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A Study on Correlation of ECG Findings with Angiographic Presentation among Acute Myocardial Infarction Patients in a Tertiary Care Hospital

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Introduction

- CVD is responsible for about 30% of all deaths worldwide each year.[9] Nearly, 80% of these deaths occur in developing countries. Indeed, CVD is the leading cause of mortality in almost every region of the world.
- The electrocardiogram (ECG) remains a crucial tool in the identification and management of AMI. Acute risk stratification in AMI is still based on simple clinical parameters; laboratory markers and 12-lead ECG.[4]
- The ECG has been a preliminary screening and one of the most useful diagnostic investigations in AMI.[5]
- Coronary angiography is currently the gold standard to evaluate AMI. It defines the coronary anatomy and determines the extent of epicardial coronary artery and coronary artery bypass graft disease.
- Various ECG presentations in relation with their angiographic finding will be investigated under this study. If correlation between ECG features and angiographic findings is found, a faster and less invasive method can be used to identify diseased vessel, therefore timely intervention can be implemented to lower its mortality rate.
- A detailed analysis of patterns of ST-segment elevation may influence decisions regarding the perfusion therapy. The early and accurate identification of the infarct-related artery can help predict the area of myocardium at risk and guide decisions regarding the urgency of revascularization.[1]

Aims and Objectives

1. To study the electrocardiographic and angiographic correlation in localizing the culprit vessel in acute ST segment elevation myocardial infarction.
2. To analyse established individual electrographic parameters for their sensitivity, specificity, positive predictive value, negative predictive value in predicting the culprit vessel in comparison with angiographic results.

Materials and Methods

Study Centre: King George Hospital, Andhra Medical College, Visakhapatnam.

Ethical Committee Approval: Obtained.

Study Duration: Six months. (August 2019-January 2020)

Study Design: Hospital-based, cross-sectional, observational study

Sample Size: 50 cases

- Patients who presented with typical chest pain (>30 min) to the emergency department were taken ECG.
- The diagnosis of acute ST elevation myocardial infarction was made according to the following criteria:
  1. Anterior wall MI: ST segment elevation by 2mm or more in two or more anatomically consequent precordial leads.
  2. Inferior wall MI: ST segment elevation by 1mm or more in two or more anatomically consequent inferior leads.
- Patients who had the above ECG criteria and raised Troponin-T were admitted in cardiology ICU and treatment is given.
- A total of 50 patients were taken into study.
- Angiogram was done within 7 days of admission
- Electrocardiographic changes in specified individual lead and the established ECG criteria for identifying the culprit artery and localizing the level of lesion were compared with angiographic localisation which is considered as gold standard.

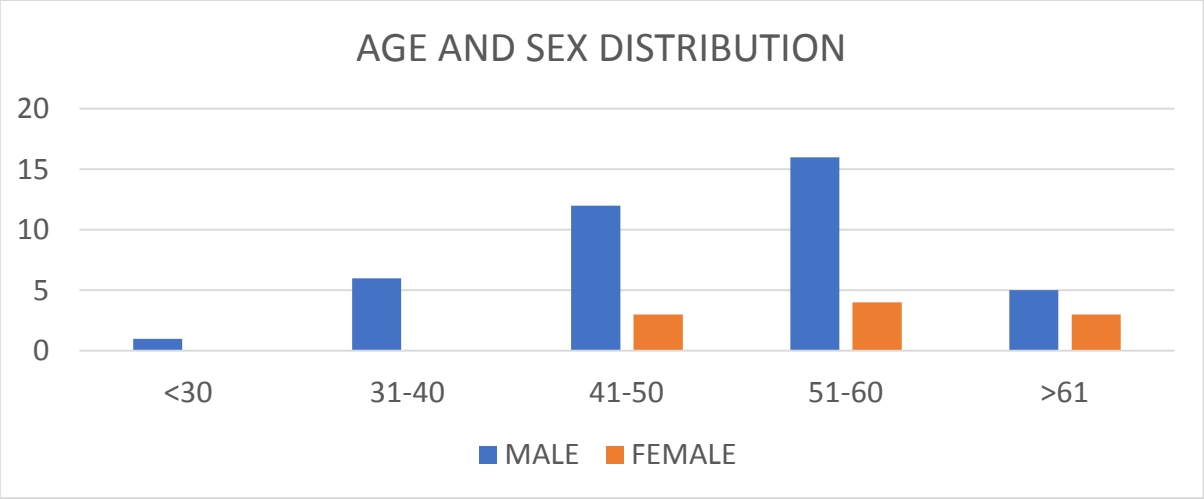
INCLUSION CRITERIA	EXCLUSION CRITERIA
1. Patient who presented with acute ST segment elevation myocardial infarction..	1. Causes of ST segment elevation, other than myocardial infarction.
2. Patient who have undergone coronary angiography	2. Left bundle branch block (LBBB).
	3. Baseline ECG abnormalities other than LBBB (eg, paced rhythm, LV hypertrophy, Brugada syndrome).
	4. Previous myocardial infarction

Statistical Analysis

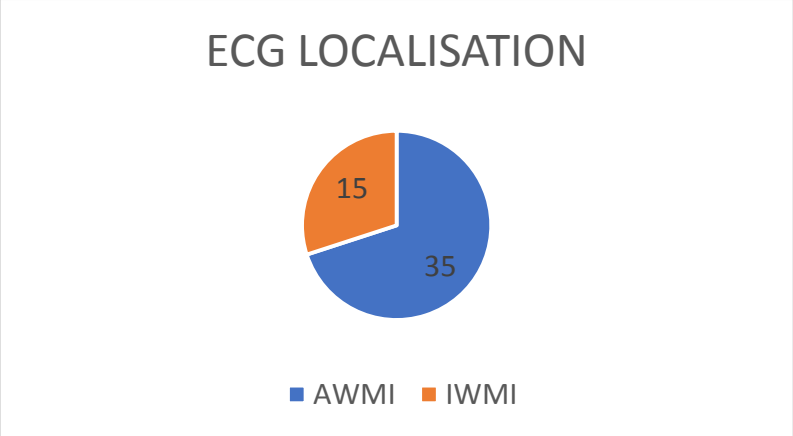
For each individual ECG criteria based on their distribution in various angiographic localisation site sensitivity, specificity, positive predictive value, negative predictive value were calculated and the p value was obtained using Fisher's exact test. Statistical analysis was done using SPSS Version 20. The following observations were made.

