

**Anatomia: per renderci conto di quanto sia
importante conoscerla bene**

**La RM in ecocardiografia come
naturale prosecuzione delle competenze
del cardiologo ecocardiografista**

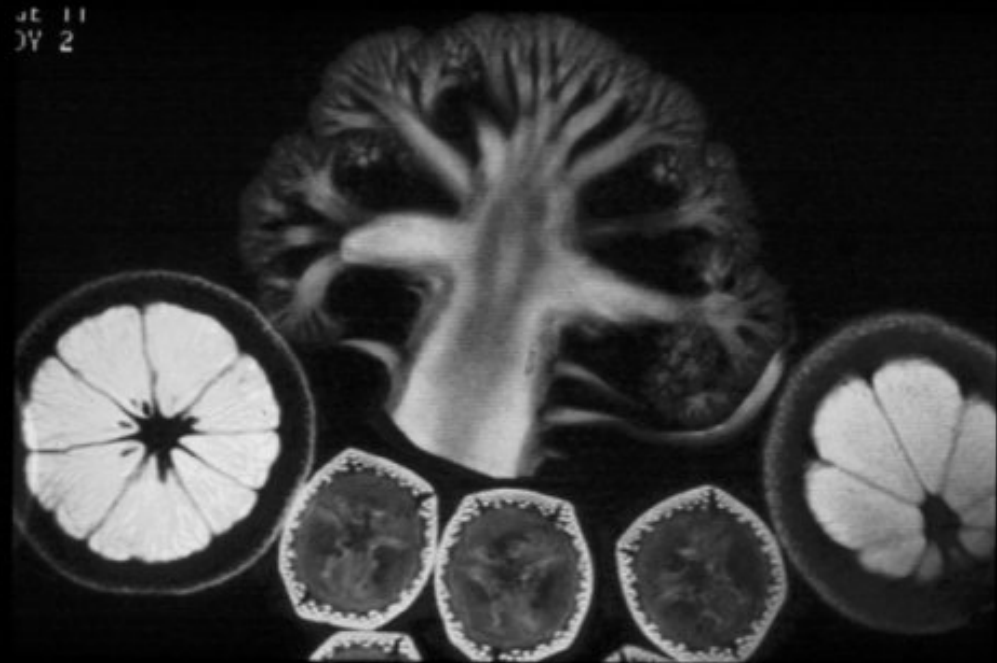
Giancarlo CASOLO

Struttura Complessa di Cardiologia
Ospedale Versilia

Watch the
glass shatter
due to
resonance



JE 11
DY 2

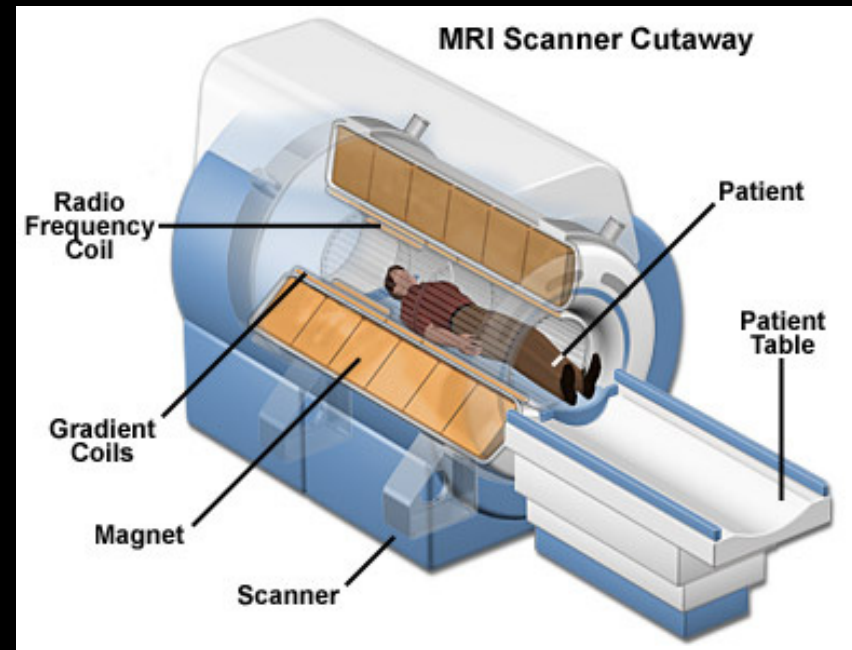


Perché la RM nello studio anatomico del cuore

- Tecnica tomografica
- Elevata risoluzione spaziale
- Intrinsecamente tridimensionale
- Poliparametricità del segnale
- Elevata risoluzione di contrasto
- Informazione indipendente dal flusso ematico

Cosa serve per studiare il cuore

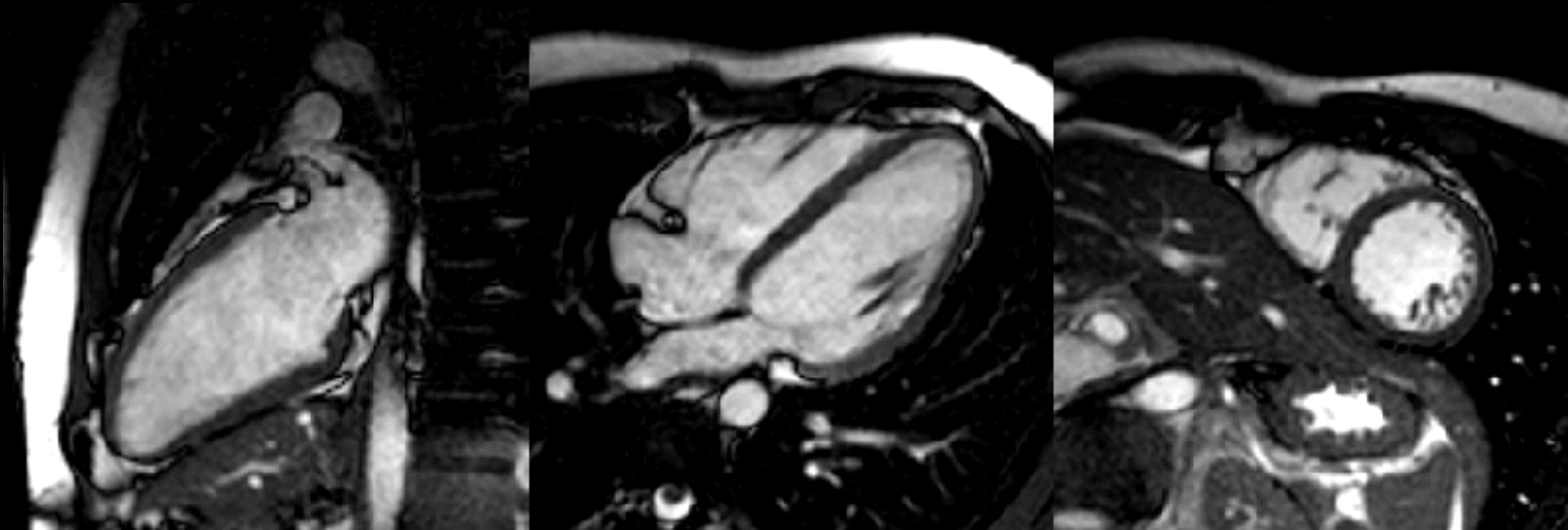
- Uno scanner
- Software dedicato
- Bobina cardiaca
- Trigger ECG
- Formazione – Training
- Tempo



ANATOMIA CARDIACA

- GLI ATRI
- LE VALVOLE AV
- I VENTRICOLI
- LE CORONARIE
- IL PERICARDIO

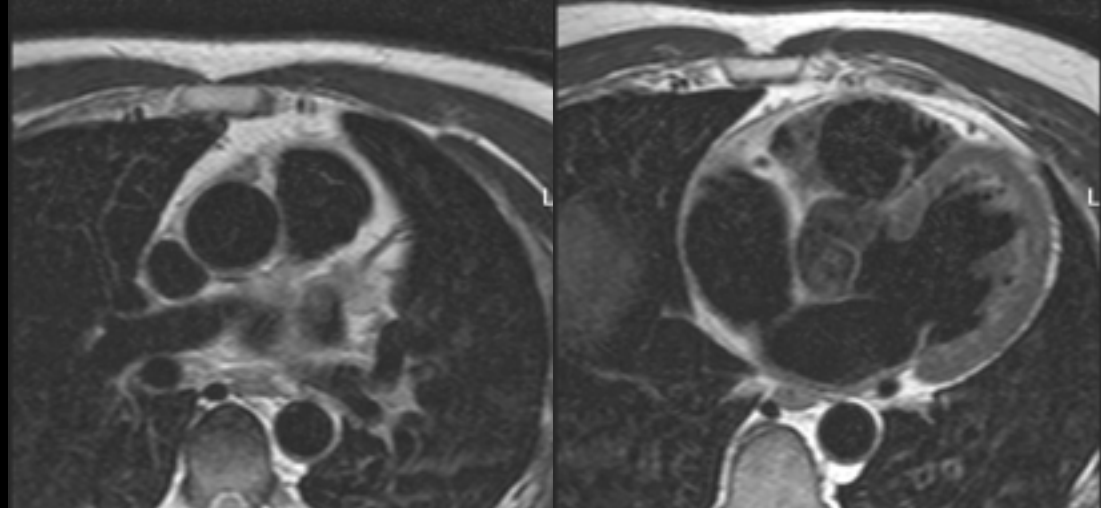
PREMESSA – SEQUENZE



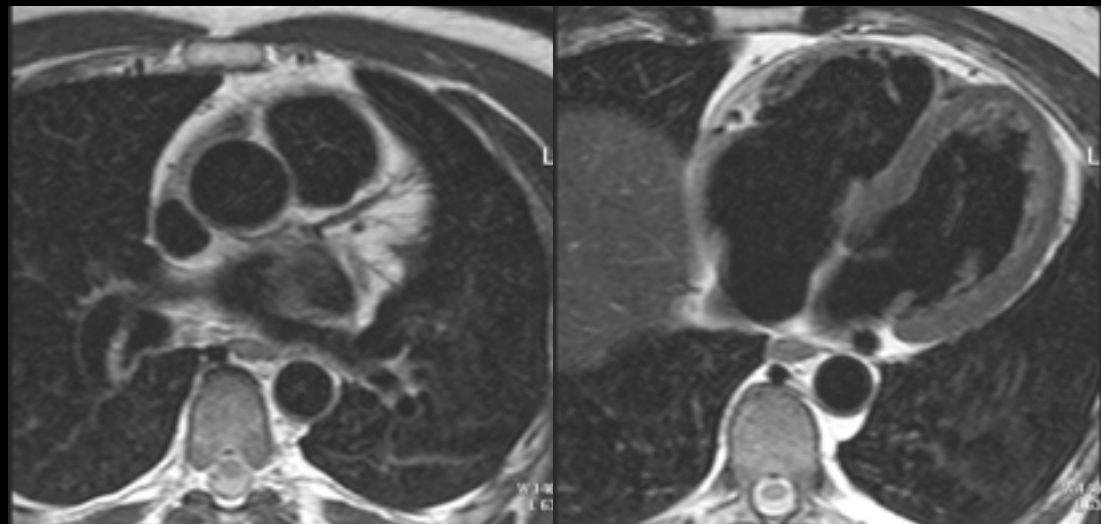
- relativamente elevata risoluzione temporale
- discreta risoluzione spaziale
- Bassa sensibilità ai flussi (minori artefatti)
- varianti: cine (T1), balanced fast field echo (T1/T2), echo planar imaging...
- funzione ventricolare, valutazione qualitativa di flussi turbolenti

PREMESSA – SEQUENZE RM – Sequenze sangue nero (TSE)

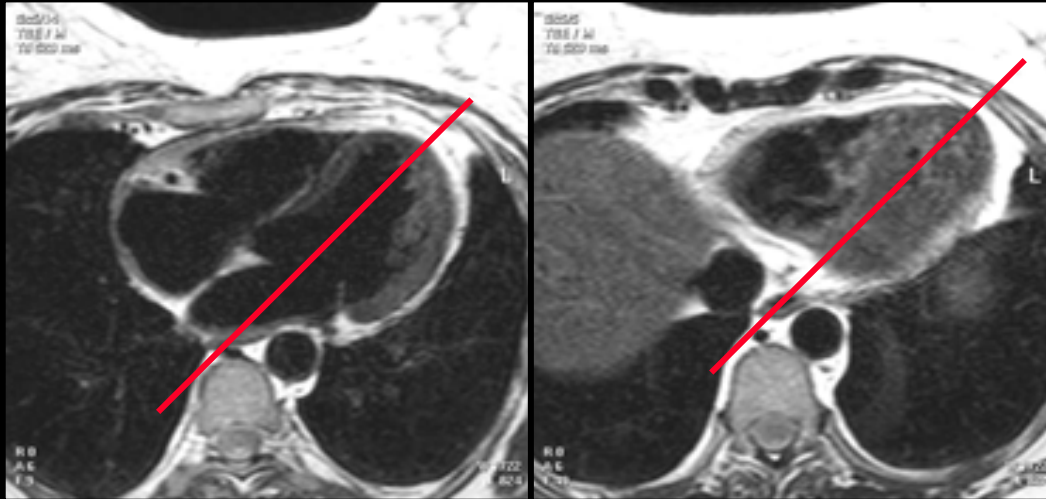
- elevate risoluzione spaziale e di contrasto tissutale
- relativa insensibilità alle disomogeneità del campo magnetico
- acquisizione lenta (1 immagine/2RR)
- varianti: 2IR-FSE, FSE, SE
- studi morfologici



Assenza di segnale dal sangue

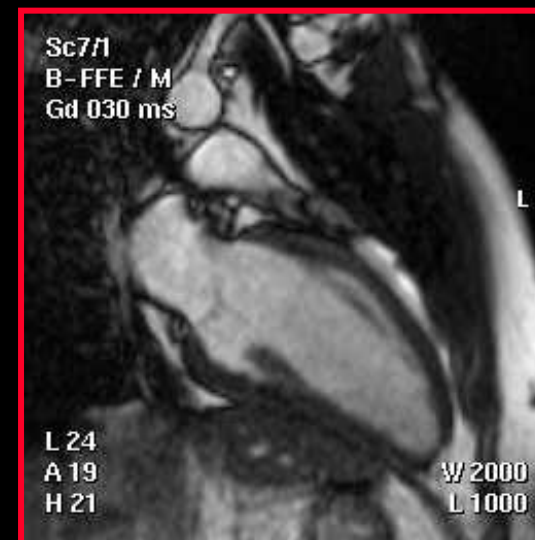


PREMESSA – PIANI DI STUDIO



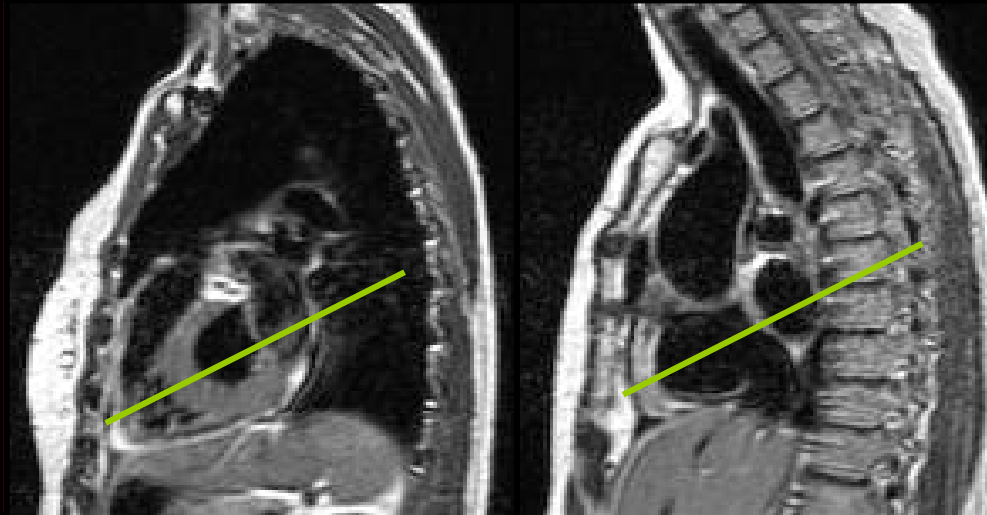
- Punto medio della mitrale
- Apice

**ASSE LUNGO VENTRICOLO SN
(2 CAMERE)**

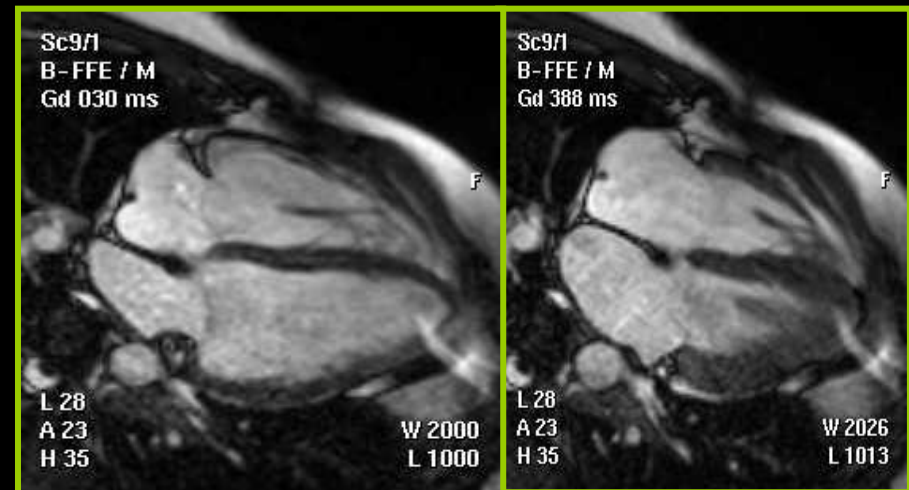


PREMESSA – PIANI DI STUDIO

SAGITTALE TSE

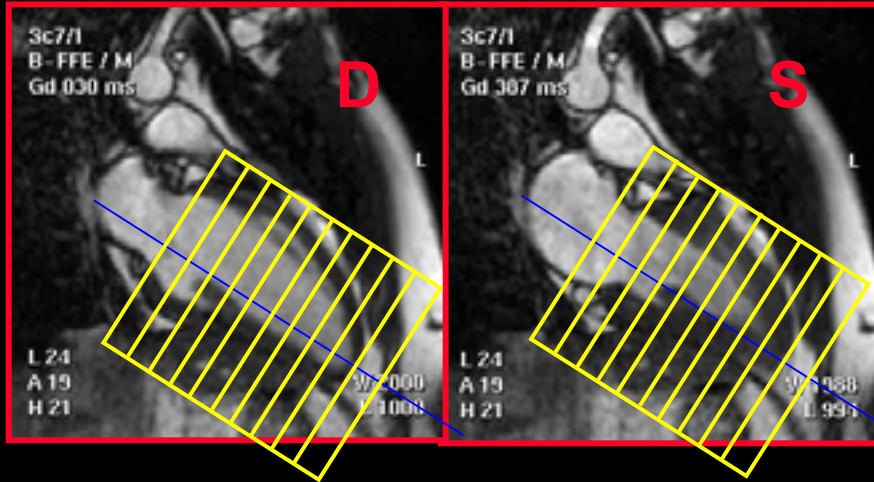


ASSE LUNGO – 4 CAMERE



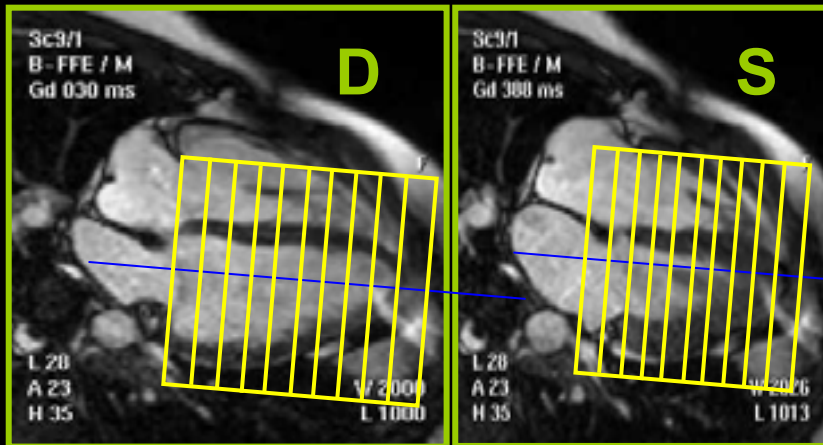
PREMESSA – PIANI DI STUDIO

ASSE LUNGO 2 CAMERE VS



- Terzo inferiore della mitrale
- Apice
- Doppia Obliquità
- Controllare dia e sis

ASSE LUNGO 4 CAMERE



ATRIO DESTRO

PARETE LIBERA

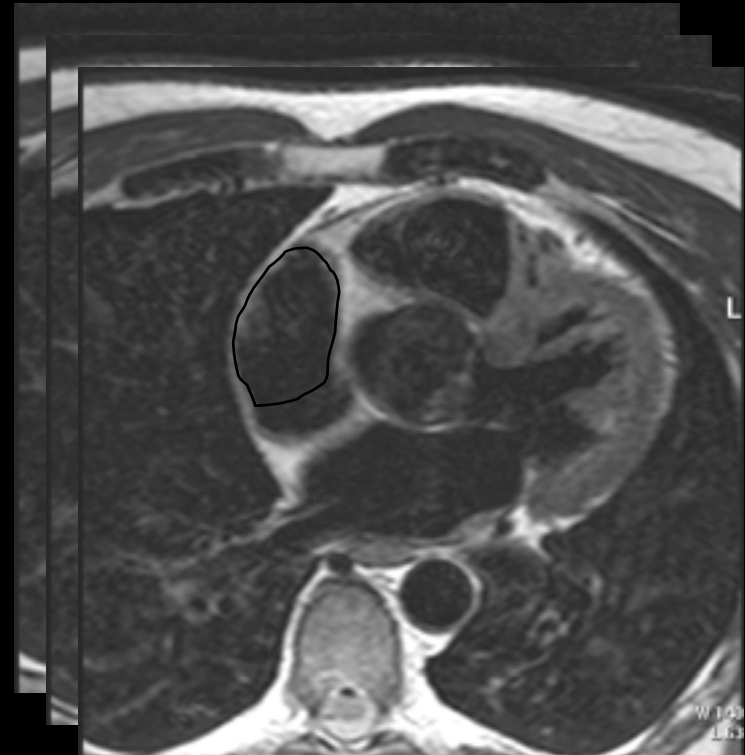
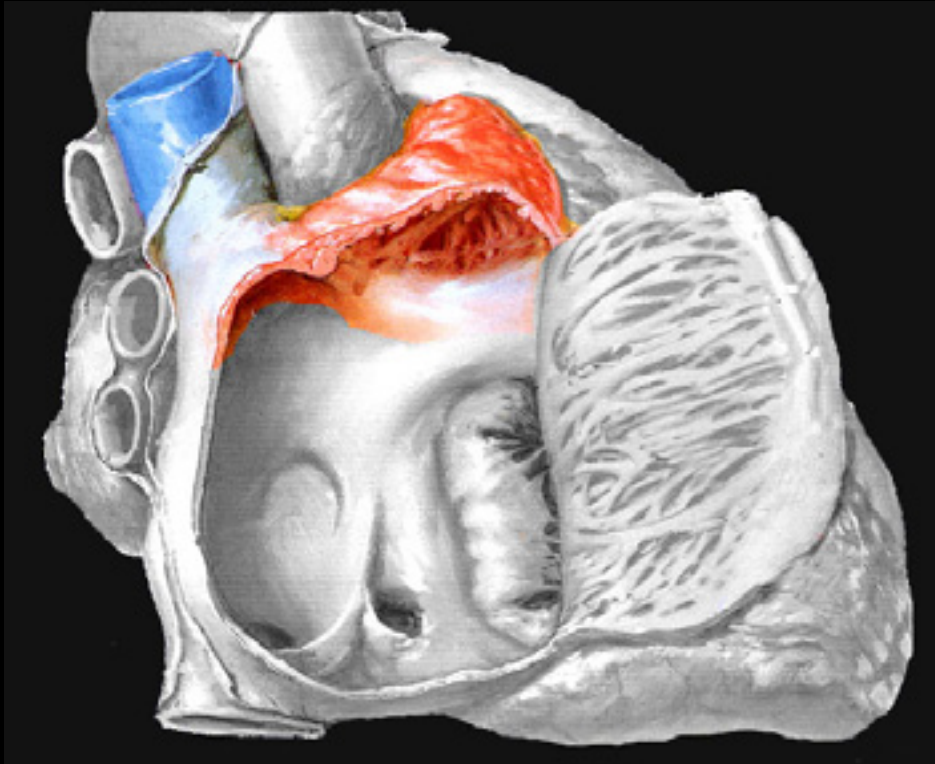
- Auricola
- Cresta Terminale
- Seno venoso (SVC e IVC)

SETTO

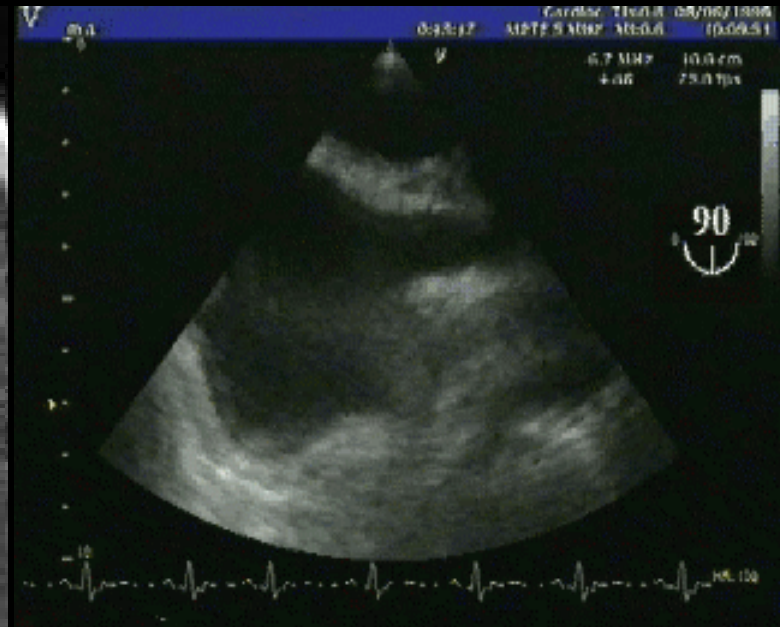
- Fossa Ovale
- Setto AV (nodo e fascio AV)
- Seno coronarico

AURICOLA

- Forma triangolare
- Ampia base di impianto

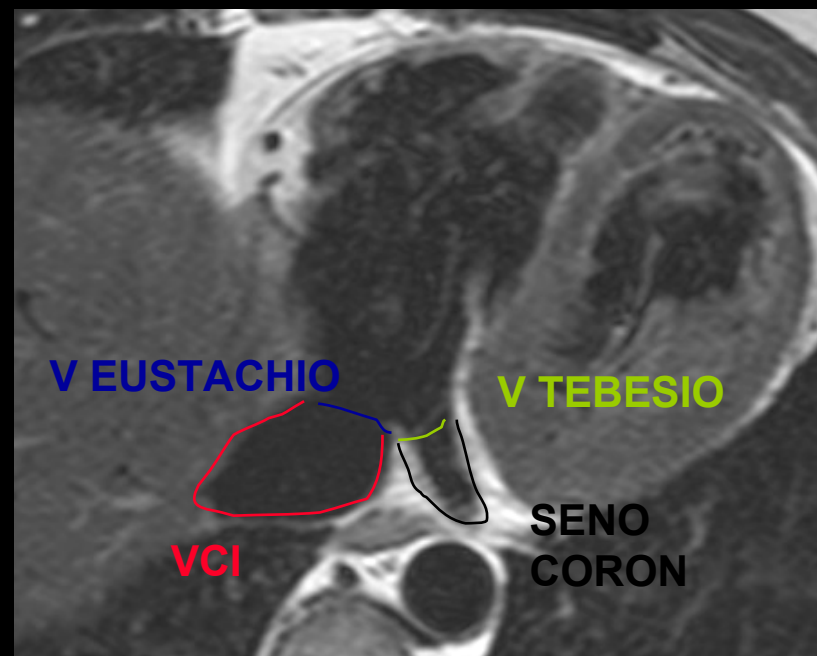
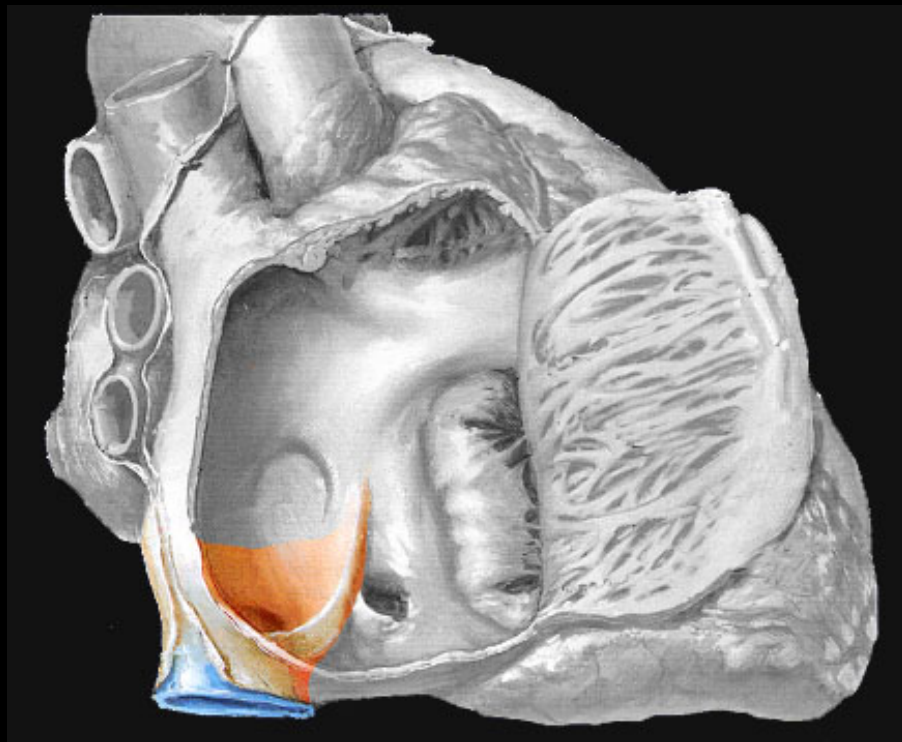


