

충남대 흉부외과 강신평

# Anatomy of coronary artery and Coronary angiography

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# Introduction

- Anatomy of coronary artery
- Interpretation of coronary angiogram
- Surgical anatomy of coronary artery
- Case study

# Basic Anatomy

Branch to SA node  
(SVC branch)

Anterior  
RA branch  
of RCA

Right coronary artery  
(RCA)

Anterior cardiac vein

Small cardiac vein

Right marginal branch

RV branch

Left main coronary artery  
(LMCA)

Left circumflex artery  
(LCx)

Great cardiac vein

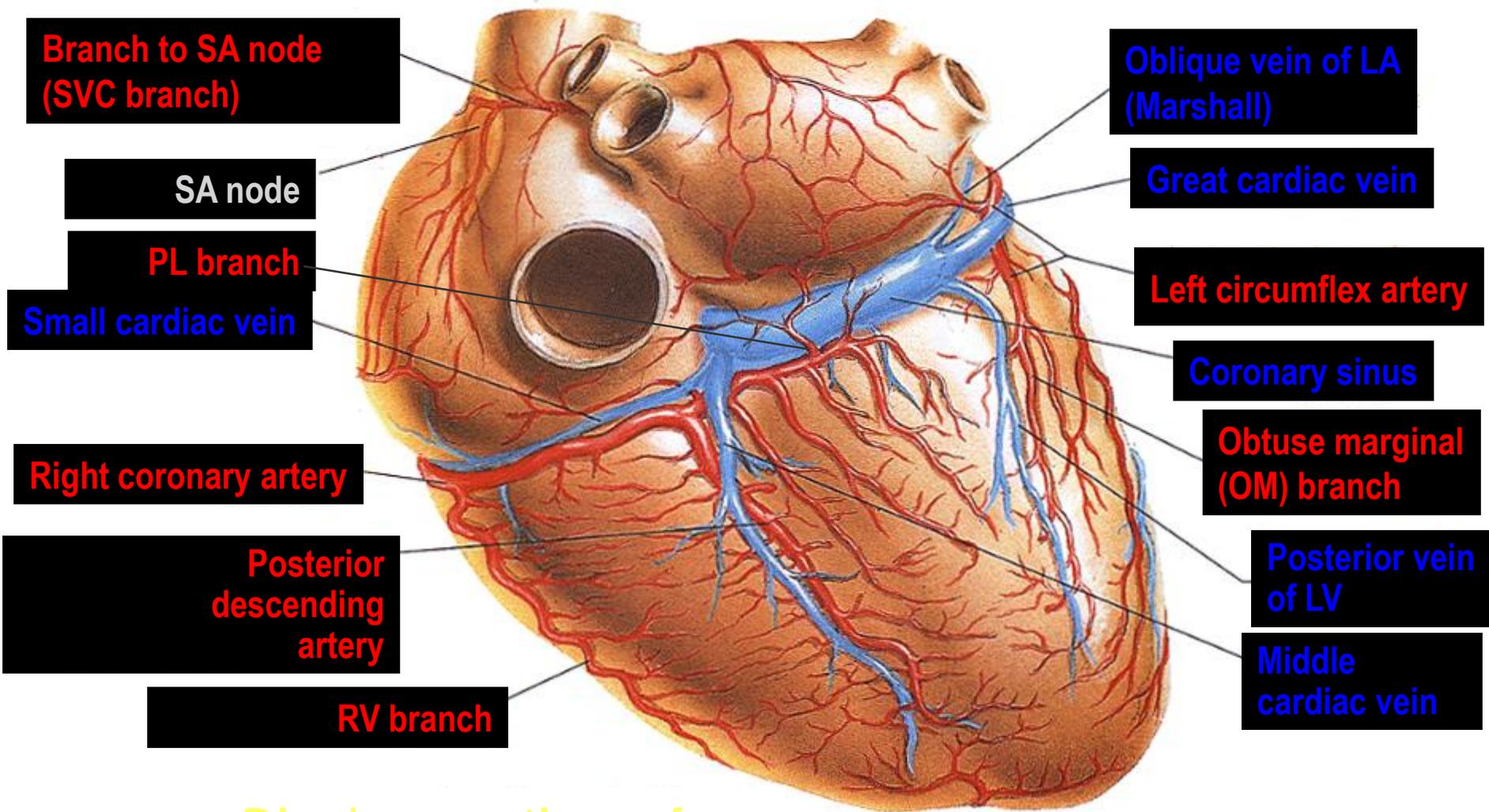
Obtuse marginal (OM)

Left anterior  
descending  
(LAD) artery

Diagonal artery  
(Dx)

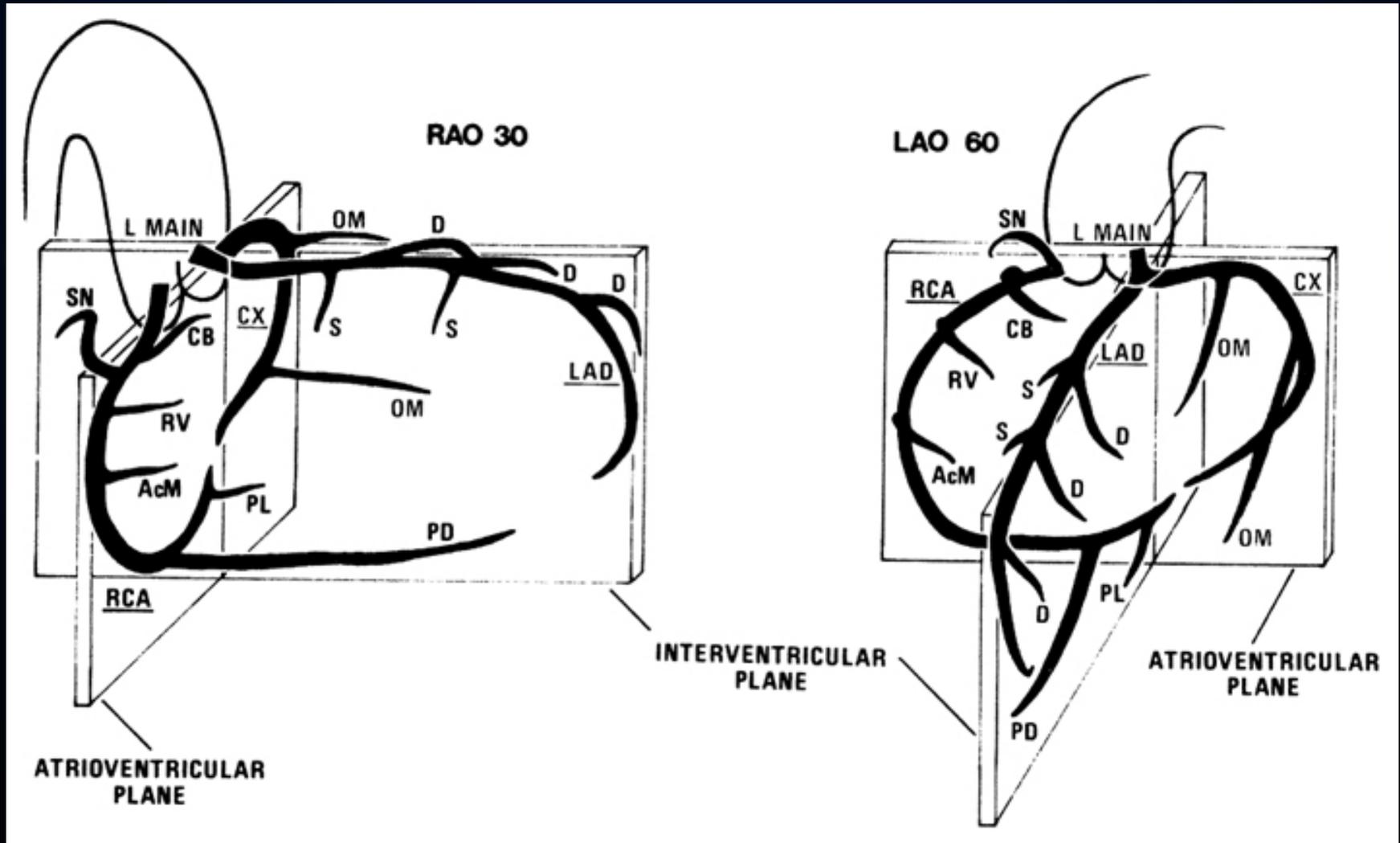
*F. S. Netter M.D.*  
© CIBA-GEIGY

Sternocostal surface



Diaphragmatic surface

# Atrioventricular and Interventricular Planes

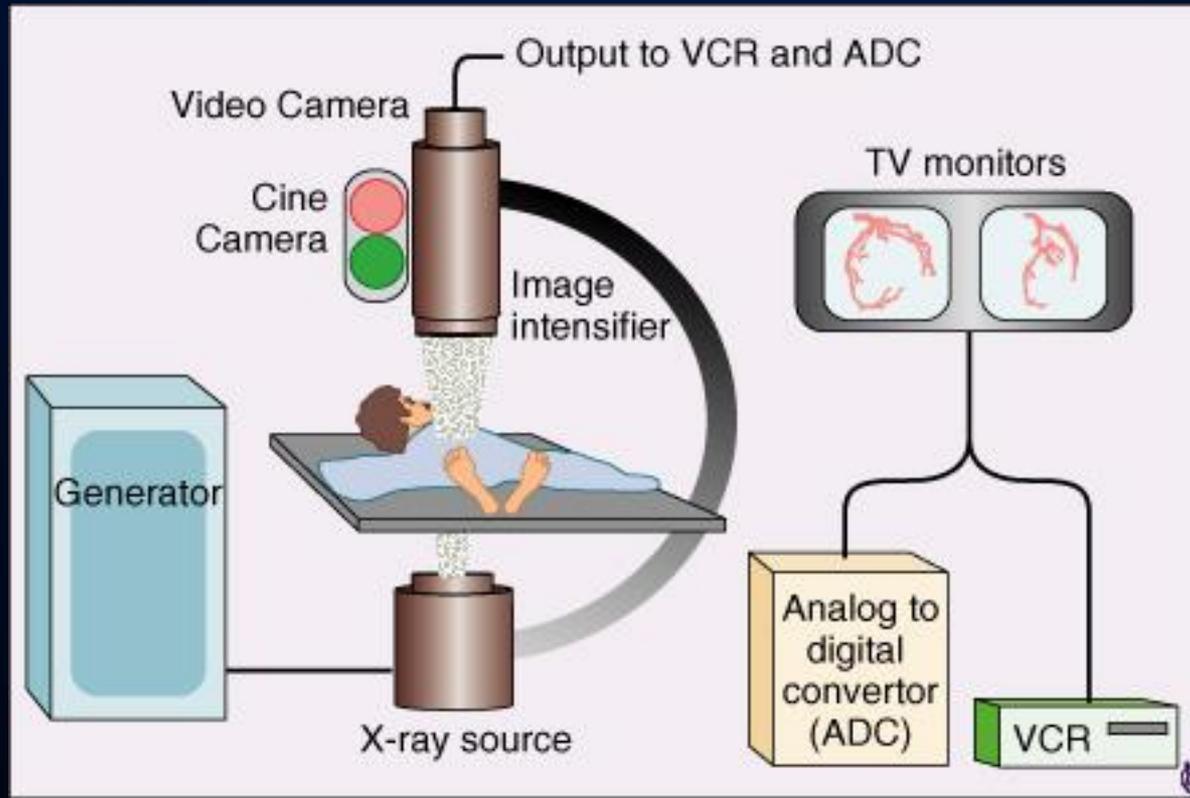


# Interpretation of coronary angiogram

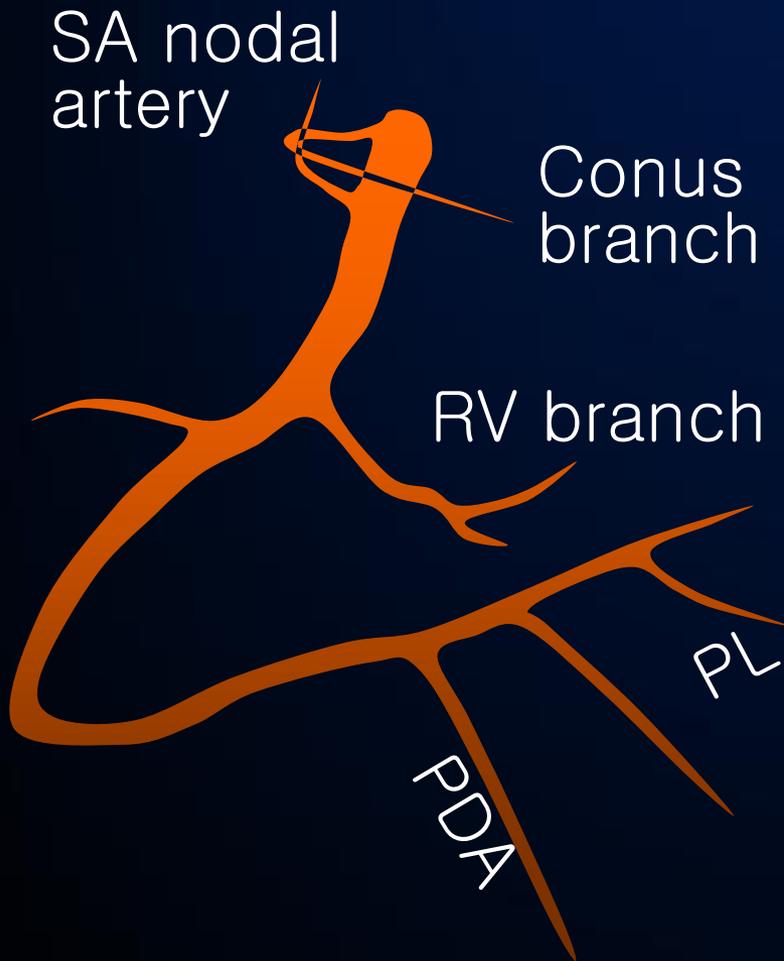
# Angiography

- 1929, Werner Forssmann
  - 1<sup>st</sup> human cardiac catheterization
  - Urethral catheter
  - Lt. antecubital vein → RA
  - Nobel prize at 1956

