ACUTE MYOCARDIAL INFARCTION IN YOUNG POPULATION

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RISK FACTORS FOR ACUTE MI IN YOUNG POPULATION

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DEPT. OF PATHOLOGY

Diabetes

Hypertension

Family History

Hyperlipidemia

Obesity

Foods habits

Smoking

Alcohol

Sedentary lifestyle

No exercise or activity

Stress

Steroids

Growth Hormones

Post COVID 19 infection

Post COVID 19 Vaccination

Narcotic Drugs

Congenital Abnormality of the Coronary Artery

Coronary Artery embedded in a tunnel in the Myocardium

Hypercoagulable state

Anti-Phospholipid Syndrome

Autoimmune Diseases Like SLE ,Polyarthritis Nodosa

MYOCARDIAL INFARCTION IN YOUNG

DR.SIVASHANKAR K
JR PATHOLOGY

Introduction

- coronary artery disease (CAD) primarily occurs in patients over the age of 40, younger people can be affected.
- Most studies have used an age cut-off of less than 45 years to define "young" patients with CAD or acute myocardial infarction (MI)

DEFINITION OF "YOUNG", PREMATURE CAD/MI

- Definition of premature CAD varies in literature from <35 to <55 years old
- Spectrum of terminology of young CAD:

No.	Terminology	Age group studied	Ref.
1	Young CAD	Less than 45 yr	Ericsson *et al*[2]
2	Young CAD	Less than 40 yr	Konishi *et al*[3]
3	Young CAD	15-39 yr	Gupta *et al*[4]
4	Very young CAD	⩽ 35 yr	Christus *et al*[5]
5	Premature CAD	Men ⩽ 45 yr Female ⩽ 55 yr	van Loon *et al*[6]
6	Premature CAD	Less than 60 yr	Genest *et al*[7]
7	Premature CAD	Less than 45 yr	Pineda *et al*[8]
8	Precocious CAD	2 case reports of familial CAD of 29 and 31 yr	Norum *et al*[9]
9	Early onset CAD	Less than 45 yr	Iribarren *et al*[10]

CAUSES OF MI IN YOUNG

ATHEROMATOUS CORONARY ARTERY DISEASE

- MI RELATED TO SUBSTANCE USE
- NON ATHEROMATOUS CAD
- HYPERCOAGULABLE STATES

ATHEROMATOUS

- SMOKING
- POSITIVE FAMILY HISTORY
- DIABETES, HYPERTENSION, OBESITY
- LIPID ABNORMALITIES- HYPERTRIGLYCERIDAEMIA AND LOW HDL
- HYPERHOMOCYSTINEMIA AND LIPOPROTEIN (a)

NON ATHEROMATOUS CAD

- CONGENITAL CORONARY ARTERY ANOMALIES

  MYOCARDIAL BRIDGING
- CORONARY ARTERY DISSECTION
- SEPTIC VEGETATION FROM INFECTED AORTIC VALVE

HYPERCOAGULABLE STATES

- ANTIPHOSPHOLIPID SYNDROME
- NEPHROTIC SYNDROME
- FACTOR V LEIDEN MUTATION

MI RELATED TO DRUG USE

- COCAINE
- BINGE DRINKING OF ALCOHOL
- AMPHETAMINE
- MARIHUANA

CLINICAL PRESENTATION

- THE CLASSIC PRESENTATION OF WORSENING ANGINA CULMINATING IN MI IS RARE IN YOUNG PATIENTS

  FIRST ONSET ANGINA

  RAPIDLY EVOLVED MI

Case 1

- 22 Year old male, a gymnasium instructor and trainer presented with acute severe chest pain.
- He collapsed and died within 30 minutes
- A postmortem was performed.

Pathological findings

- **Cardiovascular System**
- Revealed moderate Cardiomegaly with Left Ventricular Hypertrophy
- Areas of Congestion on anterior and posterior walls of the left ventricle externally
- Anterior descending branch of the Left Coronary Artery(LCA) showed complete occlusion by a fresh thrombosis and an atheromatous plaque.
- Other branches of both coronaries showed atheromatous changes.
- **Respiratory System** Revealed moderate Congestion and edema of both lungs.
- **Central Nervous System** Revealed mild Congestion and edema
- **Liver** was enlarged with moderate Congestion

