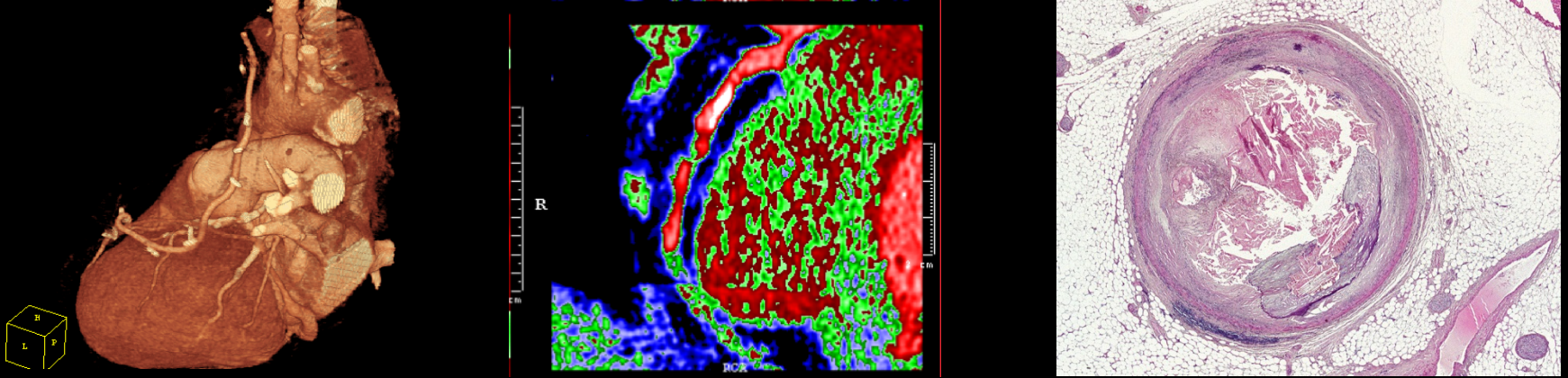




Radioanatomie des artères coronaires

Pr.Emmanuel Coche

Cliniques Universitaires St-Luc

Av.Hippocrate, 10

1200 Bruxelles

Cours BAC 13

CT multidétecteur



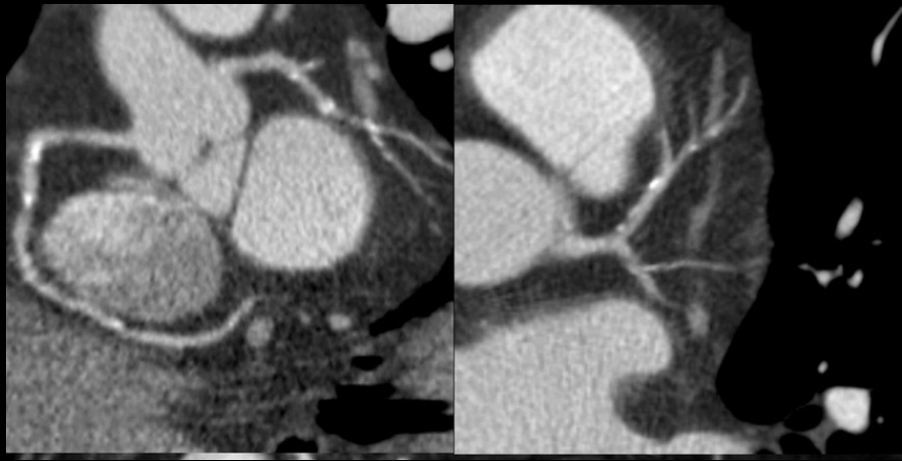
4-256 coupes/rotation

**Toshiba: 320
coupes/rotation**

16 cm de couverture

**Imagerie cardiaque en
1 battement**

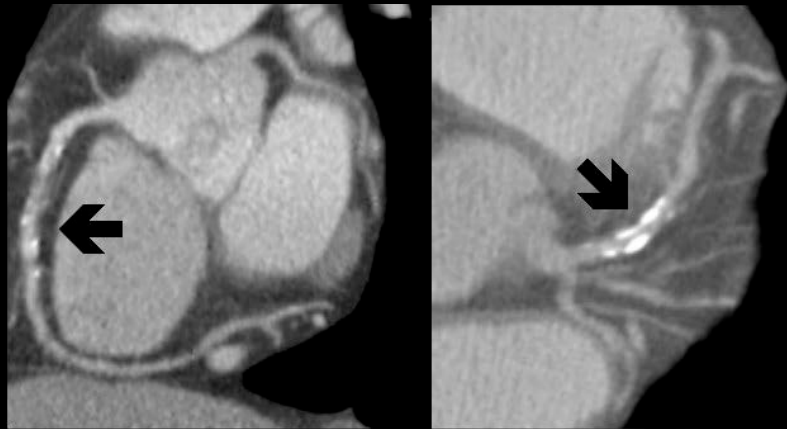
Dual source CT



4 coupes/rotation

2000: 4 x1 mm

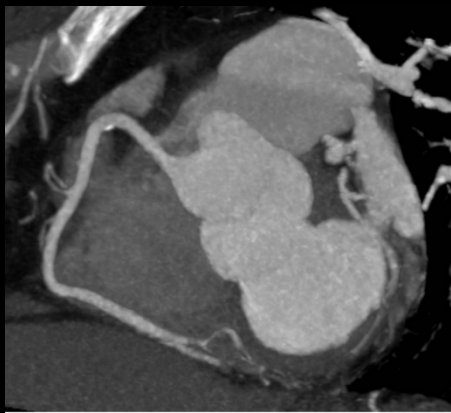
Temps d'acquisition: 45 sec



16 coupes/rotation

2004: 16 x 0.75 mm

Temps d'acquisition: 25 sec



40-64 coupes/rotation-CT
dual

2005: 40-64 x 0.625 mm

Temps d'acquisition: 10 sec

Brilliance CT Asymetrix detector

64-row Multi-Detector

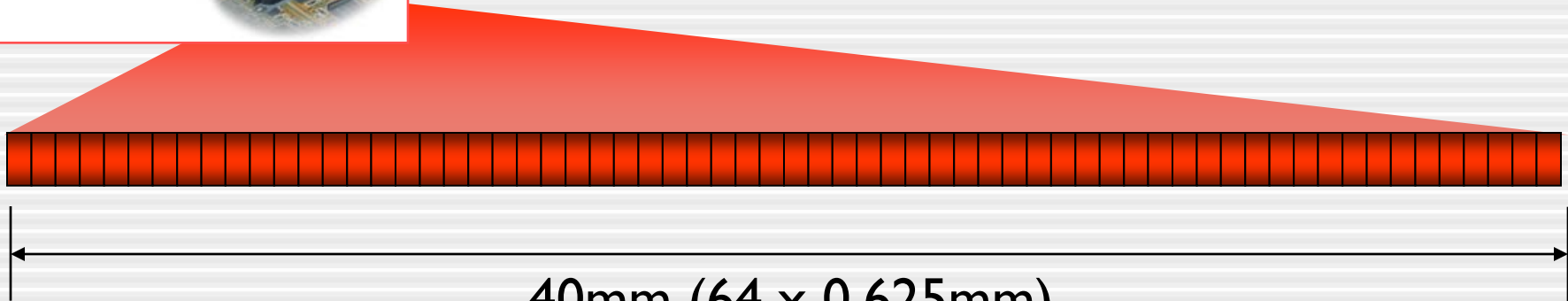
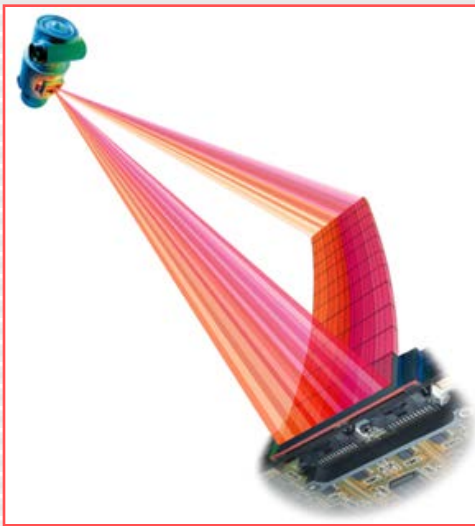
Collimation = area of detector covered

‘ConeBeam acquisition’

64-channel DAS

40mm Hi-resolution coverage

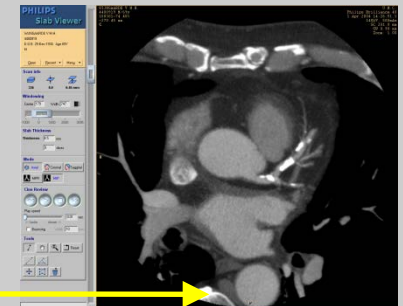
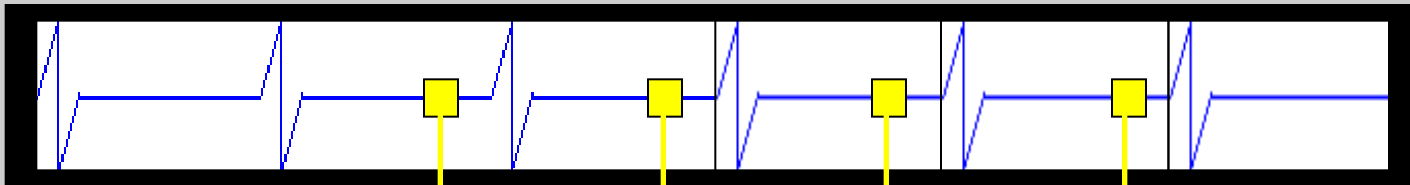
0.34mm in Z-axis



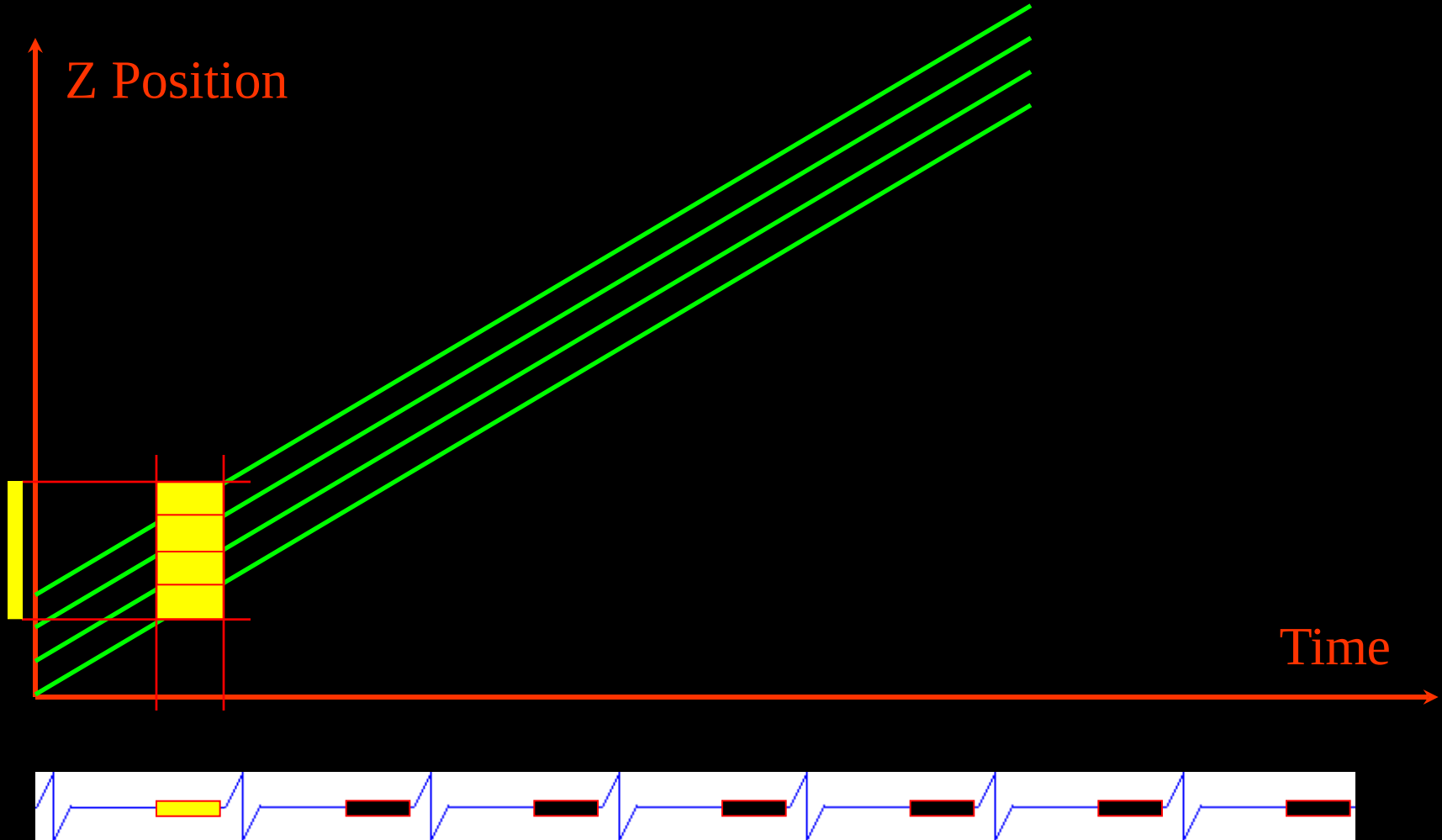
40mm (64 x 0.625mm)

Acquisition de l'examen

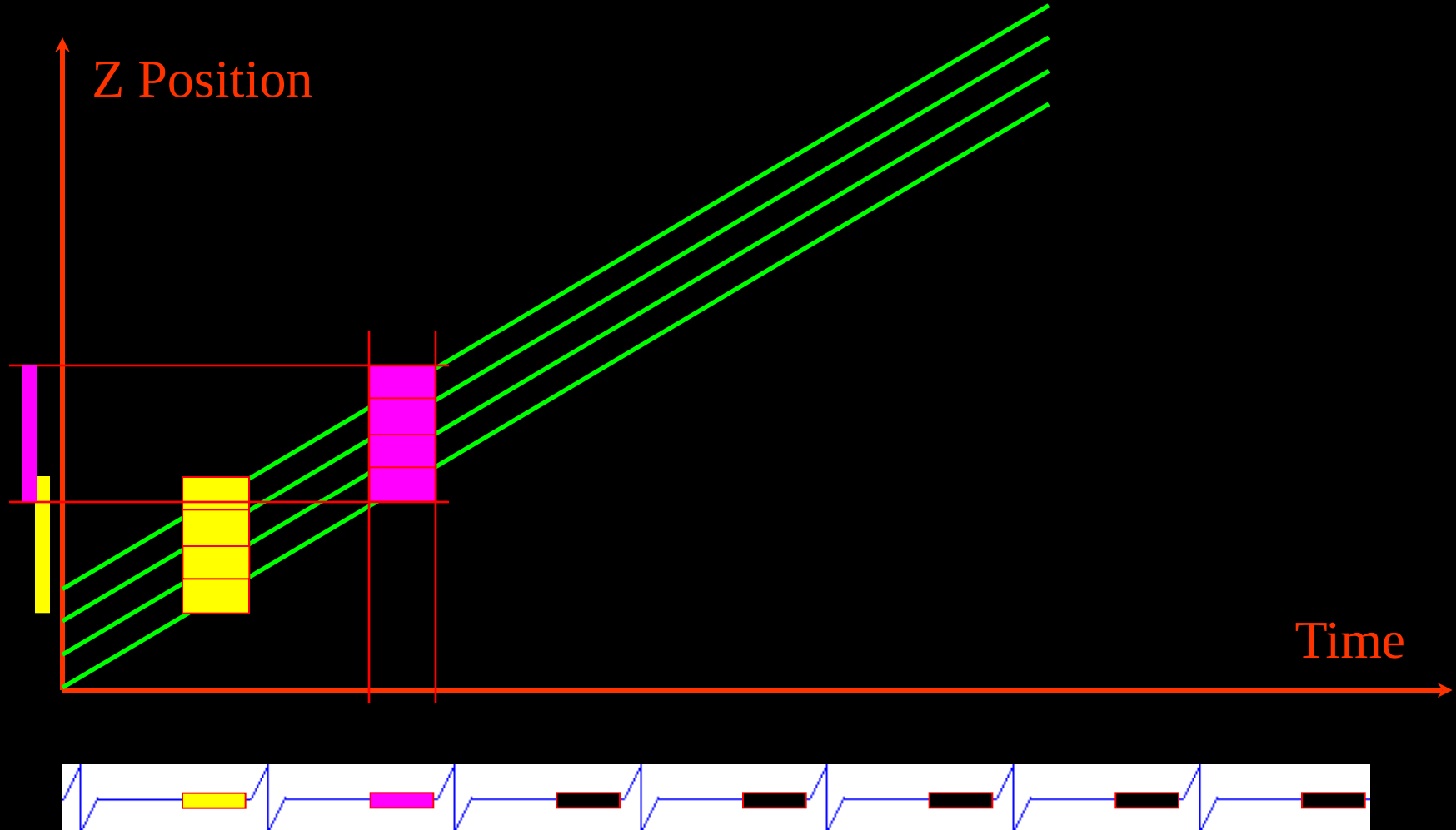
- 40-256 x 0.625 mm : collimation la plus fine
- Synchronisation cardiaque rétrospective
- Vitesse rotation la plus élevée
- 120 kV, 600-800 mAs