# Angiography machine



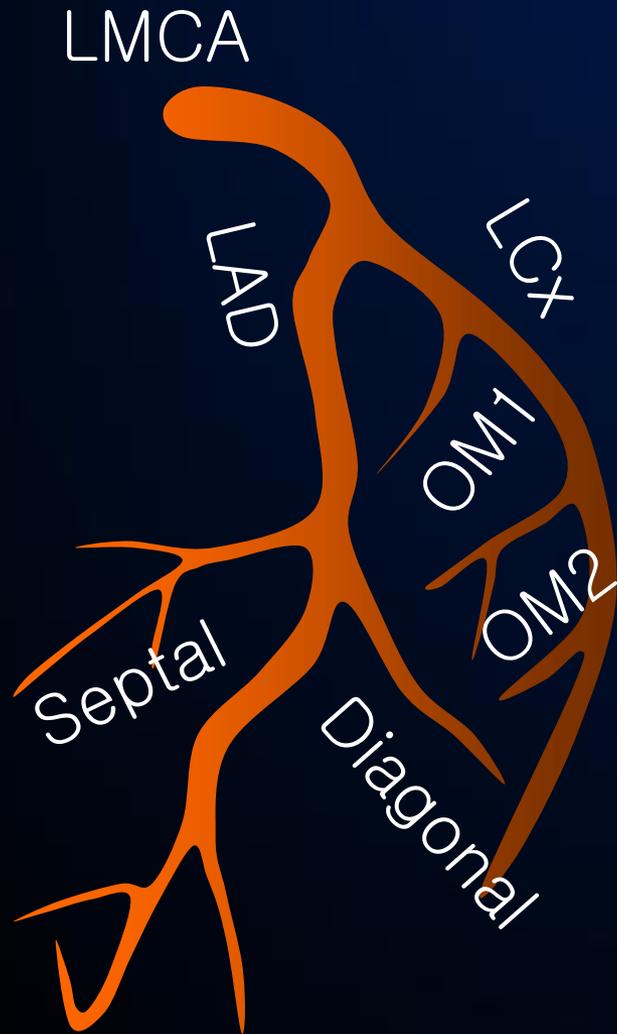
# Right Coronary Artery



# Right coronary artery

- Right dominant system(85%)
- Supplies to LV; 25-35% of LV
- Conus artery
- SA nodal artery
- RV(acute marginal) branches
- AV nodal artery
- Posterior descending artery(PDA)
- Posterolateral artery(PL)

# Left Coronary Artery

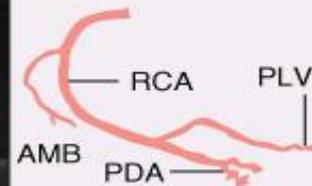
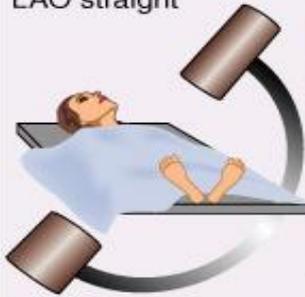


# Left coronary artery

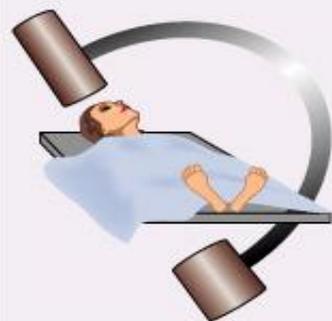
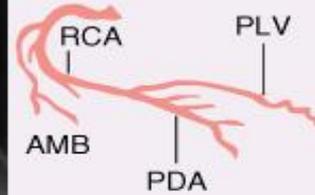
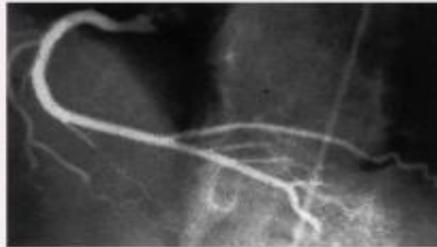
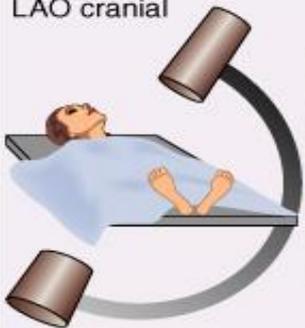
- Left main; about 10mm length
- LAD; interventricular groove, to the apex, septal br, diagonal br, ramus intermedius(1/3), supplies 45-55% of LV
- LCx; left dominant(8%), balanced (7%), OM, supplies 15-25% of LV

# Right coronary angiogram

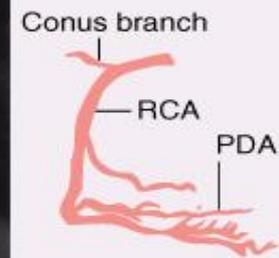
LAO straight



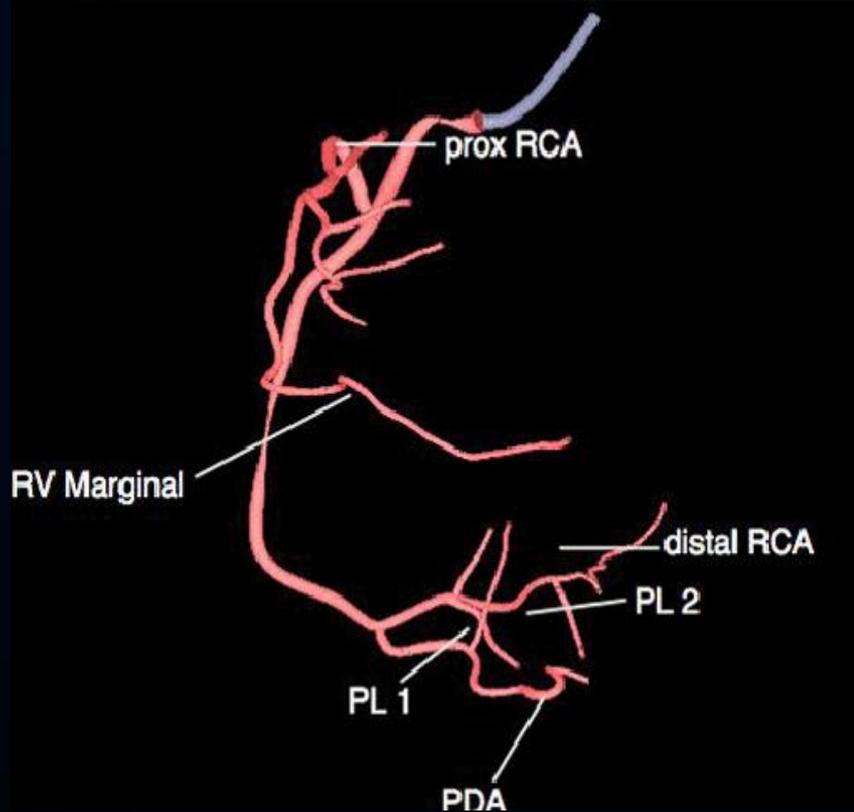
LAO cranial



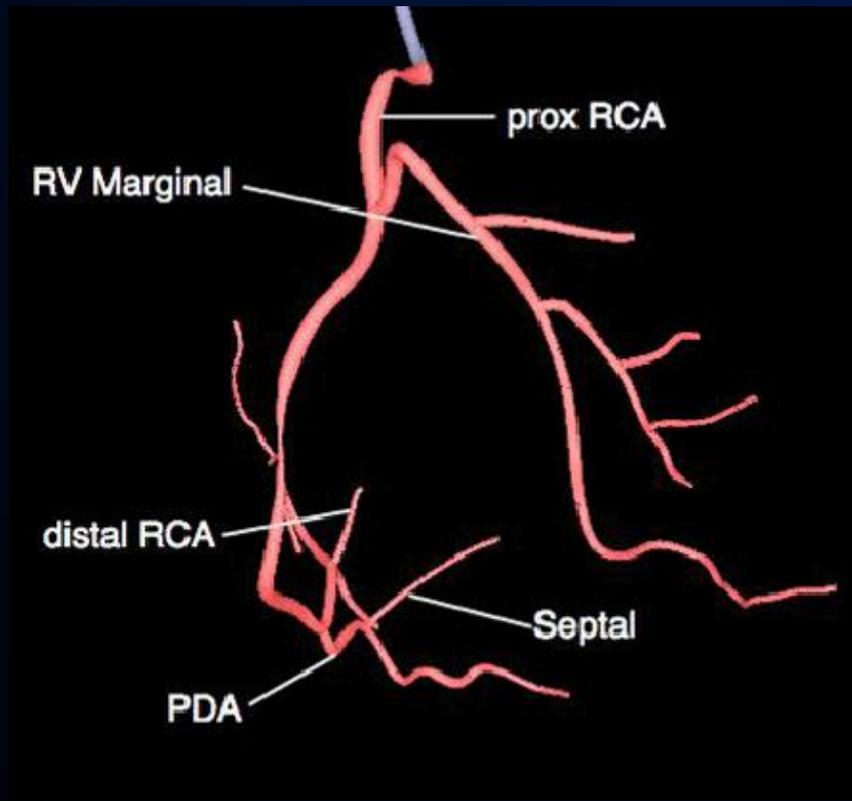
RAO straight



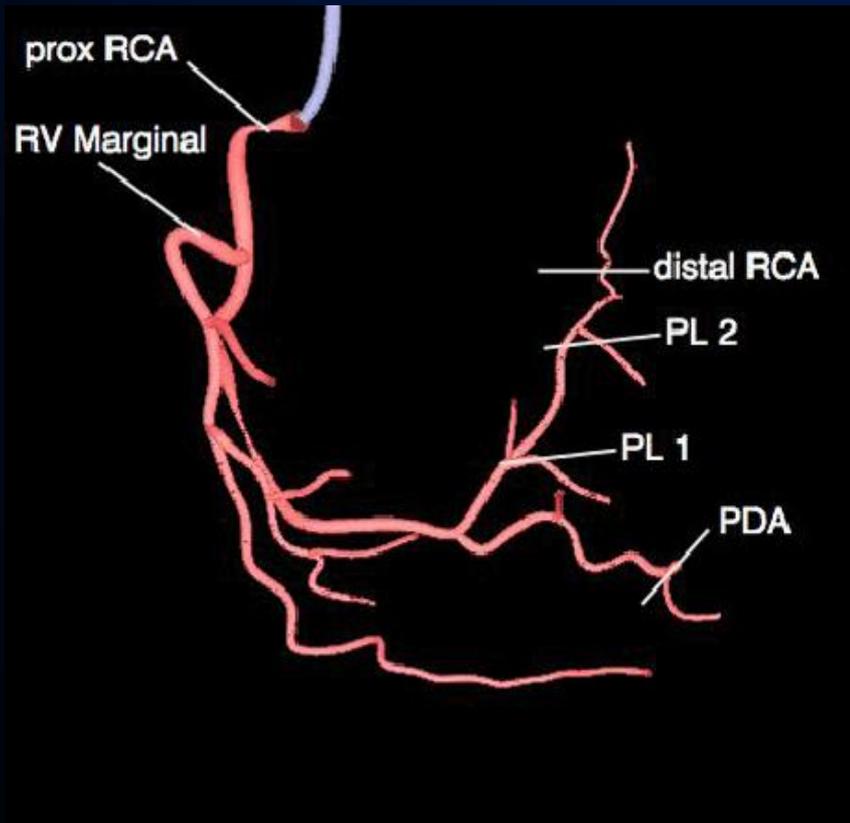
# RCA(LAO view)



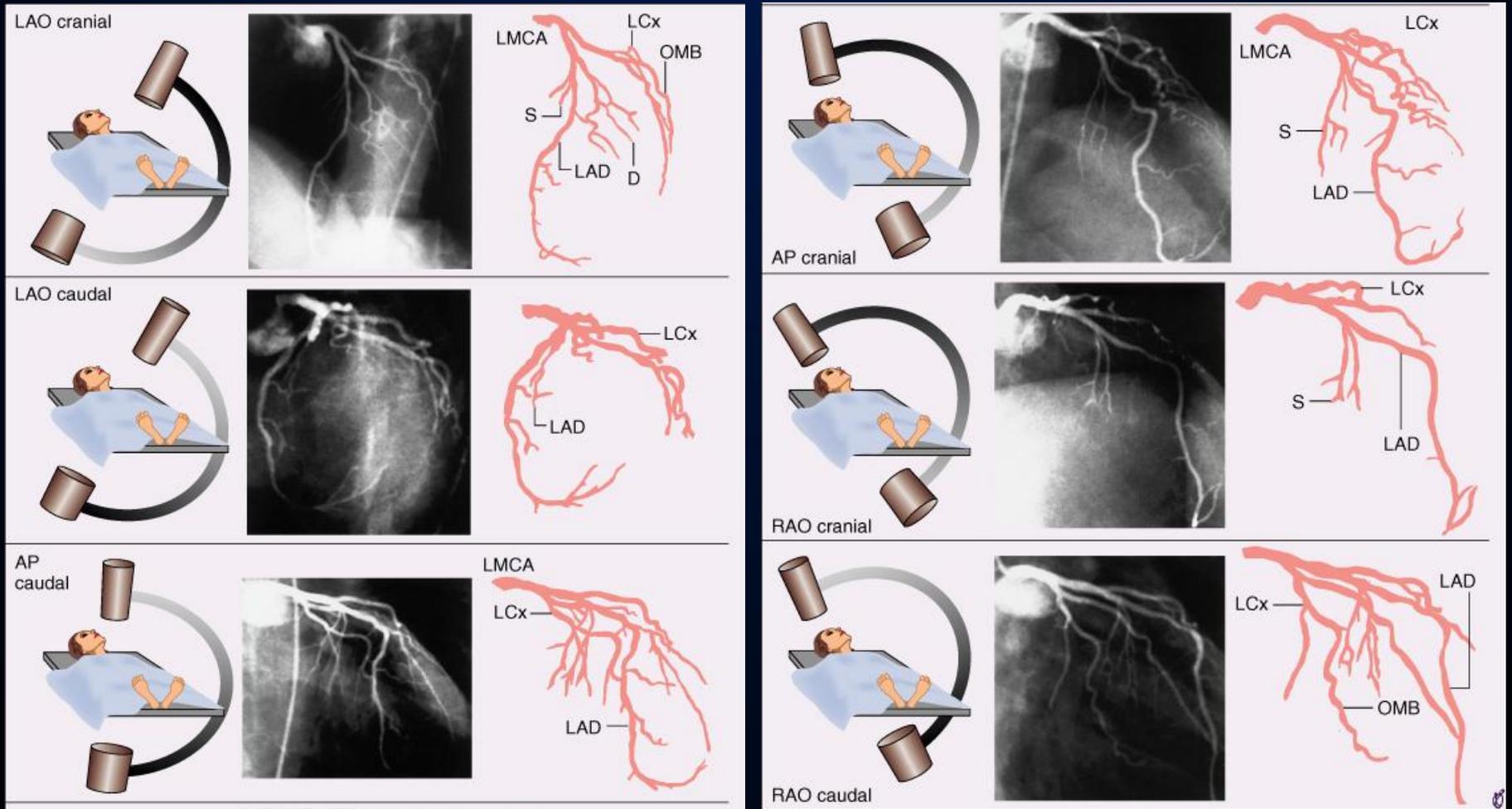
# RCA(RAO view)



