Original Article

A review of ECG changes and coronary angiographic findings in patient who underwent angiography

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Abstract

Introduction: Chest pain is one of the important clinical presentation in coronary artery disease. Patient with or without symptoms irrespective of electrocardiogram changes may or may not have significant coronary angiography changes. Whatever changes are seen on ECG findings may not be the actual lesion seen in coronary angiography. **Objective:** To determine whether significant electrocardiogram changes are associated with strong involvement of coronary angiography morphology changes. **Material and Methods:** A cross sectional study was carried out for the period of one year in Department of Cardiology, Bharati Vidyapeeth Medical College and Hospital, Sangli. 100 patients above 20 years of age, symptomatic patient, asymptomatic patient with electrocardiogram changes, patients who are willfully opting for coronary angiography were included in the study. Patients with previously diagnosed ischemic heart disease and underwent PTCA or CABG are excluded. Coronary angiography either from femoral or radial artery was done. The patients were divided into three groups depending on ST segment elevation or depression. The results of coronary angiography were carefully interpreted. Statistical analysis was done using Microsoft excel and necessary STATISTICAL ANALYSIS SOFTWARE was used wherever necessary. **Results:** Majority of patients were in age group 51-60 years(34 %) with male predominance. In clinical presentation, majority of patients presented with chest pain 88(95.65%). The majority of patients presented with single vessel occlusion(29%). 23% of patients were having normal coronary angiography. The association between ECG findings and coronary occlusion was not statistically significant. **Conclusion:** coronary angiography remains the "Gold Standard" for identifying the infarct related artery, while ECG is for identifying presence of acute ischemic event.

Keywords: Electrocardigram, Coronary angiography.

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Received Date: 13/03/2016 Revised Date: 23/03/2016 Accepted Date: 14/04/2016

Access this article online	
Quick Response Code:	Website: www.medpulse.in
	DOI: 05 May 2016

INTRODUCTION

Ischemic Heart Disease (IHD) is a dreaded complication of civilization. Hence it is properly named as "Black Plague" of the 20th century[1]. Previously, it was thought that it is mainly a disease of elderly people and more prevalent in industrialized countries. But now the picture is changed. Age old idea is no more truth. In developing countries like ours, coronary heart disease has emerged as a prominent public health problem afflicting especially men in the prime of their life, when their productivity, social and family responsibilities are the greatest. This has been attributed to rapid and widespread urbanization, Industrialization, increased sedentary habits, use of automobiles for transport, increased smoking, and environmental pollution, consumption of diet rich in saturated fatty acids, refined carbohydrates and cholesterol[2]. There is no significant rural-urban difference in the Coronary heart disease (CHD) prevalence. The prevalence is equal in rural and urban Population; there is situational or emotional stress which arises from the of living (lifestyle) in a socio-culturally different urban environment. Cardiovascular diseases account for approximately 12 million deaths annually and are the

How to site this article: Atul Jankar, Yogesh Edge, Pankaj Palange. A review of ECG changes and coronary angiographic findings in patient who underwent angiography. *MedPulse – International Medical Journal.* May 2016; 3(5): 450-458. http://www.medpulse.in (accessed 07 May 2016).

