Extent of ST-Segment Depression Predicts In-Hospital Outcome in Non ST-Segment Elevation Acute Coronary Syndrome

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Abstract:

Key words:
NST-ACS, ST-depression, ECG.

Background: *The presence of ischemic ECG changes on admission has been shown to predict outcome, the relationship between the extent of ECG changes and the risk of cardiac events is still ill defined. The severity of ST-segment depression on admission ECG has a strong association with adverse in-hospital outcome in patients with non ST-segment elevation acute coronary syndrome. The study was done to observe the extent of ST-segment depression and in-hospital outcome in patients with non ST-segment elevation acute coronary syndrome.*

Methods: *This study was conducted in the Department of Cardiology in NICVD Dhaka, from January 2006 to December 2007. Considering inclusion and exclusion criteria, a total of 183 patients were evaluated. All the patients were evaluated clinically after admission. ECG, blood biochemistry and echocardiography were done. Patients were categorized into three groups according to the extent of ST- segment depression.*

Results: *In this study, analysis of the baseline parameters revealed no statistically significant difference among the three groups of patients (p>0.05). Mean sum of the ST-segment depression analysis was done and all mean values were more in group III patients. 41.0% patients developed complications during the study period. Acute LVF (22.9%) was the most common complication followed by arrhythmia (11.5%), cardiogenic shock (4.4%) and STEMI (2.2%). All the complications were more in group III patients. During this period 6% patients died and more death (12.3%) was observed in group III patients.*

Conclusion: *The amount of ST-segment depression is a powerful predictor of adverse in-hospital outcome in patients with non ST-segment elevation acute coronary syndrome.*

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Introduction:

Cardiovascular diseases are presently the leading causes of death in industrialized countries and expected to become so in emerging countries by 2020.[1] Acute coronary syndromes are major health problem and represent a large number of hospitalizations annually. Patients with an acute coronary syndrome include those whose clinical presentations cover the following range of diagnosis: ST elevation MI (STEMI), MI without ST elevation (NSTEMI) and Unstable angina. Non-ST-segment elevation acute coronary syndrome (NSTE-ACS) represents the majority of admission to coronary care unit.[2] In unstable angina and NSTEMI the 12 lead surface ECG on admission can give important information about the site and extent of ischemia. Antman et al [3] showed that in those patients the number of leads showing ST depression indicates size and severity of the ischemic area.

Non ST-segment elevation myocardial infarction and unstable angina are more heterogenous in their presentation and may be poorly characterized in clinical practice, leading to greater variation in diagnosis and treatment. Rapid risk stratification is crucial for appropriate management of these patients and for targeting more potent and invasive therapies for higher risk patients. Early adequate medical and interventional treatment has been shown to substantially reduce cardiac events.

The admission electrocardiogram (ECG) may identify high-risk patients who will benefit most from adequate treatment, particularly in high risk-

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patients. The presence of ST segment depression during an acute episode has been shown to be a powerful and independent predictor of long term mortality;[4] Savonitto et al.[5]ST segment depression and other ECG ischemic variables may allow further prognostic discrimination.

Although the presence of ischemic ECG changes on admission has been shown to predict outcome, the relationship between the extent of ECG changes and the risk of cardiac events is still ill defined. However, such type of study was not done previously in our country.

Methods:

The study was carried out at the Department of Cardiology, National Institute of Cardiovascular Diseases, Dhaka from January 2006 to December 2007.Considering inclusion and exclusion criteria, 183 patients were included in the study. Patients having ischemic symptoms at rest and within 12 hours of admission ECG showing ST-segment depression were enrolled in this study. Patients were categorized into three groups according to the extent of ST-segment depression.

Group I: ST-segment depression <1 mm in two or more contiguous leads, Group II: ST-segment depression ≥1 to < 2 mm in two or more contiguous leads and Group III: ST-segment depression ≥2 mm in two or more contiguous leads.

After selection of the subjects, the objectives and the procedure of the study were explained to the subjects in details and their informed consent was taken. Detailed history and clinical examination was taken and all information was recorded in a standard prefixed questionnaire. Age, sex, height, weight were noted. Risk factor profile like hypertension, diabetes, dyslipidaemia, smoking and family history of coronary artery disease (CAD) was recorded. Pulse, blood pressure, angina pectoris (according to CCS class), myocardial infarction, peripheral vascular disease and stroke were recorded. RBS, blood urea, serum creatinine, serum electrolytes, serum Troponin I was done for each patient.

Standard 12 lead ECG was recorded on admission at a paper speed of 25 mm/sec. ST-segment depression was judged to be present if the J point is depressed >0.5 mm. Patients were categorized in to three groups according to the extent of ST-
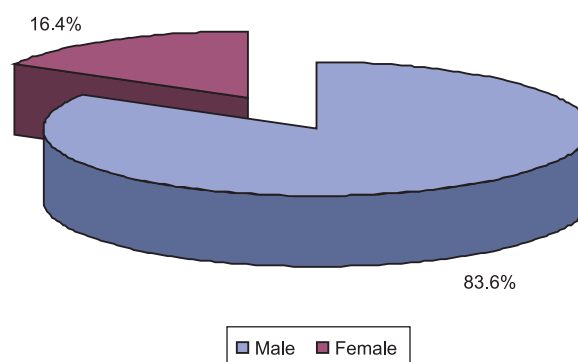
segment depression. For patient having variable ST-segment depression in different leads, maximum ST-segment depression was taken. Left ventricular ejection fraction (LVEF) was noted. In-hospital outcome such as- arrhythmia, acute left ventricular failure, cardiogenic shock, ST elevation MI, thromboembolism and death were noted.

