ANOCOR : APPORT DE L'IMAGERIE EN COUPE

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Intérêt de l'imagerie en coupe
….. quand je n'y arrive pas en coronarographie

Coro-Scanner

- Etude anatomique précise
- Reconstruction 3D
- Critères de malignité
- Résolution spatiale 0,3 mm
- Résolution temporelle 50-100 ms
- Rapide
- RX/Contraste

IRM Cardiaque

- Fonction
- Ischémie
- Atteinte myocardique
- Anatomie coronaire
- Résolution spatiale 1-1,5 mm
- Résolution temporelle 30ms
- Long

ANOCOR et CoroScanner

Auteurs	Study period	Patients	Coronary anomalies	Type scanner
Graidis C.et al. *BMC Cardiovasc. Disorders. 2015*	2008 – 2012 *Greece*	2572	n= 60, 2.33%	64-slice *GE*
Ashrafpoor D et al *Eur Radiol 2014*	2008-2013 *CCML - France*	4160	N=19, 0.48% Anocor intramural	DSCT *Siemens*
Opolski PM et al. *Am J Cardiol 2013*	2008-2012 *Poland*	8522	n=72, 0.84% Anocor from opposite sinus	64-slice *Siemens*
Xu H et al. *JTSC 2012*	2006-2011 *China*	12145	n= 124, 1.02%	DSCT *Siemens*
Fujimoto S. et al. *J. Cardiol. 2011*	2005-2009 *Japan*	5869	n= 89, 1.52%	64-slice *Toshiba*
Cheng Z et al. *Clin Radiol. 2010*	2008-2009 *China*	3625	N= 36, 0.99%	DSCT *Siemens*
Ziegler F. et al *BMC Cardiovasc. Disorders. 2009*	2005-2007 *Florida*	748	n= 17, 2.3%	64-slice *Siemens*

TABLE 3. Incidence of Coronary Anomalies and Patterns, as Observed in a Continuous Series of 1950 Angiograms

Variable	N (%)
Coronary anomalies (total)	110 (5.64)
Split RCA	24 (1.23)
Ectopic RCA (right sinus)	22 (1.13)
Ectopic RCA (left sinus)	18 (0.92)
Fistulas	17 (0.87)
Absent left main coronary artery	13 (0.67)
Circumflex arising from right sinus	13 (0.67)
LCA arising from right sinus	3 (0.15)
Low origination of RCA	2 (0.1)
Other anomalies	3 (0.27)
Coronary dominance patterns	
Dominant RCA	1641 (89.1)
Dominant LCA (circumflex)	164 (8.4)
Codominant arteries (RCA, circumflex)	48 (2.5)

LCA indicates left coronary artery. Adapted from Angelini P et al[10] with permission from Lippincott, Williams & Wilkins. Copyright 1999.

Incidence clinique des ANOCOR

Symptomatologie en rapport avec l'effort physique

- Angor plus ou moins typique
- Dyspnée
- Syncope
- Trouble du rythme
- IDM
- Mort subite
- cardiomyopathie

Maron et col, J Am Coll Cardiol 2003;41:974–80

Table 1. Frequency and Racial Differences for Cardiovascular Causes of Sudden Death in 286 Young Competitive Athletes

Cause of Death	No. (%) of Athletes	M:F	Age ± SD	White No. (%)	A-A No. (%)	Other No. (%)	p Value*
HCM	102 (36)	99:3	17.0 ± 2.5	42 (41)	56 (55)	4 (4)	0.002
Coronary artery anomalies of wrong sinus origin†	37 (13)	28:9	15.3 ± 2.5	15 (40)	18 (49)	4 (11)	NS
Indeterminant, possibly HCM‡	29 (10)	27:2	17.9 ± 4.0	15 (52)	12 (41)	2 (7)	NS
Myocarditis	20 (7)	16:4	17.1 ± 3.9	12 (60)	8 (40)	0	NS
Ruptured aortic aneurysm	12 (4)	9:3	18.4 ± 5.1	8 (67)	4 (33)	0	NS
ARVC	11 (4)	9:2	17.0 ± 2.4	10 (91)	1 (9)	0	0.033
Tunnelled coronary artery	11 (4)	11:0	16.4 ± 3.0	8 (73)	3 (27)	0	NS
Aortic valve stenosis	10 (3)	10:0	15.4 ± 1.5	10 (100)	0	0	0.017
Atherosclerotic coronary artery disease	10 (3)	9:1	17.5 ± 3.9	7 (70)	3 (30)	0	NS
Idiopathic dilated cardiomyopathy	9 (3)	8:1	17.9 ± 1.8	5 (56)	4 (44)	0	NS
Mitral valve prolapse	9 (3)	8:1	18.4 ± 6.5	5 (56)	4 (44)	0	NS
Coronary artery hypoplasia	8 (2)	8:0	18.8 ± 9.1	7 (88)	1 (12)	0	NS
Other congenital coronary anomalies§	8 (2)	5:3	15.6 ± 2.5	6 (80)	2 (20)	0	NS
Cardiac sarcoidosis	3 (1)	3:0	21.3 ± 4.6	0	3 (100)	0	NS
Long QT syndrome	3 (1)	3:0	16.7 ± 0.6	2 (67)	1 (33)	0	NS
Congenital heart disease‖	3 (1)	2:1	14.0 ± 2.3	3 (100)	0	0	NS
Myocardial infarction (etiology unresolved)	1 (0.3)	1:0	15.0 ± 0.0	1 (100)	0	0	NS

Caractéristiques cliniques et explorations fonctionnelles

able 3. Previously Published Reports of Wrong Sinus Coronary Artery Anomalies in Persons Aged ≤35 Years in Whom ECG Data Were Available

Reference (#)	Year	Age, Gender	Anomaly	Symptoms	12-lead ECG	Exercise Stress Test	Myocardial Perfusion Scintigraphy	Athlete	Outcome ECG
heidin et al. (11)	1974	14 M	LMCA	Syncope†	Normal	Normal	0	0	Alive (with surgery)
rdal et al. (26)	1976	10 F	LMCA	Syncope	Normal	Normal	0	0	Sudden death
enge et al. (27)	1980	25 M	RCA	Syncope	T wave inversion (II, III, aVF, V3–V6)	Normal	Not diagnostic	0	Alive
lustafa et al. (28)	1981	12 M	LMCA	Syncope	Normal	Normal	Normal	0	Alive (with surgery)
randt et al. (29)	1983	35 M	RCA	Anginal†	Inferior subendocardial MI	Normal	0	0	Alive (with surgery)
onaldson et al. (30)	1983	*M	LMCA	Anginal†	Normal	Positive (ventricular tachycardia)	0	0	Alive (with surgery)
onaldson et al. (30)	1983	*M	LMCA	Anginal†	Normal	Positive (subendocardial ischemia)	0	0	Alive (with surgery)
onaldson et al. (30)	1983	*M	LMCA	Syncope†	Normal	Positive (subendocardial ischemia)	0	0	Alive (with surgery)
arth and Roberts (31)	1986	14 M	LMCA	Syncope/anginal†	Normal	Normal	0	0	Sudden death
ander Sande et al. (32)	1989	14 F	LMCA	Syncope†	Normal	First degree atrioventricular block	0	0	Sudden death
laron et al. (33)	1991	21 M	LMCA	Syncope†	LVH, T wave inversion (lateral leads)	Positive (sinus bradycardia, syncope)	0	0	Alive (with surgery)
ornado et al. (14)	1992	22 M	RCA	Palpitations	Normal (PVC)	Normal	0	+	Sudden death
mansenna et al. (34)	1993	18 M	LMCA	Syncope†	T wave inversion (I, aVL, V2–V3)	Normal	0	0	Alive (with surgery)
midini et al. (35)	1994	12 M	LMCA	Syncope†	Normal	Normal	0	0	Sudden death
an Son et al. (36)	1996	9 M	LMCA	Angina, syncope†	ST-T changes (II, aVF, V5–V6)	Normal	Normal	0	Alive (with surgery)
hoon et al. (37)	1997	11 M	LMCA	Anginal†	ST-T changes; PVC	Normal	Normal	0	Alive (with surgery)
eppilli et al. (38)	1998	17 M	RCA	None	Normal (PVC)	Normal	Normal	+	Alive
eppilli et al. (38)	1998	18 M	RCA	Dyspnea†	Incomplete RBBB	Normal	Positive (ischemia)	+	Alive

ubjects aged ≤35 years but precise age of each individual patient uncertain; †on effort. 0 = absent; + = present.
LMCA = left main coronary artery; LVH = left ventricular hypertrophy; MI = myocardial infarction; PVC = premature ventricular complex; RBBB = right bundle branch block; RCA = right coronary artery.

Basso et col, J Am Coll Cardiol 2000;35:1493–501

3539 CT/53 ANOCOR/ 106 Control/ Suivi 3-5 ans

Int J Cardiovasc Imaging
DOI 10.1007/s10554-016-0849-5

ORIGINAL PAPER

Coronary arteries anomalous aortic origin on a computed tomography angiography population: prevalence, characteristics and clinical impact

José Amado[1] · Mónica Carvalho[2] · Wilson Ferreira[2] · Paula Gago[1] · Vasco Gama[2] · Nuno Bettencourt[2]

Table 2 Anomalous origins

Anomalous coronary artery	Origin	Course	Number of patients	Prevalence among the 53 patients	Prevalence among CTA population (n = 3539)
Right coronary artery	Left coronary sinus	Interarterial (Fig. 1)	17	32.1 %	0.40 %
	Left anterior descending artery	Pre-pulmonar	2	3.8 %	0.06 %
	Non-coronarian sinus	Retroaortic	2	3.8 %	0.06 %
Left circumflex artery	Right coronary sinus	Retroaortic (Fig. 2)	15	28.3 %	0.42
		Interarterial	1	1.9 %	0.03 %
Left main coronary artery	Right Coronary Sinus	Interarterial (Fig. 3)	3	5.7 %	0.08 %
		Anterior	5	9.4 %	0.14 %
		Retroaortic	1	1.9 %	0.03 %
	Non-coronarian sinus	Between the aorta and the left atrium	3	5.7 %	0.08 %
Left anterior descending artery	Right coronary sinus	Anterior	2	3.8 %	0.06 %
		Septal	1	1.9 %	0.03 %
LMCA arising from the right coronary sinus with a LAD with interarterial course			1	1.9 %	0.03 %
Single right coronary artery			1	1.9 %	0.03 %

LMCA Left main coronary artery, *LAD* Left anterior descending artery

17,6%[A] vs 21,2%[C] MACE NS/ sans lien avec Anocor

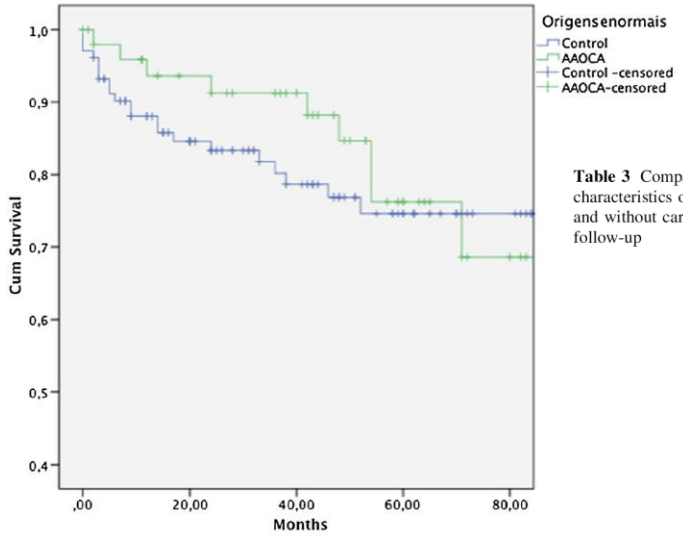

Fig. 4 Kaplan meyer curve regarding time free of any cardiovascular event

Table 3 Comparison between characteristics of patients with and without cardiac events on follow-up

	Cardiac events	Without cardiac events	*p*
Mean age (SD)	63.2 (SD 11.0)	57.5 (SD 8.8)	0.001
Male gender	50.0 %	60.9 %	0.212
Cardiovascular comorbidities	66.7 %	20.3 %	0.005
RCA anomalous origin	12.1 %	12.2 %	0.991
LMCA anomalous origin	12.1 %	7.3 %	0.375
LCX anomalous origin	0 %	12.2 %	0.035
LAD anomalous origin	3.0 %	0.8 %	0.315

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Anomalous Coronary Artery Origin and Sudden Cardiac Death

Clinical and Pathological Insights From a National Pathology Registry

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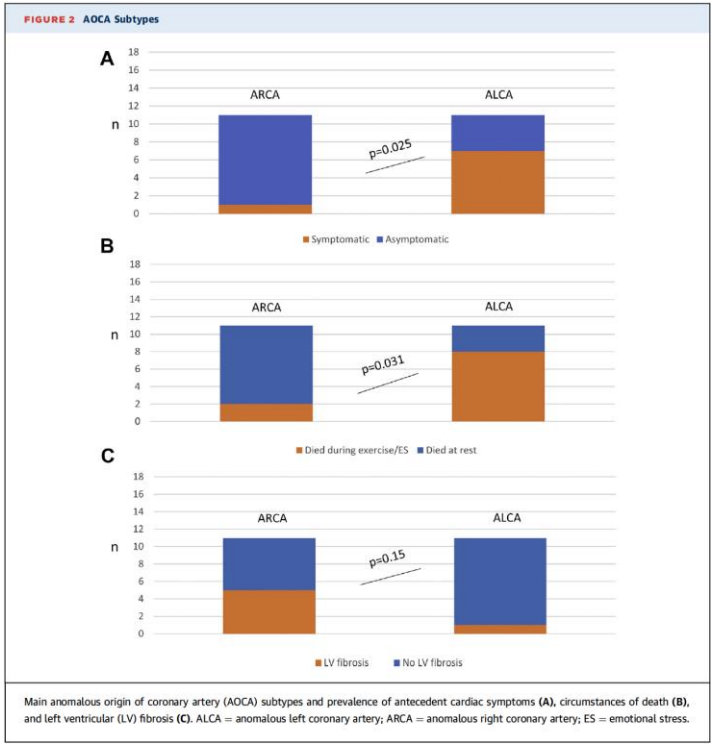


FIGURE 2 AOCA Subtypes

Main anomalous origin of coronary artery (AOCA) subtypes and prevalence of antecedent cardiac symptoms **(A)**, circumstances of death **(B)**, and left ventricular (LV) fibrosis **(C)**. ALCA = anomalous left coronary artery; ARCA = anomalous right coronary artery; ES = emotional stress.

TABLE 2 Differences Between Subtypes

	ALCA (n = 11)	ARCA (n = 11)	ALCAPA (n = 7)	p Value
Age, yrs	22 ± 15	31 ± 15	33 ± 18	NS
Male	9 (82)	9 (82)	3 (43)	NS
Cardiac symptoms	7 (64)	1 (9)	3 (43)	0.025*
Death during exercise/ES	8 (73)	2 (18)	4 (57)	0.031*
Heart weight, g	309 ± 97	380 ± 91	472 ± 98	0.014†
LV fibrosis	1 (9)	5 (45)	5 (71)	0.03†

Mécanismes potentiels des évènements

- Patients asymptomatiques
- Présentation clinique différente pour une même spécificité anatomique
- Symptômes cliniques plus fréquents chez sujets jeunes, voir absents après 50 ans

- Episodes multiples et additifs d'ischémie myocardique
- Angulation aigue de l'ostium coronaire et kinking
- Fermeture de la fente ostiale comme une valvule
- Spasme sur anomalie par atteinte de l'endothélium
- Trouble du rythme Vent sur myocarde excitable ou fibrose
- Pas d'athérome induit par l'ANOCOR

Y a-t-il des critères anatomiques de risque ?

Quelles sont les ANOCOR à risque ?

- les trajets pré-pulmonaires ?
- les trajets rétro-aortiques ?