Results

The commonest risk factor was diabetes (43.9%) followed by hypertension (21.5%), positive family history (9.1%), previous CAD (7.7%), dyslipidemia (5.3%) and asthma/COPD (2.3%)

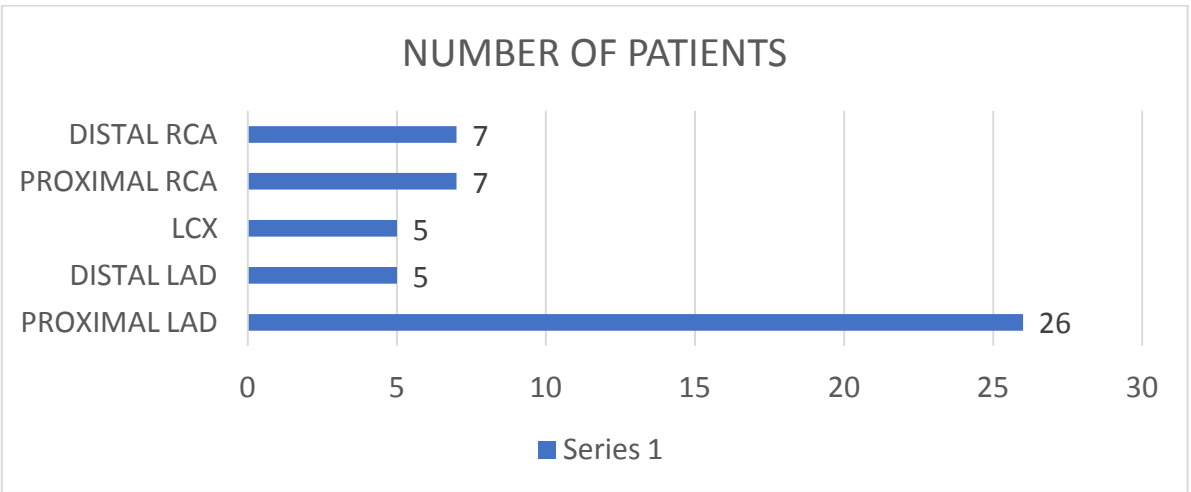


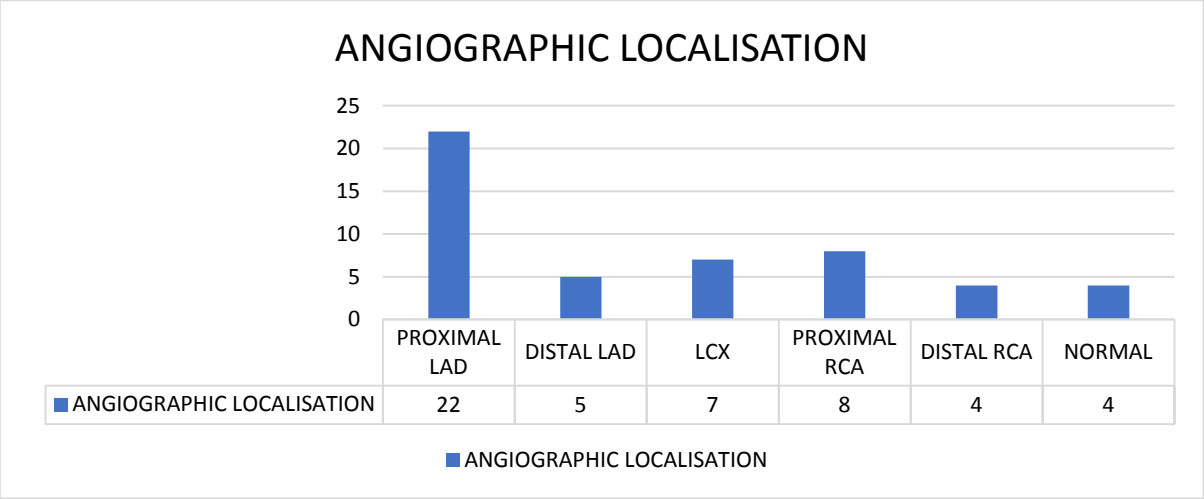
- Out of 50 patients with ST segment elevation 35 patients, i.e 70% had AWMI and 15(30%) had Inferior Wall Myocardial Infarction.
- Out of 50 patients 38(76%) were thrombolysed, 12 (24%)were not thrombolysed.



TREATMENT	NO.OF PATIENTS(%)
THROMBOLYSIS	38(76%)
NOT THROMBOLYSED	12(24%)
TOTAL	50

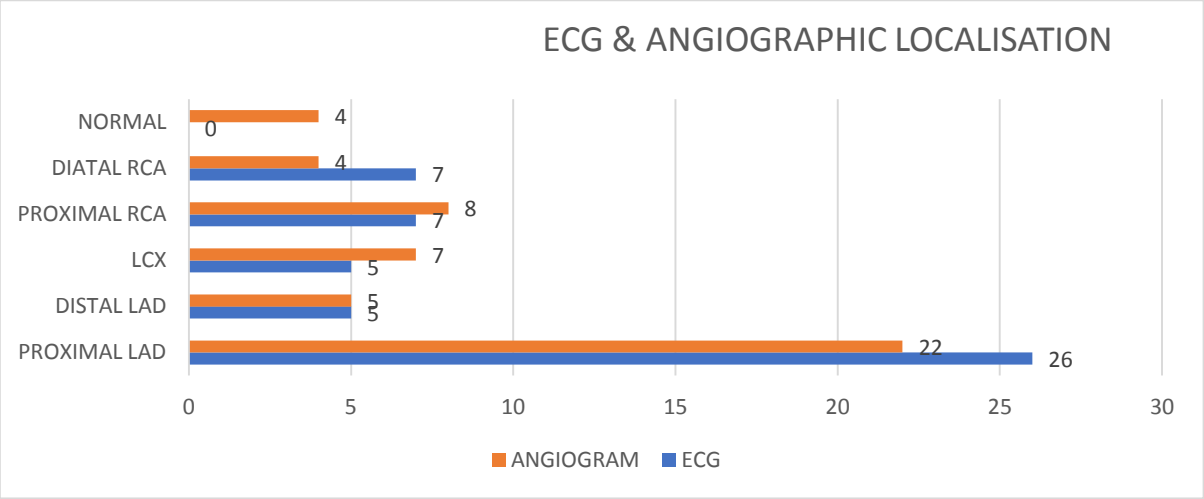
LOCALISATION WITH ECG	NO.OF PATIENTS(%)
Proximal LAD	26(52%)
Distal LAD	5(10%)
LCX	5(10%)
Proximal RCA	7(14%)
Distal RCA	7(14%)
Total	50

