Jeudi 16 novembre 2023

ANOmalies CORonaires congénitales (ANOCOR)

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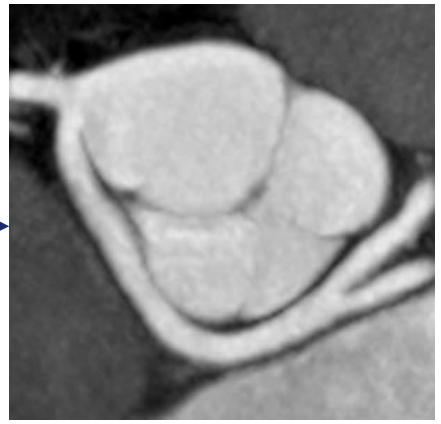
Bichat - Claude-Bernard

ASSISTANCE PUBLIQUE HÔPITAUX DE PARIS

Groupement Hospitalier de Territoire
Saint-Denis Gonesse
Plaine de France

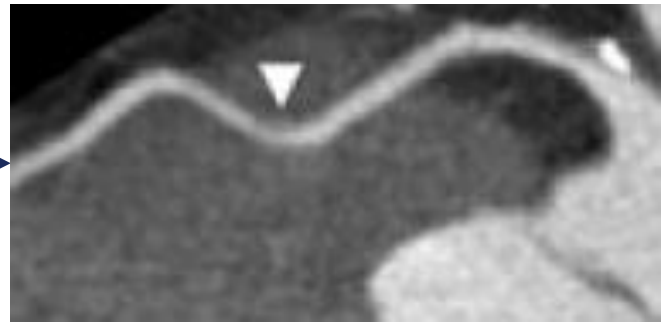
ANOMALIES CORONAIRES CONGENITALES

Connexion proximale



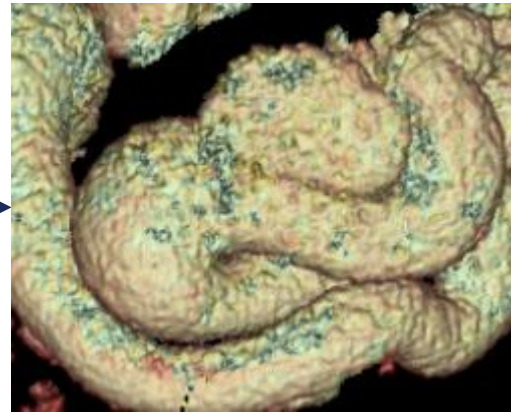
ANOCOR

Trajet



PM

Connexion distale



Fistule

- Variantes anatomiques
- Anomalies sur le trajet
- Connexions anormales distales
- Connexions anormales proximales

- Embryologie et anatomie
- Classification
- Prévalence
- Imagerie
- Ischémie myocardique
- Mort subite
- Screening
- Prise en charge
- Chirurgie
- Angioplastie
- Activités sportives

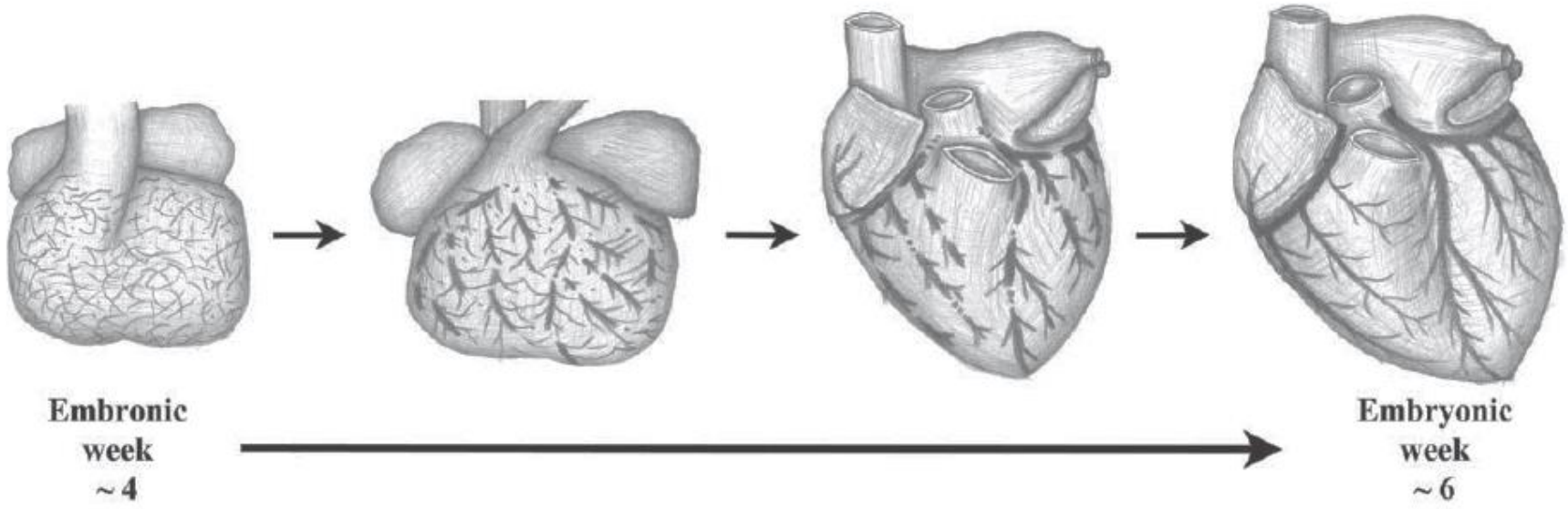
Origine anormale

Développement à partir de l'aorte

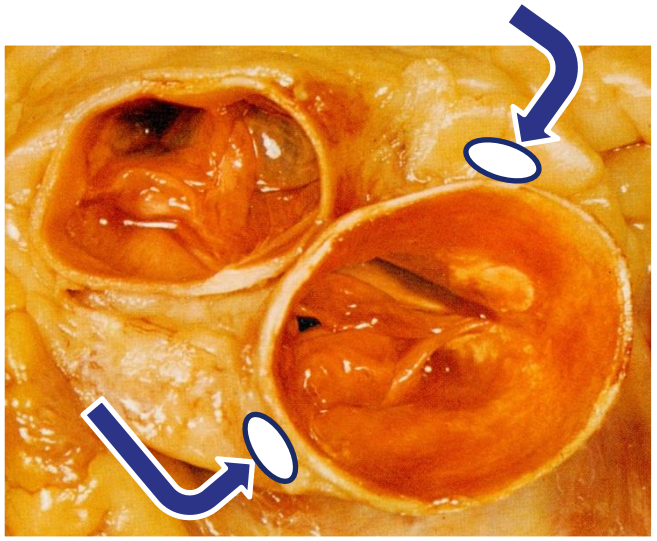
Connexion anormale

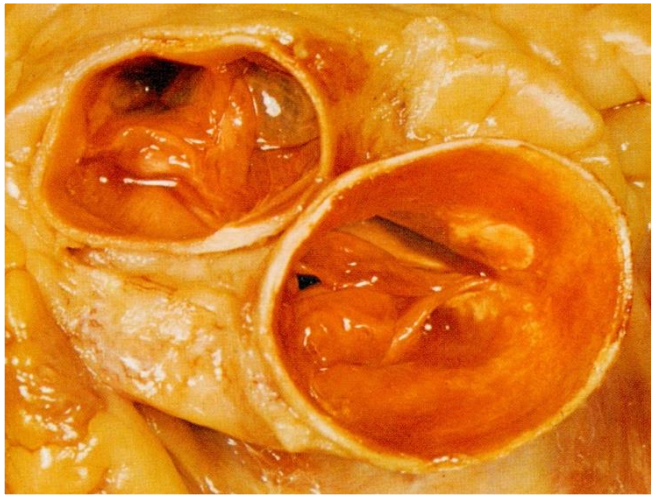
Développement vers l'aorte

Embryologie et anatomie



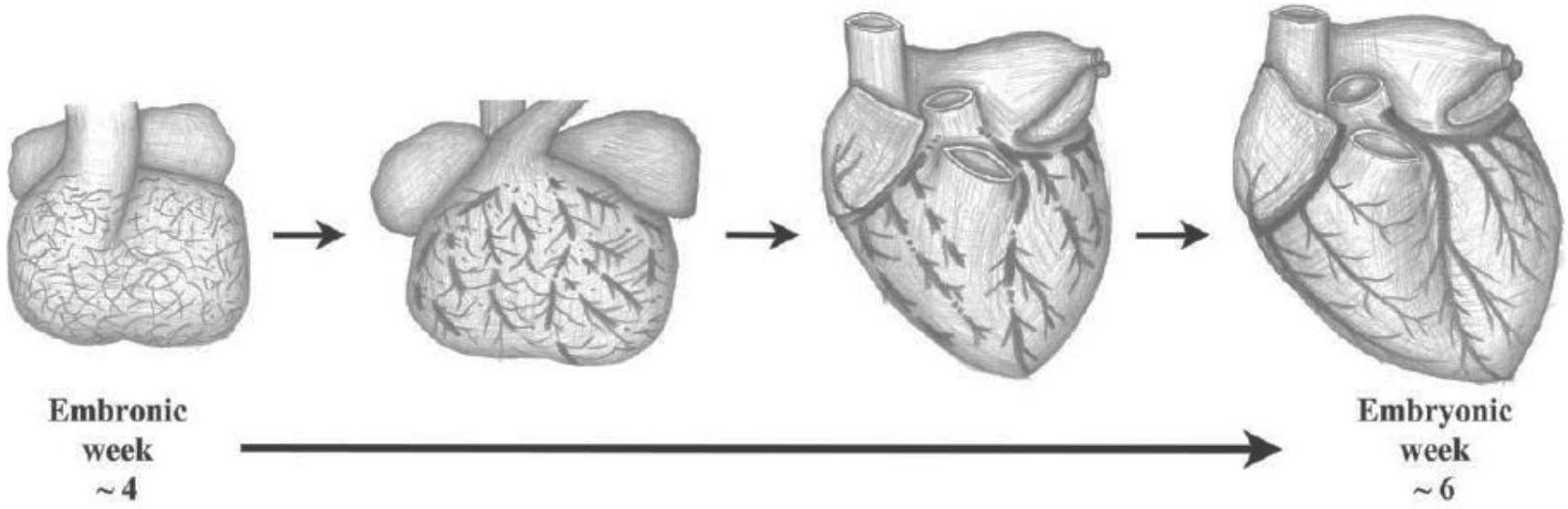
Development of coronary vessels during embryogenesis.





Lluri G. *Clin Cardiol* 2014
Bogers AJ. *Anat Embryol* 1989

Embryologie et anatomie



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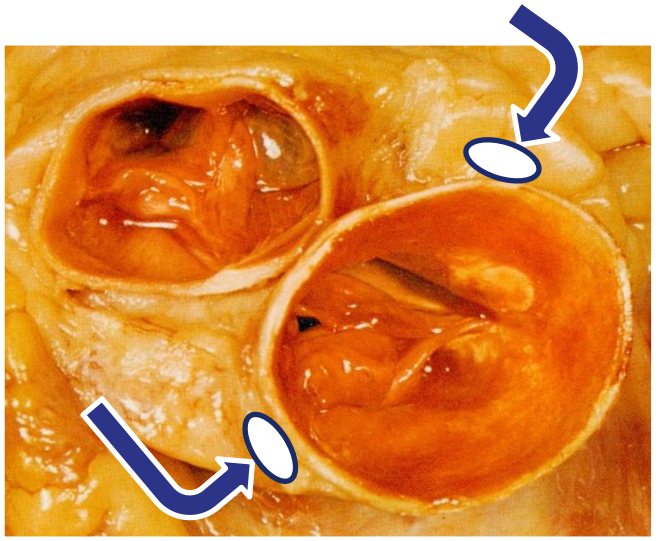
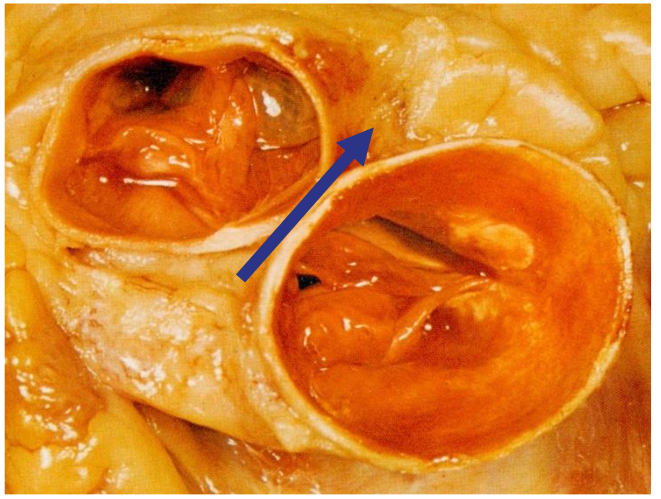
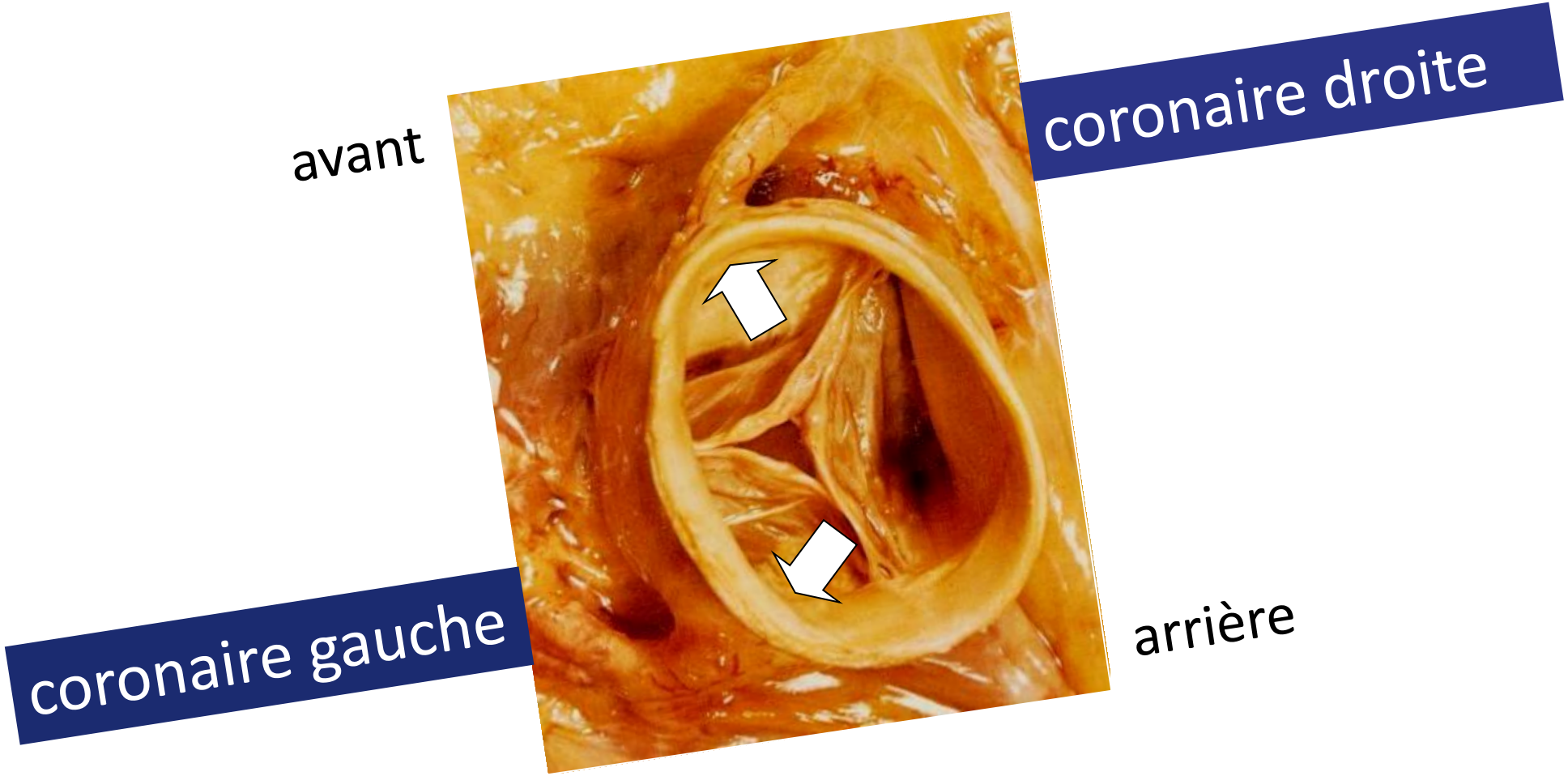


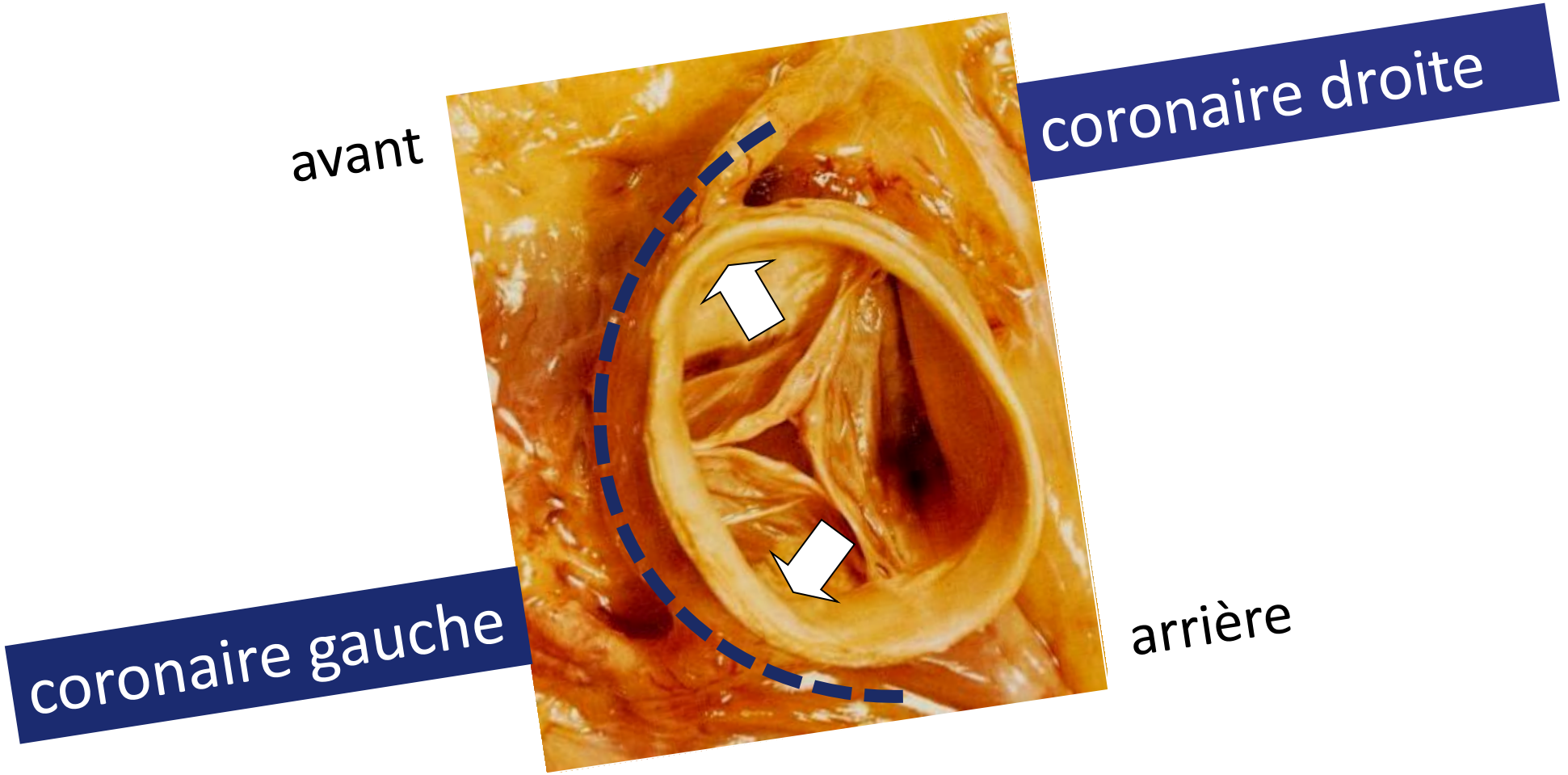


Lluri G. *Clin Cardiol* 2014
Bogers AJ. *Anat Embryol* 1989

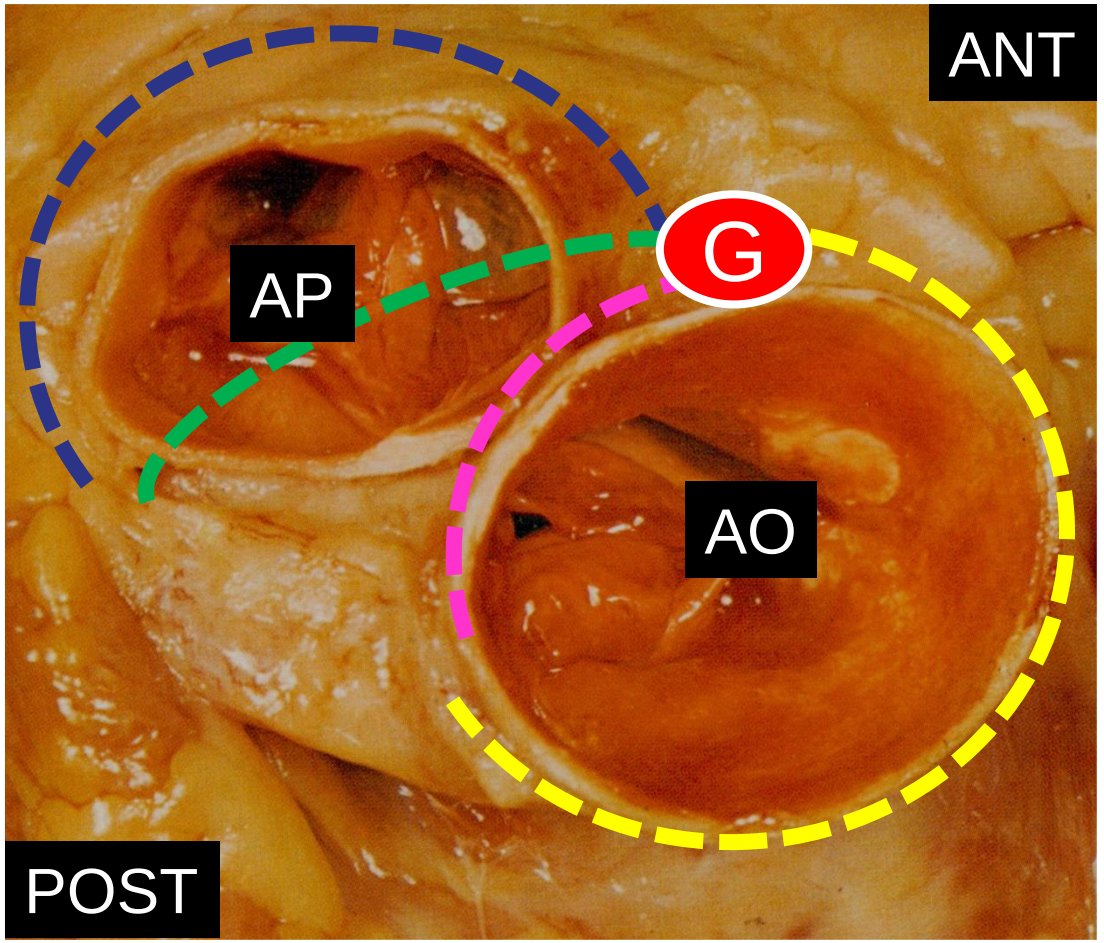
Connexions coronaires normales



Connexions coronaires anormales (- - -)

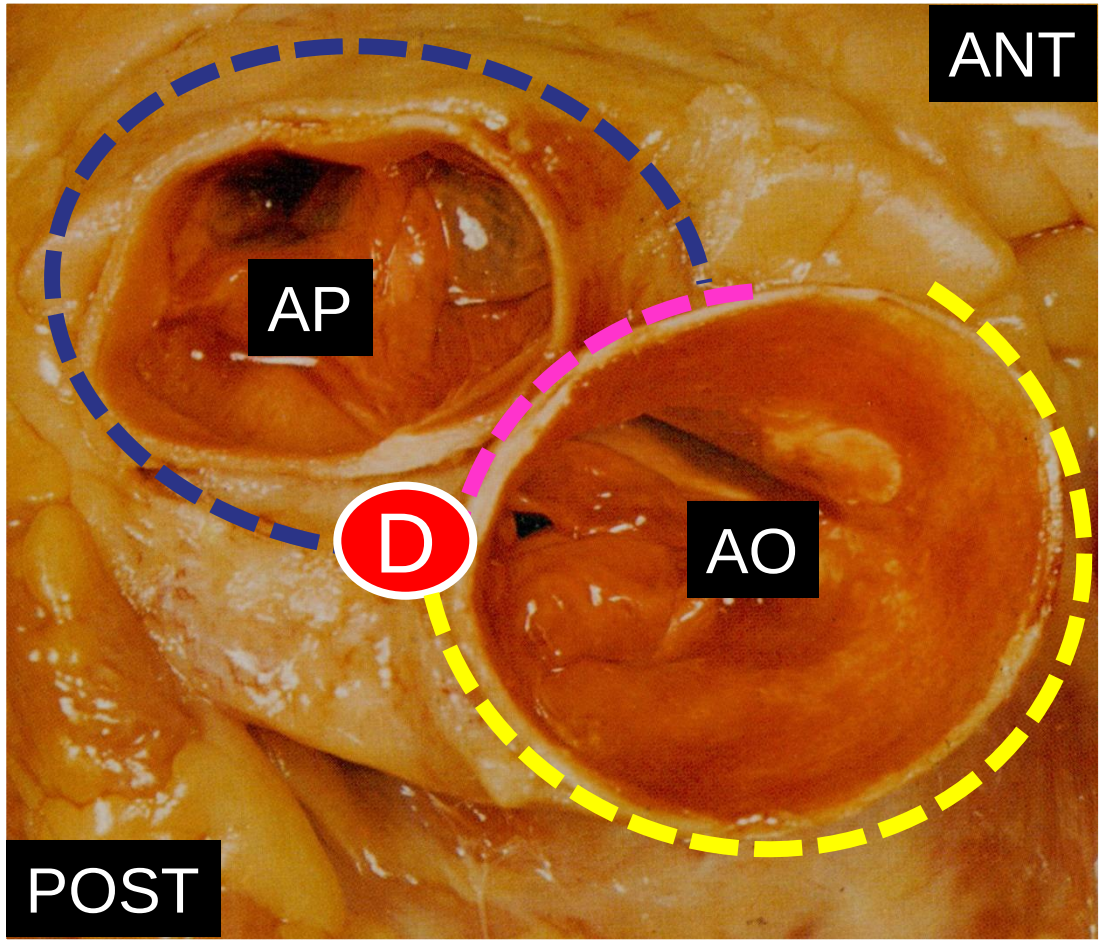


Trajets ectopiques pour la coronaire gauche



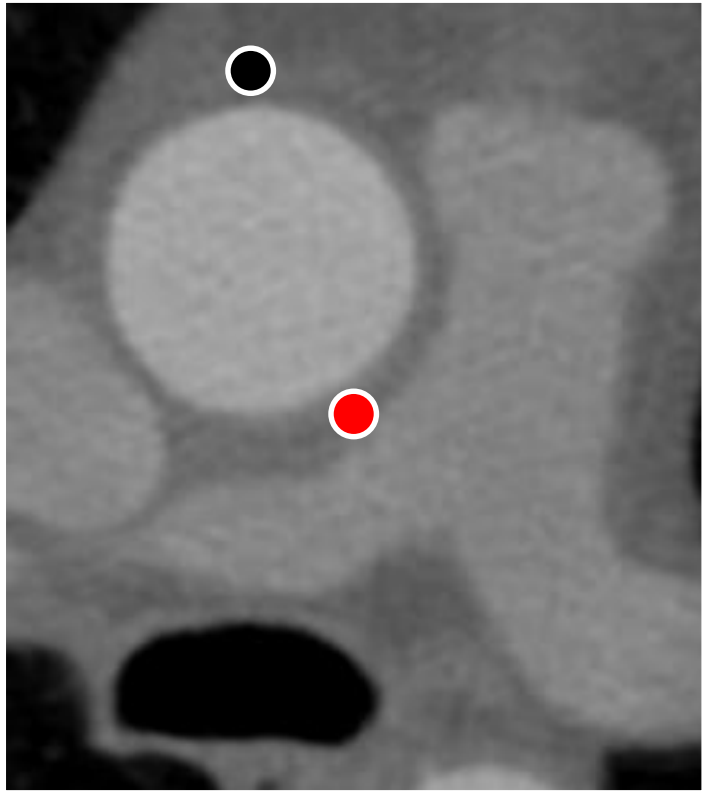
- prépulmonaire
- rétropulmonaire (intraseptal)
- interartériel (préaortique)
- rétroaortique

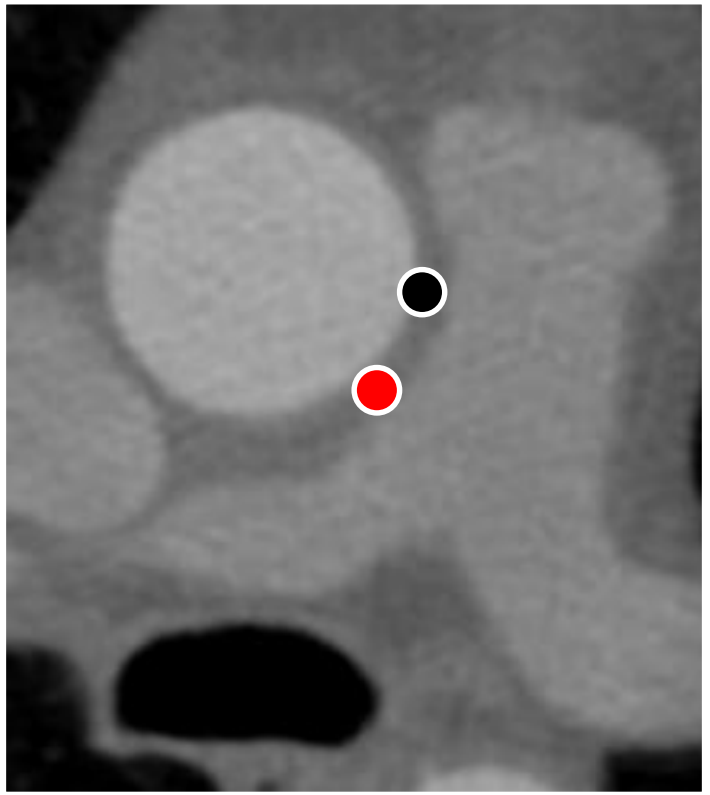
Trajets ectopiques pour la coronaire droite

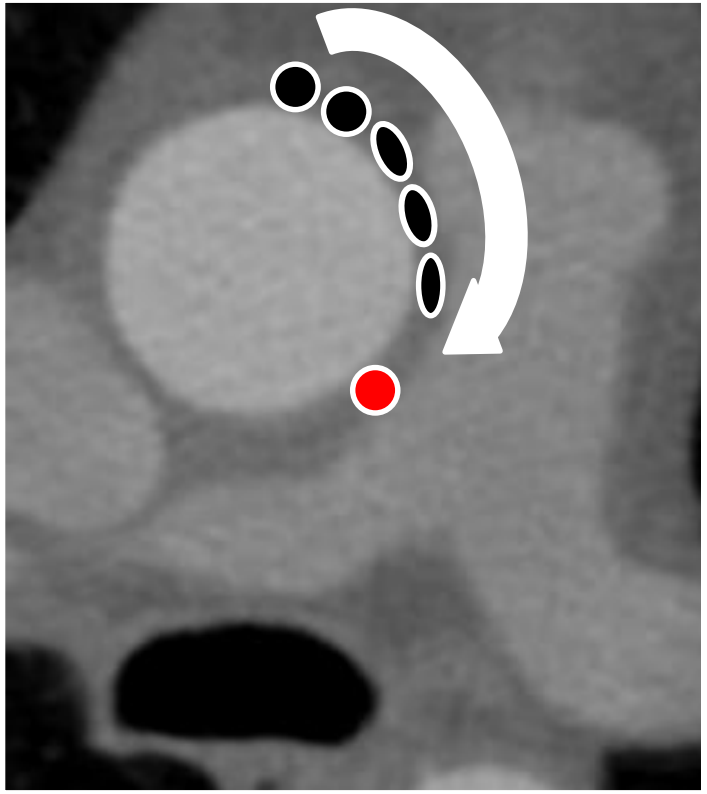


prépulmonaire
interartériel (préaortique)
rétroaortique

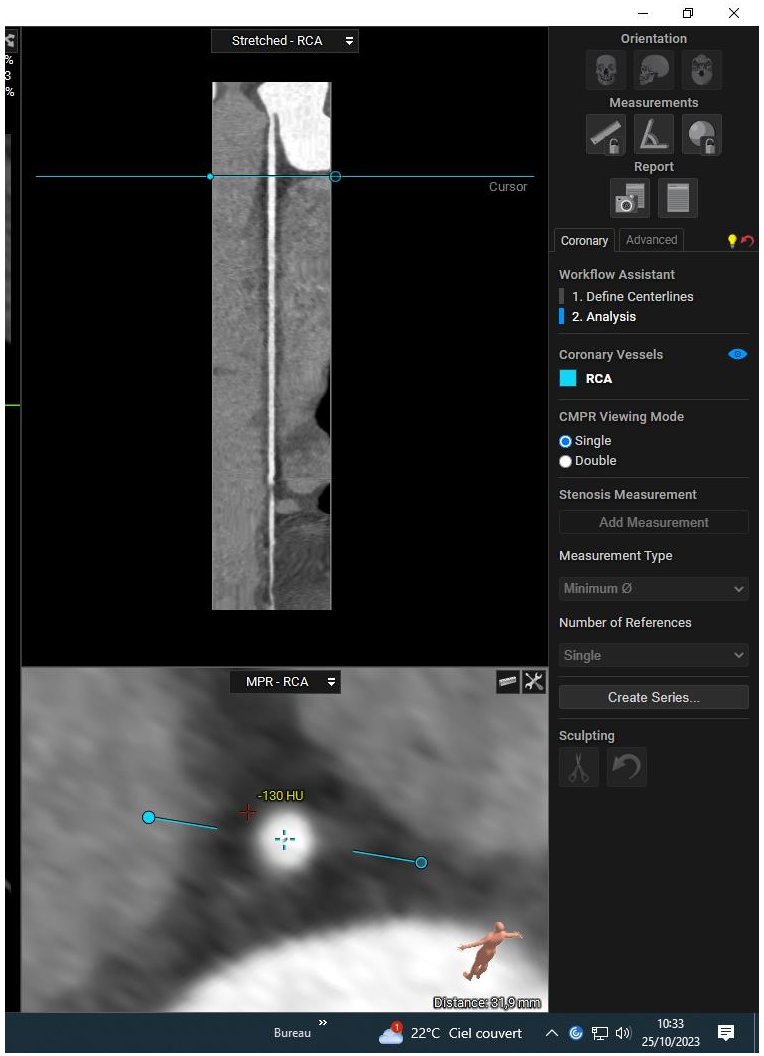
Adaptation vasculaire

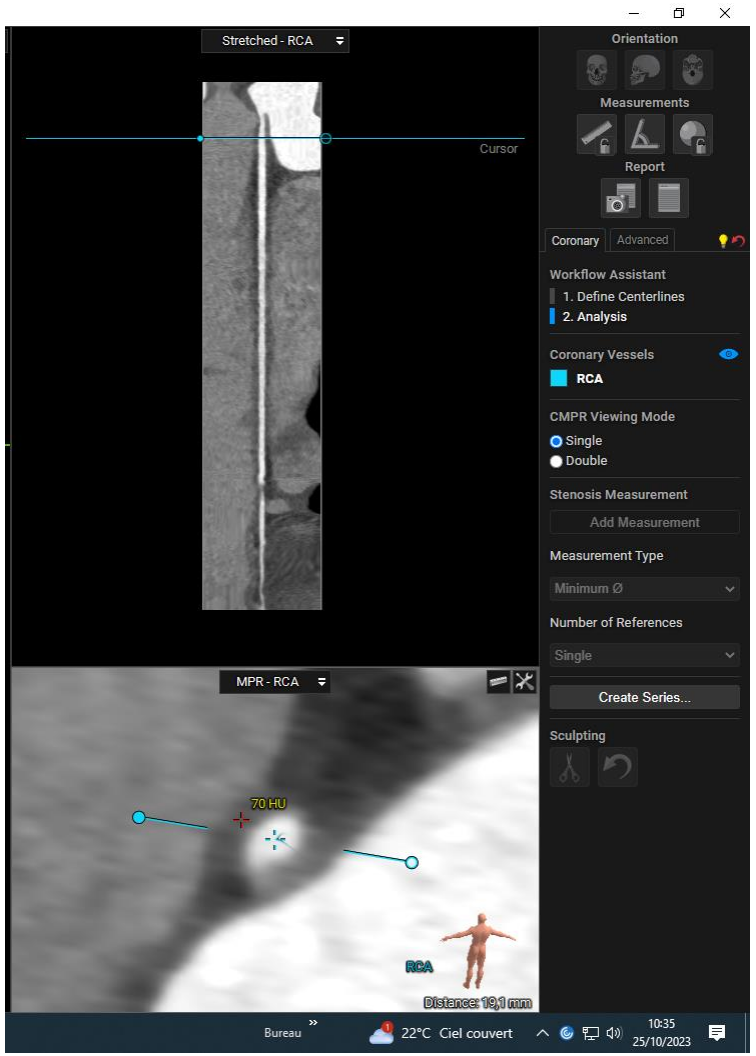


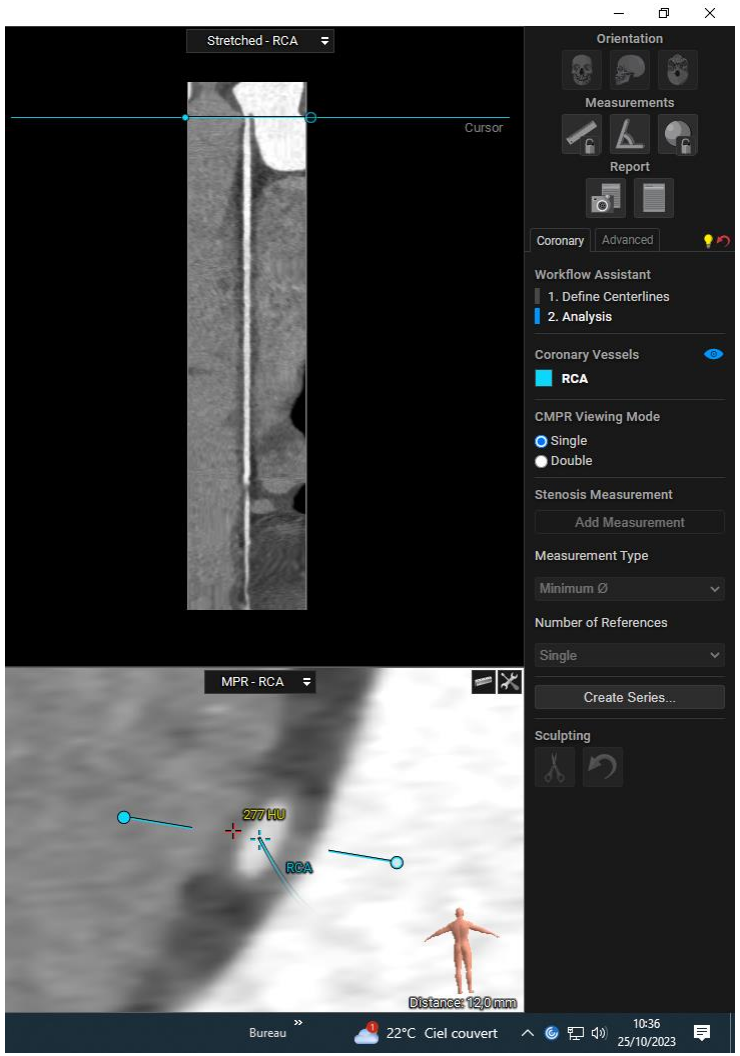




Adaptation vasculaire

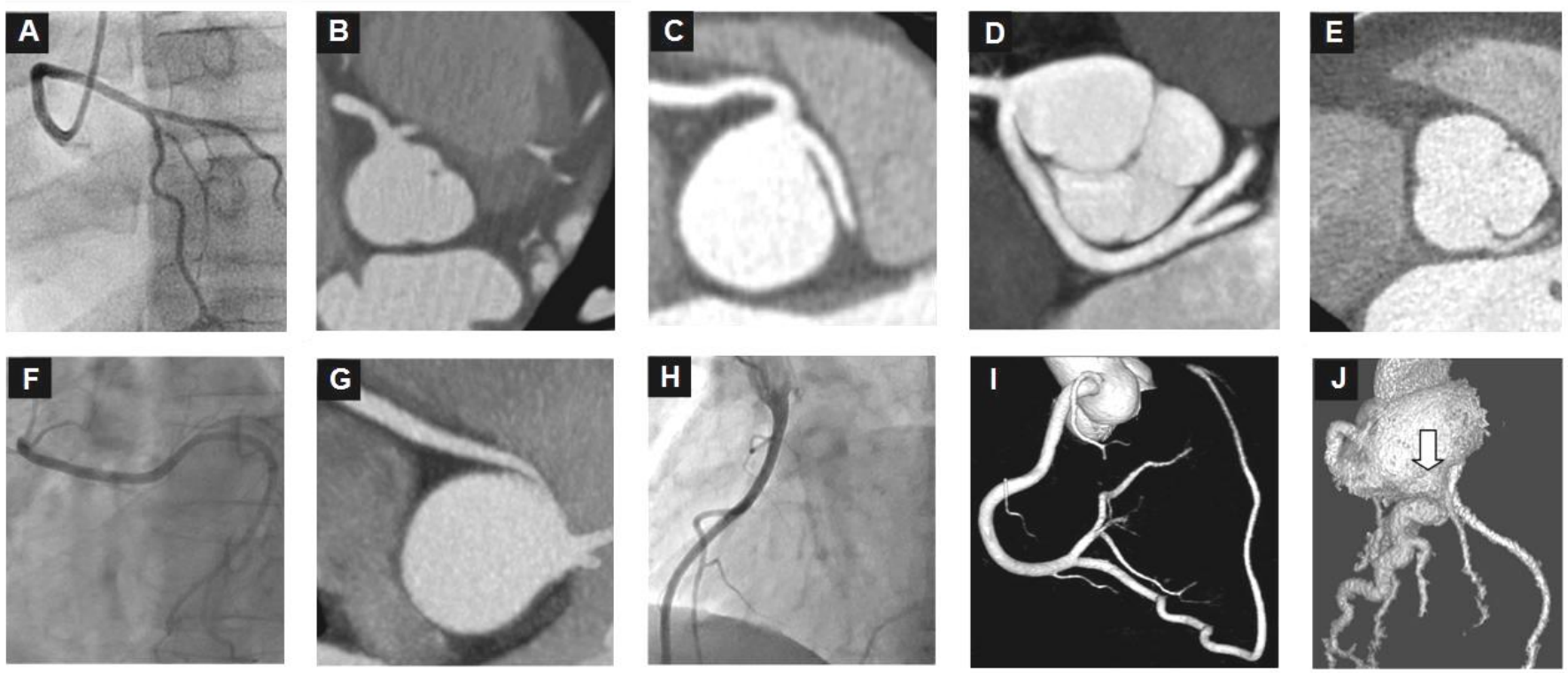






- Embryologie et anatomie
- Classification
- Prévalence
- Imagerie
- Ischémie myocardique
- Mort subite
- Screening
- Prise en charge
- Chirurgie
- Angioplastie
- Activités sportives

Nombreuses formes anatomiques



Classification

- Type d'artère
  - Tronc
  - IVA
  - Circonflexe
  - Droite
  - Septale
- Trajet
  - Prépulmonaire
  - Rétropulmonaire
  - Interartériel
  - Rétroaortique
  - Normal
- Site de connexion
  - Artère controlatérale
  - Sinus controlatéral
  - Sinus non coronaire
  - Sinus approprié
  - Aorte thoracique
  - Artère pulmonaire
- Risques
  - Mort subite
  - Arrêt cardiaque
  - Arythmies V
  - Ischémie
  - Absents

Classification

- Liens de causalité :
  - entre anomalie coronaire et symptomatologie
  - entre anomalie coronaire et ischémie myocardique
  - entre anomalie coronaire et arythmie ventriculaire
  - entre anomalie coronaire et arrêt cardiaque

Absent | Possible/Probable | Certain

Classification

Received: 20 July 2023 | Revised: 2 October 2023 | Accepted: 3 October 2023
DOI: 10.1002/ccr3.8052

CASE REPORT

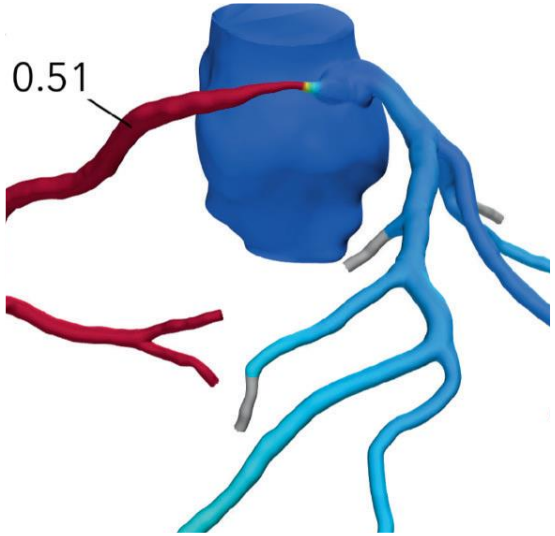
Clinical Case Reports WILEY

Percutaneous coronary intervention for ventricular fibrillation in the setting of an anomalous right coronary artery

Danish Saleh[1] | Eric P. Cantey[1] | Emily P. Marogi[2] | Benjamin H. Freed[1] | Bradley P. Knight[1] | Roger A. de Freitas[1] | Ranya N. Sweis[1] | James D. Flaherty[1]

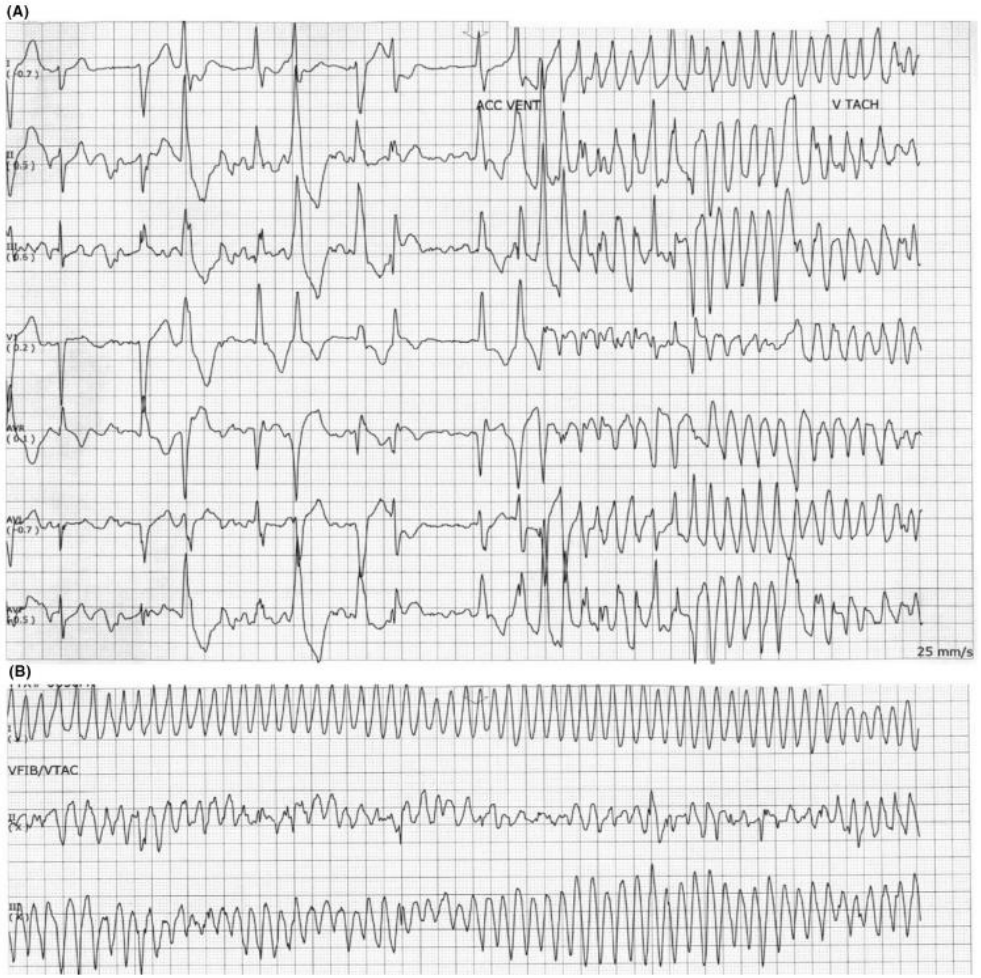
1 | HISTORY OF PRESENTATION

Our patient is a 29-year-old bedbound male with quadriplegia related to injury at the fourth cervical vertebra (C4) and a history of atrial fibrillation, who was found to be critically ill with a urinary tract infection, prompting hospital admission. On the fifth day, the patient developed cardiac arrest with ventricular fibrillation. Return of spontaneous circulation (ROSC) was achieved after defibrillation. Patient was supported with electrolyte repletion, anti-arrhythmic therapy, and transvenous pacemaker placement with rapid-ventricular pacing. Targeted-temperature management was enacted per protocol.



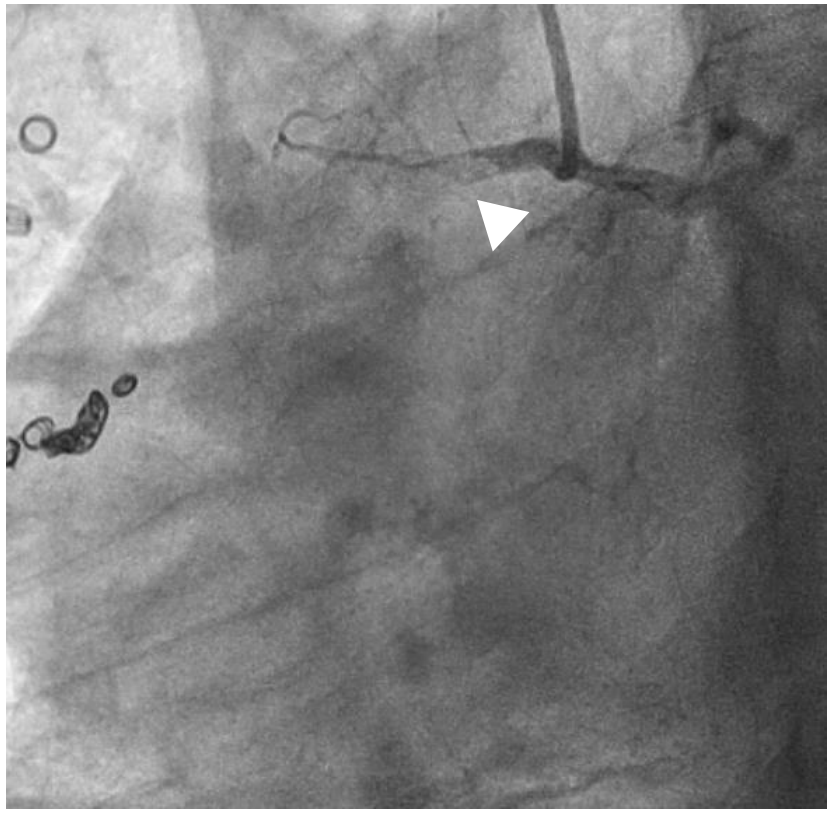
5 | PERTINENT DATA

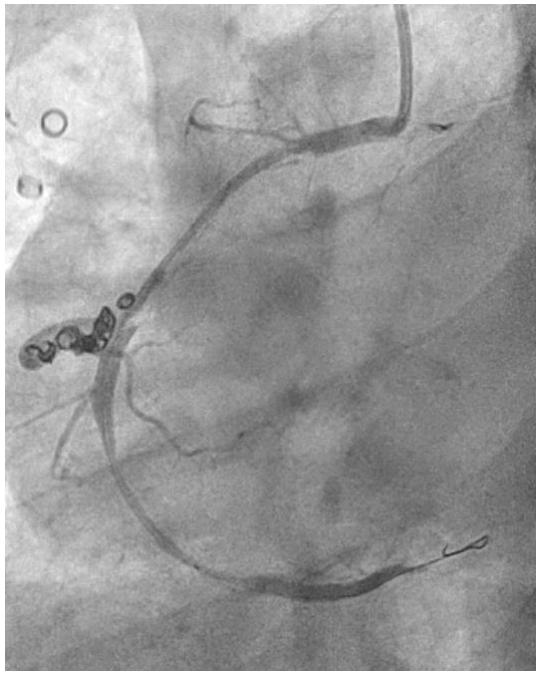
At the time of arrest, laboratories were notable for potassium of 3.0 mEq/L with hemoglobin at baseline (11.7 g/dL). Tele-strips at the time of arrest demonstrated

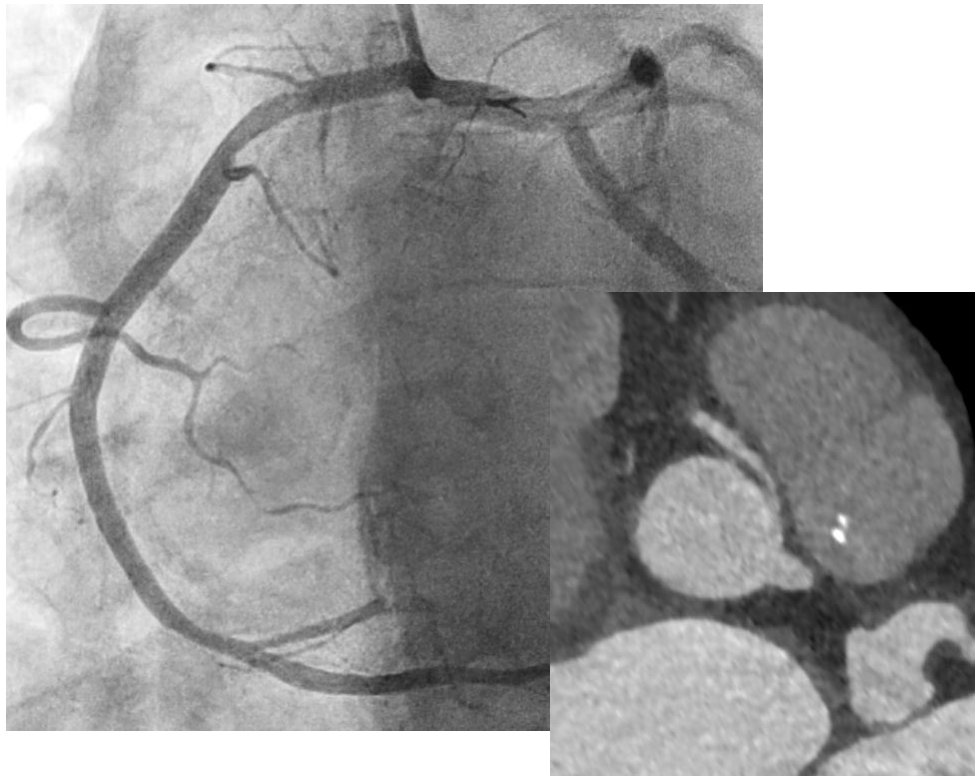


Classification

Homme de 35 ans – Maladie Rendu-Osler – MVA cérébrales/pulmonaires
SCA ST+ inférieur lors activité sportive







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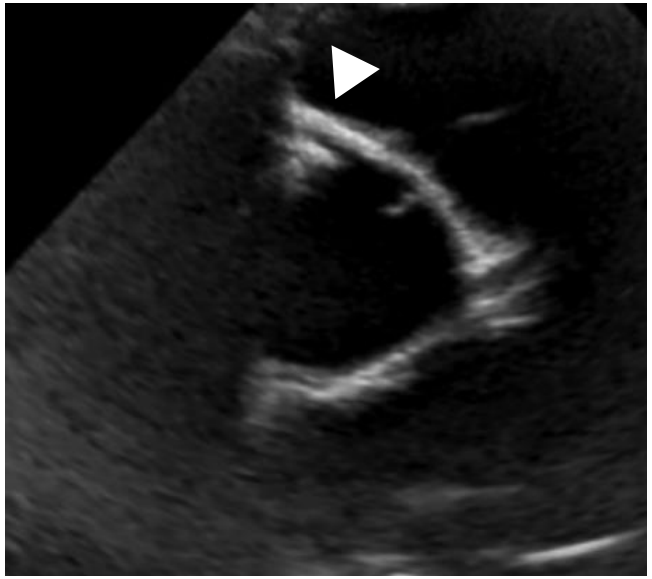
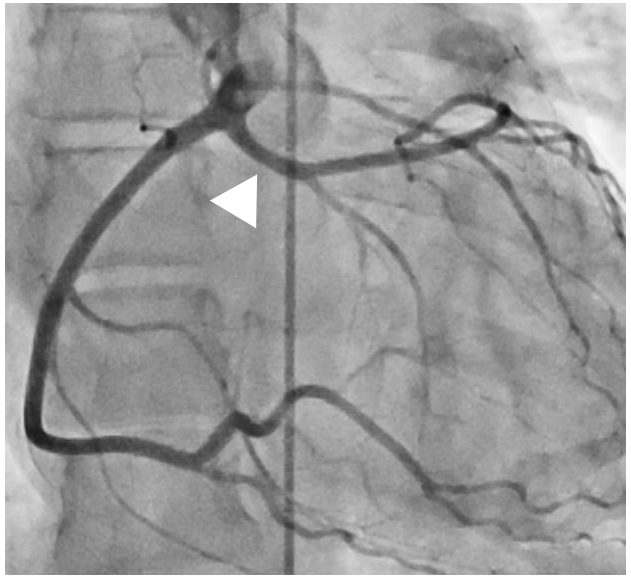
Prévalence



