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INDICATIONS FOR CORONARY ANGIOGRAPHY (CAG)

Class I: STEMI: Acute, NSTEMI: < 72 hours (timing based on risk stratification).
Class I: Disabling stable angina pectoris (CCS III-IV) despite medical therapy or high-risk criteria on clinical assessment / noninvasive testing or unexplained heart failure or survivors of cardiac arrest or severe ventricular arrhythmias or angina in conjunction with signs of heart failure or unexplained heart failure or early recurrence of angina after PCI/ CABG or pre cardiac valve surgery (♂: >35 yrs, ♀: >50 yrs.).
Class IIa: Inconclusive or conflicting results after noninvasive stress testing or unable to undergo noninvasive testing (disability, illness, or morbid obesity) or reevaluation of performed procedures (main stem PCI, high restenosis risk).
Class III: Risk of CAG outweighs the benefit (significant comorbidity) or mild angina (CCS class I or II) responding well to medical therapy. **ALWAYS USE COMMON SENSE!**

EFFICIENT CAG

Systemic evaluation of the coronary tree: → do not miss any occluded vessel or any anomaly.

- Coronary lesions have often an eccentric appearance →make several orthogonal projections to be sure you do not miss an eccentric stenosis.
- Be sensitive to catheter wedging, ostial lesions, catheter induced coronary artery spasm and over projection of tortuous vessels.
- Assess projections with a meaning:

RCA:	Proximal:	**L 45** (15-50), **Cranial** 0 (0-35)
	Mid:	**L 45**, **R30** (0-45)
	Crux:	**L 25** (15-50), **Cranial 25** (0-35)
LCA:	Left main:	**R0** (0-10), **Cranial 0** (-40 to +40)
	LAD: proximal	**R5** (5-45), **Cranial 35** (Caudal -40 to +40)
	LAD: mid / distal	**R 30** (-50-30), **Cranial 30** (0-40)
	RCx: proximal	**L45** (-5-50), **Caudal 30** (20-40)
	RCx: OM mid -distal	**L45** (-5-50), **Caudal 35** (-30-40)
LV angio:		**R** 30-0, **L**45-0
Aorta angio:		**R** 20-0, **L**45-0

RIGHT CARDIAC CATHETERIZATION (NORMAL VALUES)

Location	**Pressure** (mmHg)	**Saturation** (%)
RA	a (2-10), v (2-10)	75
RV	0-30	75
PAP	3-30	75
PCWP	a (3-15), v (3-12)	97
Cardiac Output (CO)	3-6 l/min	
Cardiac Index CI=CO/BSA	2.5-3.5 l/min/m^2	
Pulmonary Vascular Resistance PVR=(PAP-PCWP)/CO	20-130 dynes • sec • cm^{-5}	
Systemic Vascular Resistance SVR= (P_{aorta}-RAP)/CO	700-1600 dynes • sec • cm^{-5}	

(RELATIVE) CONTRA-INDICATIONS FOR CAG

Symptomatic heart failure or uncontrolled hypertension or refractory arrhythmia or severe contrast medium allergy or inability for patient cooperation or pregnancy or active infection or severe renal failure or coagulopathy / anticoagulant state (high INR / PT) or severe hemorrhage or intoxication (digitalis) or electrolyte disturbance (hypokaliema).

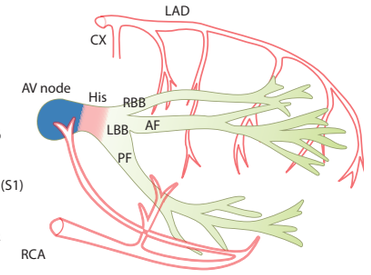
INTRACORONARY PARAMETERS OF STENOSIS SEVERITY

While coronary angiography is used as the gold standard for documentation of the presence and extent of coronary artery disease, it has its limitations in assessing the functional significance of coronary stenoses and particularly in intermediate coronary lesions i.e. lesions with diameter stenosis 40-70%. Therefore, intracoronary derived pressure, flow and intravascular ultrasound (IVUS) parameters have been validated for clinical decision making in the cathlab (see Table below). Ischemia and defer values for IVUS are: Lumen cross sectional area of >4.0 mm^2 in a coronary artery and >6,0 mm^2 for the mainstem (MS).