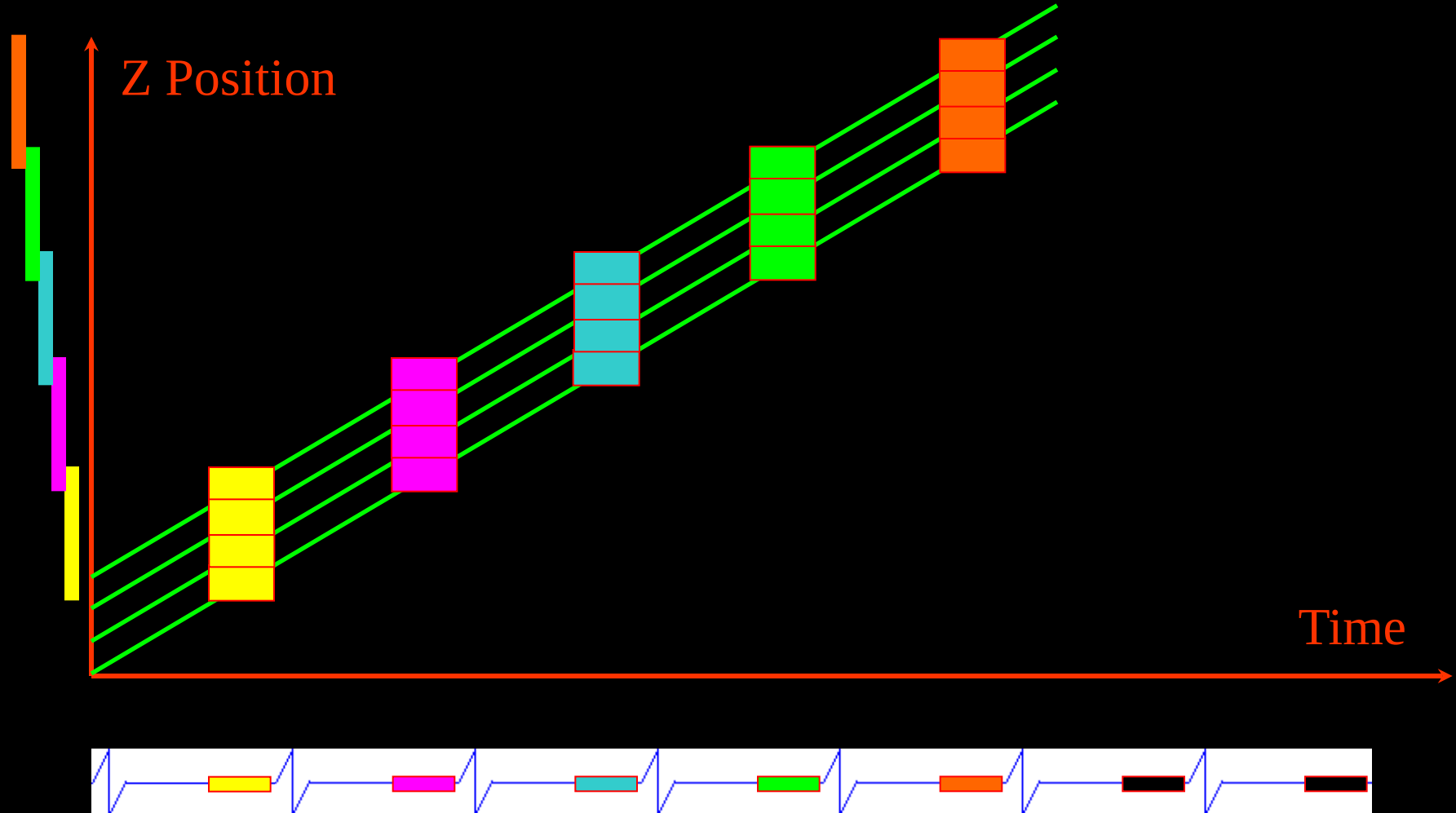
Synchronisation cardiaque rétrospective



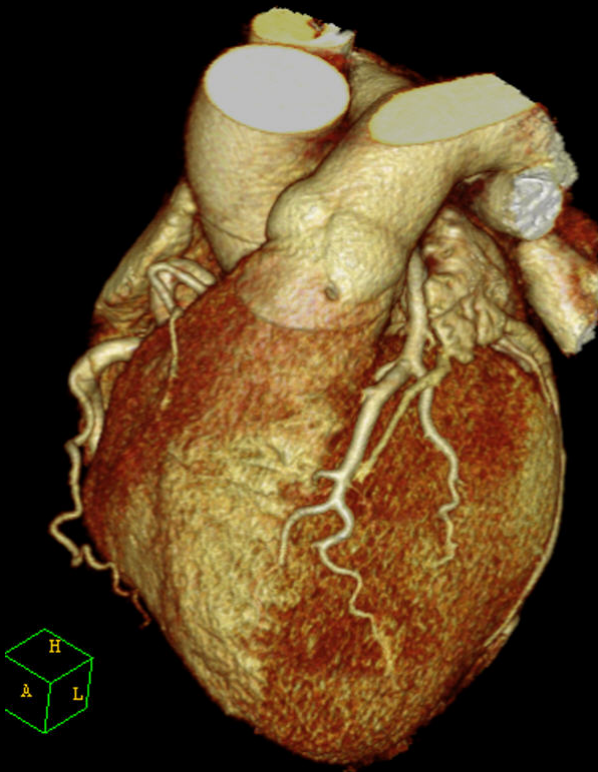
Synchronisation cardiaque rétrospective



Synchronisation cardiaque rétrospective



Acquisition spirale avec synchronisation cardiaque rétrospective



Principes du Step & Shoot

Shoot: 1

2

3

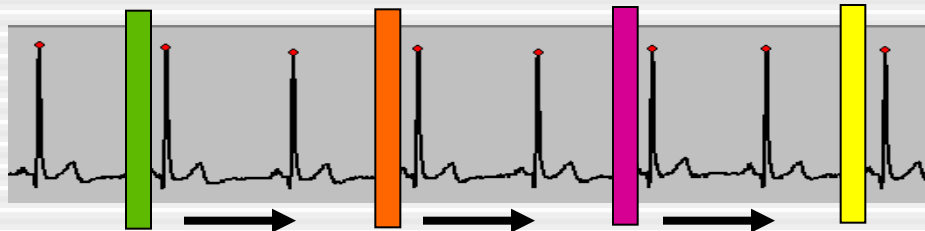
4

Step:

1

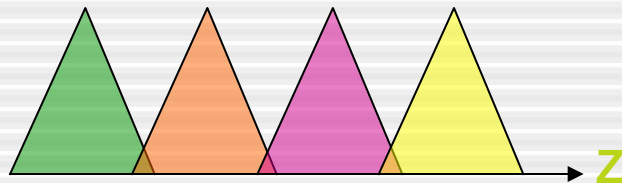
2

3

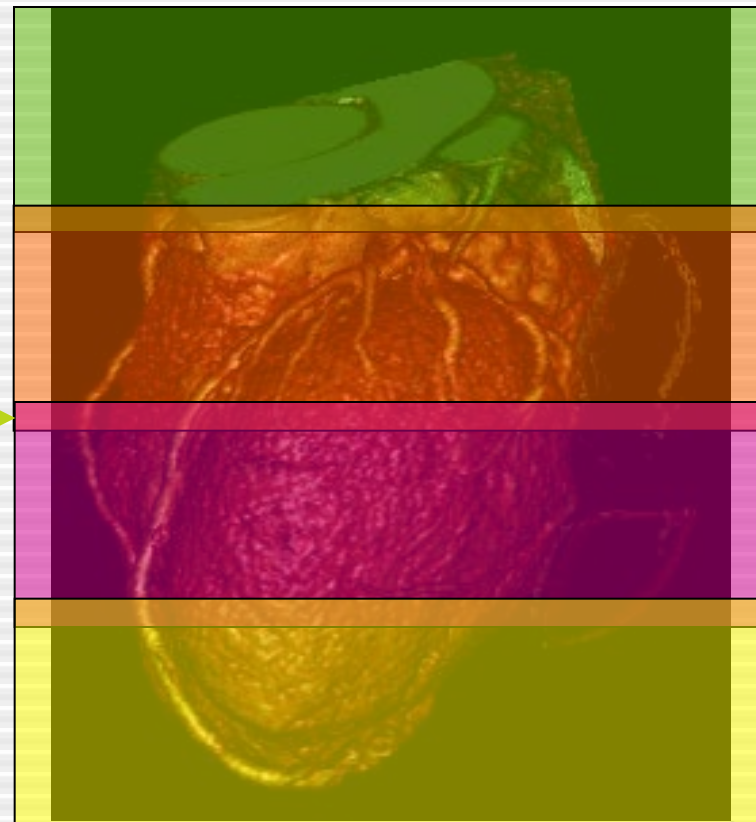


Move 32.1 mm

Overlap 8 mm



Step & Shoot Cardiac scan (4cm)

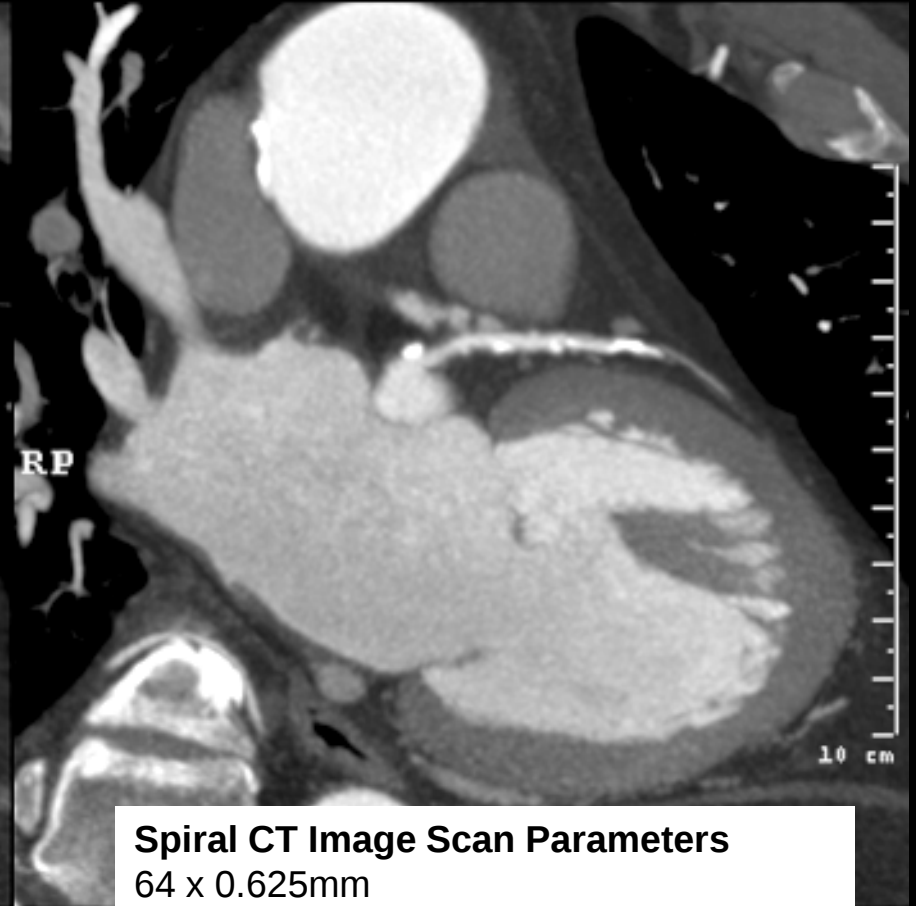


Example 2: Step and shoot



Step & Shoot Cardiac (Axial prospective)

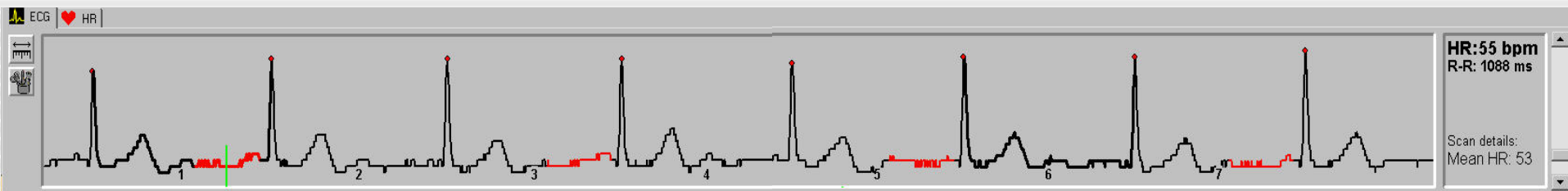
64 x 0.625mm
16cm coverage
Dose = 3.4 mSv



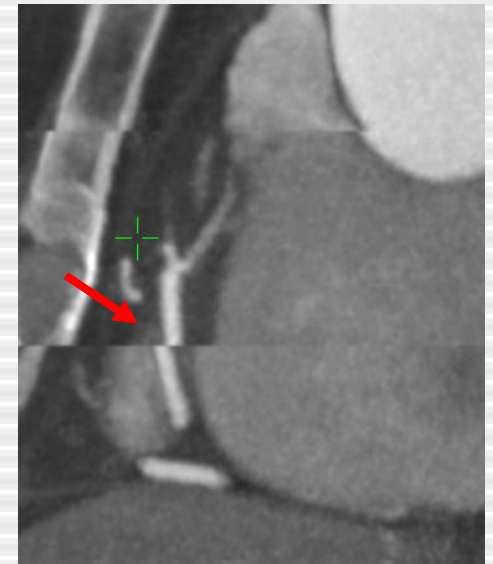
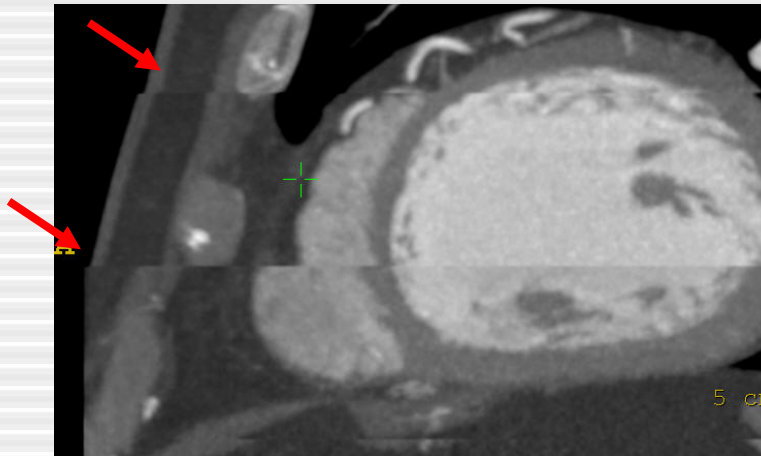
Spiral CT Image Scan Parameters

64 x 0.625mm
16cm coverage
Dose = 14.4 mSv

Exemple 2: Step and shoot



Respiré !!!



71 bpm



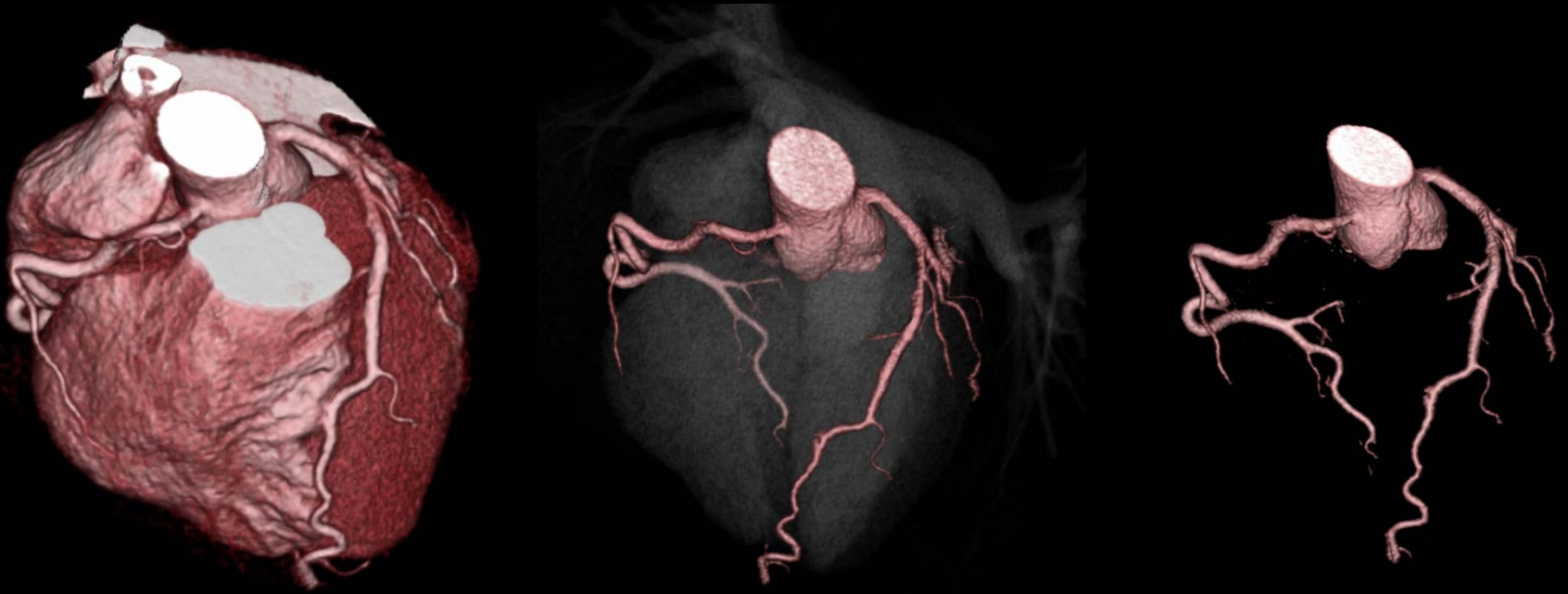
Dual Source

72 bpm



Single Source

Post-Processing



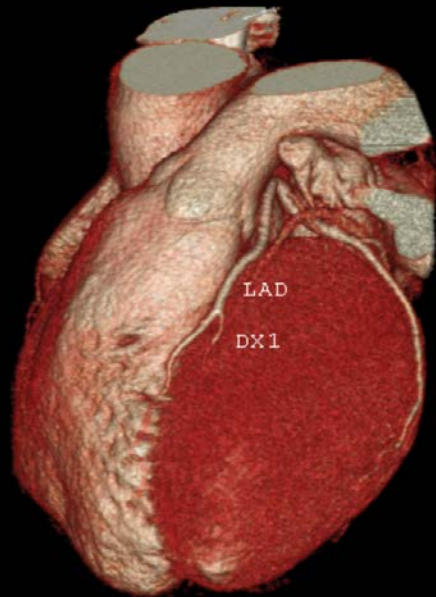
64 x 0.625mm, Standard Res., RT = 0.42sec, Pitch = 0.2, Scan Time = 7.5 sec