VENA CAVA SUPERIORE

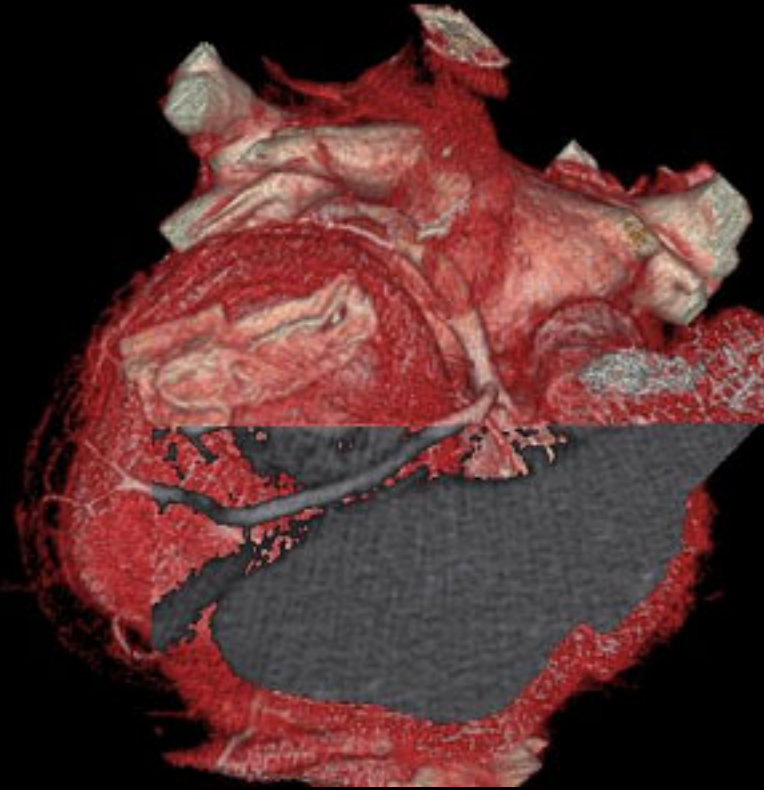
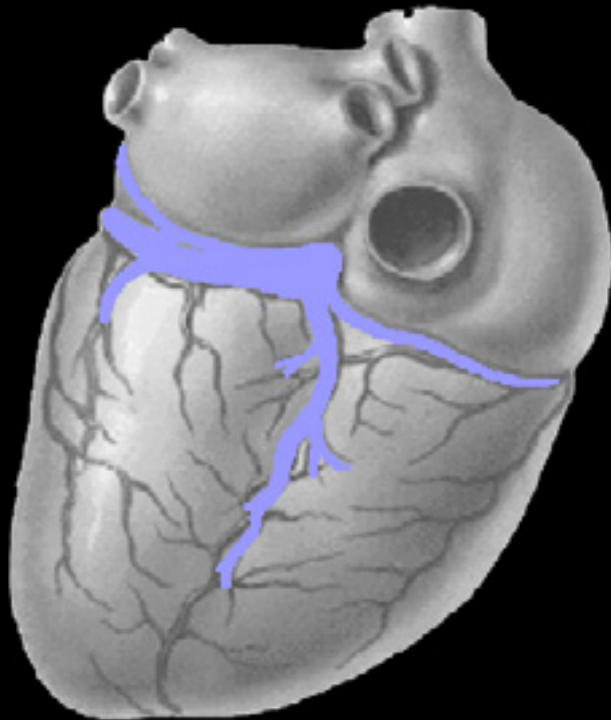
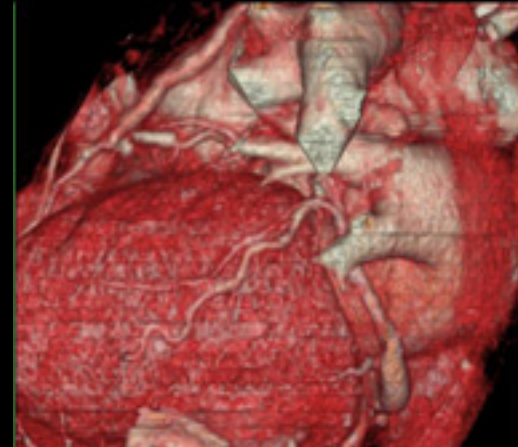
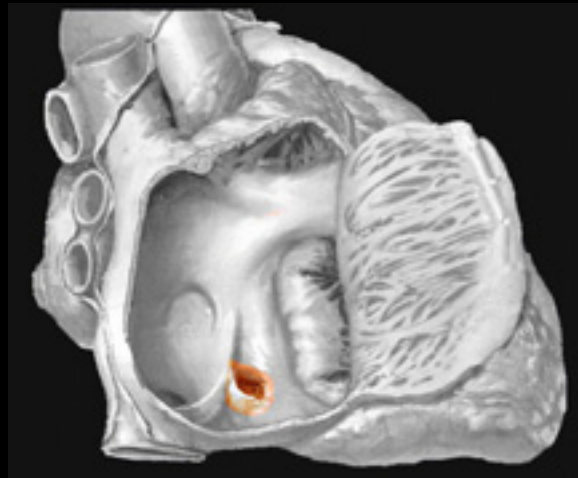


VENA CAVA INFERIORE

- Valvola di Eustachio
- Rete di Chiari

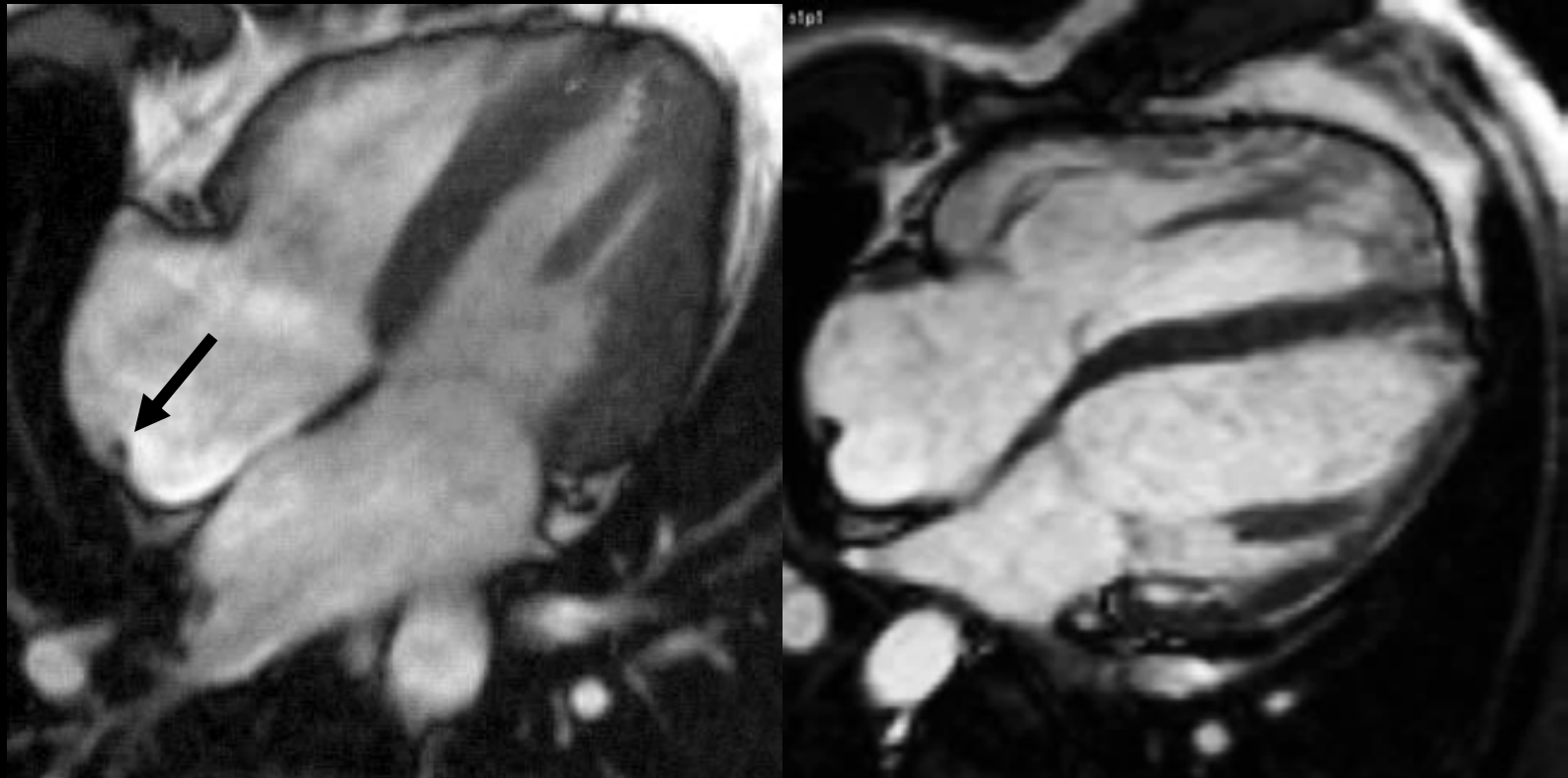


SENO CORONARICO

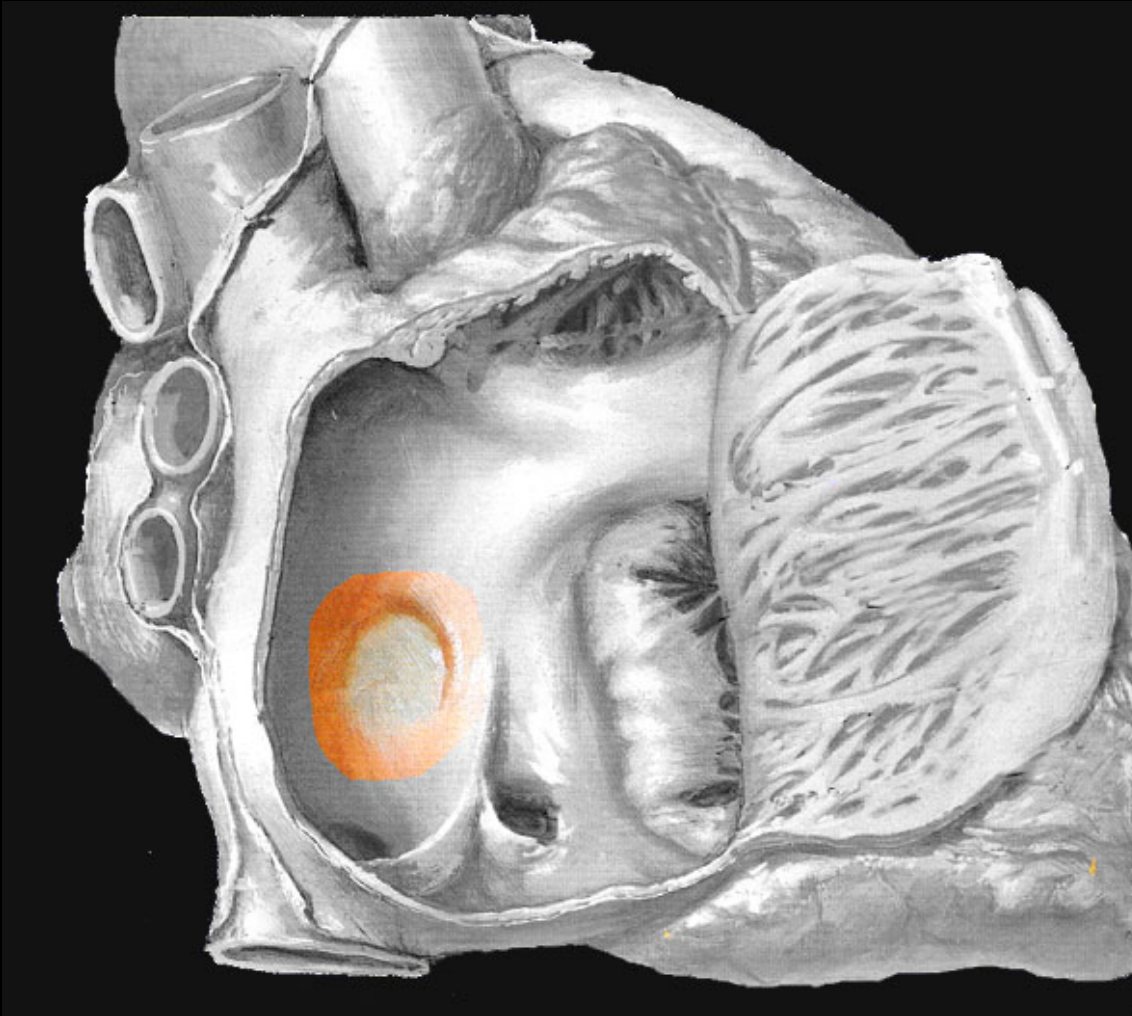


CRESTA TERMINALE

- Suddivide la porzione liscia venosa dell'AD (1mm) da quella muscolare (2-3 mm)
- Spessa fino 6 mm
- DD con trombo



FINESTRA OVALE



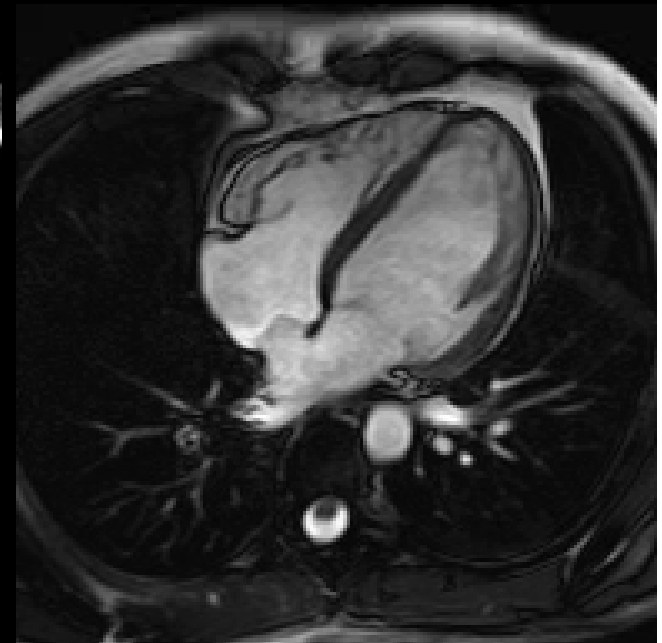
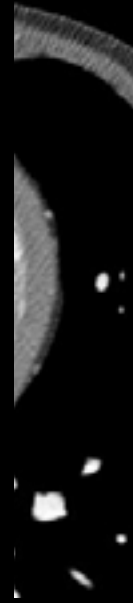
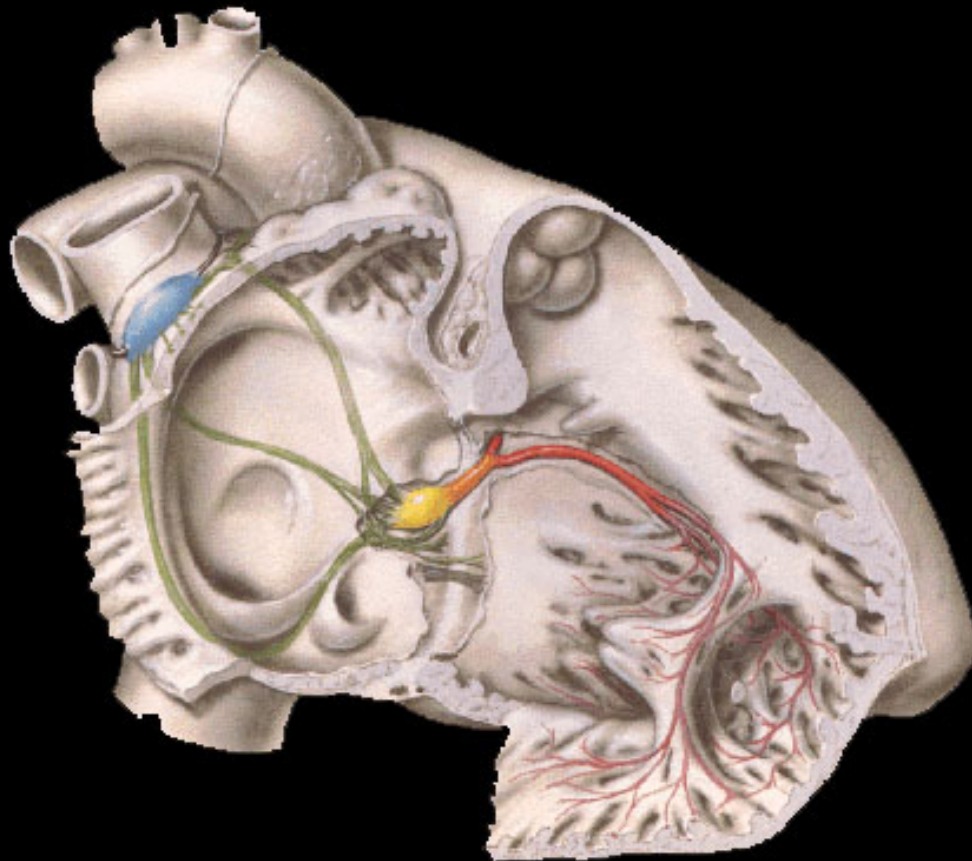
FINESTRA OVALE

- Estremamente sottile
- Pervia in 1/3 dei soggetti (ma funzionalmente chiusa)
- Sede di lesioni espansive



SETTO A-V

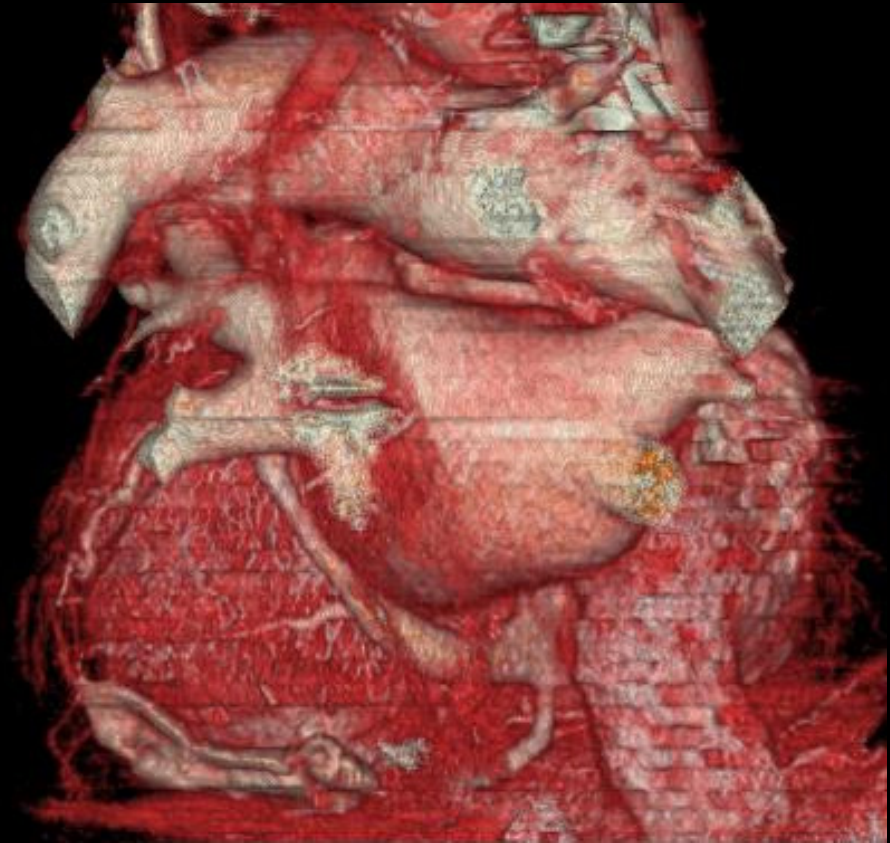
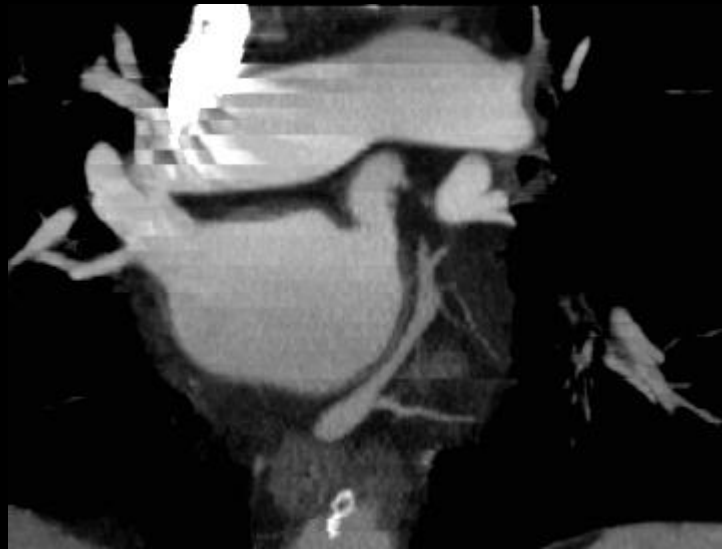
- Punto di contatto fra AD e VS
- Sede del nodo e del fascio AV



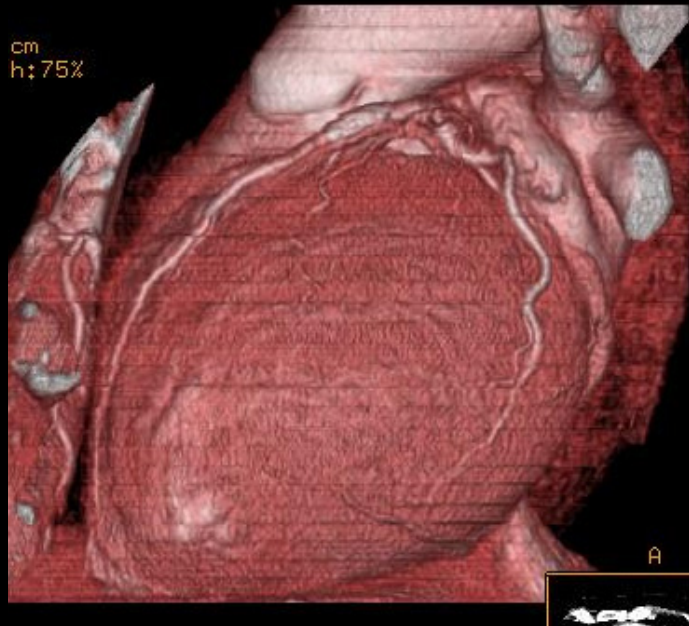
ATRIO SINISTRO

CORPO

- Liscio
- Confluenza delle vene polmonari



ATRIO SINISTRO



AURICOLA

- Appendice muscolare
- Tubulare, digitiforme
- Ostio stretto

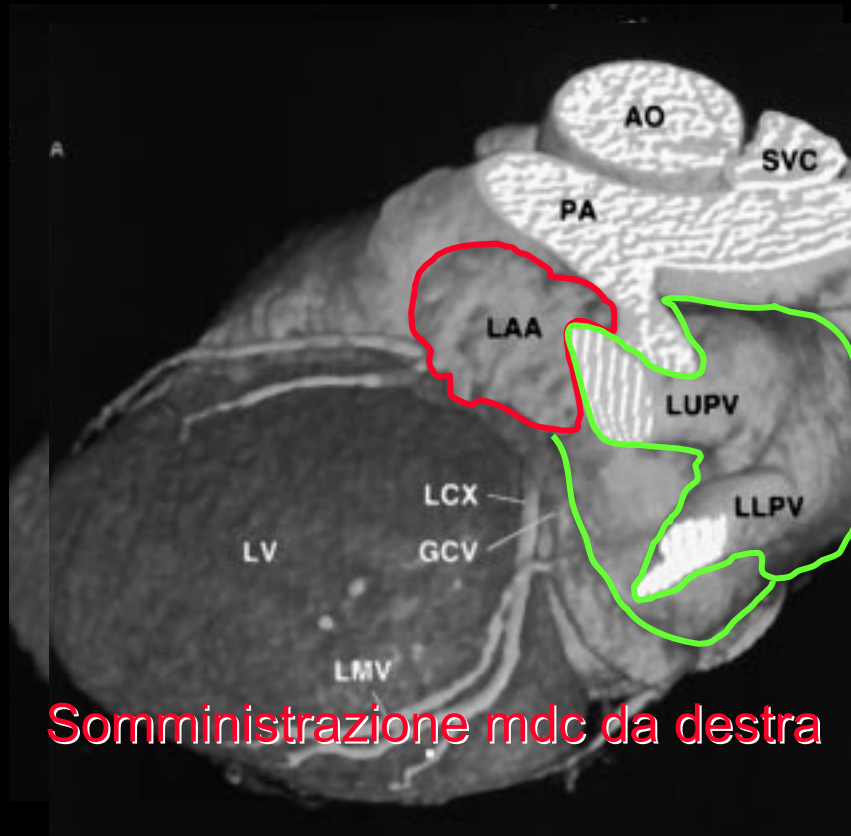


ATRIO SINISTRO

CORPO

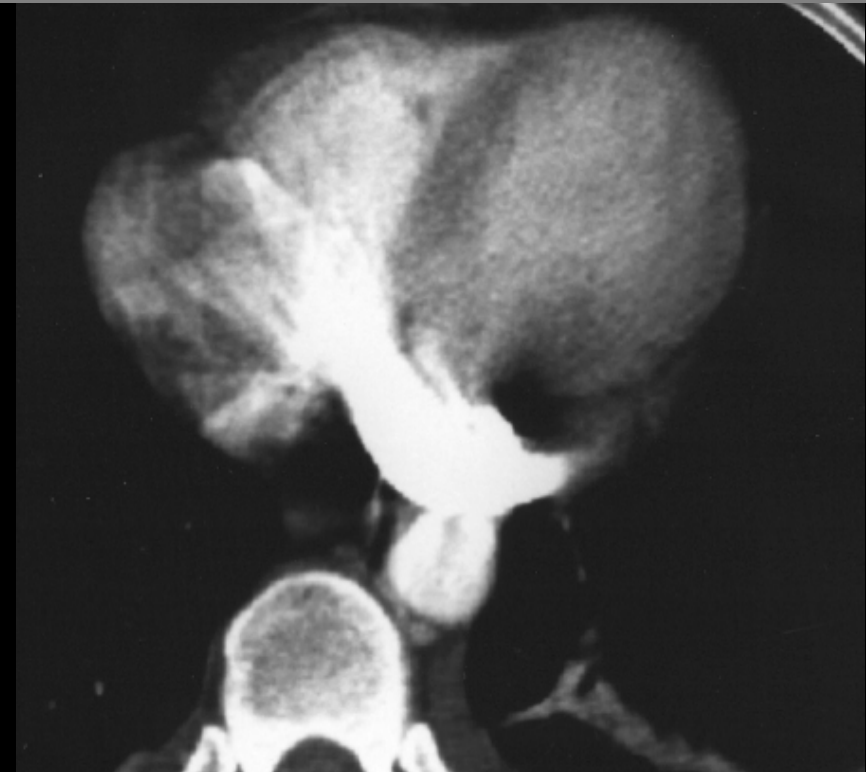
AURICOLA

Separati da Legamento di Marshall



Somministrazione mdc da destra

Eidsness WR AJR 2003;180: 544



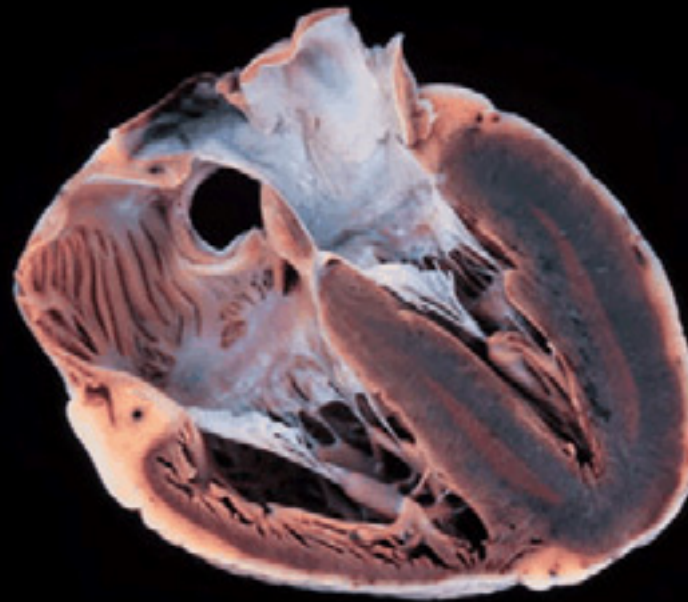
Gerber TC, Circulation. 2002;105:e79

Paragone fra gli ATRI

Atrio destro

Muscolatura più pronunciata

Auricola: foglia triangolare, base larga



Atrio sinistro

Superficie liscia

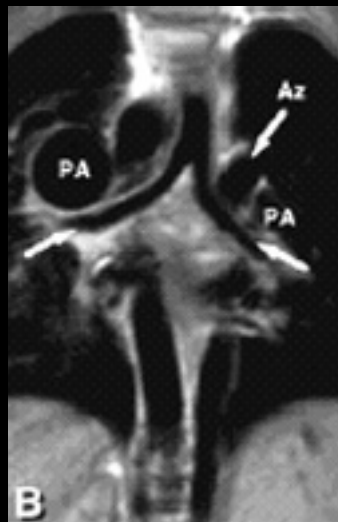
Auricola muscolare, foglia digitiforme, ostio stretto

