



## Original Article

# Coronary Arterial Lesion Site and Character in Acute Myocardial Infarction (Inferior) with Right Ventricular Infarction by Coronary Angiogram

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### Abstract

**Background:** Acute inferior myocardial infarction with right ventricular involvement who developed right ventricular failure. **Objective:** To confirm the site of coronary occlusion and lesion character by coronary angiogram (CAG). **Materials and methods:** This study was a prospective, Observational study done in National Institute of Cardiovascular Diseases (NICVD), Dhaka in-between Jan '2013 to Dec '2013. 100 patients with Acute MI (AMI) inferior with right ventricular infarction (RVI) undergone CAG were included in this study. Baseline clinical data including demographic profile, clinical history and risk factors were recorded in a preformed data sheet. Physical examination and related investigations including ECG, Echocardiography, blood sugar and renal function tests were recorded. CAG was done within seven days of hospital admission after giving conventional treatment in CCU. CAG was analyzed by visual estimation. Stenosis more than 70% was considered significant except left main coronary artery. Data processing work was consisted of registration schedules, editing computerization, preparation of dummy table, analyzing and matching of data, with the help of computer program SPSS and Microsoft excel. Quantitative data expressed as mean and standard deviation and qualitative data as frequency and percentage. Statistical hypothetical test was done by Anova test and chi-square test. Comparison was done by tabulation and graphical presentation in the form of tables, pie chart, bar diagrams, histogram and chart etc. **Result:** Among the study group 82 (82%) were male and 9 (18%) were female. Age range were 40 to 70 years (mean -  $57.46 \pm 6.77$ ), 90% below 65 years and 10% above 65 years. The important risk factors were smoking (60%), hypertension 34%, diabetes mellitus 30%, dyslipidaemia 8% and family history of IHD 2%. After stabilization with conventional treatment 100 patients underwent Coronary Angiogram. Most of the lesion of study group are situated in Right Coronary artery proximal to Acute Marginal branches (Gr-I). The frequency and percentage of it are 70 (70%), 20 (20%) are in Right Coronary Artery distal to Acute Marginal branches (Gr-II), 8 (8%) patients fell in Gr-III indicating Left Circumflex Artery. Co-dominant group (Gr-IV) includes only 2 (2%) patients. The lesion character found in angiogram was mostly in Type A, 72 (72%) and Type-B was 28 (28%). No Type-C was found in CAG. **Conclusion:** It can be assumed from this study that lesion sites were mostly situated in the right coronary artery proximal to acute marginal branch in case of acute Inferior myocardial infarction with right ventricular involvement.

**Key words:** Acute myocardial infarction, Right ventricular infarction (RVI), Coronary angiogram (CAG)

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### Introduction

The incidence of right ventricular infarction (RVI) in acute myocardial infarction (AMI) inferior settings is around 30% which becomes a life threatening if not diagnosed and managed early<sup>1</sup>. Clinically RVI with AMI (inf) can be diagnosed by hypotension, raised JVP, clear lung field in AMI (inferior) settings<sup>2</sup>. ECG is an important tool for diagnosing RVI with Inf AMI. ST segment in any of the combination of leads V4R to V6R is more sensitive than ST elevation in any right precordial leads<sup>3,4,5</sup>. The sensitivity and specificity V4R as an early indicator of RVI was 87% and 76.9%<sup>6</sup>.

Echocardiography is a noninvasive diagnostic tool for detection of cardiac motion abnormality, chamber dilatation<sup>7,8,9</sup>. Right ventricle is usually supplied by RCA, less commonly LCX and in some subjects by both RCA and LCX<sup>10</sup>. So coronary angiogram is essential tool for identifying coronary involvement and description morphology. According to angiographic report lesion site are described in four groups. They are grouped as Group-I lesion site in right coronary artery proximal to acute marginal branch. Group-II lesion site in right coronary artery distal to acute marginal branch.

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Group-III lesion site in left circumflex artery. Group-IV lesion site in co-dominant arteries<sup>11</sup>. Lesion characters are described in three types. Type A: Discrete (<10mm), Concentric, Non angulated (<45°). Type B: Tubular (10-20 mm), Eccentric, Angulated (45°-90°). Type C: Diffuse (>20 mm), Excessive tortuosity, Angulation >90°<sup>12</sup>.

The main objective of study was to determine the site of vessel involvement and to clarify the characteristics of lesion in patients with acute inferior myocardial infarction with right ventricular infarction

### Materials and Methods

*Type of study:* Cross sectional study. *Place of study:* Department of cardiology, NICVD, Dhaka. *Study period:* July 2012 to December 2012. *Study population:* Patients with Acute Myocardial Infarction (AMI) inferior with right ventricular infarction (RVI) undergone CAG. *Sample size:* A total of 50 patients were included in this study. *Inclusion criteria:* Patients who presented with AMI (inferior) with RV infarction with or without posterior infarction are included in this study. *Exclusion Criteria:* Patients having the findings of previous MI, acute antero-septal MI, permanent pacemaker, bundle branch block, pericarditis and ventricular aneurysm are excluded from the study.