- Ce sont toujours des ANOCOR inter-artérielles (mais pas toutes) impliquant la naissance de la coronaire d'un sinus opposé

4160 CT / 19 ANOCOR interartérielles / Mace : syncope, mort subite, SCA, STEMI

Eur Radiol
DOI 10.1007/s00330-014-3454-9

CARDIAC

Anatomical criteria of malignancy by computed tomography angiography in patients with anomalous coronary arteries with an interarterial course

Golmehr Ashrafpoor · Nicolas Danchin · Lucile Houyel · Ramzi Ramadan · Emre Belli · Jean-François Paul

Table 3 Anatomical CCTA criteria according to occurrence of major cardiac adverse events

	Prior MACE	No prior MACE	*p*
Patients (*n*)	7	12	–
Minimal area (mm^2)	3.6±0.7	9.0±5.3	0.001*
Distal area (mm^2)	8.6±2.1	11.4±4.7	0.26*
Area stenosis (%)	57±8	24±19	0.001*
Area stenosis ≥50 %	7 (100 %)	1 (8 %)	0.001§
Height of proximal segment (mm)	4.6±1.3	4.8±1.4	0.30*
Width of proximal segment (mm)	1.6±0.3	2.5±1.3	0.02*
Height/width ratio	2.8±0.9	2.2±1.0	0.14*
High take-off	6 (86 %)	8 (67 %)	0.36§
Take-off angle (°)	13±8	23±22	0.12*
Intra-arterial length (mm)	14.7±3.4	8.6±4.1	0.003*
Slit-like origin	6 (85 %)	4 (33 %)	0.06§

Eur Radiol
DOI 10.1007/s00330-014-3238-2

CARDIAC

Anomalous origin of the coronary artery from the wrong coronary sinus evaluated with computed tomography: "High-risk" anatomy and its clinical relevance

Maciej Krupiński · Małgorzata Urbańczyk-Zawadzka · Bartosz Laskowicz · Małgorzata Irzyk · Robert Banyś · Piotr Klimeczek · Katarzyna Gruszczyńska · Jan Baron

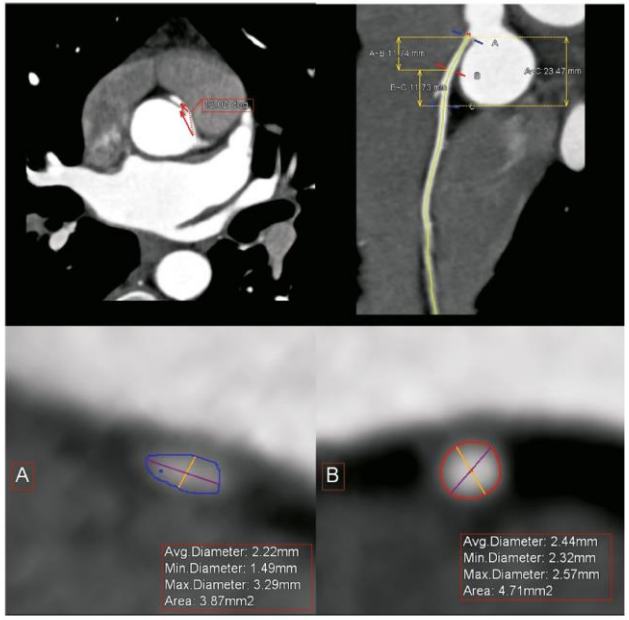


Fig. 1 Multiplanar reconstructions (*MPR*) including curved multiplanar reconstructions (*CMPR*) were used to evaluate (a) the take-off angle of the anomalous vessel, (b) the area and two orthogonal diameters of the anomalous orifice (**A**) and reference area (**B**), (c) the length between the anomalous coronary artery origin and its return to the correct anatomical position (**A**–**C**)

- 7115 patients, sur 6 ans
- 54 Anocor (0.76%) du sinus opposé

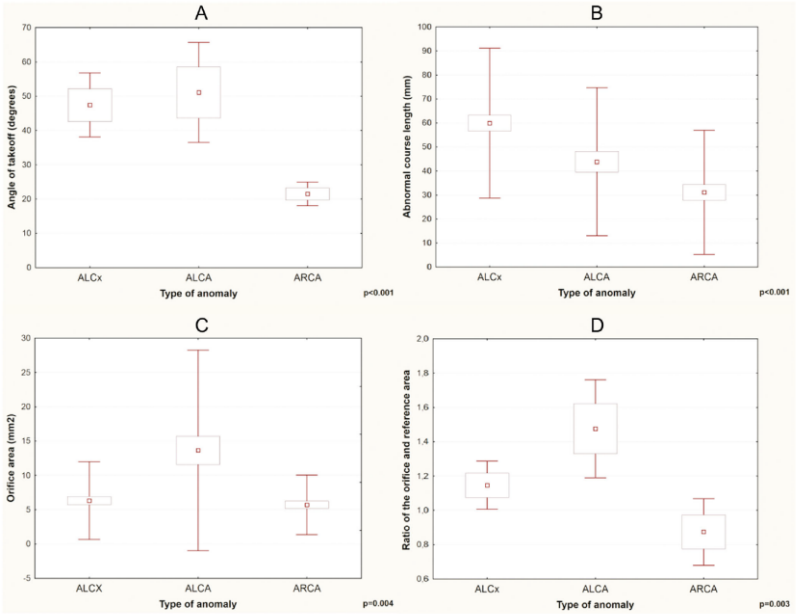
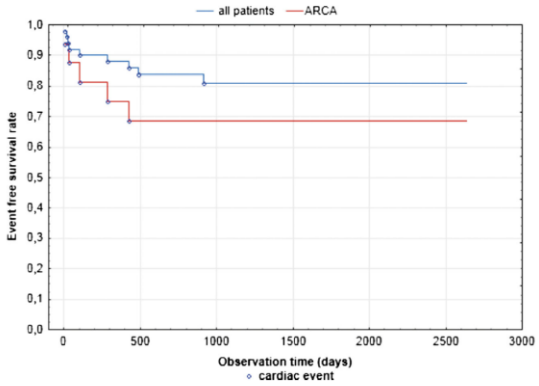


Fig. 2 Box-and-whisker plot: take-off angle (degrees) (**a**), orifice area (mm^2) (**b**), abnormal course length (mm) (**c**) and ratio of the orifice and reference area (**d**). Continuous variables are presented as mean ± standard deviation, mean±1.96 * standard deviation

Fig. 3 Kaplan-Meier plot of survival free of cardiac events. A comparison of all patients with an anomalous coronary artery originating from the wrong coronary sinus and patients with an anomalous right coronary artery originating from the left coronary artery sinus (ARCA)



Intramural Coronary Length Correlates With Symptoms in Patients With Anomalous Aortic Origin of the Coronary Artery

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Divisions of Cardiovascular-Thoracic Surgery, Medical Imaging, and Cardiology, Children's Memorial Hospital, Northwestern University Feinberg School of Medicine, Chicago, Illinois; and Department of Pediatrics and Congenital Heart Surgery, Cleveland Clinic, Cleveland, Ohio

DIU cardiologie interventionnelle

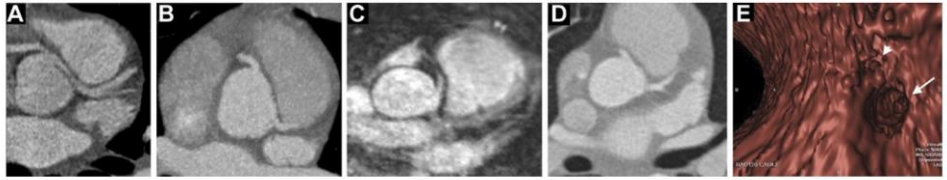


Fig 3. (A) A computed tomography scan shows a left anomalous aortic origin of the left coronary artery (AAOCA). (B) Scan shows the same patient after coronary unroofing. The coronary orifice has been moved to the left sinus of Valsalva and appears widely patent. (C) A computed tomography scan shows a right AAOCA. (D) Scan shows the same patient after coronary unroofing. (E) A computed tomography scan shows an endoluminal view of a right AAOCA from the left sinus with a normal left coronary artery ostium (white arrow) and slit-like right coronary artery (white arrowhead).

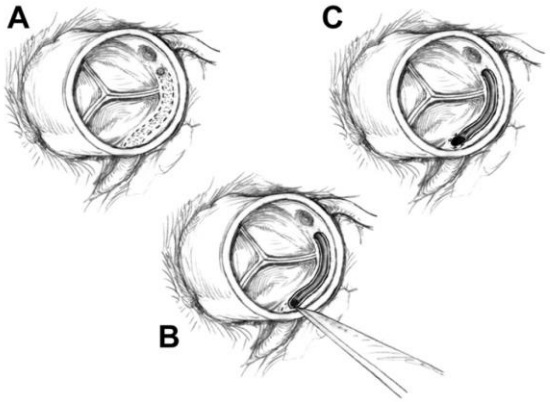


Fig 1. Anomalous aortic origin of the right coronary artery from the left sinus of Valsalva is shown. (A) The transected aortic root demonstrates an intramural course of the right coronary artery above the aortic valve commissure and with its ostium in the left sinus of Valsalva. The left coronary artery has a normal orifice and course. (B) The unroofing technique is performed with a #11 blade along the entire course of the intramural coronary artery until the coronary artery exits away from the aortic wall. (C) Tacking sutures of 8-0 Prolene are placed around the neo-ostium to prevent intimal dissection or thrombosis. (Reprinted from Oper Tech Thorac Cardiovasc Surg, Vol. 15, Mavroudis C, Backer CL, Technical Tips for Three Congenital Heart Operations: Modified Ross-Konno Procedure, Optimal Ventricular Septal Defect Exposure by Tricuspid Valve Incision, Coronary Unroofing and Endarterectomy for Anomalous Aortic Origin of the Coronary Artery, pages 18–40, Copyright 2010, with permission from Elsevier [14]).

Ann Thorac Surg 2011;92:986 –92

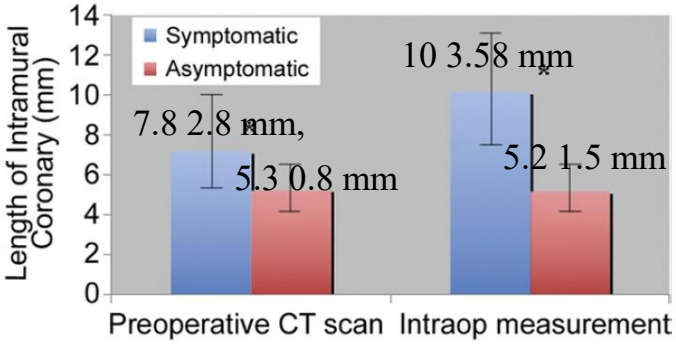
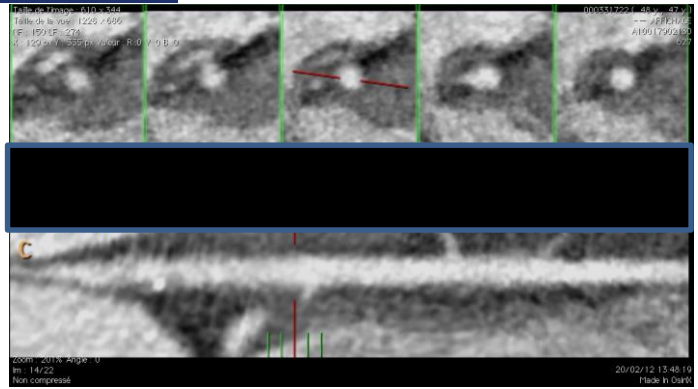


*Fig 4. Data are shown for the length of intramural coronary artery in patients with (blue) and without (red) symptoms. A greater intramural coronary length measured by preoperative imaging (computed tomography or magnetic resonance imaging) or by direct intraoperative measurement correlated with preoperative symptoms. The error bars show the standard deviation. *$p < .001$. (CT = computed tomography.)*

CT scan strongly predicted the intraoperative intramural coronary length measurement correlation (r 0.81, p 0.00001)

Coronaire droite – sinus gauche 0,03 à 0,17%

DROITE ECTOPIQUE

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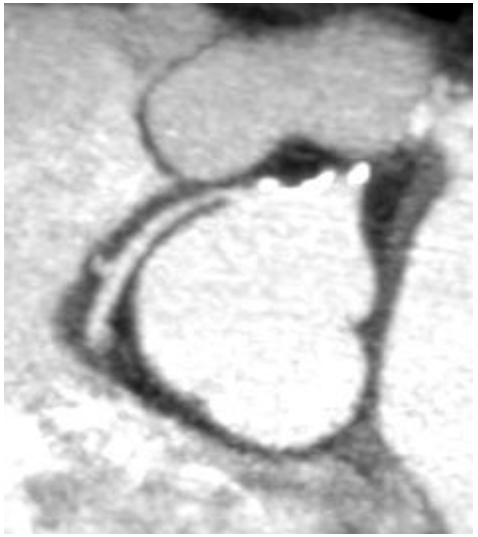

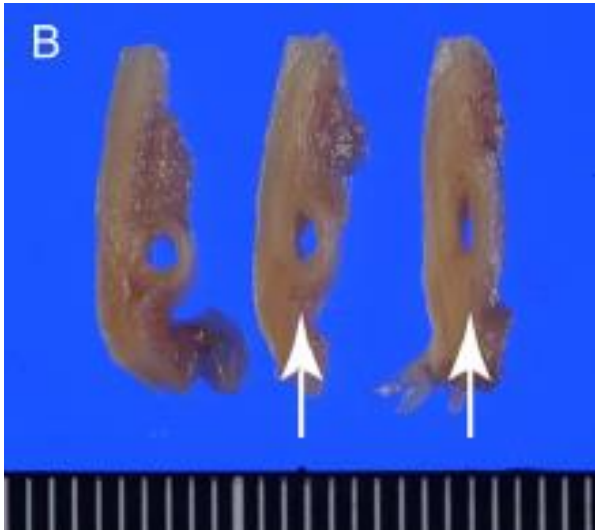
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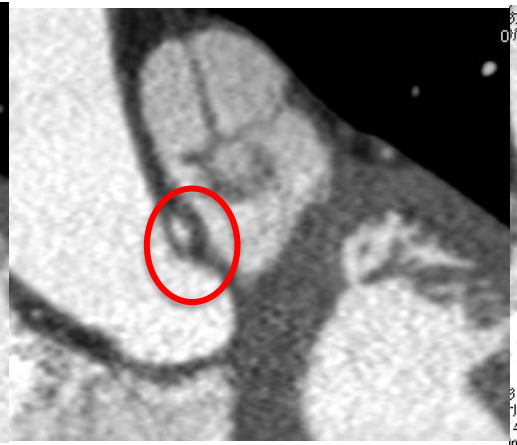

