

# Correlation Between Magnitude of ST Segment Elevation and the Proximal Right Coronary Artery Lesion in Acute Inferior Myocardial Infarction

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## Abstract:

**Introduction:** The determination of the probable site of occlusion within RCA in acute inferior MI is very important because proximal occlusions are likely to cause greater myocardial damage and an early invasive strategy may be planned in such cases. Furthermore, identification of infarct-related artery and its site in acute inferior myocardial infarction not only guide decision regarding the urgency of revascularization but also guide to avoid therapy that may adversely affect the outcome.

**Objective:** To predict the site of lesion in right coronary artery in acute inferior myocardial infarction by the magnitude of ST segment elevation in inferior leads (II, III and aVF).

**Methodology:** This cross-sectional study was conducted in the Department of Cardiology, Sylhet MAG Osmani Medical College Hospital, from January 2014 to December 2015. A total of 50 consecutive patients with inferior MI who present within 12 hours of symptom onset and received fibrinolytic therapy were selected according to inclusion and exclusion criteria. Using 12-lead ECG, height of ST segment elevation in leads II, III and aVF were measured & coronary angiography(CAG) was performed during index hospital period. CAG which

showed culprit lesion in RCA were only taken for the study. The sum of ST segment elevation in inferior leads were then correlated with the proximal lesion in RCA.

**Results:** The age of the patients ranged from 31 to 70 years with the mean age of 51.1 (SD 9.2) years. Majorities (88%) of the patients were male and ratio of male to female was 7.33:1. Out of 50 patients, 26(52%) had the lesion in proximal, 19 (38%) in mid and 05 (10%) in distal RCA. Patients with proximal RCA lesion showed a mean ST segment elevation of 12.5(SD 1.07) mm, with mid RCA lesion 8.5 (SD 0.80) mm and distal RCA lesion 6.5(SD 0.42) mm. There was a positive correlation of sum of ST segment elevation in inferior leads II, III and aVF to the proximal lesion in RCA ( $r=0.923$ ,  $P < 0.05$ ).

**Conclusion:** From the study it is concluded that the magnitude of ST segment elevation in inferior leads (II,III, aVF) can predict site of lesion in RCA in acute inferior wall myocardial infarction; the greater the sum of the height of ST segment elevation in inferior leads, the higher is the probability of lying the lesion in proximal right coronary artery.

**Key Words:** Magnitude ST Elevation ,Proximal RCA , Acute Inferior MI

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## Introduction:

Coronary heart disease (CHD) is a major cause of mortality and is a global health problem reaching epidemic proportions in both developed as well as developing countries<sup>1</sup>. In

Bangladesh coronary artery disease is the third largest cause of death today<sup>2</sup>. Despite marked disparity in values, there seems to be a rising prevalence of CAD in Bangladesh<sup>3</sup>.

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Acute myocardial infarction (AMI) is a major component of acute coronary syndrome which is usually due to anterior and inferior wall involvement<sup>4</sup>. The presentation of acute myocardial infarction is different depending on the coronary artery involved. Unlike anterior wall acute myocardial infarction, which is fairly homogenous entity, the extent of acute inferior wall MI depends on the infarct related artery and its site<sup>5</sup>. Nearly 50% of patients with acute inferior wall MI have specific hemodynamic and brady-arrhythmic complications, usually due to the total occlusion of the proximal right coronary artery (RCA) which significantly alters; an otherwise favorable prognosis<sup>6</sup>. Such patients, including those in whom electrocardiogram (ECG) shows evidence of right ventricular infarction (RVI), having increased risk for death, shock and arrhythmia<sup>7</sup>.

The incidence of mortality and complications are high in patients of acute inferior wall MI with right ventricular involvement. The incidence of right ventricular infarction in acute inferior MI setting is about 30%<sup>8</sup>. The mortality of patients with only inferior wall acute myocardial infarction is 5 - 6%, which increases to 25 - 30% along with involvement of right ventricle. The patients with RVI had a higher hospitalization rate (31% vs. 6%,  $p < 0.001$ ) and a higher incidence of major hospital complications (64% vs. 28%,  $p < 0.001$ ) than those without RVI<sup>9</sup>.

