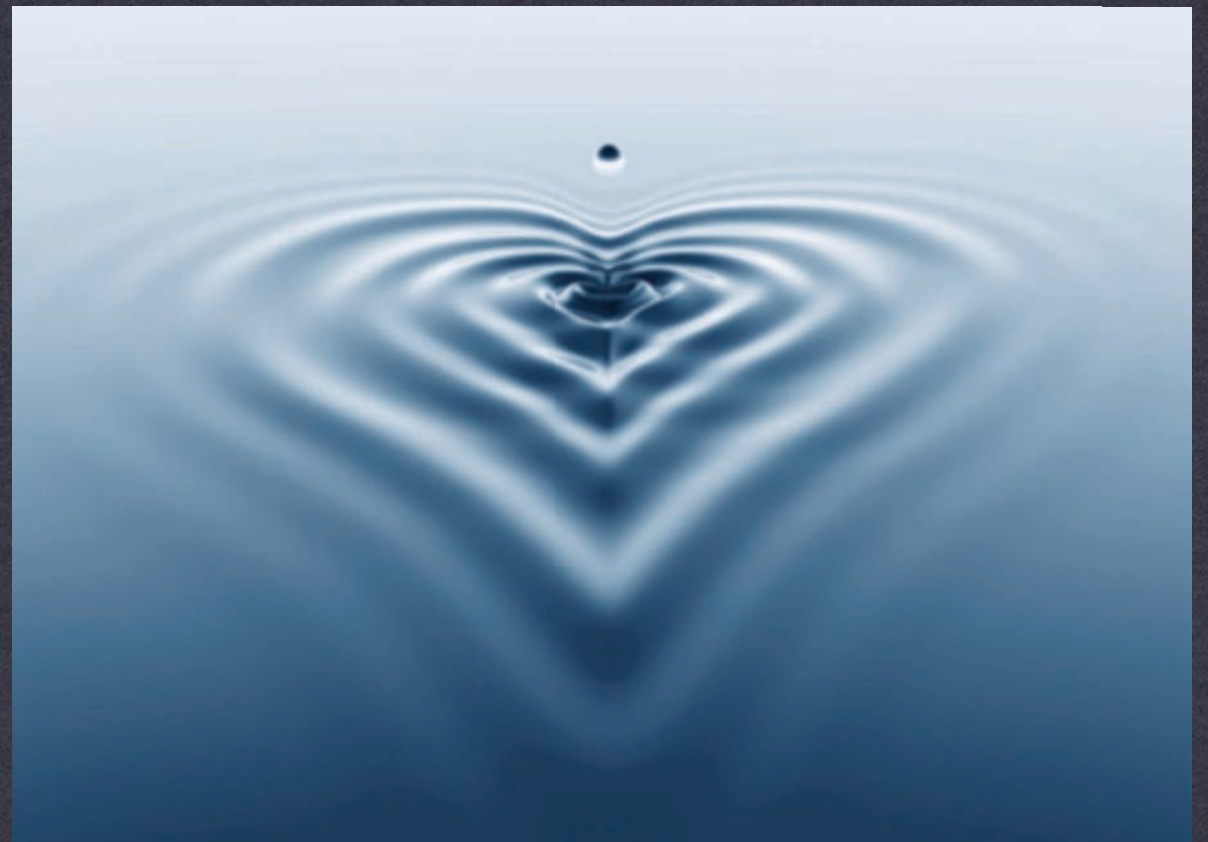


ÉCHOCARDIOGRAPHIE TRANSTHORACIQUE LES (BONNES) BASES (ET PLUS SI AFFINITÉS)

DR C.ARBELOT
RÉANIMATION POLYVALENTE PR LANGERON
DÉPARTEMENT D'ANESTHÉSIE RÉANIMATION, APHP
UNIVERSITÉ PIERRE ET MARIE CURIE, PARIS 6, FRANCE



A MÉDITER...

1.ON NE TROUVE QUE CE QU'ON
CHERCHE...

> POSER LES BONNES QUESTIONS

2.NE PAS ESSAYER DE « VOIR 3D
» (EN TOUS CAS D'EMBLÉE!)

3.PAS DE MESURE DIRECTE DE
PRESSION

4.SAVOIR ÊTRE HUMBLE ET SE BASER
SUR UN FAISCEAU D'ARGUMENTS/NE
PAS ALLER CONTRE LE BON SENS
5.SAVOIR CONNAÎTRE SES LIMITES



COUPES

« DE DÉBROUILLAGE »

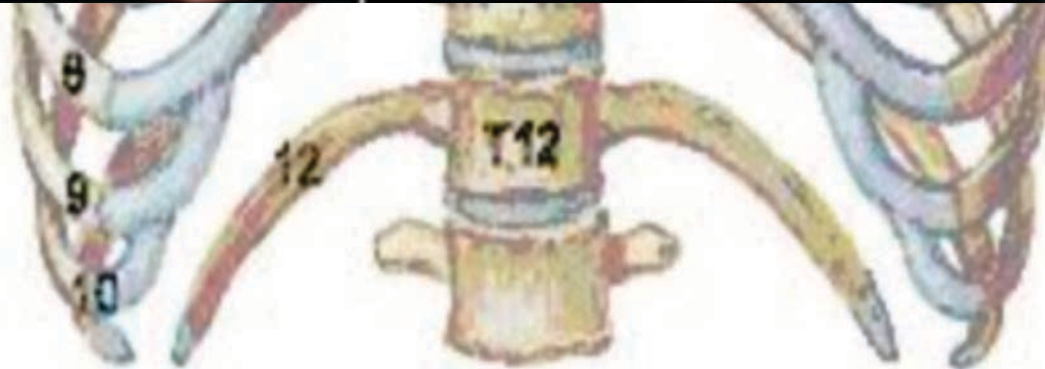
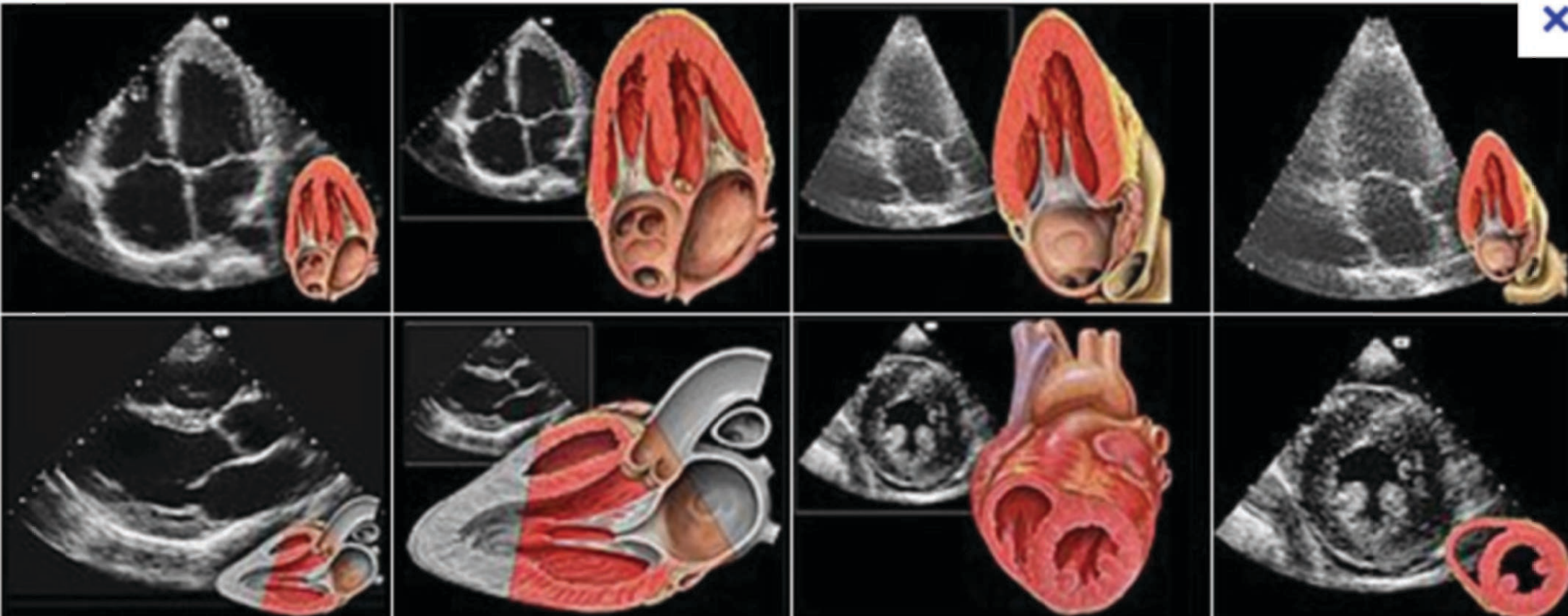
- * PARASTERNALE GRAND AXE/PETIT AXE
- * APICALE
- * SOUS COSTALE
- * (SUPRASTERNALE)
- * MODES
- * 2D
- * COULEUR
- * TM
- * DP
- * DC



Acoustic Windows



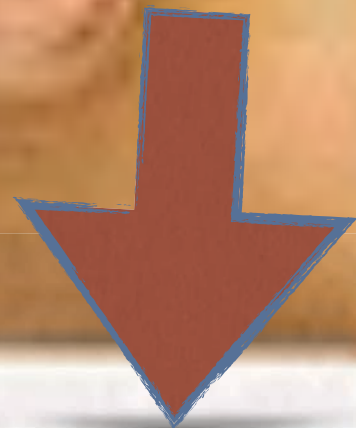
1. Parasternal



4. Suprasternal Notch



DLG au mieux



DLG idealement

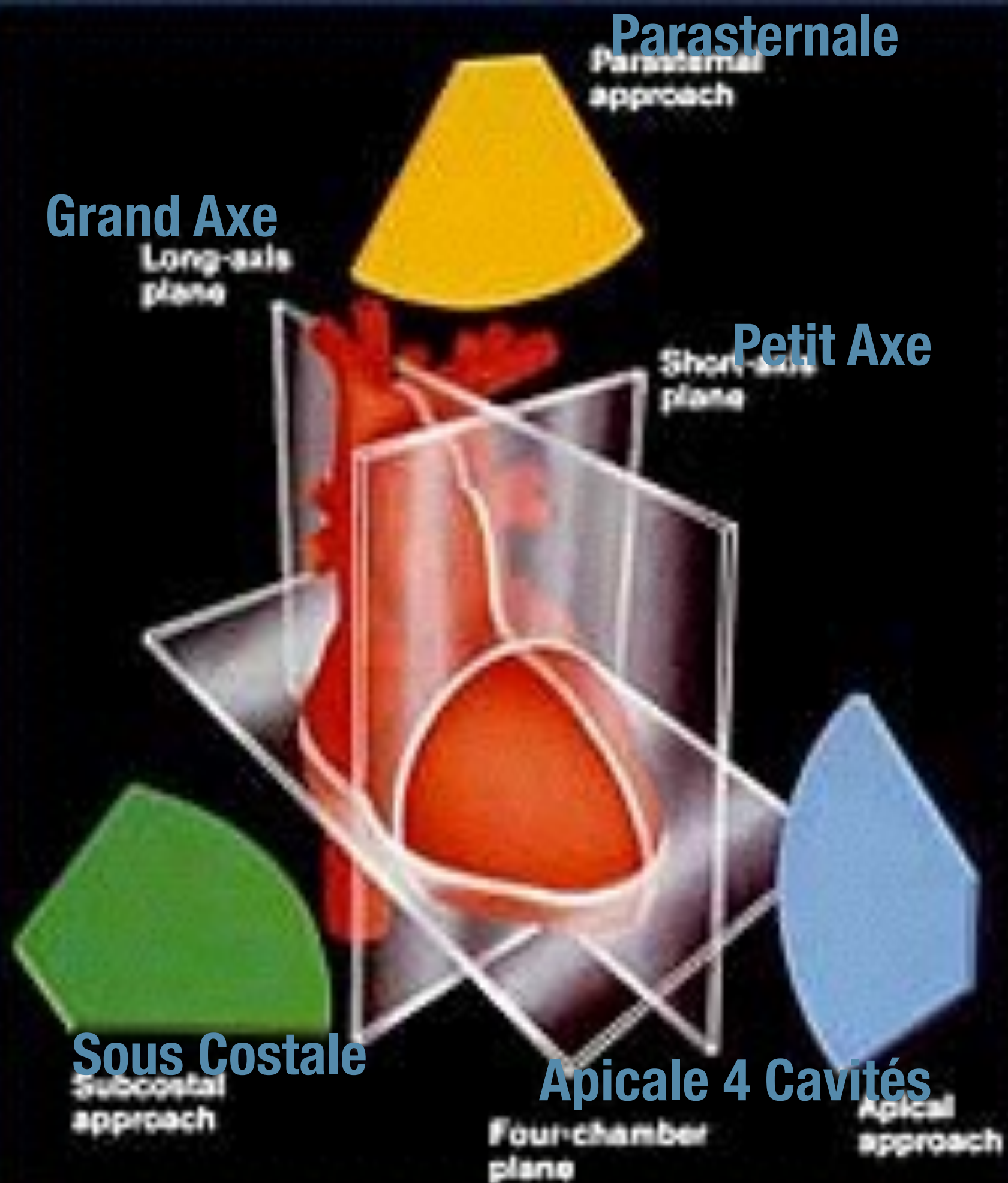
Interface = FOIE!!!

DD

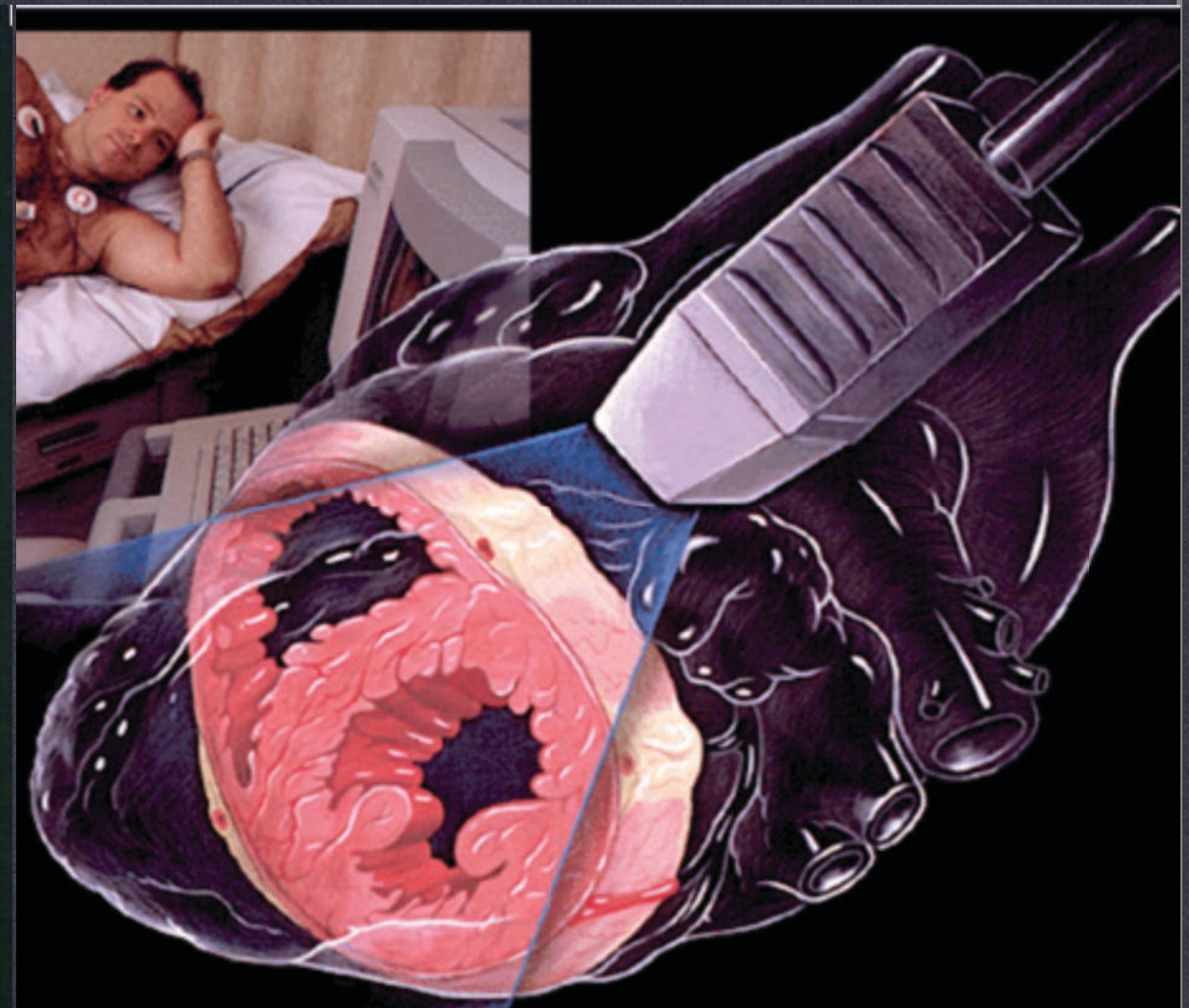
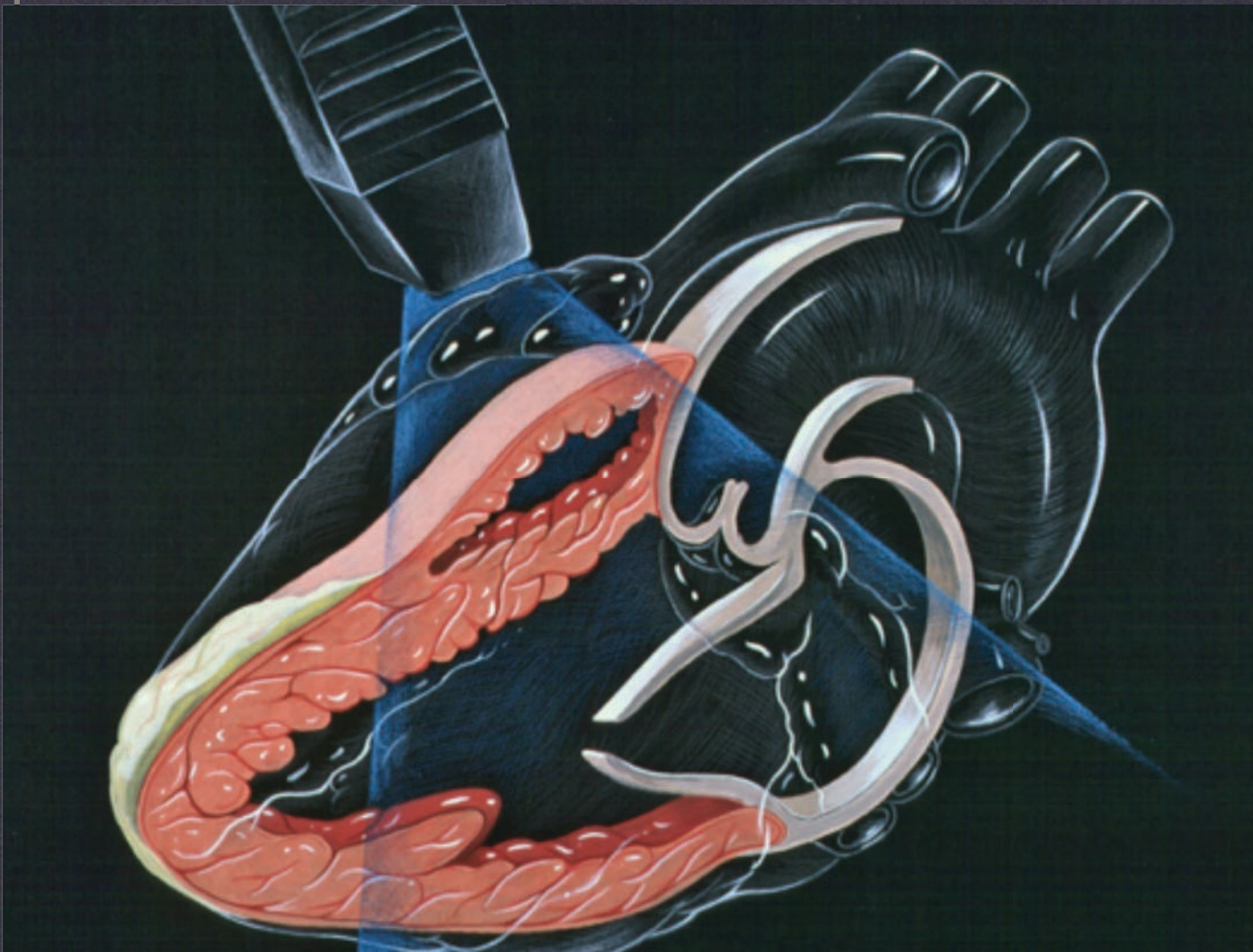


