Analysis of Clinical profile, angiographic pattern of Coronary Ectasia in Coronary Artery Disease patients

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CERTIFICATE

This is to certify that the dissertation entitled **"Analysis of Clinical profile, angiographic pattern of Coronary Ectasia in Coronary Artery Disease patients"** is a bonafide work of **Dr.M. SELVAGANESH** in partial fulfillment of the university regulations of the Tamil Nadu Dr. M.G.R. Medical University, Chennai, for DM Cardiology Branch-II examination to be held in **August 2015**.

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DECLARATION

I, **Dr.M.SELVAGANESH**, solemnly declare that, this dissertation**"Analysis of Clinical profile, angiographic pattern of Coronary Ectasia in Coronary Artery Disease patients "** is a bonafide record of work done by me at the Department of Cardiology, Government Rajaji Hospital, Madurai, under the guidance of **Dr.A.S.ARUL M.D.,D.M.,** Professor, Cardiology, Madurai Medical college, Madurai. This dissertation is submitted to The Tamil Nadu Dr. M.G.R. Medical University, Chennai in partial fulfilment of the rules and regulations for the award of Degree of DM Cardiology examination to be held in August 2015.

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CONTENTS

PERFORMA

NAME: **AGE/SEX:** **HT:** **WT:** **BMI:**

CD NO. **IP/OP no.** **CCL NO.**

D.O.A: **D.O.D:** **D.O.E:**

PRESENTATION:

Chest pain Pedal edema

Dyspnoea Abd distension

Syncope Oliguria

Palpitation Fatigue

PAST ILLNESS : Diabetes- SHT -

ACS/ CVA

RHD/Other

PERSONAL HISTORY : Smoking numbers years / Addictions

Occupation:

MENSTRUAL HISTORY :

FAMILY HISTORY :

CLINICAL FEATURES : GE –

BP: PULSE:

CVS:

RS: KILLIP class:

ABD: CNS:

Investigations: Hb: TC: DC: P L E M MPV: RDW

RBS: Bl Urea: Sr. Creatinine:

FBS : PPBS HIV ELISA

Lipid profile : Total cholesterol : LDL : HDL : TGL:

ECG: Rate: Rhythm: P wave: PR int:

QRSD: QRS axis: ST: T :

ST resolution at 90 min :

Arrhythmia:

ECHO data:

LVID d: LVID s: LVEF:

MR Thrombus

Coronary Angiogram :

LMCA –

LAD

LCx

RCA

ECTASIA : Thrombus :

Anomaly :

INTERVENTION

POBA **PCI –Stenting** **DES** **BMS**

Size :

In Hospital Events : HF Arrhythmia Shock

Mortality ;

INTRODUCTION

Coronary artery Ectasia (CAE) has been defined as an abnormal dilatation of coronary artery, with luminal diameter exceeding 1.5 times the adjacent normal reference segment. According to the extent of involvement ectasia may be labelled as focal or diffuse. Prevalence of CAE varies from 0.3% to 6 % .The highest prevalence reported from India and Pakistan (10-12% &12.5% respectively).

CAE may occur as an isolated form but most commonly seen in association with obstructive CAD . Ectasia is often viewed as a variant form of obstructive Coronary Artery Disease (CAD) and atherosclerosis is considered as a contributing factor in more than half of the cases. Although the association with atherosclerotic CAD is well evident, the relationship between traditional atherosclerotic risk factors and Ectasia remains controversial. Especially its poor correlation with Diabetes mellitus suggested Ectasia is a distinctive form of atherosclerosis characterized by positive remodeling–(Glagovian phenomenon) in contrast to obstructive disease (Negative Remodeling) .Hemodynamic factors like flow, stretch, shear stress along with inflammatory signals were proposed as the triggers for this abnormal vascular remodeling and postulated as the link between atherosclerosis and CAE in susceptible individual. Multiple studies in

this area were showing conflicting evidence, hence the exact pathogenitic mechanism still not conclusively defined and in hypothetical stage .

Thrombus formation, vasospasm ,slow flow, dissection were proposed as the pathophysiological mechanisms of clinical events related with CAE . Clinically the most common manifestation of CAE is angina, unstable angina myocardial infarction also occur in 30% of individuals, very rarely caused sudden cardiac death .Long term prognosis remains unclear. Even isolated ectasia is not a benign entity can present with myocardial infarction during follow up .No consensus or guidelines available for the management of Coronary Artery Ectasia.. In acute settings heparin infusion , if necessary thrombolysis considered mandatory . Medical management with Antiplatelet dugs is universally accepted ,but role of anticoagulation remain controversial in long term . In view of prothrombotic milieu , complexities related with Percutaneous Intervention Coronary Artery in ectatic segment Bye pass Grafting(CABG) is the preferred revascularization approach.

The etiopathogenisis of this entity puzzled the clinician since its discovery, but still there are some unclear undefined areas clinical significance remains uncertain and there is no consensus opinion regarding management. Hence further research is essential to solve these enigmas. Being in the country with highest prevalence of CAE, we planned this study to analyze the risk

factors, clinical presentation and angiographic characteristics of patients with Coronary Artery Ectasia , also to assess the prognosis during the index hospitalization as well as during follow up

REVIEW OF LITERATURE

Coronary arteries are the first branch of aorta to supply the need of the heart itself. Right and left coronary arteries arises from the root of aorta with their ostium .Both coronaries completely encircling the heart like a crown This crown like or wreath like arrangemnent (stephanos – Greek) formed the basis of nomenclature of coronary artery .Coronary means crown this is derived from the coronarius a Latin word .But Coroanrious is a translated form of Greek word stephanos (wreath), means wreath-like or crown-like arrangement .

History and Nomenclature of Ectasia

Coronary artery dilatation is a well-known but less common entity diagnosed during coronary angiography . Older studies used the term Coronary Artery Aneurysm to label these dilated coronaries. The Coronary artery aneurysm was first described by Giovanni-Battista Morgagni 1761[1].The first clinical case report describing right coronary artery aneurysm was given by

Bourgon in 1812[2] which is a post mortem report of a patient experienced sudden cardiac death .The first ante mortem (angiographic) demonstration was done by T Munkner (1958)[3] in his report of a boy with Coronary AV fistula The term "Ectasia" was coined by Lars Bjork in his report of 3 patients with Tetralogy of Fallot [4]. Syed ,and Lesch discriminated Coronary Ectasia(CAE) as diffuse dilatation of coronary artery involving more than 50% of the vessel, on the other hand focal dilatation as Coronary Artery Aneurysm (CAA)[5] .Until 1967 only postmortem studies were available Of which excellent compilation of 89 case was done by Daoud et al in 1963[6] . In 1976 Markis et al[7] published his study on ectasia and proposed a classification based on anatomical extent . He also defined ectasia as localized and diffuse . In 1983 Swaye and coworkers,reviewed the 20,087 patients from Coronary Artery Surgery Study registry(CASS registry) reported an incidence of 4.9%. [8]

Epidemiology :

The prevalence of Coronary Artery Ectasia varies form 0.3[9]-12.5%[10] among patients undergoing diagnostic angiography for varies ischemic syndromes. Highest prevalence reported from India 10% -12% [11]and Pakistan 12.5%.

Table 1 Comparative incidence of ectasia at coronary angiography

Study	Total No of cases	Cases of ectasia	% ectasia
Coronary Artery Surgery Study	20087	978	4.9%
Harikrishnan et al 2000 India	3200	144	4.5%
Lam Kt Ho 2008 Singapore	8641	104	1.2%
Pinar Bermúdez E, et al. Spain	4332	147	3.39%
Riffat Sultana et al2008 Pakistan		140	2.8%

Etiology

Coronary Artery Ectasia can be due to congenital or acquired etiology. Congenital CAE accounts for only20-30% of cases and the remaining were acquired . Congenital CAE usually associated with other Congenital Heart Disease like ventricular septal defects , pulmonary stenosis , Bicuspid Aortic valve Aortic root dilatation , and cyanotic diseases.

Atherosclerosis is the major acquired cause for CAE and it is responsible for 50-60% of cases . CAE is associated with obstructive CAD in more than three fourth of the patients indicating atherosclerotic etiology. Other causes include inflammatory diseases and connective tissue disorders(10-20%) like SLE , Scleroderma ,Poly Arteritis Nodosa , Takayasu arteritis ,Ehlers -Danlos Syndrome .Kawasaki disease an acute vasculitis commonly affects children requires special mention . According to Cohen & O' Gara, 2008, Kawasaki disease is the most common etiology in the Far East[12]. Other rare etiologies which mainly causes focal ectasia include infection ,drugs, iatrogenic trauma during percutaneous interventions. It is difficult to discriminate congenital from acquired based on clinical and angiographic criteria

Table 2: Etiologies for Coronary Ectasia

1.Congenital
2.Atherosclerosis
3.Inflammatory
Vasculitis : Kawashaki ,PAN,
Takayasu Bechets ,Syphilis ,SLE
Connective Tissue disorders:
Rheumatoid arthritis , Scleroderma
Ankylosing Spondylitis,
4.Heriditory Collagen Defects :
Marfan Syndrome ,Ehlers Dalos Syndrome
5.Drugs : Cocaine, Amphetamine
6.Infectious : Syphilis ,Mycobacterial ,Fungal
7.Iatrogenic : Following Percuteneous Coronary Intervention

Pathogenisis of CAE

Coexistence CAE with obstructive CAD in approximately 80% of cases , same risk factor profile along with histological features suggested similar pathogenitic mechanism and atherosclerosis as the common denominator . Hence CAE was considered as variant expression of atherosclerosis. Although CAE has strong association with atherosclerosis and its risk factors, unique but consistent observation is low incidence (inverse or negative association) of Diabetes Mellitus and lower age in CAE population compare to CAD group [13,14] Following theories were proposed to explain the pathogenesis of Ectasia

1. Hemodynamic
2. Inflammatory hypothesis
3. Vascular Remodeling theory
4. Genetic theory
5. Generalized vascular disorder
6. Excessive vasodilator mechanism (NO mediated)

Knowledge about the histopathological difference between obstructive CAD and CAE will help in better understanding of these pathogenitic mechanisms.

CAE is form of positive remodeling of arterial wall in contrast to CAD which is a form of negative remodeling .Histopathologically atherosclerotic CAD is mainly a disease of intimal layer characterized by intimal proliferation with spilling of plague material into tunica media, but medial layer and elastic lamina remain intact. On the contrary histopathological examination of arterial wall in CAE patients typically reveal marked destruction and reduction of the elastic fibers in the tunica media with disruption of both internal and external elastic lamina[1516]. Such a extensive medial destruction out of proportion to the intimal involvement have been reported with non-atherosclerotic CAE also[17, 18]. Hence significant loss of musculoelastic component in the tunica media layer of coronary arteries is the crux in the pathogenesis Coronary Ectasia[19].

Table : 2 Difference between Coronary artery Ectasia and CAD

	Coronary artery ectasia CAE	Coronary artery disease CAD
Inversely associated risk factors		
Diabetes mellitus	+	−
Age	+	−
More pronounced inflammatory parameters	+	−
Changes in extracellular matrix remodeling		
MMP-3 5A polymorphism	+	−
Increased plasma levels of MMP-3	+	−
Involvement of coronary artery		
Right coronary artery	+	−
Left anterior descending	−	+
Increased carotid intima-media thickness	±	+
Decreased endothelium independent dilatation	+	−
Possible association with vein involvement	+	±
Possible hazardous effect of nitrate treatment	+	−

"Coutesy : Ref [20]"

Hemodynamic theory :

Dauod et al. postulated that aneurysms (focal ectasia) are formed from transformation of kinetic energy to potential energy and pressure abnormalities beyond the level of stenosis. Siouffi et al. suggested that the excessive velocity

of blood flow, with resultant in increased shear stress at the level of stenosis induce endothelial injury and poststenotic vasodilation . Recently Chatzizisis et al.. in their experimental study proved the pivotal role of low Endothelial Shear Stress (ESS) as a trigger for the transformation of early atherosclerotic plaque to expansive remodeling (Positive remodeling Ectasia)[21] this has been confirmed in a in vivo study[22]

Vascular Remodeling Theory :

Coronary Ectasia has been viewed as form of excessive positive remodeling(expansive remodeling) of arterial wall to accommodate the increasing plaque burden during initial stages of plaque and after an episode of plaque rupture[23] This expansion may itself induce low shear stress inturn self-perpetuate a vicious cycle

Inflammatory Hypothesis :

Atherosclerosis is considered to be a chronic inflammatory disease . Spilling over of inflammatory cells from intimal into the tunica media layer and resultant destruction leads to ectasia formation. Along with hemodynamic

factors inflammation is considered as the prime pathogenic link between atherosclerosis and CAE. Cytokine induced extensive inflammation involving all the 3 layers of arterial wall is the underlying mechanism for CAE . Tokgozoglu *et al.*, demonstrated that patients with CAE have elevated levels inflammatory markers like plasma interleukin-6(IL6) and C-reactive protein (CRP) compared with those with normal coronaries[24].In addition, cell adhesion molecules(VCAM ,ICAM) which help in transmigration of inflammatory cells also increased in sera of patients with ectasia. To support the inflammatory hypothesis Neutrophil Lymphocyte Ratio (NLR) a maker of inflammation is significantly higher in patient with isolated Ectasia compared to people with normal coronaries which indicate the role of neutrophil .

Extracellular matrix destruction and loss of Tunica media :

The Neutrophils secrete elastase Matrix MetalloProteinase (MMP3) MMP2 along with collagenase. In addition secretion of Tissue Inhibitor of Mellaoproteinase(TIMP) from macrophages and smooth muscle cell were reduced by IL6.TIMP is a regulator of MMP activity in its absence there will be excessive ECM destruction by MMP in turn leads to CAE . Lamblin et al. observed more frequent expression MMP 3 5A/5A genotype in patients with

CAE than in CAD patients[25]. Senzaki H, demonstrated that high circulating levels of MMP-3 in Kawasaki disease with coronary involvement explains the role of MMP in Ectasia formation[26] ,

Vasodilatation (NO mediated) theory :

Sorrell[27] postulated that NO mediated excessive vasodilatation is the most common mechanism specifically in patients with non atherosclerotic CAE

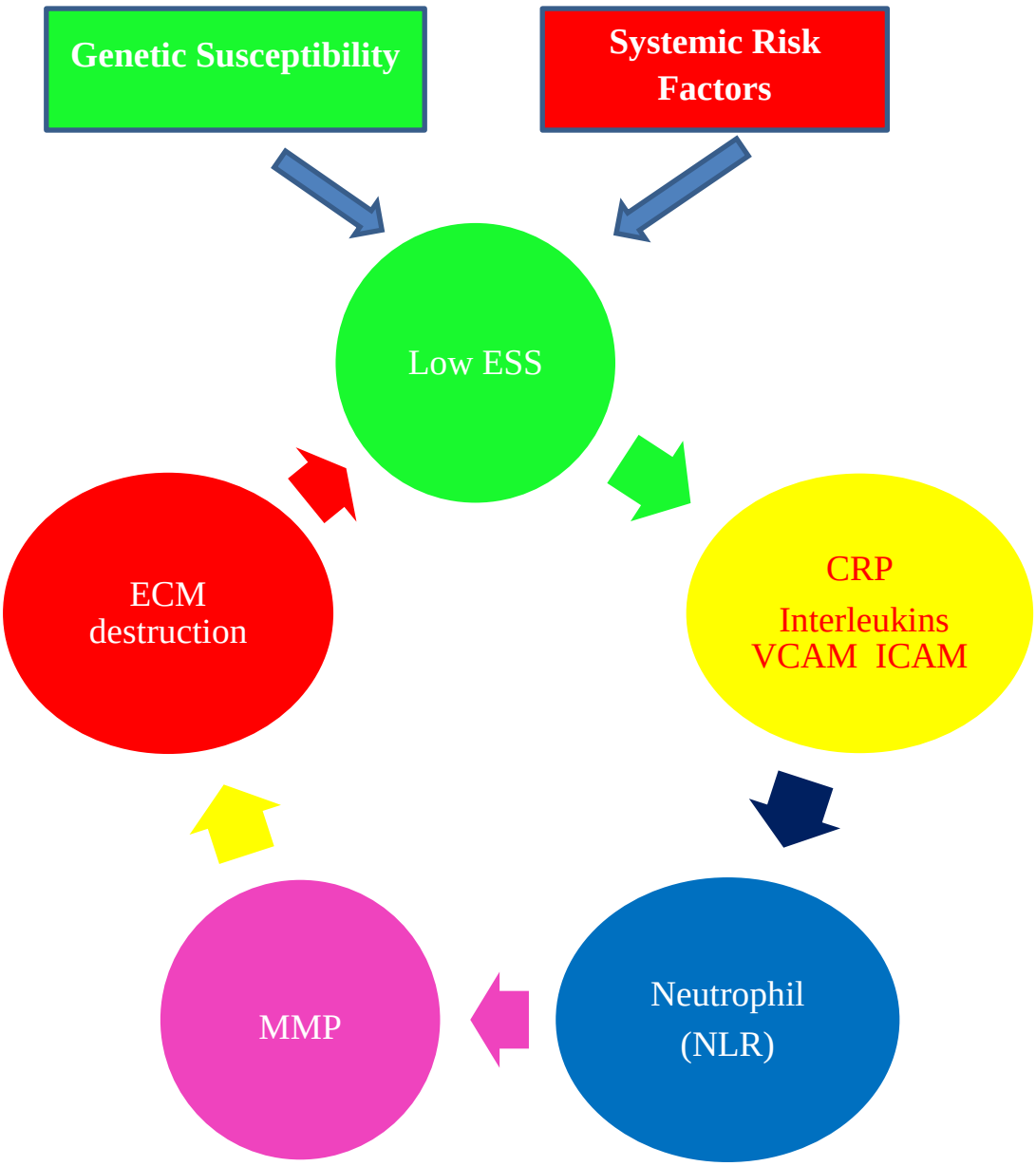
Enhanced NO production via iNOS pathway primarily mediated by inflammatory cells resulting in high NO levels and other toxins, which disrupt the extracellular matrix leads to thinning of arterial wall and Ectasia[28] Higher incidence of Ectasia has been observed in population exposed to a herbicide spray which contains acetylcholine esterase inhibitor .This agent increase acetyl choline mediated NO production[29] Moreover the role of NO in inflammation and aneurysm formation has been experimentally proved [30]

Generalized vascular disorder :

CAE may be a part of generalized disorder (deficiency) arterial wall as evidenced by its association with aneurysm of ascending aorta[31] ,abdominal aorta[32] Similarly coexistence of CAE with Venous disorders like varicosities of coronary veins and leg veins and pampiniform plexus also demonstrated . Genetic linkage with Ectasia have been suggested specifically with MMP-3 gene (MMP-3 5A allele) disruption[33], polymorphism of angiotensin-converting enzyme. HLA linkage demonstrated with HLA-DR B1* 13, DR16, DQ2, and DQ5, genes[34]

In a genetically susceptible individual with systemic risk factors ,self perpetuating vicious cycle among the hemodynamic factors, inflammation, ECM destroying enzymes (MMP) ,and expansive remodeling may transform the early atherosclerotic lesion in coronary artery to Coronary Artery Ectasia

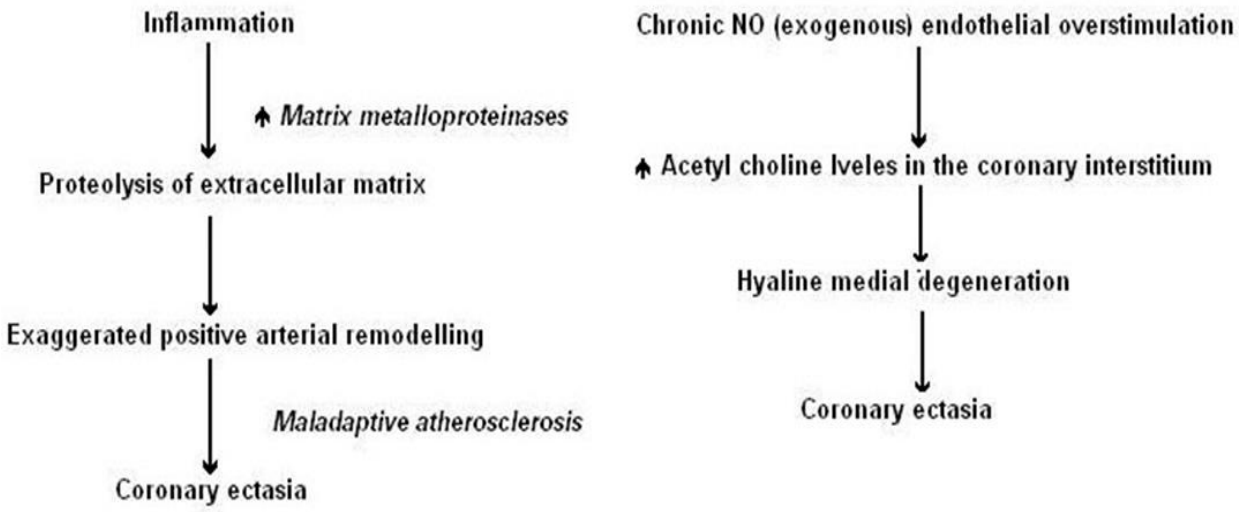
Figure 1: pathophysiology of Coronary Ectasia



Manginas et al hypothesized that pathogenesis of coronary Ectasia can be explained by 2 different pathways

Figure 2:

Pathway 1: CAE in patient with CAD **Pathway 2 : Isolated Ectasia**



Caridiovascular Risk factors and CAE :

Traditional risk factors have been studied in major studies .Except male sex ,age and Diabetes mellitus others did not provide any consistent results . Male dominance was noted in several studies [35] with ratio ranging from 1.7-3:1[36]. Prevalence of CAE is relatively more common in younger population than CAD. Giannoglou GD, et al and other previous studies also reported similar observation indicated younger age among CAE patients[37]. Diabetes mellitus

warrants special note it consistently showed lower incidence (negative association) among patients with CAE.

Inverse Association of diabetes mellitus with CAE ??

1. Atherosclerotic coronary arteries undergo expansive remodeling(positive remodeling) to accommodate an increasing plaque burden, especially during early stages of plaque accumulation[38]

2. Inflammation and the resultant overexpression of Matrix Metalloproteinase (MMP-3 activity) have been shown to play a significant role in the formation of aneurysmal disease like AAA and coronary ectasia[39]. Lamblin et al. found that MMP-3 5A/5A genotype was significantly more frequent inpatients with CAE than in the control group of CAD patients

3. But the advanced glycation crosslinks in Diabetes Mellitus inhibit the matrix metalloproteinase activation and these enzymes are down regulated[40]

4. Diabetes Mellitus promotes negative arterial wall remodeling(obstructive CAD) or at least impairs compensatory arterial enlargement during the course of the atherosclerotic process[41]

5.Advanced glycation end products formation on the connective tissue and matrix protein components result in significantly increased arterial stiffness in diabetic patients.

Smoking a common risk factor for CAD also found significantly associated with CAE. This has been attributed to the confounding effect of male dominance among CAE population. Hypertension Dyslipidemia[42] also implicated in the pathogenesis but contradictory results have been reported [43] . Similary high BMI obesity also shown to be associated with CAE . Obesity was reported to increase serum elastase activity[44]. Increased serum elastase can lead to destruction of ECM in tunica media of coronary arteries and result in ectasia(EVA study)[45]. Recently an Iranian study which specifically assessed the role of traditional risk factors found no apparent correlation between CAE and conventional risk factors[46] .Hence with available evidence the role of traditional risk factors remains controversial .

Novel Risk factors and Ectasia :

CAE patients have histological similarity with atherosclerosis, but only few patients with atherosclerosis develop ectasia .On the other hand nearly 30-40% cases CAE have non obstructive coronaries even in population who does not have other explanation like systemic inflammatory or connective tissue

diseases. To bridge the link , in addition to atherosclerosis excessive inflammatory activity has been convicted .