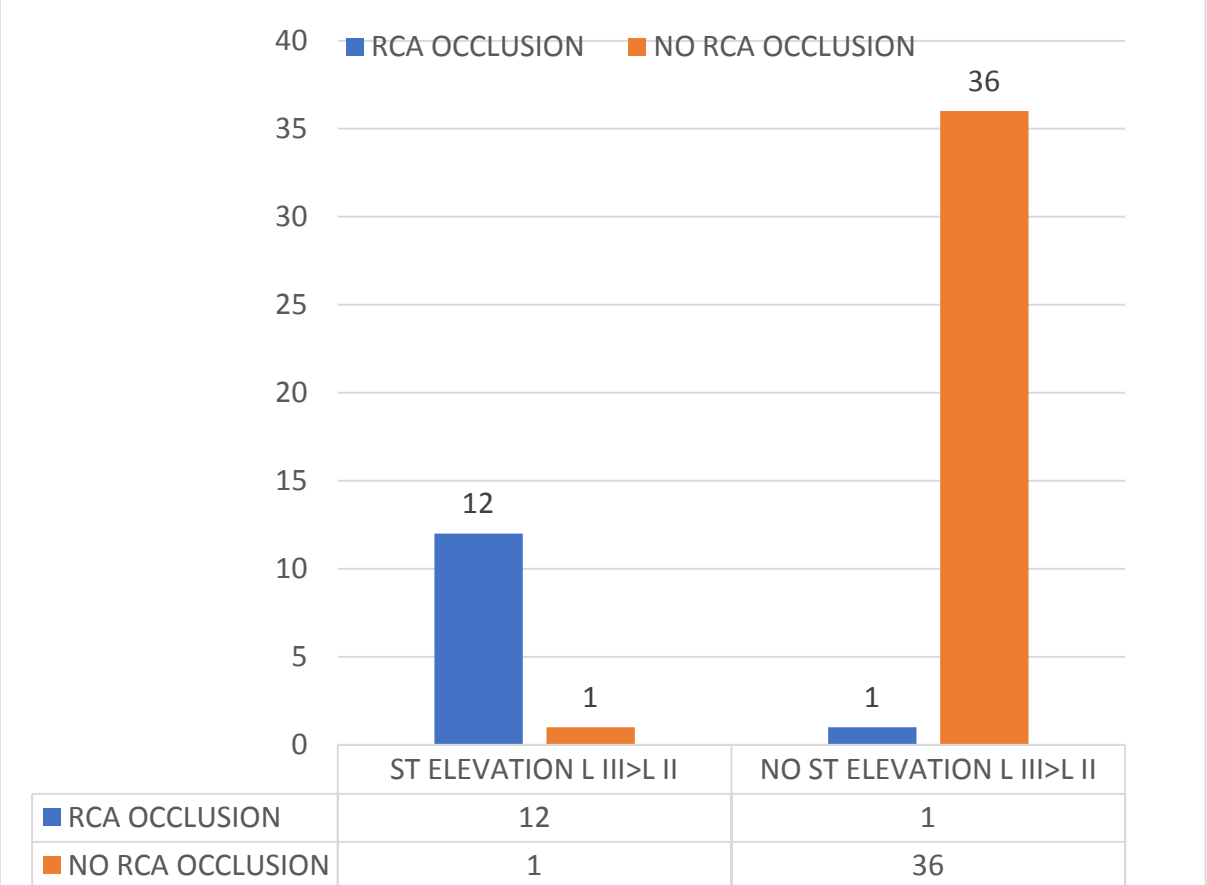


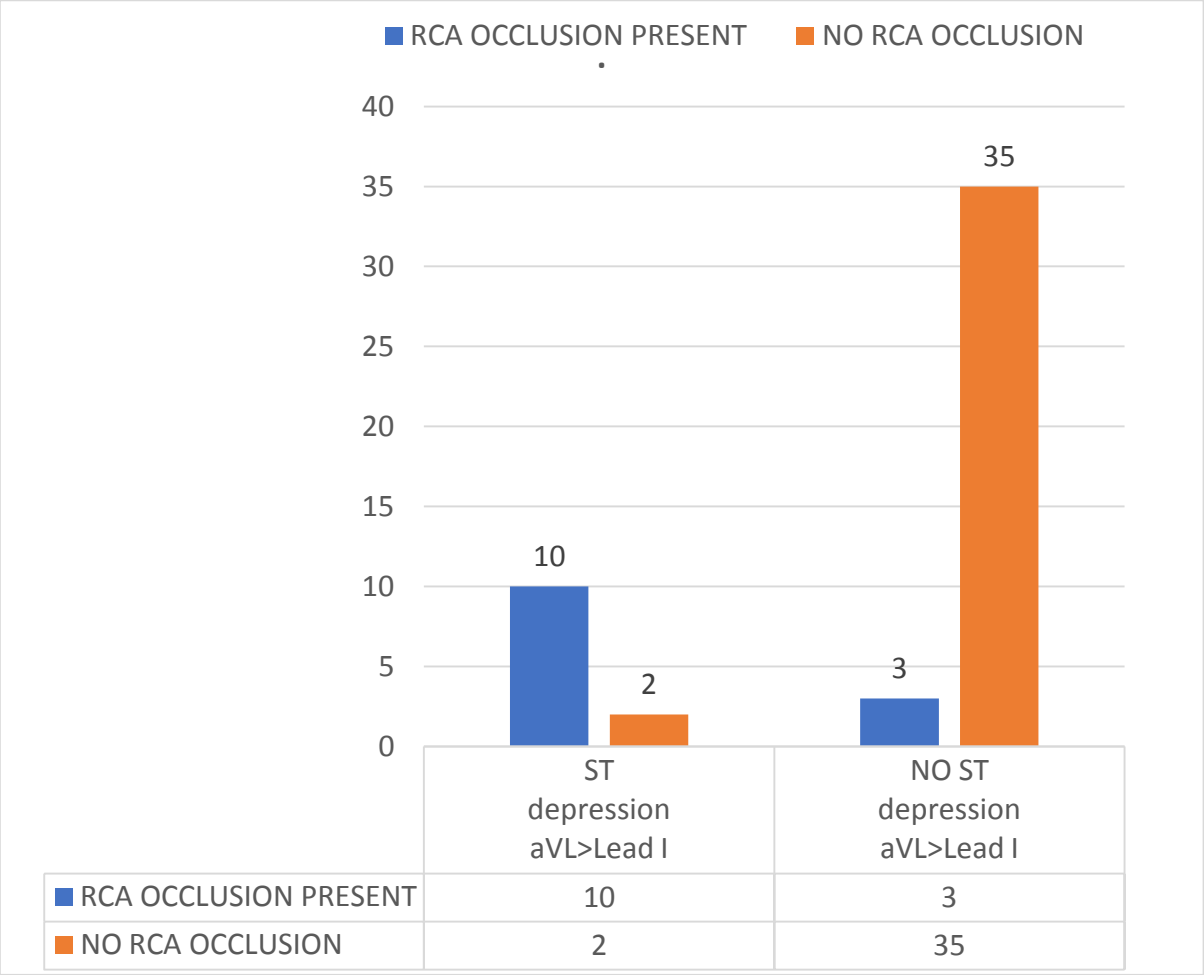


ECG LOCALISATION			ANGIOGRAPHIC LOCALISATION				
	Proximal RCA	Distal RCA	LCX	Proximal LAD	Distal LAD	Normal	Total
Proximal RCA	7	0	0	0	0	0	7
Distal RCA	1	4	2	0	0	0	7
LCX	0	0	5	0	0	0	5
Proximal LAD	0	0	0	21	1	4	26
Distal LAD	0	0	0	1	4	0	5
TOTAL	8	4	7	22	5	4	50=total

ANGIOGRAM LOCALISATION	NUMBER(%)
PROXIMAL LAD	22(44%)
DISTAL LAD	5(10%)
LCX	7(14%)
PROXIMAL RCA	8(16%)
DISTAL RCA	4(8%)
NORMAL	4(8%)


ECG & ANGIOGRAPHIC LOCALISATION
NORMAL
DIATAL RCA
PROXIMAL RCA
LCX
DISTAL LAD
PROXIMAL LAD
0
4
4
7
8
7
7
5
5
5
22
26
0
5
10
15
20
25
30
ANGIOGRAM
ECG


40
35
30
25
20
15
10
5
0
RCA OCCLUSION
NO RCA OCCLUSION
12
1
1
36
ST ELEVATION L III>L II
NO ST ELEVATION L III>L II
RCA OCCLUSION 12 1
NO RCA OCCLUSION 1 36


RCA OCCLUSION PRESENT
NO RCA OCCLUSION
40
35
30
25
20
15
10
5
0
10
2
3
35
ST depression aVL>Lead I
NO ST depression aVL>Lead I
RCA OCCLUSION PRESENT 10 3
NO RCA OCCLUSION 2 35