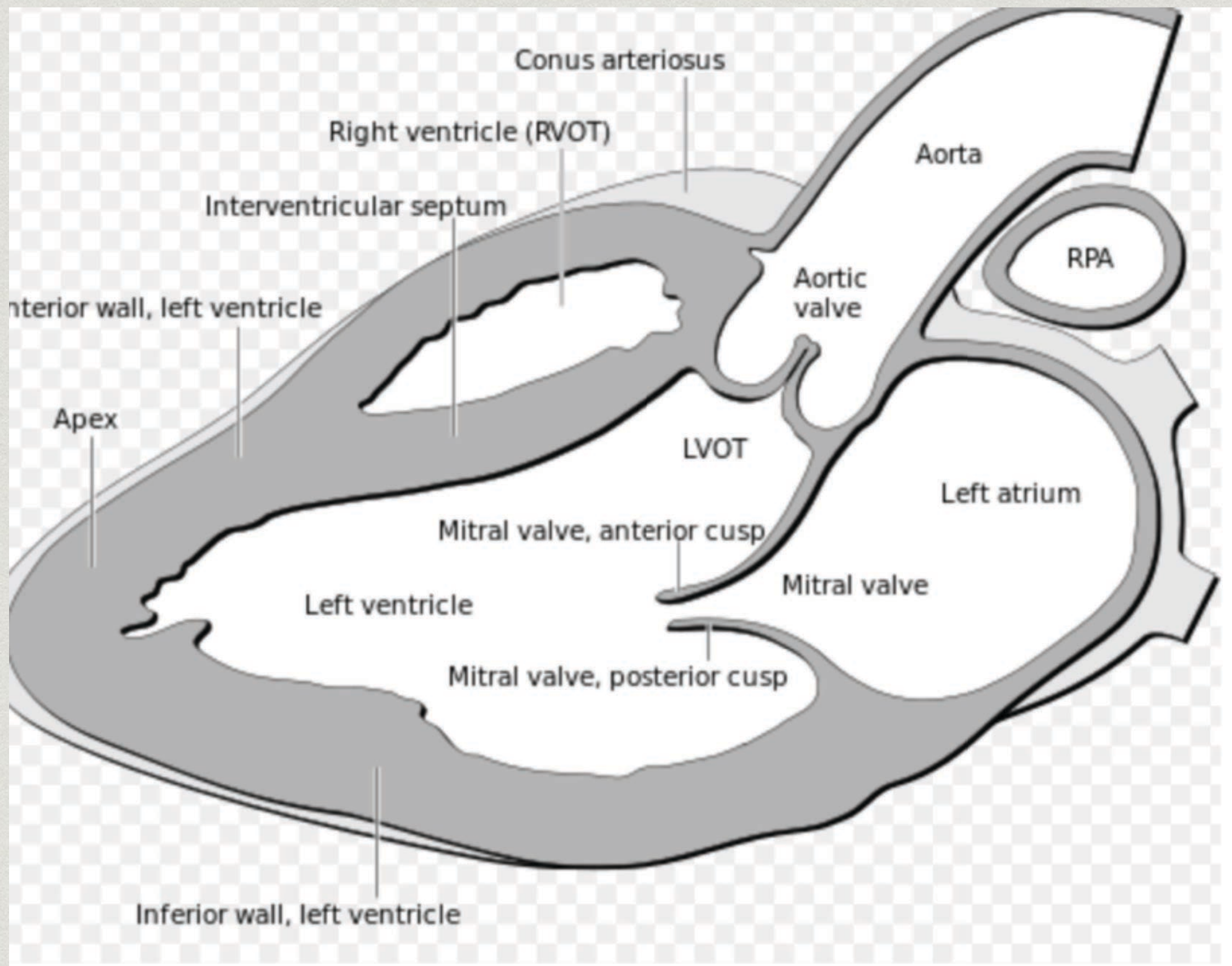
LA VRAIE VIE



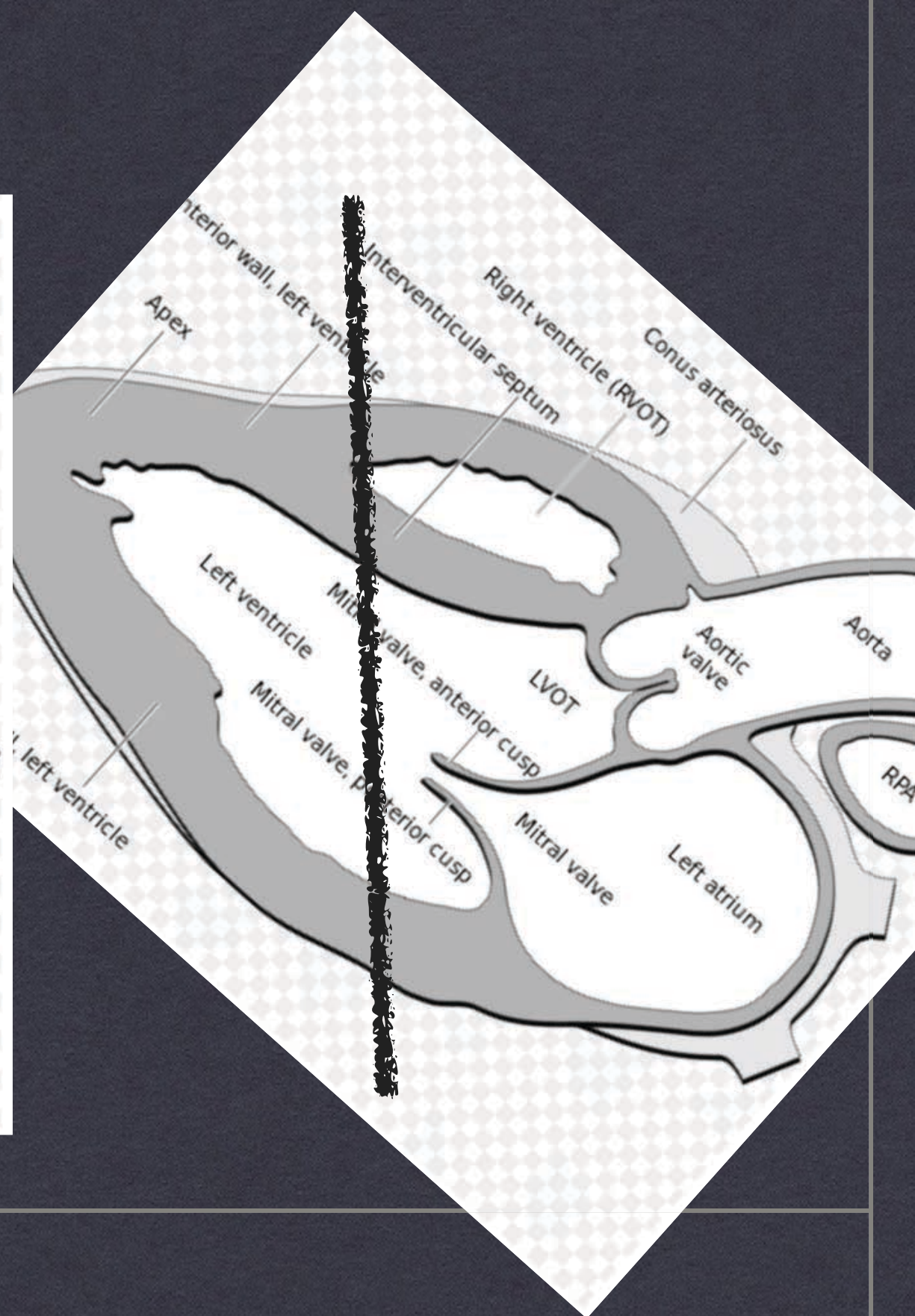
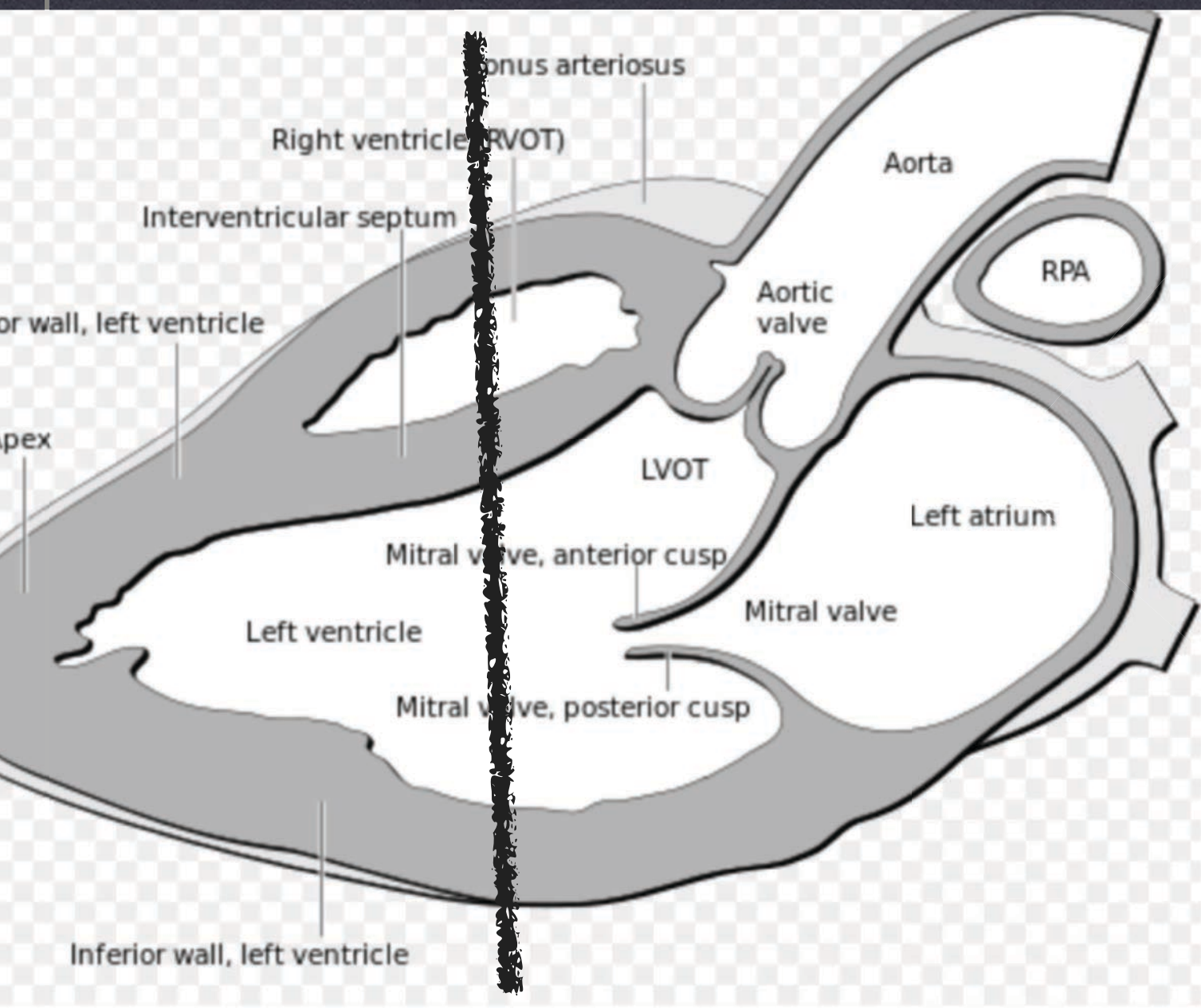


QUELLES INFORMATIONS TIRER DE LA COUPE PARASTERNALE?