commonest cause of death globally. Cardiovascular disease is also the major contributor to the burden of premature mortality and morbidity and account for 85 millions disability adjusted (DALYs) life years in 1990. By the year 2020, coronary heart disease and stroke will hold first and fourth places respectively, in the world Health organization's list of leading causes of disability. Risk factor generally applies to a variable that can predict a future cardiovascular event, but some of these predictors are also potential targets for interventions. The past 50 years have witnessed great progress in identifying a number of life style, as well as biochemical and genetic, factors associated with coronary heart disease and in disseminating this information to the public. By this time diagnostic facilities also improved dramatically in the field of coronary artery disease[3].Atherosclerosis and metabolic syndrome begin in early ages. Endothelial dysfunction is been identified in very early ages in high risk children and adolescent. Atherosclerosis has been documented in early 30s in post mortem and autopsy findings of accidental deaths[4]. Early atherosclerosis in diabetes assumes in the form of fatty streaks at the site of altered arterial shear stress such as bifurcation of vessels and is added with endothelial dysfunction. They develop when inflammatory cells predominantly monocytes, bind to receptors expressed by endothelial cells, migrate into the intima, take up oxidized low density lipoproteins (LDL) from plasma and become lipid laden foam cells or macrophages. There is also smooth muscle cell proliferation from media to intima of artery which tries to stabilize the plaque known as stable atherosclerotic plaque. It can remain asymptomatic until it becomes large enough to obstruct the arterial flow. With continued inflammatory process in the stable plaque there is release of cytokines by macrophages like:

- Tumor Necrosis Factor-α(TNF-α)
- Gamma interferon
- Platelet Derived Growth Factor
- Matrix metallo proteinases

Above factors can cause "senescence" of the overlying smooth muscles and may lead to erosion, fissuring or rupture of plaque surface. Any breach in the integrity of plaque will expose its contents to circulating blood and may trigger platelet aggregation and thrombosis. These unstable plaques may result into stable angina, unstable angina (UA), acute myocardial infarction (MI)

MATERIAL AND METHODS

Institutional Ethical committee approval(IEC NO-BVDUMC and H/ Sangli/IEC/ Dissertation 2013-14/43) was taken from college and university committee. After ethical clearance, permission from the head of Department was taken. Informed and written consent from patientswas taken. Study was carried out in Department of Medicine; Bharati Vidyapeeth Deemed University Medical College and Hospital, Sangli. In this study total 100 patients were studied. Patient with chest pain with or without ECG changes, asymptomatic patients with ECG changes, and patients who were willingfor coronary angiography, were admitted in Bharati Vidyapeeth Deemed University Medical College and Hospital, Sangli,during the period October 2013 toOctober 2015.They were subsequently managed in intensive care unit. These patients underwent coronary angiography besides other routine investigations.

Inclusion Criteria

- Patients with chest pain coming to Bharati Vidyapeeth Deemed University Medical College and Hospital Sangli, in OPD, IPD, and Casualty.
- Patient above 20 years.
- Symptomatic Patient with or without electrocardiogram ST-T changes.
- Asymptomatic patient with ECGchanges.
- Patients who arewillfully opting for coronary angiography.

Exclusion Criteria

All patients with previously diagnosed ischemic heart disease and who had previous history of PTCA (percutaneous transcoronary angioplasty) or CABG (coronary artery bypass grafting) done were excluded.

Ecg Analysis

Statistical Analysis

Statistical analysis was done using Microsoft Excel and SPSS-22. Proportion and percentage were obtained by Z test. A standard error of difference between the two proportions was used.

Study Period

- October 2013 to October 2015.

Study Method

- Cross sectional study.

RESULT AND OBSERVATION

Table 1: Distribution According To Age and Sex

Age Group Years	Male		Female		Total	
21-30	02	2.78%	00	0.00%	02	2.00%
31-40	05	6.94%	01	3.57%	06	6.00%
41-50	07	9.72%	07	25.00%	14	14.00%
51-60	25	34.72%	09	32.14%	34	34.00%
61-70	22	30.56%	09	32.14%	31	31.00%
71-80	11	15.28%	02	7.14%	13	13.00%
Total	**72**	**100%**	**28**	**100%**	**100**	**100.00%**

Majority of patients were in age group 51-60 years (34%) followed by 61-70 years (31%). Male patients were predominant in all age groups. The majority of patients were male (72%) as compared to females (28%). The mean age was 60.19±11.73 years and 57.70±9.19 years in males and females respectively.