Results:

Mean age of the study patients was 51.6±10.1 years. 37.7% of the patients were in the age group of 50-59 years .Only 5.5% patients were <40 years of age.(Table-I) 83.6% patients of the study were male and 16.4% patients were female. Male and female ratio was 5.9:1. (Figure-I)

Table-I
Distribution of the patients by age (n-183)

Age (years)	Group I (n=55) No.	%	Group II (n=63) No.	%	Group III (n=65) No.	%	Total (N=183) No.	%	p value
30 – 39	4	7.3	3	4.8	3	4.6	10	5.5	0.178
40 – 49	20	36.4	12	19.0	14	21.5	46	25.1	
50 – 59	21	38.2	27	42.9	21	32.3	69	37.7	
60 – 69	9	16.4	6	9.5	13	20.0	28	15.3	
≥70	1	1.8	15	23.8	14	21.5	30	16.4	
Mean±SD	50.0± 8.8		51.5±10.3		53.3± 9.7		51.6±10.1		

Fig.-1: *Distribution of the patients by sex (n-183)*

Smoking (77.6%) was most prevalent in all groups and highest in group III (83.1%) followed by hypertension (48.1%), family history of CAD (31.7%), diabetes mellitus (23%) and dyslipidemia (14.2%) respectively (Table-II). Among the study population 61.2% patients were diagnosed as unstable angina and 38.8% patients were of NSTEMI. Most of the patient were diagnosed as Unstable Angina (58·2%) in group I and group II (81·0%) but in group III 55·4% were NSTEMI.

Table-II

Distribution of the patients by risk factors (n-183)

Risk factors	Group I (n=55) No.	%	Group II (n=63) No.	%	Group III (n=65) No.	%	Total (N=183) No.	%	p value
Diabetes mellitus	15	27.3	15	23.8	12	18.5	42	23.0	0.510
Hypertension	29	52.7	30	47.6	29	44.6	88	48.1	0.672
Smoking	43	78.2	45	71.4	54	83.1	142	77.6	0.285
F/H of CAD	15	27.3	24	38.1	19	29.2	58	31.7	0.163
Dyslipidemia	5	9.1	8	12.7	13	20.0	26	14.2	0.160

All the patients were evaluated echocardiographically to see the LV ejection fraction. Ejection fraction was 53·5± 7·3% in group III followed by 59.6±7.2% in group II and 61·5± 9·4% in group I.

Mean sum of the ST- segment depression in all leads were 0·22±0·14 mm in group I, 0·42 ±0·15 mm in group II and 1·25± 0·70 mm in group III. In anterior leads highest mean of sum of ST- segment depression (V4-V6) was 1·0± 0·67 mm (Table-III).

59.0% patients had uneventful course in the study period but 41.0% patients had complications. All the complications were more in group III patients (Figure-2). Arrhythmias were more in group III patients. Supraventricular tachycardia (3.8%) was the most common arrhythmia followed by atrial fibrillation (3.3%), ventricular tachycardia (2.2%) and complete heart block (2.2%) (Table-IV). 22.9% patients developed acute LVF and it was the most common complication of all the three groups, followed by arrhythmia (11.5%), cardiogenic shock (4.4%) and STEMI (2.2%). In-hospital mortality was 6% in the study populations and it was significantly higher in group III (12.3%) than in the other groups (Table-V)

Table-III

Mean-sum of the ST- segment depression of the study patients (n-183)

Mean-sum of the ST- segment depression (mm)	Group I (n=55) Mean± SD	Group II (n=63) Mean±SD	Group III (n=65) Mean±SD	p value
In all leads	0.22± 0.14	0.42± 0.15	1.25± 0.70	0.001
In inferior leads	0.44±0.23	0.69±0.43	1.07±0.58	0.001
In anterior leads				
V1-V6	0 .56± 0.39	0.65±0.18	1.89±01.29	0.001
V1-V3	0.50±0.00	0.00 0.00-	2.17±1.76	0.386
V4-V6	0.48±0.17	1.00±0.67	1.29± 0.90	0.001
In high lateral leads	0.44±0.11	0.72±0.31	0.78±0.50	0.001

Table-IV

Distribution of the patients by arrhythmias and conduction disturbance (N=183)