Post-Processing



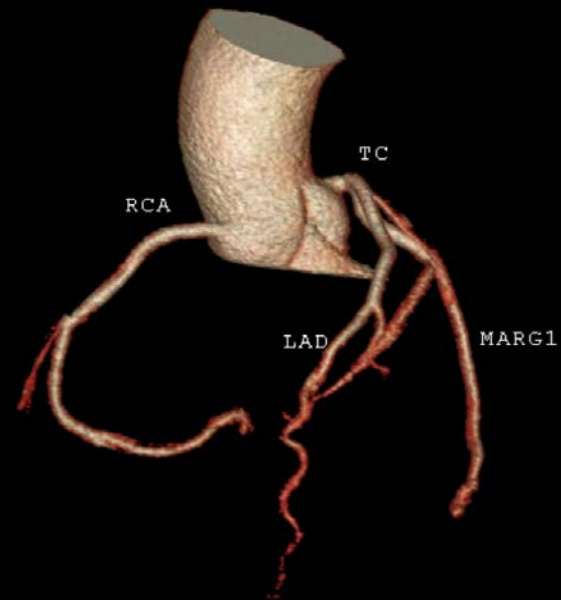
64 x 0.625mm, Standard Res., RT = 0.42sec, Pitch = 0.2, Scan Time = 7.5 sec

AR

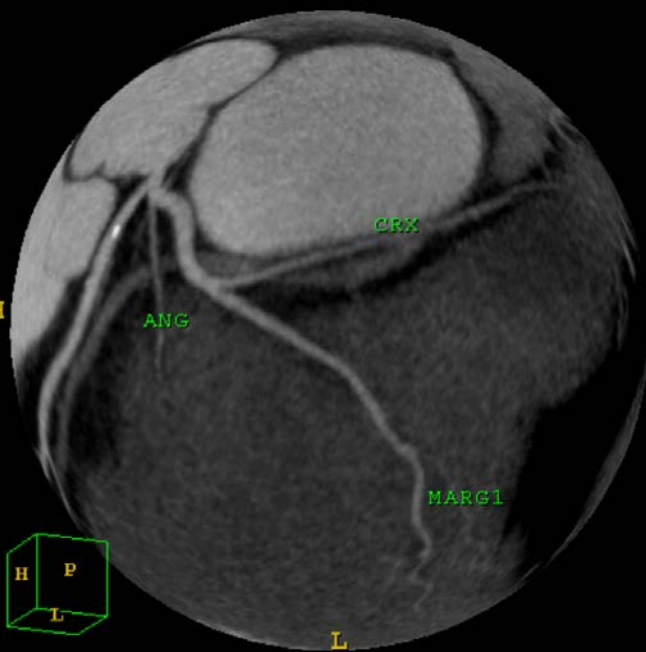


F

RAF



H



L

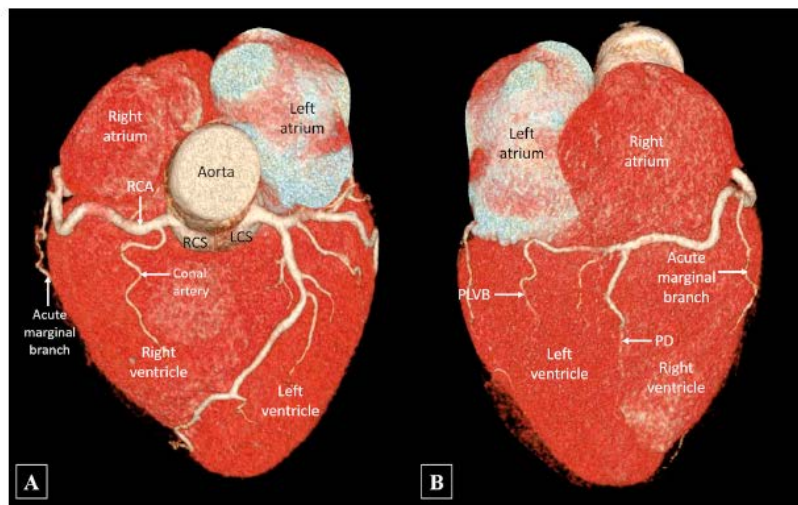
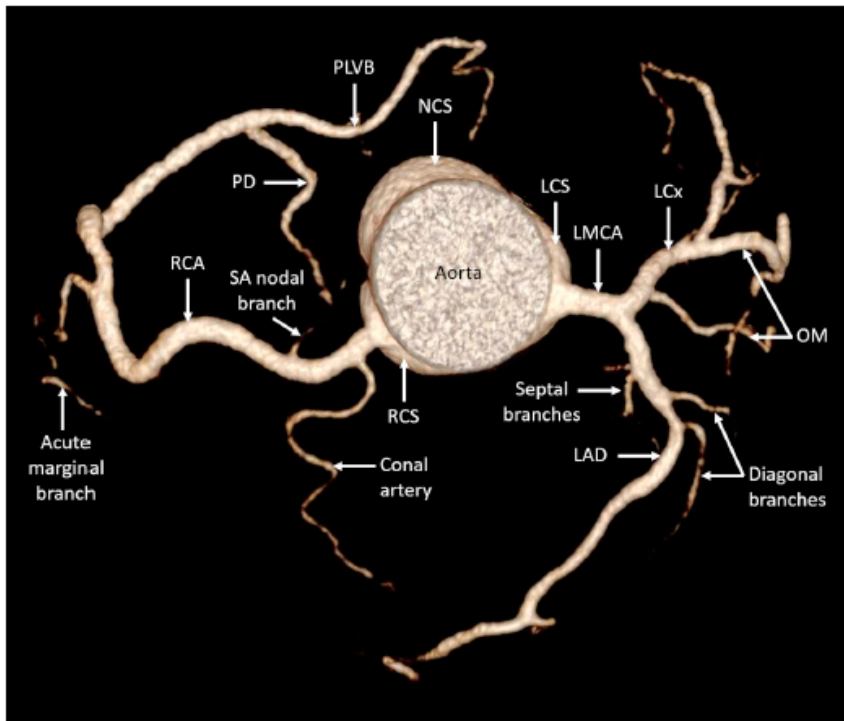


5 cm

C1 135
W1 555







Comp. Cardiac
Coronaries

Hints
Visualization Tools
Vessel Tools

Vessels

CX

RCA
LAD
CX
Diag1

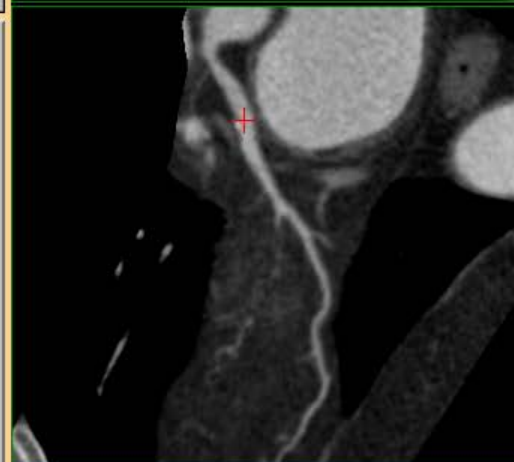
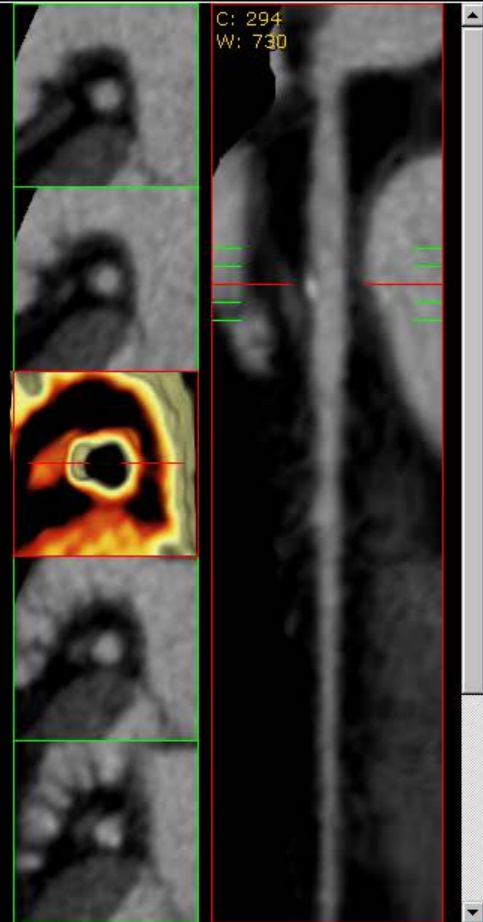
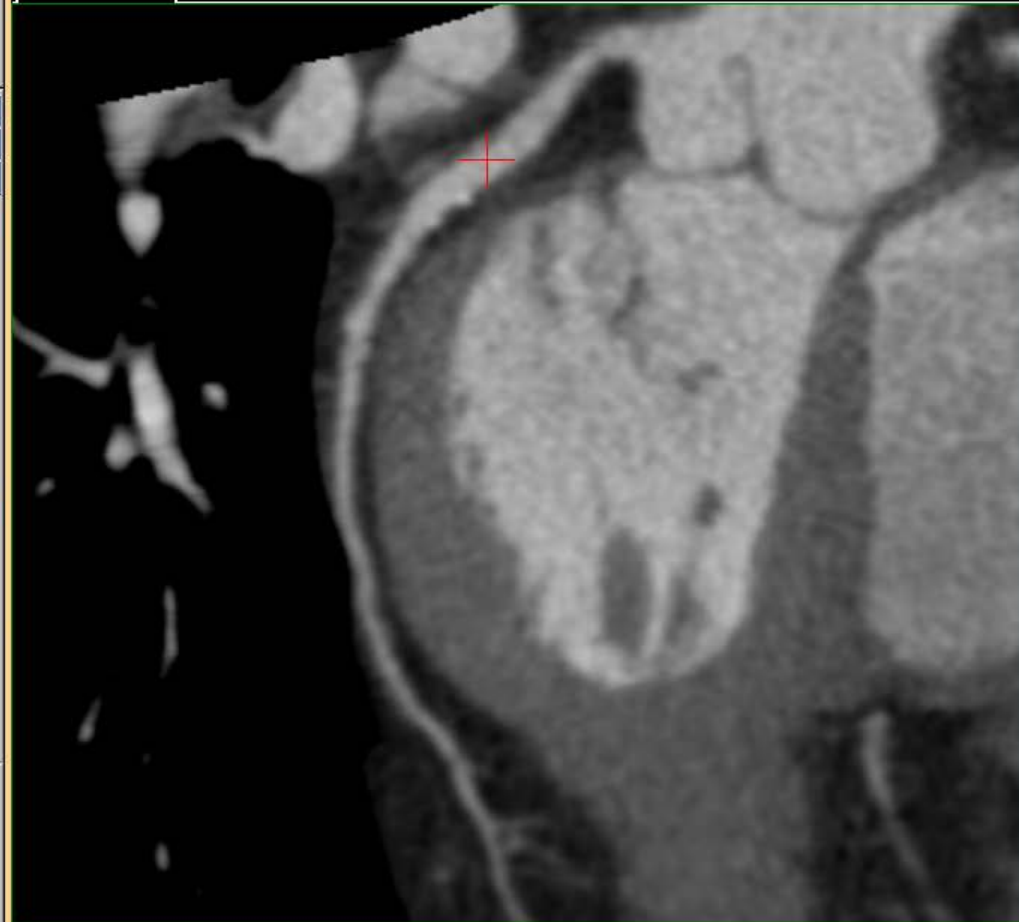
Define Vessel

Show Centerline

Heart Show Prot

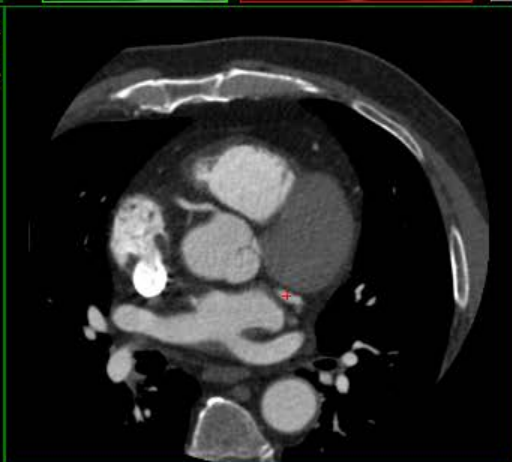
Cardiac View MIP

80.0% Phase



CARMEL^TREE1
1
80.0%

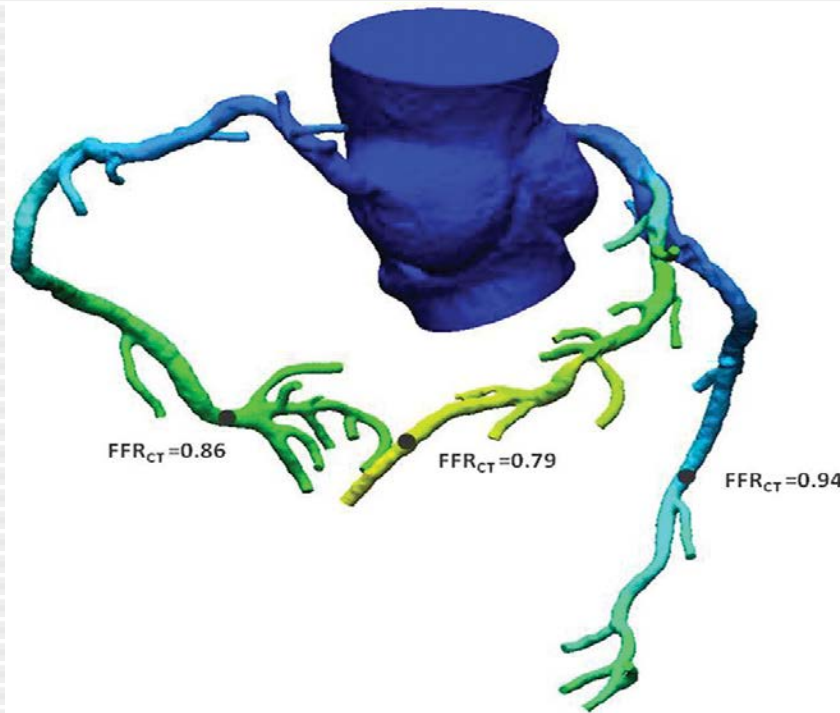
Carmel M.C.
Mx8000 IDT
7 Jul 2003
09:54:09.7



Ready

Can't set mark (1007)

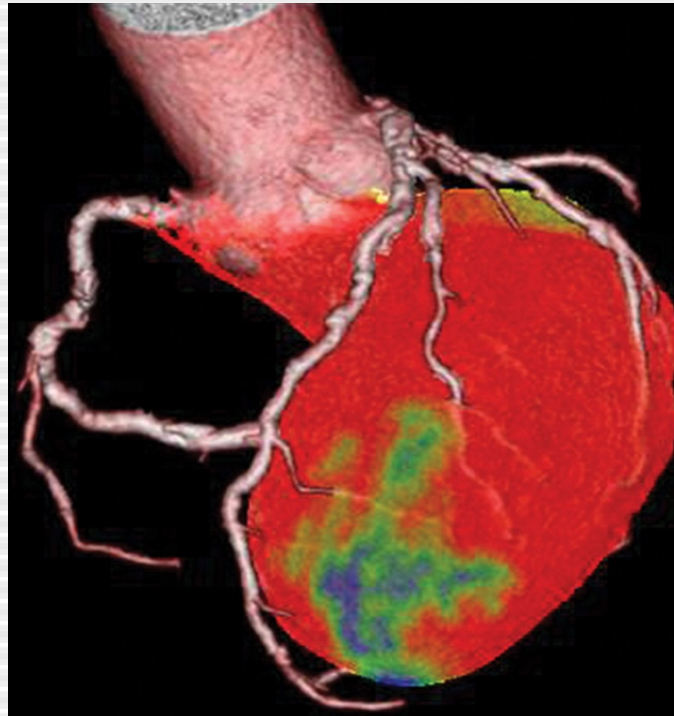
Imagerie fonctionnelle



RadioGraphics
2015; 35:991–1010

Example of an FFRCT fractional flow reserve derived from CT image has color contours that provide data on the distribution of FFRCT fractional flow reserve derived from CT throughout the coronary tree. Numerical FFRCT fractional flow reserve derived from CT values can be obtained at any location. (Adapted and reprinted, with permission, from reference 50.)

Imagerie fonctionnelle



RadioGraphics
2015; 35:991–1010

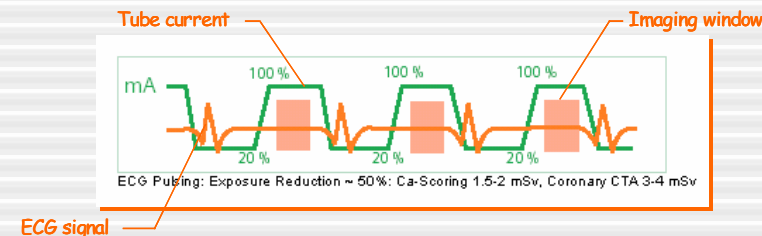
In comparison with a monochromatic short-axis myocardial perfusion image obtained at 70 keV with single-source dual-energy CT with fast tube voltage switching **(a)**, material density image **(b)** and fusion of a color-coded material density image **(c)** obtained with iodine and water selected as the basis pair more clearly delineate perfusion defects in the anterior wall of the left ventricle, allowing quantitation of myocardial perfusion as iodine density in regions of interest placed in the anterior wall (yellow circle in **d**), lateral wall (green circle in **d**), and inferior wall (blue circle in **d**). Iodine density of 0.01, 1.62, and 1.56 mg/mL was measured in these three regions. **(e)** Three-dimensionally matched fusion of volume-rendered color-coded material density and coronary CT images generated from the same CT dataset is useful to easily and precisely identify the diagonal branch as a culprit vessel. (Reprinted, with permission, from reference 45.)