Other organs revealed Congestion

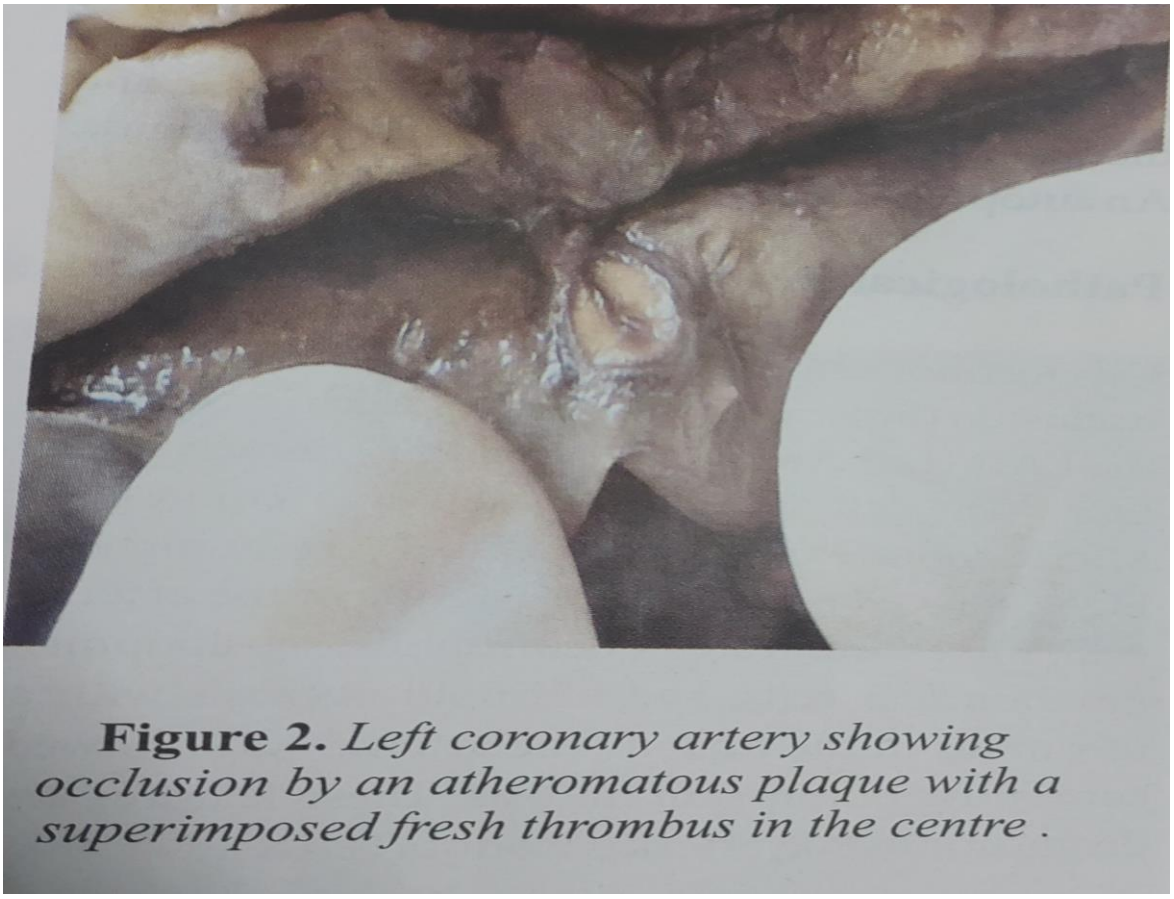
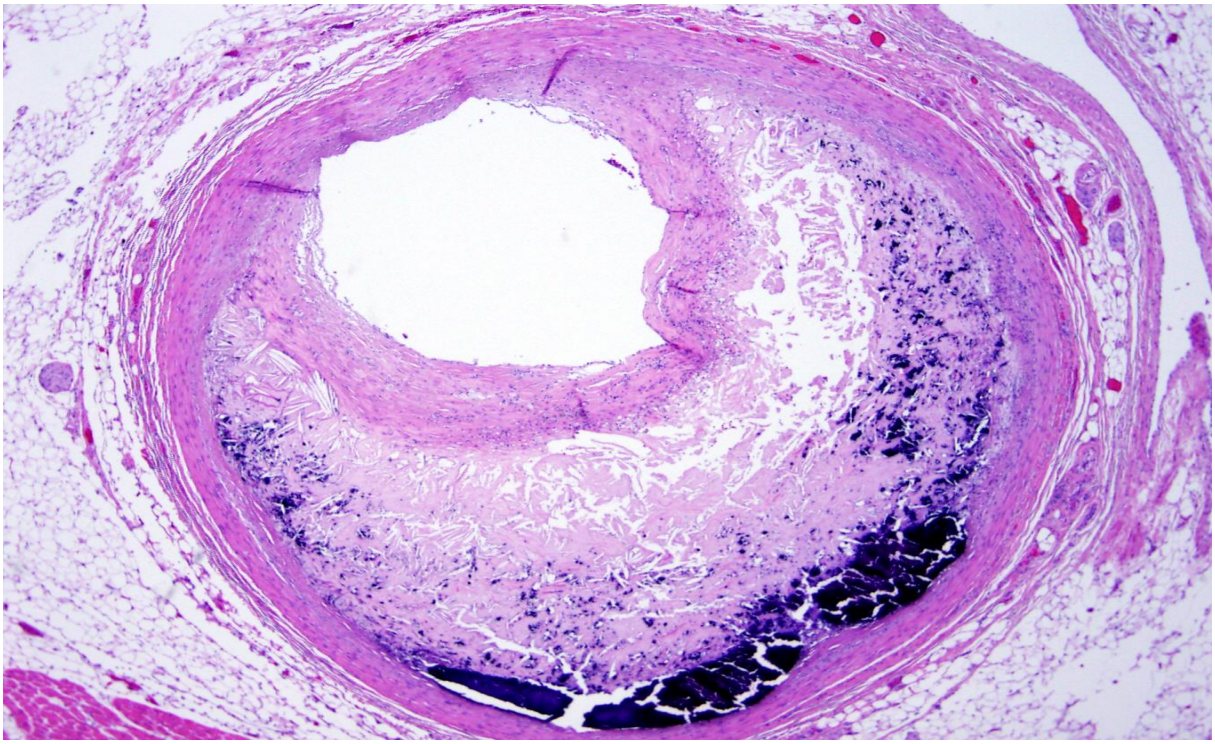
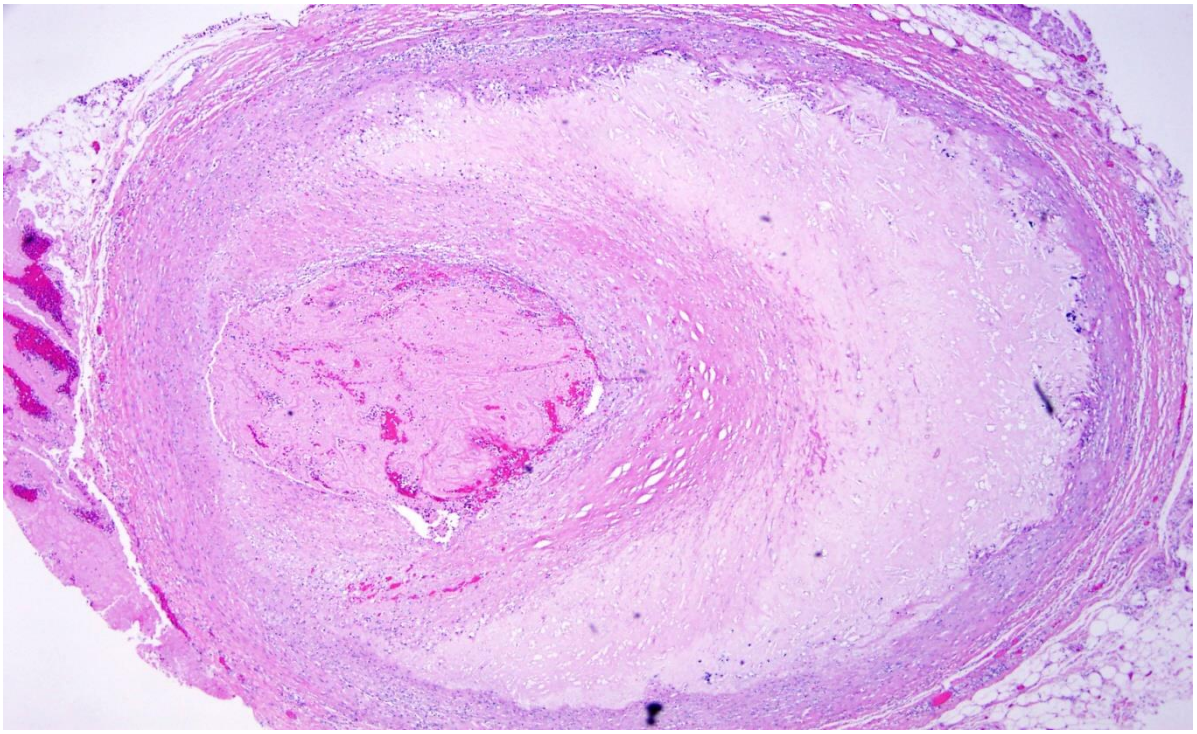


Figure 2. *Left coronary artery showing occlusion by an atheromatous plaque with a superimposed fresh thrombus in the centre .*

Microscopic Examination revealed a fresh thrombosis superimposed on an atheromatous plaque. Heart showed Congestion





DIAGNOSIS

- The cause of death was sudden cardiac death as a result of total occlusion of the anterior descending branch of the Left Coronary Artery by a fresh thrombus superimposed on a pre-existing atheromatous plaque.

Discussion

- Young Men frequenting gymnasiums who are bodybuilders or professional athletes are known to use **steroid** and **growth hormones**
- **Steroids** enhances appetite
- **Steroid** use has been shown to increase atherosclerosis as well as increase in the risk of thrombus formation.

