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# Correlation Between ST-Segment Elevation in Lead aVR and Severity of Left Main Coronary Artery Stenosis in Acute Coronary Syndrome Patients

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## Abstract

Incidence of acute coronary syndrome (ACS) is increasing day by day. ECG is the first line method to diagnose ACS. ST-segment elevation or depression determines the presence or absence of IHD or STEMI / NSTEMI. Augmented limbs leads are used, aVR, aVF and aVL to obtain information from heart. Often lead aVR is ignored; ST-segment elevation in aVR may determine left main coronary artery stenosis (LMCAS). A cross-sectional study was conducted in the Department of Cardiology, Punjab Institute of Cardiology, Lahore, Pakistan, from June 2015 to July 2016, to determine the correlation between ST-segment elevation in lead aVR and severity of LMCA stenosis on angiography in ACS patients. A total of 60 patients with acute coronary syndrome with ST-segment elevation in lead aVR undergoing angiography were included through non-probability, purposive sampling. The mean age was 56.13±9.56 years. There were 53(88.33%) males and 7(11.67%) females; male-female ratio was 7.57:1. There were 27(45%) patients with diabetes mellitus, 39 (65%) patients had hypertension, 5(8.3%) patients had hyperlipidemia and 25 (41.67%) were smokers. There were 31(51.7%) patients who had V1 1mm and 29(48.3%) had V1 2mm. The mean value of aVRST was 1.08±0.54 mm. LMCAS was found in 25(41.7%) cases, while 14 cases had 0.5mm aVRST, there was only one case who had LMCAS. out of 43 cases who had 1-2mm aVRST, 21 had LMCAS and among 3 cases of aVRST 2-3mm, all had significant LMCAS detected on angiography ($p<0.05$). There was positive relationship between aVRST and LMS ($r=0.459$, $p=0.000$). To conclude, a weak but positive relationship present between LMCAS and ST-segment elevation in lead aVR, which may help predict the severity of LMCAS on the basis of ECG instead of going directly for angiography.

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**Keywords:** Left main coronary artery stenosis, ST-segment elevation in lead aVR, acute coronary syndrome, electrocardiography, angiography

## Introduction

Left main coronary artery (LMCA) stenosis is a somewhat uncommon but is an important cause of indicative coronary artery disease (CAD).[1] Different studies have observed that LMCAS to be an autonomous sign of increased incidence of morbidity and mortality in CAD patients.[2,3] When the narrowing of the artery occupied more than half of the diameter of the lumen, it is called significant lesion. About (4% to 6%) of the total patient who go through coronary angiography have left main coronary artery disease.[4] In 70% of the cases, it is related to multivessels involvement.[5,6] LMCAS were found between 19% and 77% in patients with ST segment elevation in lead aVR.[7-9] It was reported in a previous study that LMCAS is present in 7.0% cases, out of which 42.6% case with 0.05 to 0.1 mV (n=68) ST elevation in lead aVR and 66.3% was found with ≥0.1 mV (n=92) ($p<0.001$).[10] Evidence also showed that 31% of patients presented with elevation in lead aVR – among them more than one small square elevation was found in 34.7% of all cases >0.1 mv elevation was observed in 40.7% of men and 43.8% of female patients. There was a considerable affiliation between the incidence of ST-elevation more than one small square and the disease left main stem, though it was observed in males but not in females.[11] Based on

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those reports, this study aims to determine the correlation between ST-segment elevation in lead aVR and severity of LMCA stenosis on angiography in ACS patients in Punjab region of Pakistan.

## Methods

This cross-sectional study was conducted in the Department of Cardiology, Punjab Institute of Cardiology, Lahore, Pakistan, from June 2015 to July 2016, to determine the correlation between ST-segment elevation in lead aVR and severity of LMCA stenosis on angiography in ACS patients. A total of 60 patients with acute coronary syndrome with ST-segment elevation in lead aVR undergoing angiography were included through non-probability, purposive sampling. Our inclusion criteria included patients of any age with either gender with acute coronary syndrome with ST-segment elevation in lead aVR (as per operational definition)[12] undergoing angiography. Exclusion criteria were: i) patients with anterior wall MI; ii) patients who underwent any associated procedure (such as repair or replacement of a valve or repair of the ascending aorta); iii) patients with other comorbidities like patients on hemodialysis, liver failure or respiratory problems like asthma and COPD; and iv) patients with chest deformities.

Demographic data (name, age, sex and address) was also recorded. Then patient underwent angiography. On angiography left main coronary artery stenosis was observed and marked (as per operational definition) on a predesigned data sheet.

Collected data was scrutinized, compiled, coded, and analyzed using Statistical Package for social sciences (SPSS) version 20.0 for Windows. Mean and standard deviation was calculated for quantitative variables like age. Frequency and percentages was calculated for qualitative variables like gender and left main coronary artery stenosis. Pearson correlation coefficient was calculated to measure correlation between ST-segment elevation in lead aVR and severity of stenosis. A p-value <0.05 was considered as significant.

The study was approved by the Institutional Review Board of Punjab Institute of Cardiology, Lahore, Pakistan.

## Results

The mean age of the patients was 56.13±9.56 years. The minimum age of patient was 42 years and maximum age was 83 years. There were 53(88.33%) males and 7(11.67%) females; male-female ratio was 7.57:1. Out of 60 patients, 27(45%) had diabetes mellitus, 39(65%) had hypertension and 5(8.3%) had hyperlipidemia, 35(58.3%) were non-smokers and 25(41.7%) were smokers (Table-I).