Physical examinations of all the patients were done meticulously and related investigations including ECG, Echocardiography, blood sugar, and renal function tests were recorded. CAG was done within seven days of hospital admission after giving conventional treatment in CCU.

CAG was analyzed by visual estimation. Stenosis more than 70% was considered significant except left main coronary artery. Baseline clinical data including demographic profile, clinical history and risk factors were recorded in a preformed data sheet.

**Table-I: Baseline characteristics of study subjects**

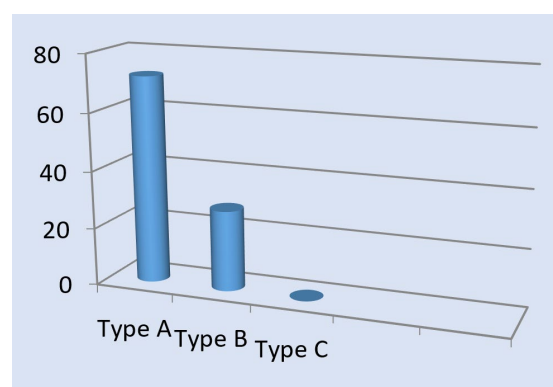
| Characteristics  | Frequency (n=100) | Percentage (%) | Mean±SD    |
|------------------|-------------------|----------------|------------|
| Age (years)      |                   |                |            |
| <65              | 90                | 90             | 57.46±6.77 |
| ≥65              | 10                | 10             |            |
| Sex              |                   |                |            |
| Male             | 82                | 82             | -          |
| Female           | 18                | 18             |            |
| Body weight (kg) |                   |                |            |
| <67              | 80                | 80             | 60.58±4.00 |
| ≥67              | 20                | 20             |            |

**Table-II: Descriptive analysis of the risk factors (Expressed as Frequency, n=100)**

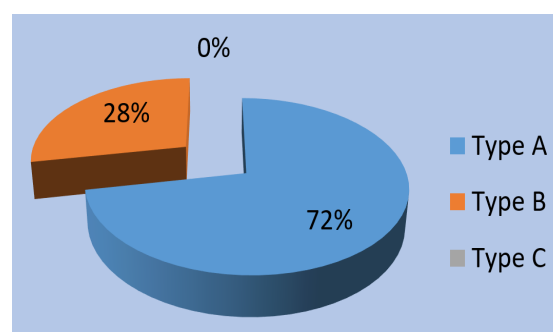
| Risk factors | Smoking | HTN | DM | F/H of IHD | Dyslipidaemia |
|--------------|---------|-----|----|------------|---------------|
| Yes          | 60      | 34  | 30 | 02         | 08            |
| No           | 40      | 66  | 70 | 98         | 92            |
| Unknown      | 00      | 00  | 00 | 00         | 00            |

### Results

Baseline characteristics of the patients included in this study are expressed in the Table-I. Descriptive analysis of the risk factors are tabulated in Table-II. The p-value of age, sex and body weight with lesion character is 0.345, 0.225 and 0.529 chronologically which has no statistically significant difference (Table-III). The p-value of HTN with lesion character is 0.005 which is statistically significant (Table-IV). Although on admission no patients had heart failure, arrhythmia but subsequently sinus bradycardia in 10 patients, idioventricular tachycardia in 5 patients, atrial ectopic in 3 patients and ventricular ectopic in 8 patients were developed transiently (Table-V).



**Figure-1: Percent distribution of risk factors**



**Figure-2: Percent distribution of lesion site**

**Table-III: Statistical analysis of lesion site with age, sex and body weight**

| Character        |        | Gr-I (n=70) | Gr-II (n=10) | Gr-III (n=8) | Gr-IV (n=2) | P value |
|------------------|--------|-------------|--------------|--------------|-------------|---------|
| Age (years)      | <65    | 58          | 14           | 06           | 02          | 0.773   |
|                  | ≥65    | 12          | 06           | 02           | 00          | 0.225   |
| Sex              | Male   | 58          | 16           | 06           | 02          | 0.941   |
|                  | Female | 12          | 04           | 02           | 00          | 0.234   |
| Body weight (kg) | <67    | 62          | 18           | 08           | 02          | 0.888   |
|                  | ≥67    | 08          | 02           | 00           | 00          | 0.256   |

