

Association of Quantitative ST- Segment Depression with Early Mortality Among Naive Patients of Non-ST-Segment Elevation Acute Coronary Syndrome

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Author's Contribution

^{1,4}Substantial contributions to the conception or design of the work; or the acquisition, analysis, or interpretation of data for the work, data collection, manuscript writing, ²Final approval of the version to be published, ^{3,5}Active participation in active methodology, ⁶Literature review, data analysis

Funding Source: None

Conflict of Interest: None

Received: Jan 08, 2022

Accepted: June 17, 2022

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ABSTRACT

Objective: To determine the association of quantitative ST– segment depression with early mortality within 30 day in patients with first non-ST – segment elevation acute coronary syndrome (NSTEMI-ACS).

Methodology: This descriptive case series study was conducted at the cardiology department of LUMHS, from October 2016 to March 2017. Patients with NSTEMI-ACS and positive cardiac biomarkers, patients older than 25 years and both genders admitted to CCU were included. The ST-Segment depression was assessed on 12 lead electrocardiography. The ST segment is the line that starts from the end of the QRS complex (J wave) to the beginning of the T wave. Normally ST segment is straight line and, isoelectric to base line, ST segment depressed below isoelectric line is said ST depression, down sloping or flat depressed ST segments indicate coronary ischemia, more than 0.5 mm ST depression significant for ischemia. All patients were followed for 30-days for early mortality. All information obtained was recorded on the study Performa.

Results: A total of 148 cases with acute myocardial infarction were integrated; the patient's average age was achieved as, 42.5±5.43 years, and males were in the majority 96(64%). On electrocardiography, ST-Segment depression was found in 60.13%, which is further divided into 0.5mm, >0.5-0.9 mm, >1-1.9 mm, and >2 mm with percentages of 12.83%, 22.29%, 16.89%, and 8.12%, respectively. Short term mortality was significantly associated with the severity of ST segment depression score (p-value 0.001).

Conclusions: In the study conclusion, the severity of ST-Segment depression score was observed to be significantly correlated with short term mortality (30-day) in cases with early NSTEMI-ACS.

Key words: NSTEMI, ACS, ST-Segment depression, short term mortality.

Cite this article as: Shah GF, Memon SH, Haider A, Memon AA, Almas T, Rani S. Association of Quantitative ST- Segment Depression with Early Mortality Among Naive Patients of Non-ST-Segment Elevation Acute Coronary Syndrome. *Ann Pak Inst Med Sci.* 2022; 18(2):84-88. doi. 10.48036/apims.v18i2.662

Introduction

Acute coronary syndrome incorporates the non–ST segment elevation myocardial infarction (NSTEMI), unstable angina and ST segment elevation myocardial infarction (STEMI).¹ The terminology covers the whole spectrum of symptoms linked to a shared pathophysiology along an acute ischemic heart disease severity gradient. In the US, ACS is one of the main causes of mortality. The inability to detect ACS can result

in delayed and inadequate therapy because several treatments have been shown to reduce mortality when used to treat ACS. Due to delays in diagnosis brought on by cardiac troponin testing to differentiate between NSTEMI and UA, the majority of patients with NSTEMI-ACS frequently need lengthy hospitalizations in the emergency room.² While, ST-segment elevation myocardial infarction (STEMI) individuals can be

identified without the need for laboratory testing based on clinical symptoms and electrocardiography (ECG) data.^{2,3}