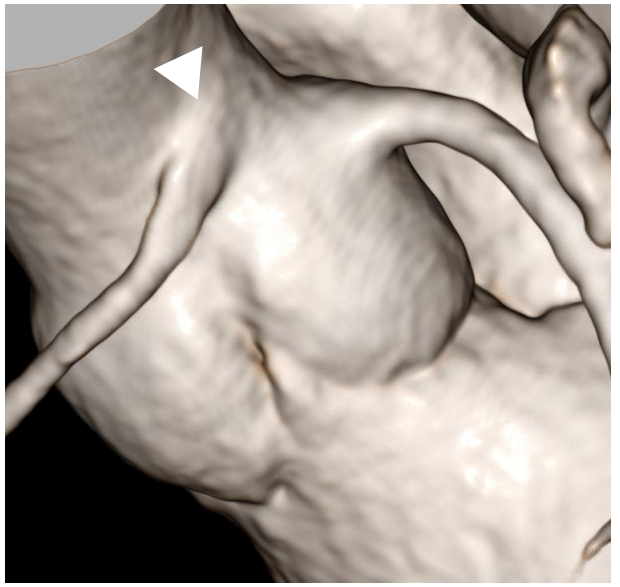
Echocardiographie

0.2%



Coronarographie

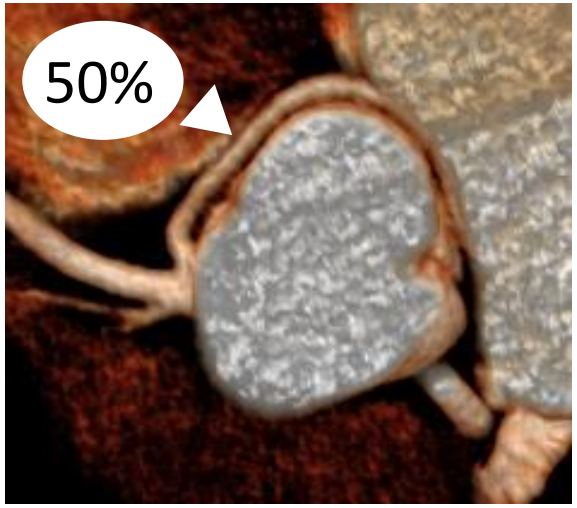
0.8%



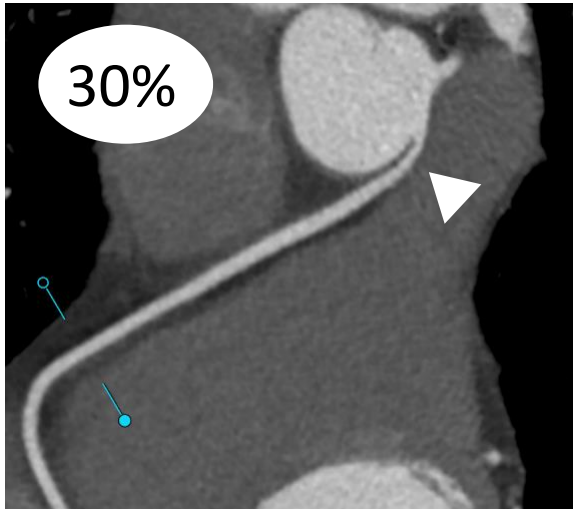
Scanner

1.2%

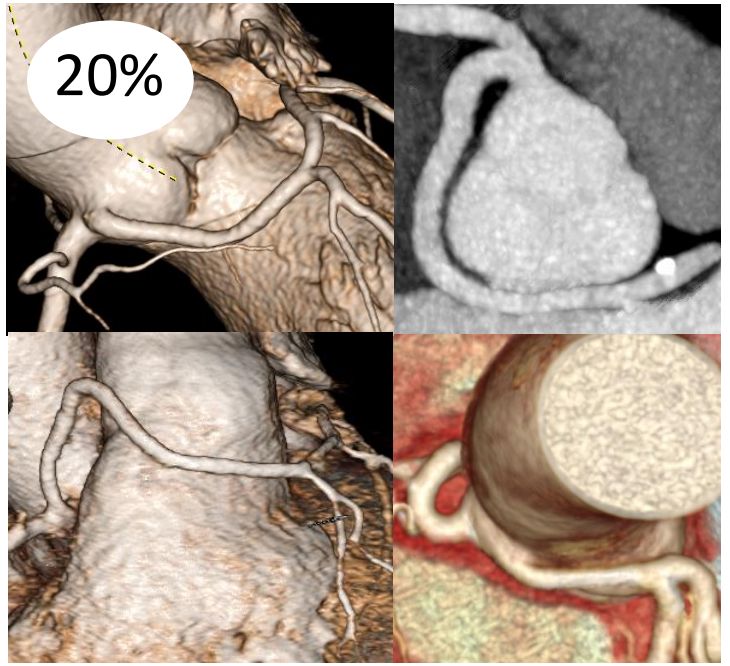
Prévalence selon l'artère coronaire



Circonflexe rétroaortique (99%)



Droite interartérielle (95%)



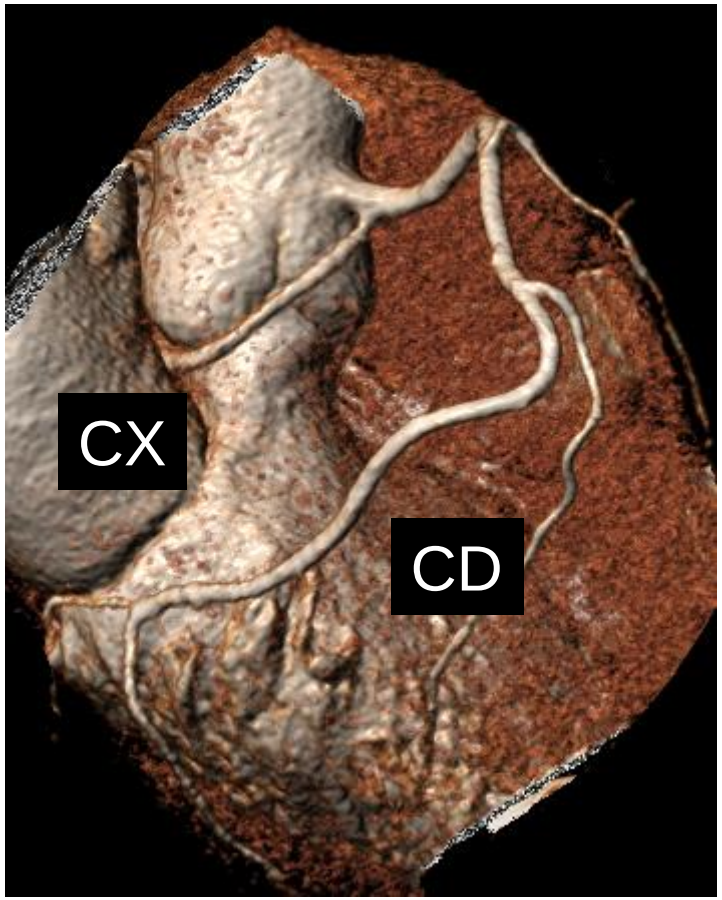
TC/IVA rétropulmonaire (45%)
prépulmonaire (30%)
rétroaortique (15%)
interartériel (10%)

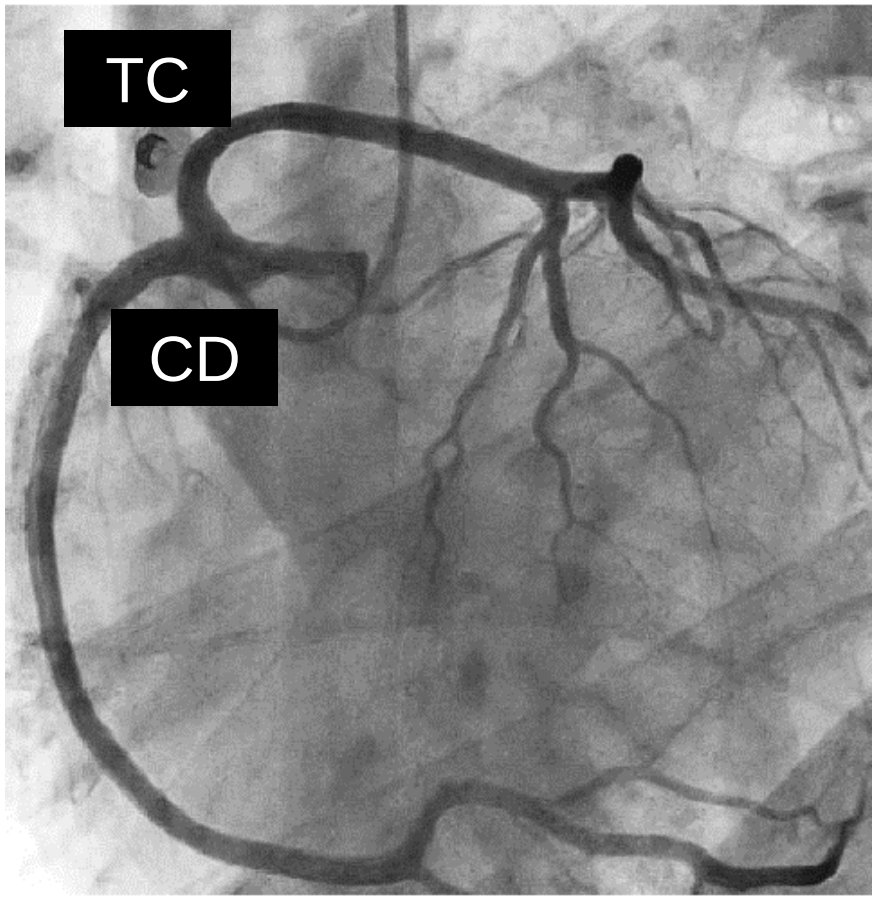
Prévalence selon le trajet ectopique

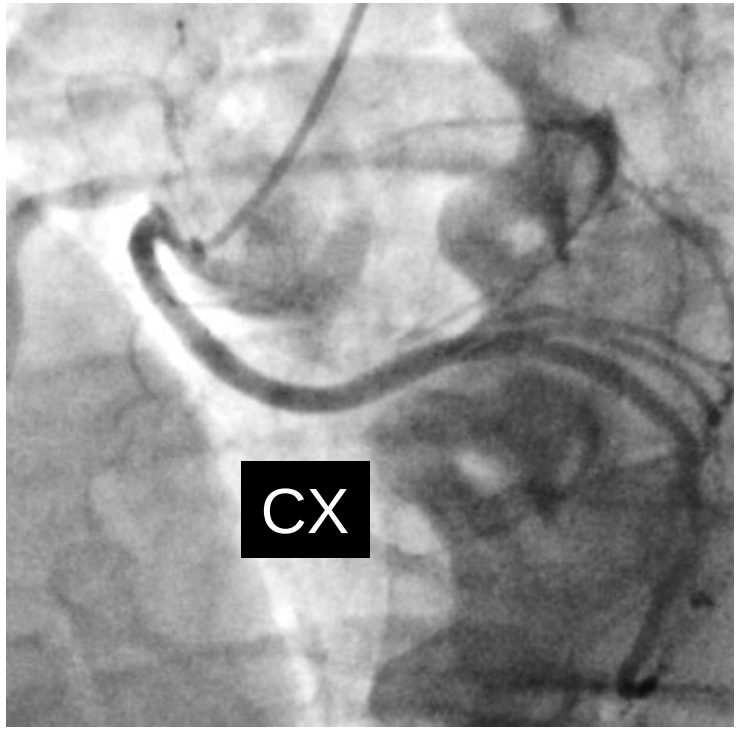
Prévalence selon le site de connexion

site de connexion	%
connexion dans sinus controlatéral	**47.0**
connexion dans artère controlatérale	**43.5**
connexion au-dessus jonction sinotubulaire	1.0
connexion anormale dans sinus habituel	1.0
artère coronaire unique	1.0
connexion avec artère pulmonaire	1.0
connexion dans sinus non coronaire	0.4
autres connexions anormales	0.1

* à partir des données du registre ANOCOR (ESC 2015)
472 patients – 496 anomalies coronaires


CX
CD


TC
CD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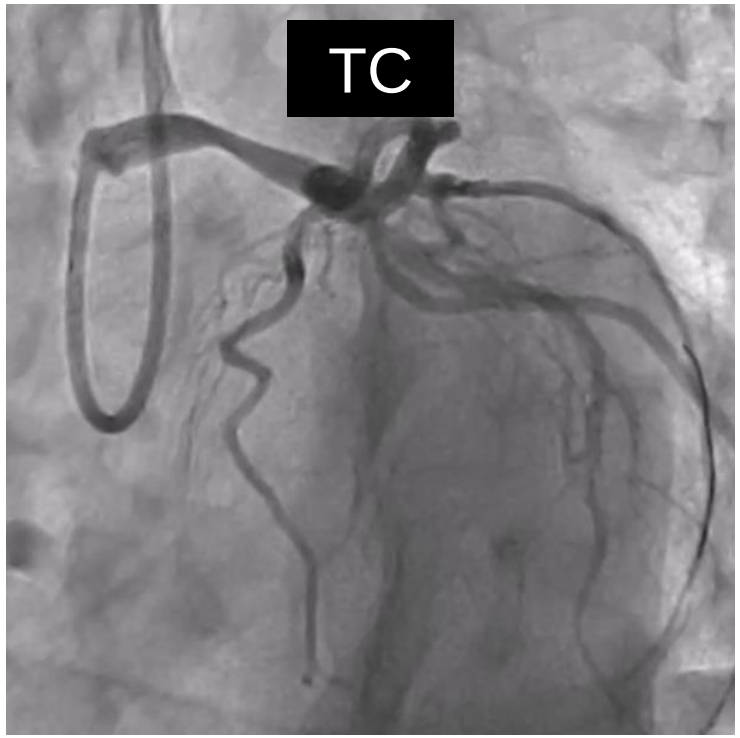
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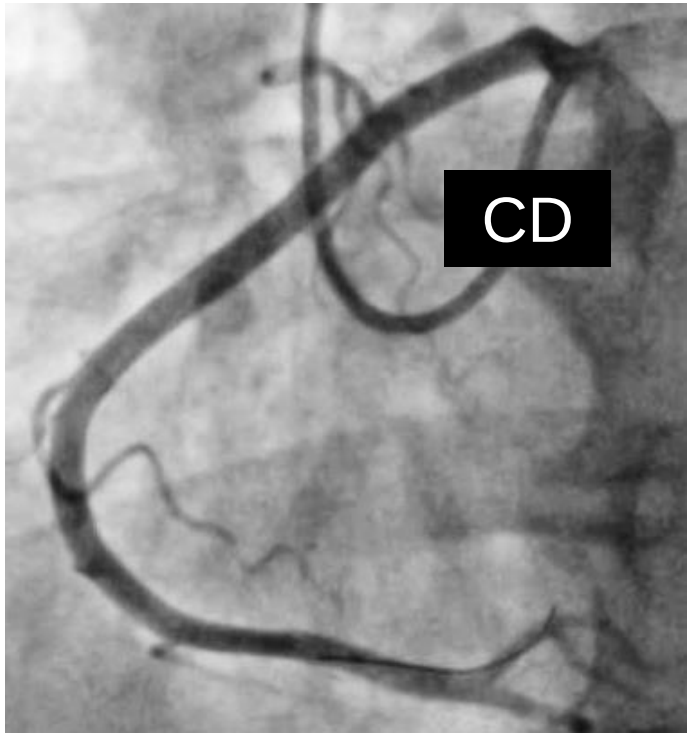
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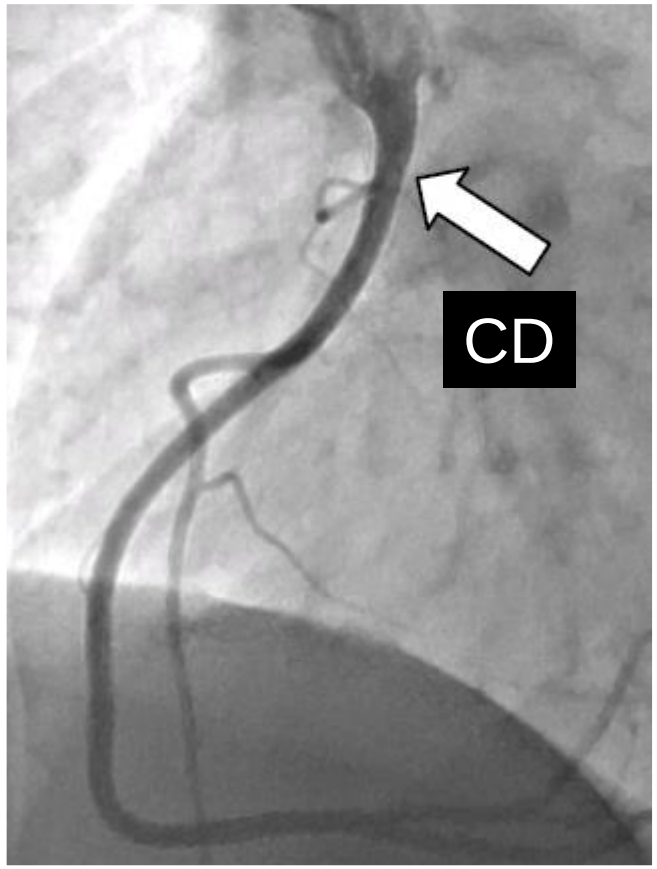
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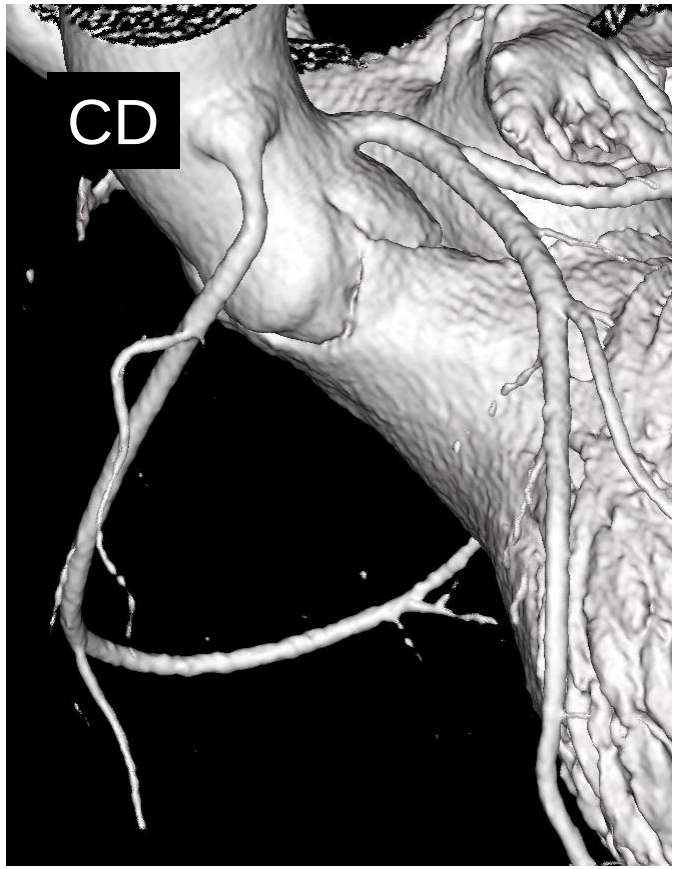
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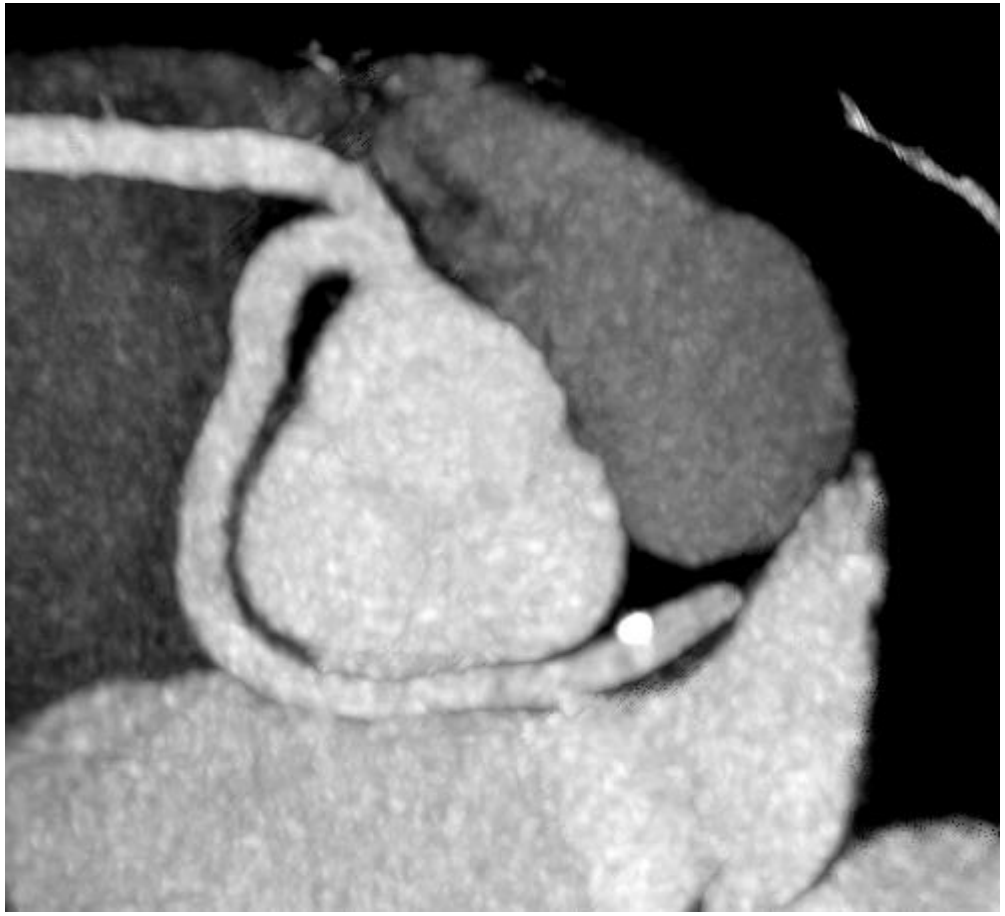
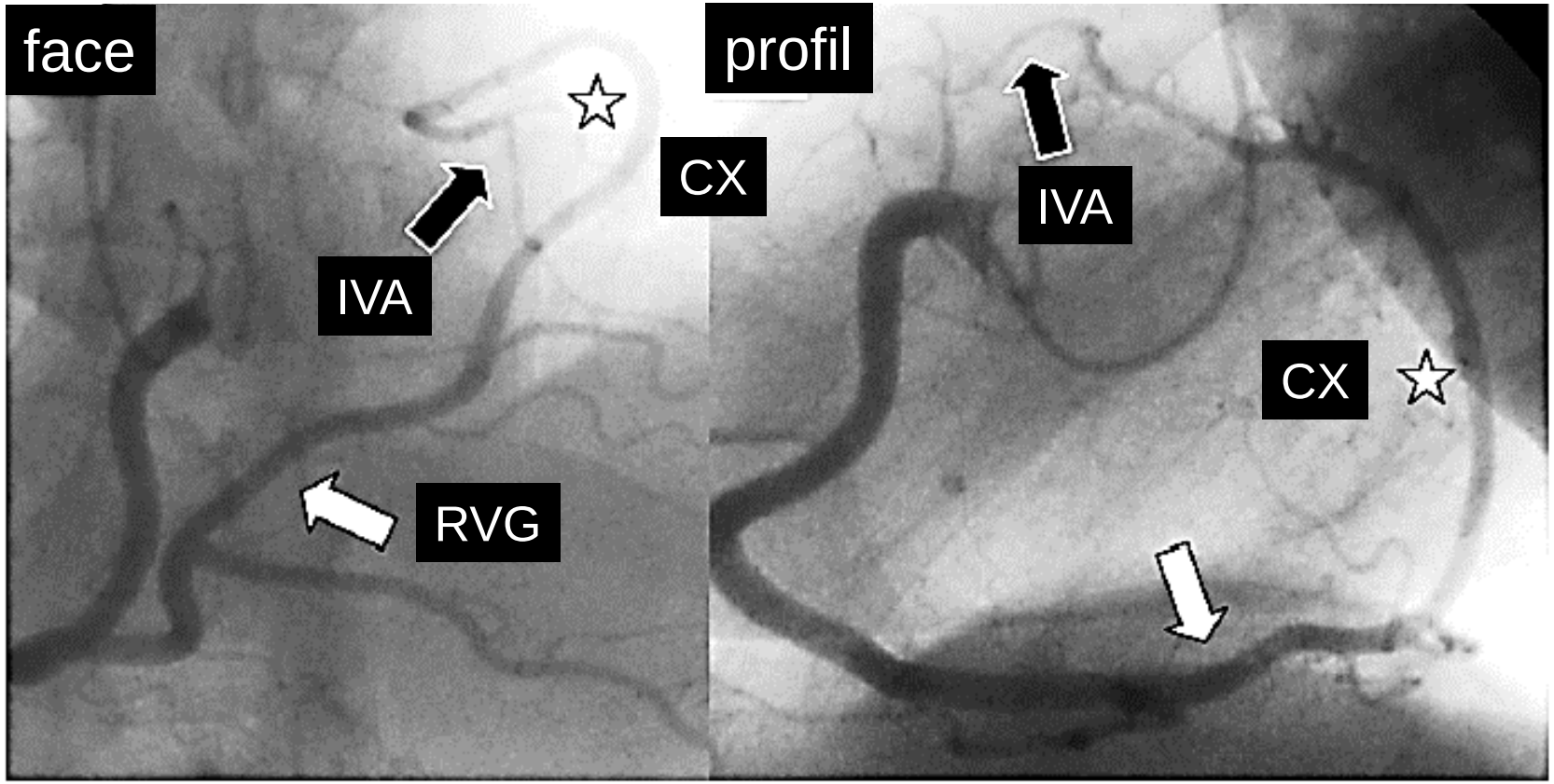
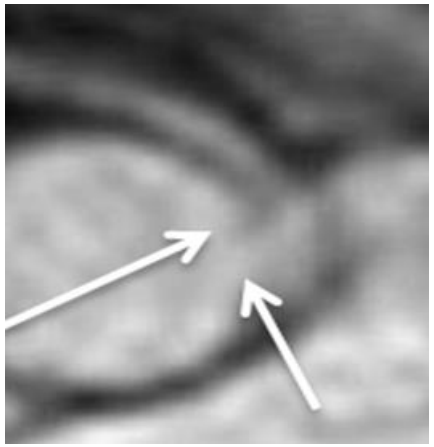


Artère coronaire unique



MRI-based study (n = 5.255)
middle school children (mean age 13 years)
2010-2017



Clinical Investigation

High-Risk Cardiovascular Conditions in Sports-Related Sudden Death:

Prevalence in 5,169 Schoolchildren Screened via Cardiac Magnetic Resonance

Angelini P. et al *Texas Heart Institute Journal • August 2018, Vol. 45, No. 4*

- L-ACAOS-IM = 2
- R-ACAOS-IM= 17

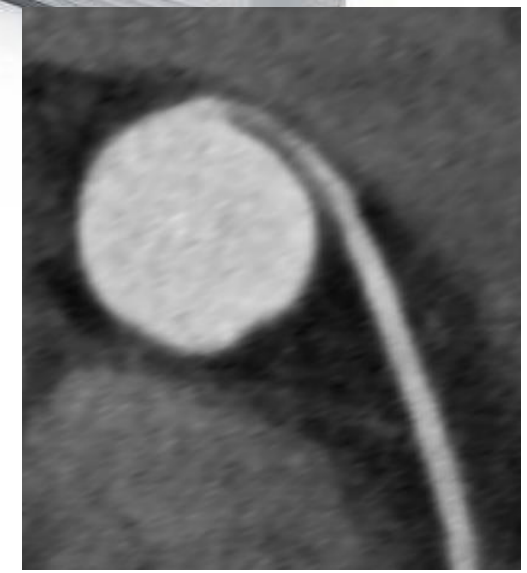
Total ACAOS = 19

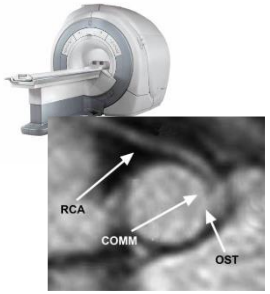
- Prevalence L-ACAOS = 0.04%
- Prevalence R-ACAOS = 0.32%

Total prevalence = 0.35% ≈ 3.5/1000

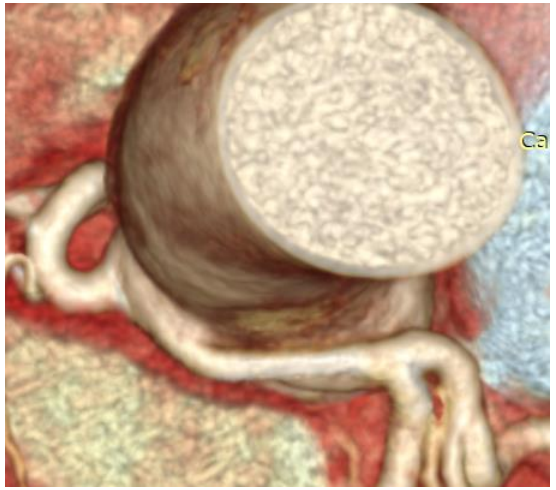
- Embryologie et anatomie
- Classification
- Prévalence
- **Imagerie**
- Ischémie myocardique
- Mort subite
- Screening
- Prise en charge
- Chirurgie
- Angioplastie
- Activités sportives

Outils d'imagerie





Piège à éviter

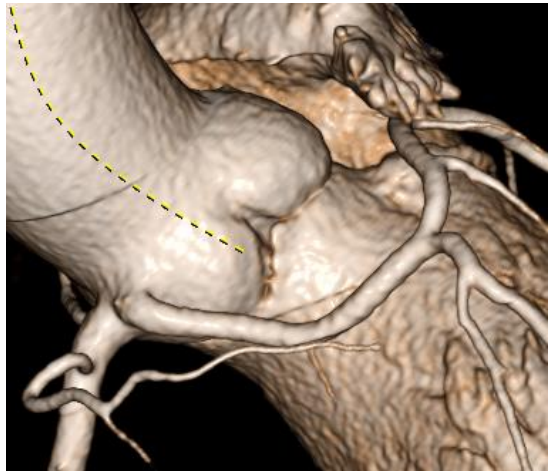


Trajet prépulmonaire

Trajet rétroaortique

Trajet interartériel

Trajet rétropulmonaire



Received: 11 October 2016 | Revised: 21 February 2017 | Accepted: 28 May 2017
DOI: 10.1111/chd.12504

ORIGINAL ARTICLE

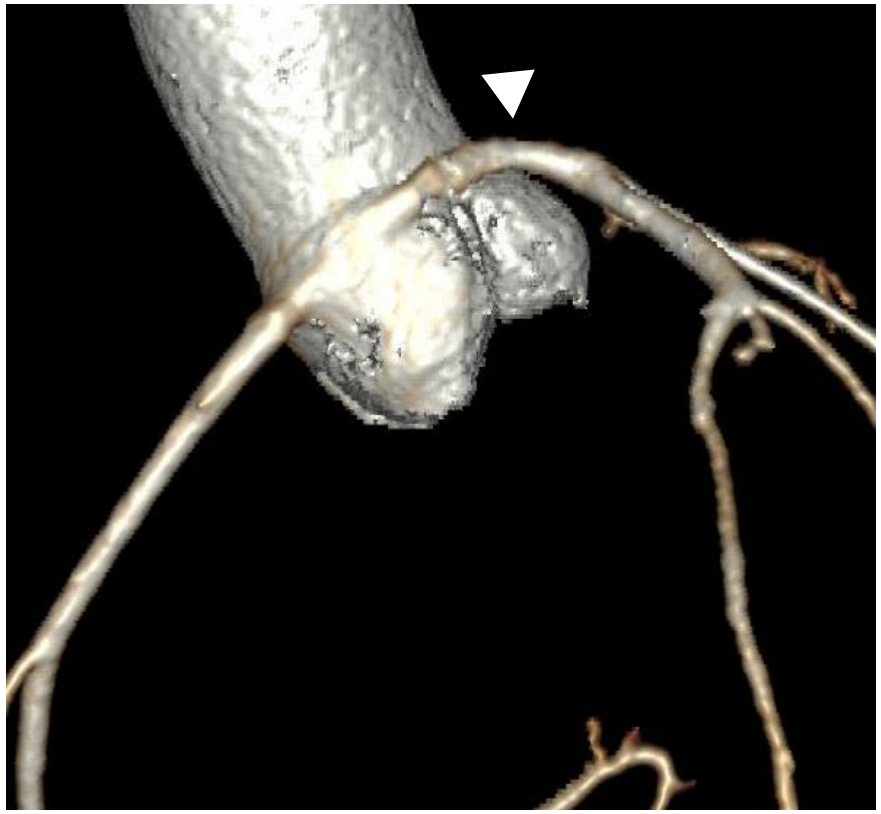
WILEY Congenital Heart Disease

Interobserver variability in the classification of congenital coronary abnormalities: A substudy of the anomalous connections of the coronary arteries registry

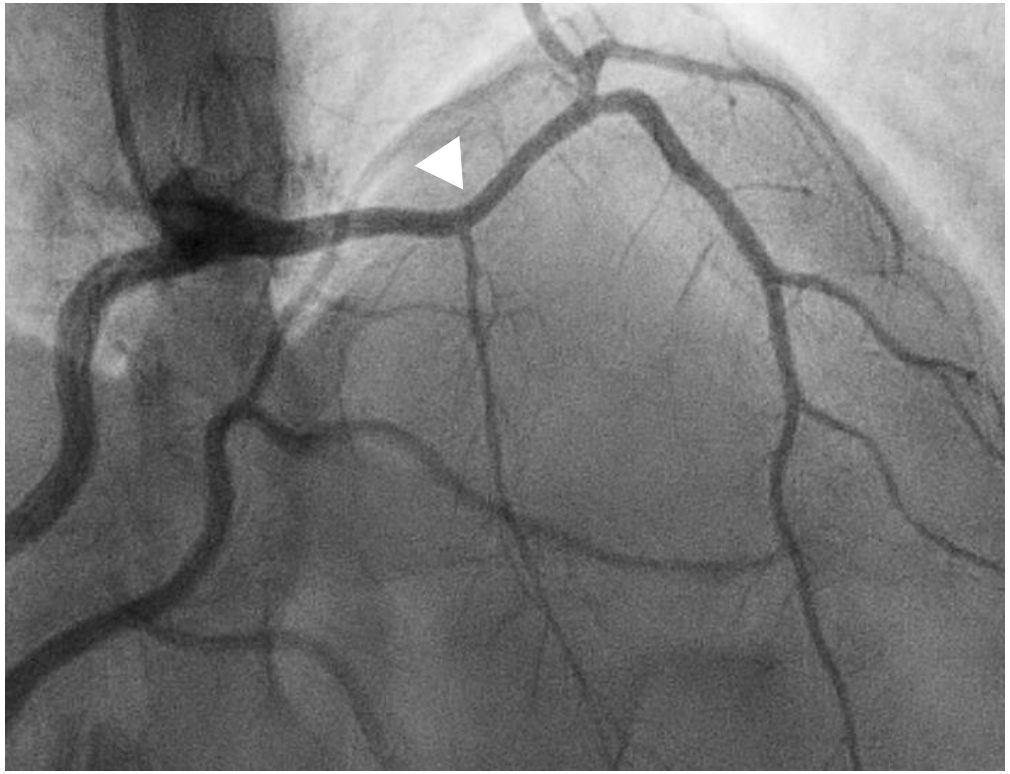
Athanasios Koutsoukis, MD[1] | Xavier Halna du Fretay, MD[2] | Patrick Dupouy, MD[3] | Phalla Ou, MD, PhD[4] | Jean-Pierre Laissy, MD, PhD[4] | Jean-Michel Juliard, MD[5] | Fabien Hyafil, MD[6] | Pierre Aubry, MD[5] | on behalf of the ANOCOR Investigators*

Congenital Heart Disease 2017

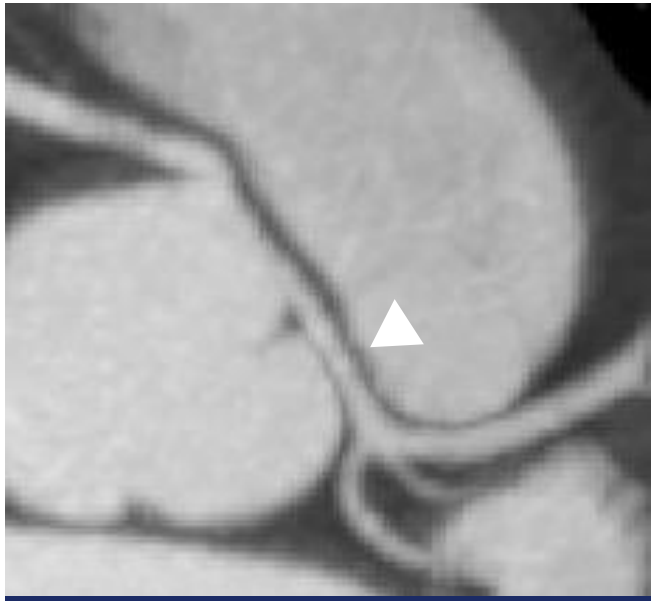
ANOCOR gauche avec trajet interartériel



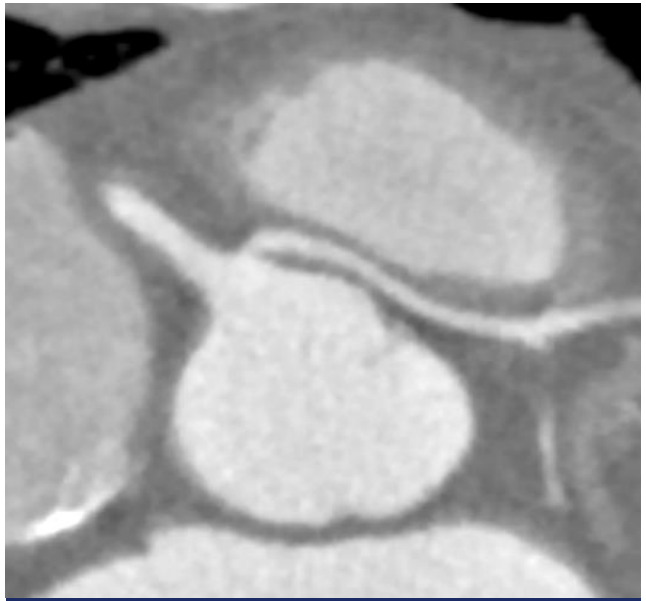
ANOCOR gauche avec trajet rétropulmonaire



Formes anatomiques gauches à ne pas confondre

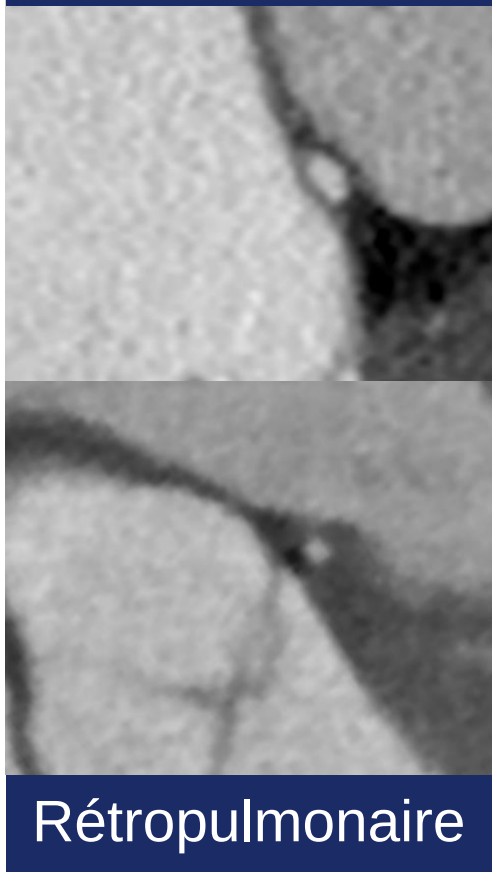


Trajet interartériel



Trajet rétropulmonaire

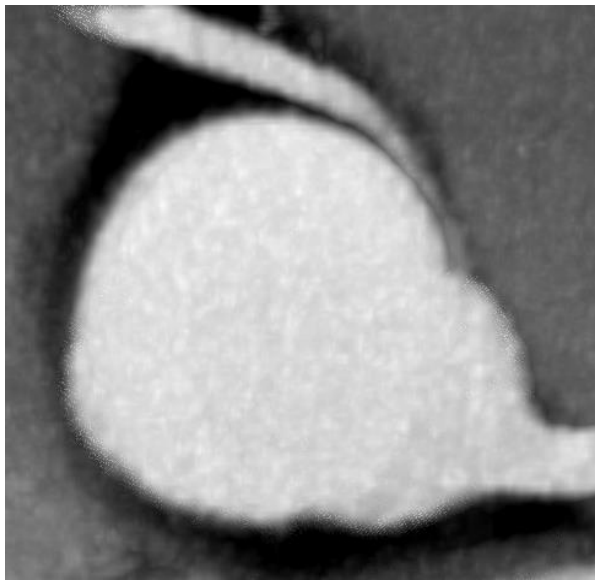
Interartériel

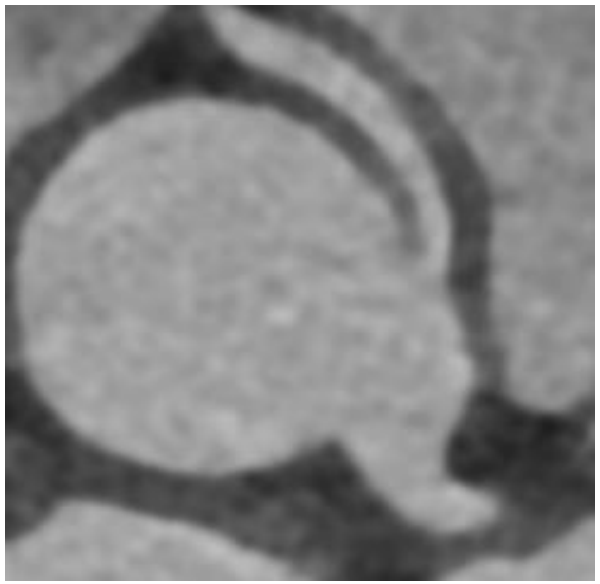


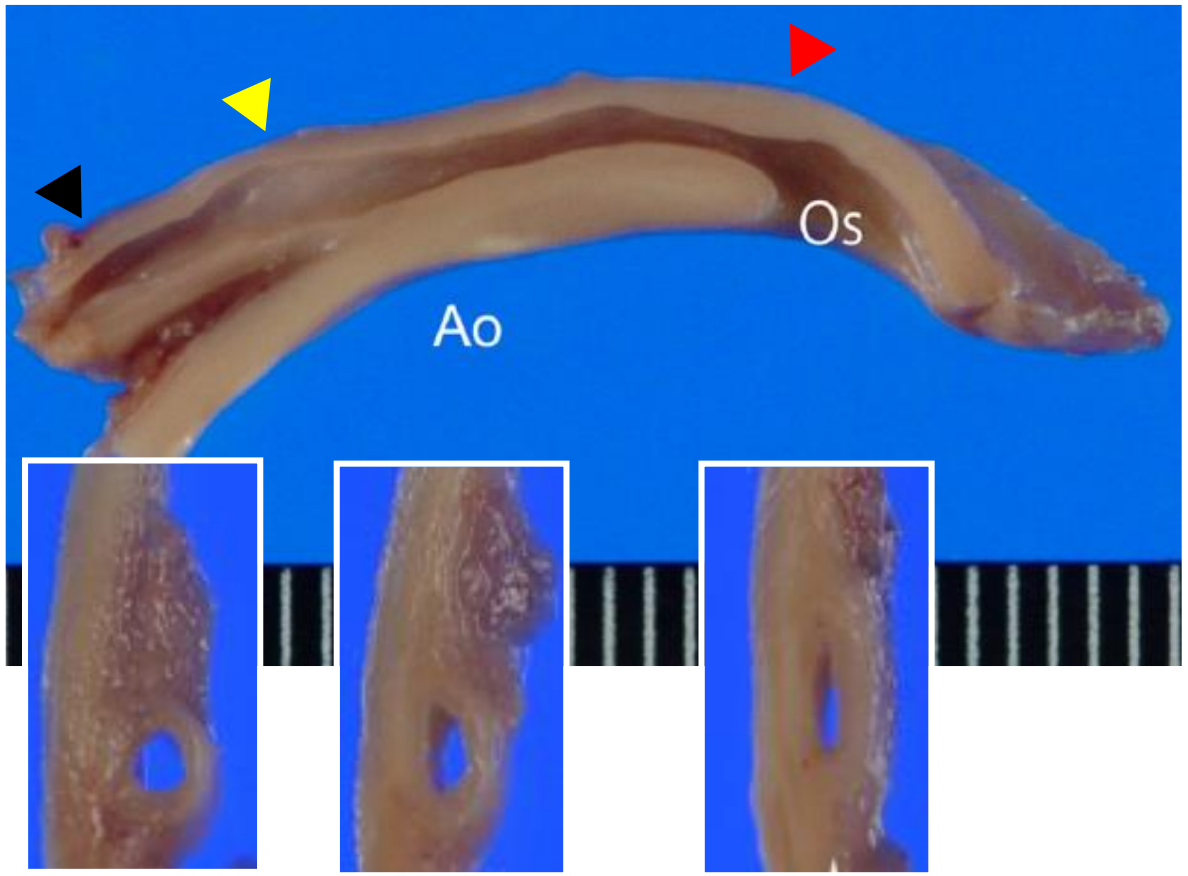
Rétropulmonaire

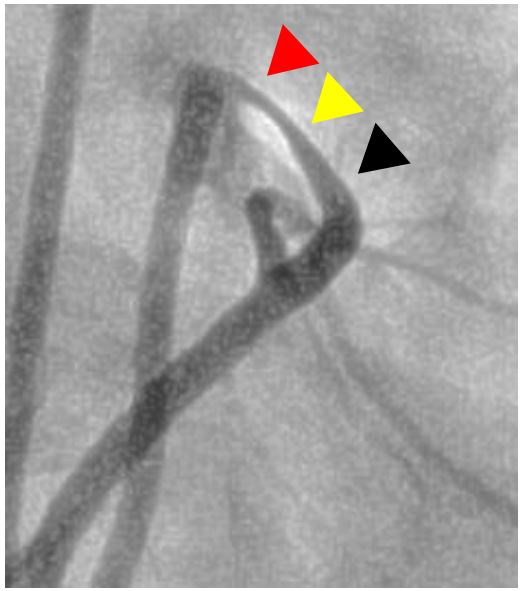
Passage aortique intramural

Passage aortique juxtamural



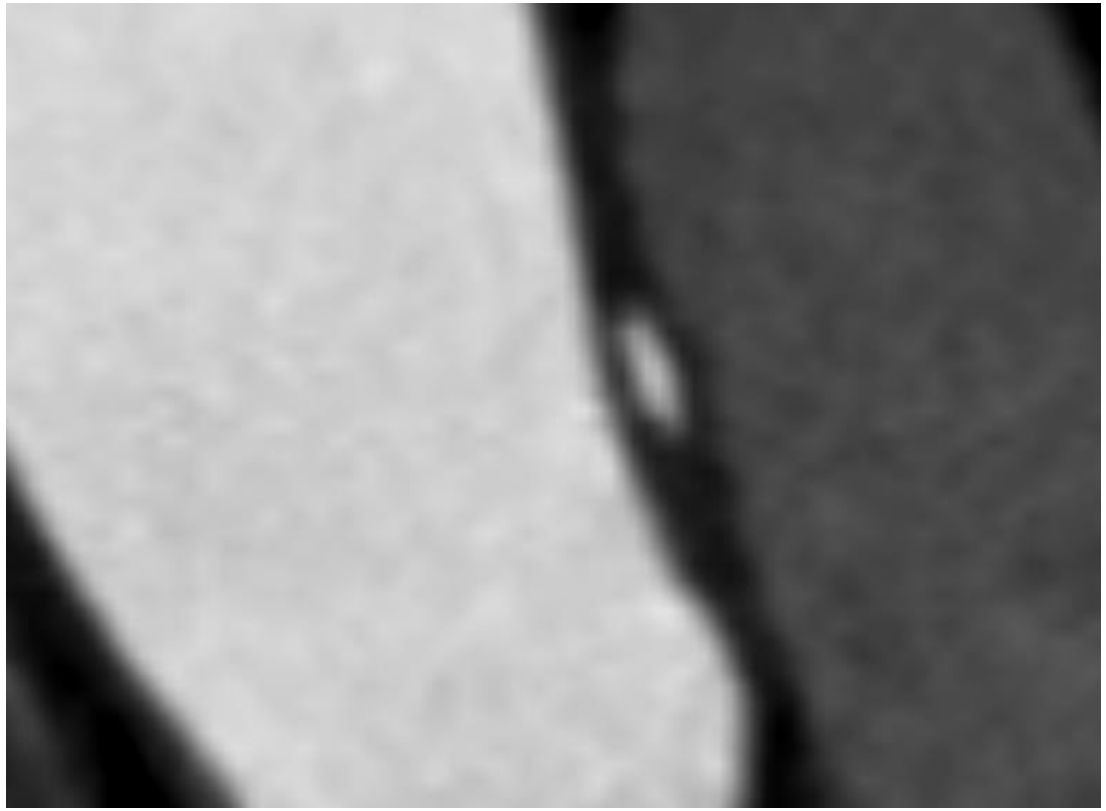


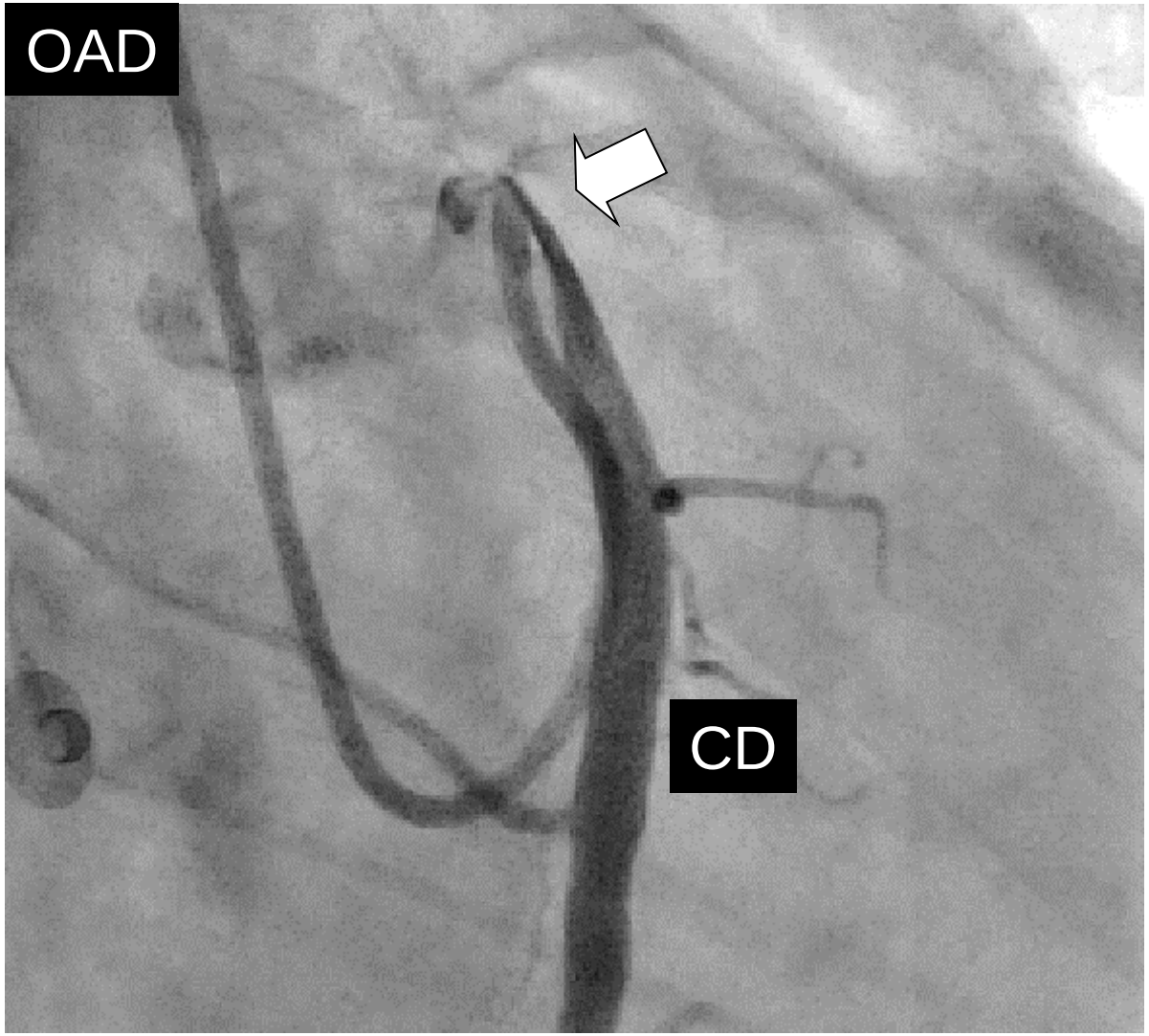




Right ANOCOR with an intramural course
Hata Y et al. Cardiovasc Pathol. 2014.

Coronaire droite avec passage intramural aortique





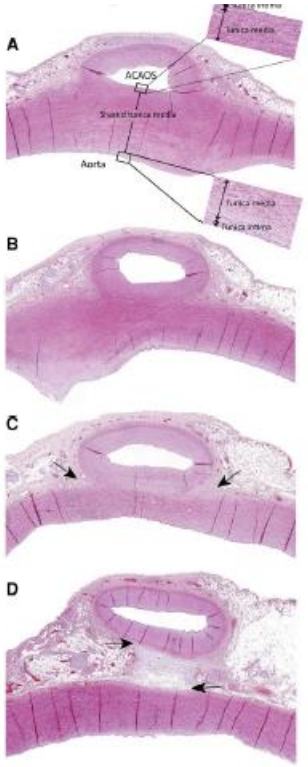
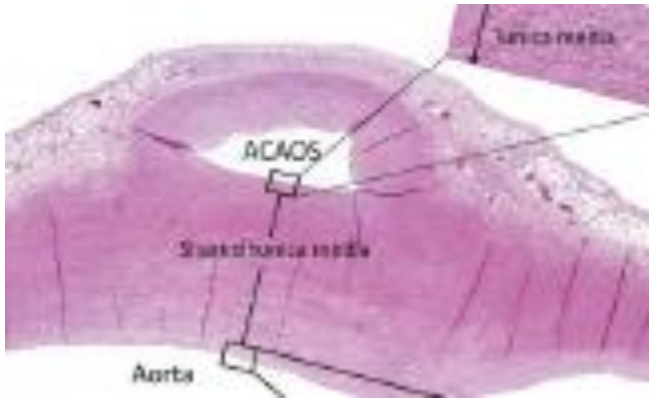
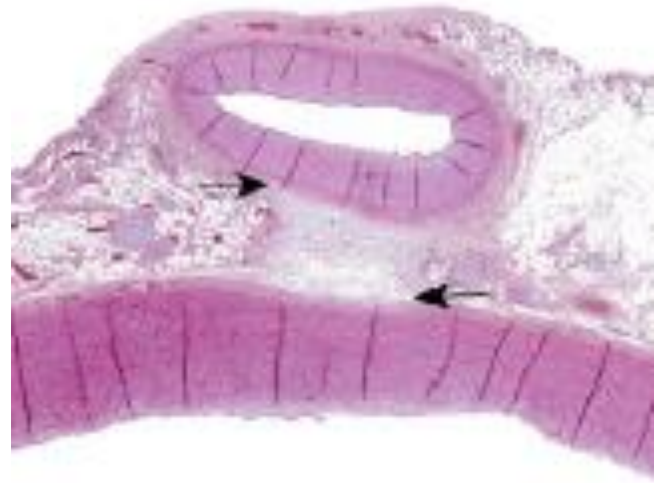


Figure 4 Haematoxylin and eosin staining of an intramural anomalous coronary artery. (A and B) The anomalous coronary artery originating from the opposite sinus of Valsalva and aorta share the tunica media. (C) The beginning of an interposing adventitia layer between the anomalous coronary artery originating from the opposite sinus of Valsalva and aorta (arrows). In (D), the anomalous coronary artery originating from the opposite sinus of Valsalva is entirely extramural (the arrows indicate the adventitial layers of both vessels). Consent was obtained for anonymous use of the tissues for research purposes. Courtesy of the Department of Pathology LUMC.

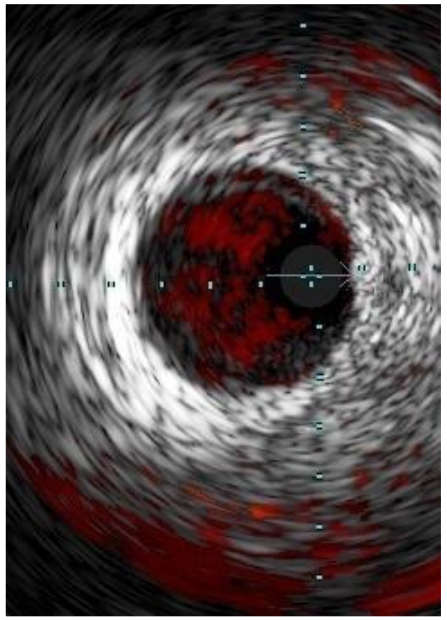




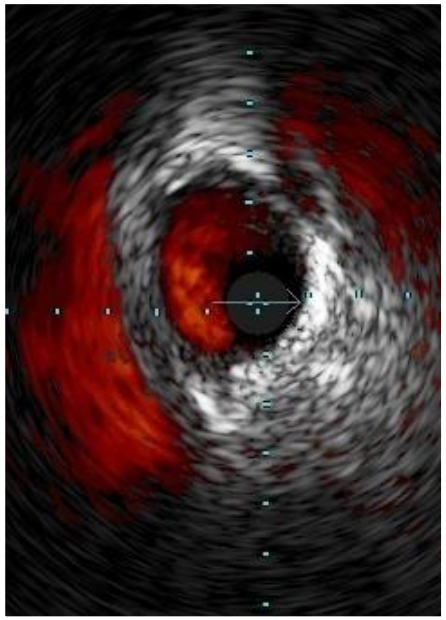
Koppel CJ. Eur Heart J Open. 2022.

