CORRELATION BETWEEN ELECTROCARDIOGRAPHIC CHANGES AND CORONARY ANGIOGRAPHIC LOCALIZATION IN ST-ELEVATION MYOCARDIAL INFARCTION

Blessy1, GNAZIYAGULNAAZ. A.S1, Durga Devi2, G. Ashok3*, M. Chokkalingam4

1 Faculty of Allied Health Sciences, Chettinad Academy of Research and Education (CARE), Kelambakkam, Tamil Nadu - 603103.

2Assistant Professor, Department of Cardiology, Chettinad Hospital and Research Institute (CHRI), Chettinad Academy of Research and Education (CARE), Kelambakkam, Tamil Nadu – 603103.

3Assistant Professor and Consultant Interventional Cardiologist, Department of Cardiology, Chettinad Hospital and Research Institute (CHRI), Chettinad Academy of Research and Education (CARE), Kelambakkam, Tamil Nadu – 603103.

4Professor and HOD, Department of Cardiology, Chettinad Hospital and Research Institute (CHRI), Chettinad Academy of Research and Education (CARE), Kelambakkam, Tamil Nadu – 603103.

*Corresponding author:
Dr. G. Ashok
Assistant Professor and Consultant Interventional Cardiologist,
Department of Cardiology,
Chettinad Hospital and Research Institute (CHRI),
Chettinad Academy of Research and Education (CARE),
Kelambakkam, Tamil Nadu, India.

ABSTRACT:

INTRODUCTION: Electrocardiogram is a fundamental tool for diagnosis, identification, prognosis and also managing the patients with suspected myocardial infarction (chest pain). METHOD: Electrocardiography is used to localizing the culprit vessel in acute ST elevation myocardial infarction (STEMI) and to diagnose the accuracy of electrocardiogram (ECG) findings by comparing them with the coronary angiographic findings. In acute ST elevation myocardial infarction (STEMI). RESULTS: Correlation of ST segment elevation on the 12 lead ECG with the affected coronary artery is established in patients with ST elevation myocardial infarction. AWMI with LAD obstruction has proximal, mid and distal which is highly elevated when compared with IWMI of RCA obstruction, LCX obstruction with IWMI+RVMI. CONCLUSION: Overall, ECG is still a valuable tool in acute myocardial infarction.
myocardial infarction for localization of culprit vessels.