Injection intraveineuse de produit de contraste

- Voie intraveineuse
 - Veine antécubitale
 - Contraste 350-400 mg I/mL
 - Débit: 4-5 mL/sec
 - ROI: Ao descendante
- Injecteur Double chambre
 - Diminution du produit de contraste injecté
 - Diminution artéfacts VCS (streak artefacts)

Recommandations pratiques

- Prise de β bloquants (exception dual source?)
 - 1/2 co tenormin la veille de l'examen
 - 1/2 co le matin de l'examen
 - Obtenir un rythme cardiaque régulier $\pm$ 70/min
- Mise en place d'électrodes
 - Éviter les artefacts dans région d'intérêt
- Examen irradiant: indications à discuter
 - Modulation de dose en fct ECG
 - Appliquer si rythme < 70 /min



IrradiationMDCT

- 6.4 ± 1.9 mSv: 16-slice CT
- 11 ± 4.1 mSv: 64-slice CT
- Dose modulation:
 - 37-40%
- Dose modulation+diminution kV
 - 53-64%
- Dose coronarographie:
 - 2.1-2.5mSv

Hausleiter et al. Circulation Online Mars 2006

Hunold et al. Radiology 2003;226:145-152

Effective Radiation Dosage, Measured in MilliSieverts (mSv)^{3,4}

Average Background Dose – U.S. 3.6 mSv/year

Three-Hour Commercial Airline Flight 0.015 mSv

Pa & Lateral Chest X-Ray 0.05 mSv

Head CT Examination 1-2 mSv

Chest CT 5-7 mSv

Abdomen & Pelvis CT 6-8 mSv

Selective Diagnostic Coronary Angiography 3-6 mSv

Diagnostic Coronary Angiography with Intervention . . . 6-30 mSv

Nuclear Medicine Stress Test

SPECT Thallium 25.3 mSv

SPECT Sestamibi 12.2 mSv

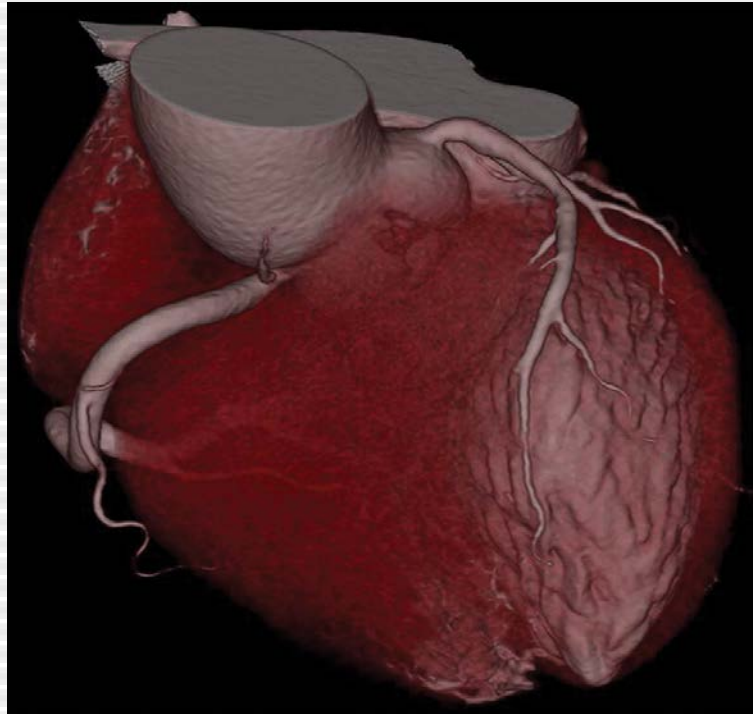
Coronary CT Angiography

Retrospective CCTA 13 mSv

Retrospective EKG-Modulated CCTA 8-9 mSv

Prospective “Step-and-Shoot” CCTA 2-3 mSv

Imagerie à moins de 1 mSv



RadioGraphics 2015; 35:991–1010

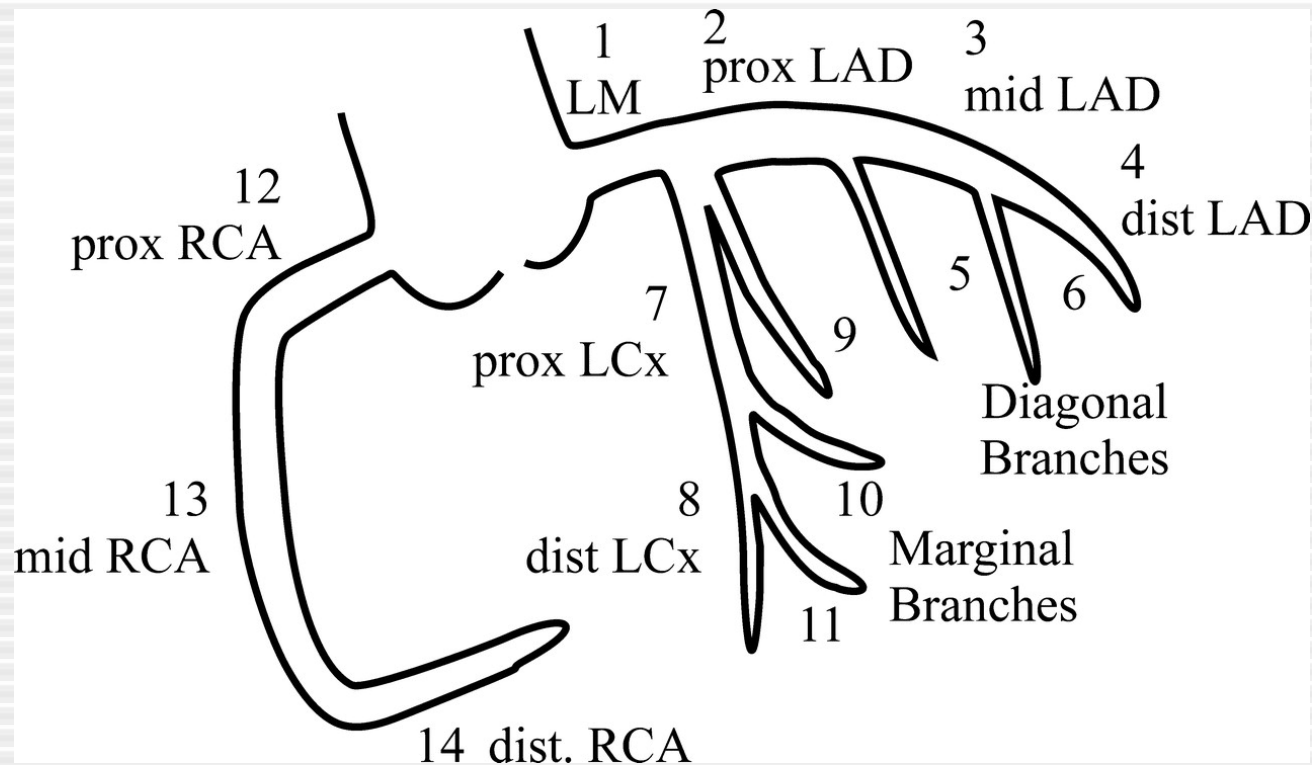
Low-dose coronary CT (effective dose, 0.97 mSv) performed with a high-pitch dual-source helical scan with 100-kVp tube voltage offers excellent image quality on a volume-rendered CT image **(a)** and on curved multiplanar reformatted CT images of the left coronary artery **(b)** and right coronary artery **(c)**. (Images courtesy of Nobuo Iguchi, MD, PhD, Department of Cardiology, Sakakibara Heart Institute, Tokyo, Japan.)

Performances diagnostiques du CT coronaire

Authors	N Pts	Sensitivity %	Specificity %	PPV %	NPV %	segments not seen %
Nieman Lancet.2001; 357	35	77	97	81	97	27
Achenbach Circulation.2001 ; 103	64	85	76	59	98	32
Gerber Invest Radio.2003; 38	25	82	96	73	97	30
Knez Am J Cardiol.2001; 88	44	78	98	85	96	6
Kopp Eur Heart J.2002 ; 23	102	93	97	81	99	0-30
Giesler AJR.2002 ; 179	100	91	89	66	98	29
Nieman Circulation.2002 ; 106	59	95	86	80	97	-
Ropers Circulation.2003 ; 107	77	92	93	79	97	-
Dewey Invest Radio.2004; 39	34	88	91	88	95	-

Leschka (64-slice CT)	67	94	97	87	99	0
Eur heart Journal 2005						

Evaluation des artères coronaires

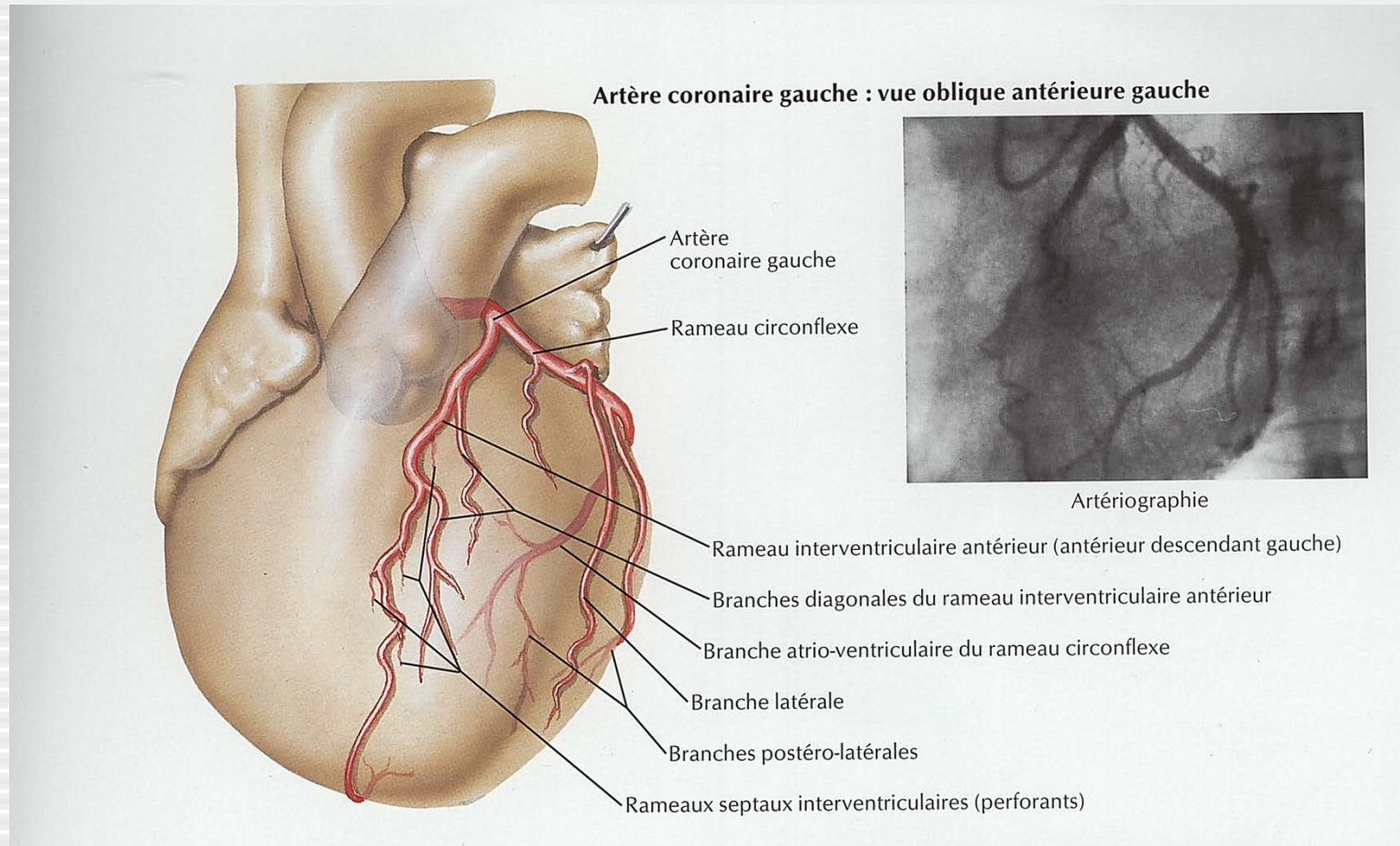


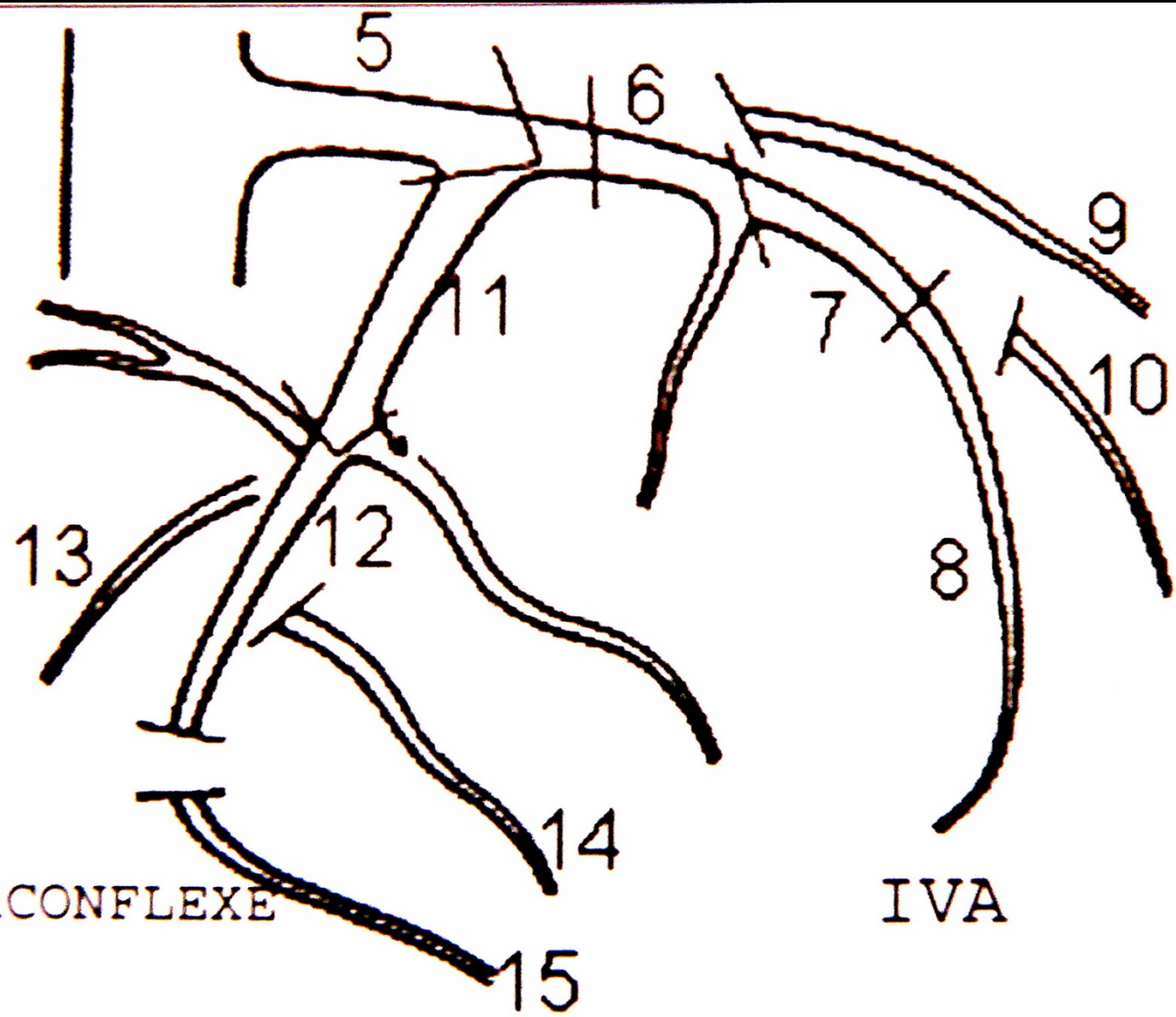
Interprétation conjointe radiologue-cardiologue

Bien analyser les anomalies extra-cardiaques!!