Steroids also cause left Ventricular Dysfunction

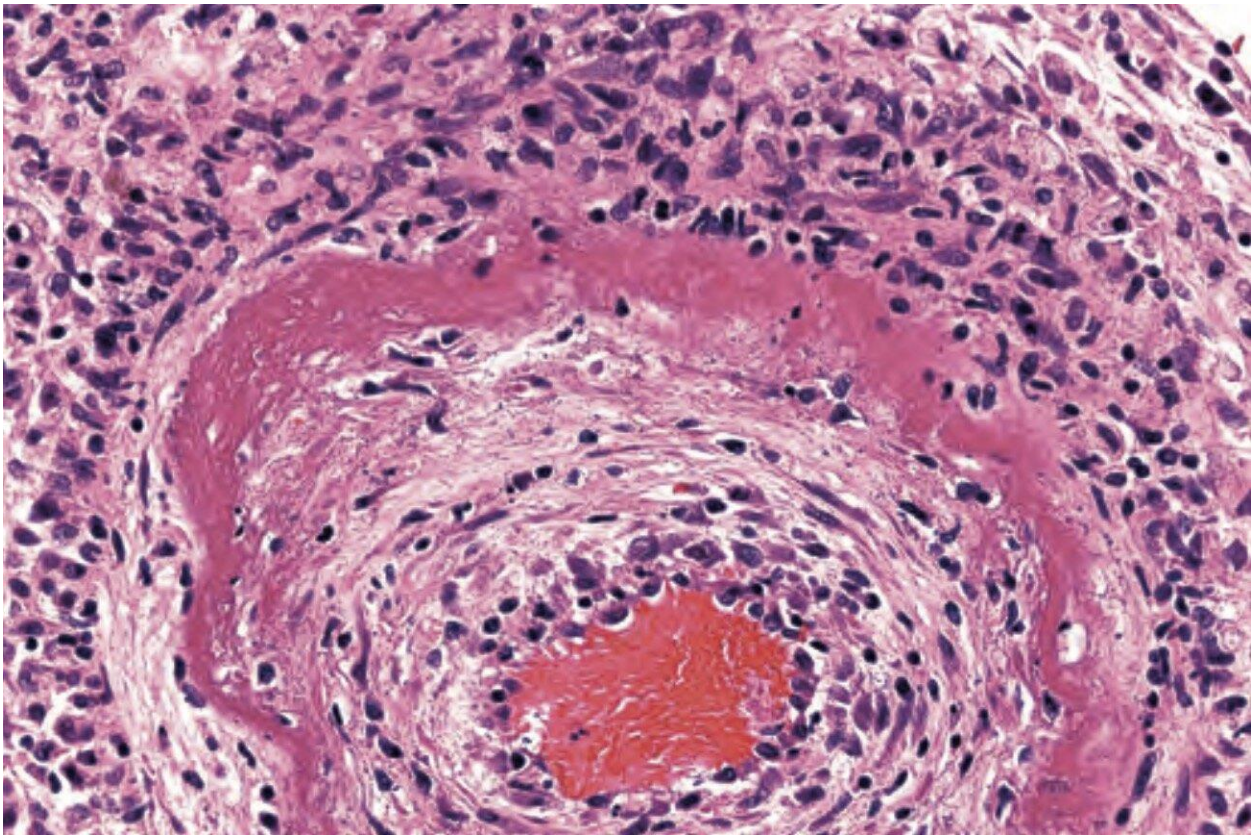
Case *2*

- 18 year old male college student collapsed and died while playing football on the college ground.
- An autopsy was performed.

Pathological findings

- On postmortem examination there was complete occlusion(Brownish White and Reddish in color) of the **Left Anterior Descending** branch of the **Left Coronary Artery.**
- Left Ventricular Wall was congested.
- **Microscopy:** The Left Anterior Descending Branch of the Left Coronary Artery showed a transmural arteritis of the arterial wall, mixed infiltrate of neutrophils, eosinophils, mononuclear cells and fibrinoid necrosis with a thrombus in the lumen.
- **Arterial Wall** showed concentric onion skin fibrosis

These features are diagnostic of **Polyarteritis Nodosa(PAN)**



DISCUSSION

- **Polyarteritis Nodosa** is a systemic vasculitis affecting medium sized vessels.
- **Cardiac** involvement usually is a Coronary arteritis that causes Stenosis, Aneurysms, Dissection, Aneurysmal rupture, Thrombosis and possible Myocardial Infarction.
- In some patients Myocarditis resulting from arteritis as well as valvular involvement may occur.

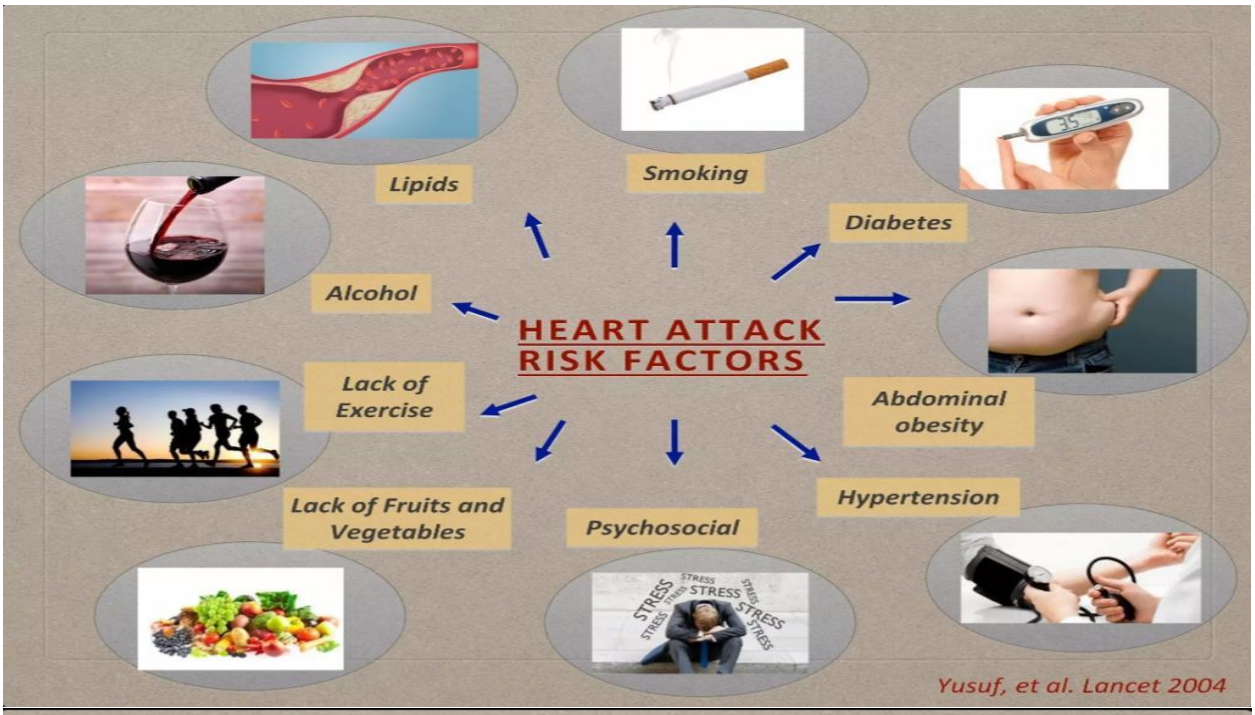
PATHOPHYSIOLOGY OF "YOUNG CAD"

- 80% accounted by Conventional coronary atherosclerotic disease
- 4% due to congenital coronary anatomy
- 5% due to embolic phenomenon
- 5% associated with coagulopathy
- 6% due to spasm, inflammatory disease, radiation, trauma, substance abuse