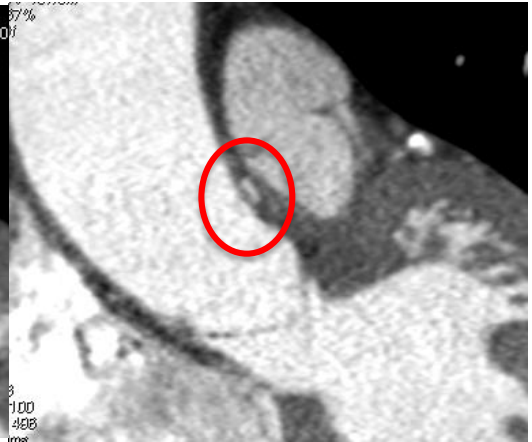

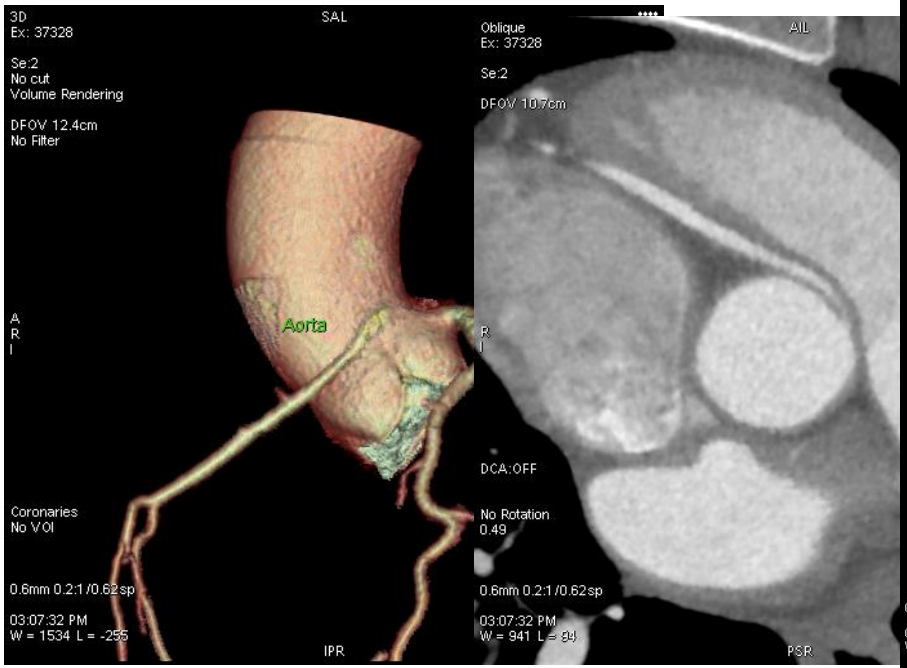
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Se:2
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Volume Rendering
DFOV 12.4cm
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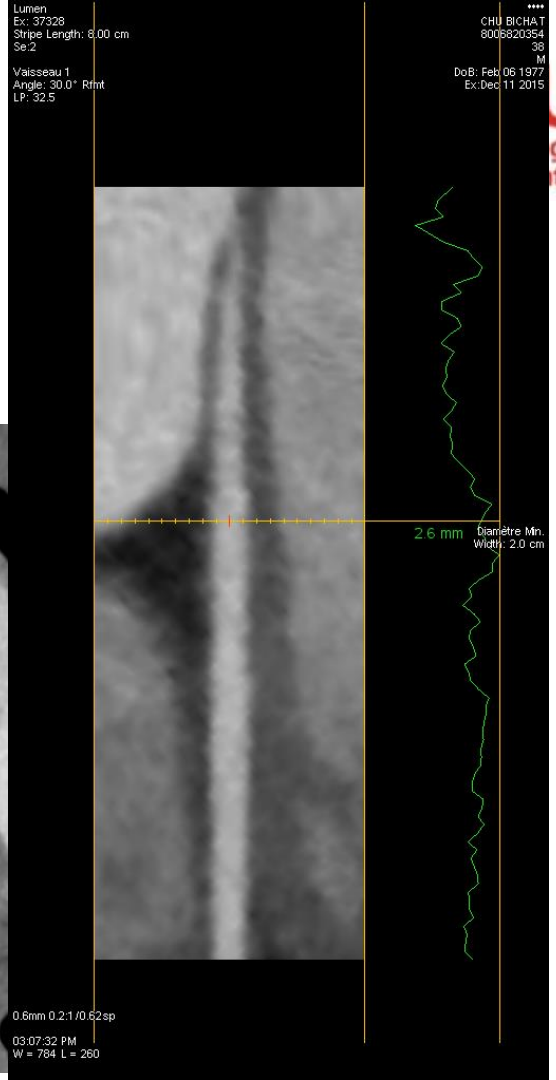
Lumen
Ex: 37328
Stripe Length: 8.00 cm
Se:2
Vaisseau 1
Angle: 30.0° Rmt
LP: 32.5
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M
DoB: Feb 06 1977
Ex:Dec 11 2015
2.6 mm
Diamètre Min.
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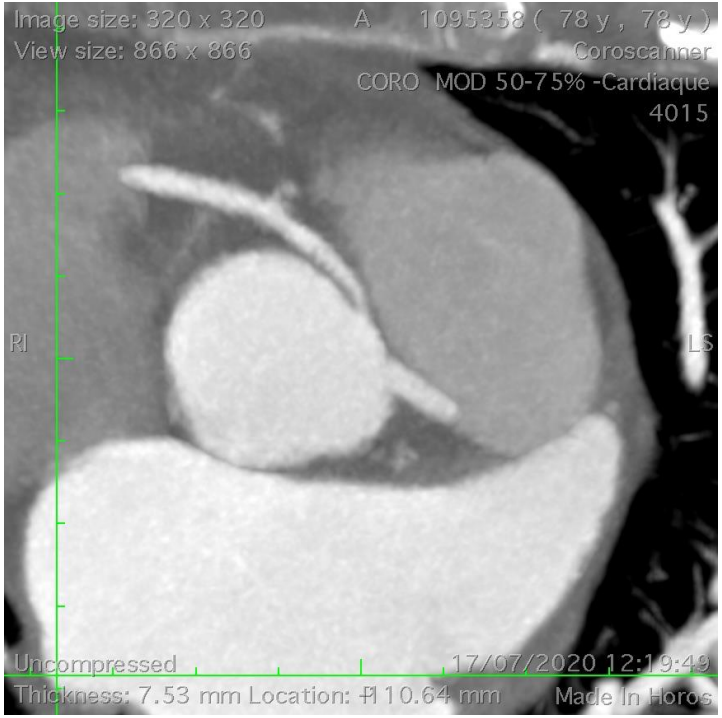
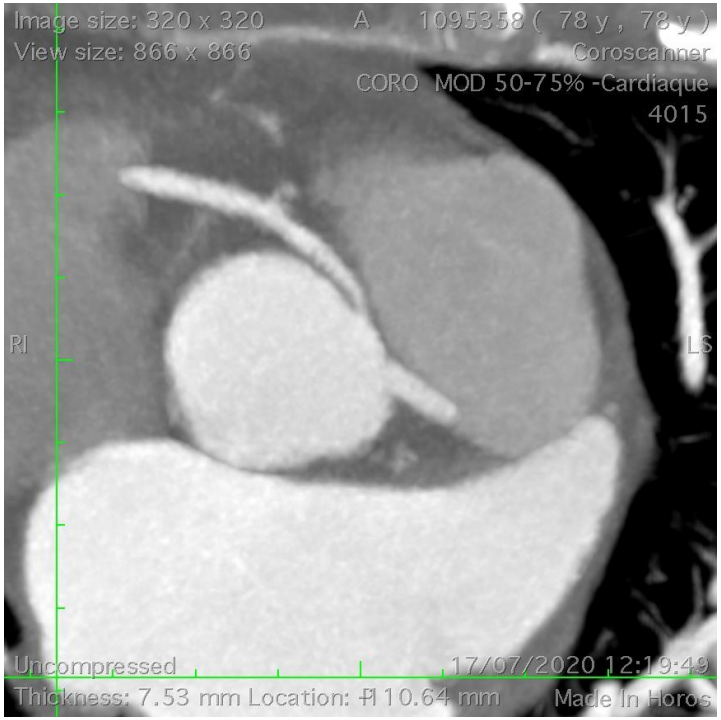
Critères de trajet intramural



- Angle de naissance < 30°
- « Sténose » / lit d'aval > 50%
- Excentricité > 2 (aspect en fente)
- Trajet sus ou sous valve pulmonaire (infundibulum)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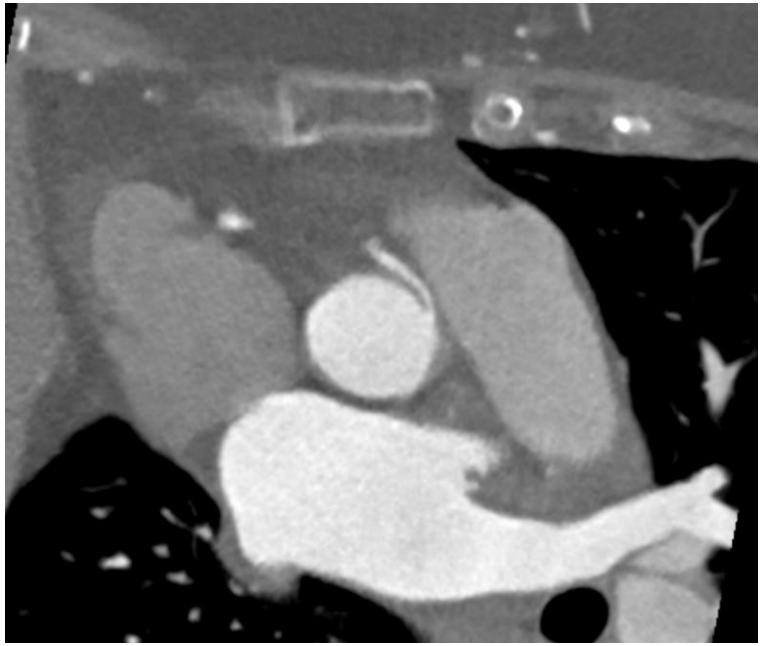

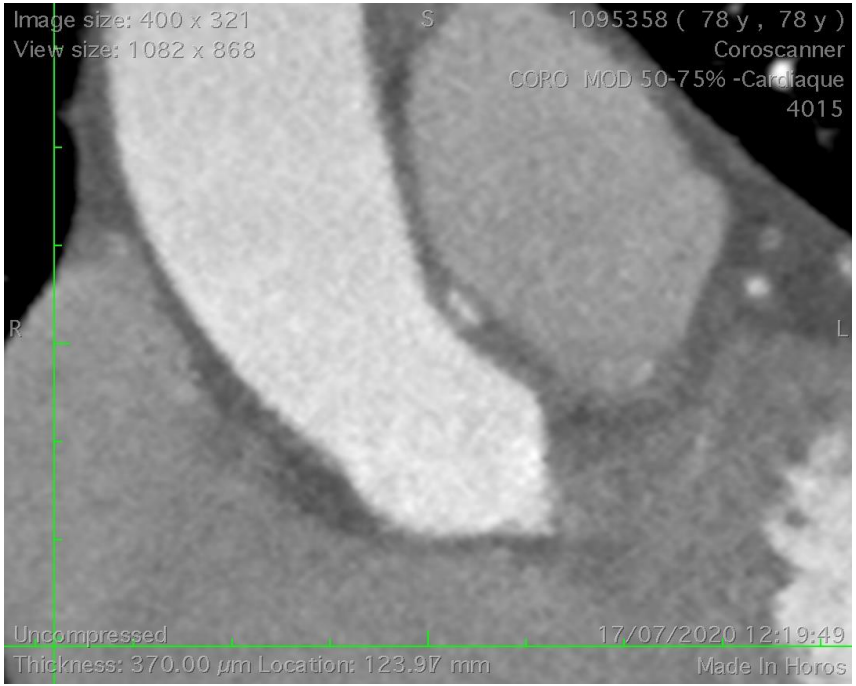
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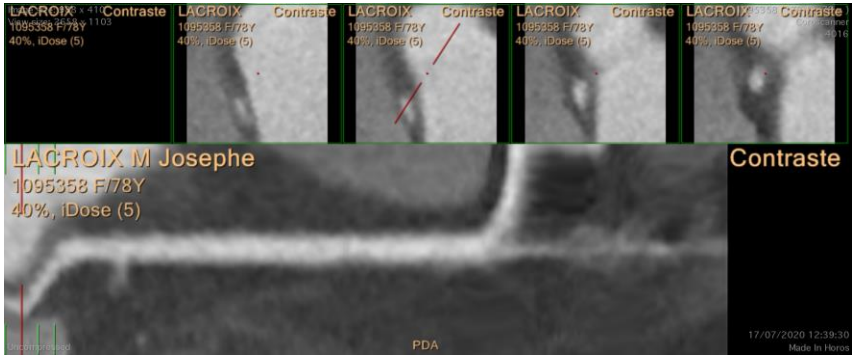
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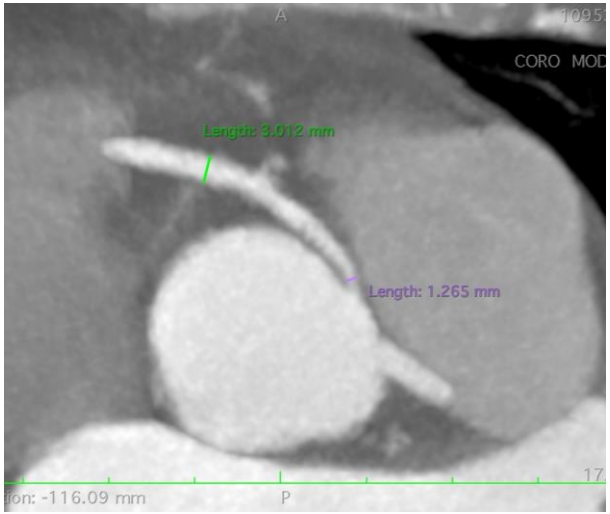
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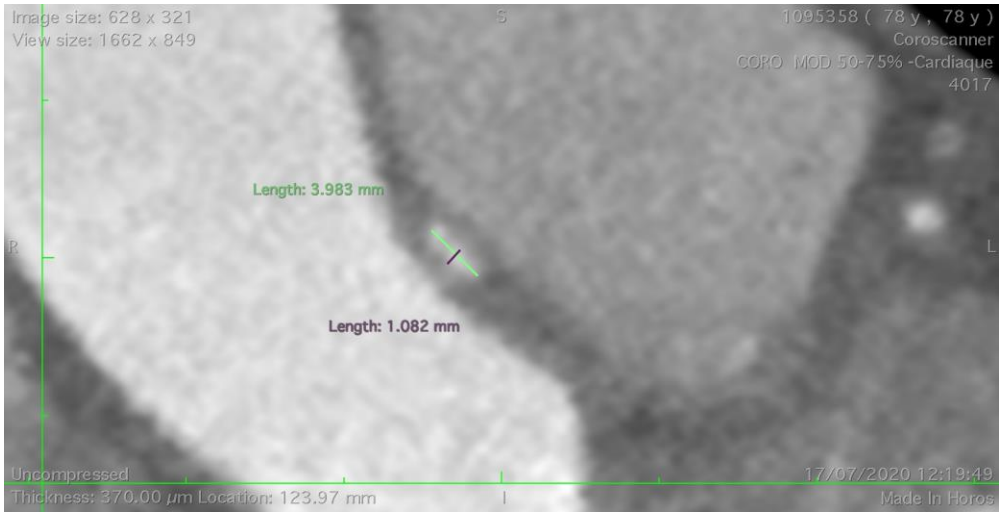
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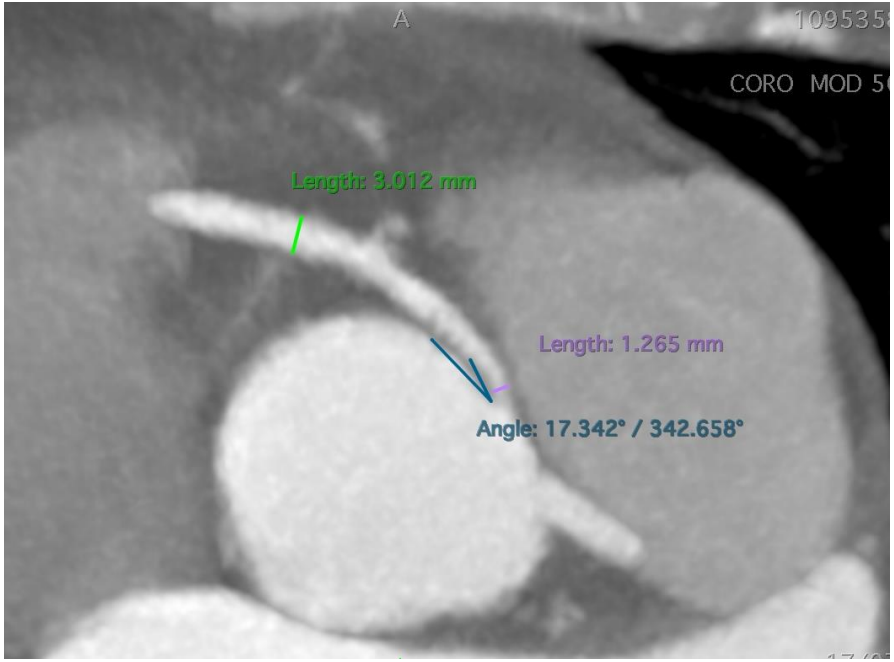
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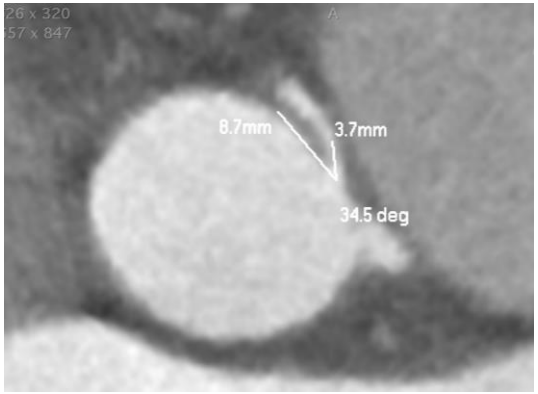
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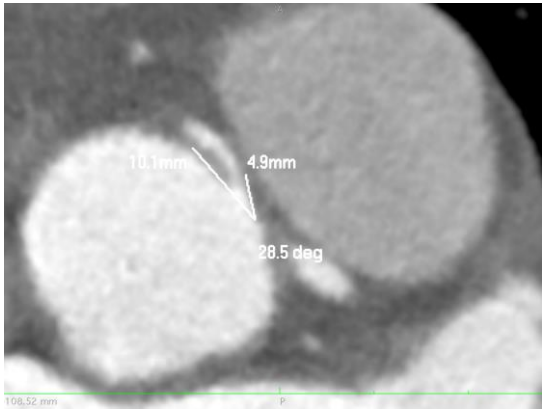
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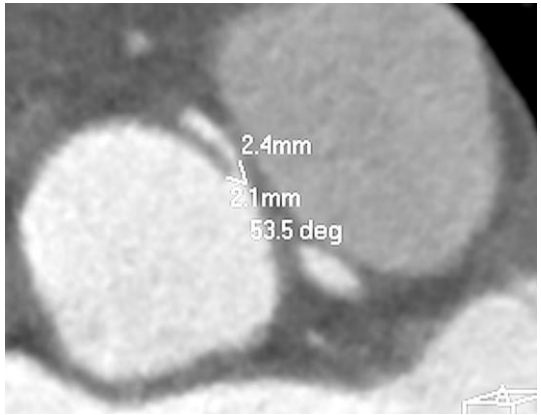
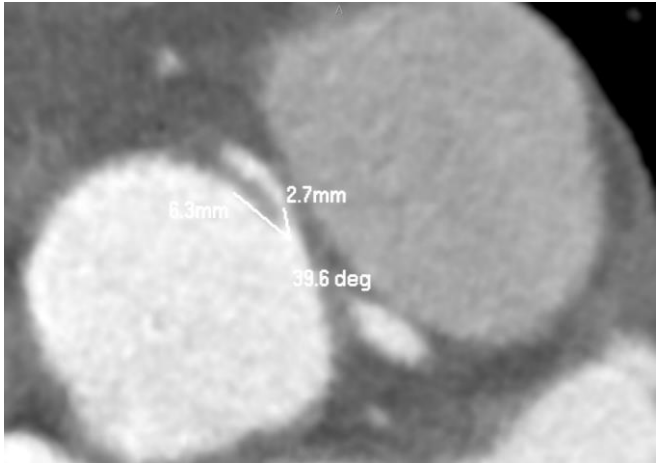
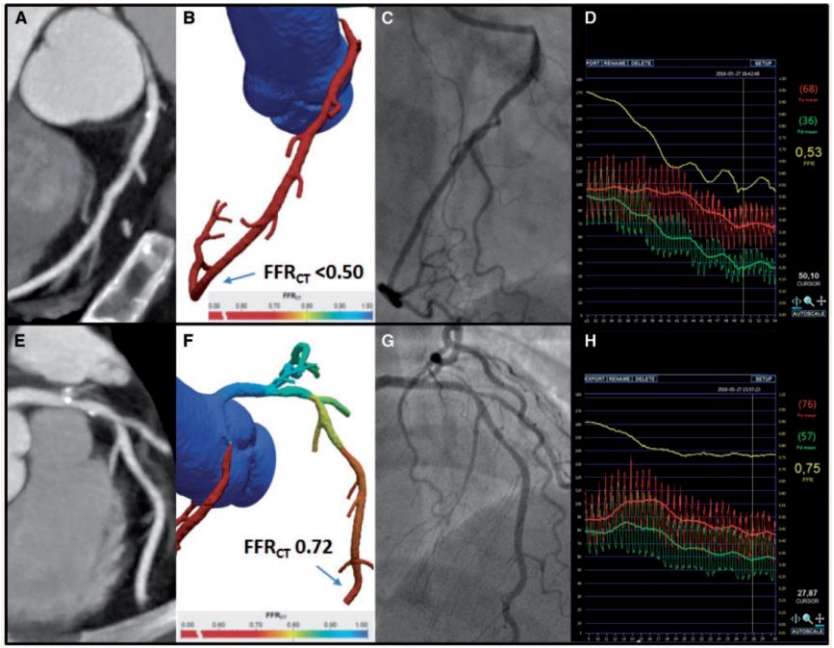