Along with atherosclerosis role of inflammation was evaluated in many studies . Markers of inflammation from Neutrophil count, genetic level markers like polymorphism of MMP have been studied in patients with coronary ectasia and compared with obstructive CAD and normal coronaries. High neutrophil count low lymphocyte count with high Neutrophil : Lymphocyte ratio (NLR) have been noted in patients with patients with isolated Ectasia compared to normal population which indicate the role of inflammation[47]. Hs CRP a well-established marker of inflammation also observed to be elevated in patients with CAE compared patients with obstructive CAD[48]. Even though some studies report contradictory results it was attributed to the study population[49]. Similarly soluble adhesion molecules like VCAM, ICAM, E selectin which are involved in the essential steps of inflammation also found to be increased to suggest the role of inflammation . Mean platelet volume a marker of platelet activation incriminated as independent effector on the pathophysiology of atherosclerosis also been assessed and proved to be elevated in the Ectatic population compared to normal control population[50] .

Proteolytic imbalance characterized by hyperactivity of MMP , elastase with reduced level inhibitors of proteolysis (TIMP) have been demonstrated in patients with arterial, venodilation like aneurysm, varicose veins ,and Ectasia [29] . Red cell Distribution Width (RDW) a marker of variability of size of circulating RBC have been viewed as strong predictor of cardiovascular risk and shown to be a marker of adverse outcome in acute cardiovascular disease also have been evaluated and found to have higher among patients with isolated Ectasia compared to healthy controls and it was positively correlated with CRP level .Exact independent pathogenic role of high RDW in coronary ectasia was not known. It has been hypothesized that in patients with Ectasia RDW may be marker underlying active inflammation, oxidative stress induced damage to RBC. Inflammatory cytokines can interfere with maturity of RBC and it also prematurely release juvenile RBC into the circulation by its effect on erythropoietin[51] .

Mean platelet volume a marker of activated platelets indicating high metabolic and enzymatic activity of platelets with overexpression of glycoprotein Ib IIIa and increased levels of thromboxane , alpha granules with its mediators involved in the process of platelet adhesion aggregation along with enhanced responsiveness to proaggregatory ADP than prostacyclins . Studies have documented higher MPV in patients with ACS[52] .

Table3: Coronary artery Ectasia :Difference between etiologies

Cause	Age	Description	Pathogenetic Mechanism
Atherosclerosis	Adults	Most common cause of CAA, clinical importance depends on association with significant coronary artery stenosis	Local mechanical stress from stenosis, atherosclerotic pathologic findings extending into tunica media
Vasculitis *Kawasaki disease*	Childhood	Most common cause of CAA in childhood in Japan, spontaneous resolution occurs in 50%	Autoimmune, vasculitis
Takayasu	Young adults	Common cause of CAA in young Asian females in Japan	Cellular immunity associated with chronic infection
Polyateritis Nodosa	Young adults	Necrotizing inflammatory lesions in small- and medium-sized arteries	Characterized by fibrinoid necrosis and infiltration by predominantly polymorphonuclear leukocytes
Connective tissue disorders	Young adults	Ehlers-Danlos syndrome, Marfan syndrome, cystic medial necrosis	IL-6, TGF-β, C-reactive protein, MMP-2, MMP-9
Mycotic	Any age	Infection with *Staphylococcus aureus* or *Pseudomonas aeruginosa*, syphilis, Lyme disease	Microembolization to vasa vasorum, direct pathogen invasion of arterial wall, immune complex deposition
Trauma/ iatrogenic	Adults	Clinical history helps establish diagnosis healing because of antiproliferative treatment with cortisone, colchicine, and anti-inflammatory drugs	Trauma from oversized balloon or high inflation pressures, coronary dissection, interventions in the setting of acute myocardial infarction, inadequate

As a conclusion we concur with the conclusion from E Yetkin & J.Waltenberger after their excellent review on novel insights into

pathophysiology of coronary ectasia "with currently available knowledge and evidence it is premature and not justified to conclude CAE as a variant of atherosclerosis . Considering the slow progression and varying manifestations of atherosclerosis , CAE may be a stage (probably an early stage) of obstructive CAD. But still the time of transition or the factors responsible the transition uncertain needs to be unrevealed . Or else the atherosclerotic process may itself triggered at the sites of CAE"

Patho physiology of myocardial ischemia :

Hemodynamic alteration inside the inappropriately dilated coronary artery is not surprising and it is characterized by disturbances in filling and washout . Characteristic flow pattern include

1.Slow flow,

2.Stagnant flow,

3.Turbulent flow

Angiogrphic signs of these flow alteration are

1.Delayed ante grade dye filling ,

2.Stasis of the dye

3.Segmental backflow (milking phenomenon).

Delayed coronary flow has been demonstrated in isolated coronary aneurysms and it was attributed due to elevated resistance and reduction in Coronary Flow Reserve (CFR)[53].. Kruger et al hypothesized these altered flow can induce myocardial ischemia demonstrated exercise induce myocardial ischemia[54] Hamaoka, *et al* [55]evaluated coronary flow dynamics, CFR in Kawasaki disease patients found a reduced coronary flow velocity. The thrombolysis in myocardial infarction (TIMI) frame count(TFC) is an angiographic measure of coronary blood flow was found to correlate well with Flo-wire derived velocity. Multiple studies demonstrated high TIMI frame count indicating slow flow[56] in patients with CAE similarly finding was observed with magnetic resonance(MRI) flow velocity (PFV) also[57] . Gulec et al found lower myocardial blush grade despite preserved epicardial flow which indicates disrupted microcirculation[58] . In a land mark study Akyurek et al[59] measured coronary flow velocity dynamics and CFR (with Flowire-Doppler wire) in patients with dilated coronaropathy (isolated ectasia) and compared with healthy control .He demonstrated reduced resting flow velocity and low CFR following maximum hyperemic stimuli with intracoronary papaverine administration (1.51Vs2.67) .This suggested flow disturbances in the major epicardial vessel as well as microvascular dysfunction. High TFC also observed in non ectatic vessel of the same patient with ectasia .These observations proved

the notion of Williams and Stewart that "Ectasia as diffuse coronary arterial disease"[60].Slow flow in CAE was also attributed to non-inflammatory endothelial dysfunction and its relation with erectile dysfunction suggested two different mechanism of endothelial dysfunction. Influence of coexisting stenosis on the TFC of patient with CAE also evaluated recently, Contrary to the expectation authors found that TFC has not been further impaired by the coexisting stenosis[61] .

Myocardial infarction is attributed to thrombus formation inside the dilated segment and distal embolization. Below a certain level of critical velocity viscosity of blood increases . Increased viscosity along with sluggish and turbulent flow results in loss of axial stream. Hence platelet and coagulation mechanisms are activated ,erythrocytes aggregability increases and thrombus formation occurs . This has been already demonstrated in Infarction related Ectatic vessel, which had low TFC, low TIMI flow higher thrombus burden score , distal embolization with poor ST resolution, inadequate collateralization[62] .In addition to embolization spasm could also be mechanism infarction in Ectatic patients but the occurance of spasm is controversial reported to occur frequently in the border of ectasia[63] .

Clinical Presentation :

Coronary artery Ectasia commonly identified inpatients submitted for ischemic symptoms like angina ,it may be an incidental finding too .Unstable angina , ST Elevation and Non ST elevation myocardial infarction can also occur. In their collective Kruger, et al reported 39% incidence Q and Non QMI .Acute left ventricular failure, pulmonary edema, ventricular arrhythmia are other manifestations sudden cardiac death following rupture of aneurysm also reported. Rupture of ectasia into right sided chambers and coronary sinus have been reported with continuous murmur as an evidence of left to right shunt[64]. Demopoulos V et al reported previous history of MI in 38.7% patients with dilated coronaropathy.

Angiogrphic pattern & Classification

Coronary artery dilatation maybe defined as Aneurysm or Ectasia . In older days overlapping use of both the terminologies ,coronary artery aneurysm , coronary artery ectasia led to under or over estimation of frequencies. Angiographically Falsetti and Carroll , Befeler et al defined “Coronary artery Ectasia CAE as non-obstructive lesions of coronary arteries with a luminal

dilation exceeding the 1.5- to 2.0-fold of normal diameters, and a coronary aneurysm (CAA) was defined as a dilation .2.0-fold of normal diameters. If no adjacent normal segment could be identified, the mean diameters of the coronary segments in a control group without heart disease served as normal values."

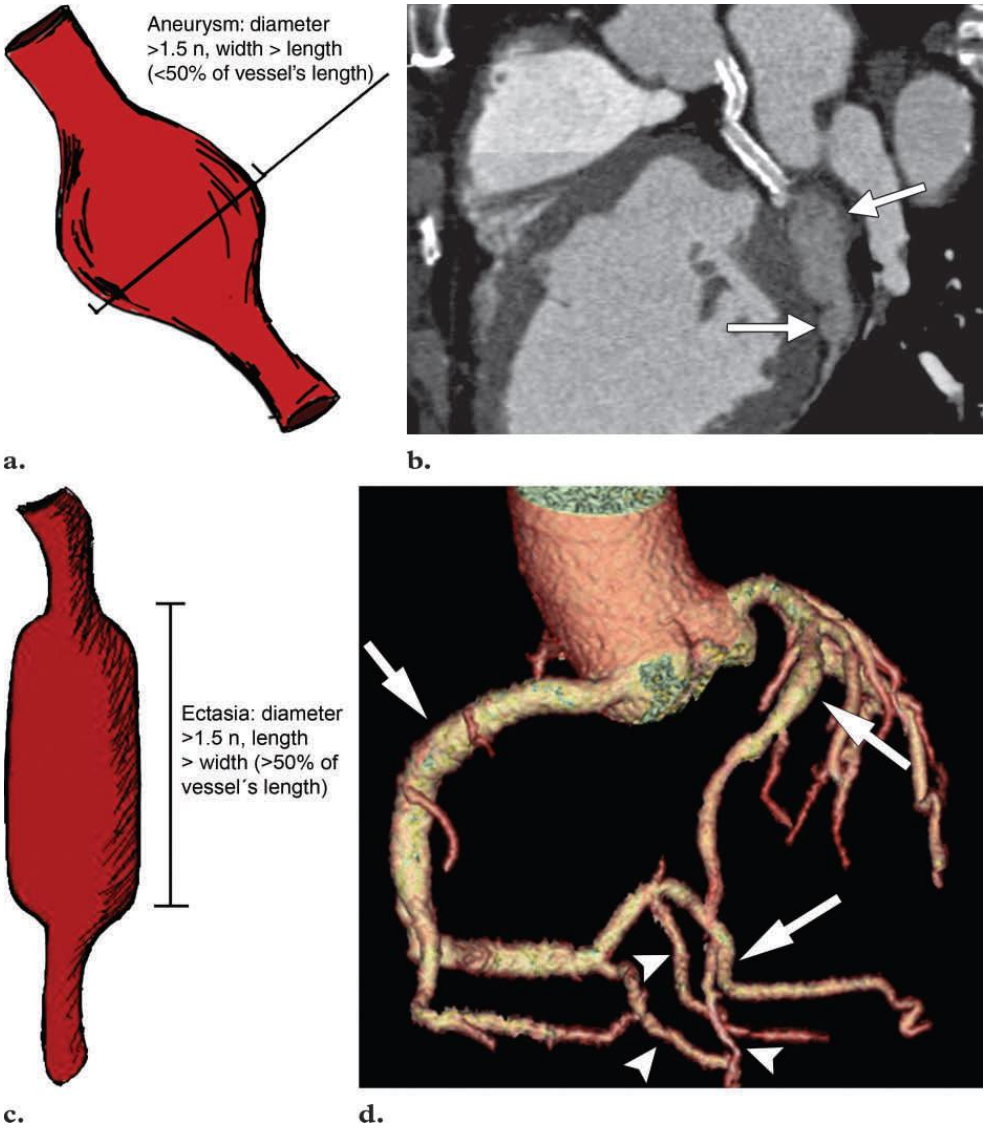


Fig 3 Saccular & Fusiform ectasia

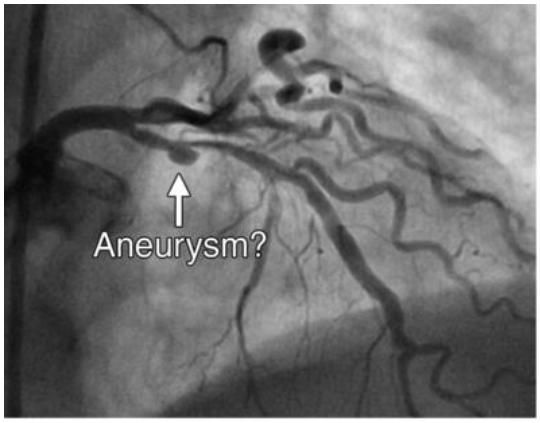
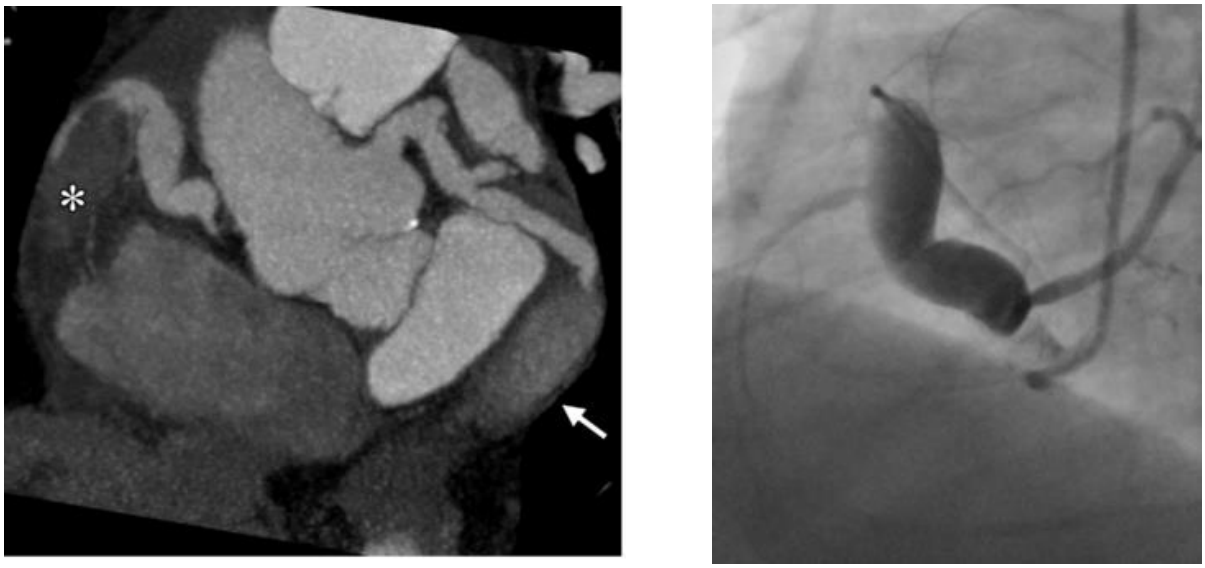


Fig 4 Saacular (discrete or focal ectasia) Ectasia



A B

Fig 5 :Coronary CT angigram (A) corresponding Conventional Angiogram (B) thrombus can be seen as attenuation of contrast (*) but in conventional angio it was seen as complete occlusion.

Saccular Ectasia previously called as coronary aneurysm, is defined as a coronary artery dilatation with transverse diameter more than the longitudinal diameter . On the other hand fusiform ectasia is aneurysmal dilatation with longitudinal diameter exceeding the transverse diameter .Coronary Ectasia is labelled as diffuse if it involves the entire length of one particular segment of coronary artery without any normal dimension in between . Focal Ectasia or discrete ectasia is the one which involves only only a part of particular coronary arterial segment .

Table 4: Classification of Coronary artery dilatation

Table 1
Classification of Coronary Artery Dilatation

Type of Dilatation and Group	Structural Changes
Focal dilatation: ANEURYSM	
Vessel wall composition	
True aneurysm	Vessel wall composed of three layers: adventitia, media, and intima
False aneurysm	Vessel wall composed of one or two layers
Shape/gross structure	
Saccular aneurysm	Transverse > longitudinal diameter
Fusiform aneurysm	Longitudinal > transverse diameter
Giant aneurysm	
Adults	>20 mm–150 mm in diameter
Children	>8 mm in diameter
Diffuse dilatation: ECTASIA	
Type I	Diffuse ectasia in two or three vessels
Type II	Diffuse ectasia in one vessel and localized disease (ie, aneurysm) in another
Type III	Diffuse ectasia in only one vessel
Type IV	Coronary aneurysm in one vessel

Initially Markis classified coronary artery Ectasia into 4 types in descending order of severity based on their analysis 30 patients with coronary ectasia from a group of 2457 patients.

Table 5 : Markis classification

Type	Diffuse	Localised
I	**Diffuse ectasia of 2 or all 3 vessel**	
II	**Diffuse in one vessl**	**Localised in other**
III	**Diffuse in one vessel only**	
IV		**Localized or segmental Ectasia**

Harikrishnan et al [65] found difficulty in classifying all the types under Markis and they proposed modified classification in which 4 major type of Markis has been sub classified into 2 or 3 subtypes. Their classification based on their analysis 144 cases of ectasia among 3200 Indian population with incidence of 4.5%. .

Table : 6 Harikrishnan et al classification

Type	I	II	III	IV
Sub types	**Diffuse Ectasia in 2 or 3 vessels**	**Diffuse Ectasia in one and**	**Diffuse Ectasia in single vessel alone**	**Localized Ectasia of**
a	**I a - Diffuse in 3 vessels**	**Localized in one**		**IV a- One vessel**
b	**Ib - Diffuse in 2 vessels *and* localized in one**	**Localized in 2 vessel**		**IV b- 2 vessels**
c	**Ic - Diffuse in two vessels**			**IV c – 3 vessels**

In 2003 , Nyamu et al[66] proposed another classification to segregate Left Main Coronary Artery (LMCA) Ectasia into separate category .They proposed the classification based on their exclusive study on isolated ectaisa divided groups into 4 major types 2 or 3 subtypes in each major groups .

Table Nyamu et al classification

Type	I	II	III	IV
Sub types	**Isolated Diffuse Ectasia in 2 or 3 vessels**	**Diffuse Ectasia and discrete Ectasia in combination**	**Isolated discrete ectasia**	**Lefy Main Coronary involvement**
a	**I a - only one vessel**	**IIa - Diffuse in ≥ 2 *plus* discrete in one**	**IIIa -In one vessel**	**IV a- Isolated LMCA involvement**
b	**Ib - Diffuse in 2 or all 3 vessels**	**IIb - Diffuse in one vessel *plus* discrete≥ 2**	**III b ≥ 2 coronaries**	**IV b- LMCA *plus* other vessel**
c	**-----**	**III c Diffuse in one plus discrete in one**		

Majority of patients with ectasia have coexisting obstructive CAD ranged from 75-80%[8]. Iresepctive of its association with CAD Right Coronary Artery (RCA)the most common vessel to have coronary ectasia (45-75%)[8] followed by Left Anterior Descending(LAD) and Left Circumflex(LCX), LMCA is the least common vessel to be affected by ectasia [65] . But in cases of stenotic CAD , involvement LAD RCA and LCX in descending order of frequency . The severity of CAD assessed by incidence of single ,double or triple vessel disease remains same and not influenced by its association with CAE. Diffuse ectasia is less frequent with concomitant stenotic(obstructive) CAD but more frequent among the dilated coronaropathy (isolated ectasia)

group, often bilateral and associated with aneurysm in other regions . Focal or discrete ectasia is more common with concomitant CAD group. Involvement of single vessel 60%-70%[35] was reported to be more common in three vessel involvement is less common .But in a Chinese study equal proportion of single(31%) double(38%) triple (31%)vessel ectasia were reported. Prevalence of CAE in right coronary artery strongly associated with CAD in LAD. In two third of patients Ectasia seen in the vessel without stenosis .In 1/3 of patients stenosis and ectasia coexist in thya same vessel . Of the various classification Markis Type 4 (Isolated focal ectasia) & Harikrishnan Type 4 a (Focal Ectasia of single vessel) is the commonest in a Turkish study. In a recent Chinese study also reported the same but specifically among patients with dilated coronaropathy Type III is the commonest one . An Indian study reported Type III ectasia as the commonest . In study by Harikrishnan et al found Type II as the commonest type. Higher predilection for ectasia in RCA is poorly understood . No uniformity in angiographic pattern also have not been explained clearly.

Diagnostic Imagings :

Until the demonstration by Munkner et al in 1958 coronary ectasia was only a postmortem diagnosis . Since then angiography remains the gold standard for diagnosing and assessing the physiological characteristics of ectatic

vessel.But it can not differentiate true from false aneurysm and emptied plaque cavities after plaque rupture is misdiagnosed as CAE by angiography .Intravascular Ultra sound IVUS (is newer modality correctly assess the luminal size and characterize arterial wall changes clearly differentiates the true aneurysm from the false one. In an IVUS based study authors demonstrated atheromatous changes inside the aneurysmal segment also and they highlighted the angiographic underestimation of stenosis severity at the ectatic segment [67]. Even though characterizes the lumen and vessel wall ,the limitation of IVUS is still it is an invasive procedure requiring radiation. Recently Coronary Artery Computed Tomography (CACT)and Coronary magnetic Resonance Angiography (Coronary MRA) are emerging as new tool .But still CACT limited by ionizing radiation but MRI doesn't having the hazard of radiation. CACT based study documented the prevalence of CAE about 3-8%[68].The hemodynamic assessment using contrast attenuation shown to have good correlation with conventional angiographic flow alterations[69].Coronary MRA along with flow data (PFV) with its advantage of non invasive technique without the hazard of radiation may be a valuable tool for demonstrating thrombus and for follow up [70,71] .Echocardiography may be an initial noninvasive tool to recognize large aneurysm or ectasia .but its sensitivity is very poor for coronary imaging in adults .But Trans Esophageal Echocardiography is a better tool than

TTE to visualize coronaries .and coronary flow reserve also can be measured but with inter, intra observer variation is high

MANAGEMENT :

The cuurently available options for therapeutic armamentarium for coronary ectasia include

1. Medical management a) anticoagulation ,b)antiplatelet , c) vasodilators (calcium channel blockers)
2. Percutaneous intervention
3. Coronary Artery Byepass Grafting
4. Aneurysmorrhectomy , aneurysm excision, distal ligation

But no consensus or guidelines available for the management of CAE. In the acute coronary syndrome(MI ,UA) thrombolytic therapy and heparin infusion is justified because of the thrombus load . On long term because of flow alteration with propensity for thrombus formation and embolization anticoagulation has been proposed by many authors but no randomized prospective trials available. The same scenario exist for antiplatelet therapy as well .But the following explanations justify the use of antiplatelet therapy .

1.Majority of CAE associated with CAD

2.Histopathological similarity between CAE and CAD

3.Even in ectatic segment atheromatous lesion evident by IVUS

4. Approximately .30% patients with ectasia had prior history MI

5.CAE was reported to manifest MI/UA during follow up

6.Platelet activation was well evident by high MPV ,increased thrombomodulin and E selectin .

Similarly arterial vasodilators specifically calcium channel blockers (Diltiazem) also been suggested to counter the coronary spasm observed with Ectasia. But nitrate therapy is detrimental and discouraged because of its steal phenomenon (further dilatation of epicardial coronaries). The role of dua l or combined antiplatelet therapy have not been tried. Sorell et al proposed a pathophysiology combination therapy for ectasia .He recommended warfarin therapy to keep INR2-2.5 antiplatelet therapy with aspirin in the same dose as recommended for CAD .ACE inhibitor and statin were suggested for their anti-inflammatory effect and h s CRP reduction[72]. Trimetazidine also suggested by some authors [73]

Percutanoeus Coronary Intervention and Stenting :

Angioplasty with implantation of stenting is an option for patients with ectasia having symptoms despite medical therapy(refractory). Successful use

Balloon angioplasty in a lesion near coronary aneurysm with excellent acute long term follow up have been demonstrated in 1990[74] Appropriate balloon, stent selection incomplete expansion are the major limitation in dealing with ectatic vessel. Different types of stents were used

1. Biliary stent
2. Autologous venous covered stent
3. Covered stent
4. Bare metal stent
5. Peripheral stent
6. Parallel stenting[75] with 2 Drug elurting stent (DES)

IVUS guidance will solve the problem inadequate expansion , poor apposition to wall. IVUS withdrawal should be done cautiously to avoid stent dislocation . Covered stents offered superior angiographic results over BMS . Because of familiarity easy use and availability Suk-Kyu Oh, et al claimed the use of peripheral stent as the optimal approach . They also demonstrated the use of parallel ballooning using two drug eluting balloons [76]. . In larger sized ectasia in angulated vessel polytertafluoroethylene (PTFE)-covered self expandable stent is advised [77].

