Original Research Article

A SINGLE CENTRE STUDY TO FIND OUT THE PREVALANCE, CLINICAL, ANGIOGRAPHIC PROFILE AND LONG-TERM OUTCOMES OF PATIENTS HAVING CORONARY ARTERY ECTASIA

Dr Shriram Agrawal[1] & Dr M S Harikrishnan[2]

Consultant Cardiologist, Agrawal Nursing Home, Narmadapuram, MP[1]
MD, DM (Cardiology), Professor Department of Adult Cardiology, Aims, Kochi[2]

Corresponding Author: Dr Shriram Agrawal, MD (MEDICINE), DNB (MEDICINE), DM (CARDIOLOGY), DrNB (CARDIOLOGY)

Abstract

Background: Isolated Coronary Artery Ectasia (CAE), is considered an uncommon angiographic finding with varying pattern of presentations and carries significant morbidity burden to the patient.

Aim: Evaluate the prevalence, its clinical, angiographic, and follow up characteristics.

Materials and Methods: Search was done for angiograms with diagnosis of ectasia from 2012-2019. These angiograms were studied and classified as per Markis. Corresponding clinical and lab parameters were gathered from electronic medical record. Data on recurrent chest pain, unstable angina, MI, hospital admission for any cause, were collected from hospital medical records, by OPD encounters on follow up and by telephonic questionnaire.

Results: The mean age was 60 years +/- 10.5 years Most common age bracket is 60-80 years (48%), with male to female ratio of 2.5 :1. Out of total 15, 634 angiograms done during the period from 2012 to 2019, 348 angiograms were found to be cases with isolated CAE or CAE with mild CAD. Ectasia with significant CAD were excluded from the study. The prevalence in the present study is 2.2 %. Most common vessel involved was LAD in diffuse coronopathy, but isolated involvement is more common in RCA. Markis class III with diffuse involvement is the most common. The mean follow up was 60 months during which 5 patients had angioplasty, other 2 patients developed thrombotic occlusion, and other 3 patients had mild disease. 4 patients died during follow up.

Conclusion: Ectasia with mild CAD may not be completely innocuous and aggressive risk stratification is needed.

1. INTRODUCTION:

Coronary artery ectasia was first described by Morgagni in 1761.(1).It is defined as dilation of >1.5 times normal adjacent segments of vessels , which can either be localized or diffuse .(2).Congenital and acquired causes of CAE have been described, atherosclerosis being most common (4).Markis (3) provided the first potential evaluation of the incidence of CAE.He (3)also introduced the following classification of CAE based on the extent of coronary involvement: type I, diffuse ectasia of two or three vessels;

type II, diffuse disease in one vessel and localized disease in another vessel; type III, diffuse ectasia of one vessel only; type IV, localized or segmental ectasia.

The evaluation and characterisation of isolated coronary artery ectasia represent a great diagnostic challenge with clinical and therapeutic implication. The present study aims to study the prevalence, clinical, angiographic, and follow up characteristics of patients with isolated CAE.

Retrospective studies from Indian subcontinent have found to be prevalence ranging from 1% to 5%. Study by Nyamu et al showed prevalence of CAE to be 1.9 %. (5).

2. METHODS:

I) SELECTION AND DESCRIPTION OF PARTICIPANTS:

Eligibility:

Inclusion Criteria: Patients who underwent CAG at AIMS during the period from 01/01/ 2012 to 31/12/ 2019.

Exclusion Criteria: 1) Patients with Significant Obstructive Coronary Artery Disease.

SELECTION PROCESS:

Study Population: Search was done for angiograms with diagnosis of ectasia from 2012-2019.

To retrospectively review the coronary angiograms of patients with diagnosis of ectatic coronaries on angiogram. Patients with concomitant significant coronary artery disease were excluded from the study. The patient clinical characteristic including age, associated risk factors: smoking status, diabetes mellitus, dyslipidaemia, and hypertension were recorded. Symptom at presentation, NYHA class past history of MI, COPD or any ACS event was recorded.

