



# CORONARY ARTERY DISEASE SURGICAL ASPECTS

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12-2021

# INTRODUCTION

HISTORY OF CARDIAC SURGERY

CORONARY ARTERY ANATOMY

ATHEROSCLEROSIS CAD

DIAGNOSIS

MANAGEMENT

SURGICAL INDICATIONS /TECHNIQUES

# Adult Cardiac Surgery: Ischemic Heart Disease

## •Alexis Carrel-

*“In certain cases of angina pectoris, when the mouth of the coronary is calcified, it would be useful to establish a complementary circulation for the lower part of the arteries. I attempted to perform an...anastomosis between the descending aorta and the left coronary. It was, for many reasons, a difficult operation.”*

American Surgical Association, 1910

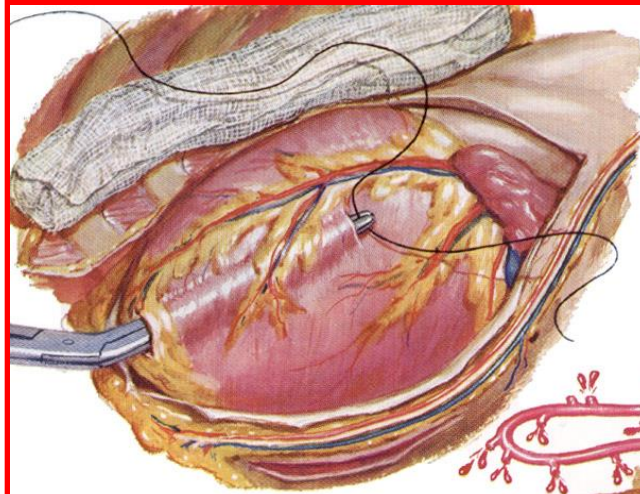
# Adult Cardiac Surgery: Ischemic Heart Disease (History)

## □ **Claude Beck**

- **1930's**- sought to increase myocardial blood flow indirectly with pericardial fat and omentum.

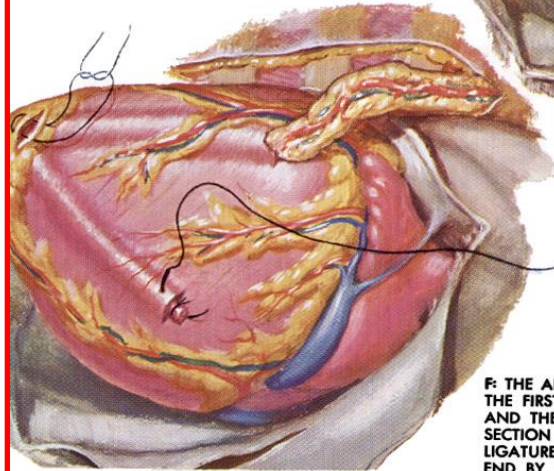
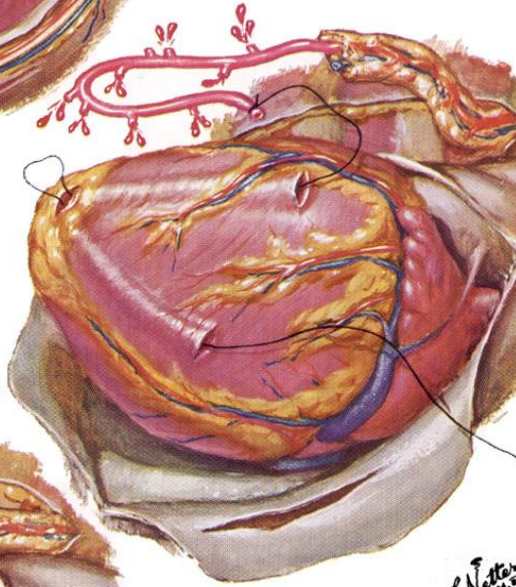
## □ **Arthur Vineberg**

- **1940's**- Mobilization of left internal mammary artery with implantation of bleeding end into the left ventricle.
- **1964**- follow-up study on 140 patients
  - 33% mortality
  - 85% relief from angina



**D:** AN INSTRUMENT IS PASSED THROUGH MYOCARDIUM FROM DISTAL TO PROXIMAL STAB WOUND THUS CREATING A TUNNEL UNDERLYING THE DIAGONAL BRANCH OF THE ANTERIOR INTERVENTRICULAR ARTERY; A LIGATURE IS PULLED THROUGH THE TUNNEL

**E:** THE POSTERIOR MYOCARDIUM MAY BE VASCULARIZED BY MAKING ANOTHER STAB WOUND ON THE POSTERIOR WALL OF THE LEFT VENTRICLE AND THE TUNNEL CONTINUED TO THIS POINT, PASSING UNDER THE TERMINAL PORTIONS OF THE LATERAL BRANCHES OF THE CIRCUMFLEX BRANCH OF THE LEFT CORONARY ARTERY; THE LEFT INTERNAL THORACIC (INT. MAMMARY) ARTERY IS DISSECTED OUT OF THE PEDICLE FOR A SUITABLE DISTANCE, ALLOWING THE BRANCHES TO BLEED FREELY



**F:** THE ARTERY IS GENTLY DRAWN THROUGH THE FIRST SECTION OF THE TUNNEL AND THEN THROUGH THE SECOND SECTION BY MEANS OF THE IMPLANTED LIGATURE; IT IS ANCHORED AT DISTAL END BY A SUTURE

*F. Netter M.D.*  
© CIB

# Adult Cardiac Surgery: Ischemic Heart Disease (History)

- **Mason Sones,**

**1950's-** cine coronary arteriography.

**1962-** direct and reproducible catheterization of the coronary arteries.

*“Collectively, all of the cardiological advances in this century pale in comparison with this priceless achievement.”*

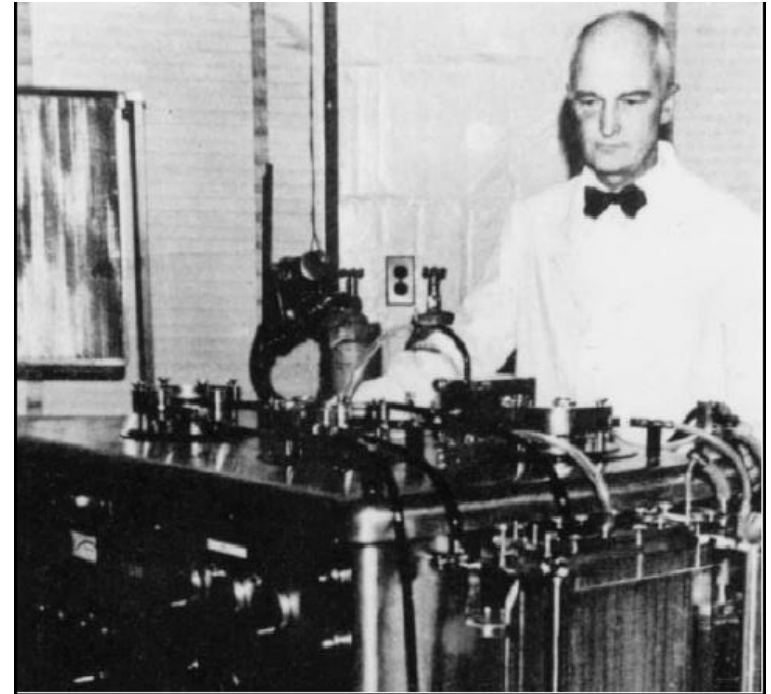
Floyd Loop, MD

# Adult Cardiac Surgery: Ischemic Heart Disease (History)

## John H. Gibbon, Jr.

*“During the long night, helplessly watching the patient struggle for life as her blood became darker and her veins more distended, the idea naturally occurred to me that if it were possible to remove some of the blue blood...put oxygen into that blood and allow carbon dioxide to escape from it, and then to inject continuously the now-red blood back into the patient’s arteries, we might have saved her life.”*

- Heart-lung machine
- May 6, 1953- ASD closure



# Heart Lung Machine





# Adult Cardiac Surgery: Ischemic Heart Disease (History)

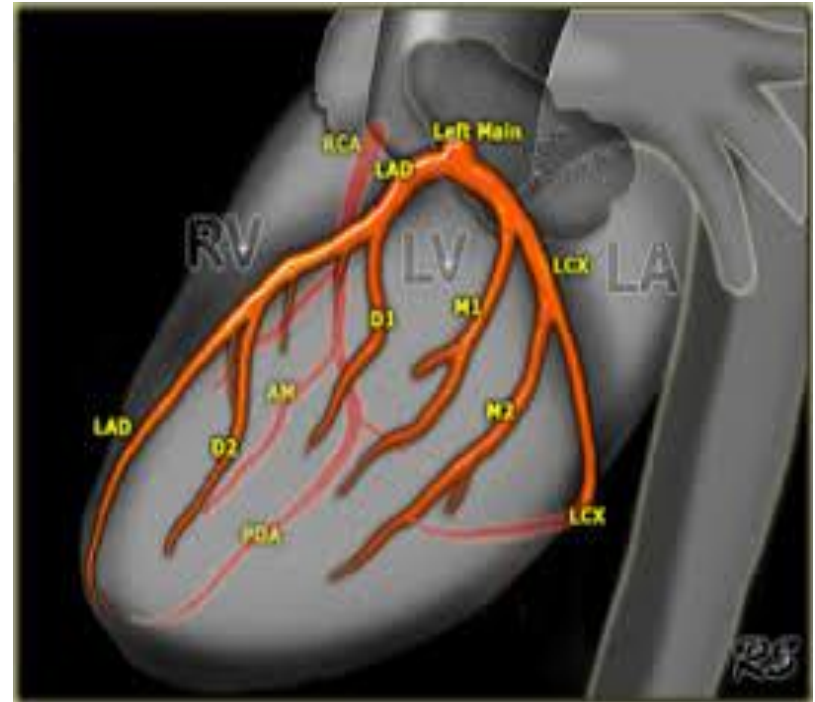
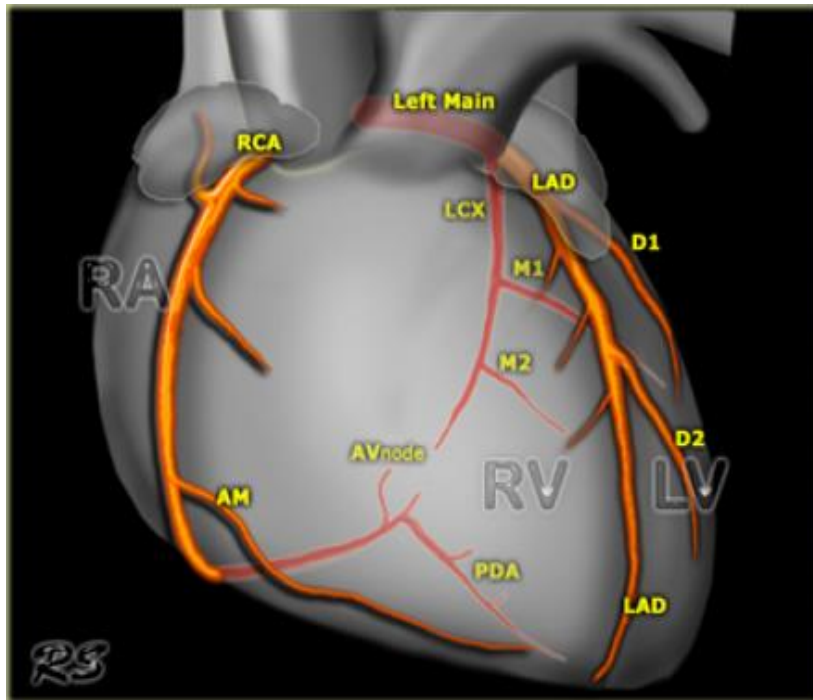
- 1962- **David C. Sabiston, Jr.-**
  - ▣ Aortocoronary saphenous vein bypass
- **KOLOSOV LIMA -LAD 1964 IN Russia**
- **Frank Spencer/George Green**
  - ▣ Internal mammary artery