	FFR	**CFR**	**RCFR**	**HSR**
Normal Value	1.0	> 3.0	1	0
Ischemia detection	< 0.75	< 2.0	< 0.65	> 0.80
Defer PCI	> 0.75	> 2.0	na	na
Defer PCI ACS	> 0.80	na	na	na
Defer PCI MS	> 0.75	na	na	na

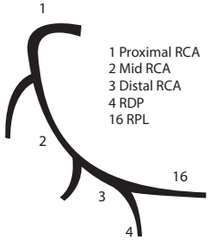
FFR: fractional flow reserve; CFR: coronary flow (velocity) reserve; RCFR: relative CFR; HSR: hyperemic stenosis resistance (mmHg • cm^{-1} • s^{-1}).

BLOOD SUPPLY CARDIAC CONDUCTION SYSTEM

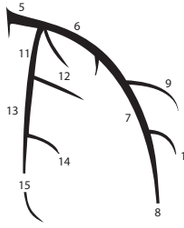


SA node: RCA in 55-60 %
AV node: RCA in 90 %
His bundle : RCA / LAD
Right bundle (RBB): LAD (S1)
Left bundle (LBB):
• Anticus (AF): LAD
• Posticus (PF): LAD/ RCA

NOMENCLATURE PCI SEGMENTS



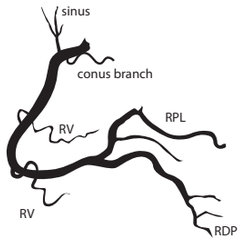
1 Proximal RCA
2 Mid RCA
3 Distal RCA
4 RDP
16 RPL



5 Left main
6 Proximal LAD
7 Mid LAD
8 Distal LAD
9 D1
10 D2
11 Proximal RCX
12 Intermediate / M1
13 Mid RCX
12 MO1
14 MO2
15 MO3

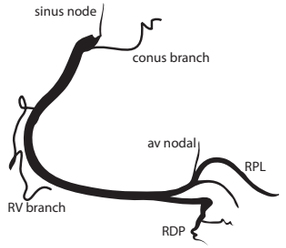
RIGHT CORONARY ARTERY (RCA):

Left Anterior Oblique and Cranial View (L20-C25)
Optimal visualisation: RCA-proximal, -distal, -crux, RDP, RPL



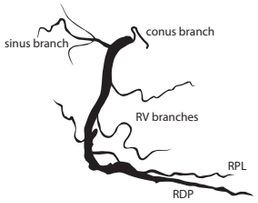
RIGHT CORONARY ARTERY (RCA):

Left Anterior Oblique View (L45-0)
Use: Catheter intubation, Optimal visualisation:
RCA- proximal, -mid and -distal



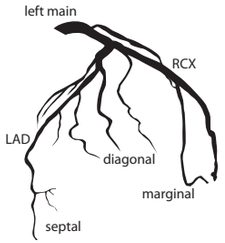
RIGHT CORONARY ARTERY (RCA):

Right Anterior Oblique View (R30-0)
Optimal visualisation: RCA-mid collateral vessels to LAD (if present)



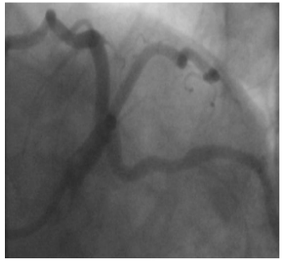
LEFT CORONARY ARTERY (LCA):

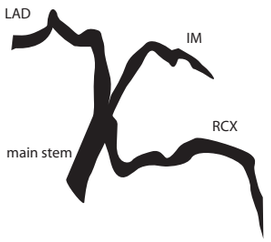
Left Anterior Oblique and Cranial View (L50-C20)
Optimal visualisation: Mainstem ostium, LAD-mid-distal, Diagonals, RCX-mid-distal



LEFT CORONARY ARTERY (LCA):

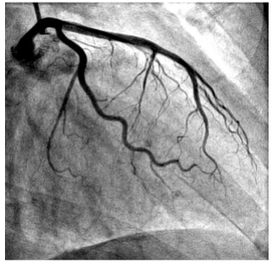
Left Anterior Oblique and Caudal View (Spider; L50-C25)
Optimal visualisation: Mainstem ostium-body-bifurcation, LAD-proximal, RCx-proximal-mid