RISK FACTORS

- The global INTERHEART study identified 9 risk factors that account for >90% of MI
- Traditional CV risk factors apply to all ages
- Majority of "young" patients have at least one identifying CV risk factor
- Higher prevalence of smoking, family history, male gender, hyperlipidaemia
- Lower rates of prior CHD history, DM, Hypt

Yusuf, et al. Lancet 2004



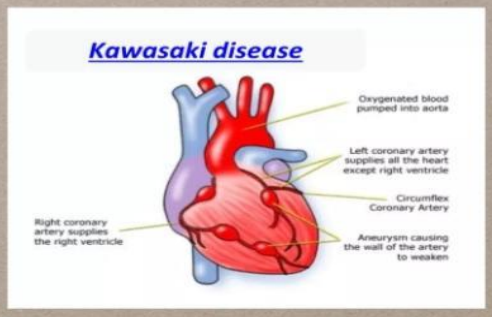
OTHER TRADITIONAL RISKS

- **Diabetes mellitus** } Lower rates than older
- **Hypertension** } patients with MI
- **Diabetes mellitus**: Increased risk for MI (odds ratio 8)
- **Hypertension**: Higher rate of untreated patients
- **Higher BMI / Central obesity**

➢ As prevalence of obesity increasing – potential future epidemic!

OTHER RARE CAUSES

- Cocaine use
- Spontaneous coronary artery dissection (more common in women, peripartum, idiopathic, atherosclerotic)
- Kawasaki disease
- Factor V Leiden
- Low levels of oestrogen
- Oral contraceptive pill
- Hyperhomocysteinaemia



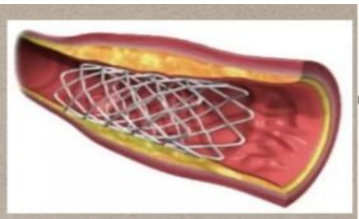
RARE RISK FACTORS – GENETIC POLYMORPHISMS

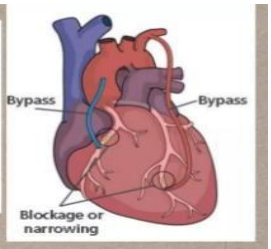
- **Cholesterol ester transfer protein (CETP) gene** – significant association with progression of atherosclerosis
- **ApoE4 allele** – homozygous individuals at risk of hyperlipoproteinaemia
- **MTHFR gene** – homocysteinaemia
- **Hepatic lipase** – HDL metabolism
- **Familial hypercholesterolaemia** – mutations in LDL receptor ApoB, PCSK9, ApoE gene

CLINICAL PRESENTATION OF "YOUNG MI"

- **Presentation**: Two-thirds NSTEMI, One-third STEMI
- **Prodrome**: Most have no previous angina, MI or CHF
- Only ~25% men had chest pain in prior 1 mth. Rate even lower among women. Compared to 2/3 in older adults
- **Extent of disease**: Usually less extensive, usually single vessel disease. Less than 10% Triple vessel disease
- **Spontaneous coronary dissection** – rare disease – but not as infrequent in young women.

MANAGEMENT





- **Guidelines-recommended therapies** apply
  -- Not age-dependent
- Risk factor modification is of utmost importance
- Smoking cessation – 1/3 relative risk reduction for mortality as well as for recurrent events
- Young patients generally do well with revascularization (Coronary stenting, bypass surgery as appropriate)

ACUTE MI IN YOUNG POPULATION

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Goa Medical College

Case Presentation

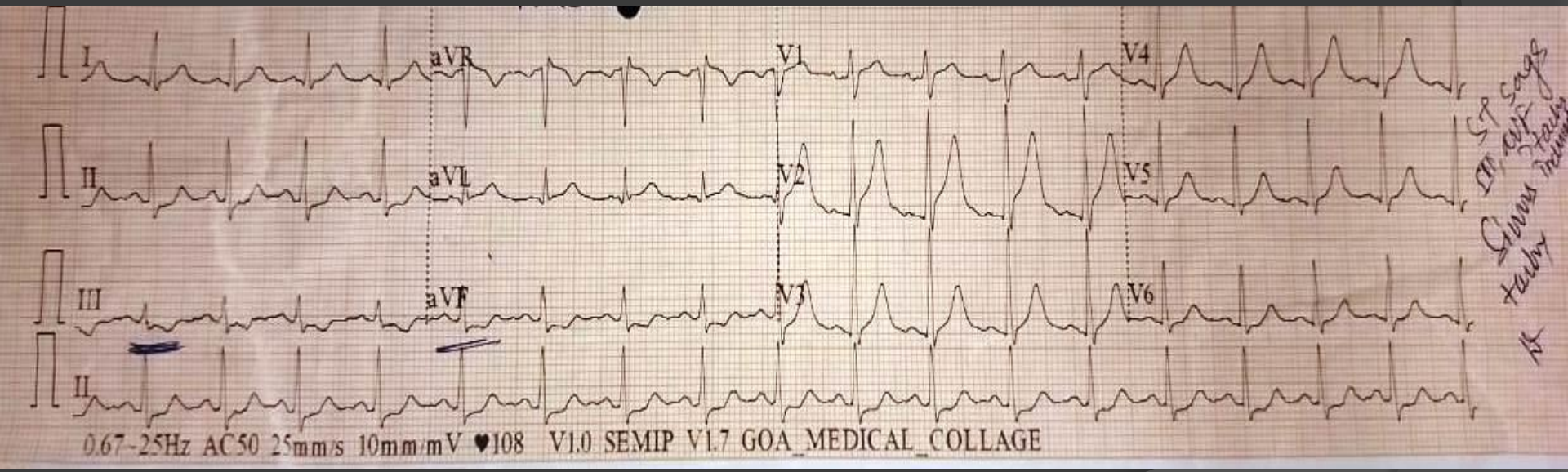
- 38 year old
- Male
- Doctor
- Goan
- Married

Clinical Presentation

- Sudden onset of chest discomfort and pain
- On anterior chest wall (described as heaviness), radiating to both upper limbs
- Difficulty in breathing
- No h/o diabetes or hypertension
- No addicitions
- Obesity ++