# Adult Cardiac Surgery: Ischemic Heart Disease (CABG)

- Early and widespread acceptance of coronary bypass was delayed.
- Best known cooperative studies (1970-80's) were the;
  - VA  
Coronary Artery Surgery Study
  - European Coronary Surgery Study



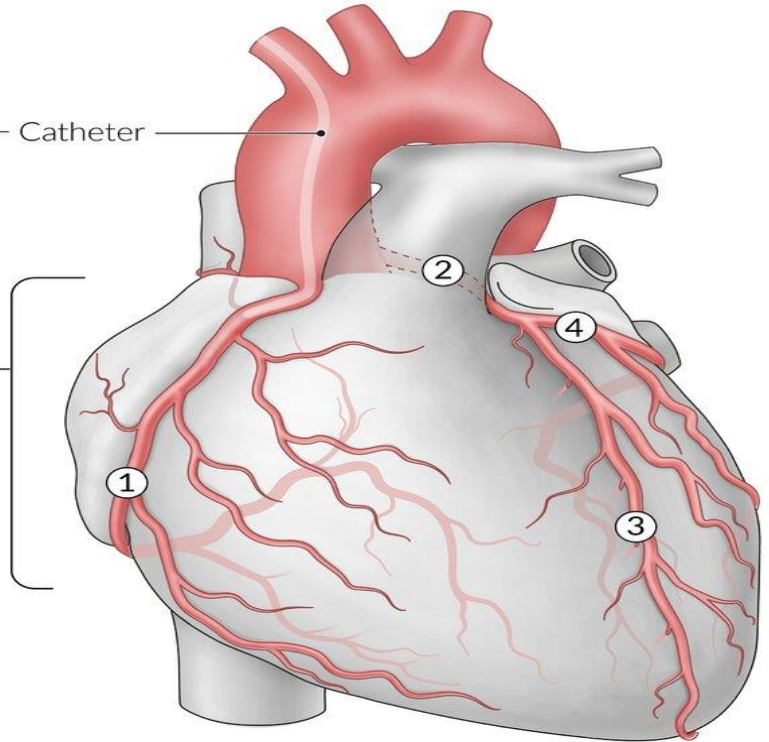
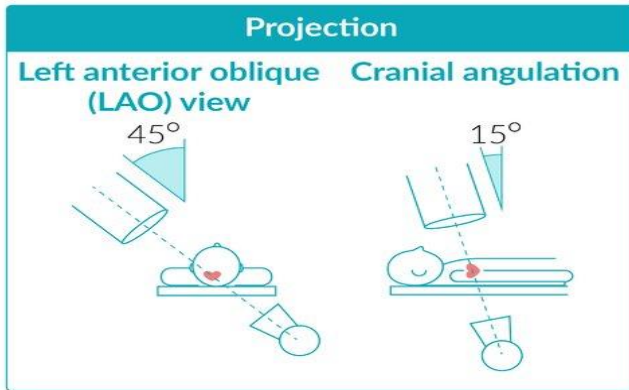
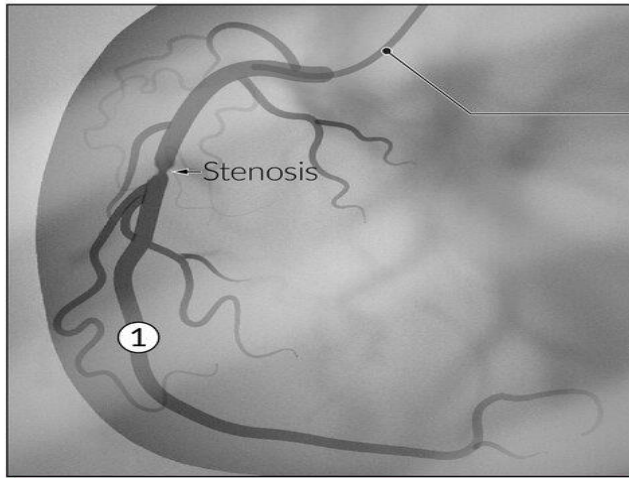
# The Normal Heart - Coronary Artery Anatomy



# Ischaemic Heart Disease

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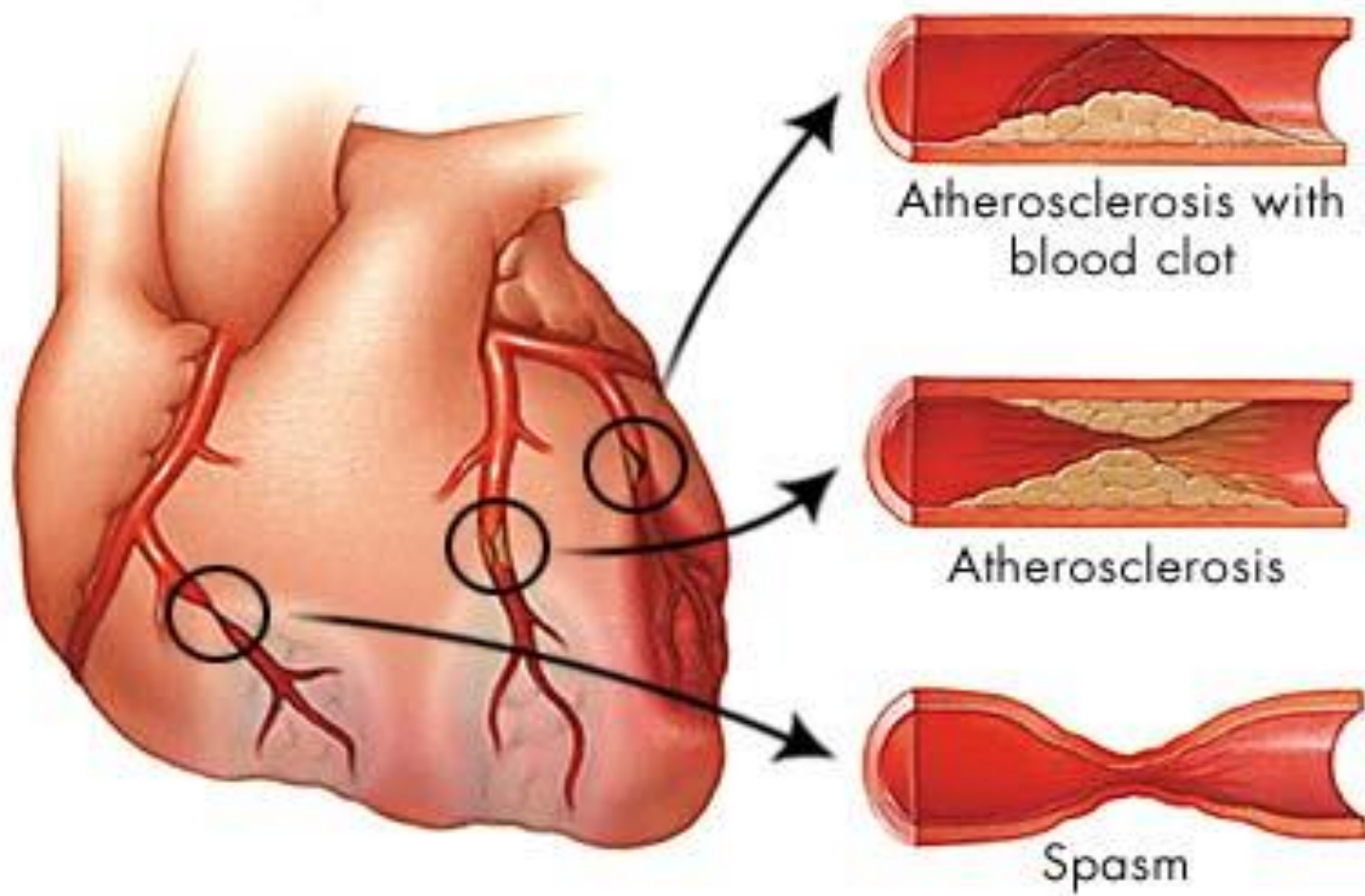
- It results from imbalance between oxygen demand and supply



- ① Right coronary artery (RCA)
- ② Left coronary artery (LCA)
- ③ Left anterior descending artery (LAD)
- ④ Left circumflex artery (LCx)

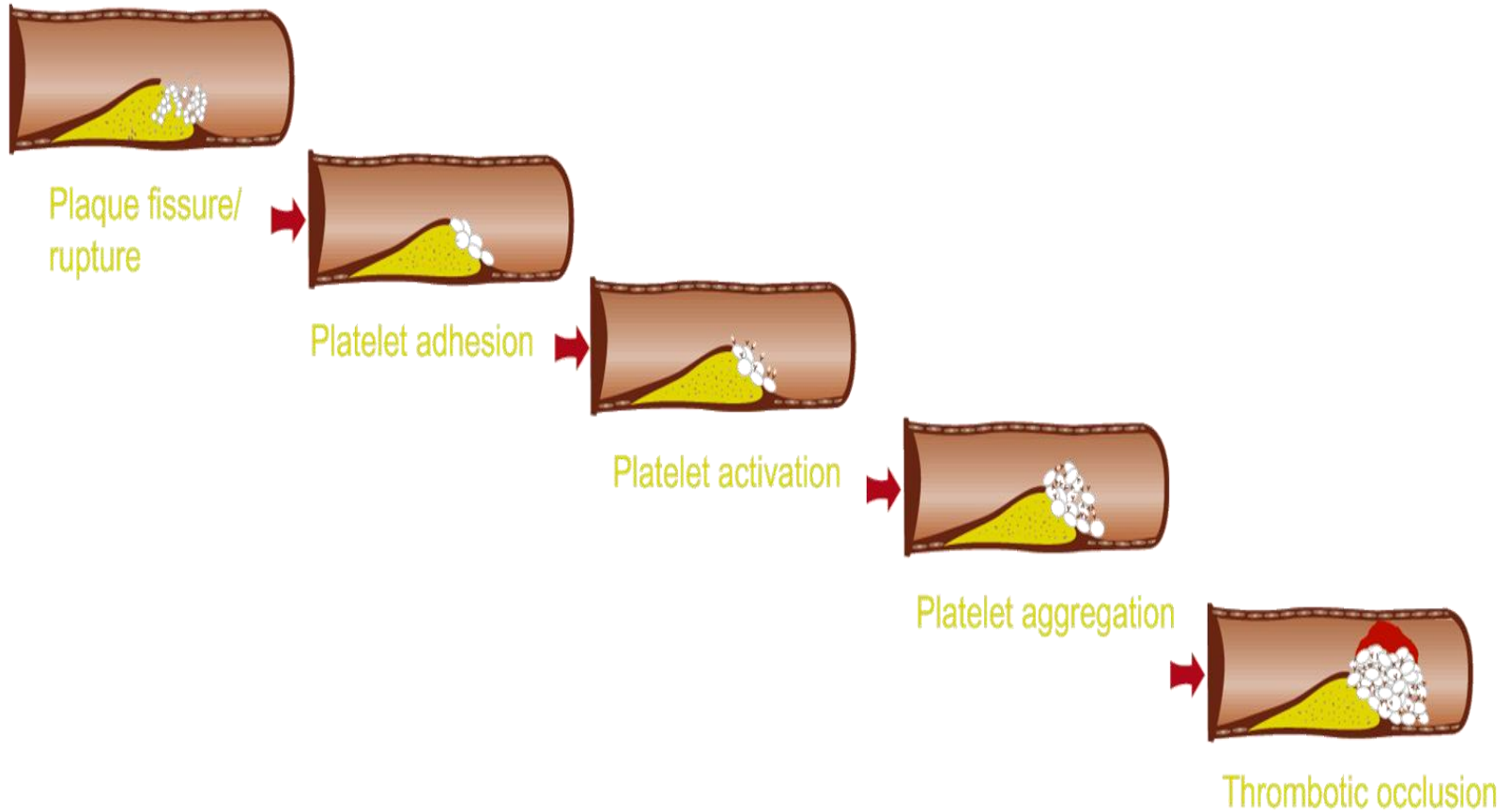
# Aetiology

- **Atherosclerosis (>90%)**
- **Embolisation**
- **Coronary spasm**
- **Vasculitis**
- **Ostial stenosis**
- **Severe LVH**
- **Congenital anomalies of the coronary arteries (e.g anomalous origin of LAD artery from pulmonary artery)**