Surgical Revascularisation :

Proximal and distal ligation surgical excision of the aneurysm segment followed by CABG is useful for ectasia which is not amenable to stenting . Irrespective of the type of procedure adopted outcome remains appreciable[78].

Prognosis :

Markis et al[7] , after 2 yrs follow up found annual mortality rate of 15%/year in CAE group which is similar to short term prognosis of patients with triple vessel disease received only medical therapy . On the contrary other landmark studies[79,19] during initial days found no difference in mortality between CAE group and isolated CAD which disproved the hypothesis that "CAE confer high risk" . In CASS registry[8] also, five year survival has not been influenced by the presence of ectasia with that authors concluded that "CAE is variant of obstructive atherosclerotic disease".

Recent study reported 5 yr mortality rate of 29.1% , among 276 patients with ectasia . A Japanese study also showed poor outcome with 37% of patients suffered 22 major cardiac events with 78% of the major event being MI or UA. Isolated ectasia is not an innocent but exercise induced ischemia is well documented . In a Turkish study among 9 patients with isolated ectasia 46%

patients with dilated coronaropathy had dynamic ECG changes with enzyme elevation indicative of ACS .

Myocardial performance index a measure of global LV function(both systolic and diastolic) shown to be abnormally higher in the segmental territory of ectatic vessel indicating dyssynchrony due to underlying chronic ischemia[80]. Similarly electrical and mechanical function of left atrium also abnormal in CAE[81] as evidenced by a measurement P A-TDI duration (delay between the onset of P wave to Tissue Doppler A-indicator of total atrial conduction and mechanical function). The link between CAE and LA dysfunction is the underlying LV diastolic dysfunction due to chronic ischemia which have been demonstrated by the good correlation between P A TDI and isovolumic relaxation time , LA size . P A TDI identified as predictor of atrial fibrillation suggesting the possibility of increased incidence of AF in CAE but not yet studied ..

AIMS AND OBJECTIVES

1. To assess the prevalence of Coronary Artery Ectasia in patients with CAD
2. To Analysis of Risk factors and clinical presentation of CAE and to compare it with patients having only obstructive CAD
3. To Describe the angiographic characteristics of CAE
4. To study the influence of CAE on outcome of CAD

MATERIALS AND METHODS

***STUDY POPULATION*:**

Adult patients >18 yrs. of age with the diagnosis of CAD , undergoing Angiography in Department of Cardiology Govt Rajaji Hospital

CASES:

Inclusion criteria:

1. Age ≥18 years with diagnosis of CAD (both Stable Ischemic Heart disease and Acute Coronary Syndrome)
2. Patients having Coronary artery Ectasia and/or Coronary artery aneurysm in Coronary angiography

Exclusion criteria:

1) Age <18yrs

2) Patients already undergone PTCA ,CABG

3) Preexisting valvular heart disease

4) Preexisting cardiomyopathies

5) Preexisting Arrhythmias

7) Concomitant acute or chronic kidney disease

8) Vasculitis (Kawasaki disease ,Takayasu arteritis)

Methods

From the study population after obtaining informed written consent detailed history were taken Demographic and personal and health information were collected from the patient . Blood samples were collected for laboratory investigations .

LABORATORY INVESTIGATIONS:

1) Fasting Blood Sugar

2) Post prandial blood sugar

3) Serum creatinine

4) Blood urea

5) Lipid profile

6) HIV ELISA

7) Echocardiography

8) Coronary angiography

Definition of risk factors.

Diabetes Mellitus :

Diabetes Mellitus was diagnosed

1. If a patient is already on oral hypoglycemic drugs or on Insulin therapy
2. If a patient has symptoms of DM

Plus

Random Blood sugar of > 200 mg/dl or

Fasting blood sugar >126mg %

Systemic Hypertension :

A patient was diagnosed to have hypertension

1.If he is on antihypertensive therapy

2. If his BP is >140/90 mm of Hg on presentation and on repeat recording (>2 occasions)

Lipid abnormality : If a patient has

1. Elevated LDL cholesterol >100 mg%
2. High TGL >150 mg%
3. HDL cholesterol < 35 mg /dl

Any patient with Body Mass Index > 30 kg/m^2 was labelled as obese

Definition of Acute Coronary Syndrome :

Myocardial infarction was defined as per Universal definition of MI [82]

Definition of myocardial infarction

Criteria for acute myocardial infarction

The term acute myocardial infarction (MI) should be used when there is evidence of myocardial necrosis in a clinical setting consistent with acute myocardial ischaemia. Under these conditions any one of the following criteria meets the diagnosis for MI:

- Detection of a rise and/or fall of cardiac biomarker values [preferably cardiac troponin (cTn)] with at least one value above the 99th percentile upper reference limit (URL) and with at least one of the following:
  - Symptoms of ischaemia.
  - New or presumed new significant ST-segment–T wave (ST–T) changes or new left bundle branch block (LBBB).
  - Development of pathological Q waves in the ECG.
  - Imaging evidence of new loss of viable myocardium or new regional wall motion abnormality.
  - Identification of an intracoronary thrombus by angiography or autopsy.
- Cardiac death with symptoms suggestive of myocardial ischaemia and presumed new ischaemic ECG changes or new LBBB, but death occurred before cardiac biomarkers were obtained, or before cardiac biomarker values would be increased.
- Percutaneous coronary intervention (PCI) related MI is arbitrarily defined by elevation of cTn values (>5 x 99th percentile URL) in patients with normal baseline values (≤99th percentile URL) or a rise of cTn values >20% if the baseline values are elevated and are stable or falling. In addition, either (i) symptoms suggestive of myocardial ischaemia or (ii) new ischaemic ECG changes or (iii) angiographic findings consistent with a procedural complication or (iv) imaging demonstration of new loss of viable myocardium or new regional wall motion abnormality are required.
- Stent thrombosis associated with MI when detected by coronary angiography or autopsy in the setting of myocardial ischaemia and with a rise and/or fall of cardiac biomarker values with at least one value above the 99th percentile URL.
- Coronary artery bypass grafting (CABG) related MI is arbitrarily defined by elevation of cardiac biomarker values (>10 x 99th percentile URL) in patients with normal baseline cTn values (≤99th percentile URL). In addition, either (i) new pathological Q waves or new LBBB, or (ii) angiographic documented new graft or new native coronary artery occlusion, or (iii) imaging evidence of new loss of viable myocardium or new regional wall motion abnormality.

Criteria for prior myocardial infarction

Any one of the following criteria meets the diagnosis for prior MI:

- Pathological Q waves with or without symptoms in the absence of non-ischaemic causes.
- Imaging evidence of a region of loss of viable myocardium that is thinned and fails to contract, in the absence of a non-ischaemic cause.
- Pathological findings of a prior MI.

Diagnosis of Unstable angina was made if a patient fulfil any of the following criteria [83]

Class	Presentation
Rest angina*	Angina occurring at rest and prolonged, usually greater than 20 min
New-onset angina	New-onset angina of at least CCS class III severity
Increasing angina	Previously diagnosed angina that has become distinctly more frequent, longer in duration, or lower in threshold (i.e., increased by 1 or more CCS class to at least CCS class III severity)

Coronary Angiography :

After obtaining an informed written Coronary angiography was done through either right femoral artery or right radial artery approach after sterile aseptic precaution under local anaesthesia using Judkins right and left (JR ,JL) coronary catheter . 4 or 5 views for LAD and 2 views for RCA were recorded .

The films were reviewed by junior resident and findings were confirmed by experienced interventional cardiologist

Angiographic views : for Left Anterior Descending Artery

1. RAO caudal
2. AP caudal
3. AP cranial
4. LAO caudal
5. LAO cranial

For Right Coronary Artery :

1. LAO

2. AP cranial

All the 3 major vessels were divided into proximal, middle, and distal segment as follows

LAD :

Proximal LAD : From its origin from LMCA to the origin of 1st Diagonal

Mid LAD : Defined as LAD segment in between 1st and 2nd diagonal

Distal LAD : LAD distal to 2nd diagonal labelled as distal LAD

RCA :

Proximal RCA : From its ostium to the origin of 1st RV branch

Mid RCA : Defined as RCA segment in between 1st RV branch and its bifurcation PDA and PLV vessel

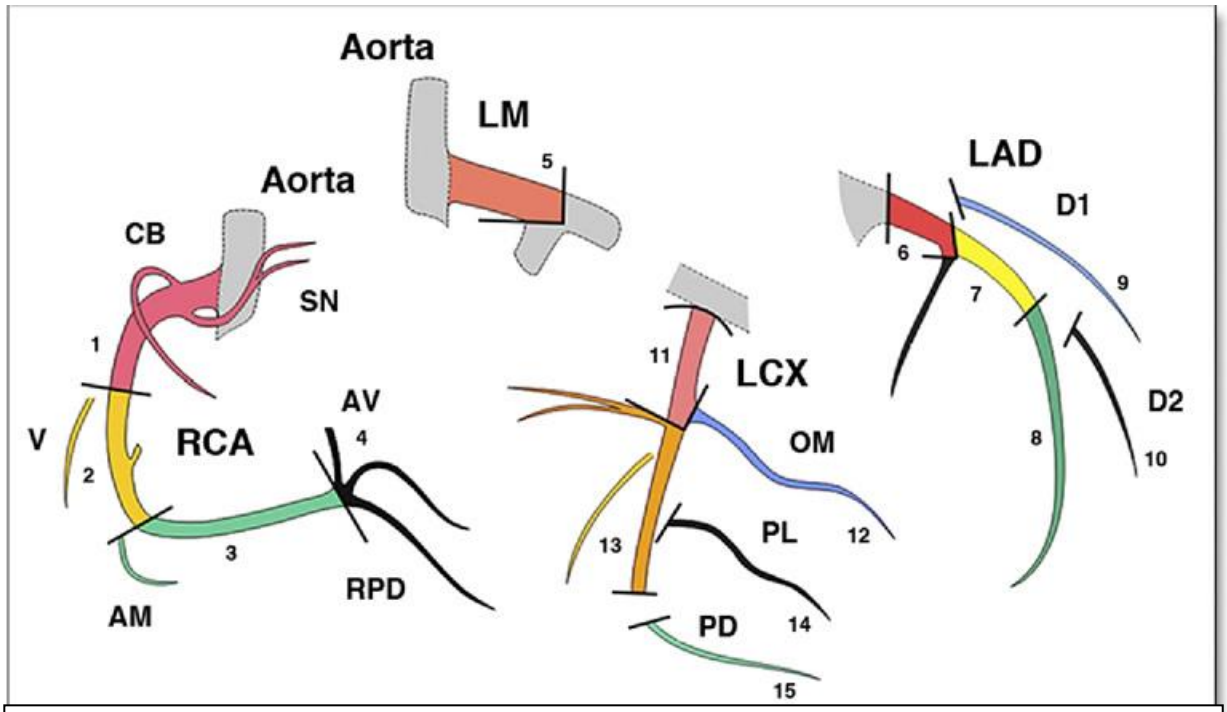
Distal RCA : RCA distal to its bifurcation as PDA and PLV vessel

LCX :

Proximal LCX : From its origin to the origin of 1st Obtuse marginal branch

Mid LCX : LCX segment in between 1st and 2nd Obtuse marginal branch

Distal LCX : LCX distal to 2nd Obtuse marginal branch labelled as distalLCX



LAD left anterior descending coronary artery; LCX left circumflex coronary artery;

LM left main coronary artery; RCA right coronary

D1 first diagonal branch; D2 second diagonal branch;

OM obtuse marginal branch PD posterior descending branch;

PL posterolateral branch RPD right posterior descending branch

Definition of Ectasia :

In our study we followed the definition used in CASS registry abnormal dilatation of coronary artery, with luminal diameter exceeding 1.5 times the adjacent normal reference segment. If no adjacent normal segment could be

identified, the mean diameters of the coronary segments in a control group without heart disease served as normal values."

Types of Ectasia :

1. *Localized* : If ectasia confined to a discrete portion of artery with an adjacent normal vessel within that segment
2. *Diffuse:* if the Ectasia involves the entire coronary aretery segment with no normal vessel in that segment

Coronary Ectasia have been classified according to Markis et al & Harikrishnan et al classification

Definition of obstructive CAD in angiogram :

Obstructive CAD was diagnosed if a patient had > 50% loss of luminal diameter compared to the reference normal segment.

Definition of Groups:

Different types of ectasia in relation the segment of particular vesselsas defined above were recorded . According to the angiography patients were categorized into three groups Group A = Isolated Ectasia patients having Ectasia without any evidence of significant obstruction in coronary artery (>50%) , Group B Mixed CAE + CAD group Patients with Ectasia and also having significant obstruction in any of the coronaries .Group C= Pure CAD group patients having only CAD without evidence of CAE

Patients were treated according to the guideline given by American College of Cardiology /American Heart association . Left ventricular systolic function was recoded with Philips IE 33 echocardiography machine . Clinical events LVF ,in hospital mortality were recorded . Outcome data during follow up were collected specifically regarding the Unstable angina ,MI mortality and recoded for analysis

Stastical Analysis ;

Continuous variables were analyzed with Mean ± SD (BMI, Lipid parameters ,age) . Categorical variables sex ,DM hypertension ,vessel involved outcome) were described with number & percentage .Chi Square test used to assess the significance P value < 0.05 were considered as stastically significant. .

RESULTS

Prevalence :

Totally 2434 patients undergone angiogram during the study period with the suspicion of Coronary Artery Disease (Chronic Stable Angina or Prior MI, ACS).Of those 1966 patients was eligible for our study . Coronary ectasia was found in 136 (5.6%) patients of whom 24 (1.0%) patients were diagnosed to have isolated ectasia (isolated ectasia group) without evidence obstructive coronary disease and 112 (4.6%) (CAE+CAD group) patients with ectasia were having associated with obstructive CAD . Remaining1830 patients were having pure obstructive CAD (CAD group)(75.2%).Baseline characters have been tabulated in Table 1. Isolated ectasia (dilated coronaropathy) was observed in 17.6%(n=24) ,remaining 82.4% had associated obstructive CAD (n=112) .

Age & Sex :

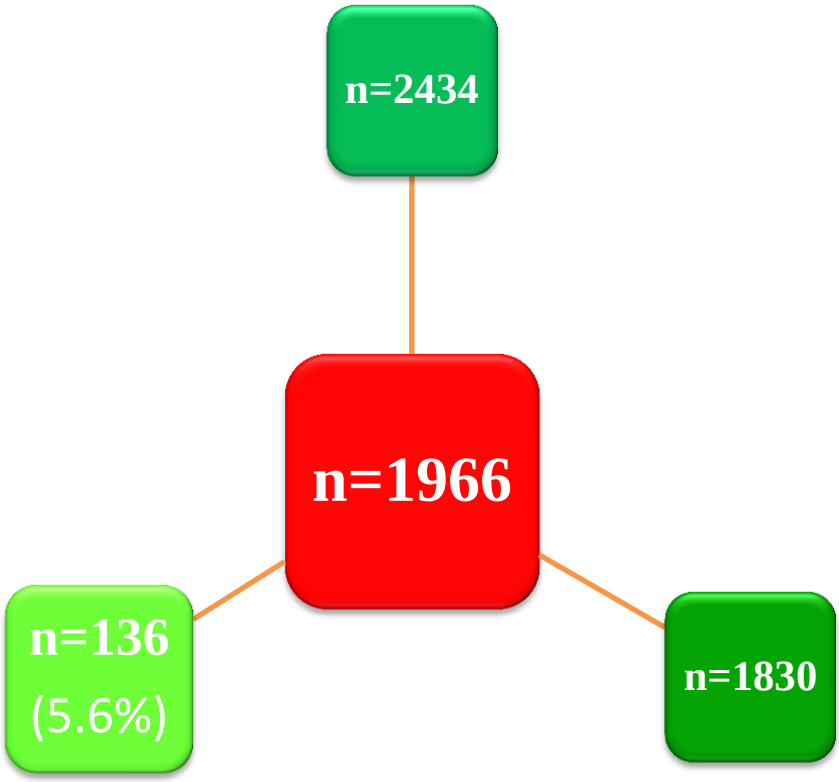
Mean age of the population in isolated ectasia is significantly lower (44±8.6 Vs 54.32±8.72 Vs 56±7.8 P<0.001) compared to mixed CAE +CAD group and isolated CAD . Sex distribution showed male predominance in all the

groups .the proportion among total ectatic population is M:F 3.1:1.Significant male dominance was noted in Isolated ectasia group (7:1 p value <0.001). But when comparing total ectasia group (n=136) to isolated CAD the male dominance nullified indicated that male sex is a significant risk factor for Dilated coronaropathy(Isolated ectasia). But male sex is not a significant risk factor mixed ectasia group (CAE+CAD) when comparing with isolated CAD group the male(2.7:1 Vs 2.5:1 P value NS) dominance is due to high incidence of CAD among males .

Smoking :

Among the isolated ectasia group 62.5% (n=15) patients were smokers whereas in mixed and isolated CAD group smokers were 53.6% (n=60),51.6% (n=944/1830) respectively.

Fig :1a



Isolataed Ectasia **CAE +CAD**

n=24

(1.0%)

n=112 (4.6%)

Fig 1b : Prevalence

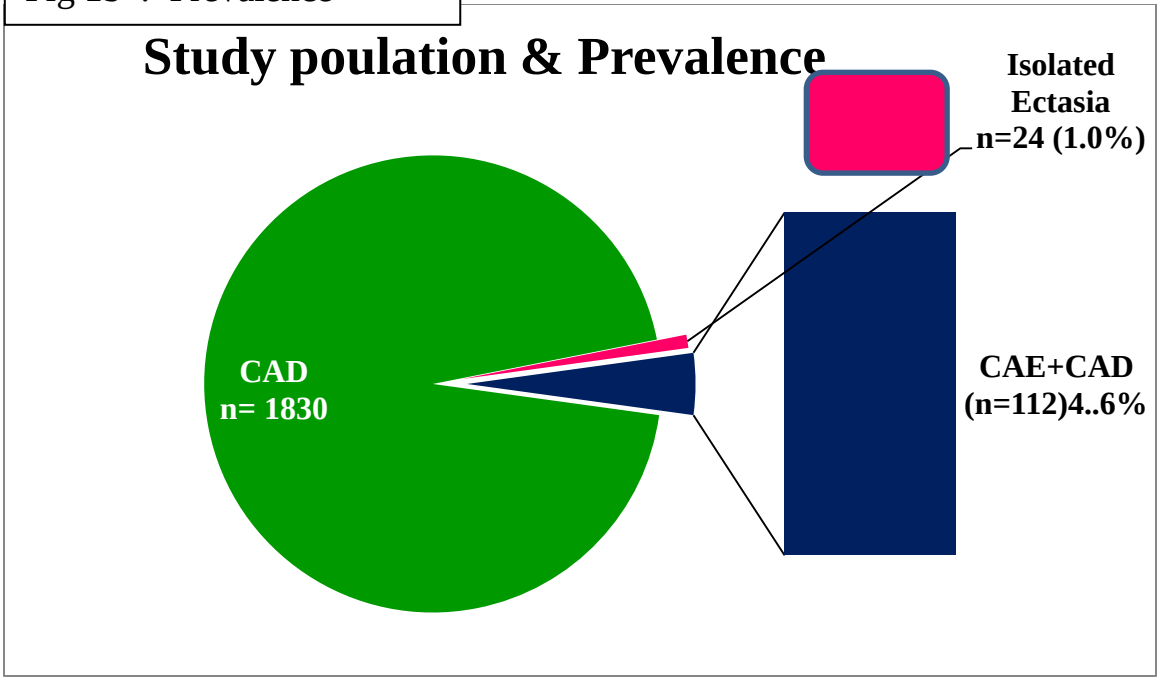


Table 1: Baseline Characters

	Isolated Ectasia n=24 (A)	CAE+CAD n=112 (B)	CAD n=1830 (C)	p value
Age (yrs)	44±8.6	54.32±8.72	56±7.8	<0.001
Sex Male	21 (87.5%)	82(73.2%)	1318(72%)	
Female	3(12.5%)	30(26.8%)	512(28%)	
Smoker	15(62.5%)	60(53.6%)	944 (51.6%)	0.813 NS
Diabetes	6(25%)	48(42.9%)	868(47.4%)	<0.05
SHT	8(33.3%)	53(47.3%)	904(49.4%)	0.55 NS
BMI (>30 mg /dl)	5(20.8%)	26(23.2%)	413(22.6%)	NS
LDL (>100 mg/dl)	7(29.2%)	41(36.6%)	679(37.1%)	NS
HDL(<35mg/dl)	13(54.1%)	51(45.5%)	866(47.3%)	NS
TGL (>150mg/dl)	5(20.8%)	43(38.3%)	763(41.7%)	NS

Table : 2 Gender distribution

	Total	Male n (%)	Female n (%)	M:F
All patients	1966	1421(72.3%)	545(27.7%)	2.6
Isolated Ecatsia	24	21 (87.5%)	3(12.5%)	7
CAE+CAD	112	82(73.2%)	30 (26.8%)	2.7
Total No CAE patients	136	103 (75.7%)	33(24.3%)	3.1
Isolated CAD	1830	1318 (72%)	512 (28%)	2.52