Corresponding clinical and lab parameters were gathered from electronic medical record. Relevant investigations like ECG, Echo, TMT, Lipid Profile, etc

B) **CORONARY ANGIOGRAPHY:**
The vessels involved with ectasia, their distribution, were visually graded to assess the coronary artery anatomy and the presence of any obstructive lesion in each vessel. Calculation of vessel lumen diameter to assess the severity of coronary lesions were visually graded. A vessel diameter stenosis >70 %, or > 50 % for left main was considered significant, according to criteria employed by CASS.

Coronary artery ectasia extent will be graded using the Markis class.
The definition of Coronary Artery Ectasia employed was that used in the Coronary Artery Surgery Study (6) – CASS where a vessel was considered ectatic when its luminal diameter exceeds 1.5 times the adjacent normal segment.
Discrete ectasia was defined when the ectatic segment was less than 1 cm and diffuse when it was more than or equal to 1 cm.

In case of diffuse ectasia, the diameter of the corresponding artery in a normal angiogram was taken.

Vessel Lumen Diameter were visually graded to assess the severity of coronary lesions. Stenosis was evaluated by comparison to the proximal and distal ectatic segments in cases with ectasia.

C) FOLLOW UP: Details of clinical follow up with relevant investigations were analyzed with respect to the nature of treatment Advised. Their long-term outcome including death from any cause, major cardiac events, MI, cardiac mortality, functional class, symptoms of angina, effect of drugs etc.will be recorded from case files. Their 5 years follow up including the effect of drugs on them.

II) TECHNICAL INFORMATION:
o PRIMARY OBJECTIVE: Prevalence of Coronary Ectasia in patients undergoing CAG will be expressed as in Percentage.
o Secondary Objective: Clinical, biochemical and angiographic profile of patients with coronary artery ectasia.

III) STASTICAL ANALYSIS:
o Statistical analysis was done using IBM SPSS 20.0 (SPSS Inc, Chicago, USA).
o For all the continuous variables, the results are given in Mean ± SD, and for categorical variables as percentage.

Hypertension was defined as per latest JCC guidelines as equal to or more than 130-139 mm hg systolic and 80-89 mm hg diastolic or patients who were already on at least one antihypertensive drug. (15). Although ACC /AHA favours the use of 10-year ASCVD risk, but dyslipidaemia in this study was defined using the criteria ACC/AHA guidelines as LDL > 70 was taken. For serum triglyceride and HDL measurement the cut off as mentioned for metabolic syndrome were taken with serum triglyceride > 150 mg/dL, and HDL <50 for females and < 40 for males. Serum Cholesterol values >200 mg/dL was taken as cut-off. (15). Treadmill test (using the Bruce Protocol) was considered positive when horizontal or down slopping ST depression of >/ 1 mm was observed during exercise with or without chest pain. (16). Also, ST elevation in lead avr was also considered positive for left main disease.

FAMILY HISTORY OF PRE-MATURE CAD – Indicate if the patient has any direct blood relatives (parents, siblings, children) who have had any of the following at age <55 years for males or <65 years for female relatives: Angina, Acute MI, Sudden Cardiac Death without obvious cause.

3. RESULTS

Of total 15, 634 angiograms done during the period from 2012 to 2019, 736 patients were found to be having coronary artery ectasia irrespective of CAD status. these 736 angiograms were studied and was found that the following data as follows:
Out of total 727 angiograms which we studied; 388 angiograms were excluded for following reasons:
1. 374 were excluded for patients having significant coronary artery disease.
2. One patient had co existing coronary artery aneurysm.

3. 4 patients the information available was incomplete and their angiograms and other parameters were not available in our electronic medical record. 348 patients out of total of 15, 634 angiograms comes to a prevalence rate of 2.2 %.

The mean age of the patients were 60 years +/- 10.5 years. Age range varied from 31-89 years. Majority of patients belonged to 61-80 years age bracket. Male to female ratio was 2.5:1. 120 (34.6 %) patients were diabetic, 43 (12.4%) smokers, and majority, 189 (54.5%) were hypertensives, and 193 (55.6%) had dyslipidaemia Out of the total 348 angiograms which were studied following values were derived:

LAB PARAMETRES
1.   **LDL and follow up LDL values**: Mean value of LDL either at the time of presentation or the closest value at the time of angiogram was taken and for follow up value was the last value available. LDL values were available for 237patients (68%) and 111 patients had no documented value. The mean value was 112 with SD +/- 33. Minimum value – 45 and Maximum value- 215.