Anatomie des artères coronaires : normale et introduction aux variantes

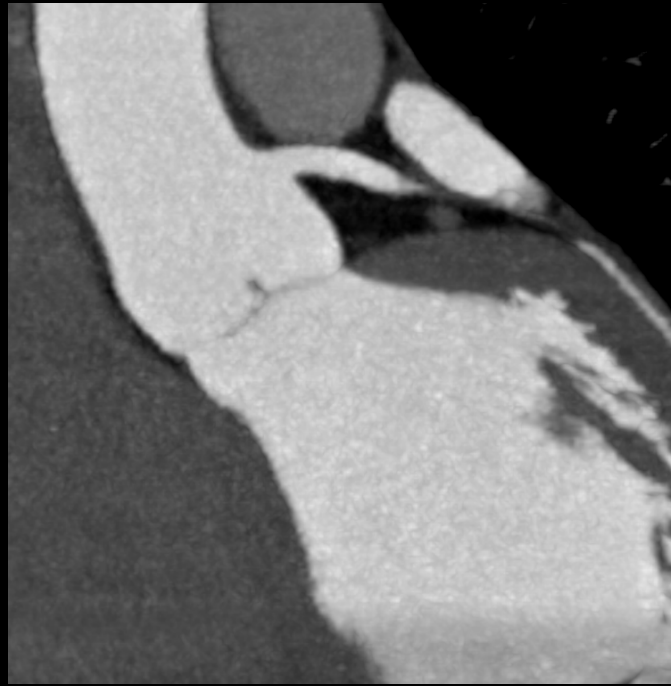
Anatomie des artères coronaires





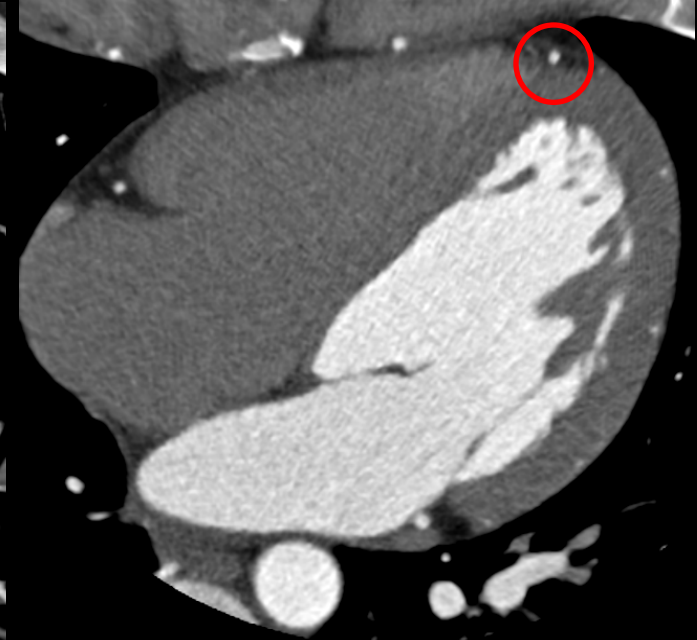
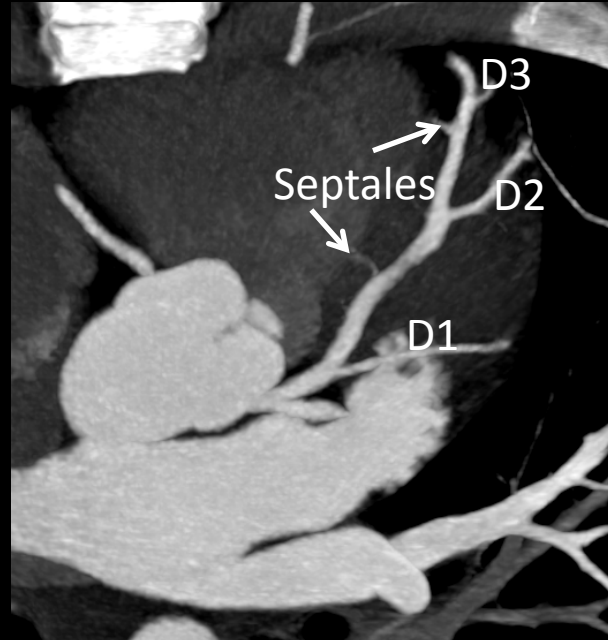
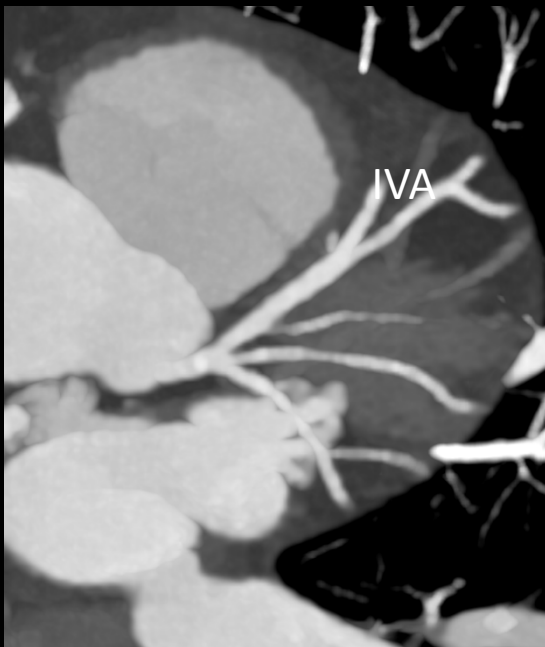
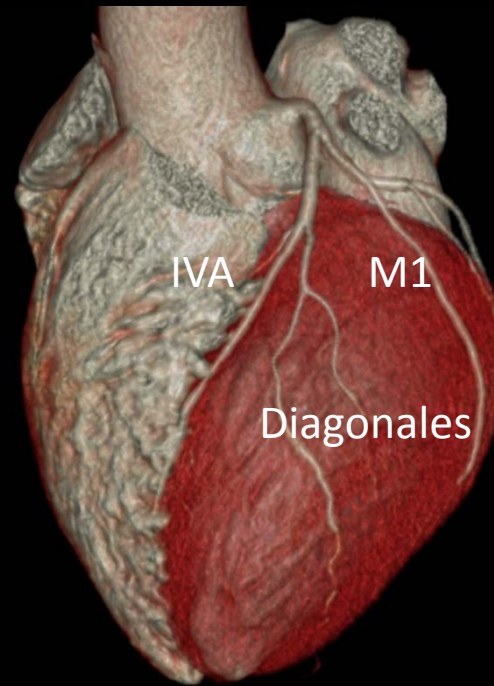
Tronc commun

- naissance du sinus coronaire G
- longueur variable
- division en artères interventriculaire antérieure et circonflexe



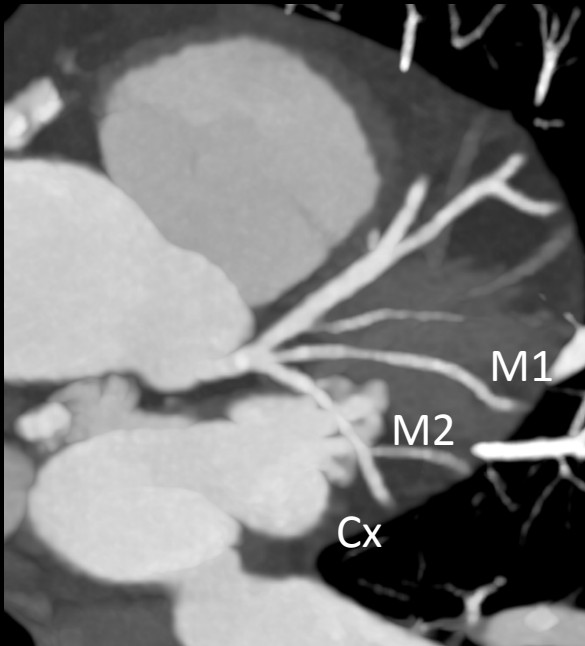
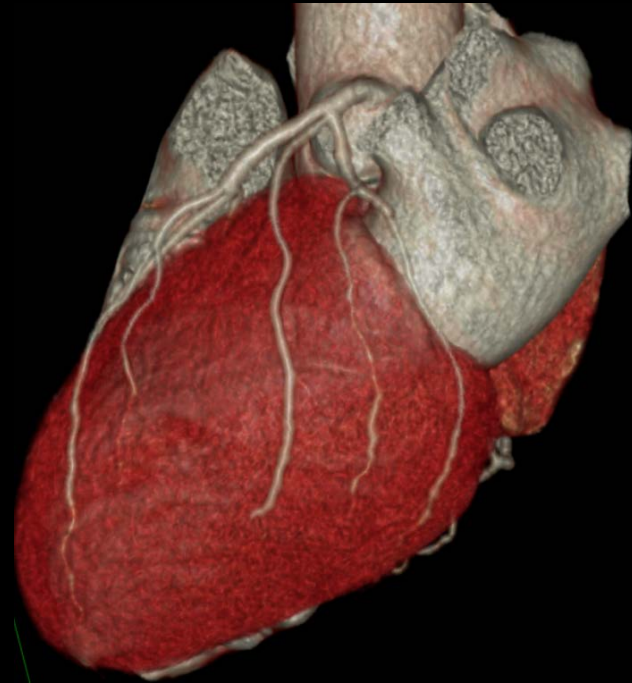
Artère interventriculaire antérieure

- naissance du tronc commun
- sillon interventriculaire antérieur
- branches septales
- 1 à 3 branches diagonales :
 - paroi antérieure du VG
 - paroi latérale du VG



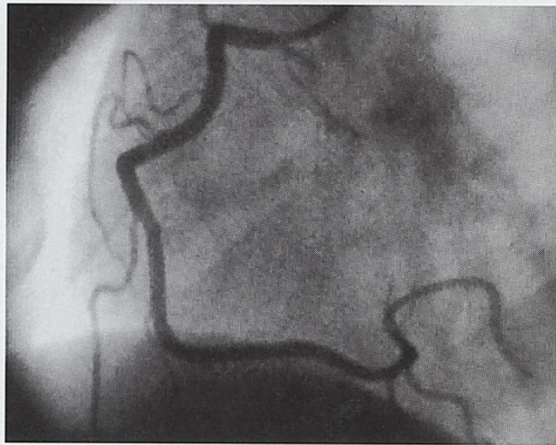
Artère circonflexe

- naissance du tronc commun
- sillon AV gauche
- 1 à 2 marginales : paroi latérale du VG
- (RVG/IVP : selon dominance)

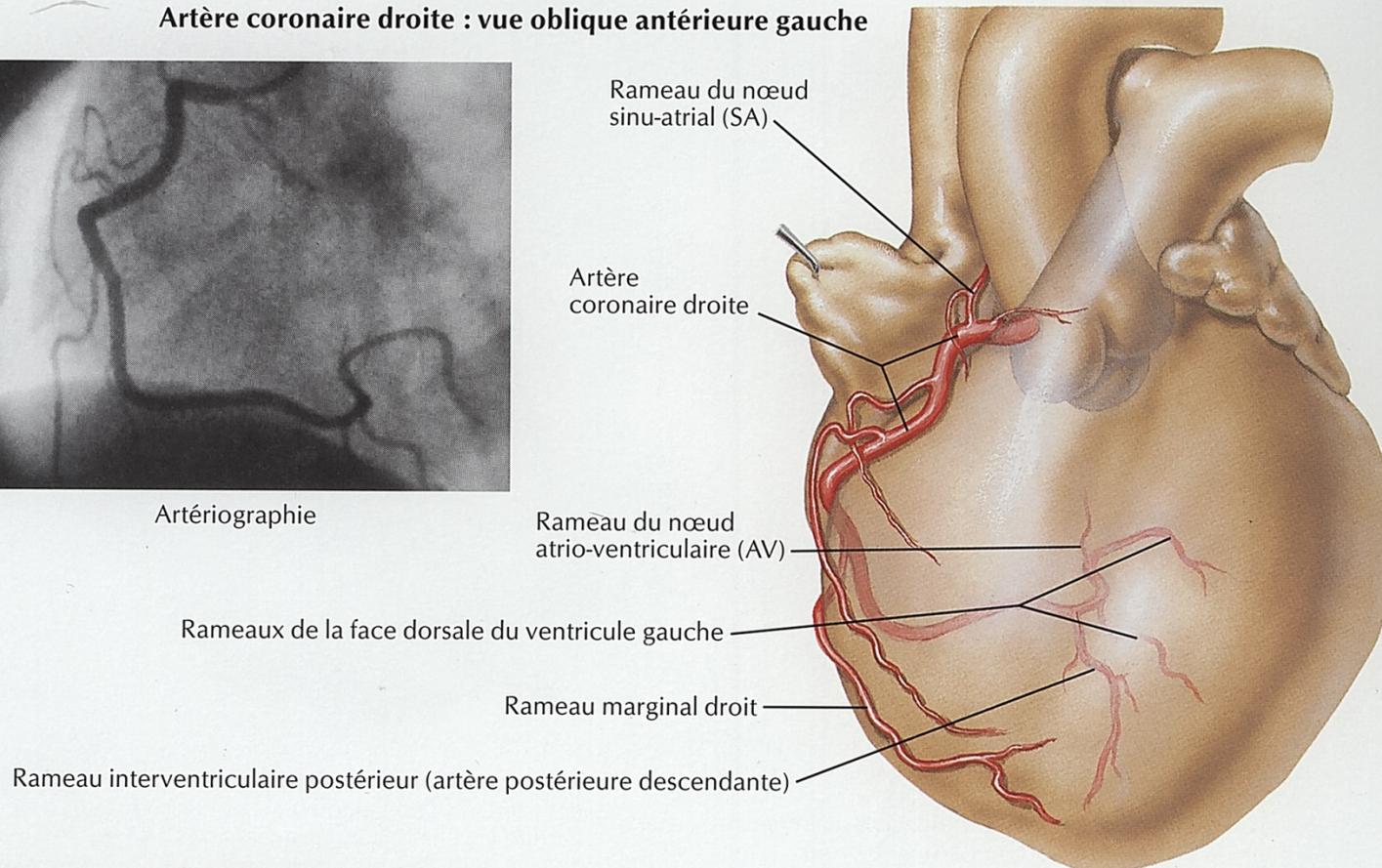


Anatomie des artères coronaires

Artère coronaire droite : vue oblique antérieure gauche

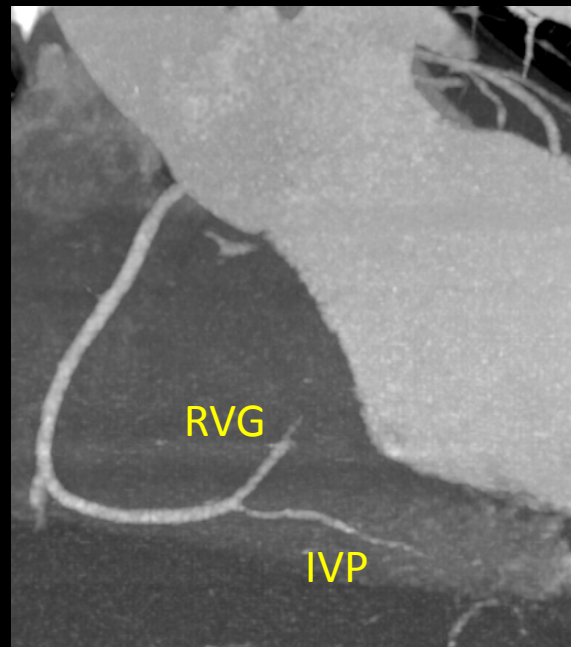
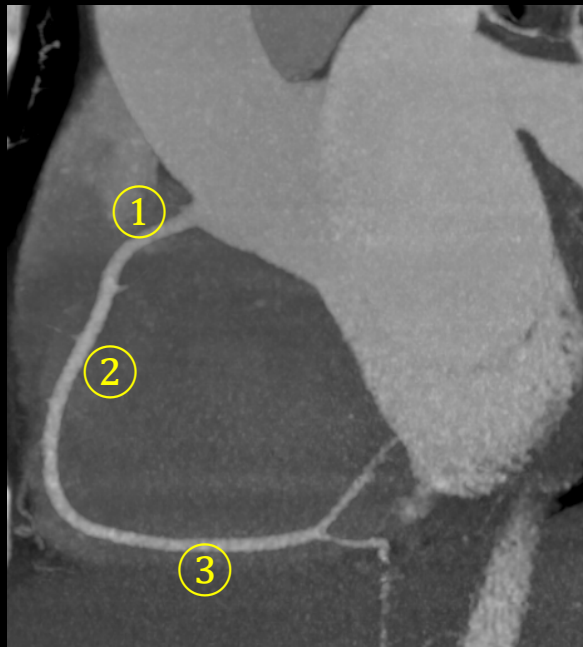
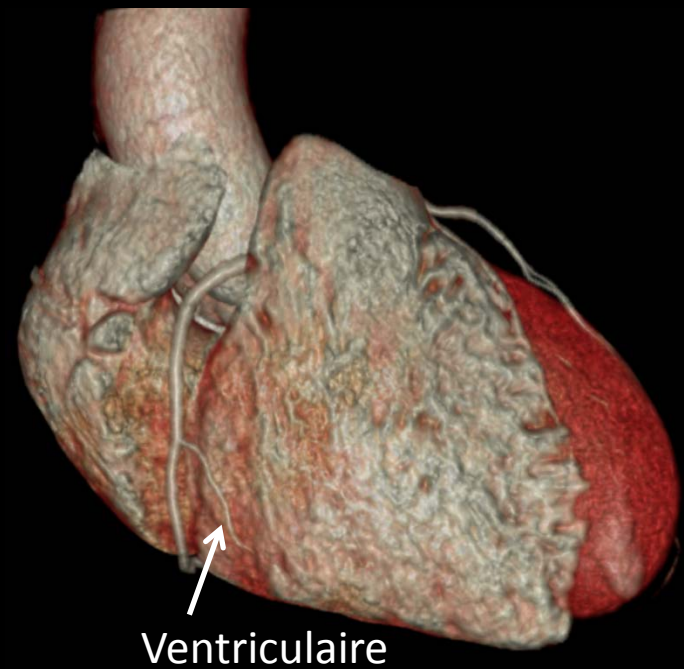


