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Coronary Angiographic Findings in Patients with Myocardial Infarction with and without ST-Segment Elevation in Lead aVR

Ahmed Alallah ELsayed Elbehery [1], Mahmoud Diaa El-Menshawy [1], Mahmoud Abdelaziz Abdelrashid [1], Mohammed Maher Allam [1]

[(1)] Cardiology Department, Faculty of Medicine- Zagazig University, Zagazig, Egypt
Corresponding Author: Ahmed Alallah ELsayed Elbehery
E-mail: Samozainahmed@gmail.com

Abstract

Objective: To achieve better management of association between ST-segment shifts in lead aVR and coronary complexity as assessed by Sx score in patients with ACS.

Patients and methods: Forty-nine patients with acute coronary syndrome and divided into two groups I patients with ACS whose ECG shows ST segment elevation in lead aVR and groups II patients with ACS but without STE in lead aVR. Electrocardiogram (ECG) 12 lead ECG was done prior to revascularization or medical therapy where ECGs were manually examined for lead AVR ST-elevation. Bedside Transthoracic Echocardiography (TTE) was performed.

Results: LMCA, LAD, LCx, and RCA stenosis were significantly higher in ACS patients with STE in aVR compared to ACS patients without STE in aVR ($p < 0.001$, 0.006, <0.001, and <0.001 respectively). 2 and 3 vessels affection were significantly higher in ACS patients with STE in aVR compared to ACS patients without STE in aVR ($p = 0.002$ and <0.001).

Conclusion: Acute coronary disease with STE in aVR is associated to worse clinical condition at presentation .

Keywords: ACS , ST-segment elevation, augmented Vector Right,

Introduction

Acute coronary syndrome (ACS) refers to a group of disorders characterized by a rapid drop in cardiac blood flow with complains of chest pain or pressure that spreads to the neck, jaw, shoulder, or arm. Even if ACS does not induce cell death, the lower blood flow alters the heart's function and increases the risk of a heart attack[1].

Reduced or full suspension of blood flow to a region of the myocardium causes myocardial infarction (MI), sometimes known as "heart attack." Myocardial infarction can be "silent," causing hemodynamic deterioration and abrupt death, or it can be a catastrophic event that causes hemodynamic deterioration and death[2].

Myocardial ischemia may be accompanied by ECG alterations and elevated biochemical markers such as cardiac troponins, in addition to the history and physical exam[3]. The aim of this study was to achieve better management of association between ST-segment shifts in lead aVR and coronary complexity as assessed by SYNTAX score (Sx) score in patients with ACS.

Material and methods

This is an observational cross-sectional study conducted on 49 patients with acute coronary syndrome in cardiology departments at Zagazig University Hospitals, Mansoura University Specialized Medical Hospital, and 15 May Hospital.

All patients were subjected to full history taking, clinical examinations Including vital signs (blood pressure, heart rate, respiratory rate, temperature), signs of Left Ventricle (LV) dysfunction. Laboratory investigations; 4ml of venous blood was obtained from the patients, Skin was cleaned with alcohol. Tourniquet was applied at upper mid arm or on the back of the hand. Blood sample was obtained with syringe. Tourniquet was taken off and needle was removed from vein. Blood sample of each patients was subdivided into two parts each is 2ml. First part was used for blood glucose test CBC test with detection of neutrophil and lymphocytes with detection of neutrophil to lymphocyte ratio. We put in EDTA tube to prevent coagulation.

Electrocardiogram (ECG) 12 lead ECG was done prior to revascularization or medical therapy where ECGs were manually examined for lead AVR ST-elevation. Bedside Transthoracic Echocardiography (TTE) was performed.

Coronary angiography was done via femoral arterial approach using 6F catheter with non-ionic, low-osmolar, iodinated contrast agent. Number of diseased vessels, and lesion sites were identified. Aluminal diameter narrowing >70% was considered as significant lesion. We analyzed the results of the invasive coronary angiography of all these patients which was done within one week of admission and during their in-hospital stay. Invasive coronary angiography was performed with standard techniques and at least 2 different views obtained for each main vessel.

Statistical analysis

Data were checked, entered and analyzed using SPSS version 23 for data processing. The threshold of significance was fixed at 5% level (P-value); P value of > 0.05 indicates non-significant results, P value of < 0.05 indicates significant results. The smaller the P value obtained the more significant are the results.

Results :

Table (1): Demographic data of MI patients with or without STE in aVR

Demographic data	MI with STE in aVR (n =23)	MI without STE in aVR (n =26)	Test of significance	P-value
Age / years Mean ± SD Min – Max	 60.91±4.17 55-68	 56.69±8.00 41-72	t =2.35	**0.028***
Sex Male Female	 14(60.87%) 9(39.13%)	 18(69.23%) 8(30.77%)	x^2 =0.37	0.539

MI: Myocardial infarction, t: Student t-test, x^2: chi-square test. *Statistically significant as p ≤0.05.