This draws the fact that majority of the patients were having dyslipidemia. Irrespective of angiogram results most of the patients were put on statins for dyslipidemia and so the follow up value was also traced.

Mean follow up LDL values were available for 136 patients (39 %) and 212 patients had no follow up value available. Mean value was 98 +/- SD 34. Minimum value - 35 and Maximum value – 212.

2.   **HDL values:** HDL values were available for 234 patients out of 348 (67.2%) available patients, and not available in 114 patients. Mean HDL value was 43 +/- SD 15. Minimum value – 15 and Maximum value- 91.

3.   **Serum Choleserol:** S Cholesterol values were available in 236 patients (67.8 %) and not available for 112 patients. Mean value was 167 +/- SD 50. Minimum value -33 and Maximum value – 486.Median is 162 (due to extreme value)

4.   **Serum Triglyceride:** S triglyceride value was available; in 233 patients and the mean value was 134 +/- SD 67. Minimum value- 40 and Maximum value- 591.Median is 122. (Due to extreme value)

5.   **Serum CRP**: CRP value was available for 61 patients only (17.5%). The mean value of CRP was 16 +/- SD of 4. Minimum value- 0.18 and Maximum value – 127.

6.   **Serum ESR**: Serum ESR was available for 115 (32.7%) patients. The mean value was 18 +/- 11. Minimum value – 2 and Maximum value – 82.

7.   **Hemoglobin** -315 patients (90%) had their haemoglobin value available and amongst them mean value is 12.8 +/-2. Minimum value is 5 and maximum value is 18.

8. Total leucocyte count TLC – Total counts was available in 316 patients. (90%). The mean value is 7,660 with minimum value of 2,000 and maximum value of 26,000.

9. HBA1C – Mean hba1c value is 6.8 indicating that majority of patients were impaired glucose tolerance, available for 157 patients (45.1%)

10.   **Mean Platelet Volume**: Available for 332 patients (95%). The mean value is 8.89, with standard deviation of 1.5. The minimum value is 4.93 and maximum is 22.88.

11.   **Neutrophil/Lymphocyte ratio**: Available for 332 patients (95%). The median value is 1.6 with minimum value being 0.13 and maximum value being 86.

1. LAD was the most common artery involved in about 299 (85%) of patients, it is often involved when all other three vessels were also involved with it, for isolated lad involvement was seen in 55 (16%) only.
2. RCA was the next most common vessel to be involved vessel in 180 (73%) patients; whereas 75 (21.5%) patients had isolated coronary artery ectasia of right coronary artery.

So, this brought us to a conclusion that in diffuse dilated coronaropathy lad is the most common artery to be involved; where as in isolated coronary artery involvement rca is the most common artery to be involved.

3. LCX was the third most common vessel to be involved in total of 172 (50%) patients; isolated involvement is seen in 31 (9%) patients
4. LMCA is also involved in 7 (2%) patients and never had isolated involvement.

Follow up of patients were also done. The average follow up of patients was 60 +/- 24 months. Data on recurrent chest pain, unstable angina, MI, hospital admission for any cause, were collected from hospital medical records, by OPD encounters on follow up and also by telephonic questionnaire.

Almost half of patients¸146 patients (42%) were lost to follow up and didn't reported to OPD after their initial encounter. Out of other 202 patients who were on follow up; 150 (43 %) patients were asymptomatic on follow up and didn't have any events;.48 patients (13.6 %) continued to be symptomatic,4 patients had mortality on follow up (1.14 %).10 patients had repeat angiogram in which 7 patients had significant obstructive lesions, out of which 5 required angioplasty and 2 were kept on medical management because of significant thrombus burden. 12 patients (4%) underwent valve replacement, either mitral or aortic valve.7 patients underwent device placement. No patients underwent CABG. Optimisation of medical management was done in rest 23 patients.