Artériographie

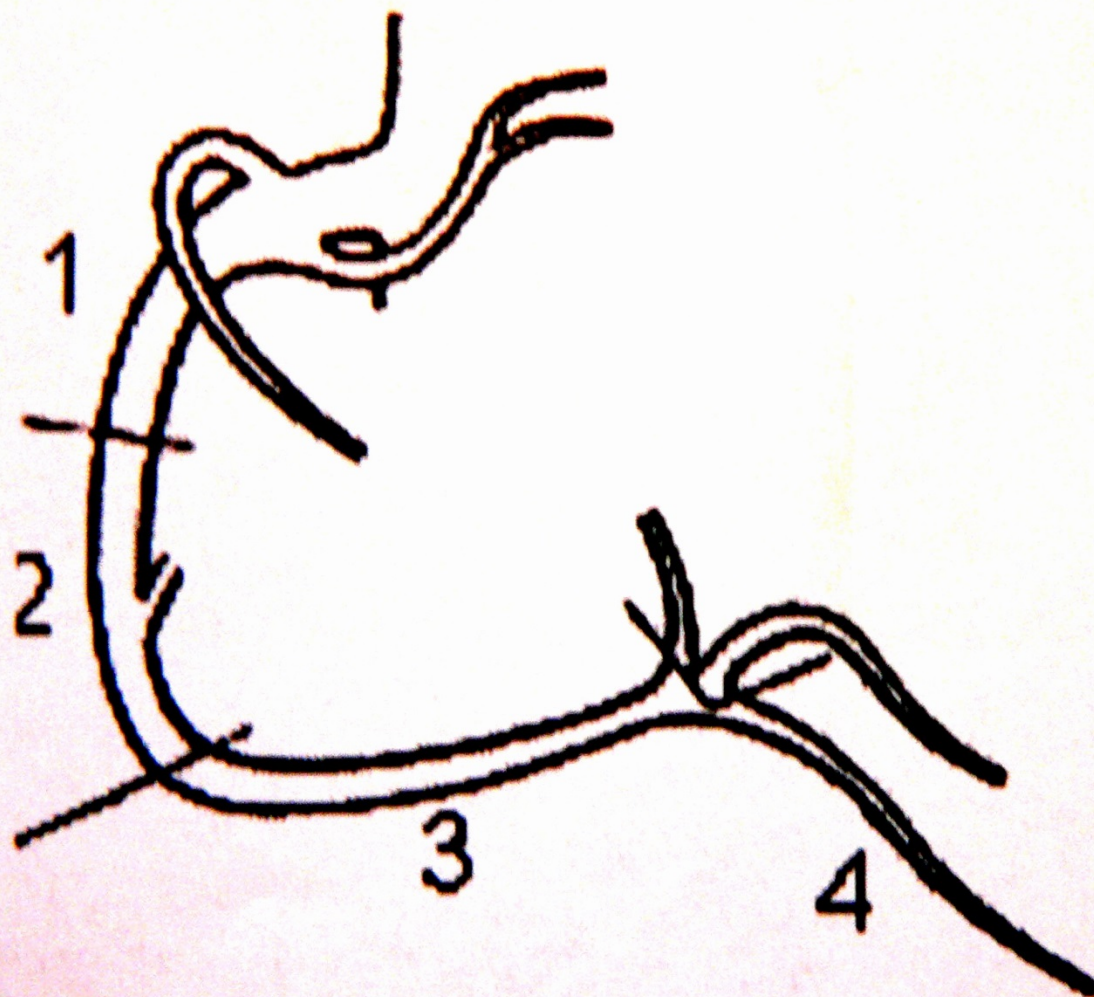


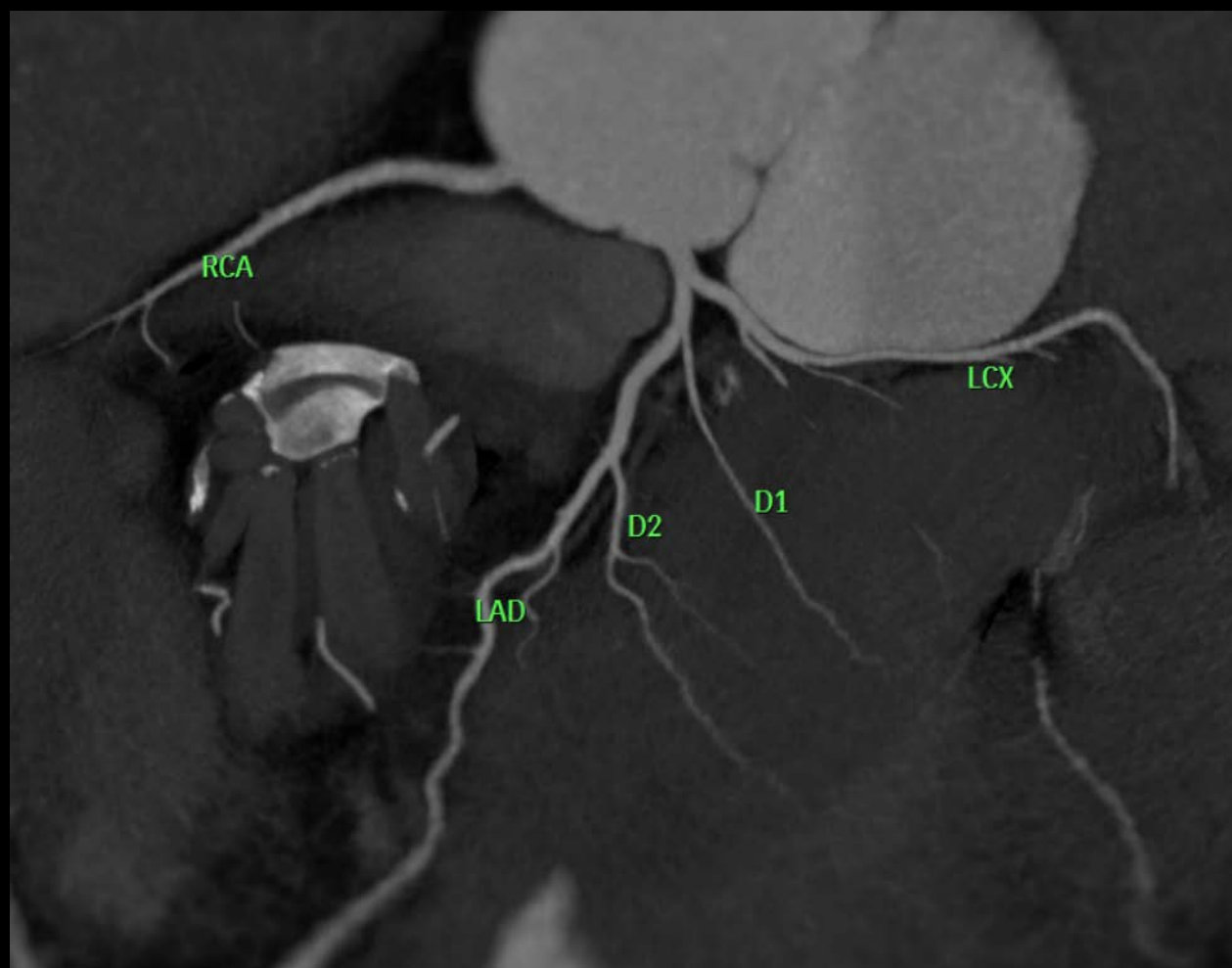
Artère coronaire D

- naissance du sinus coronaire droit
- sillon AV droit
- 3 segments : horizontal – vertical – horizontal
- 1 branche ventriculaire (« marginale D »)
- fin : IVP – RVG (selon dominance)



A coronaire D





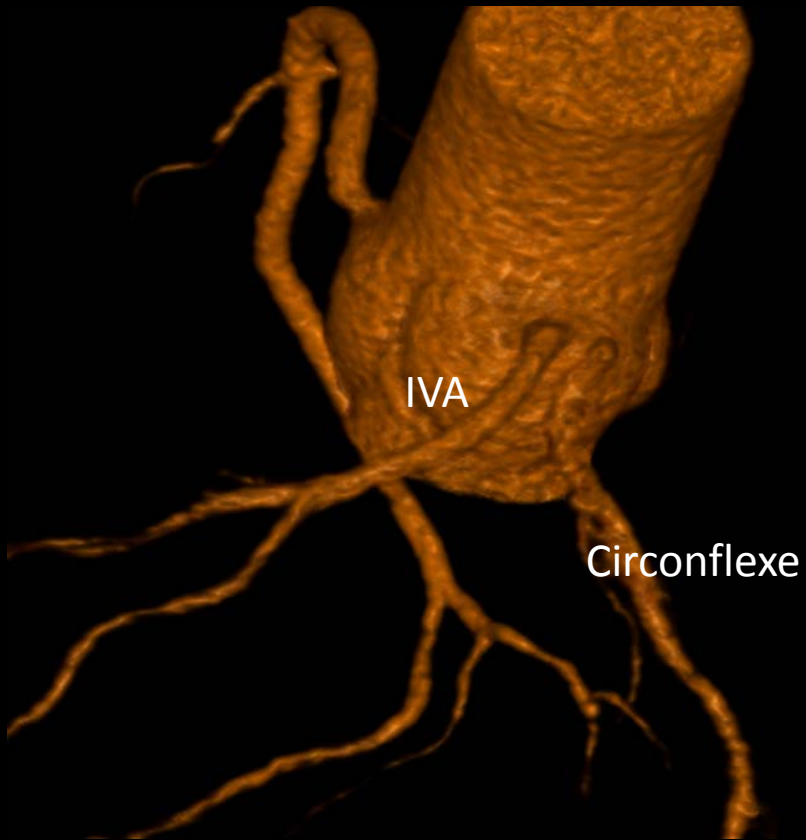
Variantes

- variantes simples : naissance ostium séparés (absence de tronc commun, artère du conus), ostium en position haute
- variantes avec anomalies de trajet : nombre ostia séparés depuis aorte ≥ 2 mais naissance en position anatomique anormale et trajet aberrant pour rejoindre sa position anatomique classique
 - ❑ trajet non malin
 - ❑ trajet malin
- coronaire unique : 1 seul ostium pour toutes la vascularisation coronaire, souvent anomalie de trajet associé. Classification complexe de Lipton (1)
- le scanner cardiaque est l'examen de référence pour détecter et caractériser ces anomalies, supérieur à la coronographie (2)

(1) Lipton MJ. *Radiology*, 1979.

(2) Schmitt R. *Eur Radiol*, 2005.

Variantes « simples »



Absence de tronc commun

Naissance en « canon de fusil »

Pas de répercussion physiopathologique

Importance pour le cathétérisme

Anomalies de trajet

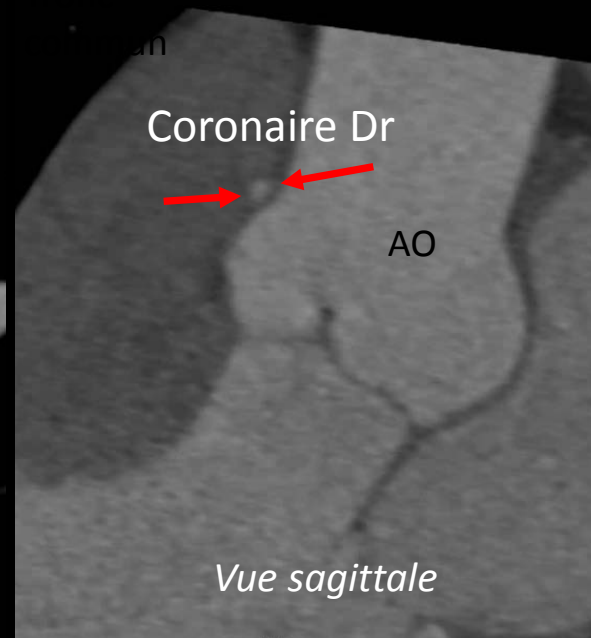
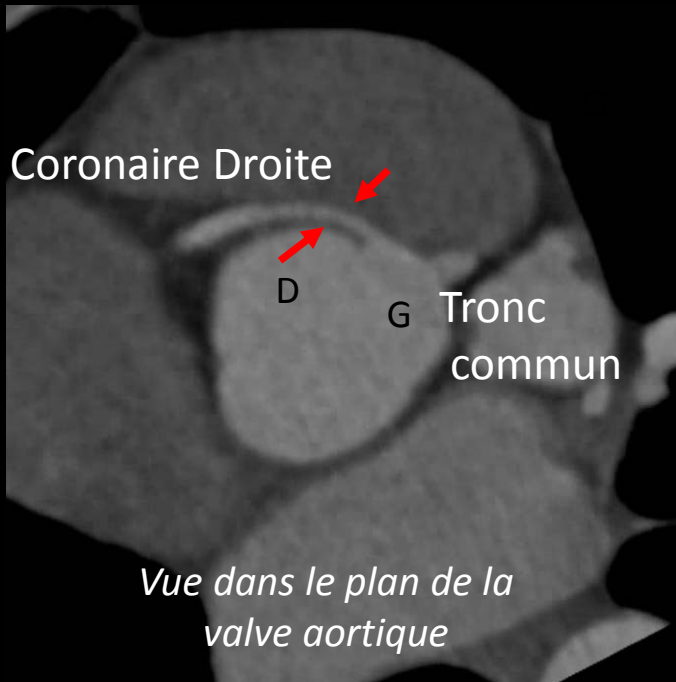
*Homme de 42 ans. Syncope à l'effort avec douleur thoracique
ECG et biologie d'entrée : examens normaux
CT-scan coronaire demandé.*

Absence d'athéromatose.

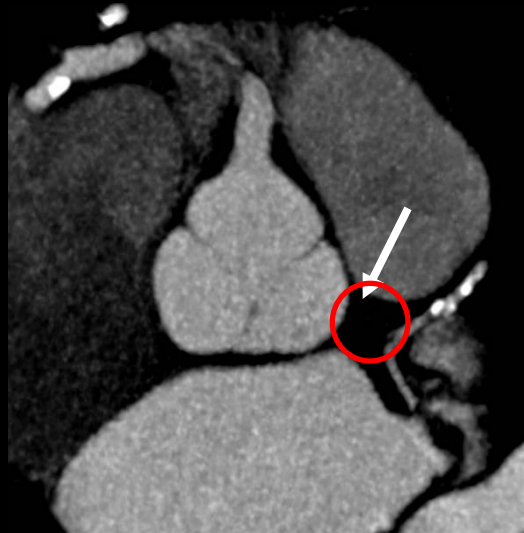
Anomalie d'origine de la coronaire droite, depuis le sinus coronaire G

Trajet interartériel (entre racine aortique et TAP), compression à son origine

Risque de compression, surtout lors de l'effort ($\uparrow$ Débit cardiaque, $\uparrow$ diamètre gros Vx)



Coronaires uniques



Absence de tronc commun
Absence d'artère naissant du sinus gauche

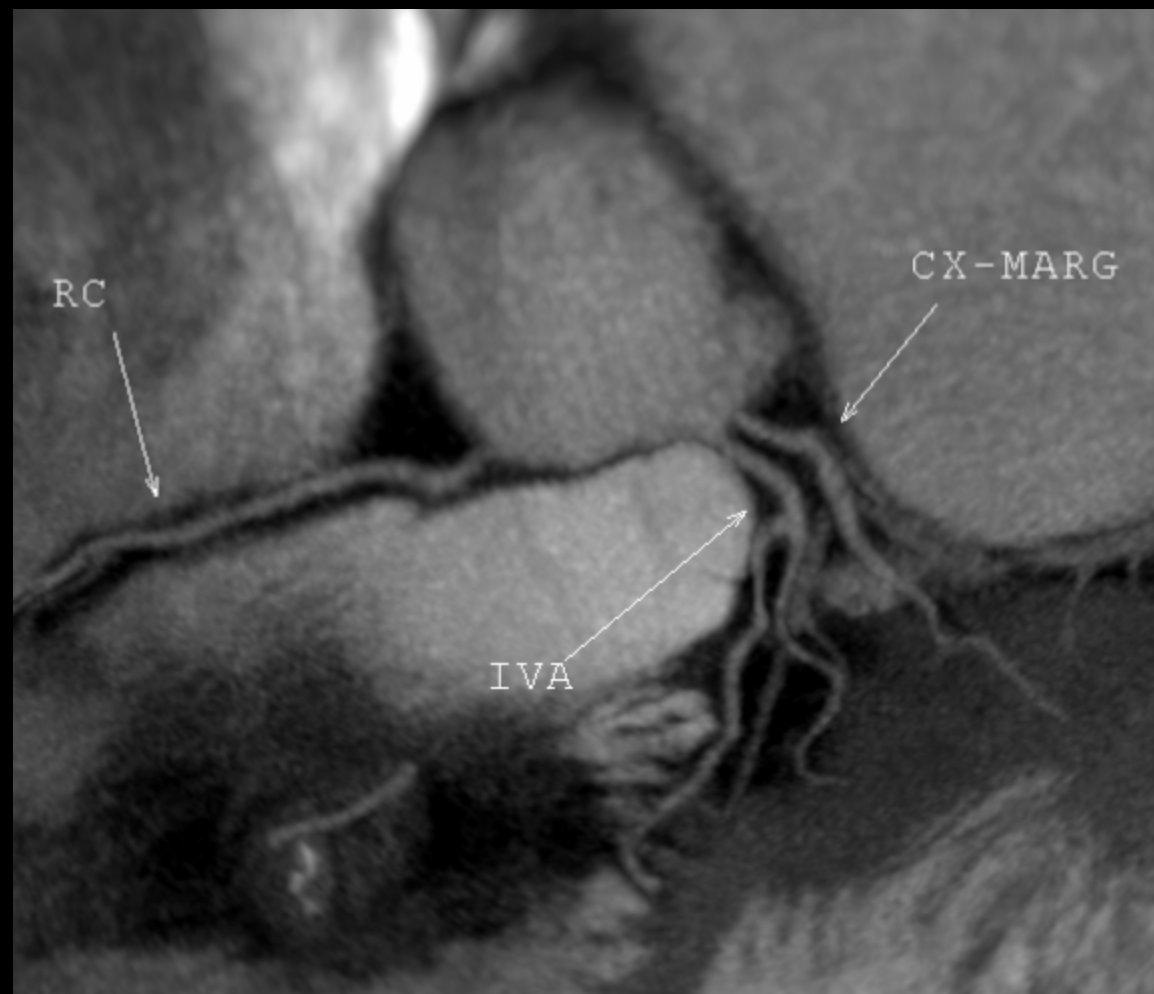
1 seule artère naissant de l'aorte

Exemple ci-dessus. Coronaire droite unique. Artère interventriculaire naissant d'une branche ventriculaire droite, injection à contre-courant.