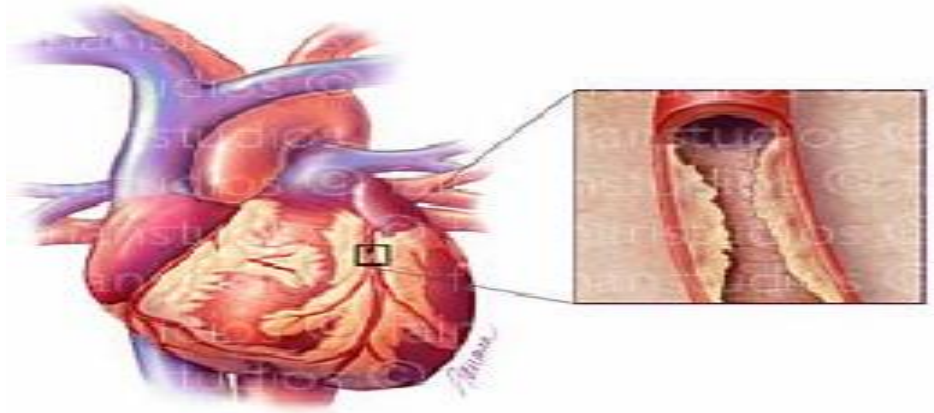
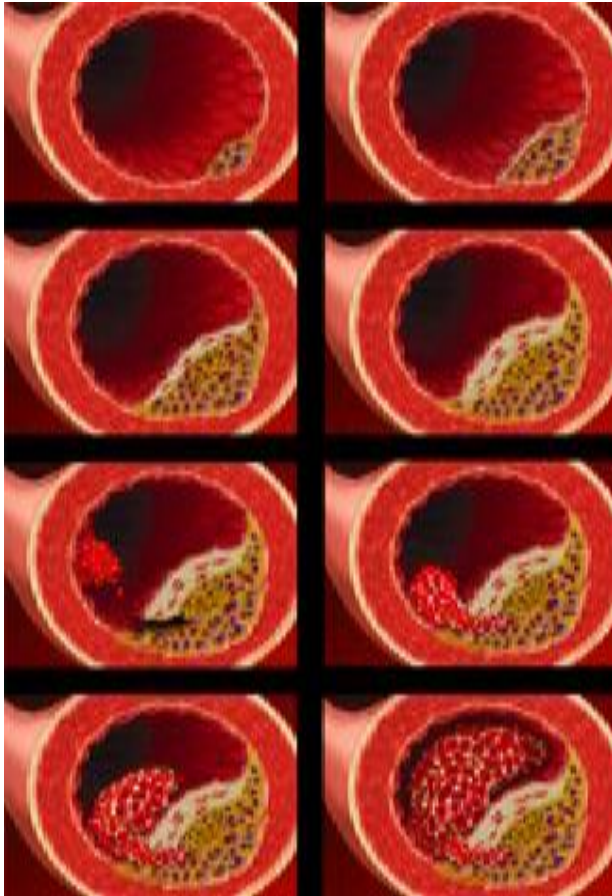




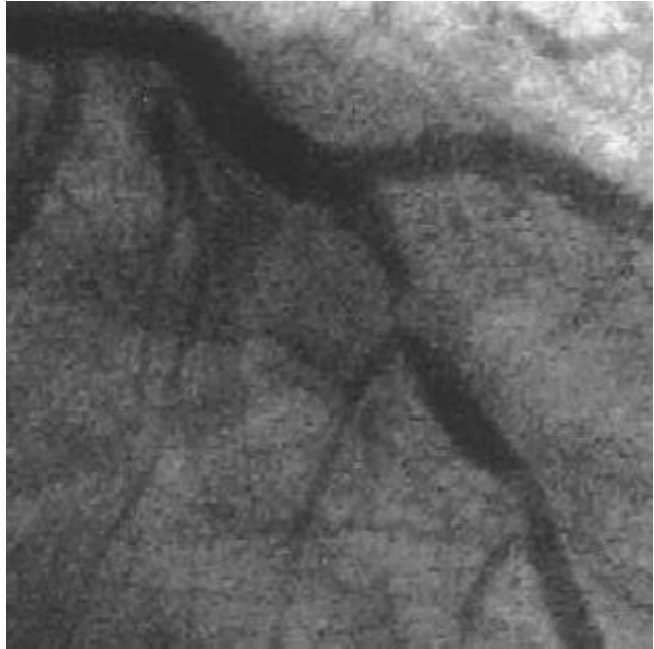
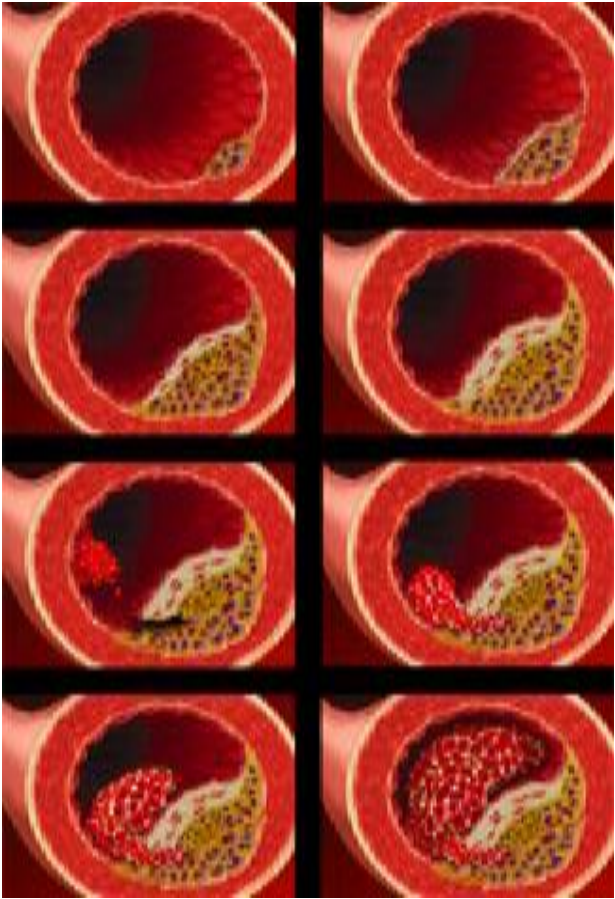
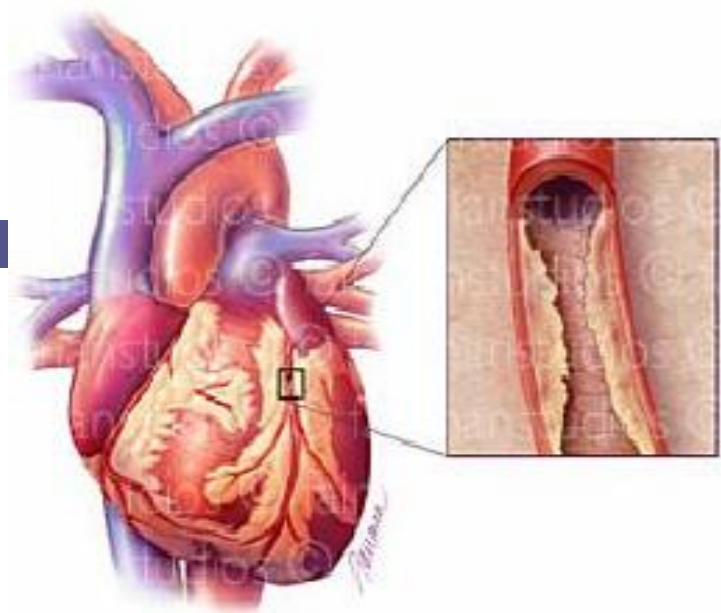
# Pathogenesis of ACS



# ATHEROSCLEROSIS



# ATHEROSCLEROSIS



# Risk Factors

## Uncontrollable

- Sex
- Hereditary
- Race
- Age

## Controllable

- High blood pressure
- High blood cholesterol
- Smoking
- Physical activity
- Obesity
- Diabetes
- Stress and anger

# CAD

## Diagnosis

1. History
2. Physical examination
3. ECG findings
4. cardiac enzymes

# Investigations

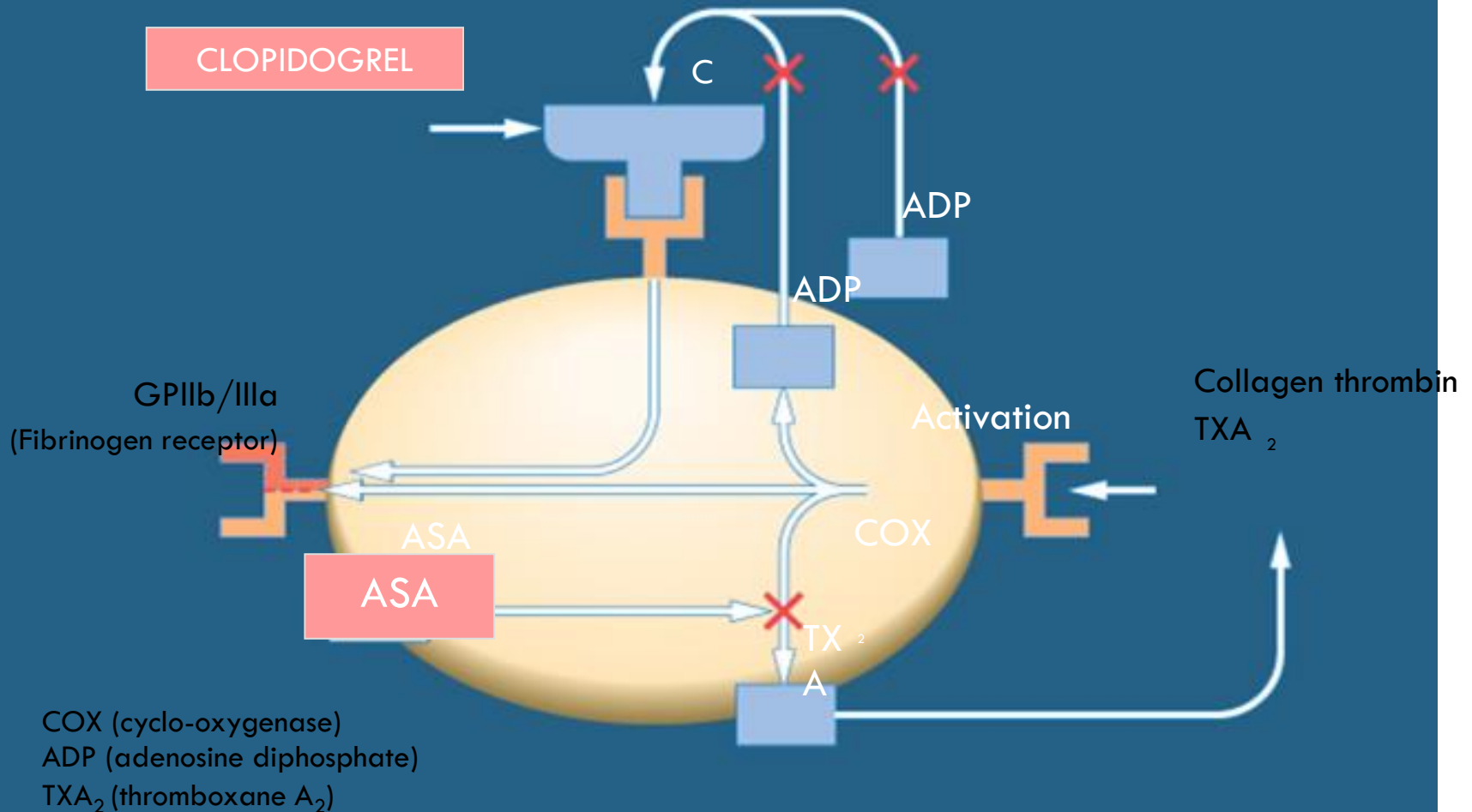
- ❑ **ECG**
- ❑ **Cardiac enzymes**
- ❑ **Chest x-ray**
- ❑ **FBS**
- ❑ **Serum lipids**
- ❑ **TMT**
- ❑ **Stress or pharmacologic stress myocardial perfusion studies**
- ❑ **Cardiac CT-Scan**
- ❑ **Coronary angiography**