# RCA(cranial view)



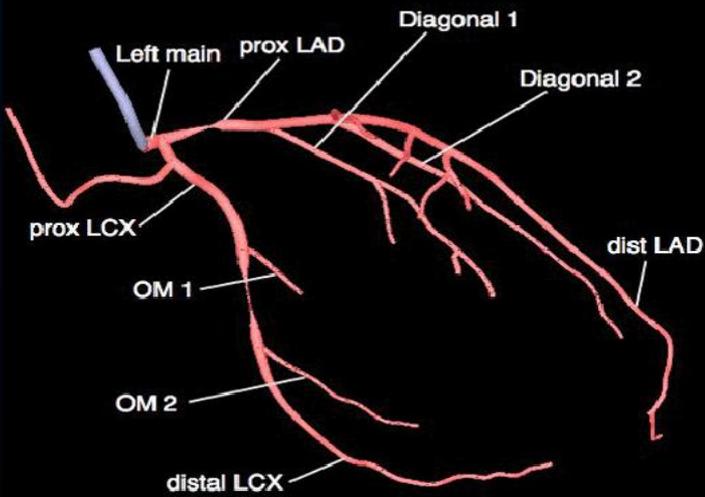
# Left Coronary angiogram



# RAO caudal



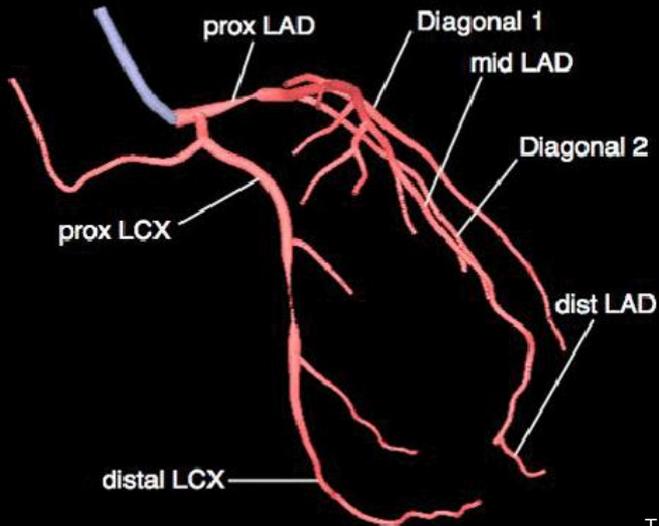
RAO: 30.0 CAUD: 30.0



# AP caudal



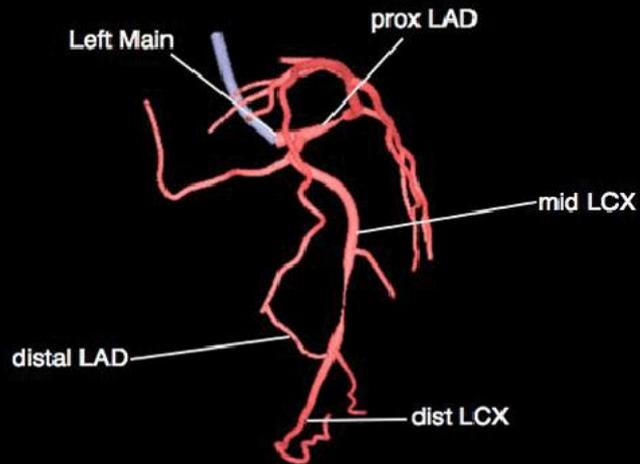
RAO: 0.0 CAUD: 30.0



# LAO caudal(spider)



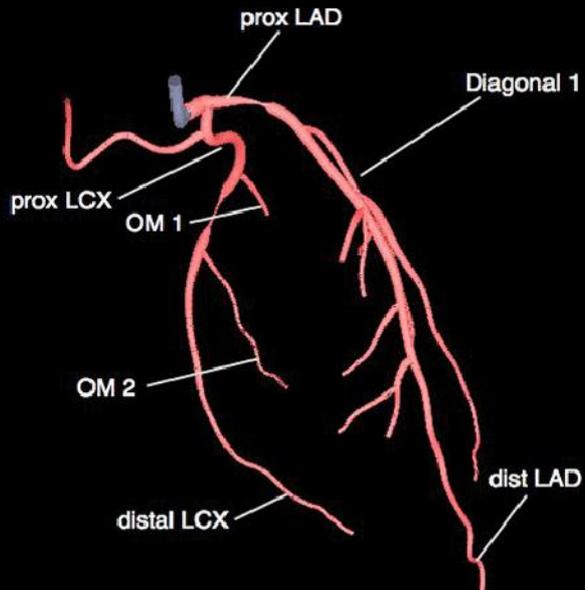
LAO: 30.0 CAUD: 45.0



# RAO cranial



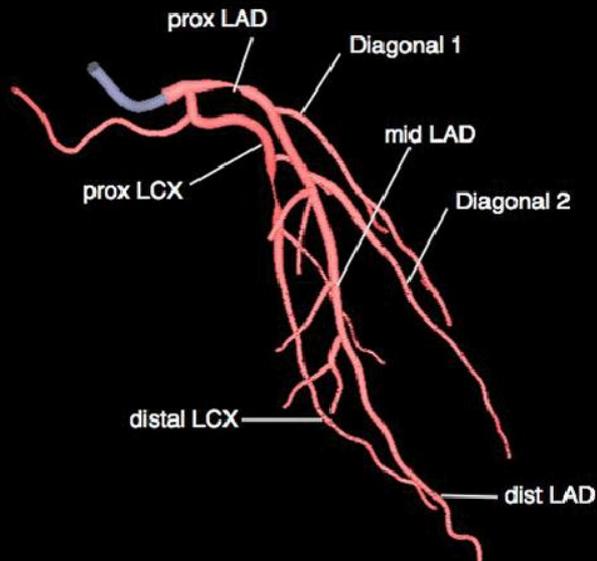
RAO: 30.0 CRAN: 30.0



# AP cranial



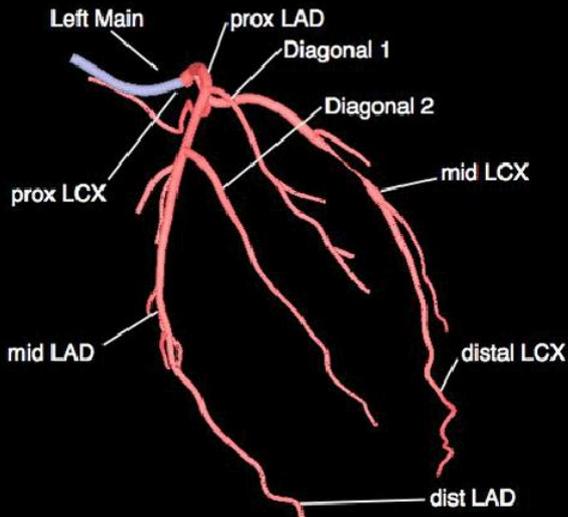
RAO: 0.0 CRAN: 30.0



# LAO cranial



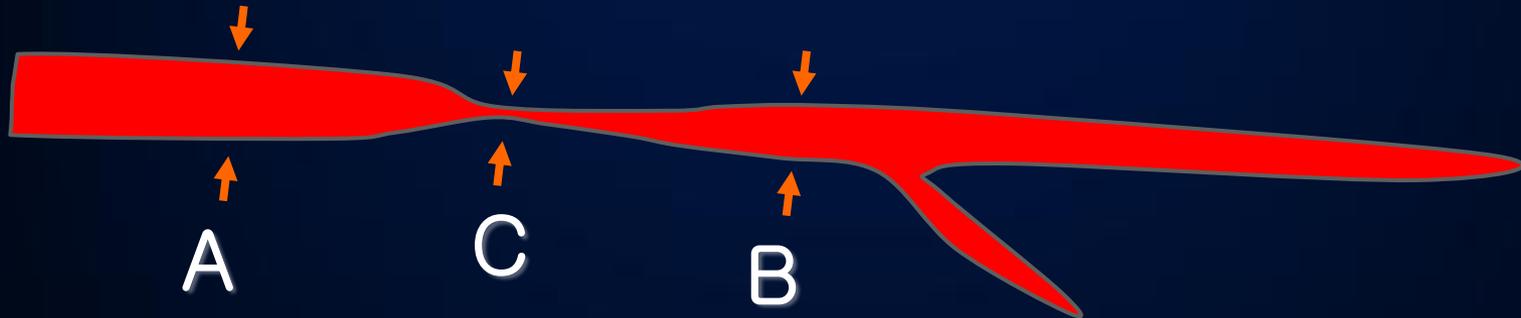
LAO: 60.0 CRAN: 30.0



# LAD vs LCx ?



# Lesion description



A; proximal reference

B; distal reference

C; minimal luminal diameter(MLD)

Reference vessel size =  $(A+B)/2$

$\% = ((\text{reference size} - \text{MLD}) / \text{reference size}) \times 100$

# Lesion description

- Number of vessel diseased; >50%, > 2mm
- LAD(LAD, Dx, Septal, RI), LCx(LCx, OM), RCA(RCA, RV, PDA, PL), LMCA, Graft(LIMA, SVG, GEA, RA)
- Ex) LAD +OM → 2 VD  
LM → 2 VD  
LM + m-RCA → 3 VD  
LAD + small PDA(< 2mm) → 1 VD

# Lesion description

- Lesion length
- Discrete( $<10$  mm), Tubular(10~20 mm), Diffuse( $>20$  mm)
- Tortuosity
- Calcification
- Thrombus
- angulation

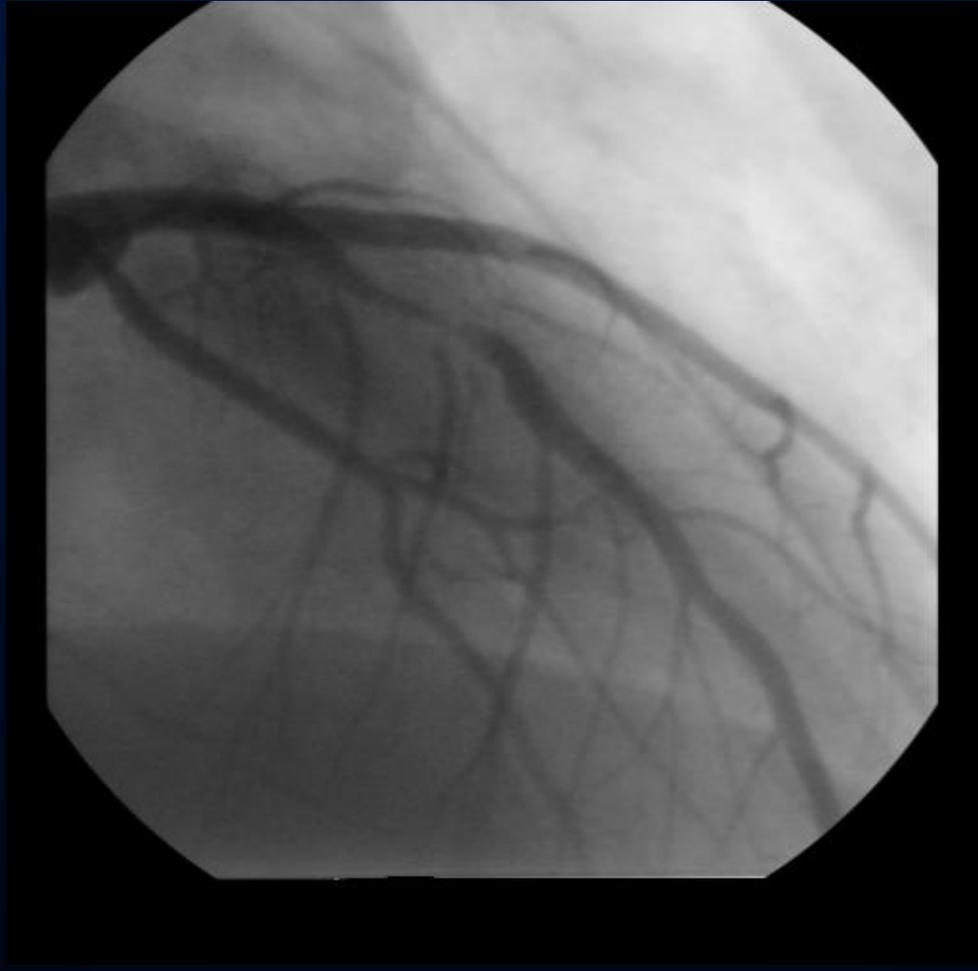
# Lesion description

- OS lesion; Origin of the lesion  $\leq 3$ mm of the vessel origin
- Bifurcation lesion