Congenital Cardiovascular Disease in the Adult Patient

Imaging Update

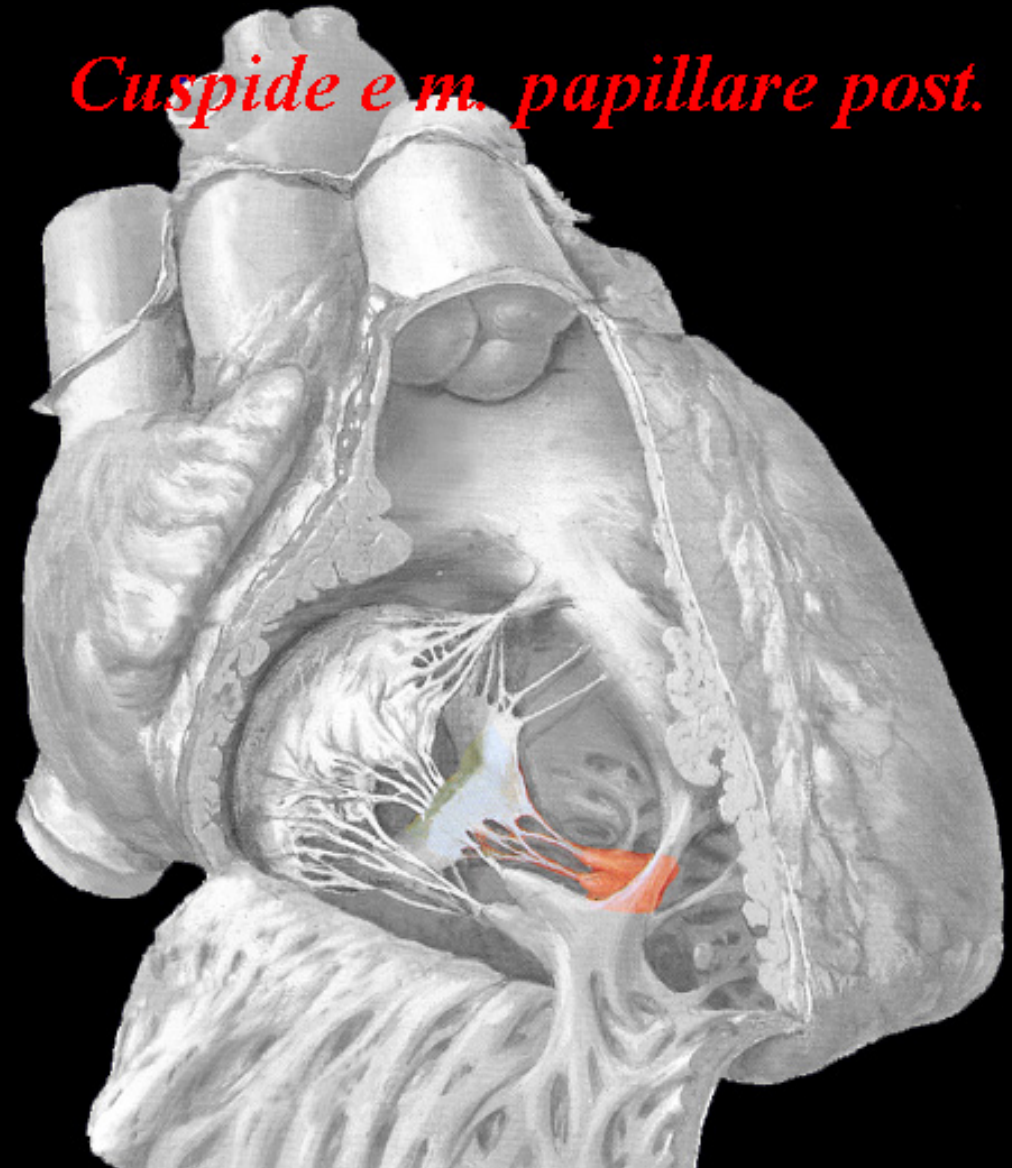
Robert M. Steiner, M.D., Gautham P. Reddy, M.D., M.P.H., and Stephanie Flicker, M.D.

Sito atriale

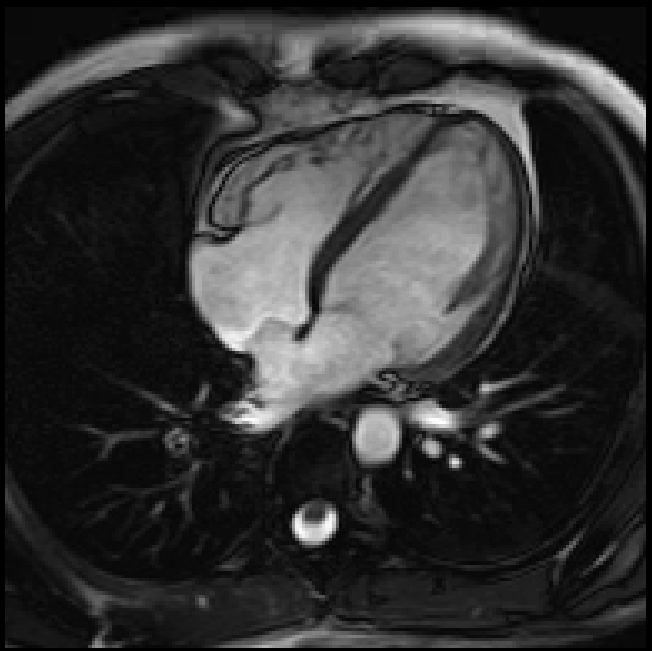
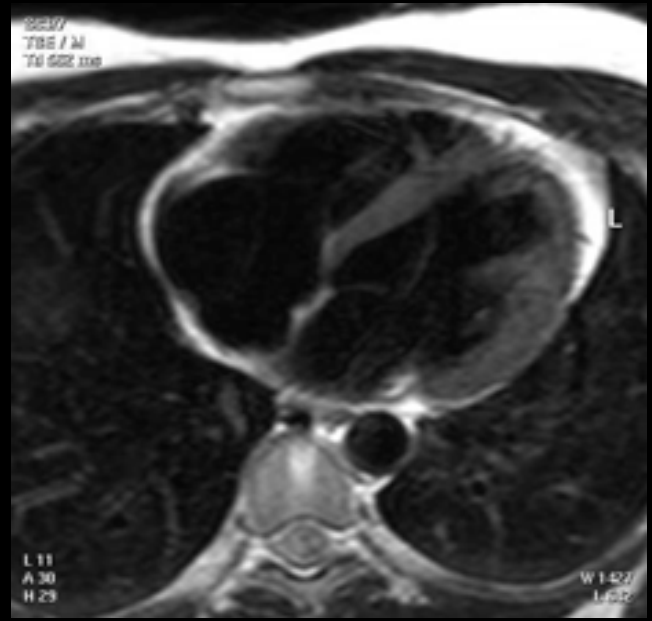
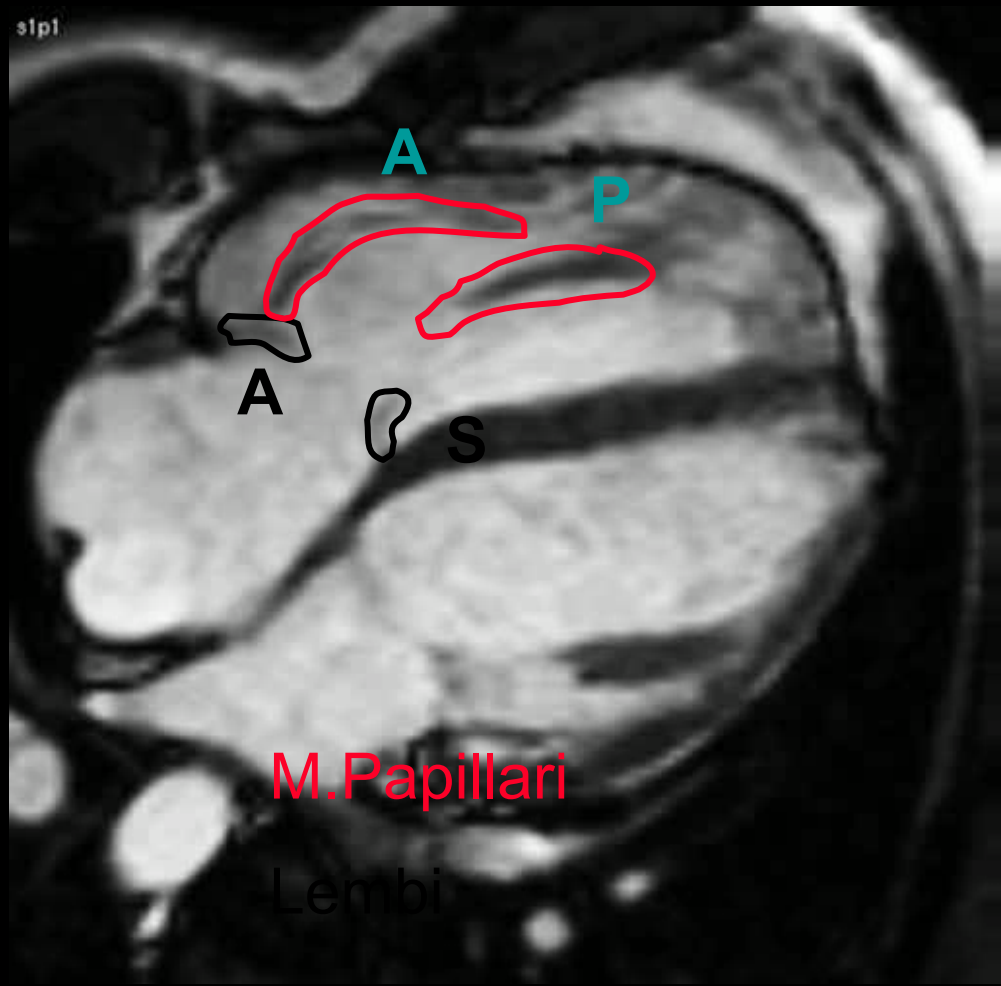


VALVOLA TRICUSPIDE

- ANULUS
 - INCOMPLETO
- LEMBI (3)
 - ANTERIORE
 - POSTERIORE
 - SETTALE
- CORDE TENDINEE
- M. PAPPILLARI (3)
 - ANTERIORE
 - MEDIALE (Lancisi)
 - POSTERIORE

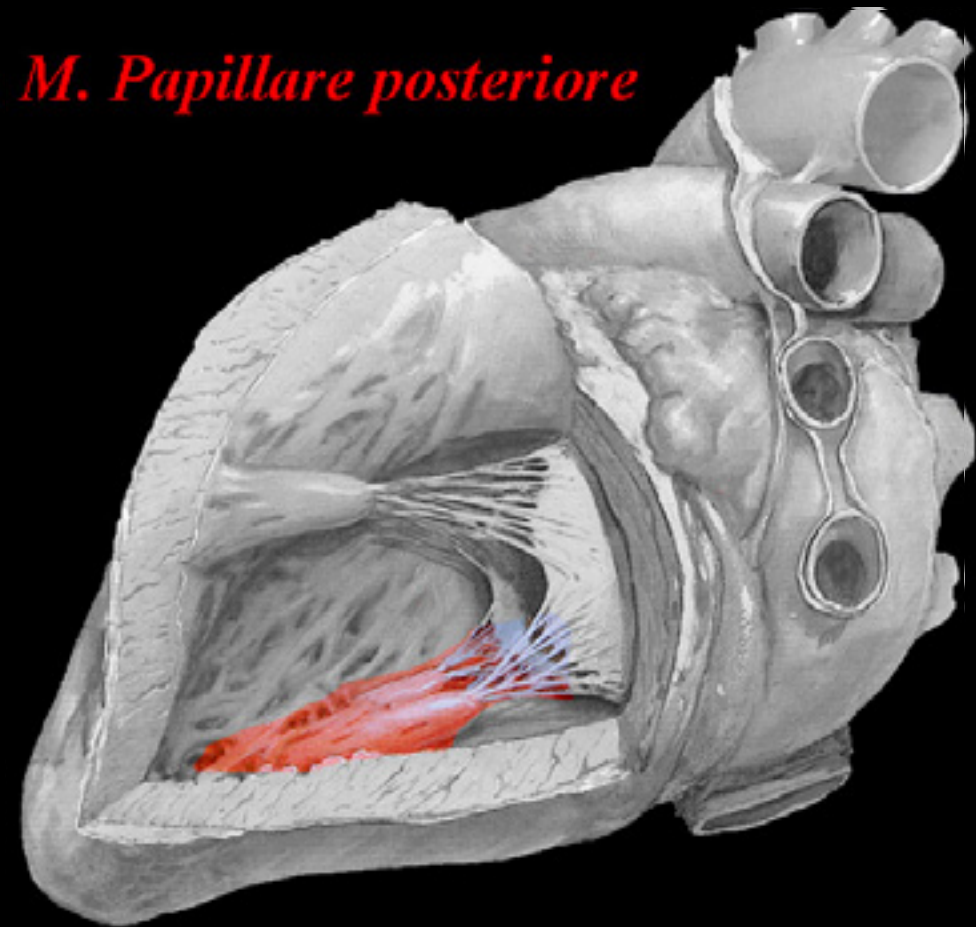


VALVOLA TRICUSPIDE

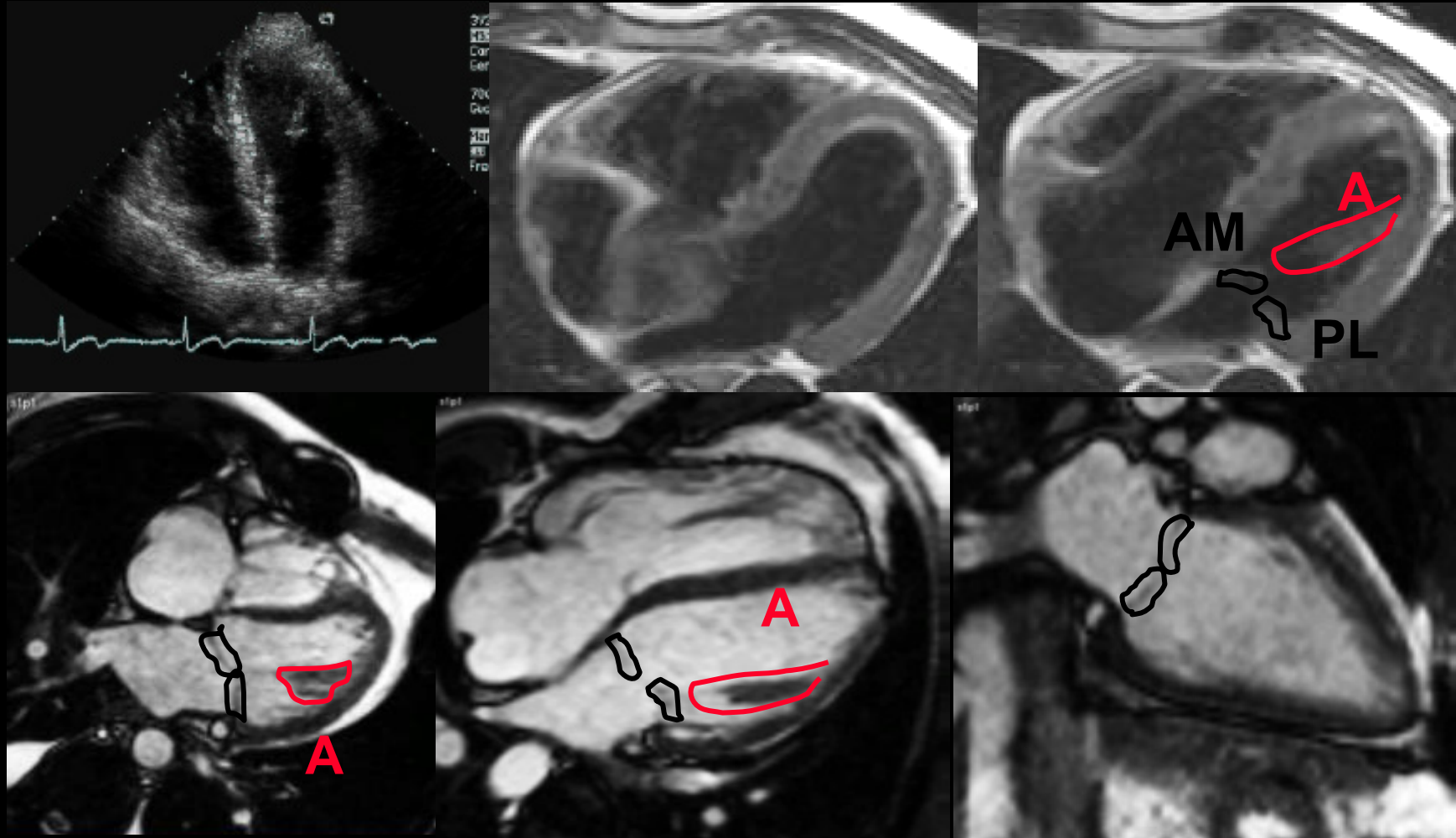


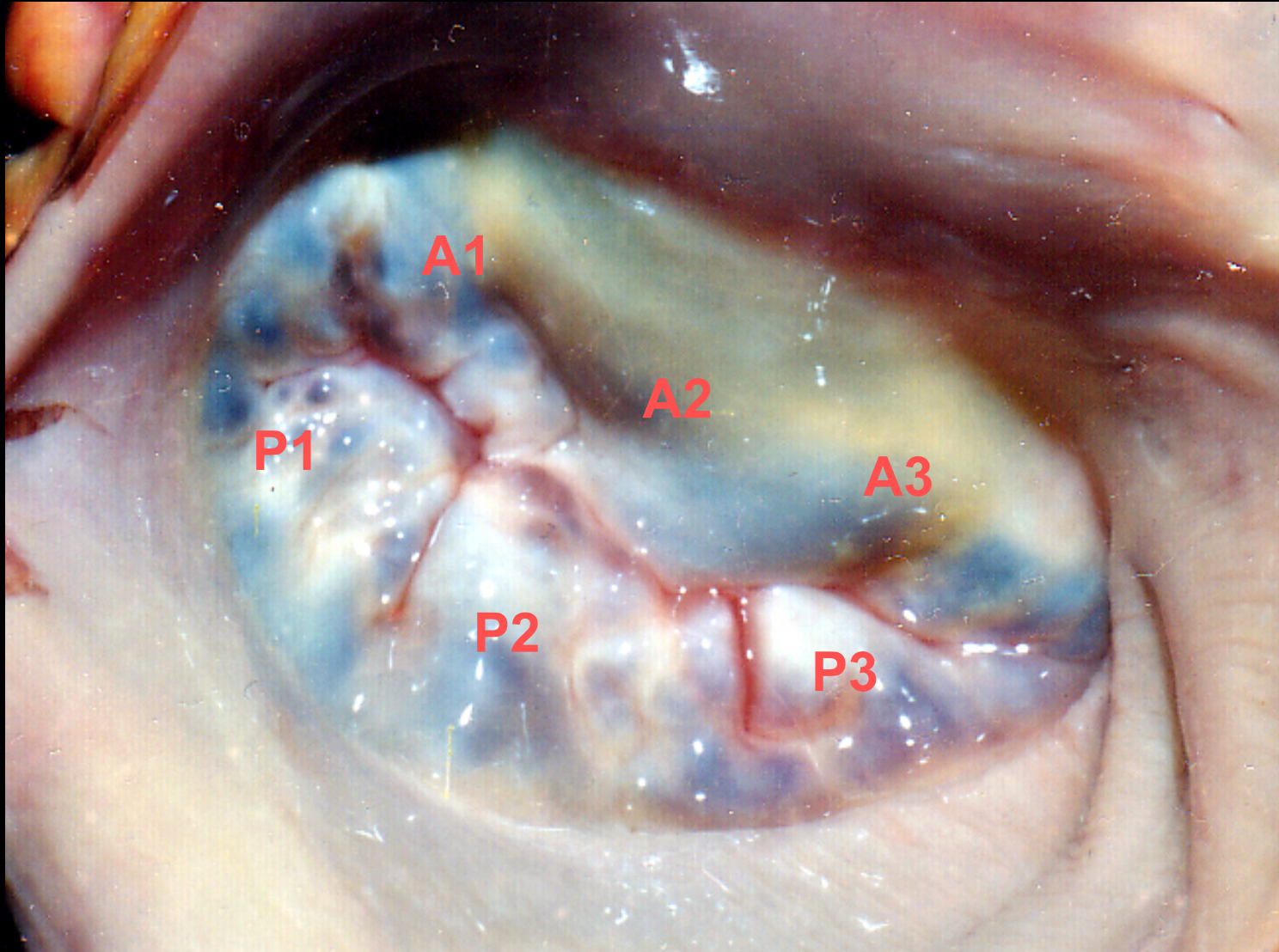
VALVOLA MITRALE

- ANULUS
 - COMPLETO
- LEMBI (2)
 - ANT-MEDIALE
 - POST-LATERALE
- CORDE TENDINEE
- M. PAPILLARI (2)
 - ANTERIORE
 - POSTERIORE