In majority (80%) of acute inferior wall myocardial infarction cases the infarct related artery is right coronary artery (RCA), while it is left circumflex artery in the rest. Acute inferior myocardial infarction (AIMI) is often complicated by atrioventricular conduction disturbance and in the presence of such complications, right coronary artery (RCA) is generally the infarct related artery and frequently associated with complication of AMI particularly hypotension and death. Therefore, immediate diagnosis the infarct-related artery and its site of lesion, has implication in evaluating prognosis and deciding management. But conclusive diagnosis of culprit artery and its site and size of lesion is feasible with the help of angiogram which is time-consuming and an invasive procedure. Several ECG criteria has been recommended for the infarct related artery prediction with variable results<sup>10</sup>. It is shown that in the setting of Acute inferior myocardial infarction while there is ST segment elevation; the severity of ST segment elevation is well known to be related to the extent of infarction and prognosis. However it has been observed in several studies that height of ST-segment elevation from bed-side ECG can predict the

site of lesion in major coronary arteries with fair degree of accuracy.

**Methods and procedure of Data Collection:** Data were collected by both qualitative and quantitative methods using a pre-designed questionnaire designed for the study. After admission a detailed history, general and physical examination were performed. Informed written consent was taken from the patients after detailed explanation of the purpose of study. A 12 lead ECG was taken on admission by placing the leads in proper position. Acute inferior wall myocardial infarction was diagnosed by typical chest pain, ST segment elevation of more than 0.1mV in at least two leads representing the inferior wall (II, III, aVF) in ECG and raised Troponin-I. Those, who met the inclusion criteria by detail history, clinical examination and relevant investigations, were taken as sample. In this way, 50 patients with acute inferior MI were selected.

All patients were managed according to the treatment protocol of the Department of Cardiology Sylhet MAG Osmani Medical College Hospital, Sylhet.

Demographic profile such as age and sex were recorded. Clinical profile such as pulse and BP were recorded. Major risk factors of ischemic heart diseases such as hypertension, diabetes mellitus, smoking, dyslipidemia and family history of premature CAD were recorded. Baseline laboratory investigations such as RBS, serum creatinine, Fasting lipid profile, serum electrolytes and Troponin-I were measured. The amount of ST segment elevation after the J point were recorded for the quantification of ST segment elevation from leads of II, III, aVF in mm. Magnitude of ST elevation was calculated by sum of ST segment elevation of leads from II, III, aVF. This summation conferred a value in mm. Diagnostic coronary angiography were performed in index hospital period via the trans-femoral approach. The lesion with highest degree of stenosis along the RCA was accepted as the culprit lesion and left circumflex artery lesion were excluded. Right coronary artery was divided into proximal (from the RV branch to the acute marginal branch) mid from the RV branch to the acute marginal branch, and distal from this point onward. In this way, total 50 patients, ECG findings sum of ST segment elevation of inferior leads were then correlated with angiographic findings of proximal right coronary artery lesion.

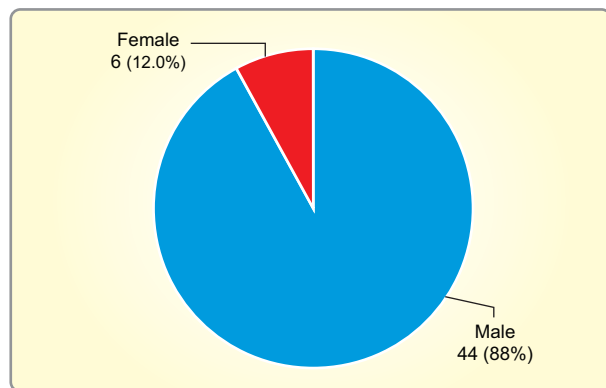
**Results:**

Fifty patients with inferior myocardial infarction were studied. The results were shown in below:

**Table-I**  
*Distribution of the Patients by Age (n=50)*

Age	Frequency	Percentage
31- 40 years	07	14.0
41-50 years	19	38.0
51- 60 years	22	44.0
61- 70 years	02	4.0
Mean(SD)	51.1(SD 9.2)	

The age of the patients ranged from 31 to 70 years with the mean age of 51.1 (SD 9.2) years.