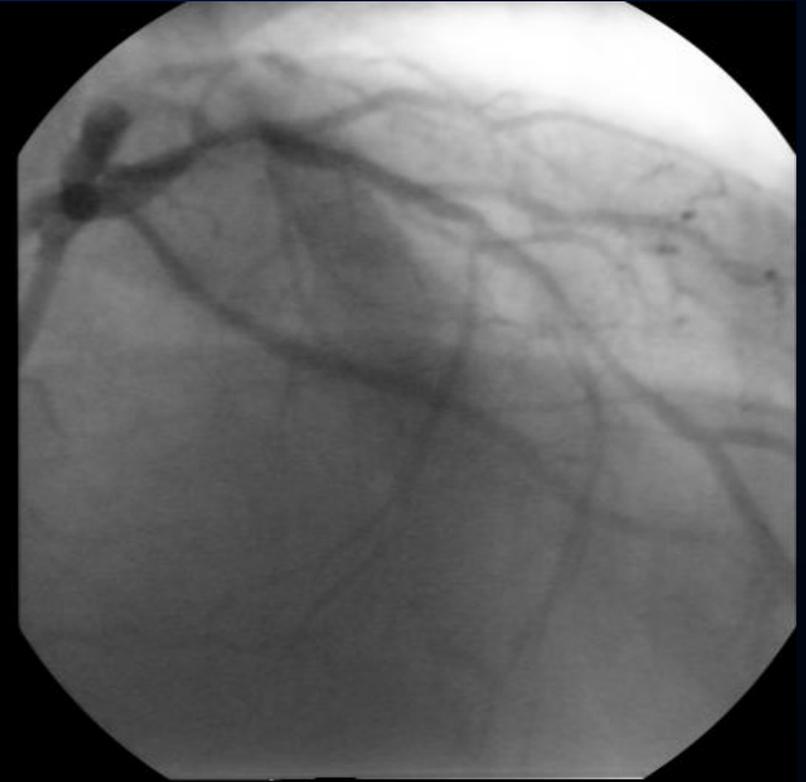
# Discrete lesion



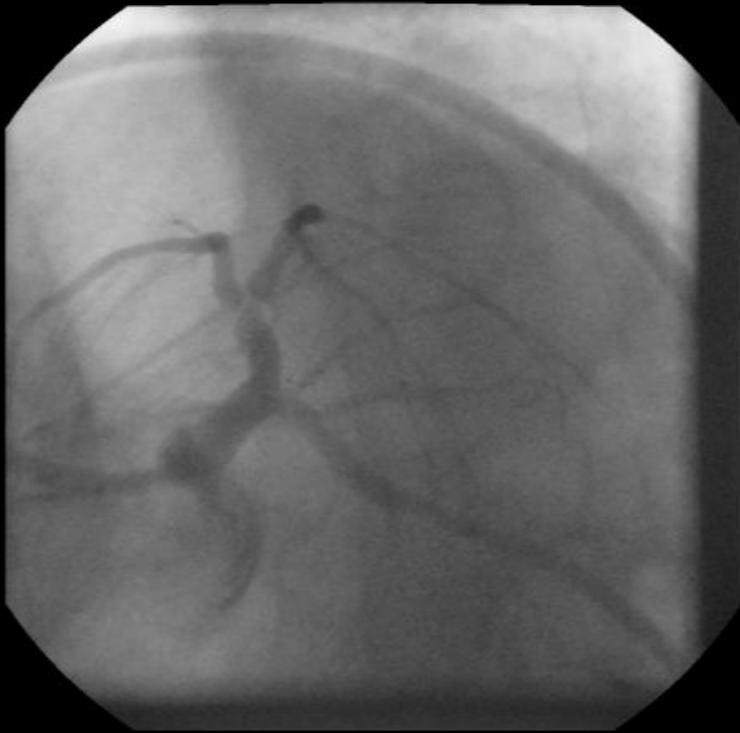
# Tubular lesion



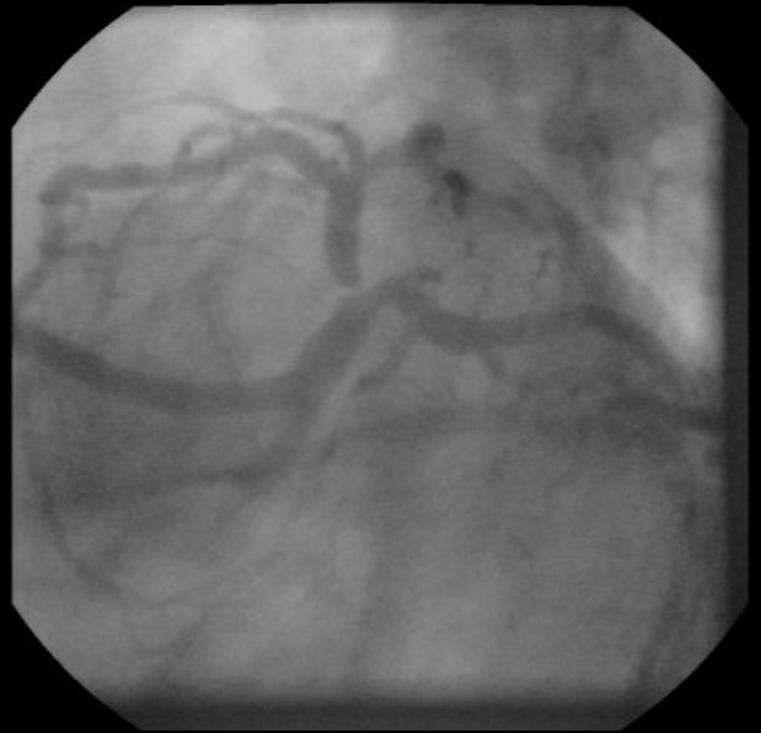
# Diffuse(long) lesion



# Bifurcation lesion



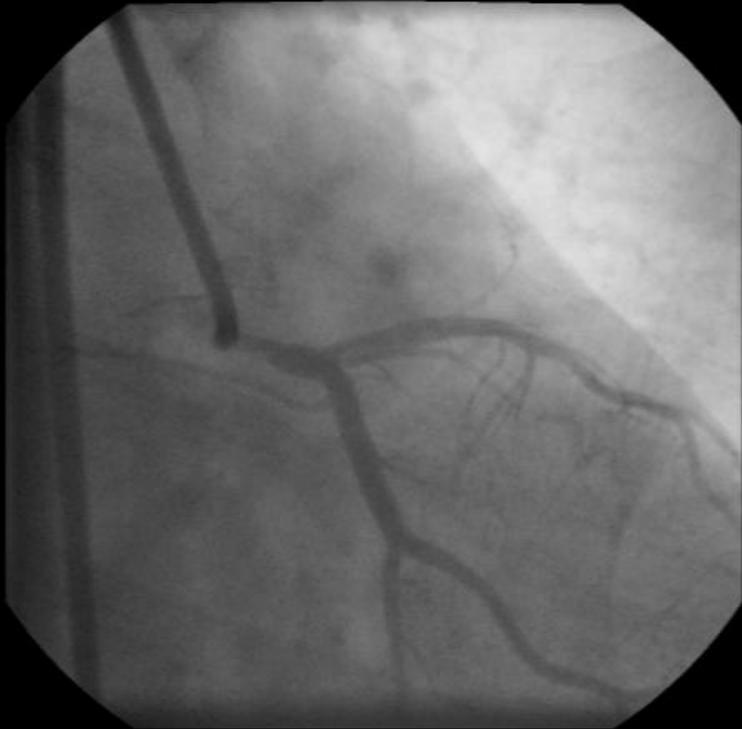
# Bifurcation lesion



# LAD os lesion



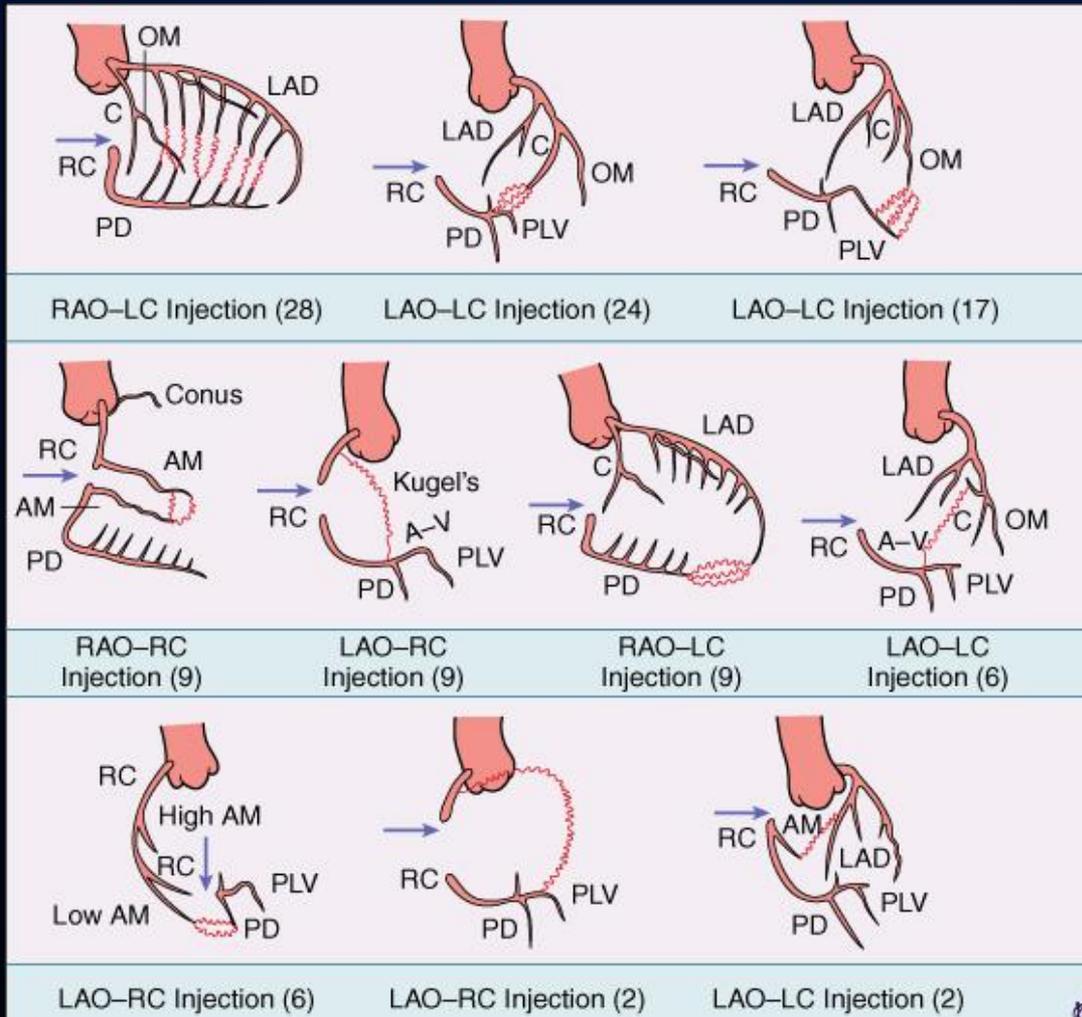
# LM os lesion



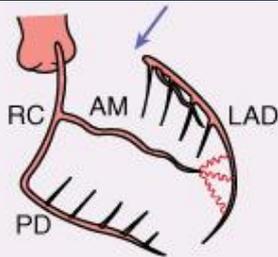
# Collaterals

- Intercoronary collaterals
- Intracoronary collaterals

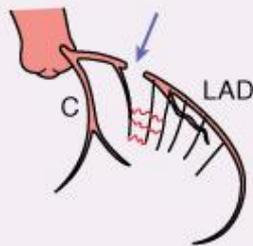
# Collaterals in RCA occlusion



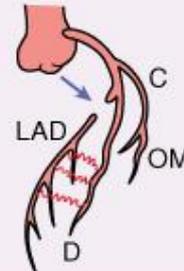
# Collaterals in LAD occlusion



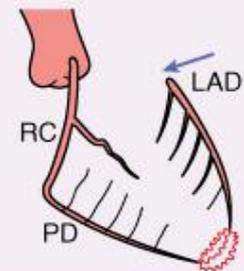
RAO-RC Injection (28)



RAO-LC Injection (27)



LAO-LC Injection (6)



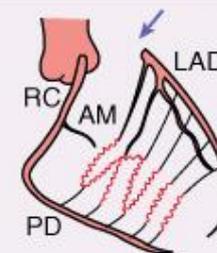
RAO-RC Injection (3)



LAO-LC Injection (17)



RAO-RC Injection (15)