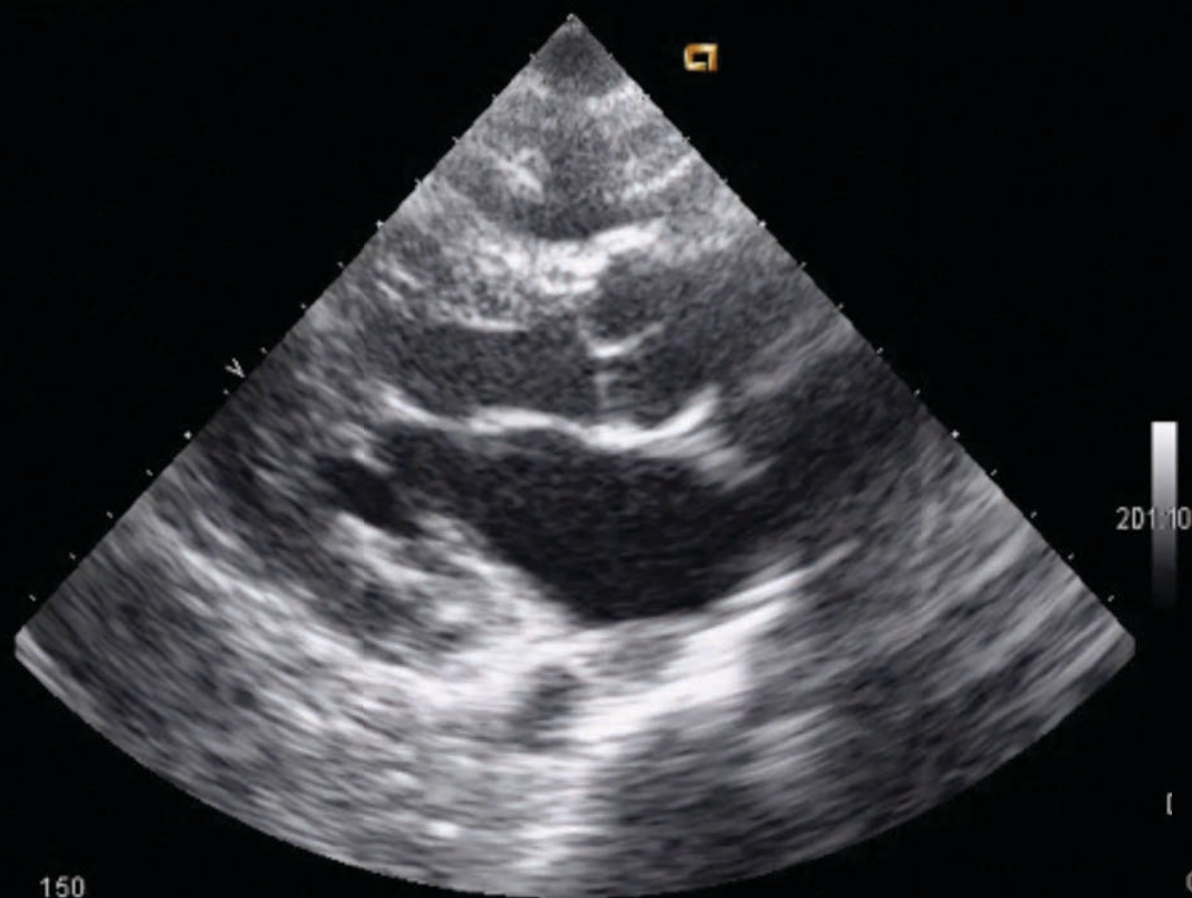
Parasternale grand axe



HOPITAL PITIE SALPETRIERE
* 24_08_2013_09_04_16

10:27:34 Su 25/08/2013 acuson
CV70

CARDIO
P42 3.2T
FPS 62s

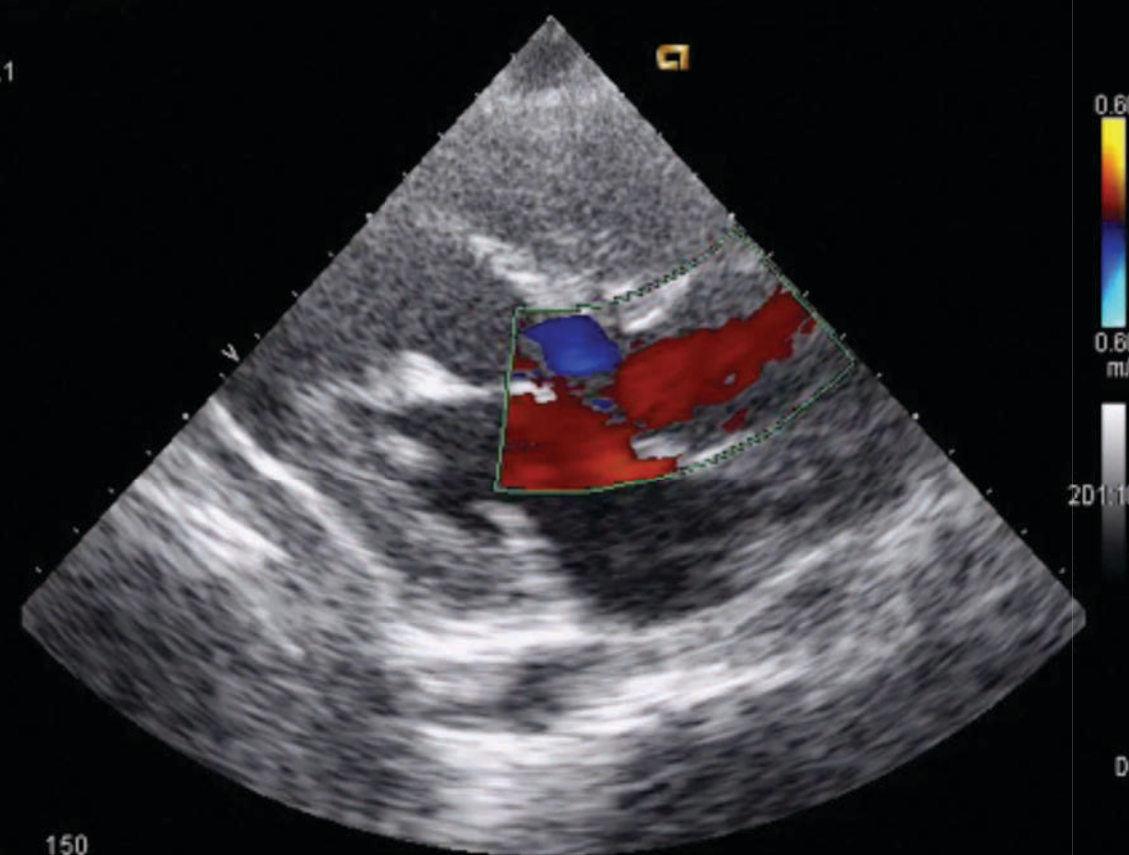


2D 56/1/30
MI 0.8 TIS 0.3 TIB 0.3 Tx 100%

HOPITAL PITIE SALPETRIERE
* 24_08_2013_09_04_16

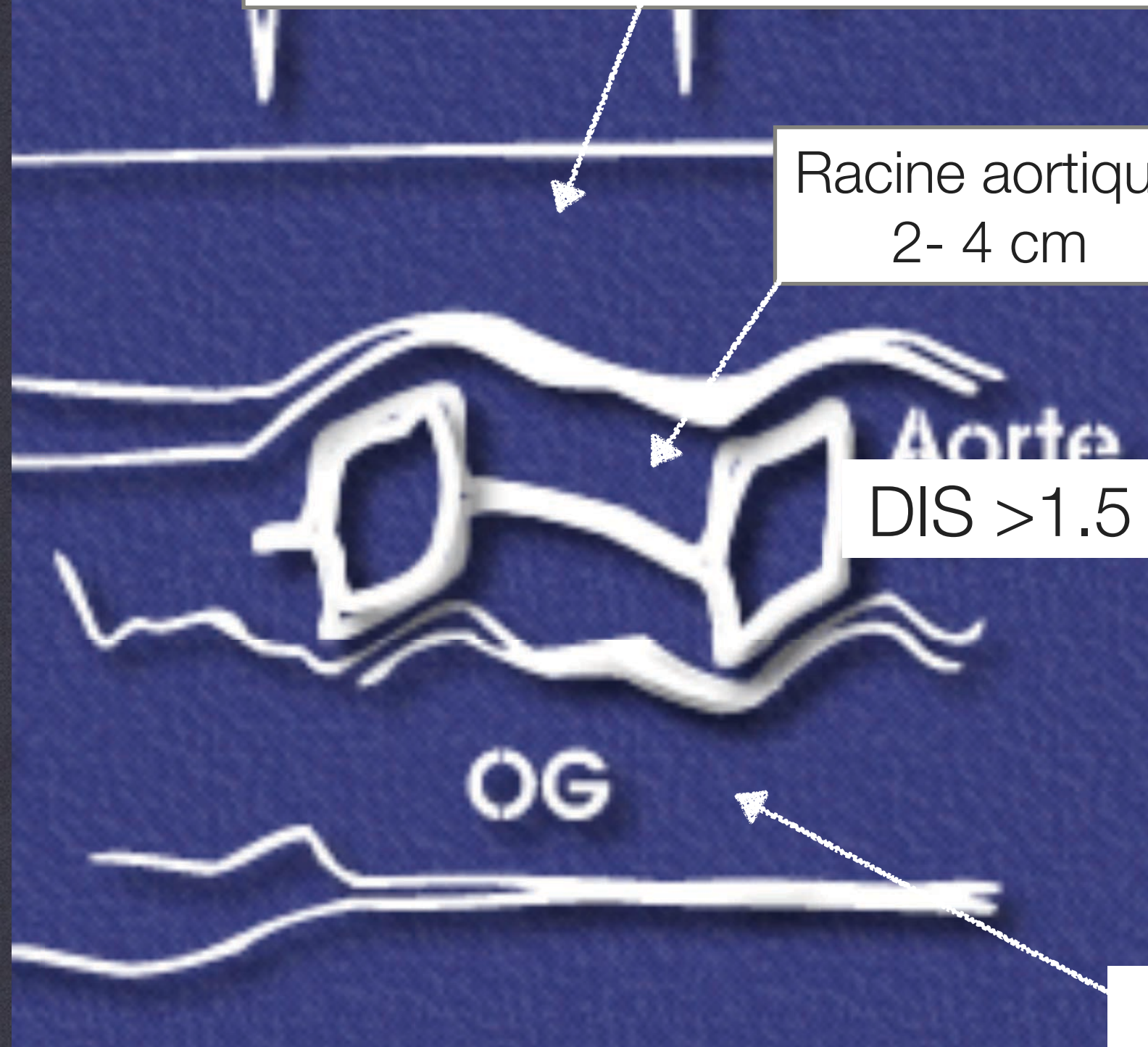
10:30:09 Su 25/08/2013 acuson
CV70

CARDIO
P42 3.2T 2.1
FPS 26s



2D 56/1/30 C 2/2/23
MI 0.6 TIS 0.6 TIB 0.6 Tx 100%

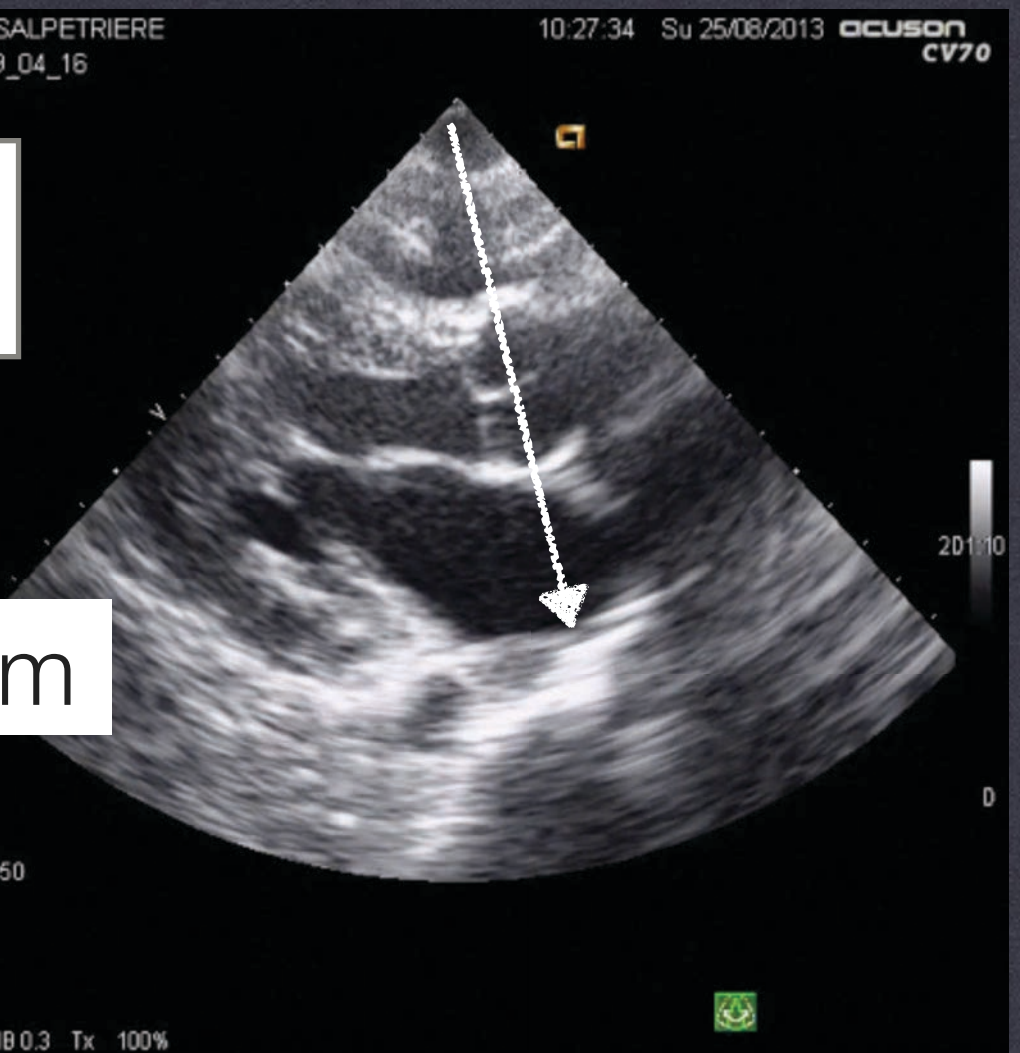
VD = contraction différente « soufflet » accolé au VG, très
compilant, basse pression
Épaisseur télédiastolique : $< 5-6$ mm
Diamètre télédiastolique (à l'union 2/3 apical 1/3 basal) < 30 mm



A 3D reconstruction of the aorta and OG (oesophageal gas) on a blue background. The aorta is shown as a white, branching structure. The OG is shown as a white, elongated structure. Arrows point from the text labels to the corresponding structures.

Racine aortique
2- 4 cm

DIS > 1.5 cm



OG
2- 4 cm

HOPITAL PITIE SALPETRIERE

* 24_08_2013_09_04_16

10:27:53 Su 25/08/2013 acuson
CV70

CARDIO

P42 3.2T

FPS 43s

AO 29.1mm

ACS 20.3mm

LA diam 36.6mm

AO/LA 0.79

Distance

AV/LA

✓ AO

✓ LA diam

✓ ACS

RV diam

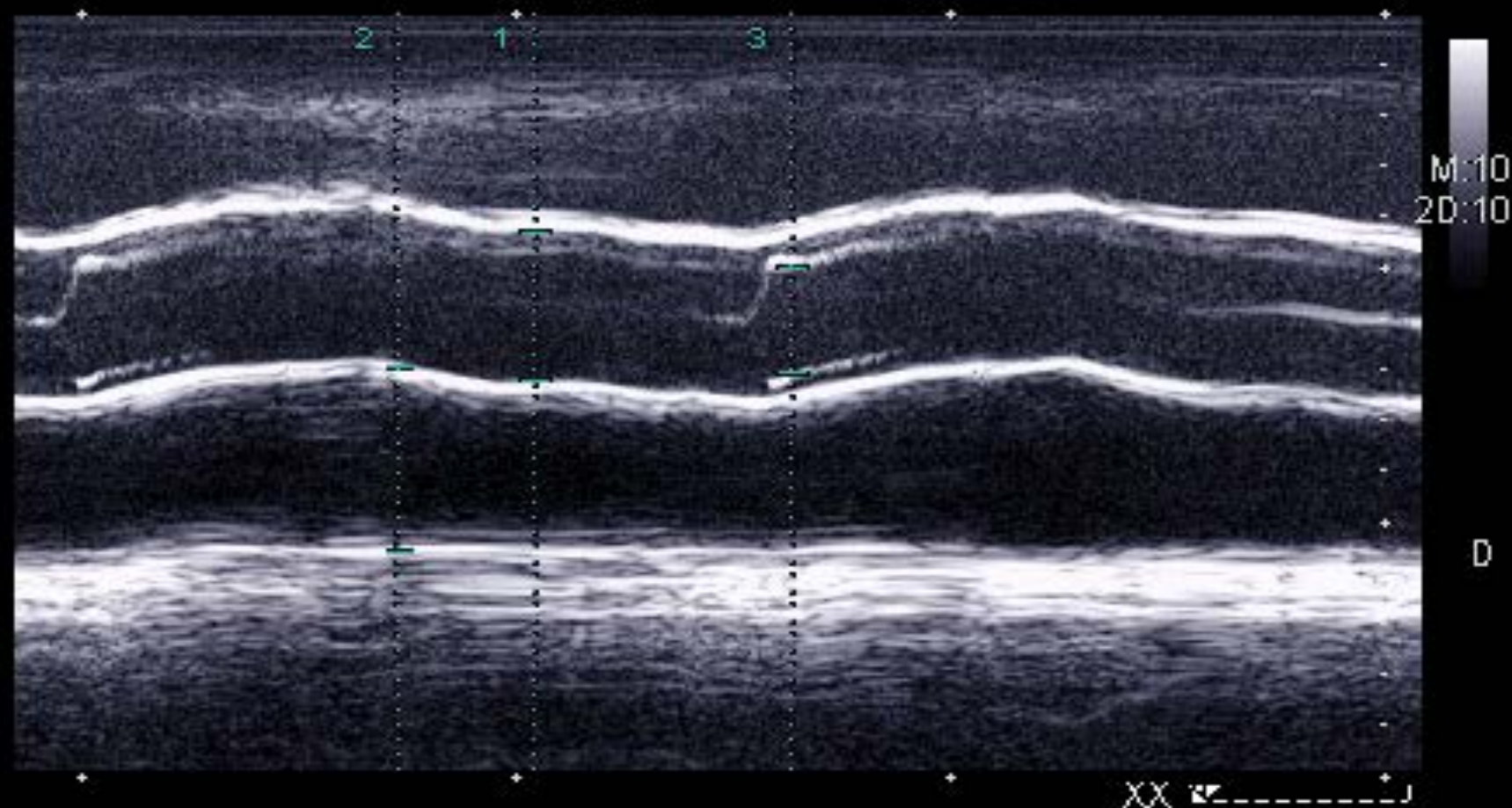
LVET

LVPEP

Report

WorkSheet

2Sec



2D 56/1/30

M 45/2/23

MI 0.9 TIS 0.3 TIB 1.0 Tx 100%

VD 0.5-2.5 cm

Septum diastole
<1.5 cm

HOPITAL PITIE SALPETRIERE
* 24_08_2013_09_04_16

10:27:34 Su 25/08/2013 acuson
CV70

CARDIO
P42 3.2T
FPS 62s

VG

- 1) Diastole
3.5- 5.5 cm
- 2) Systole
2.2- 4 cm
- 3) Fracc >30%

VD

S

VG

PP

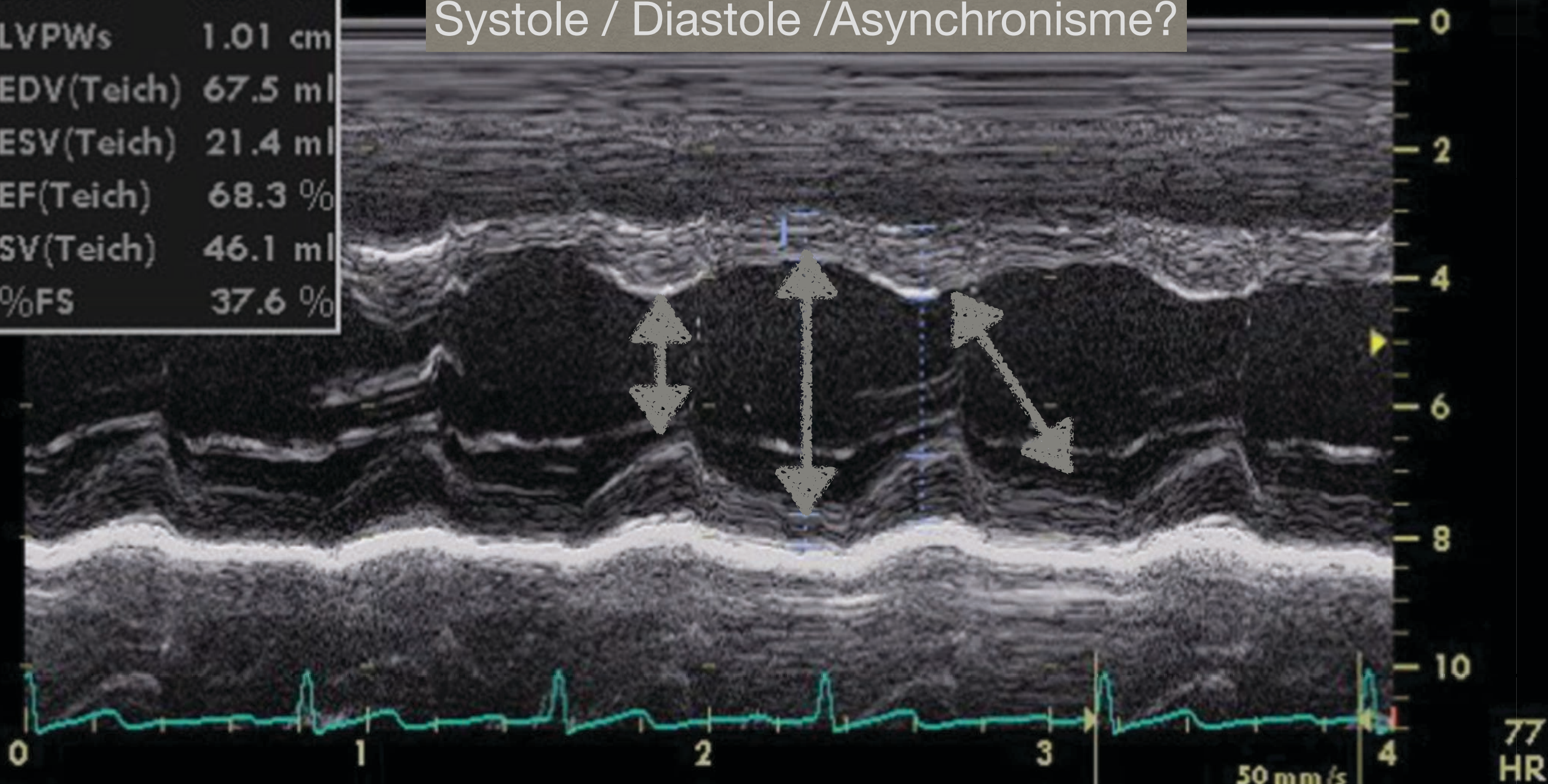
Paroi postérieure
diastole <1.5 cm

2D 56/1/30
MI 0.8 TIS 0.3 TIB 0.3 Tx 100%

1	IVSd	0.70 cm
	IVSs	1.09 cm
	LVIDd	3.94 cm
	LVIDs	2.46 cm
	LVPWd	0.51 cm
	LVPWs	1.01 cm
	EDV(Teich)	67.5 ml
	ESV(Teich)	21.4 ml
	EF(Teich)	68.3 %
	SV(Teich)	46.1 ml
	%FS	37.6 %



Systole / Diastole /Asynchronisme?