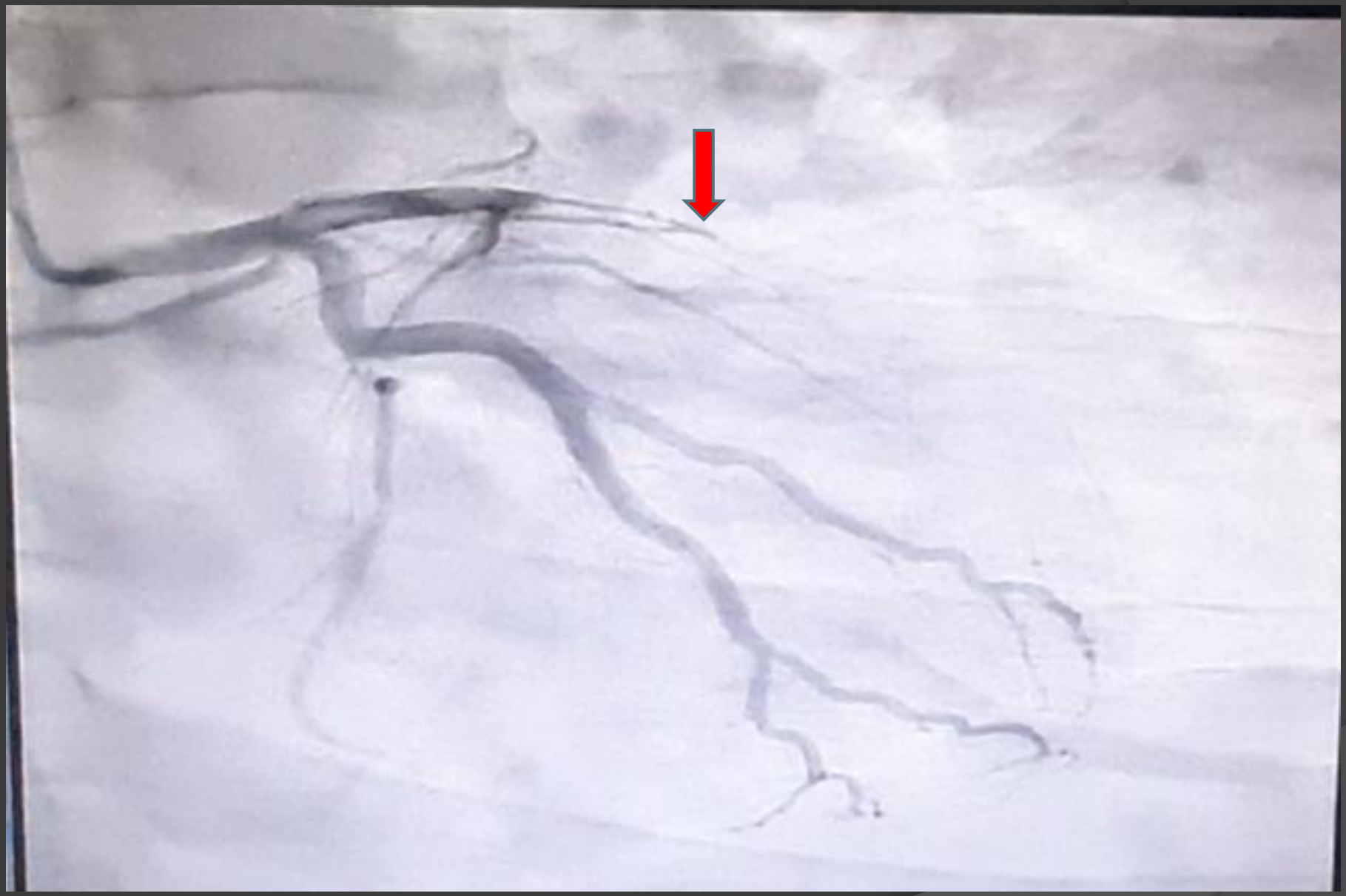
ECG changes

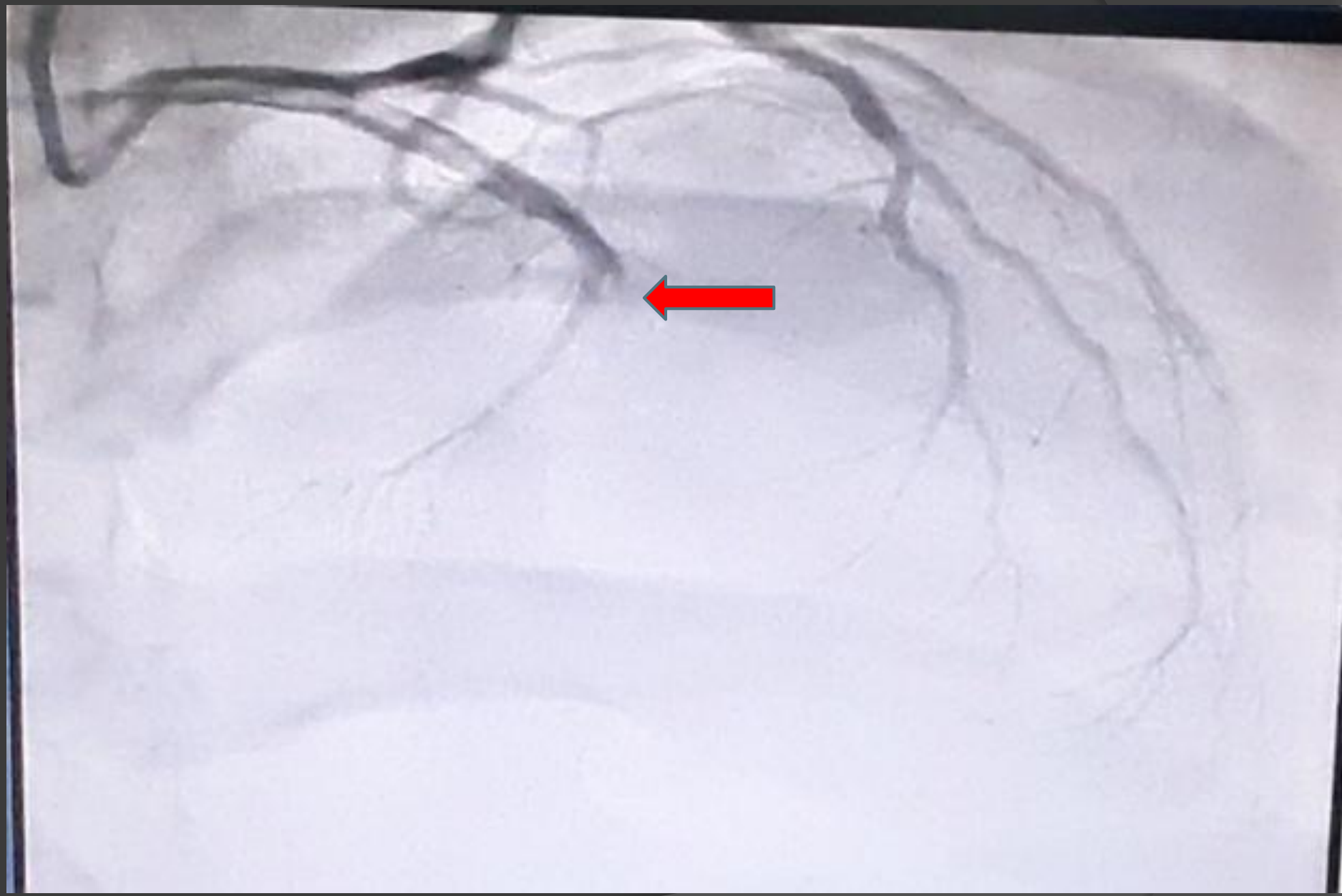
- ECG showed Sinus tachycardia with ST sags in leads II, III and aVF