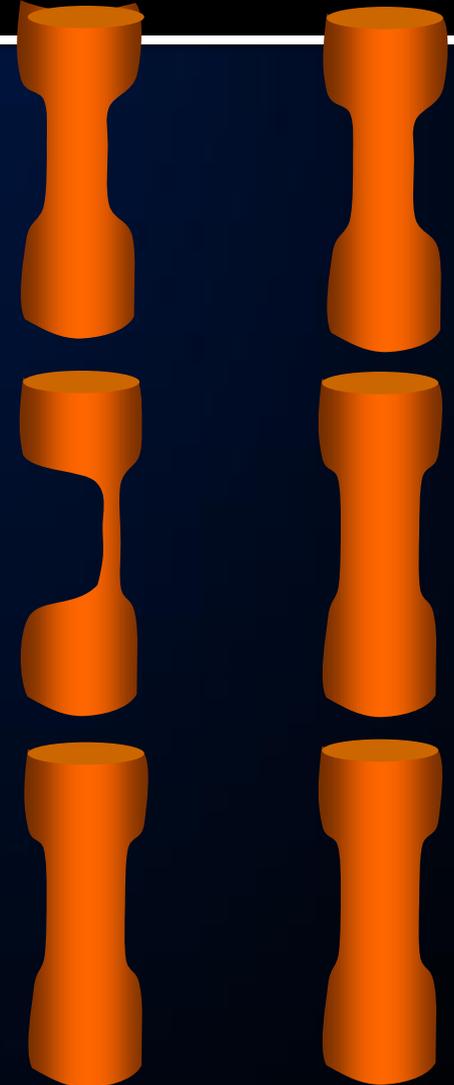
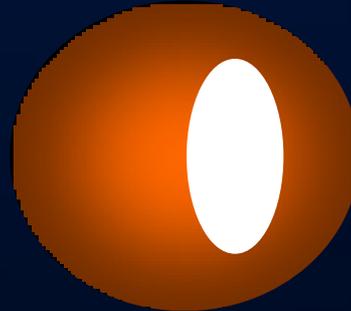
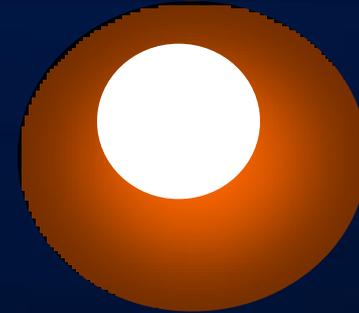
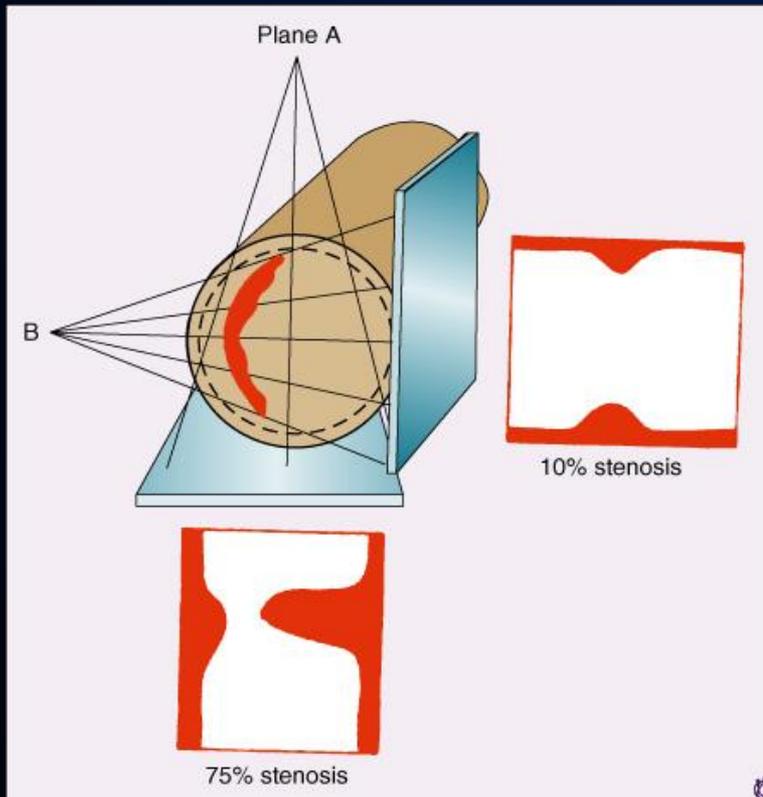


RAO-RC Injection (3)

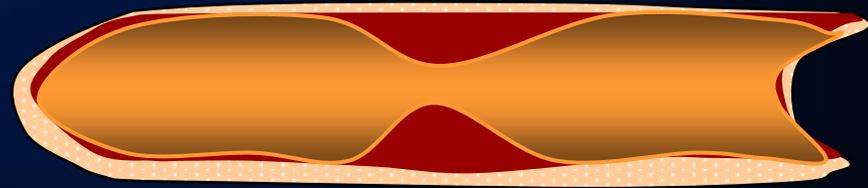
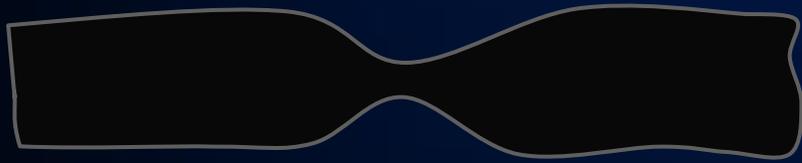
# TIMI(thrombolysis in MI) grade

- TIMI 0 ; no perfusion
- TIMI 1 ; slow and incomplete perfusion
- TIMI 2 ; slow but complete perfusion
- TIMI 3 ; normal flow

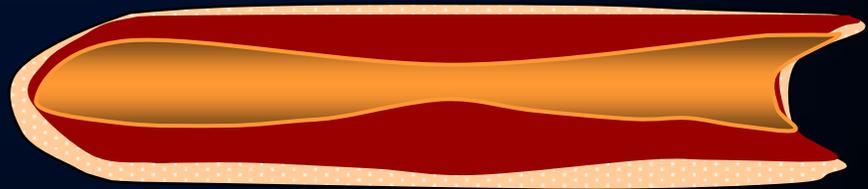
# Pitfall of coronary angiogram



# Pitfall of coronary angiogram



*Focal narrowing*

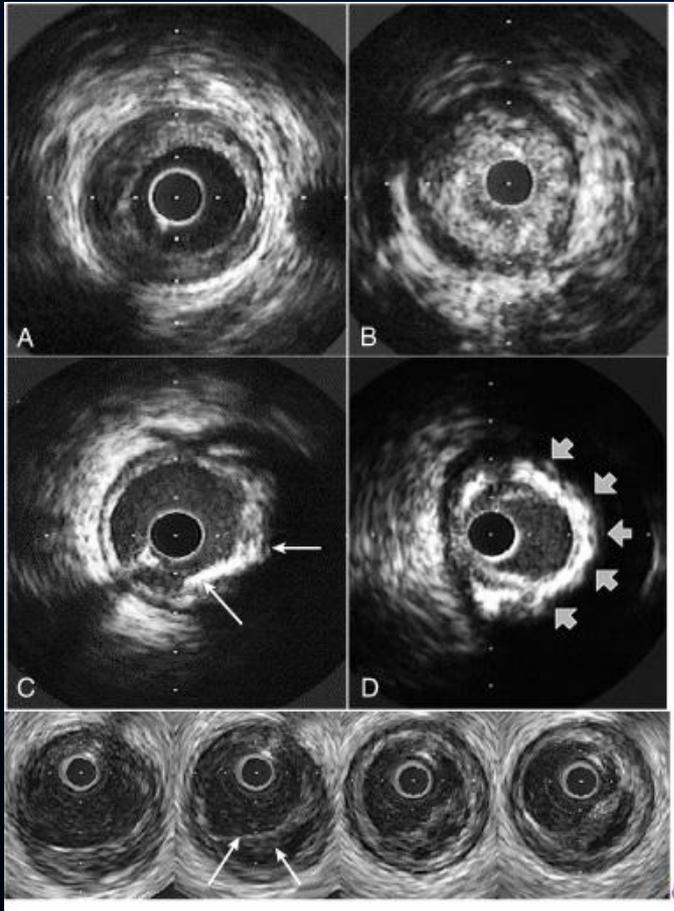


*Diffuse narrowing*

# Pitfall of coronary angiogram

- How to solve it?
- Multiple projection with different angle
- Normal caliber of major coronaries
- LMCA;  $4.5 \pm 0.5$  mm
- LAD ;  $3.7 \pm 0.4$  mm
- LCx;  $3.4 \pm 0.5$  mm for nondominant  
 $4.2 \pm 0.6$  mm for dominant
- RCA;  $2.8 \pm 0.5$  mm for nondominant  
 $3.9 \pm 0.6$  mm for dominant
- IVUS examination
- Functional study; CFR(coronary flow reserve),  
FFR(fractional flow reserve)

# Intravascular ultrasound



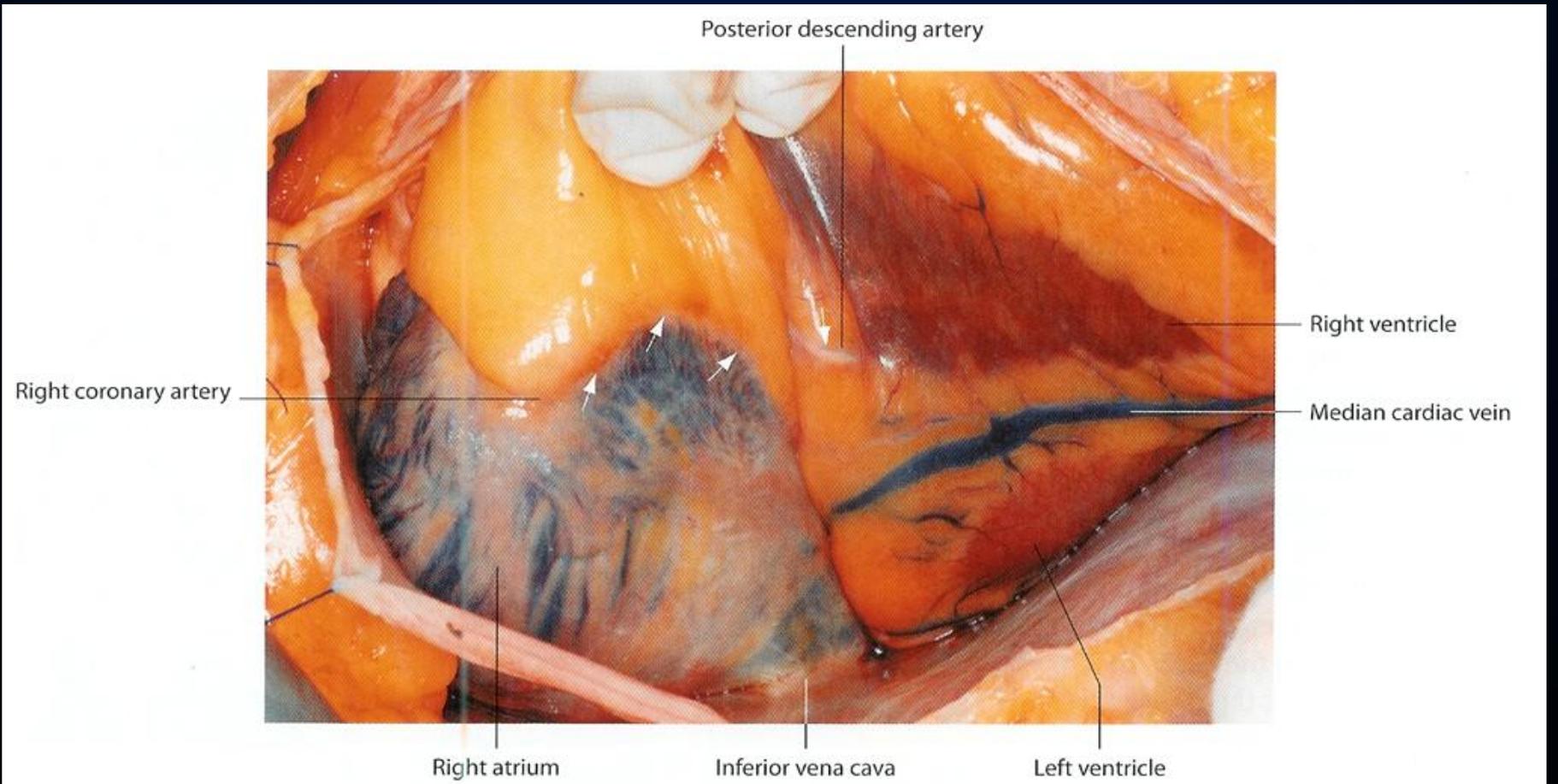
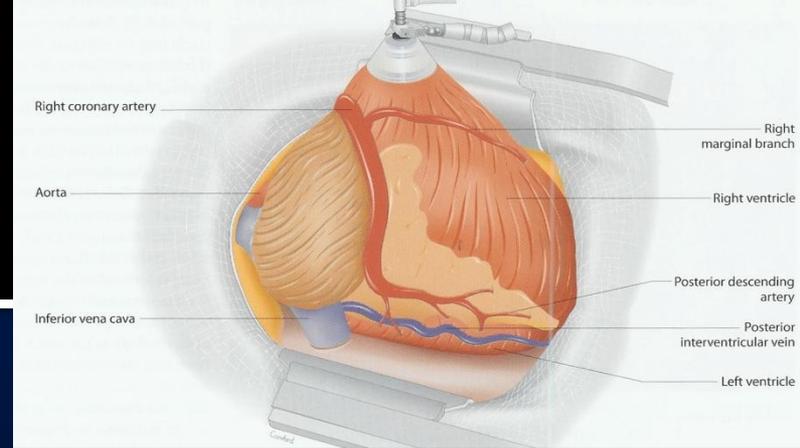
- % Area stenosis
- % Plaque burden
- Neointimal Area

# Anatomical variation

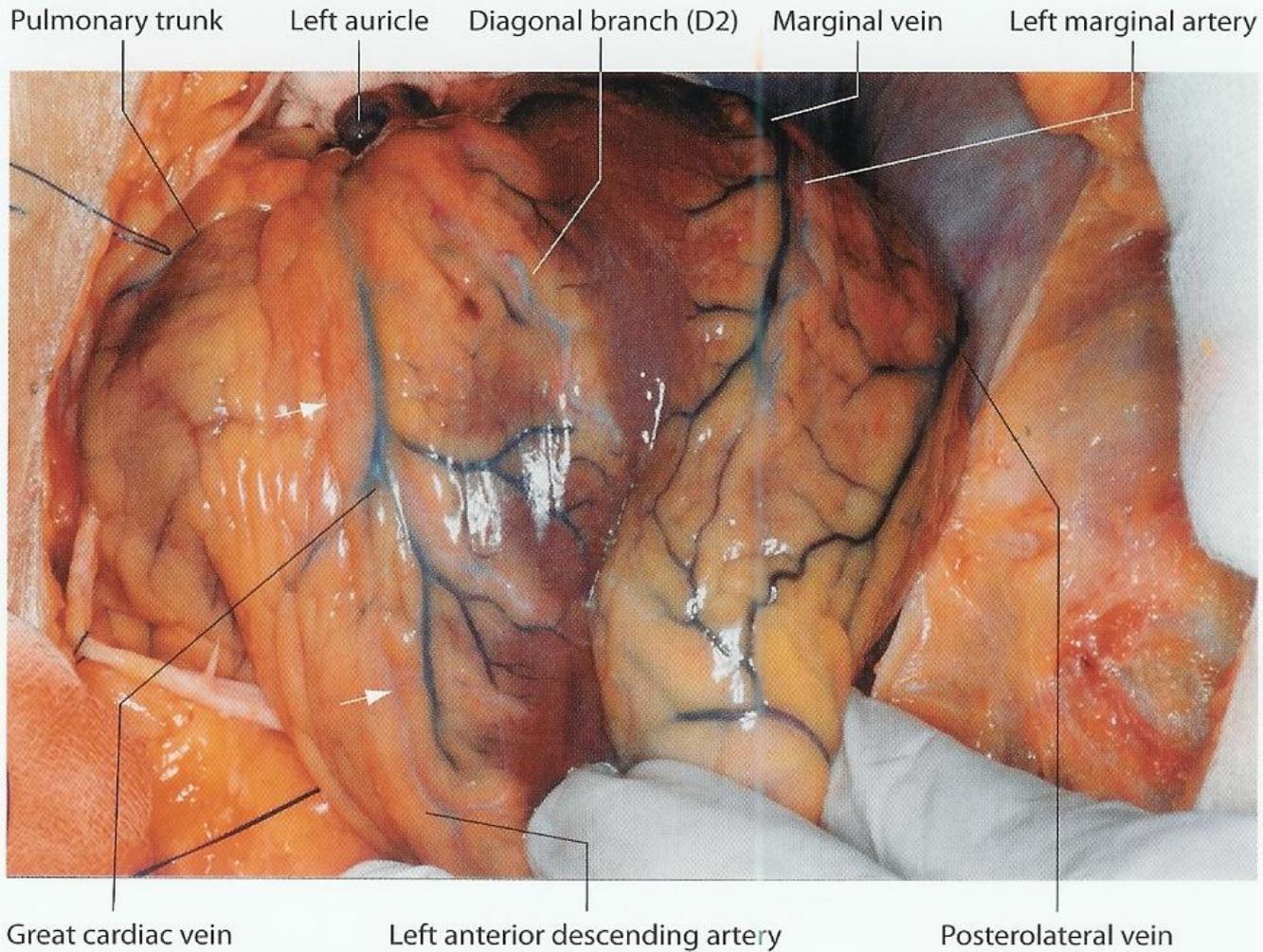
- **Anomalies of origin**
  - High take-off
  - Multiple ostia
  - Single coronary artery
  - Anomalous origin from pulmonary artery
  - Origin from systemic vessels
- **Anomalies of origin & course**
  - Origin of coronary artery from opposite sinus (ACAOS)
  - Course between great vessels
- **Anomalies of course**
  - Myocardial bridge
  - Duplication of arteries
- **Anomalies of termination**
  - Coronary artery fistula
  - Coronary arcade
  - Extracardiac termination