Out of total 348 patients, 340 patients were kept on medical management, mostly satins and antiplatelets particularly in those with a prior history of MI or ACS event. Few patients were also kept on anticoagulation.

4. DISCUSSION:

Prevalence of coronary artery ectasia has been studied in various studies across India. In a study by Nyamu et al (8) conducted in similar geographic area around 2 decades ago revealed a prevalence of 1.9 % in patients with ectasia without flow limiting CAD. This is similar to our study where prevalence in a similar geographic area is 2.2%. In a study conducted by our own department, the prevalence of ectasia was 2.2 %, out of which 0.8 % were having isolated ectasia. (9). In another study from south India, S harkrishnan et al (10) prevalence was found to be 4.5 %, and only 22 patients (0.7%) were having isolated ectasia. In a recent study from north India by Ahmed, Gaurav et al (11), the prevalence was 4.1 %. (11). So largely this study is in concordance with other studies conducted.

The most common age bracket is 60-80 years (48%), closely followed by 40-60 years of age (47%), The mean age of the patients were 60 years +/- 10.5 years, in a similar study conducted in south India; Peter Nyamu (8) found that 40-60 is the most common age bracket with 58 % population, with mean age of the population being 52.1 +/-10. Similarly in another

study in north India, Rasheed Ahmed et al (11) mean age of the study population was 55 +/- 10.9 years.

Also, as far as male to female ratio is concerned, 250 male (71.8 %) sex was pre dominant, and remainder 78 (28.2 %) females, constituted the total population. Study by Nyamu et al had 83 % population as males, and the remaining 23 females (17 %). In another study by North East India (12) published in 2017 also had male -pre dominant population (71%),

120 (34.6 %) patients were diabetic, 43 (12.4) smokers, and majority, 189 (54.5%) were hypertensives, and 193 (55.6%) had dyslipidemia. In a similar study by Nyamu et al, 54 % were hypertensives, 27 % were diabetic, 30 % were smokers, and 48 % were having dyslipidaemia. Most of the parameters were matched when compared to this study. When compared, the study from north India by Gaurav et al (11) had 16 % diabetic, 27 % hypertensive, 32 % dyslipidaemia, and around 50 % were smokers. In another study by North East India (12), 59.6 % hypertensives, 30.7 % diabetics, 38 % smokers, and 42 % dyslipidemia. This is very much sync with the results obtained in our study.

46 patients (13.3 %) patients were having family h/o CAD. In other study by Gaurav et al (11), 12.1 % patients had family history, 17 % patients had family history of CAD in North Eastern India study (12). Four- Fifth of patients 278 (80%) have good lv function.

Out of total 348 patients screened, only 24 patients were found to have OAD in the form of COPD / Asthma, and majority of them, 324 (93 %) patients were free from OAD.

Indications for coronary angiograms was typical angina or chest pain suggestive of angina, atypical chest pain, previous history of MI, and/or positive exercise test, or angiogram prior to valvular surgery.

Out of total 348 patients, 192, (55 %) patients had chest pain suggestive of angina or atypical chest pain. Other 45 % patients, i.e. 156 patients had no chest pain. Majority of patients – 282 patients (81 %)- have chronic stable angina or dyspnoea on exertion as the chief complaint. For the remaining patients, 36 patients or 10 % have h/o unstable angina or NSTEMI and 18 patients (5.0 %) patients had h/o STEMI for which angiogram was done which revealed ectatic coronary arteries.12 (4%) patients had angiogram prior to valvular lesions.204 patients (59%) were asymptomatic / FC (Functional Class) Class I. .123 (35%) patients had Class II FC. Only 23(5 %) patients were Class III – IV NYHA symptomatic. This is in consensus with other studies performed across.

When the results are compared with other studies, Gaurav et al (11), clinical presentation included AWSTEMI in 30.7 %, IWSTEMI in 13.7 %, NSTEMI /UA in 25.8 %, chronic stable angina in 23 %, atypical angina in 4.0 %, and 2.4 % were having valvular heart disease. In study by Amit Malviya et al (12), most patients have NYHA symptoms – with exertional angina in 61%, and exertional dyspnea in 21% patients, with 17 % patients with atypical chest pain. In study by Nyamu et al (8), 25 % patients had history of some MI.