Echographie endocoronaire

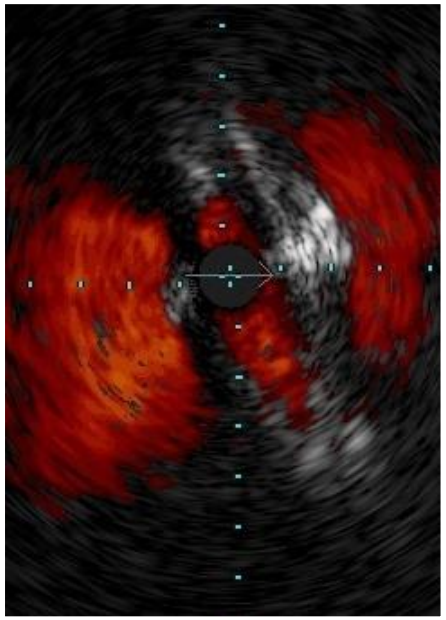
extramural



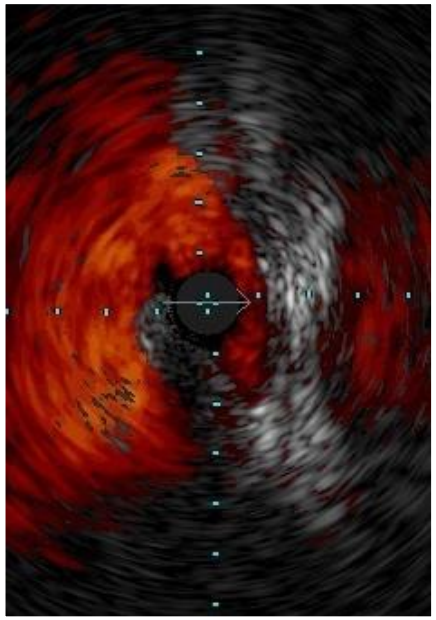
juxtamural



intramural

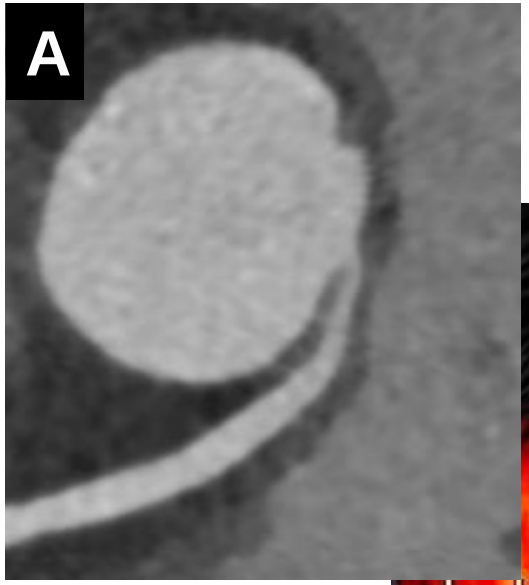


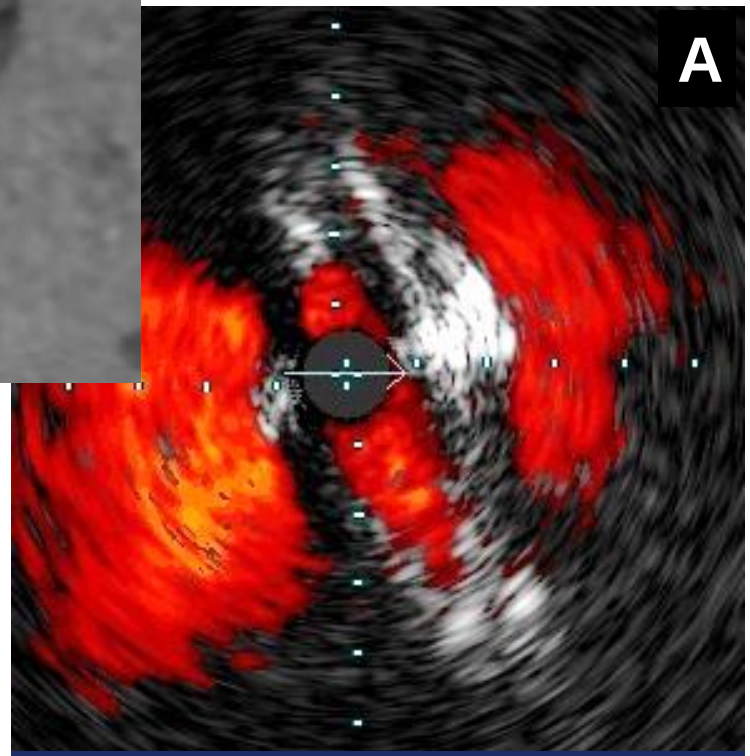
ostium



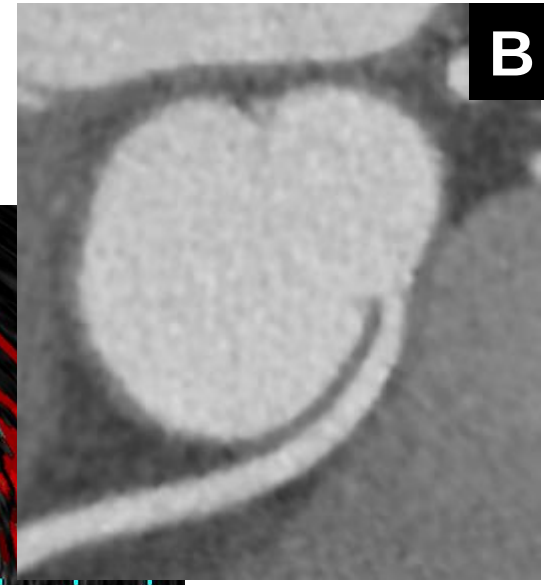
Echographie endocoronaire

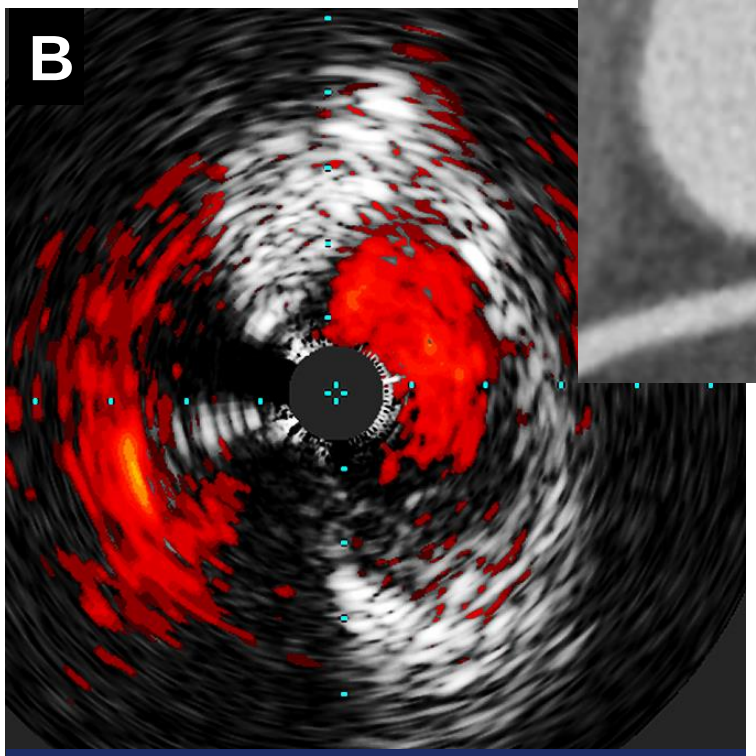
Echographie endocoronaire





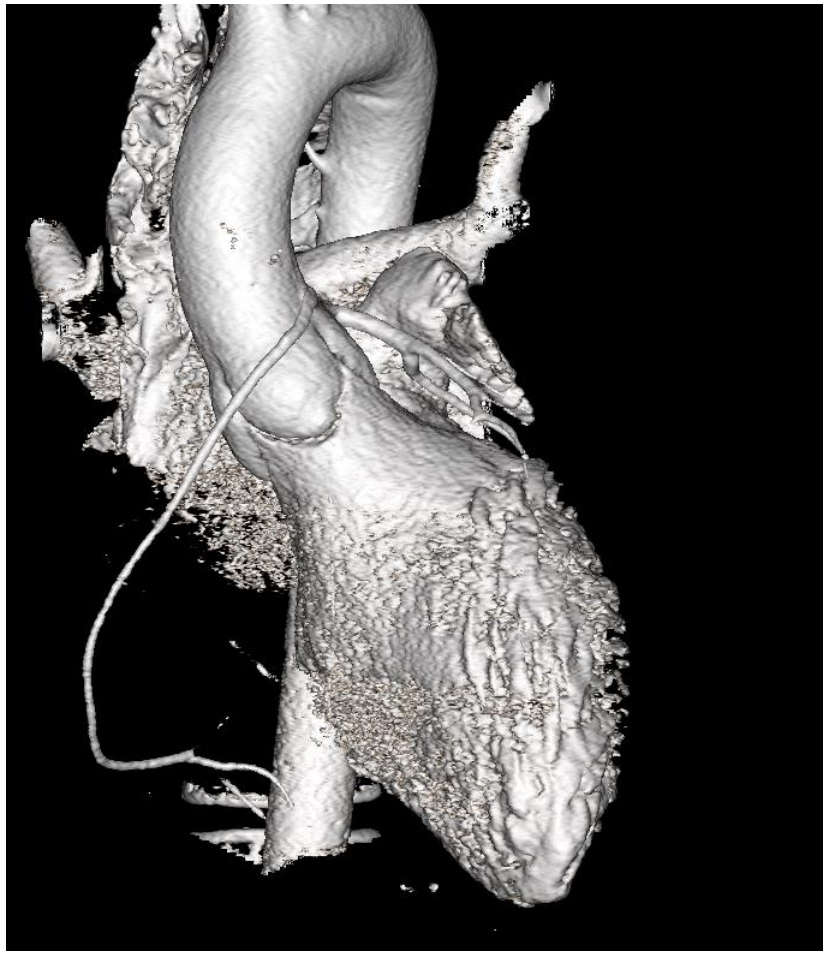
Passage intramural



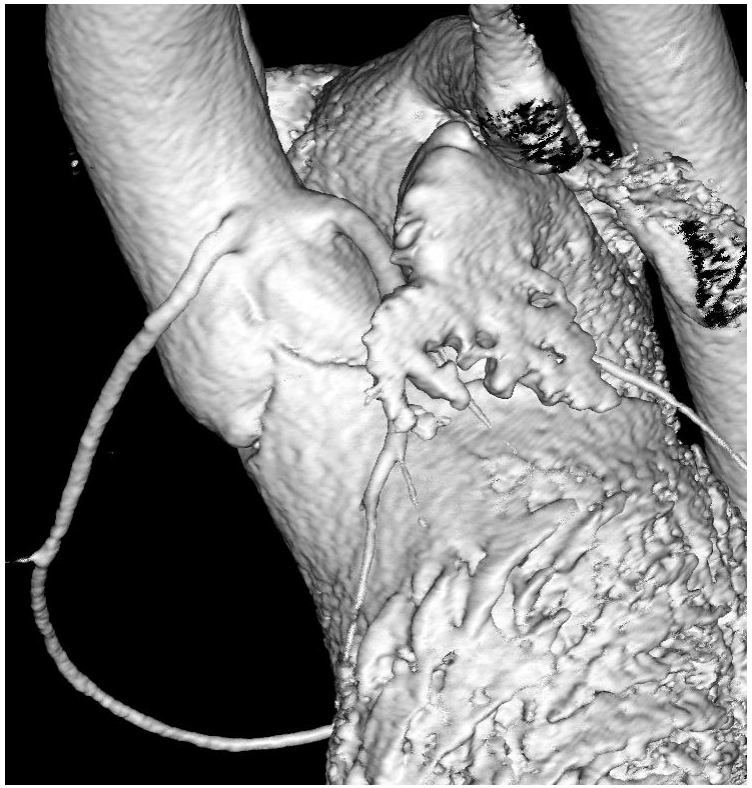


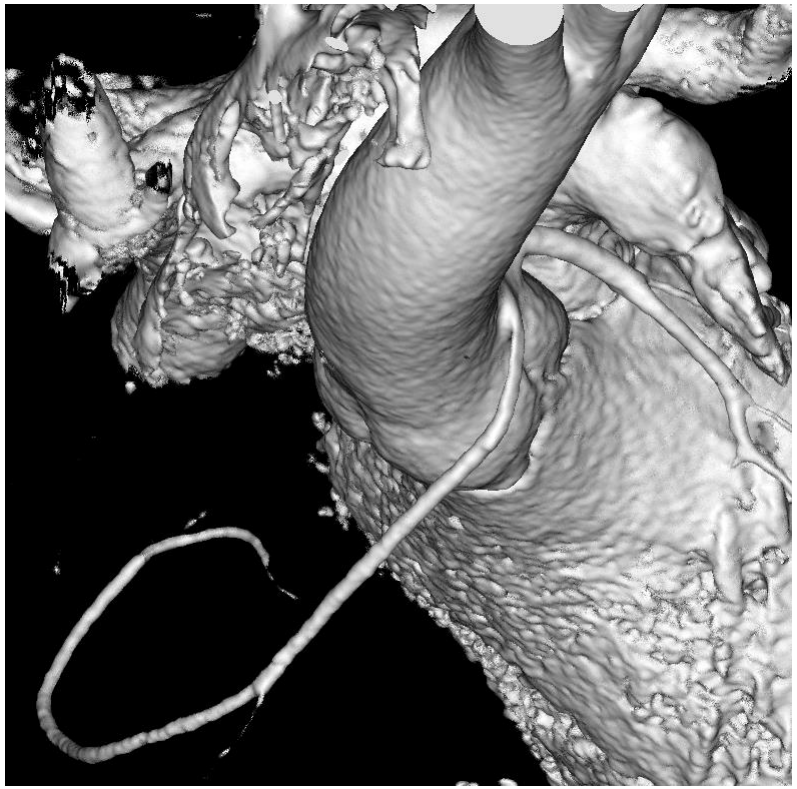
Passage juxtamural

Analyse tomographique (patient A)

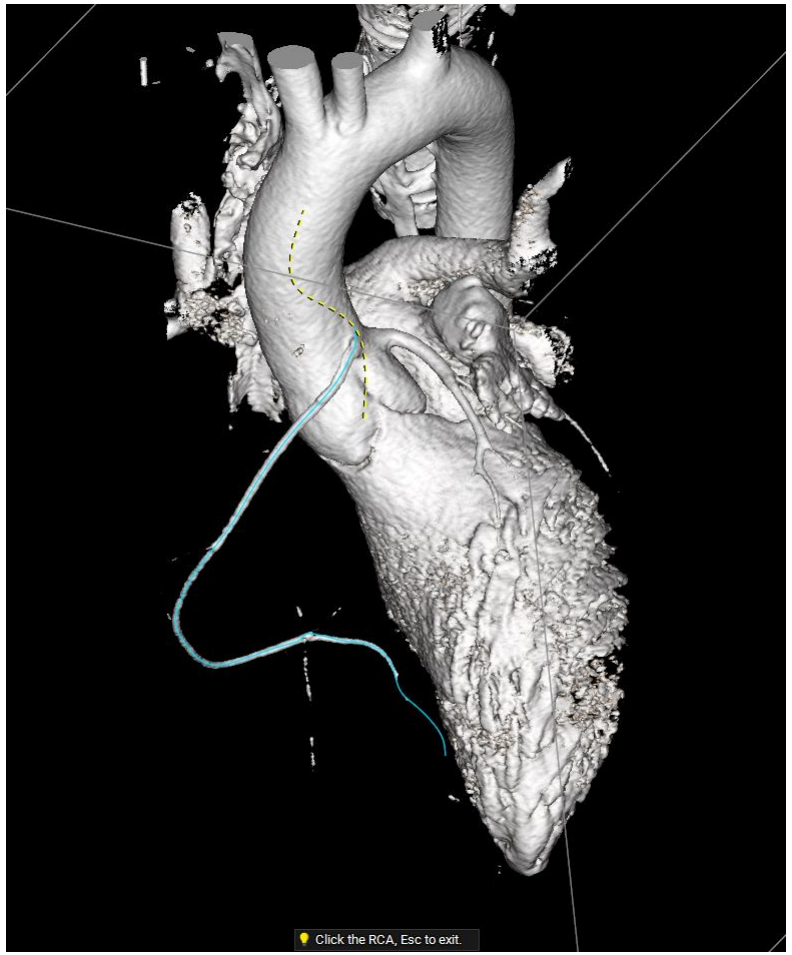


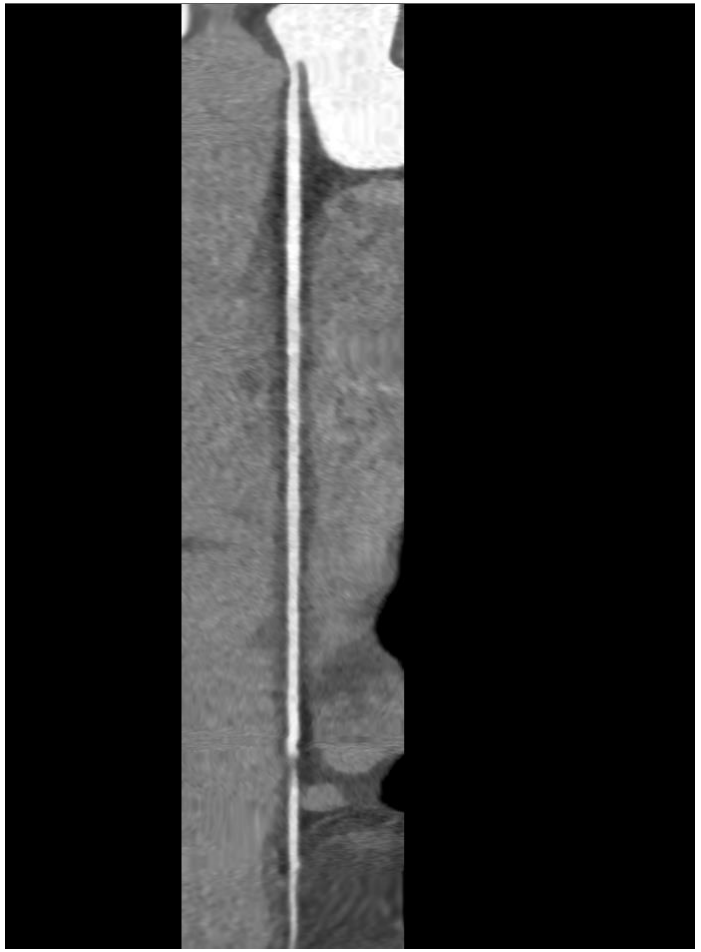
Analyse tomographique (patient A)



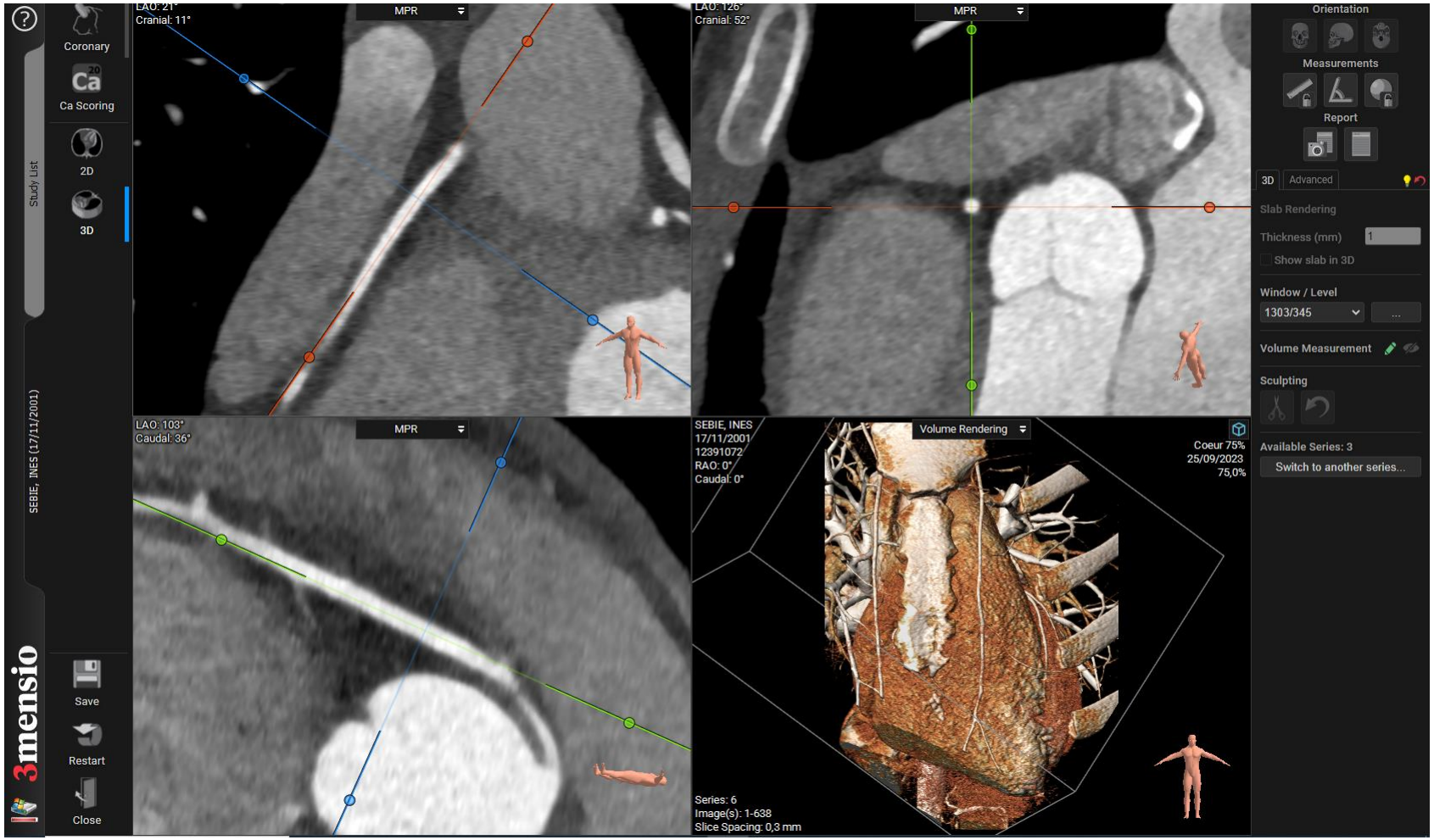


Analyse tomographique (patient A)



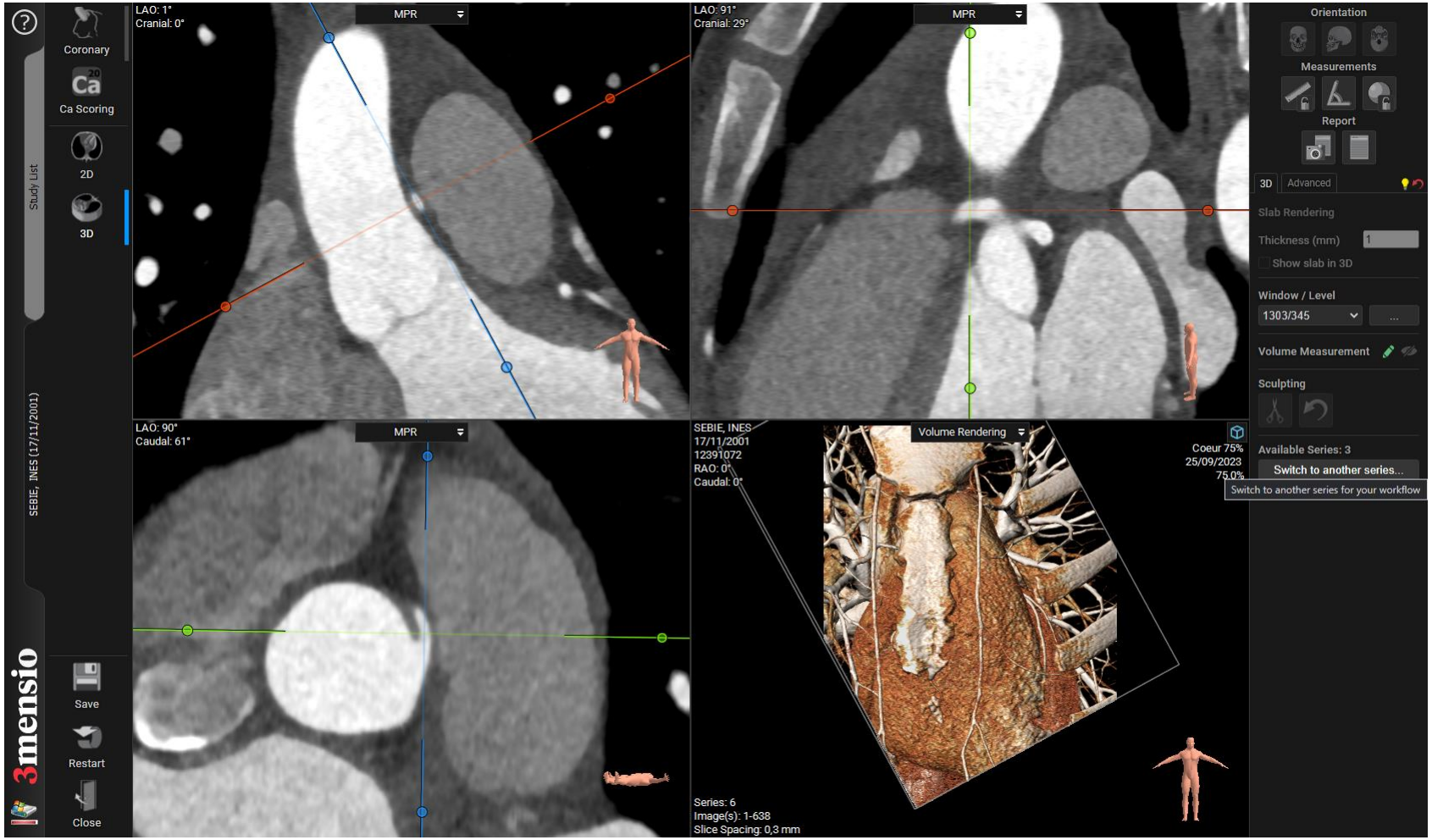


Analyse tomographique (patient A)



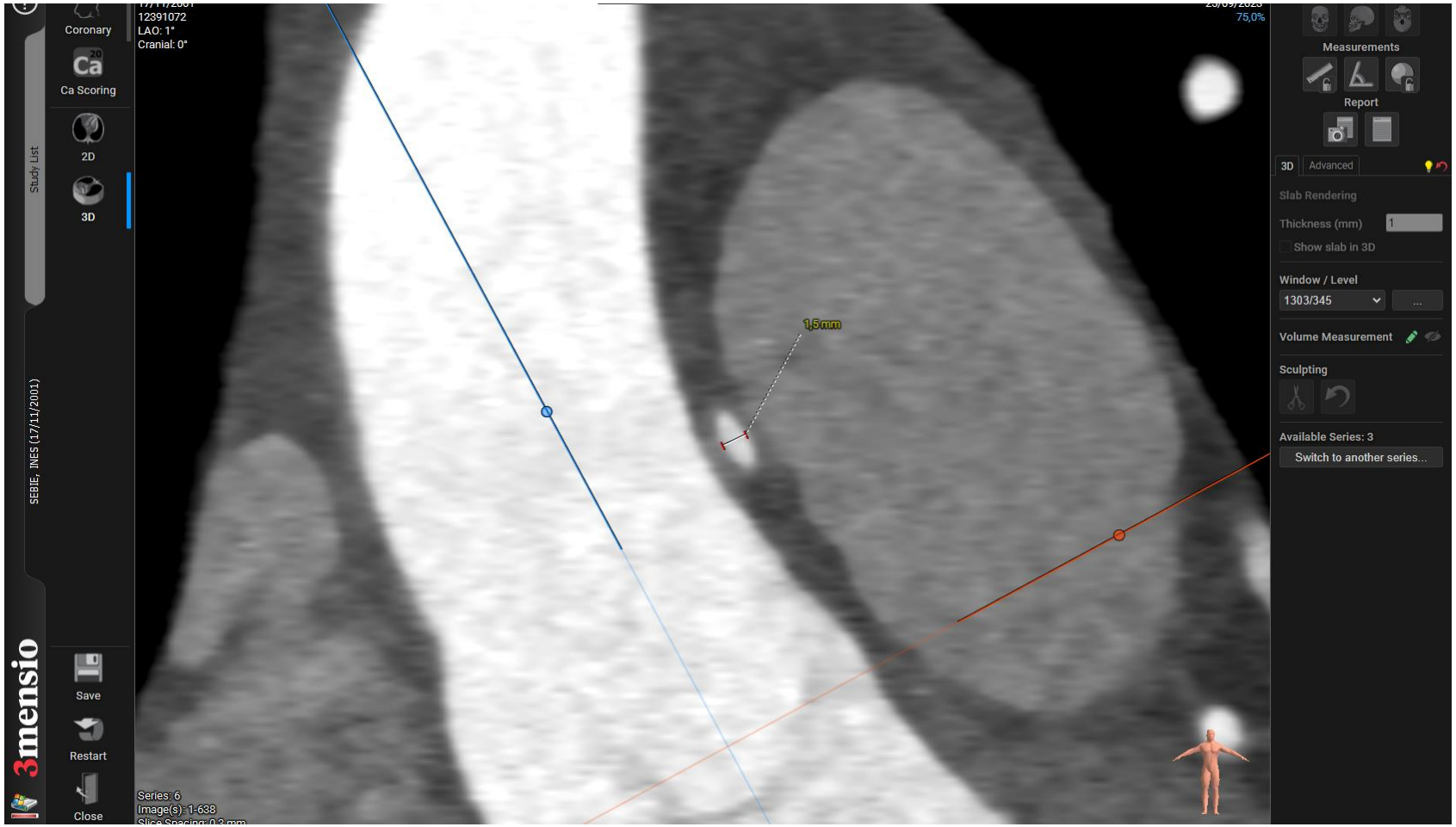
Analyse tomographique (patient A)

Analyse tomographique (patient A)



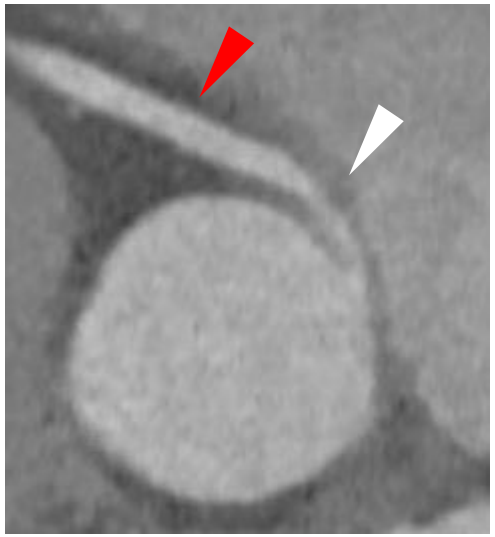
Analyse tomographique (patient A)

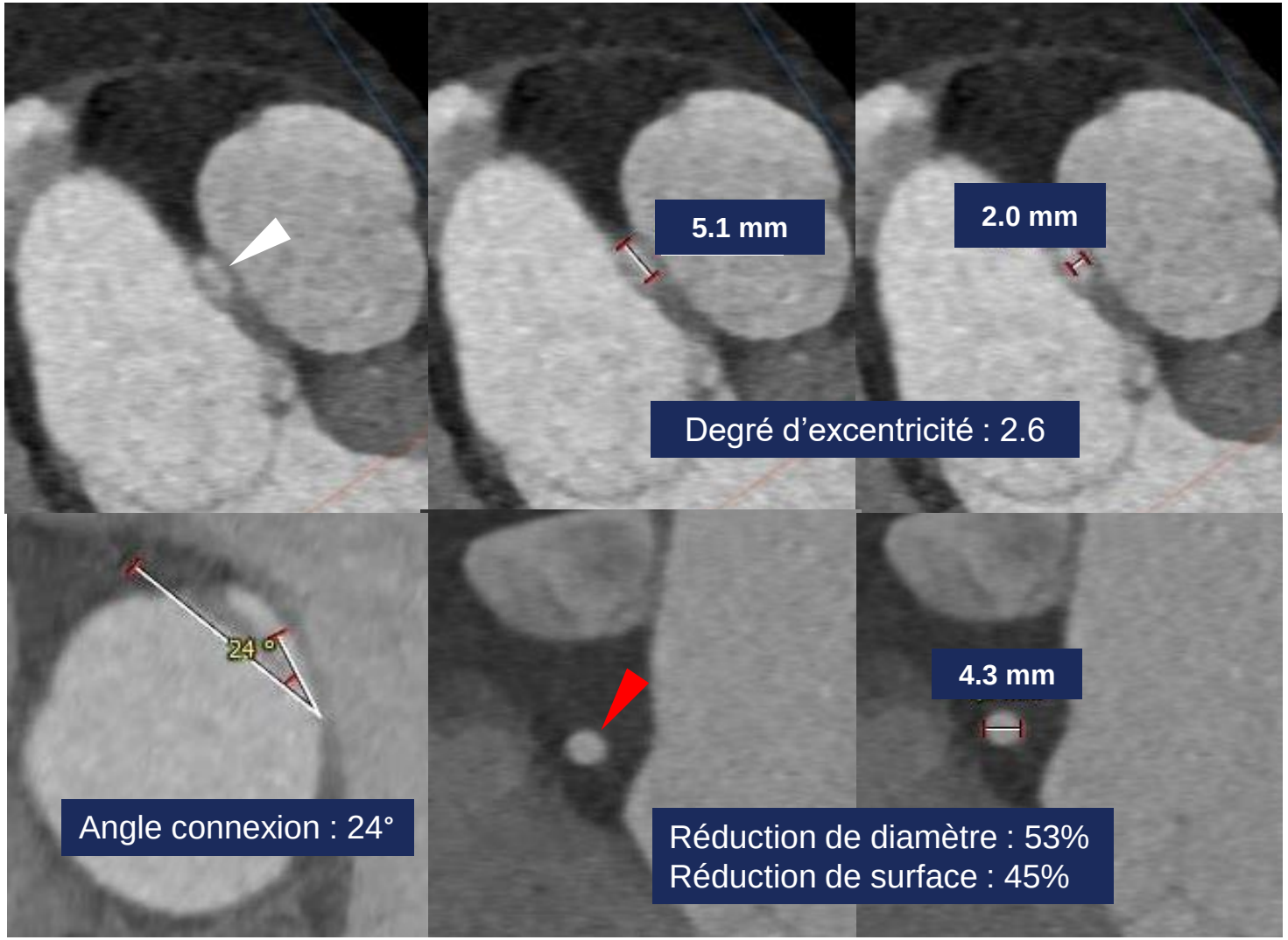
Analyse tomographique (patient A)



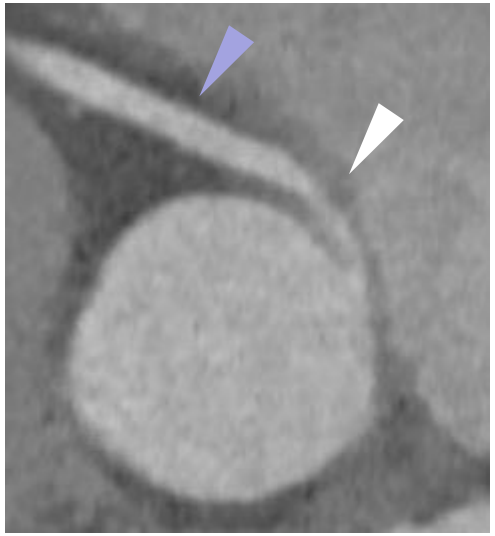
Analyse tomographique (patient A)

Analyse tomographique





Définition tomographique d'un passage intramural aortique

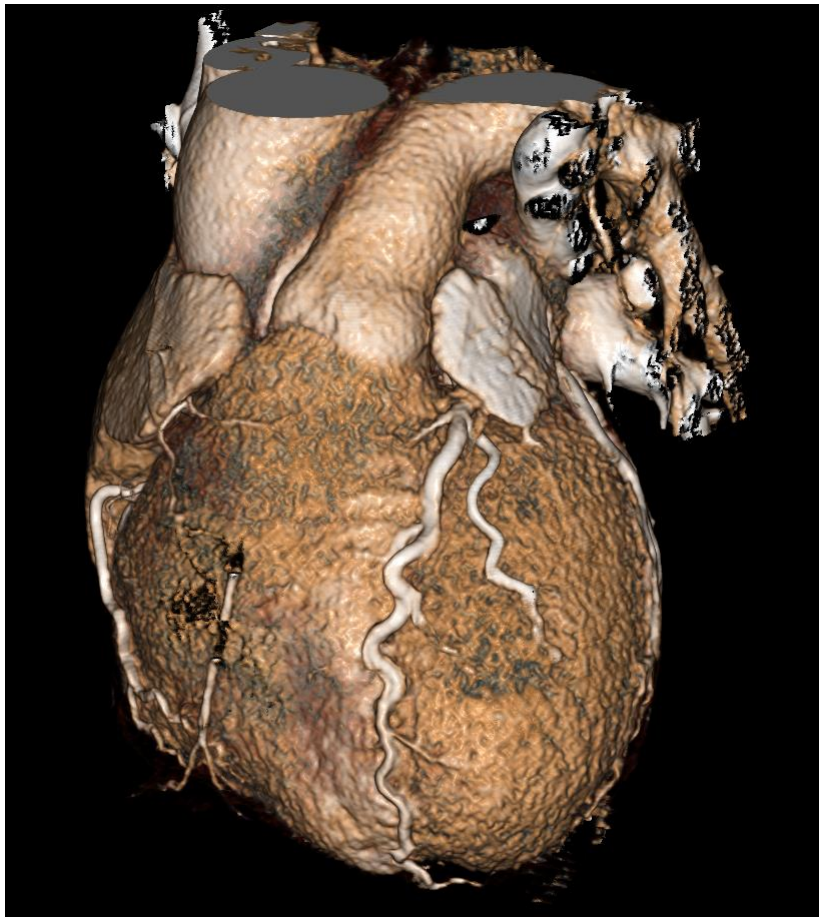


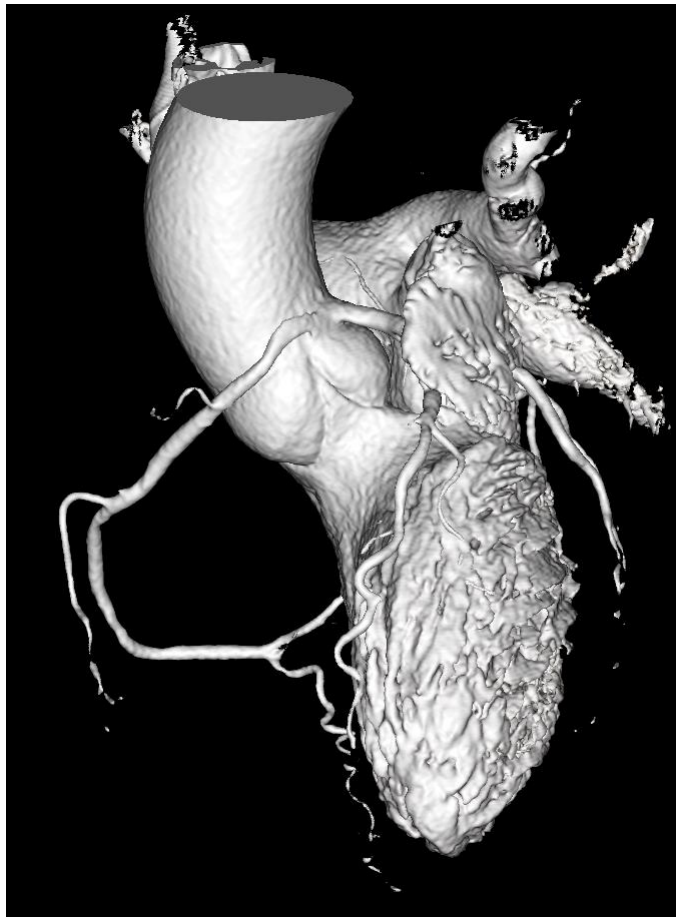
- Degré d'excentricité (grand axe/petit axe) ≥ 2.0
- Angle de connexion ≤ 30°
- Réduction de diamètre ≥ 50%

Trois critères présents* : passage intramural aortique certain
Deux critères présents* : passage intramural aortique incertain
Zéro ou un critère présent : passage intramural aortique absent

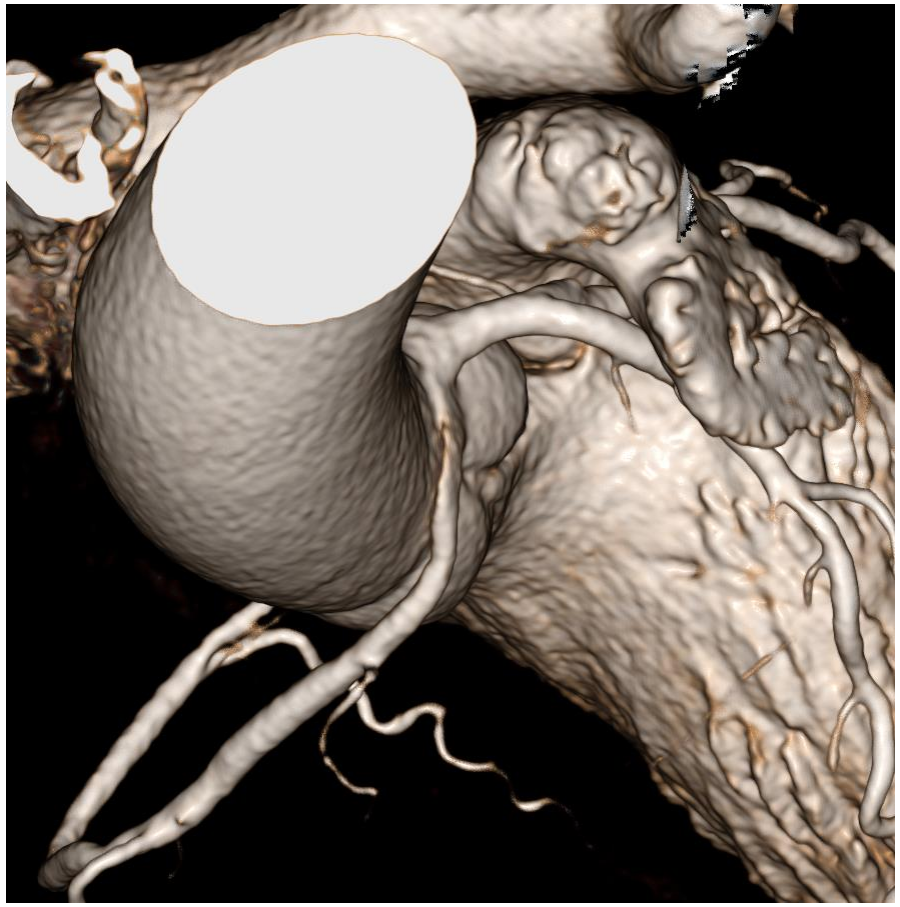
* Petit axe < 2.0 mm

Analyse tomographique (patient B)



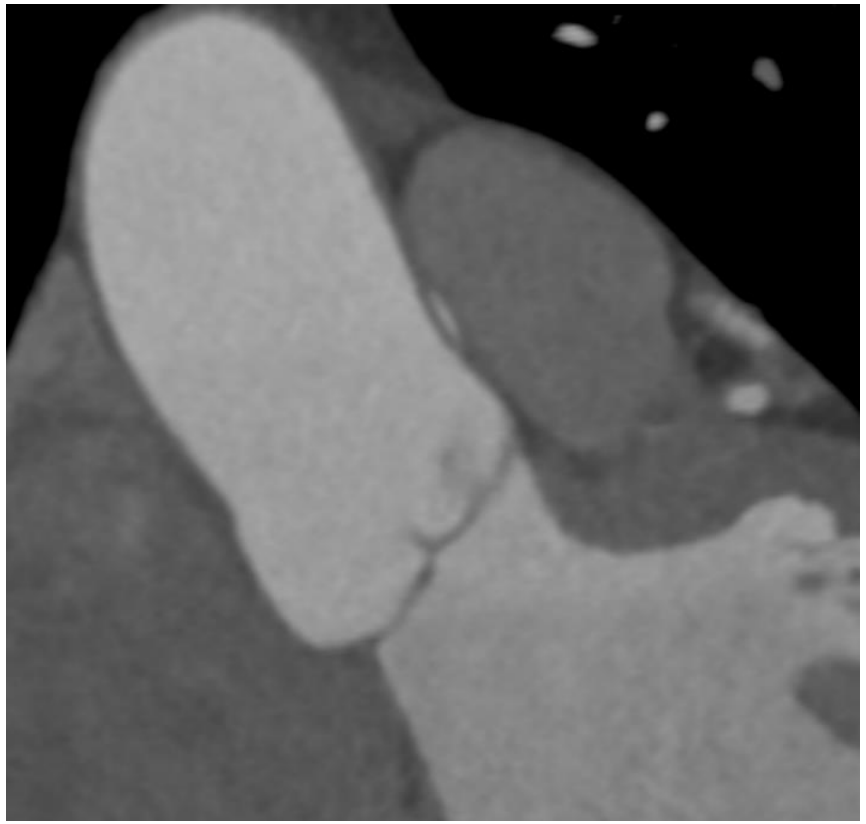


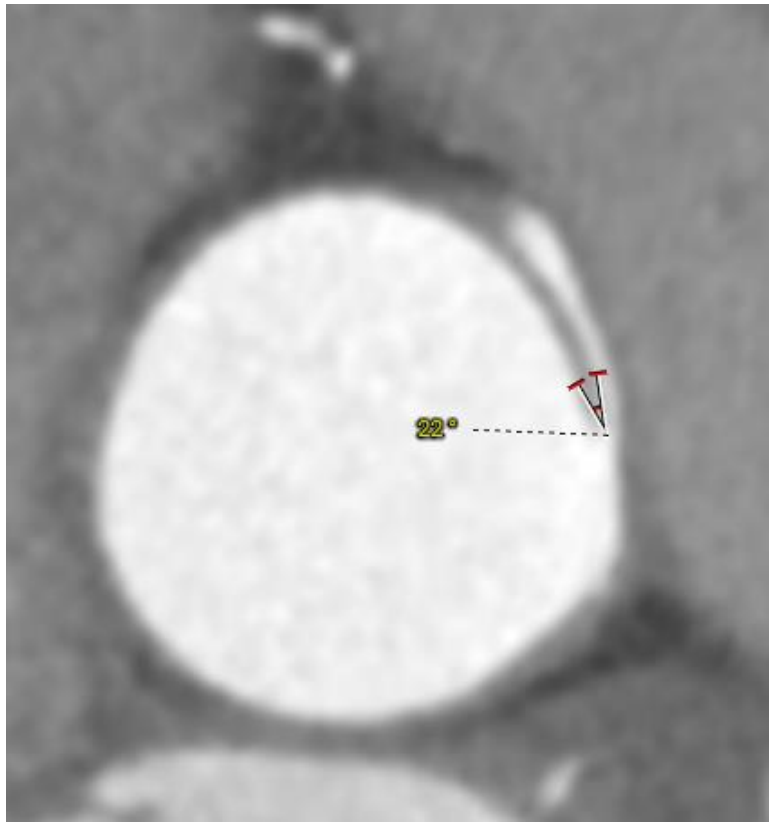
Analyse tomographique (patient B)



Analyse tomographique (patient B)

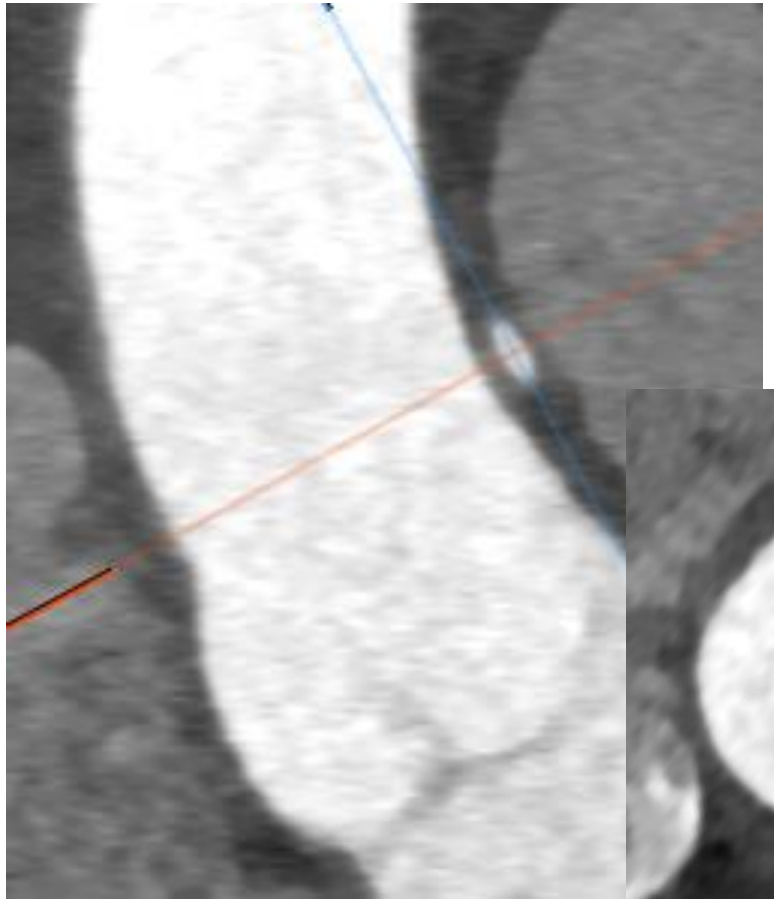
Analyse tomographique (patient B)

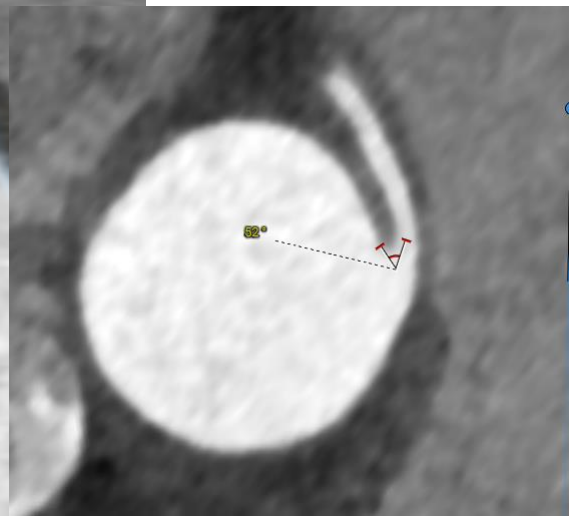


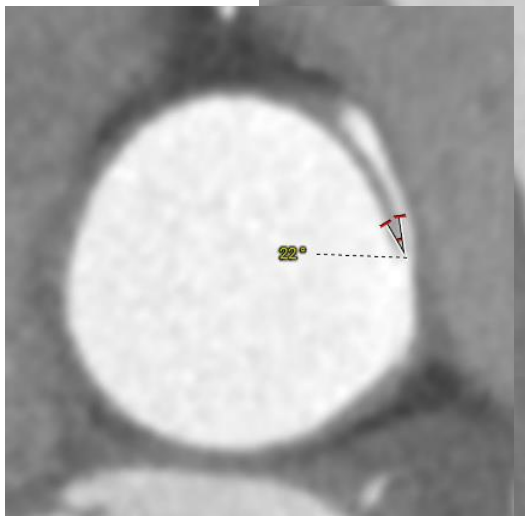


Analyse tomographique

Patient A

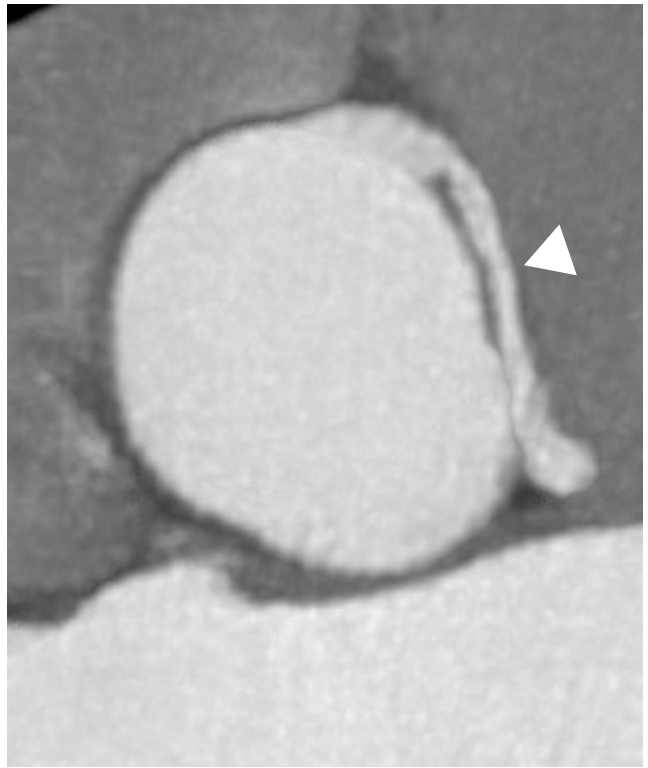


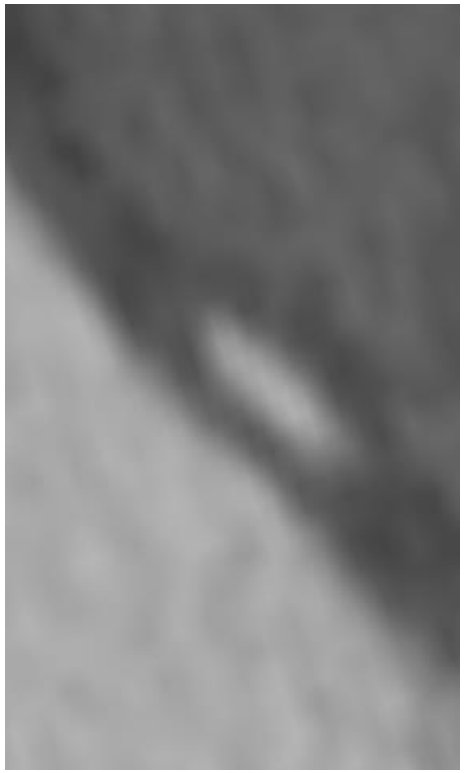




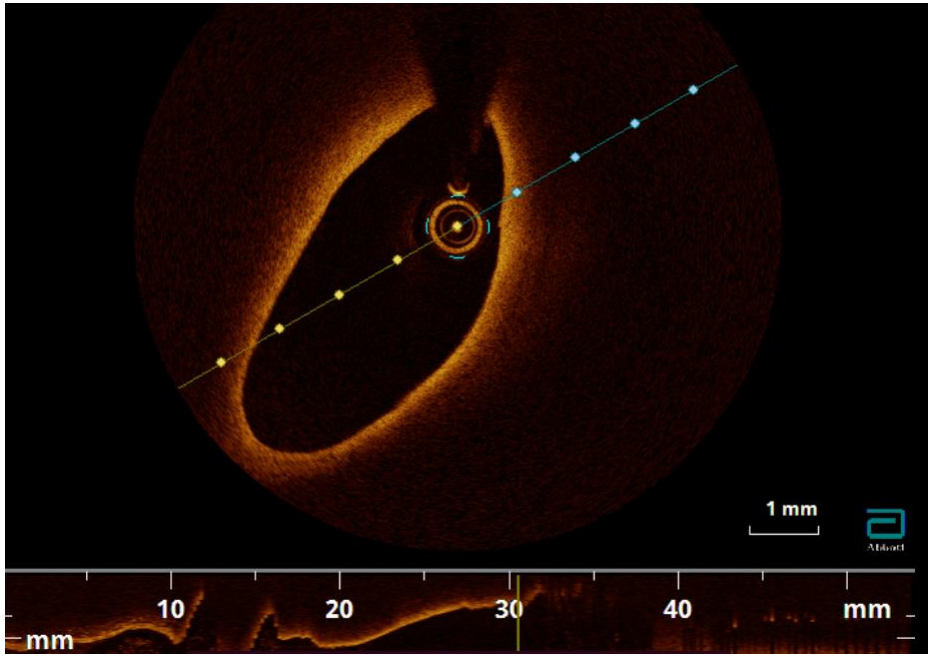
Patient B

ANOCOR gauche avec trajet interartériel





ANOCOR gauche avec trajet interartériel



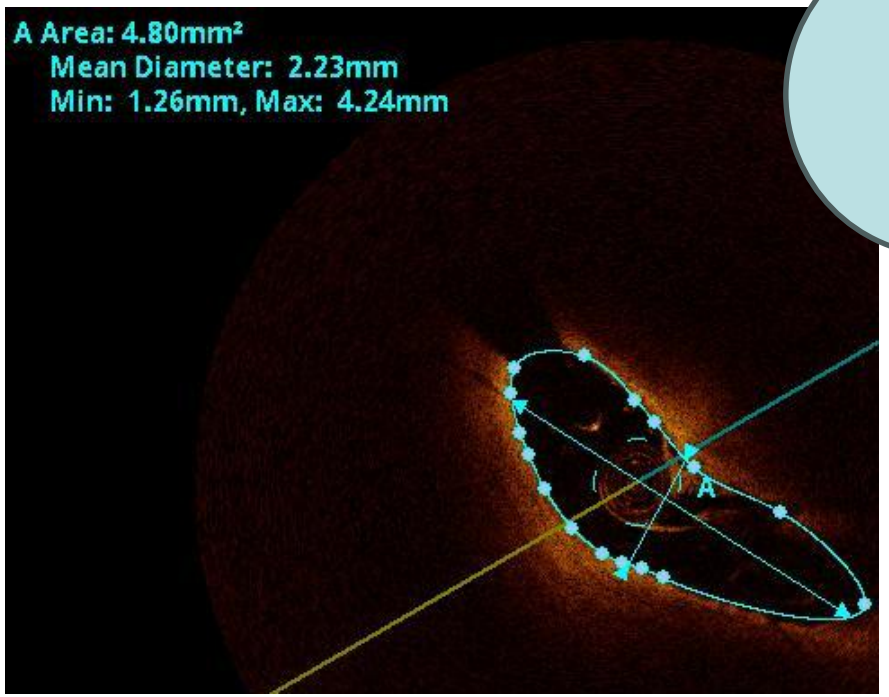
OCT

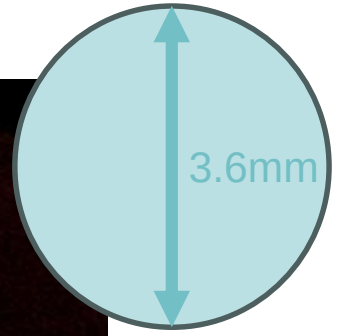
- Embryologie et anatomie
- Classification
- Prévalence
- Imagerie
- **Ischémie myocardique**
- Mort subite
- Screening
- Prise en charge
- Chirurgie
- Angioplastie
- Activités sportives

Ischémie myocardique

- Mort subite/arrêt cardiaque récupéré
- Symptômes d'allure ischémique (angor/syncope/dyspnée)
- Ischémie myocardique (avec imagerie)

ANOCOR droites ou gauches avec trajet interartériel
Ischémie myocardique peu fréquemment documentée

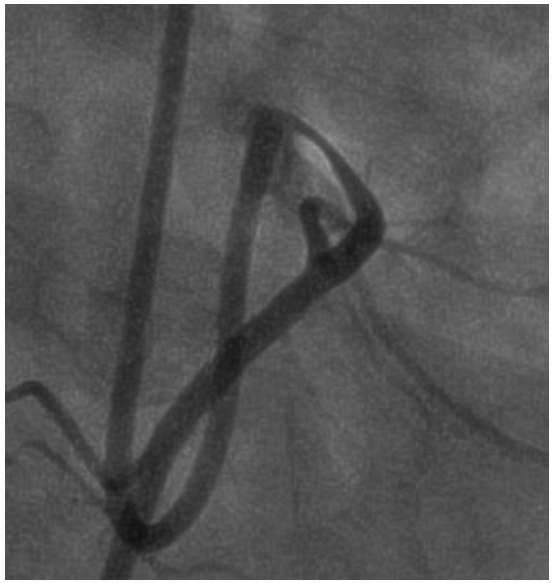


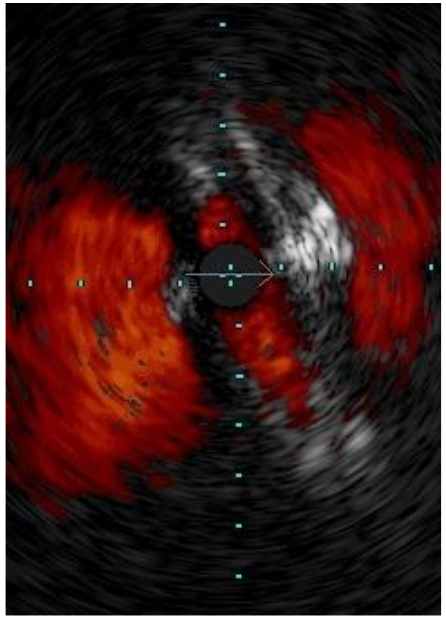


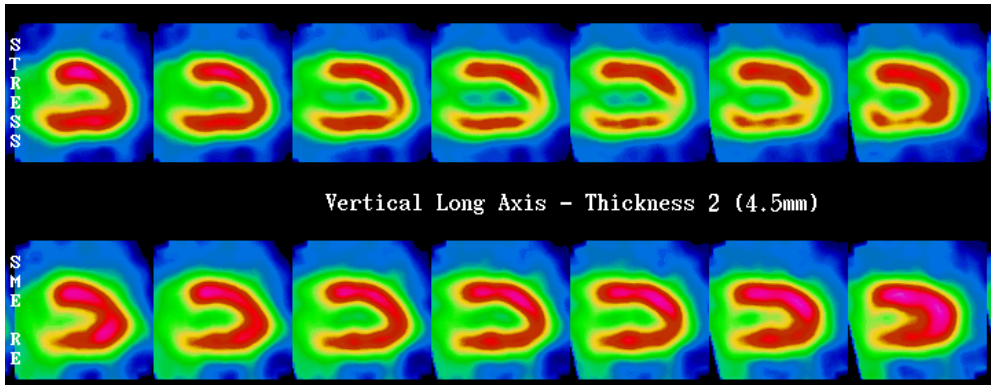
Diamètre luminal normal : 3.6 mm
Diamètre luminal minimal : 1.3 mm
Réduction de diamètre luminal : **64%**

Surface luminale normale : 10.2 mm^2
Surface luminale minimale : 4.8 mm^2
Réduction de surface luminale : **53%**

Ischémie myocardique documentée





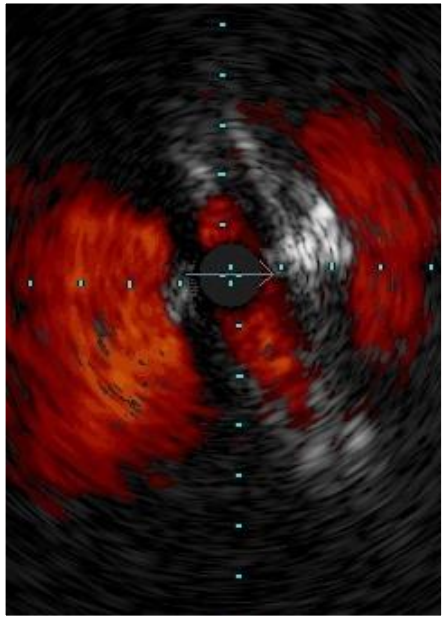


Prévalence ≈ 10%

Ischémie myocardique

Two-Tier Concept

Fixed Component



Bigler MR. et al. Front Cardiovasc Med. 2021.