2.4mm
2.1mm
53.5 deg

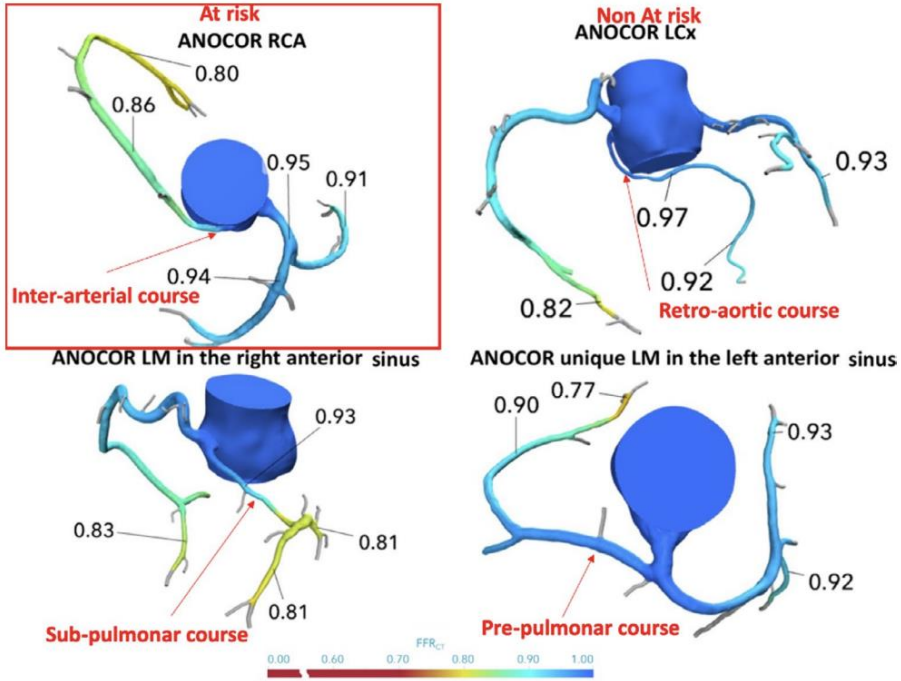

6.3mm
2.7mm
39.6 deg

FFR CT

N=54/472



Zimmermann FM et al.
doi:10.1093/eurheartj/ehw542



Adjedj J et al.
J Am Heart Assoc. 2021;10:e018593.

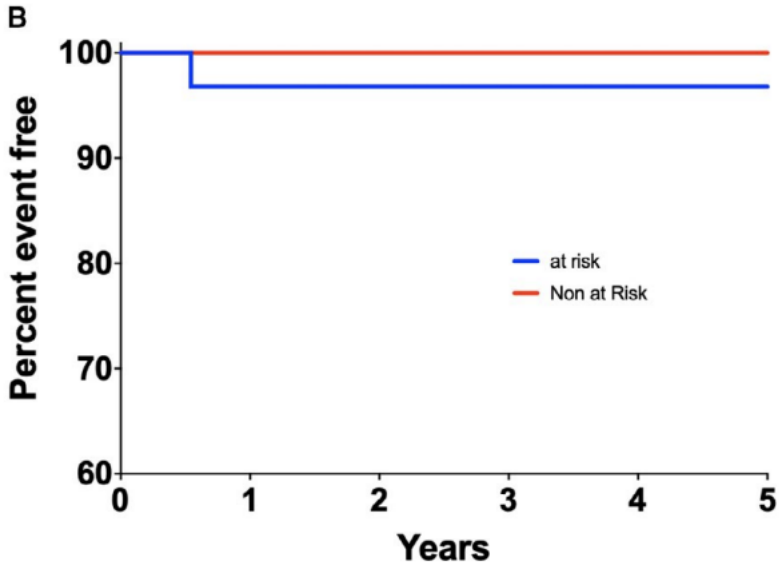


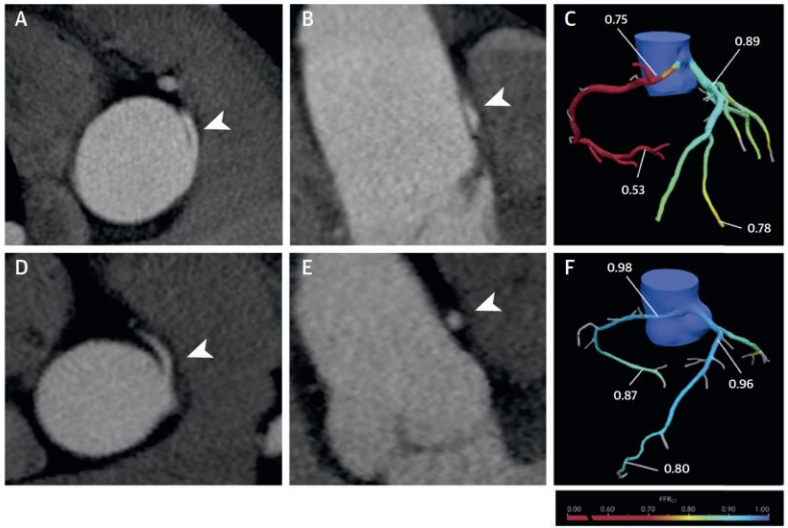
Table 2. Coronary Angiography, CT, and FFRCT Evaluation, According to Patients With ANOCOR at Risk and Not at Risk

Variable	Overall (N=54)	At Risk (N=31)	Not at Risk (N=23)	*P* Value for at Risk vs Not at Risk
Coronary angiography for non-ANOCOR vessels	N=50	N=31	N=19	
No atheroma	17 (34)	12 (38)	5 (26)	0.220
Atheroma <50%	14 (28)	8 (26)	6 (32)	0.506
Atheroma >50%	19 (38)	11 (35)	8 (42)	0.999
Coronary angiography for ANOCOR vessel	N=50	N=31	N=19	
No stenosis	26 (52)	16 (52)	10 (53)	0.999
Stenosis <50%	16 (32)	12 (39)	4 (21)	0.999
Stenosis >50%	8 (16)	3 (10)	5 (26)	0.236
CCTA of ANOCOR vessel	N=56	N=33	N=23	
Left main artery	8 (14)	2 (6)	6 (26)	0.053
Left circumflex artery	16 (29)	0	16 (69)	0.001
Right coronary artery	32 (57)	31 (94)	1 (4)	<0.001
CCTA ANOCOR course	N=56	N=33	N=23	
Retroaortic	15 (27)	2 (6)	13 (57)	<0.001
Interarterial	31 (55)	31 (94)	0	<0.001
Prepulmonar	7 (13)	0	7 (30)	0.003
Subpulmonar	3 (5)	0	3 (13)	0.058
FFRCT values				
Downstream to ANOCOR course	0.87±0.20	0.90±0.10	0.91±0.09	0.516
Distal to ANOCOR	0.82±0.11	0.83±0.11	0.81±0.11	0.499
Left anterior descending artery	0.85±0.09	0.85±0.10	0.86±0.06	0.803
Left circumflex artery	0.91±0.08	0.92±0.07	0.90±0.09	0.224
Right coronary artery	0.89±0.05	0.86±0.05	0.90±0.06	0.201

Data are given as number (percentage) or mean±SD. ANOCOR indicates anomalous aortic origin of a coronary artery; CCTA, coronary CT angiography; CT, computed tomography; and FFRCT, fractional flow reserve derived from CT.

Adjedj J et al.
J Am Heart Assoc. 2021;10:e018593.

FIGURE 1 Coronary CTA and FFR-CT Images of Right Coronary Arteries With Anomalous Aortic Origin in Presence and Absence of Intramural Path



Right coronary arteries with interarterial course and presence **(A to C)** or absence **(D to F)** of intramural path on coronary computed tomography angiography (CTA). Note typical aspects of intramural path on coronary CTA with a takeoff angle <30° **(A, white arrowhead)** and elliptic coronary luminal narrowing >50% **(B, white arrowhead)** of anomalous aortic origin of coronary artery with fractional flow reserve-computed tomography values measured at 0.75 proximally and 0.53 **(C)**. In the absence of an intramural path, the takeoff angle was >30° **(D, white arrowhead)** and luminal narrowing <50% **(E, white arrowhead)** on coronary CTA, and fractional flow reserve-computed tomography values were measured at 0.98 proximally and at 0.87 distally **(F)**.

n=62/496

AAOCA	AAOCA proximal FFR-CT	Non-AAOCA proximal FFR-CT	P values	AAOCA distal FFR-CT	Non-AAOCA distal FFR-CT	P values
Non-inter-arterial course	0.95 ± 0.04	0.98 ± 0.02	0.02	0.81 ± 0.13	0.85 ± 0.09	0.51
Inter-arterial course	0.91 ± 0.11	0.96 ± 0.02	< 0.001	0.81 ± 0.11	0.83 ± 0.1	0.61
+ Stenosis < 50 %	0.84 ± 0.15	0.96 ± 0.03	0.006	0.75 ± 0.14	0.86 ± 0.07	0.008
+ Eccentricity > 1.5	0.89 ± 0.12	0.96 ± 0.18	< 0.001	0.79 ± 0.11	0.84 ± 0.10	0.34
+ Take-off angle < 30°	0.87 ± 0.13	0.96 ± 0.03	0.001	0.78 ± 0.13	0.82 ± 0.11	0.34
No high-risk feature	0.95 ± 0.03	0.97 ± 0.02	0.09	0.89 ± 0.03	0.83 ± 0.05	0.35
1 high-risk feature	0.95 ± 0.03	0.97 ± 0.02	0.06	0.86 ± 0.05	0.84 ± 0.07	0.12
2 high-risk features	0.95 ± 0.03	0.97 ± 0.01	0.07	0.80 ± 0.10	0.83 ± 0.12	0.56
3 high-risk features	0.75 ± 0.15	0.94 ± 0.03	0.01	0.68 ± 0.15	0.84 ± 0.07	0.01

Ferrag W, Hyafil F. JACC CV Imaging 2020

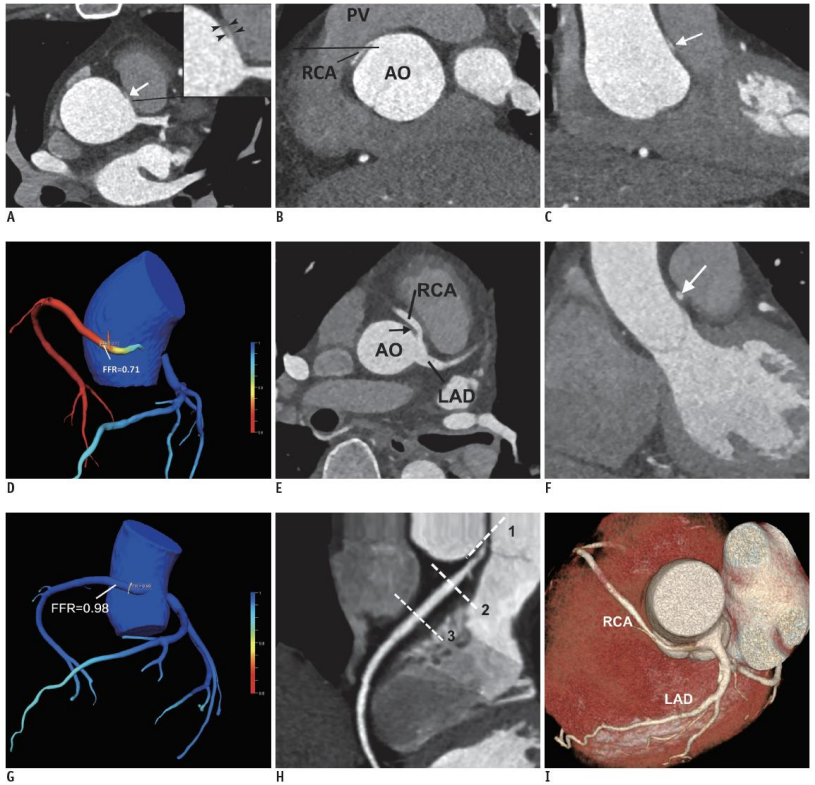


Fig. 1. Representative cases of R-ACAOS with interarterial course R-ACAOS with interarterial course in 54-year-old man presenting with typical angina (A-D) and 49-year-old man without any complaint (E-G). A. Displays separate RCA ostia with acute take-off angle (arrow). Absence of adjacent epicardial fat in magnified view (arrowheads) suggests proximal intramural course of RCA. **B.** Shows take-off level of RCA above PV (line) in coronal view. **C.** Orthogonal cross-sectional image shows classic slit-like RCA proximal segment configuration (arrow). **D.** CT-FFR value of proximal RCA is 0.71, implying ischemia resulting from R-ACAOS with interarterial course. **E, F.** Show R-ACAOS with no intermural course, epicardial fat (arrow in **E**), and oval ostium in orthogonal cross-sections (arrow in **F**) with CT-FFR value of 0.98 **(G). H.** Shows location of CT-FFR measurement in R-ACAOS in our study; line 1 is located at RCA ostia, entrance of anomalous origin of RCA, while line 2 lies at exit, indicating lumen narrowing of proximal RCA from line 1 to line 2. CT-FFR values were measured at site of line 3, 1–2 cm distal to lumen narrowing segment of proximal RCA. **I.** Displays volume rendering image of R-ACAOS. AO = aorta, CT-FFR = FFR derived from computed tomographic angiography, FFR = fractional flow reserve, LAD = left anterior descending artery, PV = pulmonary valve, R-ACAOS = RCA from left coronary sinus, RCA = right coronary artery