Fig 2 a Gender Distribution

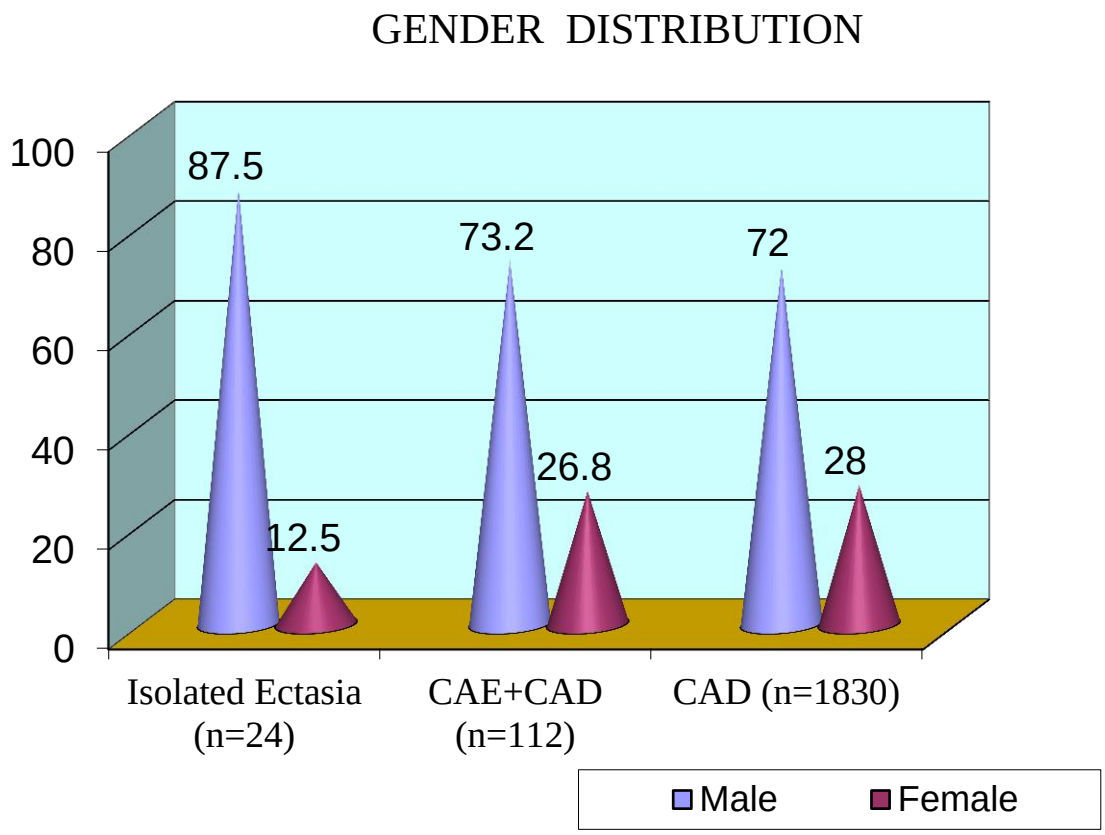


TABLE 3 Traditional Risk factors				
	Isolated Ectasia n=24	CAE+CAD n=112	CAD n=1830	p value
Age (yrs)	44±8.6	54.32±8.72	56±7.8	<0.001
Sex Male	21 (87.5%)	82(73.2%)	1318(72%)	
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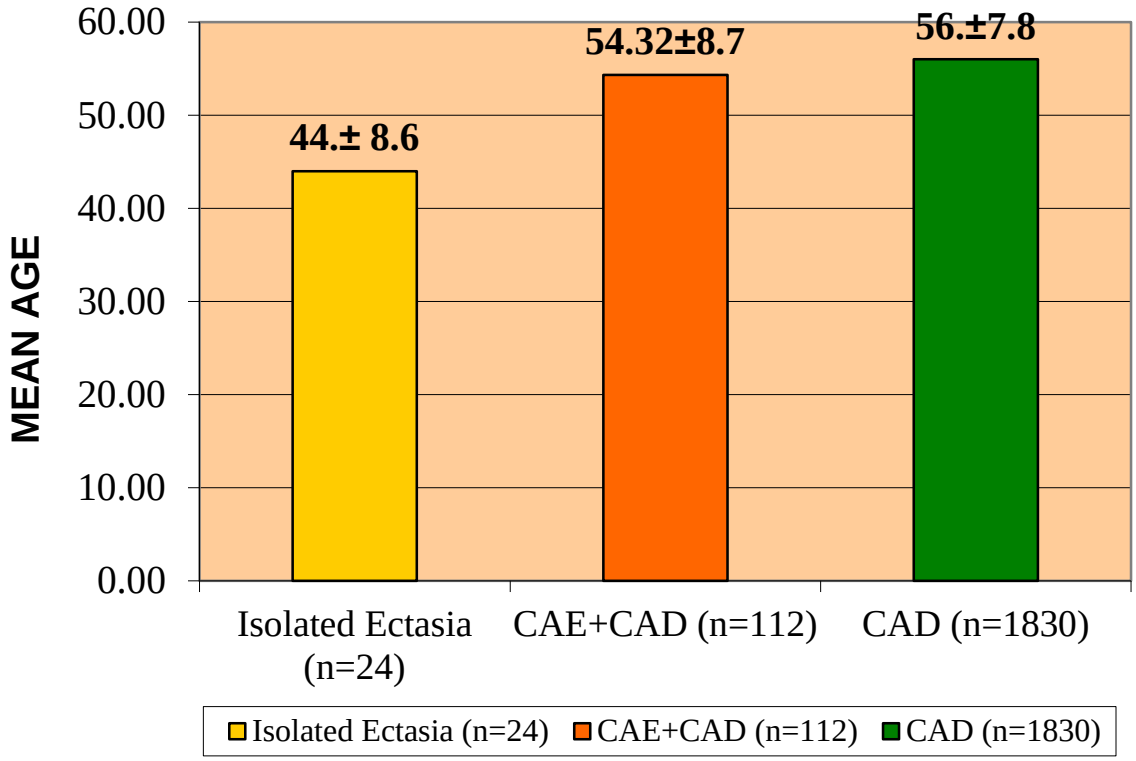
Diabetes	6(25%)	48(42.9%)	868(47.4%)	<0.05
SHT	8(33.3%)	53(47.3%)	904(49.4%)	0.55 NS
BMI (>30)	25.57±3.41	27.43 ± 3.19	28.15±3.56	<0.001
LDL (>100 mg/dl)	105± 22.68	104.9±19.8	108±16.7	0.12 NS
HDL(<35mg/dl)	37.9±-8	36.19±7.13	37.52±6.9	0.136 NS
TGL (>150mg/dl)	155.9±31.9	167.17±42.99	163.34±37.15	0.35 NS

Fig 2bAGE DISTRIBUTION Mean± SD



Conventional Risk Factors :

Diabetes Mellitus was observed in 25% (n=6/24)of patients with isolated ectasia In mixed group DM was seen in 48/112 patients and in pure CAD 47.4% of patients were having DM . Prevalence DM is similar in mixed group and pure CAD But in isolated ectasia prevalence of significantly lower

when compared to other groups indicating the inverse association between Diabetes melltus & isolated ectasia not in mixed group

Systemic Hypertension was found in 33.3% (n=8/24)of isolated ectasiagroup whereas in mixed and pure CAD group it was 47.3 % (n=53/112) and 49.4% respectively . Five among 24 isolated ectasia patients (20.8%)were obese with the BMI of >30 in mixed group 23.2% were obese in pure CAD 22.6% were obese .Mean LDL was 105± 22.68 mg% in isolated ectasia patients with LDL > 100 mg % was observed in 29.2% of te patients .

In mixed and pure CAD group mean LDL cholesterol was 104.9±19.8, 108±16.7 mg% respectively with high LDL was noted among 36.6% ,and 37.1% of the patients in these group the difference was not significant .Similarly HDL cholesterol was low in half the isolated ectasia group 54.1% but the difference between the groups were not statistically significant , the mean among different group was 37.9±-8 in isolated ectasia patients 36.19±7.13 & 37.52±6.9 in mixed group and pure CAD population. Significantly less number of people in isolated ectasia were having hypertriglyceridemia but the mean level was not statistically significant across the 3 groups .

Fig : 3 Traditional RiskFactors

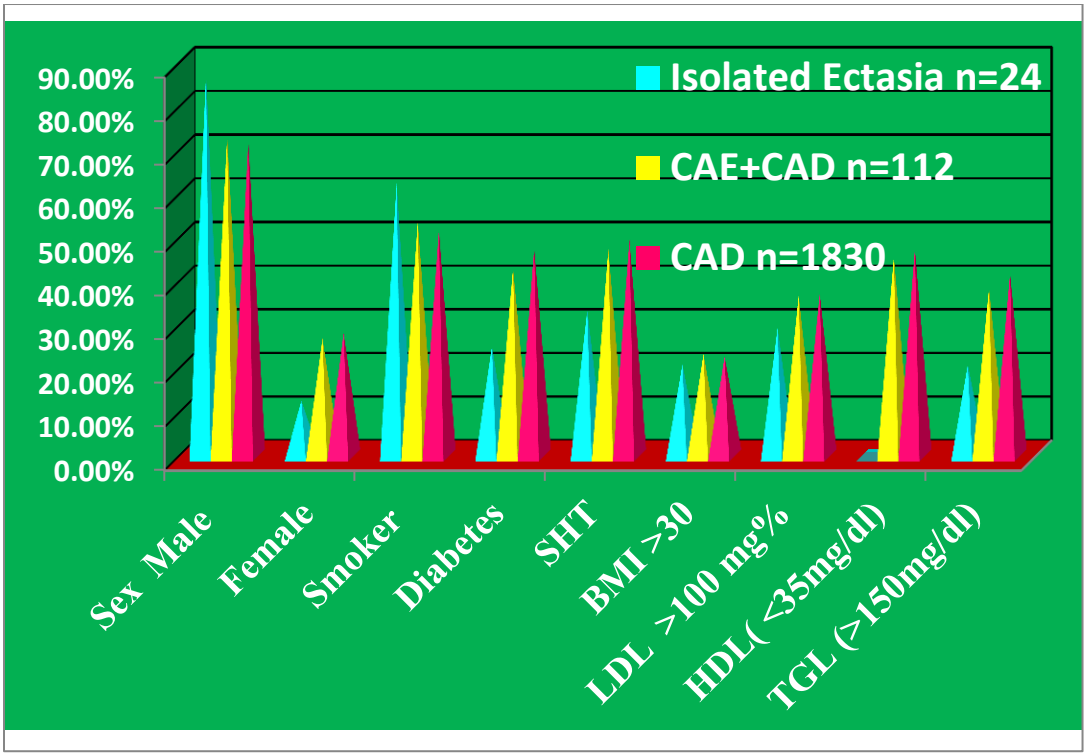


Fig 4 Tarditional Risk factors

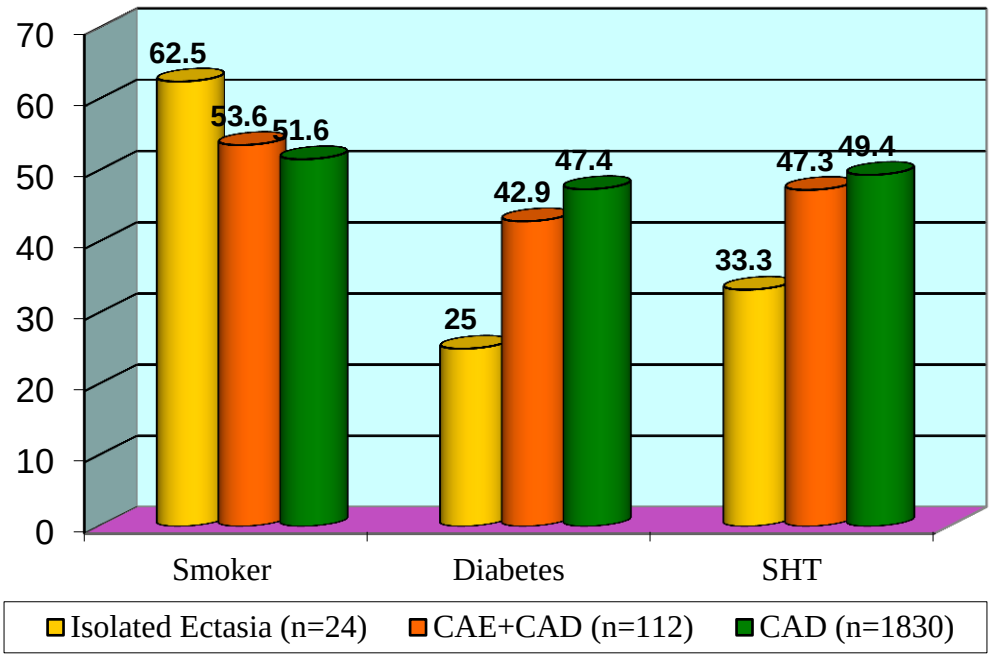


Table 4 : Novel Risk Markers

	Isolated Ectasia Mean±SD	CAE+CAD Mean±SD	Pure CAD Mean±SD	p value
Neutrophil (cells /mm^3)	5.986±1.497	6.019±1030	4.480±1.230	<0.001
Lymphocyte	1.520±0.268	1.700±0.275	1.680±0.268	0.011
NLR	3.98±0.89	3.58±0.56	2.82±0.60	<0.001
Mean Platelet voume (MPV)	9.94±1.56	9.56±1.06	9.70±1.36	0.379 NS
Red Cell Distribution Width (RDW)	12.59±0.60	12.09±0.85	12.12±0.70	<0.005

Novel Risk Markers:

With the hypothesis that inflammation with underlying atherosclerosis is possible pathogenitic mechanism of coronary artery ectasia we evaluated various risk markers of underlying inflammation . Mean Neutrophil count was significantly among isolated ectasia group and in CAE+CAD group compared to pure CAD group 5.986±1.497 Vs 6.019±1030 Vs 4.480±1.230 (P Value <0.001).In addition neutrophil to lymphocyte ratio also significantly higher (P Value<0.001) in Isolated and mixed ectasia group 3.98±0.89 & 3.58±0.56 when compared to pure CAD group 2.82±0.60. Role of Plateletlet activation was

assessed by measuring MPV .difference between the mean of MPV was not significant among the three groups 9.94±1.56 Vs 9.56±1.06 Vs 9.70±1.36 (P=0.379). Similarly Red cell Distribution Width also measured to assess the inflammatory component . RDW in patients with isolated ectasia is significantly elevated when compared with the other groups 12.59±0.60 Vs 12.09±0.85 Vs 12.12±0.70 P<0.005.This indicate platelet activity is not different among the group indicate platelet are as active as in isolated ectasia group but here we did not compare with the control group so we cannot underestimate the role of MPV.

Table 4 : Angiographic Pattern Markis classification

Markis Type	Isolated Ectasia N=24 (100%)	CAE +CAD n=112(100%)	Total N= 136
I	10 (41.7%)	2(1.79%)	12 (8.8%)
II	6(25%)	38(33.93%)	44 (32.4%)
III	4(16.7%)	26(23.21%)	30 (22.0%)
IV	4(16.7%)	46 (41.07%)	50 (36.8%)

Fig :5 a Markis Types in Isolated Ectasia

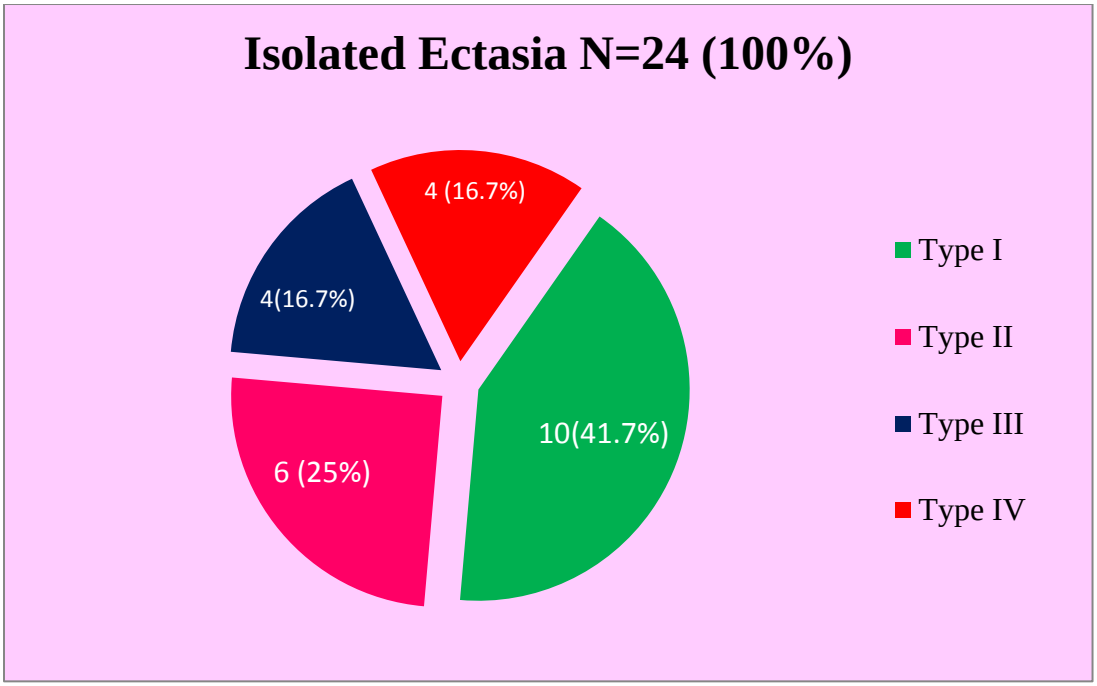


Fig :5 b Markis Classification in Mixed CAE + CAD group

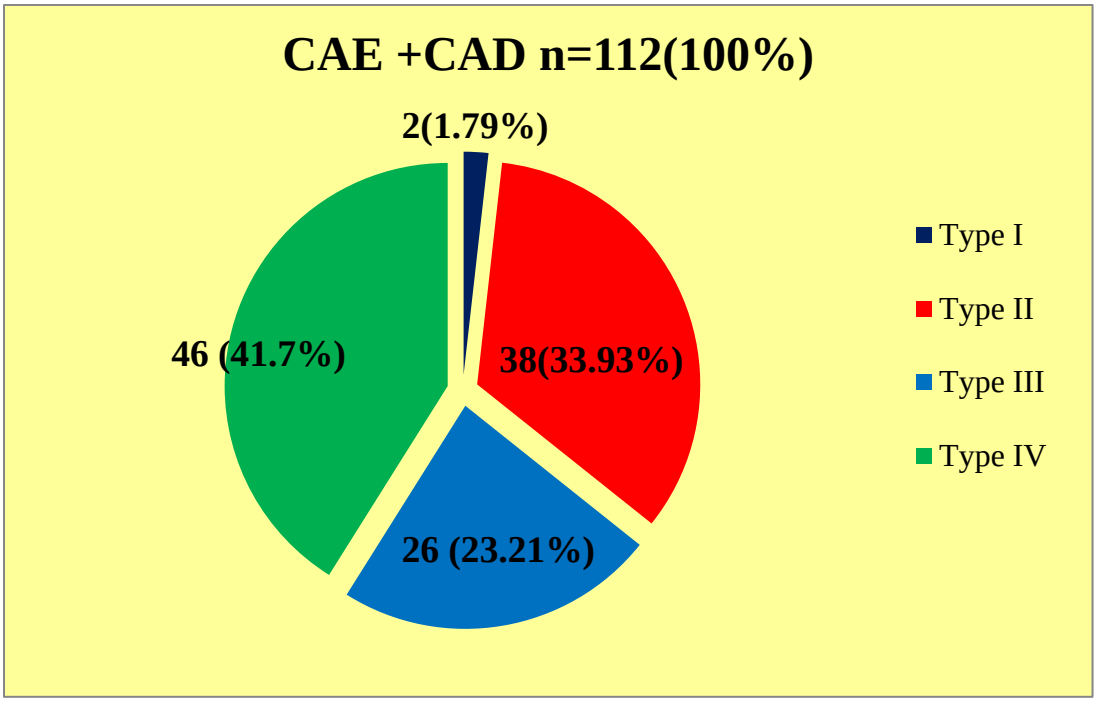
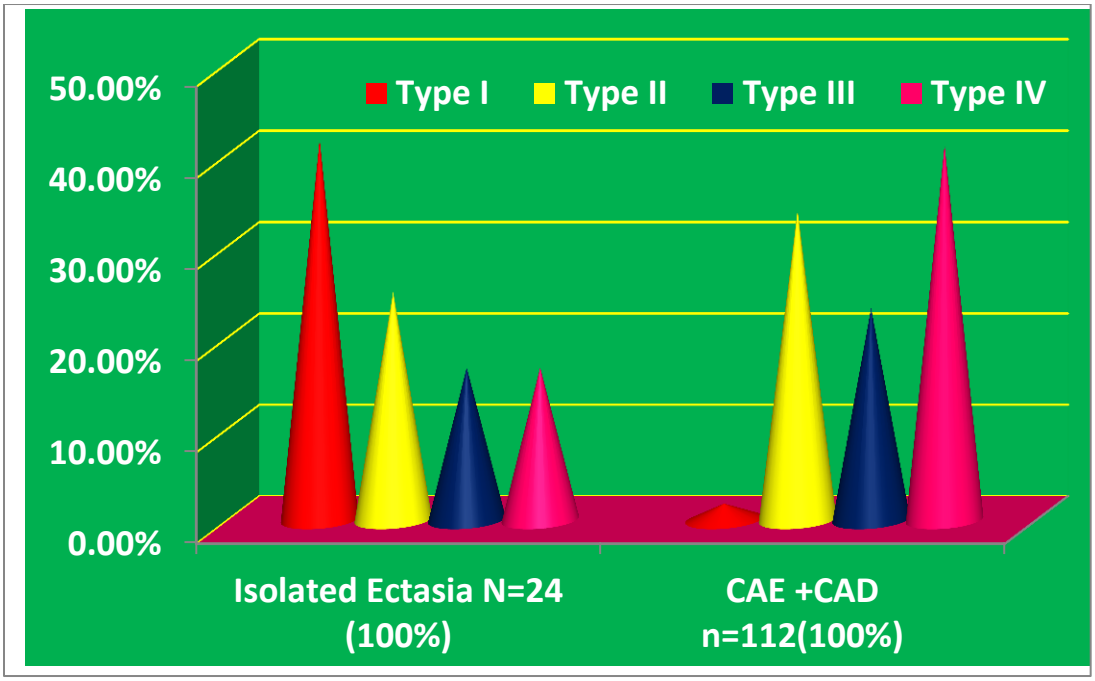


Fig 6 : Markis types in Isolated Ectasia & Mixed group



Angiographic pattern :

Markis type IV(Isolated focal ectasia) is the most common among both isolated and mixed ectasia group observed in 50 of 136 patients (36.8%) followed by Type II (combined diffuse and focal ectasia) in 44patients (32.4%) then Type III in 30patients (22%) finally least common is type I (Diffuse ectasia of 2 or more vessel) 12 (8.8%). Among the isolated ectasia group tyepe I is the most common type n=10 41.7% followed by Type II n=6(25%)type III , IV 4 16.7%each with responsible for the remaining .In this dilated coronaropathy group diffuse ectasia is more common than focal ectasia36 (70.6%) vs 15(29.4%) RCA is the the most common vessel involved . Whereas mixed group had more number of focal ectasia than mixed 109 (61.2 %) vs 69(38.8%)

In the mixed group LAD the commonest vessel involved . When combining both group isolated ectasia (n=51) and mixed CAE + CAD (n=178) totally 229 ectasia were observed among 136 patients .RCA and LAD had equal number of ectasia (n=90 , 39.3%) followed by LCX (n= 40,17.5%)and then LMCA n=9(3.9%). Among the vessels LAD has dominant focal involvement n=71 (78.9%) but all the other major vessels had dominant diffuse involvement RCA (58.9%) LCX (65%) LMCA (77.8%). Totally 105 diffuse ectasia were identified majority n=53 (50.5%) seen in RAC followed by LCX, LAD ,LMCA respectively 26 (24.8%) 19 (18.1%) 7 (6.7%) .In focal ectasia (n=124)group LAD contributed to the maximum number n= 71(57.2%) followed by RCA , LCX , LMCA (37 (29.8%), 14 (11.3%), 2 (1.6%)) in the descending order of frequency .

