

Associations between ECG Changes and Echocardiographic Findings in Patients with Acute Non-ST Elevation Myocardial Infarction

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Abstract

Original Research Article

Background: STEMI shows specific ECG changes due to sudden coronary blockage, but NSTEMI has varied ECG characteristics, including ST depressions and T wave inversions. Echocardiography, especially tissue Doppler imaging and speckle tracking, is crucial for diagnosing and predicting outcomes in acute coronary syndrome. The study aims to correlate ECG changes with echocardiographic findings in NSTEMI, offering potential diagnostic insights. **Objective:** The study aims to connect ECG alterations with echocardiographic findings in NSTEMI patients. **Methods and Materials:** This cross-sectional study took place from January to June 2023 at a Mymensingh Medical College Hospital, Mymensingh, Bangladesh. The research included 109 NSTEMI patients, both with and without cardiac history. Inclusion criteria were age above 30 and ischemic type of chest pain. **Results:** Out of 109 admitted patients, 67.4% were male and 6.4% were female. The average age was 54.34 ± 2.31 years, and prevalent conditions included 7.3% with diabetes, 11% with dyslipidemia, and 0.9% with edema, while 73% had a family history of ischemia. **Conclusion:** There were inconsistencies between the ECG and Echo in identifying the site of the infraction in the MI patients. Pulmonary hypertension, infection, ischemic stroke, and inferonasal regional wall motion abnormalities. Maximum no association was found in ECG changes and echocardiographic findings with acute non-ST elevation myocardial infarction.

Keywords: Non-ST elevation infarction ECG, Echocardiography, Troponin-I.

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INTRODUCTION

In ST-elevation myocardial infarction (STEMI), abrupt coronary blockage leads to transmural myocardial ischemia, characterized by ST elevations and strong positive T waves on the ECG. The ischemic myocardial region determines ECG ST elevations [1]. However, non-ST elevation myocardial infarction (NSTEMI) is a diverse clinical syndrome with unpredictable pathophysiology. STD and TWI are typical ECG abnormalities in NSTEMI patients. Without regard to cardiac anatomy, STD is usually found in V4-V6 lateral precordial leads [2-4]. TWI in precordial leads V1-V3/V4 induced by a lesion in the left anterior descending coronary artery (LAD) is an example of how TWI on the ECG can indicate the culprit artery in acute coronary syndrome [4]. Acute myocardial infarction (MI) diagnosis and risk classification depend on ECG echocardiography [5]. In acute coronary syndrome patients, tissue Doppler

imaging and echocardiography are useful diagnostic and prognostic tools [6]. Their clinical evaluation of NSTEMI patients is being investigated.

Our study aimed to assess the correlation between ECG alterations and echocardiographic findings in acute NSTEMI patients.

OBJECTIVE

The objective of this study was to find out the associations between ECG changes and echocardiographic findings in patients with acute non-ST elevation myocardial infarction

METHODS AND MATERIALS

This is a cross-sectional observational study design. Patients were recruited from January 2023 to June 2023 at the Mymensingh Medical College Hospital, Mymensingh, Bangladesh. 109 NSTEMI

patients with and without cardiac history were recruited ECG. The sample size was 109 patients admitted to the hospital. The inclusion criteria include patients aged above 30 years old and having or without ischemic heart disease patients.

Exclusion criteria included considerable valve stenosis or regurgitation (grade 2 or above), past MI, non-sinus rhythm, pacemaker, wide QRS complex (N120 ms), and serious lung disease or pathology, such as infection or pericardial effusion. The local ethical committee accepted the study protocol, and each patient signed an informed consent form before enrolling.

Cardiac Examination

During their hospital stay, all patients underwent Echocardiogram, RBS, Creatinine and lipid profile biomarker, and 12-lead ECG tests were performed per hospital procedure. The hospital typically recorded a 12-lead ECG upon arrival and at least once during the stay. The analysis employed the ECG nearest to the echocardiographic study time.

Data Collection and Analysis

Data are presented as means along with standard deviations for regularly distributed variables and medians with ranges for continuous variables. Baseline characteristics were compared between groups

using independent samples. Fisher's exact test for categorical variables and Student's t-test for continuous variables.

Analyzing group differences with independent samples t-tests for normally distributed variables or independent samples Mann Whitney Skewed distribution variables were studied using the U test, while categorical variables were analyzed using the X2/Fishers exact test. Spearman correlations were used to calculate associations between variables. A regression analysis tested univariate associations while a linear forward regression analysis tested multivariable associations. Tables 3 and 4 reveal tested variables. Statistics were run with IBM SPSS Statistics for Windows, Version 23.

The Echocardiogram was performed with vivid TM E95 (version 203 documentation by GE) by adult TTE probe M5Sc-D standard phased array 1.4-4.6 MHz multi-frequency transducer. Regional wall motion calculated by modified by Simpson biplane method and 2-D guided M-mode method at the department of cardiology, Mymensingh Medical College Hospital.