Table 1; showed that the age was significantly higher in MI with STE in aVR compared to MI without STE in aVR (P=0.028). There was no significant difference in sex between MI with or without STE in aVR.

Table (2): Risk factors in of MI patients with or without STE in aVR

Risk factors	MI with STE in aVR (n =23)	MI without STE in aVR (n =26)	Test of significance	P-value
Smoking	5(21.74%)	8(30.77%)	x^2 =0.51	0.475
Diabetes	19(82.61%)	9 (34.62%)	x^2 =11.48	**<0.001***
Hypertension	17(73.91%)	16(61.54%)	x^2 =0.85	0.357
Dyslipidemia	20(86.96%)	20(76.92%)	x^2 =0.82	0.365

MI: Myocardial infarction, t: Student t-test, x^2: chi-square test. *Statistically significant as p ≤0.05.

Table 2; showed that there was no significant difference in risk factors (smoking, diabetes, hypertension, and dyslipidaemia) between patients with or without MI. Diabetes was significantly higher in MI with STE in aVR compared to MI without STE in aVR (P<0.001).

Table (3): Clinical data of MI patients with or without STE in aVR

Demographic data	MI with STE in aVR (n =23)	MI without STE in aVR (n =26)	Test of significance	P-value
SBP Mean ± SD Min – Max	 156.35± 28.58 100- 189	 146.50± 29.25 100-190	t =1.19	0.241
DBP Mean ± SD Min – Max	 88.87± 15.65 58-106	 84.54± 14.76 55-105	t =0.99	0.324

ACS: Acute coronary syndrome, STE: ST-segment elevation, aVR: aVR: Augmented vector right, t: Student t-test, SBP: Systolic blood pressure, DBP: Diastolic blood pressure, HR: Heart rate, Hb: Hemoglobin, *Statistically significant as p ≤0.05.

Table 3; showed that there was no significant difference in SBP, DBP, and HR between the studied groups.

Table (4): Echocardiographic results and Ejection fraction in MI patients with or without STE in aVR

Echocardiographic results	MI with STE in aVR (n =23)	MI without STE in aVR (n =26)	Test of significance	P-value
RWMA	18(78.26%)	11(42.31%)	x^2 =6.53	**0.019***
Mitral regurgitation	12(52.17%)	7(26.92%)	x^2 =3.28	**0.070***

Diastolic dysfunction	21(91.30%)	20(76.92%)	x^2 =1.848	0.174
Ejection fraction				
EF Mean ± SD Min – Max	 54.78±6.45 41-64	 56.81±9.15 41-79	t =-0.903	0.381
EF >55 ≤55	 16(69.57%) 7(30.43%)	 15(57.69%) 11(42.31%)	x^2 =0.740	0.390

MI: Myocardial infarction, x^2 : chi-square test, RWMA: Regional wall motion abnormalities, *Statistically significant as p ≤0.05. EF: Ejection fraction, t: Student t-test

RWMA and mitral regurgitation was significantly higher in patients with MI than patients without MI (p =0.019, 0.070 respectively). Diagnostic dysfunction was insignificantly different between patients with and without MI. EF was insignificantly different between the studied groups table 4.

Table (5): Coronary stenosis by coronary angiography in MI patients with or without STE in aVR

Coronary stenosis	**MI with STE in aVR (n =23)**	**MI without STE in aVR (n =26)**	**Test of significance**	**P-value**
LMCA	11(47.83%)	2(7.69%)	x^2 =10.09	**0.001***
LAD	16(69.57%)	13(50.00%)	x^2 =1.93	0.164
LCx	11(47.83%)	5(19.23%)	x^2 =4.54	**0.033***
RCA	15(65.22%)	6(23.08%)	x^2 =8.849	**0.003***

MI: Myocardial infarction, x^2: chi-square test, LMCA: Left main coronary artery, LAD: Left anterior descending, LCx: Left circumflex, RCA: Right coronary artery, *Statistically significant as p ≤0.05.

LMCA, LCx and RCA stenosis were significantly higher in MI patients than non-MI patients (p =0.001, 0.033, 0.003 respectively). There was no significant difference in LAD stenosis between patients with or without MI table 5.

Table (6): Number of vessels affected in MI patients with or without STE in aVR

Number of vessels	**MI with STE in aVR (n =23)**	**MI without STE in aVR (n =26)**	**Test of significance**	**P-value**
Single vessel	2(9%)	10(38%)	x^2 =11.64	**0.009***
2 vessels	5(22%)	4(15%)		
3 vessels	10(43%)	2(8%)		

ACS: Acute coronary syndrome, STE: ST-segment elevation, aVR: aVR: Augmented vector right, x^2: chi-square test, RWMA: Regional wall motion abnormalities, *Statistically significant as p ≤0.05.

Table 6; showed that there was significant difference in number of affected vessels in patients with or without myocardial infarction.