**Table-I:** Risk factors (comorbidities) in patients with ACS (N=60)

| Risk Factors | Present Frequency (Percentage) | Absent Frequency (Percentage) |
|---|---|---|
| Diabetes mellitus | 27 (45.0) | 33 (55.0) |
| Hypertension | 39 (65.0) | 21 (35.0) |
| Hyperlipidemia | 5 (8.3) | 55 (91.7) |
| Smoking | 25 (41.7) | 35 (58.3) |

31(51.7%) patients had V1 of 1mm and 29(48.3%) had V1 of 2mm. The mean value of aVRST was 1.08±0.54 mm (ranging between 0.50 and 3.0 mm). Among 60 patients, 25(41.7%) had significant LMCAS on angiography (Table-II). In a total of 14 patients with 0.5mm aVRST, there was only one patient, who had LMCAS. Out of 43 patients having

1-2mm aVRST, 21 had LMCAS had LMCAS. However, in 3 patients with aVRST 2-3mm, all had LMCAS detected on angiography (2 had 2.5mm aVRST, while 1 had 3mm aVRST). The difference was statistically significant (p<0.01) (Table-III). Pearson correlation coefficient analysis showed that there was positive relationship between aVRST and LMS (r=0.459, p=0.000) (Fig. 1).

**Table-II:** Distribution of V1, aVRST, LMCAS (N=60)

| Variable | | Frequency | Percentage |
|---|---|---|---|
| **V1** | 1mm | 31 | 51.7 |
| | 2mm | 29 | 48.3 |
| | Total | 60 | 100.0 |
| **aVRST (mm) Mean±SD** | | 1.08±0.54 mm | (0.05–3.0 mm) |
| **LMCAS** | Yes | 25 | 41.7 |
| | No | 35 | 58.3 |
| | Total | 60 | 100.0 |

**Table-III:** Comparison of LMCAS in patients with different aVRST in angiography (N=60)

| Variable | | LMCAS | | Total |
|---|---|---|---|---|
| | | Yes | No | |
| **aVRST (mm)** | 0.5 | 1 | 13 | 14 |
| | 1-2 | 21 | 22 | 43 |
| | 2-3 | 3 | 0 | 3 |
| **$X^2$ value = 21.329** | | p-value = 0.0025[S] | | |

Chi-square test was applied to reach p-value; S=significant.

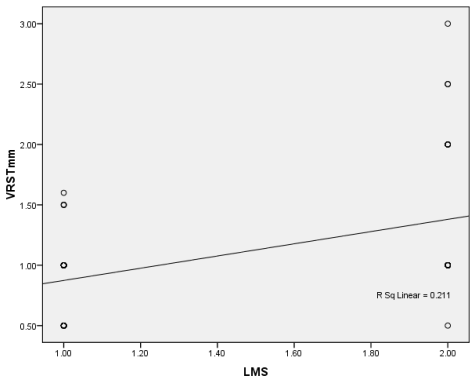


**Fig. 1:** Correlation between LMS and aVRST (r=0.459, p=0.000).

## Discussion

In our study, we included 60 ACS patients with the mean age of 56.13±9.56 years (42–83 years). A male predominance was observed. 27(45%) patients had diabetes mellitus, 39(65%) had hypertension, 5(8.3%) had hyperlipidemia and 25(41.67%) were smokers. In this study, it was found that among all patients who presented with ACS, 25(41.7%) cases had significant LMCAS, while 35(58.3%) cases did not show significant LMCAS on angiography. Ragosta *et al.* reported that significant LMCAS found in 4% to 6% of all patients underwent angiography.[4] Another study reported that LMCAS was observed in 5(19%) cases only in patients of ACS with ST-elevation in aVR.[9] However, two other studies found higher rates i.e., 55.6% and 77% respectively (LMCAS who presented with ST segment elevation in lead aVR).[7,8] In our study, the mean aVRST was calculated as 1.08±0.54 mm (0.5–3mm). In 0.5mm aVRST, there was only one patient who had LMCAS, while 13 patients had no LMCAS. Similarly, in 1-2mm aVRST, 21 patients had LMCAS, while 22 patients did not show LMCAS. 3 patients were with aVRST 2-3mm – all had significant LMCAS detected on angiography (2 had 2.5mm aVRST, while 1 had 3mm aVRST). The difference was found to be significant (p<0.05). This showed that with high peaks in lead aVR, there are more chances of presence of significant LMCAS. Barrabés *et al.* reported that the overall LMCAS was observed only in 7.0% cases, out of which LMCA was present in 42.6% and 66.3%, patients with 0.05 to 0.1 mV and ≥0.1 mV ST-Segment Elevation in lead aVR respectively (p<0.001).[10] It was also described that total 31% of patients presented with elevation in lead aVR among them more than one small square elevation was found in 34.7% of all cases >0.1 mv elevation was observed in 40.7% of men and 43.8% of female patients. There was a considerable

affiliation between the incidence of ST elevation more than one small square and the disease Left main stem, though it was observed in males but not in females.[11] There was positive relationship between aVRST and LMS i.e. r=0.459. Although the relationship was weak, it was statistically significant (p=0.000). Our study showed that ECG could be a good predictor for presence of significant LMCAS in patents of ACS. Through this was a non-interventional method, it was easily available, cheap, and effectively predict LMCAS that can replace angiography.

## Conclusion

Our data suggests that there is a weak but positive relationship between LMCAS and ST-segment elevation in lead aVR. Now, in future we can predict the severity of LMCAS on the basis of ECG instead of going directly for angiography.

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