**Fig.- 1.** *Distribution of the Patients by Sex (n=50)*

Figure 1 showed the frequency distribution of patients according to sex. There were 44 (88%) male and 6(12%) female with ratio of male to female was 7.33:1

**Table-II**  
*Distribution of the patients by CV Risk Factors (n=50)*

Risk Factors	Frequency	Percentage
Smoker	27	54
Hypertension	21	42
Diabetes mellitus	18	36
Dyslipidaemia	13	26
Family history of IHD	08	16

Table II showed that smoking was the most prevalent risk factor (54%) followed by hypertension (42%), diabetes mellitus (36%), Dyslipidaemia (26%) and family history of IHD (16%)

Table III showed that approximately two third (65%) of the patients in proximal group experienced hypotension followed by 60% had atrioventricular block, 31% had arrhythmia and 7.69 % had cardiogenic shock.

Table IV showed that out of 50 patients, 26 (52%) had the lesion in proximal, 19(38%) in mid and 05 (10%) in distal RCA. Patients with proximal RCA lesion showed a mean ST segment elevation of 12.5(SD 1.07) mm, with mid RCA lesion 8.5 (SD 0.80) mm and distal RCA lesion 6.5 (SD 0.42) mm.

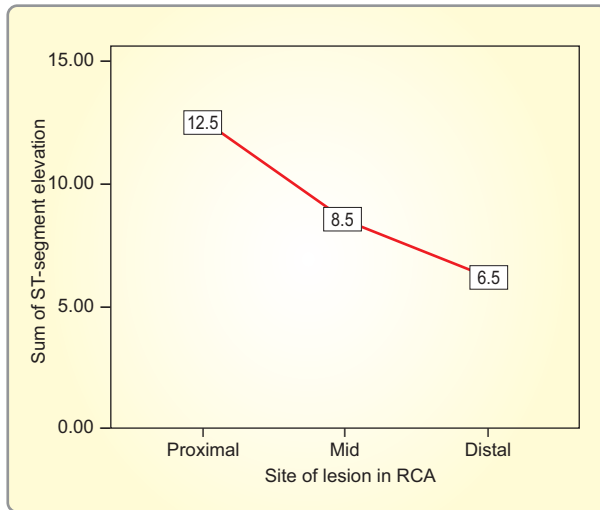
**Table-III**  
*Distribution of Patients by In-Hospital Complications*

In hospital Complications	Proximal (n=26)		Mid (n=19)		Distal (n=05)	
	No	%	No	%	No	%
Hypotension	17	65	02	10.5	00	00
Atrioventricular block	16	60	03	15.7	00	00
Arrhythmia	08	31	01	5.26	00	00
Cardiogenic shock	02	7.69	00	00	00	00

**Table-IV**  
*Association Between ST Segment Elevation and site of lesion in RCA*

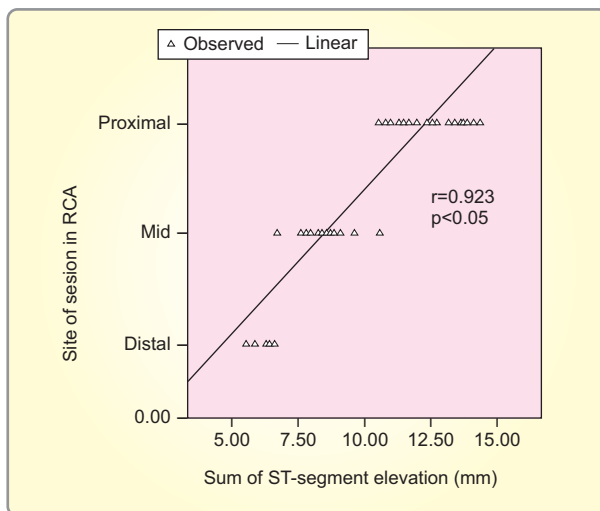
ST segment elevation in RCA (mm)	Site of lesion	Mean(SD)	Mean(SD)	Mean(SD)	p
		Proximal (n = 26)	Mid (n = 19)	Distal (n = 05)	
Lead II		3.5 (0.42)	2.00 (0.44)	1.5(0.45)	<0.05
Lead III		4.5 (0.39)	3.50 (0.43)	2.5 (0.50)	<0.05
aVF		4.5 ( 0.85)	3.00 (0.45)	2.5 (0.24)	<0.05
sum of ST segmentelevation		12.5(1.07)	8.5 (0.80)	6.5 (0.42)	<0.05