Table5: Total number of Ectasia in relation with vessel

	Isolated ectasia (n=51) (100%)	Mixed CAE+ CAD (n=178) (100%)	Total N=229
LMCA (n=9)	2(3.9%)	7 (3.9%)	9 (3.9%)
LAD (n=90)	15(29.4%)	75 (42.13%)	90 (39.3%)
LCX (n=40)	13(25.5%)	27 (15.17%)	40 (17.5%)
RCA (n=90)	21(41.2%)	69(38.76)	90(39.3%)

Fig 7: Vessel involvement

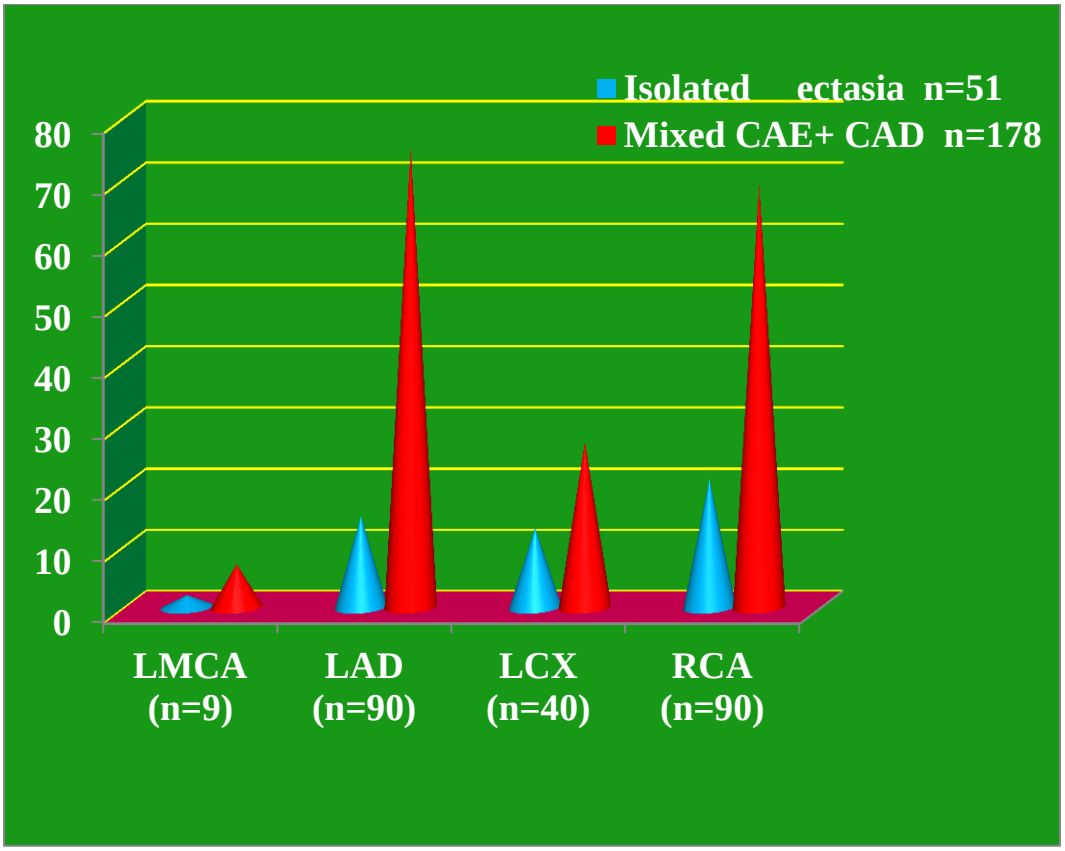


Table 6 : Vessel Involvement in Isolated Ectasia

Vessel	Diffuse n=36 (100%)	Focal (n=15) (100%)	Total (n=51) (100%)
LMCA (n=2)	2 (5.6%)	0	2 (3.9%)
LAD (n=15)	7(19.4%)	8 (53.3%)	15 (29.4%)
LCX (n=13)	10(27.8%)	3 (20%)	13 (25.5%)
RCA (n=21)	17(47.2%)	4(26.7%)	21 (41.2%)

Table 7: Vessel Involvement in (CAE +CAD)

	Diffuse n=69 (100%)	Focal (n=109) (100%)	Total (n=178) (100%)
LMCA n=7	5(7.3%)	2 (1.8%)	7 (3.9%)
LAD n=75	12 (17.3%)	63 (57.8%)	75 (42.13%)
LCX n=27	16 (23.2%)	11 (10.1%)	27 (15.17%)
RCA n=69	36(52.2%)	33 (30.3%	69 (38.76)

Table 8 Type of Ectasia relation with vessel

	Diffuse n= 105	Focal (n=124)	Total n=229
LMCA n=9(%)	7 (77.8%)	2 (22.2%)	9
LAD n=90 (%)	19 (21.1%)	71(78.9%)	90
LCX n=40(%)	26 (65%)	14(35%)	40
RCA n=90(%)	53 (58.9%)	37 (41.1%)	90

Table : 9 Distribution of ectasia in vessel

	Diffuse n= 105 (%)	Focal (n=124) (%)	Total n=229 (%)
LMCA n=9	7 (6.7%)	2 (1.6%)	9
LAD n=90	19 (18.1%)	71(57.2%)	90
LCX n=40	26 (24.8%)	14 (11.3%)	40
RCA n=90	53 (50.5%)	37 (29.8%)	90

Fig 8: Type of Ectasia relation with vessel

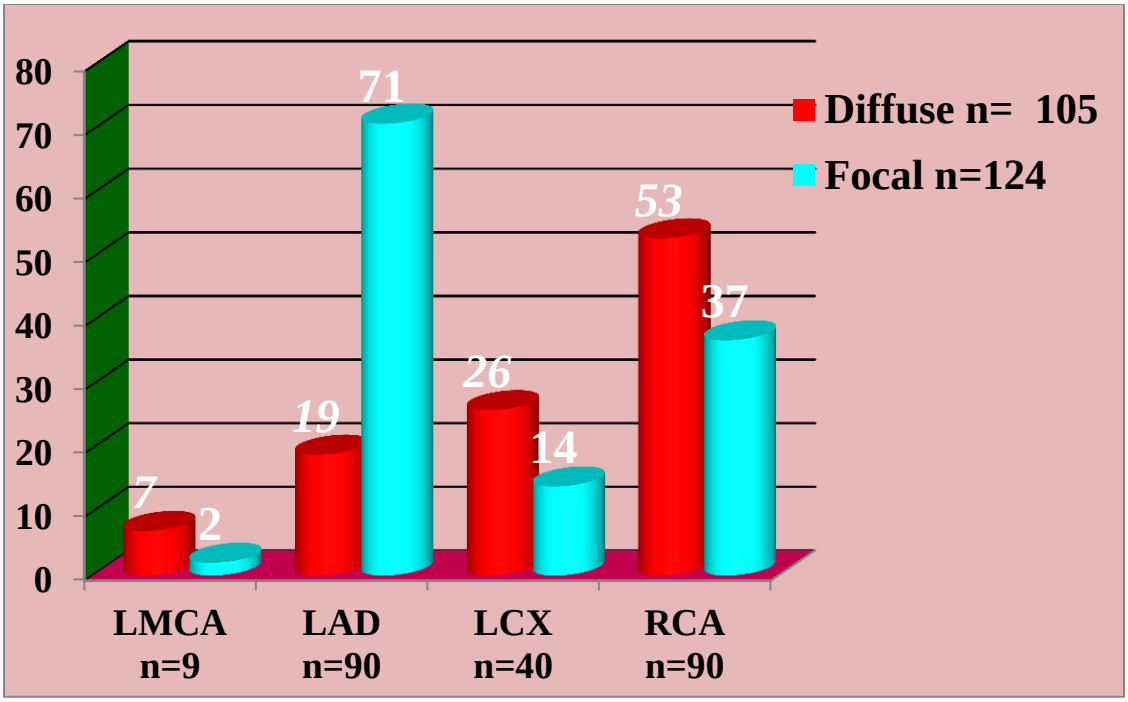


Table 10: Clinical Presentation

Clinical Presentation	Isolated Ectasia n=24 (%)	CAE+CAD n=112 (%)	CAD n=1830 (%)	P value
CSA	6(25%)	43(39.3)	768(42%)	0.46 NS
UA /NSTEMI	14(58.3%)	21(18.8%	311(17%)	<0.001
STEMI	4(16.7%)	48(42.8%)	751(41%)	<0.005

Table 11 : Outcome

	Isolated Ectasia n=24	CAE+CAD n=112	CAD n=1830	p value
EF	59.6±4.6	53.4±9.6	51 ±6.4	<0.01
In Hospital Mortality	0	7(6.3%)	104 (5.7%)	0.49 NS
PCI	0	8	462 26.7%	
CABG	3 12.5%	46 (41.7%)	302 (17.4%)	
Follow up				
	Isolated Ectasia n=24	CAE +CAD n=103	CAD n=1625	P value
Duration	12 ±2months	13±4 months	15±3 months	NA
UA/NSTEMI	9(37.5%)	32 (31.2)	278(17.1)	<0.003
STEMI	0	5 (4.9%)	83(5.1%)	<0.05
Mortality	0	6 (5.8%)	99 6.1%)	<0.05

Fig 9 ; CLINICAL PRESENTATION

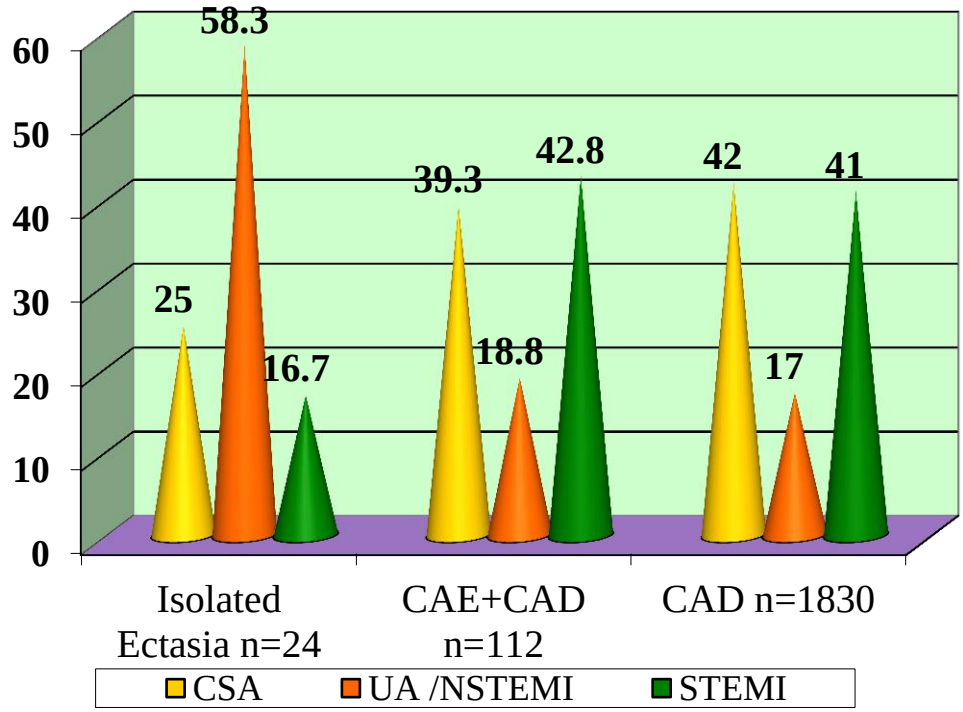
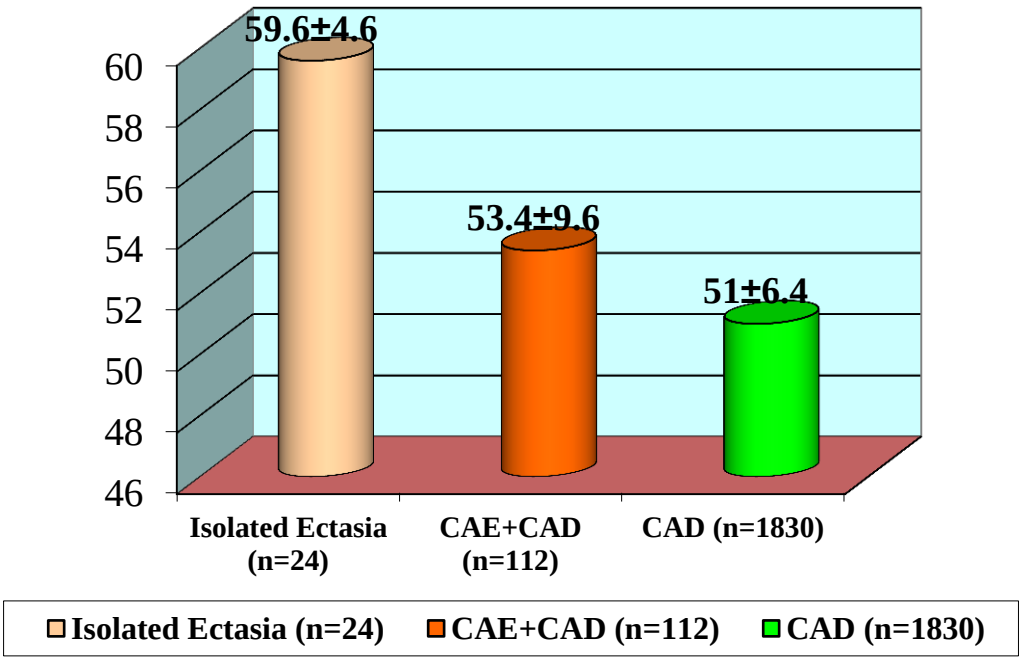


Fig 10:EF



Clinical Presentation :

In the isolated ectasia group 58.3% (n=14) P<0.001of the patients presented with Unstable angina /NSTEMI. CSA is the next common responsible for 25% (n=6)STEMI is the least common presentation 4(16.7%).On the contrary in mixed (CAE +CAD group and in the pure CAD group UA/NSTMI the least common presentation 18.8 %and 17% . But CSA is the most common indication for CAG in CAD group .In the mixed group STEMI (42.8%) the commonest presentation but the difference is not statistically significant .

Outcome :

Follow up data available foo al 24 isolated ectasia patients and for 103 patients in mixed group 1625 pure CAD patients .Duringfollow up UA angina is most frequently seen among Isolated ectasia and mixed group compared to pure CAD, 9(37.5%) vs vs 32 (31.2) vs 278(17.1). No ne of the isolated ectasaia patient had STEMI or mortality during follow up .But in mixed group approximately similar incidence of STEMI in mixed 5 (4.9%) and pure CAD group 83(5.1%).Morality during follow up also same in both mixed and pure CAD 6 (5.8%) and 99 (6.1%) vs 0 in isolated ectasia group

Fig 11 Hospital Mortality(%)

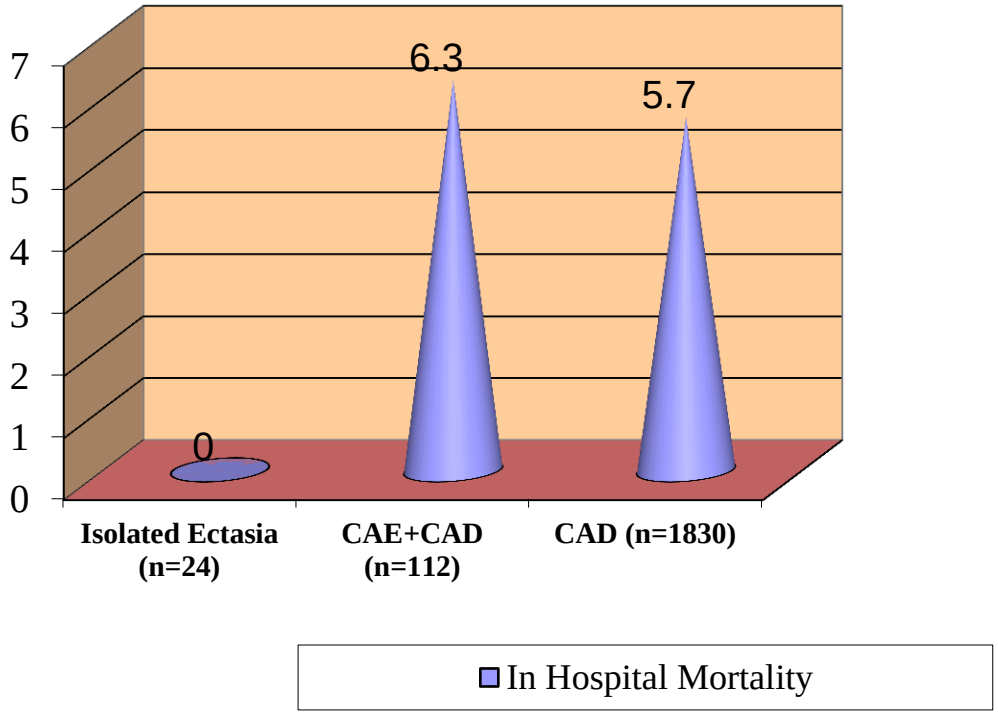
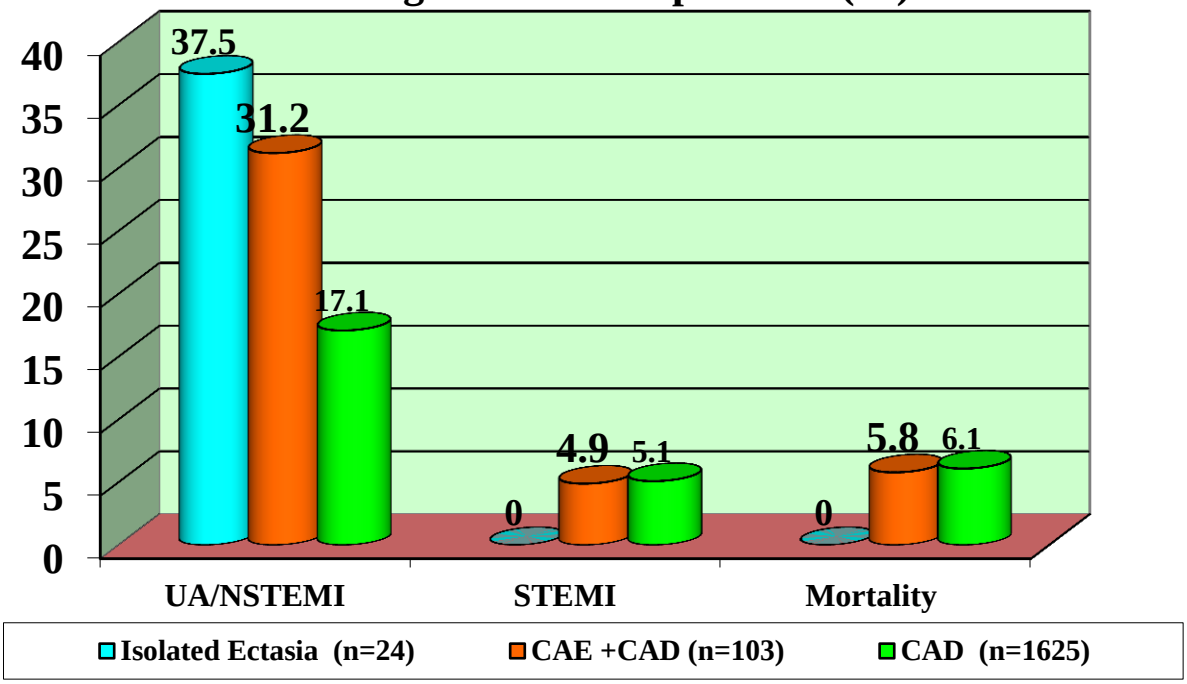


Fig 12 : Follow up Events (%)



DISCUSSION

In our study conducted in South India ,totally 136 among 2434 patients with clinical suspicion CAD had coronary ectasia .So the prevalence of ectasia was 5.6% Prevalence of isolated ectasia was 1% (n=24) . In the literature prevalence of ectasia varies from 0.3% - 12.5%. the highest prevalence reported in Indian subcontinent (India -10-12%, Pakistan 12.5%) . Except few studies majority reported prevalence < 5% (CASS registry- 4.9% Spain- 3.39% , Greek 2.7%) Similarly Harikrishnan et al from Kerala –South India reported 4.5% among 3200 angiogram The prevalence isolated ectasia without significant coronary stenosis (dilated coronaropathy) in our study was 1%(n=24) . Harikrishnan et al reported prevalence of 0.6 % Nyamu et al in their dedicated study on isolated ectasia reported a prevalence of 1.9% among 6938 angiogram .

Association with CAD :

Isolated ectasia (dilated coronaropathy) was observed in 17.6%(n=24) of all ectasia remaining 82.4% had associated obstructive CAD (n=112) . Pinar Bermúdez et al in their study found that 77.6% of the CAE patients had

associated stenosis CSP Lam et al from Singapore observed 82% of their patients with CAE had associated obstructive CAD . Several studies reported similar observation and P. Ramappa, et al in their excellent review reported found >50% of patients with ectasia in the literature had underlying stenotic atherosclerosis . In view of its significant association with atherosclerosis CASS registry concluded Coronary Ectasia as a variant of atherosclerosis . But further studies following CASS registry done to explore the relation between the traditional risk factors of found contradictory results.

Isolated ectasia - Is it a right terminology ???

By definition isolated ectasia excludes atherosclerosis, connective tissue valvular and congenital disease . But Ge et al in a IVUS based study found that atheroma burden even inside the ectatic segment . Similarly in our angiographic study 40 % of patients with isolated ectasia had non-significant stenosis with 30-40%narrowing of lumen . Conventional coronary angiogram is less sensitive in detecting narrowing less than 30% with ectasia luminal loss may also be underestimated .Hence it does not recognize minimal atherosclerosis, require IVUS to pick up this minimal atheroma So the terminology of isolated ectasia itself was questioned by “Boles U” who recommended ectasia with non-obstructive CAD for isolated ectasia .

Traditional Risk factors & CAE :

Patients in the isolated ectasia group were younger than other groups (44±8.6 Vs 54.32±8.72 Vs 56±7.8 P<0.001) .This finding is consistent with the finding of some previous studies .Gender distribution showed male predominance in all the groups .the proportion among total ectatic population is M:F 3.1:1.Significant male dominance was noted in Isolated ectasia group (7:1 p value <0.001). But when comparing total ectasia group (n=136) to pure CAD the male dominance nullified indicated that male sex is a significant risk factor for Dilated coronaropathy(Isolated ectasia). But male sex is not a significant risk factor mixed ectasia group (CAE+CAD) when comparing with isolated CAD group the male(2.7:1 Vs 2.5:1 P value NS) dominance is due to high incidence of CAD among males . Male dominance(M:F 2-3:1) was noted in some previous studies also especially in isolated ectasia group but no statistical significance was found between CAD and CAE group[85] .Some authors attributed that the difference is due to lower incidence of CAD among women but G G Hartnell reported significant male dominance despite the allowance given for lower incidence of CAD in females .

Of the traditional risk factors Diabetes mellitus has unique position with ectasia Giannoglou GD et al Williams SB et al reported negative association

between ectasia and diabetes mellitus . After a metaanalysis Huang et al concluded that DM has inverse association with CAE and act as a protective for too. In our study we found a similar relation between ectasia and DM 6 (25%) vs 48(42.9%) vs 868(47.4%) <0.05 with significantly lower incidence of DM in isolated ectasia group comparted mixed and pure CAD group. But there was no difference between mixed and pure CAD group which suggestive of significant inverse relation between DM and isolated ectasia . Other traditional risk factors like LDL HDL does not different among all the three groups . .But people with isolated ectasia had significantly lower BMI compared to others .Which we suspected probably due to less incidence of Diabetes in ectasia group .

Novel Risk markers :

Evidence for the relation between inflammation and CAE becoming strong day by day .In line with these observation our study also showed high neutrophil count and NLR in CAE group compared to pure CAD group. Mean Neutrophil in CAE vs mixed CAE +CAD vs pure CAD is 5.986±1.497 Vs 6.019±1030 Vs 4.480±1.230 (P Value <0.001) NLR is 3.98±0.89 & 3.58±0.56 vs 2.82±0.60. . Elevated markers of neutrophil mediated inflammation have already been demonstrated in by CAE Turhan H etal , and Li JJ et al86. This high inflammatory activity have been proposed as the explanation for CAE in some CAD in others . MPV platelet volume a marker of hyperactive platelet

found to be higher among CAE compared to healthy control but similar between CAE and CAD group .This was indirectly supporting the hypothesis that CAE & CAD formed from same pathogenitic mechanism .Here in our study MPV was not significantly different between groups. But we did not compare with the control Another indirect marker of inflammation is RDW which was significantly elevated among isolated CAE compared to CAD similar to report by Xiao-Lin Li et al . Hence our study also supporting the inflammatory hypothesis.

Angiographic pattern :

Markis type IV(Isolated focal ectasia) is the most common among both isolated and mixed ectasia group observed in 50 of 136 patients (36.8%) followed by Type II (combined diffuse and focal ectasia) in 44patients (32.4%) then Type III in 30patients (22%) finally least common is type I Diffuse ectasia d .In the mixed group LAD the commonest vessel involved . When combining both group isolated ectasia (n=51) and mixed CAE + CAD (n=178) totally 229 ectasia were observed among 136 patients .RCA and LAD had equal number of ectasia (n=90 , 39.3%) followed by LCX (n= 40,17.5%)and then LMCA n=9(3.9%). Among the vessels LAD has dominant focal involvement n=71

(78.9%) but all the other major vessels had dominant diffuse involvement RCA (58.9%) LCX (65%) LMCA (77.8%). .

Clinical Presentation:

Type of clinical presentation is significnly different in isolated ectasia group compared to others .In this group Unstable angina /NSTEMI most common presentation .STEMI is the least common form of presentation .Only 4 (16.7%) patients with isolated ectasia compared to other groups (42.8% ,41%) it was significantly low . Similar to our study Y Guines also reported 17% of MI among ectasia group but the clinical presentation was not stastically significant in their groups . Similar to a study from Iraq 25 % of our isolated ectasia patients had CSA .

Follow up :

Outcome of isolated ectasia in our group is entirely different from other group .In mixed and pure CAD group except for unstable angina during follow up 32 (31.2) 278(17.1) which high in CAE + CAD group , other events were similar including , mortality during hospital stay and follow up This suggests similar character of CAE associated with CAD and indicate that CAE does not increase the mortality in CAD patients but produce recurrence of symptoms despite medical therapy .But in the isolated ectasia group ,no mortality at all

during hospital stay and follow up .But recurrence of angina is high which is similar to mixed group and indicate that presence of ectasia increase the recurrence of angina .

SUMMARY and HYPOTHESIS

1. Association of CAE with obstructive CAD (82.4%) and similar risk profile even DM in both mixed CAE+ CAD and pure CAD group, supports the hypothesis that underlying pathogenesis in CAE CAD are same which is atherosclerosis.

2. Even though non-significant but presence of 30-40% narrowing even in isolated ectasia favors atheroma as the basis even for CAE .By the way this new finding questions the terminology of isolated ectasia and we support the terminology "**ectasia non-obstructive CAD**" recommended by "Boles U" for isolated ectasia

3. But why some people develop CAE others not? The answer for the question comes from the lesser incidence of DM (negative association) in isolated ectasia group and inflammatory markers essential finding in our study .