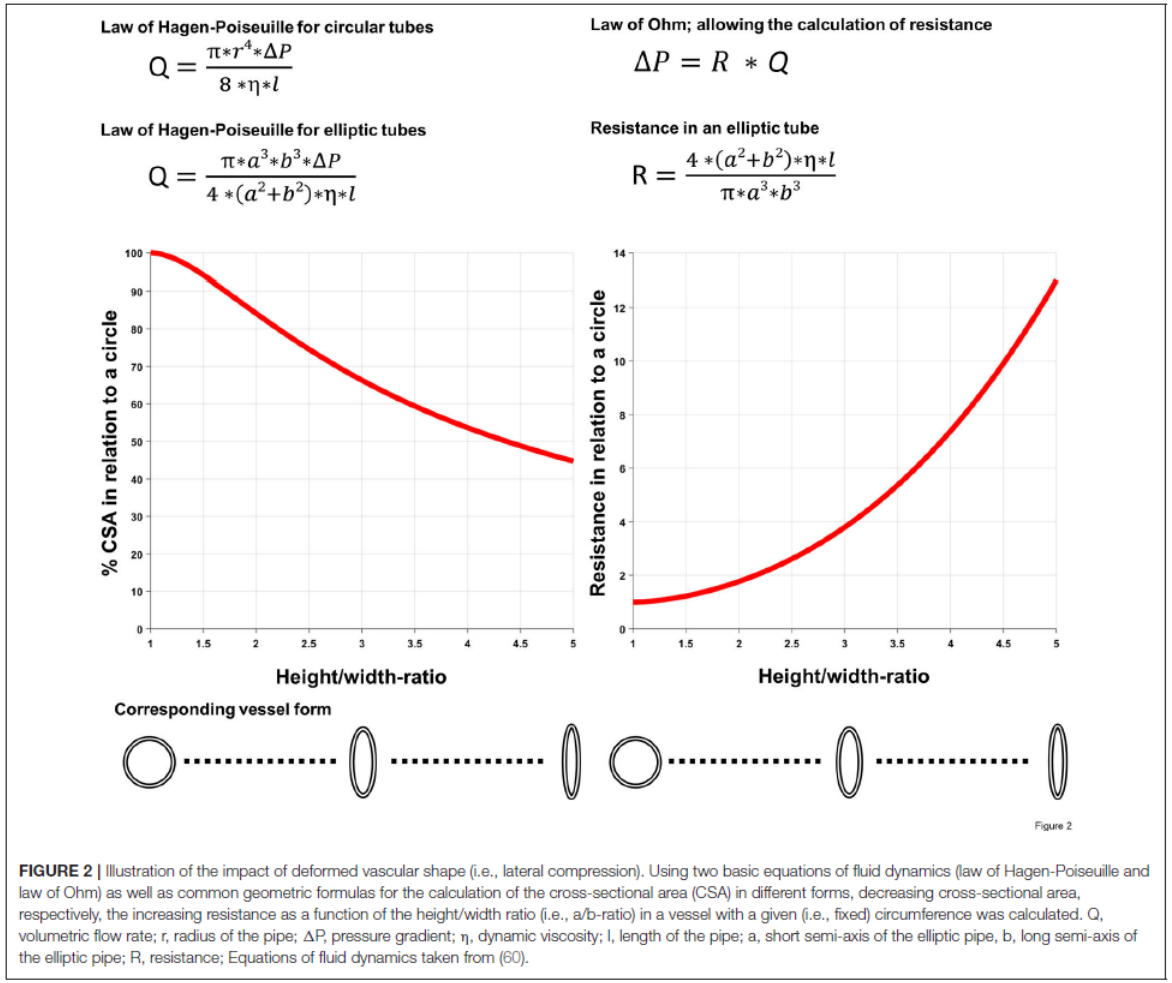
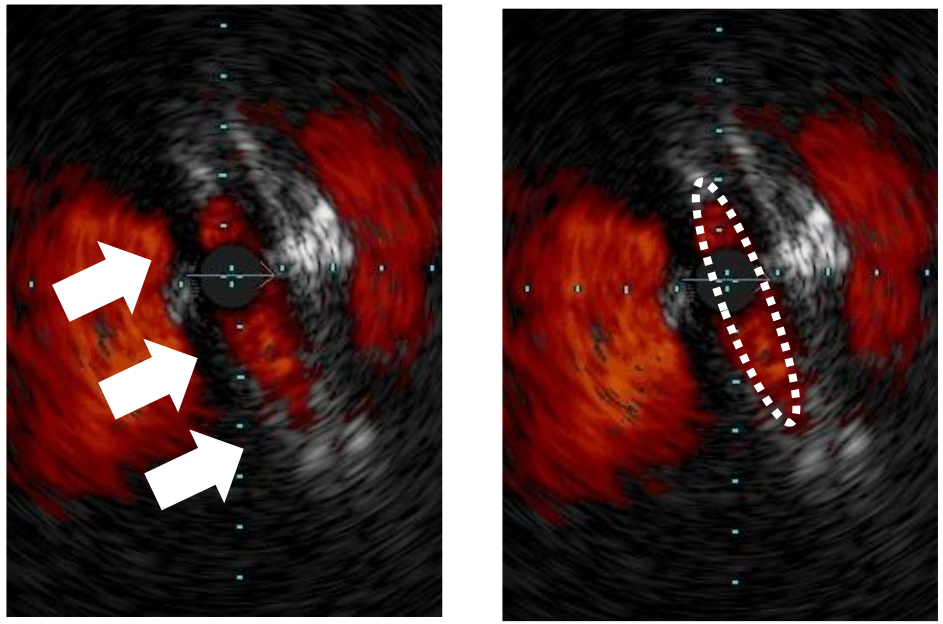


FIGURE 2 | Illustration of the impact of deformed vascular shape (i.e., lateral compression). Using two basic equations of fluid dynamics (law of Hagen-Poiseuille and law of Ohm) as well as common geometric formulas for the calculation of the cross-sectional area (CSA) in different forms, decreasing cross-sectional area, respectively, the increasing resistance as a function of the height/width ratio (i.e., a/b-ratio) in a vessel with a given (i.e., fixed) circumference was calculated. Q, volumetric flow rate; r, radius of the pipe; ΔP, pressure gradient; η, dynamic viscosity; l, length of the pipe; a, short semi-axis of the elliptic pipe, b, long semi-axis of the elliptic pipe; R, resistance; Equations of fluid dynamics taken from (60).

Ischémie myocardique

Two-Tier Concept
Dynamic Component



Bigler MR. et al. Front Cardiovasc Med. 2021.

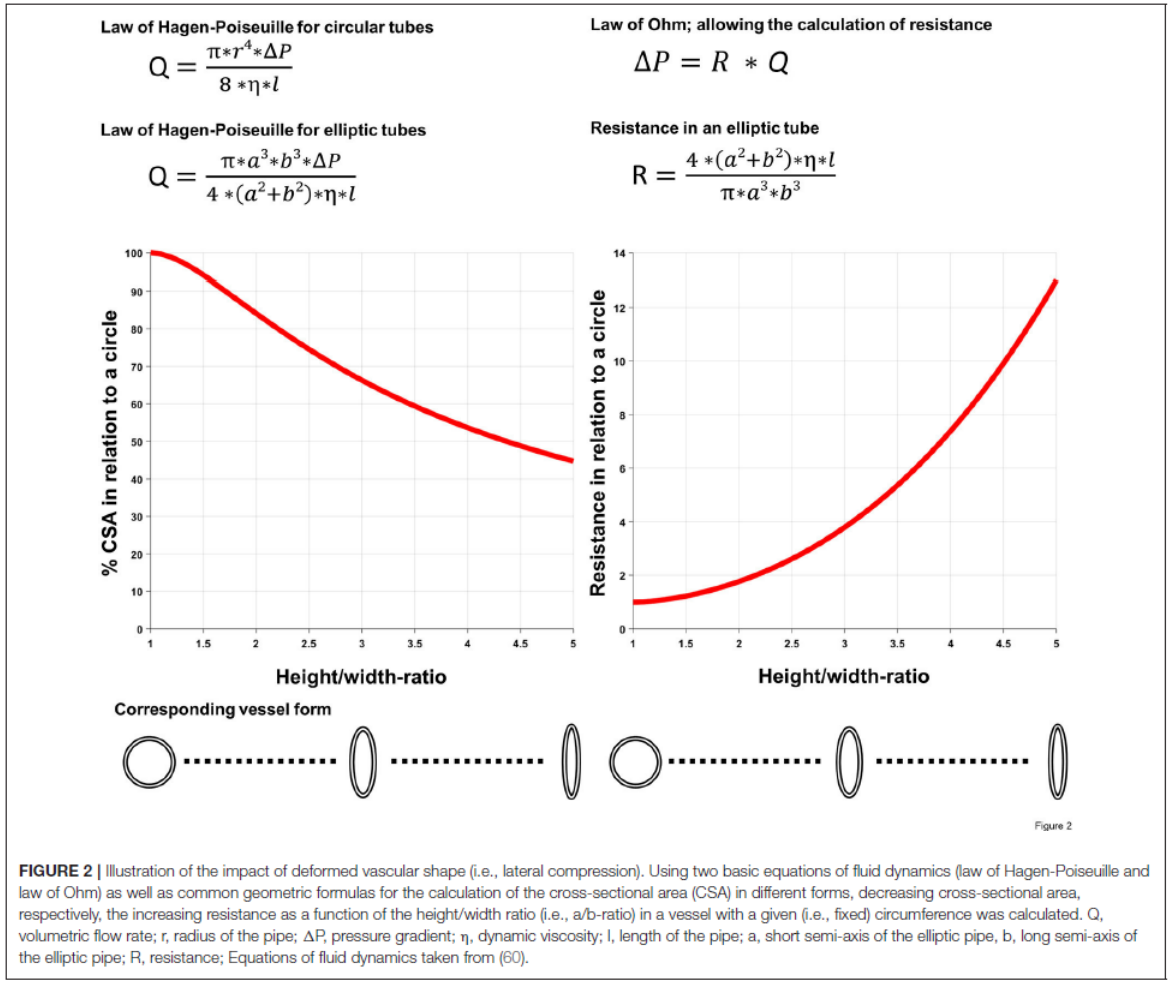


FIGURE 2 | Illustration of the impact of deformed vascular shape (i.e., lateral compression). Using two basic equations of fluid dynamics (law of Hagen-Poiseuille and law of Ohm) as well as common geometric formulas for the calculation of the cross-sectional area (CSA) in different forms, decreasing cross-sectional area, respectively, the increasing resistance as a function of the height/width ratio (i.e., a/b-ratio) in a vessel with a given (i.e., fixed) circumference was calculated. Q, volumetric flow rate; r, radius of the pipe; ΔP, pressure gradient; η, dynamic viscosity; l, length of the pipe; a, short semi-axis of the elliptic pipe, b, long semi-axis of the elliptic pipe; R, resistance; Equations of fluid dynamics taken from (60).

Recherche d'ischémie myocardique

TABLE 3 | Overview of possible stress protocols in assessing patients with ACAOS.

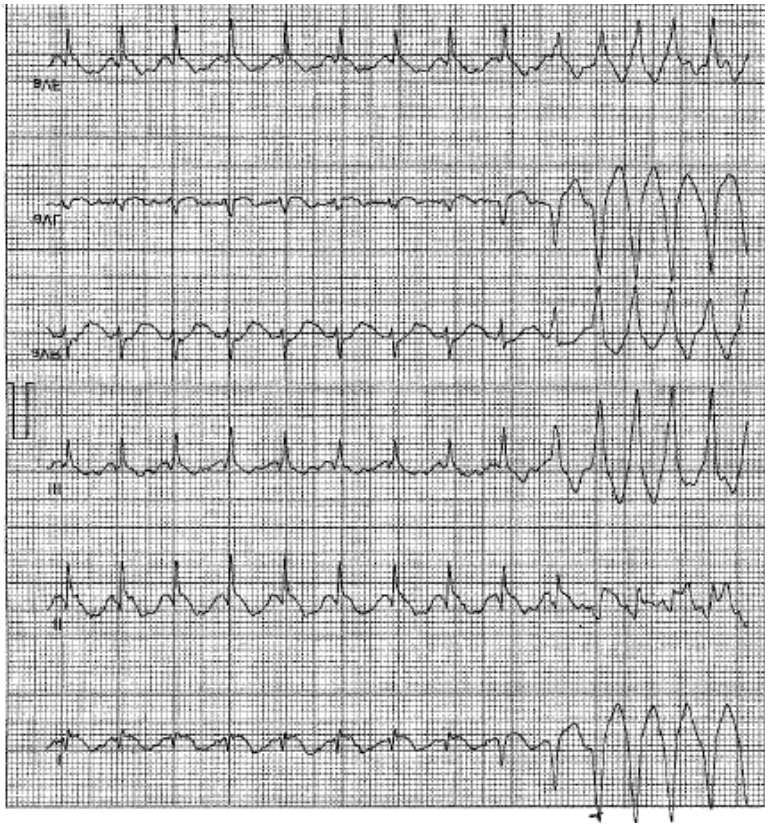
	Physical exercise		Adenosine	Regadenoson	Norepinephrine	Dobutamine	Dobutamine + volume challenge
Protocol/dose	85% of max. HR	100% of max. HR	140 µg/kg/min	Bolus: 400 µg	0.01 µg/kg/min	40 µg/kg/min	40 µg/kg/min + saline: 1.5–3 l+ atropine: 1 mg
Applied in	Non-invasive testing	Non-invasive testing	Non-invasive / invasive testing	Non-invasive testing	Invasive testing	Non-invasive / invasive testing	Invasive testing
Increase in coronary blood flow to detect relevant fixed stenosis	+++	+++++	+++	+++	++	++++	++++
Increased heart minute volume to provoke dynamic lateral compression	++	+++++	-	-	+++	++	++++
Reproducibility of symptoms	+++	+++++	-	-	++	++	+++
Tolerability	++++	++++	++	+++	++	++	++

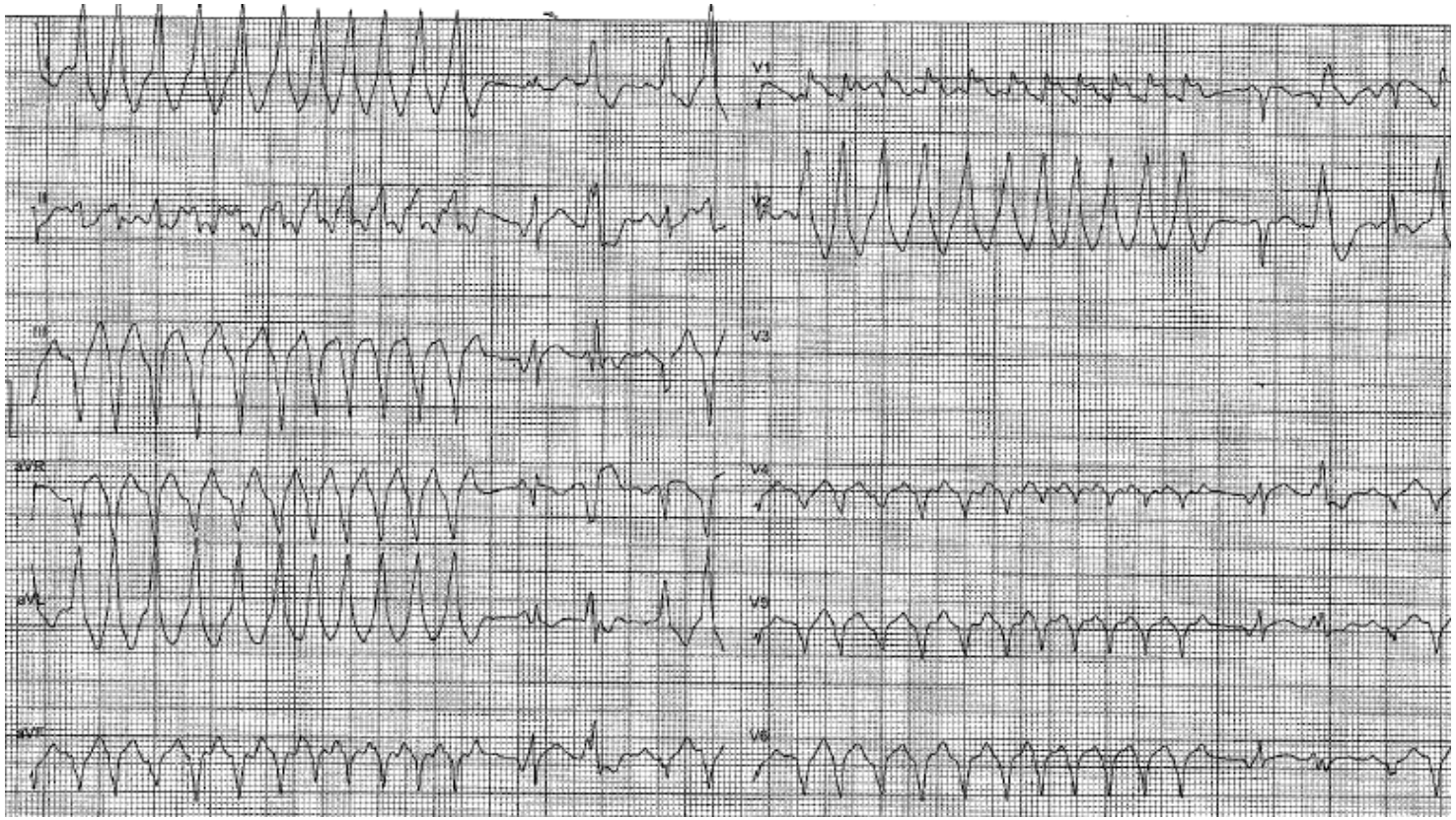
HR, heart rate.

Bigler MR. et al. Front Cardiovasc Med. 2021.

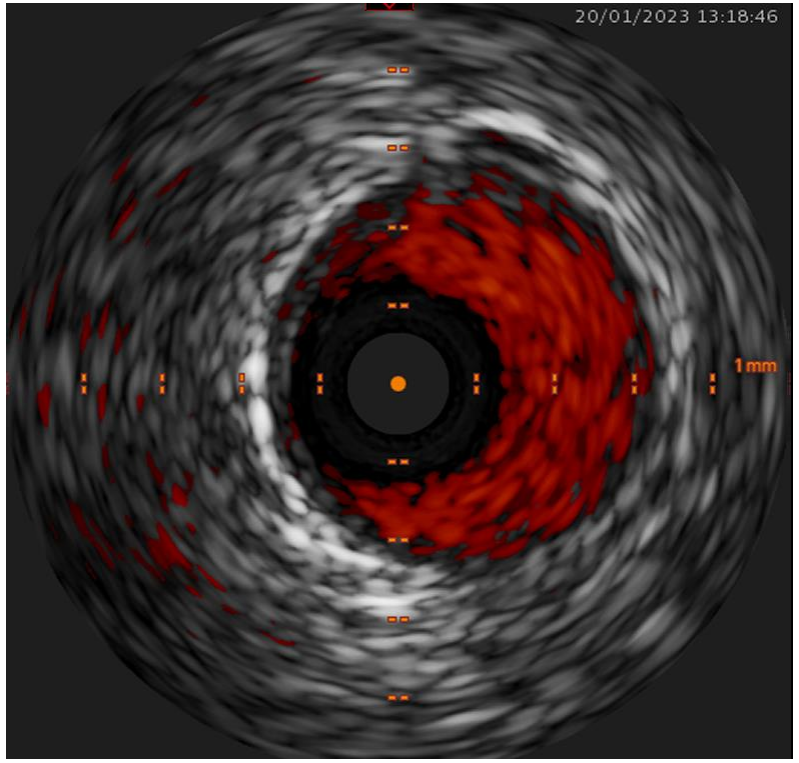
ANOCOR droite

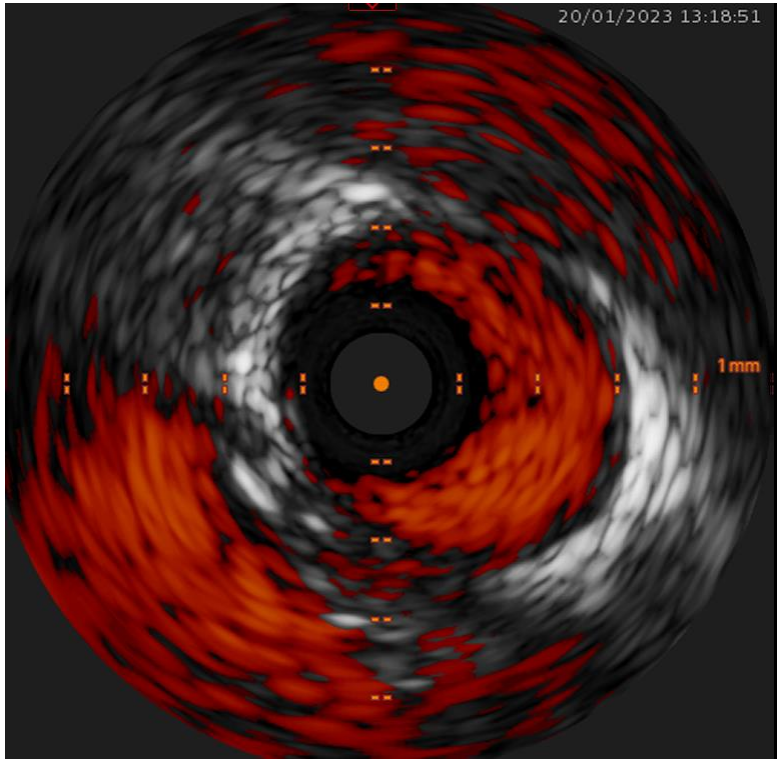
Epreuve sous dobutamine (40 gamma/kg/min)

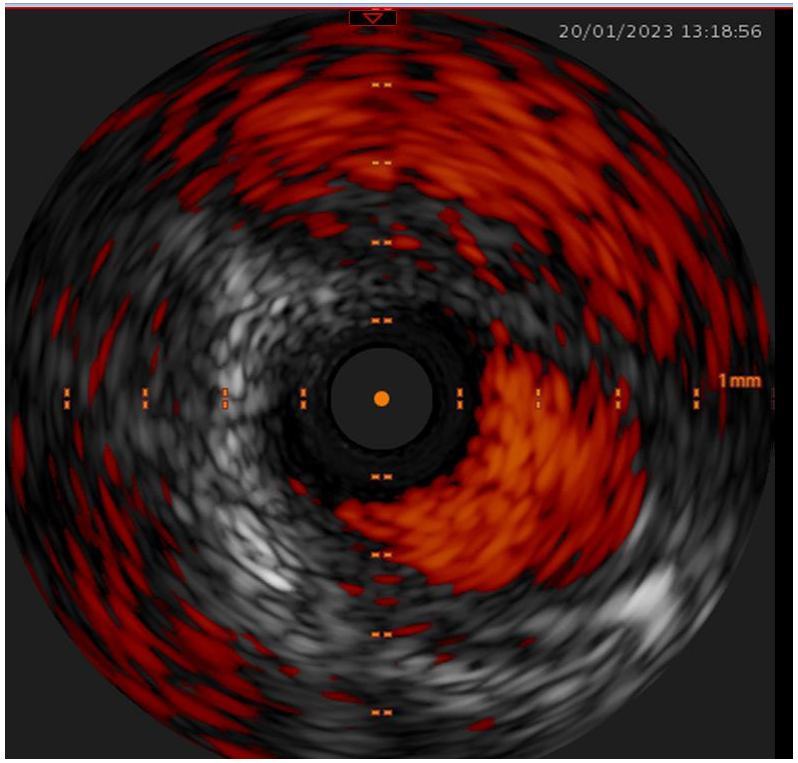




ANOCOR droite








FFR 1:
20/01/2023
13:27:58
mmHg
200
150
100
50
0
Pa
111
Pd
107
Pd/Pa
0,96
X
0 s
1 s
2 s
3 s
4 s
5 s
6 s
7 s
F
FFR
0,96
Pa
111
Pd
107
R. à zéro Pa
Normaliser
Pd/Pa
0,96
13:27:57 FFR 0,96
13:27:43 iFR Spot 0,96


FFR 5: dobu 50
20/01/2023
13:44:59
mmHg
200
150
100
50
0
Pa
107
Pd
96
Pd/Pa
0,90
X
0 s
2 s
4 s
6 s
8 s
10 s
12 s
F
FFR
0,90
Pa
107
Pd
96
R. à zéro Pa
Normaliser
Pd/Pa
0,90
13:44:57 FFR 0,90
13:44:05 FFR 0,90
13:42:32 FFR 0,90


iFR Spot 1:
20/01/2023
13:27:43
mmHg
200
150
100
50
0
1 s
2 s
3 s
4 s
iFR
SPOT
0,96
Pa
Pd
R. à zéro Pa
Normaliser
Pd/Pa
13:27:43
iFR Spot
0,96


iFR Spot 3: doobu 50
20/01/2023
13:45:33
mmHg
200
150
100
50
0
1 s
2 s
3 s
iFR SPOT
0,86
Pa
Pd
R. à zéro Pa
Normaliser
Pd/Pa
13:45:33 iFR Spot 0,86
13:44:57 FFR 0,90
13:44:05 FFR 0,90
13:42:32 FFR 0,90
13:41:01 iFR Spot 0,90

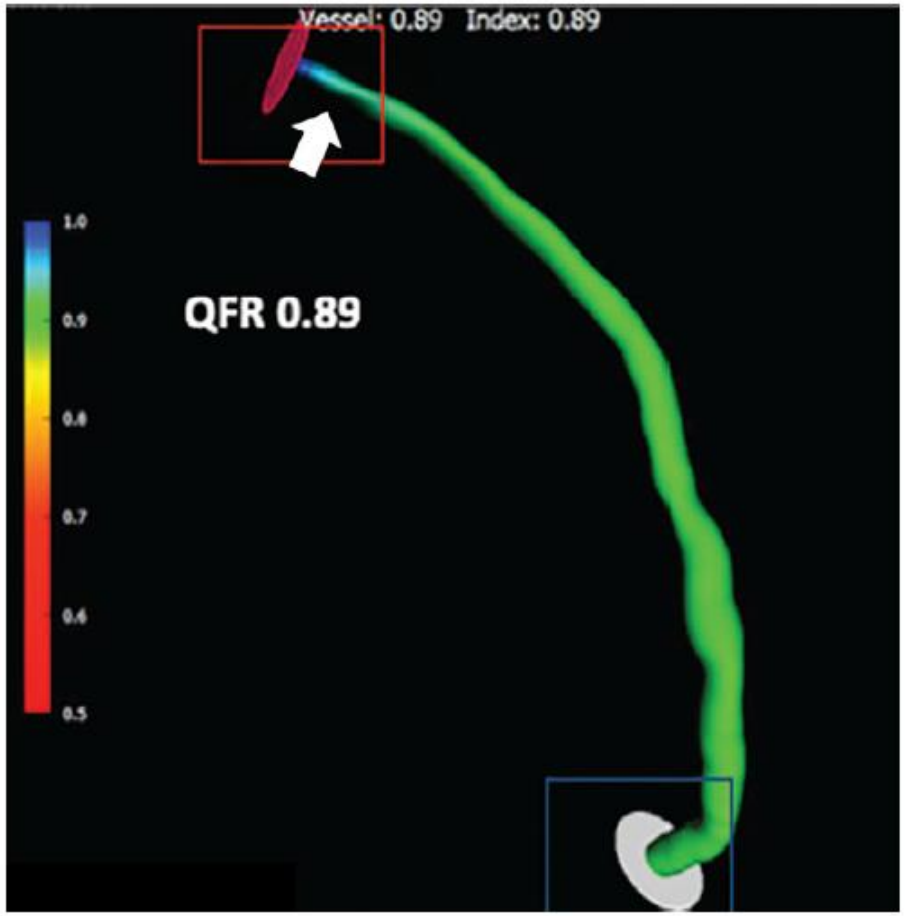


Fig. 9. Mesure du QFR avec une reconstruction 3D pour une artère coronaire droite (flèche) connectée dans le sinus gauche. QFR : quantitative flow ratio.

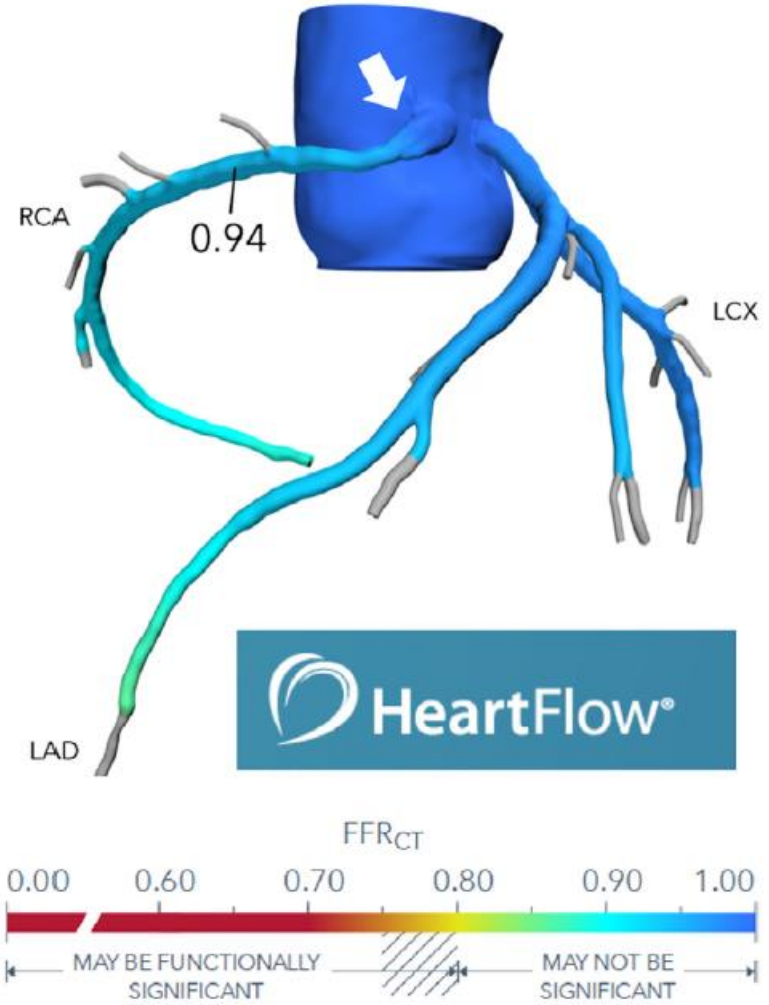


Fig. 8. Mesure de la FFR_{CT} pour une artère coronaire droite (flèche) connectée dans le sinus gauche. CT : computed tomography. FFR : fractional flow reserve.

Aubry P et al. Ann Cardiol Angio. 2023.

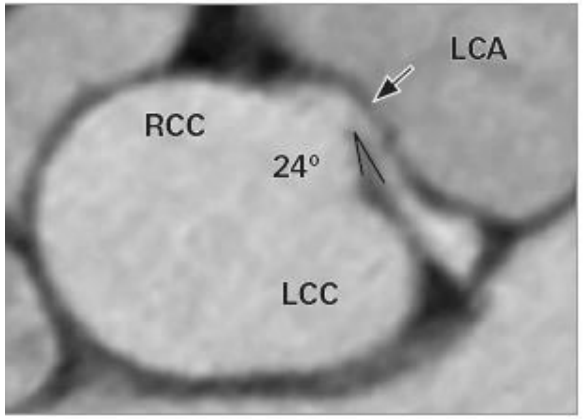
Texas Heart Institute Journal

Case Reports

Repeated Syncope During Exercise as a Result of Anomalous Origin of Left Coronary Artery With Intramural Aortic Course in a Teenage Boy

Amioka N et al. Tex Heart Inst J. 2022.

- Garçon de 17 ans
- Activité sportive (course à pied)
- Syncope d'effort
- Test d'effort
- ANOCOR gauche
- Pas d'arythmie ventriculaire



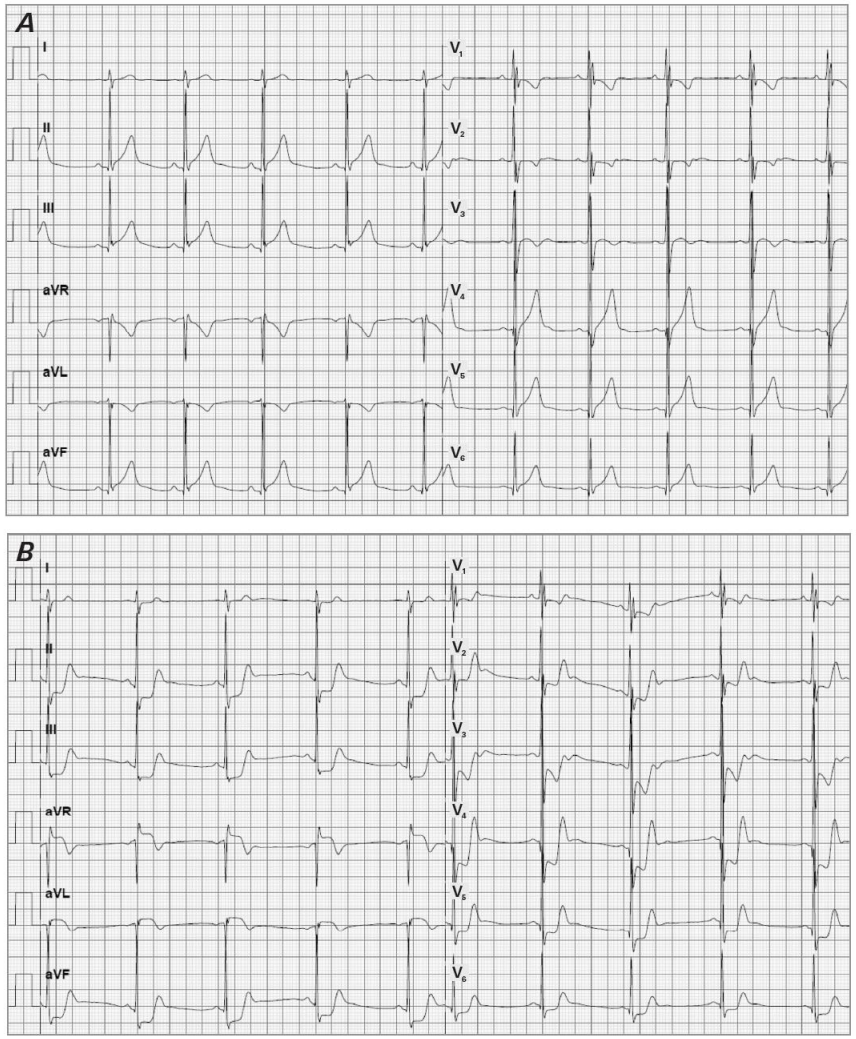


Fig. 1 *Findings of an ECG before and after a treadmill exercise stress test.* ***A****) Before exercise, there was no specific finding on the ECG other than incomplete right bundle branch block.* ***B****) On the exercise stress test, the ECG showed ST-segment elevation at lead aVR and ST-segment depression at other leads accompanied by a decrease in blood pressure (99/56 mm Hg to 68/38 mm Hg), chest pain, and faintness.*

ECG, electrocardiogram.

Coronary Anomalies

Anomalous Origin of Left Coronary Artery

with Intramural Aortic Course
Causing Symptoms in a Teenaged Athlete

Garcia-Arribas D et al. Tex Heart Inst J. 2020.

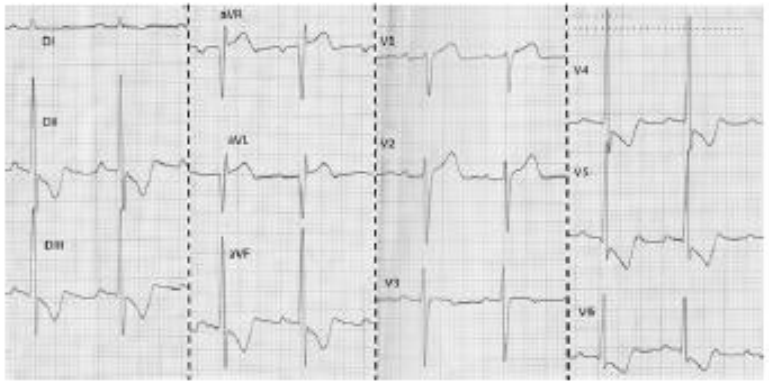
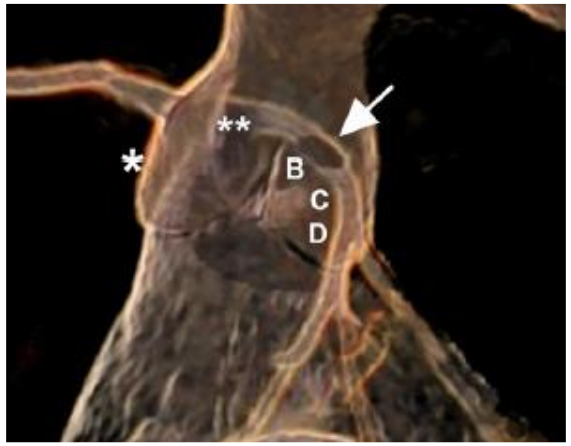


Fig. 1 *Initial electrocardiogram shows deep negative T waves in leads II, III, and aVF and from leads V_4 through V_6, along with 1-mm ST-segment elevation in lead aVR.*

- Garçon de 14 ans
- Activité sportive (football)
- Bilan d'aptitude normal (avec test d'effort)
- Syncope d'effort
- Douleur thoracique (SAU)
- ECG per critique
- ANOCOR gauche
- Pas d'arythmie ventriculaire



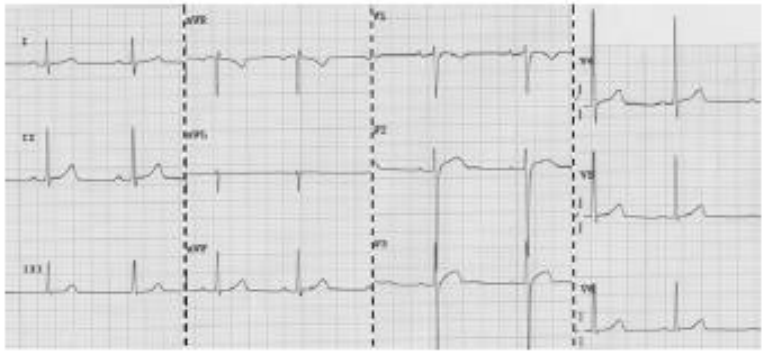
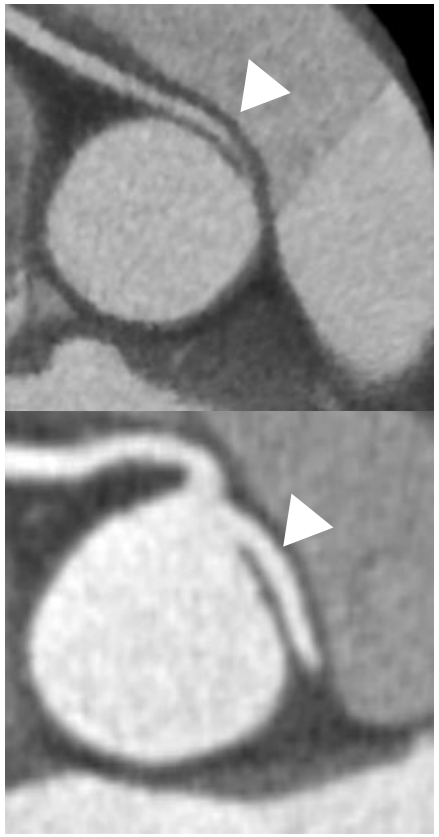


Fig. 2 *Electrocardiogram several days after admission shows gradual normalization of the inverted T waves in the precordial leads, and return to an isoelectric ST segment in lead aVR.*

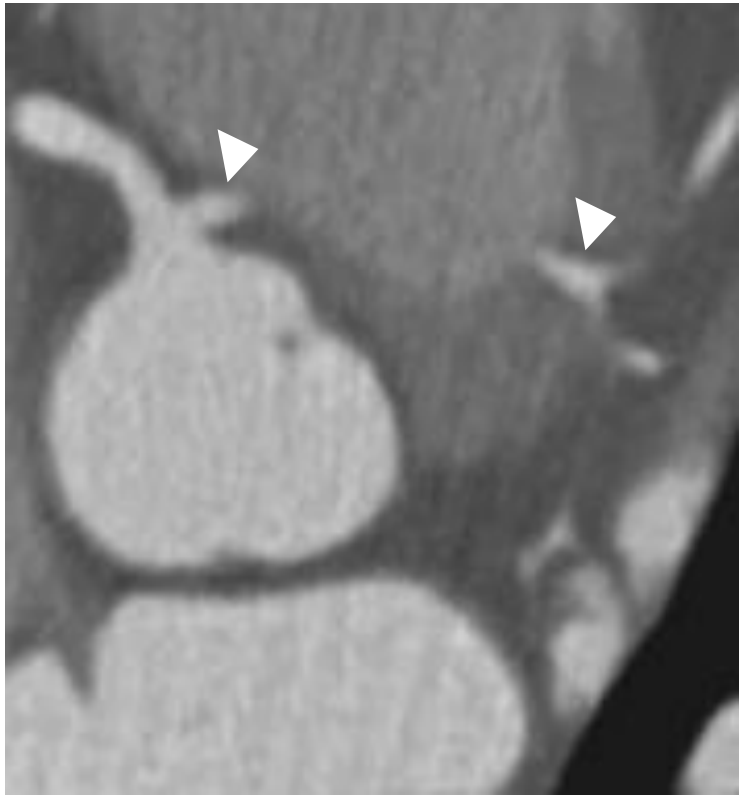
ANOCOR à risque d'ischémie myocardique

Connexions aortiques

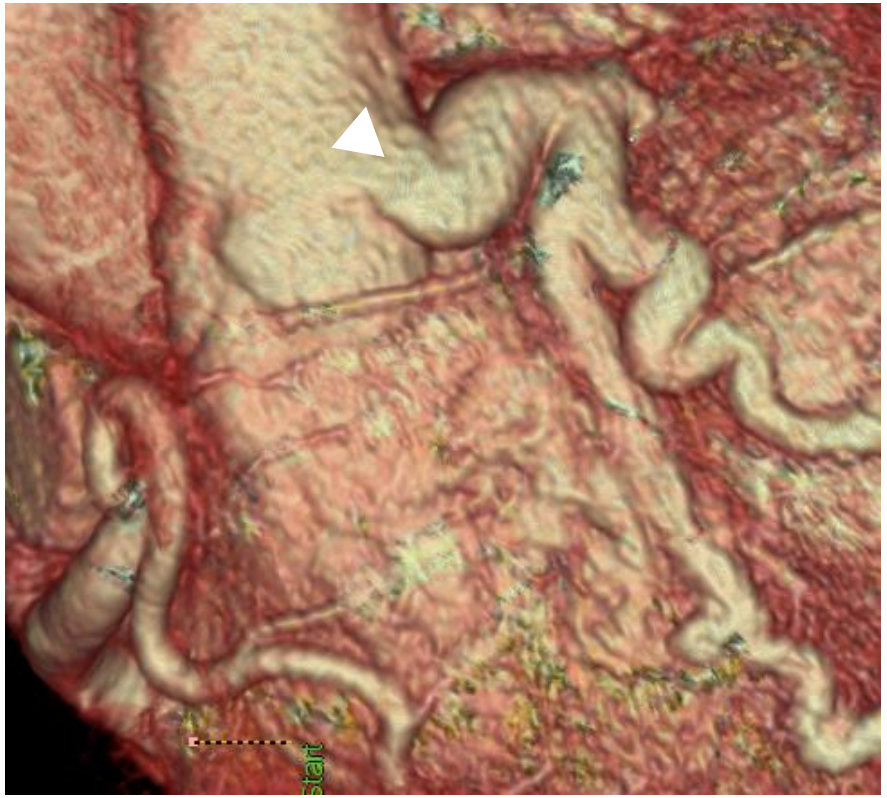
Trajet interartériel



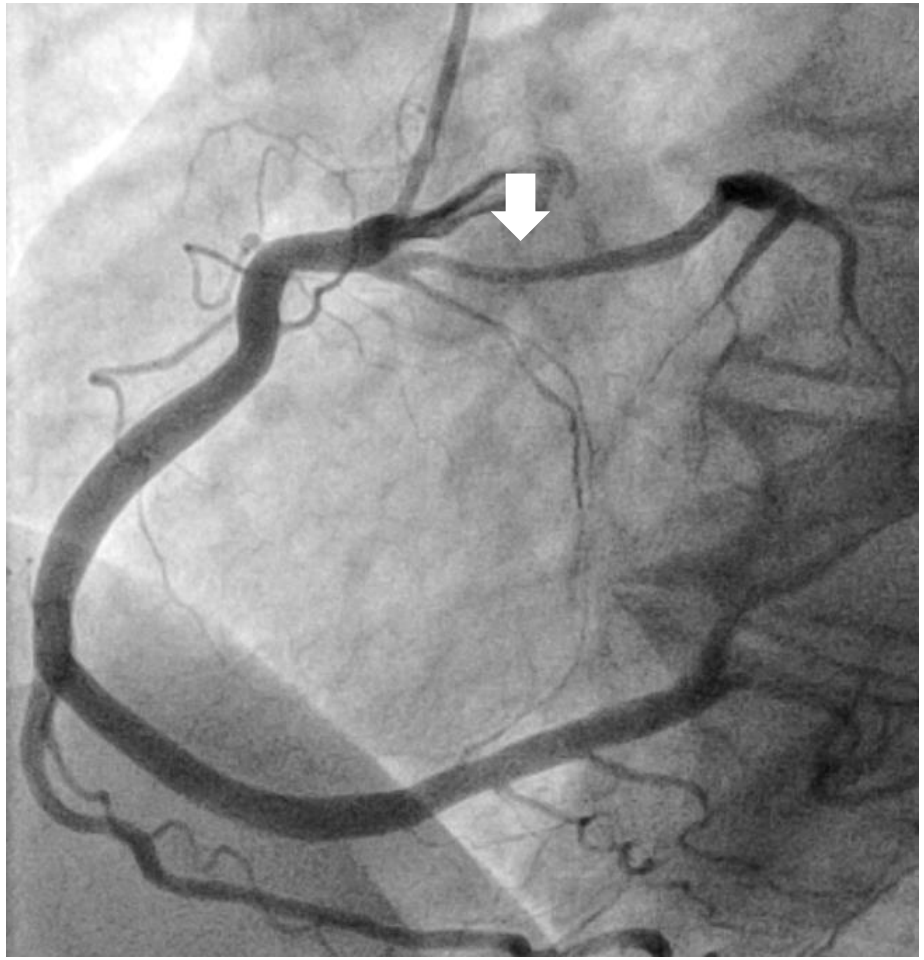
Trajet rétropulmonaire



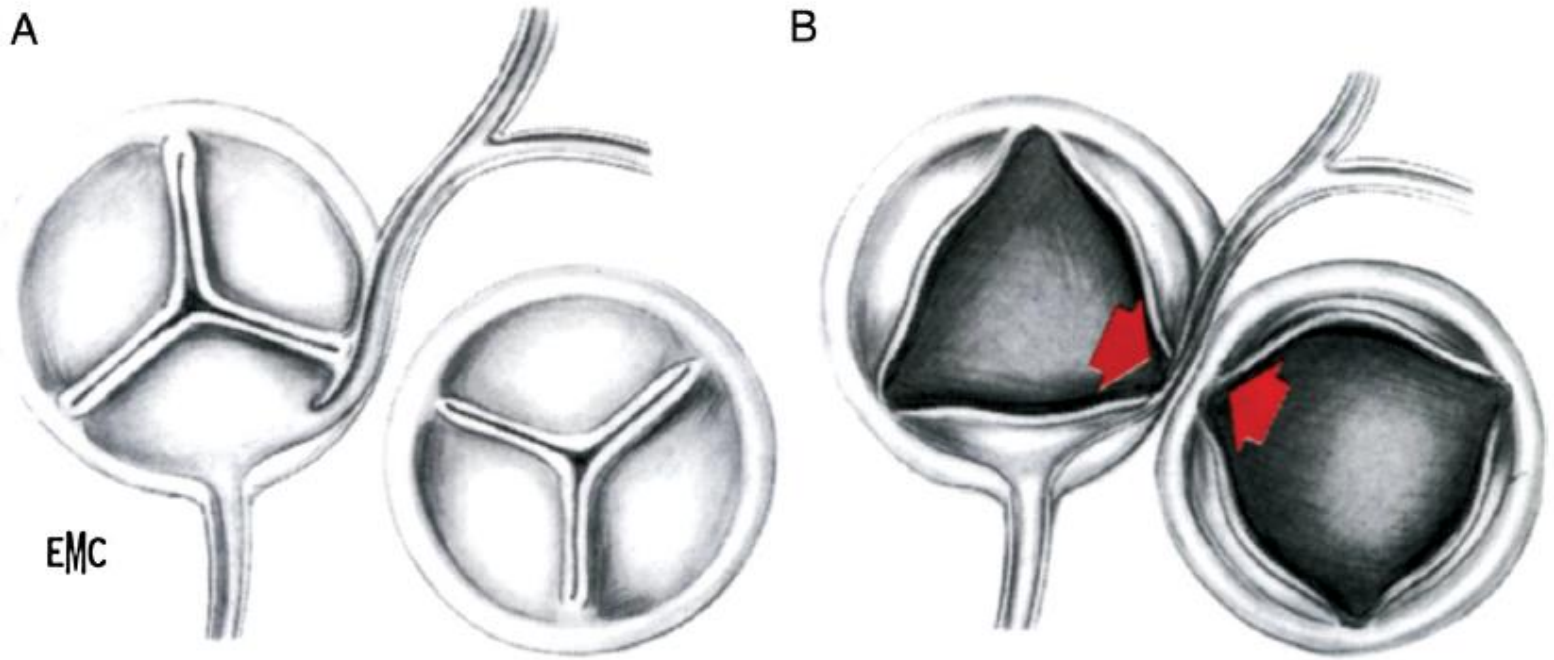
Connexions pulmonaires



Trajet rétropulmonaire du tronc gauche



Exertional dynamic compression



Raisky O, Vouhé P. EMC 2007

Never demonstrated

- Embryologie et anatomie
- Classification
- Prévalence
- Imagerie
- Ischémie myocardique
- **Mort subite**
- Screening
- Prise en charge
- Chirurgie
- Angioplastie
- Activités sportives

Etiologies de la mort subite

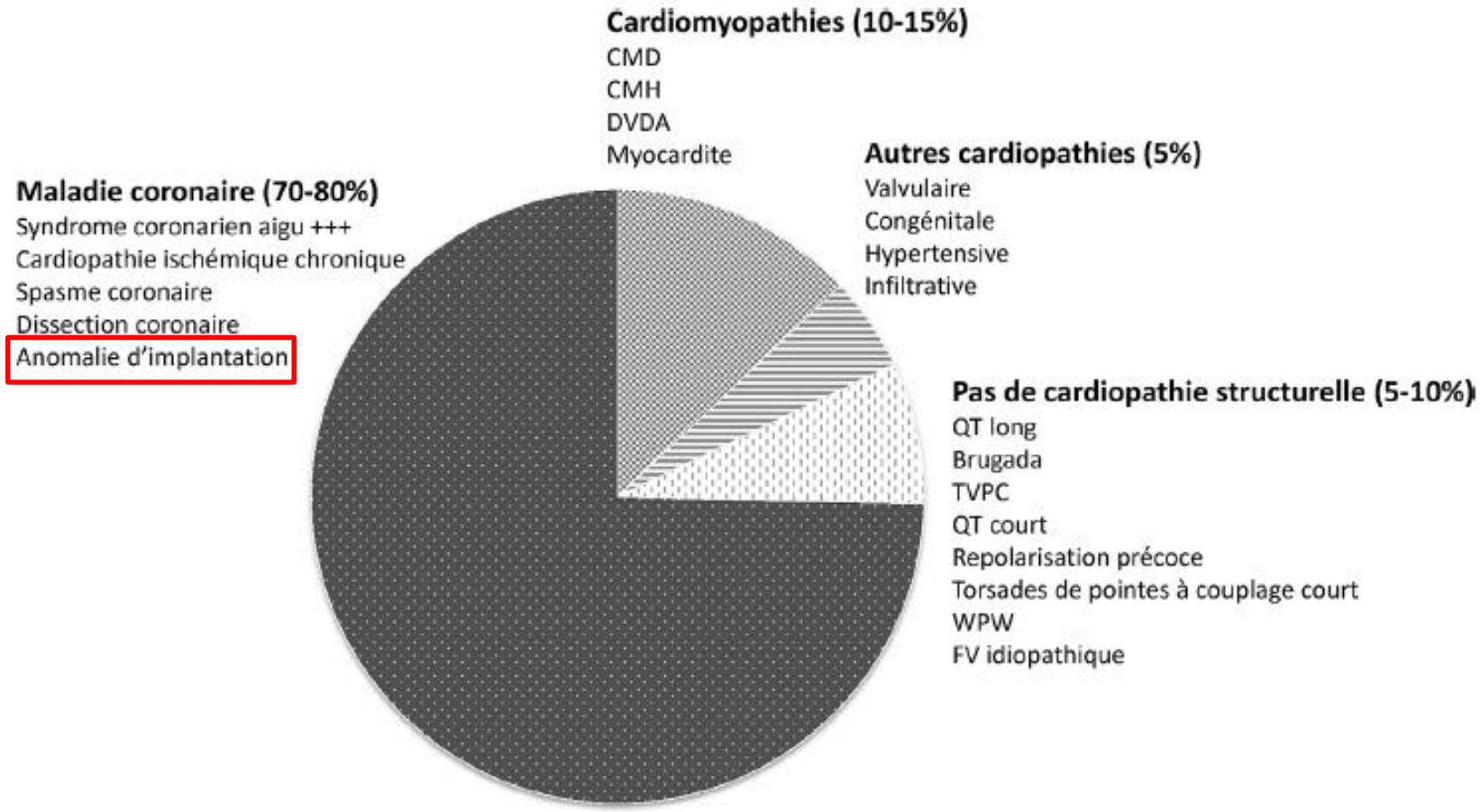
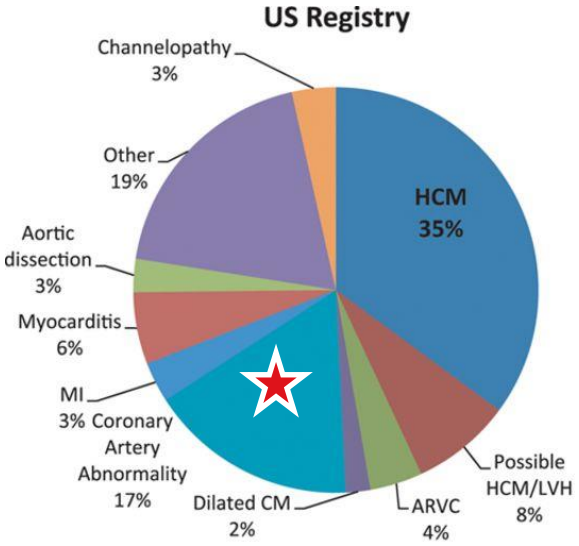
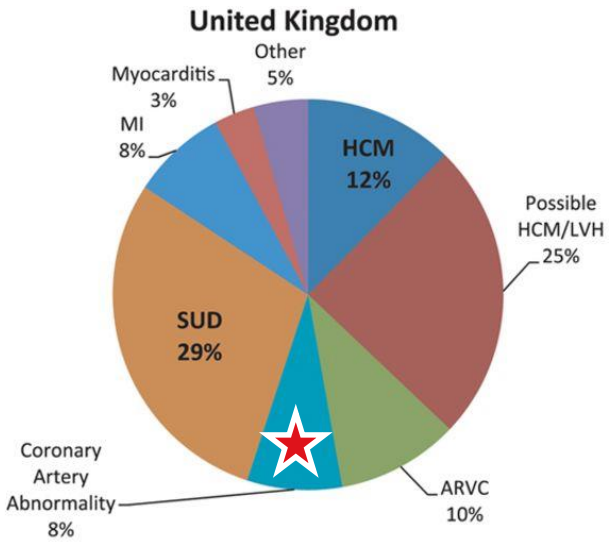


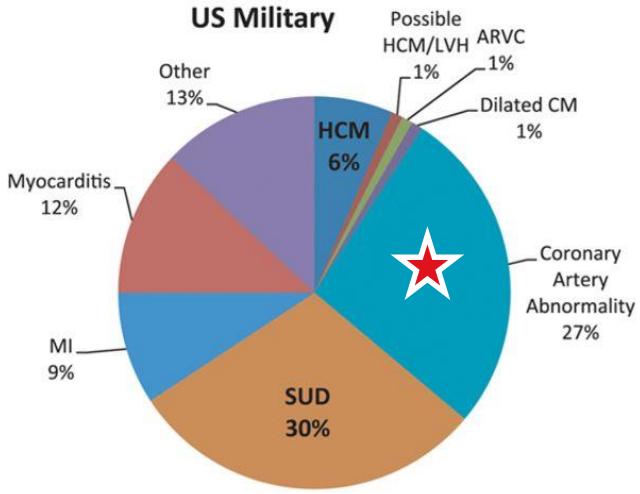
Fig. 3. Principales étiologies cardiaques de la mort subite.

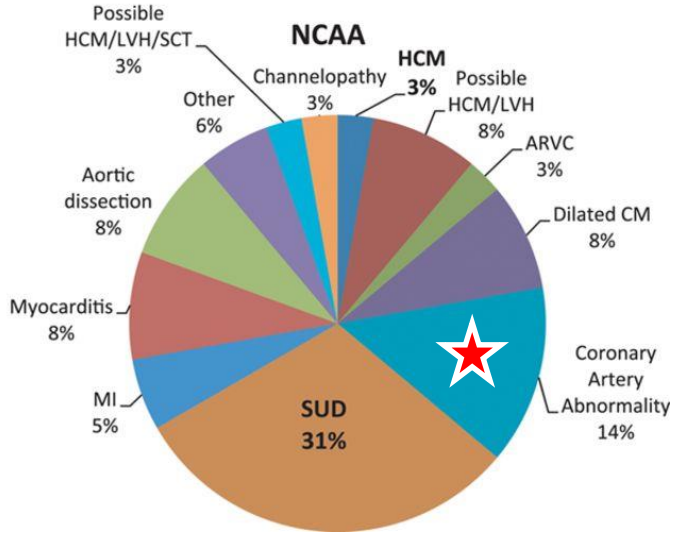
Waldmann V. Ann Cardiol Angeio. 2017.

Sudden death
in 0-35 years of age







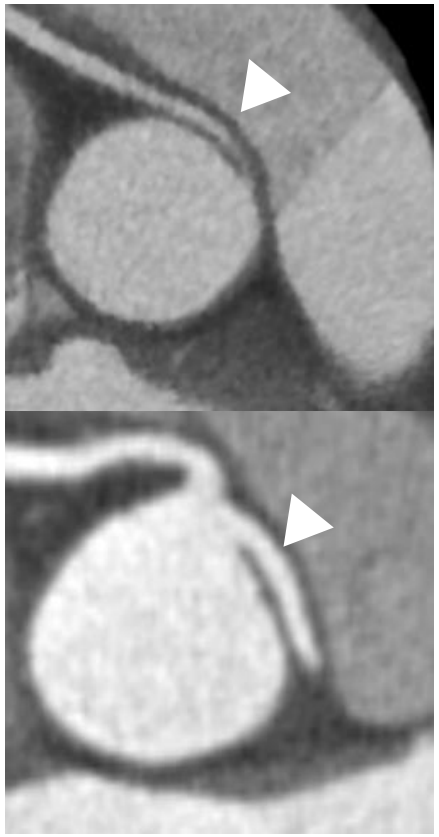


Meyer L. Circulation. 2012.