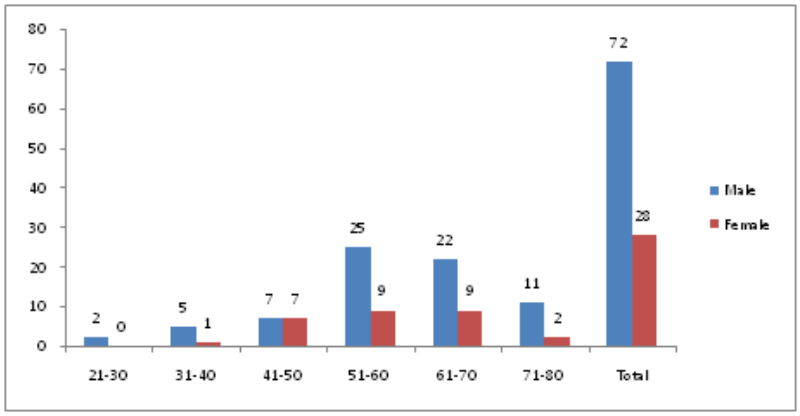

Table 2: Distribution Of Patients According To Presentation

Presentation	No. of patients	Percentage
Symptomatic patients	92	92%
Asymptomatic patients	08	8%
Total	**100**	**100%**

In this study out of 100patients, 92 patients were symptomatic with or without ECG changes, and 8 patients were asymptomatic with ECG changes. 95% confidence interval for difference: 0.7014 to 0.9786 Z = 11.738; P = 0.000. More number of symptomatic patients was statistically significant.

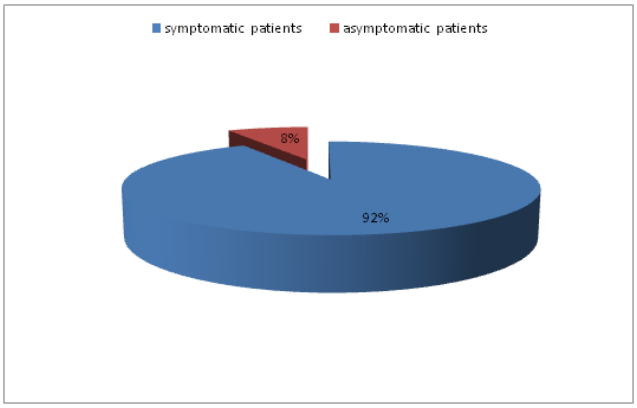

Table 3: Clinical presentation of symptomatic patients

Clinical characteristics	Symptomatic patients (n=92)	symptomatic patients
Chest Pain	88	95.65%
Sweating	58	63.04%
Dyspnoea on exertion	39	42.39%
Palpitation	9	9.78%
Breathlessness	8	8.69%

95% confidence interval for difference: 0.2133 to 0.4467, Z = 5.362; P = 0.000. Patients with chest pain were significantly more than other symptoms.