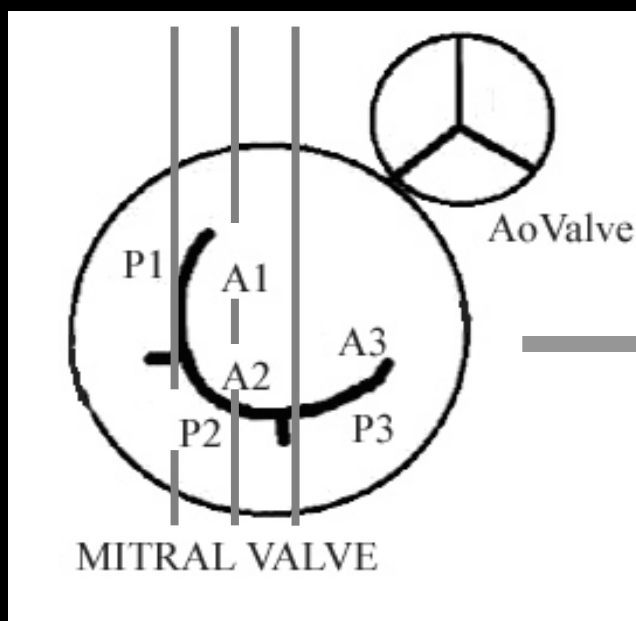


VALVOLA MITRALE

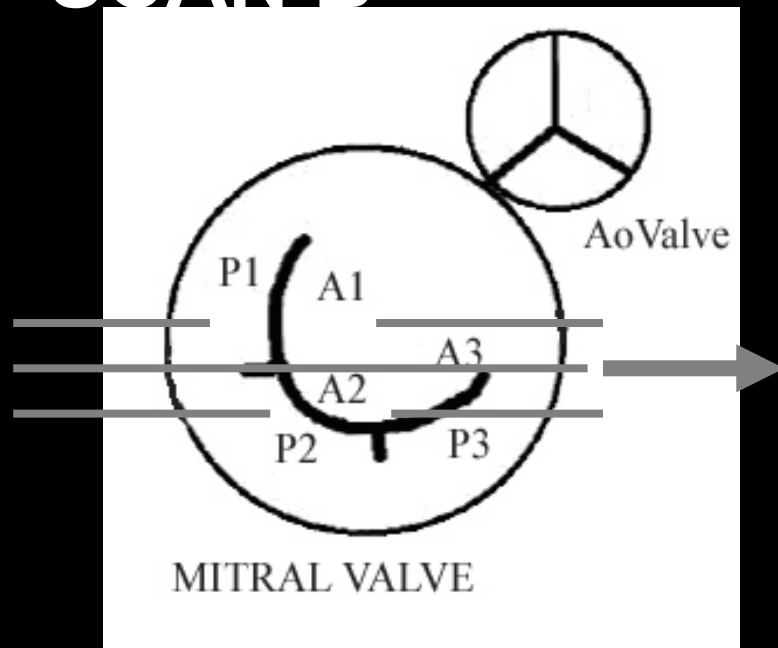




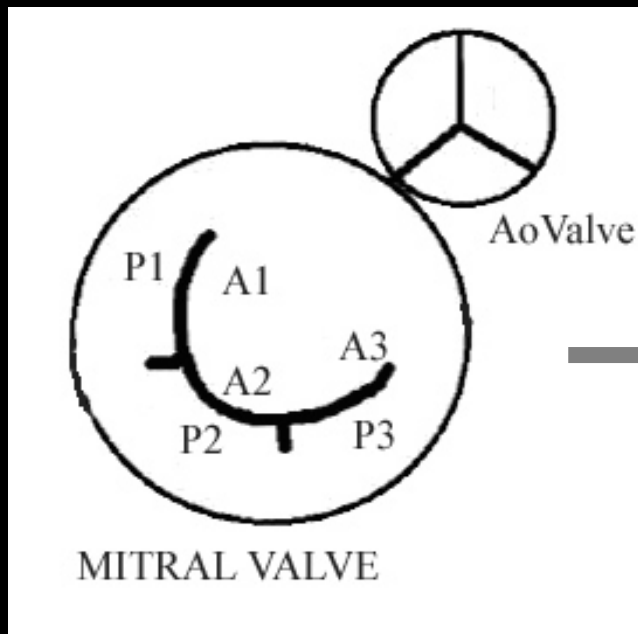
SCAN A



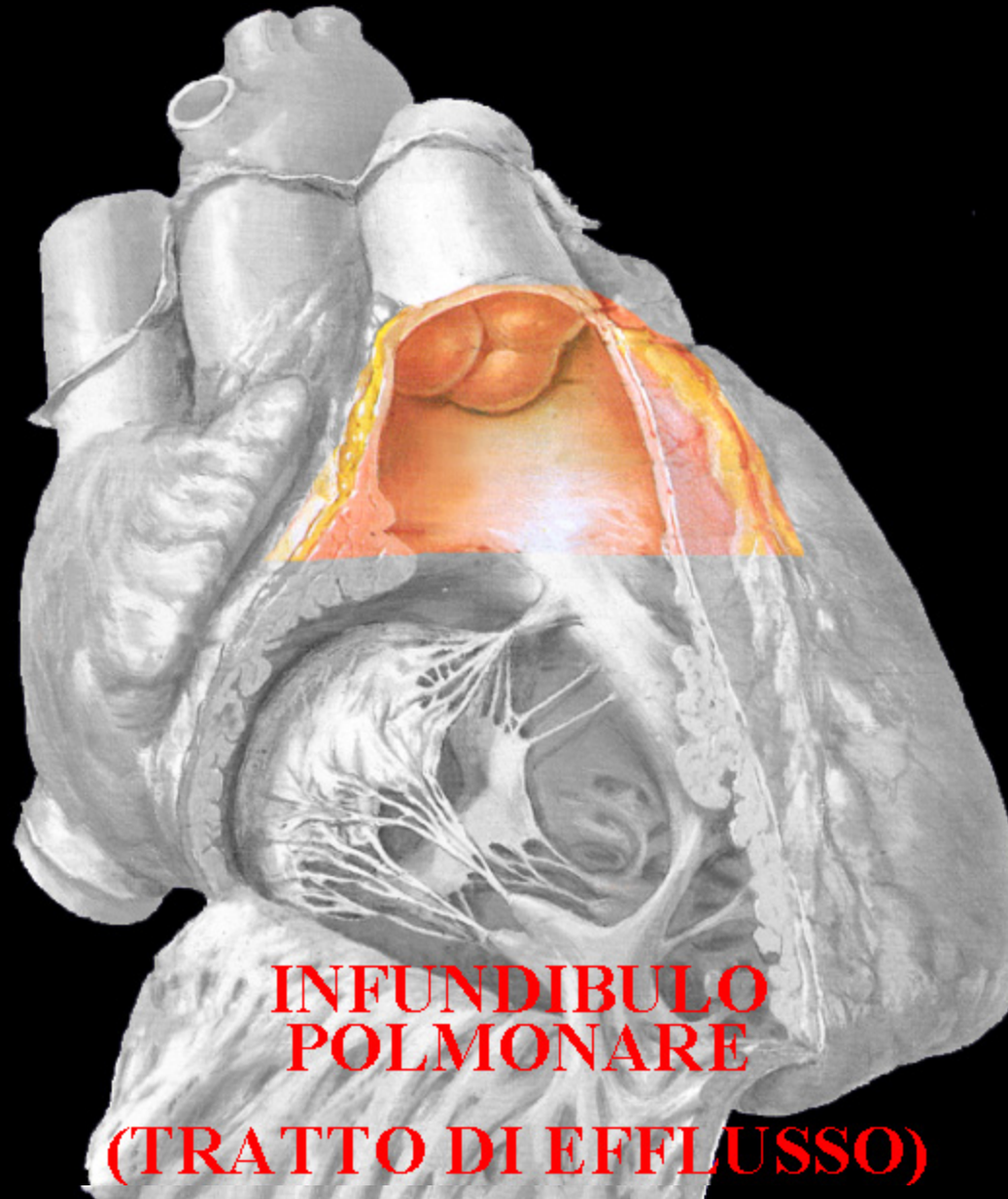
SCAN B



SCAN C



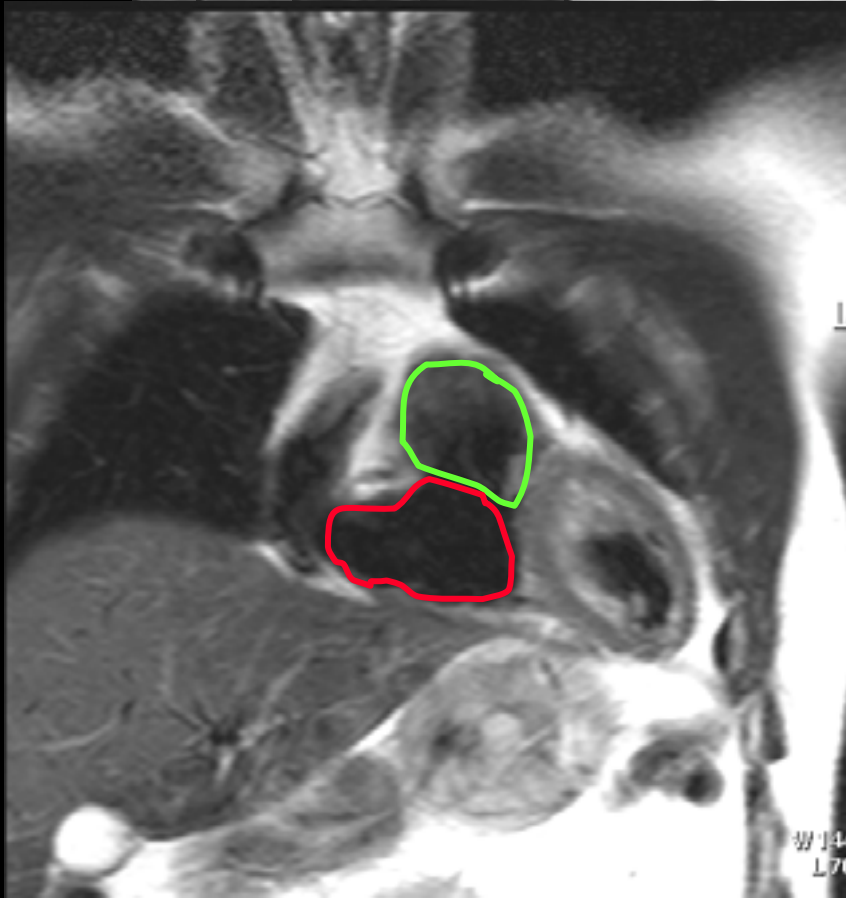
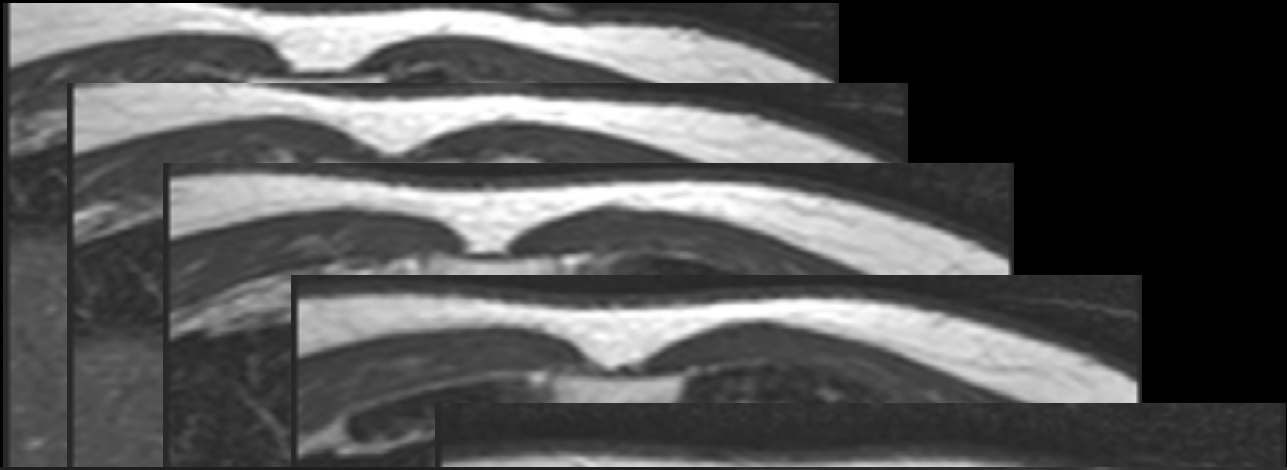
VENTRICOLO DESTRO



**INFUNDIBULO
POLMONARE
(TRATTO DI EFFLUSSO)**

SETTO INTERVENTRICOLARE



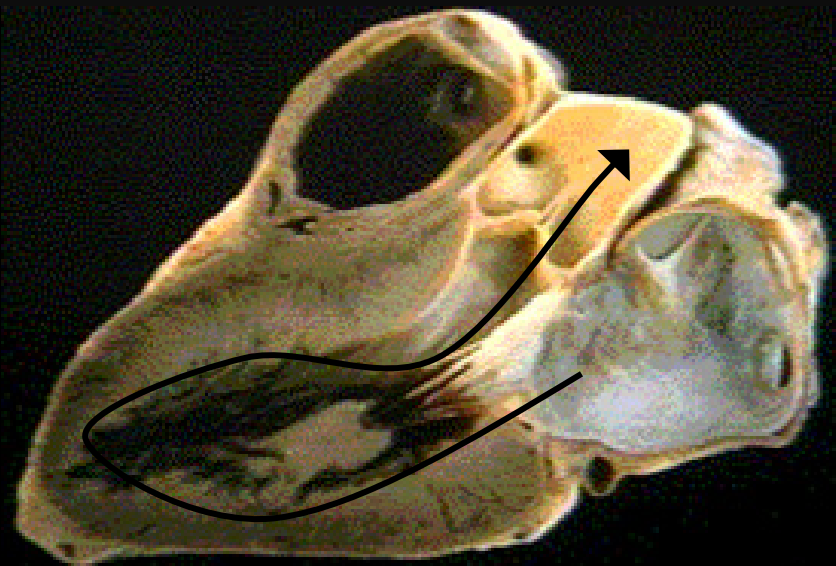
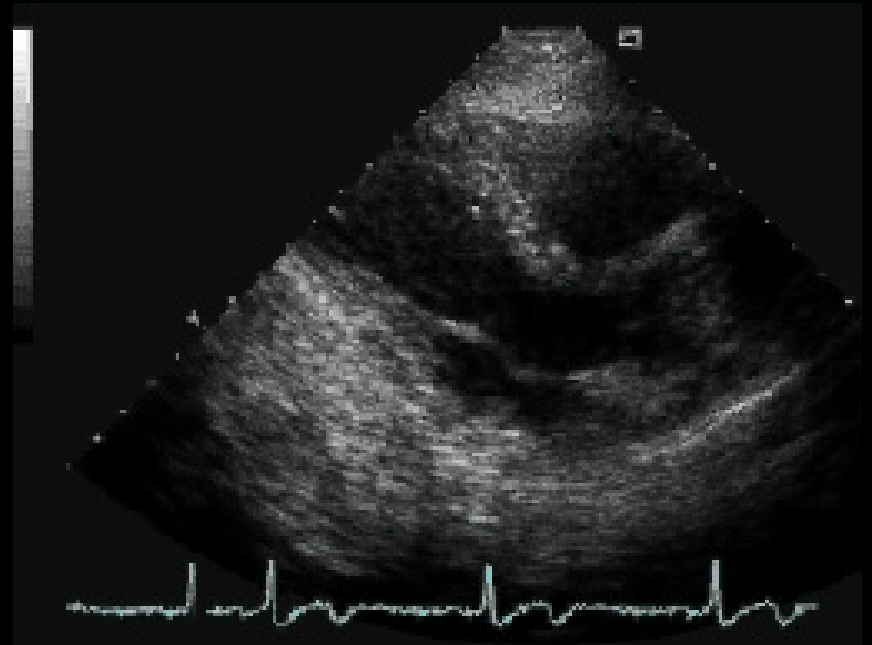
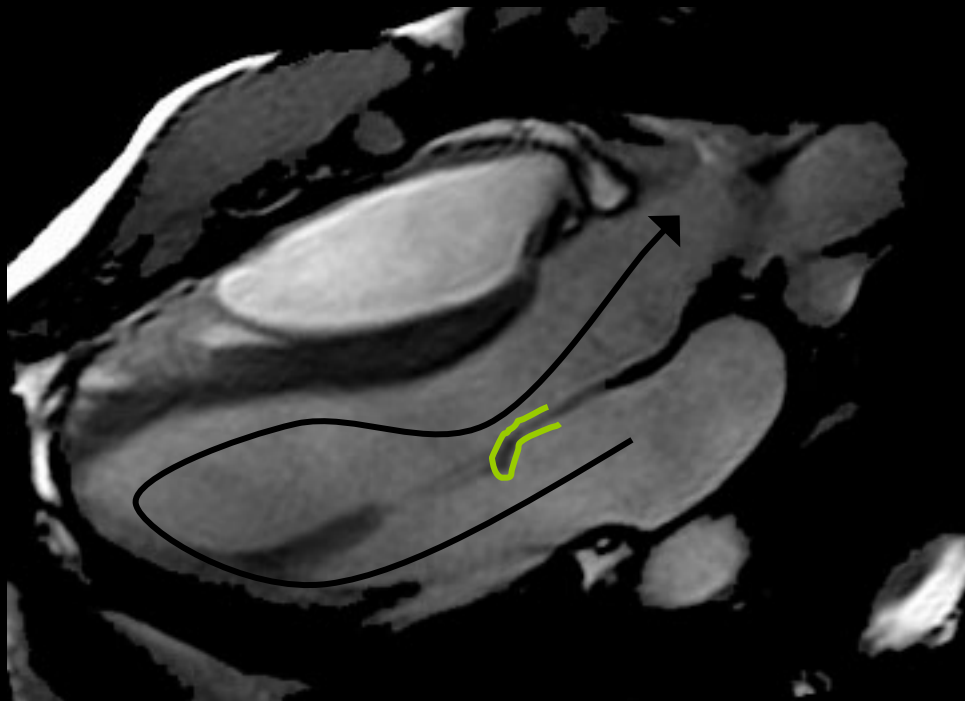


VENTRICOLO SINISTRO

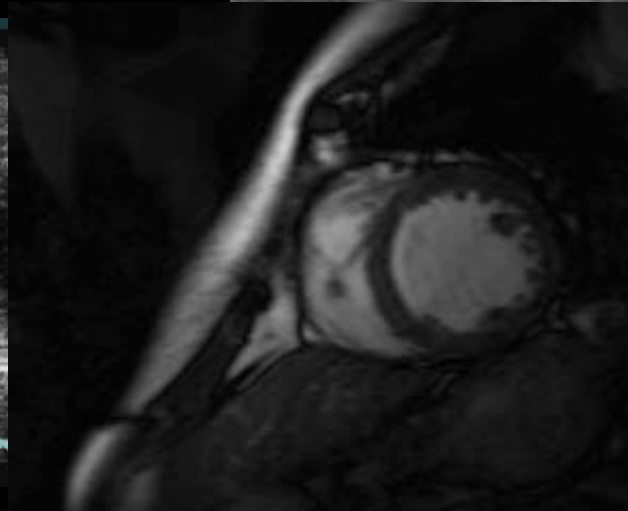
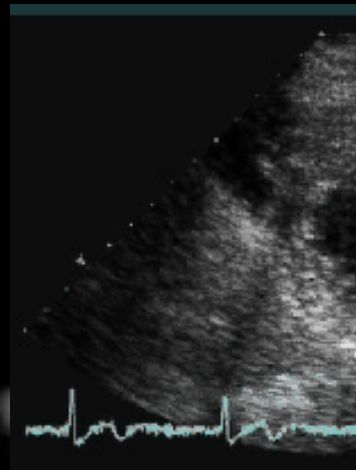
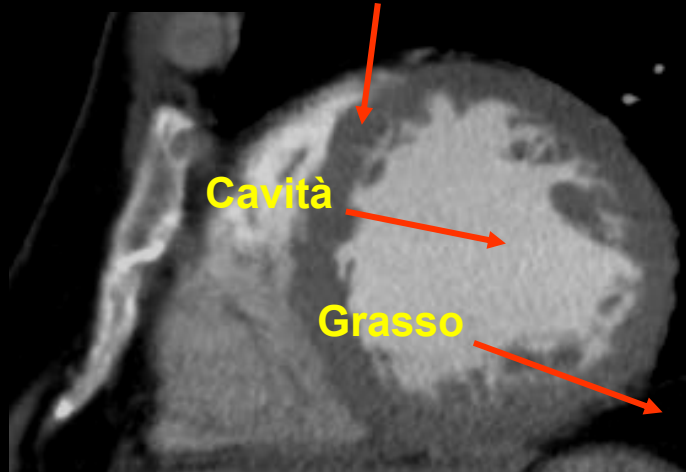
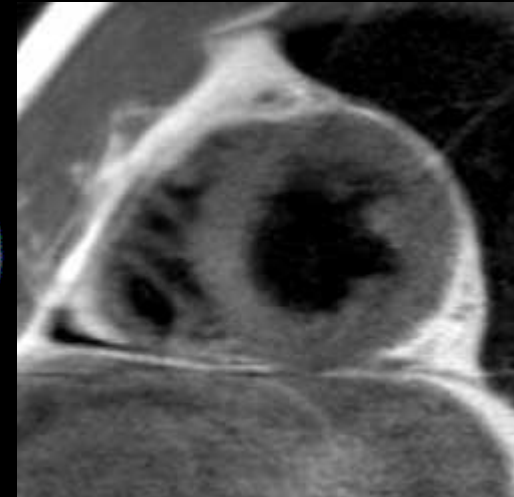
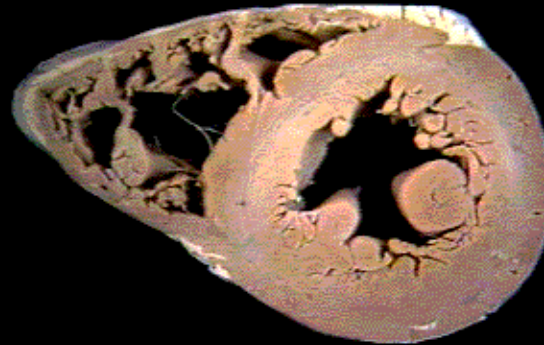
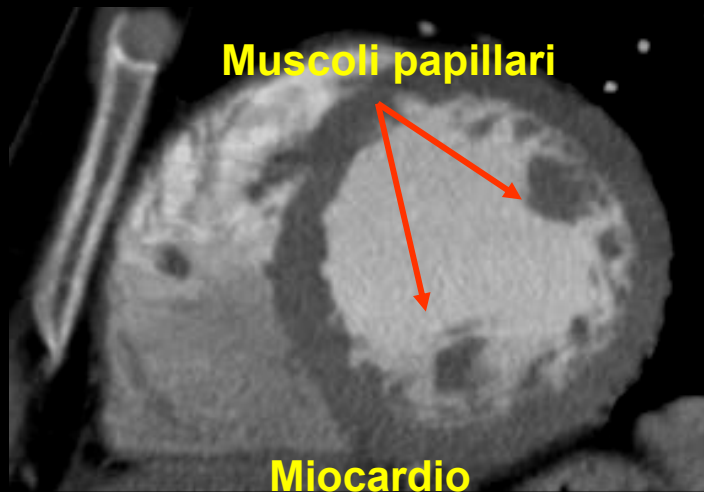
VS: tratto di efflusso



VENTRICOLO SINISTRO

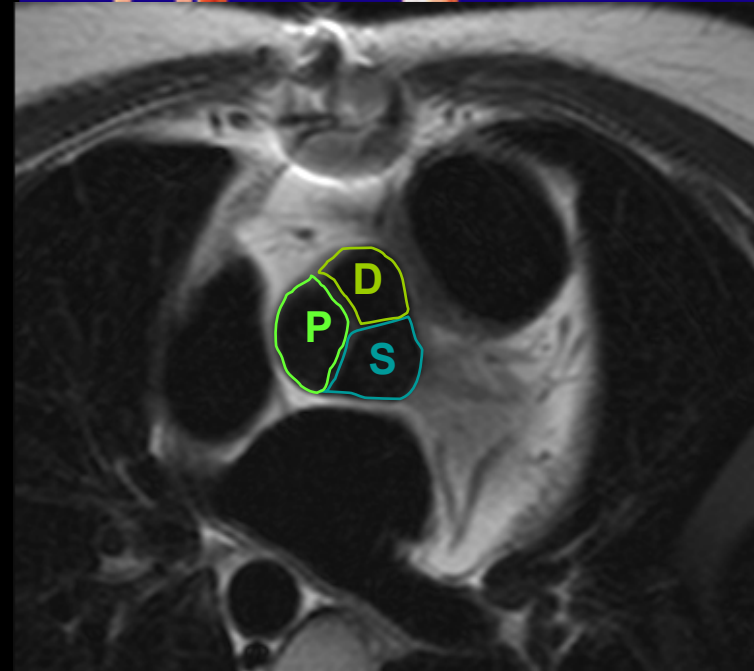
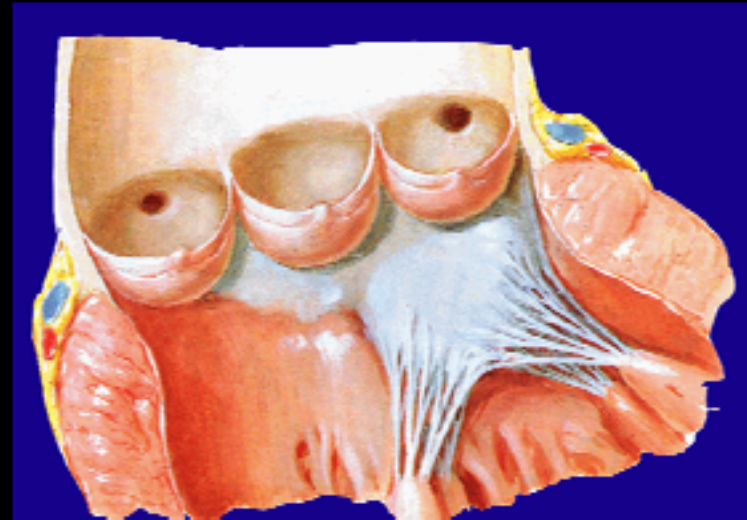


M. PAPILLARI



VALVOLA AORTICA

- **ANULUS FIBROSO**
 - COMPLETO
- **SENI DI VALSALVA**
 - DESTRA
 - SINISTRA
 - POST (non coronarica)
- **OSTI CORONARICI**
- **CUSPIDI**
- **NODULI DI ARANZIO**



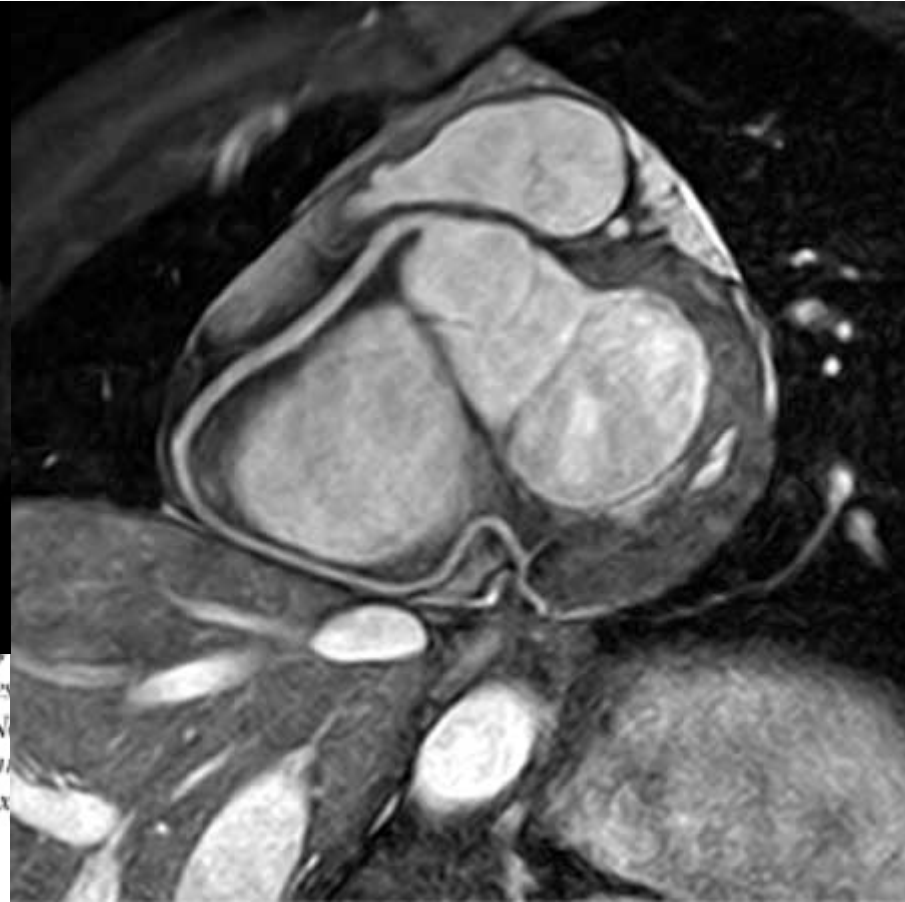
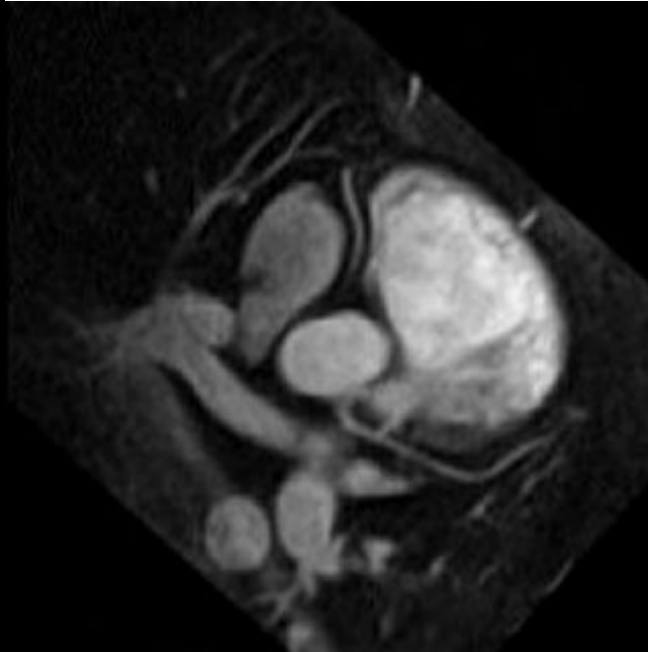
VALVOLA AORTICA

- VIRTULAMENTE AL CENTRO DEL CUORE
- CONTATTA TUTTE LE CAMERE CARDIACHE
- CONTATTA LE ALTRE VALVOLE
 - Comm.PS → MITR.
 - Comm.DS → POLM.
 - Comm.PD → TRIC



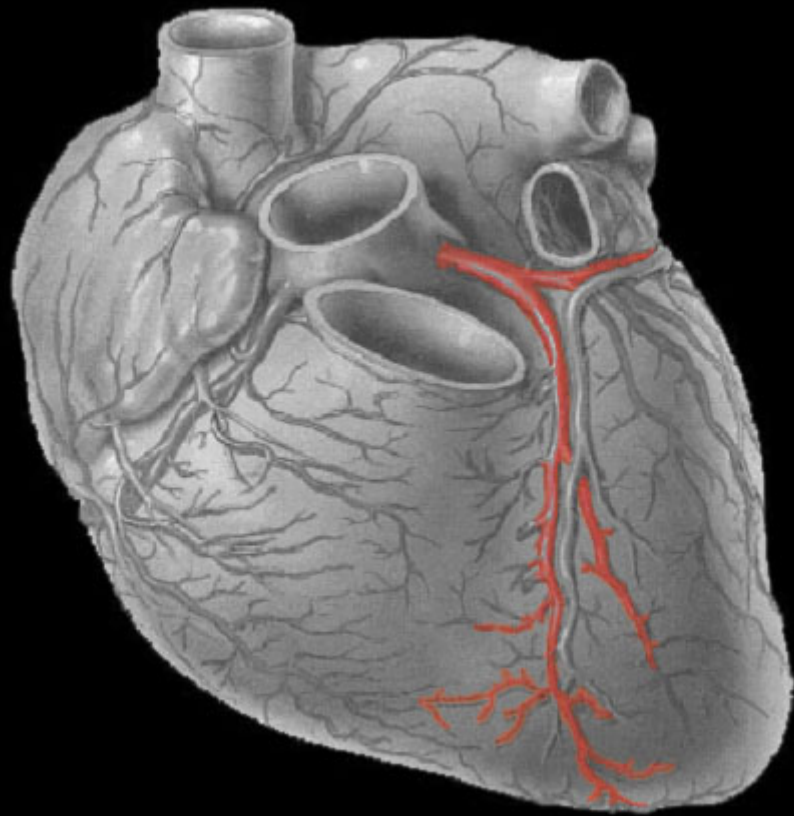
LE CORONARIE

Noninvasive Coronary Imaging in the New Millennium:



and multislice spiral computed tomography. Besides visualization of the vessel lumen, they can also detect and characterize atherosclerotic plaques. Not widely used, but considering the pace of the technology, noninvasive coronary angiography can be expected to become a standard tool in the near future.
[Rev Cardiovasc Med. 2002;3(2):77-84]