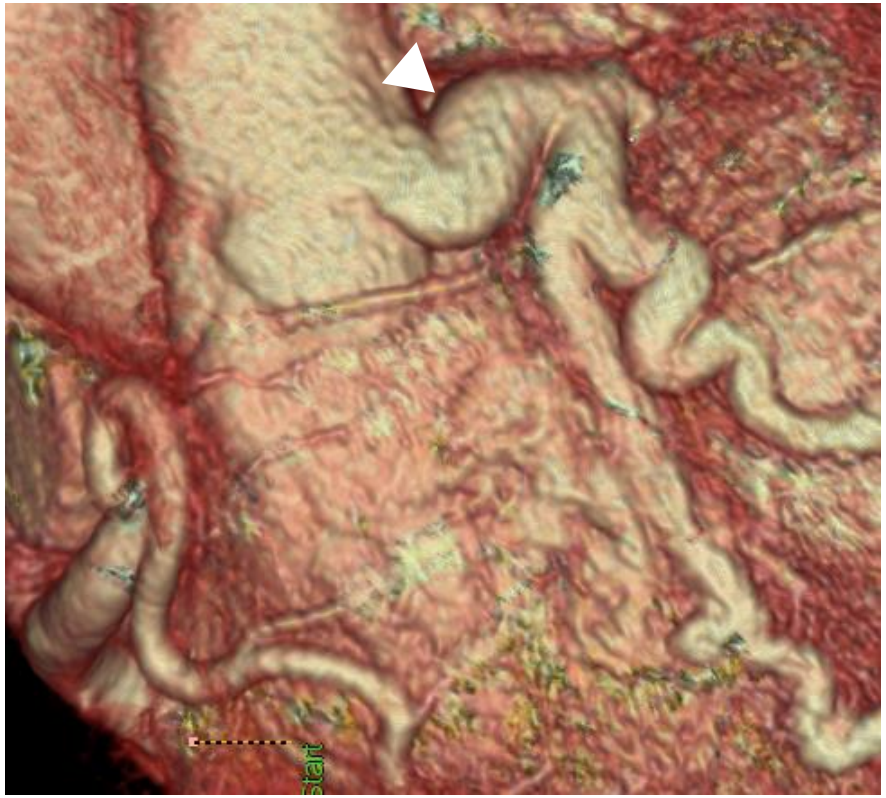
ANOCOR à risque de mort subite

Connexions aortiques

Trajet interartériel



Connexions pulmonaires



Cardiopathie congénitale à risque de mort subite	Prévalence**
ANOCOR* droite	0.3%
Cardiomyopathie hypertrophique	0.2%
Syndrome pré-excitation ventriculaire	0.15%
Syndrome de QT long	0.05%
Cardiomyopathie dilatée idiopathique	0.04%
Dysplasie ventriculaire droite arythmogène	0.04%
ANOCOR* gauche	0.03%
Syndrome de Brugada	0.02%
Tachycardie ventriculaire catécholergique	0.01%

* Anomalie de connexion avec trajet interartériel
** Nombre de cas à la naissance (estimations)

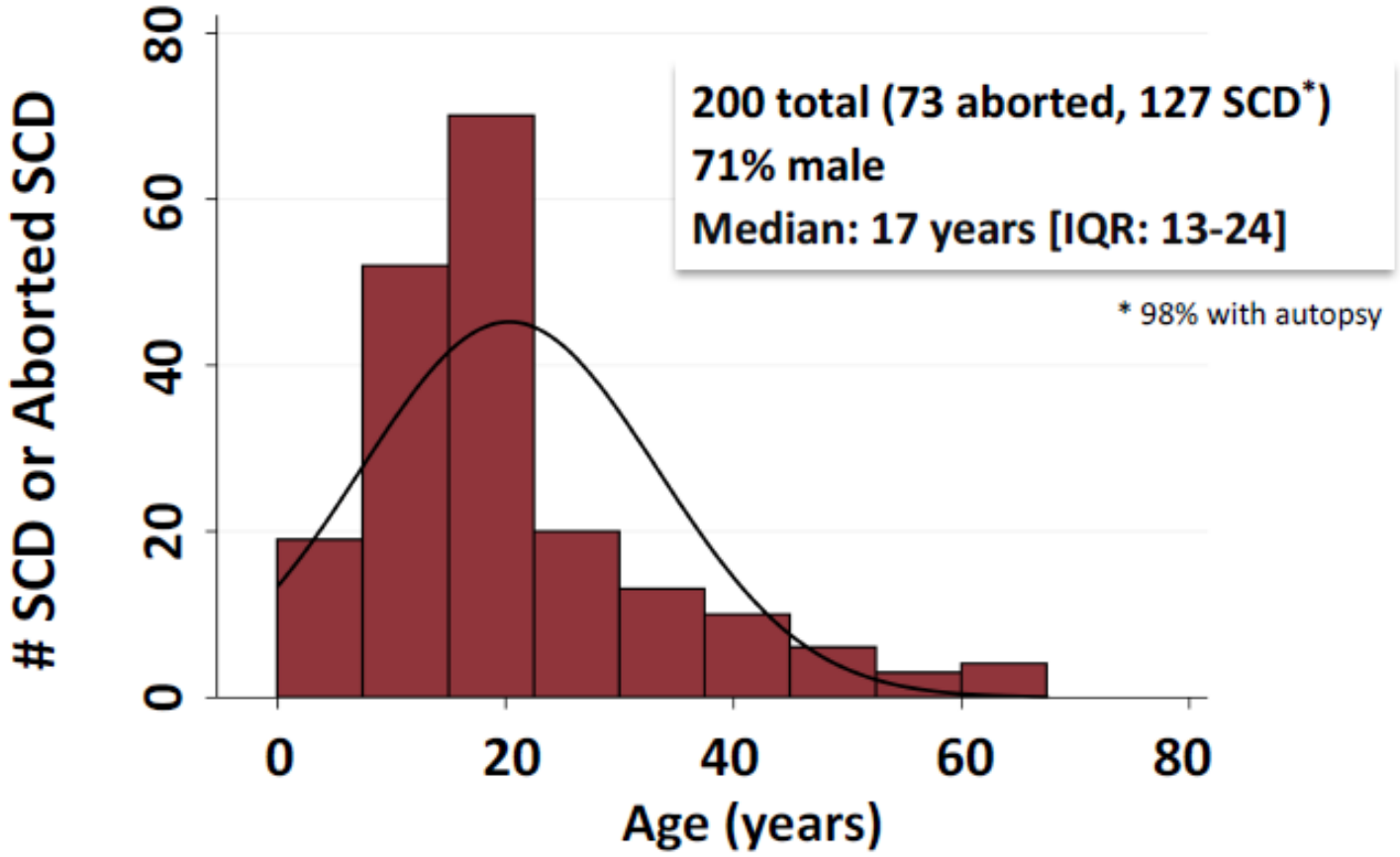
Cardiopathie congénitale à risque de mort subite	Incidence annuelle**
Tachycardie ventriculaire catécholergique	1.5%
Cardiomyopathie hypertrophique	1-2%
Syndrome de Brugada	1%
Syndrome de QT long	0.5-1%
Cardiomyopathie dilatée idiopathique	0.5-1%
Dysplasie ventriculaire droite arythmogène	0.5.1%
ANOCOR* gauche	0.2%
Syndrome pré-excitation ventriculaire	0.1%
ANOCOR* droite	0.02%

* Anomalie de connexion avec trajet interartériel
** Incidence annuelle de mort subite (estimations)

ACC.18
67th Annual Scientific Session & Expo

Age of SCD or Aborted SCD Attributed to AAOCA

NHS

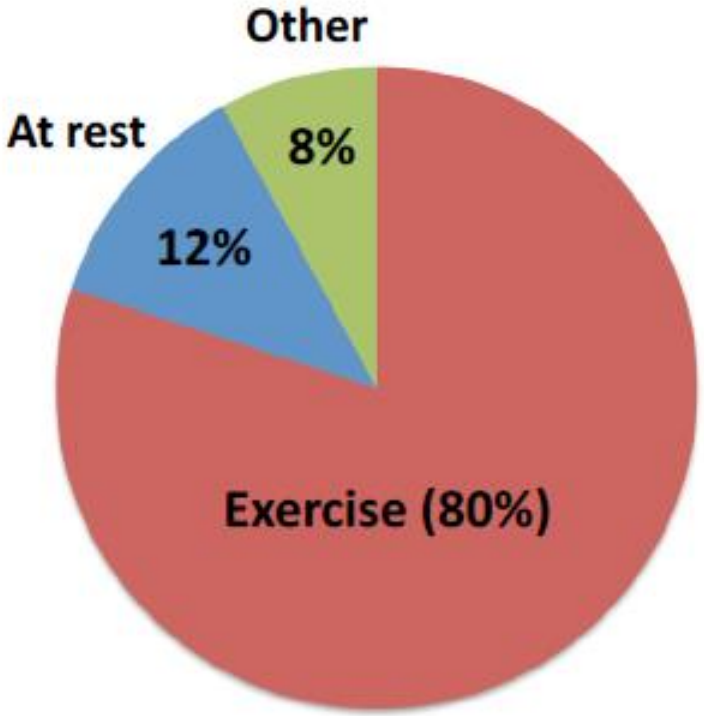


Shiwani H. ACC 2018

ACC.18
67th Annual Scientific Session & Expo

SCD/Aborted SCD Related to Exercise

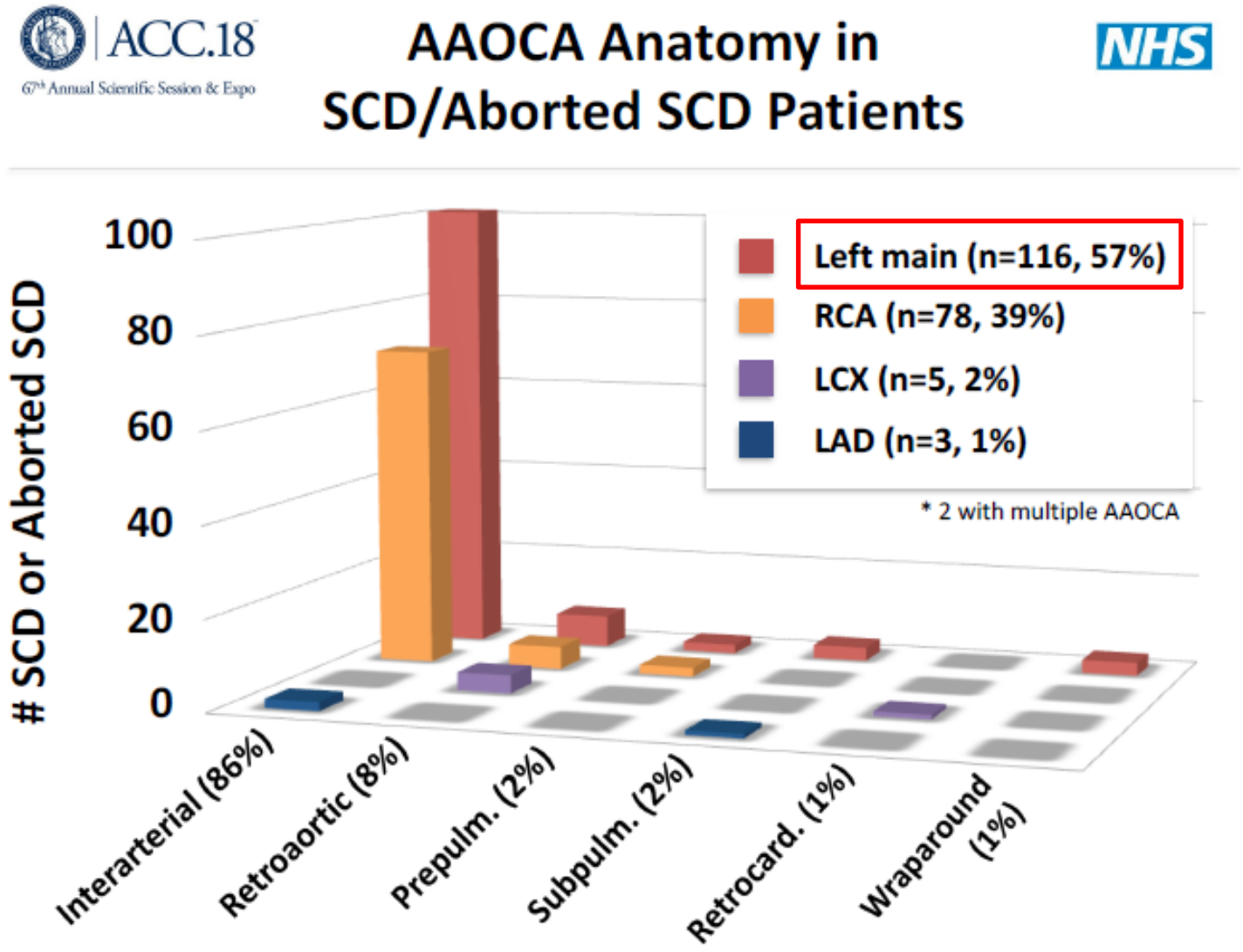
NHS



- Exercise (n=142, 80%)
- At rest (n=21, 12%)
- Other (n=14, 8%):
  - 12 babies (in crib, crying spell)
  - 2 adults w/ emotional distress

* No data available in 23 cases

Shiwani H. ACC 2018



Shiwani H. ACC 2018

ANOCOR registry
n=472 patients

SCA: 12 (2.5%)
ANOCOR-related SCA: 3 (0.6%)

SCA: sudden cardiac arrest

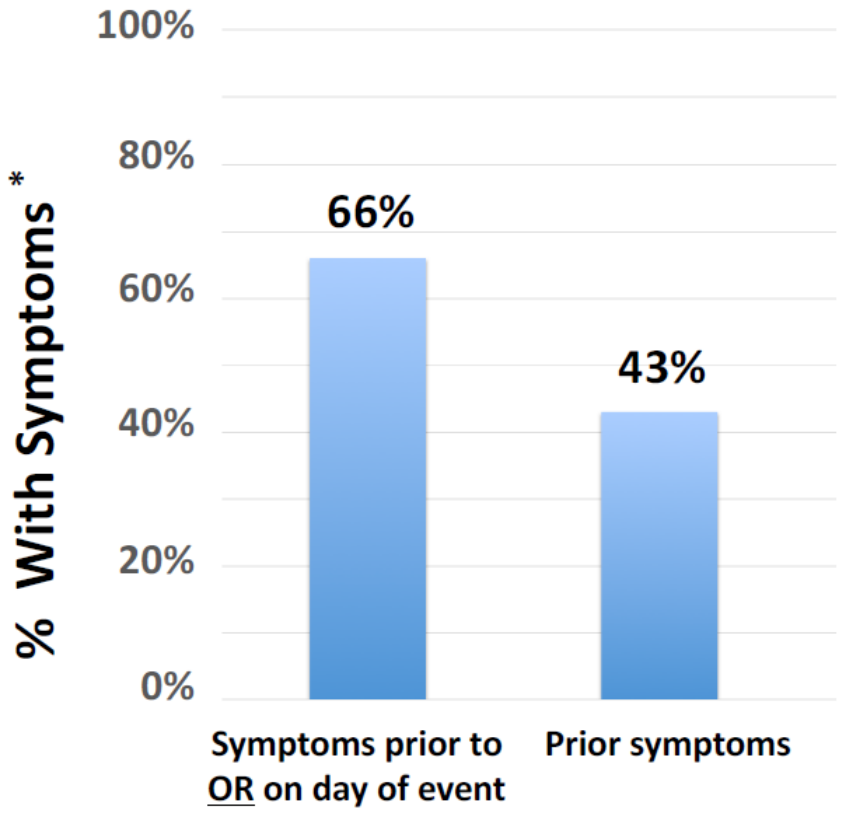
Number	Age	Artery	Connection	Course	Significant CAD
1	50	Cx	contralateral artery	retroaortic	present
2	75	Cx	contralateral artery	retroaortic	present
3	72	Cx	contralateral artery	retroaortic	present
4	16	LM	pulmonary artery	normal	absent
5	53	Cx	contralateral artery	retroaortic	present
6	48	Cx	contralateral artery	retroaortic	absent
7	57	CX	contralateral artery	retroaortic	present
8	60	RCA	ascending aorta	preaortic	present
9	31	RCA	contralateral sinus	interarterial	absent
10	60	RCA	contralateral sinus	preaortic	present
11	30	RCA	contralateral sinus	interarterial	absent
12	44	CX	contralateral sinus	retroaortic	absent

Aubry P. et al. Arch Cardiovasc Dis. 2016.

ACC.18
67th Annual Scientific Session & Expo

Cardiac Symptoms Before SCD

NHS



In patients with symptoms^:

- 45% syncope/presyncope
- 41% chest pain
- 10% dyspnea
- 9% palpitations

^ 8 reported multiple symptoms; * 41 omitted (no data)

Shiwani H. ACC 2018

ACC.18
67th Annual Scientific Session & Expo

NHS

Cardiac Testing

200 total (73 aborted, 127 SCD*)
71% male
Median: 17 years [IQR: 13-24]

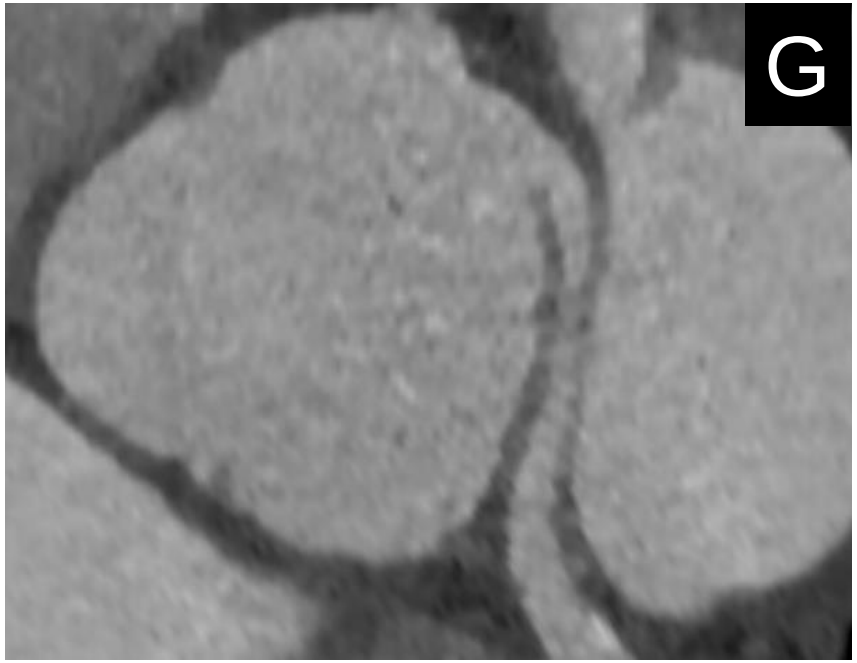
* 98% with autopsy

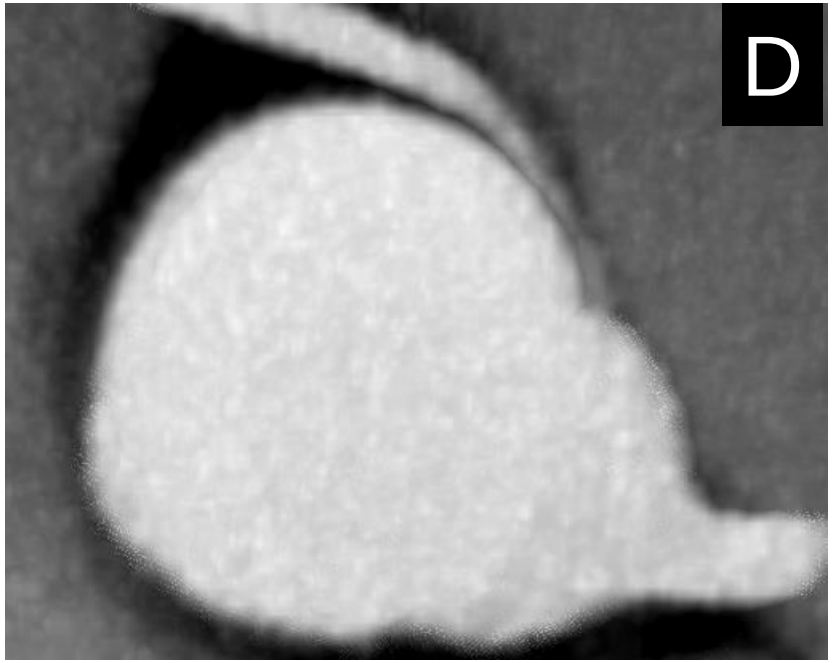
Stress Test	Before SCD / aSCD		After aSCD	Total
	Normal	Abnormal	Normal	13
	10	2	1	

85% Negative (n=11/13)

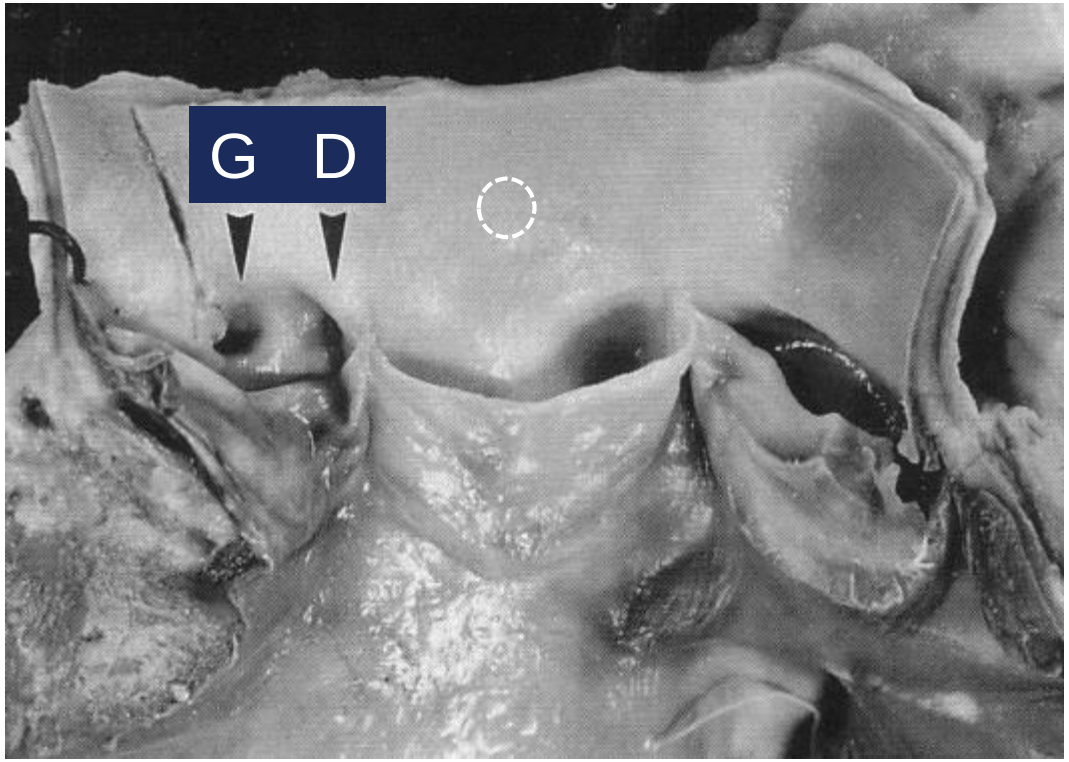
Shiwani H. ACC 2018

Sur risque de mortalité pour les formes gauches





1990 Mort subite



Corrado et al. Br Heart J. 1992.

2010 Arrêt cardiaque récupéré

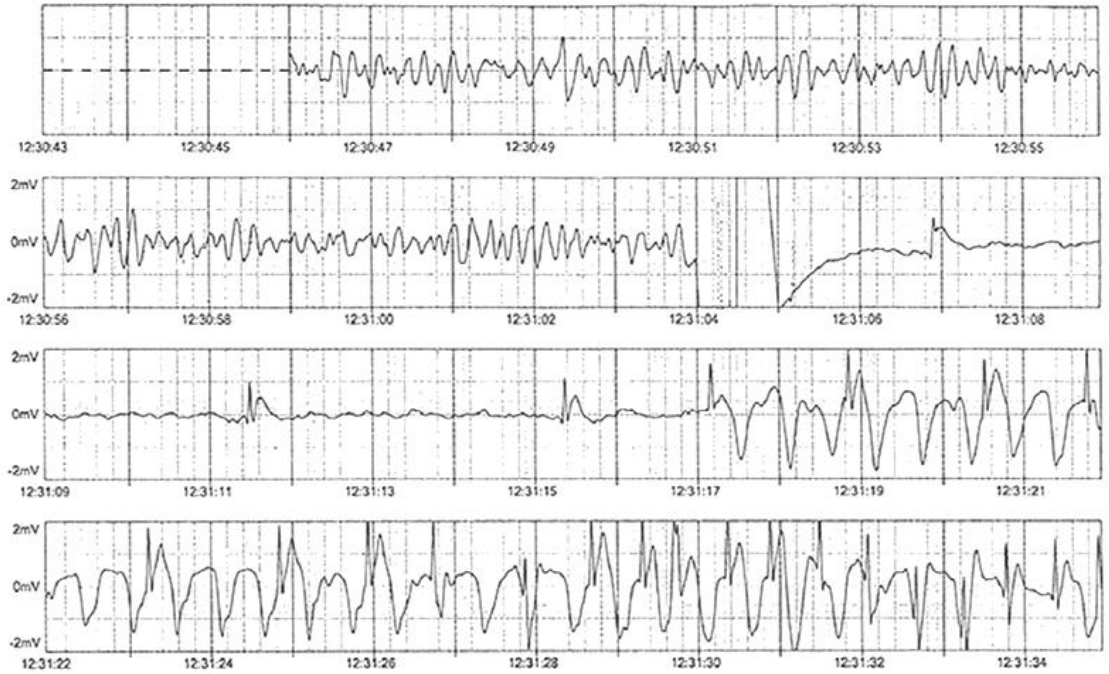
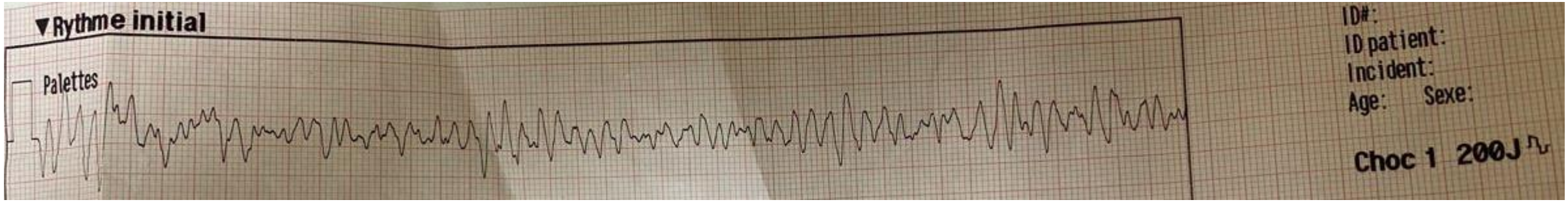
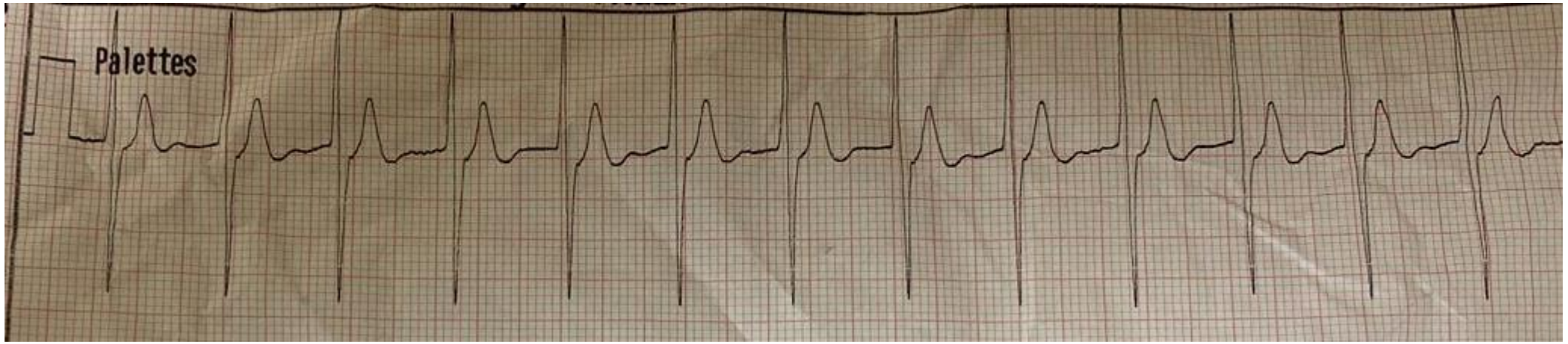


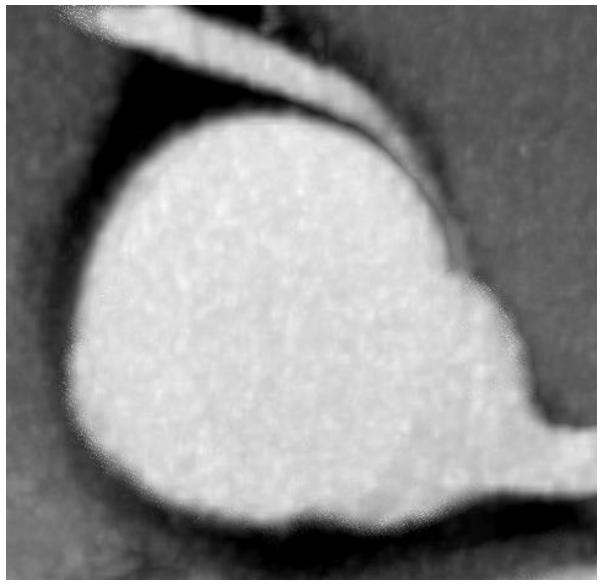
Figure 1. ECG recording from an automated external defibrillator

Mécanisme de la mort subite



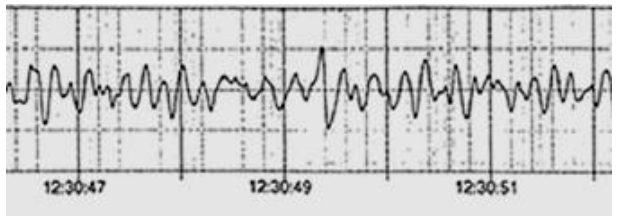


Mécanisme(s) de la fibrillation ventriculaire



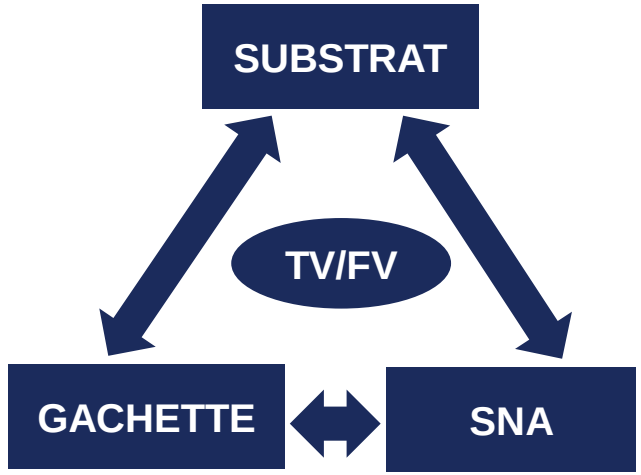
?

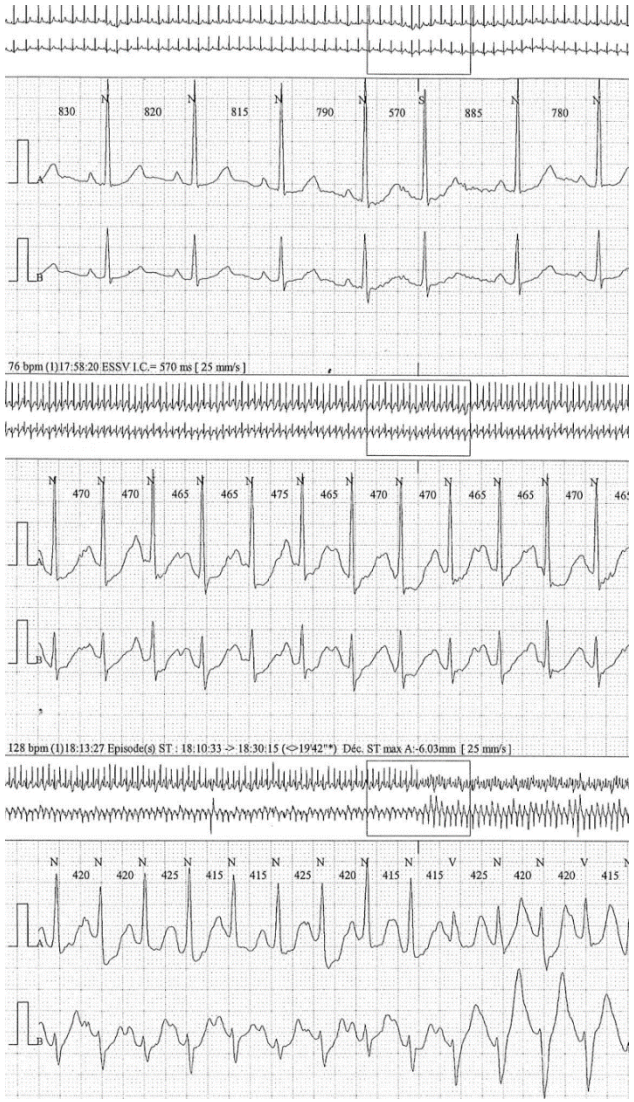
24/07/2022
vers 12.30



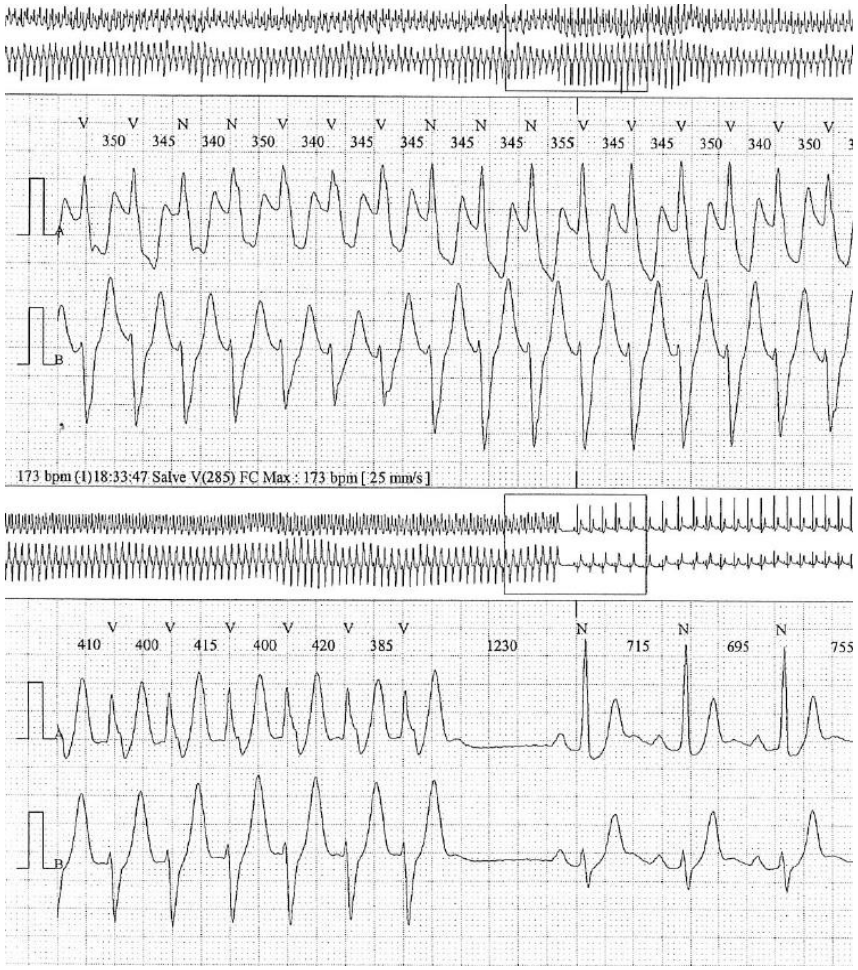
Mécanisme(s) de la fibrillation ventriculaire

- Ischémie myocardique
- Zones de fibrose myocardique
- Seuil arythmogène bas
- Hypotension post-effort
- Association de plusieurs mécanismes
- Substrat-gâchette-modulateurs (triade de Coumel)
- Association fortuite
- …





Femme de 53 ans - Palpitations (jogging)
ANOCOR droite



Stratification du risque de mort subite

- ANOCOR gauche versus ANOCOR droite
- Passage intramural aortique
- Symptomatologie d'allure ischémique
- Ischémie myocardique documentée avec imagerie
- Activité physique sportive d'intensité élevée
- Age < 35 ans

Mais… pas encore de scores de risque

Guidelines

2017 AHA/ACC/HRS Guideline for Management of Patients With Ventricular Arrhythmias and the Prevention of Sudden Cardiac Death: Executive Summary

4.3. Surgery and Revascularization Procedures in Patients With Ischemic Heart Disease

Recommendations for Surgery and Revascularization Procedures in Patients With Ischemic Heart Disease References that support the recommendations are summarized in Online Data Supplement 11.		
COR	**LOE**	**Recommendations**
I	B-NR	1. Patients with sustained VA and survivors of SCA should be evaluated for ischemic heart disease, and should be revascularized as appropriate (1-4).
I	C-EO	2. In patients with anomalous origin of a coronary artery suspected to be the cause of SCA, repair or revascularization is recommended.

SCA: sudden cardiac arrest

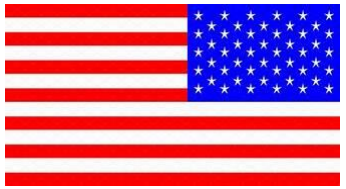
Al-Khatib et al. Circulation. 2017.

Mort subite et arrêt cardiaque récupéré

- Anomalie coronaire
- Pathologie cardiaque congénitale
- Caractère héréditaire : oui / non
- Dépistage familial : oui / non

- Embryologie et anatomie
- Classification
- Prévalence
- Imagerie
- Ischémie myocardique
- Mort subite
- Screening
- Prise en charge
- Chirurgie
- Angioplastie
- Activités sportives

PRE-PARTICIPATION CARDIOVASCULAR EVALUATION



- History (family and personal)
- Physical examination

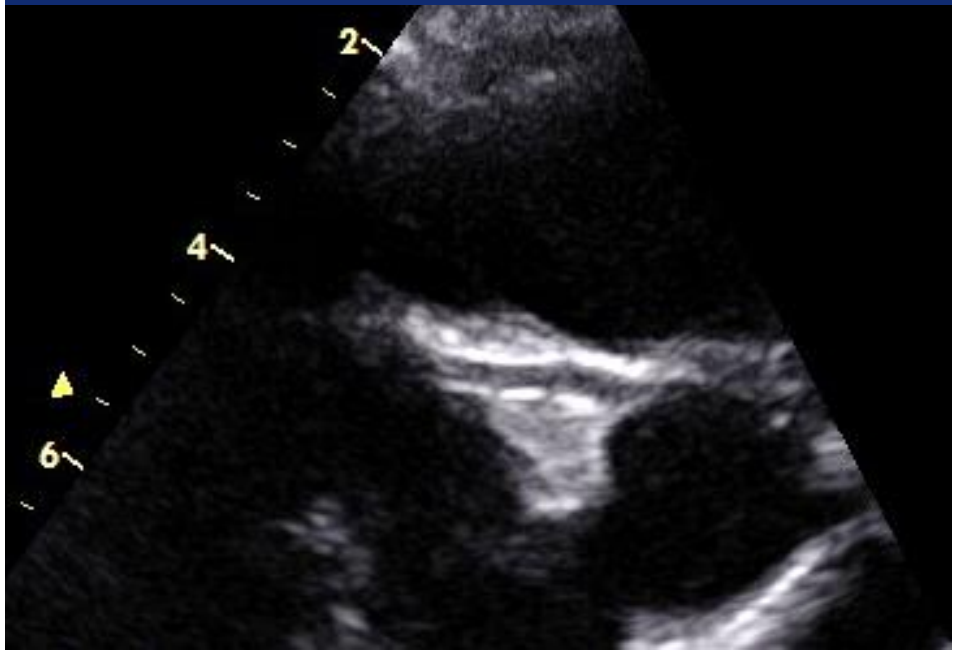
- History (family and personal)
- Physical examination
- ECG

SCIENTIFIC SOCIETIES GUIDELINES

Faut-il dépister les ANOCOR chez le jeune sportif ?

Echocardiographie transthoracique

coronaire droite normale

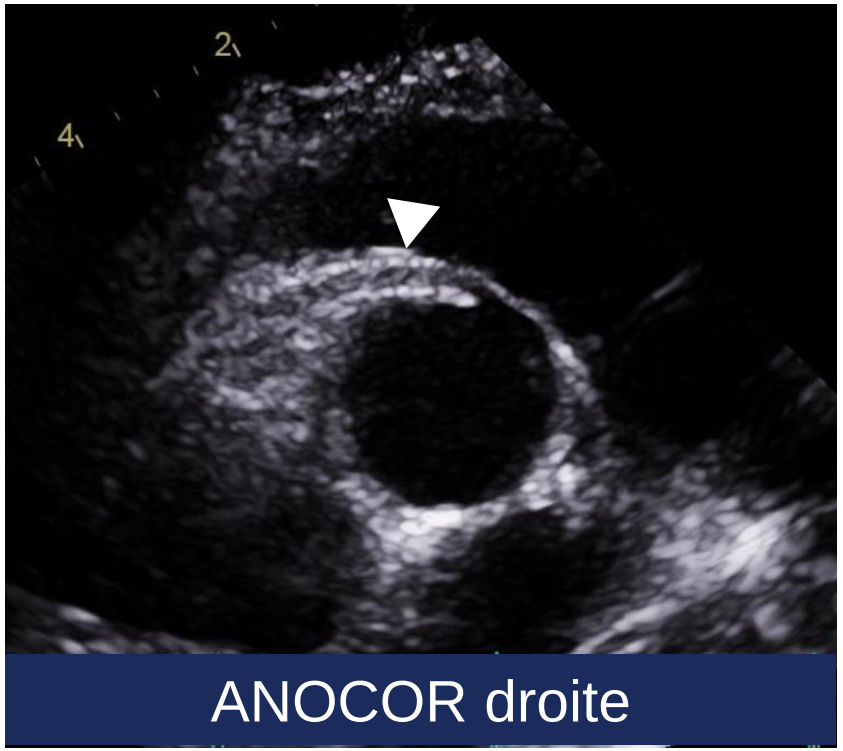


coronaire gauche normale

Faut-il dépister les ANOCOR chez le jeune sportif ?

Echocardiographie transthoracique

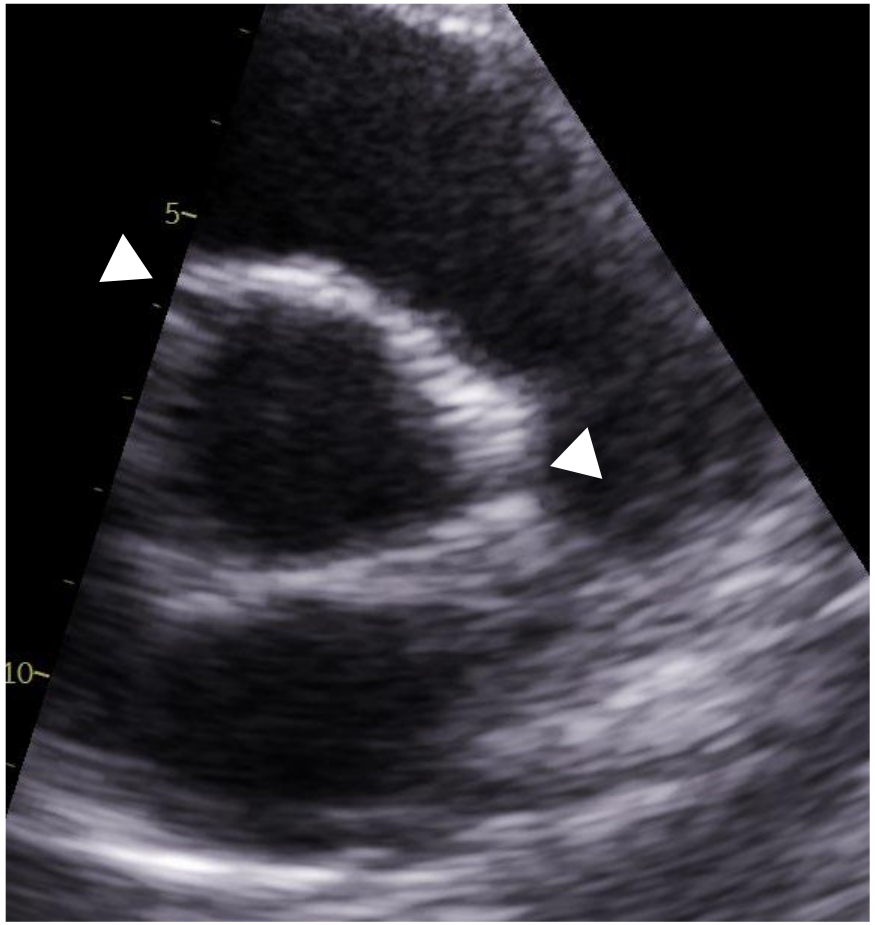
ANOCOR gauche



ANOCOR droite

Echocardiographie transthoracique

Homme de 45 ans



Faut-il dépister les ANOCOR chez le jeune sportif ?

<u>Exemple de dépistage d'ANOCOR</u>

Prévalence : 3/1.000

Population : 7.000

Test : échocardiogramme transthoracique

Sensibilité : 90%

Spécificité : 90%

- 2 faux négatifs
- 6.298 vrais négatifs

- <u>682 faux positifs</u>
- 18 vrais positifs

Faut-il dépister les ANOCOR chez le jeune sportif ?

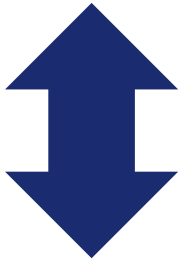
Explorations Fonctionnelles Cardio-Vasculaires
Laboratoire d'échocardiographie
Echodoppler cardiaque transthoracique
Echographe : GE Vivid 9

Réalisé le 22/07/2021
M. né le : 01/01/2004
Motif : bilan d’aptitude sportive, précordialgies atypiques

Ventricule gauche non dilaté, non hypertrophié de fonction systolique normale et de cinétique homogène.
Profil et pressions de remplissage gauches normaux.
Pas de valvulopathie significative.
Aorte de taille normale.
Cavités droites non dilatées.
Pression artérielle pulmonaire systolique et pression de l'oreillette droite normales.
Pas d'épanchement péricardique.

Au total : examen dans les limites de la normale.

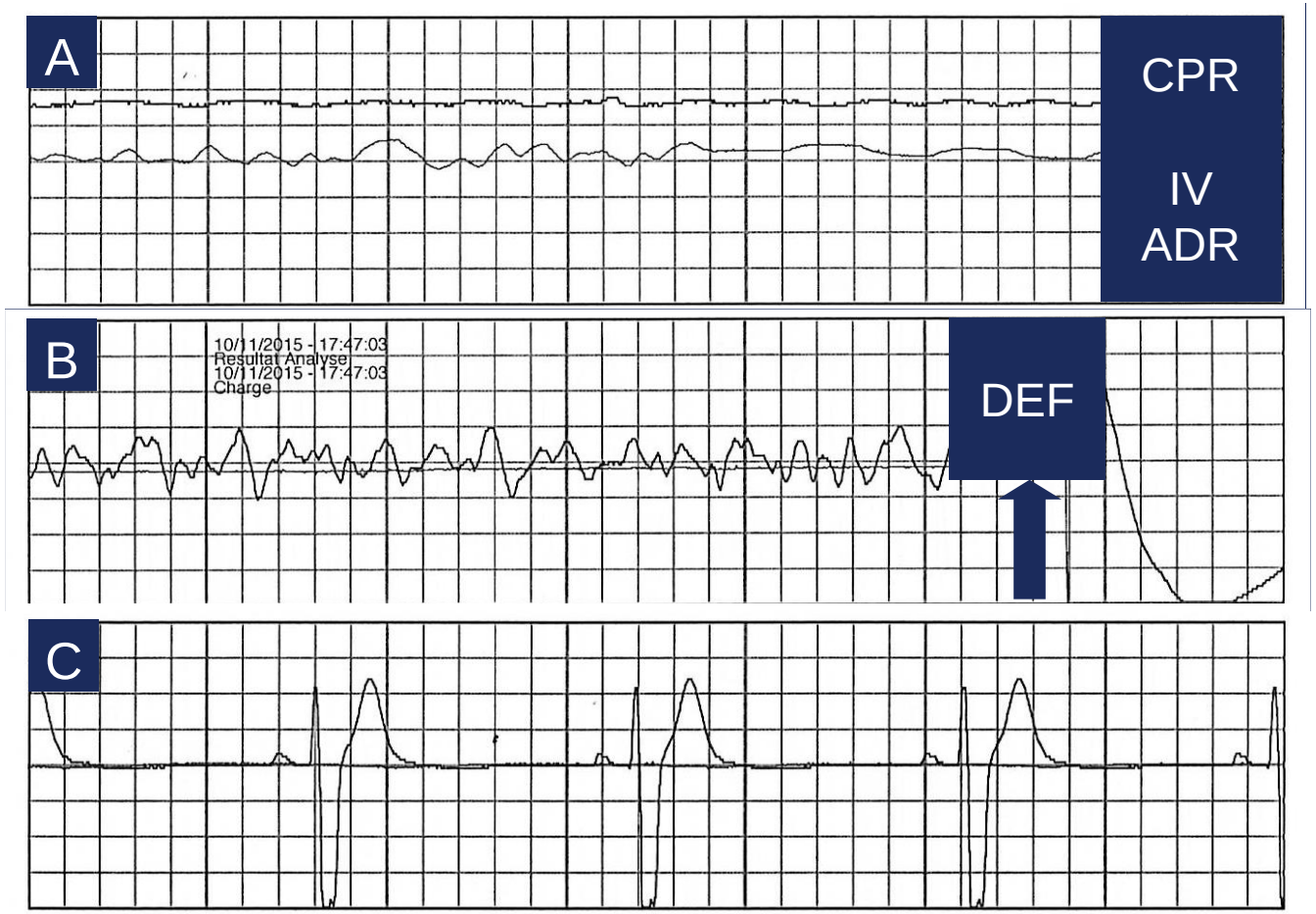
Proactive strategy with preparticipation screening



Reactive strategies with CPR/AED

Sudden cardiac arrest – High school sports activities

15-year old boy – Left coronary anomaly



- Embryologie et anatomie
- Classification
- Prévalence
- Imagerie
- Ischémie myocardique
- Mort subite
- Screening
- **Prise en charge**
- Chirurgie
- Angioplastie
- Activités sportives

2018 AHA/ACC Guideline for the Management of Adults With Congenital Heart Disease: Executive Summary

COR	LOE	Recommendations
Therapeutic		
I	B-NR	1. Surgery is recommended for AAOCA from the left sinus or AAOCA from the right sinus for symptoms or diagnostic evidence consistent with coronary ischemia attributable to the anomalous coronary artery.[S4.4.5.2-1–S4.4.5.2-3]
IIa	C-LD	2. Surgery is reasonable for anomalous aortic origin of the left coronary artery from the right sinus in the absence of symptoms or ischemia.[S4.4.5.2-4–S4.4.5.2-6]
IIa	C-EO	3. Surgery for AAOCA is reasonable in the setting of ventricular arrhythmias.
IIb	B-NR	4. Surgery or continued observation may be reasonable for asymptomatic patients with an anomalous left coronary artery arising from the right sinus or right coronary artery arising from the left sinus without ischemia or anatomic or physiological evaluation suggesting potential for compromise of coronary perfusion (eg, intramural course, fish-mouth-shaped orifice, acute angle).[S4.4.5.2-4–S4.4.5.2-6]

Stout KK. et al. Circulation. 2019.

Guidelines

2020 ESC Guidelines for the management of adult congenital heart disease

Anomalous aortic origin of the coronary artery		
Surgery is recommended for AAOCA in patients with typical angina symptoms who present with evidence of stress-induced myocardial ischaemia in a matching territory or high-risk anatomy.[c]	I	C
Surgery should be considered in *asymptomatic* patients with AAOCA (right or left) and evidence of myocardial ischaemia.	IIa	C
Surgery should be considered in *asymptomatic* patients with AAOLCA and no evidence of myocardial ischaemia but a high-risk anatomy.[c]	IIa	C
Surgery may be considered for symptomatic patients with AAOCA even if there is no evidence of myocardial ischaemia or high-risk anatomy.[c]	IIb	C
Surgery may be considered for *asymptomatic* patients with AAOLCA without myocardial ischaemia and without high-risk anatomy[c] when they present at young age (<35 years).	IIb	C
Surgery is not recommended for AAORCA in asymptomatic patients without myocardial ischaemia and without high-risk anatomy.[c]	III	C

Baumgartner H. et al. Eur Heart J. 2020.

Management of AAOCA at risk

Decision-making

- Age < 35 or ≥ 35 years
- Left AAOCA vs. Right AAOCA
- History of aborted cardiac arrest
- Ischemic symptoms/relationship with exertion
- Induced myocardial ischemia with imaging
- Anatomic characteristics (CT scan/angio/IVUS/OCT)
- Physiological assessment (iFR, FFR)
- Sports profile/Patient choice

Surgery/PCI/Medical/Observation/Physical restriction

ANOCOR Registry

Design

- Observational, prospective, multicentre cohort study
- Inclusion period: January 2010-January 2013
- Recruitment by adult interventional cardiologists (n=71)
- Population ≥15 years with at least one CA diagnosed invasive angiography and/or CTTA and without any structural congenital disease implicating the great vessels

Work supported by Groupe Athérome et Cardiologie Interventionnelle (GACI) - SFC

ANOCOR Registry

ANOCOR cohort

472 patients ≥15 years (mean age 63 years) [15-95]

496 AAOCA

AAOCA at risk

154 (31%)

Interarterial course

other AAOCA

342 (69%)

Other courses

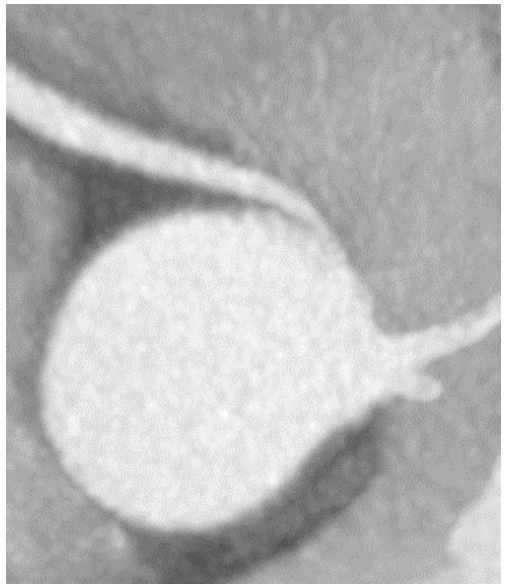
Aborted sudden cardiac arrest: 12 (2.5%) – 3 related to AAOCA (25%)

ANOCOR Registry

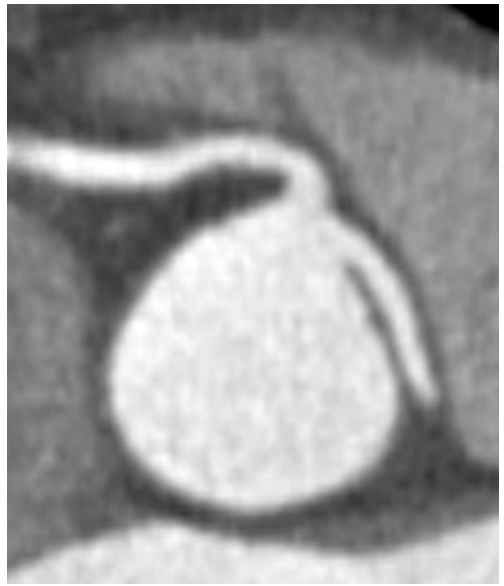
ANOCOR cohort

AAOCA at risk
154 (31%)

R-AAOCA
147 (95%)



L-AAOCA
7 (5%)



ANOCOR Registry

Revascularisation (specific treatment)

AAOCA at risk

154

Revascularisation

15 (10%)

Surgery

12 (80%)

PCI

3 (20%)

Interarterial course

Other AAOCA

342

Revascularisation

2 (0.6%)

Surgery

2 (100%)

Subpulmonic course

ANOCOR Registry

Revascularisation (specific treatment)

R-AAOCA at risk

147

Revascularisation

13 (10%)

Surgery

10 (77%)

PCI

3 (23%)

Interarterial course

L-AAOCA at risk

7

Revascularisation

2 (29%)

Surgery

2 (100%)

Interarterial course

Anomalies coronaires congénitales de l'adulte

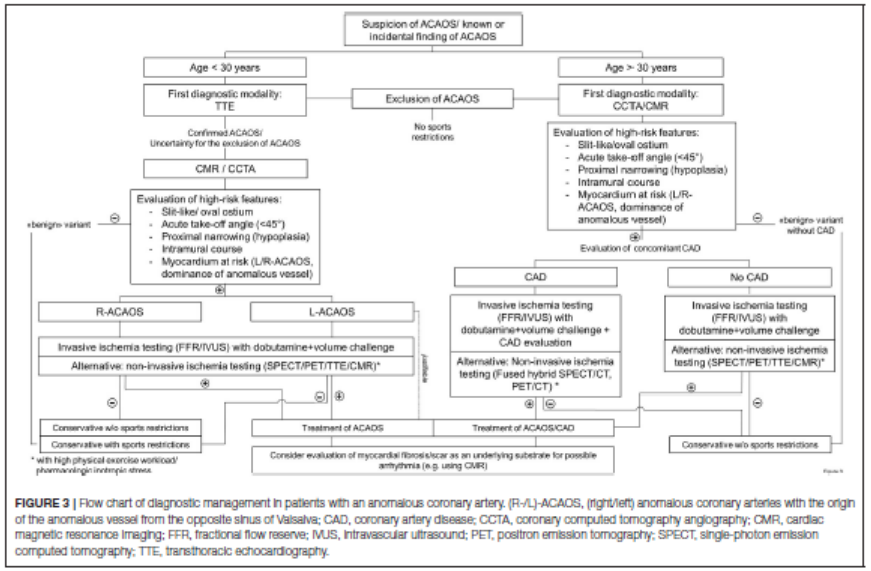


FIGURE 3 | Flow chart of diagnostic management in patients with an anomalous coronary artery. (R-/L)-ACAOS, (right/left) anomalous coronary arteries with the origin of the anomalous vessel from the opposite sinus of Valsalva; CAD, coronary artery disease; CCTA, coronary computed tomography angiography; CMR, cardiac magnetic resonance imaging; FFR, fractional flow reserve; IVUS, intravascular ultrasound; PET, positron emission tomography; SPECT, single-photon emission computed tomography; TTE, transthoracic echocardiography.

Bigler MR. et al. Front Cardiovasc Med. 2021.