Out of the total 348 angiograms which were studied following values were derived:
1. LAD was the most common artery involved in about 299 (85%) of patients, isolated lad involvement was seen in 55 (16%) only.

2. RCA was the next most common vessel to be involved vessel in 73% (255) of patients; whereas 75 patients had isolated coronary artery ectasia of right coronary artery.

So, this brought us to a conclusion that in diffuse dilated coronaropathy lad is the most common artery to be involved; where as in isolated coronary artery involvement rca is the most common artery to be involved.
LCX was the third most common vessel to be involved in total of 172 patients (50%); isolated involvement is seen in 31 patients (9%).
LMCA is also involved in 7 patients (2%), and in none of the angiograms it was involved isolated, always involved in combination with left system.

In a study from Chennai; India by Peter Nyamu et al (8) in 2003 have showed that LAD to be the most common vessel involved by CAE followed by RCA. Another study done by Sharma SN et al (26) had LAD the most common artery involved in diffuse involvement. In a recent study conducted in central and north India by Ahmed R et al in 2019 (11) RCA was found to be the common artery involved. In a study by Harihara Subramonia in 2013 (14) in Kerala had LAD as the most common artery to be involved. In a recent study by Amit Malviya et al (12), LAD was most common vessel involved in 59.6 % patients, whereas RCA was second most common in 46.1 % patients.

Single vessel disease was the most common variety with 200 patients (57%), followed by double vessel disease in 82 patients (23%), triple vessel disease in only 66 patients (19%). This is similar to study by Amit Malviya et al (12) where SVD was predominant manifestation in 61% patients., and also similar to study by Nyamu et al (5)

In our study Type-3 Markis is the most common type of involvement in 196 patients (56%) where second most common was Type-4 is in 80 patients (23%) , followed by Type-1 in 56 patients (17%) and the least common variety was Type-2 in 16 patients (5%) .This is in contrast to previous studies where Amit et al (12) reported focal ectasia , Type-4 to be most common , but similar to a recent study by Gaurav et al (11) where Class III was most common .

In the present study, majority of patients presented with anginal or non-anginal pain. 204 patients (59%) were asymptomatic / FC (Functional Class) Class I, and 123 (35%) patients had Class II FC. Markis et al (3) postulated that coronary ectasia, without significant stenosis may be the cause of angina. The aneurysmal segments produce sluggish blood flow; with increased incidence of angina pectoris and MI, regardless of severity of coexisting coronary artery stenosis. This is attributed to either to thrombotic occlusion of the aneurysmal vessel or to the repeated dissemination of micro emboli to segments distal to the ectasia. Slow coronary flow may also be a causative factor. (17).

Follow up of patients were also done. The average follow up of patients was 60 +/- 24 months. Data on recurrent chest pain, unstable angina, MI, hospital admission for any cause, were collected from hospital medical records, by OPD encounters on follow up and also by telephonic questionnaire.146 patients (42%) were lost to follow up and didn't report to OPD or any ER visits after their initial encounter. Out of other 202 patients who were on follow up; 149 (43) % patients were asymptomatic on follow up, 46 patients, (13 %) continued to have same symptoms as presentation, for the above given explanation. Four (4) patients had mortality on follow up, (1%), but the cause could not be attributed to ectasia.

Out of total 348 patients, 340 patients were kept on medical management, mostly statins and antiplatelets, and some of them on anticoagulants, particularly those with a prior history of MI or ACS event, or any paroxysmal AF history. For those who continued to be symptomatic -48 patients, 10 had re cag for worsening of symptoms. Five of them had stenotic lesions which required PCI. Three of them had single vessel disease, one had double vessel disease and one had triple vessel disease. For the other 5 patients developed ACS, 3 had same results as that of previous angiograms, the other two developed thrombotic occlusion in RCA which was kept on medical management because of high thrombus burden.

Interestingly 2 patients had coronary angiograms done before the study began and their angiogram was normal in 2010 and had the repeat angiogram during the study period was done in view of positive TMT.12 patients (4%) underwent valve replacement, either mitral or aortic, whereas 7 patients (2%) underwent device implantation, 7 patients (2%) had EPS+RFA on follow up.