# Treatment of CAD

- Nitrates
- Beta blockers
- Aspirin/PLAVIX DUAL ANTIPLATELET THERAPY
- Ca-channel blockers(in coronary spasm)
- Treating the associated risk factors
- Treating the precipitating factor
- Revascularization ( if indicated)

SURGICAL VS INTERVENTIONAL

# Synergistic Mode of Action with Clopidogrel and ASA<sup>1</sup>

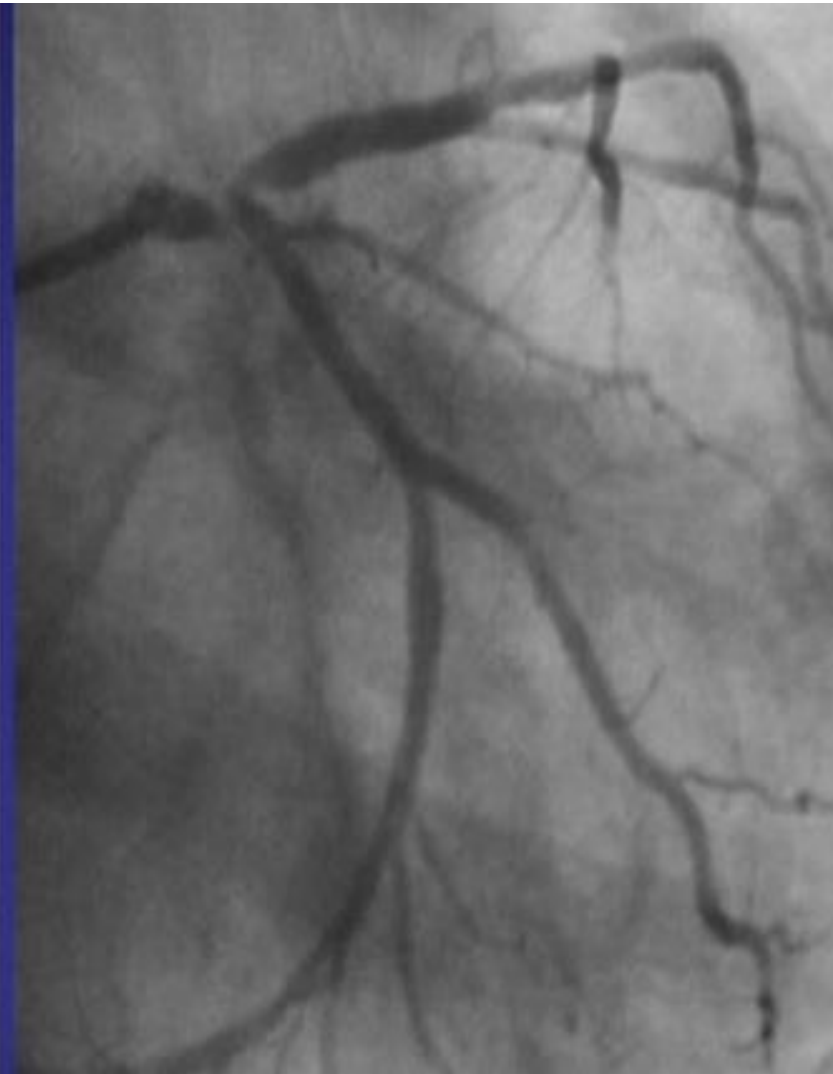


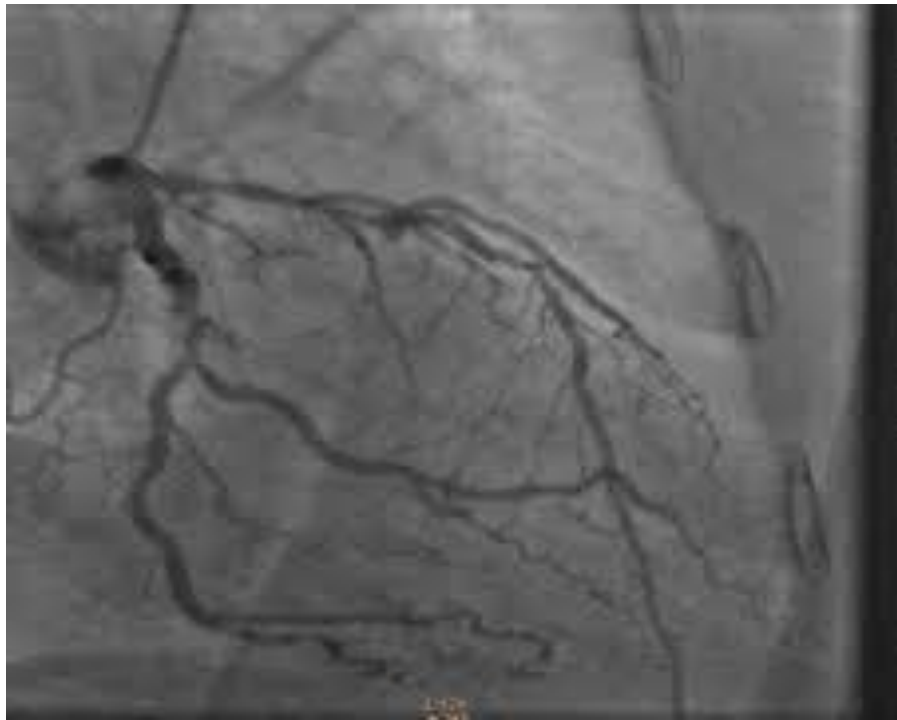
1. Schafer AI. *Am J Med* 1996; 101: 199–209.



# Indications for open-heart surgery

- **Coronary Artery Bypass Grafting: (CABG)**
  - Triple vessel disease
  - Lf main coronary artery disease
  - Unstable angina ,failed Mx therapy
  - Complications of PTCA
  - Life threatening complications of MI
  - Anomalies of Coronary arteries.



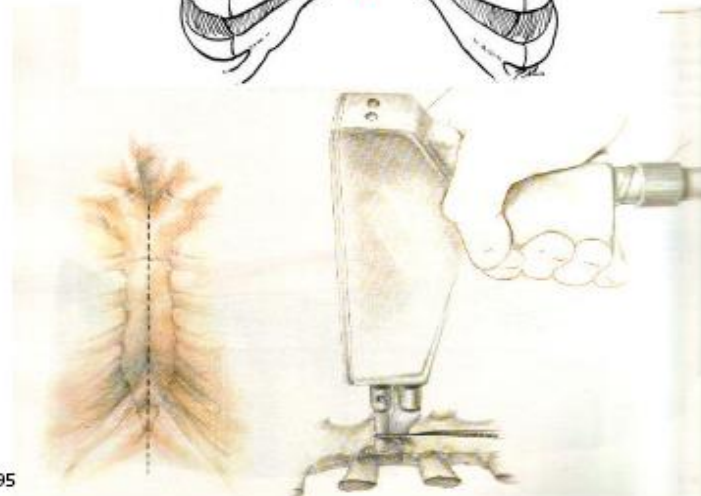
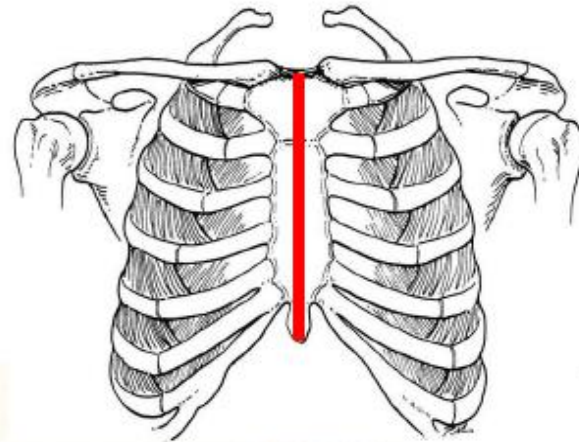


# Adult Cardiac Surgery: CABG Techniques

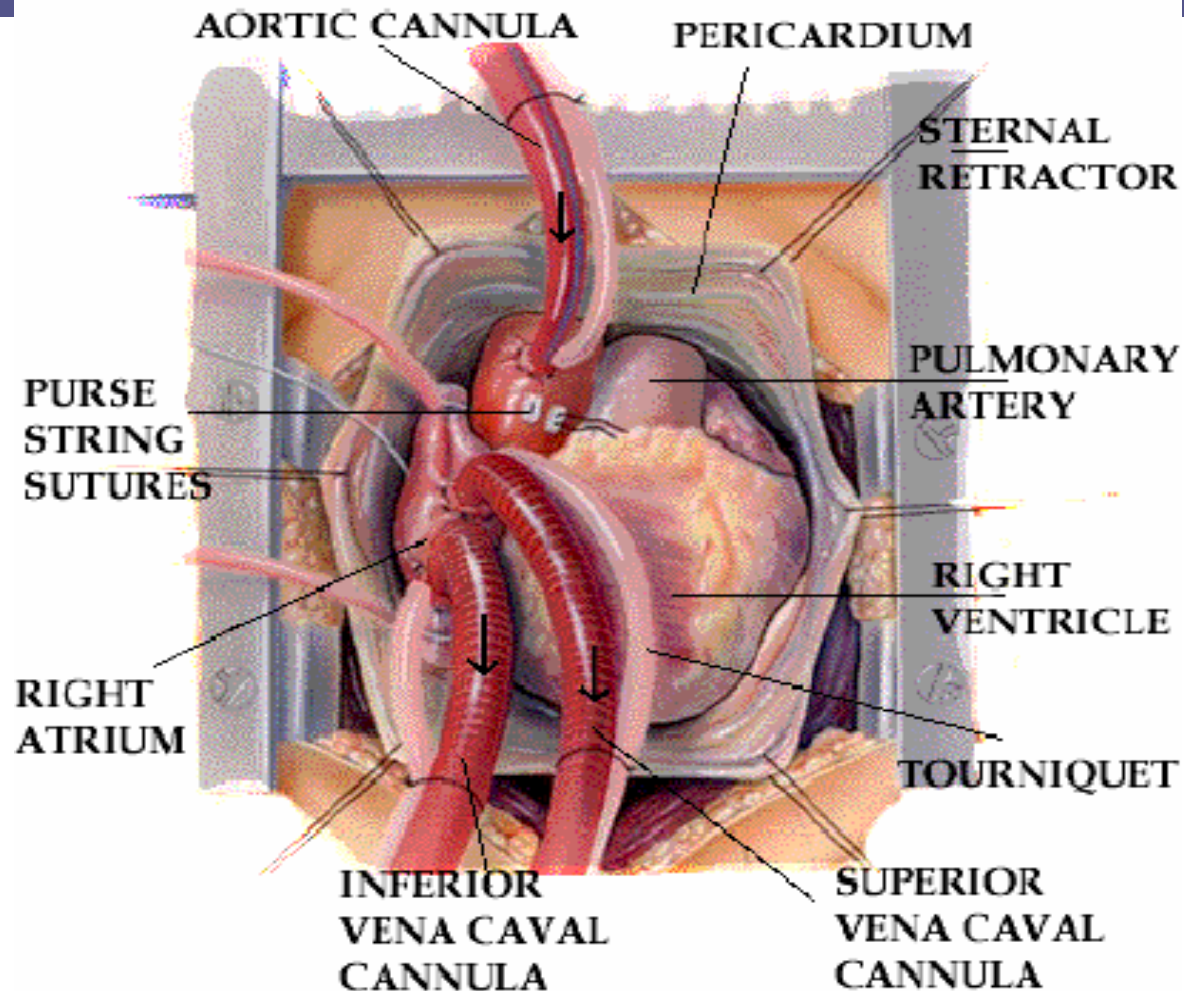
- Median sternotomy
- Cardiopulmonary bypass
- Cardioplegic arrest
- Mammary artery, reversed saphenous vein, radial artery.

