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## Clinical manifestations of right ventricle involvement in inferior myocardial infarction

### Abstract

**Background:** Early diagnosis of right ventricle (RV) involvement in inferior myocardial infarction (Inf MI) is very critical. This study was performed to evaluate the clinical findings of Inf MI with or without RV infarction.

**Methods:** From September 2010 to September 2012, 195 patients with definite diagnosis of Inf MI were evaluated in the Department of Cardiology, in Babol, north of Iran. The presence or absence of right ventricular infarction was evaluated by ST elevation in precordial V3R-V4R leads. Chest pain (CP), changes in electrocardiography (ECG), serum level of Troponin T (TnT), decreased level of consciousness, hypotension, and jugular vein prominence (JVP) in patients with and without RV involvement were noted.

**Results:** One hundred forty eight (95 males and 53 females) and 47 (31 males and 16 females) cases developed Inf MI without and with RV infarction, respectively. The mean age of the patients with and without RV infarction were  $60.59 \pm 12.9$  and  $60.9 \pm 12.2$  years, respectively ( $P=0.883$ ). CP, decreased consciousness, hypotension, and JVP were seen in 147 (99.3%), 1 (0.7%), 1 (0.7%) and 1 (0.7%) patients without RV involvement and in 44 (93.6%), 9 (19.1%), 27 (54.4%) and 9 (19.1) in RV involvement, respectively ( $p<0.05$ ). No significant differences were seen in TnT enzymes and ECG changes.

**Conclusion:** The results show that chest pain, decrease of consciousness, hypotension, JVP prominence are more frequent in inferior MI with RV involvement patients.

**Keywords:** Inferior Myocardial infarction, Right ventricle, Hypotension, Chest pain.

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Inferior wall myocardial infarction (MI) is generally regarded as being low risk, compared with anterior wall MI. However, right ventricular (RV) infarction, precordial ST-segment depression and complete atrioventricular (AV) block have also been identified as the three high-risk subsets in inferior wall MI (1). Right ventricular (RV) infarction may occur alone or in association with left ventricular inferior wall infarction. The patients with inferior myocardial infarction (MI) who have right ventricular myocardial involvement appear to have the worse prognosis than those who do not have RV involvement (2, 3). Postmortem studies revealed that almost 50% of the patients who suffer myocardial infarction of the inferior wall undergo extension of the ischemic process to the right ventricle (3). An increase of sudden death in patients with residual RV dysfunction after inferior wall MI, attribution of presence of RV infarction to occurrence of ventricular fibrillation (VF) during temporary pacing, atrioventricular conduction block, mechanical complication like left ventricular (LV) failure and cardiogenic shock were reported in different studies (2-5). Also, current studies indicated that females, age over 70, hypertension, smoking, atrio-ventricular block and bundle branch block are the predictor factors for RV involvement for those who undergo inferior MI and RV infarction in patients with these signs and symptoms are more frequent (1, 2).

As this condition has received clinical attention and as assessment of RV involvement is important to identify patients being at risk of in-hospital mortality and poorer prognosis if impaired right ventricular systolic function is present (6). The purpose of this study was to compare the clinical findings of inferior myocardial infarction with and without RV infarction.

## Methods

This study was performed on 195 patients admitted to CCU ward at Shahid Beheshti Teaching Hospital, in Babol, north of Iran with definite diagnosis of inferior MI. Diagnostic criteria for inferior myocardial infarction included typical pain of angina pectoralis for more than 30 minutes, ST elevation over than 1mm on two or more than two contiguous leads II, III and aVF, and elevated serum level of CKMB enzyme twice more than the normal level (> 140U/L). The study participants were those with less than 24 hours of CCU admission and 12 hours from chest pain initiation. Those undergoing a history of previous MI or CABG surgery or renal failure (Creatinin  $\geq$  2.5mg/dl) were excluded from the study. The presence or absence of right ventricular infarction was evaluated in the study subjects, and pericordial V3R-V4R leads were applied to determine right ventricular involvement, and ST elevation over 1 mm in this lead was considered as right ventricular infarction.

For each patient, information about gender, age, chest pain (CP), decreased level of consciousness, hypotension, jugular vein prominence, ECG alterations, serum level of Troponin T were noted. Changes in ECG and ST elevation in other leads were diagnosed and the patients were divided into 5 groups with regard to MI types: Inferior MI, Inferior-lateral MI, Inferior-Posterior MI, Inferior-Anterior MI and Inferior-V2-V3-V4 changes. For enzymatic alterations, an

increase or no increase in TnT serum levels more than 0.1  $\mu$ g/L was assessed. Glasco consciousness score (GCS) less than 8 was considered as the decreased level of consciousness, blood pressure less than 90.60 mmHg as hypotension.

The data in patients with inferior MI with and without RV involvement were compared. Chi square test, Fisher's exact test and independent t-test were used when appropriate. To evaluate the association between inferior MI with RV involvement and risk factors, OR with 95% CI was used.