Model	Predictor	Odds ratio (95% CI)	*P*
Model 1	Take-off level		0.029
	Below PV	Reference	
	Above PV	7.94 (1.23–51.10)	
	Intramural		0.093
	Not present	Reference	
	Present	4.32 (0.78–23.84)	
	Proximal vessel morphology		
	Oval (< 50% narrowing)	Reference	
	Slit-like (≥ 50% narrowing)	14.05 (2.19–90.17)	0.005
	% proximal narrowing area	0.99 (0.93–1.05)	0.655
	MLA at diastole	0.69 (0.46–1.02)	0.688
Model 2	Take-off level		0.011
	Below PV	Reference	
	Above PV	7.83 (1.61–38.02)	
	Intramural		0.042
	Not present	Reference	
	Present	5.38 (1.07–27.14)	
	Proximal vessel morphology		0.003
	Oval (< 50% narrowing)	Reference	
	Slit-like (≥ 50% narrowing)	12.56 (2.31–68.27)	

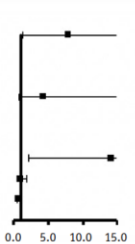


Fig. 2. Multivariate analysis of anatomical features for predicting CT-FFR ≤ 0.80 in interarterial R-ACAOS patients. Model 1 shows full model with screened significant variables from univariate analysis. RCA take-off level above PV and slit-like proximal vessel morphology are found to be main predictors of abnormal CT-FFR values. Forward step-wise selection of model 2 was applied by using likelihood ratio test, which shows that besides RCA take-off level above PV and slit-like proximal vessel morphology, intramural course also contributes to CT-FFR ≤ 0.80 in R-ACAOS patients with interarterial course. CI = confidence interval, MLA = minimum luminal area

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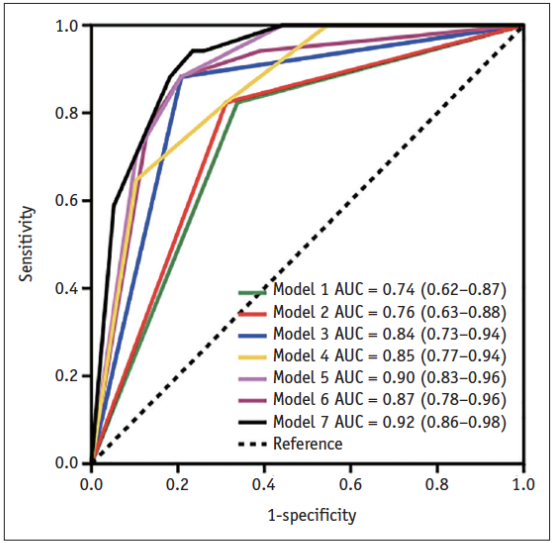


Fig. 3. AUCs for discrimination of CT-FFR ≤ 0.80 in R-ACAOS patients with interarterial course. Model 1: variable 1, take-off level (above PV); Model 2: variable 2, intramural course (present); Model 3: variable 3, proximal vessel morphology (slit-like); Model 4: variables 1 + 2; Model 5: variables 1 + 3; Model 6: variables 2 + 3; Model 7: variables 1 + 2 + 3. AUC = area under curve

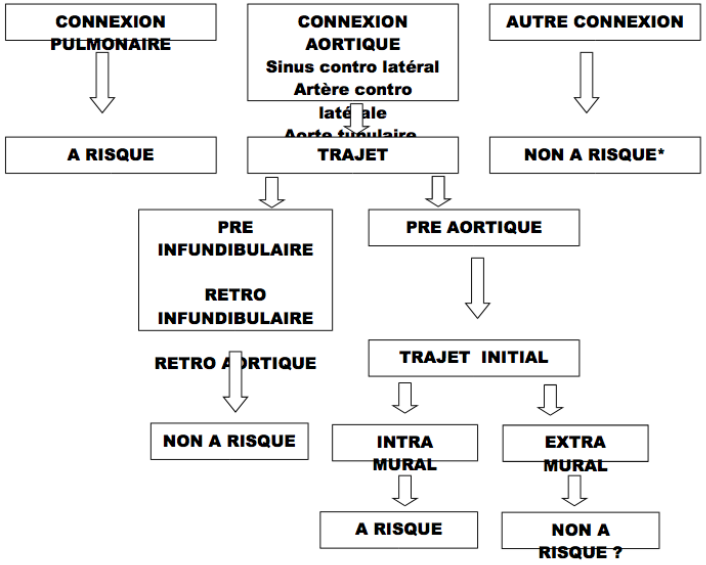
Table 2. Anatomical Features on Coronary CT Angiography in R-ACAOS Patients with Interarterial Course with Normal and Abnormal CT-FFR Values

Anatomical Features	R-ACAOS with Interarterial Course with CT-FFR ≤ 0.80 (n = 17)	R-ACAOS with Interarterial Course with CT-FFR > 0.80 (n = 77)	*P*
Proximal vessel morphology			< 0.001
Oval (< 50% narrowing)	2 (11.8)	59 (76.6)	
Slit-like (≥ 50% narrowing)	15 (88.2)	18 (23.4)	
Take-off angle, degree	9 [6–11]	10 [7–15]	0.145
Take-off level, n (%)			< 0.001
Above PV	14 (82.4)	26 (33.8)	
Below PV	3 (17.6)	51 (66.2)	
Take-off type			
Separate ostia	7 (41.2)	23 (29.9)	0.365
Shared ostia	10 (47.1)	54 (68.8)	
Intramural course, n (%)			< 0.001
Not present	1 (5.9)	53 (68.8)	
Present	16 (94.1)	24 (31.2)	
% proximal narrowing diameter	0.45 [0.37–0.59]	0.39 [0.35–0.50]	0.167
% proximal narrowing area	0.69 [0.51–0.75]	0.52 [0.42–0.61]	0.007
Length of narrowing, mm	24.10 [21.35–33.00]	25.40 [20.55–31.25]	0.837
MLA at systole	4.80 [2.75–6.80]	5.90 [4.55–7.20]	0.092
MLA at diastole	3.80 [1.80–6.15]	5.30 [4.55–6.80]	0.005
Vessel compression index	0.10 [0.01–0.25]	0.08 [0.00–0.17]	0.522

MLA = minimum luminal area, PV = pulmonary valve

Chun Xiang Tang, Korean J Radiol 2020;21(2):192-202

Classification ANOCOR



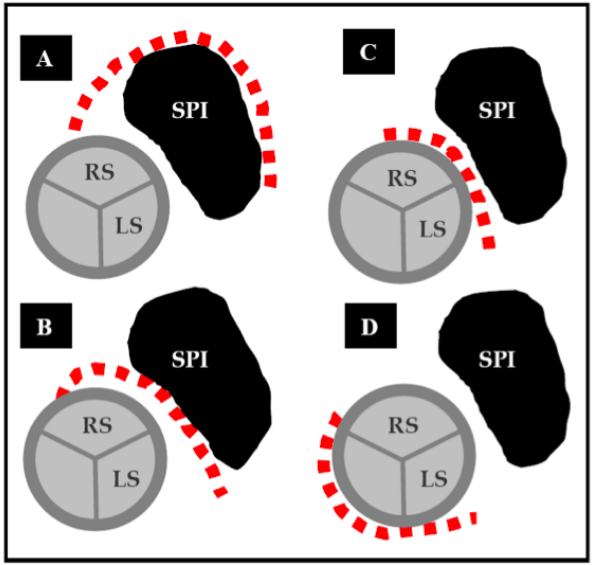


TABLE 3. Incidence of Coronary Anomalies and Patterns, as Observed in a Continuous Series of 1950 Angiograms

Variable	N (%)
Coronary anomalies (total)	110 (5.64)
Split RCA	24 (1.23)
Ectopic RCA (right sinus)	22 (1.13)
Ectopic RCA (left sinus)	18 (0.92)
Fistulas	17 (0.87)
Absent left main coronary artery	13 (0.67)
Circumflex arising from right sinus	13 (0.67)
LCA arising from right sinus	3 (0.15)
Low origination of RCA	2 (0.1)
Other anomalies	3 (0.27)
Coronary dominance patterns	
Dominant RCA	1641 (89.1)
Dominant LCA (circumflex)	164 (8.4)
Codominant arteries (RCA, circumflex)	48 (2.5)

LCA indicates left coronary artery. Adapted from Angelini P et al[10] with permission from Lippincott, Williams & Wilkins. Copyright 1999.

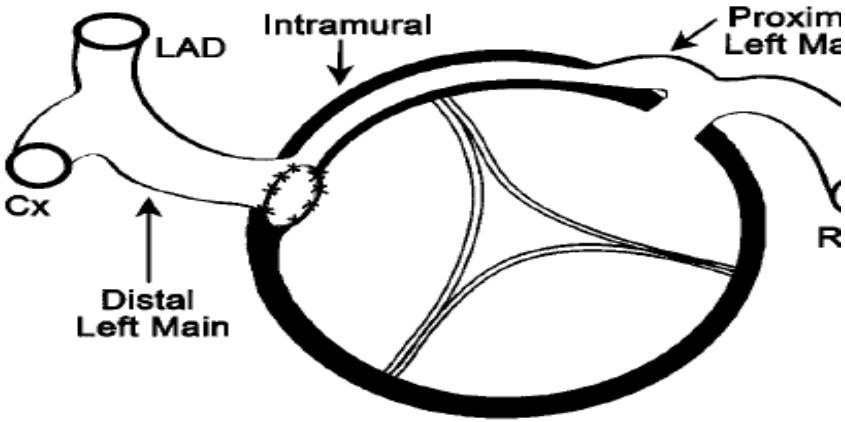
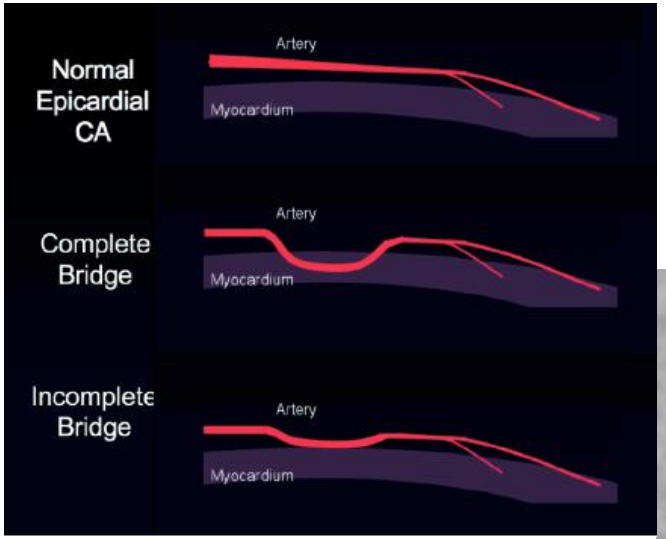
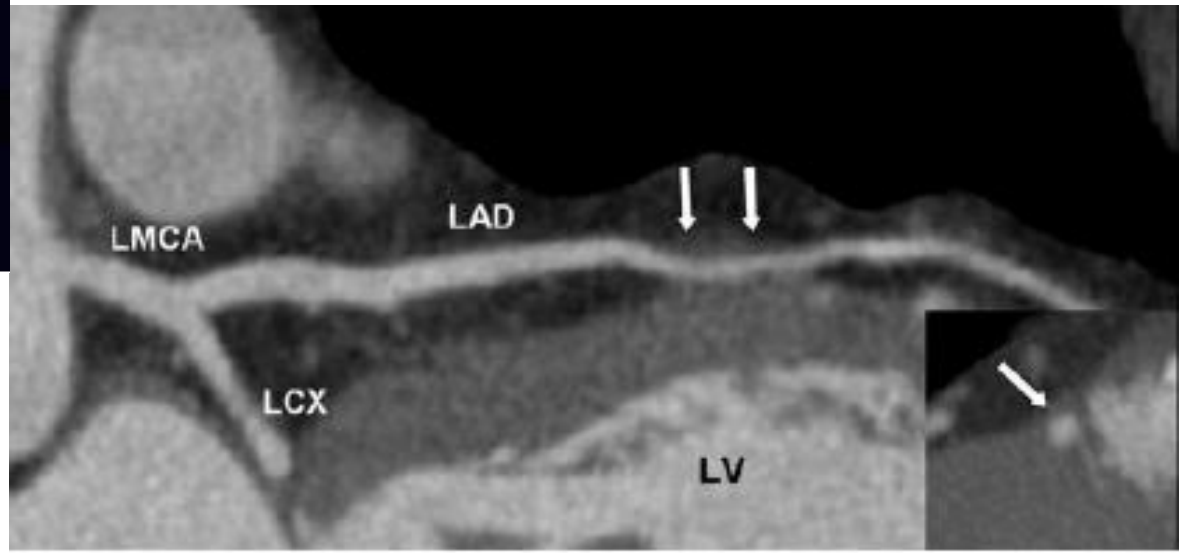


Figure 5. Diagram representation of a case of single corona ostium at the right sinus. The LM runs intramurally inside th aortic-wall left sinus, just below the anterior aortic commiss and takes off from the aorta at the center of the left cusp. A this point, a circle with stitches represents the newly create ostium after surgical repair. Cx indicates circumflex. Repro- duced from Angelini et al[27] with permission from Texas Hea Institute. Copyright 2006.

Trajet intramyocardique

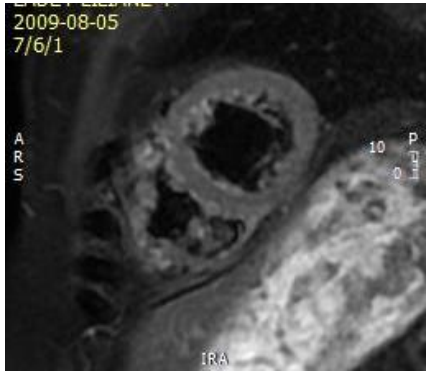


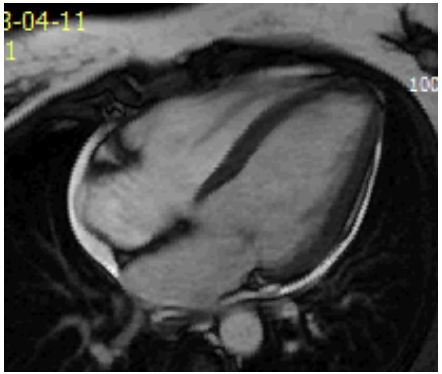


The British Journal of Radiology, March 2009

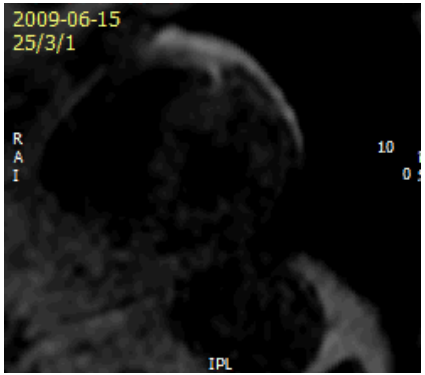
ANOCOR: place de l'IRM ?