**Table-IV: Statistical analysis of risk factors with site of lesion**

| Risk factors   | Gr-I (n=70) | Gr-II (n=20) | Gr-III (n=8) | Gr-IV (n=2) | P value |
|----------------|-------------|--------------|--------------|-------------|---------|
| Smoking        | 44          | 12           | 02           | 02          | 0.419   |
| Hypertension   | 24          | 04           | 06           | 00          | 0.223   |
| DM             | 20          | 06           | 04           | 00          | 0.747   |
| Family h/o IHD | 00          | 02           | 00           | 00          | 0.253   |
| Dyslipidaemia  | 00          | 04           | 02           | 00          | 0.868   |

**Table-V: Distribution of complications of study population on admission**

| Character     | Frequency (n=100) | %  | Mean±SD |
|---------------|-------------------|----|---------|
| Raised JVP    | 15                | 30 | 15±4.5  |
| Hypotension   | 35                | 70 | 65±0.47 |
| RBBB          | 00                | 00 | 00±00   |
| Heart failure | 00                | 00 | 00±00   |
| Arrhythmia    | 04                | 08 | 8±4.9   |

**Table-VI: Descriptive statistics of lesion site**

| Site      | Frequency (n=100) | Percentage (%) |
|-----------|-------------------|----------------|
| Group-I   | 70                | 70             |
| Group-II  | 20                | 20             |
| Group-III | 08                | 08             |
| Group-IV  | 02                | 02             |

**Table-VII: Statistical analysis of lesion character with age, sex and body weight**

| Character        | Type A (n=72) | Type B (n= 28) | P value |
|------------------|---------------|----------------|---------|
| Age (Years)      |               |                |         |
| <65              | 60            | 06             | 0.345   |
| ≥65              | 20            | 04             | 0.175   |
| Gender           |               |                |         |
| Male             | 62            | 20             | 0.225   |
| Female           | 10            | 08             | 0.125   |
| Body Weight (Kg) |               |                |         |
| <67              | 66            | 24             | 0.529   |
| ≥67              | 06            | 04             | 0.163   |

**Table-VIII: Statistical analysis of risk factor with character of lesion**

| Risk factors   | Type A (n=72) | Type B (n= 28) | P value |
|----------------|---------------|----------------|---------|
| Smoking        | 48            | 12             | 0.123   |
| Hypertension   | 16            | 18             | 0.005*  |
| DM             | 20            | 52             | 0.733   |
| Family H/O IHD | 00            | 72             | 0.105   |
| Dyslipidaemia  | 04            | 02             | 0.513   |

### Discussion

All patients were diagnosed as AMI (inferior) with RVI from clinical history, bio-chemical markers like CK-MB or Troponin-I, ECG and echocardiography. After diagnosis, patients eligible for coronary angiogram (CAG) were selected as study groups. Procedural complications like cardiac arrest, different types of arrhythmia, hypotension and allergic manifestation are meticulously observed.

All patients were grouped in I to IV according to lesion site description<sup>11</sup>. Patients were classified in Type-A, Type-B and Type-C for lesion character description<sup>12</sup>. Characters that were taken for typing lesion are length, concentric or eccentric, lesion angulations, calcification, irregularities and duration of lesion where applicable<sup>13,14</sup>. Among the baseline characteristics 82% were male and 18% were female. Though no patients had arrhythmia on admission, subsequently 20 (20%) patients developed sinus bradycardia, 10 (10%) patients idioventricular tachycardia, 6 (6%) patients atrial ectopics and 16 (16%) ventricular ectopics. Age range were 40 to 70 years (mean 57.46± 6.77), 90% below age 65 and 10% above 65 years. Body weight ranging from 54 to 69 kg (mean 60.58± 4.00), 80%

had body weight below 67 kg, 20% were more than 67 kg. The important risk factors in studied patients were history of smoking (60%) followed by Hypertension 34%, diabetes mellitus 30%, dyslipidaemia 8% and family history of IHD 2%. The composite risk factors in terms of smoking, hypertension, diabetes mellitus, family history of ischemic heart diseases and dyslipidaemia were 98 (98%) and 2 (2%) had no risk factor. This data is almost similar to another study done in Bangladesh<sup>15,16</sup>.

In other studies, where electrocardiographic criteria for prediction of arterial involvement in AMI (inferior) with RVI was evaluated by coronary angiogram where age, sex, body weight and risk factors had no statistically significant difference with lesion site and character<sup>17,18</sup>.

On admission 30 (30%) patients had raised jugular venous pressure, 70 (70%) had hypotension, 8 (8%) had Right Bundle Branch Block. Subsequently 10 (10%) developed idioventricular tachycardia, 6 (6%) developed atrial ectopics, 16 (16%) developed ventricular ectopics transiently. No patients had features of heart failure. In another study of 50 patients with Acute Inferior Myocardial Infarction with Right Ventricular involvement, 13 (26%) had raised JVP, 28 (56%) had hypotension<sup>19</sup>.