A stable plaque, vasospasm such as in Prinzmetal angina, a coronary embolism, or coronary arteritis are instances of conditions that might decrease blood flow. NSTEMI can also result from non-coronary heart damage such as cardiac contusion, myocarditis, or the presence of cardiotoxic chemicals.⁴ Moreover, because the greater oxygen requirement cannot be addressed, disorders that are mostly unrelated to the coronary arteries or the myocardium itself, like hypertension, hypotension, pulmonary embolism, aortic stenosis, and tachycardia, can induce NSTEMI.⁴⁻⁶ Given the urgency, potential underlying illness that might endanger life, and frequently vague first signs, the examination of suspected acute coronary syndromes is difficult.⁷ T-wave inversions or ST-segment depressions on the ECG may be present in NSTEMI, however they are not always present and are not required for diagnosis.⁵ NSTEMI can be distinguished from unstable angina by having an elevated concentration of a circulating myocardial necrosis biomarker, like cardiac troponin I or T (cTnI or cTnT) or creatine kinase-myocardial band (CK-MB), which is typically characterized by an initial rise, peak, and then fall in biomarker accumulation.^{7,8} On the other hand, it is reported that, in NSTEMI ACS, it has been demonstrated that a quantitative study of the ECG can offer prognostic value.⁹ In particular, it has been demonstrated that the existence of ST-segment depression during the acute episode is a potent and reliable predictor of long-term death.⁹ Recently it is observed that the depression of the ST segment at presenting Patients' in-hospital mortality is linearly correlated with the predictive value of the ECG in those with NSTEMI.¹⁰ So, Echocardiographic Wall Motion Score and Quantitative ST-Segment Depression may help us to identify high-risk patients with non-ST-segment elevation acute coronary syndromes (NSTEMI) to undergo early or very early coronary intervention by coronary angiography followed by Percutaneous Coronary Intervention (PCI). If ST-segment depression and other ECG ischemia characteristics may be quantitatively analyzed to improve prognostic distinction, it is yet unclear.⁹

Therefore this study has been done to evaluate the association of quantitative ST-segment depression with early mortality within 30-day in patients with first non-ST-segment elevation acute coronary syndrome.

Methodology

This descriptive cross-section study was conducted at the cardiology department of LUMHS, from October 2015 to March 2016. 148 patients were randomly selected and a non-probability sampling technique was used. All patients with ACS and positive cardiac biomarkers who were over the age of 25 and of either gender were included. All the cases without chest pain in whom non-ST-ACS was unclear, cases with known previous infarction or with unknown infarction but with Q waves on admission electrocardiography, cases having previous CABG surgery, STEMI, cases having hypertrophic or dilated cardiomyopathy were excluded. After informed consent, the ECG and biomarkers for echocardiography were performed. Routine blood tests were performed within 4-6 hours of admission, and cardiac enzyme CK-MB, Troponins, and echocardiography were performed within 24-48 hours of admission. These patients were managed indoors on standard protocol for NSTEMI ACS. The troponin T was done qualitatively Troponin T kit manufactured by Roche Germany. The ST-Segment depression was assessed on 12 lead electrocardiography.

The ST segment is the line that starts from the end of the QRS complex (3 waves) to the beginning of the T wave. Normally ST segment is straight line and, isoelectric to base line, ST segment depressed below isoelectric line is said ST depression, down sloping or flat depressed ST segments indicate coronary ischemia, more than 0.5 mm ST depression significant for ischemia. ST depression was categorized as <0.5 mm, 0.5-0.9 mm, 1-1.9 mm and >2 mm. All patients were followed for 30-days for early mortality due to cardiac events. All information obtained was recorded on a standard Performa attached. Data was processed and analyzed using SPSS version 26.0.

Results

In our study overall, 148 cases with NSTEMI acute coronary syndrome were included; the patient's age was observed as, 42.5±5.43 years. The majority of cases 64(42.6%) were observed in the age group of 46- 55 years. Males were found in the majority and most of the cases were found with an ejection fraction <40% and 40.52% of the cases were noted with an ejection fraction of more than 40%. The results relating to risk factors are shown in Table I.

On electrocardiography, ST-Segment depression was found in 60.13%, which is further divided as <0.5mm, m >0.5-0.9 mm, >1-1.9 mm, and >2 mm with percentages of 12.83%, 22.29%, 16.89%, and 8.12%, respectively. (Table II)

Short term mortality was significantly associated with the severity of ST-Segment Depression. 13 patients out of 30 cases were noted with ST-Segment Depression > 2 mm, p-value 0.001. (Table III)

Table I: Patients distribution according to age and gender (n=148)

Variables	N (%)
Age	42.4±5.43
Gender	Male 95(64.2%)
	Female 53(35.8%)
Hypertension	104(70.3%)
Diabetes	42(28.4%)
Smoking	70(50.7%)
Dyslipidemia	41(27.7%)
Family history	31(20.9%)
Obesity	40(27.0%)

Table II. Electrocardiography ST-Segment Depression (n = 148)

Risk factors	ST-Segment Depression	N	%
Present	<0.5 mm	19	12.83%
	>0.5-0.9 mm	33	22.29%
	>1-1.9mm	25	16.89%
	>2 mm	12	8.12%
	Total	89	60.13%
Absent		59	39.87%
Others		22(14.9%)	

Table III: Wall motion score and short-term mortality (n=30)