4. Absence of Diabetes with increased inflammation favors the ectasia formation . Presence DM enhances process of atherosclerosis and direct it

towards negative remodeling rather than ectasia (positive remodeling) This i negative remodeling effect of DM mediated by Advanced glycation End products which inhibit the effect of MMP and increase the stiff ness of vessel

5. Patients with isolated ectasia are more younger relative to the other 2 groups

6. Atherosclerosis is a slowly progressing disease with extremes effect on vascular tree. On one side aneurysm formation (dilatation) , other side with obstructive (narrowing)

7. By recapitulating Glagovian phenomenon and with current knowledge and evidence from our study ,we agree with E. Yetkin and J. Waltenberger and extending their concept **to formulate this hypothesis** that "ectasia may be an early stage expression of atherosclerosis when neutrophil mediated inflammatory phenomenon dominates .Obstructive disease is an expression of late stage wherein the mechanism is different and CAE + CAD is an intermediate transitory stage " and this need larger properly planned study for comprehensive evaluation(including vascular morphology assessment with HPE)

8. Another finding from our study is MPV is elevated but did not differ significantly between groups So platelet is active in all the stages which necessitates the antiplatelet therapy through entire spectrum of atherosclerosis

9. Here we are not able to explain the role of dyslipidemia
10. Clinical expression of mixed group is not much different from pure CAD. And it does not worsen the prognosis further more than CAD except for increased frequency of anginal episode .
11. But isolated ectasia group have 0% mortality with significantly better systolic function EF .But even here to the frequency angina is higher . This indicate Ectasia has the propensity to increase angina but does not affect the mortality .

CONCLUSION

Isolated ectasia is a unique phenomenon , seen in relatively younger population , having inverse association (less frequent) with Diabetes mellitus , neutrophil mediated active inflammation and this has nil effect on mortality . But Coronary artery ectasia if associated obstructive CAD has evidence of high inflammatory activity than pure CAD ,but does not worsen the prognosis of coexisting CAD except for increased frequency of unstable angina .

LIMITATIONS

1. The number of population in isolated group is very less
2. Other inflammatory markers hs CRP were not assessed
3. Healthy controls were not selected for comparison .
4. Diastolic function was not assessed

ABBREVIATIONS

ACS - Acute Coronary Syndrome

AWMI – Anterior Wall -Myocardial Infarction

CAD – Coronary Artery Disease

LV – Left Ventricle

MI - Myocardial Infarction

PCI – Percutaneous Coronary Intervention

ICAM – Inter Cellular Adhesion molecules

VCAM – Vascular Cell Adhesion Molecule

MPV –Mean Platelet Volume

RDW –Red Cell Distribution Width

NLR -Neutrophil Lymphocyte Ratio

In Master Chart

Y Yes D -- Diffuse ectasia

F –Focal Ectasia

1,2,3= Focal Ectasia

BIBILIOGRAPHY

1. Morgagni GB. De sedibus et causis morborum. Venetus Tom I, Epis 27, Art 28, 1761

2. Bourgon A in Biblioth Med 1812; 37: 183, cited in Packard M, Weehsler HF Aneurysm of the coronary arteries. Arch Int Med 1929; 43: 1-14

3. Munkner, T., Petersen, O., & Vesterdal, J. (1958). Congenital aneurysm of the coronary artery with an arteriovenous fistula. *Acta Radiol*, vol.50, No. 4, pp. 333–340

4. Bjork L Ectasia of Coronary Arteries 1966;87:33-34

5. Syed M, Lesch M. Coronary artery aneurysm: a review. Prog Cardiovasc Dis 1997; 40: 77-84.

6. Daoud AS, Pankin D, Tulgan H, Florentin RA. Aneurysm of the coronary artery. Report of ten cases and review of literature. Am J Cardiol 1963;11:228-37.

7. Markis JE, Joffe CD, Cohn PF, *et al*. Clinical significance of coronary arterial ectasia. Am J Cardiol 1976; 37:217–22. 392–395

8. CASS Principal Investigators and their Associates. Coronary Artery Surgery Study (CASS): a randomized trial of coronary artery bypass surgery, survival data. Circulation 1983; 68:939–50.

9. Oliveros RA, Falsetti HL, Carroll RJ, Heinle RA, Ryan GF. Atherosclerotic coronary artery aneurysm report of five cases and a review of the literature. Arch Intern Med 1974; 134: 1072-6.

10.*Muhammad Nawaz Lashari, Khalid Bhati, et al* Frequency of coronary artery dilatation aneurysm and ectasia – in patients undergoing coronary arteriography PJC 2013; 24: 17-22

11. Sharma SN, Kaul U, Sharma S,et al ., Coronary arteriographic profile in young and old Indian patients with ischaemic heart disease: a comparative study. Indian Heart J 1990;42:365-69

12. Cohen, P. & Ogara, P.T. (2008). Coronary artery aneurysms: a review of the natural history,pathophysiology, and management. *Cardiology in Review,* Vol. 16, No. 6, pp. 301–304,

13. Bermudez PE, Palop LR, Martinez-Luengas MI, Sanchez CR, Saez CP,et al. Coronary ectasia: Prevalence and clinical and angiographic characteristics.*Rev Esp Cardiol* 2003;56(5):473–479

14. Androulakis AE, Andrikopoulos GK, Kartalis AN, Stougiannos PN, Katsaros AA, et al.: Relation of coronary artery ectasia to diabetes mellitus. *Am J Cardiol* 2004;93(9):1165–1167

15.Virmani R, Robinowitz M, AtkinsonJB, et al (1986) Acquired coronary arterial aneurysms: an autopsy study of 52 patients.
Hum Pathol 17:575 583

16. Swanton RH, Thomas ML, Coltart DJ, et al (1978) Coronary artery ectasia:
a variant of occlusive coronary arteriosclerosis. Br Heart J 40:393–400

17.Mattern AL, Baker WP, McHale JJ, Lee DE. Congenital coronary aneurysms with angina pectoris and myocardial infarction treated with saphenous vein bypass graft. Am J Cardiol 1972;30:906 –9.

18. Rath S, Har-Zahav Y, Battler A, et al. Fate of nonobstructive aneurysmatic coronary artery disease: angiographic and clinical follow-up report. Am Heart J 1985;109:785–91.

19.Befeler B, Aranda JM, Embi A, Mullin FL, El-Sherif N, Lazzara R. Coronary artery aneurysms. Study of their etiology, clinical course and effect on left ventricular function and prognosis.

Am J Med 1977;62:597 607

20. E. Yetkin J. Waltenberger **Novel insights into an old controversy Is coronary artery ectasia a variant of coronary atherosclerosis?** Clin Res Cardiol 200796:331–339

21. Chatzizisis YS, Jonas M, Coskun AU, Beigel R, Stone BV, Maynard C, Gerrity RS, Daley W, RogersC, Edelman ER, Feldman CL, Stone PH. Prediction of the localization of high risk coronary atherosclerotic plaques on the basis of low endothelial shear stress: an intravascular ultrasound and histopathology natural history study. Circulation 2008;117:993–1002

22. KC Koskinas, , C L. Feldman, , Yiannis S et al Natural History of Experimental Coronary Atherosclerosis a Vascular Remodeling In Relation to Endothelial Shear Stress: A Serial, *In Vivo* Intravascular Ultrasound Study *Circulation*. 2010 May 18; 121(19): 2092–2101

23. Schoenhagen P, Ziada KM, Kapadia SR, et al (2000) Extent and direction of arterial remodeling in stable versusunstable coronary syndromes: an intravascular ultrasound study. Circulation101:598–603

24. Tokgozoglu L, Ergene O, Kinay O, Nazli C, Hascelik G, et al.: Plasma interleukin- 6 levels are increased in coronary artery ectasia. *Acta Cardiol* 2004;59(5):515–519

25. Lamblin N, Bauters C, Hermant X, et al (2002) Polymorphisms in the promoter regions of MMP-2, MMP-3, MMP-9 and MMP-12 genes as determinants of aneurysmal coronary artery disease J Am Coll Cardiol 40:43–48

26. Senzaki H, Masutani S, Kobayashi J,et al (2001) Circulating matrix metalloproteinasesand their inhibitors inpatients with Kawasaki disease. Circulation104:860–863

27. Sorrell VL. Origins of coronary artery ectasia. Lancet 1996;20:136–137

28. Paik DC, Ramey WG, Dillon J, TilsonMD (1997) The nitrite/elastin reaction: mplication for in vivo degenerativeeffects. Connect Tissue Res 36:241–251

29 .England JF (1981) Herbicides andcoronary artery ectasia. Med J Aust 1:140

30. Johanning JM, Franklin DP, Han DC, et al (2001) Inhibition of inducible nitric oxide synthase limits nitricoxide production and experimental aneurysm expansion. J Vasc Surg 33:579–586

31. Papadakis MC, Leontiadis E, Manginas A, et al (2004) Frequency of coronary artery ectasia in patients undergoing surgery for ascending aortic aneurysms. Am J Cardiol 94:1433–1435

32 .Stajduhar KC, Laird JR, Rogan KM and Wortham DC (1993) Coronary arterial ectasia: increased prevalence in patients with abdominal aortic aneurysm as compared to occlusive atherosclerotic peripheral vascular disease. Am Heart J 125:86–92

33 Tengiz I, Ercan E, Aliyev E, Sekuri C, Duman C, Altuglu I: Elevated levels of matrix metalloprotein-3 in patients with coronary aneurysm: A case control study. *Curr Control Trials Cardiovasc Med* 2004;5(1):doi:10.1186/1468- 6708-5-10

34 Akdemir R, Ozhan H, Gunduz H, Erbilen E, Yazici M, Duran S, Orkunoglu F, Albayrak S, Imirzalioglu N, Uyan C: HLA-DR B1 and DQ B1 polymor-phisms in patients with coronary artery ectasia. Acta Cardiol 2004;59(5):499–502

35 Giannoglou GD, Antoniadis AP, Chatzizisis YS, et al (2006) Prevalence of Ectasia in Human Coronary Arteries in Patients in Northern Greece Referred for Coronary Angiography.Am J Cardiol 98:314–318

36. Lam CSP, Ho KT. Coronary artery ectasia: A ten-year experience in a tertiary hospital in Singapore. Ann Acad Med Singapor 2004;33:419-422

37 Demopoulos V, Olympios C, FakiolasC, et al (1997) The natural history of aneurysmal coronary artery disease. Heart 78:136–141

38 Glagov S, Weisenberg E, Zarins CK, et al (1987) Compensatory enlargementof human atherosclerotic coronary arteries. N Engl J Med 316:1371–1375

39 Schoenhagen P, Vince DG, Ziada K, et al (2000) Increased presence of matrix-metalloproteinase 3 in humancoronary lesions with positive arterialremodeling (abstr). J Am Coll Cardiol35 Suppl A:58A–59A

40 Kuzuya M, Asai T, Kanda S, Maeda K, Cheng XW, Iguchi A. Glycation cross-links inhibit matrix metalloproteinase-2 activation in vascular smooth muscle cells cultured on collagen lattice. *Diabetologia* 2001;44:433–436

41 .Vavuranakis M, Stefanadis C, Toutouzas K, Pitsavos C, Spanos V, T outouzas P. Impaired compensatory coronary artery enlargement in atherosclerosis contributes to the development of coronary artery stenosis in diabetic patients. An in vivo intravascular ultrasound study. *Eur Heart J* 1997;18:1090–1094

42 Sudhir K, Ports TA, Amidon TM, Goldberger JJ, Bhushan V, Kane JP, Yock P, Malloy MJ. Increased prevalence of coronary ectasia in heterozygous familial hypercholesterolemia. Circulation1995;91:1375-1380.

43 Zeina AR, Sharif D, Blinder J, Rosenschein U, Barmeir E. Noninvasive assessment of coronary artery ectasia using multidetector computed tomography. Coron Artery Dis 2007;18:175-180.

44 Waly HM, Elayda MA, Lee VV, el-Said G, Reul GJ, Hall RJ. Coronary artery ectasia in Egyptia

45 Bizbiz L, Bonithon-Kopp C, Ducimetierè P, Berr C, Alperovitch A, Robert L. Relation of serum elastase activity ultrasonographically assessed carotid artery wall lesions a cardiovascular risk factors. The EVA study. Atherosclerosis 1996;120:47-55

46 Ali Reza Amirzadegan, Gholamreza Davoodi et al Abbas Soleimani et al **Association between Traditional Risk Factors andCoronary Artery Ectasia: A Study on 10057 Angiographic Procedures among Iranian Population** *J Teh Univ Heart Ctr 2014;9(1):27-32*

47 Turgay Işık, Erkan Ayhan, , Hüseyin Uyarel, et al .,Association of neutrophil to lymphocyte ratio with presence of isolated coronary artery ectasia *Arch Turk Soc Cardiol 2013;41(2):123-130*

48 Yilmaz Ozbay, Mehmet Akbulut,Mehmet Balin et al The Level of hs-CRP in Coronary Artery Ectasia and Its Response to Statin and Angiotensin-Convertin Enzyme Inhibitor Treatment

49 A. Finkelstein, Y. Michowitz, A. Abashidze, H. Miller, G.Keren, and J. George, "Temporal association between circulatingproteolytic, inflammatory and neurohormonal markers in patients with coronary ectasia," *Atherosclerosis*, vol. 179, no. 2, pp. 353–359, 2005.

50 Serafettin Demir, Mustafa Kemal Avsar, Zeynep Karakaya et al., **Increased mean platelet volume is associated with coronary artery ectasia** Postep Kardiol Inter 2013; 9, 3 (33): 241–245

51 Cakal B, Akoz AG, Ustundag Y, Yalinkilic M, Ulker A, Ankarali H: Red celldistribution width for assessment of activity of inflammatory boweldisease. Dig Dis Sci 2009, 54:842–847

52 Mathur A, Robinson MS, Cotton J, et al. Platelet reactivity in acute coronary syndromes: evidence for differences in platelet behaviour between unstable ang na and myocardial infarction. Thromb Haemost 2001; 85: 989–994

53 Tambe AA, Demany MA, Zimmerman, Mascarenhas E. Angina pectoris and slow flow velocity of dye in coronary arteries—a new angiographic finding. Am Heart J 1972;84:66 –71.

54 Kruger D, Stierle U, Herrmann G, Simon R, Sheikhzadeh A. Exercise-induced myocardial ischemia in isolated coronary artery ectasias and aneurysms ("dilated coronopathy"). J Am Coll Cardiol 1999; 34: 1461-7

55 Hamaoka K, Onouchi Z, Kamiya Y, Sakata K. Evaluation of coronary flow velocity dynamics and flow reserve in patients with Kawasaki disease by means of a Doppler guide wire. J Am Coll Cardiol 1998; 31: 833-40.

56 Papadakis MC, Manginas A, Cotileas P, Demopoulos V, Voudris V, et al.: Documentation of slow coronary flow by the TIMI frame count in patients with coronary ectasia. *Am J Cardiol* 2001;88(9):1030–1032

57 Mavrogeni S, Manginas A, Papadakis E, Douskou M, Cokkinos D, Katsiva V,Foussas S, Voudris V, Giakoumelos A, Seimenis J, Baras P, Cokkinos DV.Coronary flow evaluation by TIMI frame count and magnetic resonance flow velocity in patients with coronary artery ectasia. J Cardiovasc Magn Reson 2005;7:545–550

58 . Gulec S, Atmaca Y, Kilickap M, Akyurek O, Aras O, et al.: Angiographic assessment of myocardial perfusion in patients with isolated coronary artery ectasia. *Am J Cardiol* 2003;91(8):996–999

59 Akyurek O, Berkalp B, Sayin T, Kumbasar D, Kervancioglu C, Oral D. Altered coronary flow properties in diffusecoronary artery ectasia. Am Heart J 2003; 145: 66-72.

60 Williams MJA, Stewart RAH (1994) Coronary artery ectasia: local pathology or diffuse disease. Cathet Cardiovasc Diagn 33:116–119

61 .Koşar F, Acıkgoz N, Şahin I, Topal E, Aksoy Y, Cehreli S. Effect of ectasia size or the ectasia ratio on the thrombosis in myocardial infarction frame count in patients with isolated coronary artery ectasia. Heart Vessels 2005; 20: 199-202.

62 Erden I, Erden EC, Ozhan H, Karabulut A, Ordu S, Yazıcı M. Outcome of primary percutaneous intervention in patients with infarct-related coronary artery ectasia. Angiology 2010; 61: 574-9.

63 Suzuki H, Takeyama Y, Hamazaki Y, Namiki A, Koba S, Matsubara H, Hiroshige J, Murakami M, Katagiri T. Coronary spasm in patients with coronary ectasia. Cathet Cardiovasc Diagn 1994;32:1–7.

64 Chia HM, Tan KH, Jackson G: Non-atherosclerotic coronary artery aneurysms: Two case reports. *Heart* 1997;78(6):613–616

65 .Harikrishnan S, Sunder KR, Tharakan J, Titus T, Bhat A, et al.: Coronary artery ectasia: Angiographic, clinical profile and follow-up. *Indian Heart J* 2000;52(5):547–553

66 Peter Nyamu, MMed, Mullasari S Ajit, Peter K Joseph The Prevalence and Clinical Profile of Angiographic Coronary Ectasia *Asian Cardiovasc Thorac Ann 2003;11:122–6*

67 .Sanidas EA, Vavuranakis M, Papaioannou TG, et al. Study of atheromatous plaque using intravascular ultrasound. Hellenic J Cardiol. 2008; 49: 415-421.

68 .Leschka S, Stolzmann P, Scheffel H, et al. Prevalence and morphology of coronary artery ectasia with dual-source CT coronary angiography. Eur Radiol. 2008; 18: 2776-2784.

69 .Zeina A-R, Sharif D, Blinder J, Rosenschein U, Barmeir E. Noninvasive assessment of coronary artery ectasia using multidetector computed tomography. Coron Artery Dis. 2007; 18: 175-180.

70 S. I. Mavrogeni, A. Manginas, E. Papadakis, S. Foussas, M. Douskou, P. Baras, I. Seimenis and D. V. Cokkinos: Correlation between magnetic resonance angiography (MRA) and quantitative coronary angiography (QCA) in ectatic coronary vessels, J Cardiovasc Magn Reson 6, 17-23 (2004)

71 Mavrogeni SI, Manginas A, Papadakis E, et al. Coronary flow evaluation by TIMI frame count and magnetic resonance flo velocity in patients with coronary artery ectasia. J Cardiovasc Magn Reson. 2005; 7: 545-550.

72 Y. Ozbay, M. Akbulut, M. Balin, H. Kayancicek, A. Baydas and H. Korkmaz: The level of hs-CRP in coronary artery ectasia and its response to statin and angiotensin-converting enzyme inhibitor treatment, Mediators Inflamm 2007, 89649 (2007

73 .Dogan A, Ozaydin M, Gedikli O, Altinbas A, Ergene O. Effect of trimetazidine on exercise performance in patients with coronary artery ectasia. Jpn Heart J 2003;44:463-7

74 Ochiai M, Yamagushi T, Tagushi J, Ohno M, Yoshimura H, Kashida M, Kuwako K, Isshiki T, Kurokawa K. Angioplasty of stenoses Adjacent to aneurysmal coronary artery disease. Jpn Heart J 1990 31:749–757.

75 . W. Rha, S. P. Wani and D. J. Oh: Parallel stenting using two sirolimus-eluting stents in an ectatic coronary artery stenosis, Heart 93, 976 (2007)

76 \Suk-Kyu Oh, S-W Rha*, H Kook et al Two Different Successful Angioplasty Methods in Patients with Stenotic Coronary Artery EctasiaChonnam Med J 2012;48:185-189

77 Burzotta F, Trani C, Romagnoli E, Mazzari MA, Savino M, Schiavoni G, Crea F: Percutaneous treatment of a large coronary aneurysm using the selfexpandable Symbiot PTFE-covered stent. *Chest* 2004;126(2):644–6

78 .Harandi S, Johnston SB, Wood RE, Roberts WC. Operative therapy of coronary arterial aneurysm. Am J Cardiol. 1999;83: 1290-1293

79 Hartnell GG, Parnell BM, Pridie RB: Coronary artery ectasia. Its prevalence and clinical significance in 4,993 patients. *Br Heart J* 1985;54(4):392–395

80 Ceyhan K, Koc F, Ozdemir K, Celik A, Altunkaş F, Karayakalı M, et al. Coronary ectasia is associated with impaired left ventricular myocardial performance in patients without significant coronary artery stenosis. Med Princ Pract 2012; 21: 139-44.

81 Ozturk S, Ozyaşar M, Ayhan S, Ozlu F, Erdem A, Alcelik A, et al. Coronary artery ectasia is associated with atrial electrical and mechanical dysfunction: an observational study. Anadolu Kardiyol Derg 2012:12:00.00

82 .K Thygesen, Joseph S. Alpert, Allan S. Jaffe, et al Third universal definition of **Myocardial Infarction** *Circulation.* 2012;126:2020-2035

83 . Braunwald E. Unstable angina: a classification.
Circulation 1989;80:410 4 (14)

.

84 .Austen WG, Edwards JE, Frye RL, et al. A reporting system on patients evaluated for coronary artery disease. Report of the Ad Hoc Committee for Grading of Coronary Artery Disease, Council on Cardiovascular Surgery, American Heart Association. Circulation 1975;51:5–40.

85 .Ali Reza Amirzadegan,Gholamreza Davoodi,Abbas Soleimani et al **Association between Traditional Risk Factors andCoronary Artery Ectasia: A Study on 10057 AngiographicProcedures among Iranian Population** *J Teh Univ Heart Ctr 2014;9(1):27-32*

86 . Li JJ. Inflammation in coronary artery diseases. Chin Med J (Engl) 2011; 124: 3568-75.

