressure that result from a right ventricular infarction, further limiting left ventricle filling. Diuretics, beta-adrenergic blockers, morphine, and nitrates must be avoided if RVWI is found because they may worsen preload and cause a rapid drop in blood pressure.[6,7] The present study used an electrocardiogram to study the association of the right ventricular wall and posterior wall extension in acute inferior wall MI. Also, we have studied the risk factor of inferior wall MI with associated right ventricular wall or posterior wall extension.

MATERIALS AND METHODS

A hospital-based cross-sectional study performed at Sri Manakula Vinayagar Medical College in Kalitheerthalkuppam, Pondicherry, on 50 patients presenting with acute IWMI was investigated for 18 months.

Inclusions Criteria

All cases of IWMI presenting to emergency/inpatients with or without complications were included.

Exclusion Criteria

The exclusion criteria were right bundle branch block, pre-excitation, right ventricular hypertrophy, and hypertrophic cardiomyopathy.

The study was performed after getting informed consent from the patient and clearance from research and ethical committees. After patients are eligible, a blood sample is taken for imaging tests and investigations. To determine the extent of the right ventricular and posterior wall, patients underwent conventional 12-lead and right-sided and posterior chest ECGs. Appropriate questionnaires were employed to gather data from the patients.

A total of 4ml of blood were taken for tests such as Troponin-I, CK-MB, Liver function, Renal function, Fasting lipid profile, and Random Blood Sugar for confirmation and to determine risk factors. Random blood glucose levels were determined using the glucose oxidase and peroxidase methods to determine the patient's glycemic status on the same day of admission. Blood urea was determined using the UV kinetic method, and serum creatinine was determined using the picric acid method to evaluate renal function. The liver function test was performed using the Chemwell kit, and cardiac enzymes such as Troponin I and CK-MB were estimated by Chemwell (Identi Kit).

On the same day or the next day of admission, 2D-ECHO (echocardiogram) is a non-invasive (no skin piercing) treatment for evaluating the function and architecture of the heart. 2-D (two-dimensional) 49 echocardiography is an echocardiogram that examines the heart in two dimensions. The fasting lipid profile was assessed by the Spinreact method on the next day of admission in the fasting state.

Lead application

Accurate lead placement is very important to minimise errors and inaccurate results.6 Limb lead Application - Place the AVR in the right upper limb, AVL in the left upper limb, and AVF in the left foot. Chest lead application was applied in the following manner: V1 Fourth intercostal space at right sternum border, V2 Fourth intercostal space at left sternum border, V3 Midway between V2 and V4, V4 Fifth intercostal space at the midclavicular line, V5 At the anterior axillary line on the same horizontal level as V4, and V6 At the mid-axillary line on the same horizontal level as V4 and V5.

Statistical Analysis

The data was entered using Epi_Info (version 7.2.2.6) software package and analysed using SPSS 24.0 software, reporting the association of right ventricular and posterior wall extension in acute inferior wall MI patients. The Chi-square test was used as a significance test to evaluate. The quantitative variables' mean and standard deviation were used in the descriptive analysis, while frequency and proportion were used for categorical variables. Additionally, data was visualised using the correct designs, such as bar and pie charts. The relationship between categorical explanatory variables and the quantitative result was evaluated by contrasting the mean values. A separate sample t-test was utilised to determine statistical significance, and statistical significance was defined as a P-value of 0.05 or lower.

RESULTS

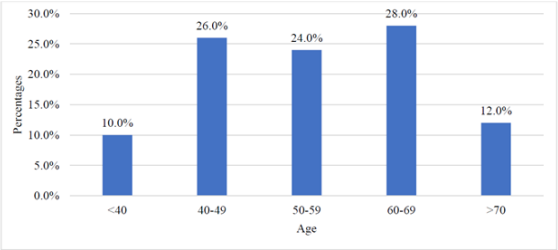

Figure 1: Distribution of age group

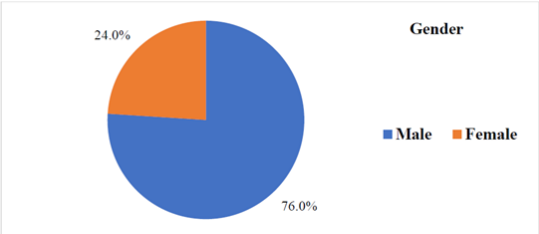

Figure 2: Gender distribution of all participants (N=50)