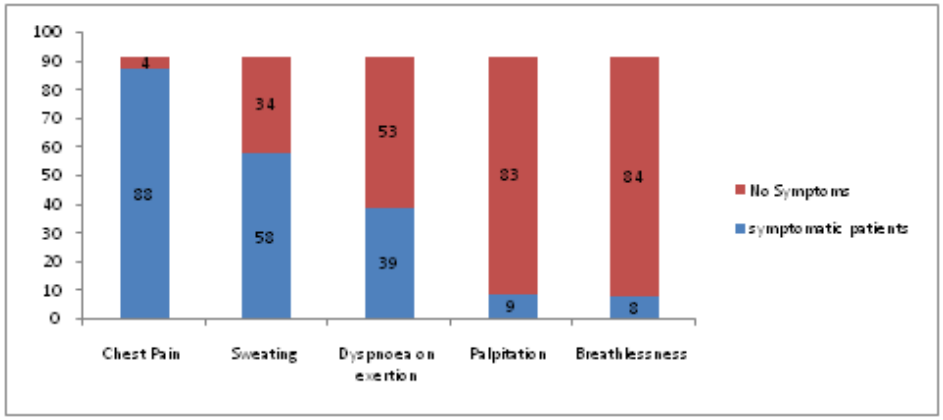

Table 4: Electrocardiographic Changes

Sr. No	ECG finding	N=number of patients	Percentage
1	Anterior wall myocardial infarction(AMI)	38	38.00%
2	Inferior wall myocardial Infarction(IWMI)	13	13.00%
3	Anterior lead ischemia	19	19.00%
4	Inferior lead ischemia	6	6.00%
5	Left ventricular hypertrophy(LVH)	5	5.00%
6	Left bundle branch block(LBBB)	3	3.00%
7	Normal	16	16.00%
	Total	**100**	**100%**

95% confidence interval for difference: 0.06488 to 0.3151, Z = 2.802; P = 0.005. There was significantly more number of patients with electrocardiographic changes of anterior wall myocardial infarction.

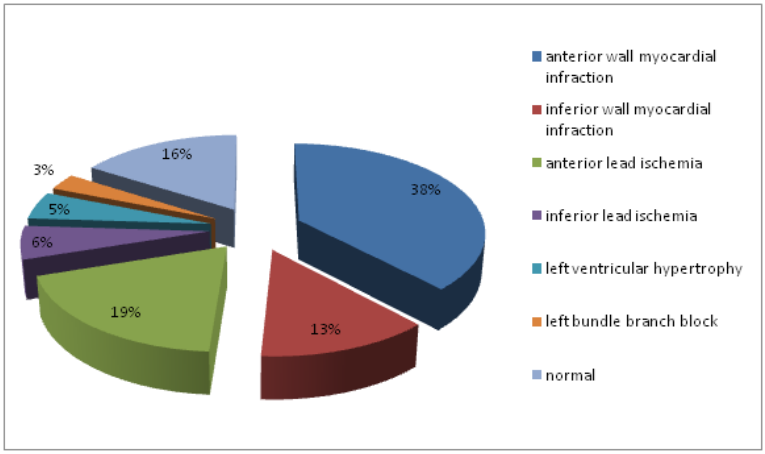

Table 5: Angiographic finding of no of coronary arteries involvement

Angiographic finding	No. of patient (n=100)	Percentage
Single vessel disease (SVD)	29	29.00%
Double vessel disease(DVD)	31	31.00%
Triple vessel disease(TVD)	17	17.00%
Normal	23	23.00%
Total	**100**	**100.00%**

95% confidence interval for difference: 0.107 to 0.147, Z = 0.154; P = 0.877An angiographic finding of coronary arteries involvement in the form of number of vessel involved was not statistically significant.

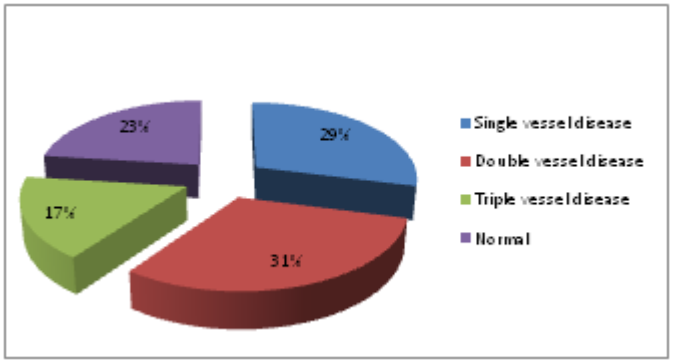

Table 6: Tyoe of coronary artery involved

Angiographic finding	No. of patient (n=100)	Percentage
Left anterior descending (LAD)	66	66.00%
Left circumflex (LCx)	36	36.00%
Right coronary artery (RCA)	40	40.00%
No Involvement	23	23.00%

CAG showed of involvement of LAD in 66patient's involvement of LCx in 36 patients and RCA involvement in 40 patients. CAG was normal in 23 patients.95% confidence interval for difference: 0.3360 to 0.7239. Z = 2.6816; P = 0.000 Significantly more number of patients had left anterior descending artery involvement.

