A STUDY OF CORRELATION BETWEEN ELECTROCARDIOGRAPHIC FINDINGS & CORONARY ANGIOGRAM IN PATIENTS OF ACUTE CORONARY SYNDROME

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ABSTRACT

BACKGROUND

In patients with Acute Coronary Syndrome, correlation of ischemic ECG abnormalities with the affected coronary territory has not been well-established. We sought to investigate the correlation of electrocardiographic abnormalities with the location of obstructive coronary artery disease (CAD) confirmed by CAG, in patients with Acute Coronary Syndrome.

MATERIALS AND METHODS

In this study, 50 patients of Acute Coronary Syndrome were included. ECGs were interpreted by cardiologist. Patients were subjected to tread-mill test and Troponin T analysis whenever required. All patients underwent Coronary angiogram. The results of Coronary Angiogram were correlated with electrocardiographic findings, in terms of identifying the culprit vessel and severity of MI.

RESULTS

We noticed that there was significant correlation between coronary anatomy and electrocardiographic finding in STEMI involving anterolateral wall and inferior wall. In rest of the Acute Coronary Syndromes like NSTEMI and LBBB, there was no significant correlation. Normal electrocardiograms were also found to be associated with significant coronary artery disease.

CONCLUSION

Coronary angiogram is the gold standard to study the complete coronary anatomy. It helps in initiating appropriate management for CAD if any. Electrocardiogram acts just like an initial tool in guiding the management. For further appropriate management it has to be followed by coronary angiogram.

KEYWORDS

Coronary Angiogram CAG, Acute Coronary Syndrome ACS, Electrocardiogram ECG, ST- Elevation Myocardial Infarction STEMI, NSTEMI- Non-ST Elevation Myocardial Infarction, Left Bundle Branch Block LBBB.

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BACKGROUND

The electrocardiogram (ECG) is an essential tool in the evaluation of patients with acute coronary syndrome, which can be ST-segment elevation myocardial infarction or Non-ST-segment elevation acute coronary syndrome. Electrocardiographic features of acute coronary syndrome with ST-segment elevation has been found correlate with coronary artery involved in the disease.[1] Such co-relation was not possible in Acute coronary syndrome with Non-ST-elevation myocardial infarction (NSTEMI).[2] Even a normal electrocardiogram cannot rule of the possibility of CAD unlike CAG. We assessed the correlation between ischemic ECG changes and the affected coronary territory in patients of Acute Coronary Syndrome.

Aim of the Study

To investigate the correlation of electrocardiographic abnormalities with the location of obstructive coronary artery disease (CAD) in patients with Acute Coronary Syndrome.

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MATERIALS AND METHODS

Patients with age more than 18 year presenting to the Emergency Department with history suggestive of Acute Coronary Syndrome were included in the study.

The term Acute Coronary Syndrome (ACS) is a broad term which defines clinical symptoms compatible with acute myocardial ischemia and includes unstable angina (UA), non-ST-segment elevation myocardial infarction (NSTEMI), and ST-segment elevation myocardial infarction (STEMI). Cardiac enzymes are detectable in NSTEMI unlike Unstable enzyme.

Patients included in the study had typical anginal chest pain or angina equivalents like breathlessness, diaphoresis, fatiguability.

Typical anginal chest pain was characterized by discomfort in the chest, jaw, shoulder, back, or arms, typically elicited by exertion or emotional stress and relieved by rest or nitroglycerin.

STEMI as defined by the ACC/AHA guidelines (ST segment elevation _1 mm present in two or more contiguous leads.[3]

Localization of Infarction

- Septal: V1 and V2
- Anterior: V3 and V4
- Lateral: V5 and V6
- Anteroseptal: V1-V4
- Anterolateral: V3-V6
- Extensive anterior: V1-V6
- Inferior: II, III, aVF
- High Lateral: I, aVL
- Posterior: tall R wave and ST depression in V1-V2

ECG findings in NSTEMI were deep symmetrical T wave inversions or ST segment depressions. Deep T inversions across all the precordial (anterior) leads suggest a proximal, severe, left anterior descending coronary artery stenosis as the culprit lesion and is considered a marker of high risk.[4]

Patients who were known case of Ischemic heart disease, rheumatic heart disease, cardiomyopathy were excluded from the study as these diseases could alter the electrocardiographic findings.

