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Original Article

Correlation of the ECG changes with Coronary angiographic findings in patients of Unstable Angina

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Abstract

Background: The complications, therapy and prognosis are significantly determined by the extent of coronary artery involvement in unstable angina. Although the 12- lead electrocardiogram (ECG) has been found useful in identifying different coronary arteries involvement in unstable angina, it has traditionally been felt to be incapable of localizing the culprit lesion of different coronary arteries. Such a capability would be important, because unstable angina due to multivessel involvement carry a worse prognosis than those with single vessel lesion.

Objective: The aim of the present study was to find out the ECG changes and extent of coronary artery involvement in patients of unstable angina, then correlate and compare the ECG changes with angiographic findings among these patients group.

Methods: This cross sectional analytical study was conducted from August, 2016 to January, 2017 in the Department of Cardiology, Dhaka National Medical College & Hospital. Patients admitted with chest pain and diagnosed as unstable angina were selected for the study.

A total of 70 patients were enrolled in this study. Among them 2 patients died in hospital due to complications of unstable angina and 6 patients did not agree to do coronary angiogram. Later on, 62 patients who got conventional standard management and subsequently underwent coronary angiography within 15 days of index event were included in the study. Based on the presence of significant ST-segment depression or T wave inversion, the study subjects were divided in to two groups. In group A (n=31), patients with ST-segment depression in at least two consecutive leads. In group B (n=31), patients with T wave inversion in at least two consecutive leads. These different patterns of ECG changes in unstable angina were correlated with angiographic findings and number of coronary arteries involved.

Results: In this study, mean age was (53.3±12.5 in group A Vs 51.5±10.3 years in group B. Male to female ratio of the whole study population was 2.6:1. Left ventricular ejection fraction (LVEF) was in group A and group B(48.35±5.37% Vs 56.7±6.86%).

Regarding the extent of coronary artery involvement. In group A, the presence of SVD was 6.5%,DVD was48.4%,TVD was 38.7% and Normal/Non critical coronary artery disease 6.5%. On the other hand in group B, 45.2%, 6.5%, 0.0% and 48.4% cases respectively. So significantly more patients had extensive coronary artery involvement in patients of having ST segment depression (group A) than patients having T wave inversion (group-B). [P=0.001].

Conclusion: This study showed that significant ST segment depression rather than T wave inversion has better correlation with more extensive coronary artery involvement in patients of unstable angina.

Key words: Unstable angina, electrocardiogram, coronary artery involvement, coronary angiography.

Introduction:

At Present coronary heart disease is the leading cause of mortality and morbidity in industrialized countries and it is emerging as prominent public health problem in developing countries.[1] It is established that 30% of all deaths can be attributed to cardiovascular disease, of which more than half are caused by coronary artery disease(CAD). Globally, of those dying from

cardiovascular diseases, 80% are in developing countries and not in the western world.[2] By the year 2020, CAD will hold first place in the World Health Organization's list of leading cause of disability.[3]

While Bangladesh is turning from agro-based socio economic structure towards industry based setting, coronary heart disease in middle aged and young group is also appearing into scene.[4] The prevalence of CAD in Bangladesh was estimated as 3.3 per thousand in 1976 and 17.2 per thousand in 1986 indicating fivefold increase of the disease by 10 years.[5] Three small scale population based studies showed average prevalence of ischemic heart disease(IHD) 6.5 per thousand population of Bangladesh.[6] According to Bangladesh Bureau of Statistics it is the fourth leading cause of death.[7]

Unstable angina can be defined as angina that occurs at rest or minimal exertion usually lasting more than 20 minutes.[8] Patients with rest angina commonly presented with transient ST-T changes in ECG may show ST segment depression or T wave inversion. ST segment depression carries a higher risk of further events than T wave inversion.[9] The leads in which the changes are seen give some indication as to the area of myocardium affected and the likely culprit artery.[10-11]