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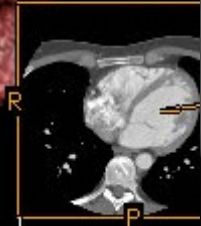
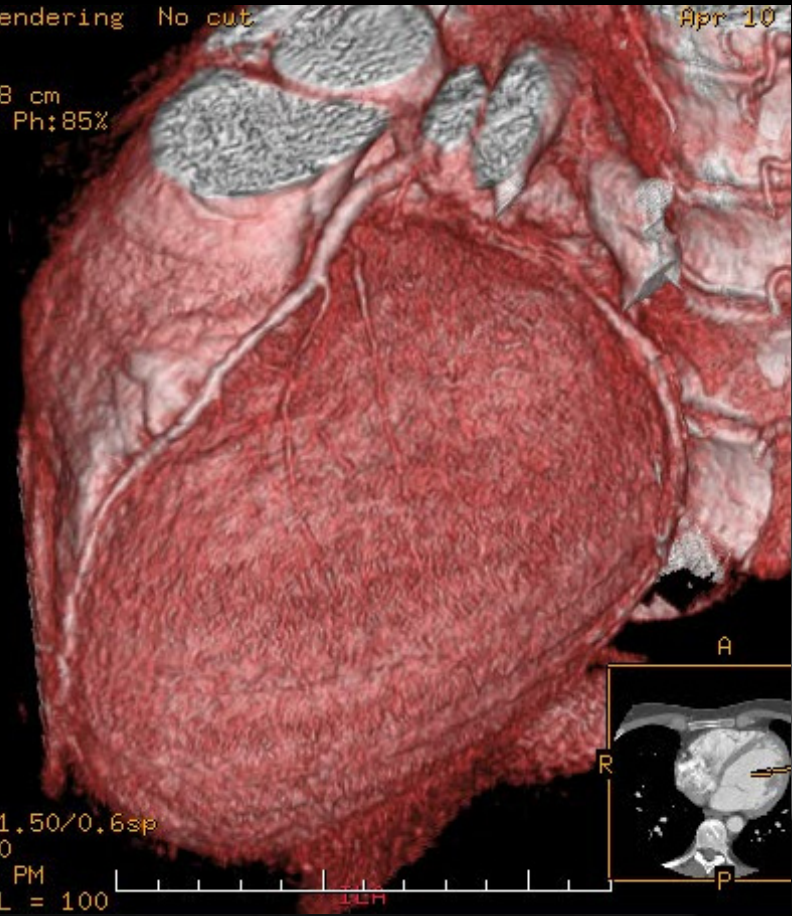


Volume Rendering No cut

Apr 10

FOV 16.8 cm
STANDARD Ph:85%
.04/0

to VOI
w 120
rA 320
.3
..2 mmP 1.50/0.6sp
ilt: 0.0
03:26:06 PM
I = 800 L = 100



DIAMETRO CORONARIE

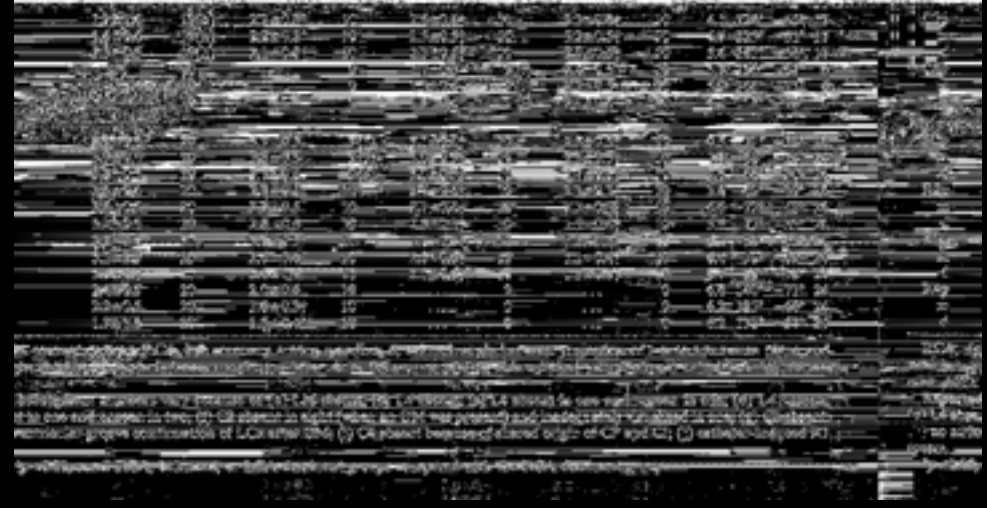
Lumen Diameter of Normal Human Coronary Arteries

Influence of Age, Sex, Anatomic Variation, and Left Ventricular Hypertrophy or Dilation

J. Theodore Dodge Jr., MD; B. Greg Brown, MD, PhD;
Edward L. Bolson, MS; and Harold T. Dodge, MD

TABLE 6. Lumen Diameter and Spatial Location of 13 Main Artery Segments, Each With Three Subsegments, in Normal Men

Subsegment	Lumen diameter								Spatial location ¹⁰			
	RCA dominant		Small RCA dominant		Balanced dominant		LCA dominant					
	Diameter (mm)	n	Diameter (mm)	n	Diameter (mm)	n	Diameter (mm)	n	r	θ	Φ	
Left main												
LMp	4.5±0.6	18(a)	4.6±0.5	10	4.3±0.4	9(a)	4.6±0.4	10	0.3	83°	7°	19
m	4.5±0.5	18(a)	4.6±0.5	10	4.4±0.4	9(a)	4.6±0.4	10	0.7	80°	4°	19
d	4.5±0.4	18(a)	4.6±0.5	10	4.4±0.3	9(a)	4.5±0.4	10	1.1	79°	0°	19
Left anterior descending												
L1p	3.7±0.5	20	3.9±0.4	10	3.8±0.2	10	3.8±0.3	10	1.6	70°	-3°	19
m	3.6±0.5	20	3.8±0.4	10	3.6±0.4	10	3.7±0.2	10	2.3	63°	-5°	19
d	3.5±0.6	20	3.8±0.5	10	3.4±0.5	10	3.5±0.3	10	3.0	59°	-8°	19
L2p	2.9±0.5	20	3.5±0.6 ^b	10	2.8±0.7	10	3.1±0.4	10	4.0	51°	-9°	19
m	2.5±0.5	20	2.9±0.7	10	2.5±0.4	10	2.8±0.4	10	5.3	44°	-12°	19
d	2.3±0.4	20	2.5±0.6	10	2.3±0.4	10	2.6±0.4*	10	6.5	39°	-17°	19
L3p	2.0±0.5	20	2.1±0.6	10	2.0±0.4	10	2.4±0.4*	10	8.0	33°	-23°	19
m	1.7±0.5	20	1.9±0.5	10	1.8±0.4	10	2.0±0.3	10	10.1	30°	-32°	19
d	1.4±0.5	20	1.7±0.4	10	1.6±0.3	10	1.9±0.5 ^b	10	11.8	31°	-40°	19
L4p	1.4±0.5	15(b)	1.3±0.3	8(c)	1.3±0.4	8(d)	1.7±0.4	7(e)	12.2	32°	-46°	16
m	1.1±0.4	15(b)	1.1±0.4	8(c)	1.2±0.4	8(d)	1.5±0.2*	7(e)	11.8	33°	-49°	16
d	0.9±0.3	15(b)	1.0±0.3	8(c)	0.9±0.3	8(d)	1.1±0.2	7(e)	11.4	34°	-52°	16
Left circumflex												
C1p	3.4±0.5	20	3.6±0.7	10	3.6±0.6	10	4.3±0.6 ^b	10	1.4	86°	-12°	19
m	3.4±0.5	20	3.5±0.8	10	3.4±0.5	10	4.2±0.6 ^b	10	1.8	94°	-24°	19
d	3.3±0.5	20	3.5±0.8	10	3.5±0.5	10	4.1±0.6 ^b	10	2.2	102°	-31°	19
C2p	2.8±0.5	11(f)	3.0±0.8	9(g)	3.1±0.5	7(h)	3.4±0.6*	7(i)	2.6	107°	-33°	18
m	2.8±0.6	11(f)	3.0±0.8	9(g)	3.2±0.4	7(h)	3.4±0.6*	7(i)	3.1	116°	-37°	18
d	2.7±0.6	11(f)	3.0±0.8	9(g)	3.1±0.4	7(h)	3.4±0.6*	7(i)	3.5	120°	-41°	18



DIAMETRO CORONARIE

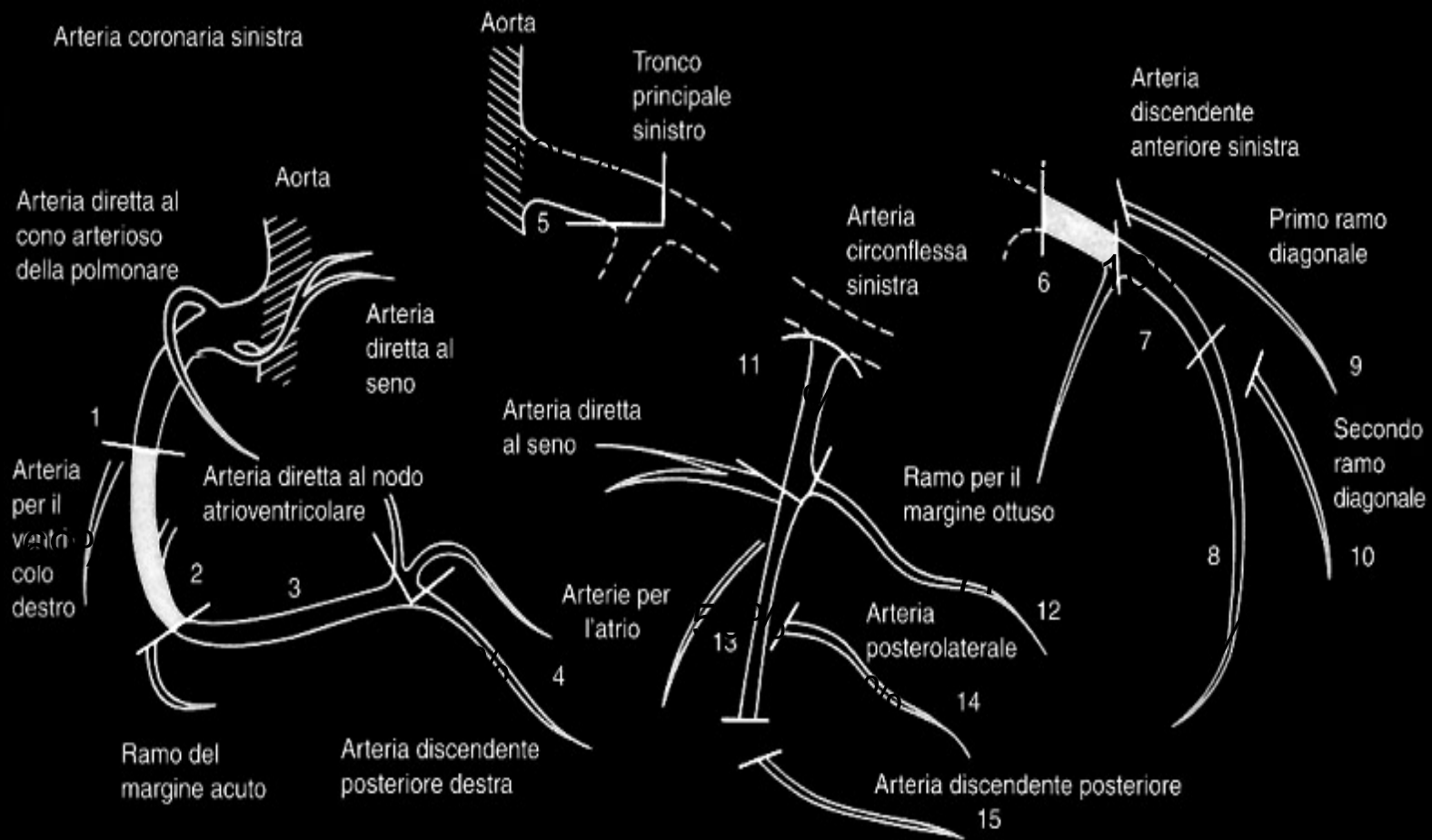
“..small vessel diameter can lead to false positive finding..”

Shmermund A. AM J CARDIOL 1998; 31: 1547-54

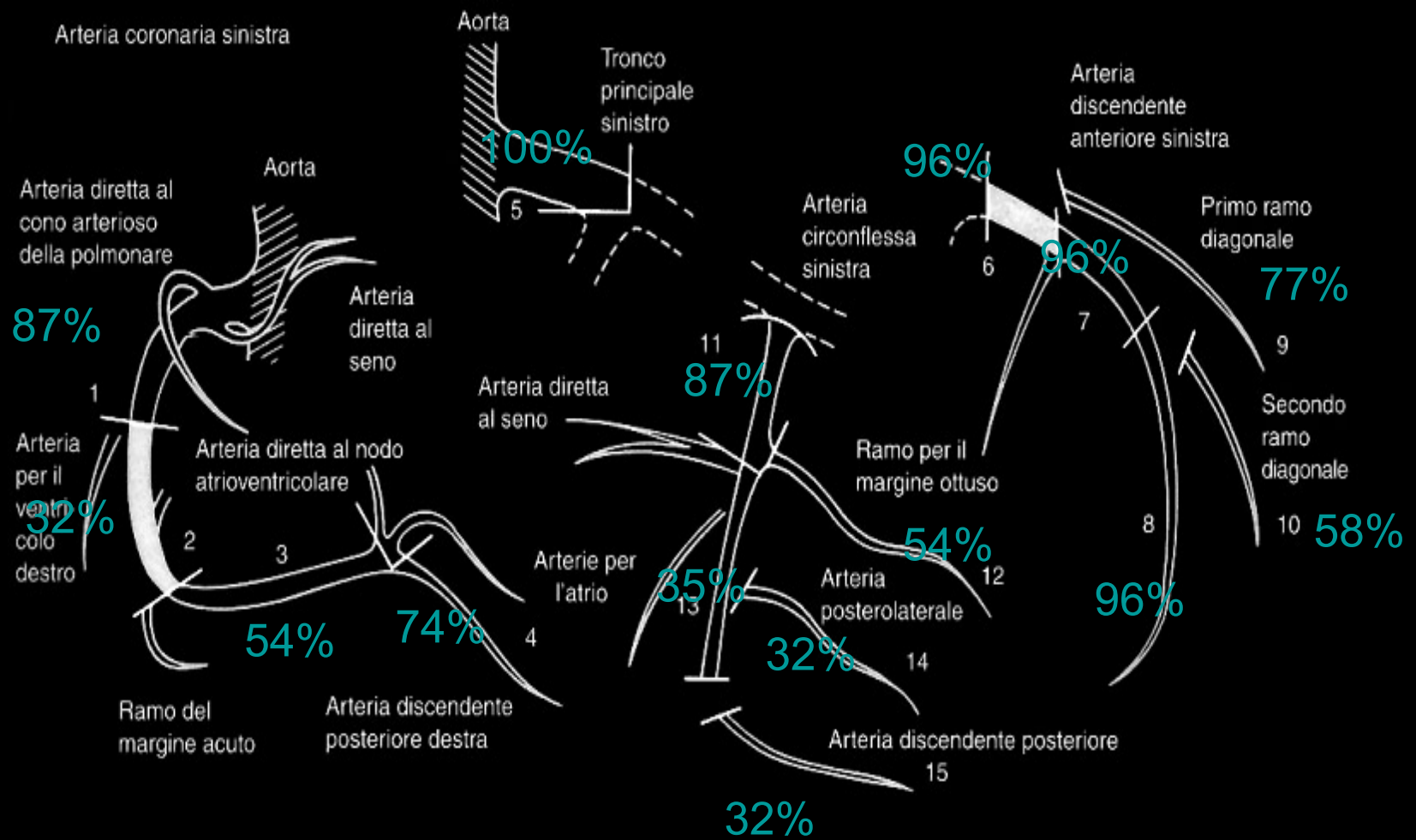
“..In MSCT and EBCT, it therefore seem reasonable to restrict evaluation to coronary segment with a diameter of more than 1.5 mm ..”

Beker C.R. JCAT 2002; 26 (5) 750-755

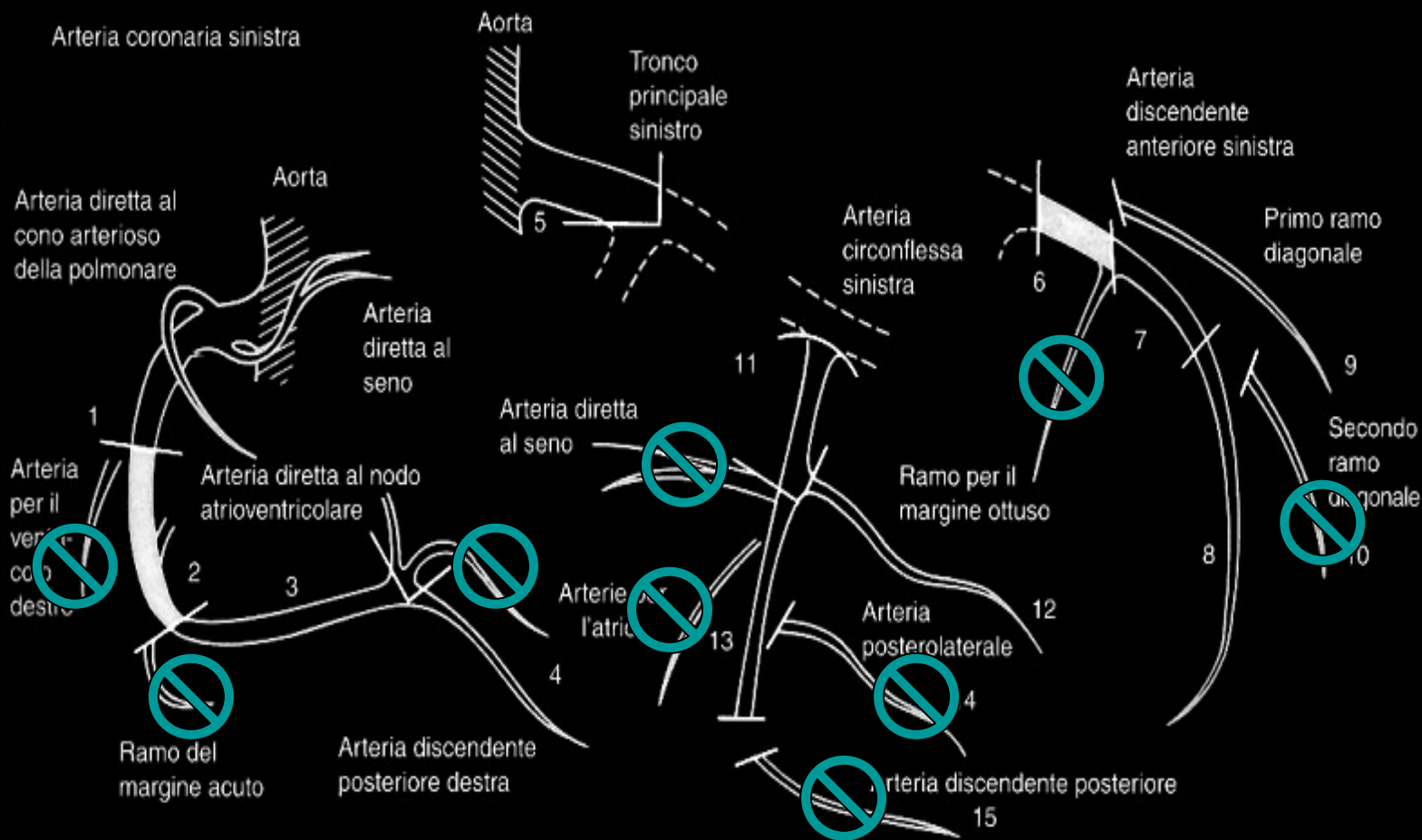
FREQUENZA CARDICA > 70 BPM

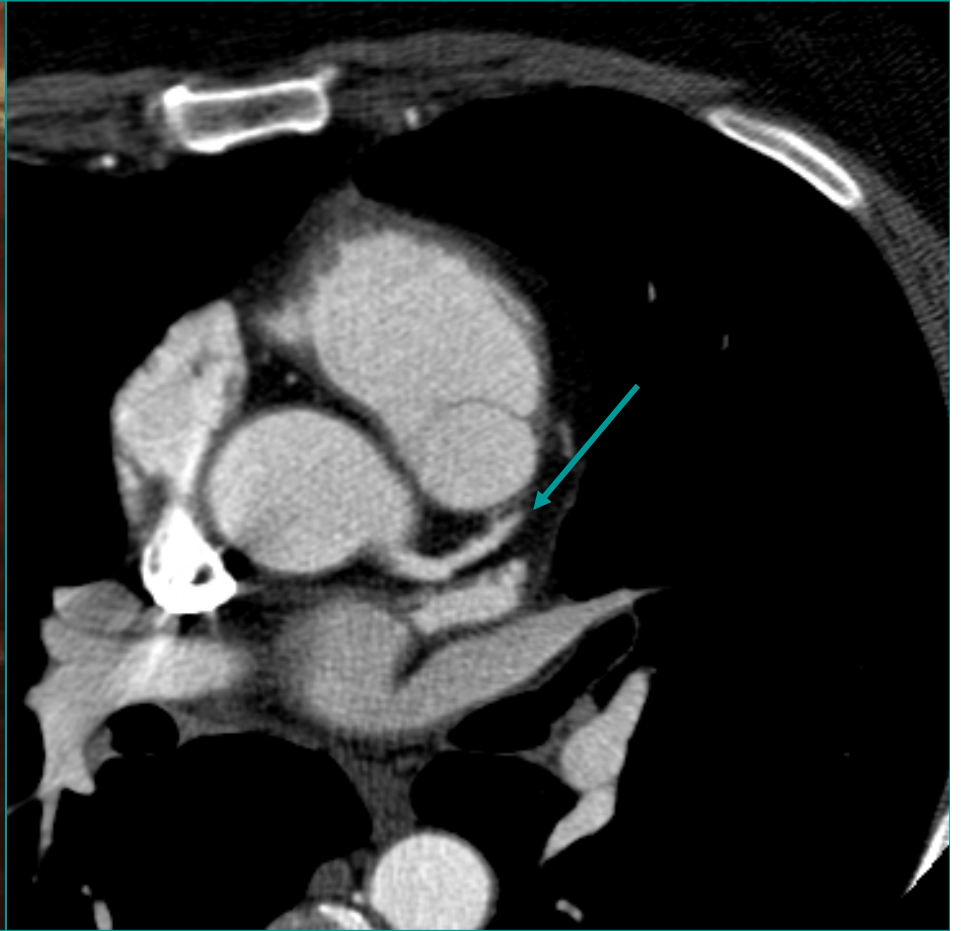
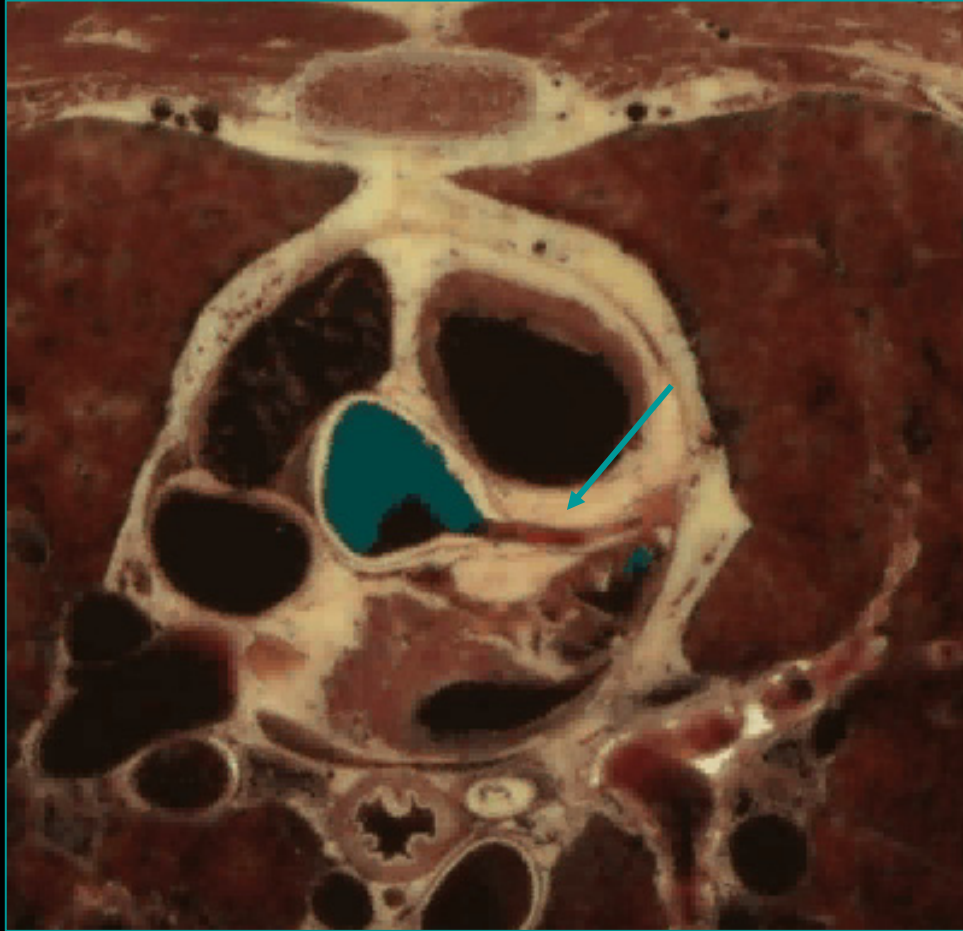