Design

This was a prospective, randomized, observational study to assess the correlation between ischemic ECG changes and the affected coronary territory in patients of Acute Coronary Syndrome.

A total of 50 patients after applying inclusion & exclusion, criteria were included in the study. For all patients detailed clinical history was taken and clinical examination was done. Electrocardiography was done and was interpreted by Cardiologist. All patients were subjected to Echocardiographic analysis. Whenever required patients were also subjected to Tread mill test and troponin I analysis.

Further patients were subjected to coronary angiogram and the results of the same were compared with the electrocardiographic patterns of the respective patients.

Statistical Analysis

Data was entered into Microsoft excel data sheet to prepare a master chart and was analysed using SPSS 22 version software. For qualitative data chi-square test was used as test of significance. Mean values and standard deviation were obtained from continuous data whereas frequencies and proportions were derived from categorical data. To identify the mean difference between two quantitative variables Independent t test was used as test of significance. p value (Probability that the result is true) of <0.05 was considered as statistically significant after assuming all the rules of statistical tests.

RESULTS

Overall 50 patients were enrolled in the study. The following data have been summarized in Table 1.

Sl. No.	Parameters			Count	Percentage
1.	Age	<40 years		7	14.0%
		41 to 50 years		10	20.0%
		51 to 60 years		17	34.0%
		61 to 70 years		13	26.0%
		>70 years		3	6.0%
2.	Sex	Female		17	34.0%
		Male		33	66.0%
3.	Symptomatology	Chest Pain		45	90.0%
		Breathlessness		6	12.0%
		Others		1	2.0%
4.	Past History	Hypertension	Absent	40	80.0%
			Present	10	20.0%
		Diabetes	Absent	40	80.0%
			Present	10	20.0%
		Others	Nil	47	94.0%
			COPD	1	2.0%
			COPD with Old CVA	1	2.0%
			Post PTCA	1	2.0%

5.	Echocardiography	Anterior and Lateral Wall	5	10.0%
		Anterior Wall	16	32.0%
		Global	1	2.0%
		Inferior Wall	6	12.0%
		IVS And Apex	2	4.0%
		Normal	20	40.0%
6.	Coronary Angiography Findings	Normal Study	9	18.0%
		SVD-LAD	17	34.0%
		SVD-LCX	3	6.0%
		SVD-RCA	7	14.0%
		DVD-LAD AND RCA	1	2.0%
		DVD-LAD, LCX	1	2.0%
		DVD-LAD, RCA	4	8.0%
		DVD-RCA, LAD	1	2.0%
		DVD-RCA, LCX	1	2.0%
		TVD	6	12.0%

Table 1. Study Group Profile

Mean age of subjects was 54.94 ± 11.506 Years. Majority of subjects were in the age group 51 to 60 years (34%). 66% were males and 34% were females.

In the study 90% presented with chest pain, 12% had breathlessness and 2% had other complaints (Fever with cough).

In the study on Echocardiography, 10% had anterior and lateral wall, 32% had anterior wall, 2% had global, 12% had inferior wall, 4% had IVS and apex MI and 40% had normal echocardiography.