# Sternotomy

- Sternotomy approach
  - allows almost all cardiac procedures
  - best overall access to the heart
- The sternum is divided with a saw



# HEART ON CARDIOPULMONARY BYPASS

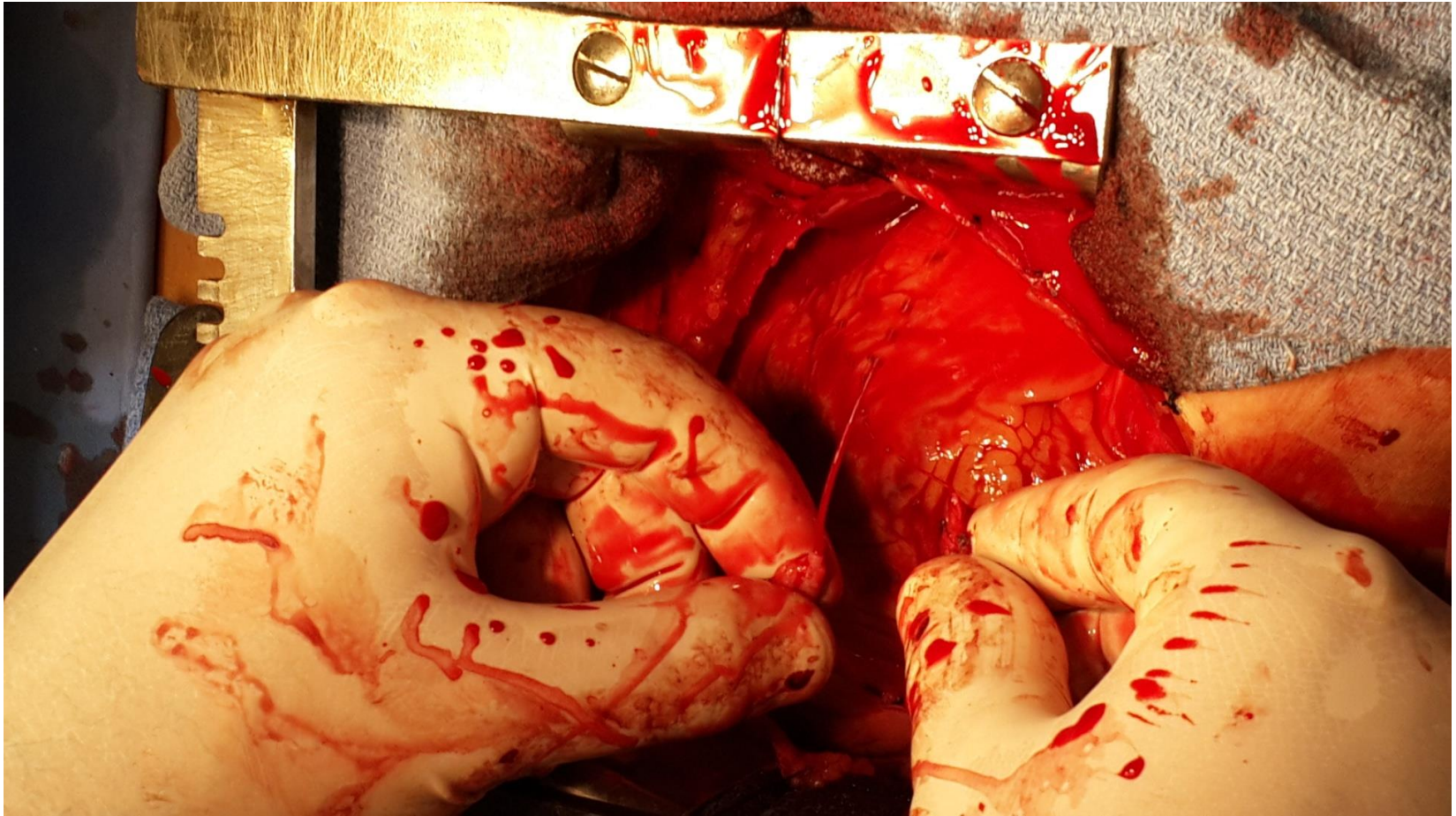


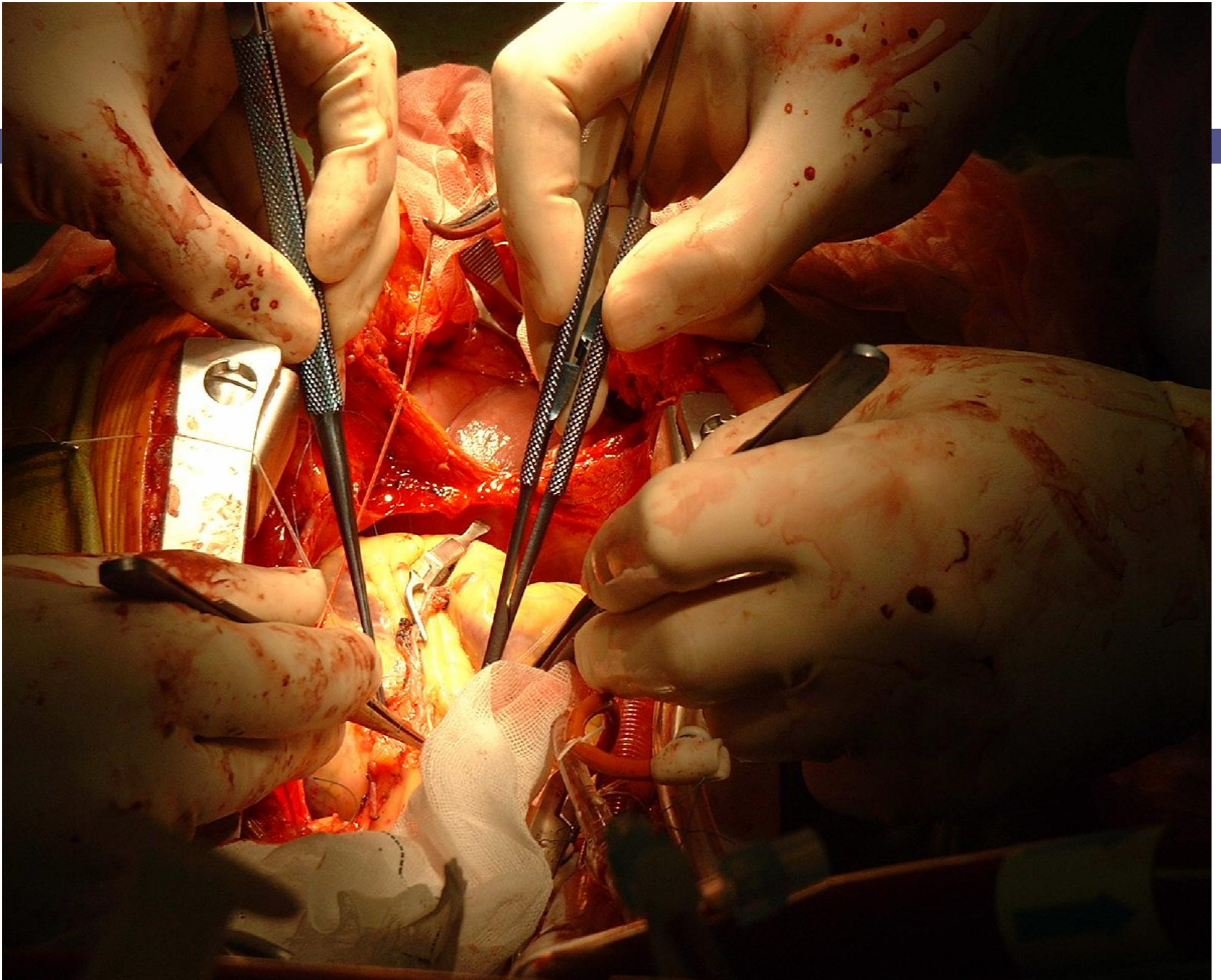
# Heart Lung Machine





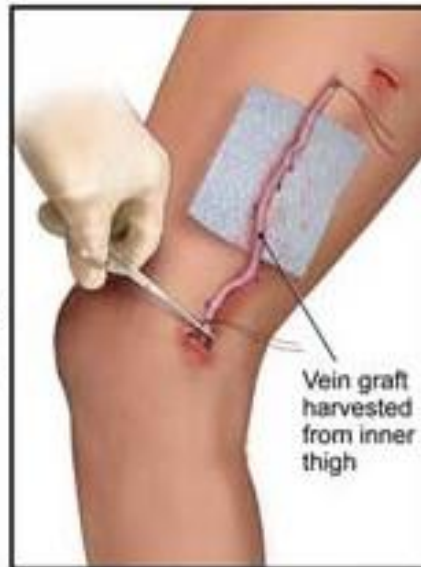
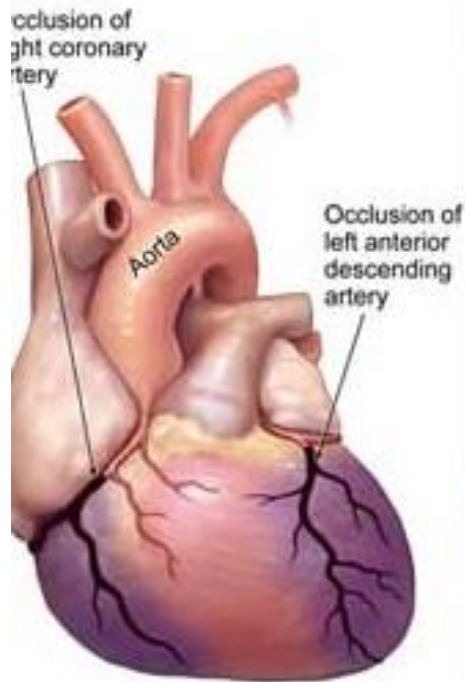