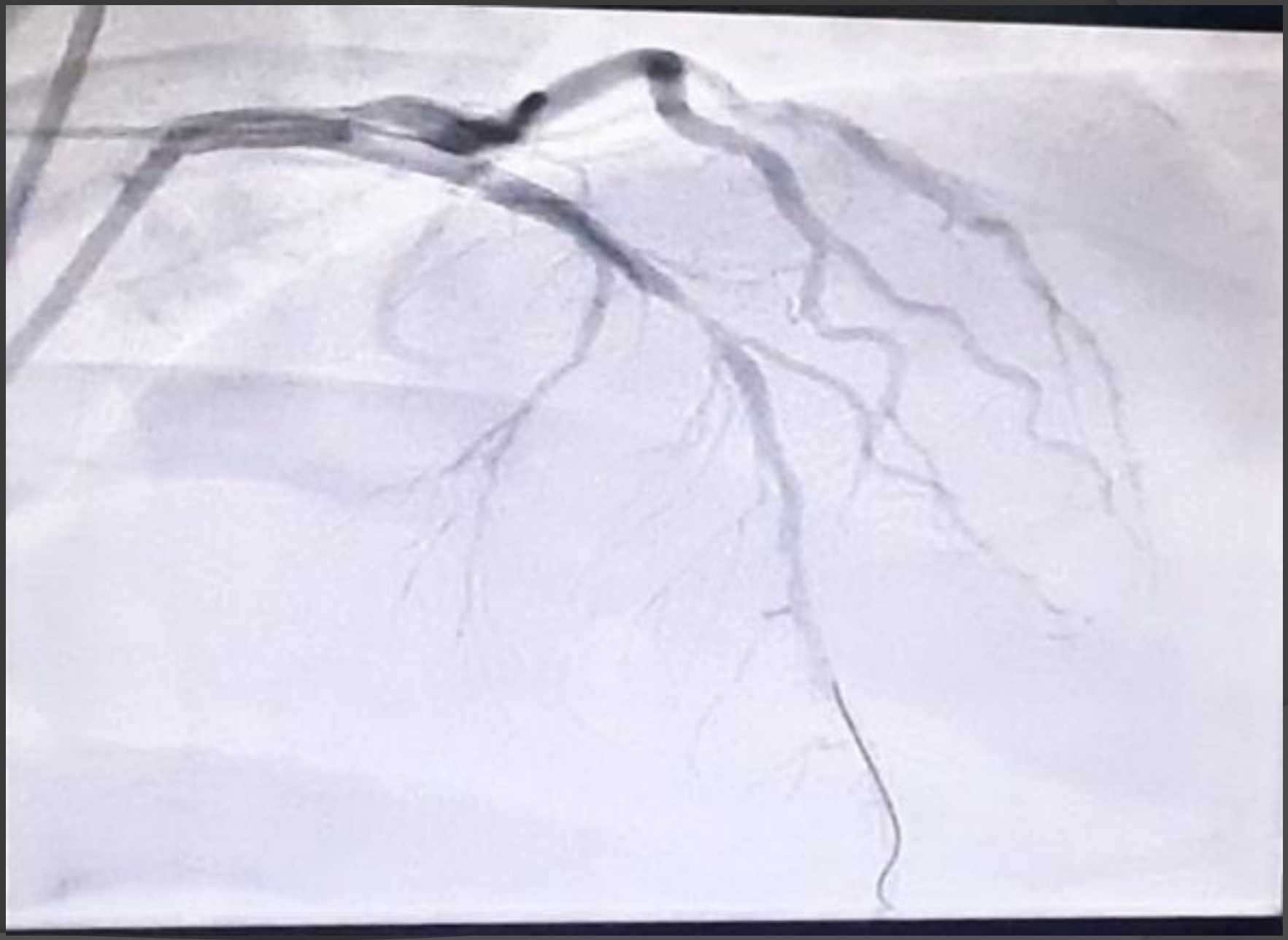


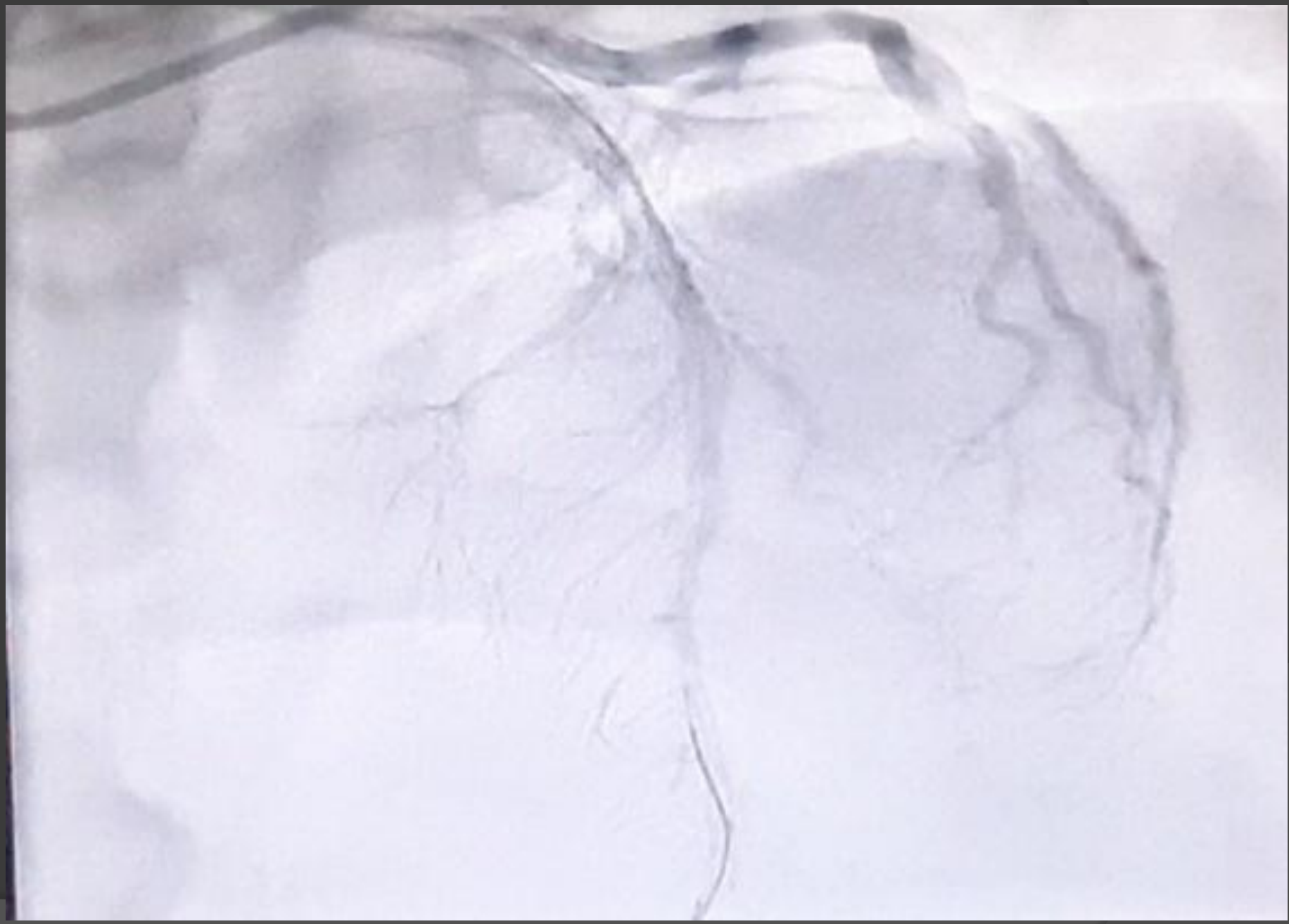
Clinical course

- Was admitted for observation.
- Had sudden onset of VT and V fibrillation, DC shock given and
- immediately shifted to Cathlab









Myocardial Infarction

- Irreversible necrosis of the heart muscle secondary to prolonged ischemia.
- Detection of rise in cardiac biomarkers

- with at least one:

1) Symptom of ischemia
2) ECG changes
3) Pathologic Q waves in ECG
4) Evidence of loss of viable myocardium or wall motion abnormalities.

Epidemiology

- MI under the age of 40 years accounts for around 3-10% of cases of CAD.