The varied Pathophysiology and outcome of patient's admitted with a clinical diagnosis of unstable angina, imposes a need for risk stratification of patients to allow targeting of angiography and revascularization.[12-13] In the early phase following admission, these may best be achieved on the basis of clinical parameter and non invasive screening data available to the clinician. In ECG ST segment depression and inversion of the T wave are common electrocardiographic abnormalities knowing the various ischemic morphologic features is critical for a timely diagnosis of high risk myocardial ischemia. ST segment depression is often a sign of myocardial ischemia of which coronary insufficiency is a major cause. It is significant when it is more than 1 mm and horizontal or down slopping . Deep T wave inversion or positive-negative biphasic T waves also indicates myocardial ischemia but less significant than ST segment depression.[14] The purpose of this study is to examine the prognostic significance of simple clinical and electrocardiographic variables.[9]

Though adverse events in Unstable angina occur early after admission and can be predicted by clinical and ECG characteristics, and by the presence of transient ischemia during ST segment monitoring .Risk stratification by this simple assessments can identify patients with Unstable angina at high risk.[15]

Therefore, it was worthwhile to do this type of study in the context of this country to correlate the ECG findings with the CAG findings for the diagnosis of extent of coronary artery disease in Unstable angina, so that it could be able to take prompt and appropriate treatment strategy earlier to reduce the mortality and morbidity.

Materials and Methodology:

This cross sectional analytical study was conducted from August, 2016 to January, 2017 in the Department of Cardiology, Dhaka National Medical College & Hospital. Patients admitted with chest pain and diagnosed as unstable angina were selected for the study.

A total of 70 patients were enrolled in this study. Among them 2 patients died in hospital due to complications of unstable angina and 6 patients did not agree to do coronary angiogram. Later on, 62 patients who got conventional standard management and subsequently underwent coronary angiography within 15 days of index event were included in the study. Based on the presence of significant ST-segment depression or T wave inversion, the study subjects were divided in to two groups. In group A (n=31), patients with ST-segment depression in at least two consecutive leads. In group B (n=31), patients with T wave inversion in at least two consecutive leads. These different patterns of ECG changes in unstable angina were correlated with angiographic findings and number of coronary arteries involved.

Result and observation:

In this cross sectional analytical type of study, 62 patients of Unstable angina were enrolled.

Table I shows the distribution of patient according to age group. The Mean ±SD of group A and group B were in 53.3±12.5 and 51.5±10.3 years respectively (p=0.529).

Table II shows the distribution of patients according to sex. In group A male was predominant than female which was 24(77.4%) cases and 7(22.7%) cases respectively. In group B male was also predominant than female which were 21(67.7%) cases and 10(32.3%) cases respectively (p=0.393) Male and female ratio was 2.6:1.

Table III shows the distribution of risk factors among the study patients. In group A and group B the smoking was in 16(51.6%) cases and 11(35.5%) cases respectively (p=0.202). In group A and group B hypertention was in 26(83.9%) cases and 23(74.2%) respectively(p=0.349).

In group A and group B diabetes mellitus was in 25(80.6%) cases and 12(38.7%) respectively(P=0.001).In group A and group B dyslipidaemia was in 14(45.2) cases and 17(54.8%) respectively(p=0.446). In group A and group B family history of CAD was in 24(77.4%) cases and 17(54.8%) cases respectively (P=0.107).

Table IV shows comparison of left ventricular ejection fraction between two groups. In group A and group B the mean left ventricular ejection fraction (%) was 48.35±5.37 and 56.7±6.86 respectively (p=0.023S).

Table V shows the distribution of study patients according to number of diseased coronary vessel. In group A single vessel disease, double vessel disease, triple vessel disease and non critical coronary artery disease or normal coronary arteries were in 2(6.5%) cases, 15(48.4%) cases,12(38.7%) cases, 2(6.5%) cases respectively. In group B single vessel disease, double vessel disease, triple vessel disease and non critical coronary arteries or normal coronary arteries were in 14(45.2%) cases, 2(6.5%) cases, 0(0.0%) cases and 15(48.4%) cases respectively.The difference between group A and group B was statistically significant (p=0.001).