S No	Ip No	Age	Sex	Smoker	DM	SHT	BMI	LDL (mg%)	HDL(mg%)	TGL(mg%)	Neutrophil	Lymphocyte	NLR	MPV	RDW
1	512	43	M	Y	N	Y	25.7	120	28	165	7.14	1.54	4.64	8.9	12.34
2	1340	42	M	Y	N	N	22	97	34	146	5.5	1.43	3.85	11.2	12.5
3	3345	51	M	Y	N	N	23.4	88	53	149	6.12	1.31	4.67	7.6	12.95
4	7834	46	M	N	N	N	23	94	45	138	5.23	1.7	3.08	9.4	12.87
5	9716	32	M	Y	Y	Y	31.5	126	30	145	7.34	1.61	4.56	8.6	12.98
6	12345	49	M	Y	N	N	26	100	52	140	4.43	1.16	3.82	11.8	12.14
7	16790	30	F	N	N	N	26	90	31	178	4.24	1.2	3.53	9.2	12.97
8	18904	57	M	Y	N	Y	25	87	33	136	6.56	1.94	3.38	7.4	12.72
9	23489	41	M	Y	Y	Y	25.5	130	29	223	8.11	1.67	4.86	11.9	11.65
10	37008	37	M	Y	N	N	24.8	92	45	130	7.23	1.48	4.89	7.8	10.97
11	38987	54	F	N	Y	N	24	93	33	150	4.64	1.38	3.36	9.2	12.12
12	42560	46	M	N	N	N	32	118	47	148	4.42	1.17	3.78	9.9	12.47
13	47134	42	M	N	N	N	25.6	100	32	143	6.56	1.2	5.47	10.7	12.9
14	50235	41	M	Y	N	N	25	84	42	139	5.34	1.11	4.81	9.7	11.86
15	53478	40	M	Y	Y	Y	35	148	33	256	8.74	1.64	5.33	12.6	12.89
16	52989	37	M	N	N	N	21	88	44	150	4.13	1.81	2.28	10.4	12.78
17	54760	29	F	N	N	Y	24	96	28	147	7.65	1.72	4.45	8.9	12.92
18	55890	40	M	Y	Y	N	22	93	40	133	5.12	2.1	2.44	7.6	12.82
19	57878	45	M	N	N	Y	22	99	45	143	3.96	1.45	2.73	10.7	13.91
20	62340	43	M	N	N	N	30	169	34	139	3.49	1.23	2.84	11.3	11.72
21	64768	55	M	Y	N	N	23.8	76	45	138	7.85	1.83	4.29	12.6	12.99
22	66540	65	M	Y	Y	Y	26	139	31	220	7.42	1.64	4.52	9.7	12.96
23	73467	40	M	N	N	N	24	100	30	140	6.53	1.72	3.80	10.1	12.79
24	77818	52	M	Y	N	N	26.3	100	46	146	5.92	1.43	4.14	11.4	12.94

		Angiographic pattern ECTASIA				Clinical Presentation			OUTCOME & Follow up			Mortality	
S No	Ip No	LMCA	LAD	LCX	RCA	CSA	UA	MI	EF	UA	MI	Inhosp	Follow up
1	512	D	F		F		Y		62				
2	1340		D	D	D		Y		58		Y		
3	3345		F	D	F		Y		56.8	Y			
4	7834		F		D	Y			64		Y		
5	9716		D	D	D		Y		61				
6	12345				F	Y			64				
7	16790		D	D	D		Y		60	Y			
8	18904		D		D		Y		62.5				
9	23489		F	F				Y	49				
10	37008			D	D		Y		67	Y			
11	38987			D	D	Y			60	Y			
12	42560	D	F		F		Y		64.8				
13	47134				D		Y		55				
14	50235		D	D	D		Y		58				
15	53478				D			Y	50	Y	Y		
16	52989		D	D	D		Y		57				
17	54760			D	D			Y	53	Y			
18	55890					Y			62				
19	57878		F		D		Y		64.6		Y		
20	62340		F		D		Y		59.6				
21	64768		F	F	D	Y			61	Y	Y		
22	66540				D			Y	57				
23	73467		D	D	D	Y			60	Y			
24	77818			F			Y		64	Y			

S No	Ip No	Age	Sex	Smoker	DM	SHT	BMI	LDL (mg%)	HDL(mg%)	TGL(mg%)	Neutrophil	Lymphocyte	NLR	MPV	RDW
1	105	46	F	N		Y	22.4	100	38	134	4.16	1.31	3.18	9.21	12.34
2	80346	56	M	Y	Y	Y	31	141	29	190	4.29	1.42	3.02	8.92	10.4
3	79980	42	M	Y		Y	23.8	97	25	128	5.12	1.48	3.46	9.12	11.2
4	1342	55	M	Y			24.5	87	42	149	6.12	1.65	3.71	7.21	12.9
5	79729	54	F	N	Y		21	118	31	129	5.67	1.59	3.57	10.87	11.86
6	1388	36	M	Y			26.4	99	42	136	7.91	1.7	4.65	11.92	12.87
7	1423	65	F	N	Y	Y	26	134	33	235	6.66	1.83	3.64	9.57	12.98
8	1456	71	F	N	Y		24	99	35	254	5.8	1.49	3.89	9.89	12.14
9	1812	62	M	Y		Y	22	95	45	144	7.2	2.21	3.26	9.76	10.12
10	2114	58	M	N		Y	27	111	50	139	6.92	1.7	4.07	11.2	11.72
11	2574	54	M	Y	Y		25	86	30	224	5.9	1.87	3.16	8.34	12.92
12	3261	50	M	Y			26.8	92	43	129	4.9	1.7	2.88	12.54	11.86
13	3652	52	M	Y		Y	29	116	34	137	5.8	1.74	3.33	9.87	12.79
14	5121	30	M	Y			25.6	99	45	136	4.97	1.67	2.98	8.75	11.2
15	7002	44	F	N	Y	Y	32.4	115	31	220	3.93	1.23	3.20	12.89	12.9
16	8831	54	M	N			24.9	87	37	145	5.61	1.41	3.98	7.89	11.86
17	8821	51	M	Y	Y	Y	22.8	129	42	143	5.71	1.76	3.24	9.34	12.87
18	9306	50	M	Y			29	95	29	158	3.91	1.82	2.15	10	12.94
19	9402	65	M	Y	Y	Y	35	139	47	138	4.31	1.43	3.01	9.97	12.14
20	9720	62	M	Y		Y	27	87	29	200	4.41	1.67	2.64	9.85	11.82
21	10420	47	M	Y	Y	Y	24.6	145	23	219	4.42	1.38	3.20	9.92	12.79
22	10298	38	M	Y			32.6	100	49	137	4.72	1.23	3.84	8.91	11.86
23	11341	52	M	N			27	92	44	165	5.9	1.69	3.49	10.45	12.34
24	11560	55	F	N			26	114	27	149	5.27	1.64	3.21	8.99	12.75
25	11738	57	M	Y	Y	Y	33.2	128	43	147	5.12	1.57	3.26	9.02	11.95
26	12427	63	M	Y			23	87	47	150	4.41	1.31	3.37	8.87	12.97

		Angiographic pattern ECTASIA				Clinical Presentation			OUTCOME & Follow up			Mortality	
S No	Ip No	LMCA	LAD	LCX	RCA	CSA	UA	MI	EF	UA	MI	Inhosp	Follow up
1	105				D		Y		57.5	Y			
2	80346		F	D		y			60		Y		
3	79980				D		Y		58.8				
4	1342		F		D			Y	49	Y		Y	
5	79729		F		D	y			62				
6	1388		D		D		Y		55		Y		Y
7	1423		F	D		Y			64				
8	1456				D			Y	48				
9	1812		2	2			Y		61	Y			
10	2114			Y		y			55				
11	2574		D					Y	46.8				
12	3261	Y					Y		54				
13	3652		D	D		Y			58				
14	5121		D					Y	50	Y			
15	7002		F		D	Y			56	Y			
16	8831		2	2			Y		57				
17	8821		F		D	y			60				
18	9306		D	D	D		Y		49				
19	9402		D		F	Y			60	Y			
20	9720				D		Y		56		Y		
21	10420		D	F	D	y			65	Y			
22	10298		2	2		Y			70.2				
23	11341				D			Y	52				
24	11560		1					Y	50.4				
25	11738		F		D			Y	45			Y	
26	12427	Y					Y		56	Y			

S No	Ip No	Age	Sex	Smoker	DM	SHT	BMI	LDL (mg%)	HDL(mg%)	TGL(mg%)	Neutrophil	Lymphocyte	NLR	MPV	RDW
27	12512	74	M	N			23.4	85	32	283	6.43	1.23	5.23	8.98	12.88
28	12122	54	M	Y	Y		31.3	120	34	146	6.67	1.78	3.75	9.98	12.14
29	13426	57	M	Y		Y	26	131	41	143	5.71	1.8	3.17	9.96	10.36
30	13612	52	M	N			23	77	42	144	6.12	1.67	3.66	9.75	11.72
31	13980	64	M	Y	Y	Y	32	89	31	190	5.13	1.12	4.58	9.23	11.65
32	14100	61	F	N			28	99	39	127	5.54	1.86	2.98	10.45	10.57
33	14212	39	M	Y			29	83	28	180	3.92	1.43	2.74	9.23	11.12
34	14676	56	M	N	Y	Y	25.7	126	39	132	7.76	1.92	4.04	9.96	12.49
35	13782	58	M	Y			24.9	90	34	176	5.98	1.58	3.78	9.24	11.86
36	14880	56	F	N		Y	32	87	44	137	3.71	1.41	2.63	9.87	12.5
37	15602	53	F	N	Y	Y	28.2	120	42	189	4.84	1.17	4.14	9.91	11.95
38	15304	57	M	Y	Y		24.9	96	30	320	5.62	1.21	4.64	9.72	12.87
39	15798	51	M	N	Y		26.5	85	45	228	6.72	1.47	4.57	9.67	12.98
40	15902	34	M	Y			32.1	119	36	142	6.54	1.78	3.67	9.89	12.74
41	16008	51	F	N		Y	25.8	86	34	132	7.84	1.94	4.04	10.67	11.23
42	16112	50	M	Y	Y	Y	33.2	145	38	176	5.98	1.7	3.52	8.47	11.72
43	16342	54	M	N	Y	Y	25	139	26	200	6.97	1.89	3.69	9.89	11.45
44	16443	54	M	Y			34.4	97	45	145	6.23	1.45	4.30	11.23	10.97
45	16724	68	M	Y			27	89	52	134	6.75	1.89	3.57	9..56	12.32
46	16902	63	F	N	Y		24.8	87	29	131	7.12	1.9	3.75	9.87	12.78
47	17016	65	M	Y		Y	26.7	99	27	265	5.67	1.45	3.91	8.78	11.92
48	17918	64	M	N	Y	Y	34.2	150	33	141	6.45	1.56	4.13	7.92	10.12
49	18236	52	M	Y			25.8	86	45	142	5.13	1.36	3.77	11	13.1
50	18453	58	F	N			28.4	89	49	143	6.54	1.62	4.04	9.54	11.2
51	19230	53	F	N	Y	Y	27	95	32	248	5.92	1.45	4.08	8.72	12.9
52	20431	65	M	N	Y	Y	31.8	131	36	142	5.62	1.23	4.57	7.08	11.96

				Angiographic pattern ECTASIA				Clinical Presentation			OUTCOME & Follow up			Mortality	
S No	Ip No			LMCA	LAD	LCX	RCA	CSA	UA	MI	EF	UA	MI	Inhosp	Follow up
27	12512			1				y			64				
28	12122						D			Y	46.8	Y			
29	13426				D			y			61.5				
30	13612				1					Y	40				
31	13980				F		D		Y		67				Y
32	14100				1				Y		62		Y		
33	14212				F	D				Y	41	Y			
34	14676						D		Y		60				
35	13782					D				Y	59				
36	14880			1					Y		65	Y			Y
37	15602				F		D	y			61				
38	15304				D					Y	57				
39	15798					1		y			58				
40	15902						D			Y	36				
41	16008				F	D				Y	41	Y			
42	16112				F		D	Y			56				
43	16342				D		F	y			58.2				Y
44	16443				2	2		Y			62.4				
45	16724						D			Y	36.5				
46	16902					1				Y	45.6				
47	17016				F		D	Y			65				
48	17918				F	D		y			60				
49	18236				1				Y		67	Y			
50	18453						D			Y	46				
51	19230				3	3	3			Y	41				
52	20431				F		D	Y			69	Y			

S No	Ip No	Age	Sex	Smoker	DM	SHT	BMI	LDL (mg%)	HDL(mg%)	TGL(mg%)	Neutrophil	Lymphocyte	NLR	MPV	RDW
53	20450	52	M	Y			29	94	42	141	6.71	1.56	4.30	9.71	12.79
54	22134	50	M	Y			26	92	27	175	7.34	1.83	4.01	9.42	12.14
55	22750	55	F	N			28.2	117	49	139	7.23	2.11	3.43	9.12	12.64
56	23982	60	M	N	Y	Y	30	97	34	223	6.43	1.65	3.90	8.21	12.34
57	24113	66	M	Y			26.9	87	41	133	4.23	1.49	2.84	7.27	12.5
58	24523	64	M	Y	Y		24.7	131	29	253	5.49	1.24	4.43	9.62	11.95
59	25678	55	F	N			24	99	47	146	4.89	1.56	3.13	9.57	12.87
60	26563	53	M	Y		Y	31.7	93	42	147	6.62	1.52	4.36	9.89	12.98
61	26775	60	M	Y	Y	Y	35	133	29	242	5.39	1.74	3.10	9.76	12.14
62	27891	76	M	N		Y	27	79	39	143	3.84	1.5	2.56	9.27	10
63	28113	61	M	Y			26.6	86	36	149	4.92	1.72	2.86	8.34	11.72
64	28654	54	M	N		Y	24.4	85	31	139	6.89	1.9	3.63	9.54	11.65
65	29300	62	M	Y	Y		29.6	93	37	200	6.2	1.78	3.48	8.87	10.97
66	29876	57	M	Y	Y	Y	32	97	43	134	6..76	1.82	3.71	9.85	10.97
67	30012	49	F	N	Y		27.2	112	27	197	5.08	1.48	3.43	9.94	12.12
68	30129	55	M	N		Y	27	92	41	138	5.3	1.7	3.12	8.19	11.74
69	31467	43	M	Y			26	119	44	137	5.92	1.89	3.13	6.34	12.9
31	31547	42	F	N			26.3	96	24	312	6.21	1.67	3.72	10	11.86
71	32765	54	M	Y	Y	Y	27.8	139	33	134	7.15	1.92	3.72	9.97	10.99
72	32890	48	M	N			26	93	46	142	6.63	1.86	3.56	9.85	12.68
73	33123	66	M	Y	Y		33	95	29	231	6.49	1.72	3.77	9.92	11.97
74	33567	60	F	N			28.9	97	48	144	4.92	1.8	2.73	8.91	12.78
75	34567	46	M	Y	Y	Y	27.6	127	25	195	5.76	1.9	3.03	10.95	11.92
76	35789	59	F	N			25.7	87	44	149	6.78	1.92	3.53	8.99	10.12
77	36142	57	M	Y			25	84	28	176	5.34	1.99	2.68	9.02	13.71
78	37456	45	M	Y	Y	Y	26.1	87	29	226	6.23	1.78	3.50	8.87	11.72

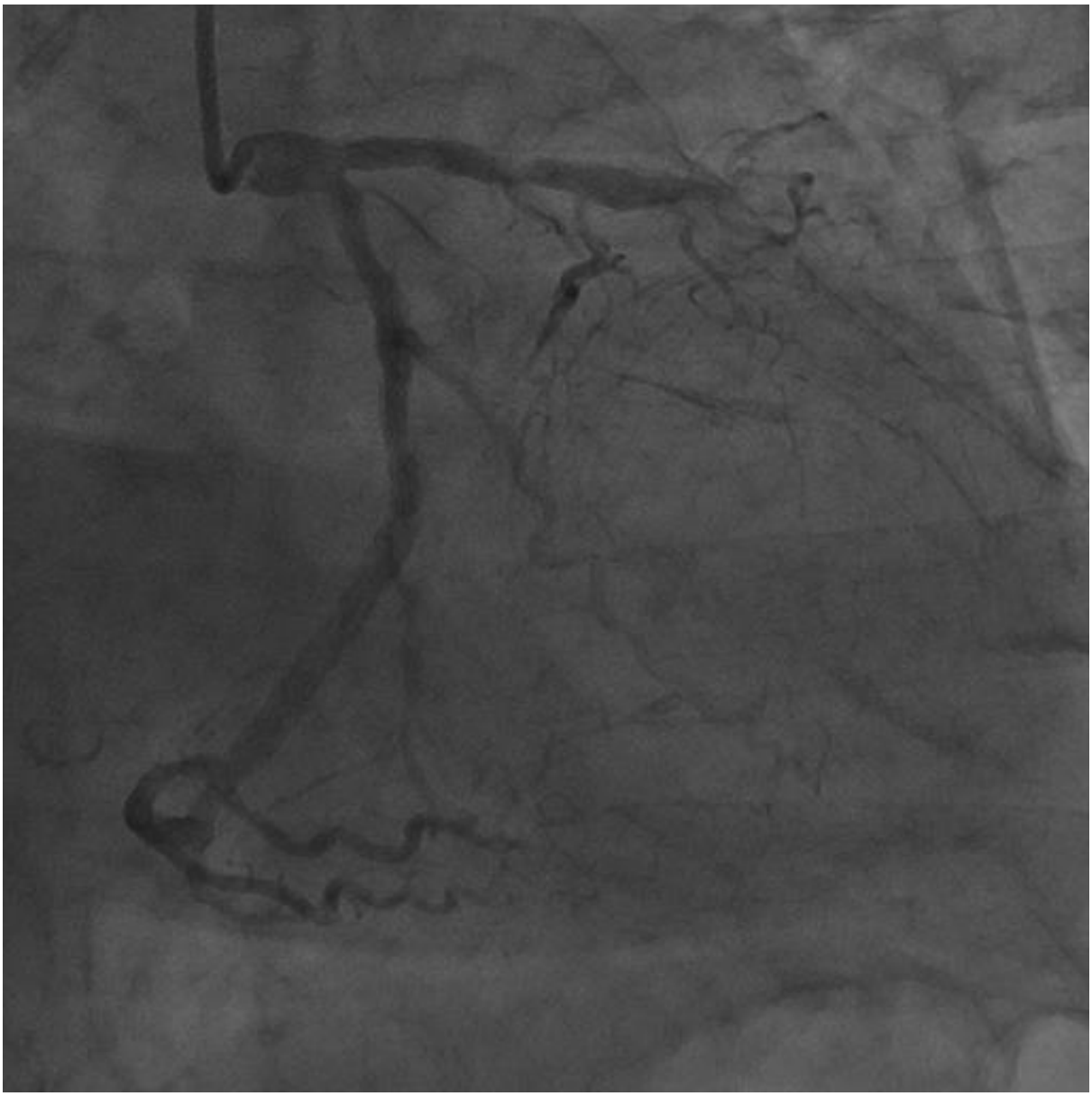
				Angiographic pattern ECTASIA				Clinical Presentation			OUTCOME & Follow up			Mortality	
S No	Ip No			LMCA	LAD	LCX	RCA	CSA	UA	MI	EF	UA	MI	Inhosp	Follow up
53	20450						1			Y	51				
54	22134				F		D			Y	48	Y			
55	22750				2		2		Y		57				
56	23982					D	F	Y			65				
57	24113				D					Y	42				
58	24523				2		2	Y			56				
59	25678				D					Y	50	Y			
60	26563					D	F	y			58				
61	26775				F		D		Y		65			Y	
62	27891				1					Y	47				
63	28113				D		D	y			64.8	Y			
64	28654				2		2			Y	43				
65	29300					1				Y	51				
66	29876				F		D	Y			60				
67	30012				F	D				Y	45.8	Y			
68	30129				2		2			Y	41				
69	31467			D	F		F			Y	46				
31	31547						1			Y	50				
71	32765				F	D		Y			67		Y		
72	32890						D			Y	34				
73	33123				1			Y			54				
74	33567						1			Y	36				
75	34567						1		Y		67			Y	
76	35789				2		2			Y	39	Y			
77	36142						F			Y	45				
78	37456				2		2	Y			56	Y			

S No	Ip No	Age	Sex	Smoker	DM	SHT	BMI	LDL (mg%)	HDL(mg%)	TGL(mg%)	Neutrophil	Lymphocyte	NLR	MPV	RDW
79	37908	30	M	N			27.6	83	41	129	6.79	1.56	4.35	8.98	12.91
80	38132	48	M	Y	Y	Y	29.6	117	43	127	7.12	1.98	3.60	9.98	11.86
81	38654	61	F	N		Y	26.2	97	27	244	6.7	1.45	4.62	9.96	12.79
82	39160	67	M	Y		Y	24.7	119	39	123	4.98	1.67	2.98	9.75	12.94
83	39735	56	M	Y			22.8	98	45	139	5.96	1.78	3.35	11.23	13.18
84	40987	51	F	N	Y	Y	31.4	148	27	219	6.54	1.87	3.50	10.45	11.29
85	42342	59	M	Y			23	129	41	143	6.1	1.52	4.01	9.23	12.89
86	42998	40	M	Y	Y		26	98	32	182	6.46	1.72	3.76	9.96	11.96
87	43506	64	M	N		Y	30.5	89	42	147	7.89	2.1	3.76	9.24	12.49
88	43978	45	M	Y			29	145	44	136	8.46	3.2	2.64	9.87	12.94
89	44320	53	M	Y	Y	Y	26.8	98	34	179	6.7	1.84	3.64	9.91	12.86
90	44765	48	F	N			27.5	86	47	135	5.43	1.93	2.81	9.72	11.95
91	45797	58	M	N	Y	Y	24.9	112	42	145	6.12	1.54	3.97	9.67	12.87
92	47657	55	F	N		Y	32.4	74	31	183	6.79	1.79	3.79	12.69	12.98
93	48797	68	M	Y		Y	27	99	41	147	7.23	1.67	4.33	10.67	12.14
94	49876	62	M	N	Y	Y	26.9	120	31	149	6.13	1.78	3.44	9.97	10.98
95	49897	53	M	Y	Y		25.7	115	27	220	6.84	1.45	4.72	9.89	11.72
96	50976	44	M	N		Y	24	89	45	146	7.12	1.96	3.63	11.23	13.91
97	51113	59	F	N			24.7	86	30	134	4.98	1.64	3.04	9.56	11.28
98	53972	52	M	Y	Y	Y	36	135	39	137	5.84	2.1	2.78	9.87	12.92
99	54675	67	M	Y	Y		27	93	29	193	5.97	1.65	3.62	8.78	11.96
100	56743	60	M	N	Y	Y	28.2	132	37	144	6.98	1.93	3.62	7.92	12.79
101	57567	50	F	N			26.4	97	37	141	6.79	1.89	3.59	11	12.94
102	58902	46	M	N		Y	25.6	92	39	149	6.54	1.76	3.72	9.54	10.92
103	59136	43	M	Y	Y		23.7	114	31	198	5.12	1.94	2.64	8.72	10.12
104	61900	47	F	N			27	97	40	142	7.34	1.89	3.88	7.08	11.14

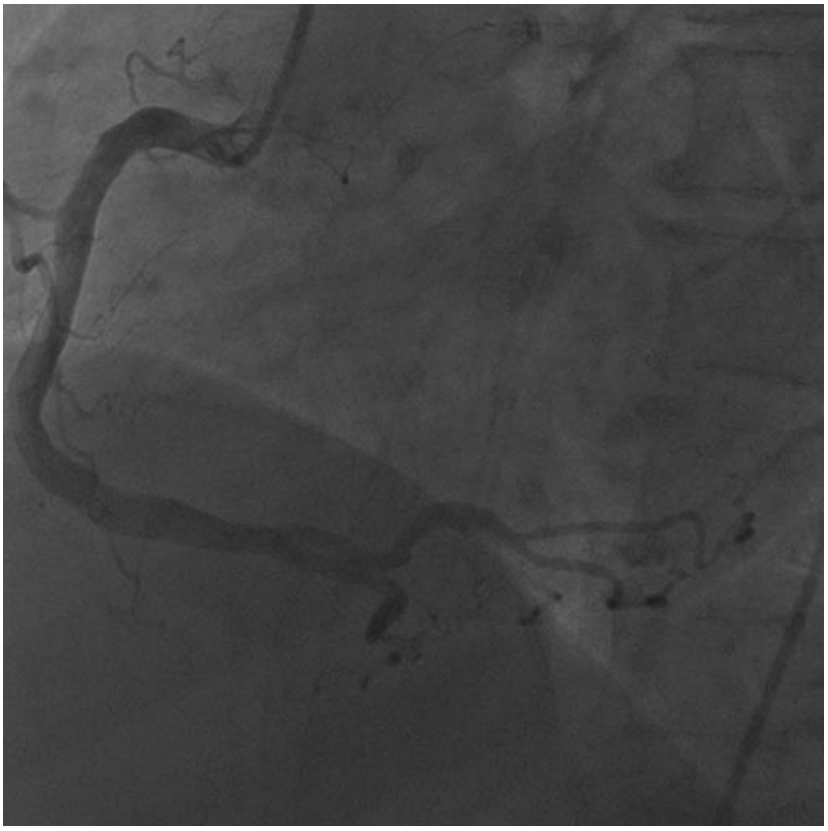
				Angiographic pattern ECTASIA				Clinical Presentation			OUTCOME & Follow up			Mortality	
S No	Ip No			LMCA	LAD	LCX	RCA	CSA	UA	MI	EF	UA	MI	Inhosp	Follow up
79	37908						1			Y	52				
80	38132				F		D	Y			65	Y			
81	38654				1					Y	39				
82	39160				2		2			Y	31				
83	39735				F		D	Y			64	Y			
84	40987					D	F	Y			65				
85	42342						1		Y		56				
86	42998				2		2			Y	24			Y	
87	43506				F		D	Y			54				
88	43978				2		2			Y	43	Y			
89	44320				F	D		Y			60	Y			
90	44765						D			Y	36				
91	45797				2		2	y			57				
92	47657				F		D			Y	47	Y			
93	48797							Y			56				
94	49876				2		2	Y			68				
95	49897			D		F	F	Y			61	Y			Y
96	50976				1					Y	45				
97	51113			D	F		F		Y		58			Y	
98	53972				F	D				Y	44				
99	54675						1	Y			56				
100	56743				1			Y			61	Y			
101	57567				1					Y	34				
102	58902				2		2			Y	49				
103	59136						D	Y			57				
104	61900				2		2			Y	42	Y			