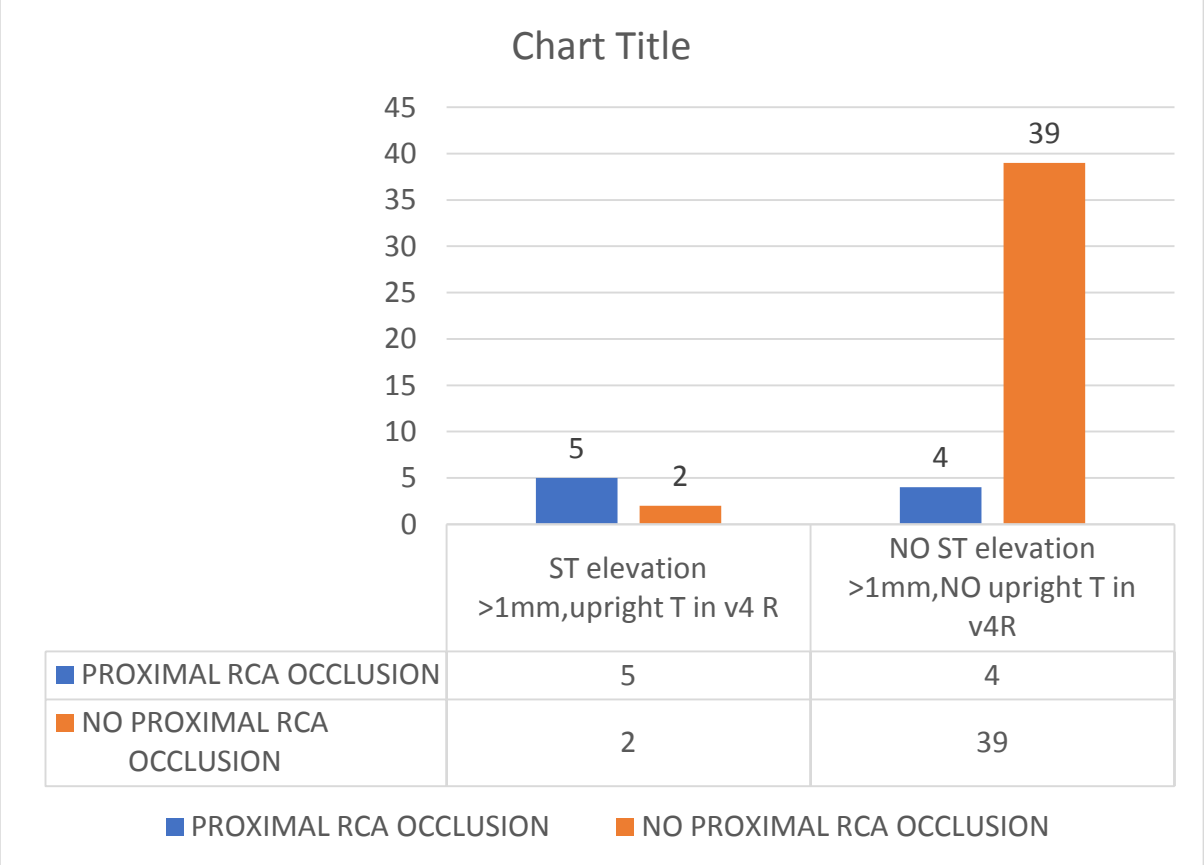
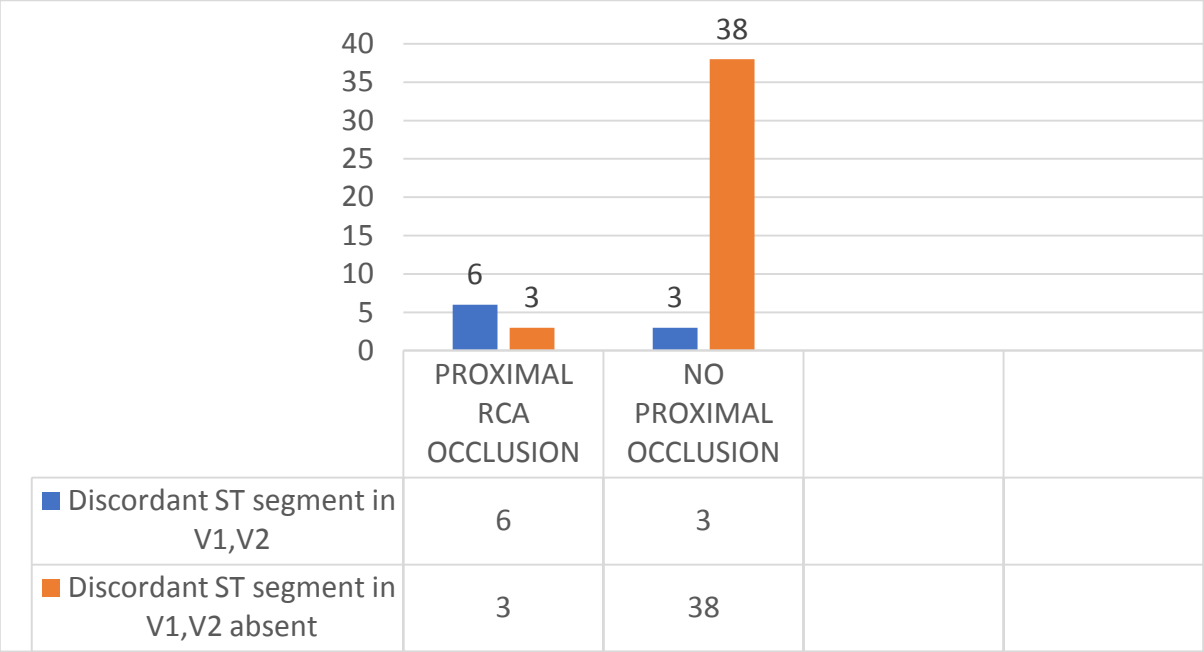
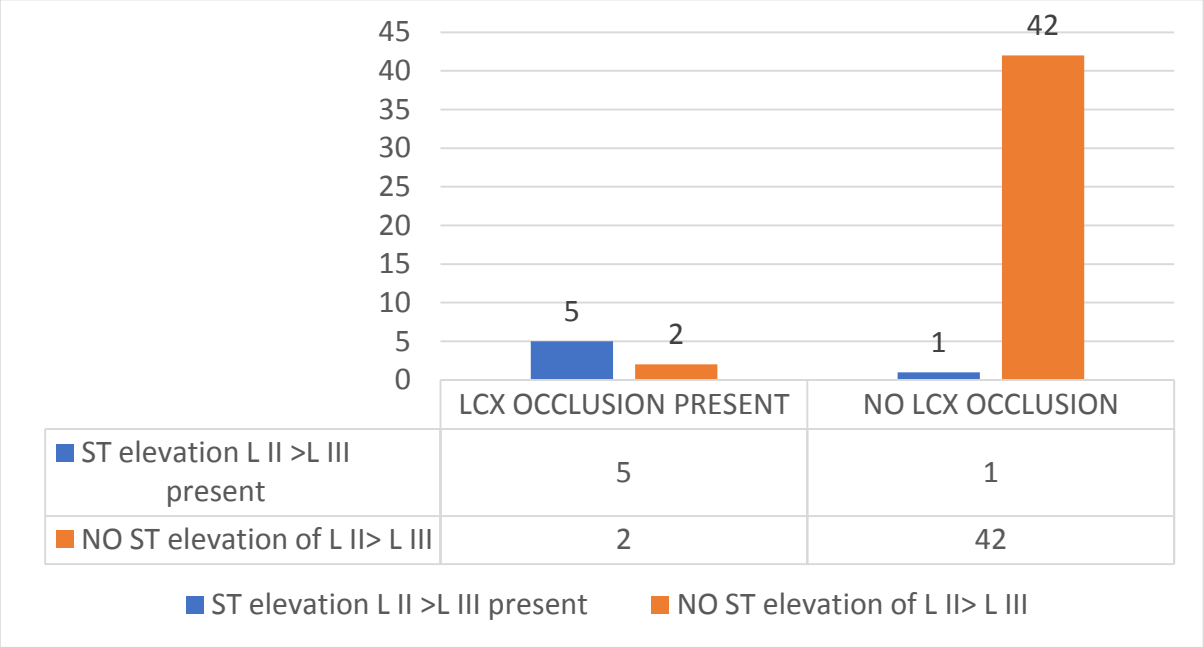