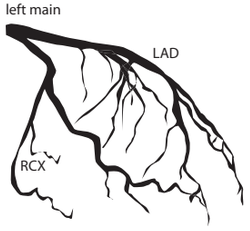




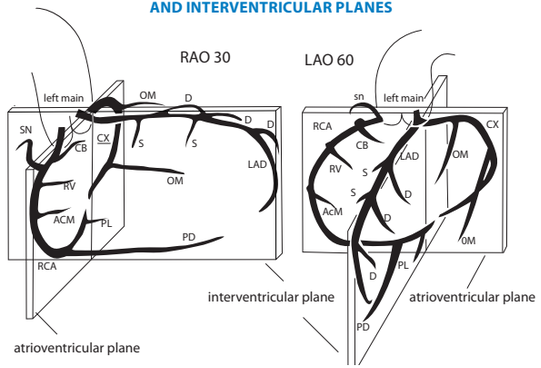
LEFT CORONARY ARTERY (LCA):

Right Anterior Oblique View (R30-0)
Optimal visualisation: Mainstem body, LAD-mid-distal, MO





MODEL OF CORONARY ARTERIES IN ATRIOVENTRICULAR AND INTERVENTRICULAR PLANES



OVERVIEW CORONARY VESSELS INCLUDING LEFT AND RIGHT DOMINANCE

- **Right dominance** in 85% of patients: RCA → crux → RPL and RDP.
- **Left dominance** in 10% of patients: RCA → RPL and no RDP (LCA).
- **Balanced** in 5% of patients:RCA → RDP and no RPL (LCA).

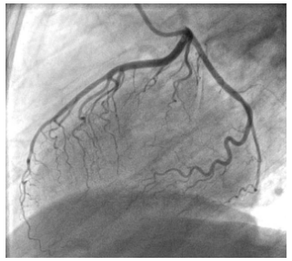
ELECTROCARDIOGRAPHIC CULPRIT PREDICTION

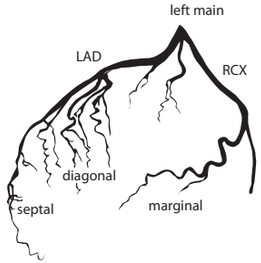
ECG in RCA occlusion: ST depression in aVL > I, ST elevation III > II, V4R isoelectric or elevated, S:R in aVL>3.
ECG in RCX occlusion: ST elevation II > III, V4R negative T, S:R in aVL < 3.
ECG in Anterior infarction: (table below)

Main stem	LAD, proximal to S1 / D1:	LAD, distal to S1 / D1:
1) ST ↑ vector -90 ° 2) ST ↑ in aVR > V1 3) ST ↑ in V1-2 4) ST ↑ V1 ≥ 2,5 mm 5) RBBB, Left axis 6) ST ↓ II ≥ 1,0 mm 7) ST ↓ maximal in V5-6	1) See mainstem nr. 2-7 2) ST vector -90 ° and -30 ° 3) ST ↑ V1-6 4) ST ↓ II, III, aVF	1) ST vector: 0 ° - 90 ° 2) ST ↑ V1-6, II - aVL 3) No ST ↓ III 4) ST ↓ II, III, aVF

LEFT CORONARY ARTERY (LCA):

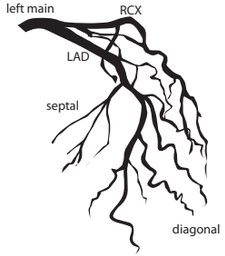
Left lateral view (L90-0)
Optimal visualisation: LAD-mid-distal, LIMA anastomosis (if present), RCx-mid-distal





LEFT CORONARY ARTERY (LCA):

Right Cranial View (R5-C40)
Optimal visualisation: LAD-proximal-mid-distal, LIMA anastomosis (if present), Diagonals



LEFT CORONARY ARTERY (LCA):

Right Caudal View (R5-C40)
Optimal visualisation: MS-bifurcation, LAD-proximal, RCx-proximal-mid-distal, MO-bifurcation