ORIGINAL ARTICLE

ASSOCIATION OF ST ELEVATION IN LEAD AVR WITH LEFT MAIN STEM AND TRIPLE VESSEL DISEASES IN PATIENTS WITH NON-ST ELEVATION MYOCARDIAL INFARCTION

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Objectives: To determine frequency of left main stem (LMS) and triple vessel coronary artery disease (3VCAD) in patients of Non-ST-elevation myocardial infarction (NSTEMI) and to compare the frequency of LMS and 3VCAD in patients with NSTEMI with or without ST elevation in lead aVR.

Methodology: Total 346 patients with NSTEMI having age 30-70 years were included in this descriptive cross-sectional study. The data on demographic details was collected. All patients underwent electrocardiography (ECG) and cardiac specific troponin-I assessment. Patients were categorized as NSTEMI with or without ST-elevation in lead aVR. Coronary angiography was performed in all patients and angiographic findings were noted.

Results: Mean age of patients was 51.87±10.03 years. There were 218 (63.01%) males and 128 (36.99%) female patients. 182 (52.60%) patients of NSTEMI had ST elevation in aVR. LMS disease was found in 53 (29.10%) patients with ST elevation in aVR. Sensitivity, specificity, positive predive value and negative predictive value of ST elevation in aVR for LMS disease was 62.35%, 50.57%, 29.12% and 80.49% respectively. 3 VCAD was found in 54 (29.70%) with ST elevation in aVR. Sensitivity, specificity, positive predive value and negative predictive value of ST elevation in aVR for 3VCAD was 77.14%, 53.52%, 29.67% and 90.24% respectively.

Conclusion: NSTEMI patients with ST elevation in aVR may have higher chances of having LMS disease or 3VCAD. There is high negative predictive value for ST elevation in aVR to predict LMS disease or 3VCAD.

Keywords: NSTEMI, aVR, ST-elevation, Left main stem disease, triple vessel disease

Citation: Usman HT, Hashmi KA, Saleemi MS, Akhtar A. Association of ST Elevation in Lead aVR with Left Main Stem and Triple Vessel Diseases in Patients with Non-ST Elevation Myocardial Infarction. Pak Heart J. 2021;54(04):348-351. DOI: https://doi.org/10.47144/phj.v54i4.2128

INTRODUCTION

The patients with Non-ST elevation myocardial infarction (NSTEMI) have variable degree of severity of coronary artery disease and prognosis.[1] The electrocardiogram (ECG) at first medical contact and at the time of admission has a crucial contribution in easy and an early risk stratification.[1,2] Previous studies have proved that patients with even ST depression of >0.5 mm on the admission ECG may need early invasive management strategy.[2] Different risk scoring methods like TIMI scoring system for NSTEMI have also used ST deviation as an independent predictor of adverse outcome.[3,4]

The lead aVR is often ignored in clinical practice.[5] However, different studies have shown that ST elevation in lead aVR can predict adverse events in NSTEMI patients more accurately.[6,7] Furthermore, ST elevation in aVR is a simple and an easy indicator of left main stem (LMS) or triple vessel disease (3VCAD) and can guide for the triage of these high-risk patients.[6,8] Yan AT et al. showed that among 5064 patients with NSTEMI 5.8% had minor (0.5-1 mm) ST elevation in aVR, and 1.5% had major (>1 mm) ST elevation in aVR. Triple vessel disease was found in 46.5 % patients with ST elevation in aVR compared to 26.1% with no ST-elevation in aVR.[9]

Considering the literature, the rationale of our study is to find out the diagnostic value of ST elevation in aVR with LMS disease or 3VCAD for the patients with NSTEMI. These patients will be further investigated with coronary angiography. If lead aVR will have diagnostic value of 80% for LMS disease or 3VCAD, then in future this prognostic information from ECG could be taken routinely to diagnose LMS disease or 3VCAD.

It will help in early anticipation of LMS and 3VCAD on the basis of ECG of the patient presenting with NSTEMI. This will also help to make local guidelines regarding early prediction of disease, proceed for angiography and patient's definitive management.