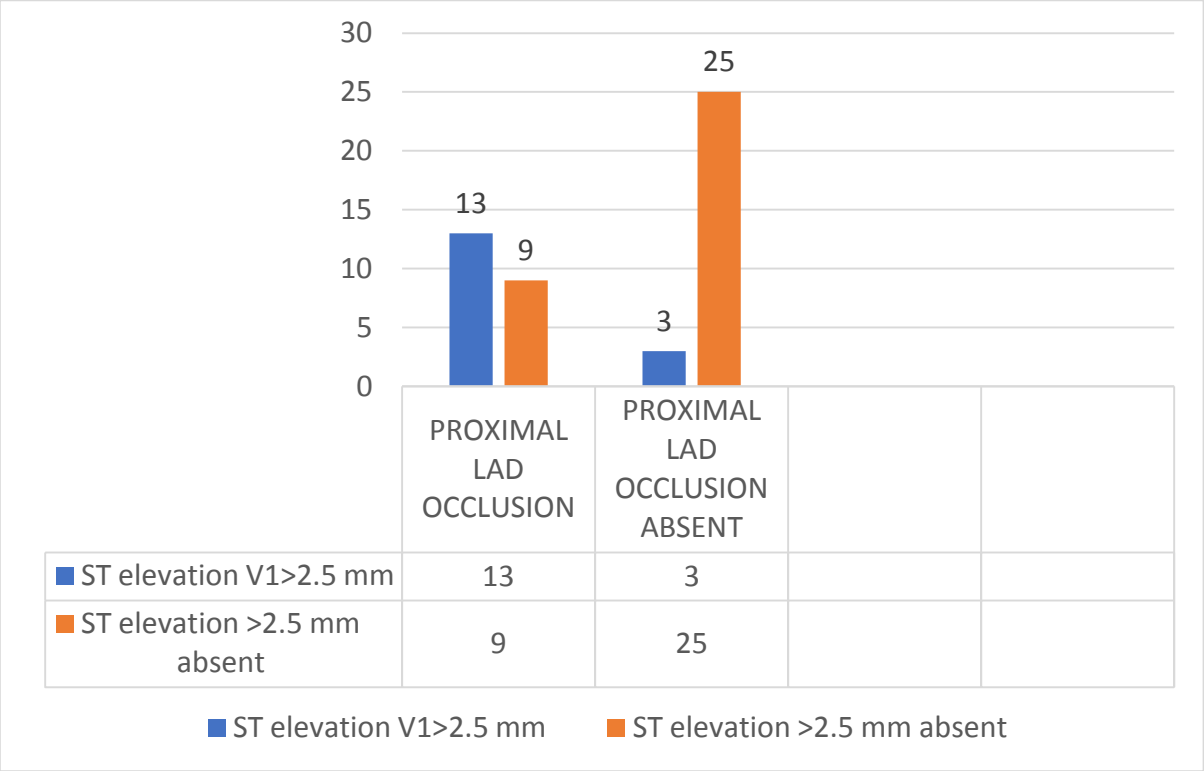
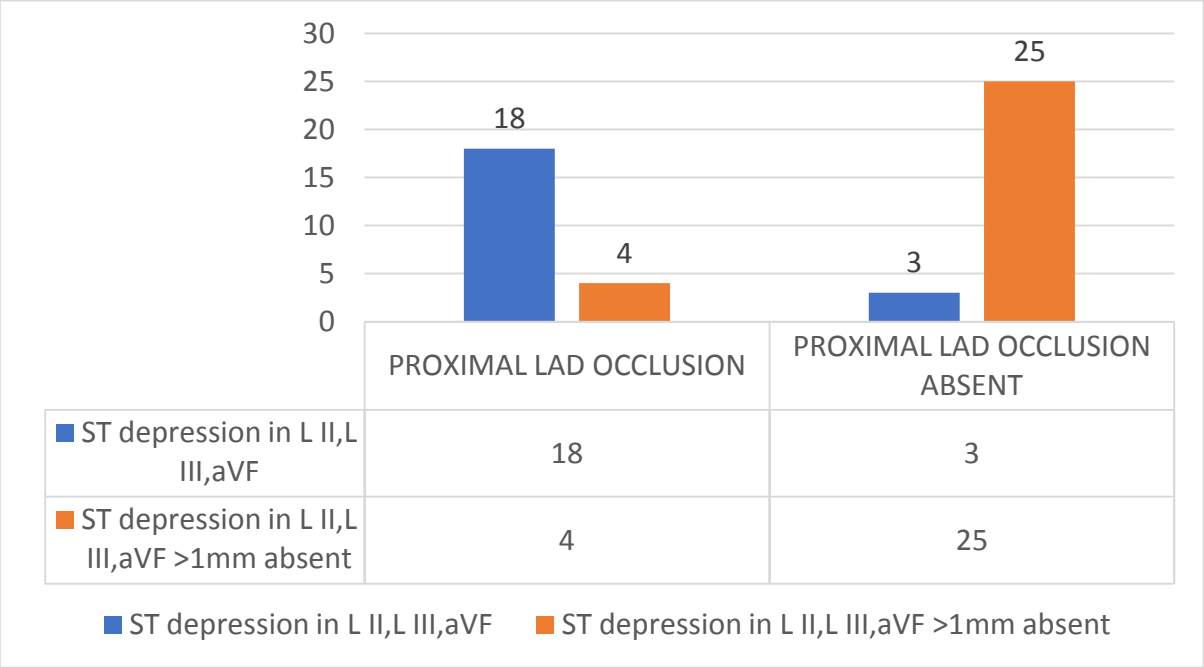