HOCM - Severe Systolic Anterior Motion of Mitral Valve Leaflet - TTE

medicaldump.com

MI: 1.4
S3
29 OCT 10
14:55:59

03987.29
GAIN 63
COMP 63
78BPM

16CM
60HZ

T
P 1.6 3.2 R

Subscribe Please

CMH? > 15 MM

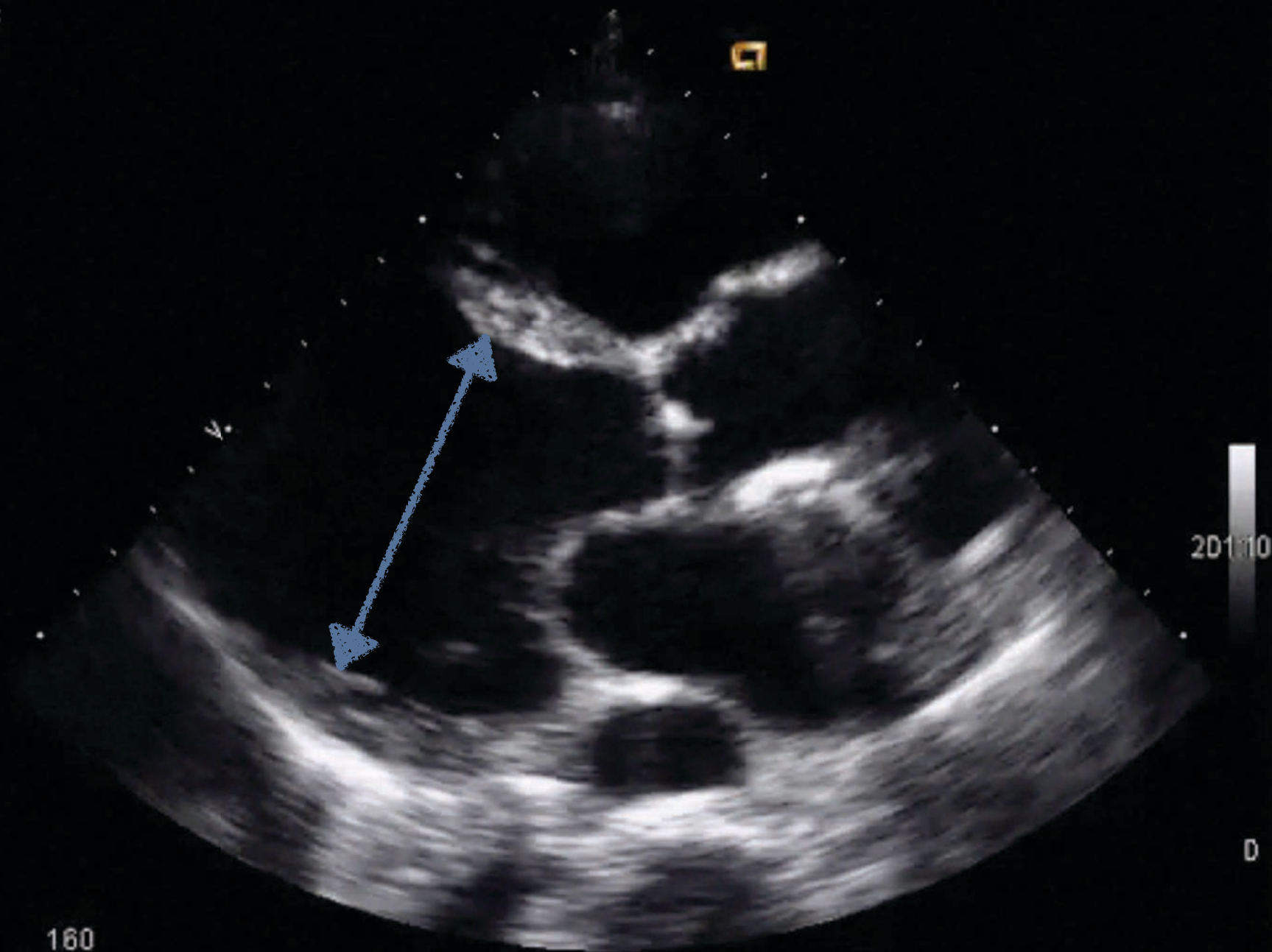
HOPITAL PITIE SALPETRIERE
GOMIS,ANTOINE 05_10_2014_14_46_35

15:57:33 Tu 07/10/2014 acuson
CV70

CARDIO DIFF

P42 3.0T

FPS 59s



2D 56/1/26

MI 0.8 TIS 0.4 TIB 0.4 Tx 100%

CMD? > 55 MM

MI: 1.6
63
9 OCT 10
1.52.27

medicaldump.com

0 04081.20
AIN 63
OMP 63
77BPM

6CM
20HZ

T
P
1.6 3.2

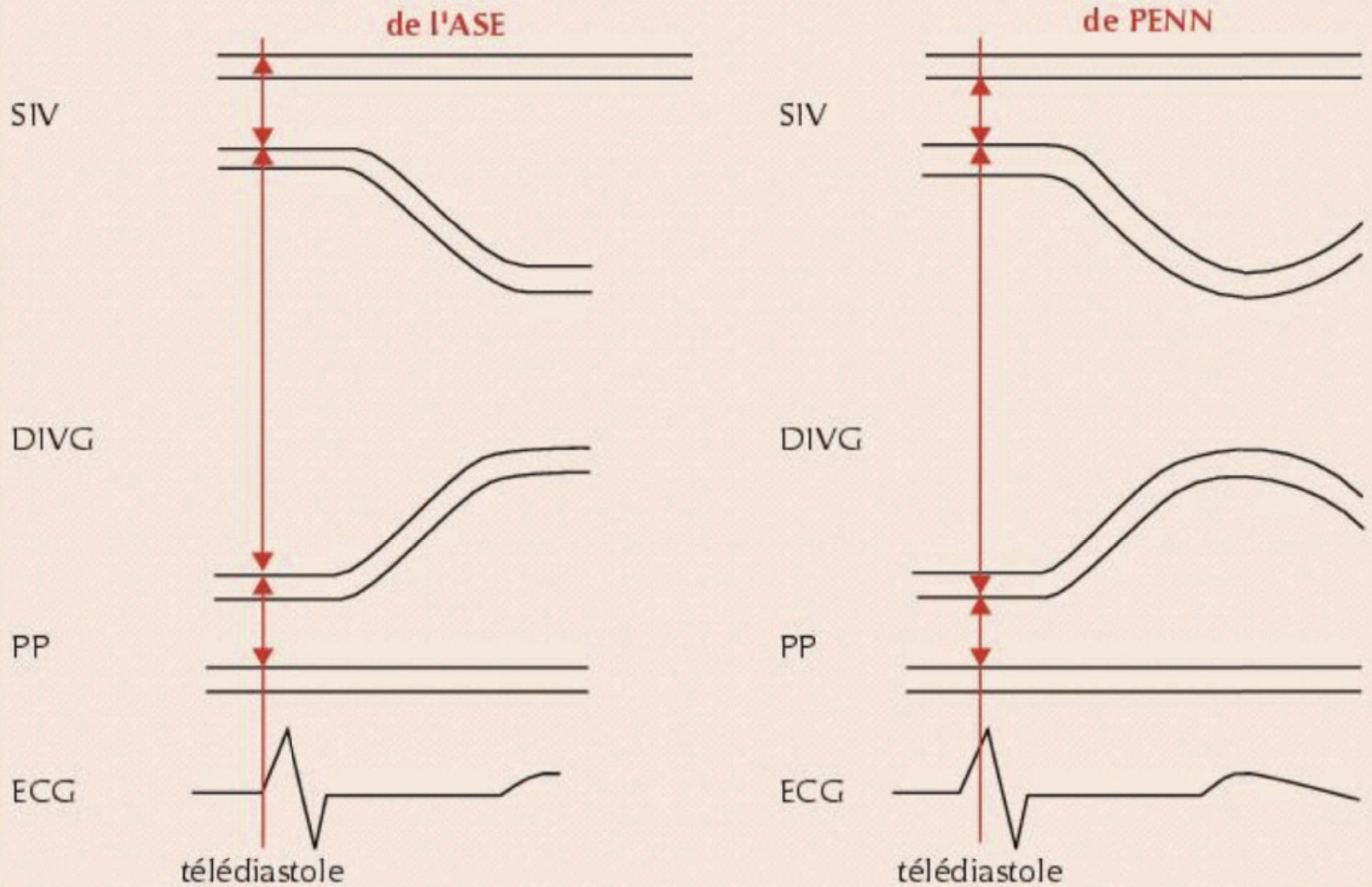
Subscribe Please

SAM

**PP? => ASYMÉTRIQUE PRÉDOMINANT AU NIVEAU DU SEPTUM INTER-VENTRICULAIRE
ENTRAÎNANT UN RAPPORT SEPTUM INTER VENTRICULAIRE SUR LA PAROI POSTÉRIEURE
SUPÉRIEURE À 1.5.**

=MOUVEMENT SYSTOLIQUE ANTÉRIEURE DE LA VALVE MITRALE AVEC CONTACT SEPTAL

Mesure des paramètres ventriculaires diastoliques selon la convention

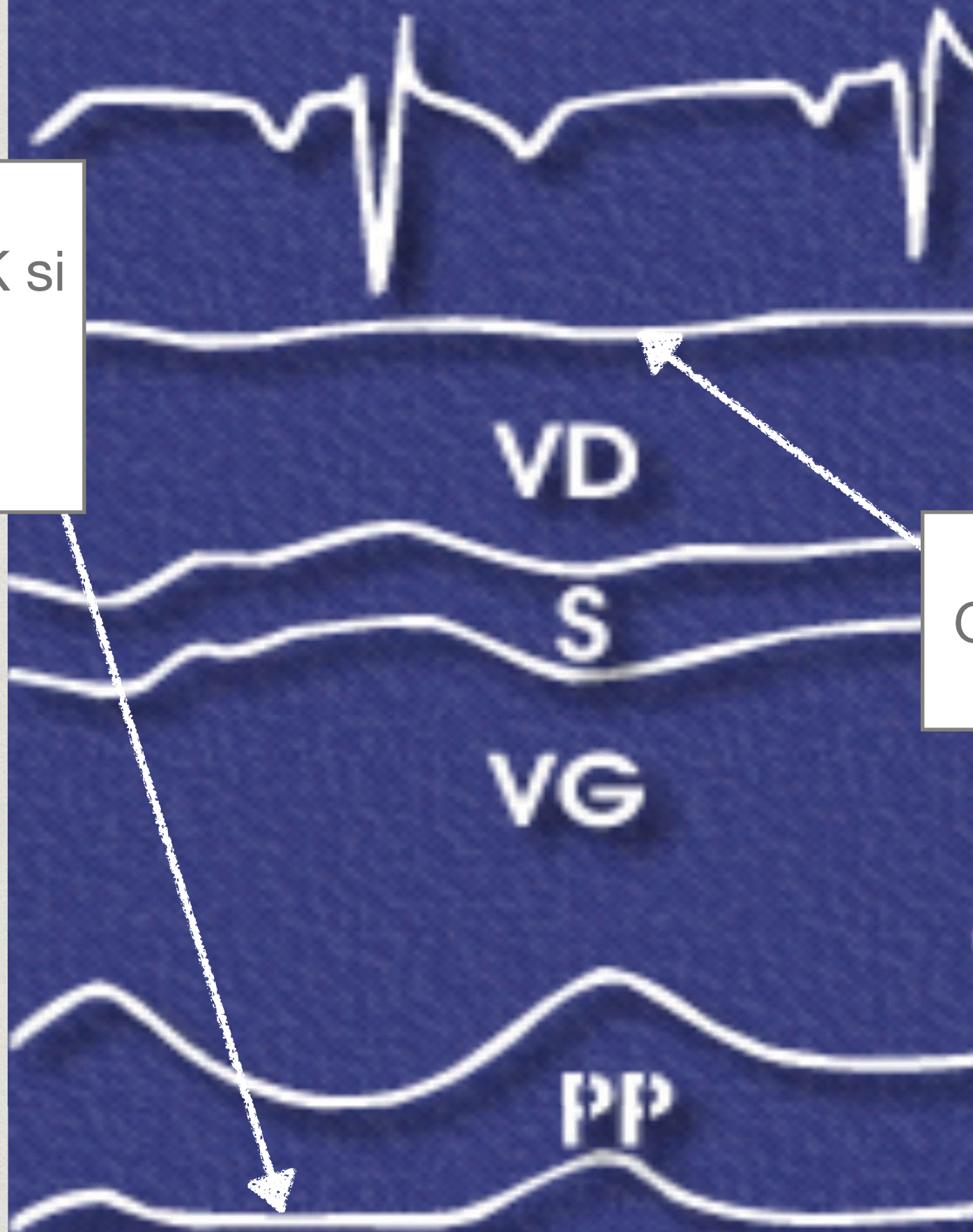


TM

Décollement
péricardique
postérieur?



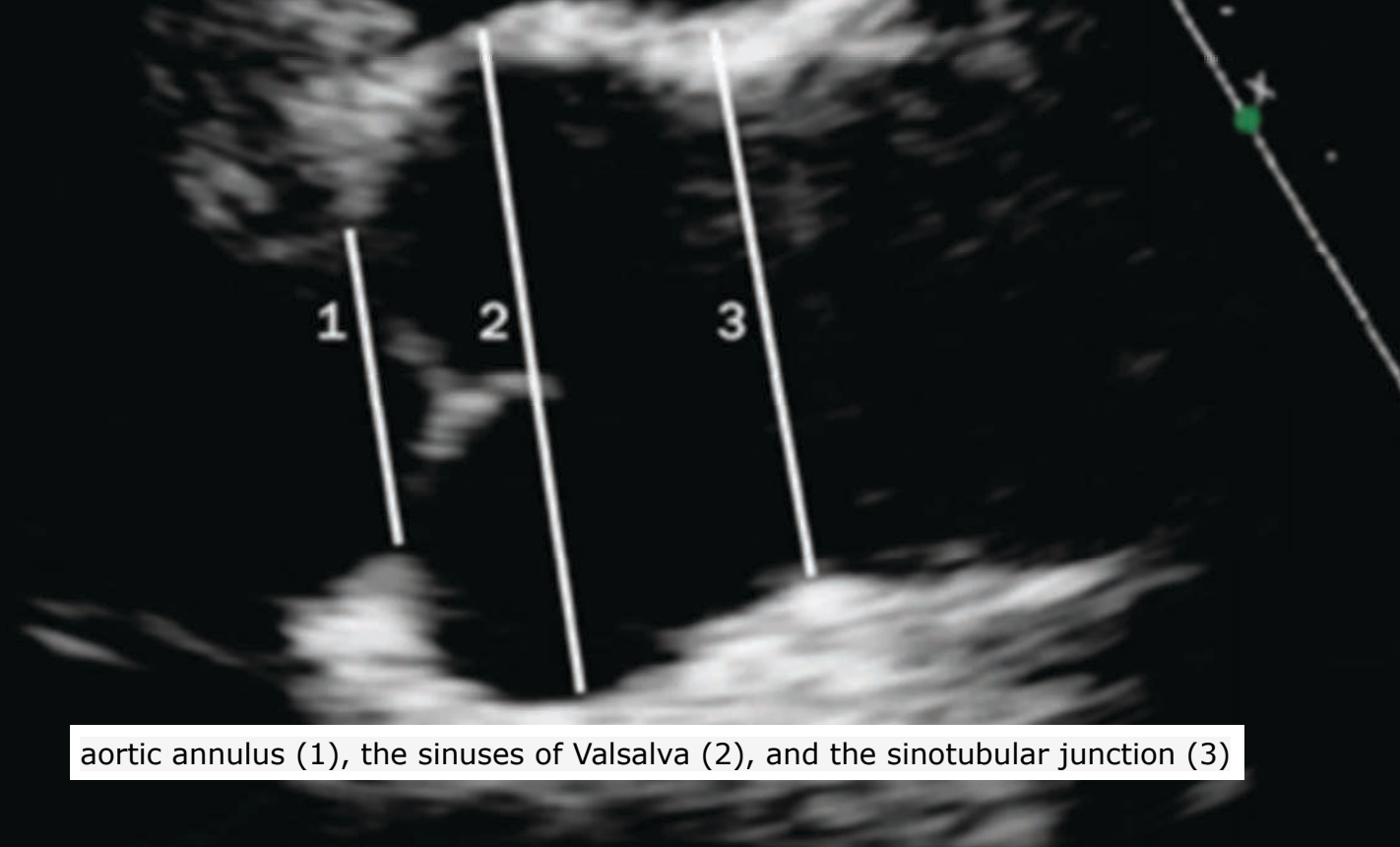
POSTERIEUR
Epanchement PK si
- > 2/3 cycle
- systolo-
diastolique



ANTERIEUR
Graisse le plus
souvent

AUTI
À OB

CILES



HOPITAL PITIE SALPETRIERE
RAKOTO 10_06_2014_12_01_34

CARDIO

2 3.2T 2.1
S 26s

14:30:17 We 11/06/2014

OCUSON

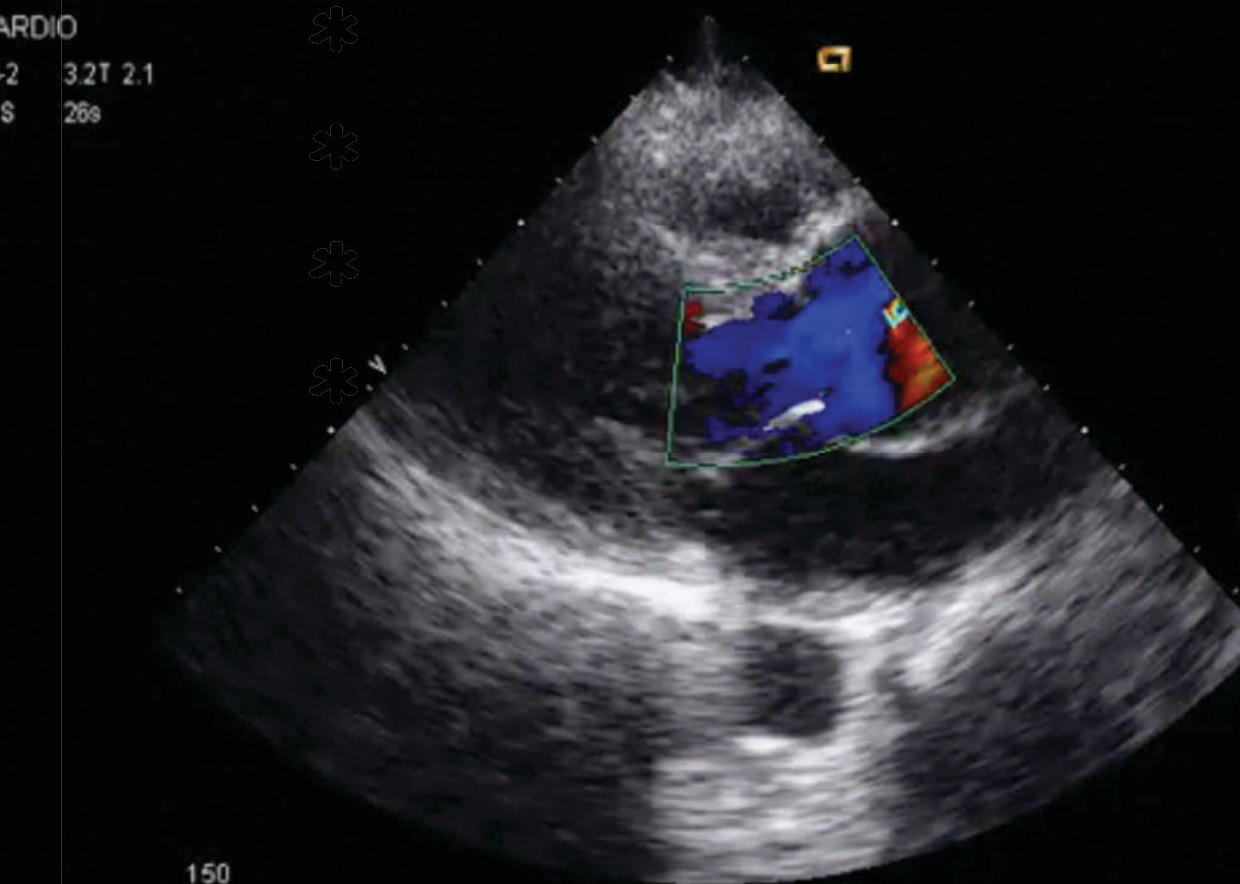
HOPITAL PITIE SALPETRIERE
RAKOTO 10_06_2014_12_01_34