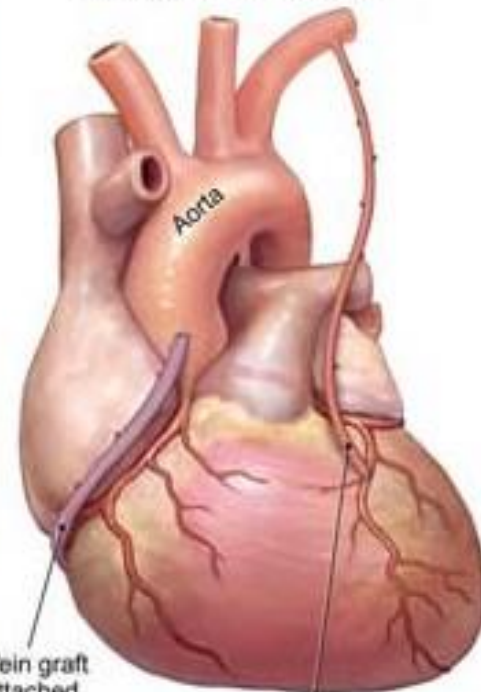


# Coronary Artery Bypass Grafts

Preoperative Condition



Postoperative Condition

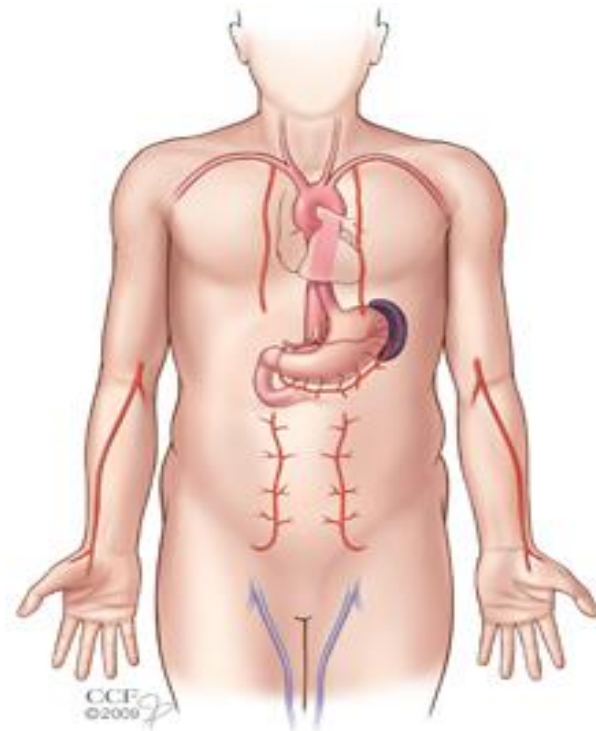
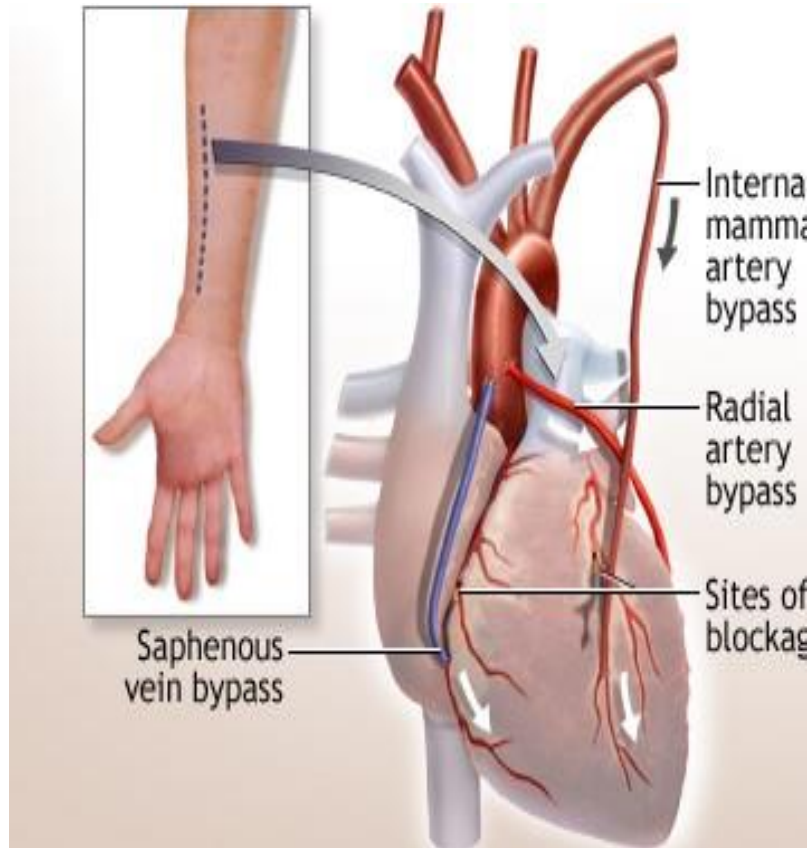


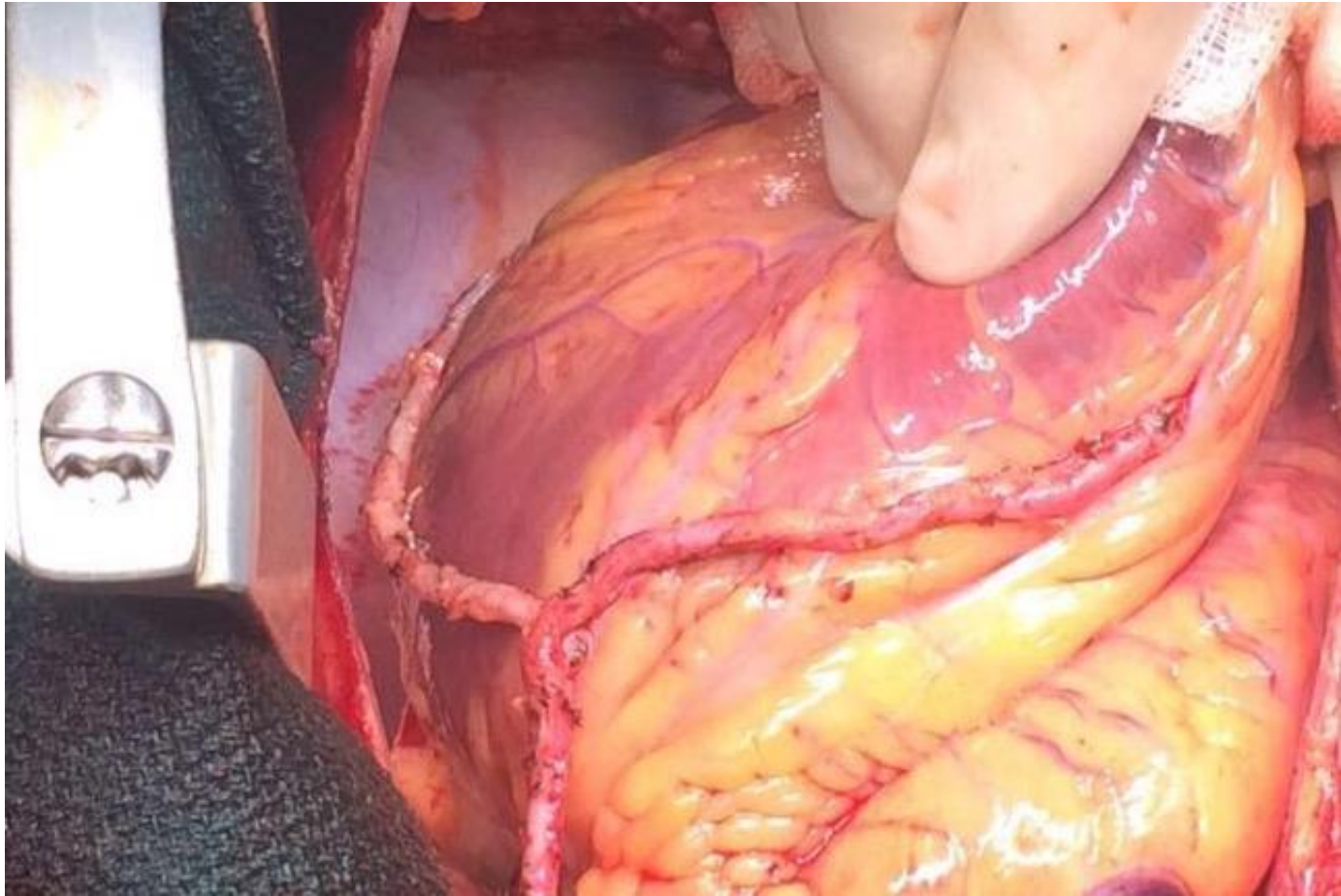
Vein graft attached to right coronary artery