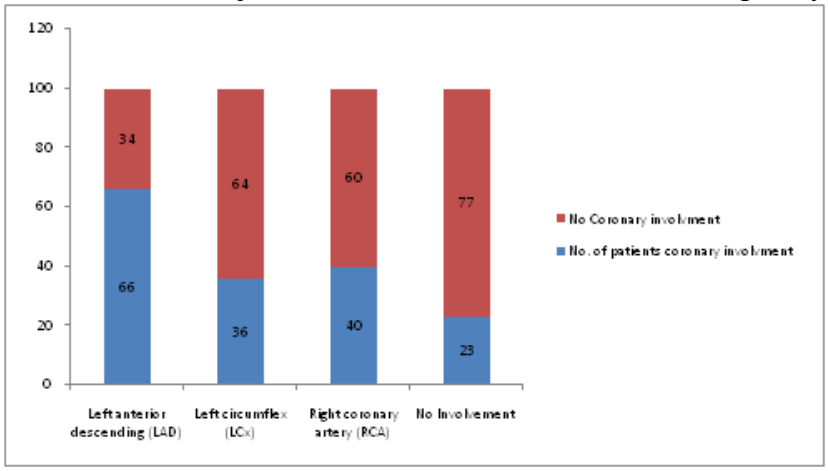

Table 7: ECG findings and type of coronary arteries involved

ECG Finding	LAD	LCx	RCA
Anterior wall infarction (AWMI)-38	36	15	12
Inferior infarction(IWMI)-13	8	7	10
Anterior lead ischemia-19	8	3	6
Inferior lead ischemia-06	0	2	2
Left ventricular hypertrophy(LVH)-5	2	0	0
Left bundle branch block(LBBB)-3	1	0	0
Normal ecg-16	6	7	6

Out of 100 patients, ECG shows AWMI in 38 patients, IWMI in 13 patients, 19 had anterior lead ischemia, 06 had inferior lead ischemia, LVH in 5 patients, and LBBB in 3 patients. ECG was normal in 16 patients. LAD was predominantly involved in anterior wall changes, while RCA was predominantly involved in inferior wall changes.