ECG of all patients immediately after admission showed ST elevation in lead II, III, aVF and aV4R. 6 (6%) had associated ST depression and T-wave inversion in lead I and aVL. Thirty (30%) had ST elevation in V7 and V8 indicative of posterior involvement. In other studies, it was seen that RVI was associated with 25% posterior infarction<sup>20</sup>.

Regarding bio-chemical markers, all patients had raised CK-MB level indicating AMI. Among them 70 (70%) had CK-MB level above 100 U/ml, it means that large area of myocardium was damaged. These all patients had features of hypotension on admission and fell into Gr-I. Another study showed that 65% of the study population had CK-MB level more than 100 IU/ml whose arterial lesion was situated in the Right Coronary Artery proximal to Acute Marginal branches<sup>21,22</sup>.

Echocardiography showed inferior wall involvement in all patients, 30 (30%) had posterior wall involvement, 20 (20%) had inferior, posterior and septal wall involvement. Ejection fraction of all patients was within normal limit. In another study posterior wall involvement was found in 60% patients, septal wall involvement in 10% patients<sup>23,24</sup>. Regarding hemodynamic status, minimum pulse rate was 76 and 90 per minute (mean 83.00±4.025), mean SBP and DBP were 119±21.6 and 84.2±12.2 mmHg respectively.

All patients were given conventional treatment of AMI in Coronary Care Unit (CCU). Among 125 patients, 45 were given Inj. Streptokinase without any events during infusion. Forty patients were to give fluid challenge to increase right ventricular pump. After stabilization with conventional treatment 100 patients underwent Coronary Angiogram. Ten patients died before angiogram; 15 patients did not undergo angiogram due to unstable haemodynamic status. Above figures indicate high mortality rate of RVI<sup>25</sup>.

Most of the lesion of study group are situated in Right Coronary artery proximal to Acute Marginal branches (Gr-I). The frequency and percentage of it are 70 in number, 70 in percentage. Twenty (20%) are in Right Coronary Artery distal to Acute Marginal branches (Gr-II). Eight (8%) patients fell in Gr-III indicating Left Circumflex Artery. Co-dominant group (Gr-IV) includes only 2 (2%) patients.

The lesion character found in angiogram was mostly in Type A, 72 (72%), followed by Type-B, 28 (28%). No Type-C was found in CAG. In another study, lesion site was situated in Gr-I in case of Acute Myocardial Infarction with Right Ventricular involvement<sup>26</sup>. In that study, total 125 patients were studied where 53 had Right Ventricular Involvement. Among 53 patients, culprit lesion was situated proximal to acute marginal branch of right coronary artery in 38 (71%) patients, 15 (29%) in Gr-II. In this study, 75% of lesion was in Type-A, 25% in Type-B. In cross tabulation of lesion character with lesion site, the P-value is 0.218 from ANOVA test. It means that lesion site has no statistically significant difference with lesion character<sup>27</sup>.

Age, sex and bodyweight have no statistically significant difference with lesion site which correlates with another study<sup>28</sup>. In cross tabulation of lesion site with smoking, hypertension, diabetes mellitus, Family History of Ischemic Heart Disease, Dyslipidaemia, the P-value are 0.419, 0.223, 0.747, 0.157 and 0.086. There is no statistically significant difference of lesion site with Smoking, Hypertension, Diabetes Mellitus, Family History of Ischemic Heart and Dyslipidaemia. These findings are as like as a study done in Bangladesh<sup>29</sup>.

In cross tabulation of lesion character with smoking, hypertension, diabetes mellitus, Family History of Ischemic Heart disease, dyslipidaemia, the P-value are 0.123, 0.005, 0.733, 0.105 and 0.513. There was no statistically significant difference of lesion character with Smoking, Diabetes Mellitus and Dyslipidaemia. Hypertension has statistically significant difference with lesion character (P<0.05) in this study. This result also correlates with another

study<sup>30</sup>. It is seen that most of the lesion is situated in right coronary artery (RCA) proximal to acute marginal branch (75%).

There is no statistically significant difference among age, sex, body weight, risk factors with lesion site. From above discussion, it is also seen that Gr-I lesion site in case of acute Inferior right myocardial Infarction is associated with high level of CK-MB, hypotension and in some cases with posterior wall infarction. Findings from above study are mostly similar to another study<sup>31</sup>. It can be assumed from above study that lesion site was mostly situated in the right coronary artery proximal to acute marginal branch in case of acute inferior right ventricular myocardial infarction.

### Conclusion

It can be assumed from above study that lesion site is mostly situated in the right coronary artery proximal to acute marginal branch in case of acute Inferior myocardial infarction with right ventricular involvement. It will help the interventional cardiologist to predict lesion site before going to primary percutaneous coronary intervention.

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