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Original Article

# Culprit Arteries in Patients with Inferior Wall Myocardial Infarction (IWMI) With St Segment Depression in Lead AVR

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## ABSTRACT

ACS is an imbalance between the myocardial oxygen demand and consumption of oxygen by the heart. While coronary plaque rupture, which results in STEMI, is almost always the cause of this mismatch development of thrombus blocking a coronary artery. **Objective**: To determine the frequency of culprit arteries in patients with inferior wall myocardial infarction (IWMI) with ST Segment depression in Lead AVR. **Methods:** This cross sectional study was conducted at Department of Adult Cardiology, NICVD, Karachi, Pakistan from November 4, 2020 to May 3, 2021. All patients who fulfilled the inclusion criteria were enrolled and consent was taken. All patients were initially stabilized and then were prepared for coronary angiography. Interpretation of coronary angiogram was done to assess the culprit arteries i.e. LCX, RCA. Data were collected in proforma. **Results**. Out of 317 patients, 233 (73.5%) were male while 84 (26.5%) were female with mean age of 51.4±12.4 years. Left circumflex coronary artery was found in 184 (58%) patients. Right coronary artery was found in 133 (42%) patients. **Conclusions**: This study concludes that LCX artery is more likely to be culprit in patients with inferior wall myocardial infarction and ST-segment depression in lead AVR. STEMI patients with IWMI should be worked up for the presence of culprit arteries to ensure adequate treatment.

## INTRODUCTION

Finding the culprit artery on the presenting electrocardiogram (ECG) in patients with STEMI can help with earlier risk assessment and improved treatment planning for reperfusion. Inferior STEMI can result from an obstruction in LCX artery or RCA artery so it needs prompt recognition of culprit vessel to initiate treatment. It needs ECG analysis depending upon ST-segment elevation or ST-segment depression in various leads [1]. Compared to anterior wall MI, inferior-wall MI is associated with a better outcome. Decreased blood supply to the inferior area of the heart cause inferior wall myocardial infarctions, it is usually supplied by posterior descending artery (PDA) which in 80% cases originates from right coronary artery while in 20% of patients it is from left circumflex artery. Coronary artery infarction results in decreasing perfusion that results in myocardial ischemia and necrosis are the key principles of pathophysiology of myocardial infarction [2, 3]. Right dominance is said to apply when it gives posterior descending artery. Typical presentation includes chest pain or heaviness, shortness of breath, sweating with pain radiation to arms and additionally it may result as dizziness or nausea [4]. The heart rate, hypotension and signs of poor perfusion should receive special attention during a physical examination and also evaluated for right

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ventricular infarction is present concurrently. Heart disease is indicated by discomfort brought on by exertion, diaphoresis, nausea, vomiting, and pain radiating to the right arm. Other potentially fatal conditions to consider include pneumothorax, esophageal rupture, pulmonary embolism, aortic dissection, and cardiac tamponade. Given the possibility of unusual symptoms, especially in older and female patients, a high level of suspicion is required. Consider cardiac reasons of these symptoms rather than believing they are caused by a gastrointestinal disease given that symptoms include exhaustion, vomiting and epigastric pain [5]. Due to paucity of data we have designed this study to make local guidelines for expert management of patients.

# METHODS

This cross-sectional study was conducted at Department of Adult Cardiology, NICVD Karachi, Pakistan from November 4, 2020 to May 3, 2021. By using WHO calculator sample size was calculated by taking anticipated frequency as 29% [6], with margin of Error of 5% and Confidence level of 95%, then the estimated sample size was n=317 patients. By using Non-Probability, Consecutive Sampling 317 patients were included fulfilling inclusion criteria of age between 30-80 years, of either gender and presenting with inferior wall myocardial infarction (IWMI) defined as history of chest pain with new onset ECG changes of at least 1mm elevation in inferior lead (II, III, AVF) and positive Hs troponin I with ST segment depression in AVR lead (in accordance with operational definition) with any duration. We excluded Patients with anterior or lateral wall STEMI, coronary artery bypass surgery or PCI, Patients with bundle branch block or electrolyte imbalance and patients with non-obstructive coronaries on angiography. An informed written consent was taken at the time of admission, data regarding the age, gender, smoking status, diabetes, hypertension, height and weight was recorded on proforma. All patients were initially stabilized and then were prepared for coronary angiography. Angiography was performed by consultant > 3 years of experience. Interpretation of coronary angiogram was done to determine culprit artery labelled as the artery had at least one lesion >70% needing acute intervention. Data were analyzed through the statistical software SPSS. 22.0 version. Mean was calculated for age, height, weight and BMI. Frequency and percentage were calculated for gender, diabetes, hypertension, smoking status and culprit arteries i.e. (LCX, RCA).

# RESULTS

In this study 317 patients were enrolled with age ranges from 30 to 80 years with mean age was 51.4±12.4 years, with mean weight of 66.3±11.1 kgs, mean height of 1.62±1.3 meters and mean body mass index of 27.3±5.2 kg/m$^2$ as shown in Table 1.