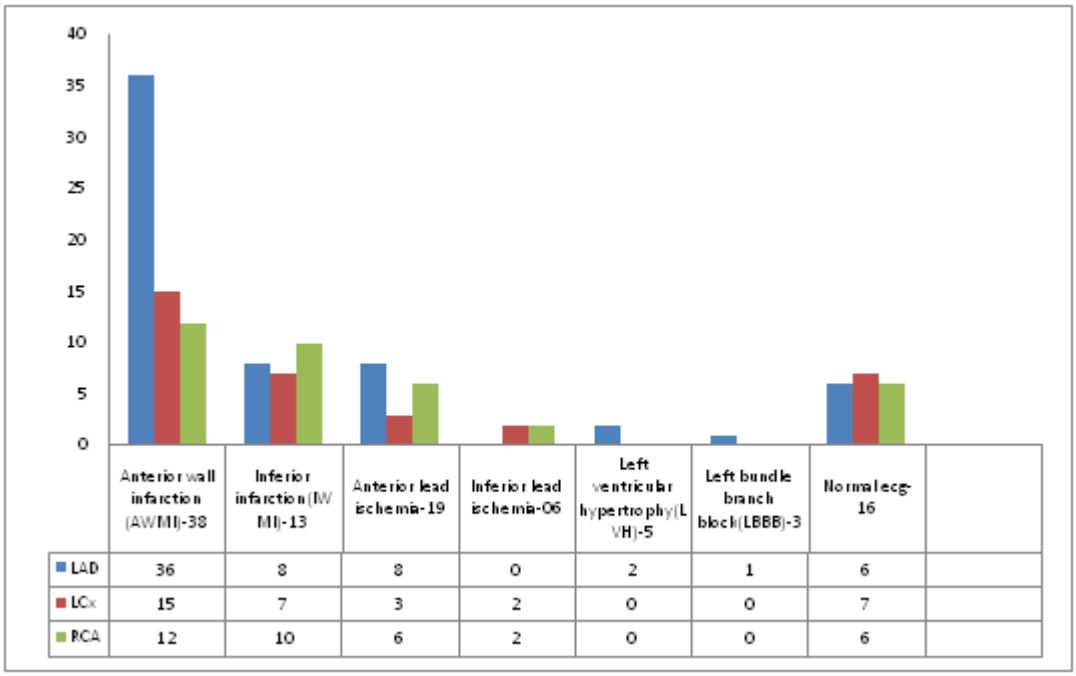

Table 7a: Svd -coronary angiography correlation with ecg changes

LAD Left anterior descending artery) 23			LCx (Left circumflex artery) 3			RCA (Right coronary artery) 3		
AWMI	IWMI	Normal ECG	AWMI	IWMI	Normal ECG	AWMI	IWMI	Normal ECG
18	0	5	1	1	1	0	3	0

Out of 29 patients of SVD, LAD involvement was seen in 23 (79.31%) patients. LCx involvement in 3 (10.34%) and RCA involvement seen in 3 (10.34%) patients.

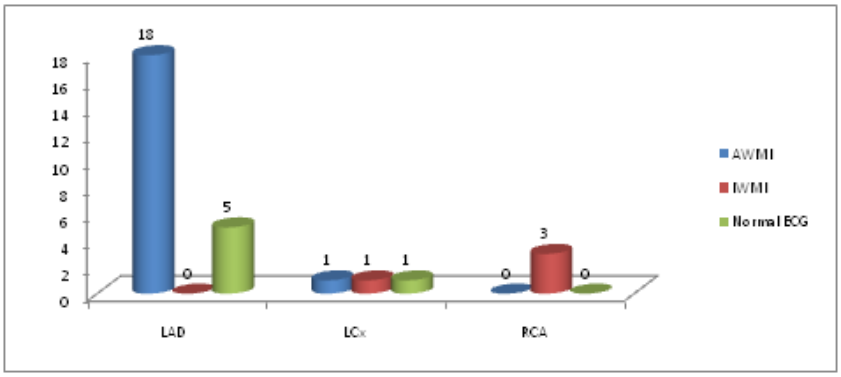

Table 7b: DVD - coronary angiography correlation with ECG changes

LAD , LCx 11			RCA, LAD 15			LCx, RCA 5		
AWMI	IWMI	Normal ECG	AWMI	IWMI	Normal ECG	AWMI	IWMI	Normal ECG
7	2	2	9	3	3	2	2	1

Out of 31 patients of DVD, LAD and LCx involvement seen in 11 (35.48%) patients RCA and LAD in 15 (48.38%) patients, LCx and RCA in 5 (16.12%) patients.

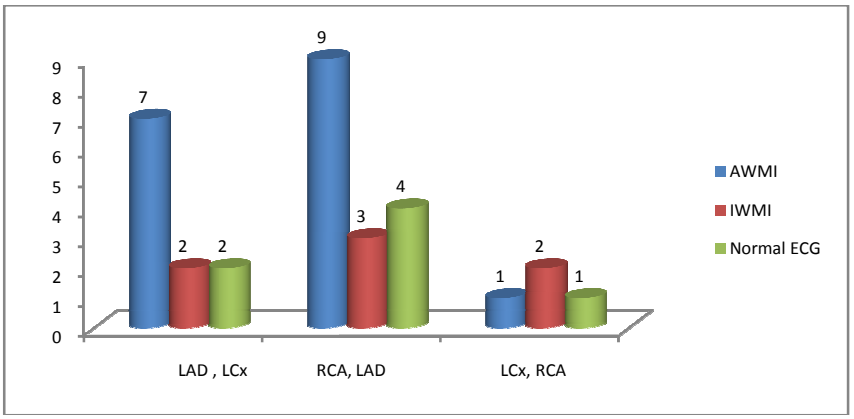

Table 7 C: TVD -coronary angiography correlation with ECG changes

ECG Findings	Number of patients(17)	Percentage
AWMI	11	64.70%
IWMI	3	17.64%
Normal ECG	3	17.64%