Internal mammary artery relocated and attached to LAD

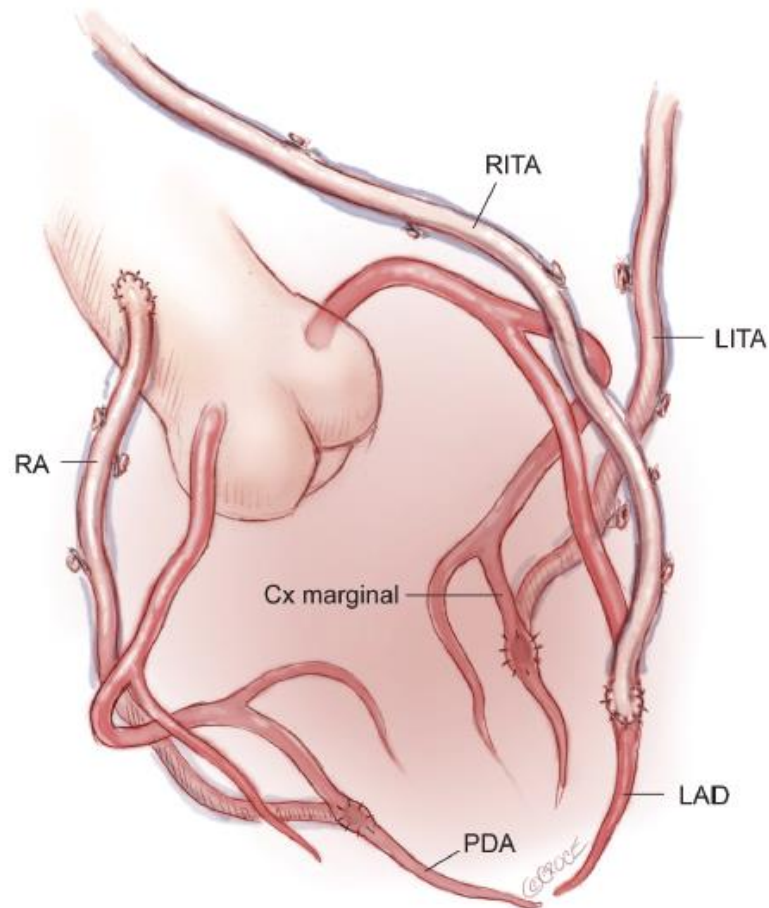
Artery

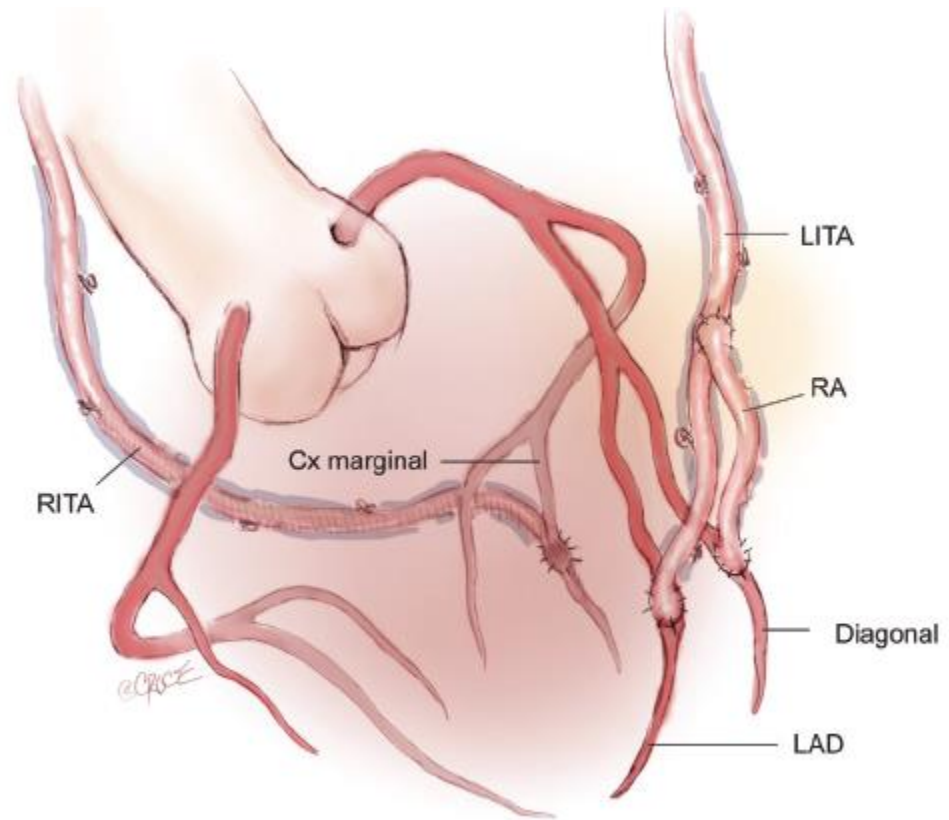
# Arterial vs Venous conduits

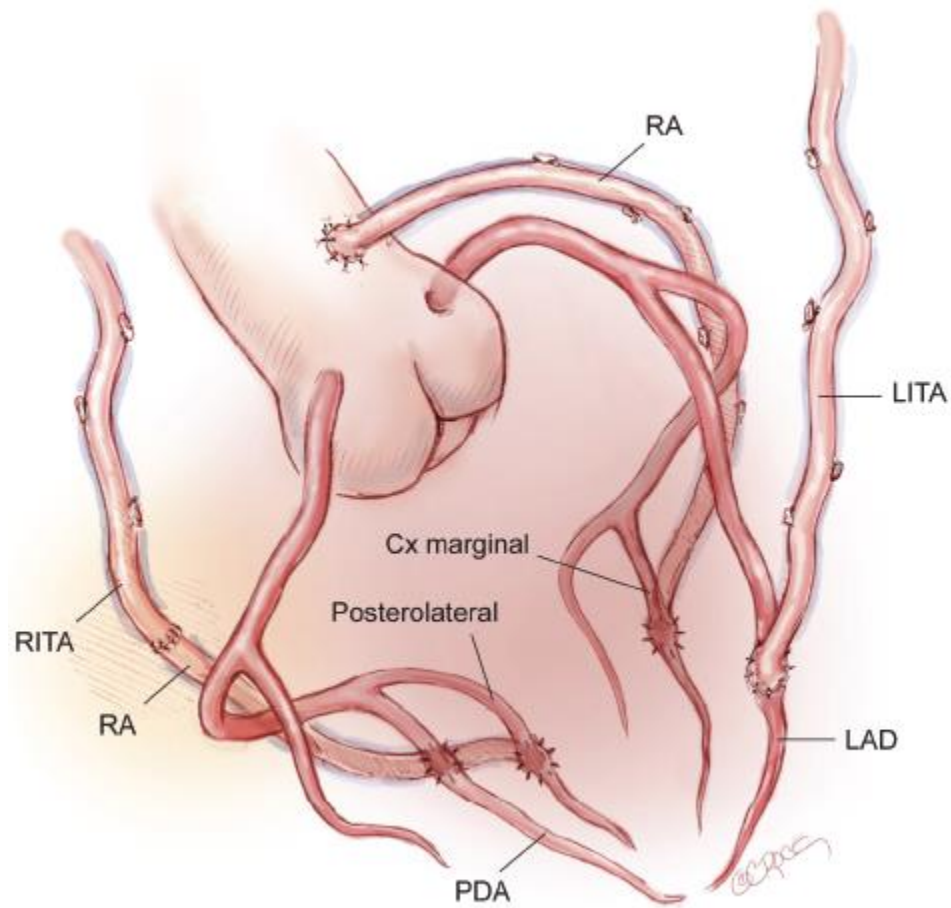




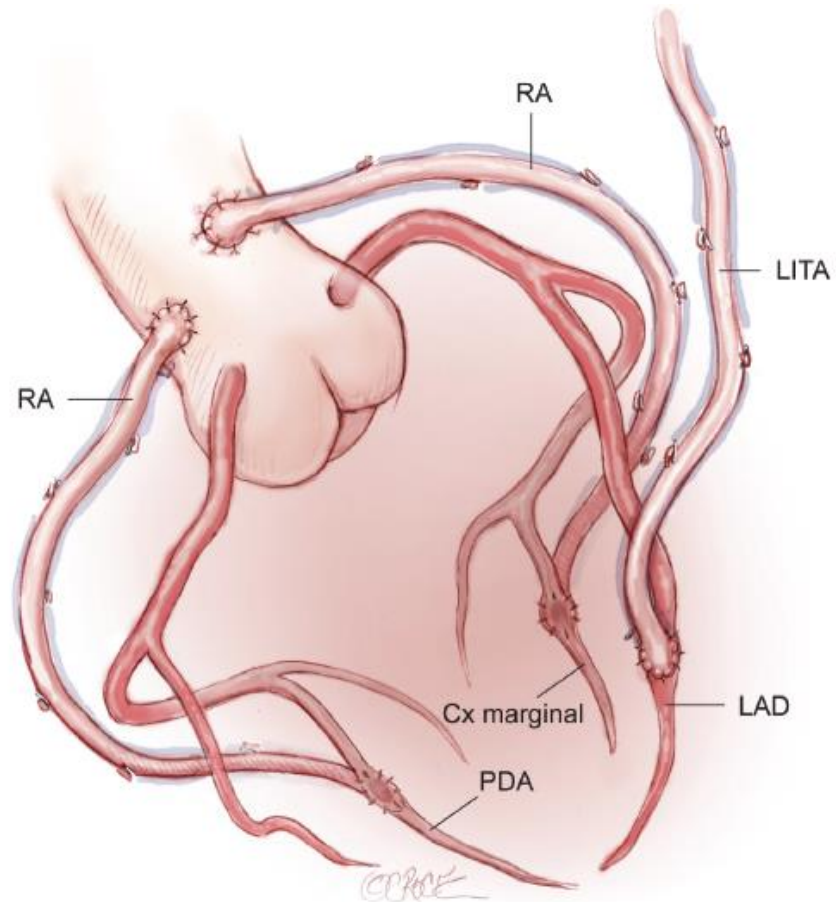
# Total arterial revascularization

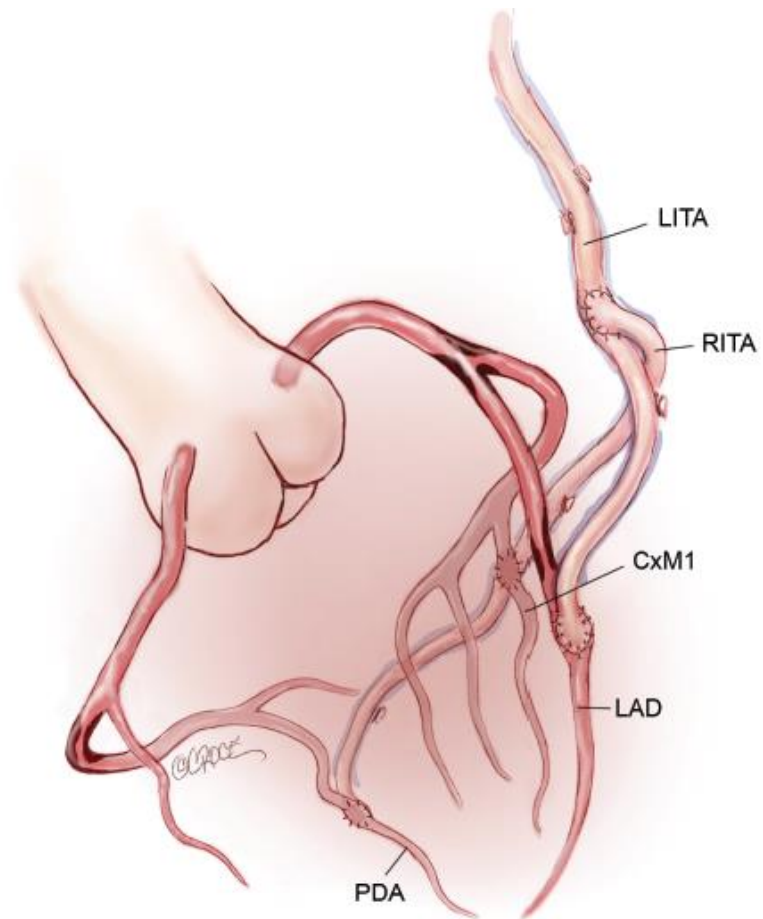


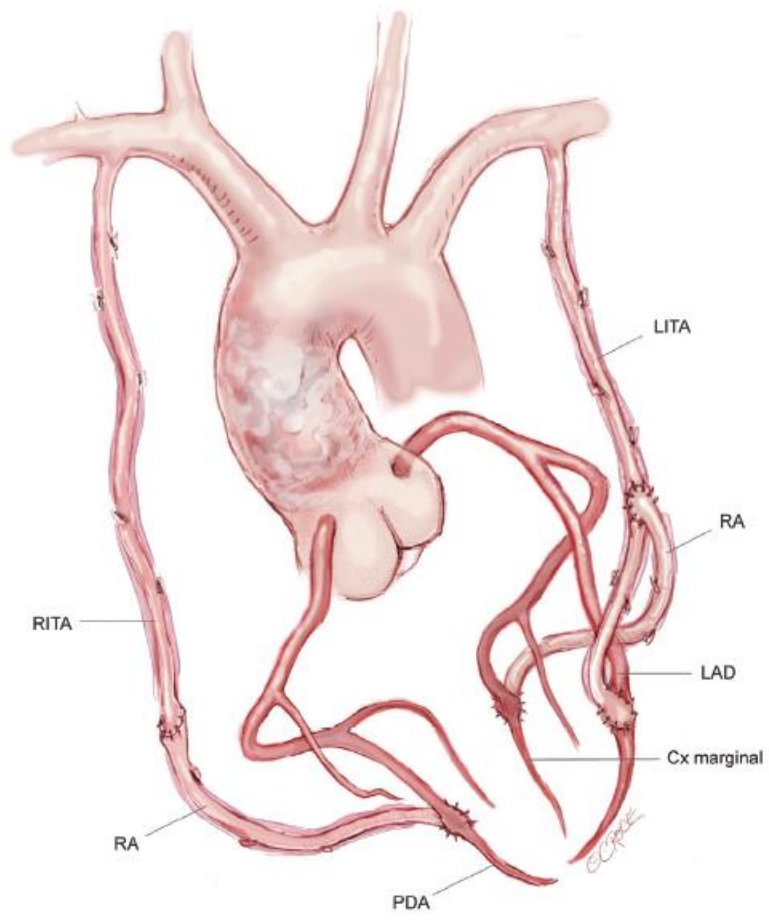




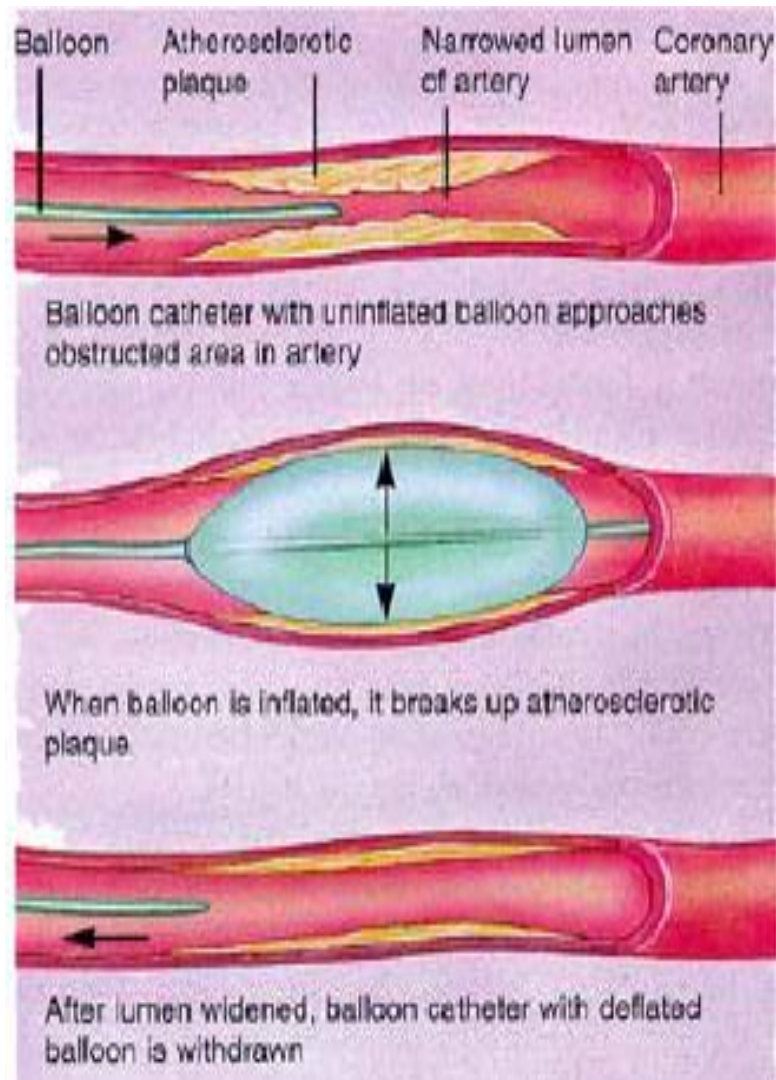


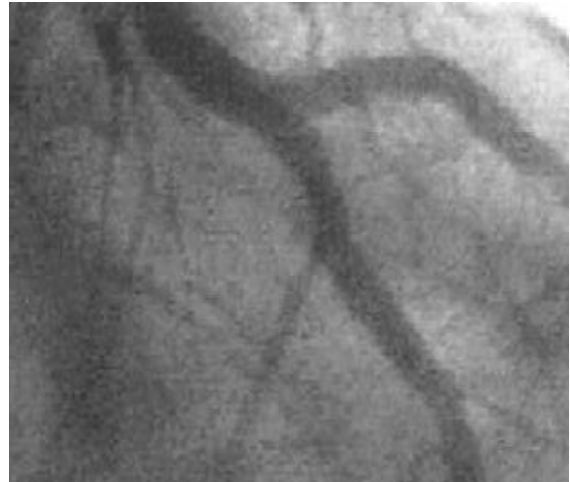
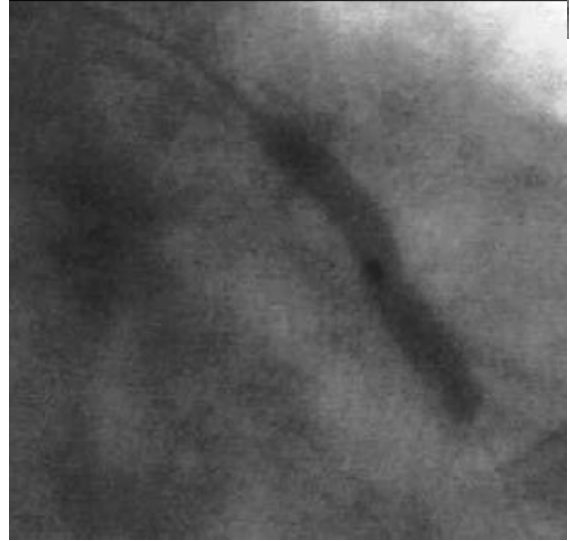
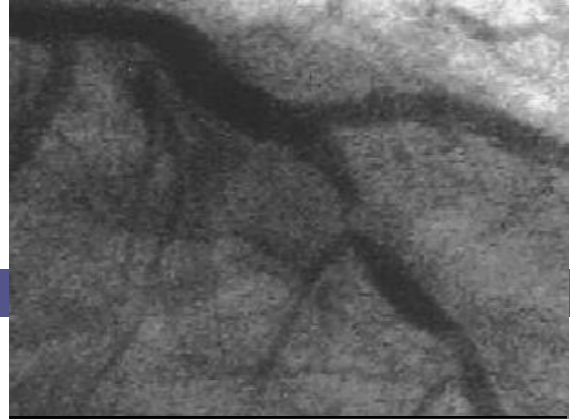
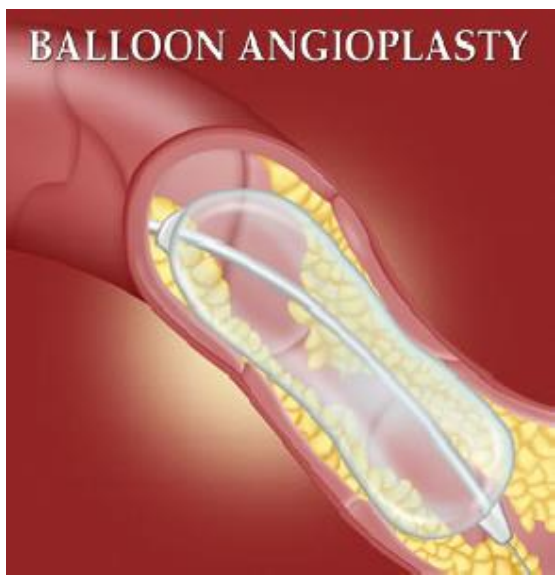


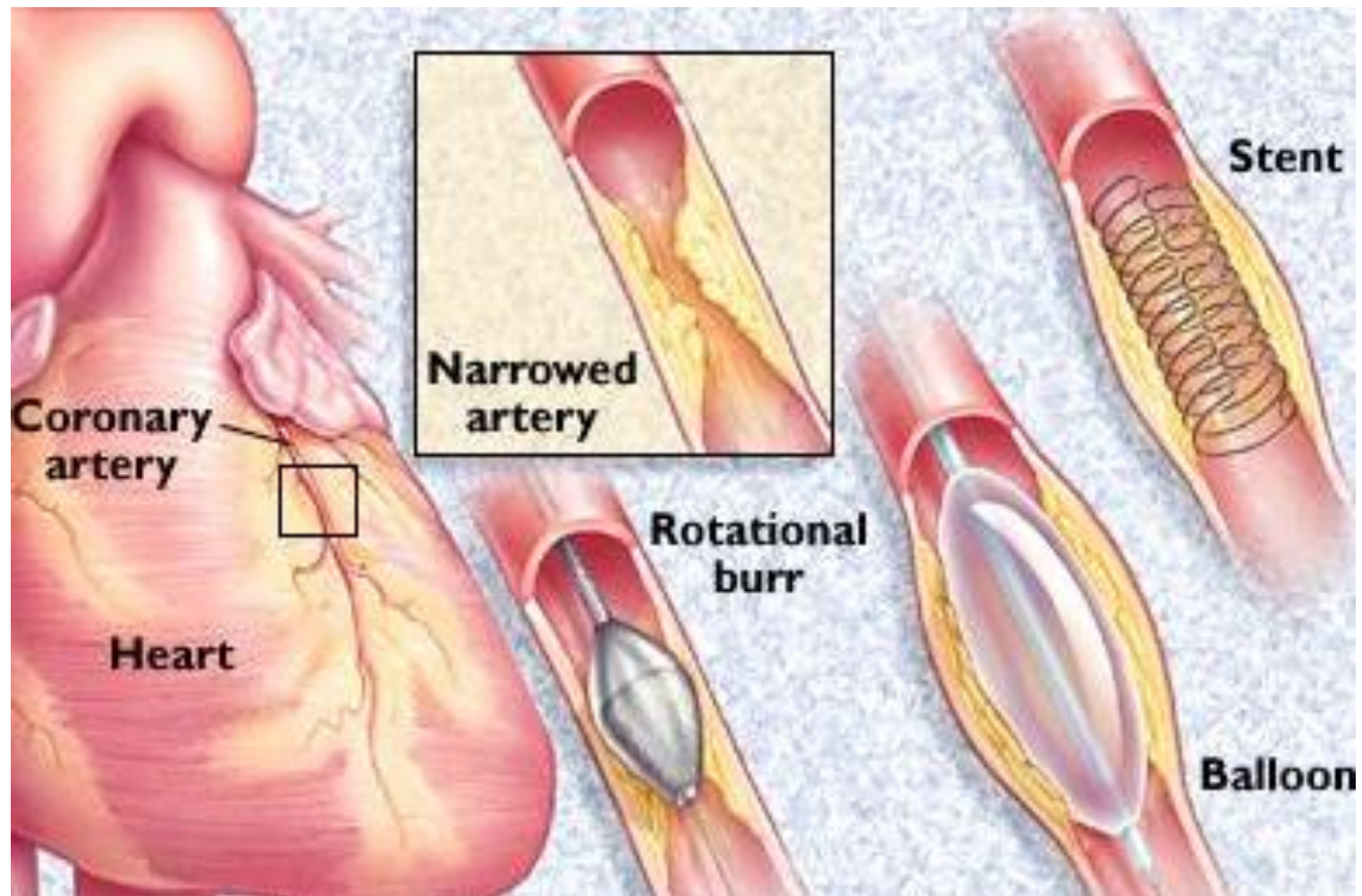




# PTCA







# Off-Pump Coronary Artery Bypass (OPCAB)

# Procedure

- Median sternotomy of varying sizes.
- Depending on the physiology of the patient, the smallest incision will be made.