Table VI shows the site of lesions in different coronary arteries in both groups of patients. LMCA involvement was in 1(3.2%) and 0(0.0%) cases in group A and group B respectively (p=0.313).LAD involvement was in 27(87.1%) and 8(25.8%) cases in group A and group B respectively(p=0.001).LCX involvement was in 19(61.3%) and 6(19.4%) cases in group A and group B respectively (p=0.001).RCA involvement was in 25(80.6%) and 4(12.9%) cases in group A and group B respectively (p=0.001)

Table-i: Distribution of the patients by age group (N=62)

Age group (years)	Group A (n=31) No. (%)	Group B (n=31) No. (%)	p value
< 40	7(22.6%)	5(16.1%)	
40-50	6(19.4%)	12(38.7%)	
51-60	8(25.8%)	6(19.4%)	
61-70	10(32.3%)	8(25.8%)	
Mean ±SD	53.3±12.5	51.5±10.3	0.529ns

Data were analyzed by unpaired student's t-test

ns=Non Significant

Table-ii: Distribution of the patients by sex (N=62)

Sex	Group A (n=31) No. (%)	Group B (n=31) No. (%)	p value
Male	24(77.4%)	21(67.7%)	0.393ns
Female	7(22.6%)	10(32.3%)	

Data were analyzed by chi-square test

ns=Non Significant

Table-iii: Distribution of the patients by risk factors (N=62)

Risk factors	Group A (n=31) No. (%)	Group B (n=31) No. (%)	p value
Smoking	16(51.6%)	11(35.5%)	0.202ns
Hypertension	26(83.9%)	23(74.2%)	0.349ns
Diabetes mellitus	25(80.6%)	12(38.7%)	0.001S
Dyslipidaemia	14(45.2%)	17(54.8%)	0.446ns
Family history of CAD	24(77.4%)	17(54.8%)	0.107ns

Data were analyzed by chi-square test s=significant

ns=Non Significant

Table-iv: Comparison of LVEF between two groups (N=62)

Echocardiographic findings (LVEF %)	Group A (n=31) Mean±SD	Group B (n=31) Mean±SD	p value
	48.35±5.37	56.7±6.86	0.023S

Data were analyzed by unpaired student's t-test

s= Significant

Table-v: Distribution of the patients according to number of involvement of coronary vessels (N=62)

Coronary vessels involvement	Group A (n=31) No. (%)	Group B (n=31) No. (%)	p value
Single vessel disease (SVD)	2(6.5%)	14(45.2%)	<0.001S
Double vessel disease (DVD)	15(48.4%)	2(6.5%)	
Triple vessel disease (TVD)	12(38.7%)	0(0.0%)	
Non critical coronary artery	2(6.5%)	15(48.4%)	
disease (NC-CAD)/ normal			
Total	31(100.0%)	31(100.0%)	

Data were analyzed by chi-square test

s=significant

Table-vi: Distribution of the patients according to involvement of different coronary arteries (N=62)

Vessels involved	Group A (n=31) No. (%)	Group B (n=31) No. (%)	p value
LMCA Yes	1(3.2%)	0(0.0%)	0.313nS
LMCA No	30(96.8%)	31(100.0%)	
LAD Yes	27(87.1%)	8(25.8%)	<0.001S
LAD No	4(12.9%)	23(74.2%)	
LCX Yes	19(61.3%)	6(19.4%)	0.001S
LCX No	12(38.7%)	25(80.6%)	
RCA Yes	25(80.6%)	4(12.9%)	<0.001S
RCA No	6(19.4%)	27(87.1%)	

Data were analyzed by chi-square test

s=significant

LMCA= Left Main Coronary Artery, LAD = Left Anterior Descending

LCX = Left Circumflex, RCA = Right Coronary Artery.

Discussion:

Unstable angina is an emergency situation requiring immediate diagnosis and treatment. Presentation of unstable angina is different depending on the coronary artery involvement, severity, degree of collateral circulation and myocardial O_2 demand. Critical stenosis in the proximal part of the left anterior descending artery (LAD), severe triple vessel disease and left main coronary stenosis have all been recognized as clinical conditions complicated by a high incidence of large infarction, pump failure, arrhythmias and sudden cardiac death.[10] Changes in ST segment (ST segment depression and/or T wave inversion) in different lead of surface ECG can predict the extent of coronary artery involvement.[9] Thus an early prediction of the extent of coronary artery involvement is not only important from an academic stand point, but also from a clinical point of view.