# Surgical view

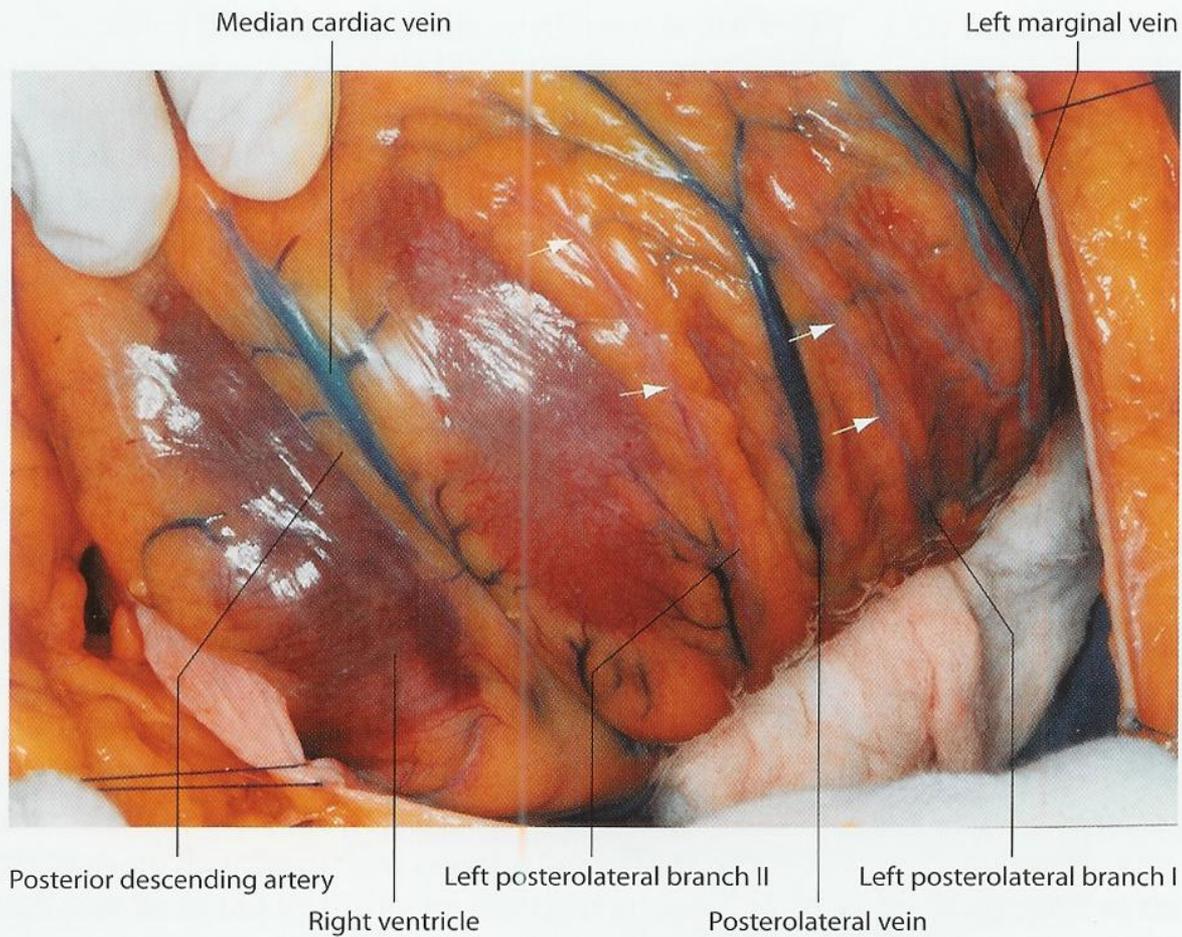
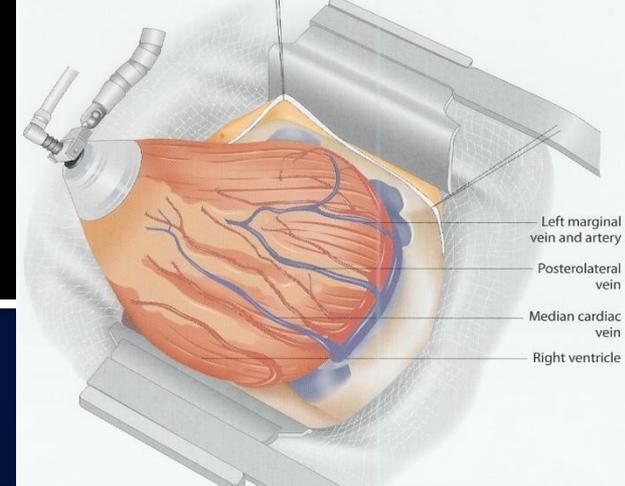
# RCA



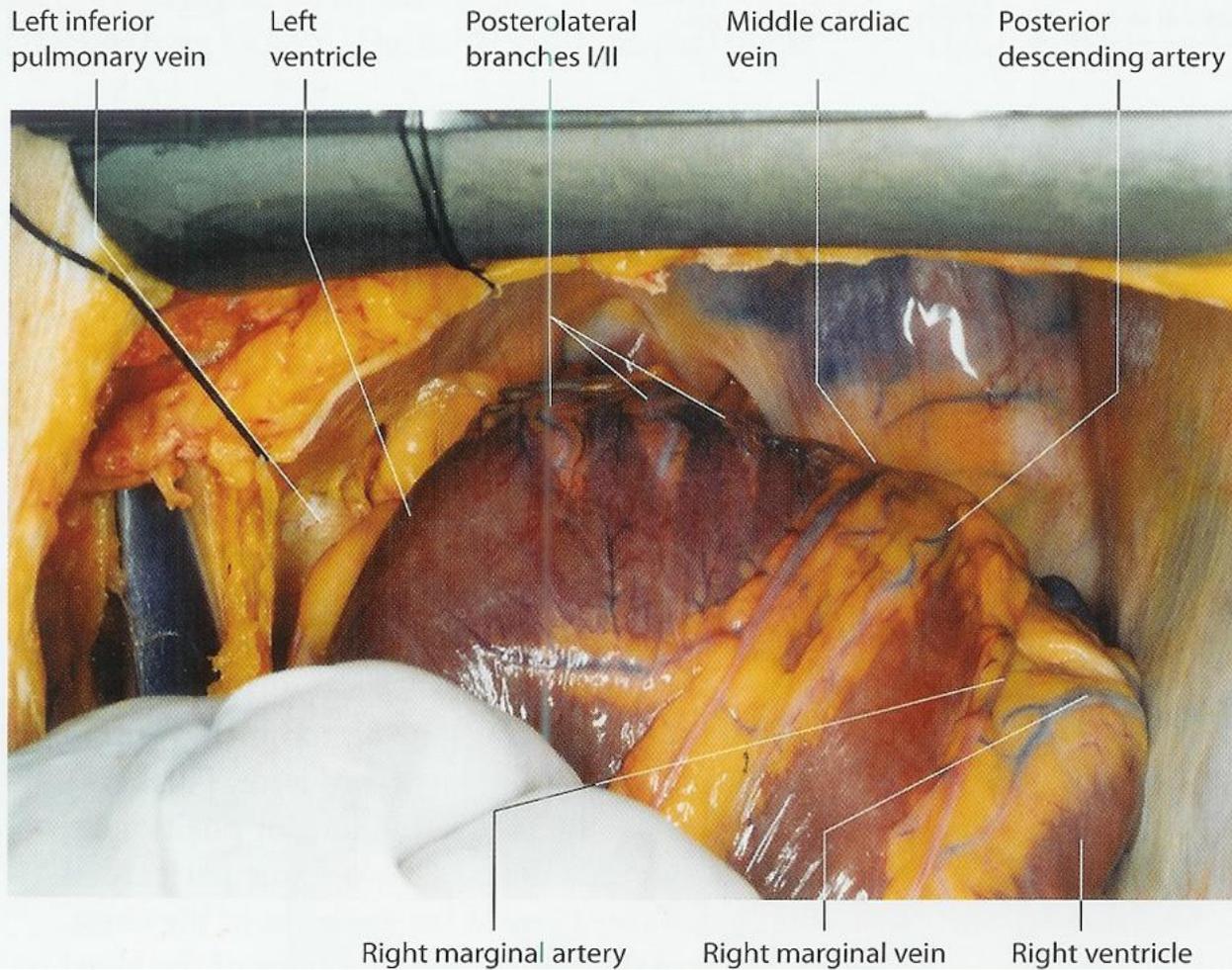
# LAD, Dx



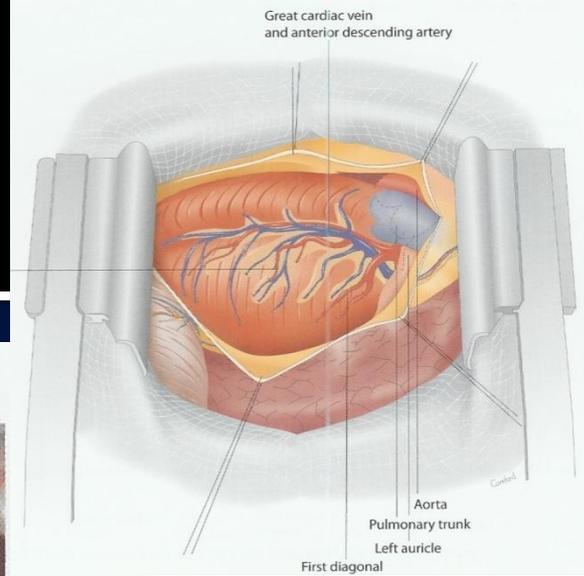
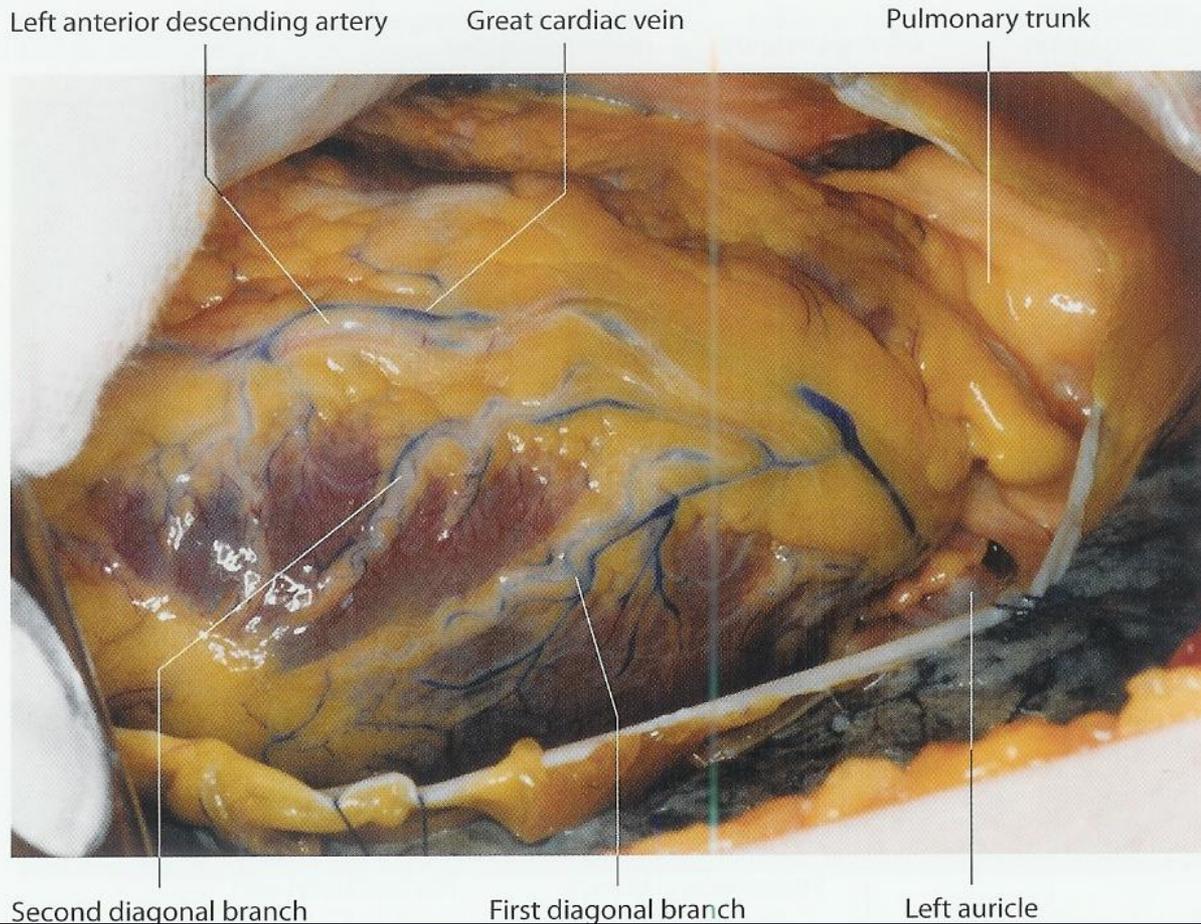
# PDA, PL