Risque : territoire d'infarctus plus étendu en cas de sténose « proximale »

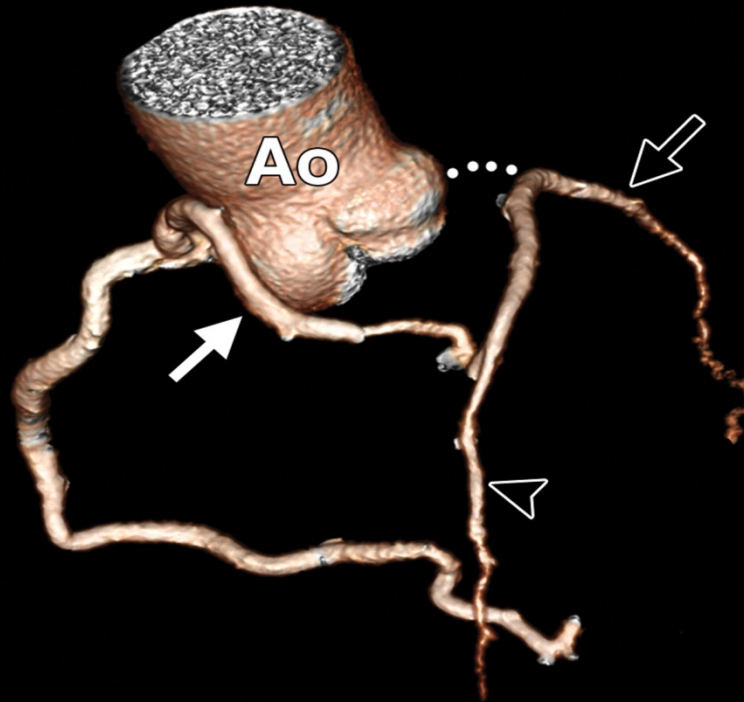
Radioanatomie coronaire

- Nombre
 - ...ou bien une seule artère pour tout le cœur...
 - absence gauche ou droite

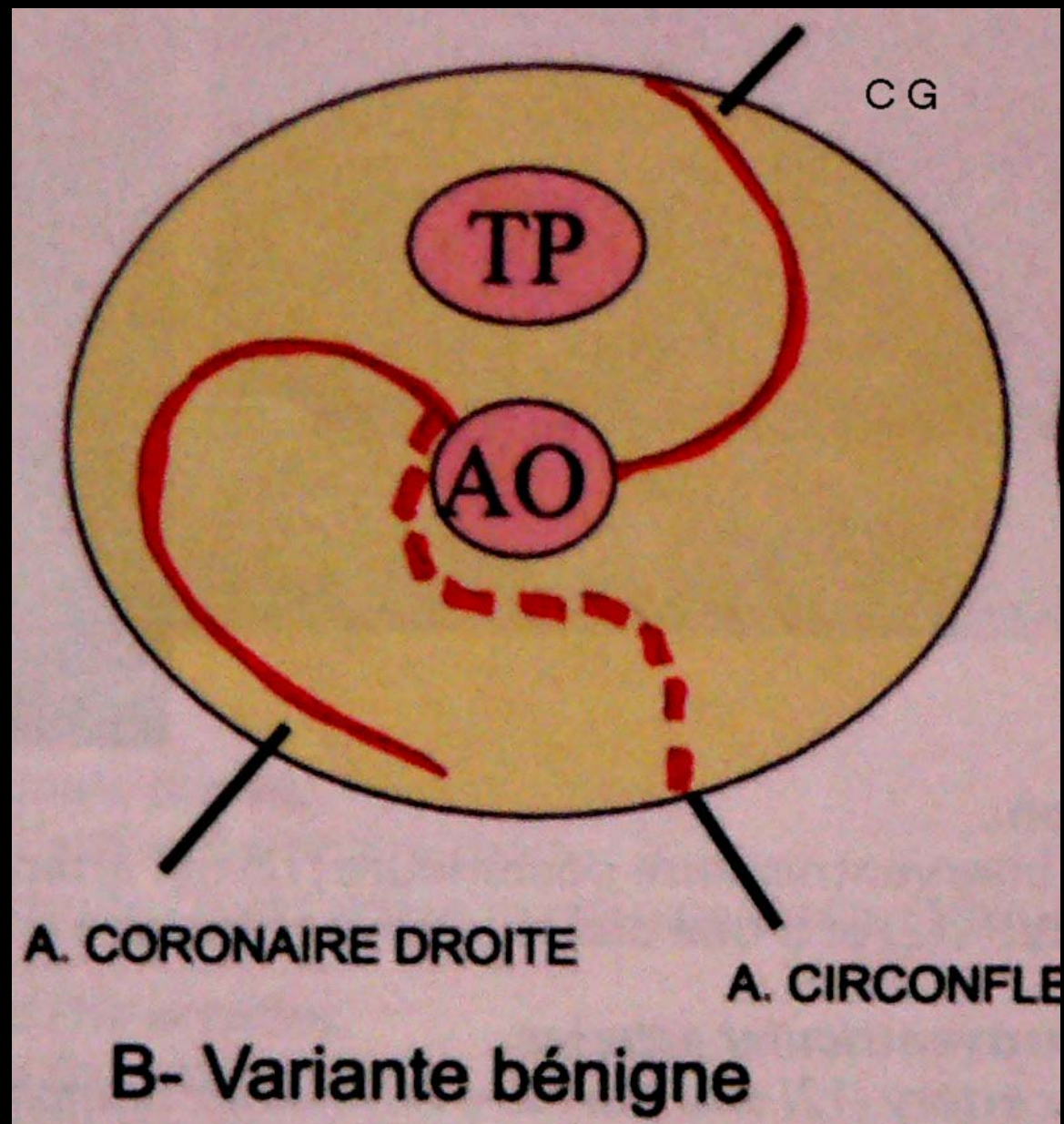




Atrésie LMA



Atresia of the LMCA in a 47-year-old woman with exertional chest pain and positive results on a stress test. The patient presented with LMCA atresia in adulthood. Volume-rendered image shows a large conus artery (solid arrow) collateral to the LAD artery (arrowhead). The LAD artery and LCX artery (open arrow) are diminutive overall. Ao = aorta, dotted line = expected region of the LMCA.