Variable	ST-Segment Depression				P-value
	<0.5 mm	>0.5-0.9 mm	>1-1.9 mm	>2 mm	
Mortality	5/3.37%	5/3.37%	7/4.72%	13/8.78%	0.001
Risk factors	Ejection fraction				
	<40%			88(59.48%)	
>40%				60(40.52%)	

Discussion

The second biggest cause of mortality in developing nations is acute coronary syndrome (ACS), which continues to be the world's biggest cause of death in developed nations.¹¹ Clinically significant troponin levels and the severity of ST-segment depressions may serve as reliable prognostic indicators.¹¹ This study has been done to assess the association of quantitative ST-segment depression with early mortality within 30-day in patients with first non ST-segment elevation acute coronary syndrome (NSTEMI-ACS). In this study average age of the

patients was 42.5±5.43 years and male were in majority 96(64%). Consistently Sawar S et al¹⁰ reported that the patient's average age was 56.65±10.86 years and males were in majority 80.8% compared to the females 19.2%. On other hand Shaikh MK et al¹² also conducted the study to assess whether there is a correlation between both the Grace Risk Score and In-hospital death rate in Pakistani individuals diagnosed with NSTEMI AND UA and consistently they reported that the average age of the patients was 60±0.07 years and males were most common 69.1% out of all 530 study participants. In the support of this study Zahid MA et al¹¹ reported that the average age of the subjects was 55.9±9.1 years, males were predominant with the male-female ratio of 2:1.

In this study on electrocardiography ST-Segment depression was found in 60.13%, which is further divided as <0.5mm, m >0.5-0.9 mm, >1-1.9 mm and >2 mm with percentage of 12.83%, 22.29% 16.89% and 8.12% respectively and short-term mortality was significantly associated with severity of ST-Segmental Depression (p=0.001). Consistently Zahid MA et al¹¹ reported that the patients using an analysis of ST segmental depression, 51 patients (56.7%) had ST-segmental depression 0 mm, 34 patients (37.8%) ST-segmental depression 1-2 mm, five patients (5.6%) cases had ST-segmental depression >2 to 3mm, while no any cases was found with ST segment depression >3 mm and furthermore inconsistently they observed that the only one patients died during the hospital stay, although between the groups, there has been no noticeable difference in mortality (p=0.457).¹¹

Our findings were also supported by the study of Sawar S et al¹⁰ as they reported that the ST segmental depression < 2 mm was observed in 41.6% and 58.4% of the respondents had ST segmental depression ≥2 mm and consistently they observed that the degree of ST segment depression and in-hospital mortality were statistically significantly correlated. Our findings were also correlated with the observations of the study by Savonitto S et al⁹ as the total amount of ST-segment depression across all ECG leads in individuals having NSTEMI ACS is a strong predictor of all-cause death at 30 days, regardless of clinical factors, and it is correlated with the intensity and severity of coronary artery disease. Even just a little amount of ST-segmental elevation (1 mm) in the anterior or inferior leads is individually linked to poor outcomes.⁹ The degree of ST segment deviation on admission ECG is not only a short- and long-term predictor of death but also of additional problems.^{13,14} Despite considerable advancements in cardiac therapy and its management,

acute myocardial infarction (AMI), which encompasses ST elevation MI and non-ST elevation MI, continues to be one of the world's top causes of mortality.^{15,16} In the support of this study Awan MS et al¹⁷ also concluded that the proportion of ST-segment depression on admission from standard 12 leads in individuals having NSTEMI, the ECG is a reliable indicator of in-hospital death.

Additionally, a greater degree of ST segment depression on the admissions ECG is substantially linked to higher in-hospital mortality in non-ST elevation MI.¹⁷ T-wave inversion, transitory ST-segment elevation, ST-segment depression, or a combination of any of these abnormalities may be seen on the ECG in individuals with NSTEMI. Depending on the intensity of the incident, 30–50% of individuals might be presented with either of these results. A crucial and accurate indicator of myocardial ischemia and prognosis is a novel deviation in the ST-segment of even 0.05 mV.^{17,18}

Conclusion

It was concluded that echocardiographic ST-Segment depression was significantly associated with short-term mortality within 30 days in patients with early non-ST-Segment elevation acute coronary syndrome. Further large-scale studies are recommended to assess the more accurate results regarding ST-Segment depression with short term mortality in patients with early non-ST-Segment elevation acute syndrome

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