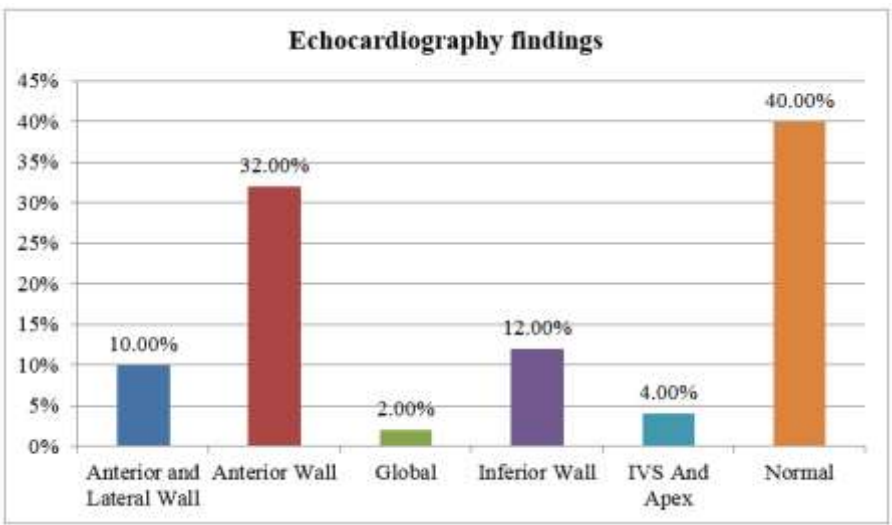

Figure 1. Echocardiography Findings

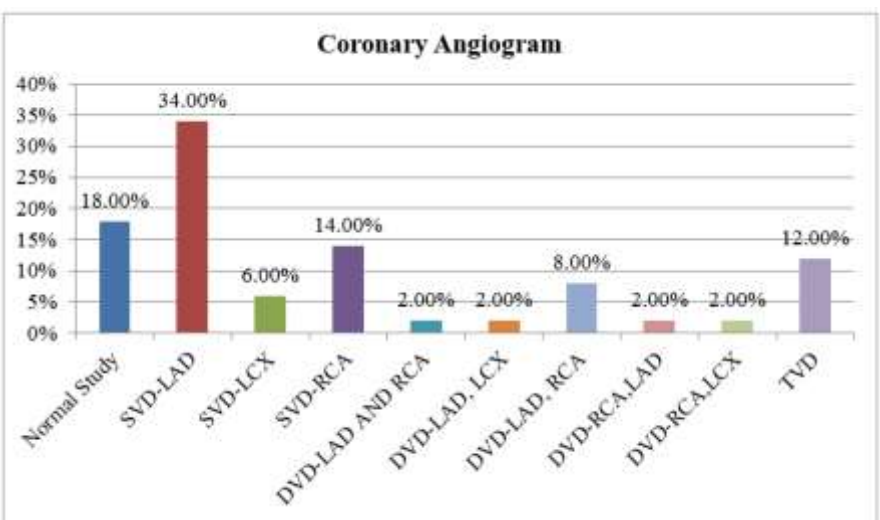

Figure 2. Coronary Angiogram

		Count	%
Management	Medical Management	15	30.0%
	CABG	7	14.0%
	CABG with Aorta Femoral Bypass Graft	1	2.0%
	PTCA to LAD	15	30.0%
	PTCA to LAD Dual Stenting	1	2.0%
	PTCA to LCX	1	2.0%
	PTCA to LCX and RCA	1	2.0%
	PTCA to Mid LAD	1	2.0%
	PTCA to PROXIMAL and MID RCA	1	2.0%
	PTCA to RCA	6	12.0%
	PTCA to RCA and LAD	1	2.0%

Table 2. Coronary Angiogram Guided Management which was advised for the Subjects

In the 30% medical management, 14% underwent CABG alone and 2% underwent CABG with aorta femoral bypass graft, 30% had PTCA to LAD and others as shown in above table.