- Arteries or veins can be harvested from the patients chest wall, arm, and or leg.
- Adenosine and Esmolol are used to slow the heart rate.
- Deep pericardial sutures and the use of specialized instruments to prop the heart in a position that will allow the surgeon to access occluded arteries.





# Instrumentation

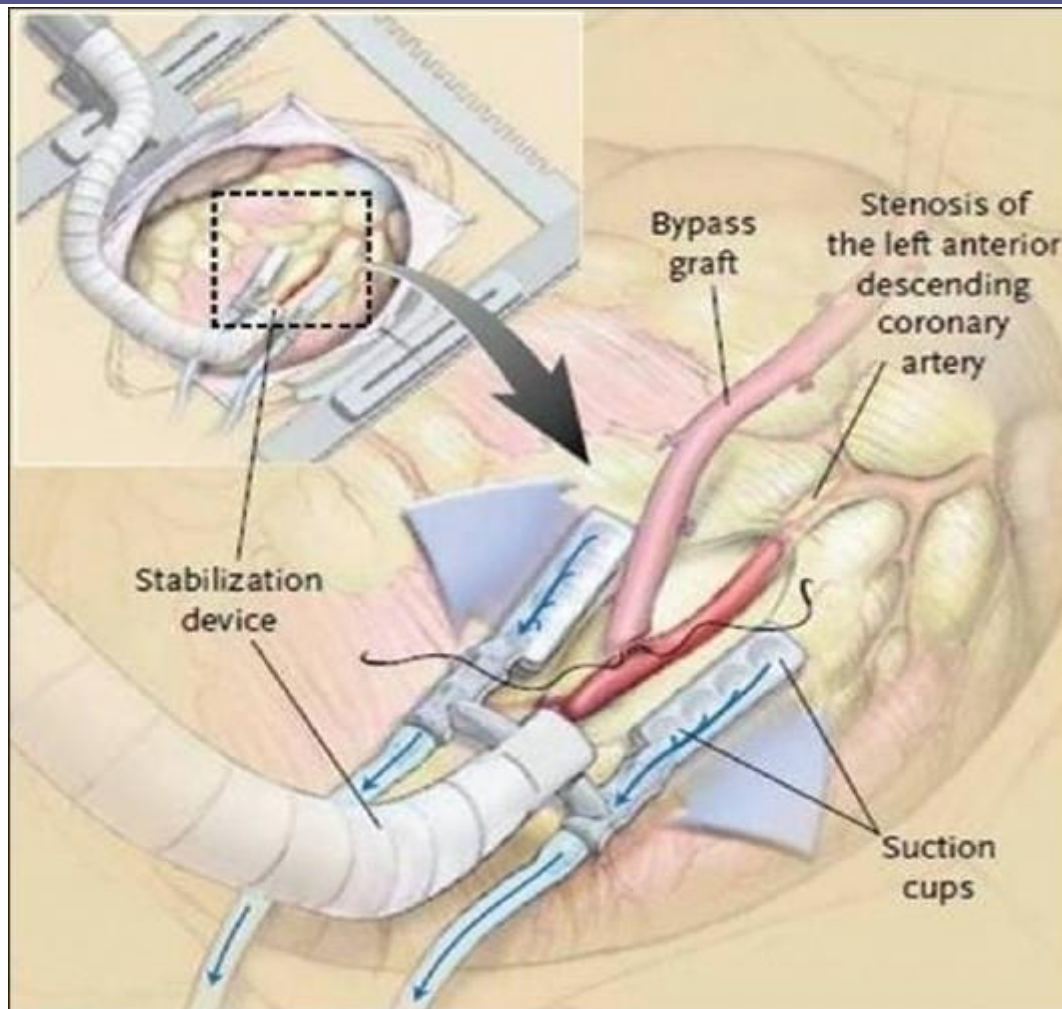
## □ **Octopus Device**

- Has multiple small suction cups that are applied to the heart surface.
- When suction is turned on, the cups stick to the surface, and hold the heart steady, with movement being less than 1 mm.



## □ **Drug Therapy**

- Esmolol and Adenosine have been found effective in slowing, and even temporarily stopping the heart beat for short periods (around 20 seconds).





**Any Questions**

# SUMMARY