CARDIO

P4-2 3.2T 2.1
FPS 13s

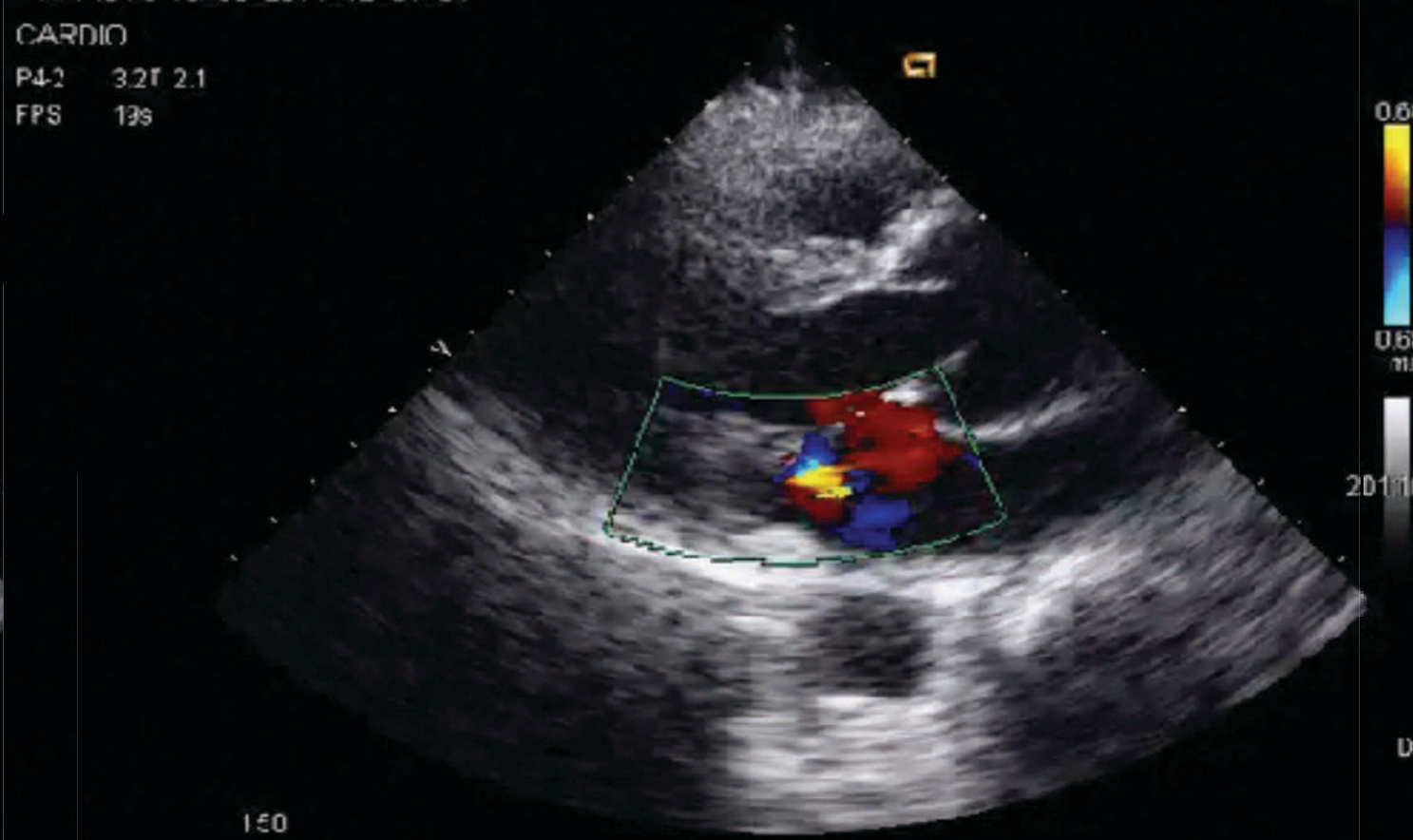
14:30:31 We 11/06/2014

OCUSON
CV70



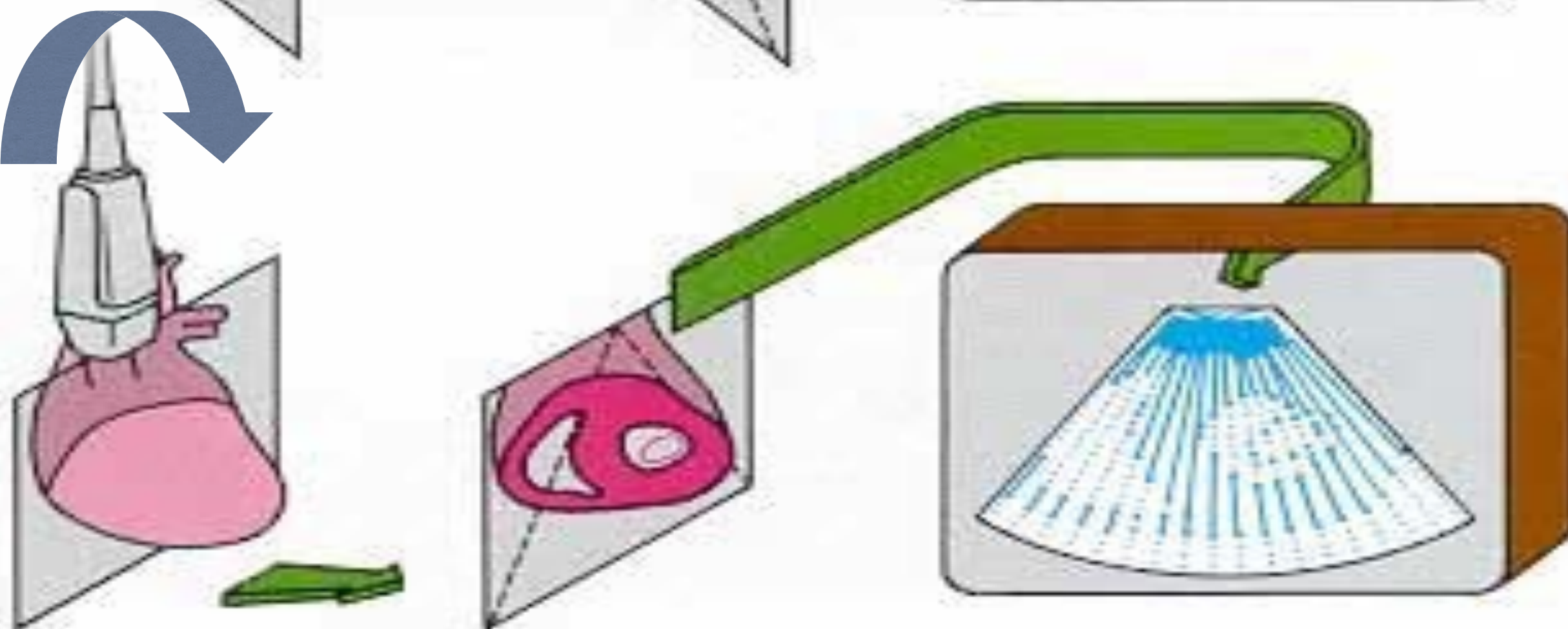
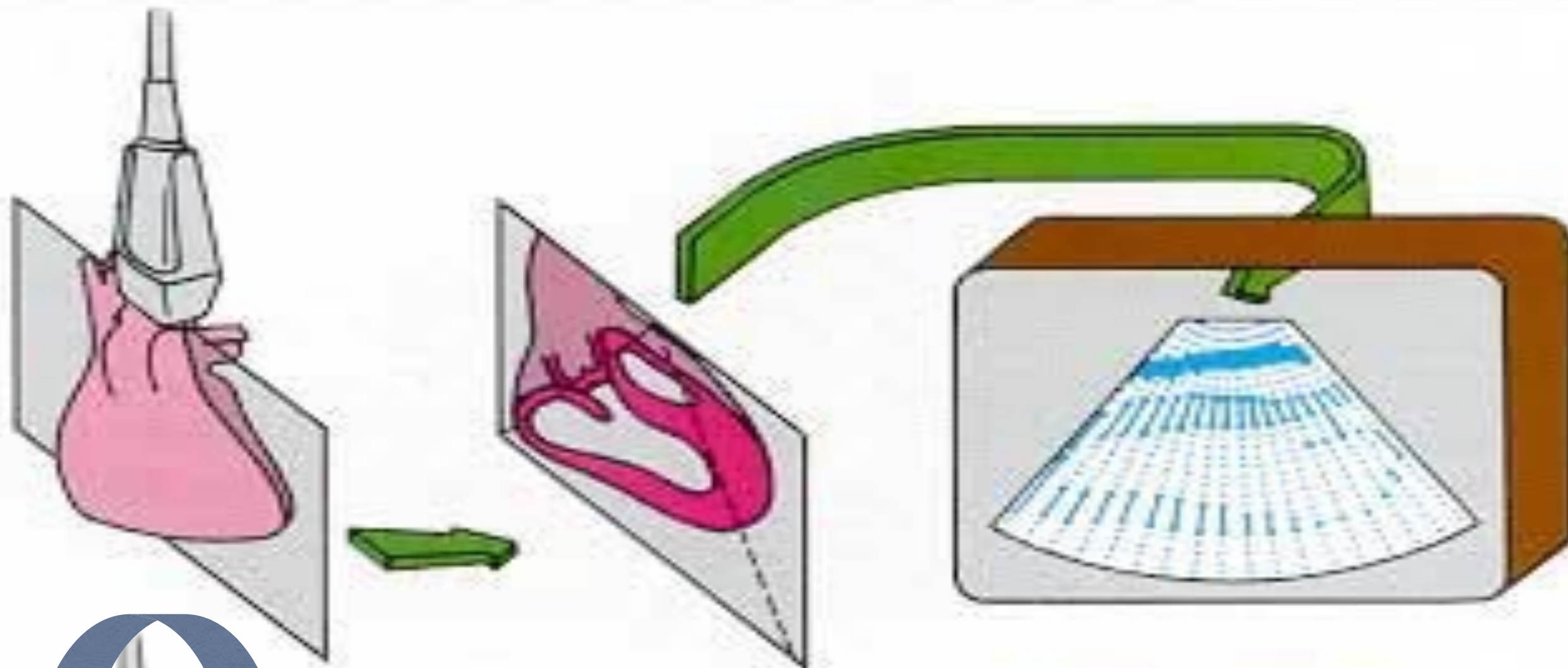
150

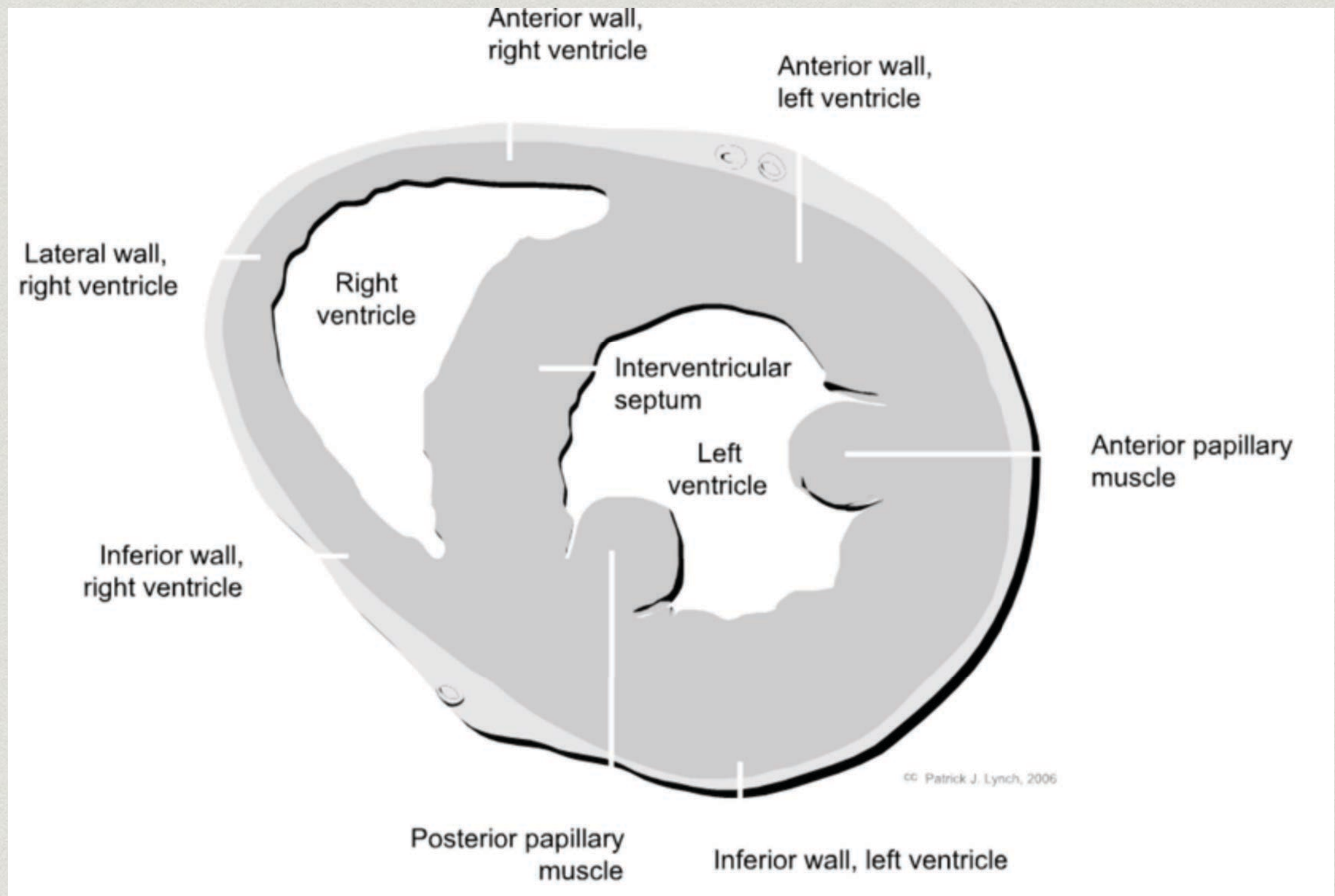
0 56/130 C 2/2/23
MI 0.6 TIS 0.6 TIB 0.6 Tx 100%