**Keywords:** ECG, Chest pain, Coronary angiographic, Myocardial Infarction


**INTRODUCTION:** The heart is an important vital organ in our body. The coronary artery delivers blood to the heart muscles, then the heart will supply oxygenated blood to other organs in the body. Any blockage in the arteries in a coronary artery can lead to serious health issues or possibly even a death (atherosclerosis). Coronary arteries are mainly divided into left and right coronary arteries [1]. Left Main Coronary Artery (LMCA): It supplies blood to the left side of the heart, mostly to the left atrium and left ventricle. It is divided into two branches. One is Left Anterior Descending Artery (LAD) gives branches as diagonal and septal. It supplies blood to the anterior side of heart. Secondly, Left circumflex artery (LCX) is down distal to the left AV groove [12]. Divides into obtuse marginal and supplies into posterior and outer side of heart. Right Coronary Artery (RCA): It supplies to the right atrium and right ventricle. The Sinoatrial node (SA node) and Atrioventricular node (AV node), supplies to the conduction system of the heart and regulates the heart rhythm [13]. RCdivides into smaller branches, right posterior descending artery, acute marginal artery, and posterolateral branch. Myocardial is usually divided into 3 coronary arteries, even though there are numerous varieties in origin and distribution of coronary arteries [1]. Major contribution to left ventricular myocardial blood flow by the left anterior descending arteries i.e., coronary artery (LAD 50 %), and the rest is similarly contribute by right coronary artery (RCA) and left circumflex artery (LCX). More over the right ventricle is basically supplied by RCA, which directly corresponds to the area of ischemic myocardium. Acute coronary syndrome caused by clot formation and plaque rupture in heart. Decreased blood flow in the coronary arteries is due to the acute syndrome. The acute coronary syndrome is also known as acute myocardial ischemia (lack of blood flow to the heart) [21]. The most common symptom of acute coronary syndrome is chest pain sometimes it may radiating to the left shoulder and may associate with sweating, nausea, breathlessness, palpitation, and giddiness. Patients have different risk factors, clinical profile, and prognosis. Major risk factors of acute coronary syndrome are classified into two types one is known modified factors such as age, sex, and family history, secondly modified factors such as smoking, diabetic Mellitus, hypertension, and thyroids [21]. Electrocardiogram (ECG) is one of the oldest and primary diagnostic tools to investigate the rhythm rate of heartbeats. ECG can measure the rhythm rate of heart in two stages is electrical pumps and heart electrical activity that can measures the three electrodes on the skin especially in the left arm, right arm, and left chest [11]. It is the electrical activity of the heart muscle as the changes with its time. Some of the heart rhythms are Sinus bradycardia, Sinus tachycardia, and normal sinus rhythm [16]. Mainly it shows the blood flow in the arteries and the valves of the heart. It also rates how fast the heart beats per minute. It can also short the flow of blood that returns to the heart and fill before it starts the next cardiac cycles for the next heartbeats [17]. Electrical activity is generated by the SA node results in ventricular contraction or heartbeats. Various abnormal rhyme results in variants that leads to arrhythmia. Additionally, electrocardiogram is used for the diagnosis of patients with suspected Acute Coronary syndrome [18]. ST-segment elevation in leads V1-V4 is mainly caused by transmural ischemia (thickness of the wall) which is located in the anterior wall of the left ventricle [19]. It is called the anterior wall myocardial infarction (AWMI).
ST-segment elevation in leads II, III and aVF are caused by transmural ischemia (thickness of the wall) located in the inferior wall of the left ventricle known as Inferior wall Myocardial infarction (IWMI) [19]. ST-segment elevation leads II, III, aVF and VR4-VR6 are caused by transmural ischemia located in the inferior wall of the left ventricle and Right ventricle [2]. It is called an Inferior wall + Right Ventricular Myocardial infarction (IWMI+RVMI) [4].

In this study, we correlate electrocardiographic changes and Coronary angiographic localization in patients with ST elevation Myocardial Infarction [3] in tertiary care hospital. Analysis of AWMI, IWMI and IWMI + RVMI shows significant change in coronary proximal, mid and distal arteries [5]. Particularly, the change in RCA, RCX and LAD were noticed in coronary artery disease patients. Overall our result shows that our study have potential in correlating the electrocardiographic changes and Coronary angiographic localization in patients with ST elevation Myocardial Infarction [20].

Materials and Methods: The study was conducted at Department of cardiology OP, Chettinad Hospital and Research Institute, Tamil Nadu, India. The institutional ethical committee approved this study. Prior to investigation, the participants were selected following the inclusion and exclusion criteria. The included all ACS STEMI patients, Patients with Diabetes Mellitus, Hypertension, Smoking patient and obesity. Similarly, the excluded alcoholic patient, Patient under the age of 30, Patients who is already a known case of Coronary Artery Disease [17]. The informed consent was obtained from 150 individuals. The participants were subjected to coronary angiographic patients with ST elevation myocardial infarction investigation, along with the gold-standard method to evaluate correlation of the electrocardiographic changes and coronary angiographic patient localization in ST-elevation with myocardial infarction [20]. Demographic data were collected which include hospital number, name, age, gender, presenting complaints, family history. In addition, the clinical measurements such as ECG findings and Echo cardiograph findings were recorded. The clinical parameters such as dyslipidemia, diabetes mellitus, hypertension and thyroid were collected along with the social economical status such as smoking and alcoholic. Coronary angiography has 3 division they are Right coronary artery (RCA), left anterior descending artery (LAD) and circumflex artery (LCX). All the clinical parameters and other data were stored and analyzed by using an excel sheet. Statistical analysis was performed using an EXCEL sheet.