T2-T1





Ciné-SSFP, rapport T2/T1



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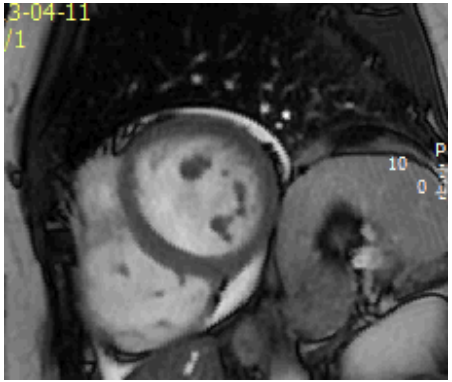
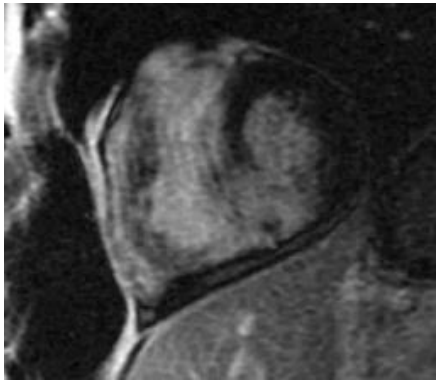


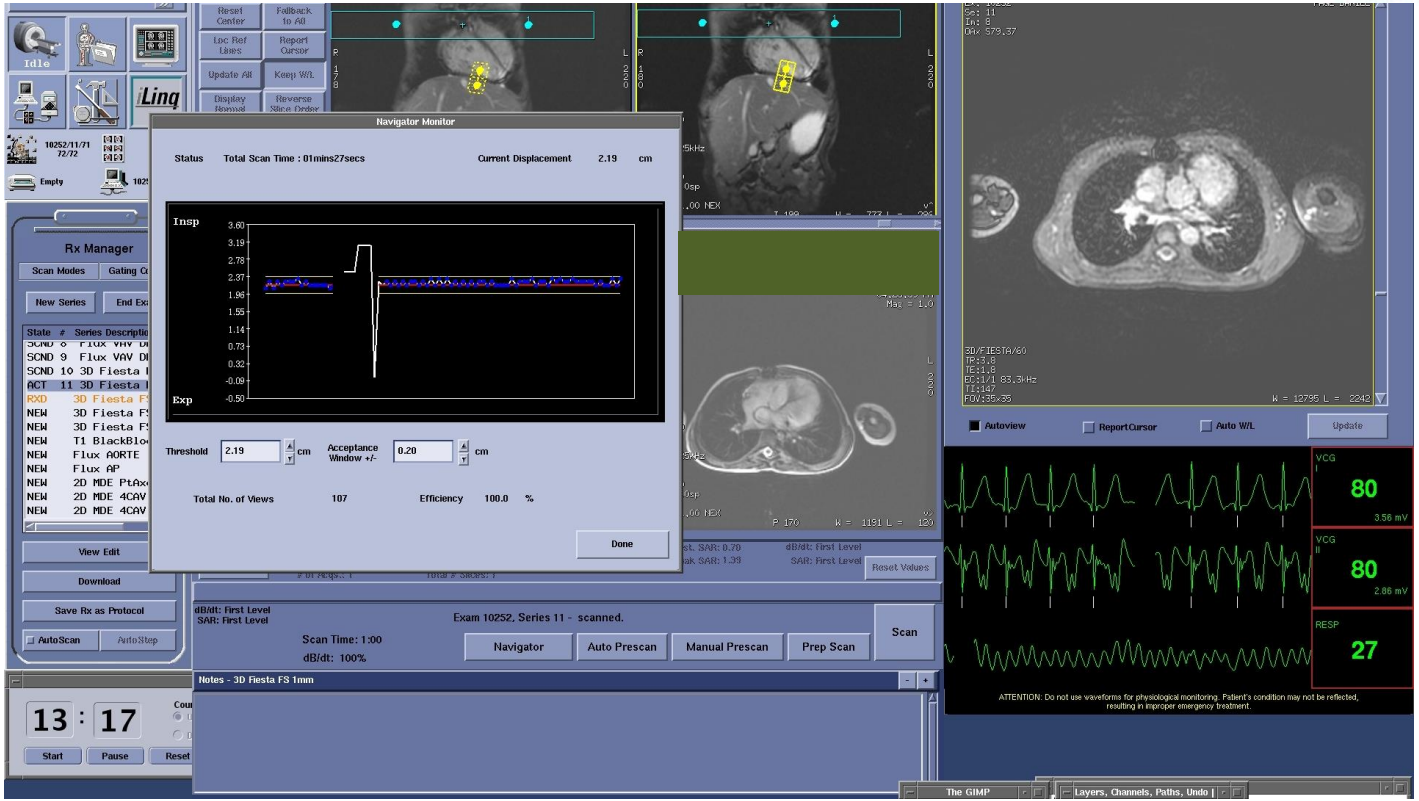
SSFP post-Gad



Rehaussement tardif post-Gad

Phalla Ou, Bichat

Double gating ECG & Respiratoire



ELSEVIER

Clinical Imaging 34 (2010) 337–343

CLINICAL IMAGING

Anomalous origin of the coronary arteries in children: diagnostic role of three-dimensional coronary MR angiography

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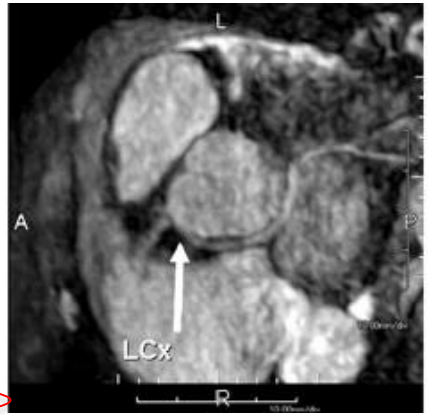
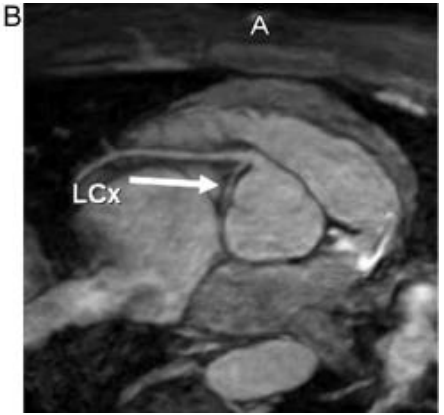
Received 22 July 2009; accepted 24 August 2009

Class	Anomaly of origin	Age
Absent	No anomalies of origin	9
Absent	No anomalies of origin	11
Absent	No anomalies of origin	13
Absent	No anomalies of origin	14
Absent	No anomalies of origin	14
Absent	No anomalies of origin	15
Absent	No anomalies of origin	21
Benign	Elongated LMCA with angulated origin of LCx	6
Benign	Elongated LMCA with angulated origin of LCx	14
Benign	LCx from RCA and retro-aortic course	9
Benign	LCx from RCA and retro-aortic course	12
Benign	LCx from RCA and retro-aortic course	14
Benign	LCx from RCA and retro-aortic course	29
Malignant (severe)	Single coronary artery, LMCA with interarterial course and myocardial bridging	7
Malignant (severe)	RCA from LSV with interarterial course	15



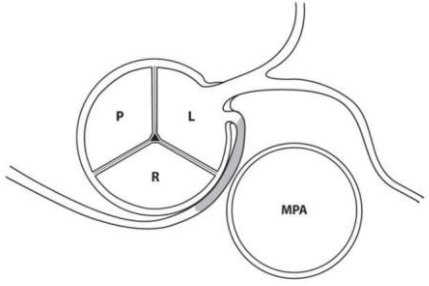


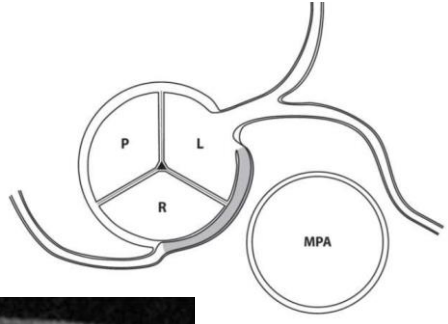
Pediatr Radiol (2015) 45:1146–1152
DOI 10.1007/s00247-015-3302-3

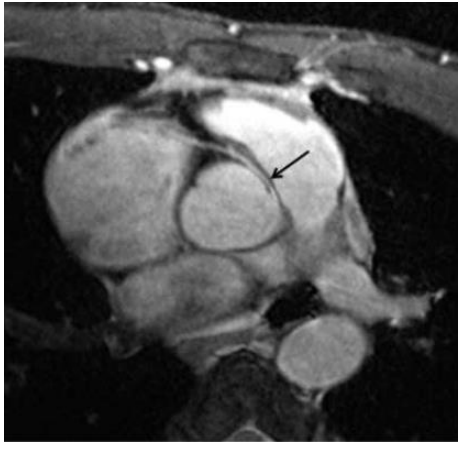
ORIGINAL ARTICLE

High-resolution coronary MR angiography for evaluation of patients with anomalous coronary arteries: visualization of the intramural segment

David M. Biko · Claudia Chung · David M. Hitt · Gregory Kurio · Olaf Reinhartz · Taylor Chung





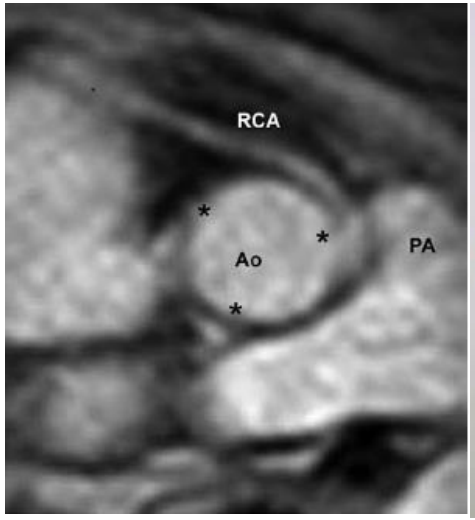


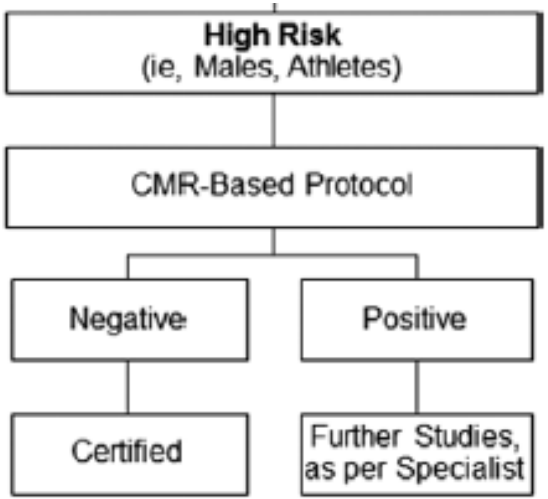
Novel Imaging of Coronary Artery Anomalies to Assess Their Prevalence, the Causes of Clinical Symptoms, and the Risk of Sudden Cardiac Death

Paolo Angelini, MD

Circ Cardiovasc Imaging **July 2014**

From the Center for Coronary Artery Anomalies, Texas Heart Institute, Houston, TX.





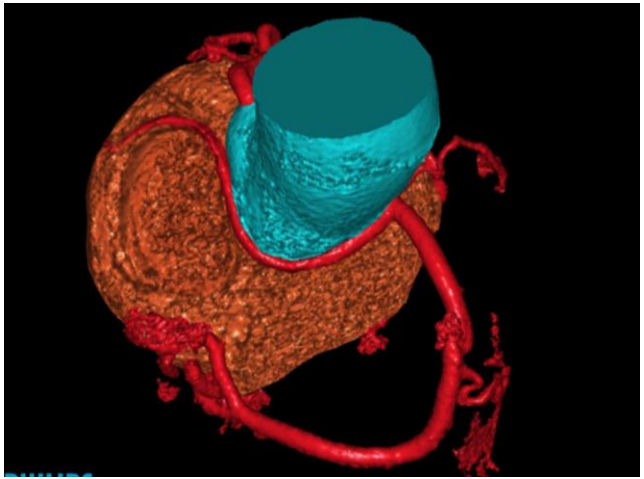
Angelini P, Shah NR, Uribe CE, Cheong BY, Lenge V, Lopez JA, Lawless CE, Masso AH, Willerson JT. Novel MRI-based screening protocol to identify adolescents at high risk of sudden cardiac death. *J Am Coll Cardiol*. 2013;61:E1621.

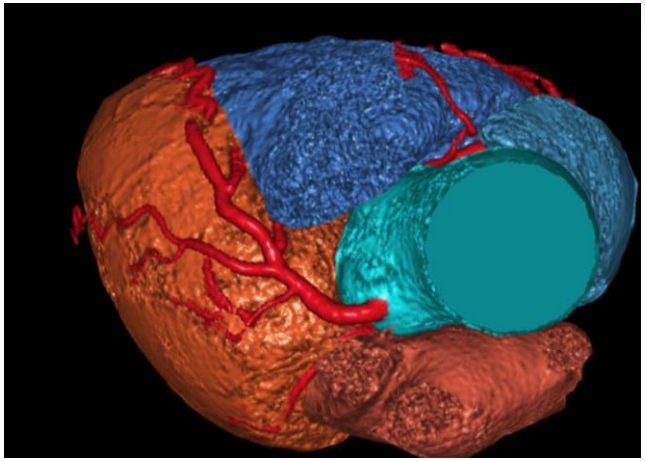
Conclusions

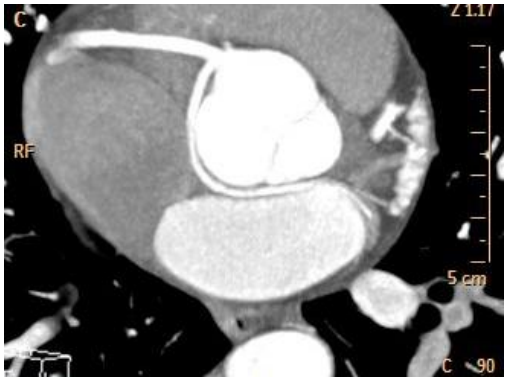
- Imagerie en coupe indispensable
- Aide au diagnostic anatomique
- Ne pas insister sur la coro et demander 1 coro-scanner
- Critères de gravité (malignité à préciser) Coro-scanner
- Critères de retentissement (IRM)
- Aide à la décision thérapeutique pour les ANOCOR à risque