Table (7): Suggested management in MI patients with or without STE in aVR

Suggested management	MI with STE in aVR (n =23)	MI without STE in aVR (n =26)	Test of significance	P-value
PCI	10(43.48%)	13(50.00%)	x^2 =0.21	0.648
CABG	10(43.48%)	3(11.54%)	x^2 =6.39	**0.012***
Medical management	4(17.39%)	12(46.15%)	x^2 =4.59	**0.032***

MI: Myocardial infarction, x^2: chi-square test, PCI: Percutaneous Coronary Intervention, CABG: Coronary artery bypass graft, *Statistically significant as p ≤0.05.

Table 7; showed that there was no significant difference in PCI between in patients with or without myocardial infarction. CABG was significantly higher in MI with STE in aVR compared to MI without STE in aVR (P=0.012). Medical management was significantly lower in MI with STE in aVR compared to MI without STE in aVR (P=0.032).

Discussion:

The present study classified the ACS patients into myocardial infarction patients with or without STE in aVR according to the elevated troponin or cardiac enzyme level for identifying patients at increased risk for death or the development of acute myocardial infarction (MI).

Furthermore, the current finding showed that patients with myocardial infarction (MI) had no significant difference in SBP, DBP, and HR between the MI with STE in aVR and MI without STE in aVR groups.

In line with our presented outcome, ***Wong et al.***[4] who evaluated the prognostic implications of aVR ST elevation during ST elevation acute myocardial infarction (AMI). The results reported that SBP and DBP had no significant difference between MI patients with STE in aVR and MI without STE in aVR groups.

Nevertheless, ***Aygul et al.*** [5] reported discrepant results in their study conduct on 950 MI patients to investigate the value of ST elevation in lead aVR in predicting the left anterior descending coronary artery (LAD) occlusion site proximal to first septal perforator (S1) and its effect on in-hospital outcome in MI patients. The findings showed that there was a statistically significant elevation in SBP and DBP in MI with STE in aVR group in comparison with MI without STE in aVR group. This difference could be justified by larger recruited sample size in addition to ethnic consideration.

In the present study, it was found that RWMA and mitral regurgitation (MR) was significantly higher in MI patients with STE in aVR compared to MI patients without STE in aVR (p =0.019, 0.06 respectively).

Further, ***Garg et al.*** [6] was contrasted to our results regarding RWMA and mitral regurgitation as there was no significant difference between MI with STE in aVR and MI without STE in aVR.

The contradictory results regarding MR severity could be related to different baseline characteristics, coronary artery risk factors, and time of performing echocardiography[7].

Our results revealed that the LMCA, LCx and RCA stenosis were significantly higher in MI with STE in aVR than MI without STE in aVR (p =0.001, 0.033, 0.003 respectively). There was no significant difference in LAD stenosis between patients with or without MI.

Our findings are in consistent with ***Aygul et al.*** [5] who concluded that LMCA, RCA, LCx and LAD occlusion in MI with STE in aVR group was more than MI without STE in aVR group.

Depending on our results, there was significant increase in number of affected vessels in MI patients with STE aVR group in comparison with MI without STE aVR group.

This results are in agreement with ***Gupta et al.*** [8] who attempted to determine the relationship between presenting clinical status and coronary artery disease risk factors and ST-segment deviation in lead aVR. It was found that patients with more significant ST-segment elevation in lead aVR have a worse clinical condition at presentation than those with less or no ST elevation. Multivessel coronary artery disease is more likely in patients with ST-segment elevation in aVR >0.5 mm.

Our results are harmonious with ***Aygul et al.*** [5] who investigated that 3-vessel disease had a higher prevalence in the MI patients with STE aVR group. Significant vessel disease was more prevalent in the MI patients with STE aVR group compared to MI without STE in aVR group. Collectively, MI patients with STE aVR was suggestive of significant vessel disease.

In the current study, there was no significant difference in PCI between MI patients with STE aVR group and MI without STE aVR group.

The obtained data in the present study come in line with ***Aygul et al.*** [5] who observed that there was no statistically significant difference in PCI in both MI patients with STE aVR group and MI without STE aVR group.

CABG was significantly higher in MI with STE in aVR compared to MI without STE in aVR (P=0.012).

Our findings are in harmony with ***Aygul et al.*** [5] who reported that CABG in MI with STE in aVR showed a significant management compared to MI without STE in aVR ($p < 0.01$)**.**

Medical management was significantly lower in MI with STE in aVR compared to MI without STE in aVR (P=0.032).

In contrary, ***Aygul et al.*** [5] found that there was no significant difference between MI with STE aVR and MI without STE in aVR regarding MI management via medications.

Conclusions

Acute coronary disease with STE in aVR is associated to worse clinical condition at presentation. Moreover, STE in aVR could be used as a significant predictor for left main coronary artery (LMCA) stenosis (OR: 14.67 and p value <0.001) and 3 vessels disease (OR:

3.97, p value =0.004). In addition, GABG considered the best management to improve ASC with STE in aVR

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