## Results

From a total of 195 subjects with inferior MI, 148 (75.9%) and 47 (24.1%) had without and with RV infarction, respectively. The mean age of the patients with inf MI with RV involvement was 60.59 $\pm$ 12.9 and those without RV involvement was 60.89 $\pm$ 12.2 years (p=0.883). Among the patients without right ventricular infarction, 95 (64.2%) were males and 53 (35.8%) subjects were females. Those with right ventricular involvement, 31 (66%) were males and 16 (34%) were females (P=0.825). Totally, chest pain (CP) was seen in 191 (97.9%) patients. Those without right ventricular infarction, CP was seen in 147 (99.3%) and in patients with right ventricular infarction, 44 (93.6%) subjects had CP (P=0.044). ECG changes and ST-elevation in these two groups are shown in table 1. Troponin T enzyme changes showed no significant difference between the two groups (P=0.425). From 195 cases, 193 (99%) revealed increased serum level of TnT. Meanwhile, in the group without RV involvement, 147 (99.3%) cases were found with increased serum levels. In the group with RV involvement, 46 (97.9%) cases displayed enzyme changes (p>0.05). Frequency on decreased consciousness, hypotension, and jugular vein prominence in both groups are shown in table 2.

**Table 1. Evaluation of Electrocardiogram alterations in the two groups (p<0.001)**

Group	ECG pattern	inferior MI	inferior-lateral MI	inferior-posterior MI	inferior-anterior MI	inferior-V <sub>2</sub> V <sub>3</sub> V <sub>4</sub> changes
Inf MI with RV involvement		33 (70.2)	6 (12.8)	2 (4.3)	4 (8.5)	2 (4.3)
Inf MI without RV involvement		144 (97.3)	4 (2.7)	-	-	-

ECG, Electrocardiography, MI, Myocardial Infarction, Inf, Inferior, RV, Right ventricle

**Table 2. Analysis of frequency distribution of decreased consciousness, hypotension, jugular vein prominence, chest pain, RBBB and enzyme change between the two groups.**

Variables	Inf MI with RV involvement group		Inf MI without RV involvement		OR (95% CI for OR)	P value
	+	-	+	-		
Decreased consciousness	9 (19.1)	38 (80.9)	1 (0.7)	147 (99.3)	34.8 (4.2-283.3)	≤0.001
Hypotension	27 (57.4)	20 (42.6)	1 (0.7)	147 (99.3)	198.4 (25.5-1541.3)	≤0.001
JVP	9 (19.1)	38 (80.9)	1 (0.7)	147 (99.3)	38.8 (4.2-283.3)	≤0.001
Chest pain	44 (93.6)	3 (6.4)	147 (99.3)	1 (0.7)	10.02 (1.01-98.7)	0.04
RBBB	47 (100)	0 (0)	3 (2)	145 (98)	-	≤0.001
Enzyme change	46 (97.9)	1 (2.1)	147 (99.3)	1 (0.7)	3.1 (0.2-52.1)	0.425

JVP, Jugular vein prominence, RBBB, Right bundle branch block, inf MI, inferior myocardial infarction RV, right ventricle

## Discussion

In the present study, we compared the clinical findings in patients with inferior MI with and without RV involvement. Right ventricular involvement in patients with inferior myocardial infarction increase the mortality rate and it is a critical necessity for the early diagnosis of RV infarction in Inf MI patients (6, 8). In this study, we found that there were no significant differences between these two groups regarding age, gender, and serum TnT levels. However, chest pain, different ECG patterns, decrease of consciousness, hypotension, JV prominence, and asymptomatic clinical features were seen more in Inf MI patients with RV involvement.

In the present study, we found significant difference in ECG pattern between two groups, but other studies assessed this difference in more details. Wong et al. in their study showed the significance of V1 ST elevation- during acute inferior myocardial infarction (15). They also showed the prognostic value of V1 ST elevation identifying patients with acute inferior myocardial infarction who are at higher risk. Also, the results of our study represent significant prevalence difference of anterior MI in patients with RV infarction. In this study, we found higher number of consciousness in patients with RV infarction. The reason for higher consciousness in patients with RV involvement may be due to hypotension in patients with Inf MI with RV involvement.

The higher number of cases with JVP prominence in patients with RV involvement may be due to increasing of end diastolic pressure of right ventricle in RV infarction. The reason for the development of hypotension in patients with RV involvement during Inf MI may be due to reduction of stook volume of right ventricle or association with activation of vagus system. Our study showed that hypotension is eligibly more frequent in RV infarcted IMI patients than those Inf MI patients without RV involvement. The results obtained by Shiraki et al. also confirmed the findings of our study (17). They examined 53 patients with inferior AMI caused by right coronary artery occlusion. Assessment of associations between in-hospital outcome and hypotension or shock before admission and after admission indicated independent of concomitant left ventricular involvement, RVMI was significantly associated with post admission hypotension or shock, but not with preadmission hypotension or shock. These findings highlight the importance of identifying RVMI immediately after admission in the setting of inferior MI.

Pirzada et al. in their study considered AV block in 220 Inf MI patients with or without RV infarction (18). In this study, RV infarction was found in about 38% of patients defined as high risk subgroup. High degree AV block significantly influenced the outcome when associated with

RV infarction, leading to high mortality. The weakness of our study is the low sample size, especially in group Inf MI with RV involvement. So, more researches are needed to find out the impact of clinical manifestations on the outcome of Inf MI with and without RV involvement.

In conclusion, the results of our study indicated that less CP occurrence, different ECG pattern, decrease of consciousness, hypotension, JVP prominence, may be more frequent in Inf MI patients with RV involvement and this clinical manifestation must be considered in Inf MI patients admitted to hospital for early diagnosis of RV infarction.

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**Conflict of Interest:** None declared.

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