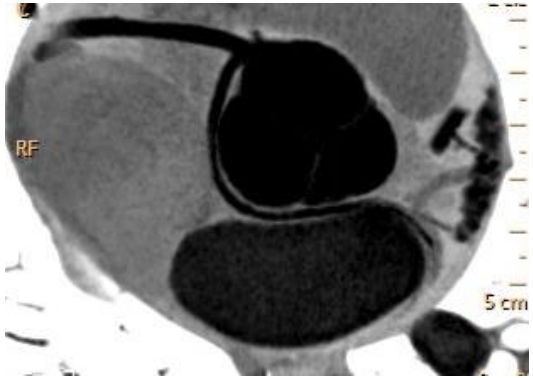
Cx Rétro Aortique0,32 à 0,67%

CX ECTOPIQUE





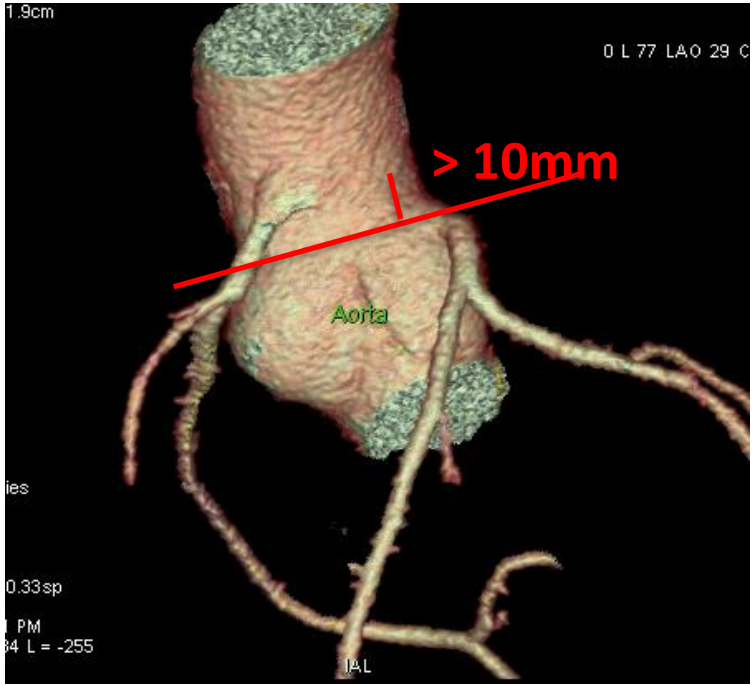

C
RF
5 cm
C 90

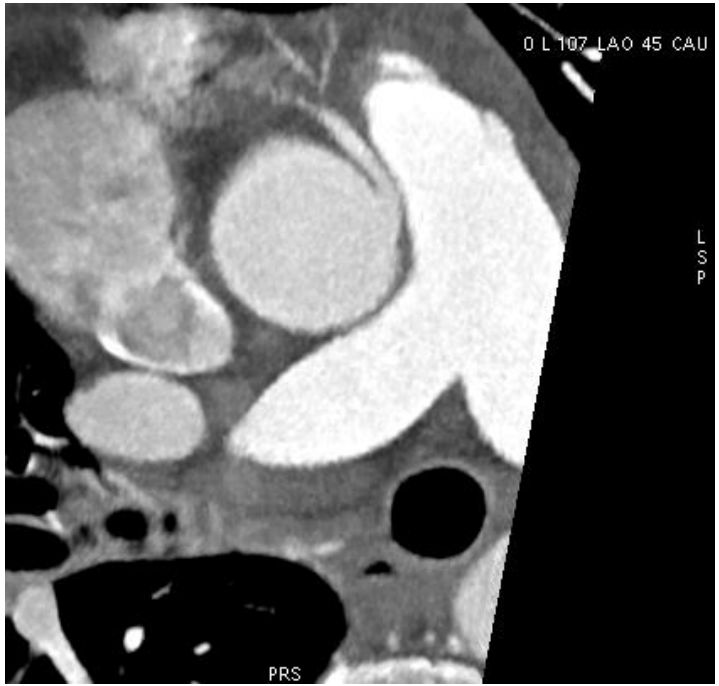

RF
5 cm

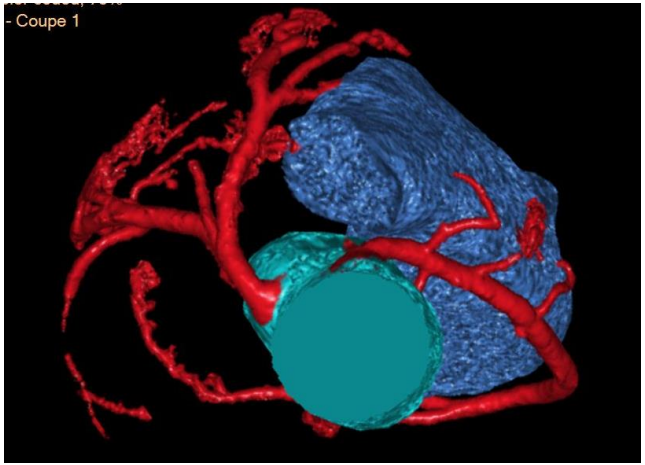
Coronaire Droite Aorte Tubulaire

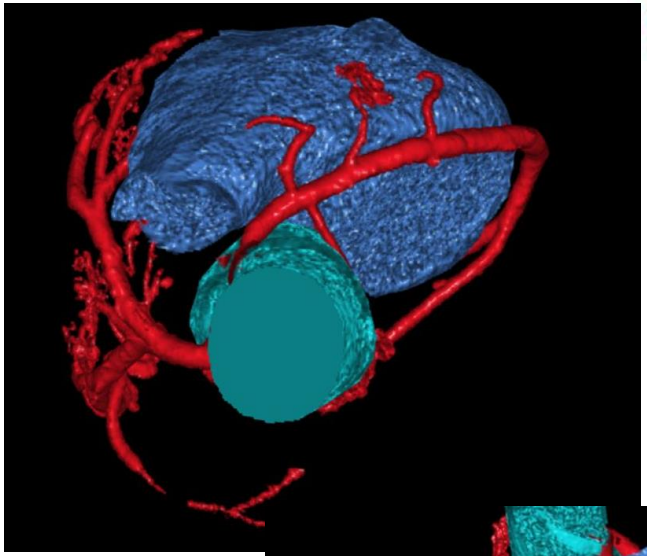
DROITE ECTOPIQUE

High take-off






- Coupe 1

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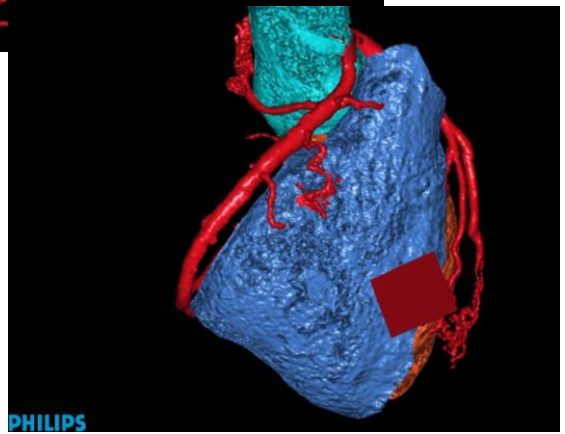
Volume-color coded, 75%
Série 408 - Coupe 1
7096054 F/75Y
Zoom 1.36
PHILIPS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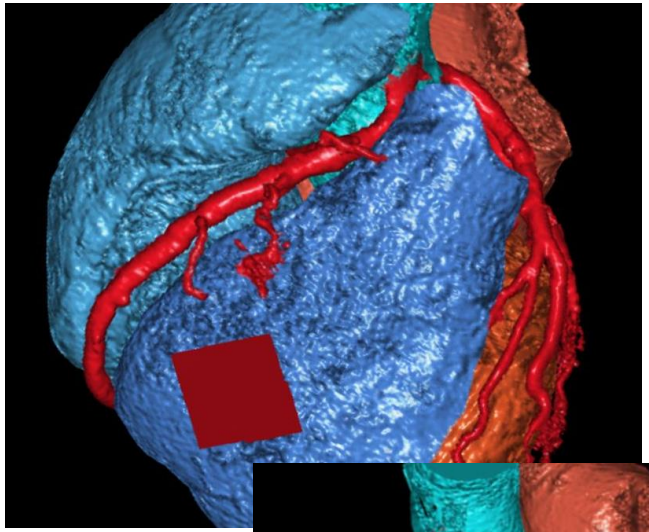
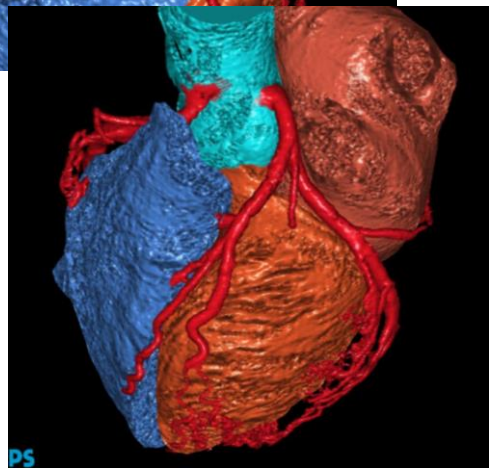
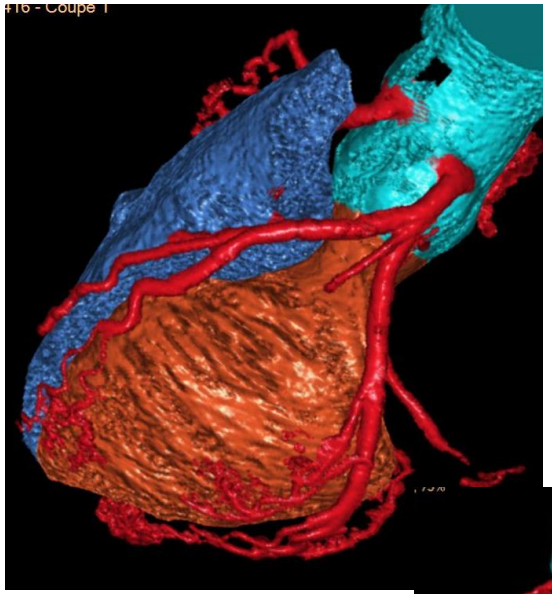
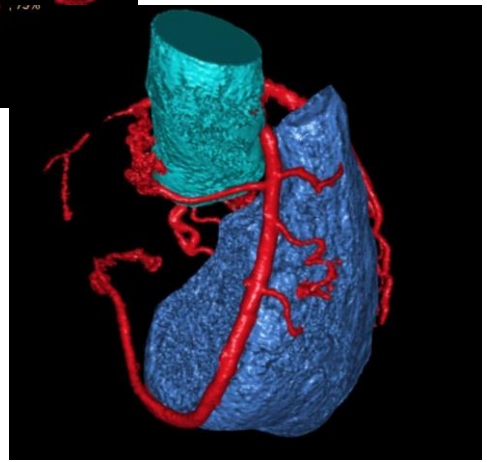


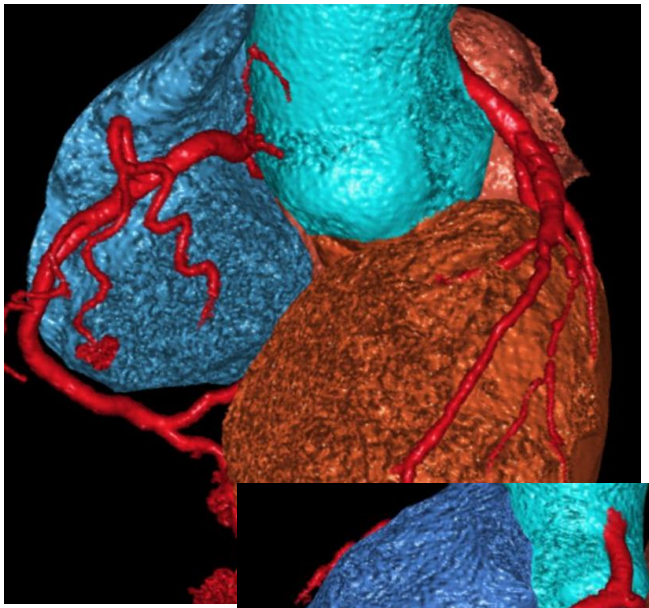


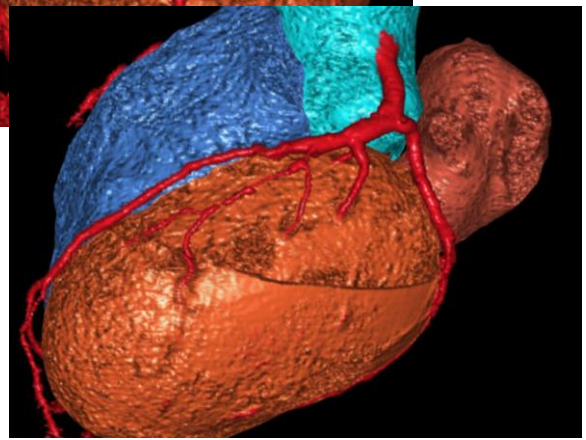


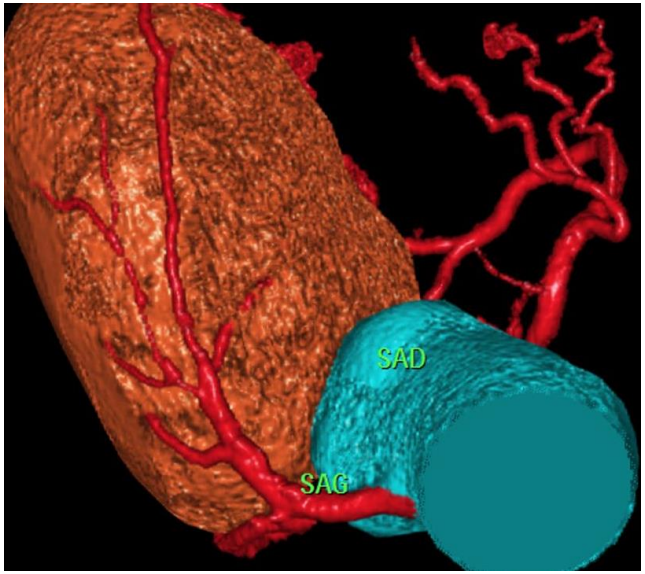


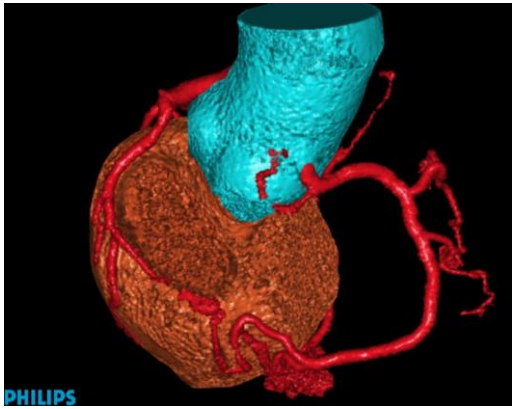
Coronaire Droite Sinus postérieur

DROITE ECTOPIQUE

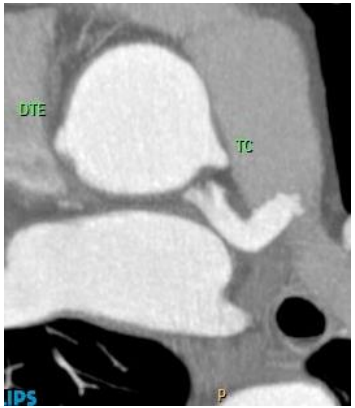





SAD
SAG


PHILIPS


DTE
ADT
P
AG
TC
P


DTE
TC
P


ADT
P
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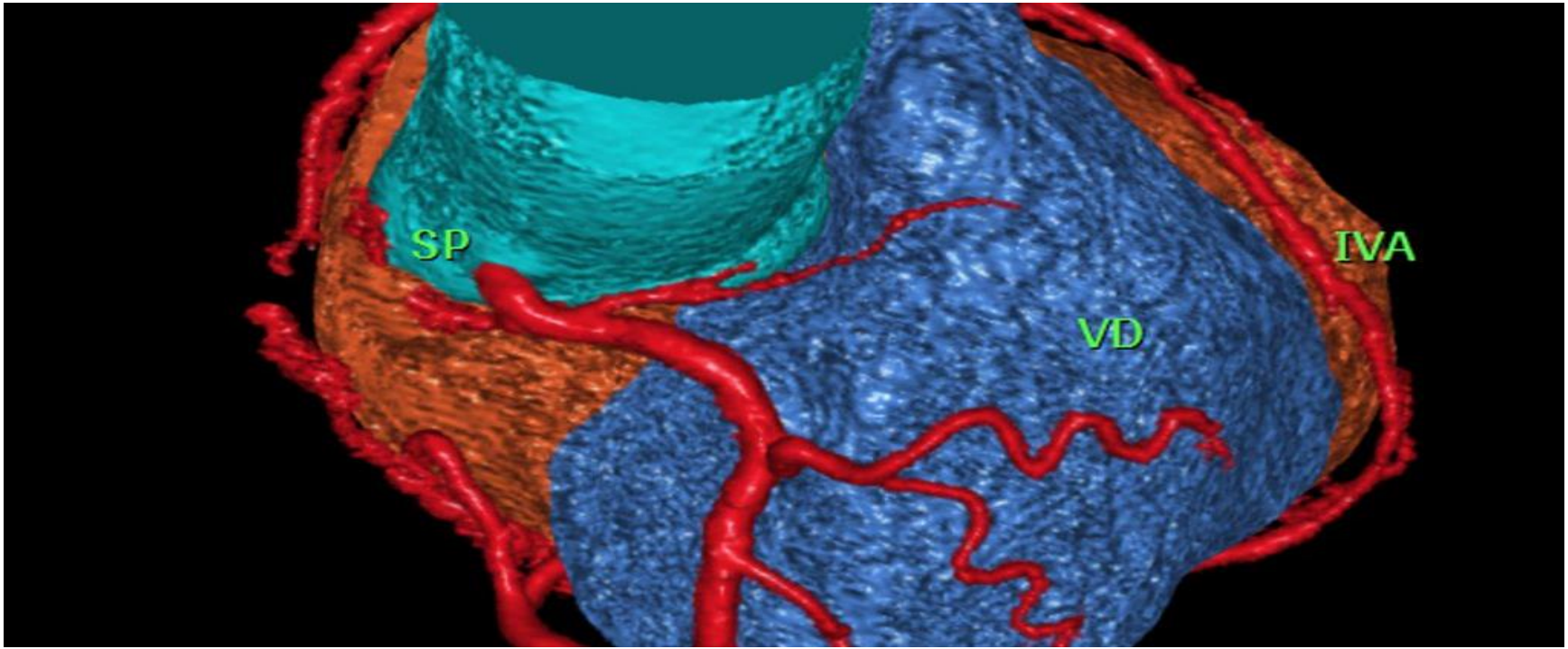
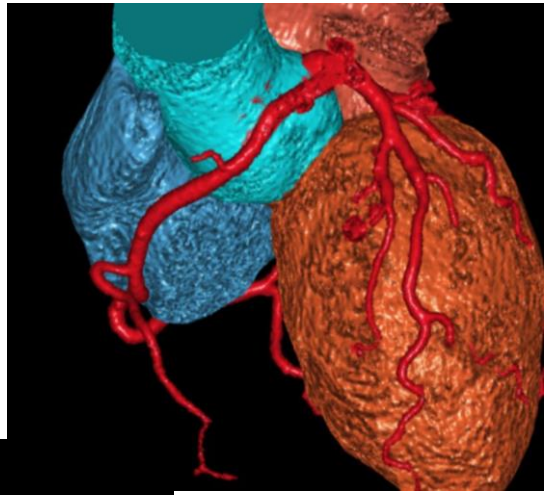
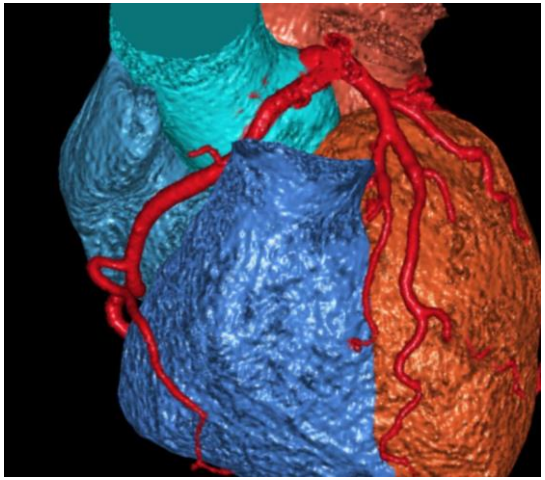
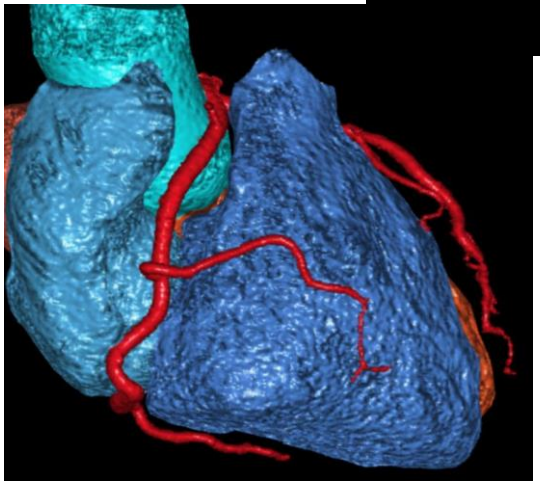