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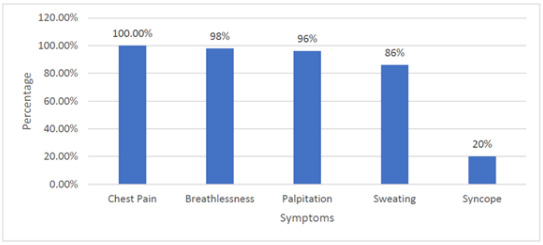

Figure 3: Observed symptoms in all subjects (N=50)

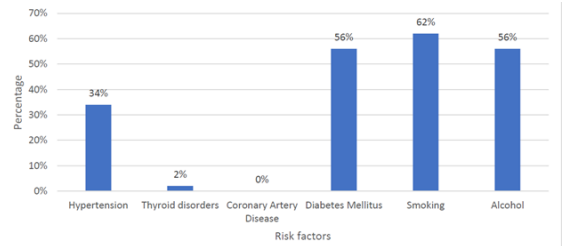

Figure 4: Risk factor in all subjects (N=50)

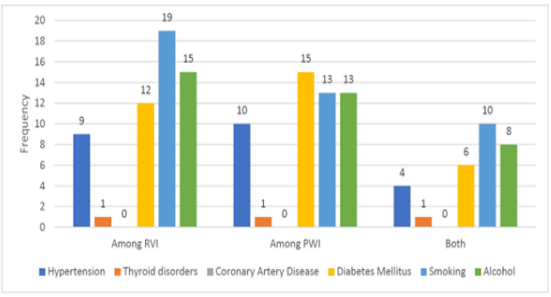

Figure 5: Bar chart of risk factors among only RVI, PWI, and both in all subjects (N=50)

Among the studied population (n=50), 14 (28%) of the age group between 60-69 years, 13 (26%) of the age group between 40-49 years, 12 (24%) of the age group between 50-59 years, 6 (12%) of the age group between >70 years [Figure 1]. Among the study population, 38 (76 %) of them were male, 12 (24%) of them were female [Figure 2].

Of 50 participants with symptoms, 100% of them had chest pain, 49 (98%) of them had breathlessness, 48 (96%) of them had Palpitation, 43 (86%) of them had Sweating, and 10 (20%) of them had a syncope [Figure 3].

Of 50 participants with symptoms, 17 (34%) of them had hypertension, 1(2%) of them had a thyroid disorder, 28 (56%) of them had Diabetes Mellitus, 31 (62%) of them had smoking, and 28 (56%) of them had alcohol [Figure 4].

Of 23 participants who had RVI, 9, 12, 19, and 15 had hypertension, Diabetes Mellitus, Smoking habits, and alcohol habits, respectively. Twenty-six participants had PWI; 10, 15, 13, and 13 participants had hypertension, Diabetes Mellitus, Smoking habits, and alcohol habit, respectively. Of 12 participants who had RVI & PWI, 4, 6, 10, and 8 participants had hypertension, Diabetes Mellitus, Smoking habits, and alcohol habits, respectively [Figure 5].

Among the study population, 23 (46 %) participants had Right ventricular infarction, and 26 (52%) had posterior wall infractions, per ECG analysis. Among the study population, 12 (24%) participants had right ventricular and posterior wall infractions. Most of the participants were observed without LCX 14 (28%), whereas 36(72%) reported with LCX [Table 1].

Of 23 participants with RVI, 18 had RCA, and 5 had LCX. Of 26 participants who had PWI, 19 participants had RCA, and 7 had LCX. Of 12 participants with RVI and PWI, 10 had RCA, and 2 had LCX [Table 2].