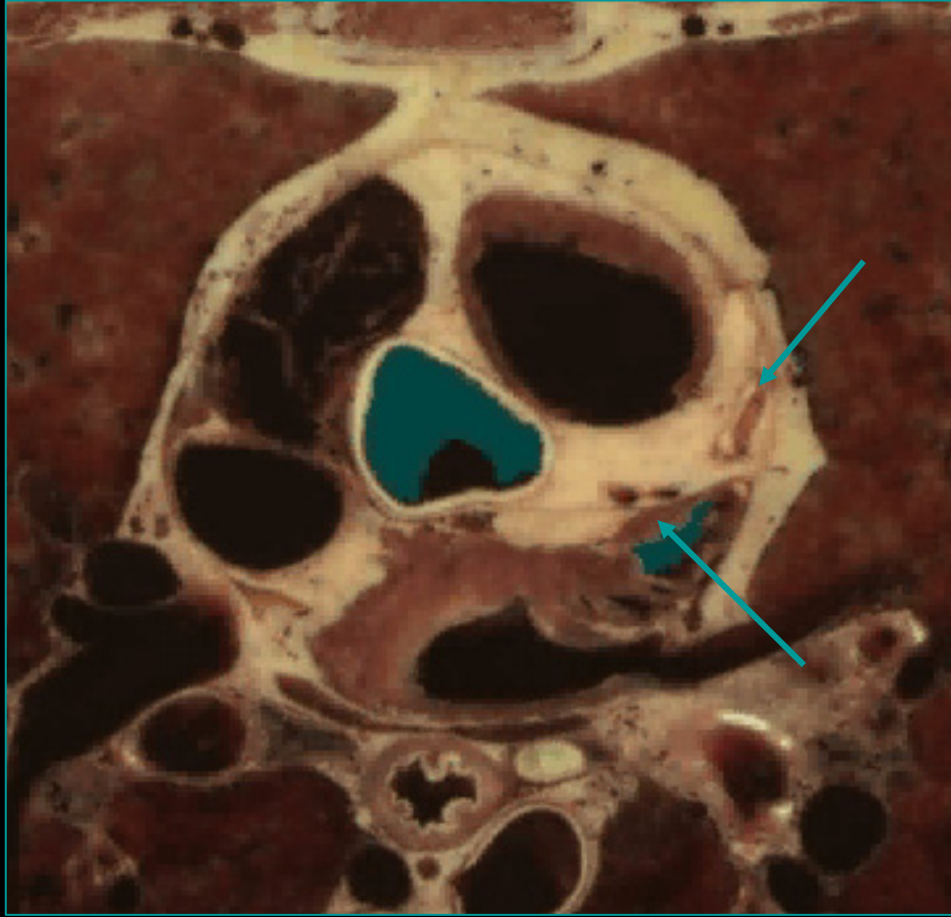
FREQUENZA CARDICA > 70 BPM

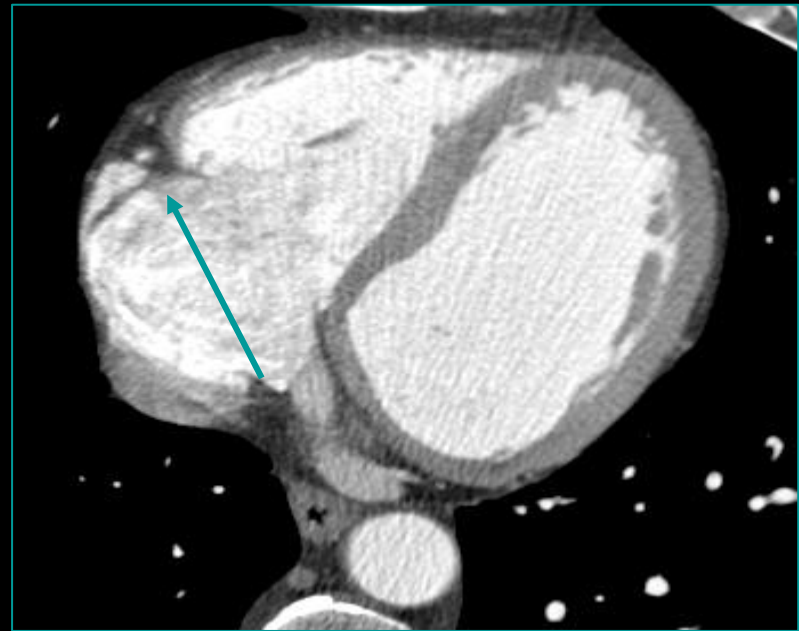
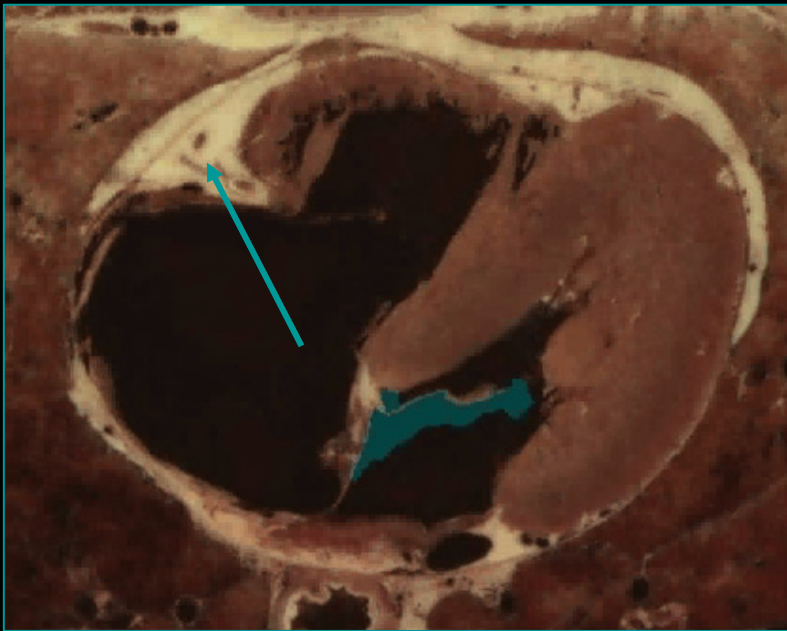
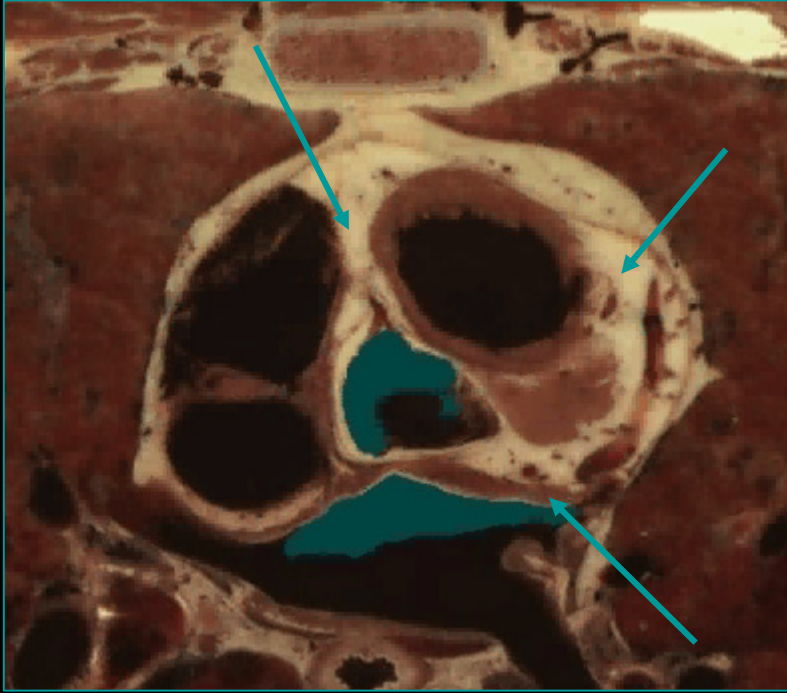


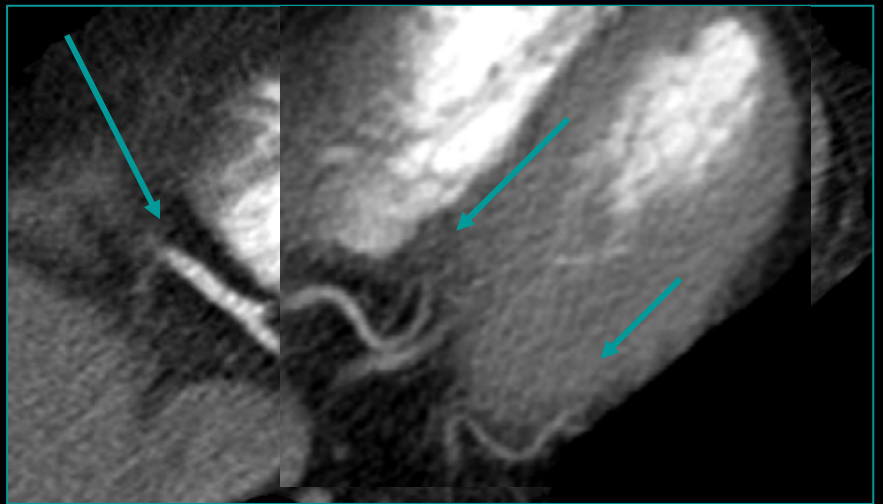
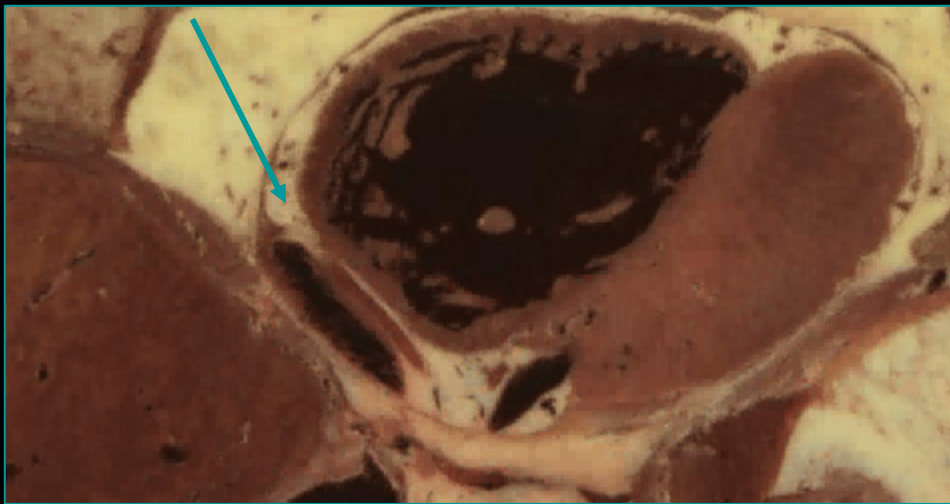
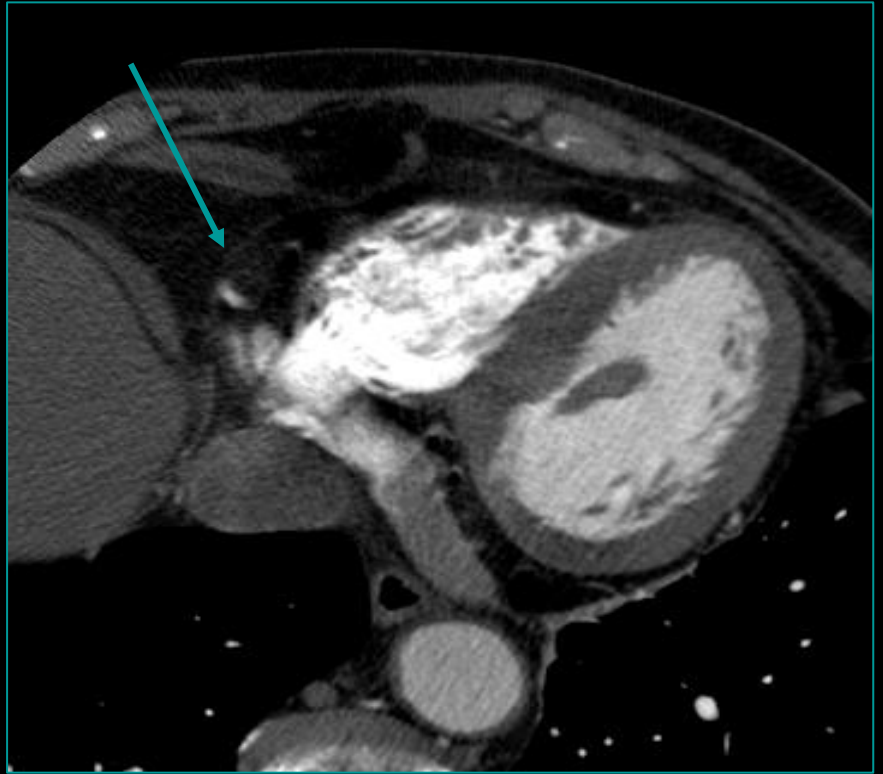
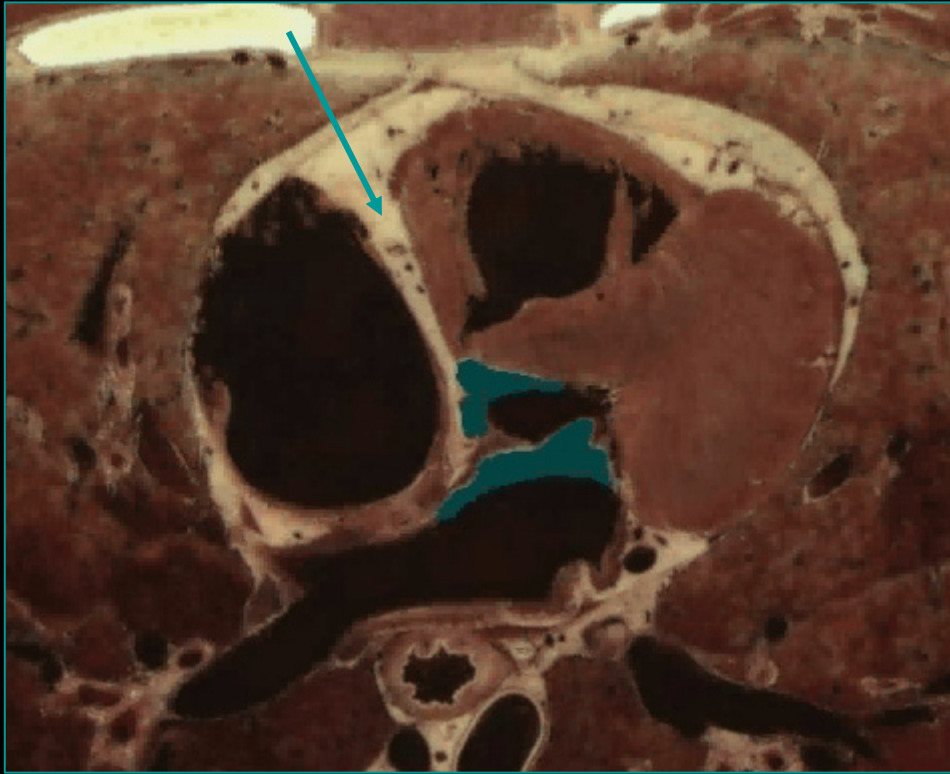
Arteria coronaria sinistra

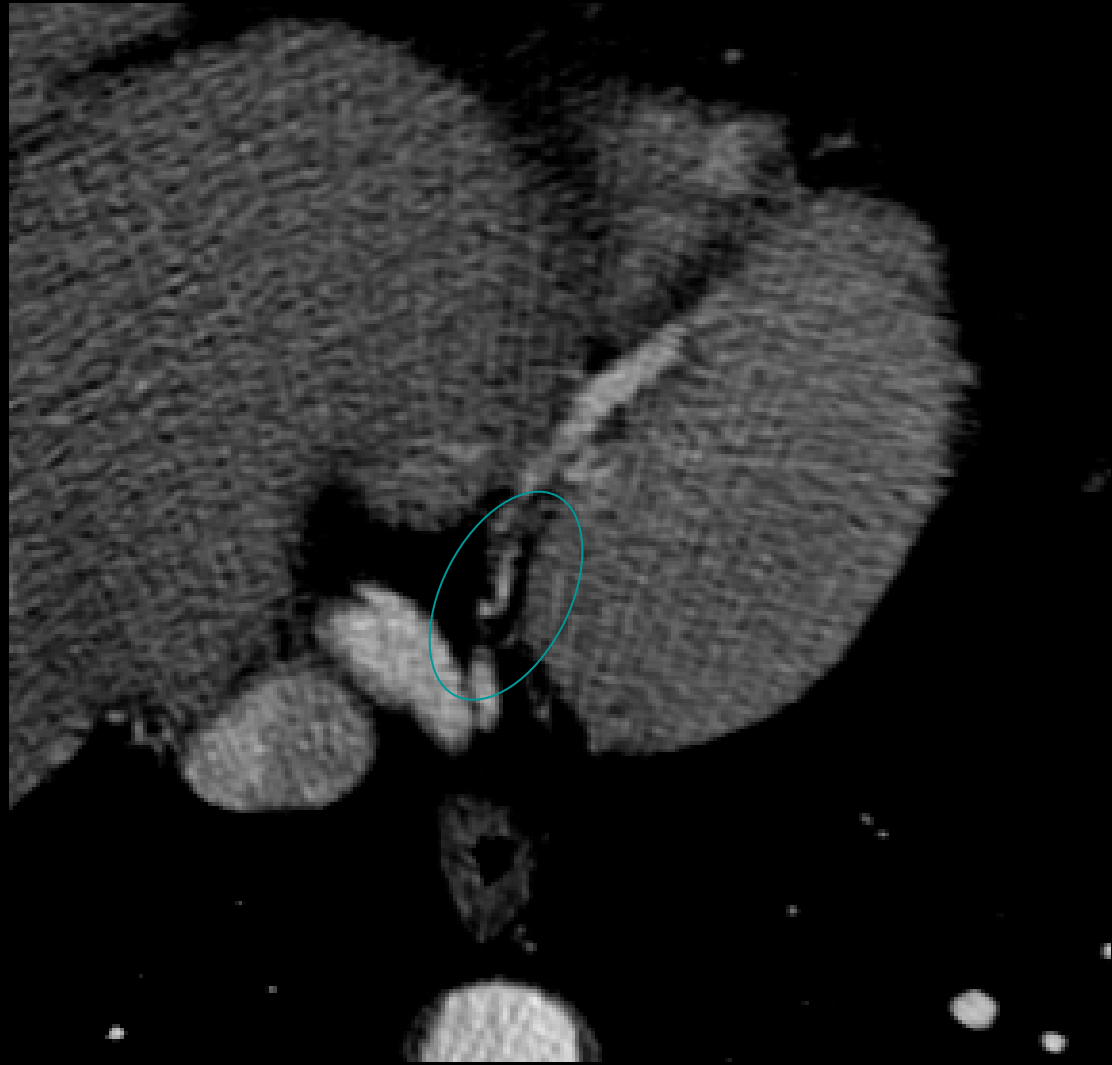


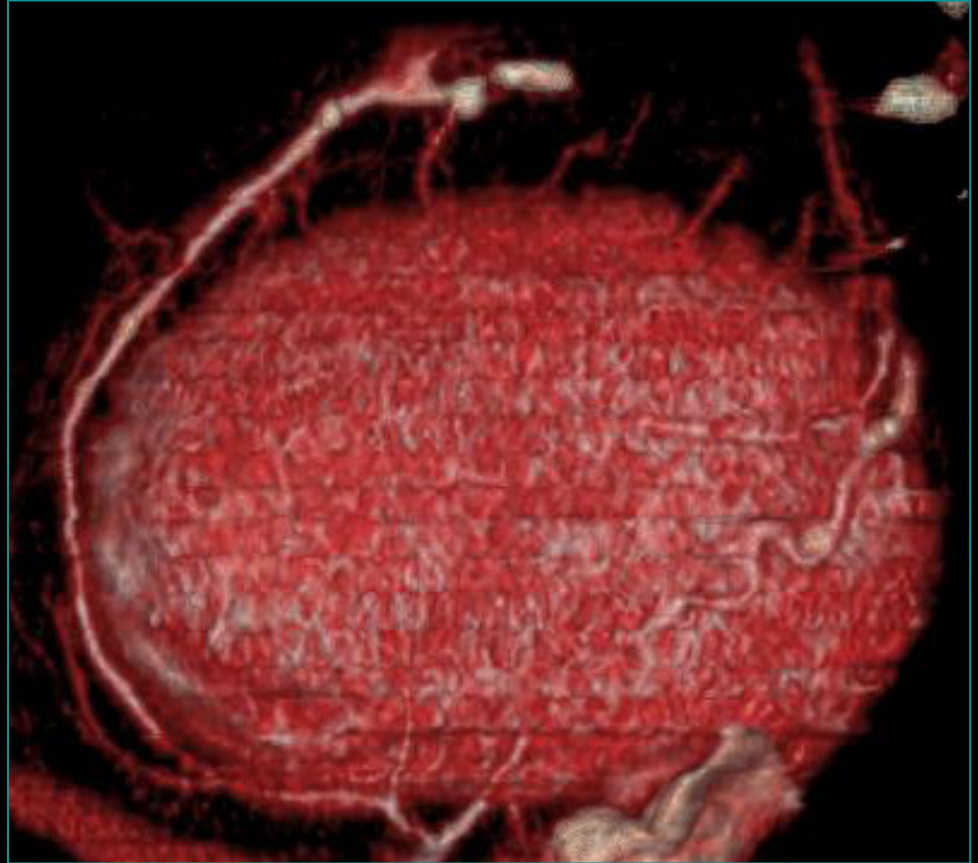
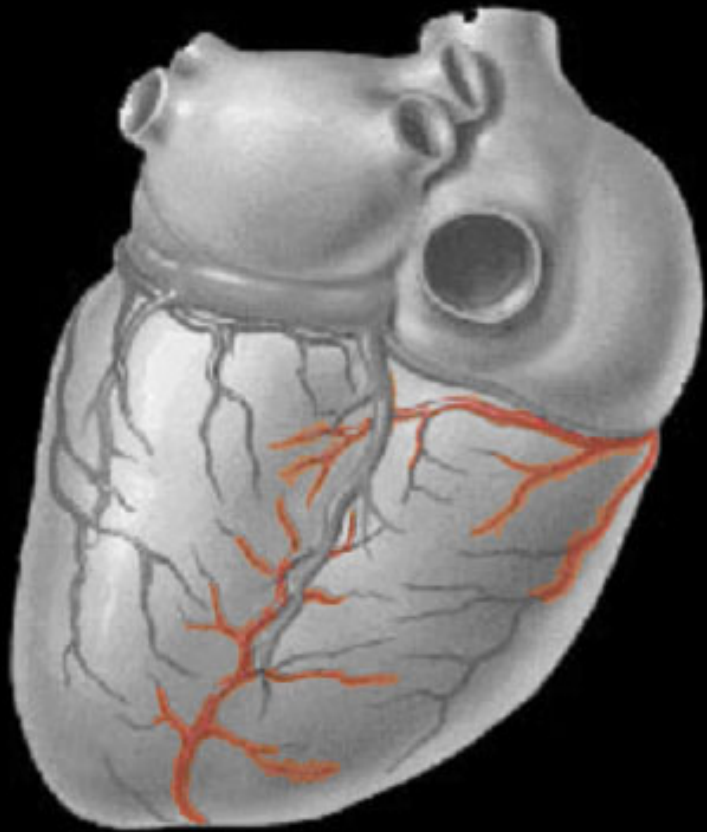


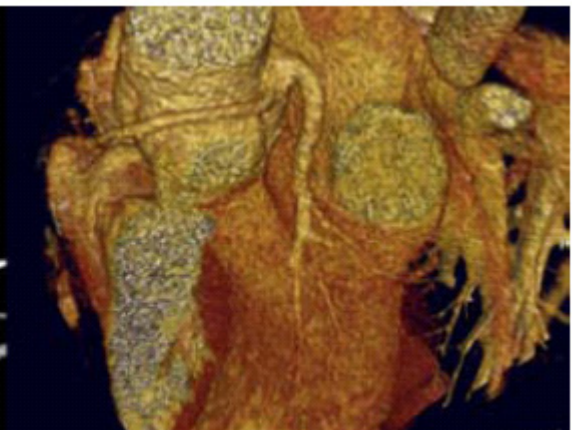
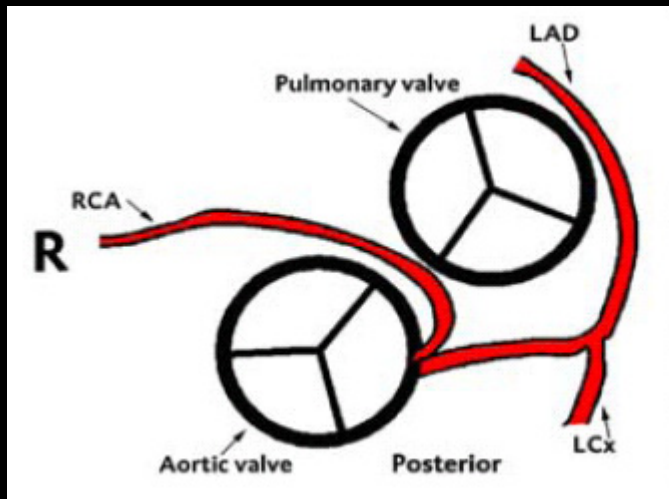
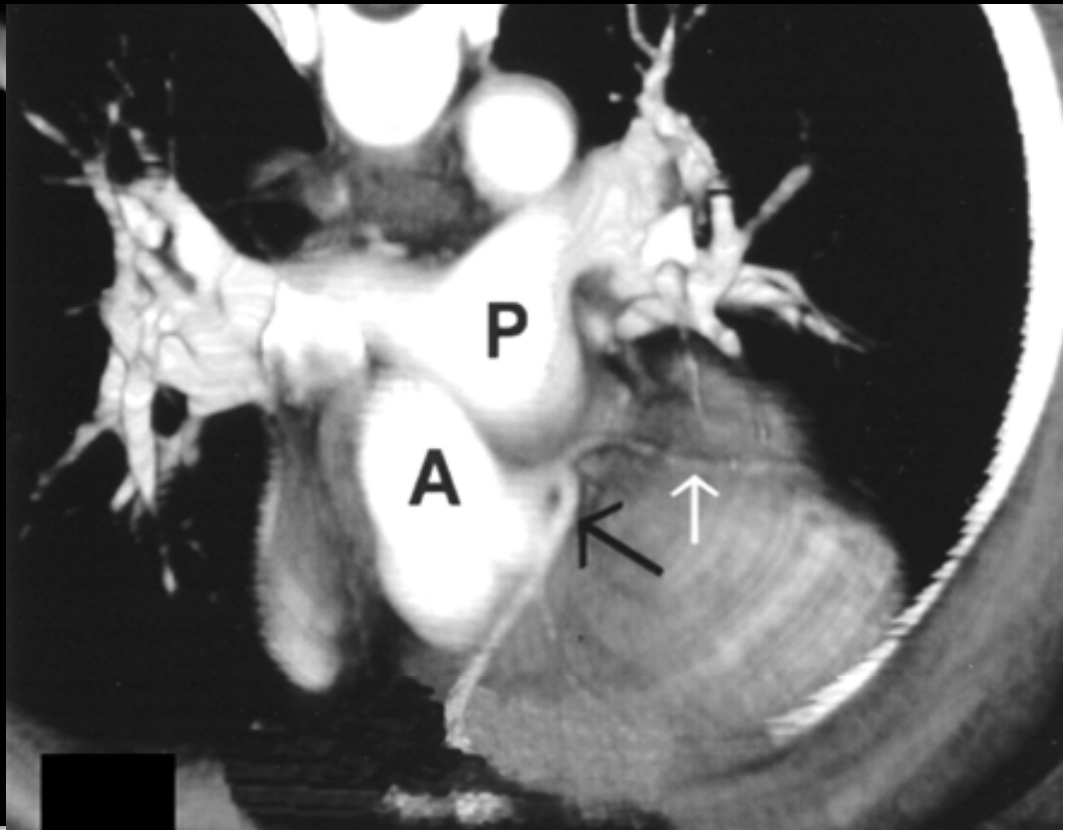
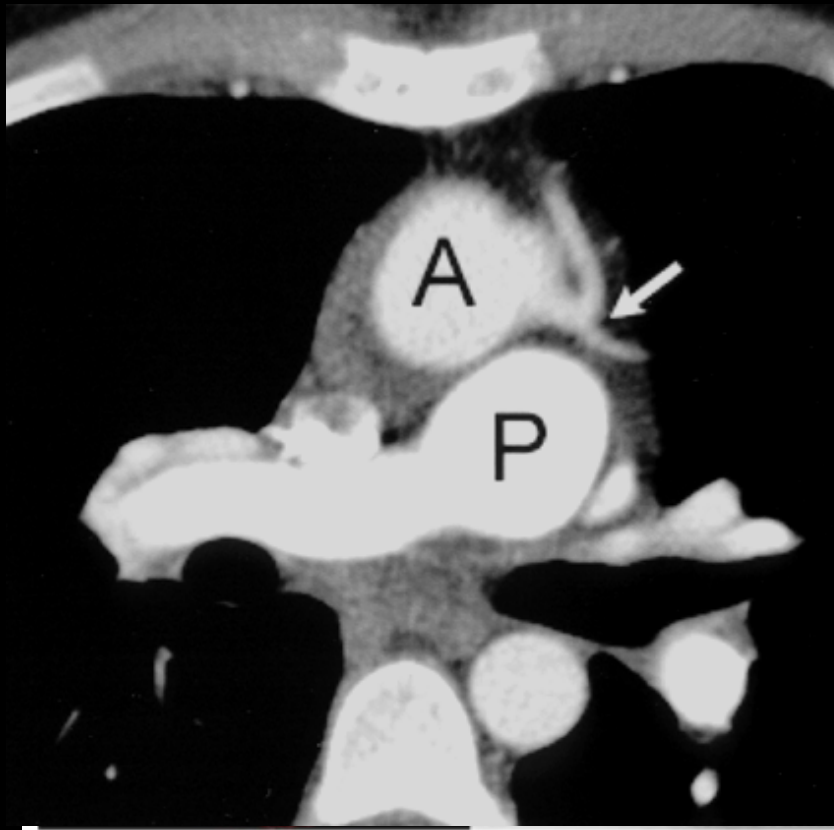