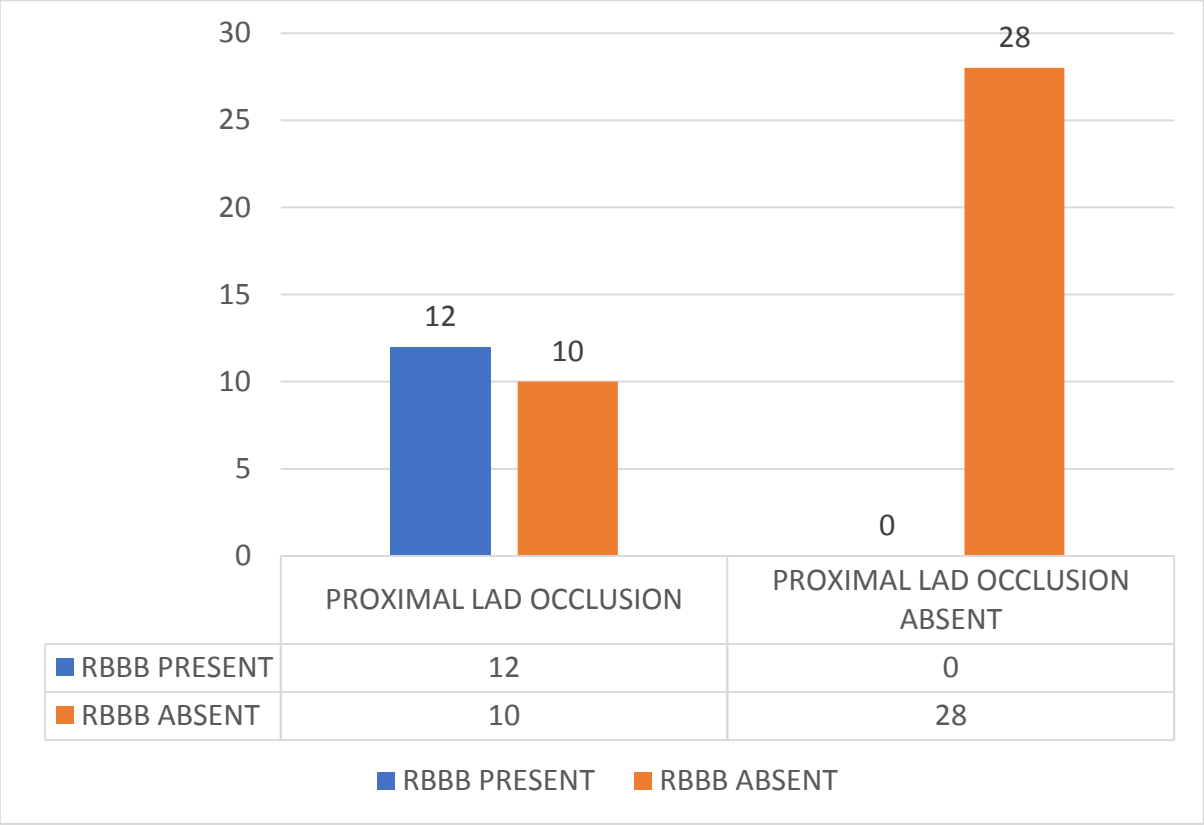
Chart Title
45
40
35
30
25
20
15
10
5
0
5
2
4
39
ST elevation >1mm,upright T in v4 R
NO ST elevation >1mm,NO upright T in v4R
PROXIMAL RCA OCCLUSION 5 4
NO PROXIMAL RCA OCCLUSION 2 39
PROXIMAL RCA OCCLUSION
NO PROXIMAL RCA OCCLUSION