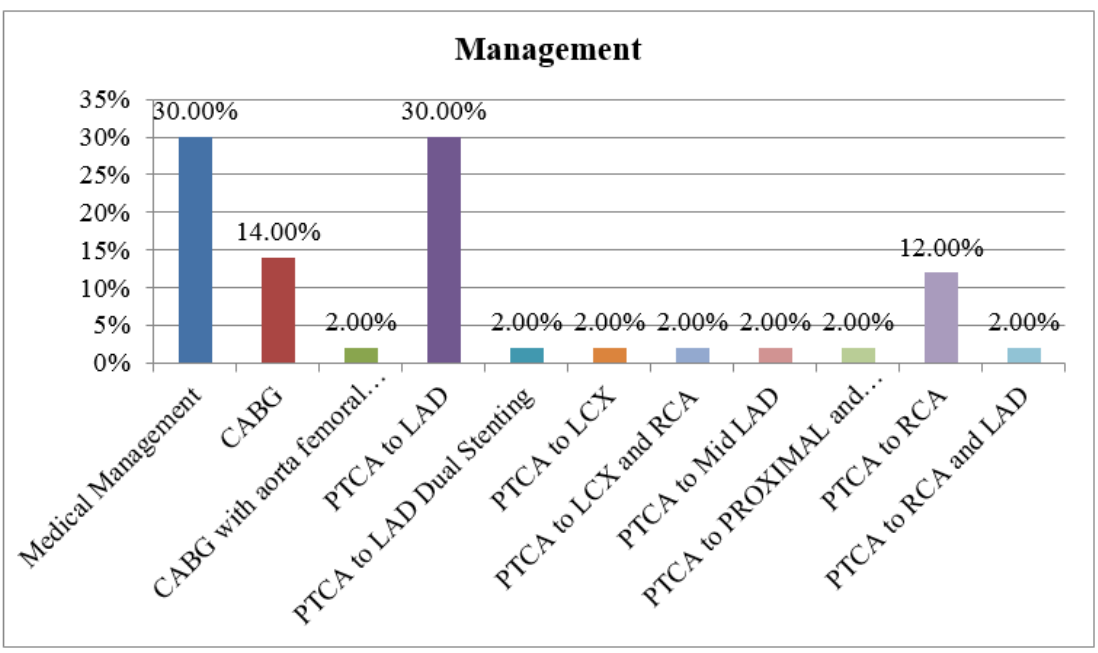

Figure 3. Management

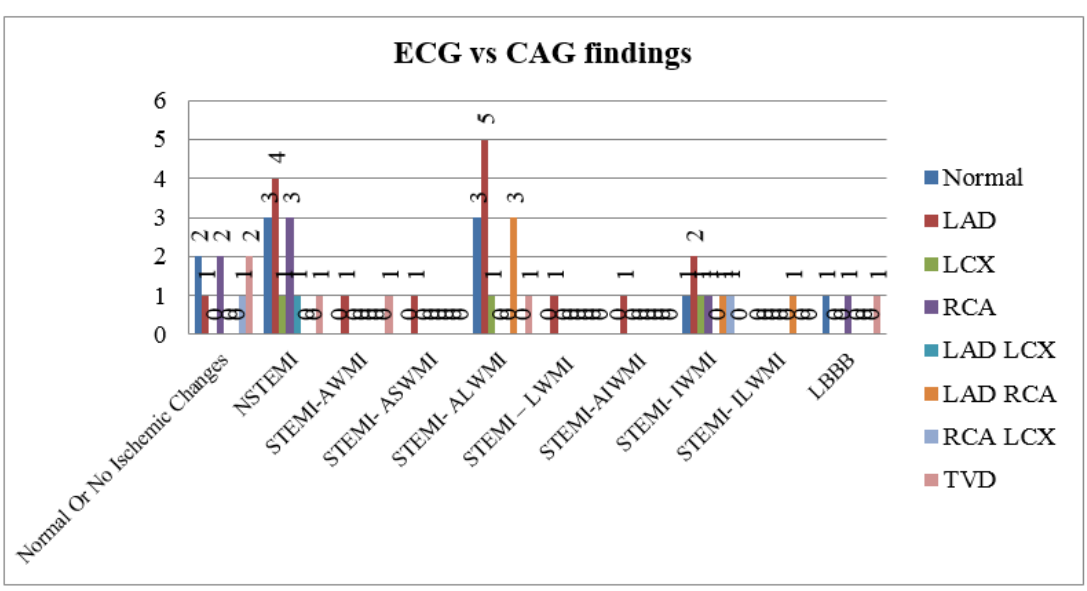

Figure 4. Bar Diagram Showing Association Between ECG and CAG Findings

	Normal	LAD	LCX	RCA	LAD LCX	LAD RCA	RCA LCX	TVD
Normal or No Ischemic Changes	2	1	0	2	0	0	1	2
NSTEMI	3	4	1	3	1	0	0	1
STEMI-AWMI	0	1	0	0	0	0	0	1
STEMI- ASWMI	0	1	0	0	0	0	0	0
STEMI- ALWMI	3	5	1	0	0	3	0	1
STEMI – LWMI	0	1	0	0	0	0	0	0
STEMI-AIWMI	0	1	0	0	0	0	0	0
STEMI- IWMI	1	2	1	1	0	1	1	0
STEMI- ILWMI	0	0	0	0	0	1	0	0
LBBB	1	0	0	1	0	0	0	1

Table 3. Association Between ECG and CAG Findings

X^2 =42.92, df = 63, p =0.9752

In the study there was no significant association between ECG and CAG findings.