Out of 17 patients of TVD, 11 (64.70%) patients were having AWMI, 3 (17.64%) patients were having IWMI and ECG was normal in 3 (17.64%) patients

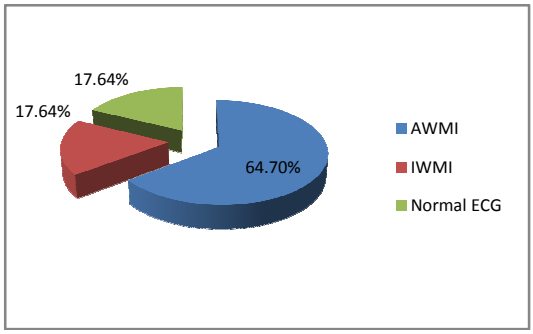

Table 7 d: Normal coronary angiography correlation with ecg changes

ECG Findings	Number of patients (23)	Percentage
AWMI	12	52.17%
IWMI	3	13.04%
Normal ECG	8	34.78%

23 patients who had normal CAG presented with following ECG changes - 12(52.17%) patients were having AWMI, 3 (13.04%) patients were having IWMI and 8 (34.78%) patients were having normal ECG.

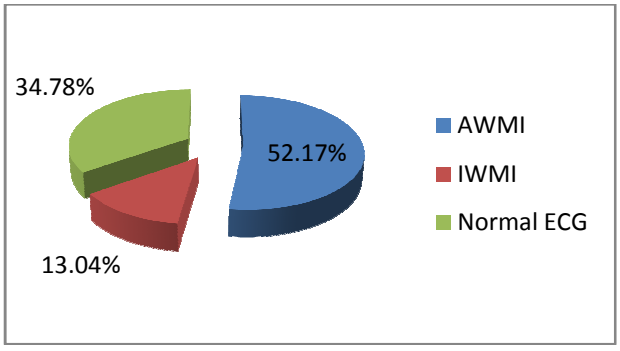

Table 8: Comparison of coronary angiography morphology in different group of patients

Group I				Group II				Group III			
Symptomatic patients with ECG changes (N = 76)				Symptomatic patients with normal ECG (N = 16)				Asymptomatic patients with ECG changes (N = 8)			
Normal CAG	CAD (N = 61)			Normal CAG	CAD (N = 12)			Normal CAG	CAD N = 4		
	SVD	DVD	TVD		SVD	DVD	TVD		SVD	DVD	TVD
15	24	24	13	4	3	6	3	4	2	1	1

Symptomatic patients + normal ECG + positive CAG (group II) =12/16= 75%, Symptomatic patients + normal ECG + negative CAG (group II) =4/16= 25% Z=6.930; p=0.000, (Symptomatic patients with normal ECG have positive CAG which is statistically significant.), Symptomatic patients with positive ECG + positive CAG = 61/76 = 80.26% , Symptomatic patients with normal ECG + positive CAG = 12/16 = 75.00%, Z =0.1677; p = 0.498 (statistically not significant), 75% symptomatic patients with normal ECG had significant coronary artery involvement.