SP
IVA
VD

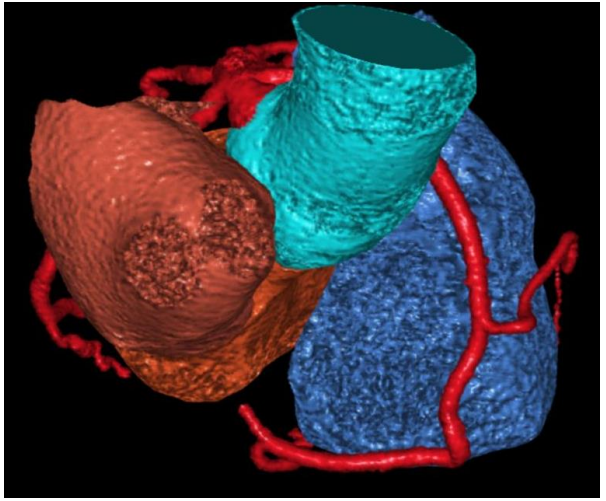
Coronaire Droite – TC gauche

DROITE ECTOPIQUE



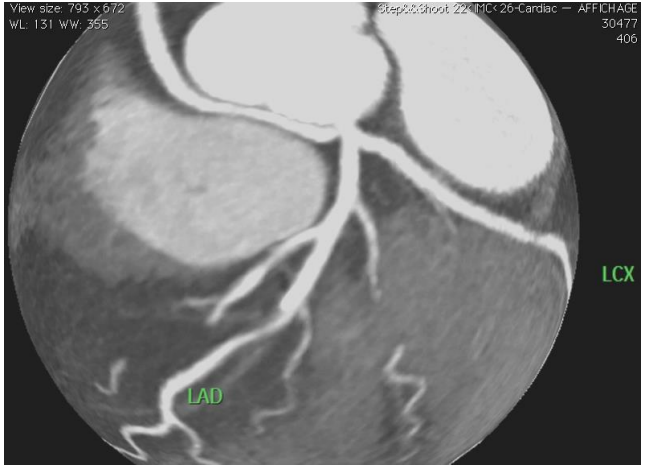






anoCor

DIU cardiologie interventionnelle



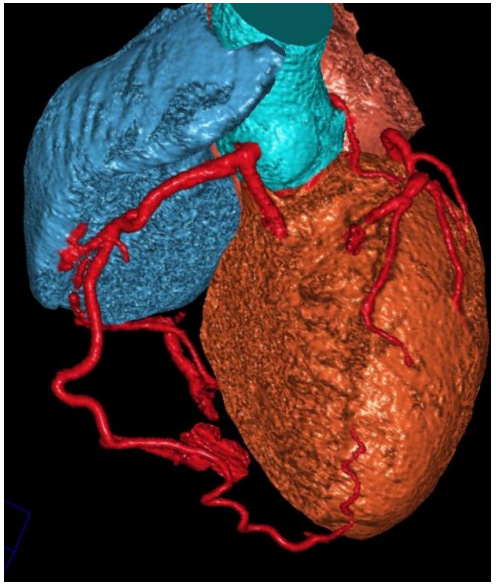
TC sinus droit et trajet rétro-pulmonaire

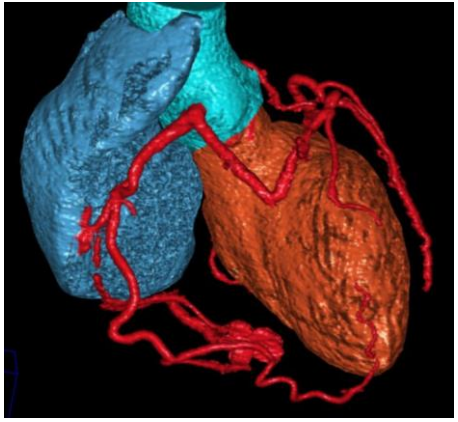
RESEAU GAUCHE ECTOPIQUE

Coronaire Gauche naissant dans le sinus droit 0,09 à 0,11%

Trajet retro infundibulaire

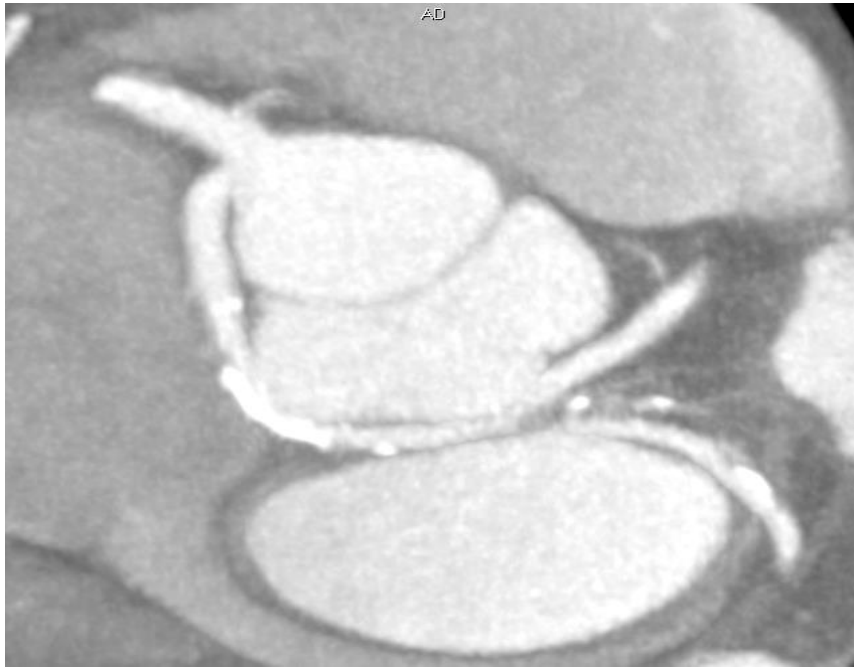
RESEAU GAUCHE ECTOPIQUE





TC RETRO-AORTIQUE

RESEAU GAUCHE ECTOPIQUE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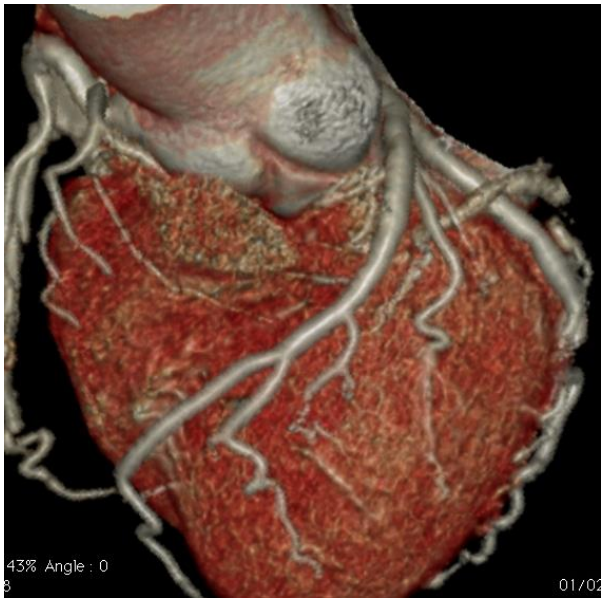
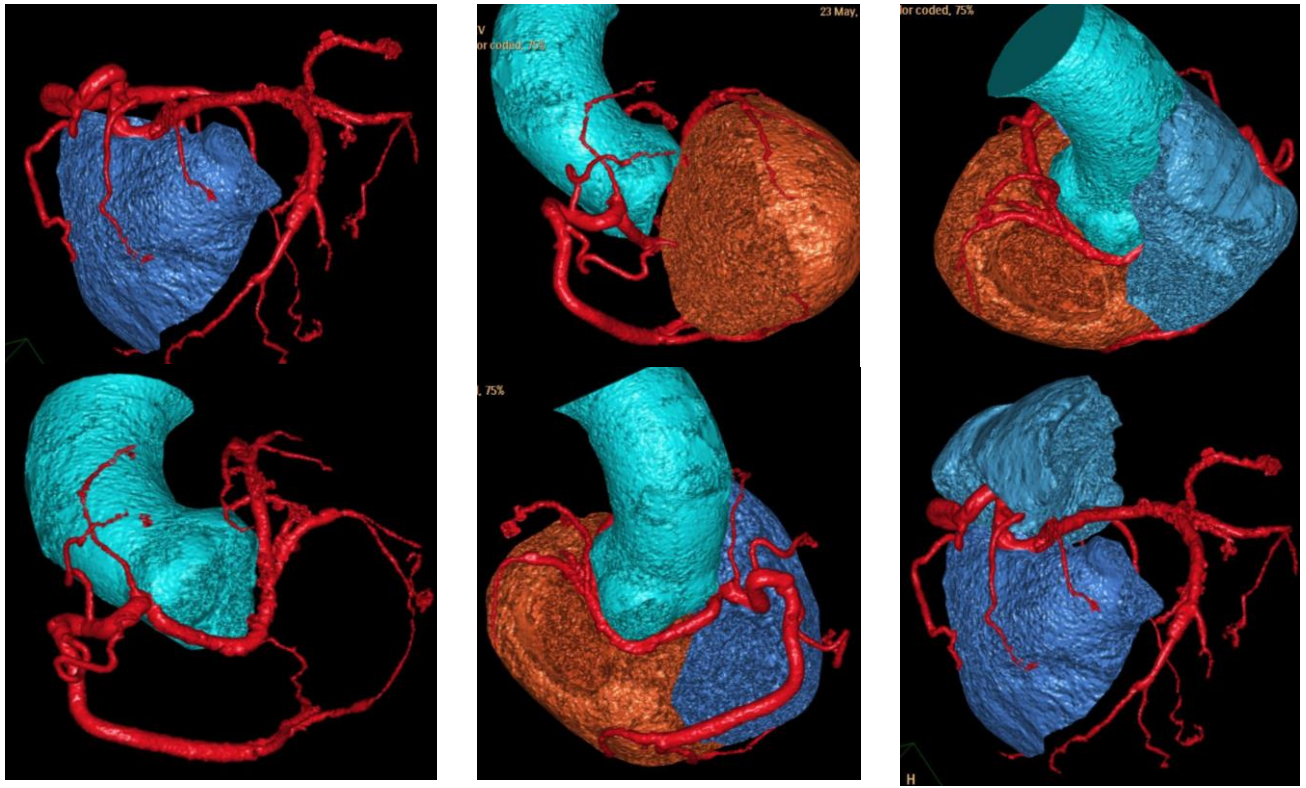
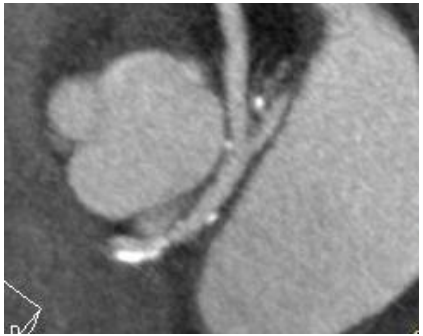
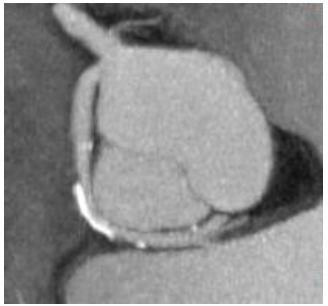
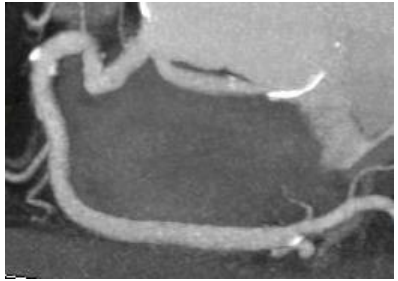

43% Angle : 0
01/02

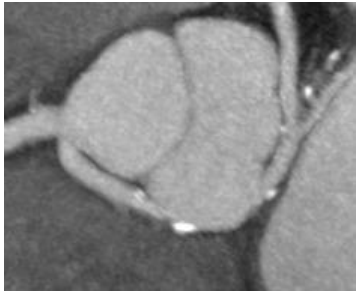



FP





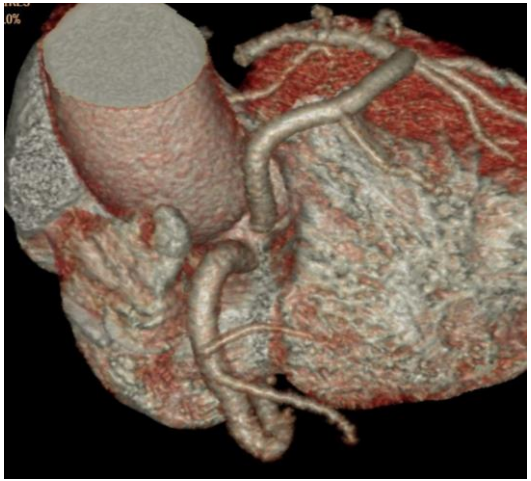




IVA Pré Pulmonaire

RESEAU GAUCHE ECTOPIQUE

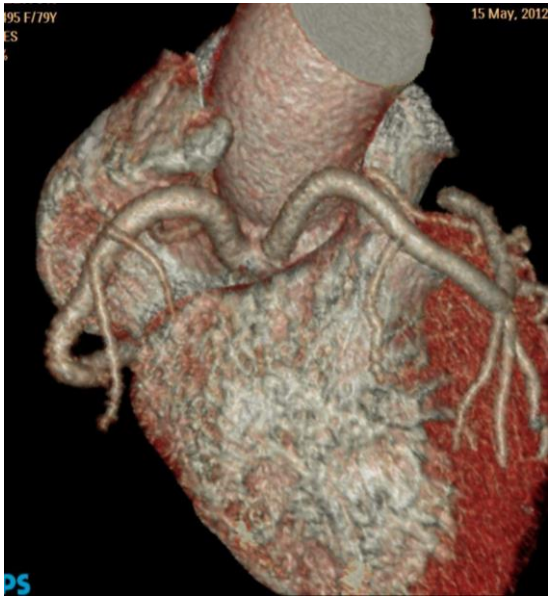

128 LF : 256



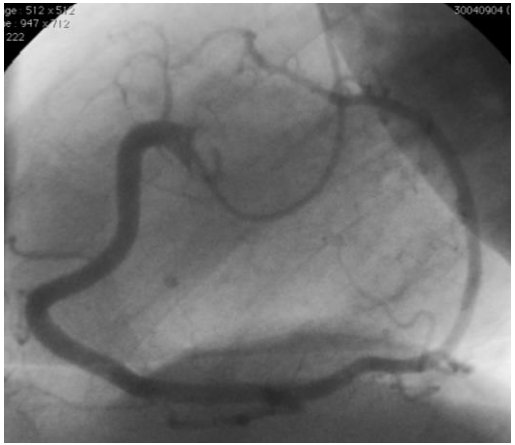

Philips, iCT 256
15 May, 2012 13:01:48.92
LC 22.57 mm
Z 1.23
5 cm


15 May, 2012

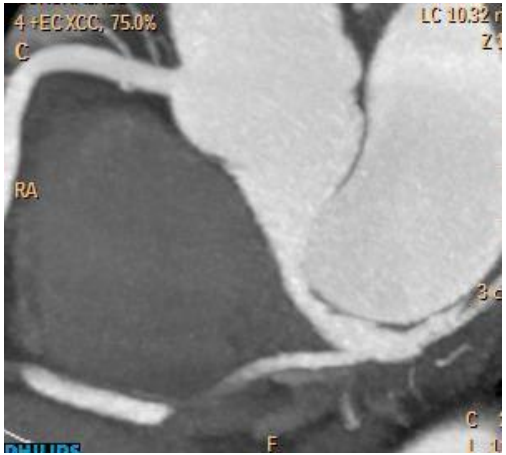

4 X, 75.0%
C
LC 7.90 mm
Z 1.23
FR
5 cm
C 186
L 1533
PHILIPS
P


15 May, 2012

ARTERE CORONAIRE UNIQUE




AIRES
CC, 75.0%
27 Jan, 2012 13:40:59:46
LC 10.32 mm
Z 1.36
3 cm
C 257


4 +EC XCC, 75.0%
LC 10.32
C
RA
F


C
AR
3 cm
C 257
L 1186
PHILIPS
FPR


AIRES
CC, 75.0%
LC 10.32
Z


169 LF : 626