Statistical analysis: The statistical analysis was performed using the SPSS software package (version 21.0, SPSS, Chicago, IL, U.S.A.). The chi square was executed to determine the significant change in coronary artery disease between AWMI, IWMI and (IWMI+RVMI) were compared. Further, the Pearson’s correlation analysis was carried to determine the interdependency between the coronary RCA, LCA and LCX. The statistical significant was considered, if p-value < 0.05.

Results: The study population considered the overall 150 patients there were 122 patients are male (81.3%) and 28 patients were female (18.6%) with cardiac angiography. Some of the clinical parameters show more significance in diabetic patients they are highly prone to this study out of 150 patients 81 patients have diabetes mellitus (54%), 71 patients have hypertension (43.7%), 11 patients have dyslipidemia (7.4%), and 3 patients have thyroid (2%).

Mostly in this study age on set for diabetic patients is above > 60 Years (38%), other is ≤ 40 Years (13.3%), 41 - 50 (23.3%), and 51 - 60 (25.4%) mostly are male. Based on ECG study 150 patients were categorized into AWMI with LAD obstruction (Proximal-42, Mid-35, Distal-7) 84 (56%), 55 (36%) patients had IWMI with 35 (63.6%) of RCA obstruction and 20 (36.4%) had LCX obstruction, 11 patients had IWMI+RVMI with all the 11 (100%) had proximal RCA obstruction. Among AWMI, most of the patients had an obstruction in Proximal LAD (50%) followed by Mid LAD (42%) and few patients had an obstruction in Distal LAD (8%). Among IWMI, Most of the patients had an obstruction in Mid RCA (68%) followed by Proximal RCA (20%) and less in Distal RCA (12%).

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Among IWMI+ RVMI all patients had an obstruction in Proximal RCA (100%). Analysis based on gender in male compared to other risk factors. (Table 1). Total number of male patients is 122 with the higher significance $P < 0.0001$ and its $\%$ $Z$ value is 6.914. Meanwhile total number of female patients is about 28 with the level of significance $P < 0.0009$ and its $\%$ $Z$ value is 18.63.323. This shows that level of significance is higher in male than female. Therefore, gender shows highly significance in coronary angiographic patients.

Table 1: Gender wise distribution

<table>
<thead>
<tr>
<th>Gender</th>
<th>Number of Patients</th>
<th>Z-score</th>
<th>$P$ value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>122</td>
<td>81.3</td>
<td>0.0001</td>
</tr>
<tr>
<td>Female</td>
<td>28</td>
<td>18.63</td>
<td>0.0009</td>
</tr>
</tbody>
</table>

**Age wise distribution:** Age wise distribution is not significant based on this study (table 2). More than 50 per cent of sample is in the age group above 60. Limited number of patients on some group is of aged people. Out of 150 patients; 20 patients are from age $\leq 40$ Years (13.3%), 35 patients are from age $41-50$ (23.3%), 38 patients are from age $51-60$ (25.4%). 57 patients are from age $>60$ Years (38%) Therefore, there is no significance between ages. Hence the chi-square shows significance on above 60 age onset.

Table 2: Age wise distribution

<table>
<thead>
<tr>
<th>Age</th>
<th>No of patients</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>$&lt;40$</td>
<td>20</td>
<td>13.3</td>
</tr>
<tr>
<td>$41-50$</td>
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<td>23.3</td>
</tr>
<tr>
<td>$51-60$</td>
<td>38</td>
<td>25.4</td>
</tr>
<tr>
<td>$&gt;60$</td>
<td>57</td>
<td>38</td>
</tr>
</tbody>
</table>

**Distribution on risk factors:** Group of patients were progressed based on risk factors such as diabetes, hypertension, DLP and thyroidism are included in this study. Total number of DM patients 81 is associated with the level of significance $p < 0.0001$, hypertension patients of about 71 which is associated with $p<0.0001$ level of significance. On the basis of thyroidism number of patients is 3 which is associated with level of significance of about $p < 0.0001$. Out of 150 patients: 81 patients have diabetes (54%), 71 patients have hypertension (43.7%), 11 patients have Dyslipidemia (7.4%), 03 patients have Thyroidism (2%). Therefore, this study shows the highly significance involvement of risk factors associated with disease.