- Incidence of MI is approximately 8 times lower in patients 18 – 45 years than in older patients.

Clinical Presentation

- Angina progressing rapidly to fully evolved MI
- Symptoms present less than 1 week duration.
- Rarely presents with classic presentation of worsening angina culminating in MI

Causes of MI in young

Medscape® www.medscape.com

Normal coronary arteries	Abnormal coronary arteries
Coronary artery spasm	Accelerated atherosclerosis
Cocaine and amphetamine abuse	Smoking
Alcohol (39)	Diabetes
Hypercoagulable states	Familial hypercholesterolaemia
Antiphospholipid syndrome	Combined hyperlipidaemia
Nephrotic syndrome	Type II remnant dyslipidaemia
Embolic phenomena	Anomalous coronary arteries
Endocarditis	Myocardial bridging
Paradoxical embolism (40)	Spontaneous coronary artery dissection
	Peripartum
	Immunosuppression
	Hypertension (22)
	Coronary artery aneurysms
	Kawasaki's disease

Causes of MI in the Young

- Substance Abuse (cocaine/amphetamine)
- Atheromatous Coronary Artery Disease
- Coronary Artery Dissection/Aneurysm (Kawasaki's, Takayasus)
- Hypercoagulable State:

a) Anti-phospholipid Antibody Syndrome (primary/secondary)
b) Factor V Leiden

Athermatous CAD

- 80% of acute MI in the young
- The athermatous process starts early
- CAD was found in 20% of men and 8% of women between the ages of 30 – 34 years of age

**RomJ Intern Med* January 2006 Ginghin et al

Non-Atheromatous CAD

- Aortic Dissection
- Aneurysms, ectasia and anamolous origin of coronary arteries
- Coronary artery aneurysms (congenital or acquired secndary to Kawasaki's disease in childhood)

MI with Normal Coronary Arteries

- Coronary Artery Spasm
- Myocardial bridges
- Hypercoagulable States
- Embolic Phenomenon

*Characteristics and Prognosis of Myocardial Infarction in Patients With Normal Coronary Arteries *CHEST* Volume 117, Issue 2, February 2000, Pages 333-338

MI with Normal Coronary Arteries

- 1-2% occurrence based on CAG
- Typical patient is young, without any previous history of chest pain.
- Mean age at largest series of MI in patients with normal coronary arteries patients was 43 years and 43% were women.
- Significantly less frequent angina prior to MI
- CV-risk profile is lower than patients with CAD

* Characteristics and Prognosis of Myocardial Infarction in Patients With Normal Coronary Arteries *CHEST* *Volume 117, Issue 2*, February 2000, Pages 333-338

Principles of Management of Acute MI

- Reperfusion (minimize total ischemic time)
- Restore of balance O2 supply and demand
- Pain relief
- Prevention of Complications

Medical Management

- Analgesia
- Aspirin
- Beta Blockers
- ACE inhibitors/ARB
- Thienopyridines

Reperfusion

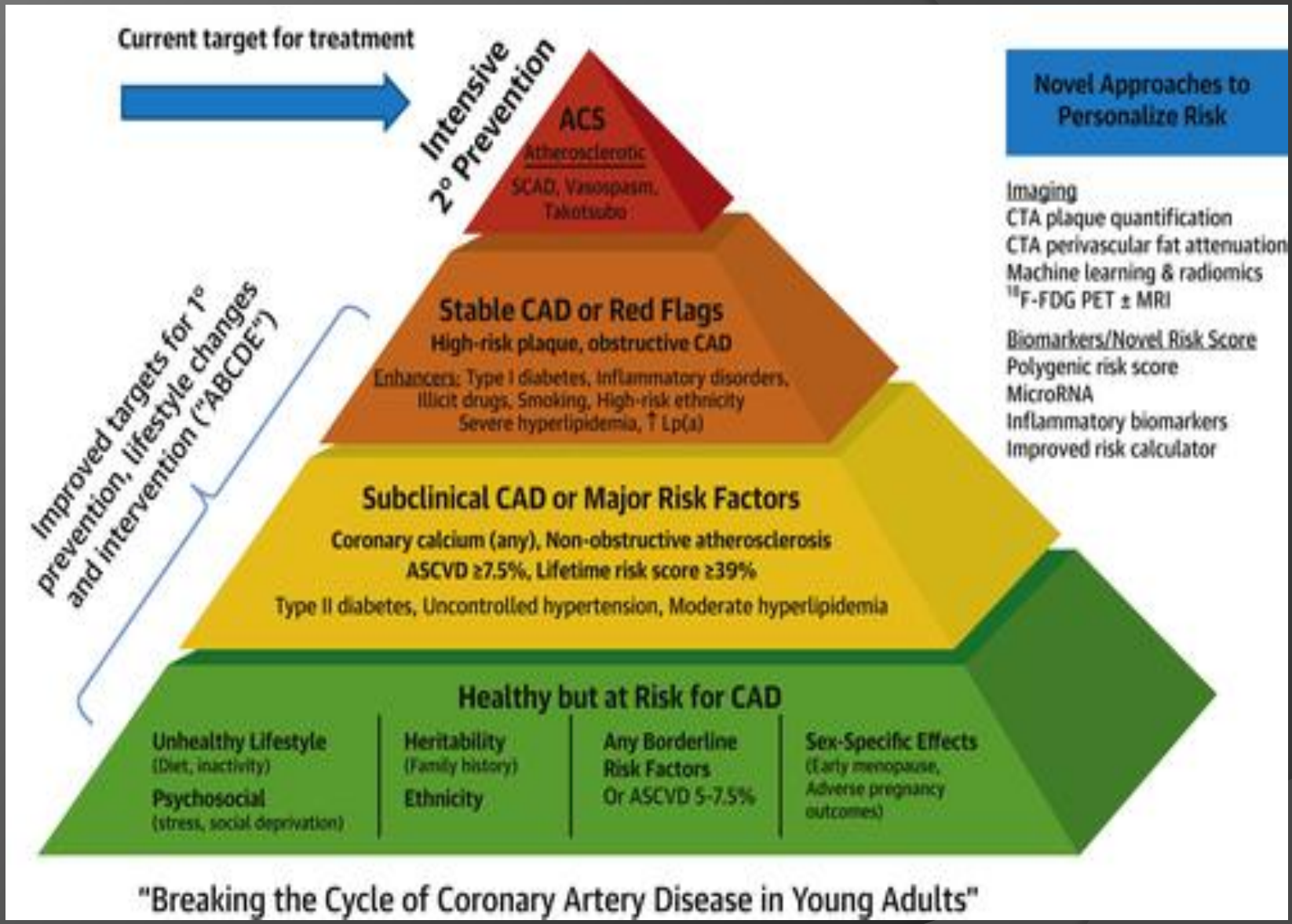
Primary Invasive Strategy	***Fibrinolytic Therapy***
Goal Door to Balloon time 90 mins May give > 12 hrs Patients with cardiogenic shock Primary PTCA Facilitated PTCA Rescue PTCA	Door to needle time 30 mins May give within 12 hrs of onset of symptoms Contraindications: Hemorrhage Intracranial mass/stroke AVM Active bleeding

2007 Focussed Update of the ACC/AHA

Secondary Prevention

Control of Modifiable Risk factors:

- Smoking cessation
- Weight loss
- Exercise
- Lipid and Sugar Management
- Anti-coagulation for hypercoagulable states



Erin D. Michos et al. *J Am Coll Cardiol* 2019; 74:1879-1882.