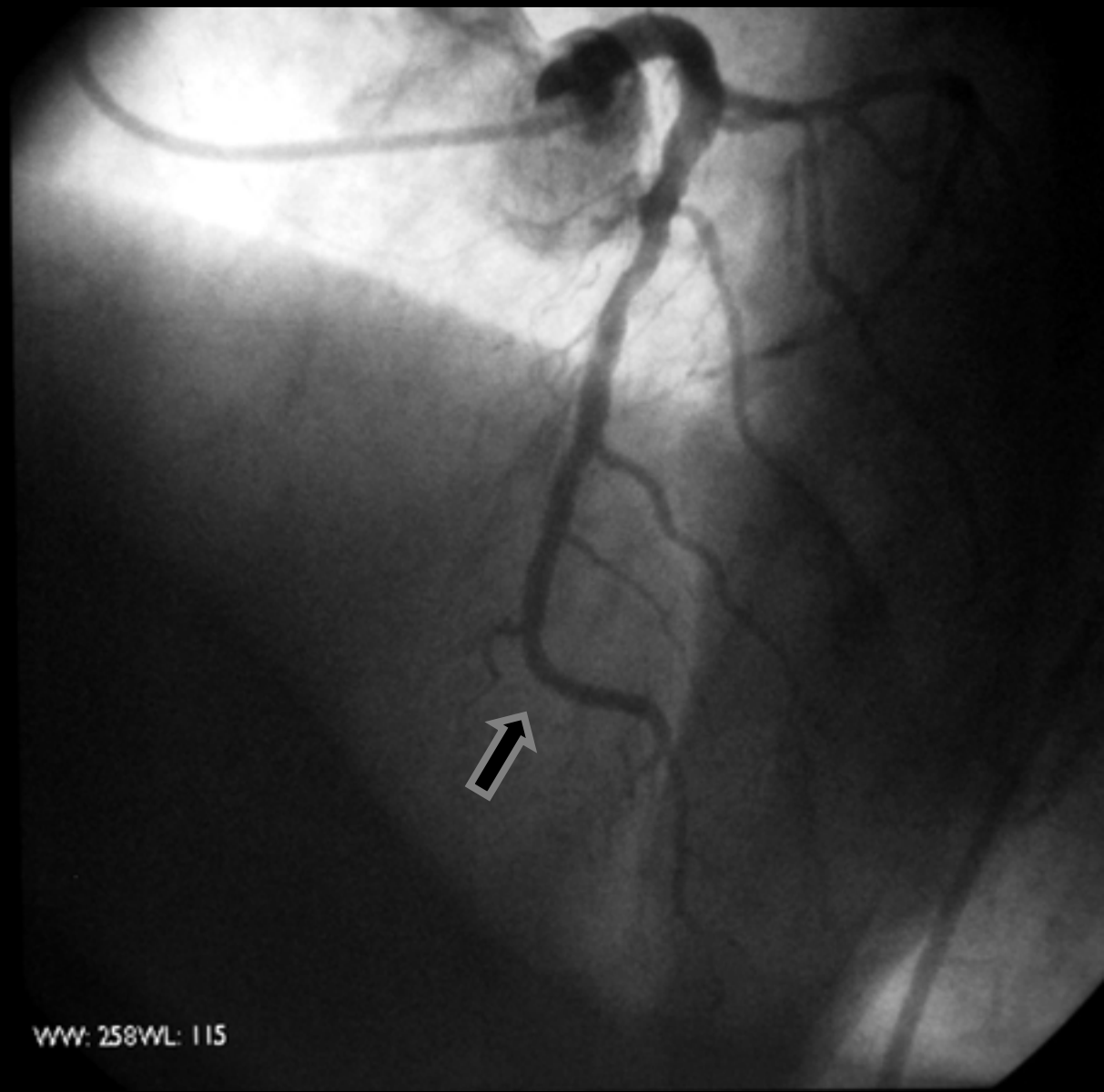








R. C. Gilkeson AJR 2003; 180:973-980

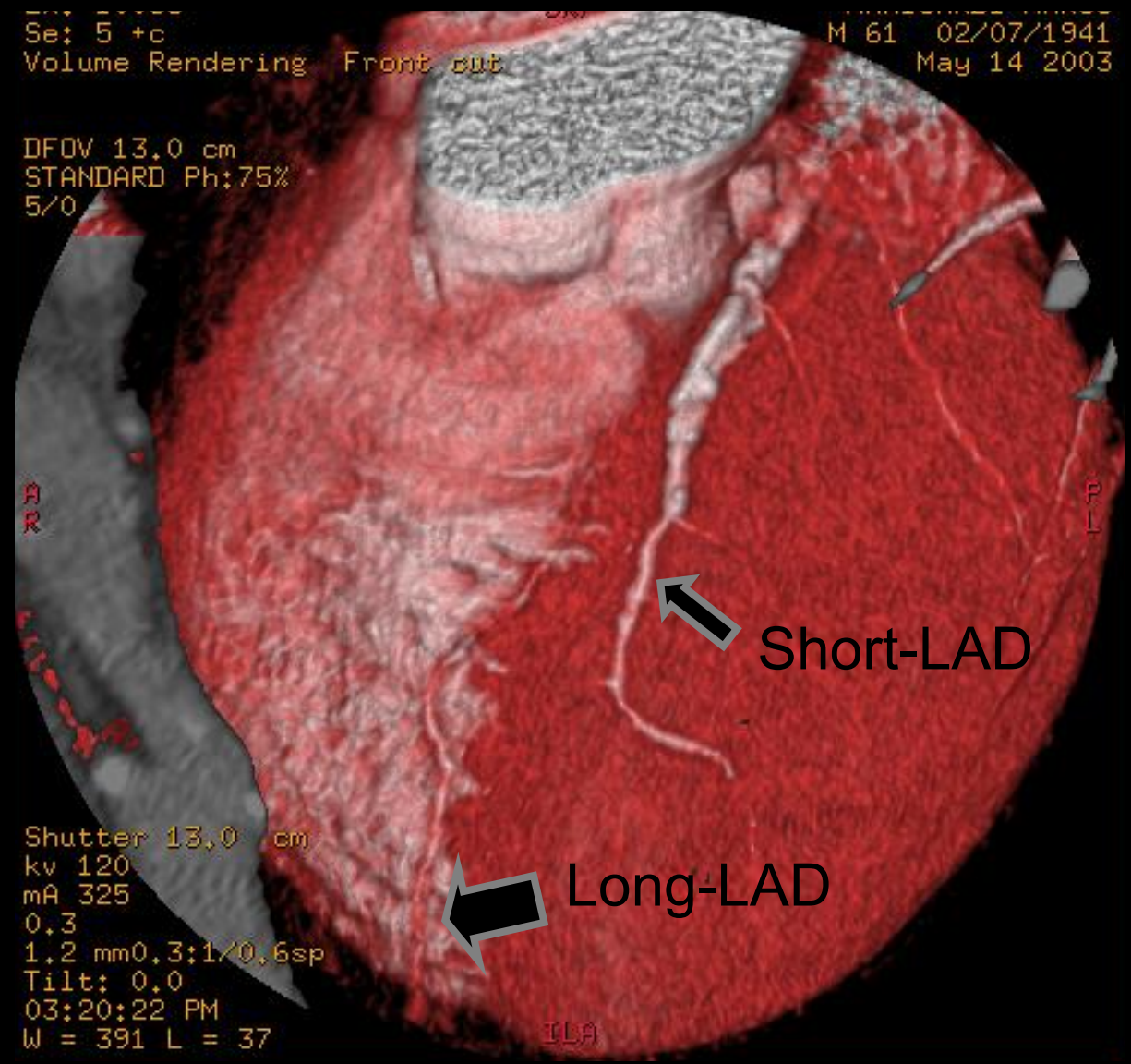


WW: 258WL: 115

Se: 5 +c
Volume Rendering Front cut

M 61 02/07/1941
May 14 2003

DFOV 13.0 cm
STANDARD Ph:75%
5/0



Short-LAD

Long-LAD

Shutter 13.0 cm
kv 120
mA 325
0.3
1.2 mm0.3:1/0.6sp
Tilt: 0.0
03:20:22 PM
W = 391 L = 37

ILA

Se: 5 +c
End of Section LP: 24.1

DFOV 12.1 cm
STANDARD Ph:75%
5/0

DFOV 12.0 cm
STANDARD Ph:75%
5/0

R
I
P

R

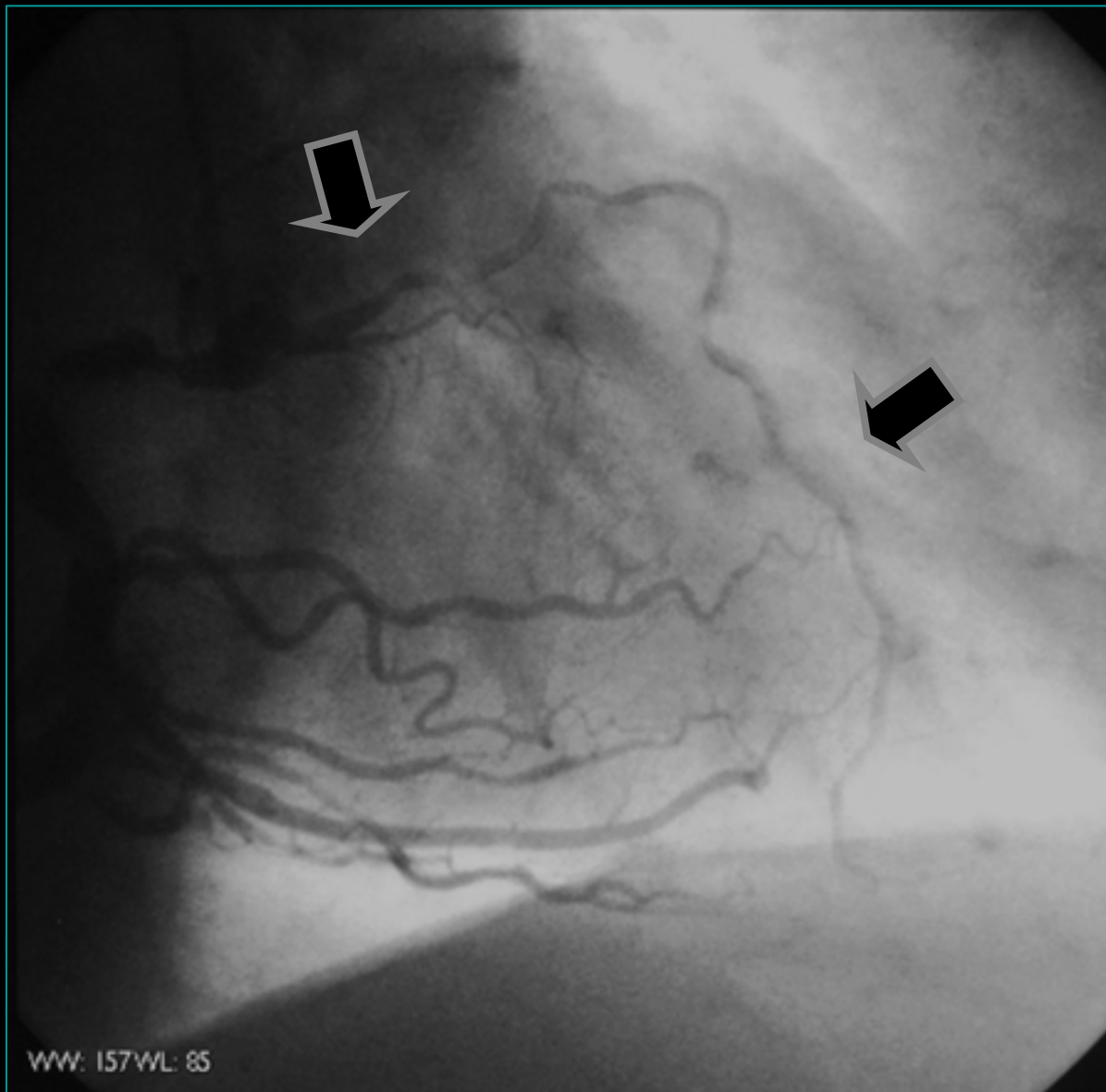
L

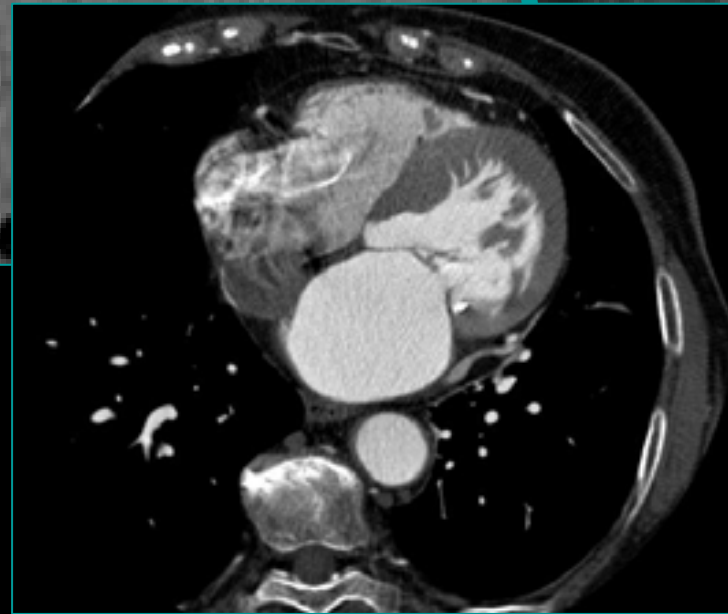
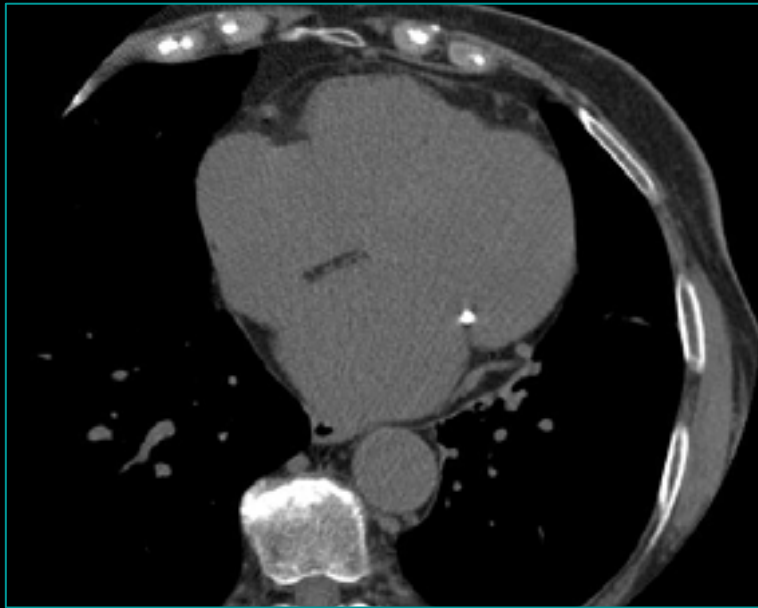
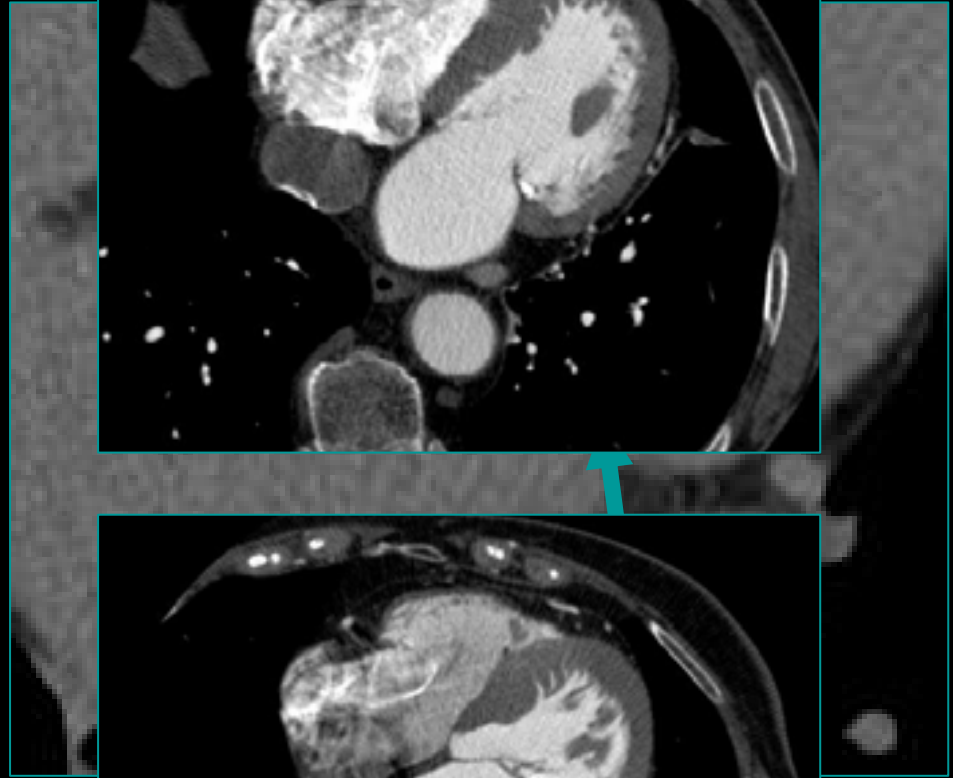
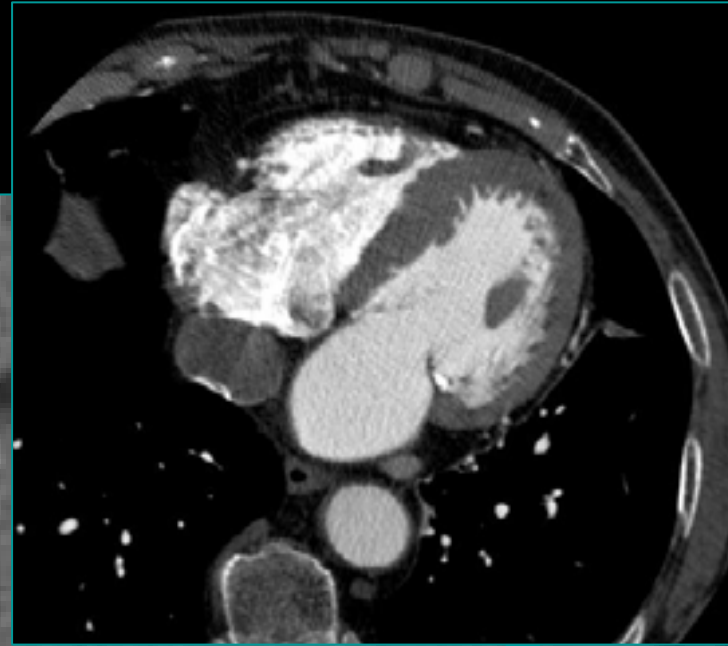
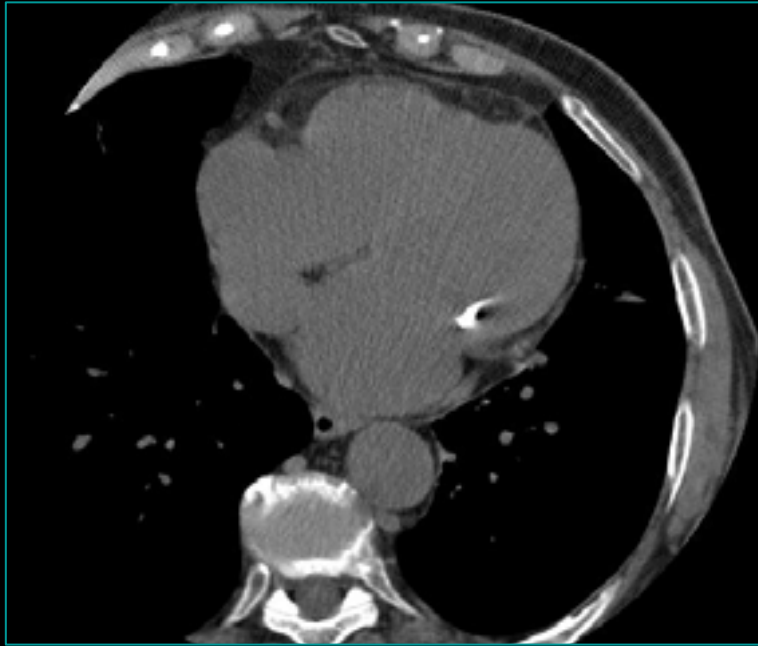
5.0/MIP Best L5section
kv 120
mA 325
0.3
1.2 mm0.3:1/0.6sp
Tilt: 0.0
03:20:22 PM
W = 477 L = 155

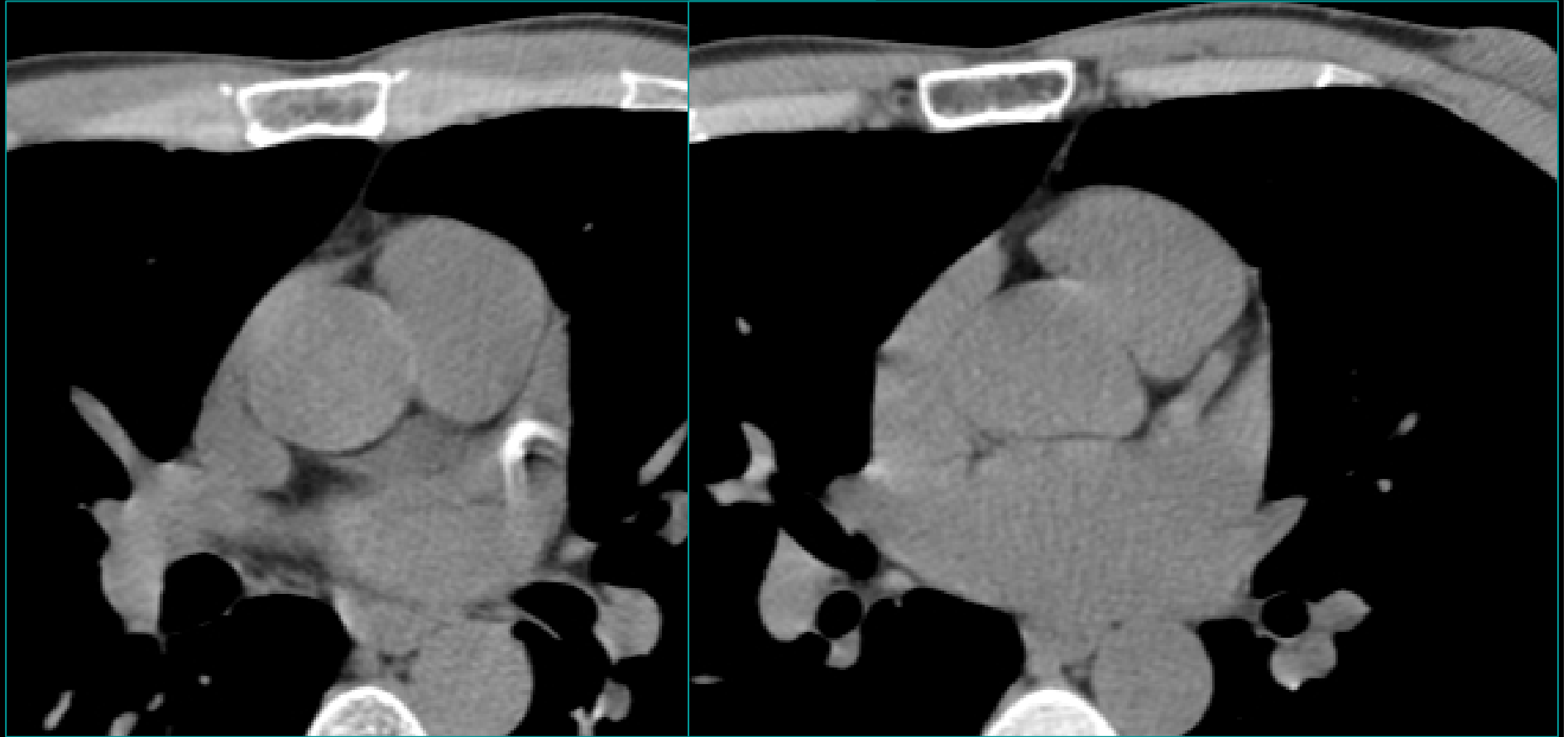
kv 120
mA 325
0.3
1.2 mm0.3:1/0.6sp
Tilt: 0.0
03:20:22 PM
W = 477 L = 155

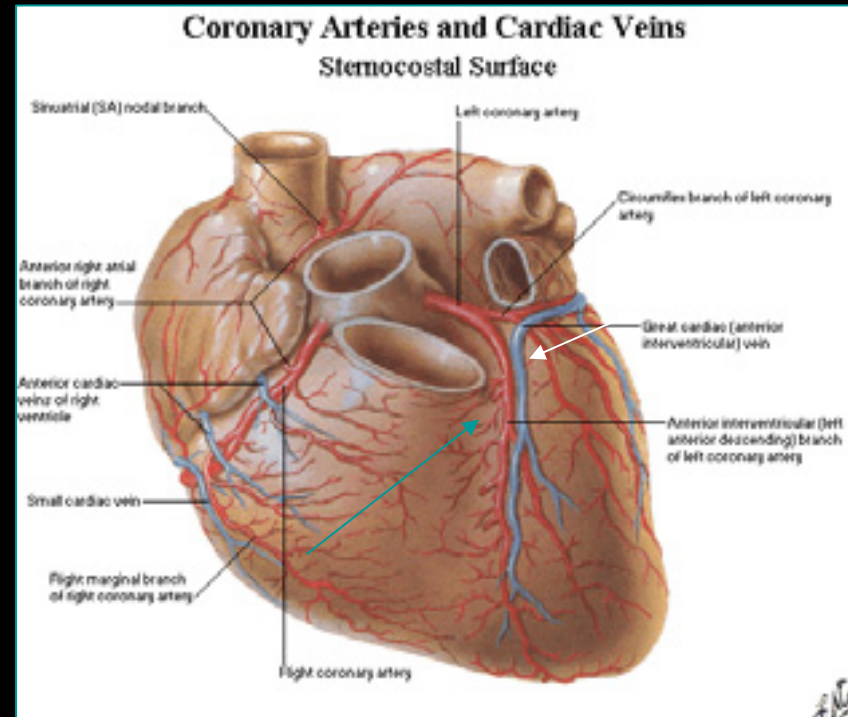
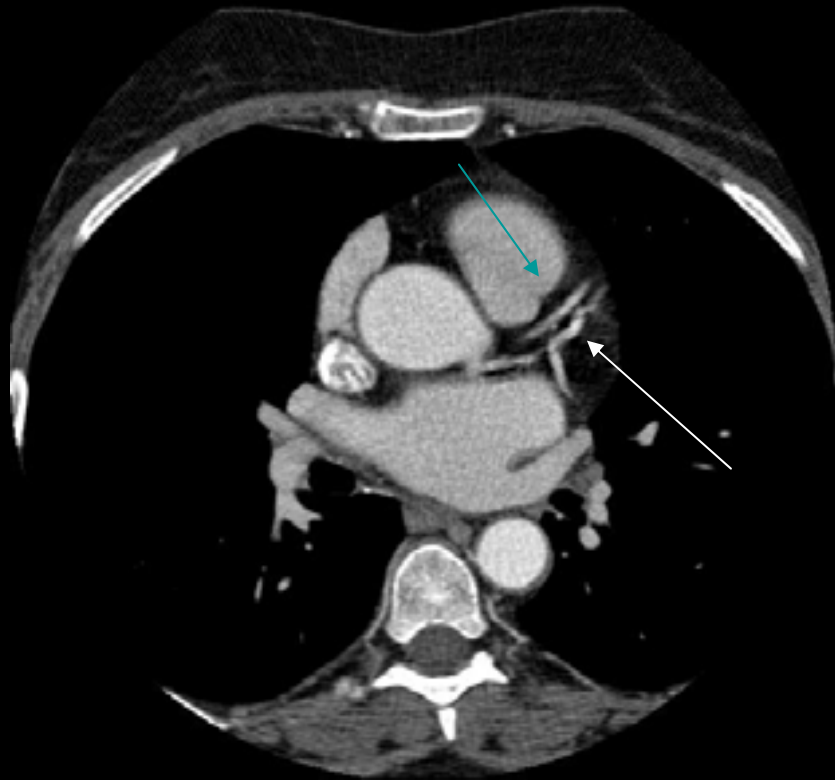
P