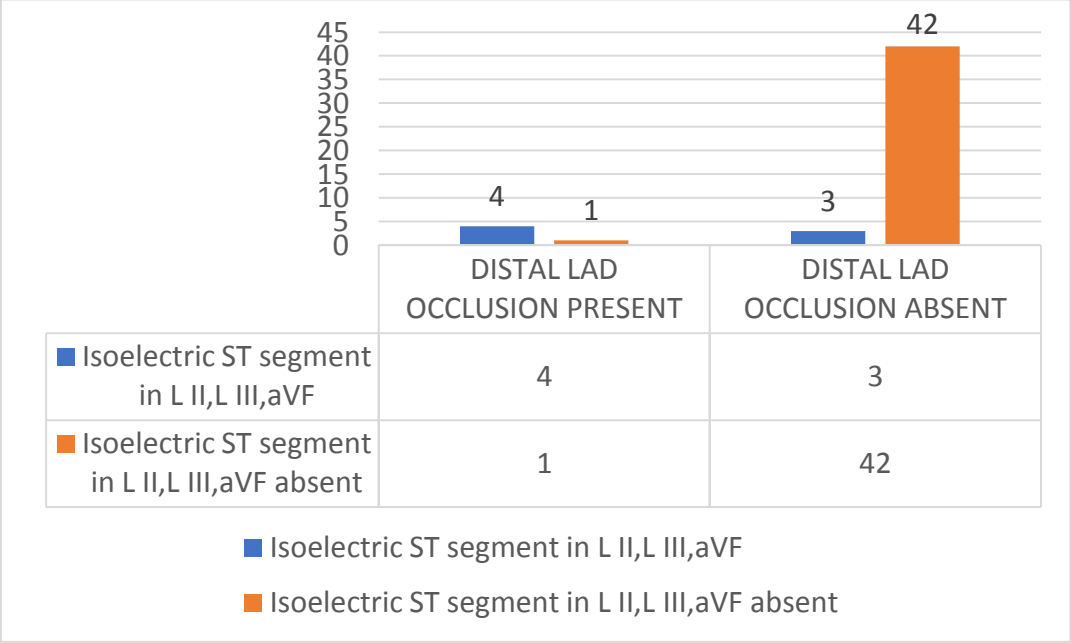

40
35
30
25
20
15
10
5
0
6
3
3
38
PROXIMAL RCA OCCLUSION
NO PROXIMAL OCCLUSION
Discordant ST segment in V1,V2
6
3
Discordant ST segment in V1,V2 absent
3
38