Because ECG is a less expensive, simple, non-invasive and can be a bedside test, this study was conducted to find-out the role of initial ECG changes in the prediction of culprit lesion in coronary artery by correlating ECG and CAG findings.

In this study, the mean age of group A patients was 53.3±12.5 years and that of group B patients 51.5±10.3 years ranging from 3o to 70 years (Table 1). No statistically significant mean age difference was found between two groups (p=0.529). Similar age incidences were reported in the previous studies in our country.[16-17]

Out of 62 patients of this study, 24 cases (77.4%) group A and 21(67.7%) of group B were male, with male to female ratio was 2.6:1 (Table 2). The numbers of female patients were less in all previous studies.[16-17] The overall lesser incidence of unstable angina among the female population in our country is probably due to the protective effect of estrogen in premenopausal age and lesser incidence of smoking in this sex. Also poverty, ignorance and social customs often prevent women from seeking medical help outside home environment even in case of serious illness.

The distribution of risk factors among the study population was documented (Table 3).In group A and group B the smoking was in 16(51.6%) cases and 11(35.5%) cases respectively (p=0.202).In group A and group B, hypertension was in 26(83.9%) cases and 23(74.2%) cases respectively (p=0.349). In group A and group B diabetes mellitus was in 25 (80.6%) and 12 (38.7%) cases respectively (p=0.001).In group A and group B dyslipidaemia was 14(45.2%) and 17(54.8%) cases respectively (p=0.446).In group A and group B family history of CAD patients were in 24(77.4%) and 17(54.8%) cases respectively (p=0.107).No statistically significant difference was found between two group of patients in risk factor analysis (p>0.05) except diabetes mellitus (p=0.001).This finding consistent with cannon et al study.[18]

All the patients were evaluated by echocardiographically to see the left ventricular ejection fraction (LVEF) in the present study. LVEF was significantly lower in group A than group B(48.35±5.37% Vs 56.7±6.86%;p=0.023) [Table 4].These results were also consistent with that of Haraphongse et al.[19]

The distribution of study population according to the extent of coronary artery involvement .In group A, the presence of SVD was 2 cases(6.5%),DVD was 15 cases(48.4%),TVD was 12 cases(38.7%) and Normal/ Non critical coronary artery disease 2 cases(6.5%).On the other hand in group B, the presence of SVD was 14 cases (45.2%),DVD was 2 cases(6.5%),TVD was 0 cases (0.0%), and Normal or Non critical coronary artery disease was 15 cases(48.4%).This finding is consistent with de Servi et al (1985) who showed a large number of patients with unstable angina showing significant ST segment depression had multivessel coronary artery disease.[20] This finding also consistent with MA Siddeque et al (2007). This study showed that patients with significant ECG changes had more extensive Coronary artery involvement than patients with less significant ECG changes.[21]

The involvement in different coronary arteries was observed. In group A,LMCA lesion present in 1 cases((3.2%), LAD lesion present in 27 cases(87.1%), LCX lesion present in 19 cases(61.3%), RCA lesion present in 25 cases(80.6%). On the other hand in group B, LMCA lesion was present in 0 cases (0.0%), LAD lesion was 8 cases(25.8%), LCX lesion was 6 cases(19.4%), RCA lesion was 4 cases(12.9%).This finding is consistent with de Servi et al[17] (1985) who showed a large number of patients with unstable angina showing significant ST segment changes had multivessel coronary artery disease. Regarding LMCA lesion, this finding is consistent with O Rourke and Hubbar et al showed that significant ST segment depression were associated with LM/LME coronary artery disease.[22-23]

Conclusion:

This study showed that admission electrocardiogram of unstable angina patients having significant ST segment depression rather than T wave inversion has better correlation with more extensive coronary artery involvement as determined by coronary angiography. It may be concluded that admission ECG may be a valuable tool for early prediction of extensive lesion in coronary artery. So that we should able to provide prompt and appropriate management earlier to reduce the mortality and morbidity.

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