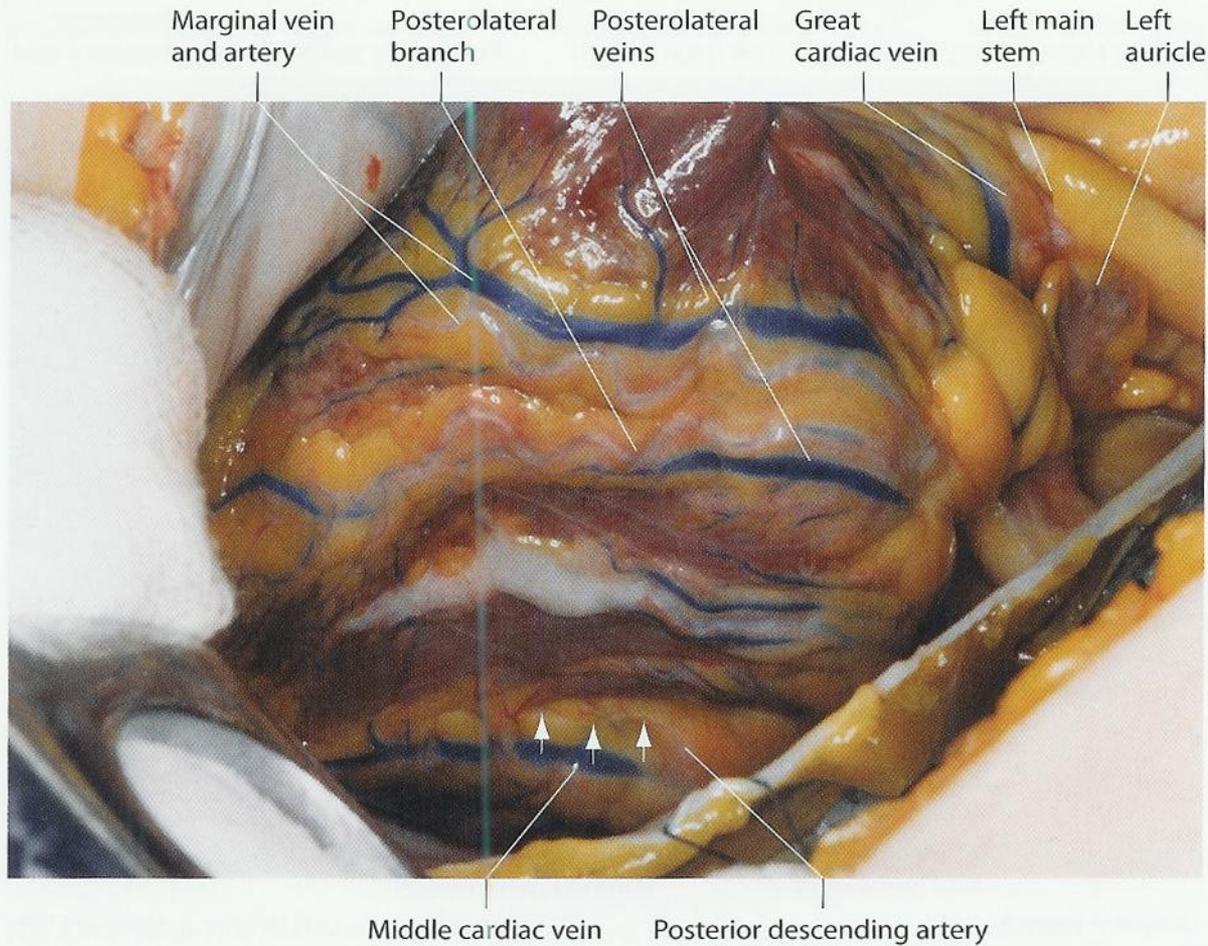
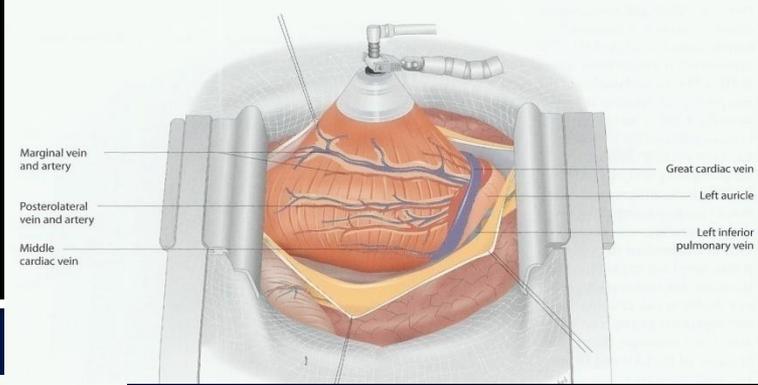
# PDA, PL



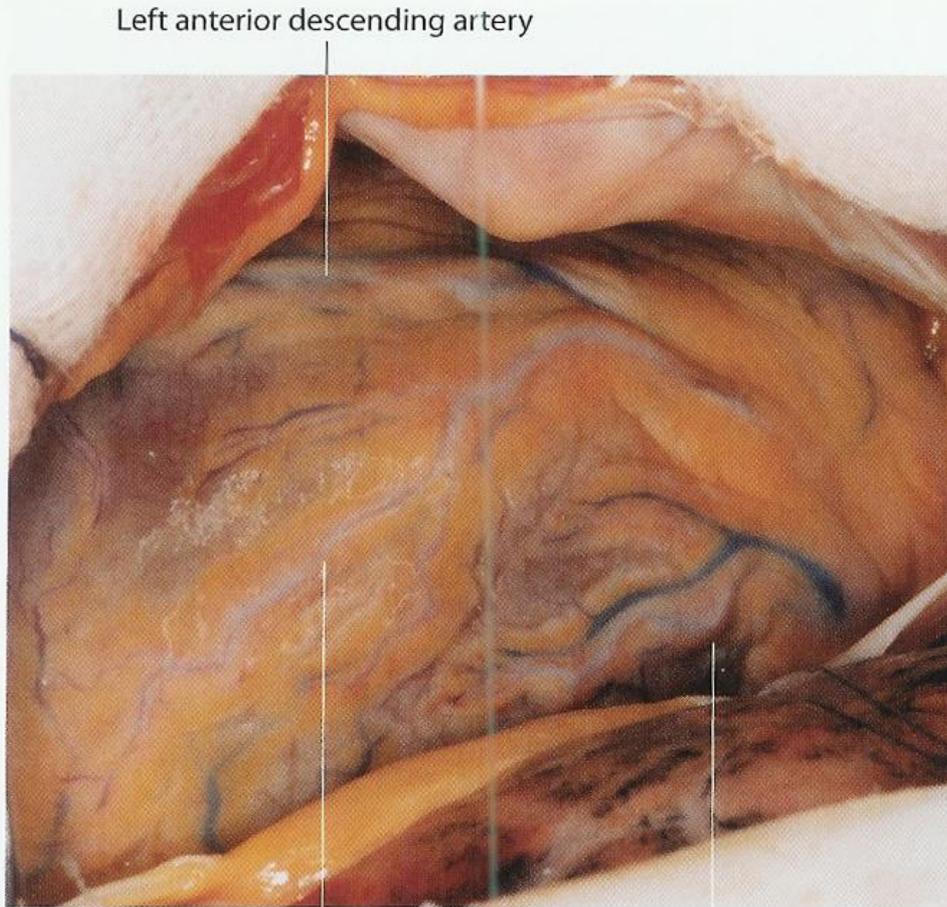
# LAD, Dx



# PDA, PL

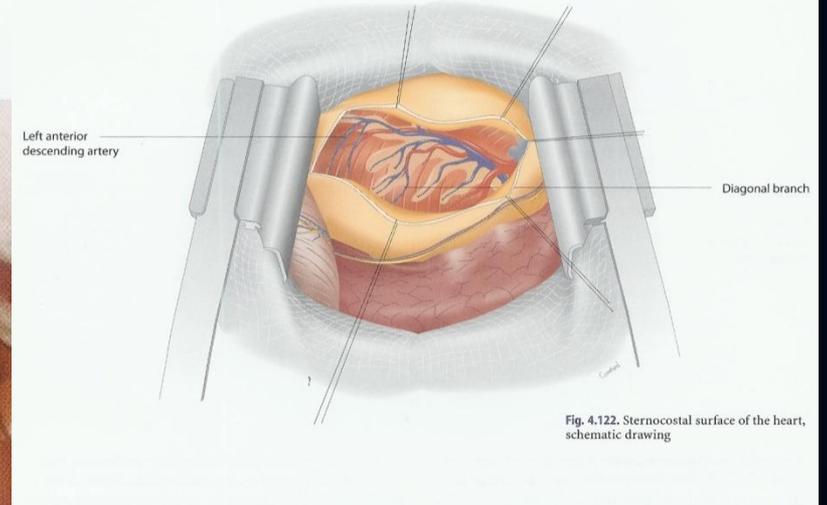


# Left anterior thoracotomy(LAD, Dx)

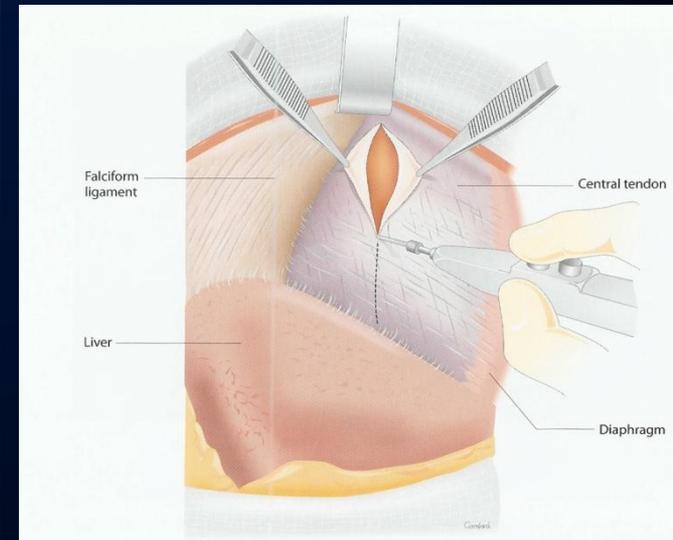
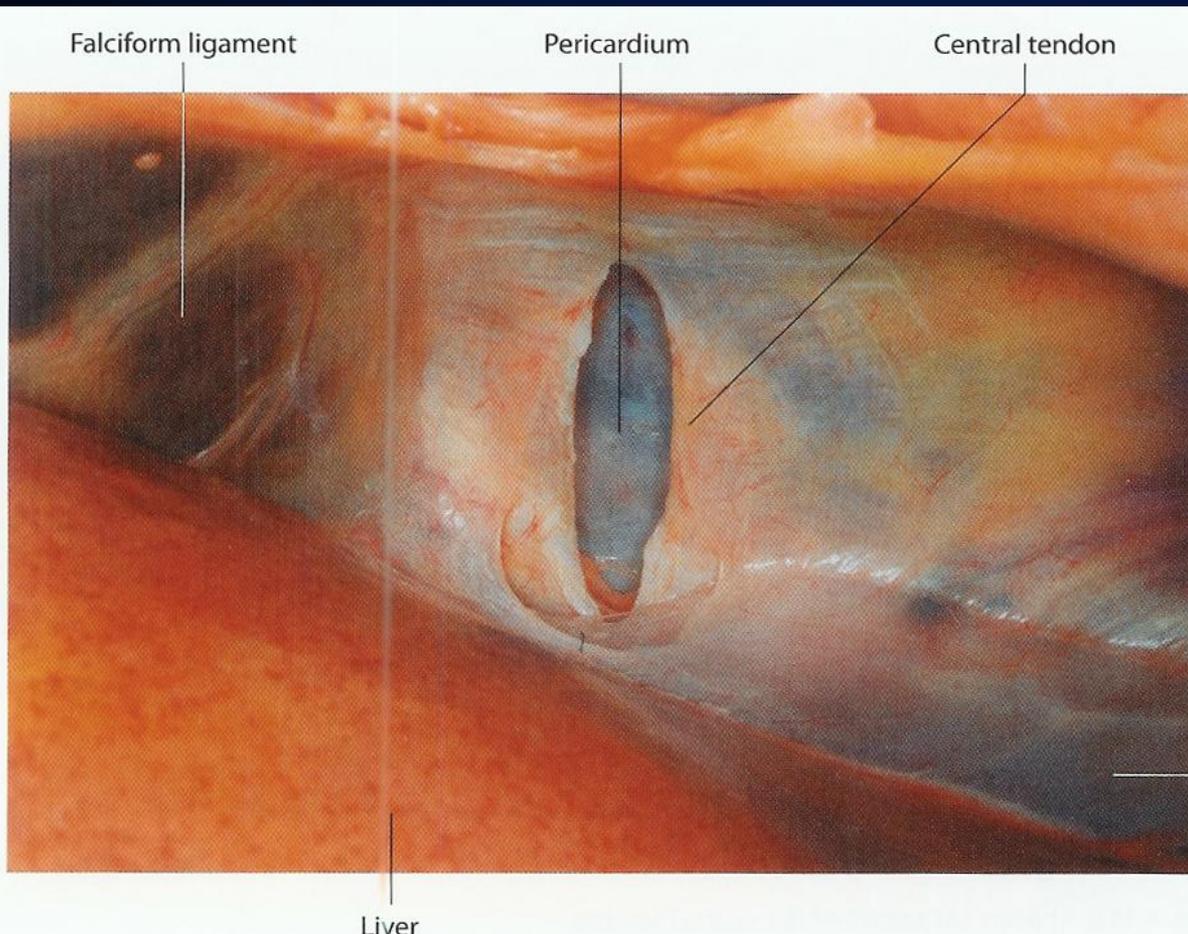