In-hospital Outcome	Group I(n=55) No.	%	Group II (n=63) No.	%	Group III (n=65) No.	%	Total (N=183) No.	%	p value
Arrhythmia	3	5.5	6	9.5	12	18.5	21	11.5	a. 0.182 b. 0.016* c. 0.248NS
Atrial fibrillation	1	1.8	2	3.2	3	4.6	6	3.3	a. 0.215NS b. 0.127NS c. 0.579NS
Supraventri-cular tachycardia	1	1.8	2	3.2	4	6.2	7	3.8	a. 0.215NS b. 0.063NS c. 0.422NS
Ventricular tachycardia	1	1.8	1	1.6	2	3.1	4	2.2	a. 0.466NS b. 0.256NS c. 0.562NS
Complete heart block	0	0.0	1	1.6	3	4.6	4	2.2	a. 0.362NS b. 0.645NS c. 0.362NS

Table-V
Distribution of the patients by other complications (N=183)

In-hospital Outcome	Group I(n=55)		Group II (n=63)		Group III (n=65)		Total (N=183)		p value
	No.	%	No.	%	No.	%	No.	%	
Acute LVF	6	10.9	13	20.6	23	35.4	42	22.9	a. 0.219[NS] b. 0.178[NS] c. 0.014*
Cardiogenic shock	1	1.8	3	4.8	4	6.1	8	4.4	a. 0.362[NS] b. 0.645[NS] c. 0.362[NS]
STEMI	0	0.0	1	1.6	3	4.6.	4	2.2	a. 0.533[NS] b. 0.512[NS] c. 0.291[NS]
Death	1	1.8	2	3.2	8	12.3	11	6.0	a. 0.557[NS] b. 0.053[NS] c. 0.029*

Discussion:

ACS is clinical a event that cause considerable immediate morbidity and mortality and high risk of a further coronary accident within a year[6]. 153 were male (83·6%) and 30 were female (16·4%) with male and female ratio 5·90:1. Mean age of the study patients was 57·6±10·1 years.

Maximum numbers (37.7%) of patients were in 50-59 years group. 62.8% patients were in between 40-59 years. No statistically significant difference regarding age and sex was found between patients of study groups.

South Asians have multiple risk promoters seem to pose potentially atherogenic condition. It may be due to altered metabolic condition, frequent infection, inflammation, constant stress and narrowness of the arteries.[7] CAD most probably occurs in relatively early age groups in our country.

Smoking was the most common risk factor in all patients, followed by hypertension, family history of CAD, diabetes mellitus and dyslipidemia. Smoking was the most prevalent in all the three groups and maximum number of smoking (83.1%) and dyslipidemia (20%) were found in group III patients. There was no statistically significant difference in risk factor distribution in the three groups of patients.

A qualitative analysis of the ECG has been shown to provide prognostic information in NSTE-ACS.[8] More specifically; the presence of ST- segment depression during an acute episode has been shown to be a powerful and independent predictor of long term mortality.[5] However it is still not well understood, whether a quantitative analysis of ST-segment depression and other ECG ischemic variables may allow further prognostic discrimination.

In ECG analysis mean –sum of the ST segment depression in all leads was 0·22±0·14 mm in group I, 0·42±0·15 mm in group II and 1·25±0·70 mm in group III patients. In anterior leads, mean sum of ST-segment depression was more in group III. In high lateral leads (I, aVL), maximum mean sum of ST-segment depression was in group III. Savonitto et al[9] found similar type of mean-sum of the ST-segment depression in their study.

Regarding in-hospital outcome, 41% patients developed complications during the study period and all the complications were more in group III patients. 18.2% patients in group I, 36.5% in group II and 64.6% patients in group III developed complications like acute LVF, arrhythmia, cardiogenic shock and ST elevation MI. Acute LVF (22.9%) was the most common complication, followed by arrhythmia (11.5%), cardiogenic shock (4.4%) and STEMI (2.2%) Ullah et al[10] and Nicod et al [11] found similar type of complications in their study.

Supraventricular tachycardia (3.8%) was the most common arrhythmia observed in the study followed

by atrial fibrillation (3.3%), ventricular tachycardia (2.2%) and complete heart block (2.2%). Al-Khatib et al[12] also found similar incidence of ventricular arrhythmia (2.1%) in their study.

In-hospital mortality was 6% in the study population and more mortality (12.3%) was found in group III patients. Nicod et al[11] found 8.1% in-hospital cardiac mortality in their study.

So, magnitude and distribution of ST-segment depression can determine which patient will benefit from an invasive treatment versus a conservative management strategy. Presence of ST-segment depression on admission ECG is sufficient to propose early invasive treatment to the patient.

Conclusion:
Non ST elevation acute coronary syndromes encompass a wide spectrum of clinical presentation with different baseline risk and extent of coronary disease. Early risk stratification of the patients with non ST-ACS is important. 12 lead surface ECG on admission can give important information about the site and extent of ischemia. ECG is a simple, less expensive, noninvasive, bed side test for detecting ischemia. The most important finding of the present study is that amount of ST-segment depression is a powerful and incremental predictor of adverse in-hospital outcome in patients with non ST-segment elevation acute coronary syndrome. The sum of the ST-segment depression provides much more information than the simple qualitative assessment of ST-segment depression. Early adequate medical treatment and intervention in these patients may substantially reduce cardiac events.

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