ANOVA



**Fig-2:** Relationship between sum of ST elevation and of lesion in RCA

Fig.-2: showed that the mean heights of ST-segment elevation in Lead II, Lead III and aVF having a decreasing trend from proximal to distal site of RCA



**Fig.-3 :** Scatter diagram showing correlation between magnitude of ST segment elevation (sum) in Lead II, III and aVF and the proximal right coronary artery lesion (n=50)

Figure 3 showed that there was a significant positive correlation between magnitude of ST segment elevation (sum) in Lead II, III and aVF and the proximal right coronary artery lesion:( $r=0.923;p<0.05$ ).

Discussion: In this study, the age of the patients ranged from 31 to 70 years with the mean age of 51.1 (SD 9.2) years. This result correlated with the study where the mean age of the patients with acute inferior myocardial infarction was 53.6 (SD 10.3) years ranging from 31 to 73 years<sup>11</sup>.

In the present study 44(88%) were male and 6 (12%) were female with a ratio of male to female was 7.33:1. This result correlated with the study where found that 85% patients were male and 15% patients were female with male and female ratio was 5.6:1<sup>12</sup>.

In this study smoking was the most prevalent risk factor (54%) followed by hypertension (42%), diabetes mellitus (36%), dyslipidemia (26%) and family history of IHD (16%). Nearly similar distribution of risk factors reported in the studies of others. In acute inferior myocardial infarction reported smoking (71.6 %) was the most common risk factor in all Patients, followed by hypertension (50%) family history of IHD (26.6%), diabetes mellitus (21.6%) and dyslipidemia (18.3%) among the series of acute inferior myocardial infarction with right ventricular infarction<sup>12</sup>.

In the present study majority of the patients in proximal group exhibited higher rates of in-hospital complications like hypotension (65%), atrioventricular block (60%) and arrhythmias (31%) compared to their mid and distal counter parts which bears similarity with findings of others; where it is found that higher incidence (58.6%) of conduction disturbance among the series of acute inferior myocardial infarction.

In the current study showed that more than half (52%) of the patients had lesion in proximal, 38% in mid and rest 10% in distal part of RCA. In similar type study, (2008) reported that out of 60 patients, 29 (48.4%) had the culprit lesion in proximal, 23(38.5%) in mid and 8(13.4%) in distal part of RCA<sup>13</sup>.

In the present study, the sum of ST segment elevation in inferior leads (II + III +aVF) was 12.5 (SD 1.07) mm for proximal, 8.5 (SD 0.80) mm for mid and 6.5 (SD 0.42) mm for distal RCA. This study showed a positive correlation of sum of ST segment elevation in inferior leads to the proximal lesion in RCA ( $r=0.923, P < 0.05$ ). These findings were consistent with other studies. Similarly in a study found that sum of ST elevation 12.61 (SD 3.79) mm for proximal, 6.88 (SD 1.20) mm for mid and 5.05 (SD 0.97) mm for distal RCA<sup>14</sup>. They also demonstrated a significant positive correlation between the magnitude of ST segment elevation and the proximal lesion in RCA ( $r = 0.82, p < 0.01$ )<sup>14</sup>. Similar study found

sum of ST segment elevation 11.7(SD 1.8) mm in proximal, 7.2 (SD 0.97) mm in mid and 5.8 (SD 0.2) mm in distal RCA lesions<sup>15</sup>. Similar study also reported sum of ST segment elevation of 10.90 (SD1.30) mm for proximal, 7.38 (SD 1.19) mm for mid and 5.5 (SD 0.53) mm for distal RCA. The findings of positive correlation of sum of ST segment elevation in inferior leads to the proximal lesion in RCA seen in my study, was consistent with the previously reported literatures.

Conclusion: From the finding of this study we may conclude that the sum of ST Segment elevation in inferior leads is associated with the site of lesion in right coronary artery. We may also conclude that the more is the sum of ST Segment in the inferior leads, the more proximal is the site of lesion in right coronary artery.

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