LIMITATIONS
1) Lack of suitable control group.
2) Estimation of stenosis in the presence of ectasia was done visually and chances of error could not be eliminated.
3) 146 patients (42%) were lost to follow up which constitutes a large proportion of total population studied.
4) This was mainly a retrospective analysis of angiogram reported to have ectasia, further work especially prospective studies, delineating its natural history and management is needed.

5. CONCLUSION:

1) Most of the parameters were not different from the previous studies.
2) Prevalence of Coronary Artery Ectasia is 2.2 %.
3) LAD is the most common artery involved in diffuse involvement and RCA is the most common in isolated involvement.
4) Long Term follow up revealed 7/ 348 (2%) developing obstructive lesions during follow up period
5) 4 patients had mortality on follow up but none due to progression of lesion.
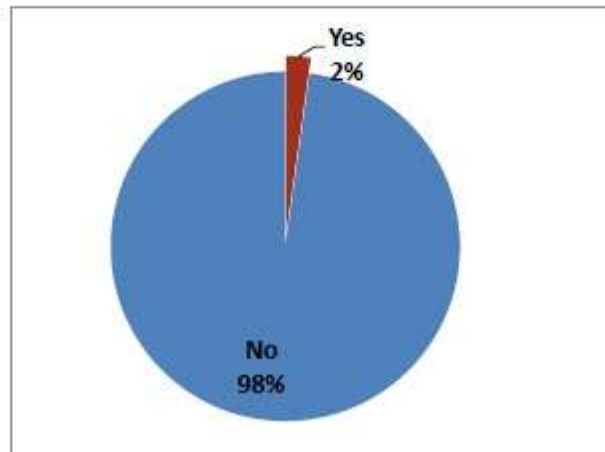
GRAPH-1 : PREVELANCE OF ISOLATED CORONARY ECTASIA

TABLE-1: RETROSPECTIVE REVIEW OF ANGIOGRAM :

		YEAR	TOTAL ANGIO	ECTASIA
			2324	82
2012				
2013			2052	105
2014			2105	111
2015			2064	95
2016			1837	89
2017			1816	94
2018			1769	73
2019			1667	78
TOTAL			15634	727

TABLE-2 AGE DISTRIBUTION

Age group	Frequency (n)	Percentage (%)
<=40	10	2.8
41-60	164	47.12
61-80	169	48.5
>80	5	1.43
Total	348	100

TABLE-3 LV SYSTOLIC FUNCTION

LV	N	%
Not done	16	4.6
Good	278	79.6
Mild	16	4.6
Moderate	22	6.6
Severe	16	4.6
Total	348	100.0

GRAPH-2 : TMT EVALUATION
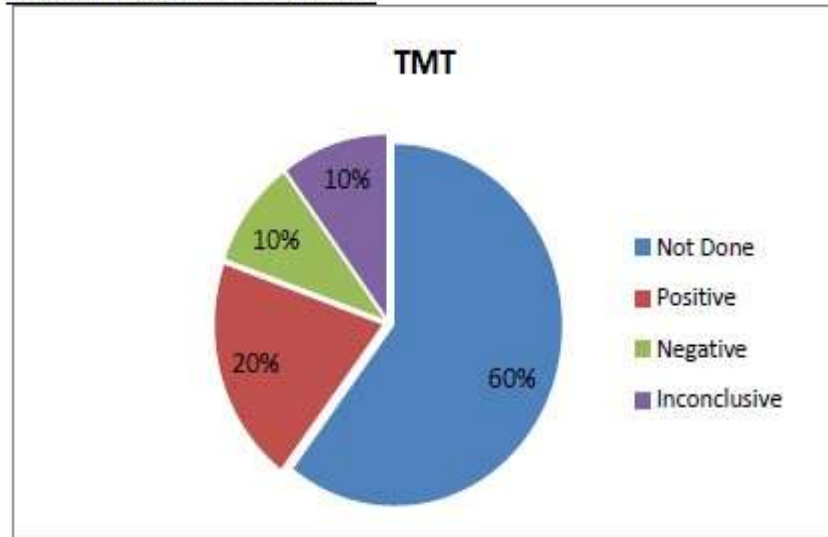
TABLE-4 DEMOGRAPHIC PROFILE