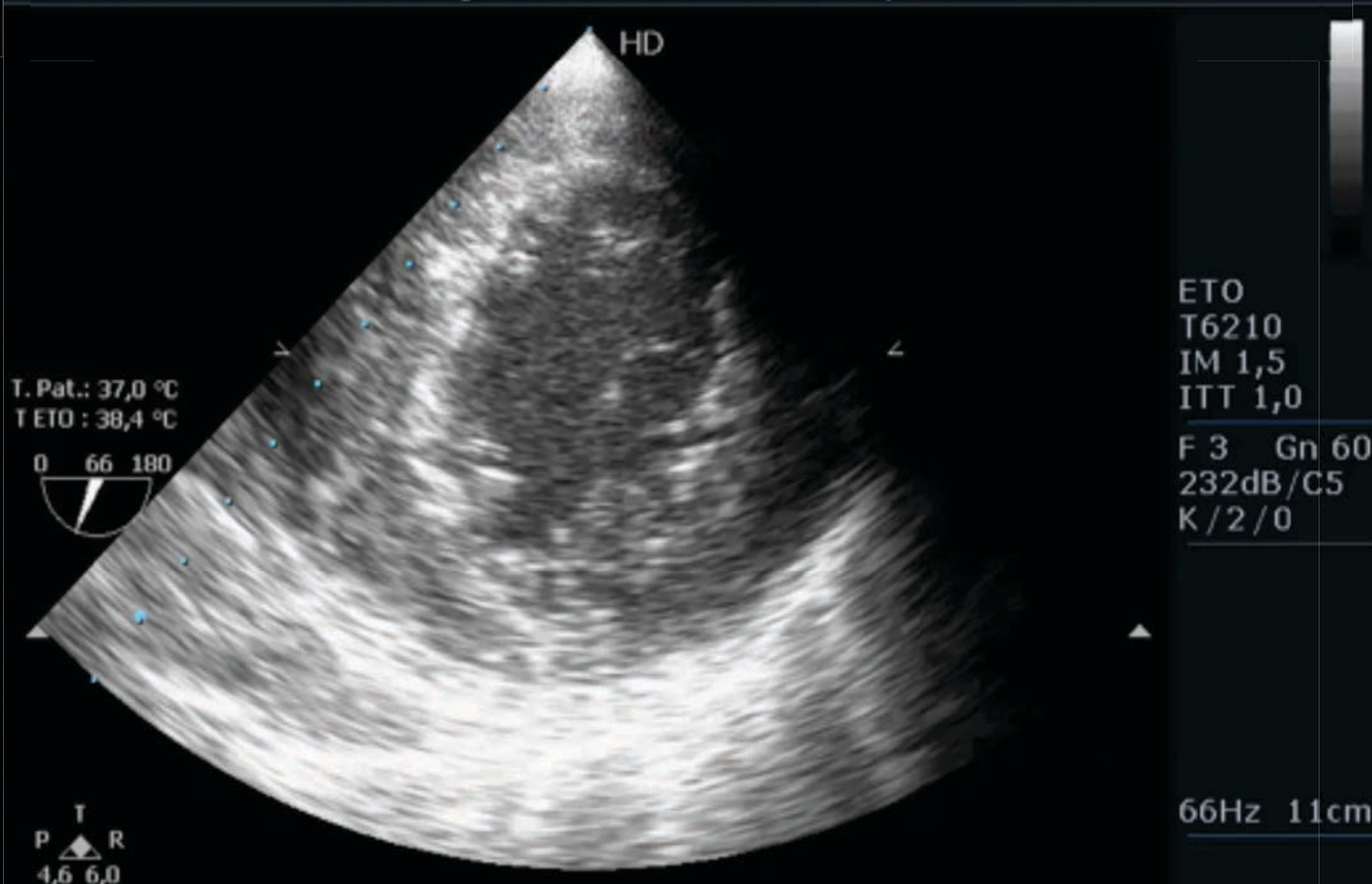
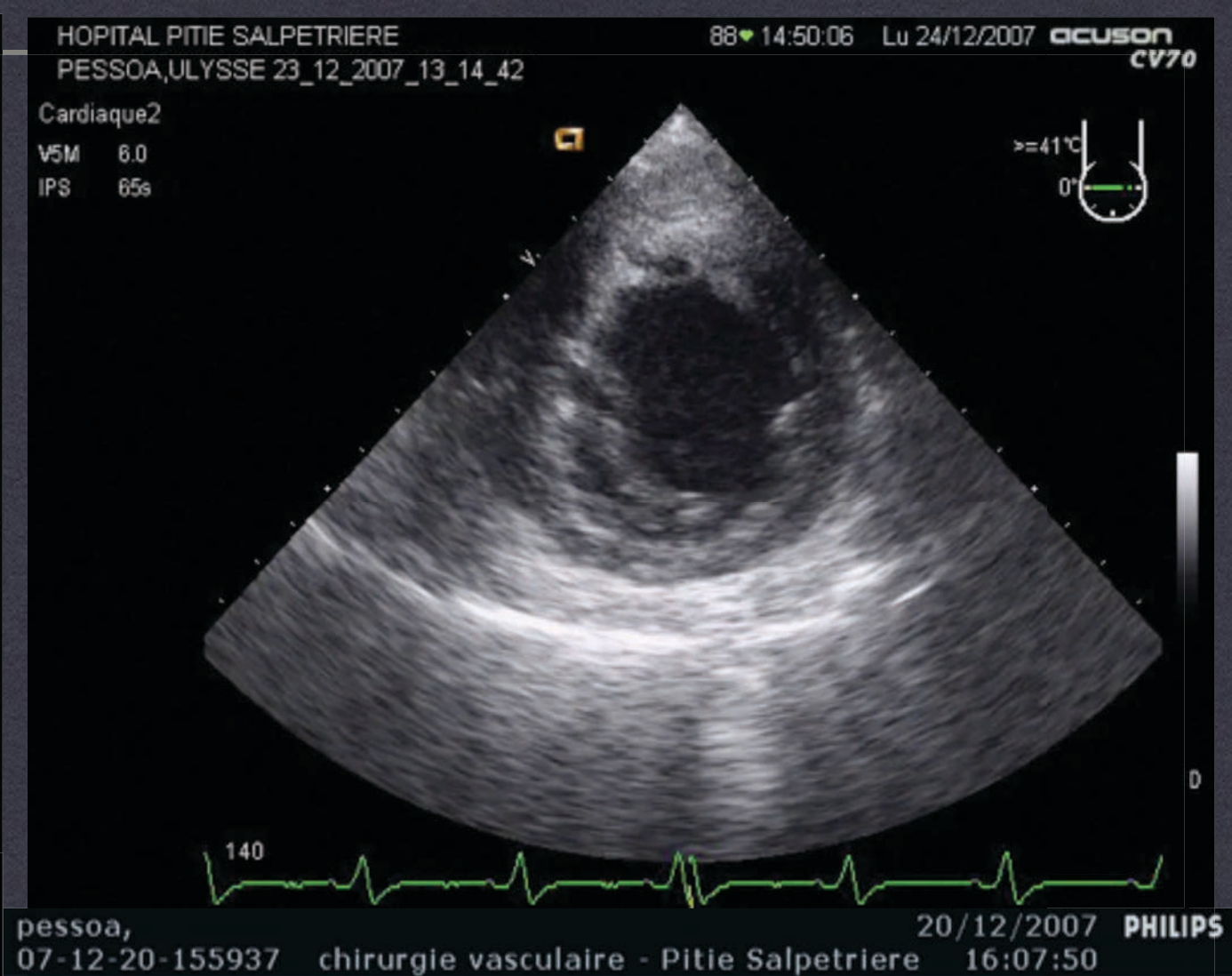
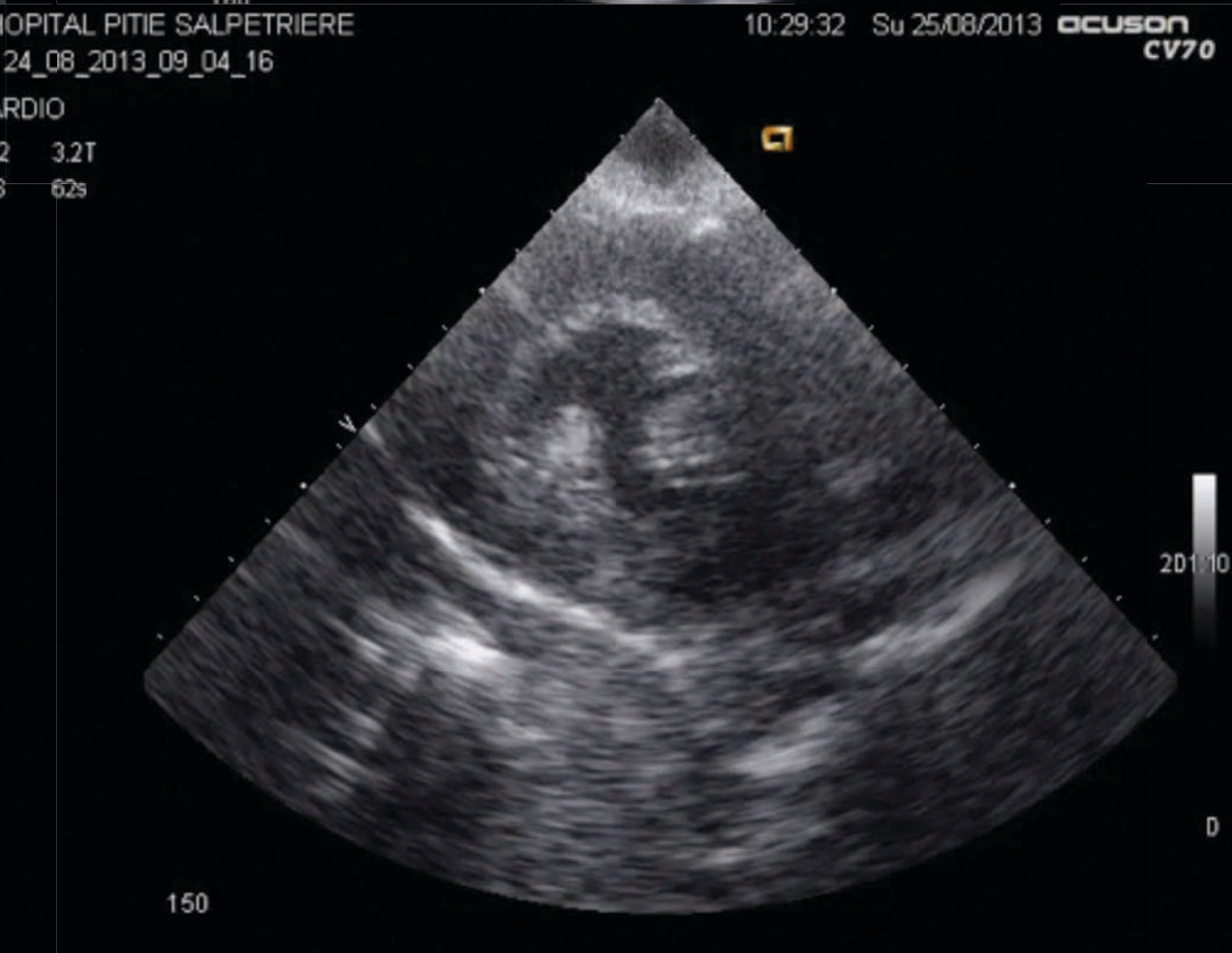
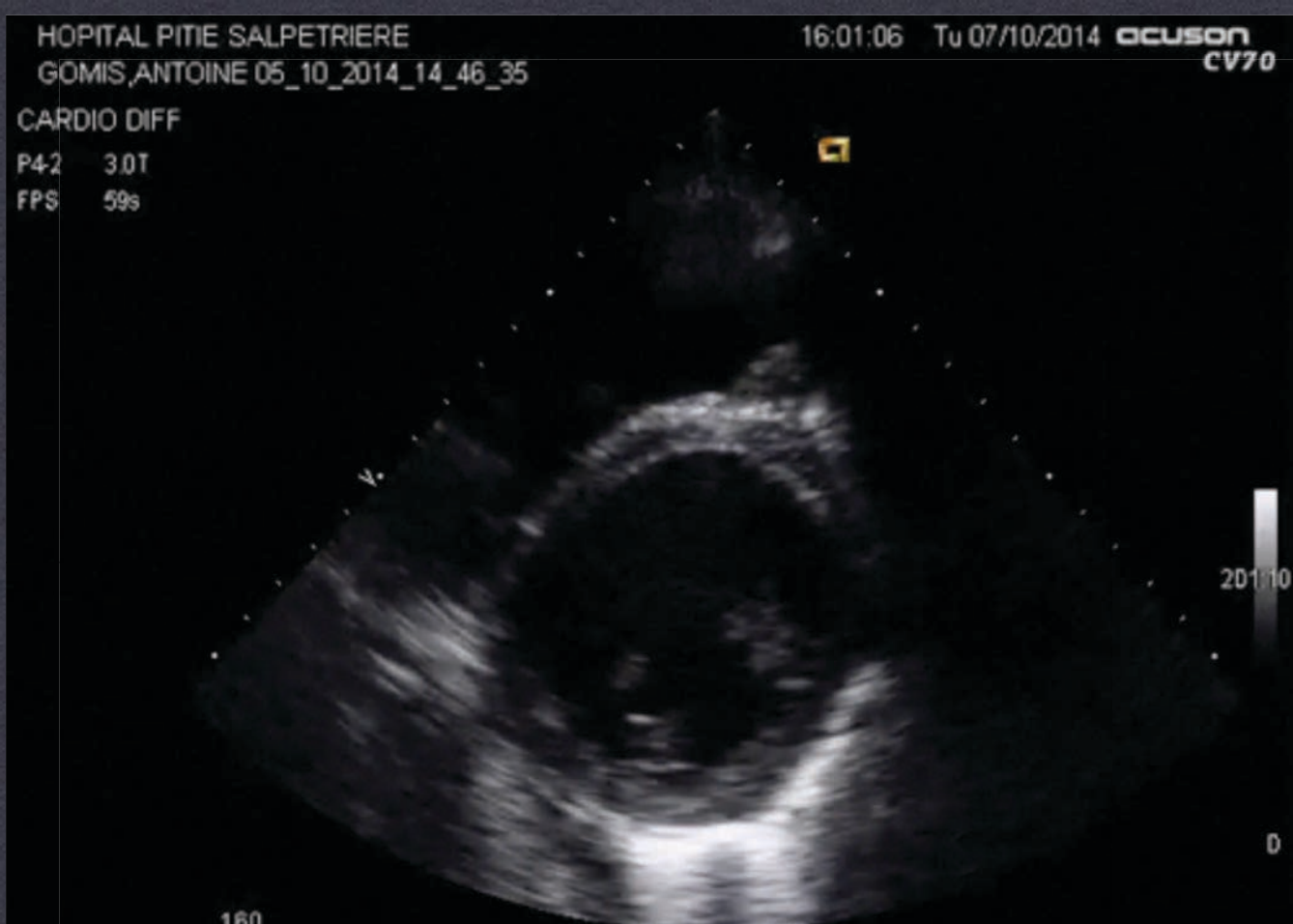
150

20 56/130 C 2/2/23
MI 0.6 TIS 0.6 TIB 0.6 Tx 100%

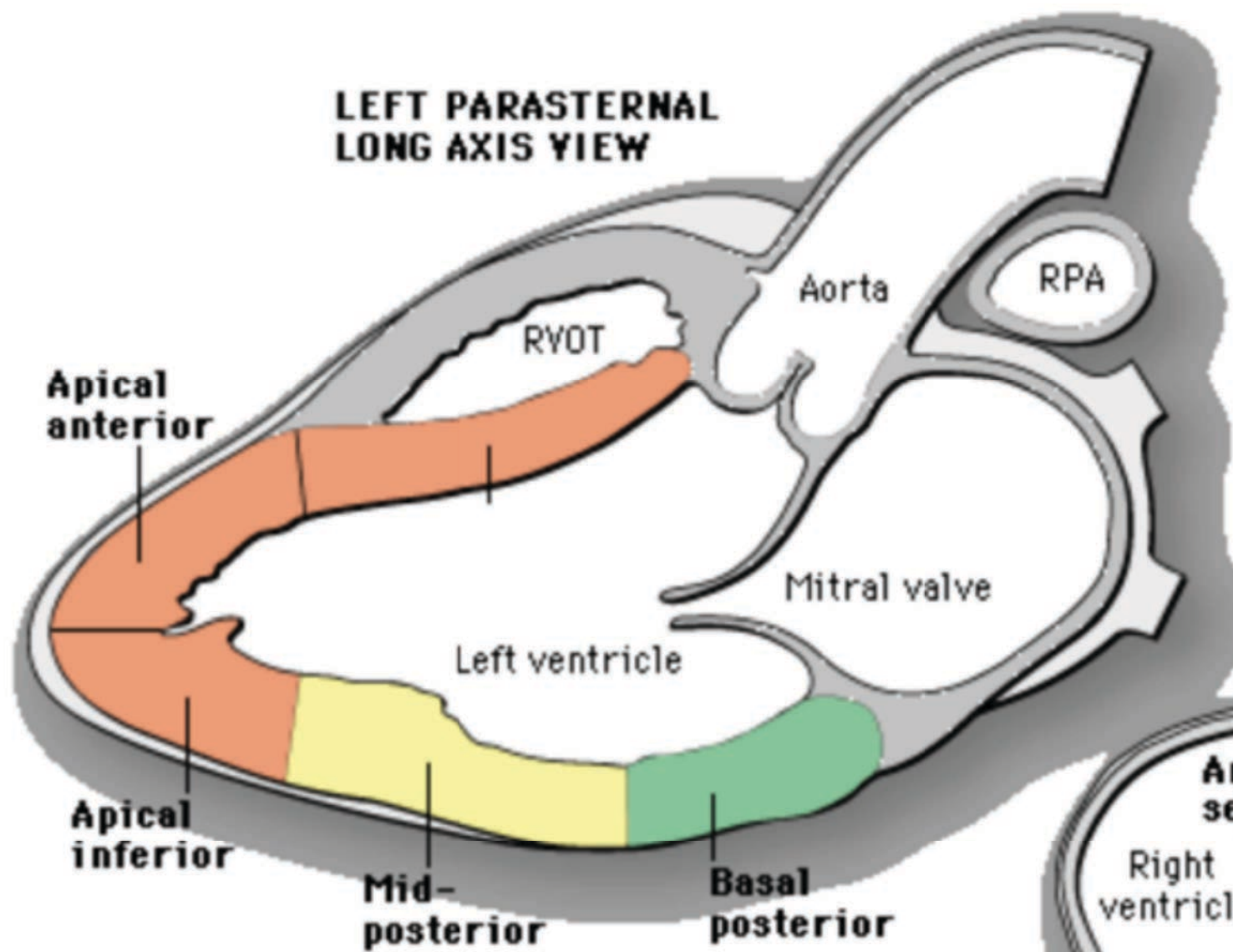




Parasternale petit axe



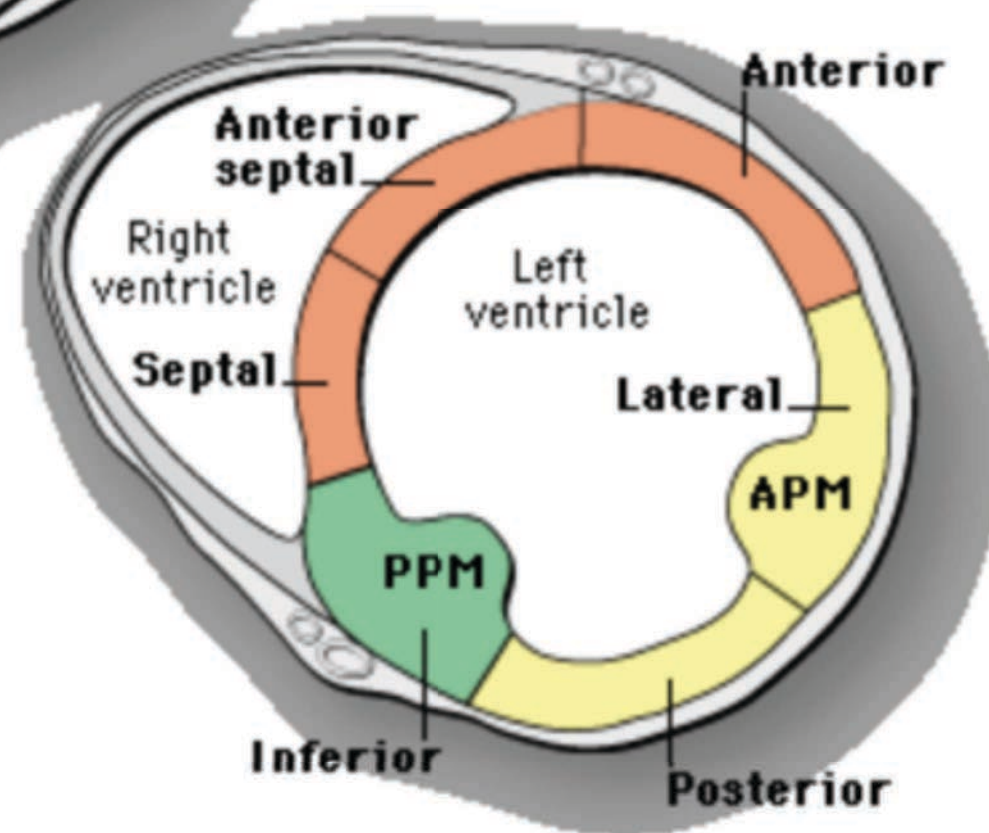
LEFT PARASTERNAL LONG AXIS VIEW

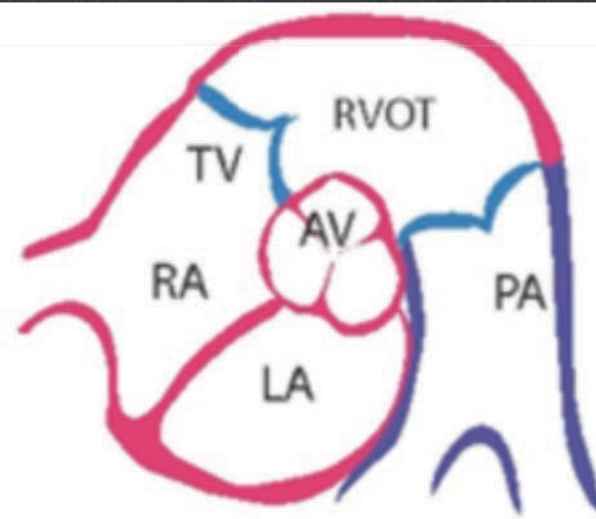
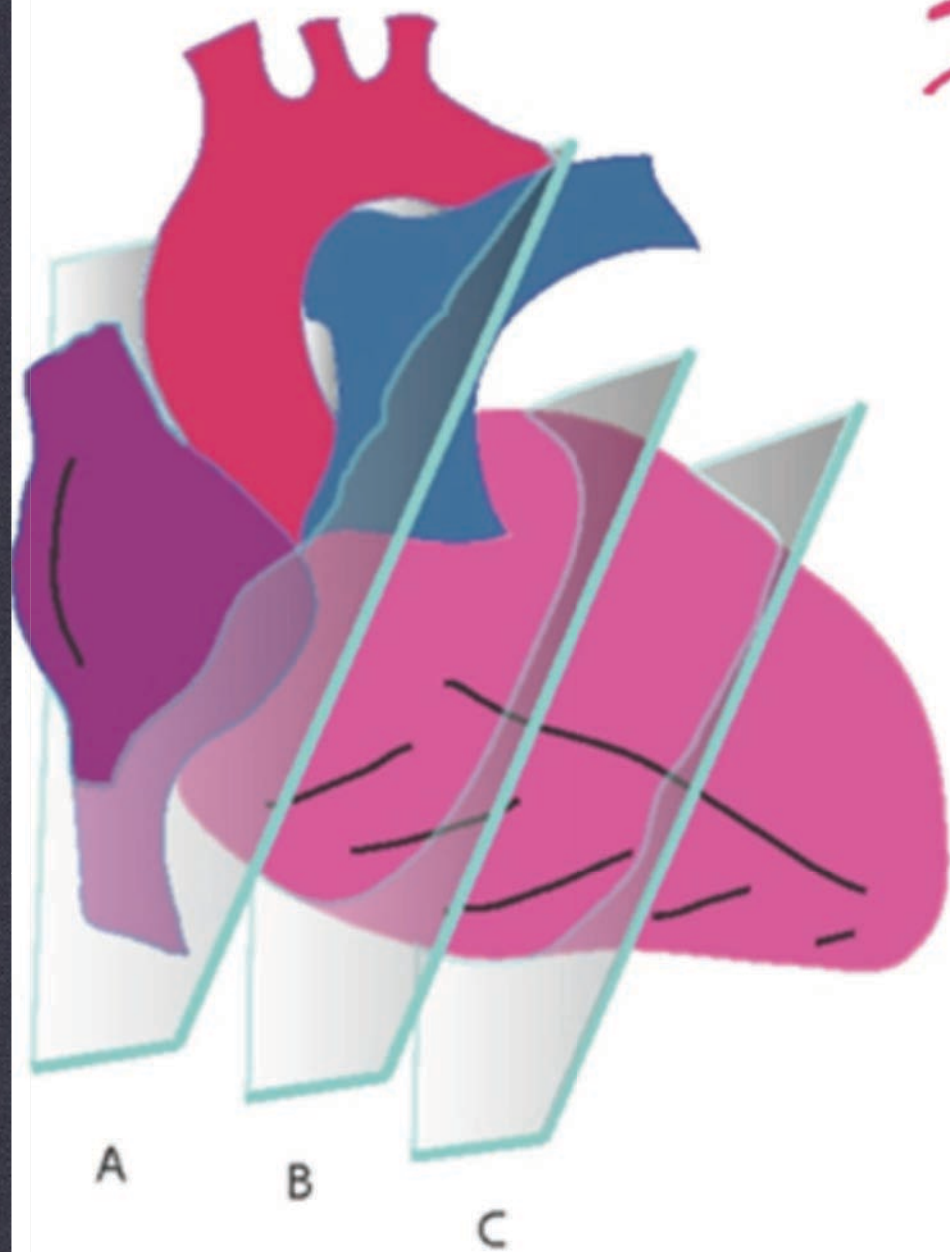