METHODOLOGY

This descriptive cross-sectional study was carried out in the department of Cardiology at Chaudhary Pervaiz Elahi Institute of Cardiology, Multan from 1st of November, 2020 to 30th of April 2021. After approval from the Ethical Review Board of the hospital and taking informed consent from the patients, a total 346 consecutive patients with NSTEMI of either gender of age 30 to 70 years were included in the study. Patients with previous history of acute coronary syndrome, coronary angiography, coronary revascularization procedure, nephropathy, severe left ventricular failure or cardiogenic shock were not included in the study. NSTEMI was diagnosed by the history of severe excruciating or crushing chest pain with radiation to left arm, neck jaw or back and a positive cardiac troponin I marker with either ST depression in any 2 of the consecutive leads. On 12-lead ECG, ST elevation of more than 0.5 mm in lead aVR was labelled as ST-elevation in aVR. Left main stem (LMS) was defined as significant narrowing (more than 50%) of the left main coronary artery on coronary angiogram. Triple vessel disease was labelled as significant narrowing (>75%) of all three major coronary arteries on coronary angiogram. The patients were labeled diabetic if already using hypoglycemic drugs either oral or parenteral or fasting blood sugar level of more than 126mg/dl, hypertensive if already on antihypertensive medication or recorded blood pressure of more than 140/90mmHg at three different occasions, smoker was defined as a person who smoked more than 100 cigarettes in his/her life time, obese if body mass index was more than 30kg/m2 and having dyslipidemia if total cholesterol level was more than 200mg/dl or getting treatment with cholesterol lowering drugs. Positive family history for CAD in the patient was considered if the patient had a first-degree male relative of age less than 55 years or a first degree female relative of age less than 65 years had history of CAD. The data on demographic details such as age, gender, history of smoking, diabetes, hypertension and family history of ischemic heart disease was collected via a questionnaire. Blood samples were drawn for assessment of diabetes, dyslipidemia if not previously known. All patients also underwent ECG and cardiac specific trop-I assessment. Patients were categorized as NSTEMI with ST-elevation in aVR (yes/no) as per operational definition. Coronary angiography was performed in all patients as per hospital protocols. Coronary angiogram was reported by two senior consultant cardiologists with at least 5-year post fellowship experience by visual estimate and who were unaware of the ECG findings of the patients. Angiography findings were noted in pre designed Performa. All patients were managed as per hospital protocol.

The statistical Package for Social Sciences (SPSS) for Windows, version 23.0 was used for all analyses. Categorical variables like gender, dyslipidemia, hypertension, diabetes, smoking, stress, family history, ST-elevation in aVR lead and LMS disease and 3VCAD were presented as percentages and frequencies. Frequency of LMS and 3VCAD among patients with ST elevation positive in aVR and no ST elevation in aVR groups was compared by chi-square test. A p-value <0.05 was considered statistically significant. Data was stratified on patients age, gender, smoking, diabetes, hyperlipidemia, family history of ischemic heart disease to see the effects on frequency of left main and 3VCAD. Post stratification chi-square test was used. Specificity, sensitivity positive and negative predictive values of ST elevation in aVR for predicting LMS disease and 3VCAD was also calculated.

RESULTS

Total 346 patients were included in the study. Mean age of the patients was 51.87±10.03 years. Minimum age was 30 years and maximum age was 70 years. There were 218 (63.01%) males and 128 (36.99%) females. Dyslipidemia was found in 141 (40.75%), hypertension in 192 (55.49%), diabetes in 168 (48.55%) patients, 136 (39.31%) were smokers and 76 (21.97%) patients have family history of ischemic heart disease. Out of 346 patients, 182 (52.60%) had ST elevation in aVR. Left main stem coronary artery disease was found in 85 (24.57%) patients of NSTEMI. Triple vessel disease was found in 70 (20.23%) patients of NSTEMI. Table 1 shows the comparison of LMS disease and 3VCAD in patients with and without ST-elevation in aVR. P-value was also mentioned in Table 1 along with specificity sensitivity, positive predictive values and negative predictive values. Table 2 shows the stratification of LMS disease and 3VCAD with ST elevation in aVR with different risk factors of CAD.