VARIABLES	NUMBER	PERCENTAGE
MALES	250	71.8
FEMALES	98	28.2
DIABETES MELLITUS	120	34.5
SYSTEMIC HYPERTENSION	189	54.3
FAMILY HISTORY	46	13.2
SMOKING	43	12.4
CHEST PAIN	192	55.2
COPD	24	6.9
RHD/VHD	17	4.9
DYSLIPIDEMIA	193	55.6 %

TABLE-5 LAB PARAMETRES

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
LDL	237	45	215	109.52	33.794
FOLLOW UP LDL	136	35	212	97.99	34.758
HDL	234	15	91	42.67	13.467
CHOLESTEROL	236	33	486	167.52	49.436
TRIGLYCERIDE	235	40	591	134.04	67.046
CRP/ Hs CRP	61	.18	127.00	14.3330	25.19854
TC	316	2	26	7.66	2.651
HB/ANEMIA	315	5	18	12.84	2.137
HBA1C	157	0.0	16.0	6.870	2.4755
ESR	115	2	82	18.83	18.449
MPV	331	4.9	22.9	8.896	1.5844
neutrophil/Lymphocte ratio	331	.13	86.00	2.6532	5.65952

GRAPH- 3 INVOLVEMENT OF VESSEL FREQUENCY

	LMCA	LAD	LCX	Rca
isolated	0	55	31	75
combination	7	244	141	180

isolated   combination
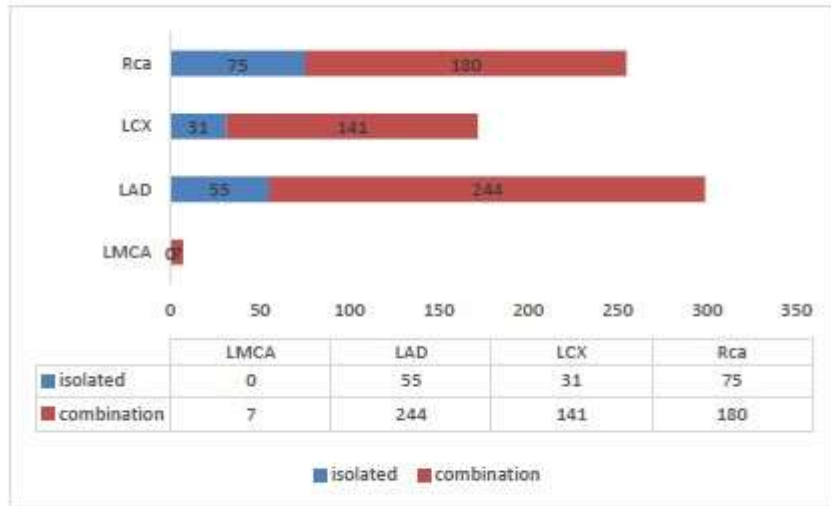
TABLE-6 NUMBER OF VESSELS INVOLVED

VESSEL	NUMBER	PERCENTAGE
SVD	200	57.4
DVD	82	23.56
TVD	66	18.96

TABLE-7 MARKIS CLASSIFICATION DISTRIBUTION

Markis Class	n	%
Diffuse >1	56	16.6
Diffuse 1 and focal 1	16	4.6
Diffuse 1	196	56.3
Localized	80	23.0
Total	348	100.0

TABLE -8 : TIMI GRADES

TIMI	n	%
Partial perfusion	175	50.3
Normal	173	49.7
Total	348	100.0

TABLE-9 : FOLLOW UP DATA

FOLLOW UP	NUMBER	PERCENTAGE
No follow up	146	42.0
Asymptomatic	150	43.0
Symptomatic	48	13.6
Death / MACE (IV)	4	1.4
Re CAG	10	2.0
PTCA	5	1.4
Medical Management	316	90.8
Valve replacement	13	3.7
EPS+RFA	7	2.0
PPI/AICD/CRT	7	2.0

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