Table 3: Distribution on risk factors

<table>
<thead>
<tr>
<th>Risk factors</th>
<th>No. Of Patients</th>
<th>Chi-square Value</th>
<th>$P$ value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Present</td>
<td>Absent</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

AWMI, IWMI and (IWMI+RVMI): Out of 150 patients: 84 Patients had AWMI (84%), 55 Patients had IWMI (55%), 11 Patients had IWMI+RVMI (11%). Therefore, myocardial infarction shows the highly difference (shows in Fig 1) between anterior wall Myocardial infarction (AWMI), Inferior wall Myocardial infarction (IWMI) and Inferior wall + Right Ventricular Myocardial infarction (IWMI+RVMI).

Proximal LAD, mid LAD and distal LAD: Out of 150 patients, 84 had AWMI, 42 patients had lesion in Proximal LAD (42%), 35 patients had lesion in Mid LAD (35%), 7 patients had lesion in distal LAD (7%). Therefore, this shows (Fig 2) that there are drastic changes between proximal LAD, mid LAD and distal LAD among 150 patients.
LCX and RCA: Out of 150 patients, 55 patients had IWMI, 20 patients had lesion in LCX (20%), 35 patients had lesion in RCA (35%). Hence, this concludes that the patient with LCX has lesser lesion compared to RCA patients (Fig.3).

Proximal RCA, mid RCA and distal RCA: Out of 35 patients (RCA): 7 patients had lesion in proximal RCA, 24 patients had lesion in Mid RCA, and 04 patients had lesion in Distal RCA (shown in figure 4).

DISCUSSION: This study investigates the correlation between that there will be more correlation between coronary localization in patients with ST elevation of myocardial infarction. Gender wise distributions were correlated with the 0.001 significance. Among them males are more prone to get myocardial infarction. This shows that level of significance is higher in male than female. Therefore, gender plays a vital role in patients with proven coronary artery disease. On the basis of the age wise distribution there is no level of significance was noticed compared to gender, since there are a limited number of samples below 60 ages also limited number of sample below 60 age results in no correlation between age wise distributions. Group of patients were progressed based on risk factors such as diabetes, hypertension, DLP and thyroidism are included in this study. Some of major risk factors show the high level of significance among coronary angiographic patients with ST elevation myocardial infarction. Among these 4 risk factors hypertension play a major role that correlates with the coronary angiographic patients. Also the associations of risk factors were shown in table 3. Out of 150 patients: 84 Patients had AWMI, 55 Patients had IWMI, and 11 Patients had IWMI + RVMI. Therefore, myocardial infarction was more linked with anterior wall Myocardial infarction (AWMI) compared with Inferior wall Myocardial infarction (IWMI) and Inferior wall + Right Ventricular Myocardial infarction (IWMI+RVMI). Among 84 AWMI, 42 patients had lesion.
in Proximal LAD, 35 patients had lesion in Mid LAD, and 7 patients had lesion in distal LAD. Therefore, this result shows drastic involvement of proximal LAD, mid LAD and distal LAD among 150 patients. Similarly among 55 IWMI, 20 patients had lesion in LCX, 35 patients had lesion in RCA. Hence, this concludes that the patient with LCX has lesser lesion compared to RCA patients. Out of 35 patients (RCA): 7 patients had lesion in proximal RCA, 24 patients had lesion in Mid RCA, and 04 patients had lesion in Distal RCA. Out of 150 patients 11 patients had lesions in proximal PCA with the Inferior wall + Right Ventricular Myocardial infarction (IWMI+RVMI) had proximal RCA obstruction.

**CONCLUSION:** Overall, our study correlates the potential risk factors with electrocardiographic changes across the Coronary angiographic localization in patients with ST-elevation myocardial infarction. Also, our study demonstrates the most contributing regions associated with CAD on coronary angiography investigation. However, further study is needed to be conducted in a larger sample with other risk factors of coronary artery diseases to confirm the results of this study.

**Reference:**

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