Among all subjects, the mean pulse rate was 78.48 ± 10.34, it was 121.68 ± 13.67 for Systolic Blood Pressure, it was 77.6 ± 8.22 for Diastolic Blood Pressure, and it was 22.52 ± 2.19 Body Mass Index [Table 3].

The mean creatine kinase Mb was 46.72 ± 53.6; the mean blood urea was 23.74 ± 7.06. The mean serum creatinine was 1.04 ± 0.24. The mean total cholesterol was 166.34 ± 42.79. The mean Triglycerides b was 155.08 ± 82.63; the mean high-density cholesterol was 47.62 ± 54.82; the mean low-density cholesterol was 91.3 ± 25.34. The mean very low-density cholesterol was 32.06 ± 18.94, the mean random blood sugar was 149.18 ± 72.86, the mean Echo-Ef Was 45.6 ± 6.36 [Table 4].

The clinical variables in patients with RVI were investigated and recorded in the present study. The mean difference of all clinical variables between RVI was statistically non-significant (p-value >0.05) [Table 5].

In the case of Creatine Kinase Mb, Blood Urea, Serum Creatinine, Triglycerides, High-Density Cholesterol, Low-Density Cholesterol, Very Low-Density Cholesterol, and Random Blood Sugar, there was no statistically significant difference between posterior wall infarctions (p-value >0.05). The difference in ECHO-EF between posterior wall infractions was not statistically significant, although the mean difference in total cholesterol was (p-value 0.05) [Table 6].

Table 1: Descriptive analysis of ECG RVI, ECG PWI, right ventricular infarction, posterior wall infarction, ECG RCA, and ECG LCX in the study population (N=50)

Right ventricular infarction	Frequency	% Proportion
Yes	23	46.00%
No	27	54.00%
Posterior wall infarction		
Yes	26	52.00%
No	24	48.00%
Right ventricular infarction and posterior wall infarction		
Yes	12	24%
ECG RCA		

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Yes	36	72.00%
No	14	28.00%
ECG LCx	Frequency	% Proportion
Yes	14	28.00%
No	36	72.00%

Table 2: Frequency of RCA and LCX involvement in the study population (N=50)

Parameter	Among RVI	Among PWI	Both
ECG RCA	18	19	10
ECG LCX	5	7	2

Table 3: Descriptive analysis of vital signs and anthropometric parameters in all subjects (N=50)

Parameter	Mean ± SD	Median	Minimum	Maximum
Pulse Rate	78.48 ± 10.34	78.00	58.00	102.00
Systolic Blood Pressure	121.68 ± 13.67	120.00	90.00	150.00
Diastolic Blood Pressure	77.6 ± 8.22	80.00	60.00	90.00
Body Mass Index	22.52 ± 2.19	22.50	18.20	27.10

Table 4: Observation of investigation in study population (N=50)

Variables	Means ± SD	Median	Minimum	Maximum
Creatine Kinase Mb	46.72 ± 53.6	27.50	10.00	329.00
Blood Urea	23.74 ± 7.06	23.50	15.00	50.00
Serum Creatinine	1.04 ± 0.24	1.00	0.50	1.60
Total Cholesterol	166.34 ± 42.79	161.50	87.00	303.00
Triglycerides	155.08 ± 82.63	134.00	45.00	340.00
High-Density Cholesterol	47.62 ± 54.82	34.00	12.00	318.00
Low-Density Cholesterol	91.3 ± 25.34	95.00	32.00	145.00
Very Low-Density Cholesterol	32.06 ± 18.94	24.50	11.00	96.00
Random Blood Sugar	149.18 ± 72.86	134.00	20.00	419.00
Echo-EF	45.6 ± 6.36	45.00	35.00	60.00

Table 5: Comparisons of the mean of clinical variables between RVI (N=50)