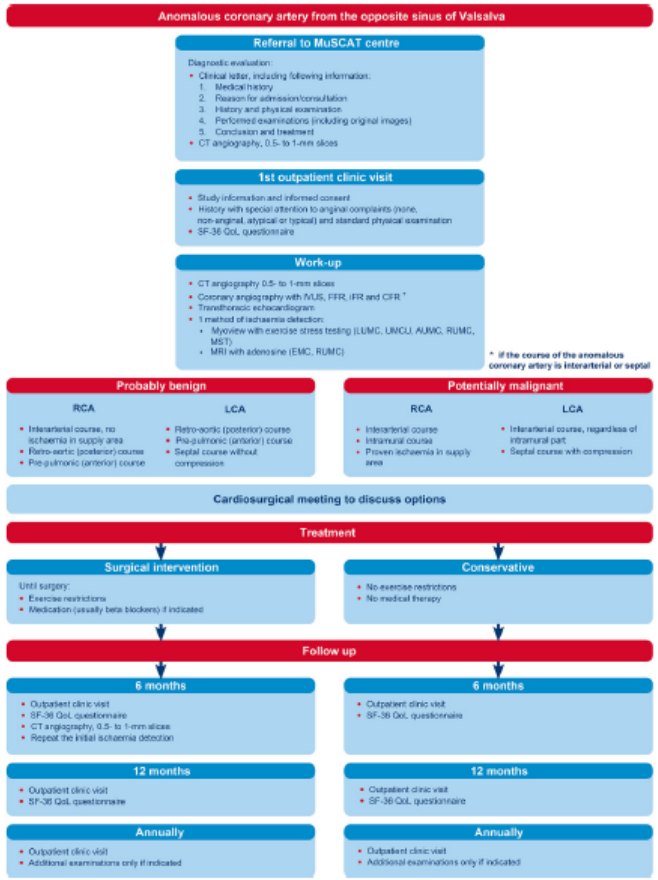


Fig. 2 Flowchart of study protocol. *IVUS* Intravascular ultrasound, *FFR* fractional flow reserve, *IFR* instantaneous wave-free ratio, *CFR* coronary flow reserve, *LUMC* Leiden University Medical Centre, *UMCU* University Medical Centre Utrecht, *AUMC* Amsterdam University Medical Centre, *EMC* Erasmus University Medical Centre, *RUMC* Radboud University Medical Centre, *MST* Medisch Spectrum Twente, *RCA* right coronary artery, *LCA* left coronary artery, *QoL* quality of life

Koppel CJ. et al. Neth Heart J. 2022.

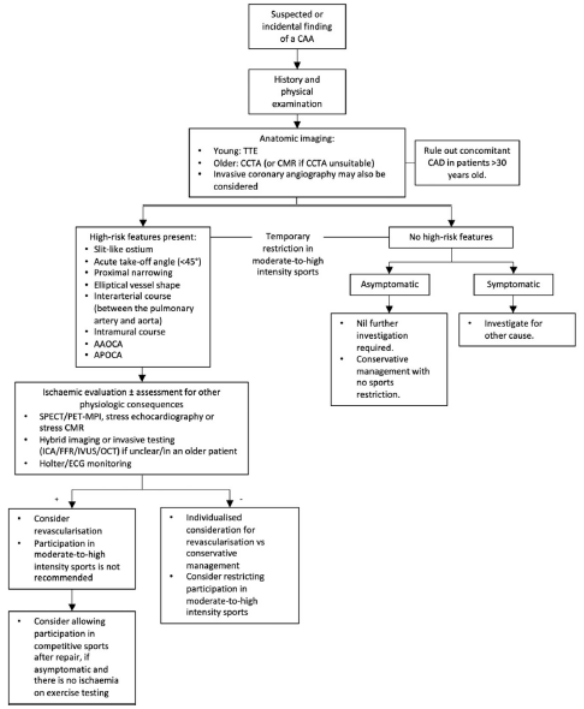


FIG 3. Proposed management algorithm for CAAs. APOCA, anomalous pulmonary origin of a coronary artery; AAOCA, anomalous aortic origin of a coronary artery; CAA, coronary artery anomaly; CAD, coronary artery disease; CCTA, coronary computed tomograpy angiography; CMR, cardiac magnetic resonance; ECG, electrocardiogram; MPI, myocardial perfusion imaging; SPECT, single-photon emission computed tomography; TTE, transthoracic echocardiogram. (Color version of figure is available online.)

Lau W. et al. Curr Probl Cardiol. 2023.

Anomalies coronaires congénitales de l'adulte

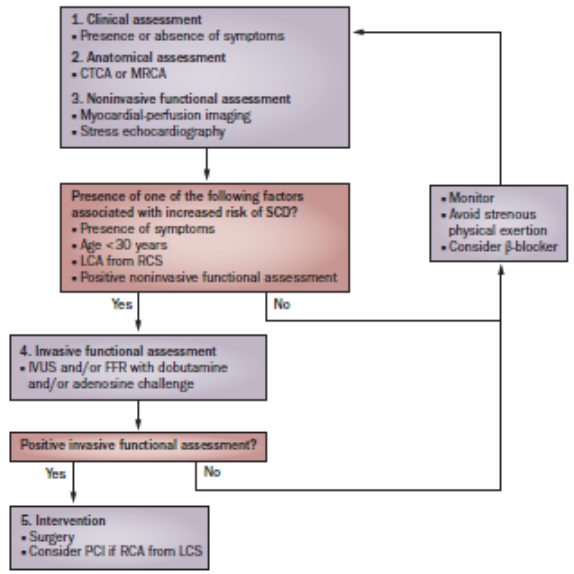


Figure 4 | Proposed algorithm for assessment and management of patients with ACAOS. Patients should be assessed for symptoms, followed by anatomical and noninvasive functional assessment of their coronary arteries. If classified as being at low risk of SCD, a conservative (medical) approach is recommended. High-risk patients should have invasive functional assessment, and those with evidence of ischemia should be discussed in a surgical and PCI multidisciplinary meeting to determine the most-appropriate mode of revascularization. Abbreviations: ACAOS, anomalous origination of a coronary artery from the opposite sinus; CTCA, CT coronary angiography; FFR, fractional flow reserve; IVUS, intravascular ultrasonography; LCA, left coronary artery; LCS, left coronary sinus; MRCA, magnetic resonance coronary angiography; PCI, percutaneous coronary intervention; RCA, right coronary artery; RCS, right coronary sinus; SCD, sudden cardiac death.

Lim JCE. et al. Nat Rev Cardiol. 2011.

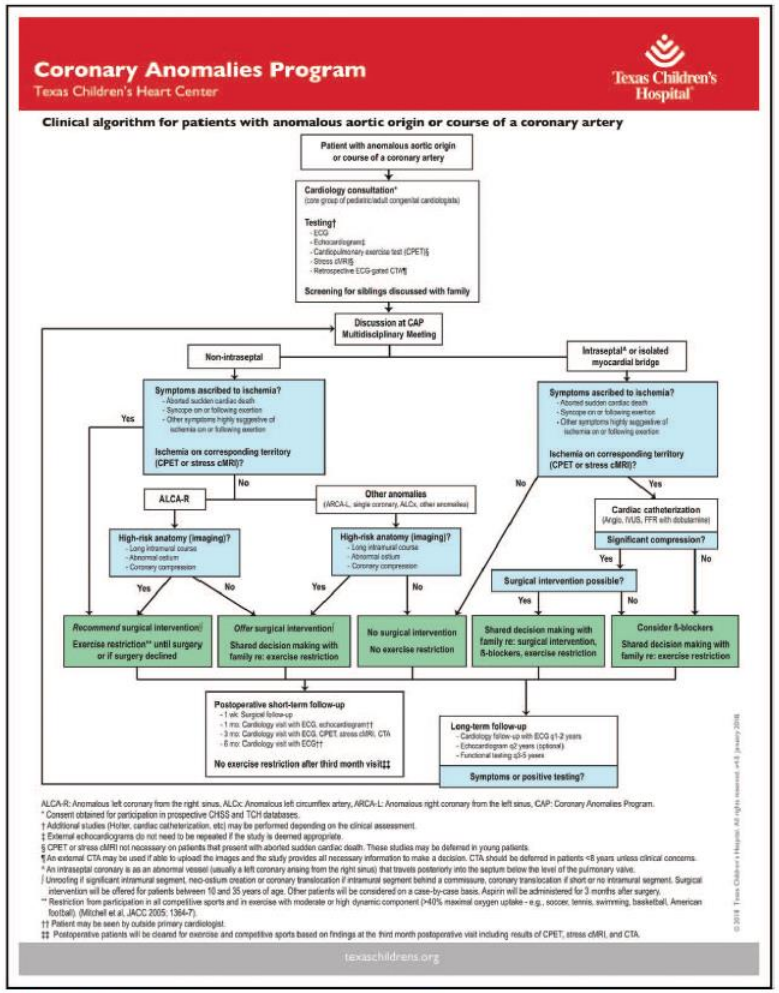
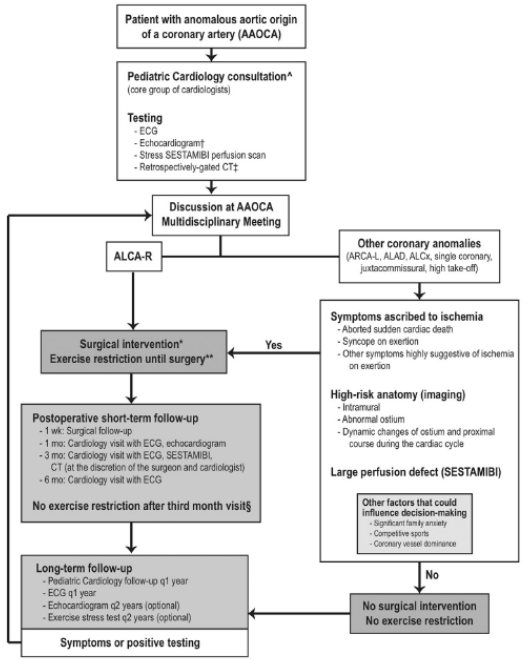


FIGURE 4. Algorithm for the evaluation and management of patients with coronary anomalies in the Coronary Anomalies Program at Texas Children's Hospital. Printed with permission from Texas Children's Hospital © 2018. Adapted from Mery *et al.* [23▪▪].

Molossi S. et al. Curr Opin Cardiol. 2019.



AAOCA: Anomalous aortic origin of a coronary artery, ALAD: Anomalous left anterior descending artery, ALCA-R: Anomalous left coronary from the right sinus, ALCx: Anomalous left circumflex artery, ARCA-L: Anomalous right coronary from the left sinus.
^ Consent obtained for participation in prospective CHSS and TCH databases on AAOCA.
† External echocardiograms do not need to be repeated if the study is deemed appropriate.
‡ An external MR or CT may be used if able to upload the images and the study provides all necessary information to make a decision.
* Unroofing if significant intramural segment, neo-ostium creation or coronary translocation if intramural segment behind a commissure, coronary translocation or ostioplasty if no intramural segment. Surgical intervention will be offered for patients between 10 and 35 years of age. Other patients will be considered on a case-by-case basis.
** Restriction from participation in all competitive sports and in exercise with moderate or high dynamic component (>40% maximal oxygen uptake - e.g., soccer, tennis, swimming, basketball, American football). (Mitchell et al, JACC 2005; 1364-7).
§ Postoperative patients will be cleared for exercise and competitive sports based on findings at the third month postoperative visit including results of SESTAMIBI and CT (if performed).

Figure 4. Clinical algorithm used by the Texas Children's Hospital coronary anomalies program to evaluate and manage patients with AAOCA. © 2013 Texas Children's Hospital (reprinted with permission).

Mery CM. et al. Semin Thoracic Surg. 2014.

Anomalies coronaires congénitales de l'adulte

Aubry P. et al. Front Cardiovasc Med. 2021.

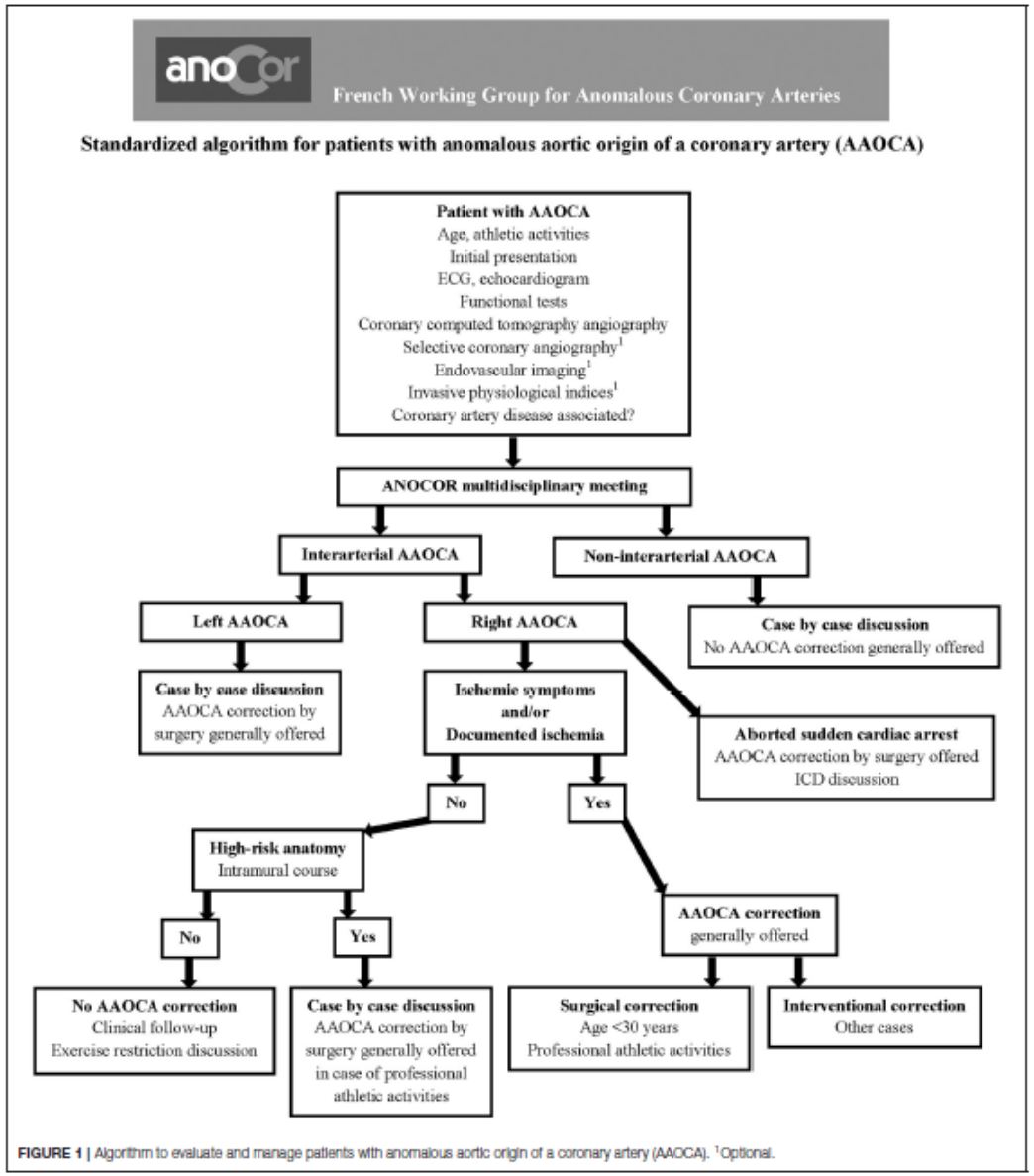
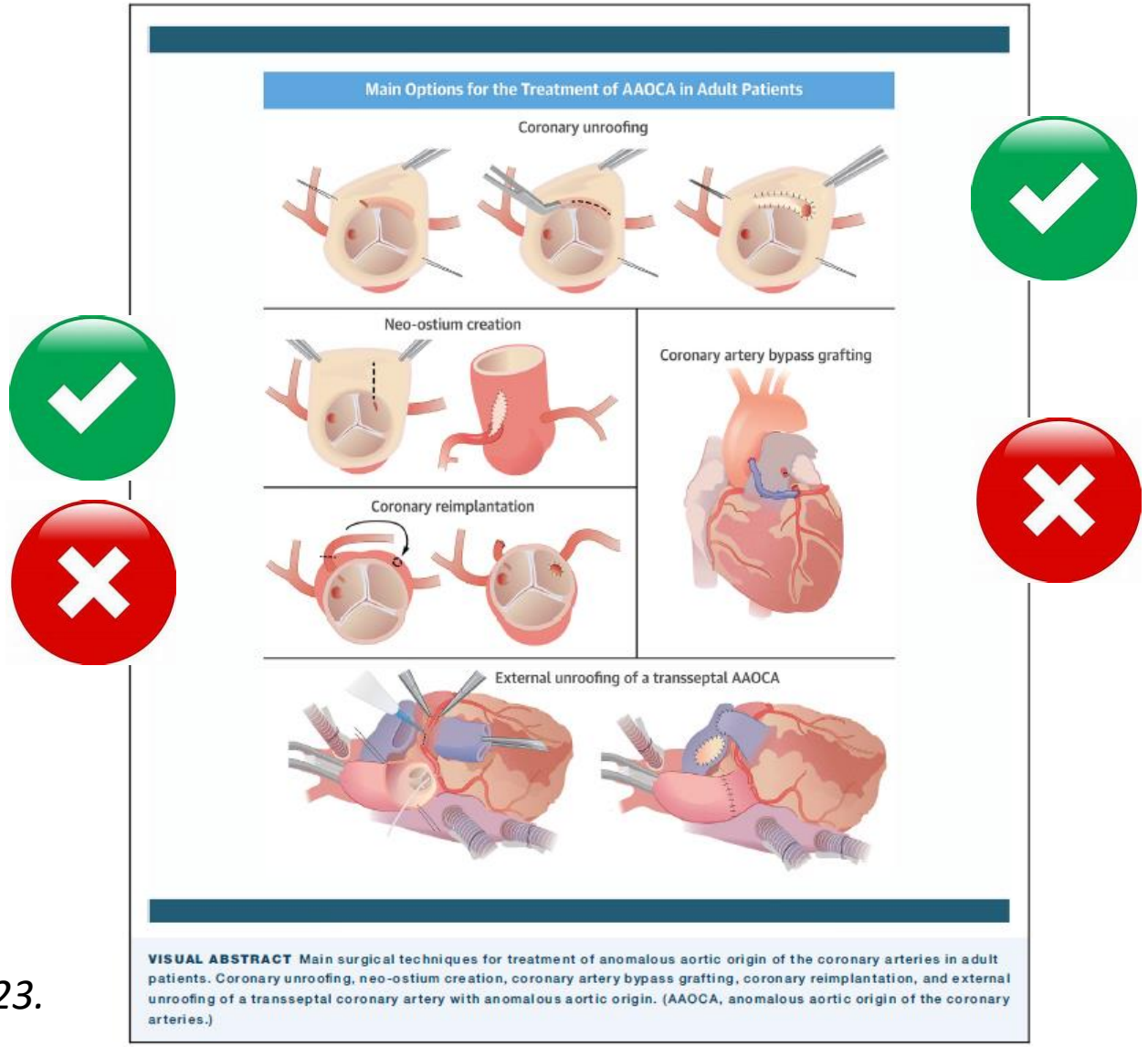


FIGURE 1 | Algorithm to evaluate and manage patients with anomalous aortic origin of a coronary artery (AAOCA). [1]Optional.

- Embryologie et anatomie
- Classification
- Prévalence
- Imagerie
- Ischémie myocardique
- Mort subite
- Screening
- Prise en charge
- **Chirurgie**
- Angioplastie
- Activités sportives

Chirurgie

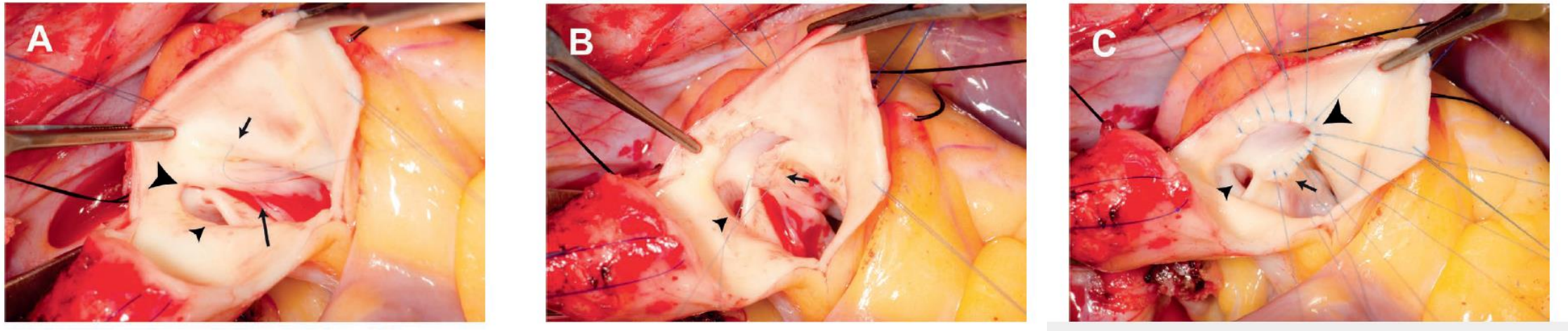


VISUAL ABSTRACT Main surgical techniques for treatment of anomalous aortic origin of the coronary arteries in adult patients. Coronary unroofing, neo-ostium creation, coronary artery bypass grafting, coronary reimplantation, and external unroofing of a transseptal coronary artery with anomalous aortic origin. (AAOCA, anomalous aortic origin of the coronary arteries.)

Gaudino M. et al. Ann Thorac Surg. 2023.

Chirurgie

Unroofing technique

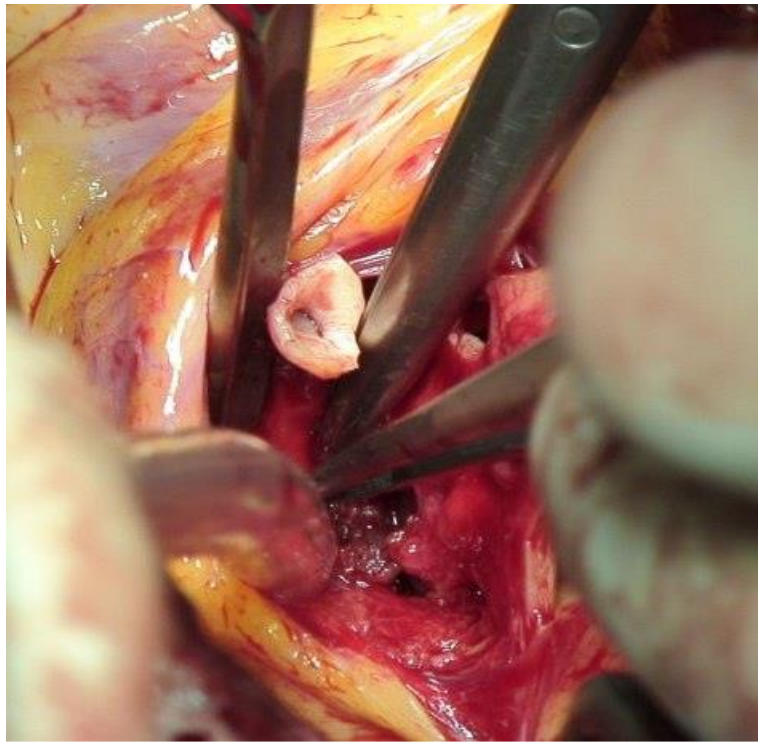


Molossi S. et al. MD Cardiovasc J. 2019.

Chirurgie

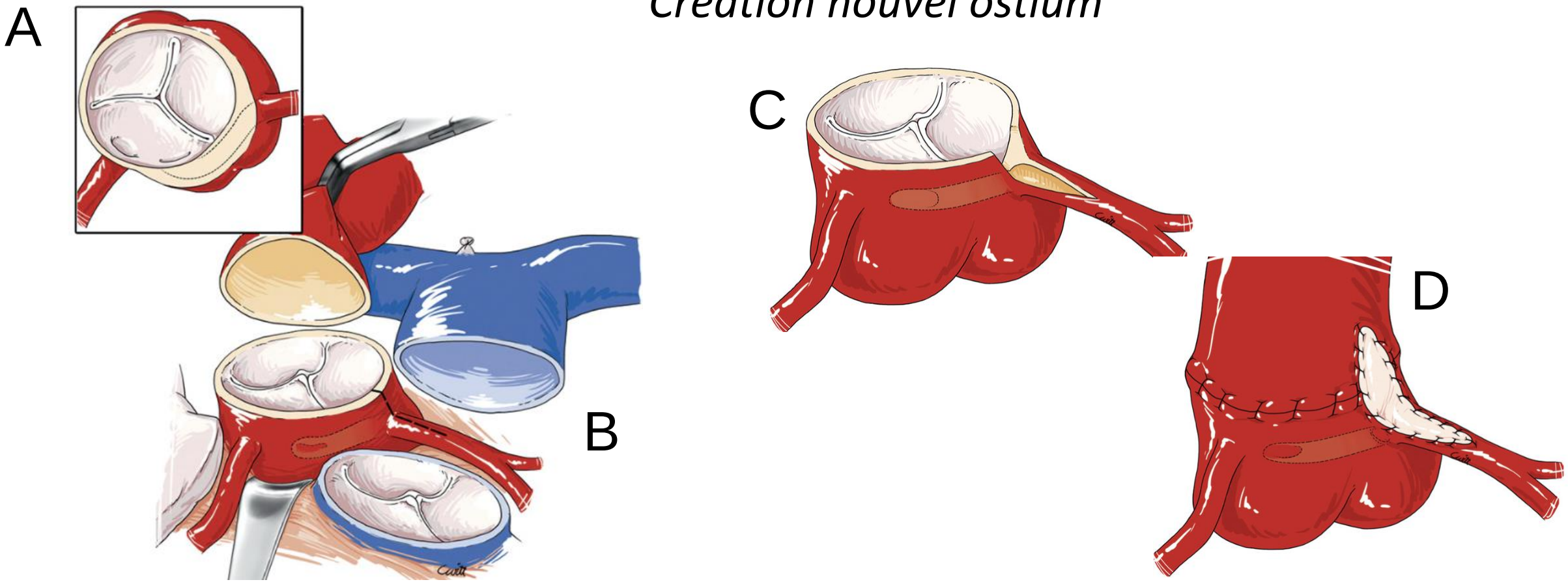
Réimplantation coronaire

Pas adapté



Chirurgie

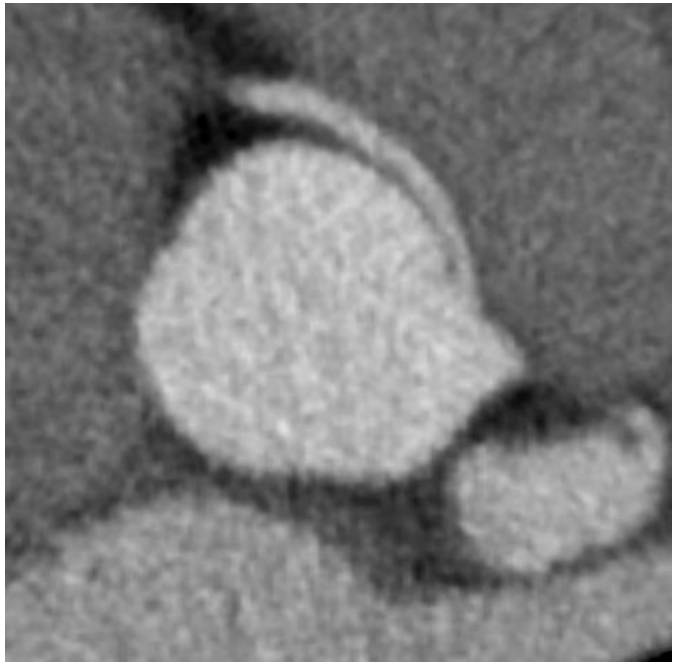
Création nouvel ostium

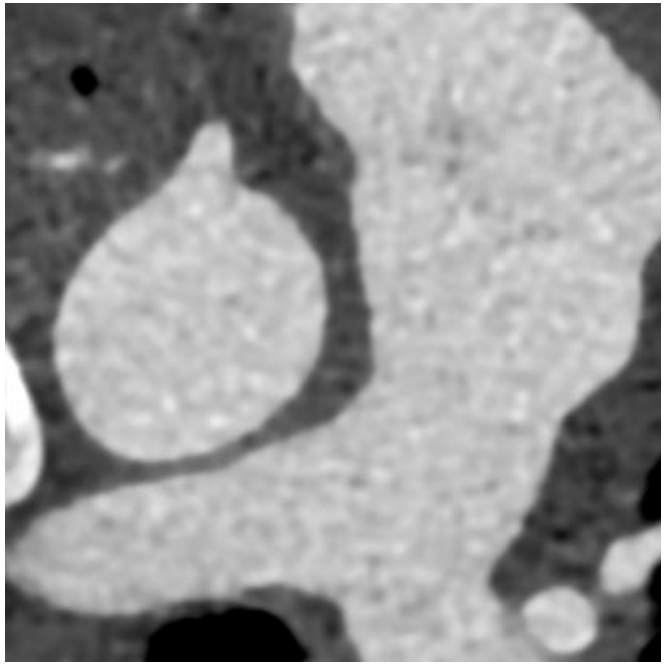


Vouhé P. Bulletin Académie Nationale Médecine. 2014.

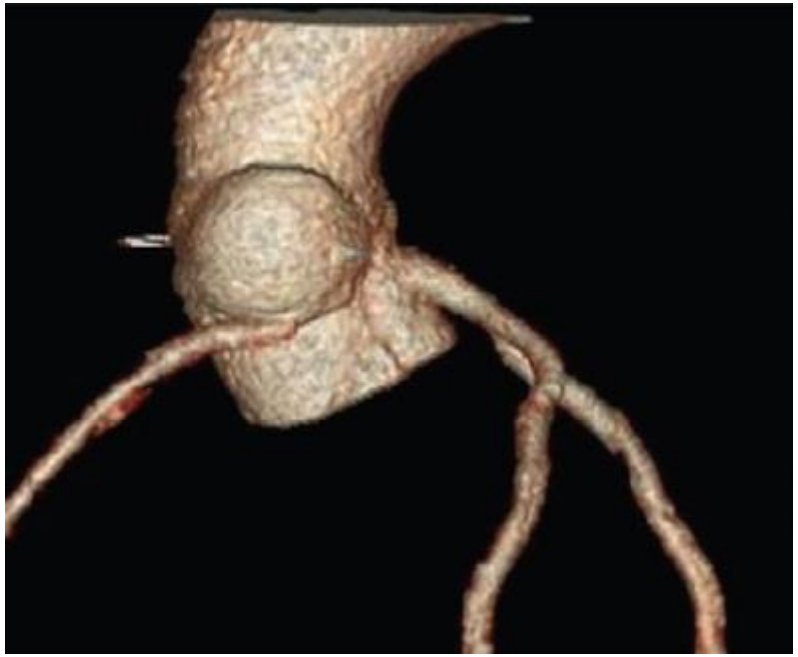
Chirurgie

Création néo-ostium





1 year after surgery



Lalombarda F. et al. Eur Heart J CV Imag. 2014.

Chirurgie

MCO par diagnostic ou acte
Année: 2022
Catégorie d'établissement: Etablissements Publics et Privés
Type de code: Actes classants en CCAM

Répartition par GHM des séjours selon l'acte classant codé

DDEA001 : Réimplantation d'une artère coronaire pour anomalie congénitale d'origine, par thoracotomie avec CEC

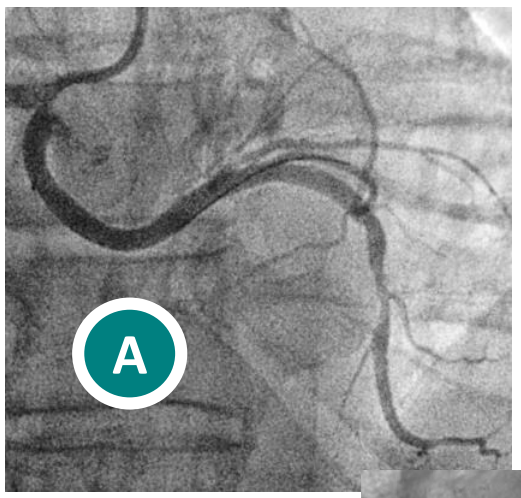
CMD	GHM	Libellé	Effectif	DMS
05	05C062	Autres interventions cardiothoraciques, âge supérieur à 1 an, ou vasculaires quel que soit l'âge, avec circulation extracorporelle, niveau 2	30	8,30
		Total	58	

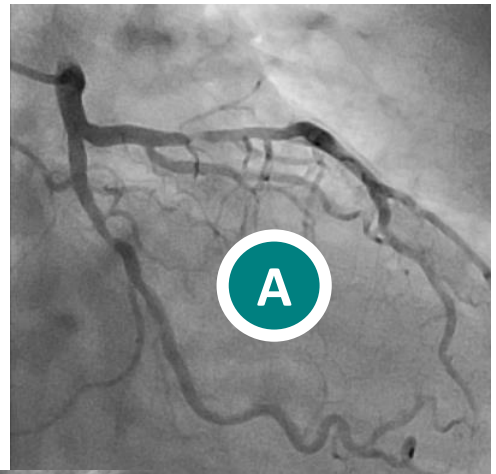
Anomalies de connexion coronaire et chirurgie

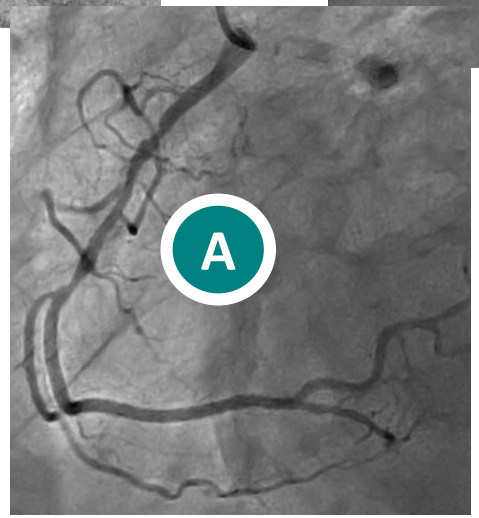
- Recommandations : souvent ciblées sur une population jeune
- Décisions thérapeutiques : indiquées sans tenir compte de l'âge
- Etudes randomisées contrôlées : aucune
- Histoire naturelle et corrigée : mal connue à long terme
- Effet sur le risque de mort subite : ?
- Correction chirurgicale : techniques spécialisées
- Echecs : thrombose précoce, sténose cicatricielle, anévrisme

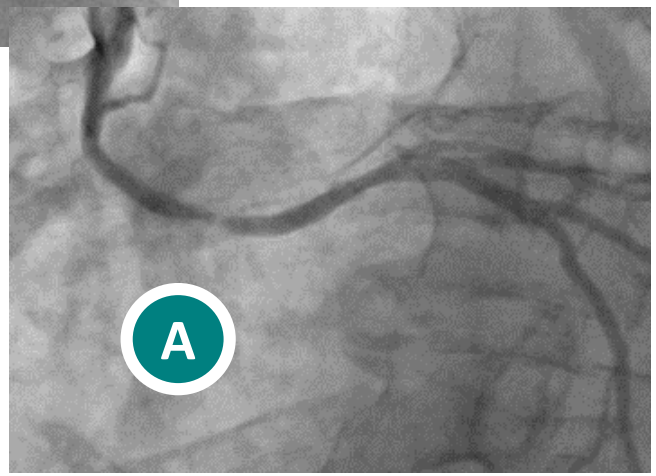
- Embryologie et anatomie
- Classification
- Prévalence
- Imagerie
- Ischémie myocardique
- Mort subite
- Screening
- Prise en charge
- Chirurgie
- **Angioplastie**
- Activités sportives

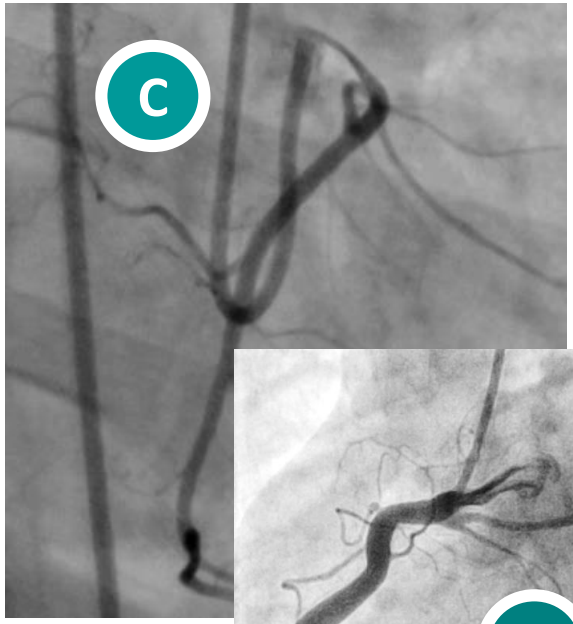
Sténoses acquises/Sténoses congénitales

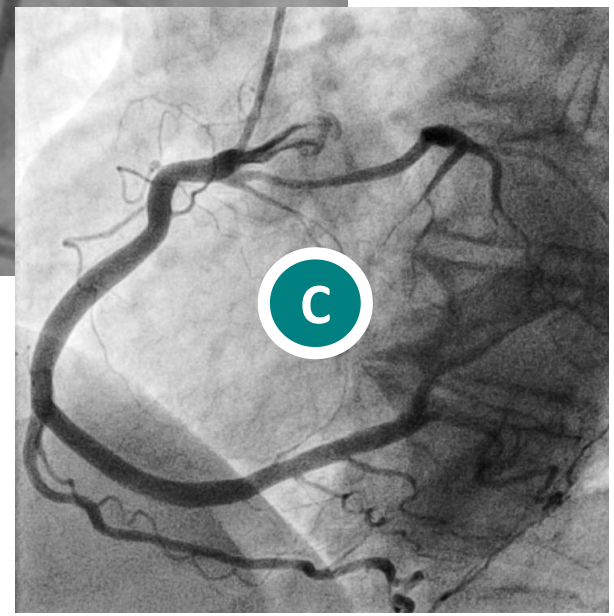




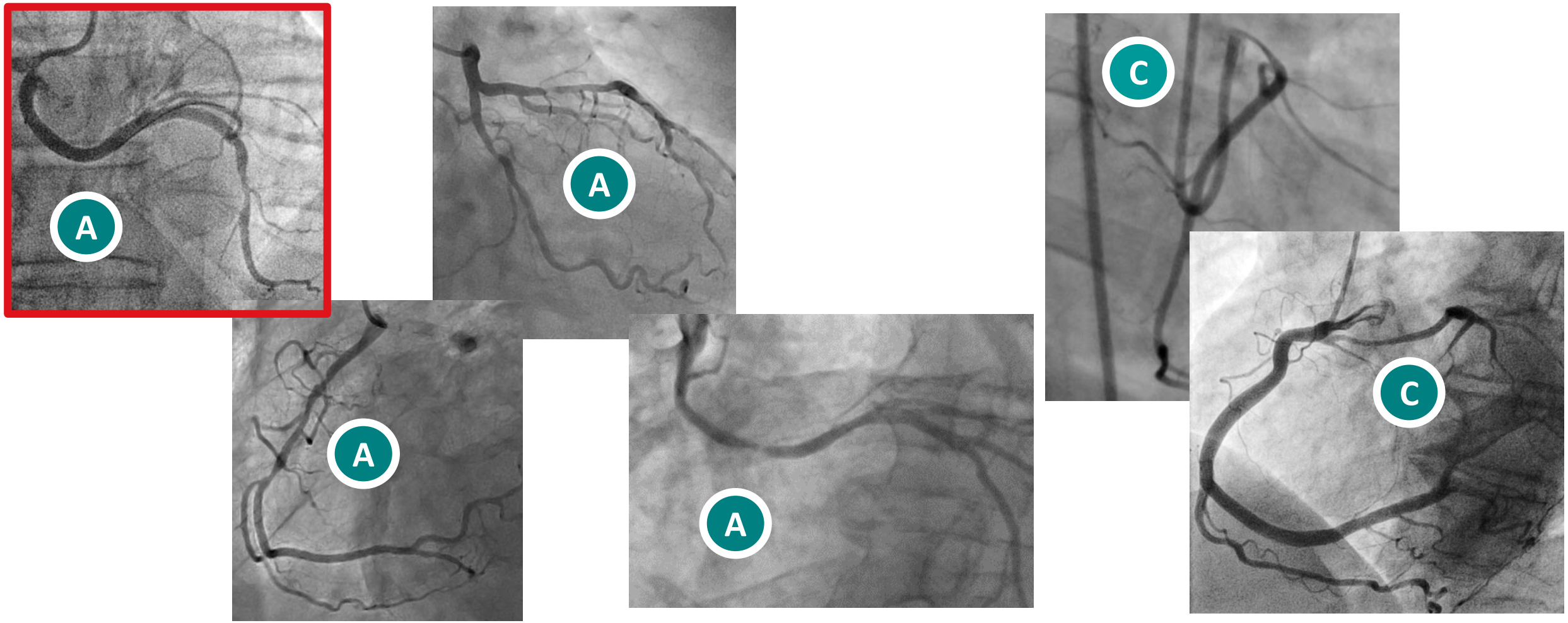








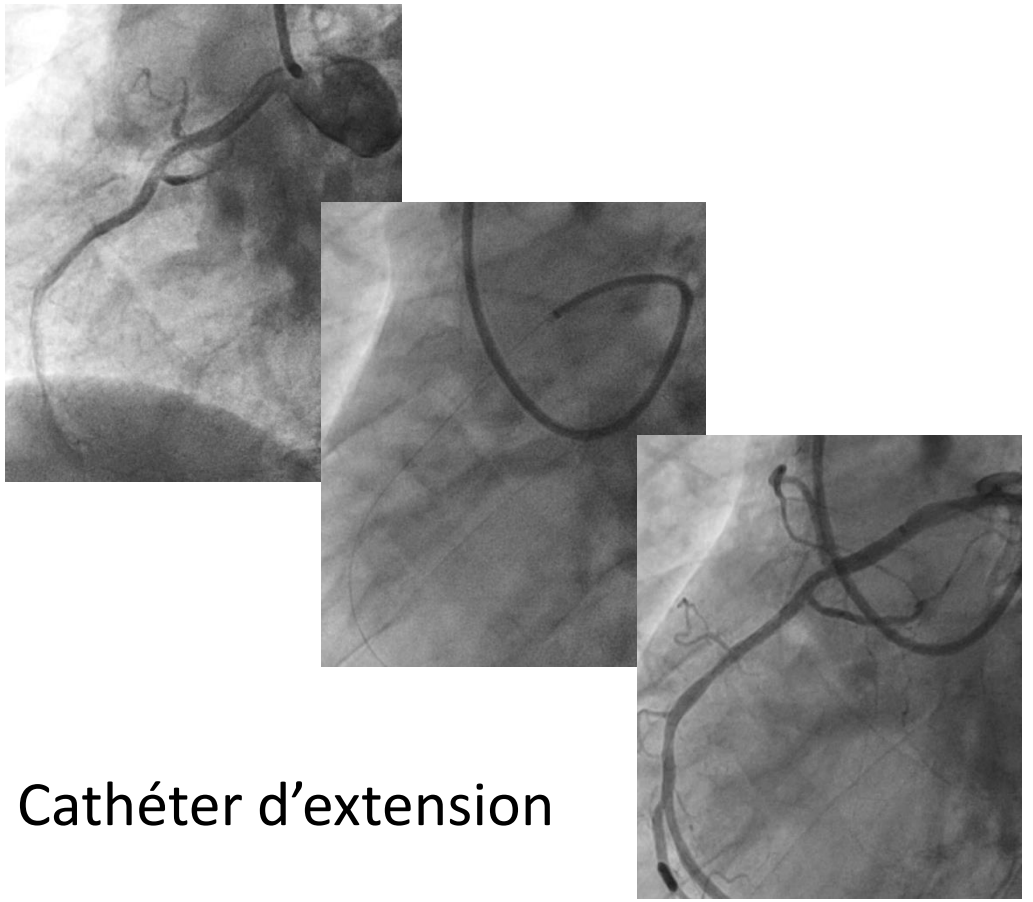
Sténoses acquises/Sténoses congénitales



Sténoses acquises distales

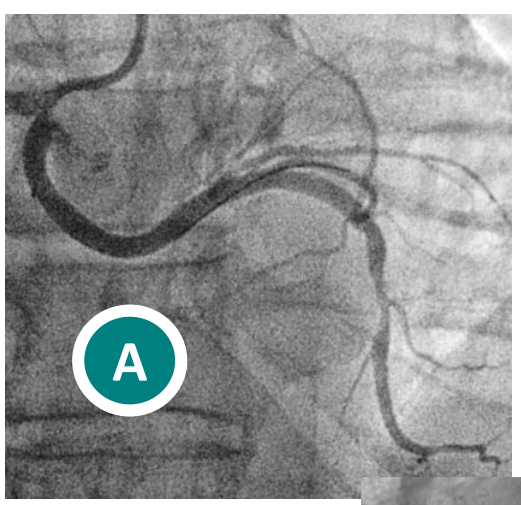
Techniques de cathétérisme pour angioplasties complexes

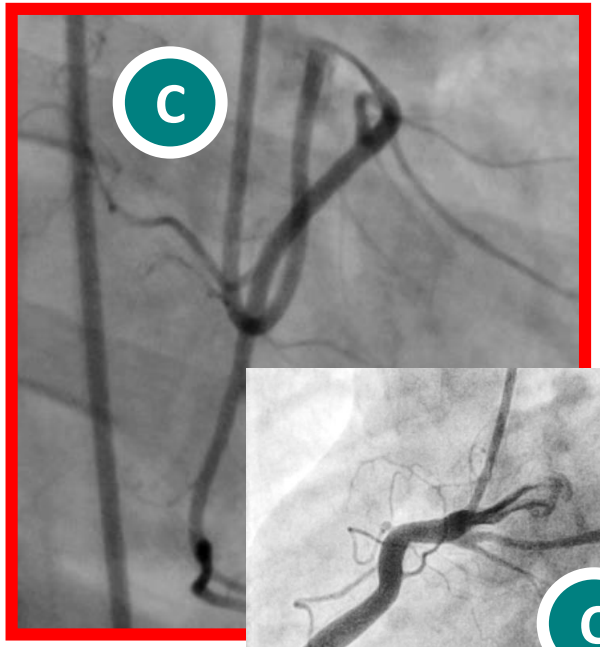
Double guide

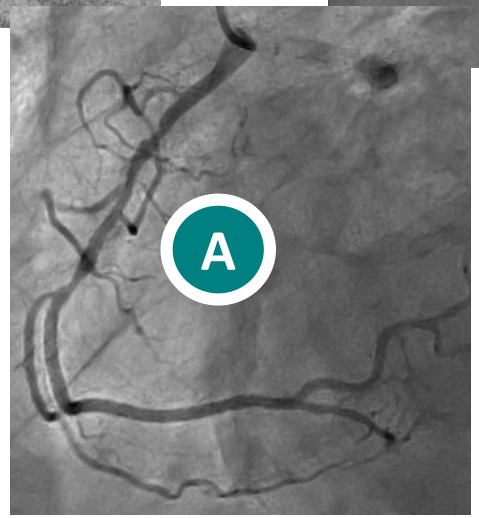


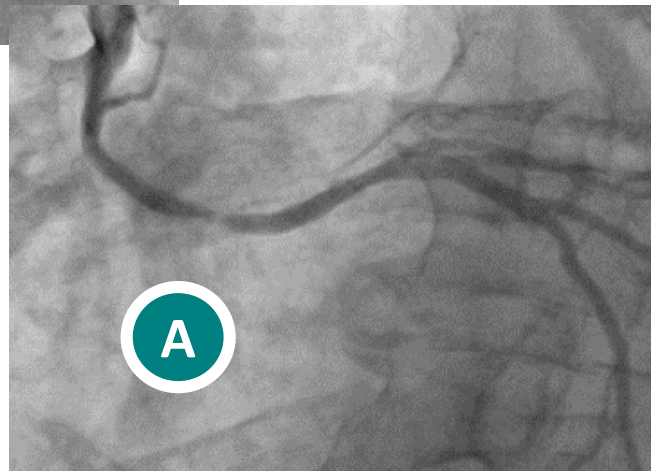
Cathéter d'extension

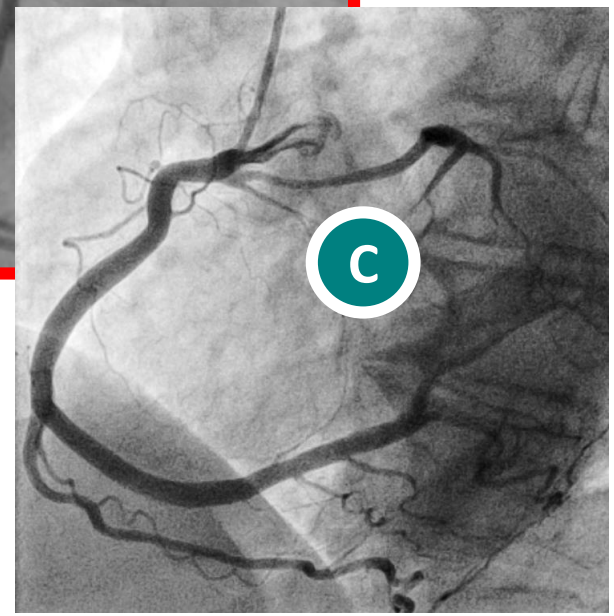
Sténoses acquises/Sténoses congénitales











http://dx.doi.org/10.1016/j.jtcvs.2016.06.066

Expert consensus guidelines: Anomalous aortic origin of a coronary artery

Julie A. Brothers, MD,[a] Michele A. Frommelt, MD,[b] Robert D. B. Jaquiss, MD,[c] Robert J. Myerburg, MD,[d] Charles D. Fraser, Jr, MD,[e] and James S. Tweddell, MD[f]

Percutaneous Coronary Intervention

Due to safety issues with stenting anomalous coronary arteries in growing children, this procedure is not advisable in the pediatric population, **but may be considered in select cases in the adult population**.

J Thorac Cardiovasc Surg 2017;153:1440-57

Anomalous connections of coronary artery and PCI

Six-Month Success of Intracoronary Stenting for Anomalous Coronary Arteries Associated With Myocardial Ischemia

Doorey AJ. et al. Am J Cardiol. 2000.

N=14

Origin of the Right Coronary Artery from the Opposite Sinus of Valsalva in Adults: Characterization by Intravascular Ultrasonography at Baseline and After Stent Angioplasty

Angelini P. et al. Cathet Cardio Interv. 2015.

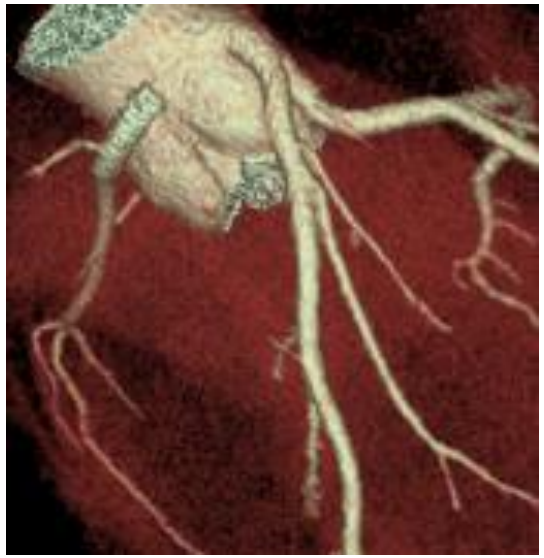
N=42

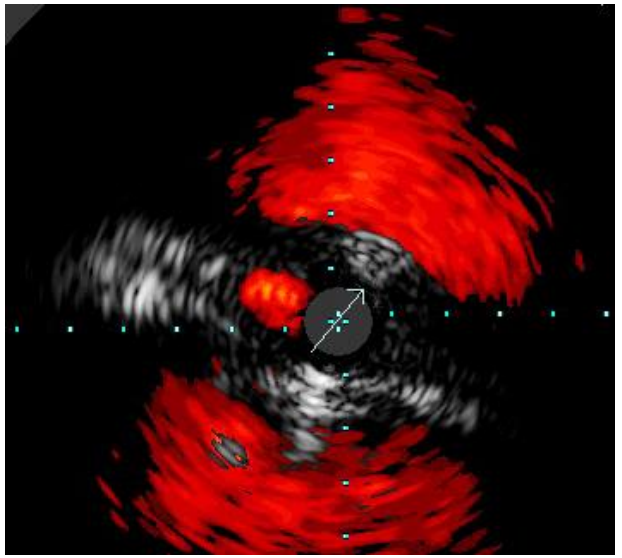
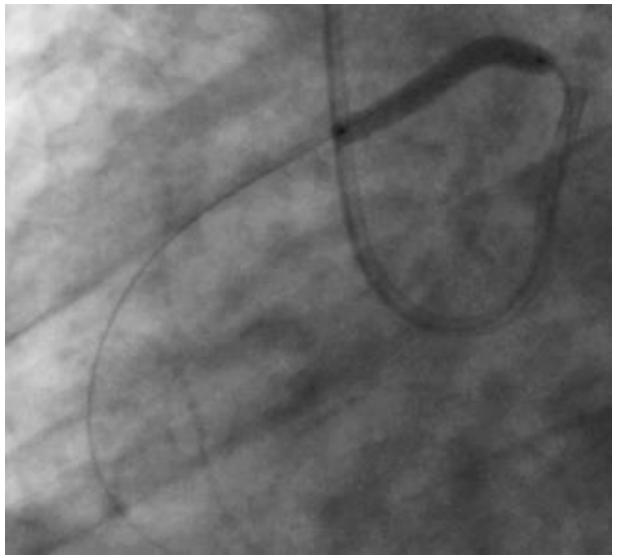
Place of Angioplasty for Coronary Artery Anomalies With Interarterial Course

Aubry P. et al. FCVM. 2021.

N=17

Angioplastie coronaire droite ectopique



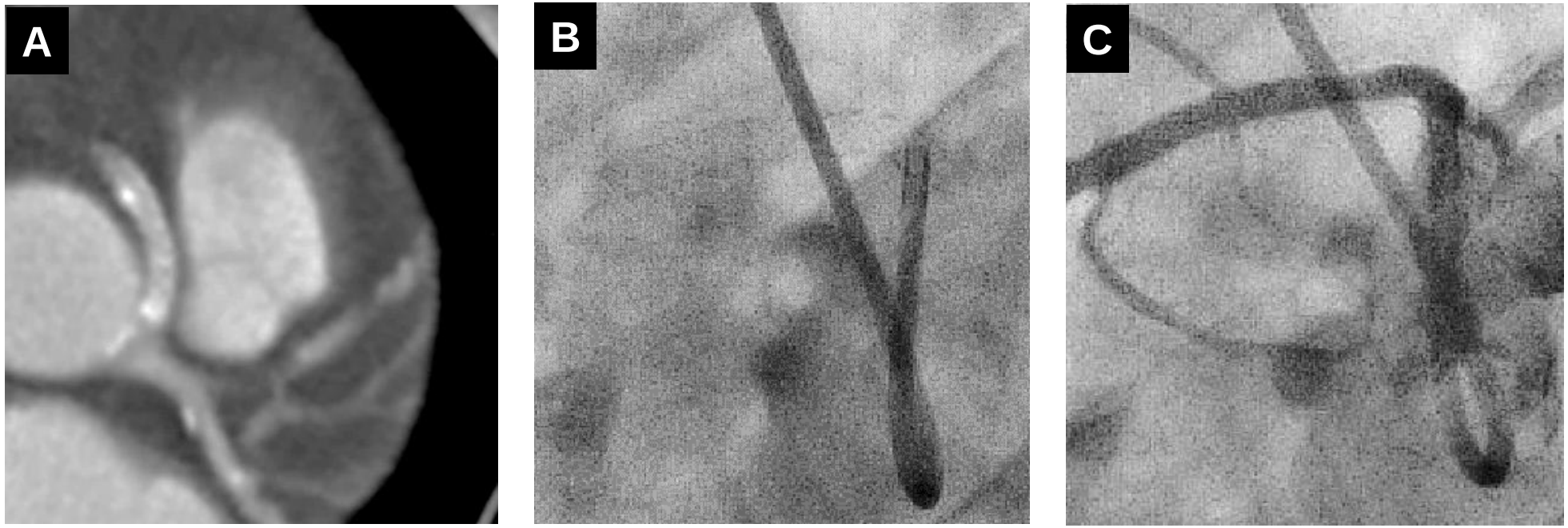



Est-ce possible ?

Est-ce risqué ?