Radioanatomie coronaire

- Ectopie
 - origine postérieure au sinus Valsalva
- de CD ou du TC gauche

Radioanatomie coronaire

- Dominance
- Variation anatomique bénigne
- Variation anatomique léthale

Radioanatomie coronaire

- Naissance croisé CD ou CG au niveau du sinus de Valsalva OPPOSE

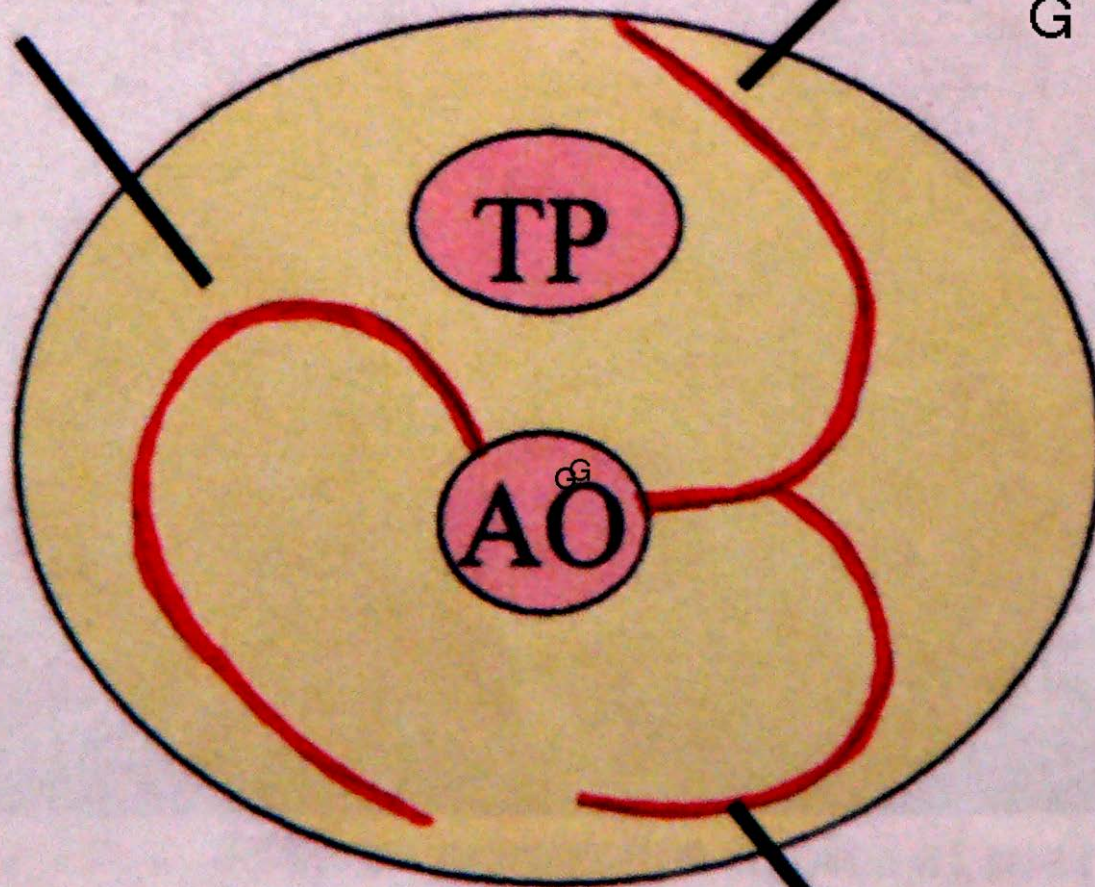
- CD CROISE = LETHALE A

L'EFFORT

A. CORONAIRE DROITE

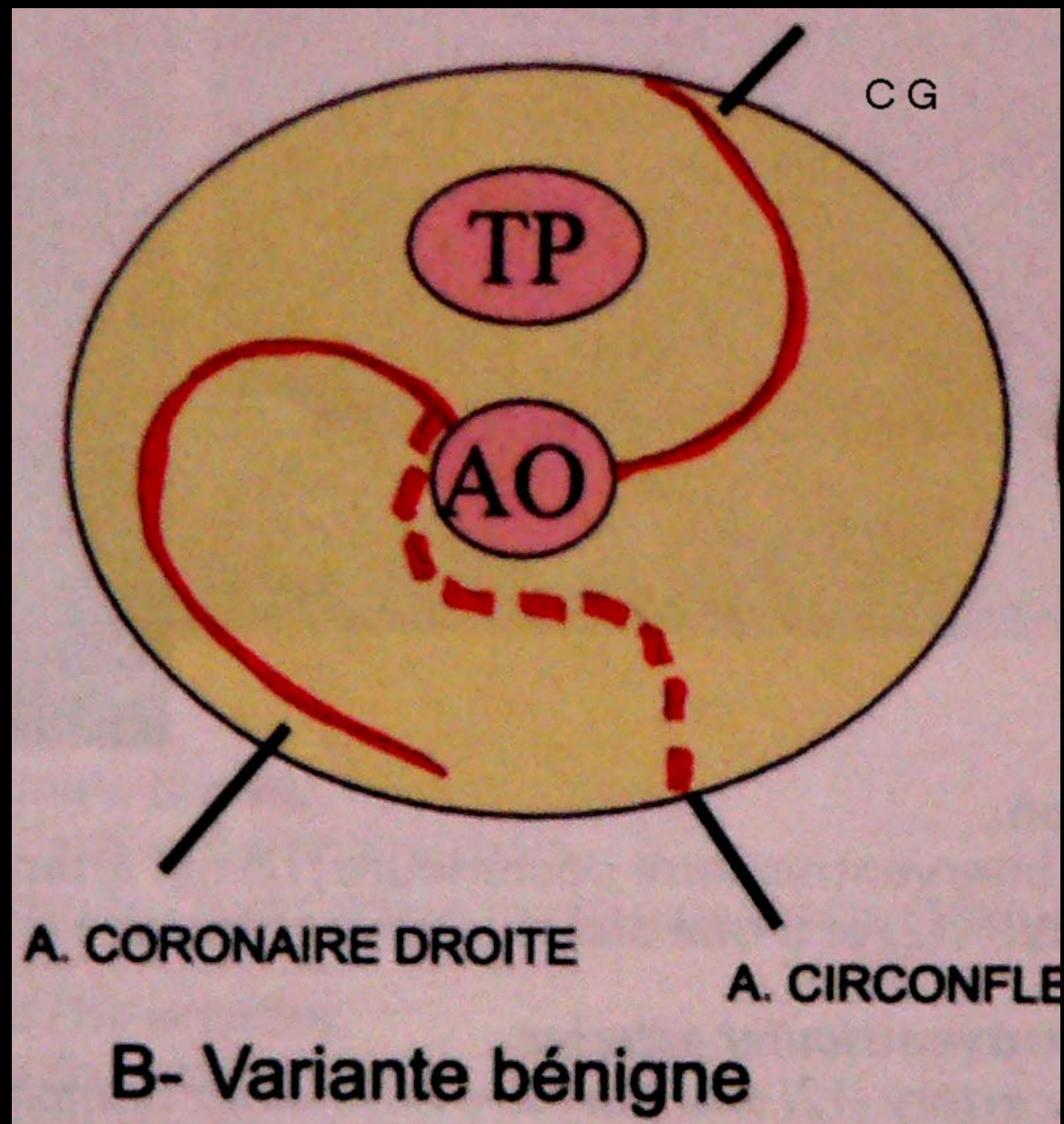
A. CORONAIRE G

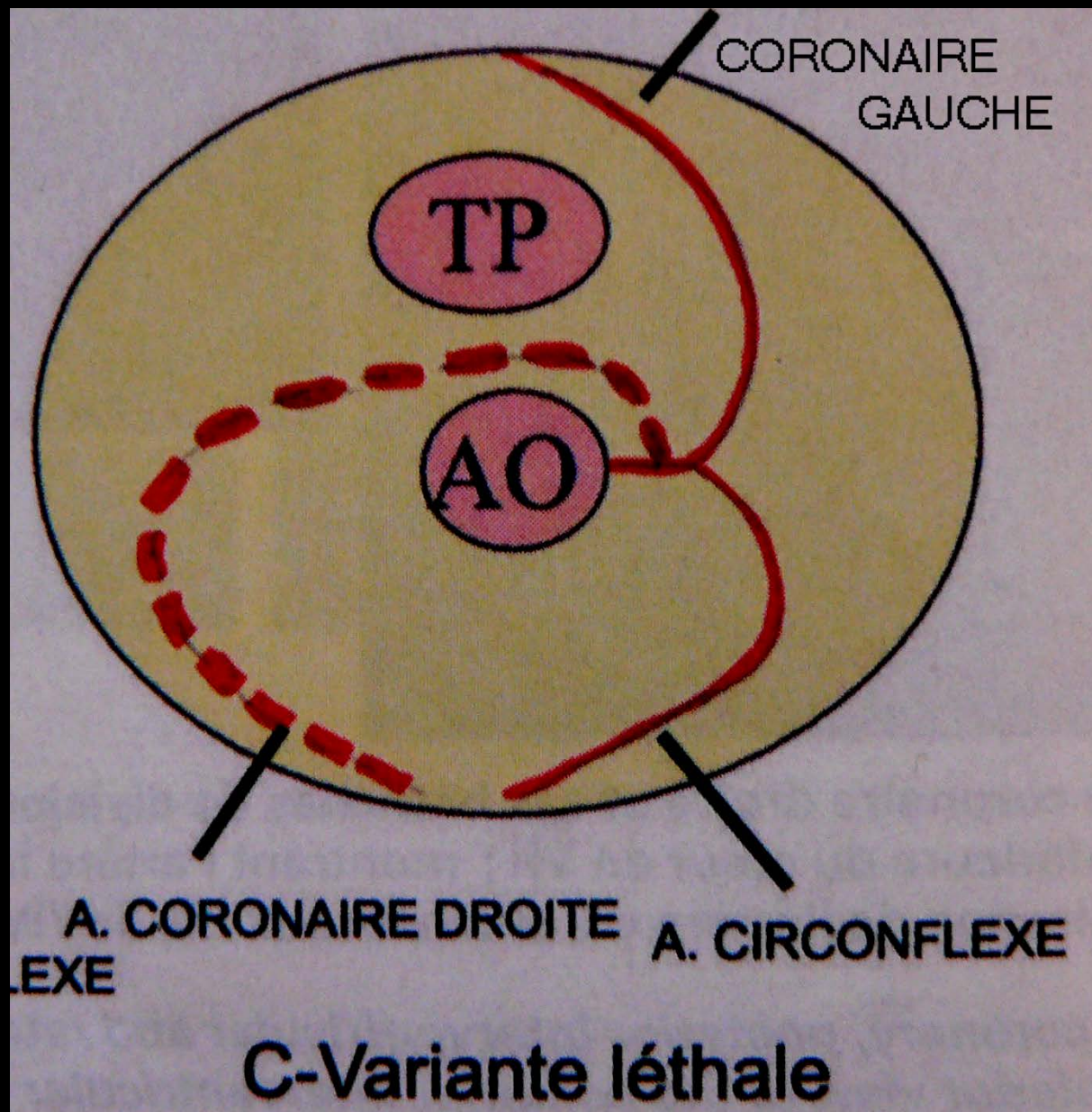
G

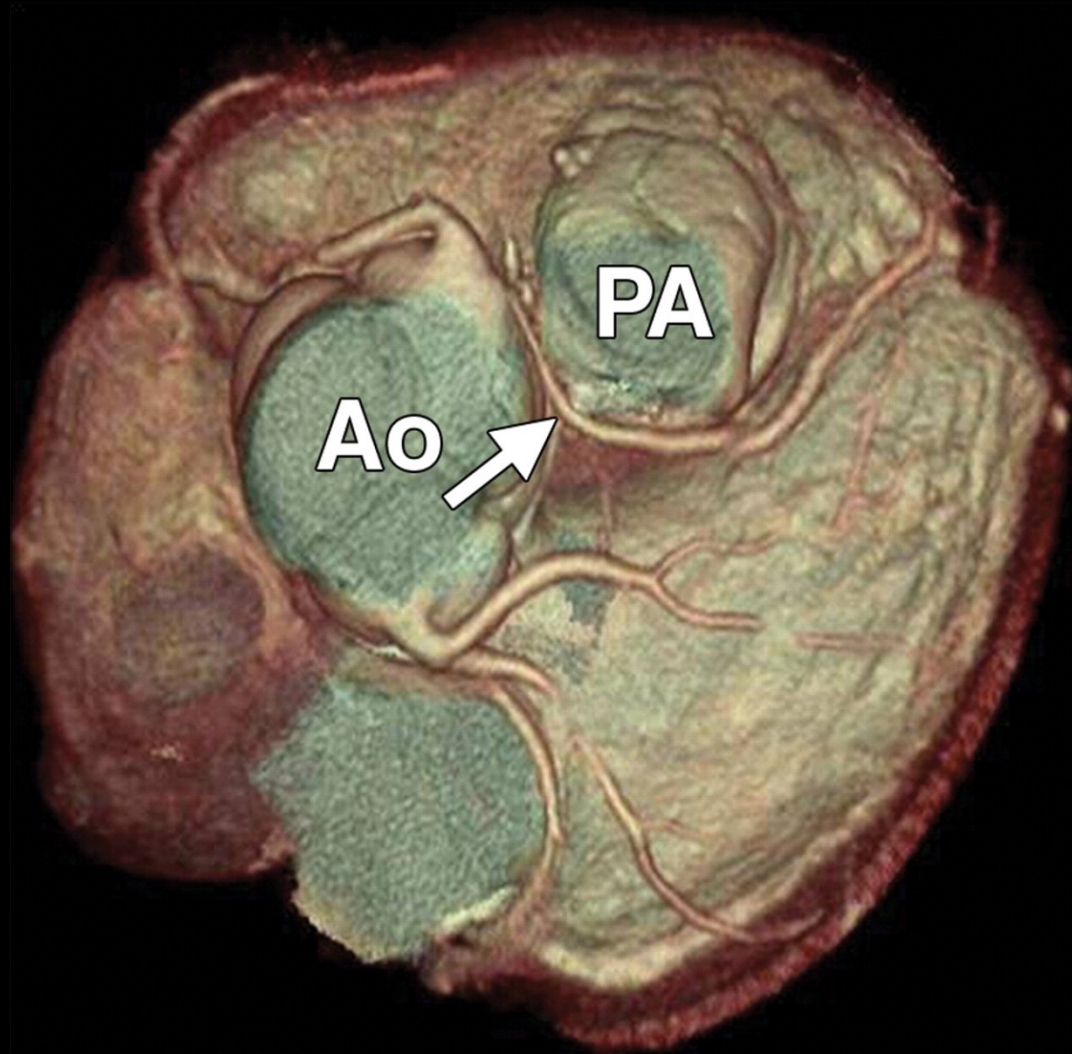


A. CIRCONFLEXE

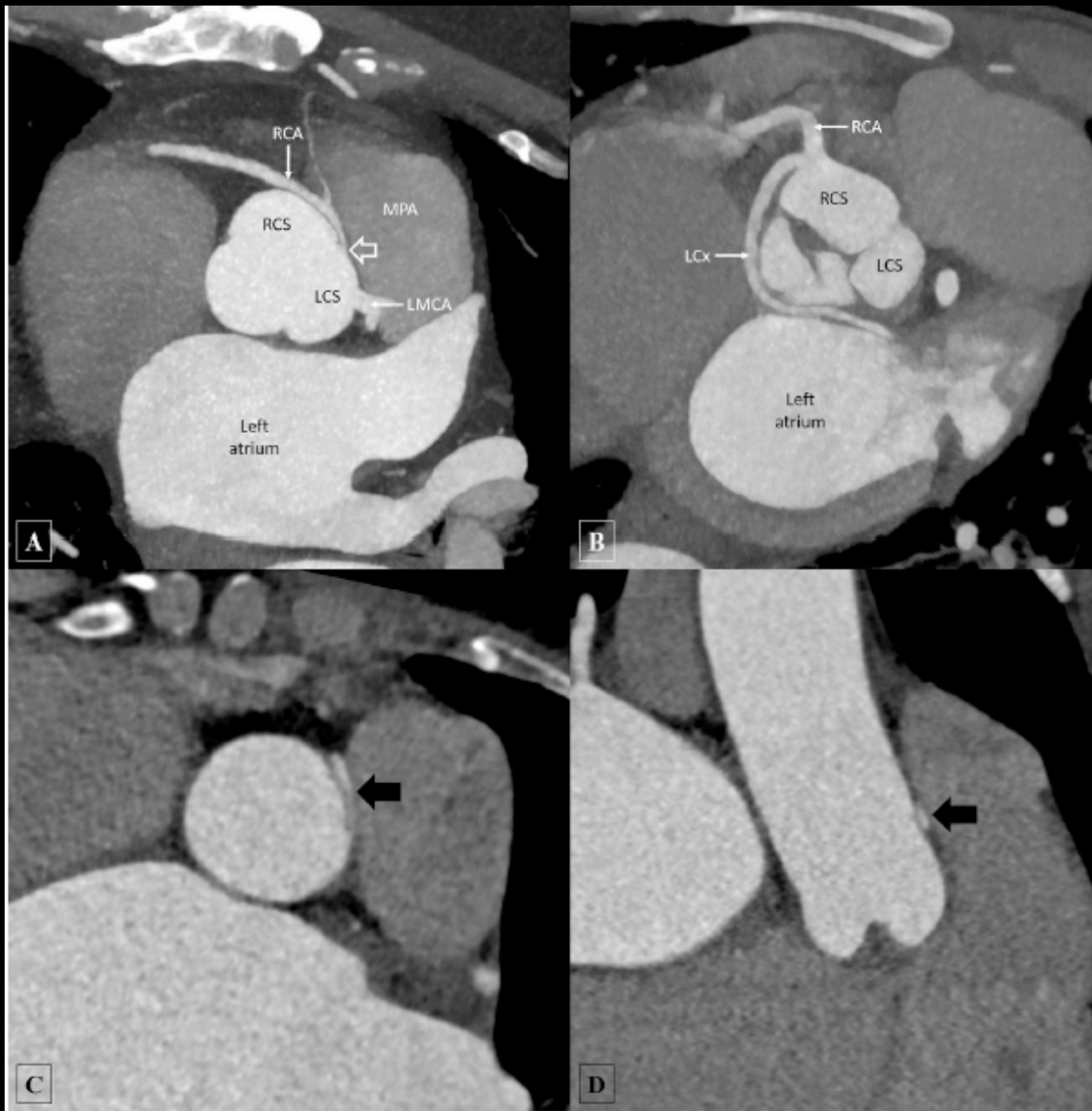
A. C







RadioGraphics 2012; 32:453–468



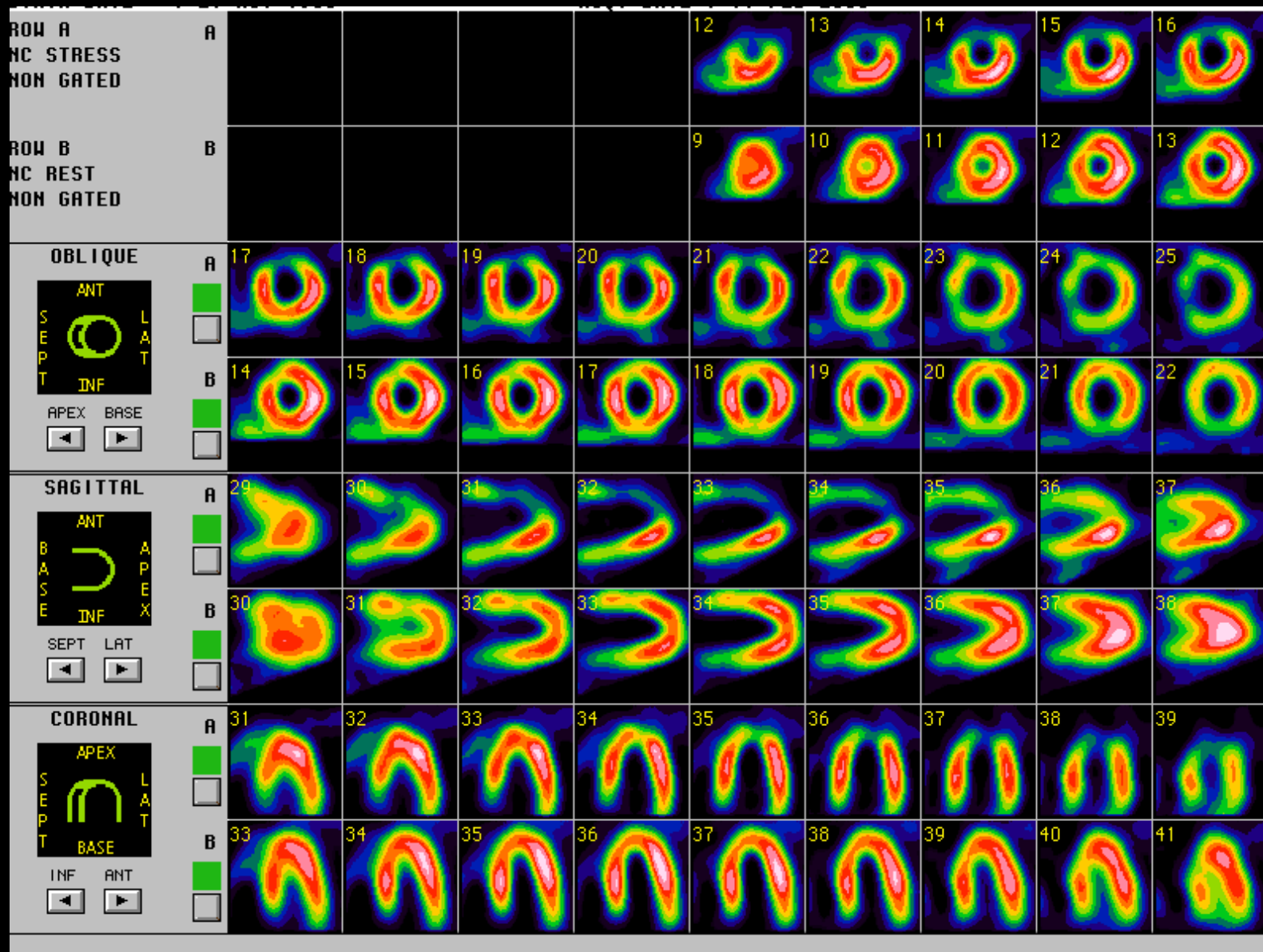
Cas clinique

Homme de 38 ans

Douleurs précordiales à l'effort

Scinti + coronarographie

Tc 99 m-Sestamibi SPECT



Courtesy of Clinique Ste Thérèse-Luxemburg

Image size: 512 x 512
View size: 1138 x 618
X: 0 px, Y: 0 px, Value: 0
WL: 56 WW: 124

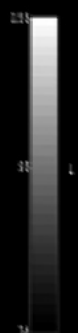
CART 1004
1
Coro LU



Im: 55/03
Zoom: 120% Angle: 0
Thickness: 0.0 mm Location: 0.0
X: 0.00 mm Y: 0.00 mm Z: 0.00 mm

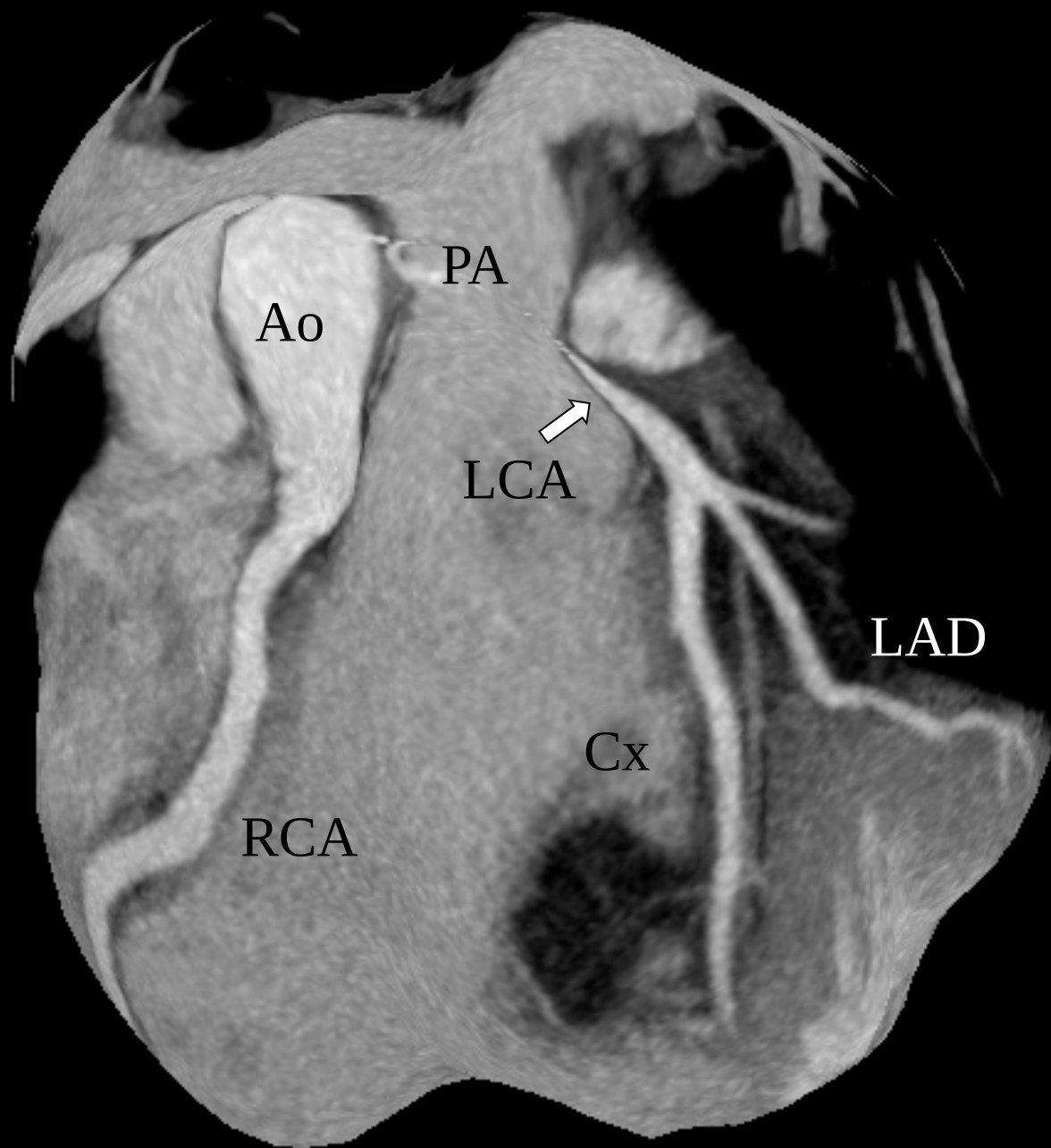
Image size: 512 x 512
View size: 1138 x 618
X: 0 px, Y: 0 px, Value: 0
WL: 56 WW: 124

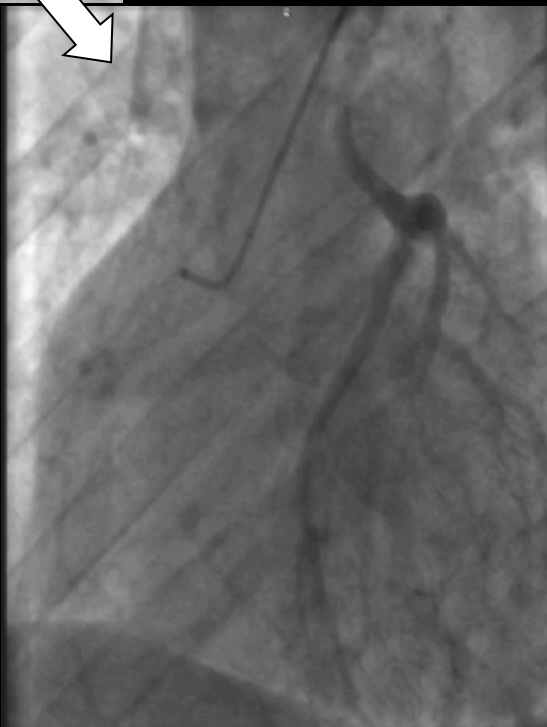
CART 1004
1
Coro LU

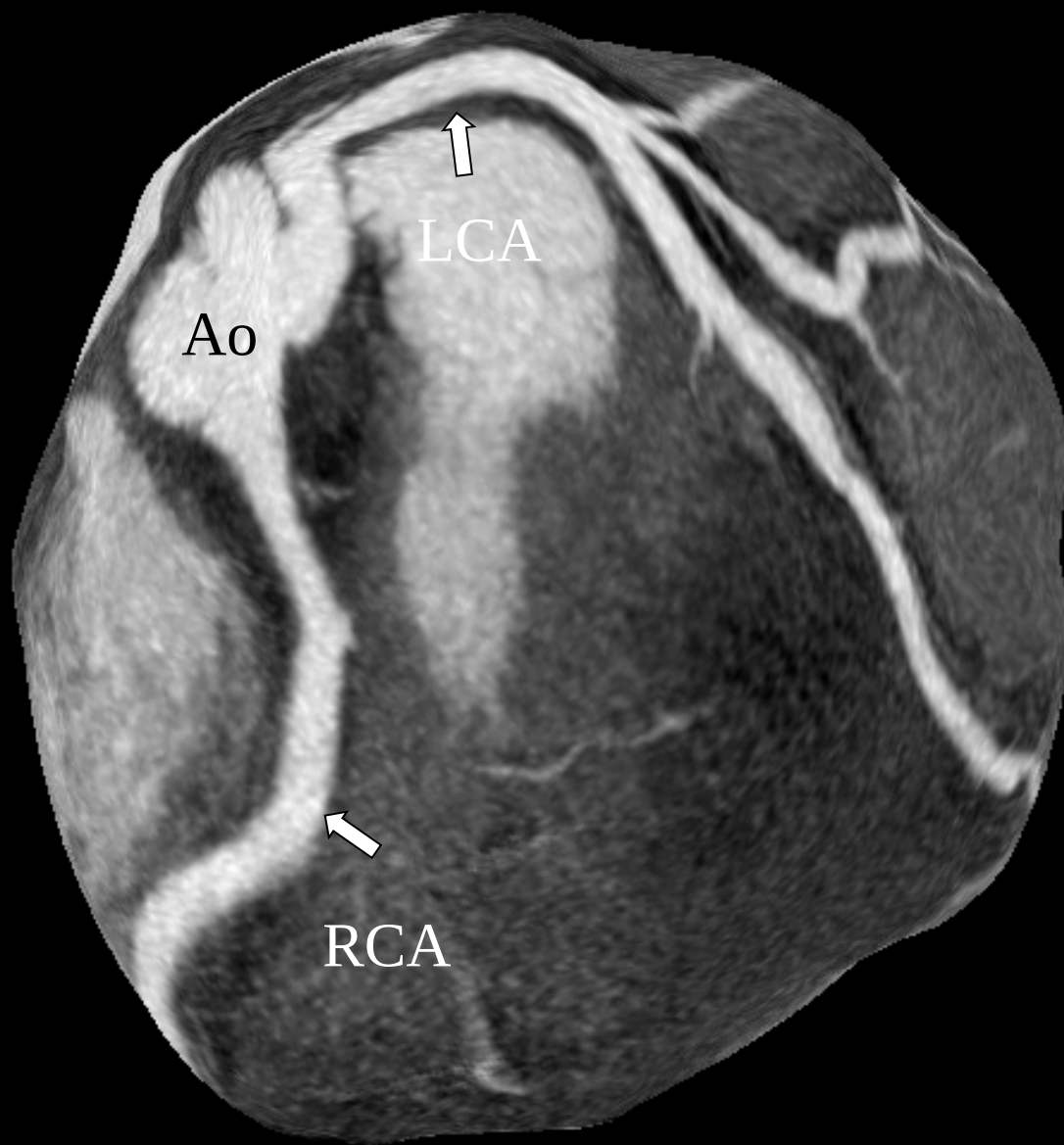


Im: 76/03
Zoom: 120% Angle: 0
Thickness: 0.0 mm Location: 0.0
X: 0.00 mm Y: 0.00 mm Z: 0.00 mm

14.07.08
9/02/05
Made with Data







Correction post-chirurgicale