Table 1: Comparison of left main coronary artery and triple vessel disease among patients with and without ST elevation in aVR

	ST elevation in aVR	
	Yes	**No**
Left Main Stem Stenosis		
Yes	53 (29.10%)	32 (24.60%)
No	129 (70.90%)	132 (80.50%)
P-value	0.038	
Sensitivity	62.35%	
Specificity	50.57%	
Positive predictive value	29.12%	
Negative predictive value	80.49%	
Triple Vessel Disease		
Yes	54 (29.70%)	16 (9.80%)
No	128 (70.30%)	148 (90.20%)

P-value	<0.001
Sensitivity	77.14%
Specificity	53.62%
Positive predictive value	29.67%
Negative predictive value	90.24%

Table 2: Stratification of LMS disease and 3VCAD with ST elevation in aVR with different risk factors of CAD

Risk factors	ST elevation in aVR		P-value
	Yes	No	
	Left Main Stem Stenosis		
	Yes	No	
Age 30-50 years	33	64	0.132
Age 50-70 years	20	65	0.166
Males	31	84	0.041
Females	22	45	0.414
Dyslipidemia	26	47	0.009
Hypertension	27	67	0.130
Diabetics	26	67	0.105
Smokers	20	51	0.497
Family history	9	37	0.460
	Triple Vessel Disease		
	Yes	No	
Age 30-50 years	25	72	0.018
Age 50-70 years	29	56	0.001
Males	34	81	0.001
Females	20	47	0.001
Dyslipidemia	20	53	0.020
Hypertension	30	64	0.001
Diabetics	28	65	0.005
Smokers	20	51	0.001
Family history	14	32	0.080

DISCUSSION

The simple and easy predictors of coronary complexities are always welcome by the cardiologists that can help in deciding treatment strategy.[9] These predictors must be useful in making revascularization decisions as well as helpful for predicting adverse events after coronary angiography.[10] ST-elevation in lead avR have been shown to be linked with LMS disease and 3VCAD.[9-11]

Hussien et al have shown that ST-segment elevation in lead aVR had good sensitivity (77%) but moderate specificity (65%), positive predicted value (PPV) of 64% and negative predicted value (NPV) of 78% in diagnosing LMS disease or 3VCAD and concluded that ST elevation in aVR could be used as a predictor before angiogram.[12] Our study showed low sensitivity specificity and PPV of ST elevation in aVR for diagnosing LMS disease and 3VCAD while high negative predictive value for ST elevation in aVR for predicting LMS disease and 3VCAD. This could be due to the larger sample size in our study and division of studied population by Hussien et al in different groups according to severity of ST elevation in aVR.

Kosuge et al. in their study reported that ST-segment elevation in lead aVR as a good predictor of LMS stenosis based on ECG. The analysis of the study revealed that 78% sensitivity and 62% specificity of ST elevation in aVR for predicting LMS or 3VCAD.[13] These results are comparable to our study Nabati et al showed that ST elevation in aVR is seen in 7.3% to 32.3% of the patients presenting with NSTEMI.[14] Our study showed 52.60% patients have ST elevation in aVR. The difference in our study from Nabati et al is due to the criteria of labelling ST elevation in aVR. Nabati et al labelled ST elevation of more than 1mm as ST elevation in aVR[14] while we labelled ST elevation of more than 0.5mm as ST elevation in aVR.

Iqbal et al conducted a study on patients with acute coronary syndromes having ST elevation in aVR and showed only 121 patients out of 249 of STEMI are true positives who have ST elevation in aVR and LMS disease while only 02 are true negative who do not have ST elevation in aVR and do not have LMS. In case of NSTEMI, 52 patients are true positive and 37 are truly negative.[15] This difference from our study may be due to the difference in inclusion criteria in both studies. Iqbal et al have included patients with all types of acute coronary syndromes but we have included patients only with NSTEMI.

Our study also has limitations. This is a single center studied conducted on the patients admitted via emergency with limited number of patients. Therefore, this study doesn't represent the exact picture for the whole population of the country. So, it does not necessarily represent situations prevailing in other part of the country. So, the results may not be similar with large scale survey. The need of the hour is to conduct a larger survey with larger sample size at multiple cardiac centers of the country and this study could become the basis for that larger multicenter survey.

CONCLUSION

NSTEMI patients with ST elevation in aVR may have higher chances of having LMS disease or 3VCAD. There is high negative predictive value for ST elevation in aVR to predict LMS disease or 3VCAD.

AUTHORS' CONTRIBUTION:

HTU: Conceiving and designing the study, data collection, data analysis, formulation of result and writing the manuscript, and responsible for accuracy of results and integrity of research.

KAH MSS, AA: Conceiving and designing the study, interpretation of data, critical review of manuscript, approval of final draft, and responsible for accuracy of results and integrity of research.

Conflict of interest: Authors declared no conflict of interest.

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