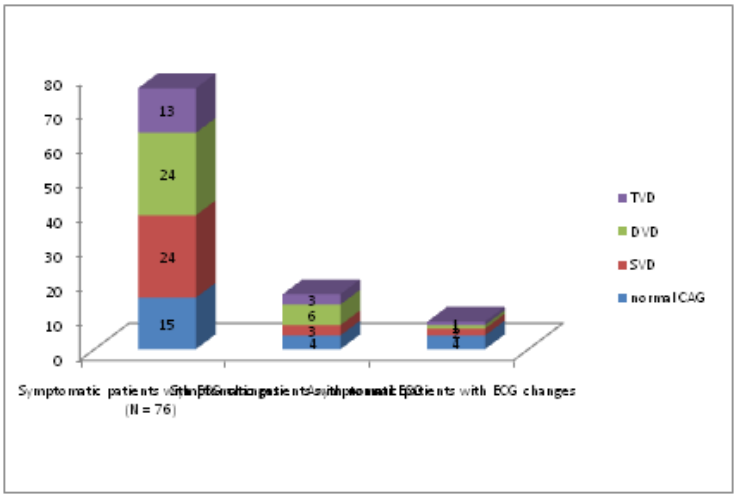

Figure 8: Comparison of coronary angiography morphology in different group of patients

LIMITATIONS OF THE STUDY

In our study primary angioplasty was not done in any patient. Patient's presenting with AMI were thrombolysed initially and then referred to cardiology department for CAG.Some patients were thrombolysed outside our hospital and were referred for angiography. Time of angiography was not standardized. Patients were not followed afterwards. Our study included limited number of patients. Therefore more data is required for confirmation.

SUMMARY

This particular study was conducted on 100 patients, with newly detected ischemic heart disease, who presented in medicine OPD or casualty, and admitted in ICU of Bharati Vidyapeeth Deemed University Medical College and Hospital, Sangli during the period October 2013 to October 2015. We studied correlation of coronary angiographic finding in patients with electrocardiographic changes. All 100 patients underwent ECG and coronary angiography, Relevance of ECG changes correlated with regard to culprit artery localization. Out of these 100 patients, ECG was normal in 16 patients, but due to symptoms of unstable angina and who were willfully opting for coronary catheterization, were taken for coronary angiography with informed and written consent. Out of 38 patients of AWMI, on angiography it was found that LAD was the commonly involved culprit artery. LCx and RCA were also seen involved in some cases of AWMI. Out of 13 patients of IWMI, on angiography it was found that RCA was the commonly involved culprit artery, with involvement of LCx and LAD in decreasing order. In patients with anterior wall ischemia and inferior lead ischemia, on angiography it was found that involvement of all three major vessels (LAD, LCx, and RCA) as a culprit artery was equally seen. Patients with left ventricular hypertrophy and left bundle branch block had significant coronary artery disease involving LAD. In 16 patients with normal ECG with symptoms of angina, on angiography it was found that 12 patients had significant coronary artery disease, while CAG was normal in 4 patients. Therefore 75%

patients with normal ECG had coronary artery disease. ECG reflects the physiology of the myocardium during acute ischemia, whereas coronary angiography identifies vessel anatomy. For this reason, it is possible to observe severe coronary artery stenosis upon angiography without ECG evidence of acute ischemia.

CONCLUSION

Thus, we concluded that coronary angiography remains the "gold standard" for identifying the infarct related artery, while ECG is for identifying the presence of acute myocardial ischemic event. The patients with significant ECG change may have extensive coronary artery involvement or sometime even normal coronaries on angiography. Patient with normal ECG changes may show normal coronary angiography or extensive coronary artery disease. ECG reflects the physiology of the myocardium during acute ischemia, whereas coronary angiography identifies vessel anatomy. For this reason, it is possible to observe severe coronary artery stenosis on angiography without ECG evidence of acute ischemia. It is possible to observe restored vessel patency upon angiography with ECG evidence of ongoing ischemia due to "no-reflow", reperfusion injury, or myocardial damage that has already developed before reperfusion occurs. Hence coronary angiography is more advanced and reliable investigation for diagnosis of coronary artery disease in present era.

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Source of Support: None Declared
Conflict of Interest: None Declared