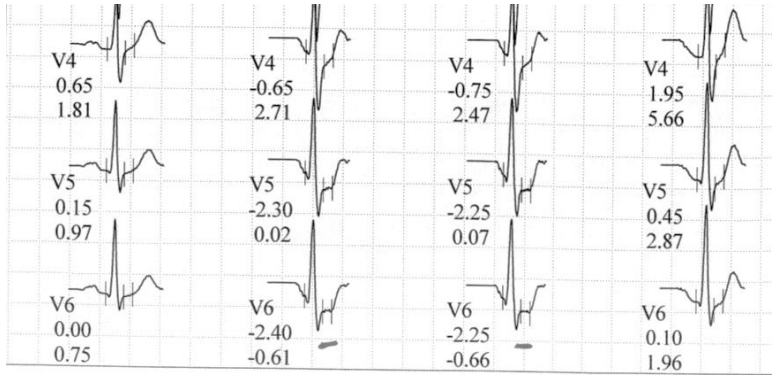
# ANOCOR stenting registry
n = 36 (2014-2023)

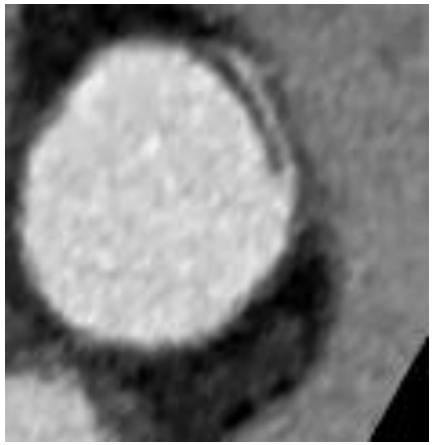
24-month follow up



ANOCOR stenting registry
n = 36 (2014-2023)

- 64-year old man
- Intensive sport activities (biking >100 km)
- Dizziness during exercice following by syncope
- Exercice stress test: asymptomatic (250 watts), positif ECG
- CTCA: right coronary AAOCA





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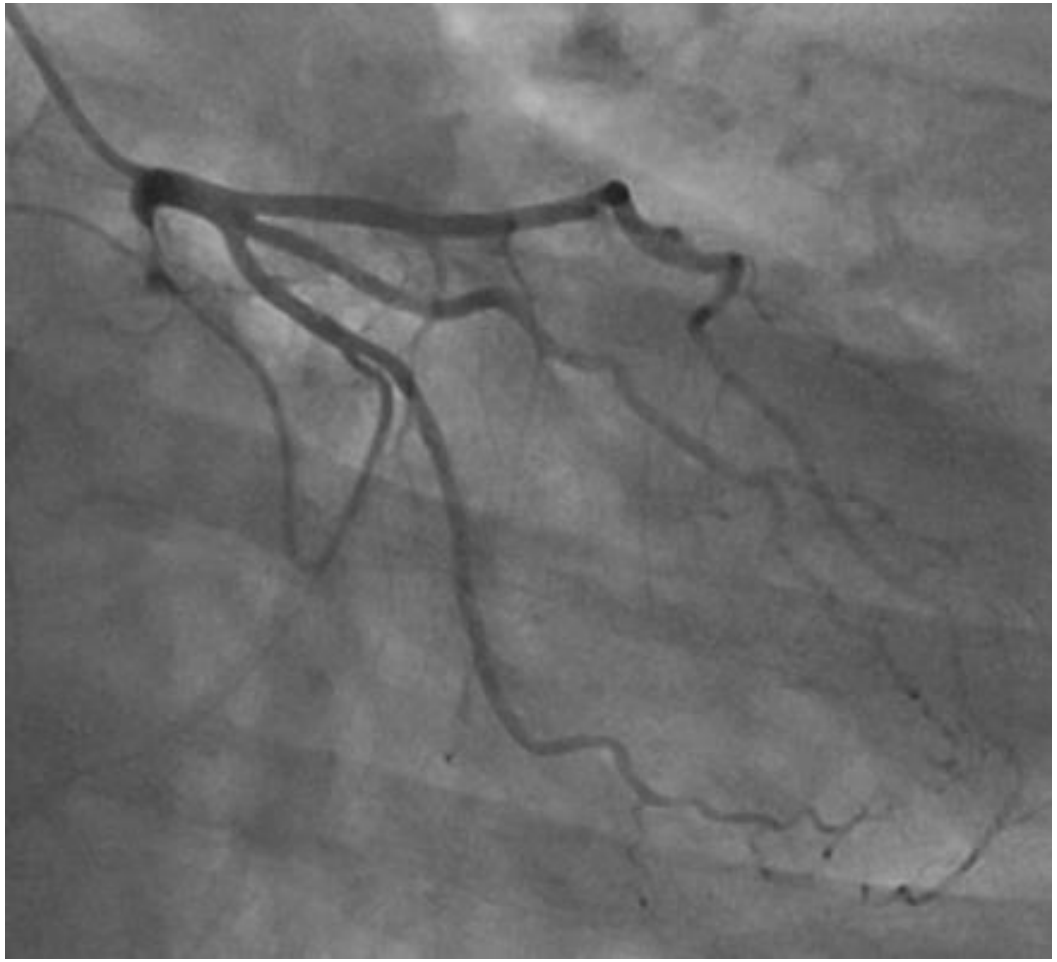

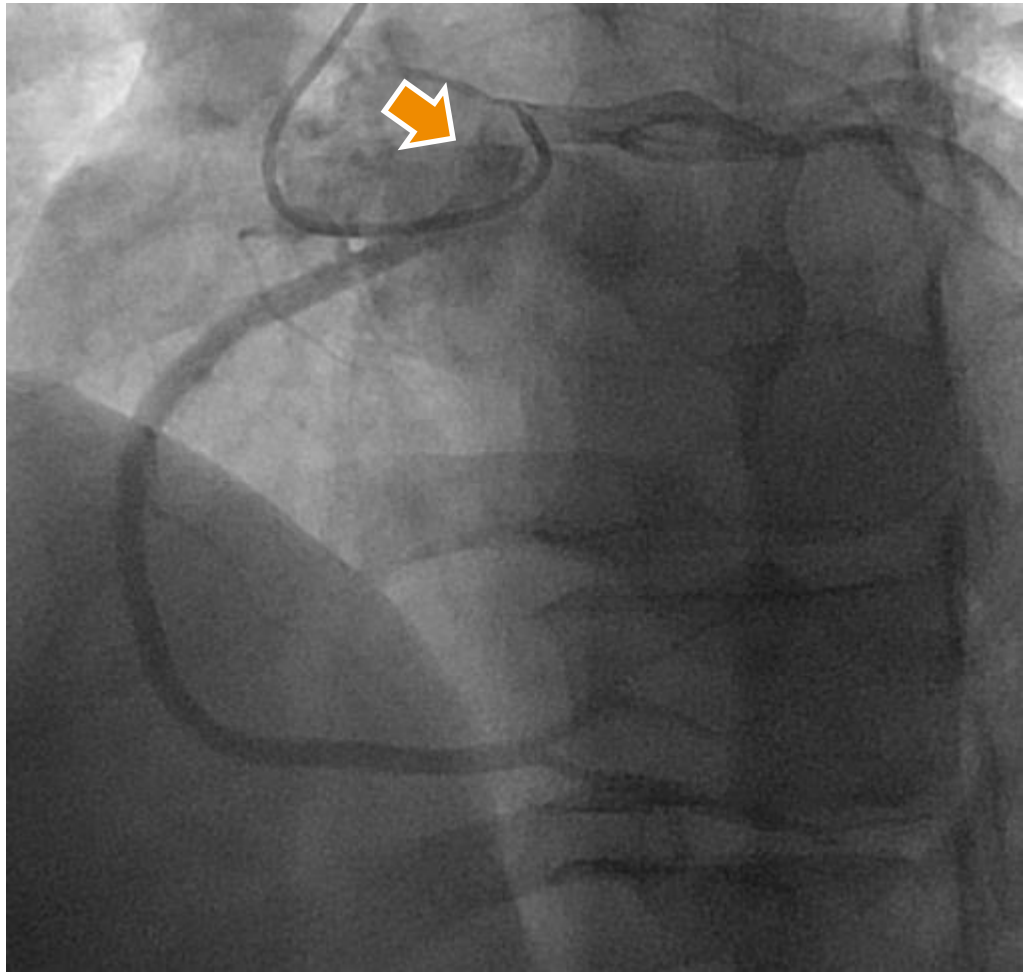

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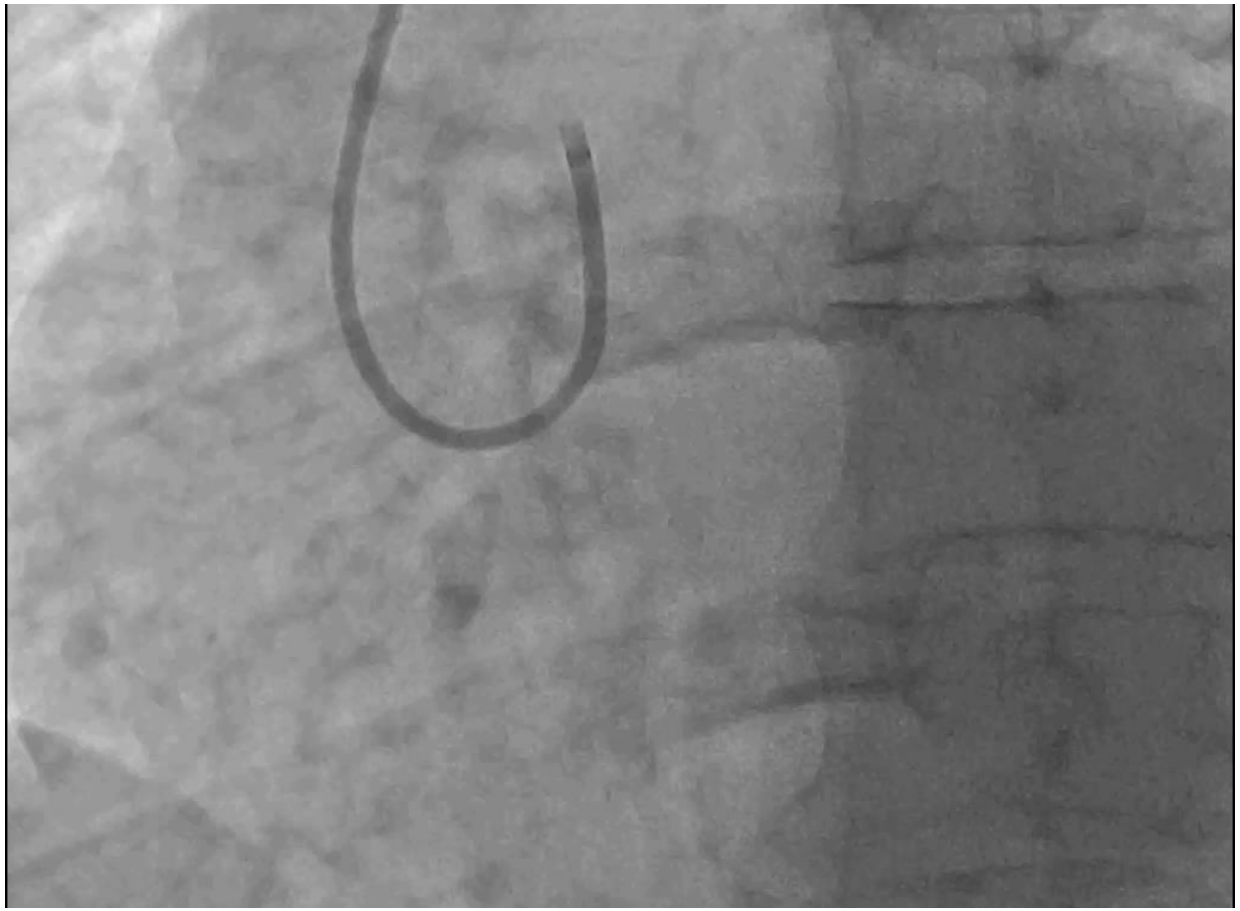

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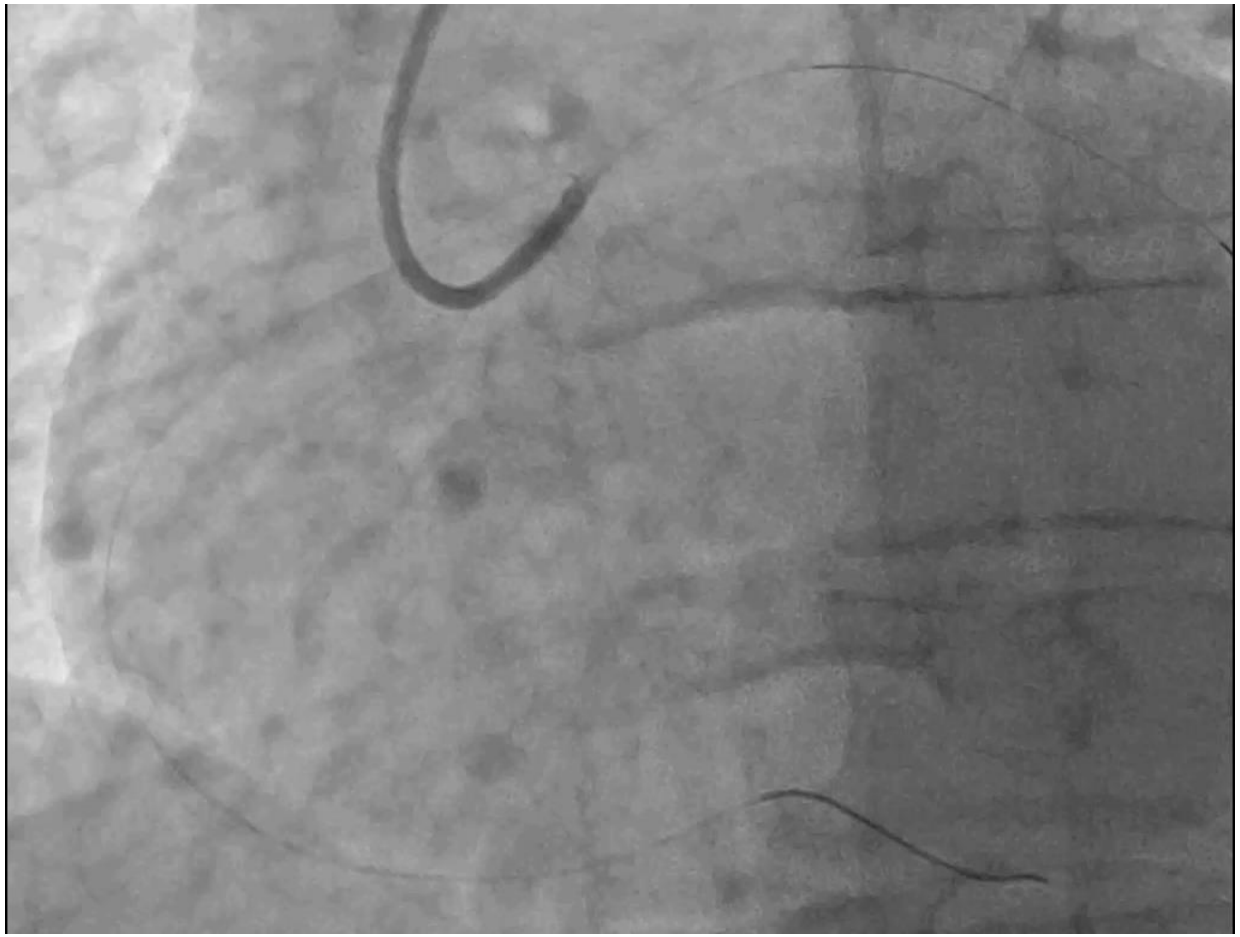

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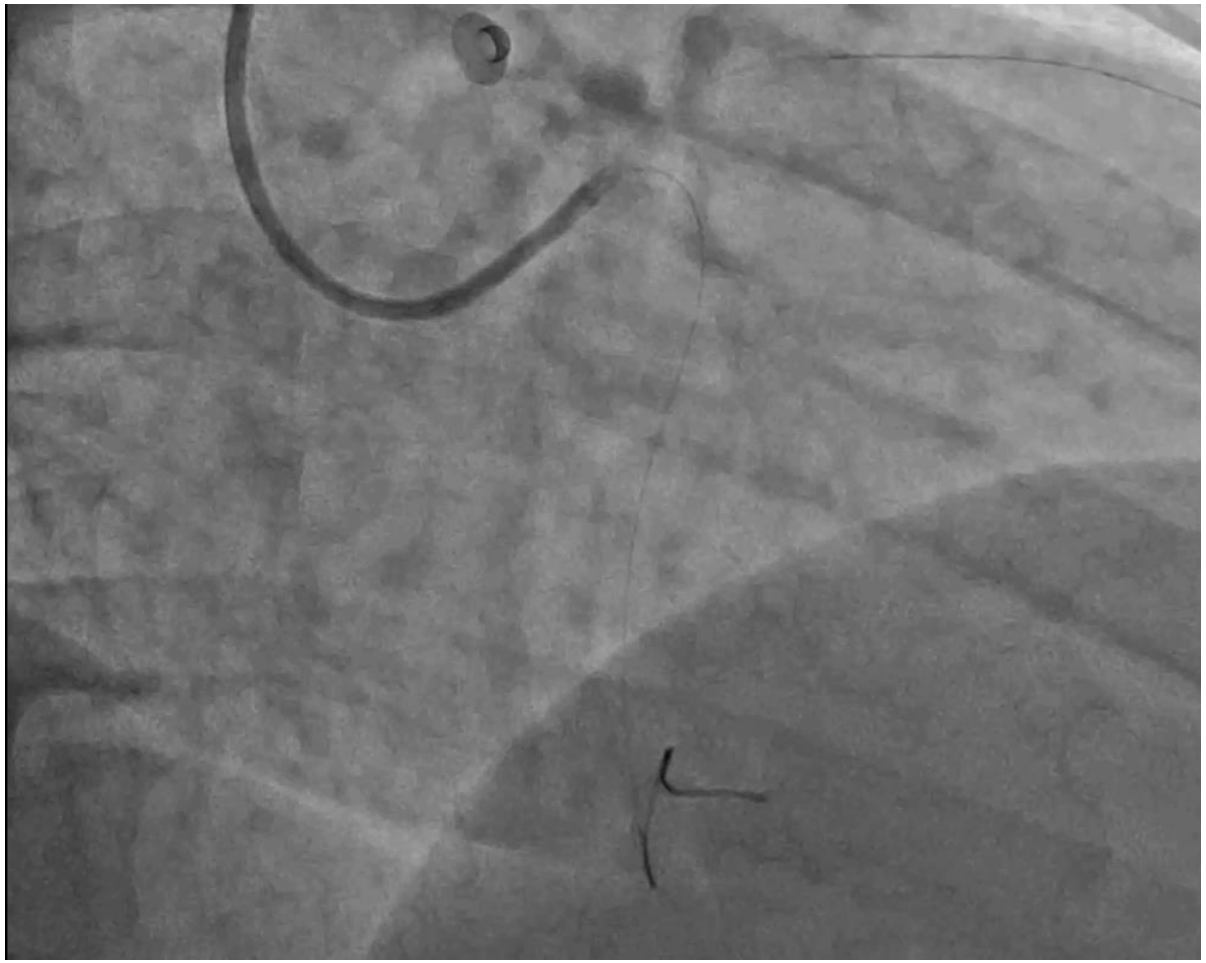
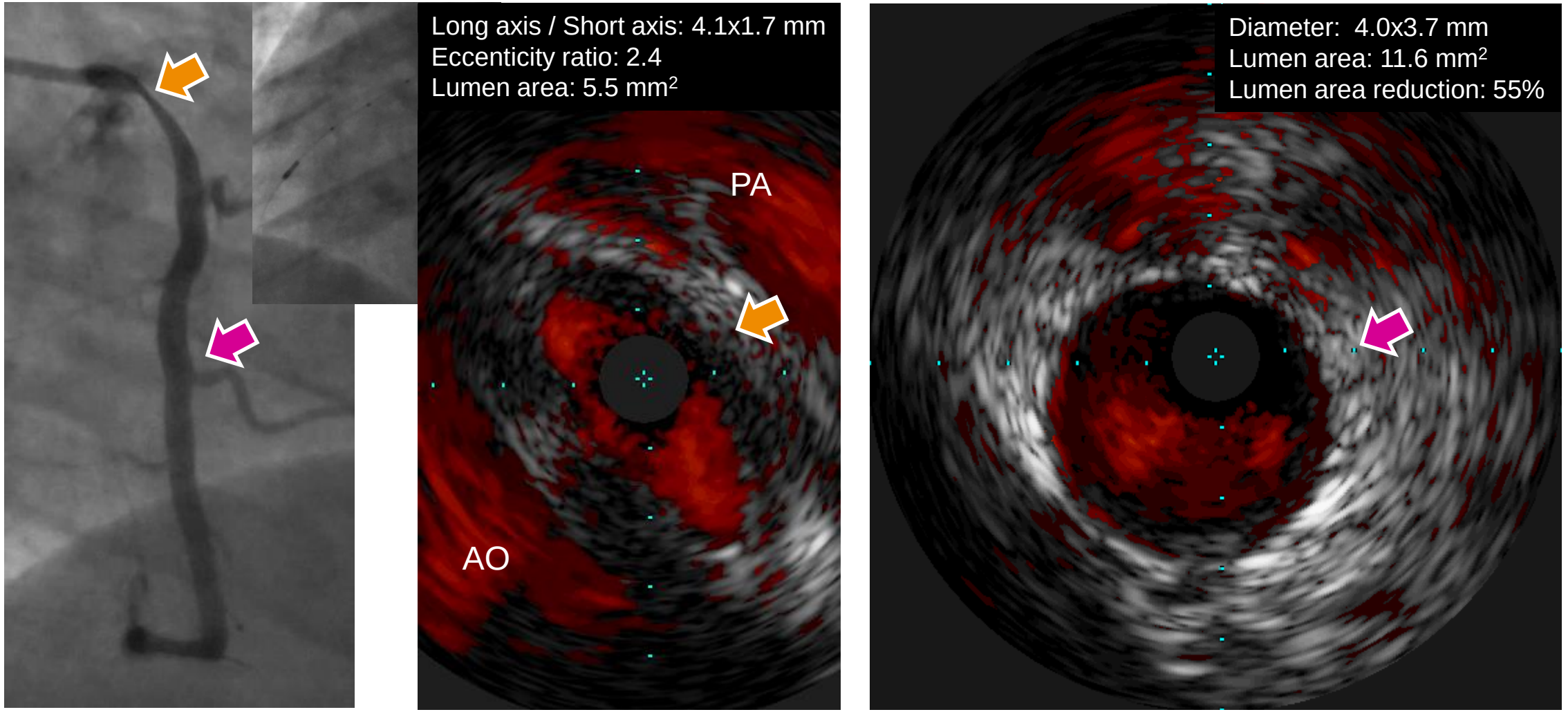


Angiography and IVUS



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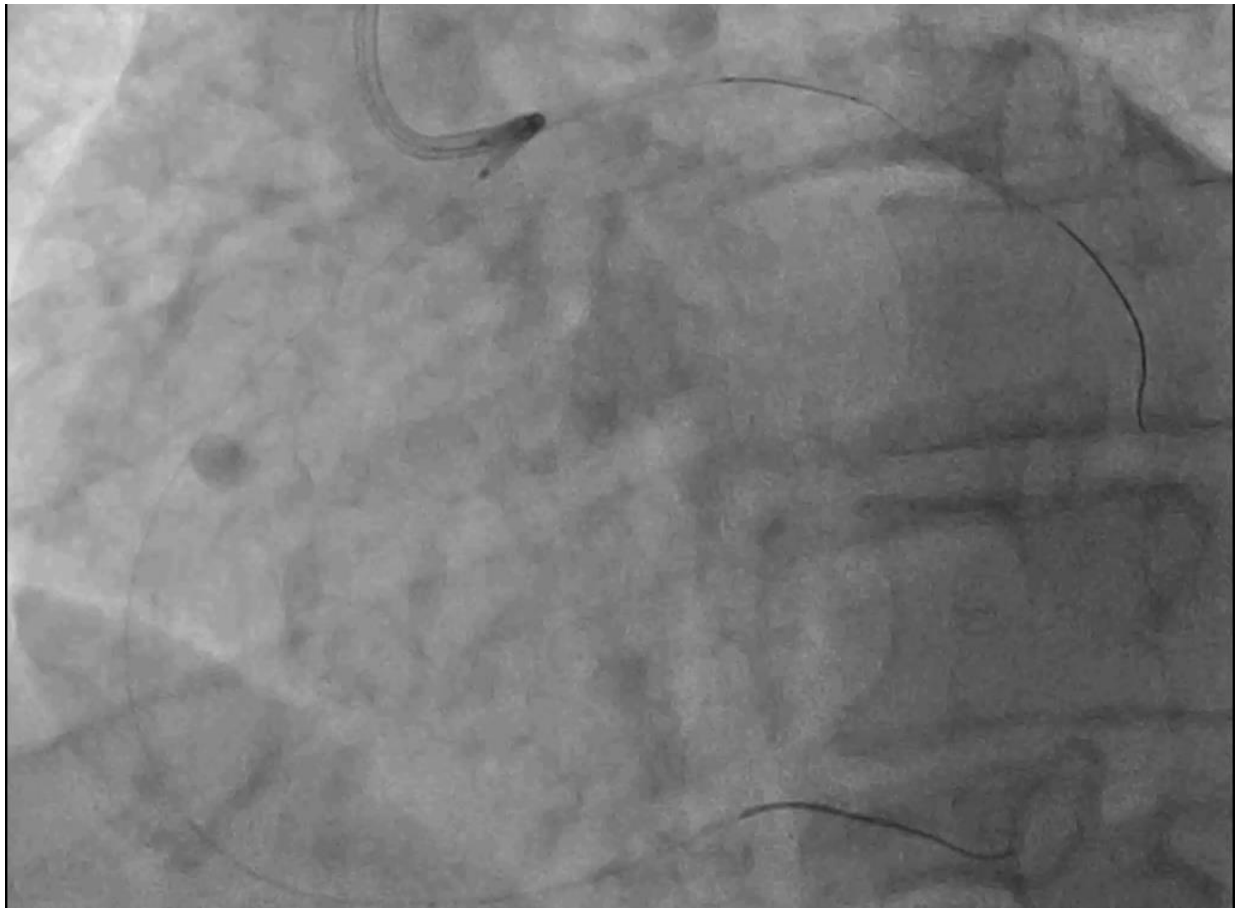
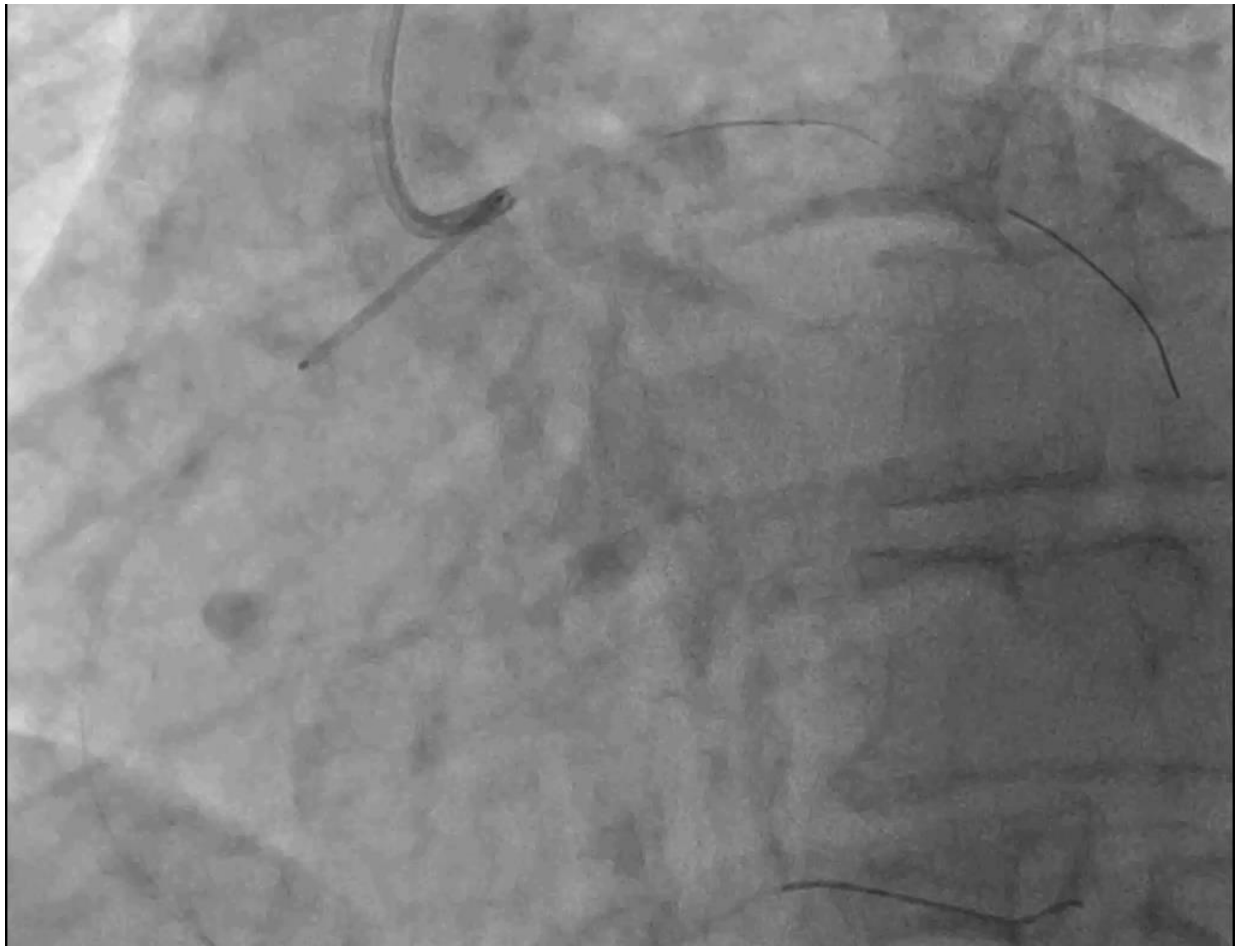


PCI



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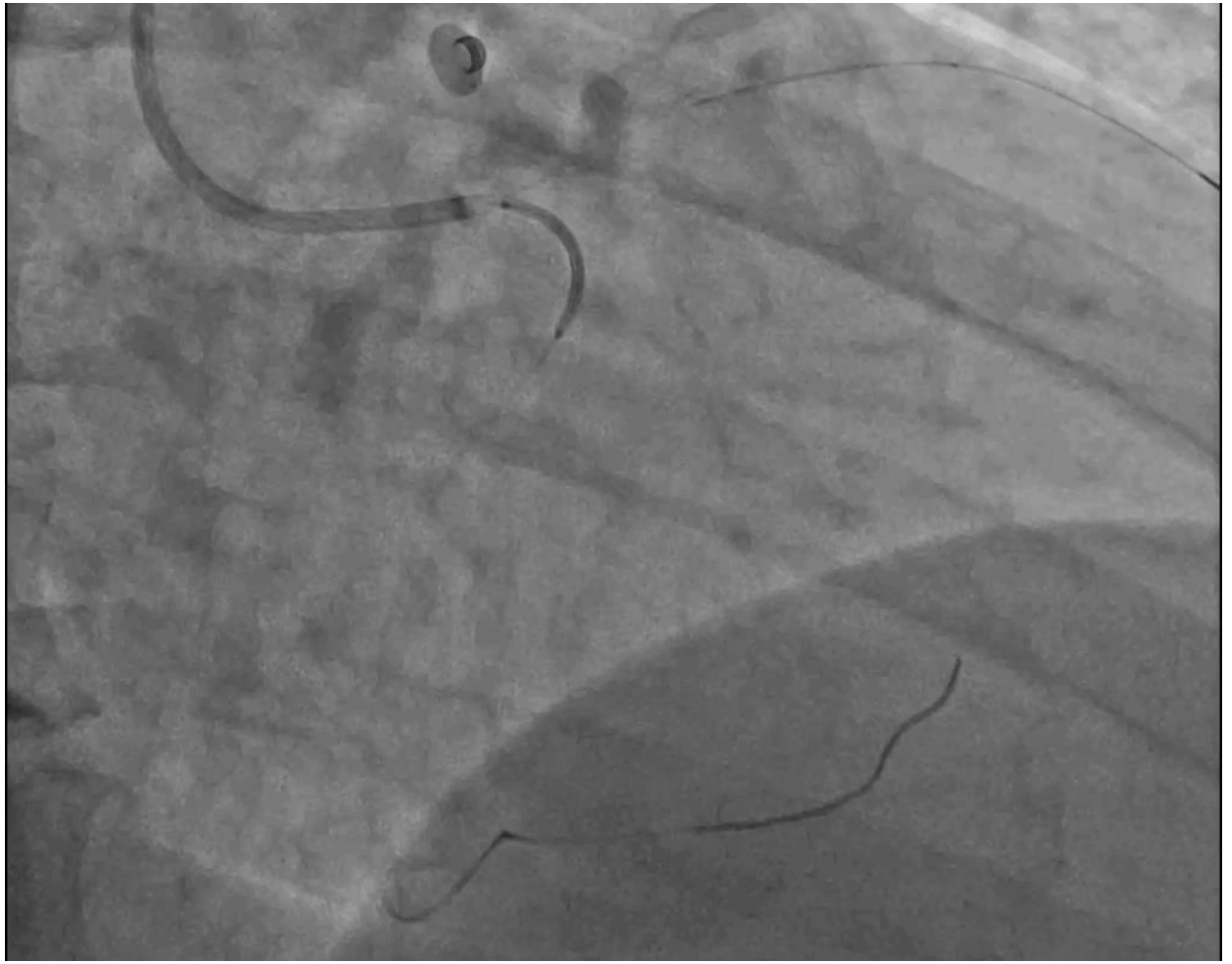

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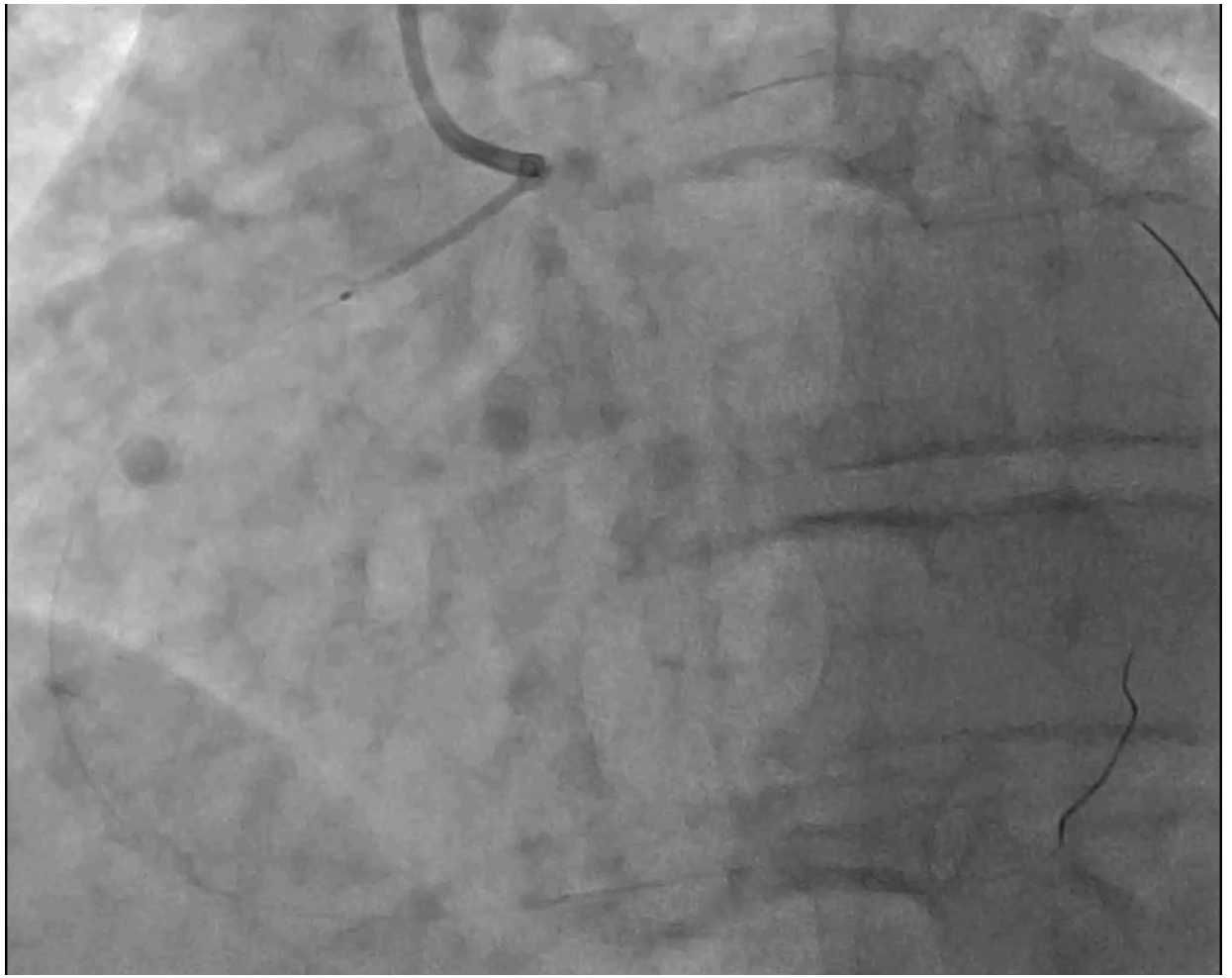
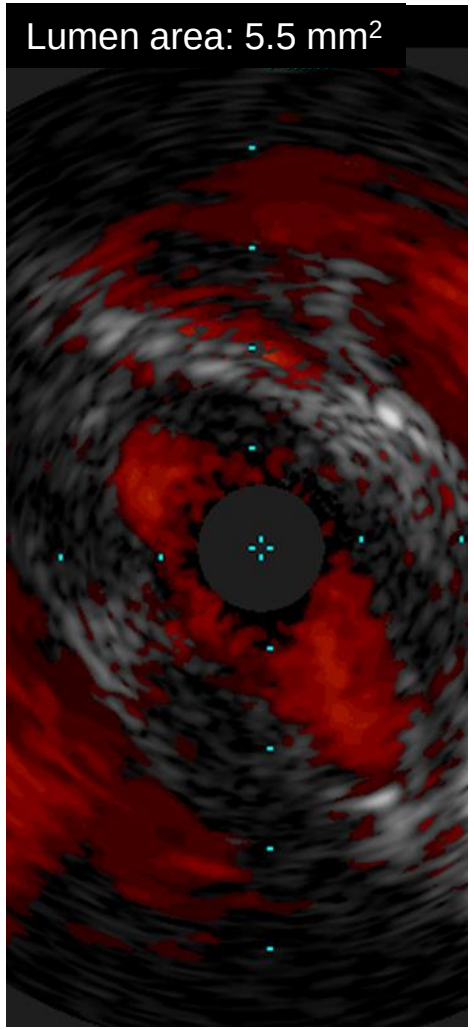
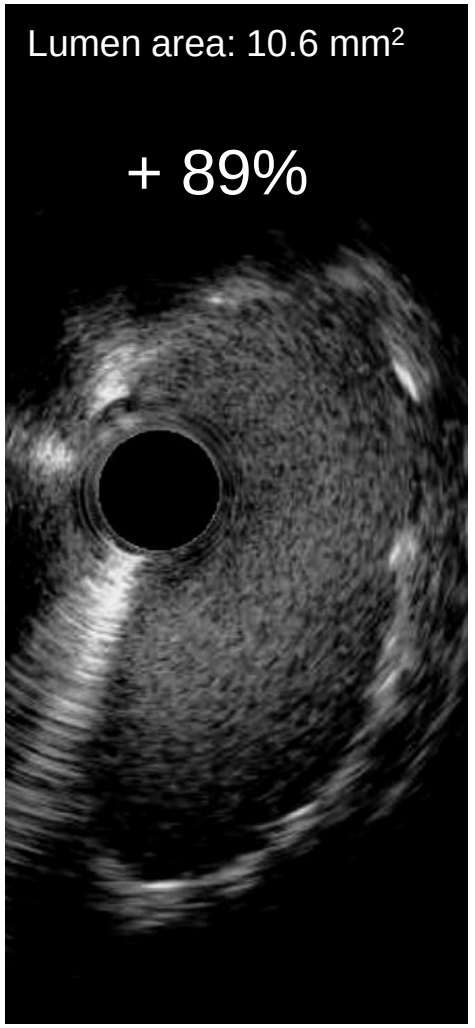


PCI

PCI

PCI





Angioplastie coronaire droite ectopique

Est-ce utile ?
Est-ce néfaste ?

Effets	Angioplastie
Symptômes d'allure ischémique	✓
Ischémie myocardique	✓
Réduction risque de mort subite	?
Resténose intrastent	✓
Dissection aortique	✗
Déformation structure du stent	✗

Angioplastie coronaire droite ectopique

Journal of the American Heart Association

CONTEMPORARY REVIEW

Therapeutic Management of Anomalous Coronary Arteries Originating From the Opposite Sinus of Valsalva: Current Evidence, Proposed Approach, and the Unknowing

Marius Reto Bigler, MD, PhD; Alexander Kadner, MD; Lorenz Räber, MD, PhD; Afreed Ashraf, BMed; Stephan Windecker, MD; Matthias Siepe, MD; Massimo Antonio Padalino, MD, PhD; Christoph Gräni, MD, PhD

J Am Heart Assoc. 2022;11:e7869. DOI: 10.1161/JAHA.122.027098

Therefore, PCI is currently rather an ultimate option in nonsurgical candidates until more evidence is available from future trials on the long-term patency of PCI in ACAOS. However, it is plausible that with this growing evidence, PCI will become a valuable therapeutic option for the treatment of ACAOS, especially in older patients.

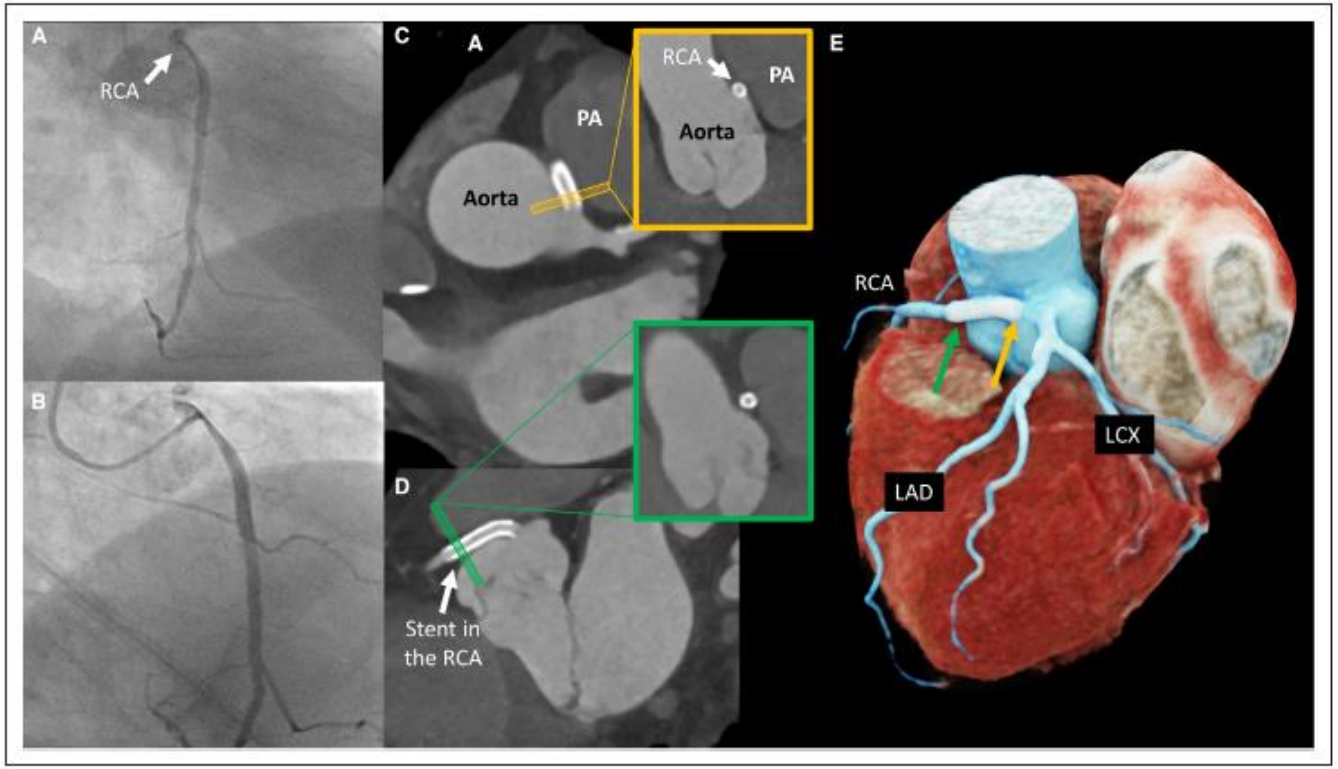
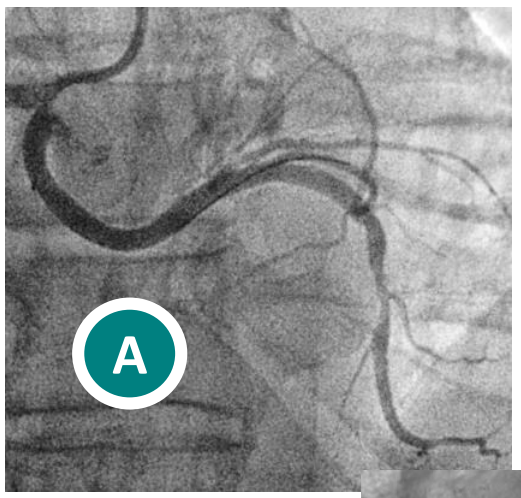
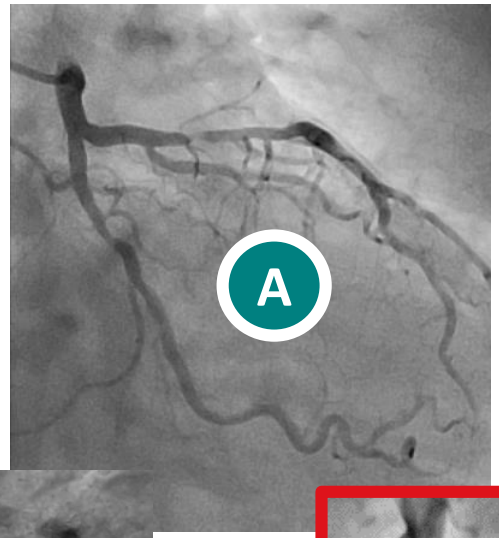
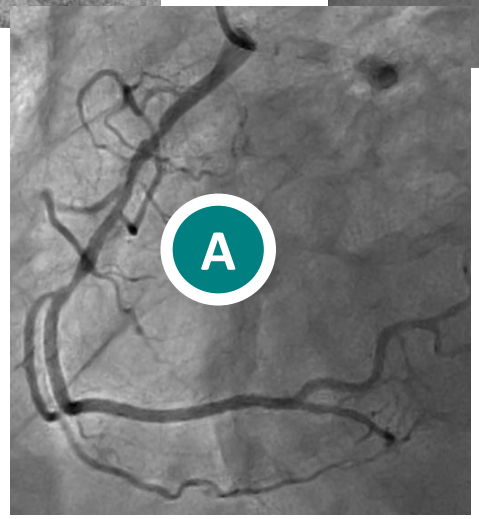


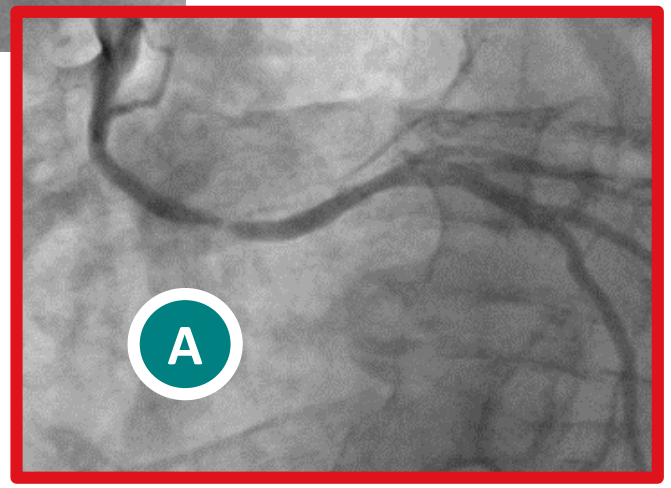
Figure 4. Illustration of a percutaneous coronary intervention in a right anomalous coronary artery originating from the opposite sinus of Valsalva. (A and B).
Invasive coronary angiography illustrating the proximal narrowing within the intramural course from two projections (A, right anterior oblique 40°, caudal 8°; and B, right anterior oblique 46°, cranial 4°). **C** and **D**, Postinterventional CCTA illustrating the correct placement of the 2 stents within the intramural course. C, ostial cross-section, D, distal cross-section. **E**, 3-dimensional reconstruction from the postinterventional CCTA-images. CCTA indicates coronary computed tomography angiography; LAD, left anterior descending (coronary artery); LCX, left circumflex (coronary artery); PA, pulmonary artery; and RCA, right coronary artery.

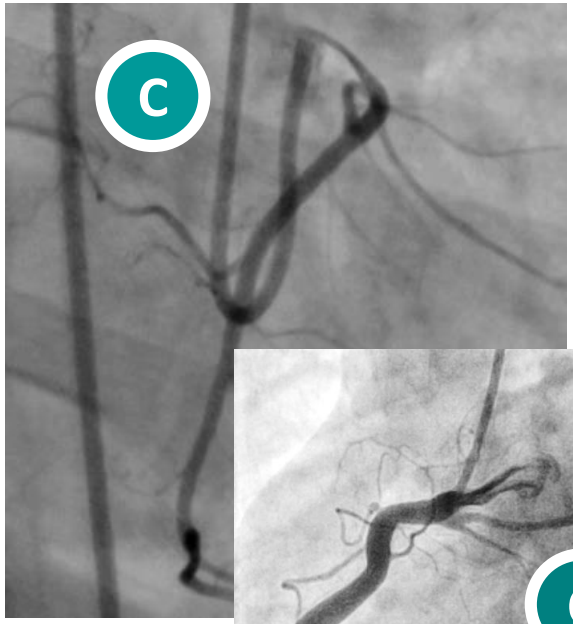
Sténoses acquises/Sténoses congénitales

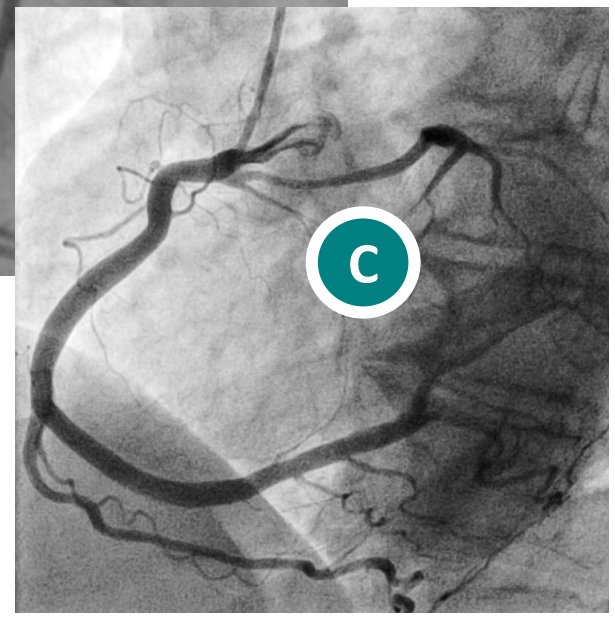






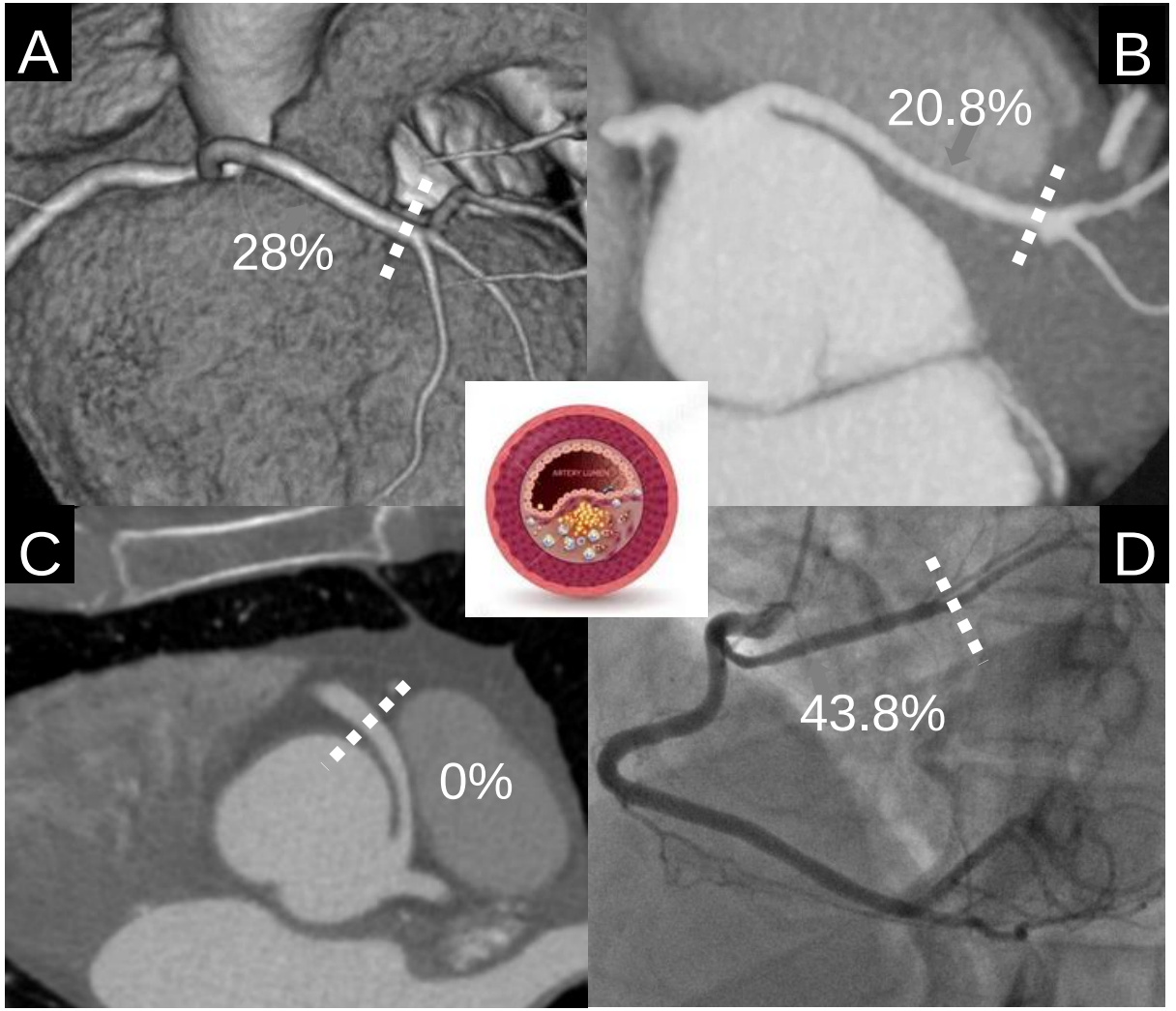






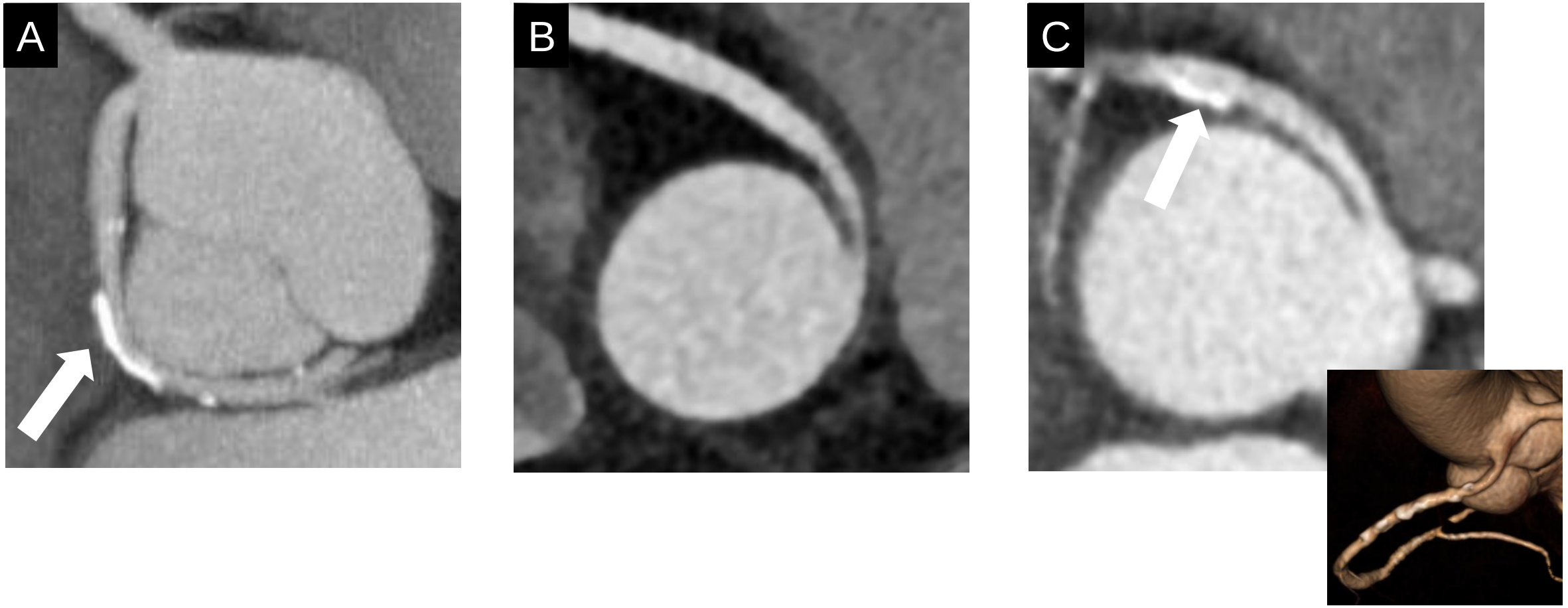
Prevalence and location of CAD in AAOCA

ANOCOR Registry

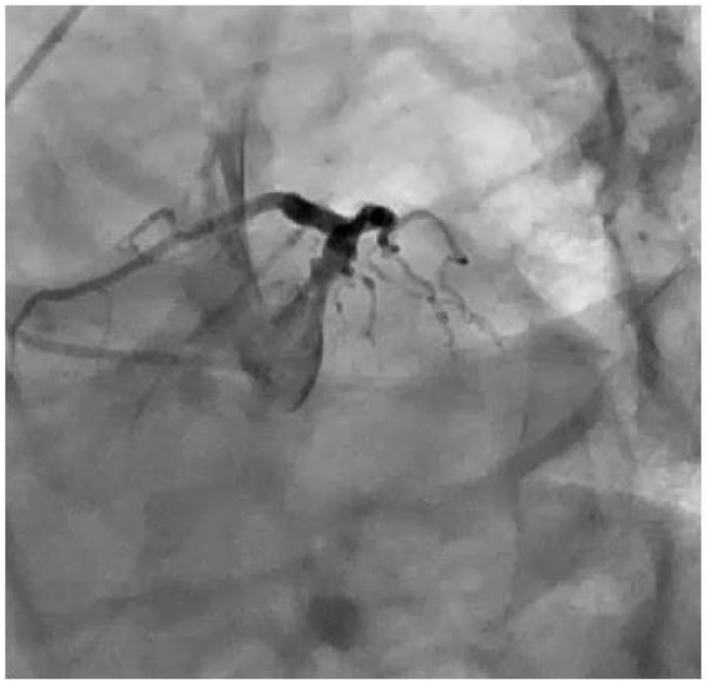


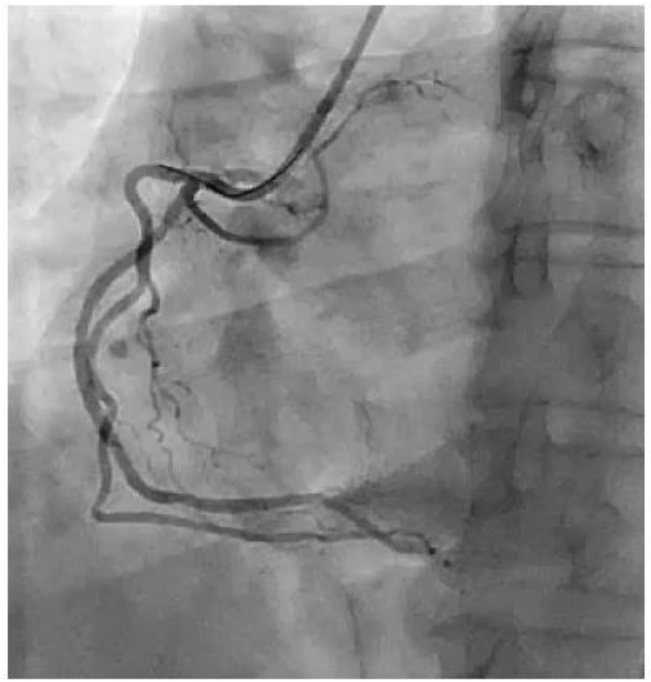
In press

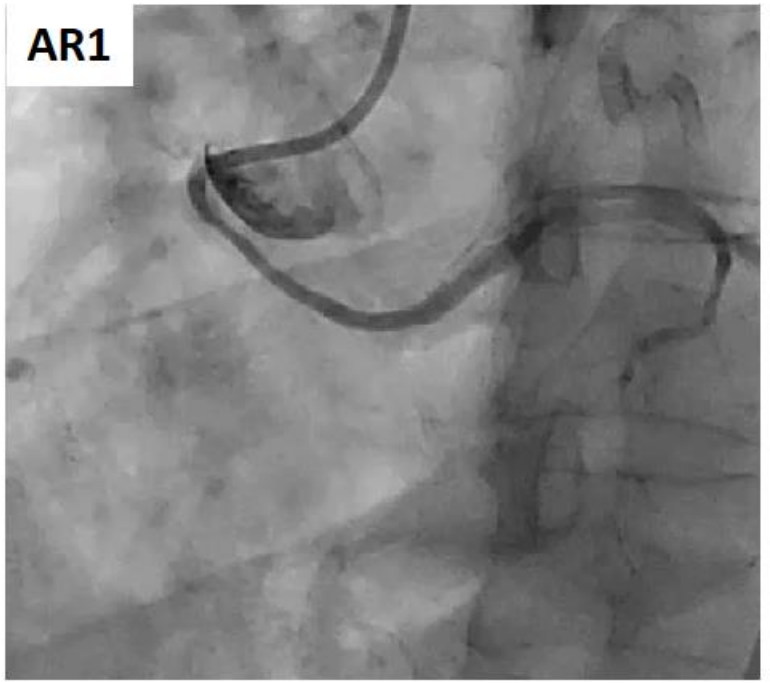
Athérome coronaire et trajets ectopiques