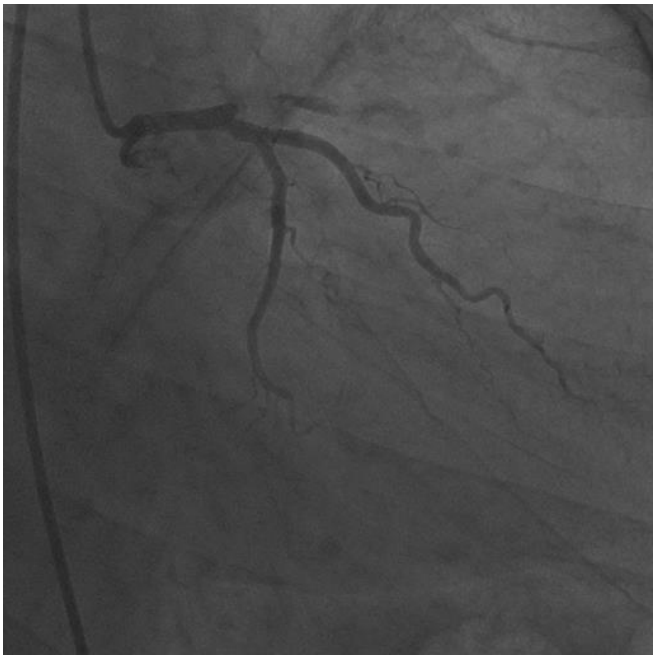
S No	Ip No	Age	Sex	Smoker	DM	SHT	BMI	LDL (mg%)	HDL(mg%)	TGL(mg%)	Neutrophil	Lymphocyte	NLR	MPV	RDW
105	62654	65	M	Y	Y	Y	29	137	33	147	7.28	1.92	3.79	9.87	10.72
106	65890	54	F	N			31.6	99	41	137	6.99	1.86	3.76	9.91	12.91
107	66726	59	M	Y	Y		22.9	160	28	213	6.89	1.94	3.55	9.82	12.86
108	68900	52	F	N	Y	Y	27.6	127	31	133	6.96	1.98	3.52	9.67	10.87
109	70987	39	M	Y			26.5	98	32	151	6.9	1.85	3.73	9.89	12.72
110	72346	46	M	Y			28.6	87	41	130	7.34	1.76	4.17	8.67	11.87
111	75002	52	F	N		Y	29	94	43	139	5.62	1.98	2.84	7.98	12.91
112	79896	50	F	N	Y		27.8	79	33	227	7.23	2.18	3.32	8.87	11.86

				Angiographic pattern ECTASIA				Clinical Presentation			OUTCOME & Follow up			Mortality	
S No	Ip No			LMCA	LAD	LCX	RCA	CSA	UA	MI	EF	UA	MI	Inhosp	Follow up
105	62654						1			Y	44			Y	
106	65890				1				Y		57				
107	66726				2	2		Y			62.5	Y			
108	68900				1					Y	46.4				
109	70987				2		2	Y			64	Y			
110	72346						D	Y			59				
111	75002				2		2			Y	43				
112	79896				F		D		Y		57	Y			Y



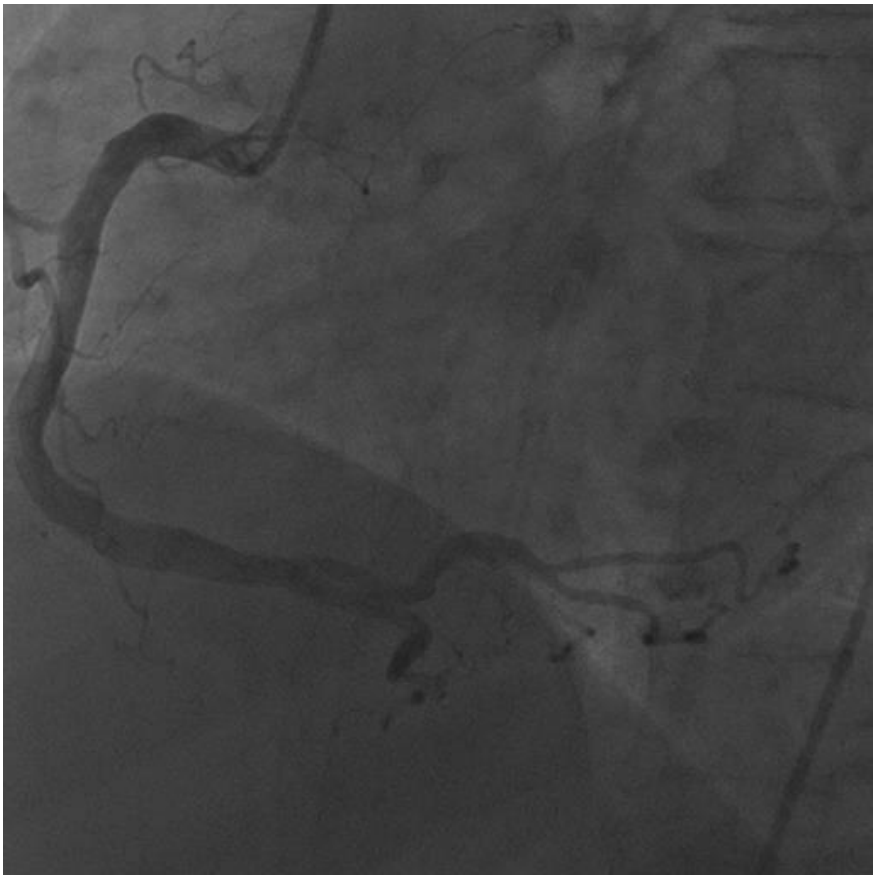
Ectasia of LMCA + LAD (Focal) + LCX arteries with obstructive CAD

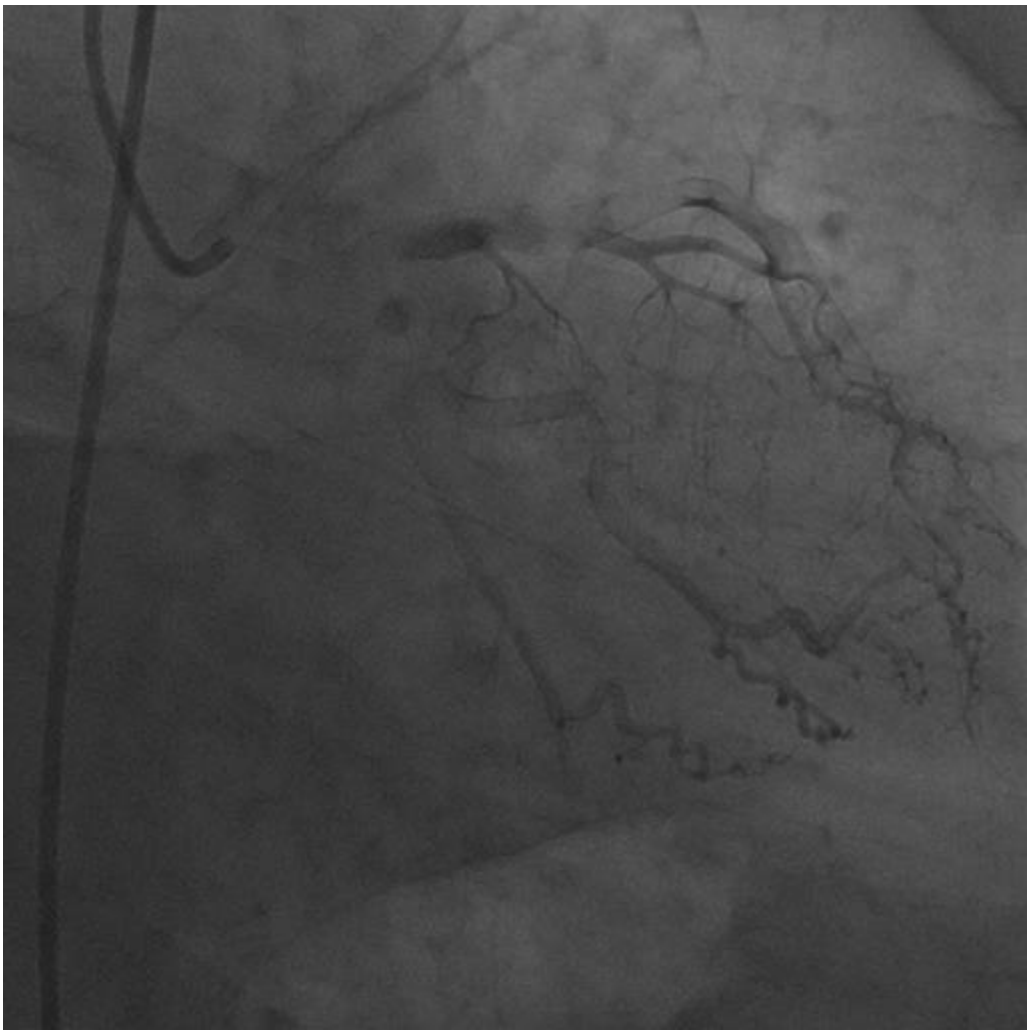




Young female presented with AWMI had

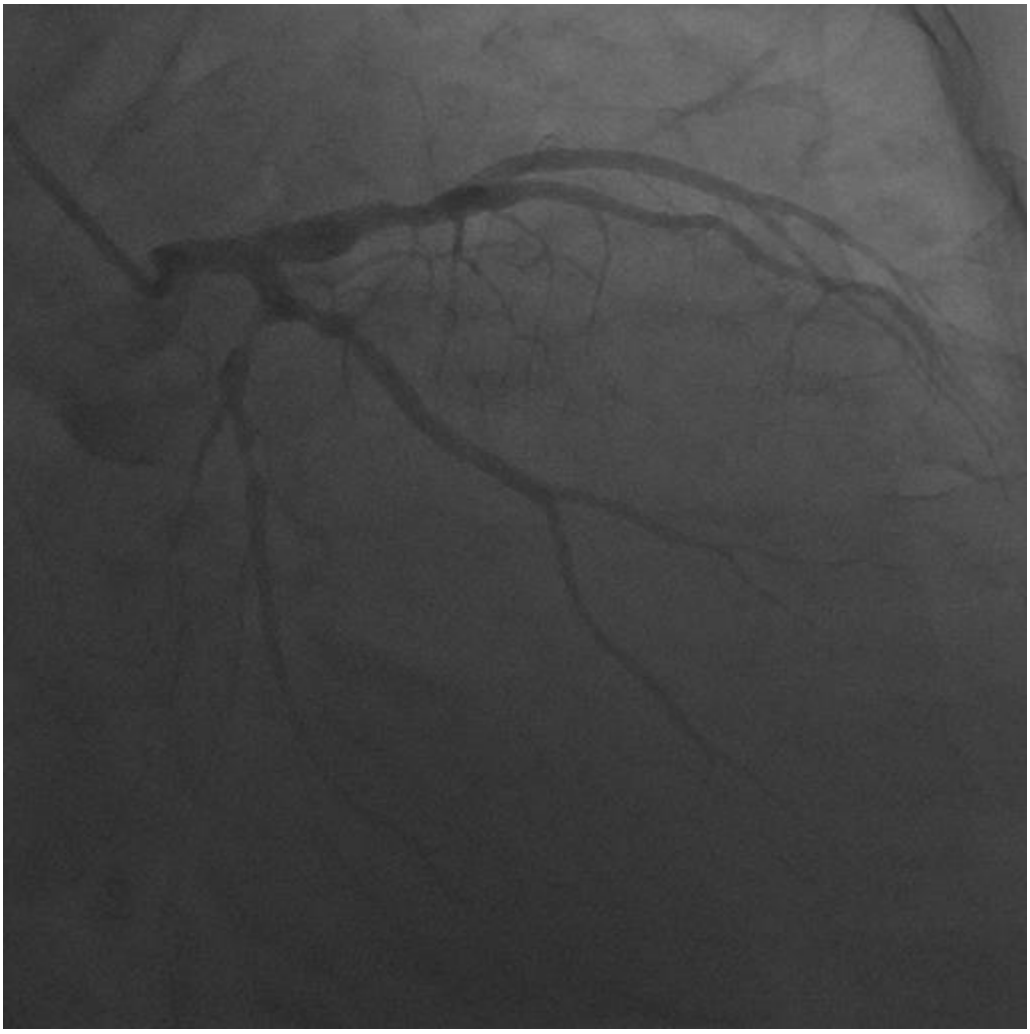
Ectasia of RCA (8mm) + total occlusion in LAD with thrombus



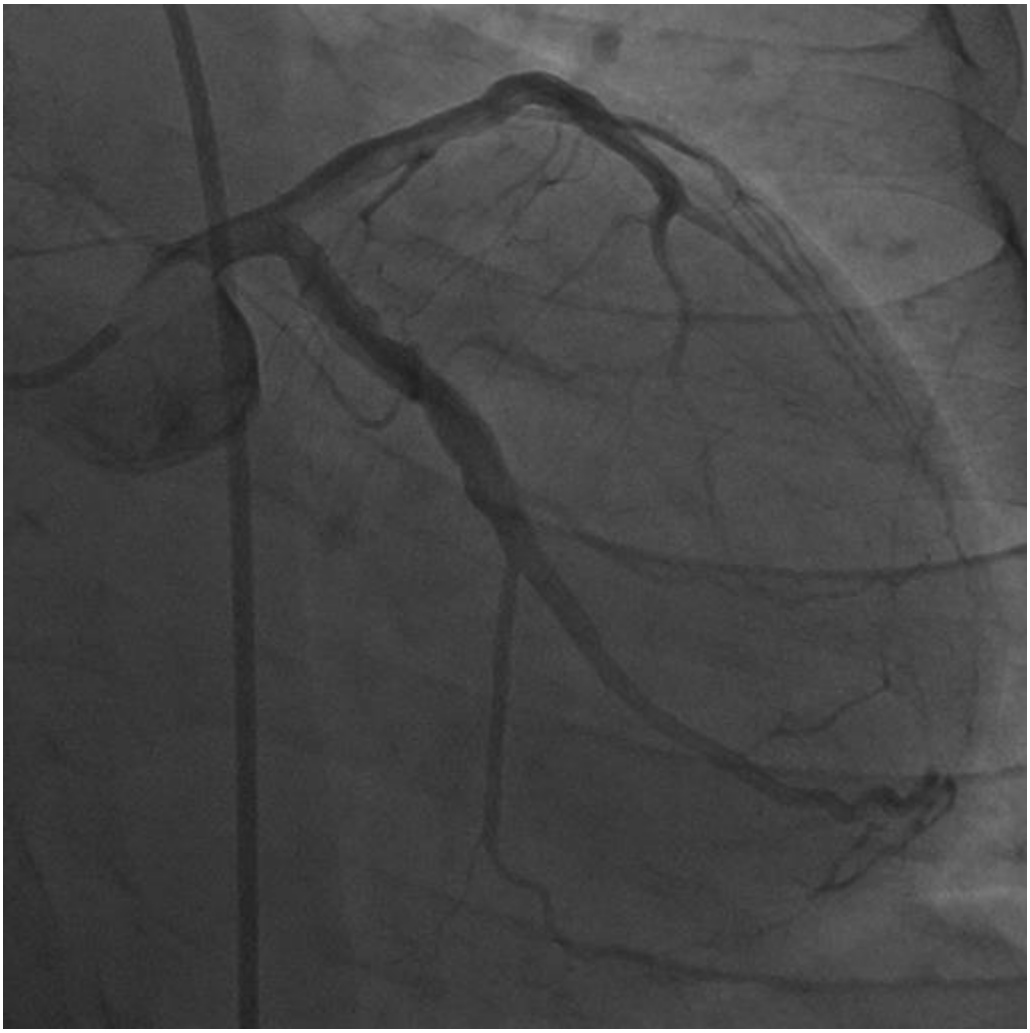


Ectasia of LAD (6.5mm)

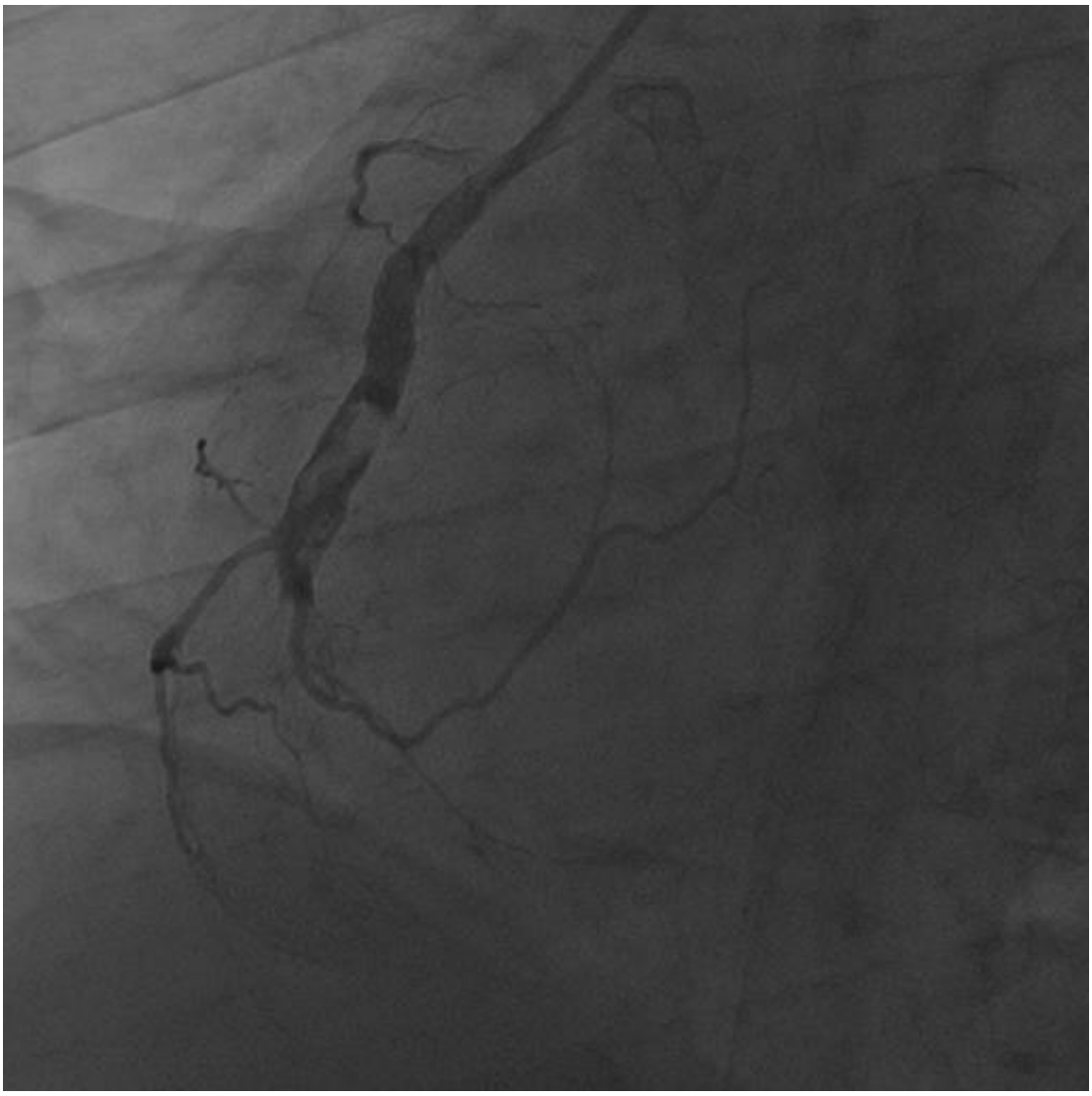
with stasis of dye



Focal Ectasia of LAD



Ectasia of LCX



A 30 years male patients presented with inferior wall MI -RCA is Ectatic (6.5 mm size) having thrombus inside.

Ref.No.12332/E1/5/2014

Madurai Medical College,
Maduai -20. Dated: 27. 01.2015

Institutional Review Board/Independent Ethics Committee
Dean, Madurai Medical College &
Government Rajaji Hospital, Madurai 625 020 .
Capt.Dr.B.Santhakumar,MD (FM).

Convenor
deanmdu@gmail.com

Sub: Establishment – Madurai Medical College, Madurai-20 –
Ethics Committee Meeting – Meeting Minutes - for December 2014 –
Approved copy – reg.

The Ethics Committee meeting of the Madurai Medical College, Madurai was held on January 05th 2015 at 10.00 Am to 12.00 Noon at Anaesthesia Seminar Hall at Govt. Rajaji Hospital, Madurai . The following members of the Ethics Committee have attended the meeting.

1.Dr.V.Nagarajan,M.D.,D.M(Neuro) Ph: 0452-2629629 Cell No.9843052029 nag9999@gmail.com.	Professor of Neurology (Retired) D.No.72, Vakkil New Street, Simmakkal, Madurai -1	Chairman
2.Dr.Mohan Prasad, MS.M.Ch. Cell.No.9843050822 (Oncology) drbkcmp@gmail.com	Professor & H.O.D of Surgical Oncology (Retired) D.No.32, West Avani Moola Street, Madurai.-1	Member Secretary
3. Dr.L.Santhanalakshmi, MD (Physiology) Cell No.9842593412 dr.l.santhanalakshmi@gmail.com.	Vice Principal, Prof. & H.O.D. Institute of Physiology Madurai Medical College	Member
4.Dr.K.Parameswari, MD(Pharmacology) Cell No.9994026056 drparameswari@yahoo.com.	Director of Pharmacology Madurai Medical College.	Member
5.Dr.S.Vadivel Murugan, MD., (Gen.Medicine) Cell No.9566543048 svadivelmurugan_2007@rediffmail.com.	Professor & H.O.D of Medicine Madurai Medical College	Member
6.Dr.A.Sankaramahalingam, MS., (Gen. Surgery) Cell.No.9443367312 chandrahospitalmdu@gmail.com	Professor & H.O.D. Surgery Madurai Medical College.	Member
7.Mrs.Mercy Immaculate Rubalatha, M.A., Med., Cell.No.9367792650 lathadevadoss86@gmail.com	50/5, Corporation Officer's Quarters, Gandhi Museum Road, Thamukam, Madurai-20.	Member
8.Thiru.Pala.Ramasamy, B.A.,B.L., Cell.No.9842165127 palaramasamy2011@gmail.com	Advocate, D.No.72,Palam Station Road, Sellur, Madurai-20.	Member
9.Thiru.P.K.M.Chelliah, B.A., Cell No.9894349599 pkmandco@gmail.com	Businessman, 21 Jawahar Street, Gandhi Nagar, Madurai-20.	Member

The following Project was approved by the Ethical Committee

Name of P.G.	Course	Name of the Project	Remarks
Dr.M.Selvaganesh selvapacemaker@yahoo.com	PG in DM (Cardiology) Madurai Medical College and Govt. Rajaji Hospital, Madurai	Analysis of Clinical profile, Angiographic pattern of coronary ectasia in coronary artery disease patients	Approved

Please note that the investigator should adhere the following: She/He should get a detailed informed consent from the patients/participants and maintain it Confidentially.

1. She/He should carry out the work without detrimental to regular activities as well as without extra expenditure to the institution or to Government.
2. She/He should inform the institution Ethical Committee, in case of any change of study procedure, site and investigation or guide.
3. She/He should not deviate the area of the work for which applied for Ethical clearance. She/He should inform the IEC immediately, in case of any adverse events or Serious adverse reactions.
4. She/He should abide to the rules and regulations of the institution.
5. She/He should complete the work within the specific period and if any Extension of time is required He/She should apply for permission again and do the work.
6. She/He should submit the summary of the work to the Ethical Committee on Completion of the work.
7. She/He should not claim any funds from the institution while doing the work or on completion.
8. She/He should understand that the members of IEC have the right to monitor the work with prior intimation.

Member Secretary
Ethical Committee

Chairman
Ethical Committee

27.1.15

DEAN/Convenor
Madurai Medical College & Govt. Rajaji Hospital, Madurai.

27.1.15

To
The above Applicant
-thro. Head of the Department concerned

Analysis of Clinical profile, angiographic pattern of Coronary Ectasia in Coronary Artery Disease patients

Dissertation submitted in partial fulfillment of the regulation for the final examination of

DOCTOR OF MEDICINE

BRANCH II - CARDIOLOGY

AUGUST 2015

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