Coronary territories

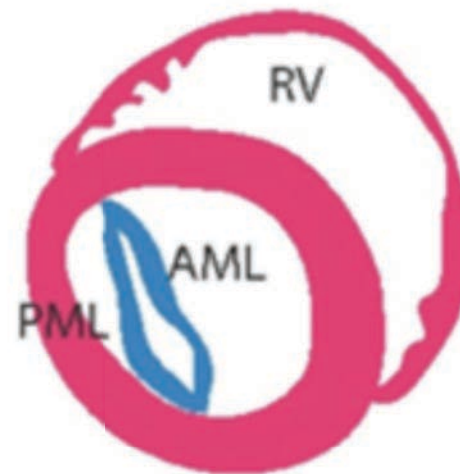
-  Left anterior descending-LAD
-  Left circumflex artery-LCx
-  Posterior descending artery of RCA, and LCx

SHORT AXIS VIEW

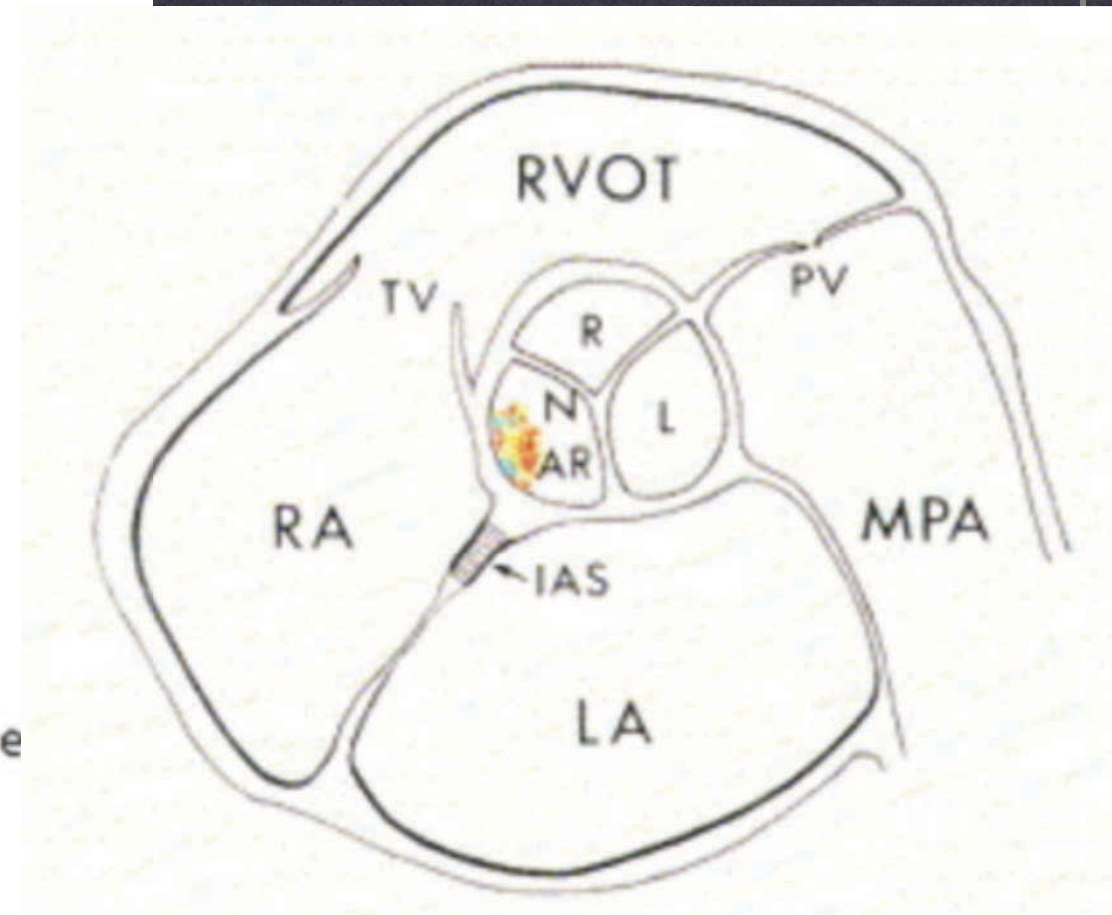
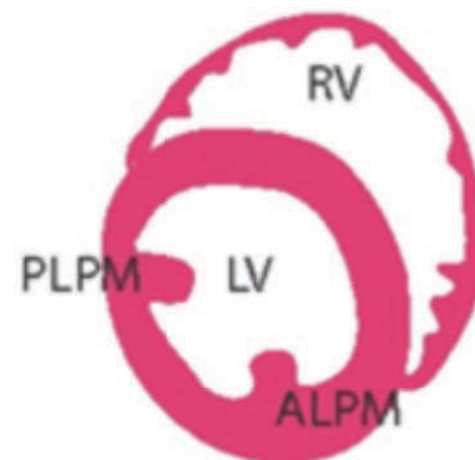




B. Mitral Valve Level



C. Mid-Ventricular Level



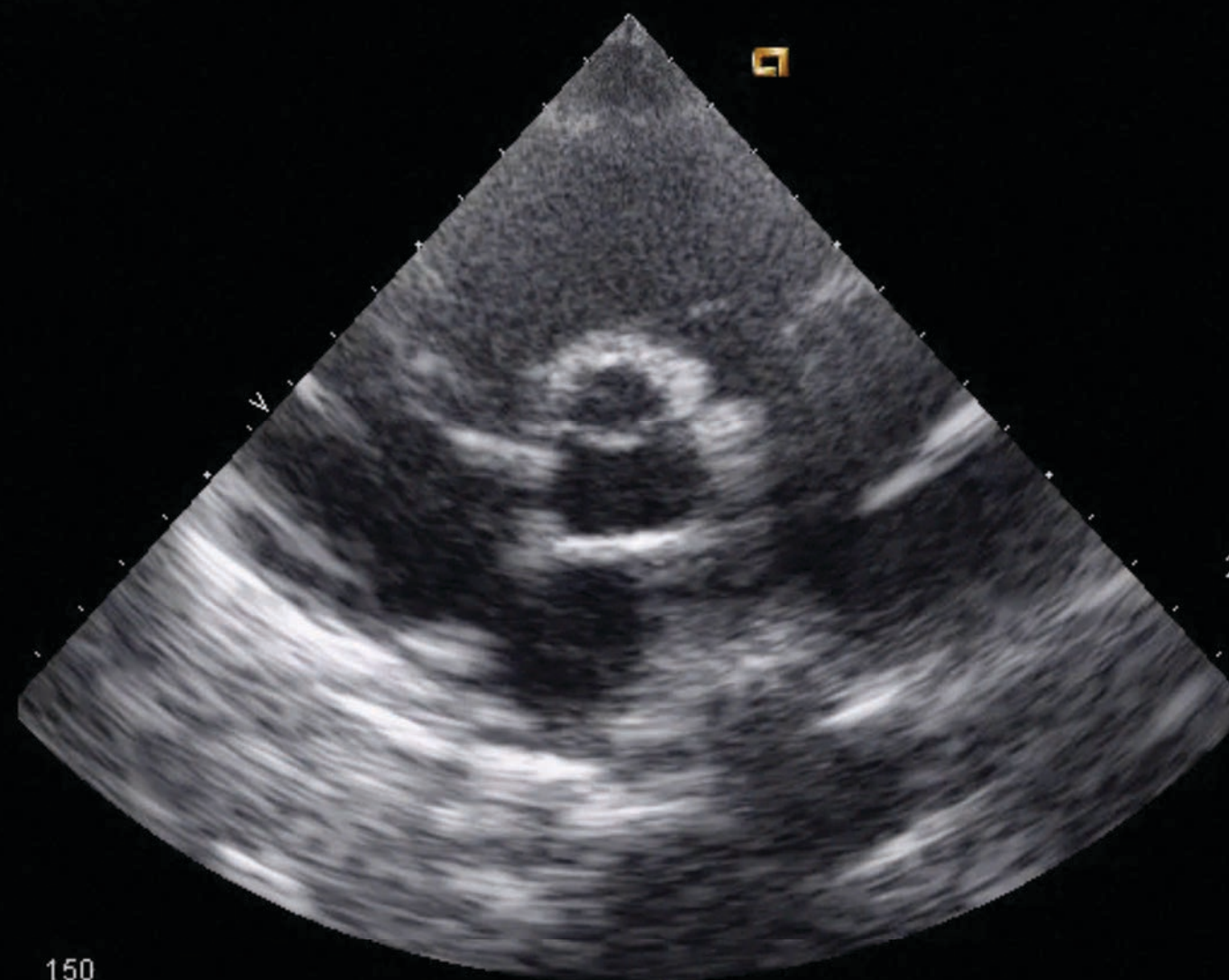
HOPITAL PITIE SALPETRIERE
* 24_08_2013_09_04_16

10:29:45 Su 25/08/2013 **acuson**
CV70

CARDIO

P4-2 3.2T

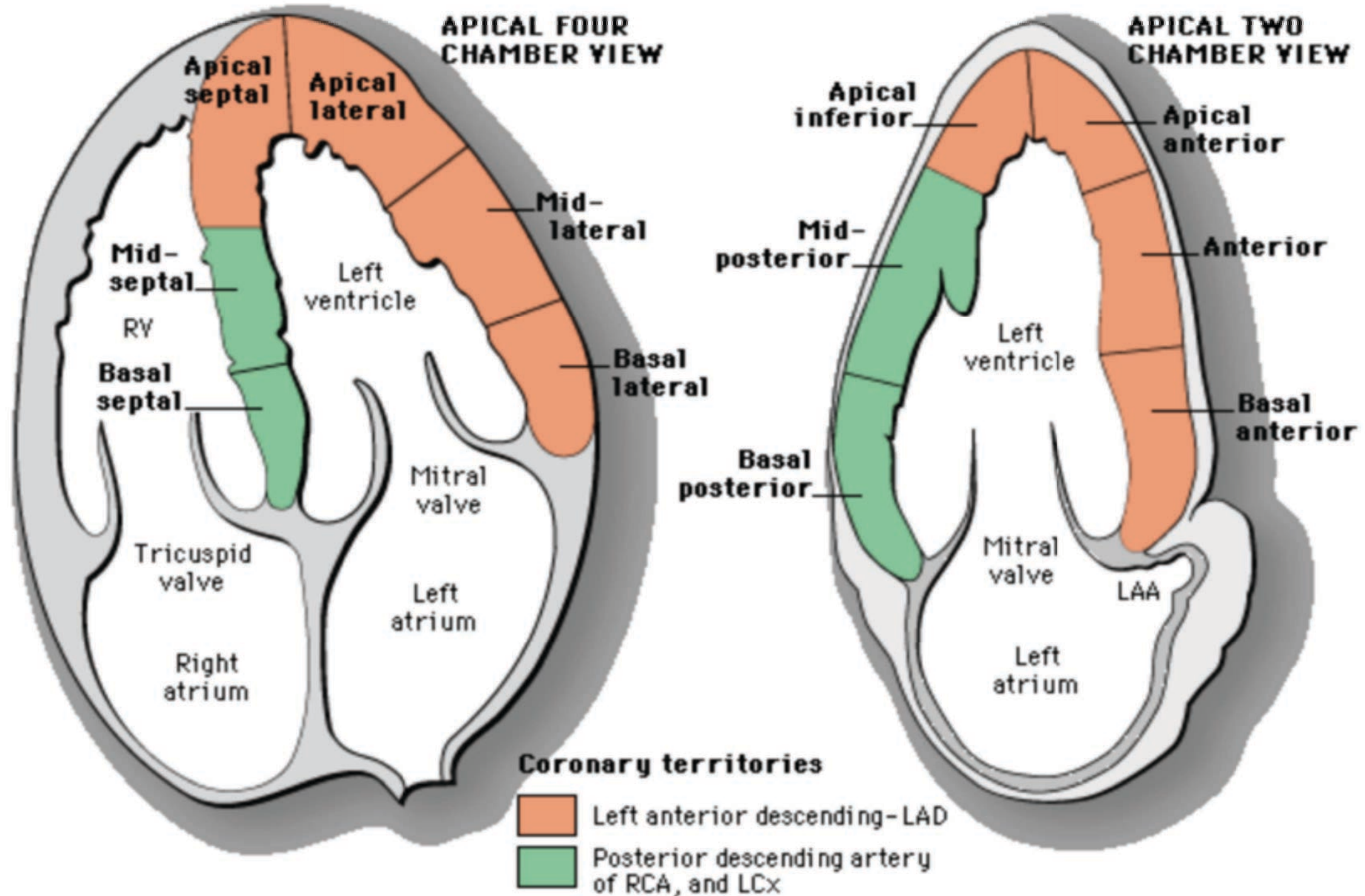
FPS 62s



2D 56/1/30

MI 0.8 TIS 0.3 TIB 0.3 Tx 100%





COUPES APICALES

4-5 ET 2 CAVITÉS

LE COEUR GAUCHE...

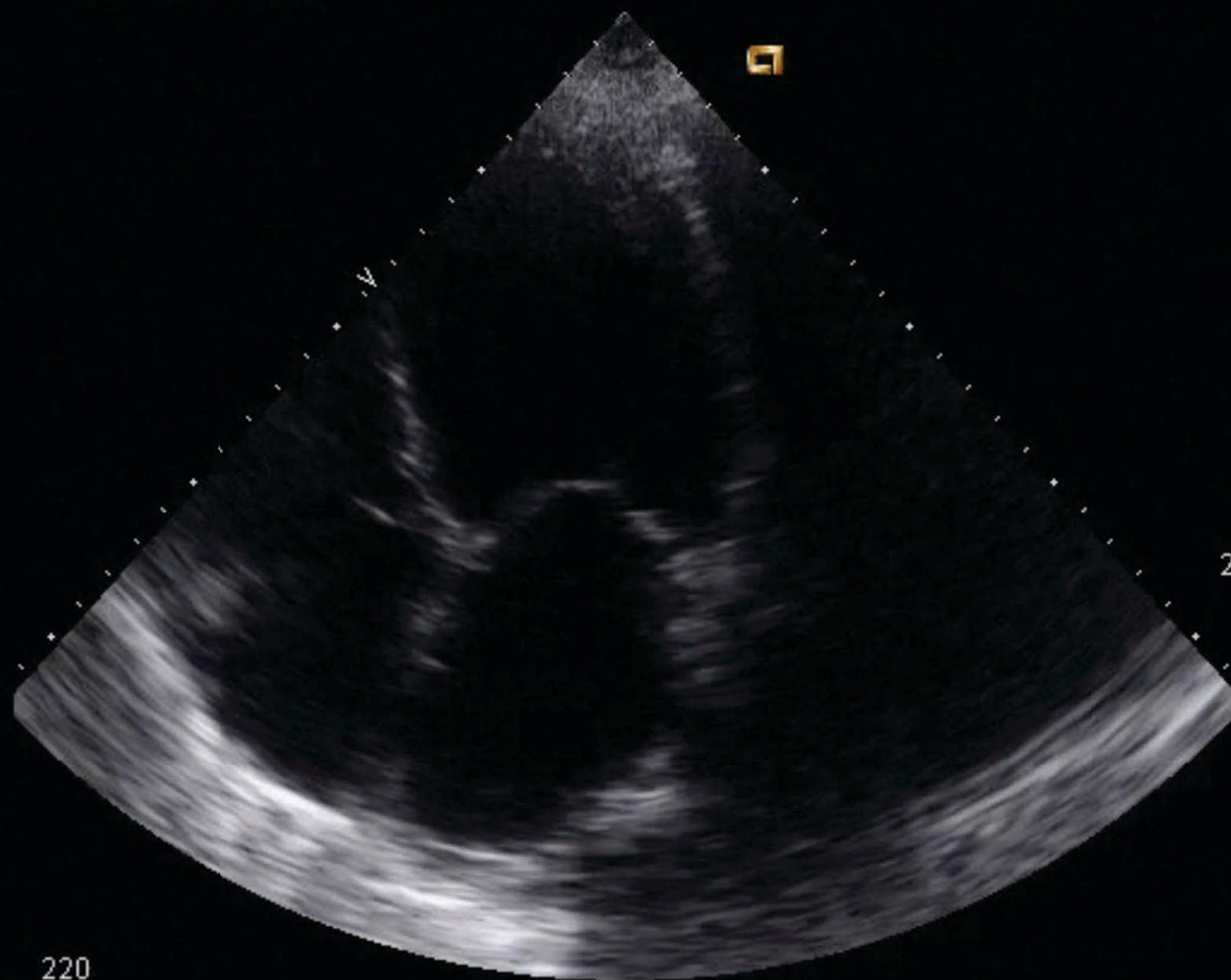
HOPITAL PITIE SALPETRIERE
OUBOUZID 12_08_2013_16_05_02

10:07:22 We 14/08/2013 **acuson**
CV70

CARDIO

P42 3.2T

FPS 45s



2D 56/1/30

MI 0.9 TIS 0.3 TIB 0.3 Tx 100%



* 24_08_20

Cinétique globale
(FeVG-Simpson) et
segmentaire

CARDIO

P42 3.2T

FPS 62s

Cinétique
SIV?

IT (DC)

Doppler Mitral

Doppler Mitral
Tissulaire à l'anneau

SOG-SOD

150

FOP?