**Table 1:** Descriptive Statistics of Demographic Characteristics

| Variable | Range | Mean |
|---|---|---|
| Age (years ) | 30-80 | 51.4±12.4 |
| Weight (kg) | 60-961 | 66.3±11.1 |
| Height (meter) | 38-1.68 | 1.62±1.3 |
| BMI (kg/m2) | 24-30 | 27.3±5.2 |

In distribution of gender, 233 (73.5%) were male while 84 (26.5%) were female. Diabetes mellitus was documented in 124 (39.1%) patients. Hypertension was noted in 175 (55.2%) patients. Out of 317 patients, 140 (44.2%) patients were smoker while 177 (55.8%) were non-smoker as shown in Table 2.

**Table 2:** Descriptive Statistics of Clinical Characteristics

| Variable | | Frequency (%) |
|---|---|---|
| Gender | Male | 233 (73.5) |
| | Female | 84 (26.5) |
| Diabetes | | 124 (39.1) |
| Hypertension | | 175 (55.2) |
| Smoker | | 140 (44.2) |
| Non-smoker | | 177 (55.8) |

Left circumflex coronary artery was observed as culprit artery in a greater number of patients, 184 (58%) while right coronary artery was found to be culprit vessel in 133 (42%) patients suffering from inferior wall myocardial infraction with St-segment depression in lead AVR with an in significant p-value as shown in Table 3.

**Table 3:** Stratification of Culprit Arteries IWMI With ST Segment Depression in Lead AVR

| Variable | Culprit Arteries | | N | p-value |
|---|---|---|---|---|
| | Yes | No | | |
| RCA | 133(42%) | 184(58%) | 317 | 0.67 |
| LCX | 184(58%) | 133(42%) | 317 | |

# DISCUSSION

There is recent rise of mortality due to STEMI worldwide. Mortality rate varies depending upon type of STEMI and presentation from of 4% to 10%, where inferior wall MIs have lower mortality rate then other type of STEMI. Presence of right ventricular involvement up to one third of inferior wall MI increases risk and mortality. After initial stabilization patient is soon shifted to catheterization lab in order to achieve door-to-vessel time of less than 90 [6, 7]. ECG remained the initial investigation to determine the type of STEMI and most likely culprit vessel. Addressing the culprit vessel is the primary goal of STEMI intervention so patient should be sent for urgent cardiac angiography to the hospital if the ECG shows signs of STEMI [8]. Recent research is focused on lead AVR in case of inferior STEMI to predicting culprit artery and perhaps patient outcome. Additionally, the majority of studies have only looked at how lead AVR ST changes help distinguish between RCA and

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LCX infarctions, giving no additional insight into the significance of the occlusion site in either the RCA or the LCX [9, 10]. The findings of this study suggest that in individuals with inferior STEMI, ST segment deviation in lead AVR can assist in distinguishing between RCA and LCX infarction. However, the ability to distinguish between RCA and LCX lesions using previously established electrocardiographic criteria is only fair. Different patient coronary anatomy and multi vessel involvement could make it more difficult to interpret ECG patterns [11]. In this study, out of 317 patients, 233 (73.5%) were male while 84 (26.5%) were female while it was also seen in similar fashion in study by Kanei *et al.*, [12], who observed 78% with male dominancy and same observation was in the study by of Pourafkari *et al.*, [13], in which 61 (82.4%) were male patients. Other studies by Sinha *et al.*, also reported males as 415 (71%) and females as 170 (29%) and Almansori *et al.*, also noted to have 539 (76%) men [14, 15]. The mean age reported in our study was 51.4±12.4 years it was also in agreement with study where mean age was noted as 58±12 years [16]. In this study 124 (39.1%) patients of diabetes mellitus were noted and it was not in agreement with observation of Fiol *et al.*, who found around 17.7% patients with diabetes this may be due to collection of sample [17]. In current study, hypertension was noted in 175 (55.2%) patients that was consistent with the finding of study by Zimetbaum *et al.*, who observed 57% hypertensive patients [18]. In this study, 140 (44.2%) patients were smokers while 177(55.8%) where non-smokers similar pattern was observed in another study where 52% were smokers [19]. In this study right coronary artery was found to be culprit in 133 (42%) patients while left circumflex coronary artery was noted in 184 (58%) patients. LCX was the culprit artery in patients with ST depression in lead AVR more than those without ST-segment depression. Similarly Sahi *et al.*, also demonstrated that in patients with IWMI, the amount of ST-segment depression in the lead AVR is a reliable predictor of IRA [20]. Although this study helps in prediction of culprit artery but precise location of segment as proximal, mid or distil portion and moreover we did not included patients with late presentation or old infarction so findings does not simply apply to all.

## CONCLUSIONS

Findings of this study support in prediction of culprit vessel with large accuracy depends upon St-segment depression in lead AVR. Although solely ECG based findings cannot replace angiographic report but it adds to further strengthen the diagnosis, so further large scale studies are recommended.

## Authors Contribution

Conceptualization: AR

Methodology: MY, AF, AR, FA

Formal analysis: AF, NB

Writing-review and editing: KF, MY, Y, S

All authors have read and agreed to the published version of the manuscript.

## Conflicts of Interest

The authors declare no conflict of interest.

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