Variables	Right ventricular infarction (Mean± SD)		P-value
	Yes (N=23)	No (N=27)	
Creatine Kinase Mb	46.43 ± 37.48	46.96 ± 65.01	0.973
Blood Urea	23.91 ± 7.53	23.59 ± 6.78	0.875
Serum Creatinine	1.07 ± 0.28	1.01 ± 0.19	0.384
Total Cholesterol	164.48 ± 37.35	167.93 ± 47.59	0.780
Triglycerides	157.39 ± 83.83	153.11 ± 83.13	0.857
High-Density Cholesterol	42.57 ± 32.24	51.93 ± 68.86	0.553
Low-Density Cholesterol	93.35 ± 26.59	89.56 ± 24.61	0.603
Very Low-Density Cholesterol	32.57 ± 20.01	31.63 ± 18.35	0.864
Random Blood Sugar	144.78 ± 71.44	152.93 ± 75.19	0.698
ECHO-EF	44.35 ± 4.84	46.67 ± 7.34	0.202

Table 6: Comparative of the mean of the clinical variable between posterior wall infarction (N=50)

Variables	Posterior wall infarction (Mean± SD)		P-value
	Yes (N=26)	No (N=24)	
Creatine Kinase Mb	57.35 ± 65.2	35.21 ± 35.14	0.146
Blood Urea	23.69 ± 7.1	23.79 ± 7.17	0.961
Serum Creatinine	1.07 ± 0.18	1.02 ± 0.29	0.473
Total Cholesterol	178.23 ± 46.91	153.46 ± 34.29	0.040
Triglycerides	172.27 ± 87.69	136.46 ± 74.1	0.127
High-Density Cholesterol	51.08 ± 62.7	43.88 ± 45.82	0.647
Low-Density Cholesterol	90.73 ± 24.6	91.92 ± 26.64	0.871
Very Low-Density Cholesterol	33.65 ± 19.73	30.33 ± 18.31	0.541
Random Blood Sugar	149.35 ± 66.76	149 ± 80.4	0.987
ECHO-EF	43.85 ± 6.68	47.5 ± 5.52	0.041

DISCUSSION

The greatest cause of death for both men and women in the United States and worldwide is atherosclerosis of the coronary and peripheral arteries. In the US, AMI affects around 1.5 million people annually.[2] Right ventricular infarction develops in roughly a third of patients with acute IWMI; in 10% of these patients, hemodynamic abnormalities become clinically severe. IWMI is typically believed to have a better prognosis in the short and long term than anterior wall myocardial infarction because the volume of myocardium fed by the right coronary artery or the left circumflex artery is significantly less than that of the left anterior descending artery. However, difficulties in the hospital increase when the right ventricle is involved, which has important prognostic ramifications.[3,4]

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Acute posterior wall myocardial infarction (PWI) occurs in up to 20% of acute MI cases, mostly in the presence of inferior or lateral acute MI. True PWIs are measured rare, with an occurrence of 3.3%. PWI is left ventricular necrosis that rises beneath the atrioventricular sulcus. Most people with typical PWI ECG abnormalities have stenosis or occlusion of the left circumflex coronary artery.[8] Since no particular leads of the normal ECG immediately show this region, an ECG diagnosis of PWI is challenging. The characteristic infarction pattern only emerges on the ECG in the electrodes dorsally between the spine and the left scapula,[9] because electrical forces in PWI are lost in a dorsal orientation. Leads V1 and V2 on a conventional ECG of a real PWI are mirror images of the leads V1 and V2 of an anterior MI, causing ST-segment depression in PMI rather than ST-segment elevation in an acute anterior MI. Compared to the usual 12-lead ECG, adding posterior cheat leads V7 through V9 significantly improves the capacity to distinguish posterior damage patterns. Lead V7 should be placed at the level of lead V6 on the posterior axillary line, lead V8 on the left side of the back at the point of the scapula and lead V9 in the middle of lead V8 and the left paraspinal muscles.[10]