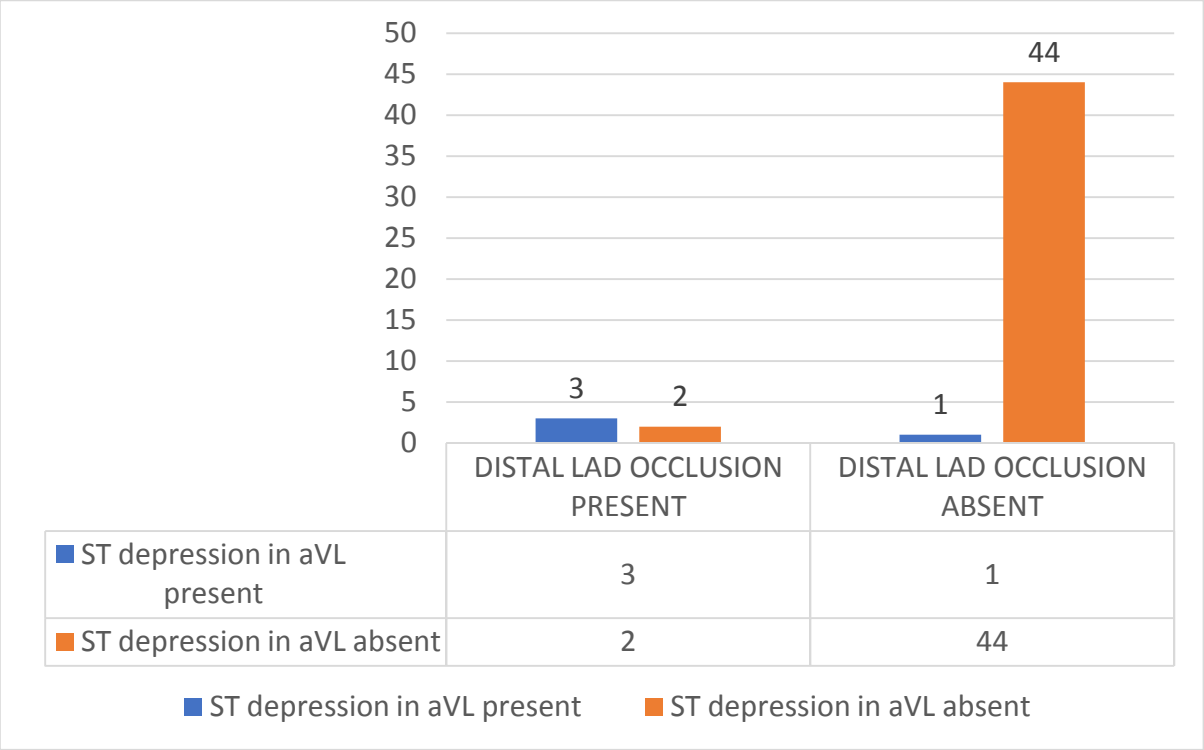

45
40
35
30
25
20
15
10
5
0
5
2
1
42
LCX OCCLUSION PRESENT
NO LCX OCCLUSION
ST elevation L II >L III present
5
1
NO ST elevation of L II> L III
2
42
ST elevation L II >L III present
NO ST elevation of L II> L III


30
25
20
15
10
5
0
13
9
3
25
PROXIMAL LAD OCCLUSION
PROXIMAL LAD OCCLUSION ABSENT
ST elevation V1>2.5 mm
13
3
ST elevation >2.5 mm absent
9
25
ST elevation V1>2.5 mm
ST elevation >2.5 mm absent


30
25
20
15
10
5
0
18
4
3
25
PROXIMAL LAD OCCLUSION
PROXIMAL LAD OCCLUSION ABSENT
ST depression in L II,L III,aVF
18
3
ST depression in L II,L III,aVF >1mm absent
4
25
ST depression in L II,L III,aVF
ST depression in L II,L III,aVF >1mm absent


30
25
20
15
10
5
0
12
10
0
28
PROXIMAL LAD OCCLUSION
PROXIMAL LAD OCCLUSION ABSENT
RBBB PRESENT
12
0
RBBB ABSENT
10
28
RBBB PRESENT
RBBB ABSENT


45
40
35
30
25
20
15
10
5
0
4
1
3
42
DISTAL LAD OCCLUSION PRESENT
DISTAL LAD OCCLUSION ABSENT
Isoelectric ST segment in L II,L III,aVF
4
3
Isoelectric ST segment in L II,L III,aVF absent
1
42
Isoelectric ST segment in L II,L III,aVF
Isoelectric ST segment in L II,L III,aVF absent



Comparison of various criteria to identify culprit vessel in AWMI (ANTERIOR WALL MYOCARDIAL INFARCTION)						
Parameters	**Present Study**		**Vasudevan *et al.*[7]**		**Engelen *et al.*[5]**	
	Sensitivity	**Specificity**	**Sensitivity**	**Specificity**	**Sensitivity**	**Specificity**
PROXIMAL LAD						
ST elevation V_1> 2.5 mm	59%	89.2%	71%	66%	12%	100%
ST elevation aVR	63.6%	92.8%	50%	100%	43%	95%
Complete RBBB	54.5%	100%	-	-	-	
Inferior lead ST depression > 1mm	81.8%	89.2%	90%	85%	49%	85%
DISTAL LAD						
Absence of inferior leads ST depression	80%	93.3%	82%	89%	50%	86%
ST depression in aVL	60%	97.7%	10%	100%	22%	95%
RBBB= Right bundle branch block						

Comparison of Sensitivity and Specificity of our study with other similar studies						
ECG Parameters	**Present Study**		**Nair and Glancy *et al.*[10]**		**Markandeya Rao *et al.*[1]**	
	Sensitivity	**Specificity**	**Sensitivity**	**Specificity**	**Sensitivity**	**Specificity**
RCA occlusion						
ST depression aVL> LI	76.9%	94.5%	100%	60%	82%	73%
ST elevation >1mm, Upright T in V4R	55.5%	95.1%	86%	100%	71%	66%
LCx occlusion						
ST elevation LII> LIII	71.4%	97.6%	60%	100%	55%	84%
RCA= Right coronary artery, ECG= Electrocardiogram, LCx= Left circumflex						

Discussion

- Out of 35 patients with Anterior Wall MI, ECG criteria for proximal LAD occlusion with 100% specificity is RBBB. Most sensitive (81.8%) finding for proximal LAD occlusion is ST depression >1mm in inferior leads with p-value =0.001 which is consistent with study done by Vasudevan et.al
- ST elevation in L II > L III remains the most sensitive(71.4%) and most specific(97.6%) with positive predictive value (PPV=71.4%,) Negative predictive value=95.4% with p value<0.001 for LCX occlusion which is consistent with Nair and Glancy et.al study
- Isoelectric ST segment in L II,L III, aVF is the most sensitive(80%),ST depression in aVL has specificity of 97.7% in case of Distal LAD occlusion on angiogram which are consistent with studies done by Vasudevan et al. and Engelen et. al.
- Most specific (95.1%)ECG criteria for proximal RCA occlusion is ST elevation > 1mm,upright T in V4R (sensitivity =55.5%,positive predictive value=71.4%, Negative predictive value=90.6%, p value <0.001) and ST depression in aVL>L1 has sensitivity of 76.9% ,specificity=94.5 %, PPV=83.3%, NPV=92.1%) for distal RCA occlusion which is consistent with study done by Nair and Glancy et. al
- ST elevation in L II=L III has sensitivity and specificity of 57.1% & 95.3% respectively for LCX occlusion.
- ST elevation in aVR (sensitivity-63.6%, specificity-92.8%) and Q wave in aVL (sensitivity-68.1%, specificity-92.8%) for proximal LAD occlusion.

Conclusion

The admission ECG is valuable in locating, localising the culprit artery and also provide information about the extent of the myocardial injury.

The ECG changes predict the culprit vessel but cannot be a substitute for the angiogram which is considered to be the gold standard.

Limitations

Our study was conducted in a limited timeframe and population. A larger population from different continents and longer study will be needed to provide more accurate information regarding the appropriateness of ECG findings.

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Conflicts of Interest: None

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