JACC JOURNAL OF THE AMERICAN COLLEGE OF CARDIOLOGY

Goan Scenario

Original Article

A descriptive study of socioclinical characteristics of young patients presenting for coronary angiography at Goa Medical College

ABSTRACT

Background: The magnitude of risk factor clustering for coronary artery disease (CAD), as well as the CAD, is increasing in developing countries, especially in the young.

Objectives: The objective of this study was to study the sociodemographic, clinical, and angiographic profile of young patients (<45 years of age) presenting for coronary angiography at the Department of Cardiology, Goa Medical College, Bambolim.

Materials and Methods: Ninety-four patients aged <45 years were interviewed using a semi-structured questionnaire between August 2018 and February 2019. The data were presented as proportions and means, and an appropriate test of statistical significance was applied toward drawing statistically sound conclusions.

Results: There was a striking male preponderance with males contributing 97.9% of the patients. The proportion of patients with normal coronaries and single-, double-, and triple-vessel disease was, respectively, 21.3%, 56.8%, 18.9%, and 24.3%. Diabetes mellitus and use of tobacco were associated with CAD in a statistically significant manner ($P < 0.05$). Only around one-third of diabetics in the study group were subjected to fasting or random blood sugar estimation, and HbA1c was estimated in only 17%.

Conclusion: Public awareness of the early-onset CAD and its risk factors, proper laboratory workup of patients to identify clustering of risk factors, and further research to dwell in to the sex bias among the reported patients is required.

Keywords: Coronary angiography, coronary artery disease, young myocardial infarction

Desai M, Viegas M, Borker S, Kamat US, Cacodcar JA, Pinto SB. A descriptive study of socioclinical characteristics of young patients presenting for coronary angiography at Goa Medical College. Heart India 2021;9:40-5.

Study Methods

- Aug 2018 to Feb 2019
- Of the total 978 patients, 94 (9.8%) were < 45 yrs old
- Male preponderance (92 were male and 2 females)
- CAD detected in 766, 74 of which were < 45 years (9.6%)

Desai M, Viegas M, Borker S, Kamat US, Cacodcar JA, Pinto SB. A descriptive study of socioclinical characteristics of young patients presenting for coronary angiography at Goa Medical College. Heart India 2021;9:40-5.

Findings

- Only around one-third of diabetics in the study group were subjected to fasting or random blood sugar estimation, and HbA1c was estimated in only 17%.

- Diabetes mellitus and use of tobacco were associated with CAD in a statistically significant manner ($P<0.05$).

Angiographic patterns

Out of 74 patients with some coronary occlusion on CAG:

- 21.3% had normal coronaries
- 42 (56.8%) had a SVD,
- 14 (18.9%) had a DVD, and
- 18 (24.3%) had a TVD.

Desai M, Viegas M, Borker S, Kamat US, Cacodcar JA, Pinto SB. A descriptive study of socioclinical characteristics of young patients presenting for coronary angiography at Goa Medical College. Heart India 2021;9:40-5.

Discussion

- CAD in South East Asians presents a decade earlier then the rest of the world.

- Suresh G, Subramanyam K, Kudva S, Saya RP. Coronary artery disease in young adults: Angiographic study – A single centre experience. Heart India 2016;4:132-5.
- Sharma M, Ganguly NK. Premature coronary artery disease in Indians and its associated risk factors. Vasc Health Risk Manag 2005;1:217-25.
- Ardeshna DR, Bob-Manuel T, Nanda A, Sharma A, Skelton WP, Skelton M, *et al. Asian-Indians: A review of coronary artery disease in* this understudied cohort in the United States. Ann Transl Med 2018;6:12.

younger age at presentation of Asian-Indians

- Attributed to the typical Asian-Indian phenotype characterized by

1. typical abdominal fat distribution
2. Typical biochemical abnormalities:

- insulin resistance,
- high triglycerides,
- high LDL, and
- low HDL.

*Patel SA, Shivashankar R, Ali MK, Anjana RM, Deepa M, Kapoor D, et al. Is the “South Asian Phenotype” Unique to South Asians?: Comparing cardiometabolic risk factors in the CARRS and NHANES studies. Glob Heart 2016;11:89-96.

*Enas EA, Mohan V, Deepa M, Farooq S, Pazhoor S, Chennikkara H. The metabolic syndrome and dyslipidemia among Asian Indians: A population with high rates of diabetes and premature coronary artery disease. J Cardiometab Syndr 2007;2:267-75.

*Unnikrishnan R, Anjana RM, Mohan V. Diabetes in South Asians: Is the phenotype different? Diabetes 2014;63:53-5.

- Normal coronaries (clinically insignificant coronary occlusion) and SVD are known to be more common in young CAD patients compared to the older ones.

*Zimmerman FH, Cameron A, Fisher LD, Ng G. Myocardial infarction in young adults: Angiographic characterization, risk factors and prognosis (Coronary Artery Surgery Study Registry). J Am Coll Cardiol 1995;26:654-61.

- This may result from Coronaries occlusion by a blood clot originating elsewhere, disorders of blood coagulation or coronary vasospasm induced by drugs like amphetamine and cocaine.

*Aggarwal A, Srivastava S, Velmurugan M. Newer perspectives of coronary artery disease in young. World J Cardiol 2016;8:728-34.

Diabetes Mellitus

- Independent risk factor for CAD.
- A prothrombotic, procoagulant state resulting from excessive expression of glycoprotein II (b)/III (a), increased plasminogen activator inhibitor I, and reduced levels of protein c and antithrombin III account for this positive association between DM and CAD.

*Leon BM, Maddox TM. Diabetes and cardiovascular disease: Epidemiology, biological mechanisms, treatment recommendations and future research. World J Diabetes 2015;6:1246-58.

*Morgan KP, Kapur A, Beatt KJ. Anatomy of coronary disease in diabetic patients: An explanation for poorer outcomes after percutaneous coronary intervention and potential target for intervention. Heart 2004;90:732-8.

- Regular physical activity is known to delay atherosclerosis and has a positive impact on the prevention of CAD.
- a word of caution in young patients with:

1) Hypertrophic cardiomyopathy,
2) coronary artery anomalies,
3) aortic stenosis, aortic dissection,
4) arrhythmogenic left ventricle etc.

*Thompson PD, Franklin BA, Balady GJ, Blair SN, Corrado D, Mark Estes NA, *et al. Exercise and acute cardiovascular events placing* the risks into perspective – A scientific statement from the American Heart Association, Council on Nutrition, physical activity, and metabolism and the council on clinical cardiology in collaboration with the American College of Sports Medicine. Circulation 2007;115:2358-68

Prognosis in the young

- Short term & medium term follow up: better outcomes (better baseline characteristics)
- Long term: may have higher morbidity & mortality
- Modifiable risk factors have greater influence on prognosis.
- Increased prevelance of smoking, hypertension & obesity in the young.

**Acute myocardial Infarction in young adults from American Heart Journal Elvis Brscic, MD, et al*

STEMI Program in GOA

Dept. of Cardiology, GMC

- PHC's in Goa
- Software Company Tricock
- Uploading of ECG's and reporting by the team
- Diagnosis
- Thrombolysis (reteplase/tenecteplase)
- TRANSFER to higher centre (GMC, Victor, Manipal or Healthway hospitals


Thank you for your
kind attention