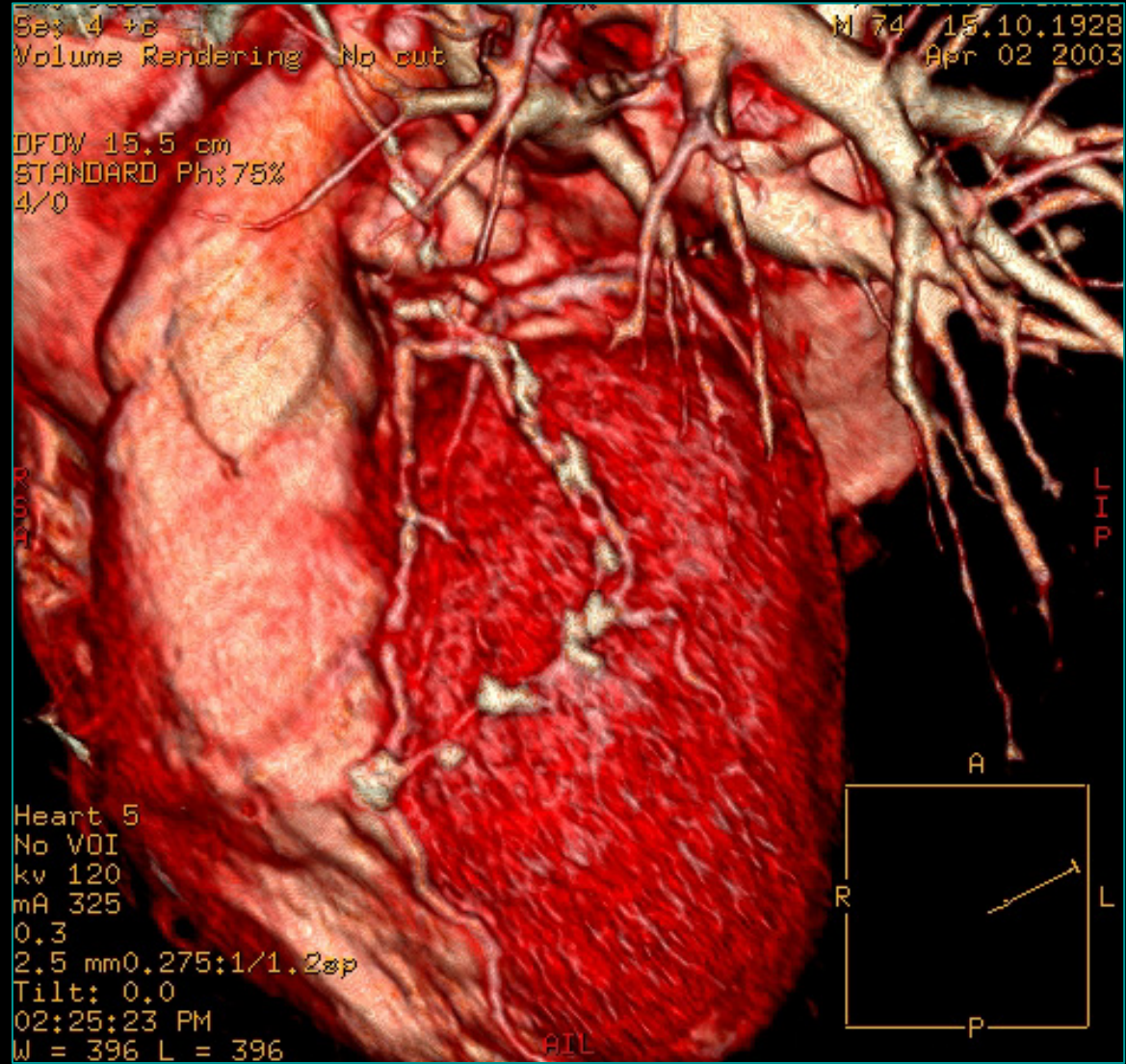
P
S
R





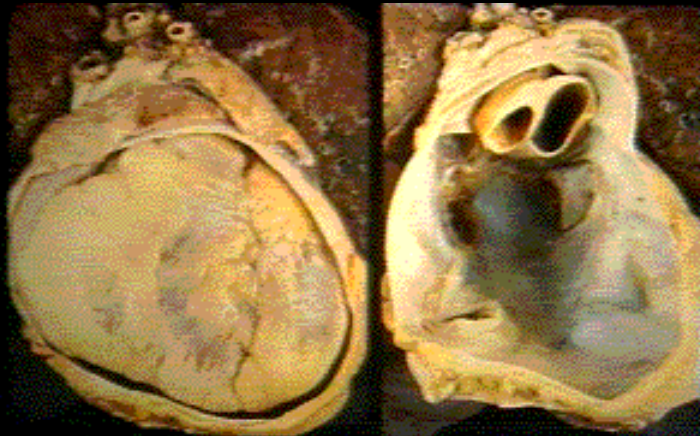






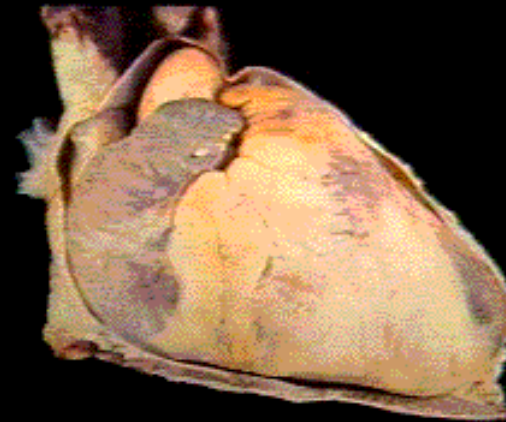
PERICARDIO

- P. FIBROSO



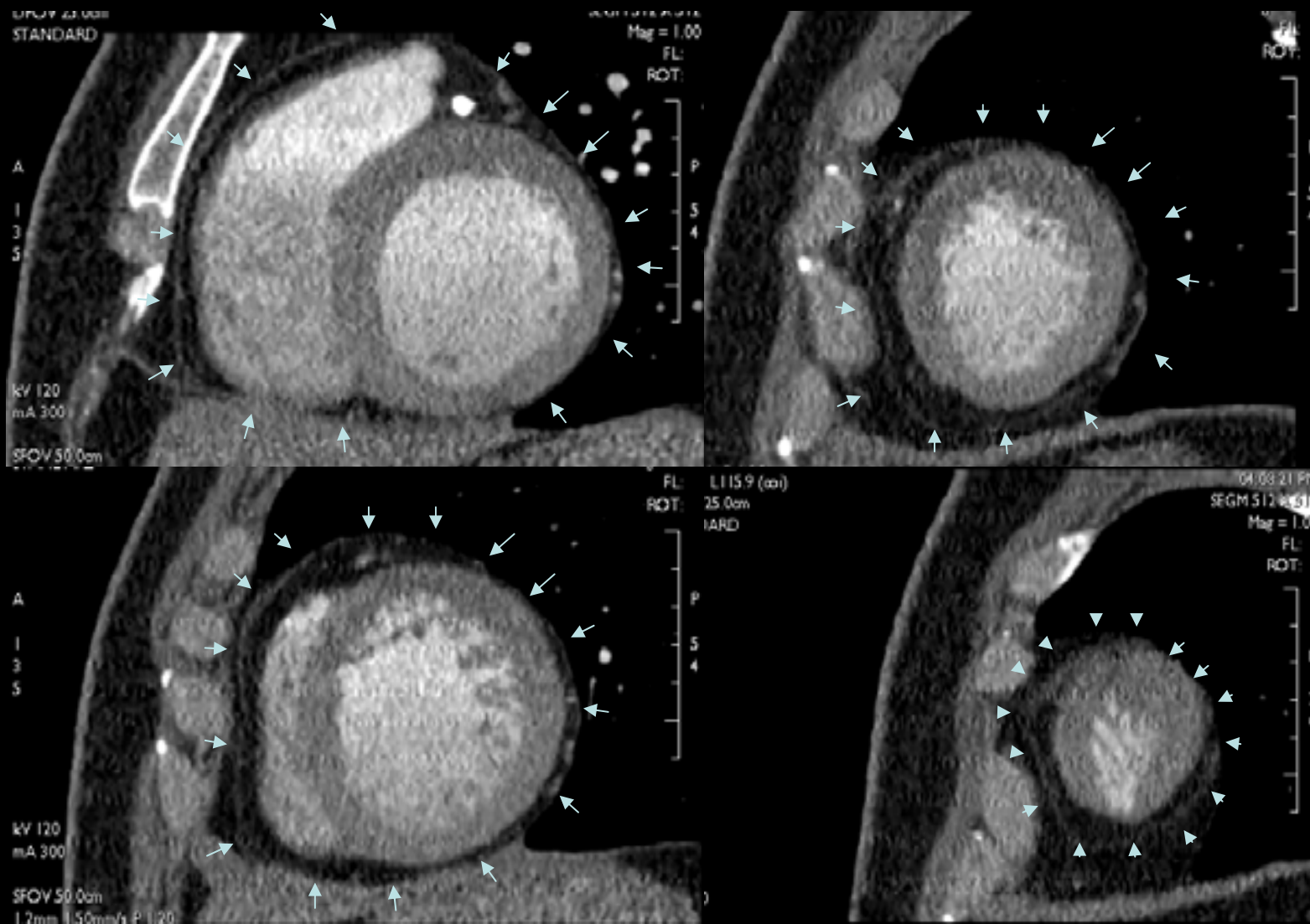
Sacco robusto e spesso che si inserisce su Ao, AP, SVC, IVC, VP, diaframma, pleura, sterno, esofago

- P. SIEROSO

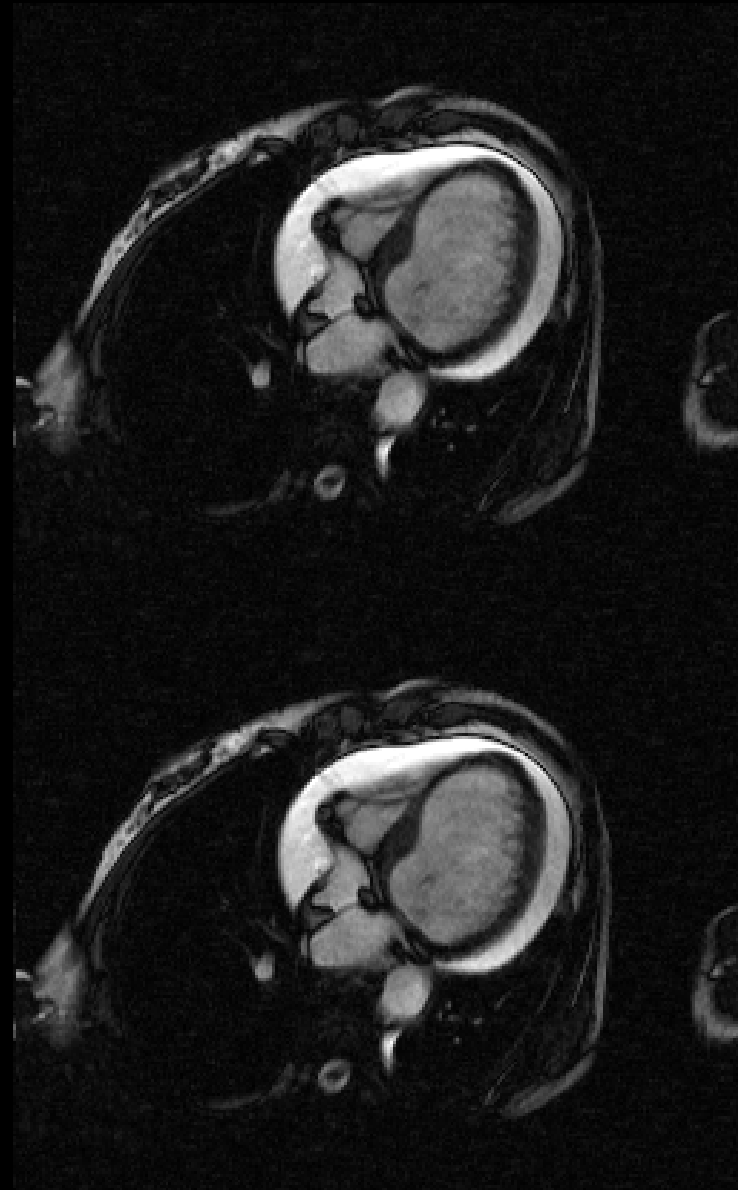
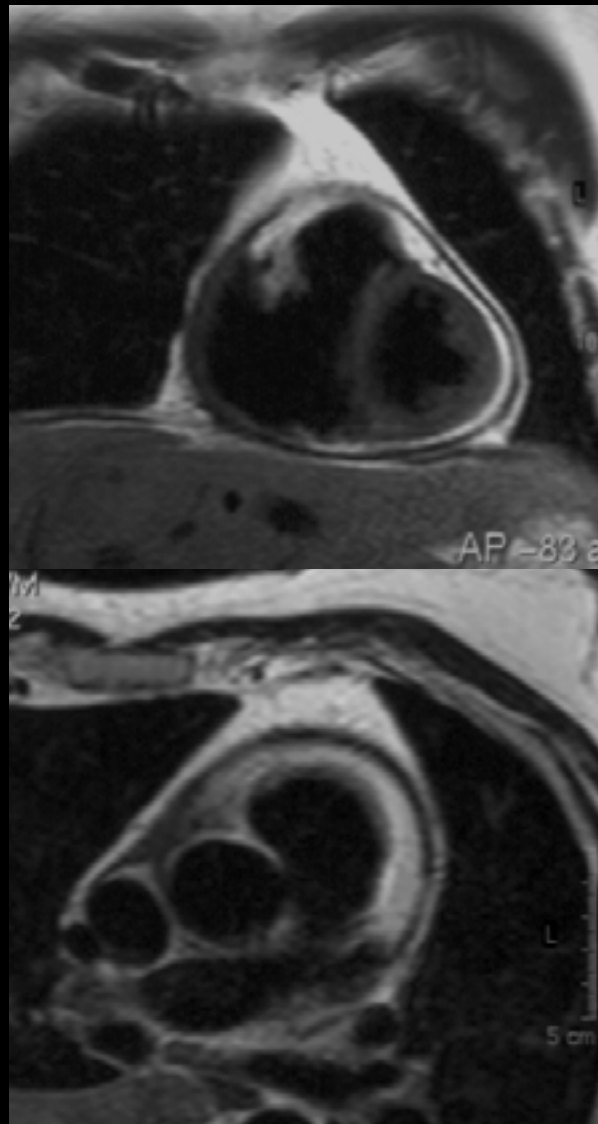


Lamina di cell mesoteliali che riveste P.fibroso, cuore e grossi vasi intrapericardici da cui è separato da grasso, tess.linf, vasi e nervi

PERICARDIO-TC

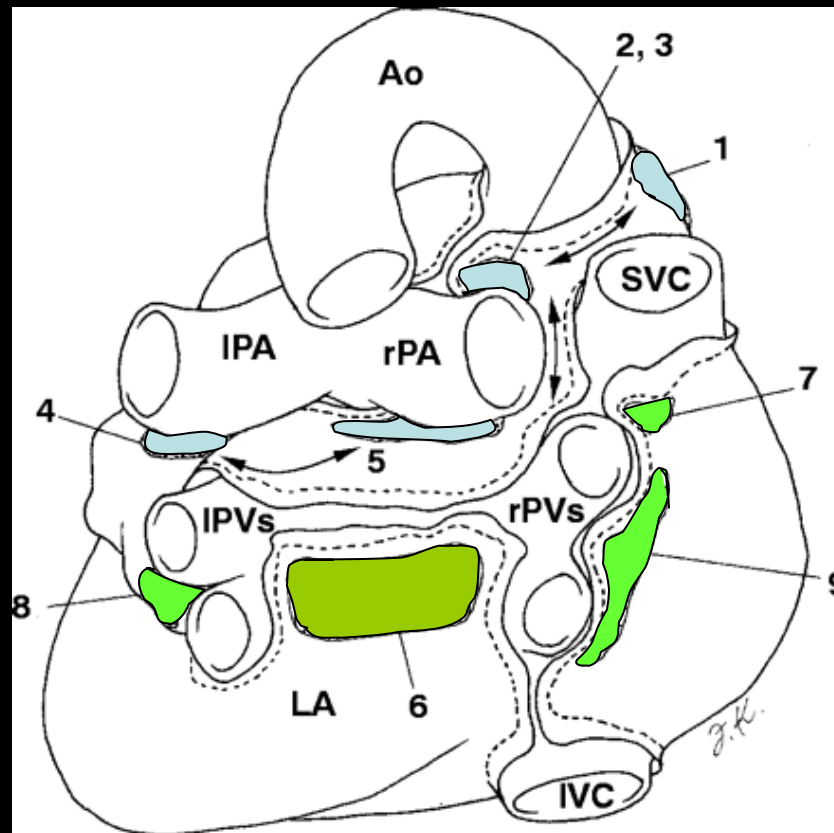


PERICARDIO-RM



PERICARDIO

- CAVITA' PERICARDICA PROPRIAMENTE DETTA
- SENO TRASVERSO
- SENO OBLIQUO

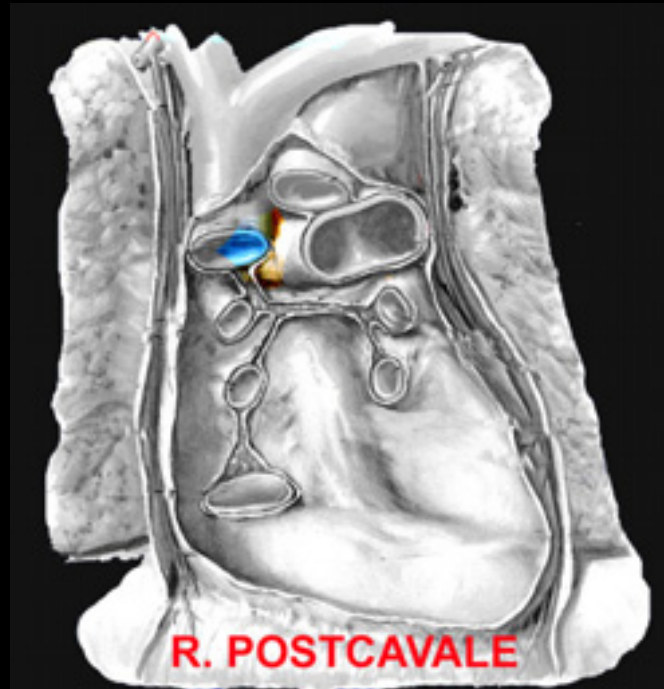


Nomina Anatomica

Kodama F. AJR 2003; 181:1101-1108

RECESSI DELLA CAVITA'PERICARDICA PD

- RETROCAVALE
- DELLA V. POLMONARE DS.
- DELLA VENA POLMONARE SIN.

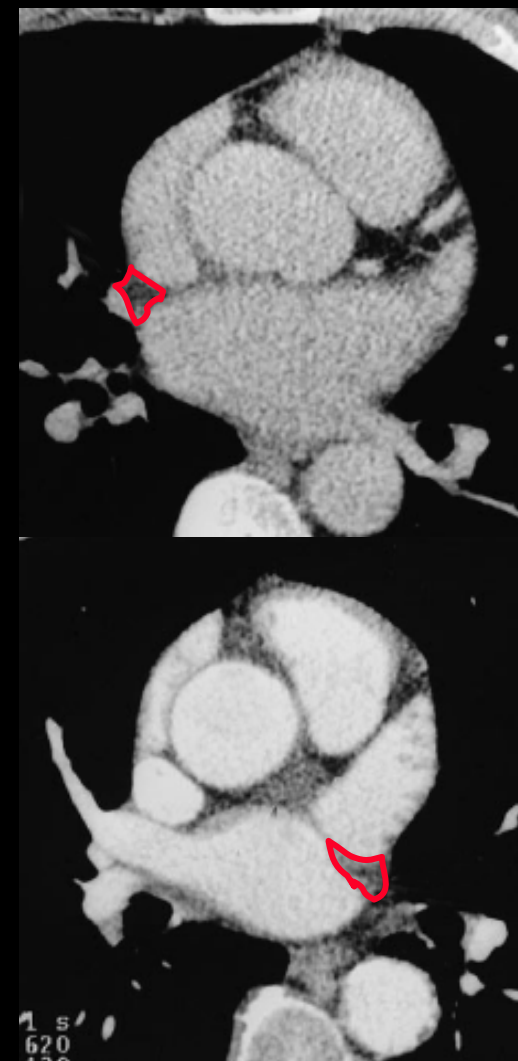
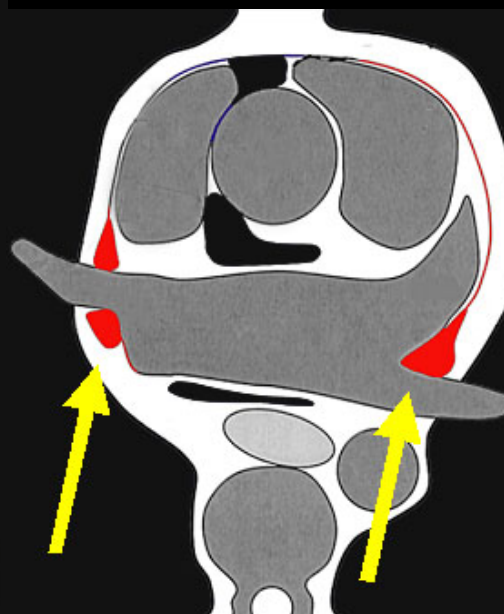
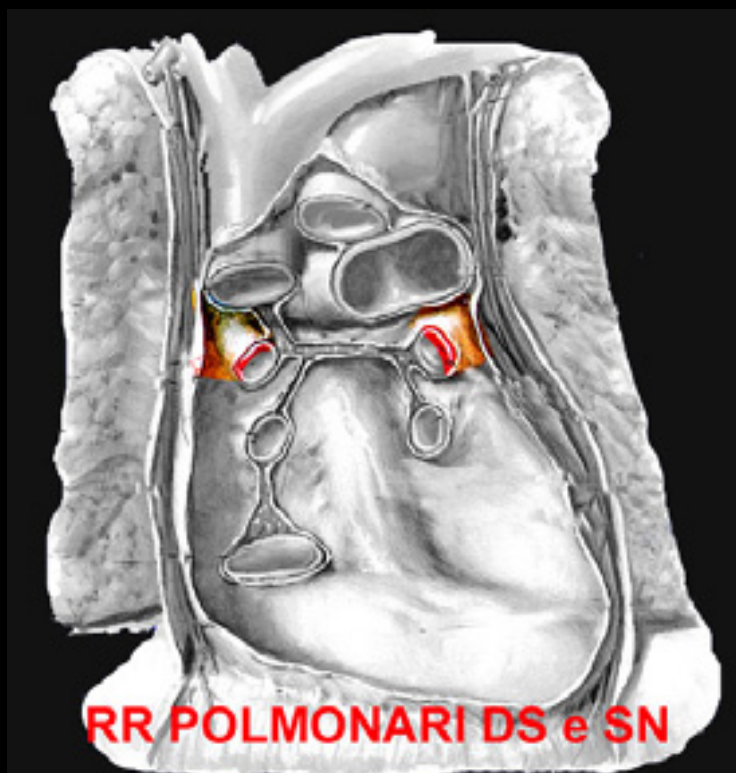


Nomina Anatomica

Veseley TM, Surg Anat Radiol 1986; 8:221-227

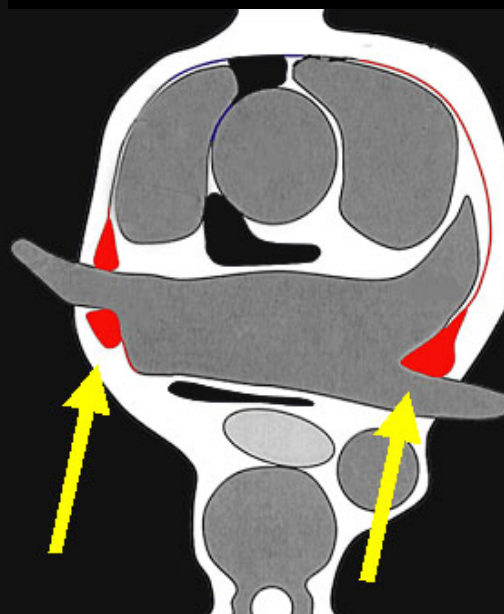
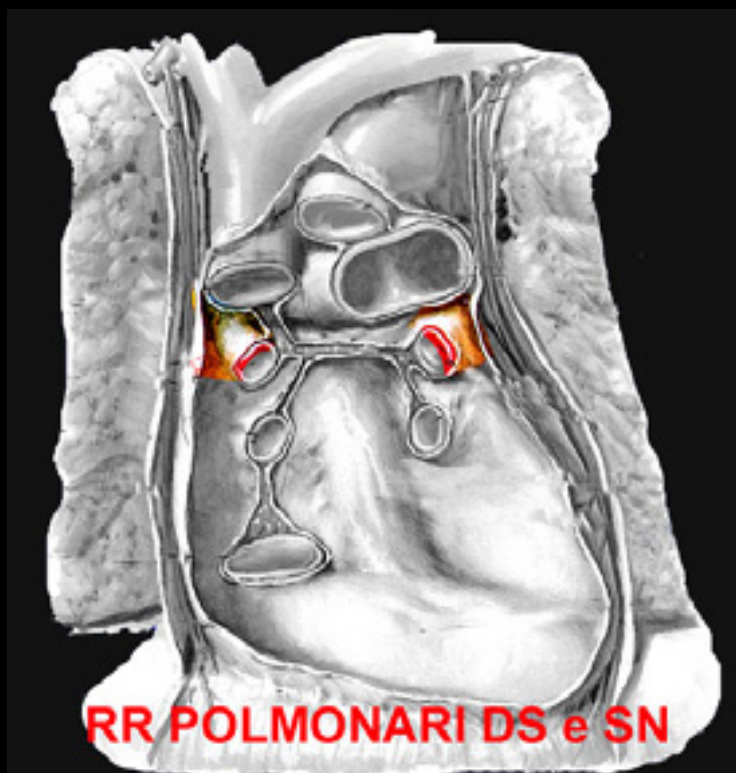
RECESSI DELLA CAVITA' PERICARDICA PD

- RETROCAVALE
- DELLA V. POLMONARE DS.
- DELLA VENA POLMONARE



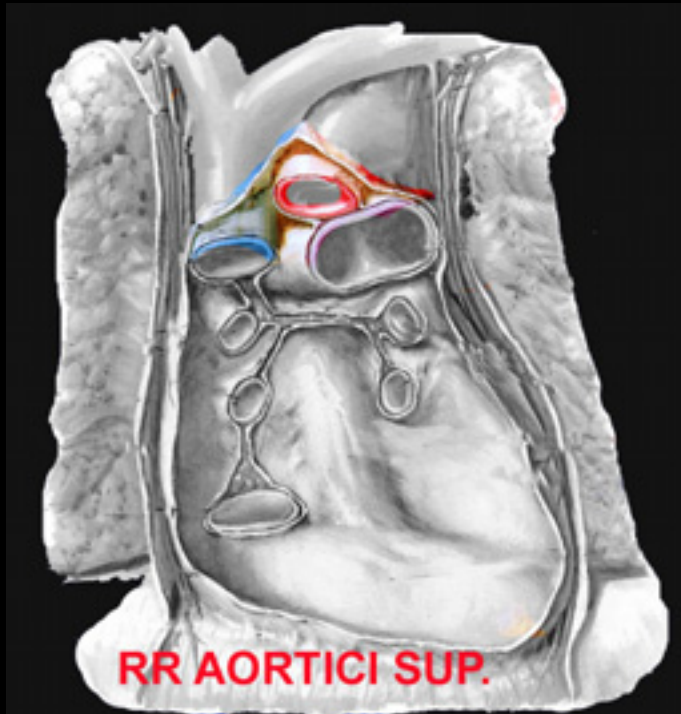
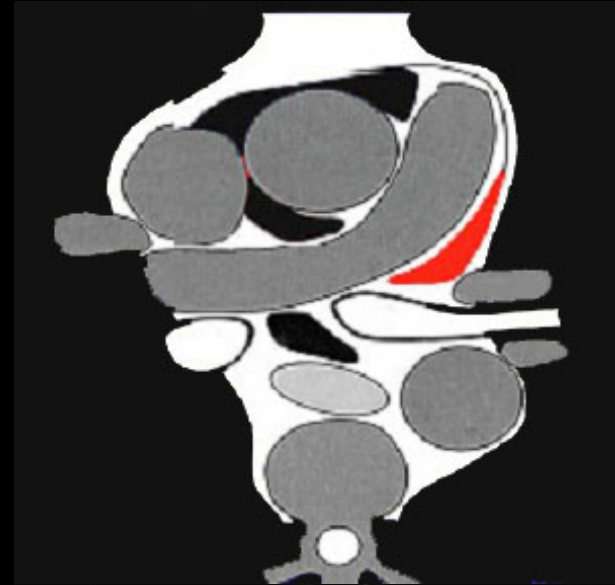
RECESSI DELLA CAVITA' PERICARDICA PD

- RETROCAVALE
- DELLA V. POLMONARE DS.
- DELLA VENA POLMONARE



RECESSI DEL SENO TRASVERSO

- **AORTICO SUPERIORE**
 - ANTERIORE
 - POSTERIORE
 - LATERALE DX.
- **AORTICO INFERIORE**
- **POLMONARE SINISTRO**
- **POLMONARE DESTRO**



RECESSI DEL SENO OBLIQUO

- RECESSO PERICARDICO POSTERIORE



Nomina Anatomica

Veseley TM, Surg Anat Radiol 1986; 8:221-227