DISCUSSION

For patients presenting with chest pain or any other angina equivalents ECG is the simple basic bed-side initial diagnostic. Though a normal ECG doesn't rule out the possibility of acute coronary syndrome, an ECG suggestive of ischemia helps to classify ACS STEMI, NSTEMI, or unstable angina, and hence guides to initiate the appropriate treatment. The earlier the treatment is started, better will be the salvage of myocardium. It is truly said as 'TIME IS MYOCARDIUM'. Thus, ECG acts as cost effective basic bed-side tool which can be used as initial diagnostic test in remote resource deprived areas and to initiate the treatment as early as possible where other sophisticated tests are not available.

However, for the further appropriate management of coronary artery disease ECG, Coronary angiography is the gold standard procedure which best delineates the coronary anatomy. Although to some extent ECG can predict the culprit coronary artery involved in the CAD, it has its own limitations.

ST-segment elevation myocardial infarction is a medical emergency due to transmural ischemia requires urgent revascularization. Multiple studies have shown good correlation between ST-segment elevation on the ECG and the occluded coronary artery in patients with ACS.

Anterior myocardial infarctions which shows ST-segment elevations in the precordial leads V1-V4 (anterior, anteroseptal patterns) on ECG is usually due to LAD coronary artery. Rarely ST-segment elevation in leads V1-V4 might be due to RCA occlusion with concomitant right ventricular infarction.

ST-segment elevations in leads V4–V6 (lateral, anterolateral patterns), without ST elevation in leads V1–V3, is usually due to an obstruction of the LCX or distal diagonal branch rather than the main LAD.[5]

Consistent with previous studies, in our study we found that all of our patients with anterior STEMI (AWMI, ASWMI, ALWMI, LWMI) had LAD obstructive CAD in 66.67% cases, while RCA was the culprit vessel among patients with inferior STEMI almost in 50% of cases.

Inferior wall myocardial infarctions showing ST-segment elevation in leads II, III, and aVF is associated with occlusion of either the RCA (in the majority of cases) or the LCX artery. As told before LCX involvement can also show ST elevations in V4-V6 and ST elevations more in lead II than III. In our study we found that RCA was culprit vessel in 50 % cases. Out of 9 myocardial infarctions involving inferior wall 2 had involvement LCX involvement and 4 had involvement of LAD vessel. The explanation for LAD involvement in Inferior myocardial infarctions in type 3 LAD which wraps around the inferior wall.

In literature, correlation of ischemic ECG changes with culprit lesion location in NSTEMI has not been extensively reported.[6,7,8] In our study, we found that out of 13 patients of NSTEMI, 5 had LAD lesions (38%) 5 had RCA lesions (23%) 3 cases normal coronaries and 1 case TVD.

When evaluating reports of angiographic studies after the usage of fibrinolytic agents, the term recanalization be applied only if pre-treatment coronary arteriogram documents occlusion of the culprit vessel and if flow is restored post-thrombolysis. After thrombolysis the lesion in the culprit vessel is likely to change, hence this could be the explanation for the discrepancy between culprit artery localization on ECG and post thrombolysis angiogram.

Limitations of the Study

Sample size was limited.

Coronary abnormalities could have been more specific in terms of percentage of occlusion of the vessel, location of the lesion- proximal, midportion, distal.

CONCLUSION

Coronary angiogram is the gold standard test to find the complete coronary anatomy and further initiate appropriate management.

Electrocardiogram acts like an initial tool in guiding the management, which has to be followed by coronary angiogram to start appropriate management.

Normal Electrocardiogram doesn't rule out the possibility of Coronary Artery Disease. Whenever CAD is strongly suspected, patient should be subjected to CAG, even though electrocardiogram, echocardiogram, cardiac enzymes, tread mill test are normal.

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