Second diagonal branch

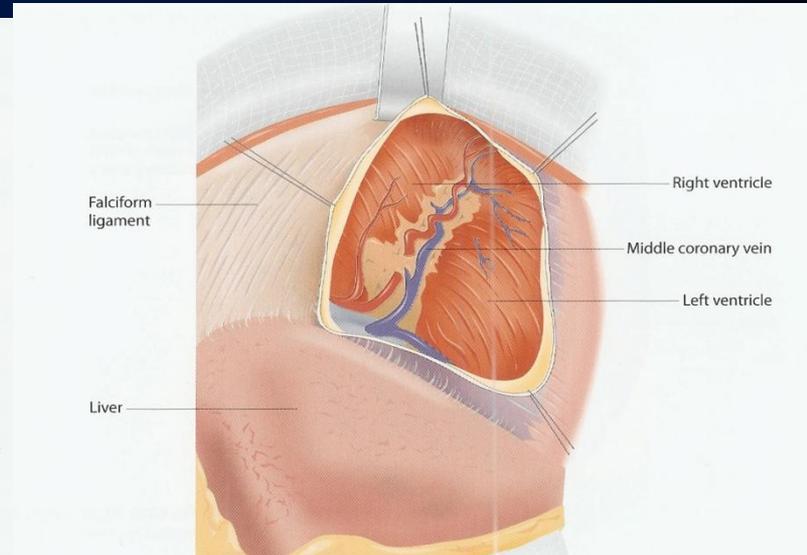
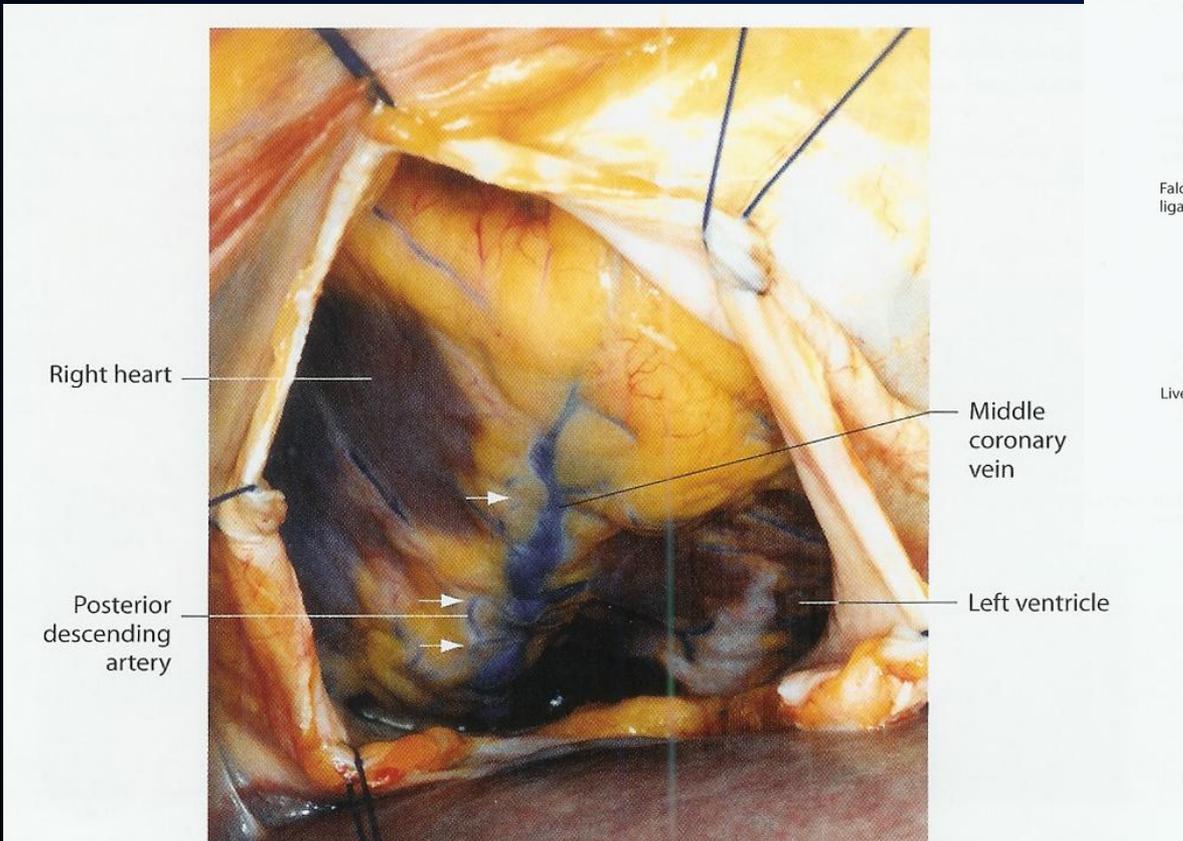
First diagonal branch



# Transdiaphragmatic approach



# Transdiaphragmatic approach(PDA)

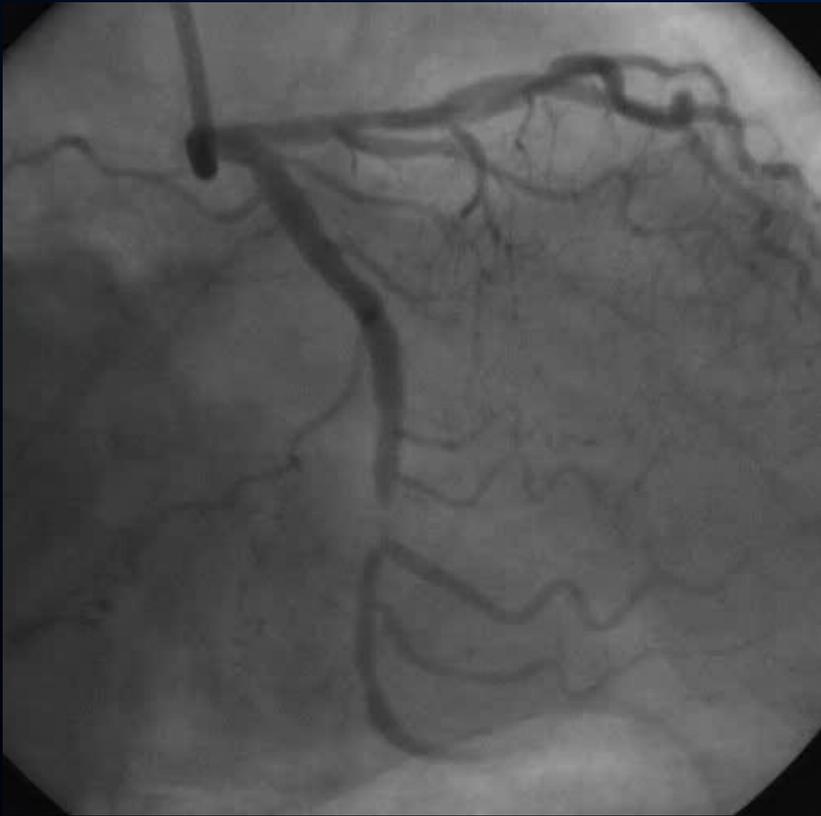


# Case study

# Ramus, LAD diffuse



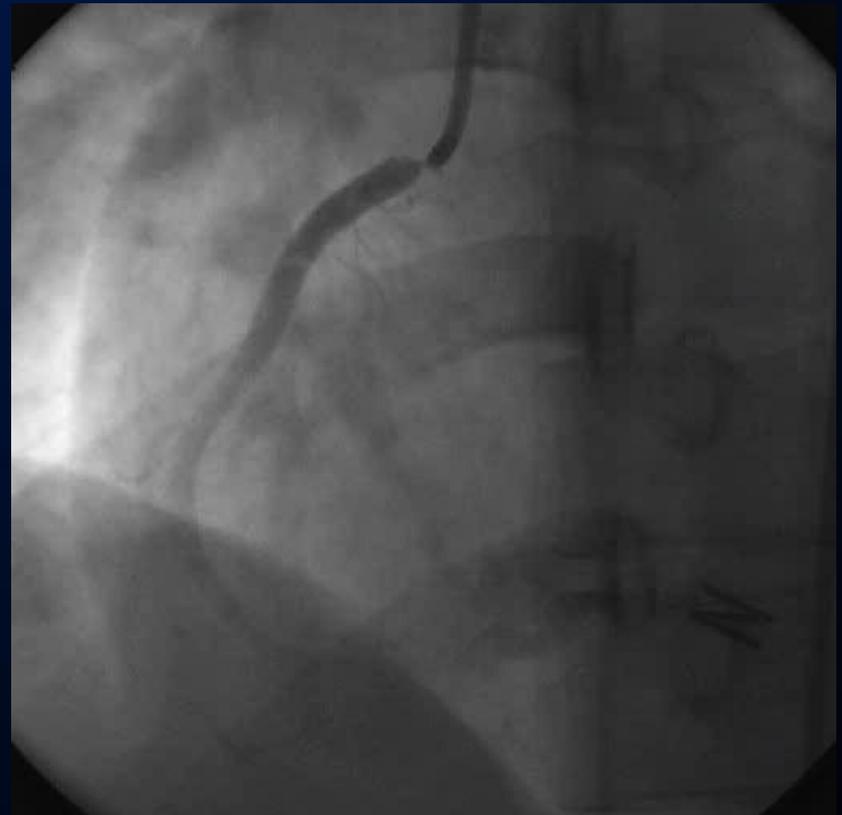
# m-LCx discrete, p-LAD diffuse



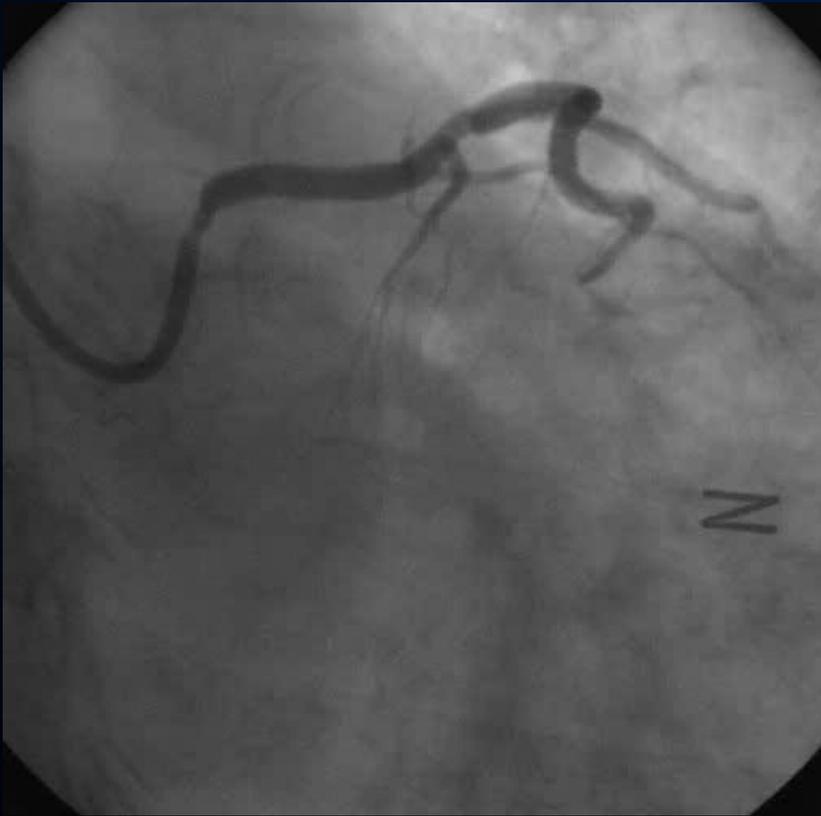
# 1<sup>st</sup> Dx total occlusion



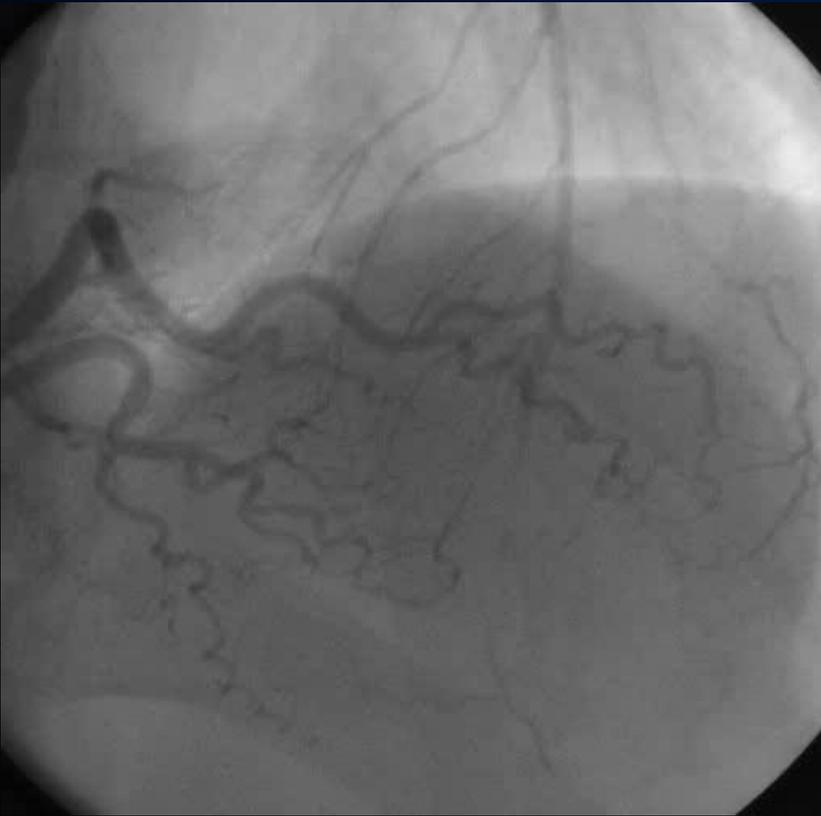
# Both ostial lesion



# Double left coronary os



# p-LAD total occlusion



# p-LAD total occlusion with aneurysm



# Myocardial bridge