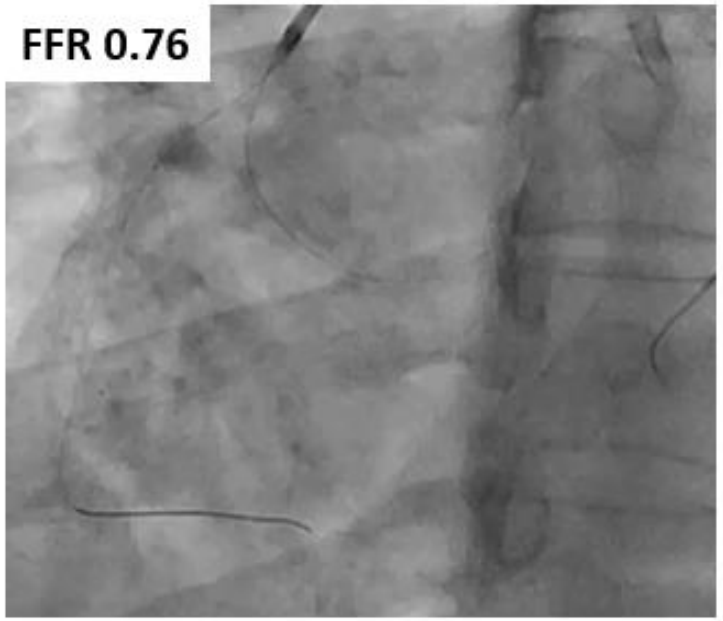
Angioplastie artère circonflexe ectopique
Sténose athéromateuse

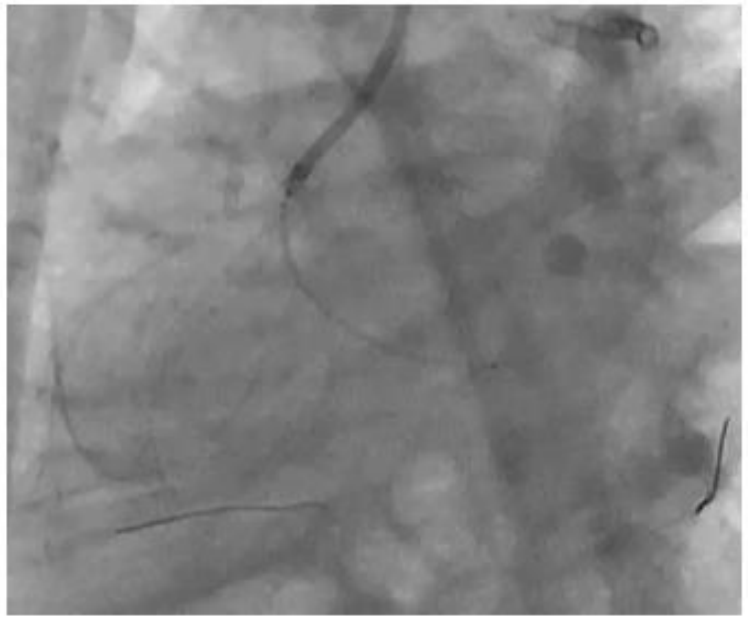


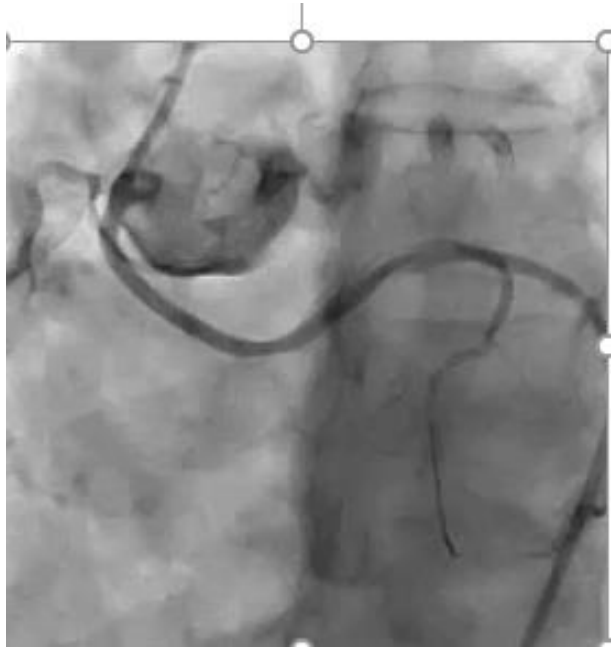


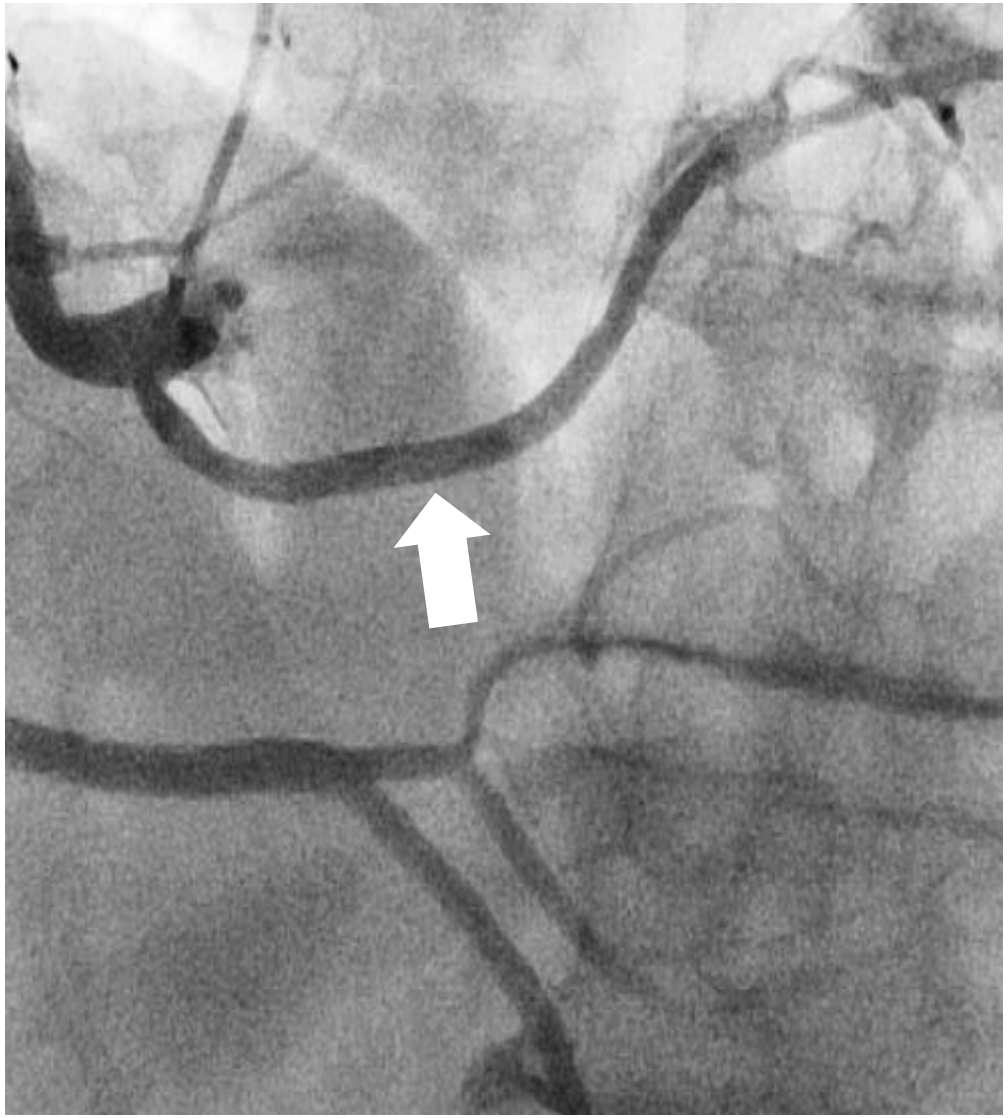


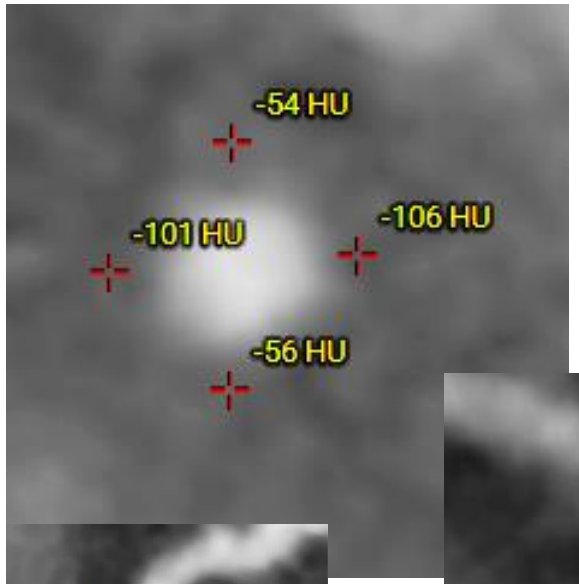
Angioplastie artère circonflexe ectopique
Sténose athéromateuse

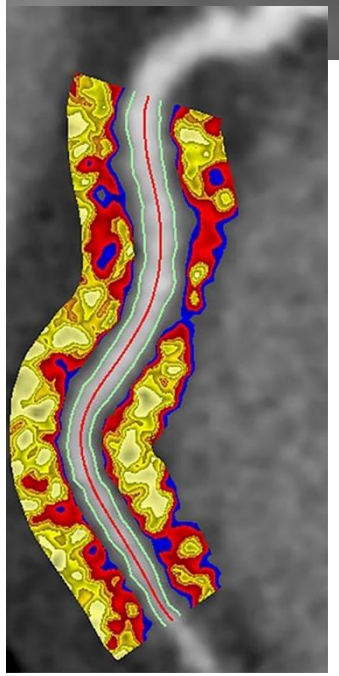




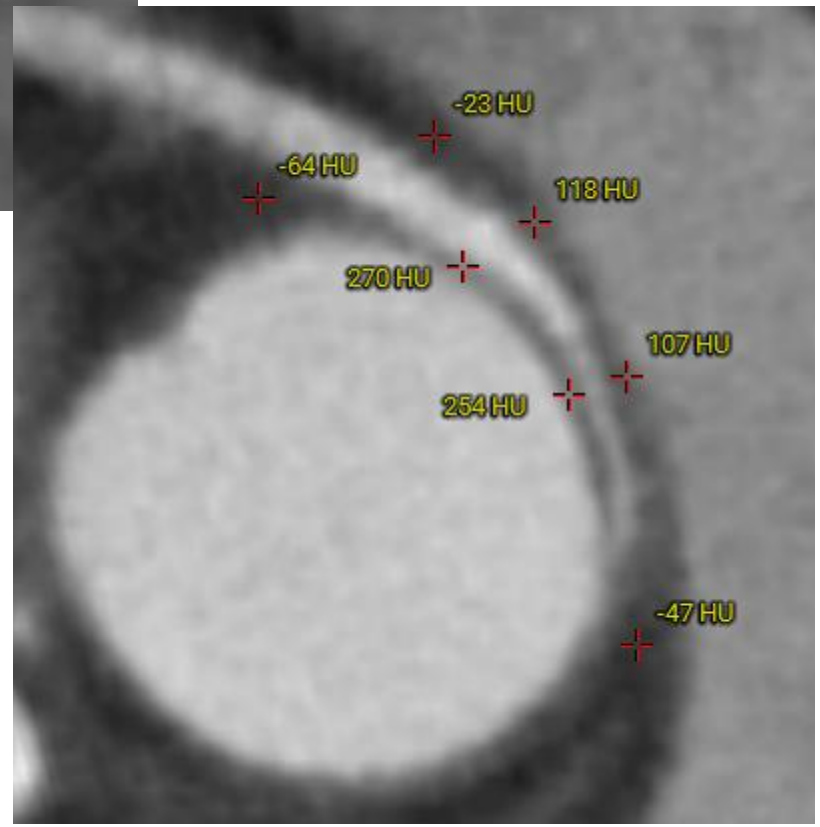




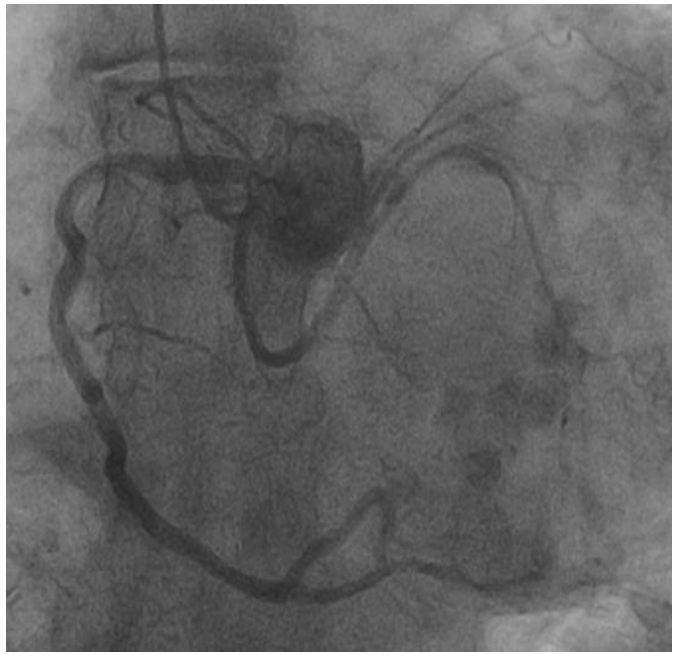


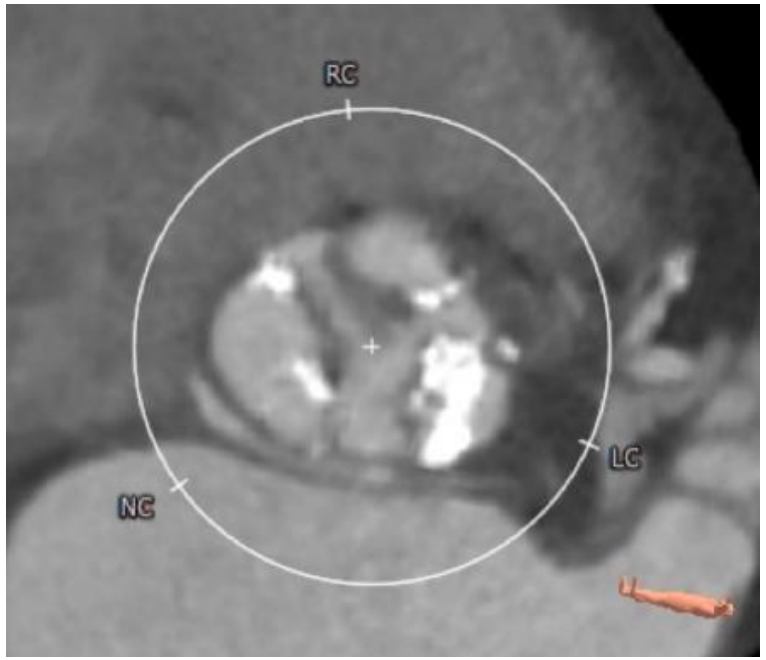


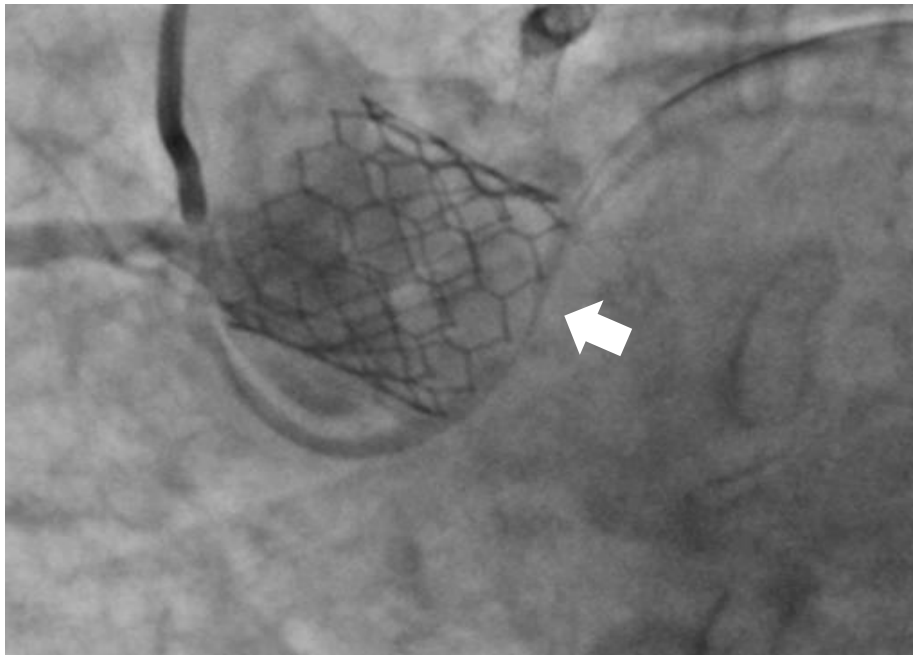
Graisse périvasculaire



Cas rare mais… à connaître



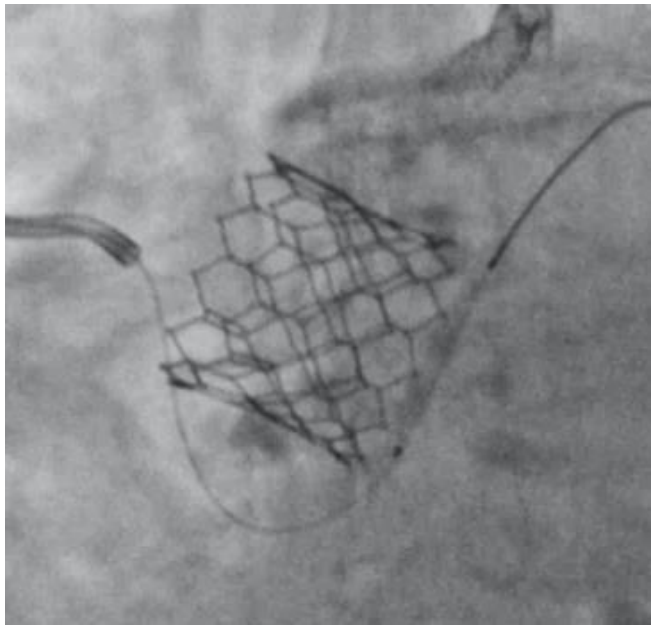


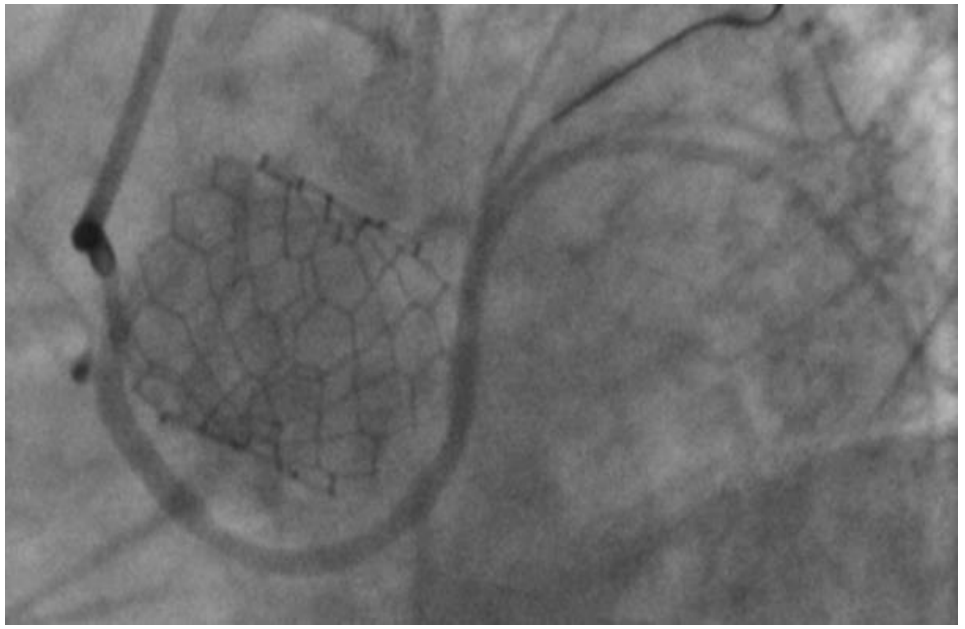


Courtesy of Dr Cavalerie (Toulouse)

Etat de choc
Sous-décalage ST latéral

Cas rare mais… à connaître



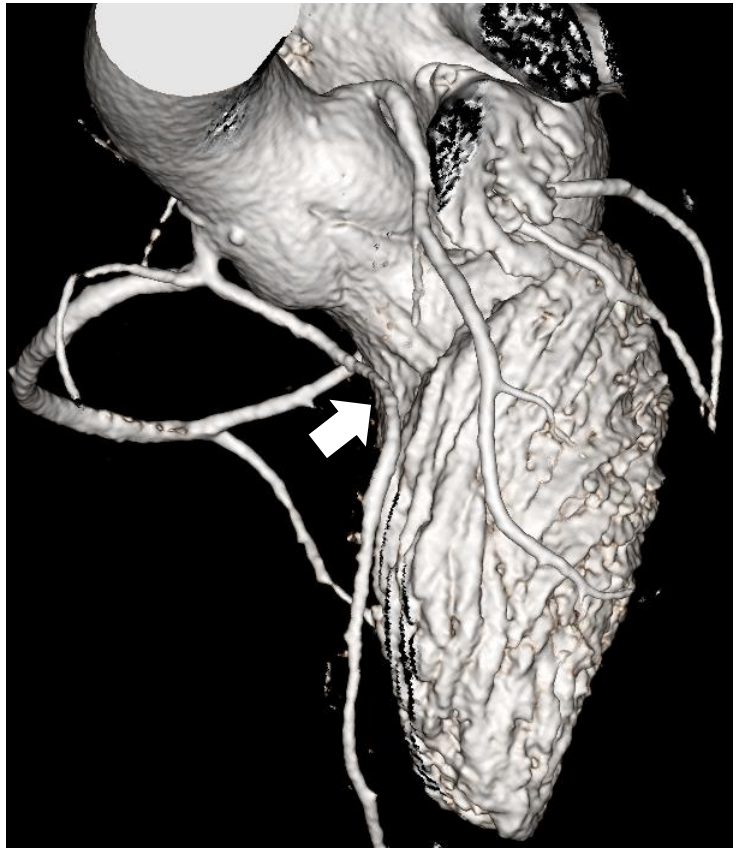


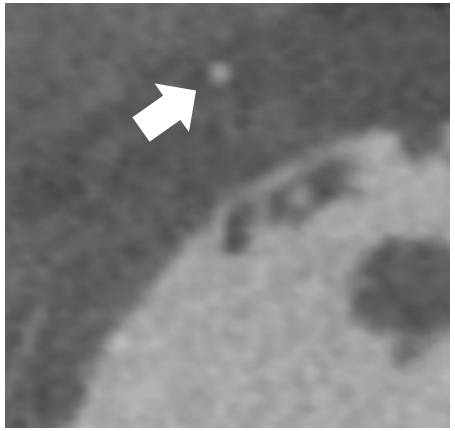
Courtesy of Dr Cavalerie (Toulouse)

Cas clinique

- Homme de 59 ans
- Maladie de Hodgkin
- Pas de facteurs de risque cardiovasculaires
- Tennis de table
- Blockpnée d'effort depuis quelques mois
- Echocardiogramme d'effort :
  asymptomatique (145 watts), positif ECG, hypocinésie antérieure
- Scanner coronaire anormal

Cas clinique

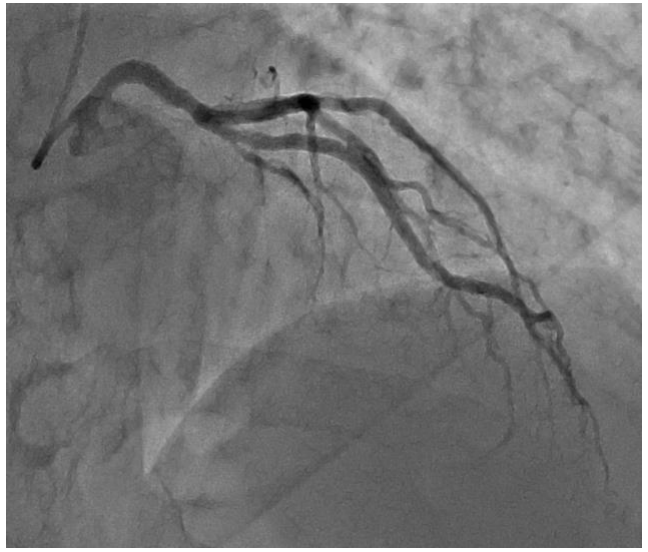


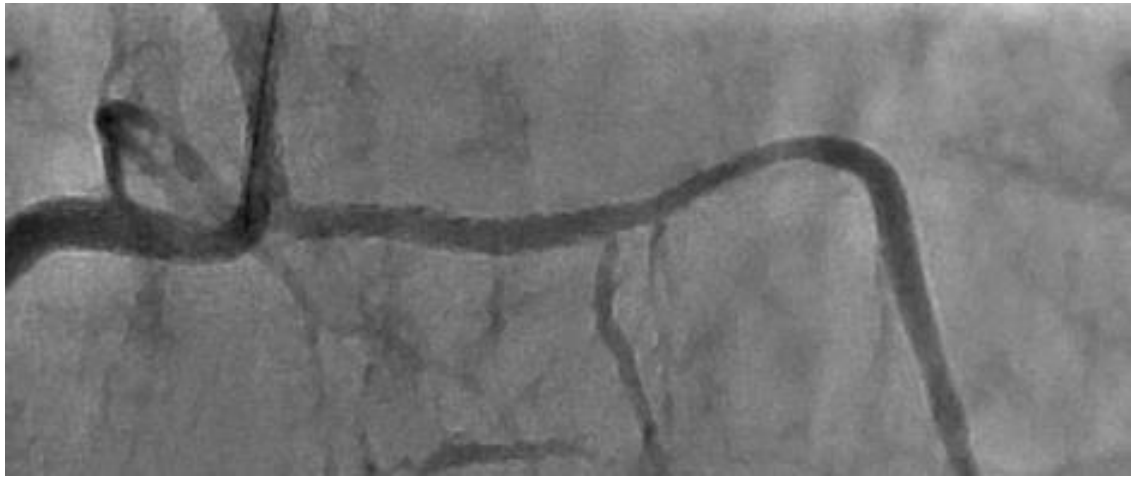


Cas clinique

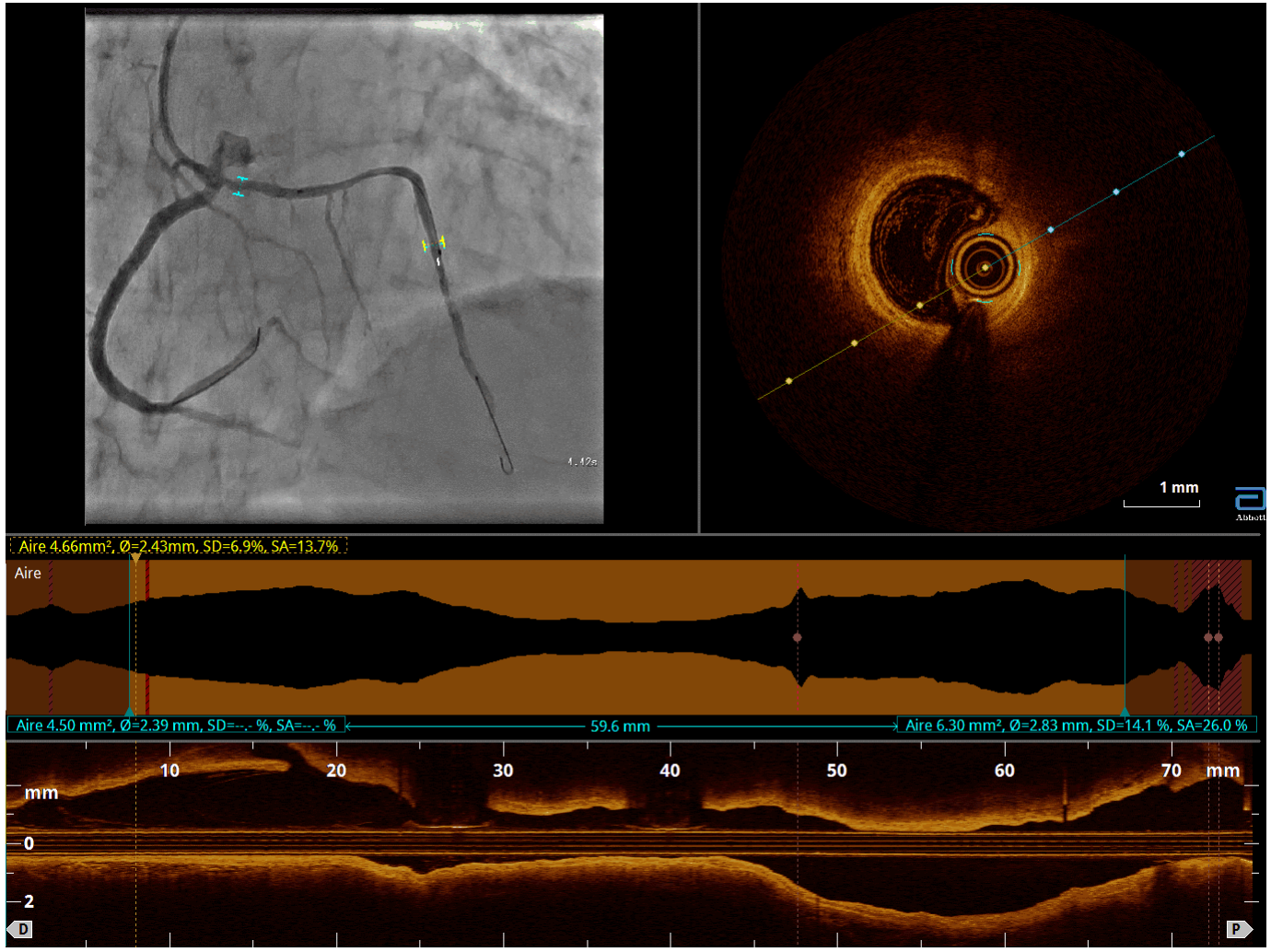
- Mise sous bébloquant
- Echocardiogramme d'effort :
  asymptomatique à 120 watts, négatif ECG et sans anomalie de la cinétique
- Garde une blockpnée d'effort
- Exploration invasive

Cas clinique





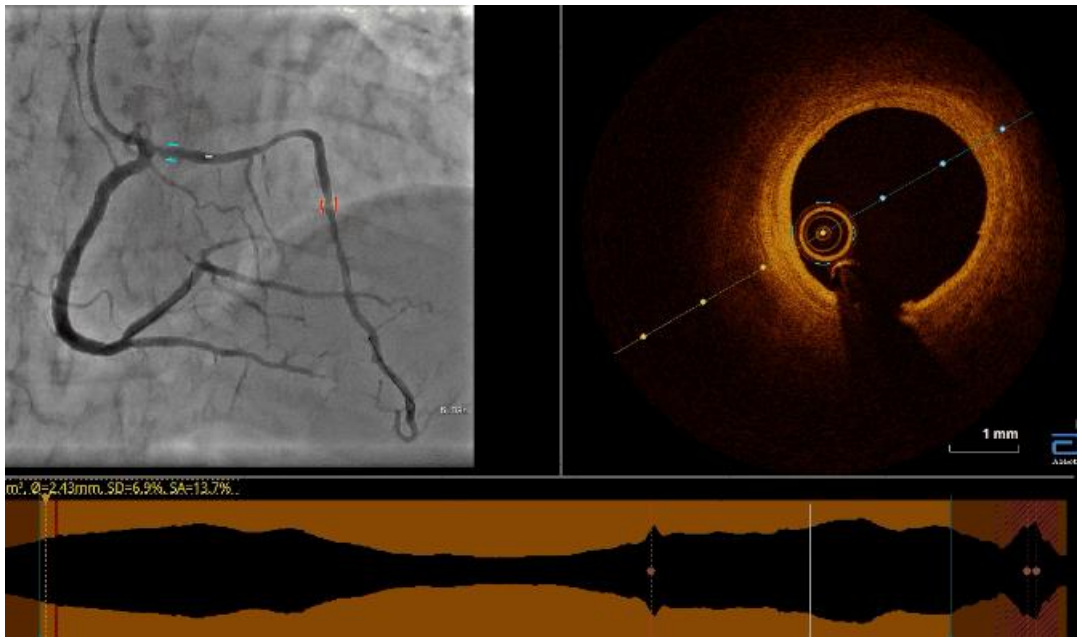
Cas clinique



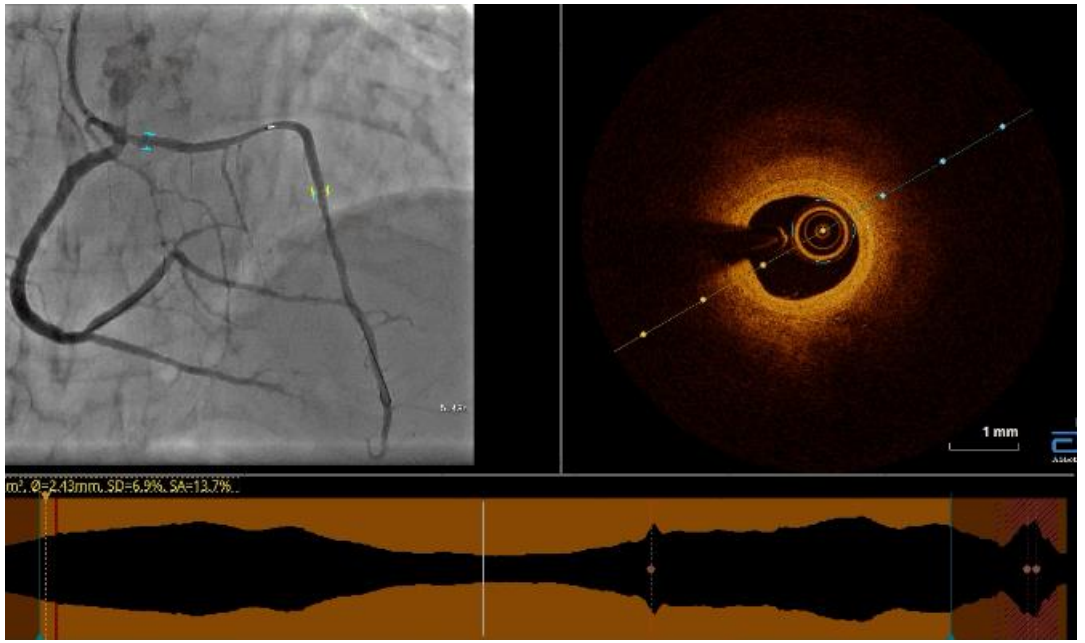
Cas clinique

Réduction de diamètre = 50%

Réduction de surface = 70%

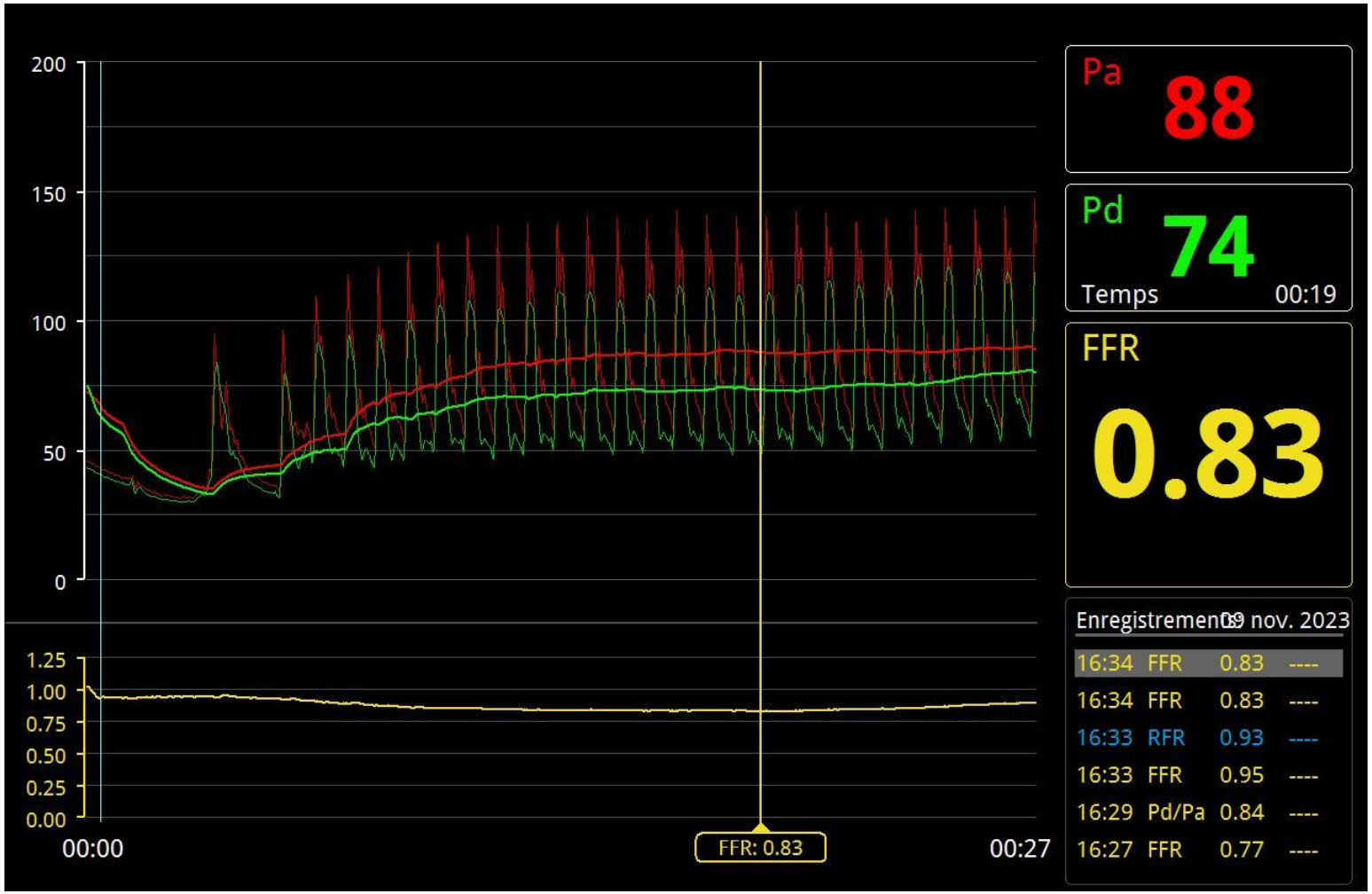


Tronc commun proximal



Tronc commun distal

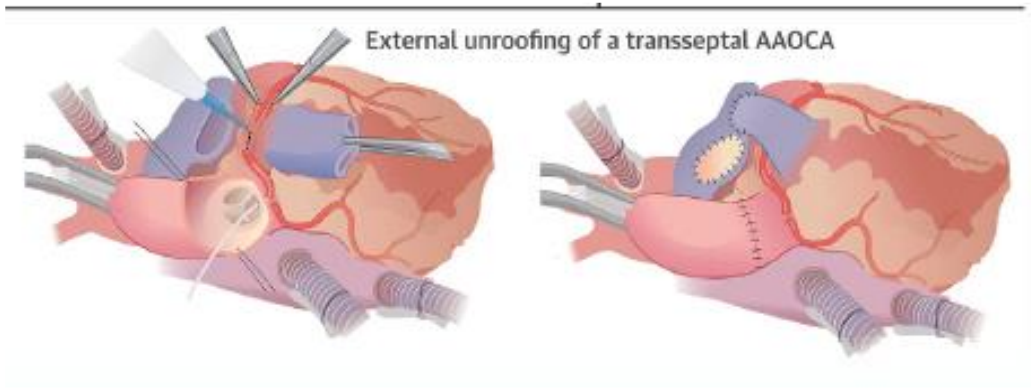
Cas clinique



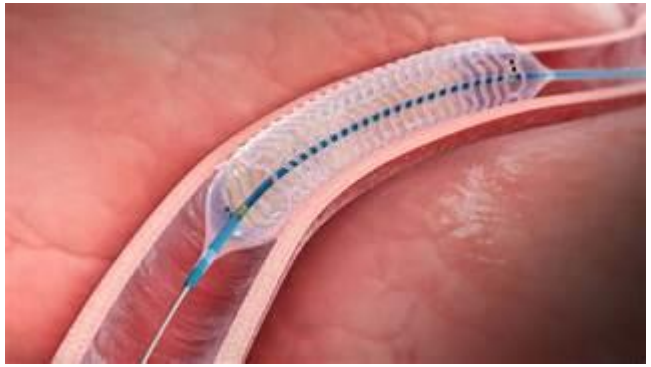
Cas clinique

Traitement médical

Chirurgie



Angioplastie



- Embryologie et anatomie
- Classification
- Prévalence
- Ischémie myocardique
- Mort subite
- Imagerie
- Prise en charge
- Chirurgie
- Angioplastie
- Activités sportives

Paradoxe du sport

A 'paradox of sport' is that in addition to the undisputed health benefits of physical activity, vigorous exertion may transiently increase the risk of acute cardiac events.

- 2/100.000 morts subites annuelles chez le sportif
- Risque de mort subite x 2.5 chez le jeune sportif / jeune non sportif
- Bénéfices connus physiques et psychiques de l'activité physique sportive

Sudden death and sport activities

Table 1. Causes of Sudden Death in 387 Young Athletes*

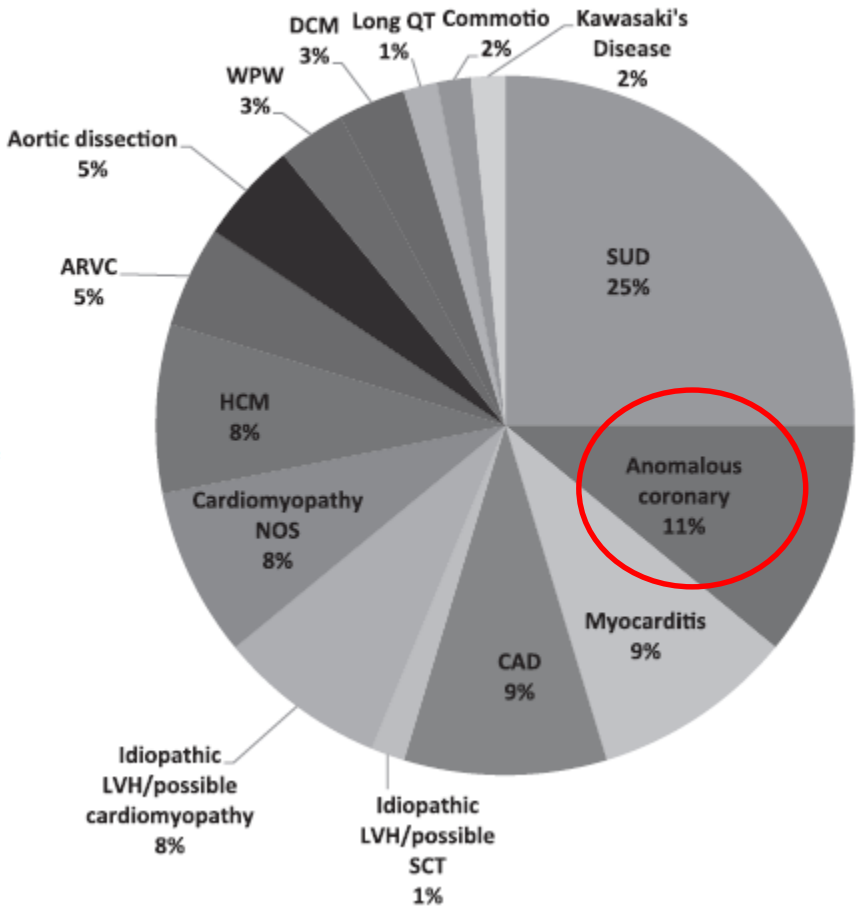
Cause	No. of Athletes	Percent
Hypertrophic cardiomyopathy	102	26.4
Commotio cordis	77	19.9
Coronary artery anomalies	53	13.7
Left ventricular hypertrophy of indeterminate causation†	29	7.5
Myocarditis	20	5.2
Ruptured aortic aneurysm (Marfan syndrome)	12	3.1
Arrhythmogenic right ventricular cardiomyopathy	11	2.8

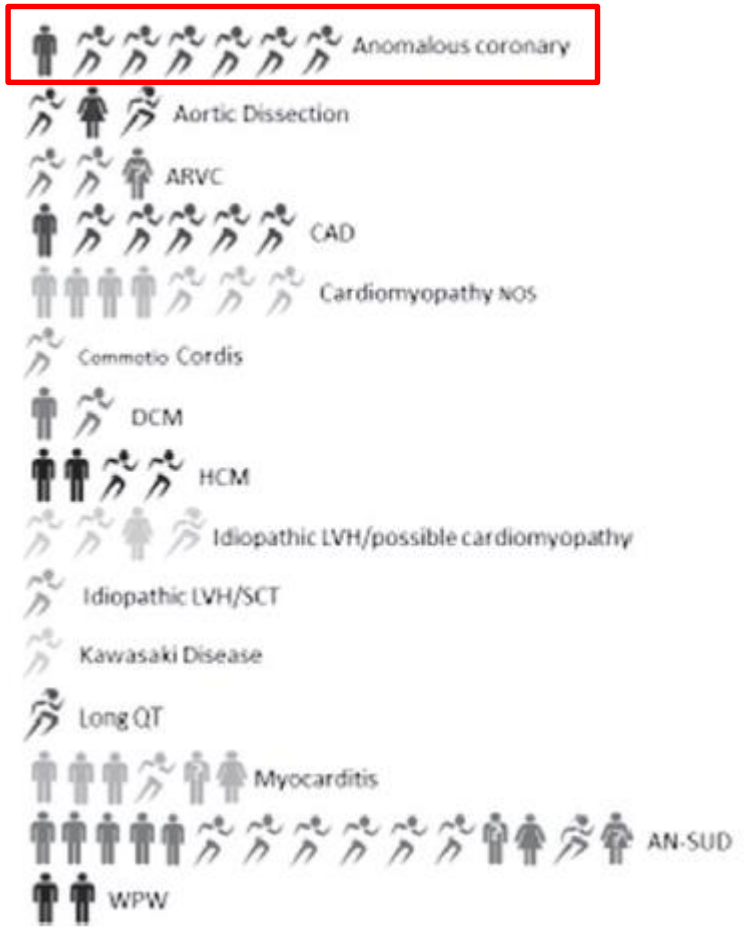
Maron B. J Am Coll Cardiol. 2005.

Sudden death and sport activities

Incidence, Cause, and Comparative Frequency of Sudden Cardiac Death in National Collegiate Athletic Association Athletes
A Decade in Review

Harmon KG. Circulation. 2015.





Effets délétères du sport sur la pathologie

- Anomalies de connexion des artères coronaires
- Cardiomyopathie hypertrophique
- Syndrome de pré-excitation ventriculaire
- Syndrome du QT long
- Cardiomyopathie dilatée sans étiologie retrouvée
- Dysplasie arythmogène ventriculaire droite
- Syndrome de Brugada
- Tachycardie ventriculaire catécholergique

2020 Guidelines on sports cardiology and exercice in patients with cardiovascular disease

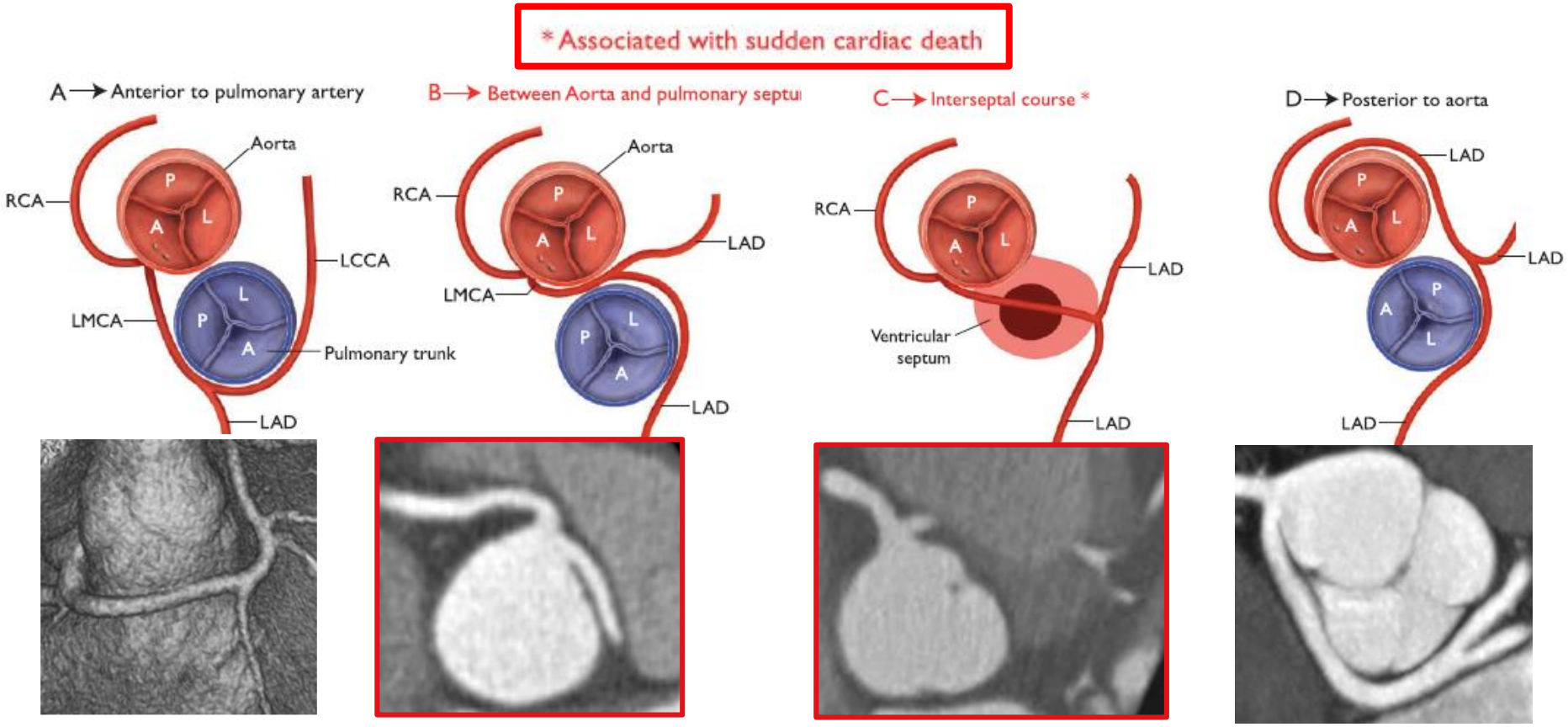
Recommendations for exercise in young individuals/athletes with anomalous origins of coronary arteries

Recommendations	Class[a]	Level[b]
When considering sports activities, evaluation with imaging tests to identify high-risk patterns and an exercise stress test to check for ischaemia should be considered in individuals with AOCA.	IIa	C
In asymptomatic individuals with an anomalous coronary artery that does not course between the large vessels, does not have a slit-like orifice with reduced lumen and/or intramural course, competition may be considered, after adequate counselling on the risks, provided there is absence of inducible ischaemia.	IIb	C
After surgical repair of an AOCA, participation in all sports may be considered, at the earliest 3 months after surgery, if they are asymptomatic and there is no evidence of inducible myocardial ischaemia or complex cardiac arrhythmias during maximal exercise stress test.	IIb	C
Participation in most competitive sports with a moderate and high cardiovascular demand among individuals with AOCA with an acutely angled take-off or an anomalous course between the large vessels is not recommended.[c]	III	C

AOCA = anomalous origin of coronary arteries.
[a]Class of recommendation.
[b]Level of evidence.
[c]This recommendation applies whether the anomaly is identified as a consequence of symptoms or discovered incidentally, and in individuals <40 years of age.

Pelliccia A et al. Eur Heart J. 2020.

2020 Guidelines on sports cardiology and exercice in patients with cardiovascular disease



Pelliccia A et al. Eur Heart J. 2020.

Recommendations for participation in leisure time or competitive sports in athletes-patients with coronary artery disease: a position statement from the Sports Cardiology Section of the European Association of Preventive Cardiology (EAPC)

Mats Borjesson[1,2]*, Mikael Dellborg[3], Josef Niebauer[4], Andre LaGerche[5], Christian Schmied[6], Erik E. Solberg[7], Martin Halle[8], Emilio Adami[9], Alessandro Biffi[10], Francois Carré[11], Stefano Caselli[12,13], Michael Papadakis[14], Axel Pressler[15], Hanne Rasmusen[16], Luis Serratosa[17], Sanjay Sharma[18], Frank van Buuren[19], and Antonio Pelliccia[20]

ESC European Society of Cardiology

European Heart Journal (2019) **40**, 13–18
doi:10.1093/eurheartj/ehy408

- Specifically, in CAA originating from the wrong sinus, with acute angled take-off from the aorta and anomalous coursing between the aorta and the pulmonary artery, the risk for SCA/SCD is believed to be the highest. Strong consideration should be given to surgical correction of such an anomaly in symptomatic patients. Prior to successful correction, participation in high-intensity sport is discouraged. Level of recommendation: Class II, level of evidence C.
- Traditionally, CAAs without inter-arterial course have been considered having a low risk of SCA/SCD. In the absence of ischaemia and arrhythmias on stress testing or symptoms (dizziness, fainting or syncope), there is no indication for surgical repair or treatment. At present, because of a lack of adequate data, an individualized approach for competitive sports participation is recommended, based on comprehensive evaluation (N.B.: expert consensus). Level of recommendation: Class III, level of evidence C.
- In case of previous surgical correction and lack of persistent, inducible ischaemia, all competitive sports are allowed. Level of recommendation: Class III, level of evidence C.
- In other types of CAA, such as anomalous origin of the circumflex artery from the right sinus, it is relevant to confirm the absence of inducible ischaemia and, in this case, no restriction exist regarding competitive sport participation. Level of recommendation: Class IIa, level of evidence C.

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AHA/ACC SCIENTIFIC STATEMENT

Eligibility and Disqualification Recommendations for Competitive Athletes With Cardiovascular Abnormalities: Task Force 4: Congenital Heart Disease

A Scientific Statement From the American Heart Association and American College of Cardiology

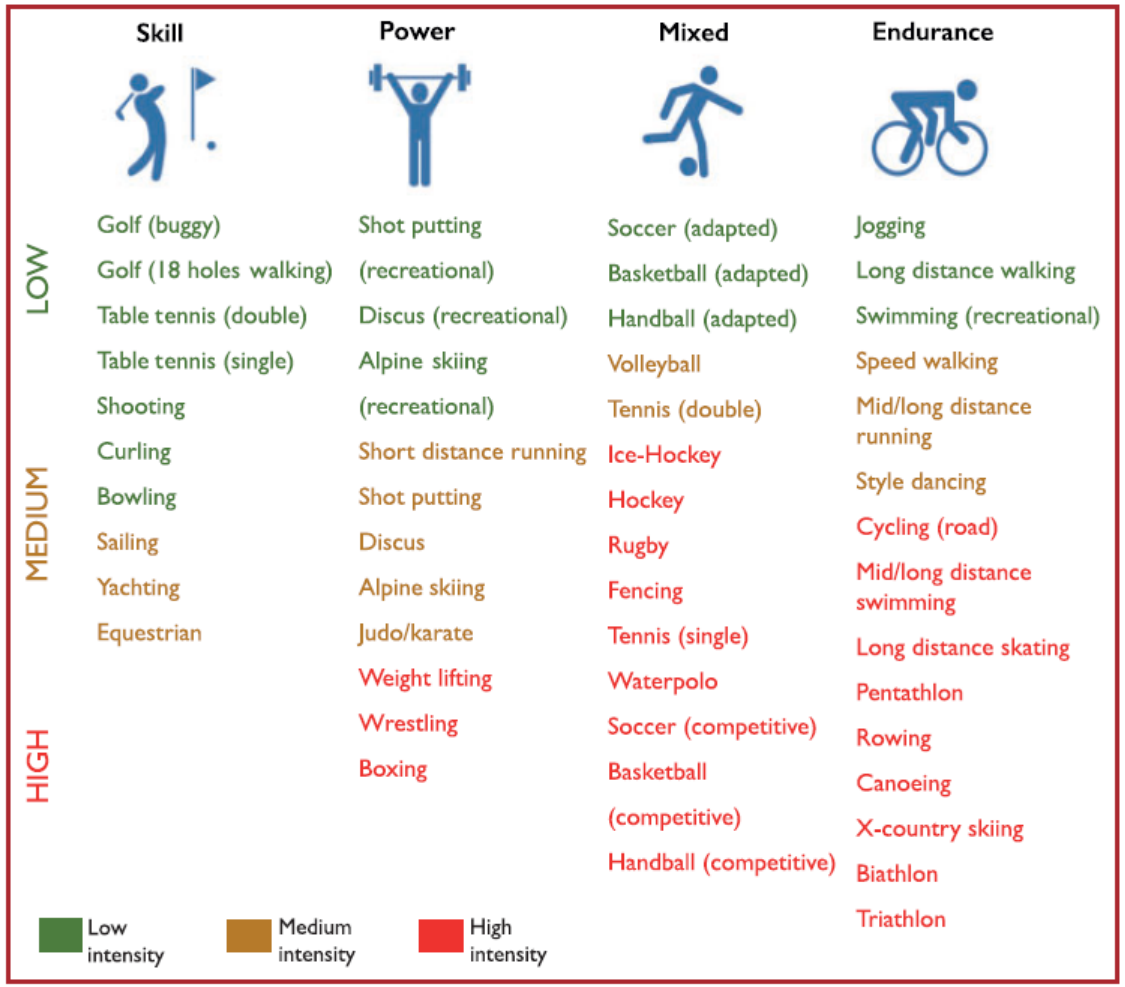
George F. Van Hare, MD, FACC, *Chair**
Michael J. Ackerman, MD, PhD, FACC*
Juli-anne K. Evangelista, DNP, APRN, CPNP-AC, FACC*
Richard J. Kovacs, MD, FAHA, FACC*
Robert J. Myerburg, MD, FACC*
Keri M. Shafer, MD*
Carole A. Warnes, MD, FACC*
Reginald L. Washington, MD, FAHA*

2. Athletes with an anomalous origin of a right coronary artery from the left sinus of Valsalva should be evaluated by an exercise stress test. For those without either symptoms or a positive exercise stress test, permission to compete can be considered after adequate counseling of the athlete and/or the athlete's parents (in the case of a minor) as to risk and benefit, taking into consideration the uncertainty of accuracy of a negative stress test *(Class IIa; Level of Evidence C)*.

Restriction sportive

Eléments décisionnels

- ANOCOR gauche versus ANOCOR droite
- Forme anatomique interartérielle
- ANOCOR corrigée ou non
- Age
- Symptomatologie d'allure ischémique
- Ischémie myocardique documentée
- Type de sport
- Niveau de sport
- Pratique en compétition
- Projet sportif
- Avis patient
- Avis entourage familial si besoin
- Avis cardiologue du sport



Pelliccia A. et al. Eur Heart J. 2020.

Restriction sportive

- Aucune
- Sur activité sportive d'intensité basse
- Sur activité sportive d'intensité moyenne
- Sur activité sportive d'intensité élevée
- Sur la pratique en compétition
- En attendant une correction de l'anomalie coronaire
- Après la correction de l'anomalie coronaire

Information éclairée du patient

Pratique sportive dans un en environnement adapté

Cas complexe à gérer

- Jeune sportif de 15 ans
- Centre de formation (pôle espoirs)
- Echocardiogramme systématique
- Découverte ANOCOR droite avec trajet interartériel
- Pas de symptomatologie d'allure ischémique
- Pas d'ischémie myocardique documentée

Que proposer ?

Groupe de travail multidisciplinaire sur les ANOmalies congénitales des artères CORonaires

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http://anocor.fr

Ouverture début 2024

Groupe multidisciplinaire ANOCOR

Anomalies Coronaires Congénitales

Ce site est destiné aux professionnels de santé et aux patients, ainsi qu'à leur entourage, souhaitant obtenir des informations sur les Anomalies Coronaires Congénitales (ANOCOR). Les formes anatomiques sont très nombreuses, allant de la banale anomalie sans conséquence clinique aux anomalies pouvant être responsables de symptômes cardiaques graves dont l'arrêt cardiaque. Même si les techniques d'imagerie, surtout radiologiques, permettent le diagnostic de ces anomalies rares, leur compréhension reste incomplète et leur prise en charge n'est pas encore parfaitement codifiée. Le site ANOCOR a pour objectifs d'aider les professionnels de santé dans leur démarche de recherche et de transmettre aux patients nos connaissances actuelles. Bonne navigation.