In the present study, a total of 50 patients were enrolled, and it was seen that the majority of them were male, 38 (76 %) and 12 (24%). Among the total participants, a maximum of patients, 14 (28%) were reported in the age group of 60-69 years. Rodrigues et al. also stated similar findings in their study, where most patients were male and in the age group of more than 60.[11] The symptoms of MI were studied in all patients, and chest pain symptoms were observed in all patients, followed by breathlessness in 49 (98%) patients. However, only 10 (20%) patients were reported with symptoms of syncope. In their study, McSweeney Jean et al. found that unusual fatigue (70.7%), sleep disruption (47.8%), and shortness of breath were the most common symptoms in participating patients.[12]

Further, we have evaluated the risk factors in all participating patients. Smoking was observed in the highest number of patients, 31 (62%), followed by diabetes mellitus and Alcoholism in 28 (56%). However, coronary artery disease was not reported in any of the patients. The present study also assessed the risk factors in patients reported with RVI and PWI. The smoking and alcoholism risk factors were observed highest, followed by diabetes mellitus in patients with RVI and PWI. These findings in the present study follow earlier reported studies.[12,13]

In our study prevalence of RVI was observed at 23 (46%), PWI at 26 (52%), and incidences of both RVI and PWI were found to be in 12 (24%) patients. These findings in the present study are consistent with previously reported studies. Khan et al., in their study, reported a 34% prevalence of RVI.[13,14] The occlusion of RCA, which leads to MI, was studied with the help of ECG in the current study. It was observed in the present study that 36 (72%) patients were reported with ECG RCA. However, 14 (28%) patients were recorded with ECG LCX. Of 23 patients with RVI, 18 and 5 participants had RCA and LCX, respectively. Of 26 patients, who had PWI, 19 participants had RCA, and 7 participants had LCX. Of 12 participants with RVI and PWI, 10 had RCA, and 2 had LCX. These findings were consistent with the outcomes reported in a study by Khandait et al.[14]

Moreover, we have also reported the vital sign of the patients. Among the study population, the mean pulse rate was 78.48 ±10.34; systolic blood pressure was 121.68 ± 13.67, Diastolic Blood Pressure was 77.6 ± 8.22, and Body Mass Index was observed to be 22.52 ± 2.19. These findings were in line with observations made in earlier studies.[9] Among the study participants in our study, the mean Creatine Kinase Mb was 46.72 ± 53.6; the mean Blood Urea was 23.74 ± 7.06. The mean Serum Creatinine was 1.04 ± 0.24, the mean Total Cholesterol was 166.34 ± 42.79, the mean Triglycerides was 155.08 ± 82.63, the mean HDL was 47.62 ± 54.82, the mean LDL was ± 25.34, the mean Very Low-Density Cholesterol was 32.06 ± 18.94, the mean Random Blood Sugar was 149.18 ± 72.86, the mean Echo-EF was 45.6 ± 6.36. The mean value of total cholesterol and triglycerides is more than 150 have been reported in MI patients. The findings in our studies are comparable to earlier reported studies.[8]

Investigation and evaluation were conducted on the clinical parameters in individuals with RVI (N=23) and PWI (N=26). The mean difference between RVI and PWI in terms of creatine kinase MB, blood urea, serum creatinine, triglycerides, HDL, LDL, very low-density cholesterol, and random blood sugar was not found to be statistically significant in our study ($p>0.05$). While there was a statistically significant difference in total cholesterol and echo-EF between posterior wall infractions (p-value 0.05), none existed. However, a study by Nowosielski et al. discovered that cardiovascular magnetic resonance (CMR) and ECHO-EF only have a weak correlation during the acute stage of myocardial infarction. Acute MI and cholesterol ratio were shown to be correlated by Wattanasuwan et al.[15,16]

A limitation of the current study is its small sample size of 50 patients, which may not accurately represent the prevalence of a broader population. RCA and LCX participation was predicted only based on ECG criteria and not by CAG.

CONCLUSION

Including right-sided and posterior chest leads to the conventional 12-lead ECG improves the capacity to diagnose RWI and PWI in patients with acute IWMI. Maintaining a healthy right ventricular preload and giving inotropic support was necessary for RVI therapy. Right ventricular and posterior wall infarctions, linked to high morbidity and mortality rates, are more likely to occur in those with inferior myocardial infarction.

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