RESULTS

Table 1: Characteristics of the study population

Variables	Mean/ N=109	SD/ Percentage %
Sex		Sex (male)
Male	74	67.4
Female	7	6.4
Age	54.34	12.31
Systolic blood pressure (mm Hg)	128.22	22.87
Diastolic blood pressure (mm Hg)	85.48	14.10
BMI (kg/m ²)		
Average	7	6.4
Malnourished	1	0.9
Hypertension		
Present	15	13.8
Absent	6	5.5
Diabetes		
Present	8	7.3
Absent	6	5.5
Ischemic Type of chest pain	95	87.2
Dyahpidaemia		
Present	12	11
Absent	7	6.4
Oedema		
Present	1	0.9
Absent	10	9.2
Family history of IHD		
Present	8	7.3
Absent	4	3.7
Smoking		
Yes	22	20.2
No	2	1.8

Table 1 shows the total number of patients admitted in the hospital was 109 where the number of male patients admitted to hospital during the study period was 74 which consist around 67.4% of the total sample and female patients were 7 consisting 6.4% of the total admitted patients during the study period. The mean age of the participants was 54.34 ± 2.31 years and mean systolic Blood pressure was 128.22 ± 22.87 mmHg and diastolic blood pressure was 85.48 ± 14.10 mm Hg.

Among the patients 0.9% of the patients were malnourished and 7.3% of the patients had diabetes. 87.2% of the patient's Ischemic type of chest pain present. 11% and 0.9% of the patients had dyahpidaemia and oedema respectively. 73.% of the patients had a record of a family history present of ischemia. Smokers were 20.2% in the study with a frequency of 22 patients.

Table 2: Association of ECG and Echocardiography Findings

Name of disease	Apical wall hypokinesis	No RWMA	Lateral wall hypokinesis	Septal wall hypokinesis	Basal septal wall hypokinesis	Anterior wall hypokinesis	Anterior & Inferior wall hypokinesis	Inferior wall hypokinesis
Lateral Ischemia	2(1.8)	1(0.9)	1(1.8)	2(1.8)	0	1(0.9)	0	1(0.9)
Anterior Ischemia	4(3.7)	5(4.6)	0	15(13.8)	0	5(4.6)	0	0
Inferior Ischemia	2(1.8)	9(8.3)	0	9(8.3)	0	0	0	3(2.8)
Anteri & Inferior Ischemia	0	1(0.9)	0	3(2.8)	1(0.9)	1(0.9)	1(0.9)	0
Anterior& Septal Ischemia	0	0	0	1(0.9)	0	1(2.5)	0	0
Inferior& Septal Ischemia	0	0	0	1(0.9)	0	0	0	0
Anterior & Lateral Ischemia	0	0	0	1(0.9)	0	0	0	0

$X^2 = 111.84$, 5% significance value= 0.614, No RWMA= No region wall motion abnormalities.

Table 2 shows ECG changes and Echocardiography findings where a higher percentage of the patients have Anterior Ischemia and Septal wall hypokinesis 13.8% and inferior ischemia with No

RWMA 8.3% of the patients. But in this association significance level is larger than 5% which indicates no association is present in ECG changes and Echocardiography findings.

Table 3: Serum Troponin I level findings

Name of test	Male		Female	
	Mean	SD	Mean	SD
Serum Troponoin I ng/dl	4.63	7.4	2.61	4.8

Table 3, shows the serum troponin I level in both male and female groups. The level is higher in males (4.63 ± 7.4 ng/dl) serum troponin I levels than in female groups (2.61 ± 4.8 ng/dl)

outcomes in patients with acute STEMI [9, 10]. NSTEMI patient data, however, are scarce. We are not aware of any prior research that examined ECG and echocardiogram parameters using more modern imaging techniques. It is crucial to recognize these people using additional diagnostic modalities, such as echocardiography, in light of the high prevalence of NSTEMI patients with a wholly occluded culprit artery and the limits of the ECG to detect this subgroup. But our study did not demonstrate a relationship between ECG changes and echocardiography-based indicators. Surprisingly, regional echocardiographic alterations matched the ischemia ECG regions. NSTEMI patient

DISCUSSION

Information about the clinical use of novel echocardiographic modalities in coronary artery disease is beginning to emerge. According to several studies and a recent meta-analysis, the strain obtained by speckle tracking echocardiography is related to overall left ventricular function and is useful for predicting

data, however, are scarce. We are not aware of any prior research that examined ECG and echocardiogram parameters using more modern imaging techniques. It is crucial to recognize these people using additional diagnostic modalities, such as echocardiography, in light of the high prevalence of NSTEMI patients with a wholly occluded culprit artery and the limits of the ECG to detect this subgroup [11]. The distribution of STD in the 12 ECG leads did not correlate with the sites of wall motion abnormalities in Echo in this study's NSTEMI (STD and TWI) patient population, which had sub-endocardial ischemia. Contrary to what Kuch J. *et al.*'s research from Poland found, more than half of the patients with apical hypokinesis that was picked up by Echo also had both antero-septal and anterior wall MI. In 209 patients (32%) with Echo-2D-diagnosed myocardial contractility anomalies in the apical region of the heart, several MI localizations were found by ECG.

Limitations of the Study

Our investigation has definite restrictions. The number of patients was minimal. Therefore, as CMR was not included in the protocol, all hypotheses regarding pathophysiological causes should be viewed as speculative. Details study regarding

CONCLUSION

The fatality rate from MI is substantially higher than it is everywhere in the world. There were inconsistencies between the ECG and Echo in identifying the site of the infarction in the MI patients. Patients with MI should receive care that is individualized for their unique risk factors and underlying reasons. Furthermore, real-time Echo, standardized ECG biomarkers and ECG monitors should be accessible round-the-clock in both emergency and intensive care units.

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