VPulm

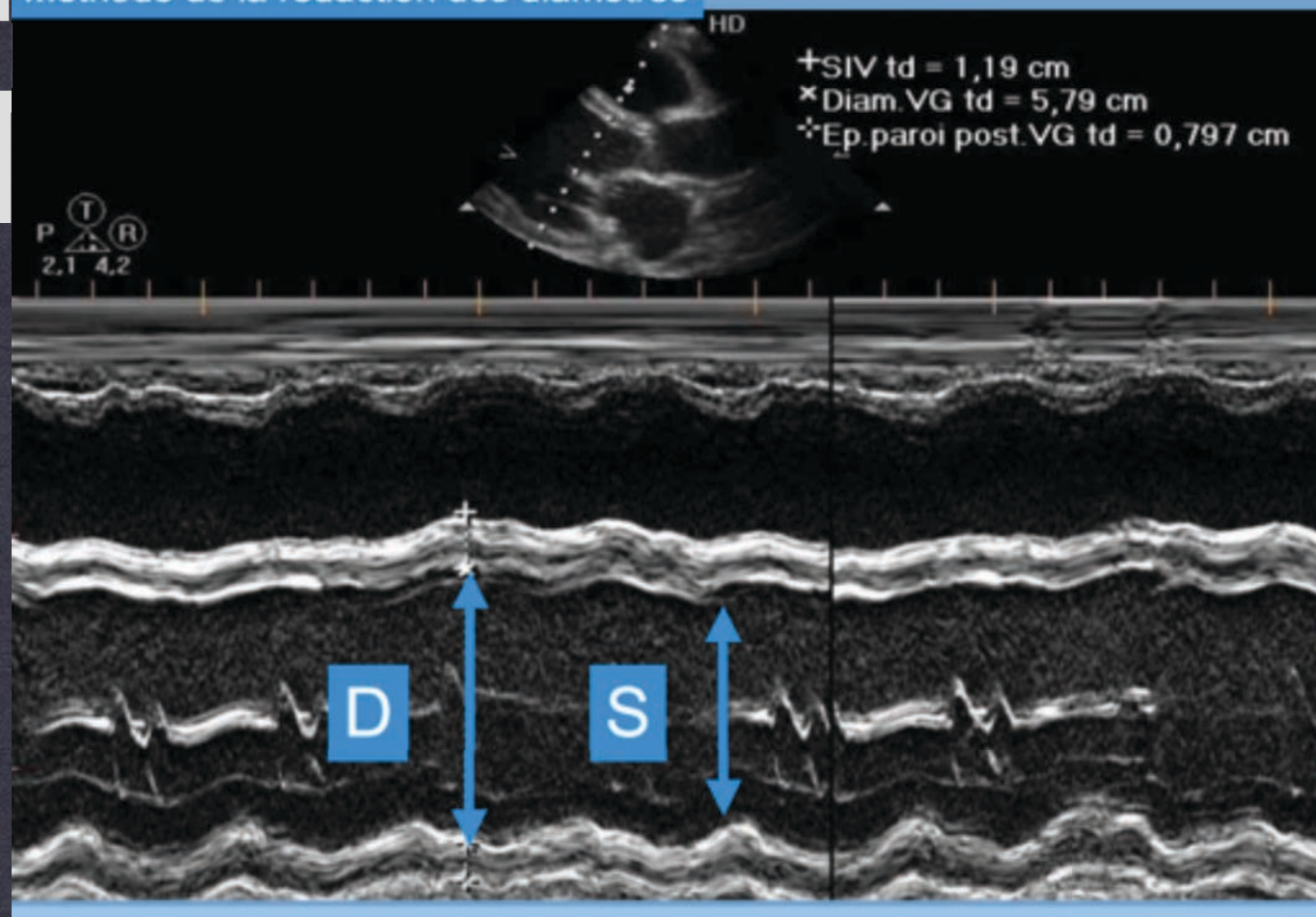


EVALUER LA FONCTION

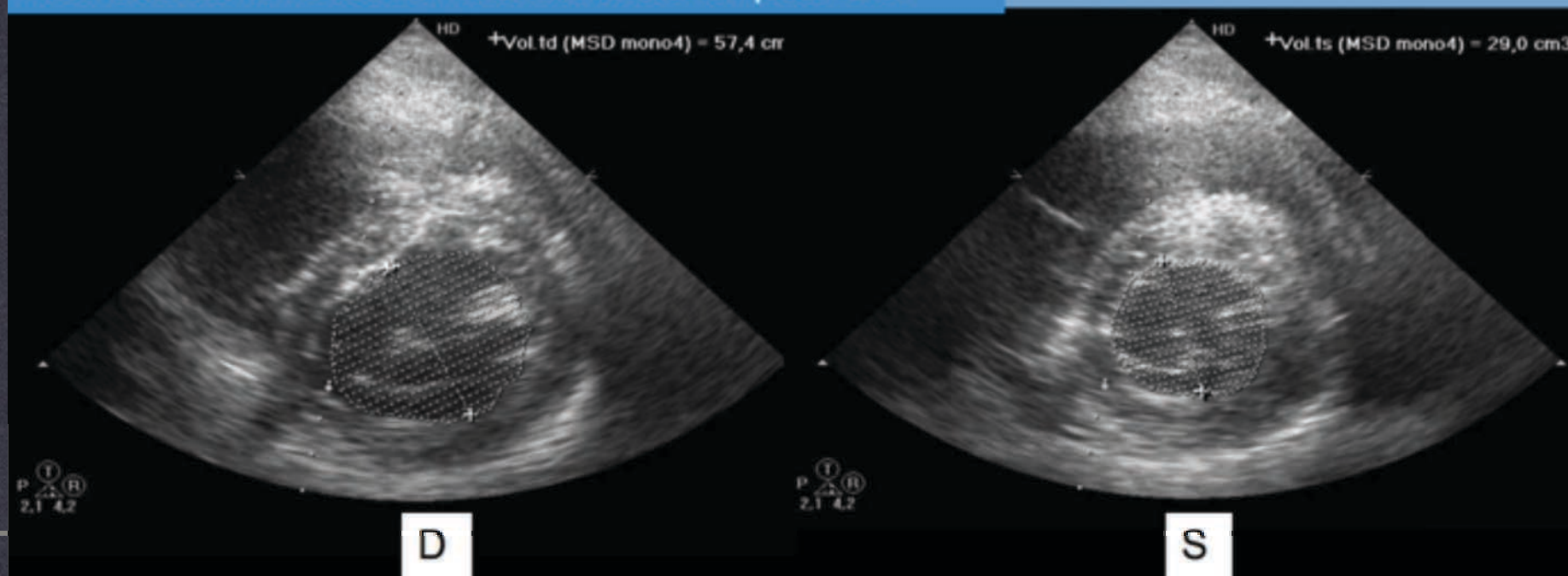
CONT

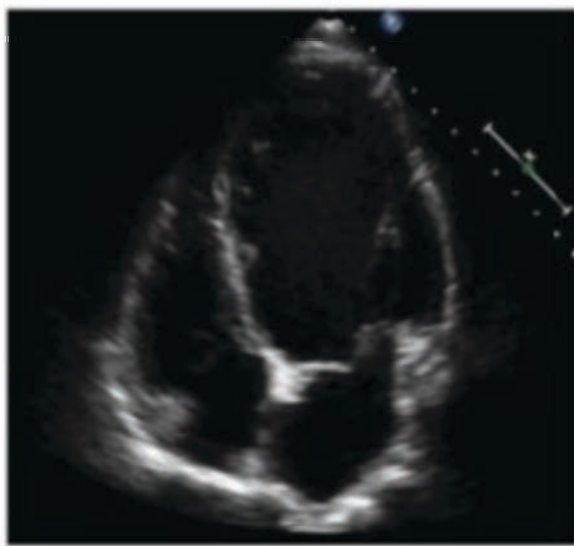
DELS)

Méthode de la réduction des diamètres

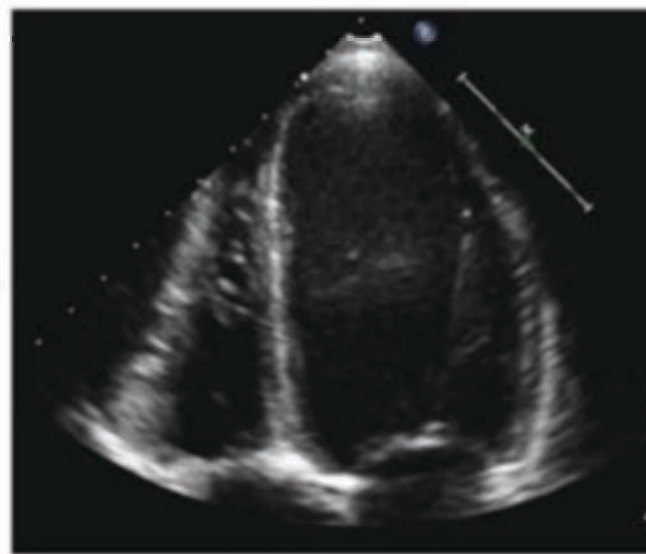


Méthode de la réduction des surfaces en petit axe

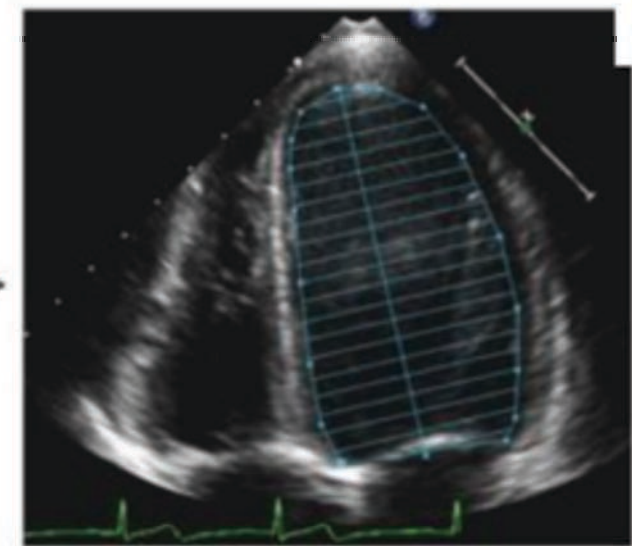




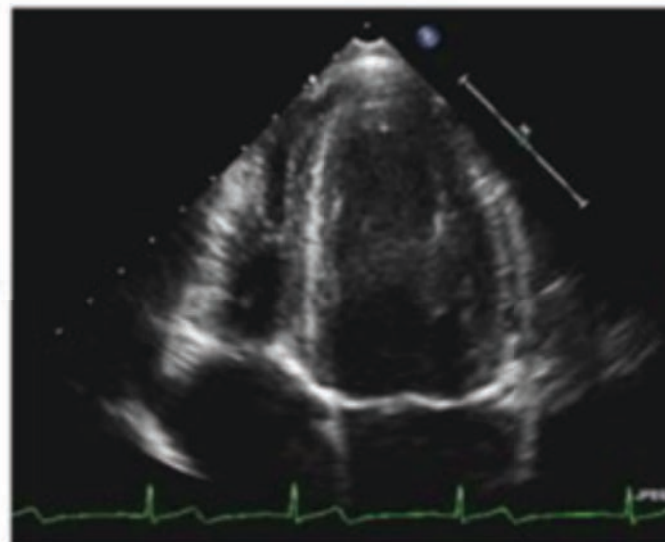
1. Get a good Apical 4 chamber view



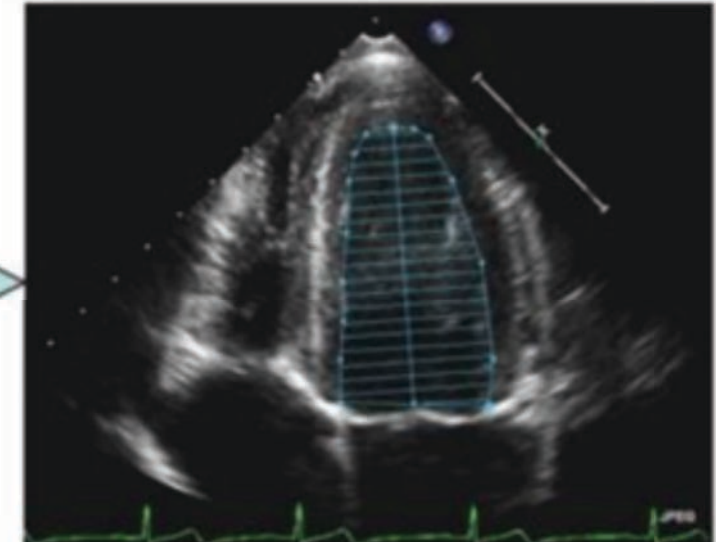
2. Zoom on the LV



3. Trace the LV diastolic endocardial border



4. Roll the trackball to systole in the same cardiac cycle



5. Trace the LV systolic endocardial border

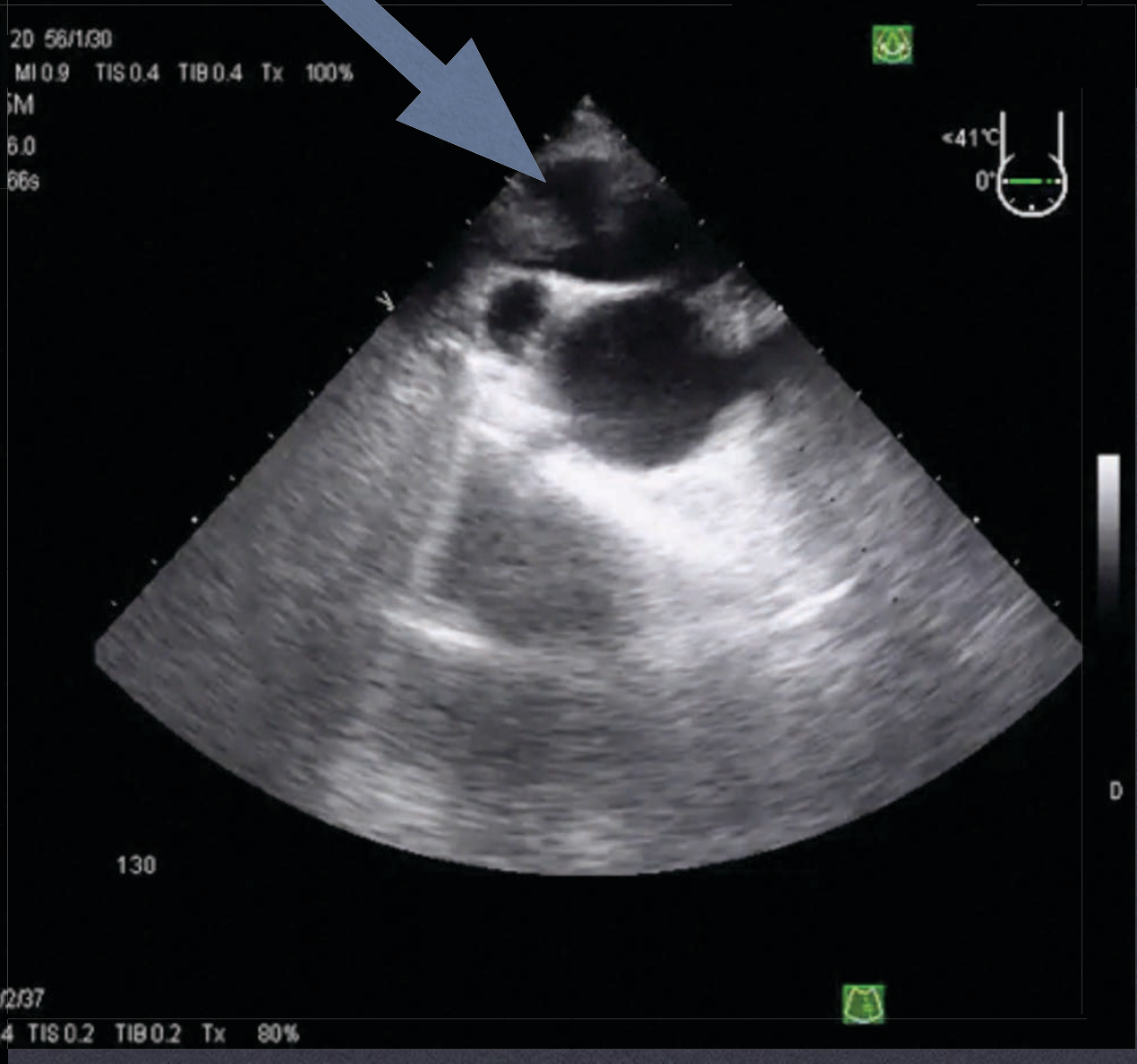
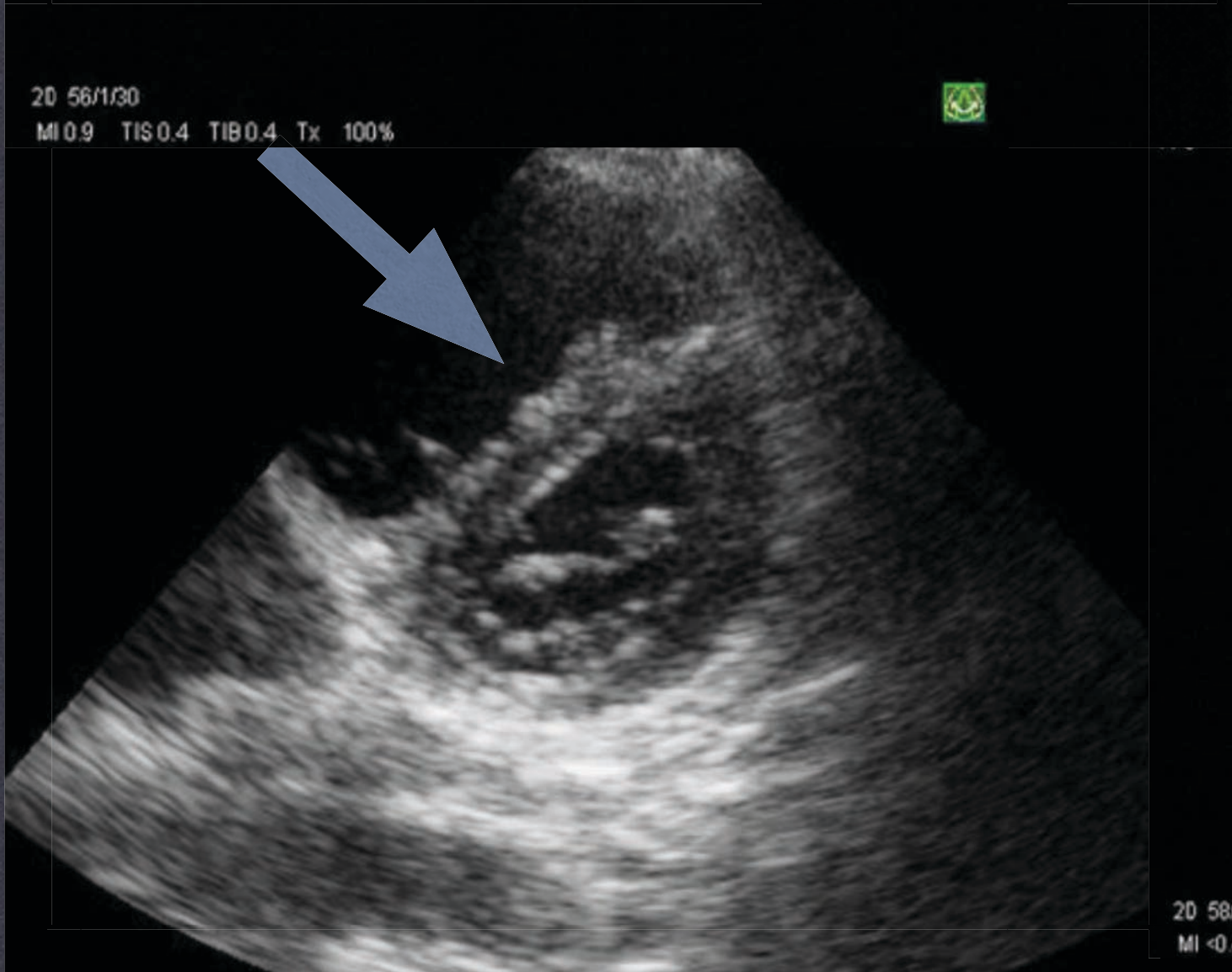
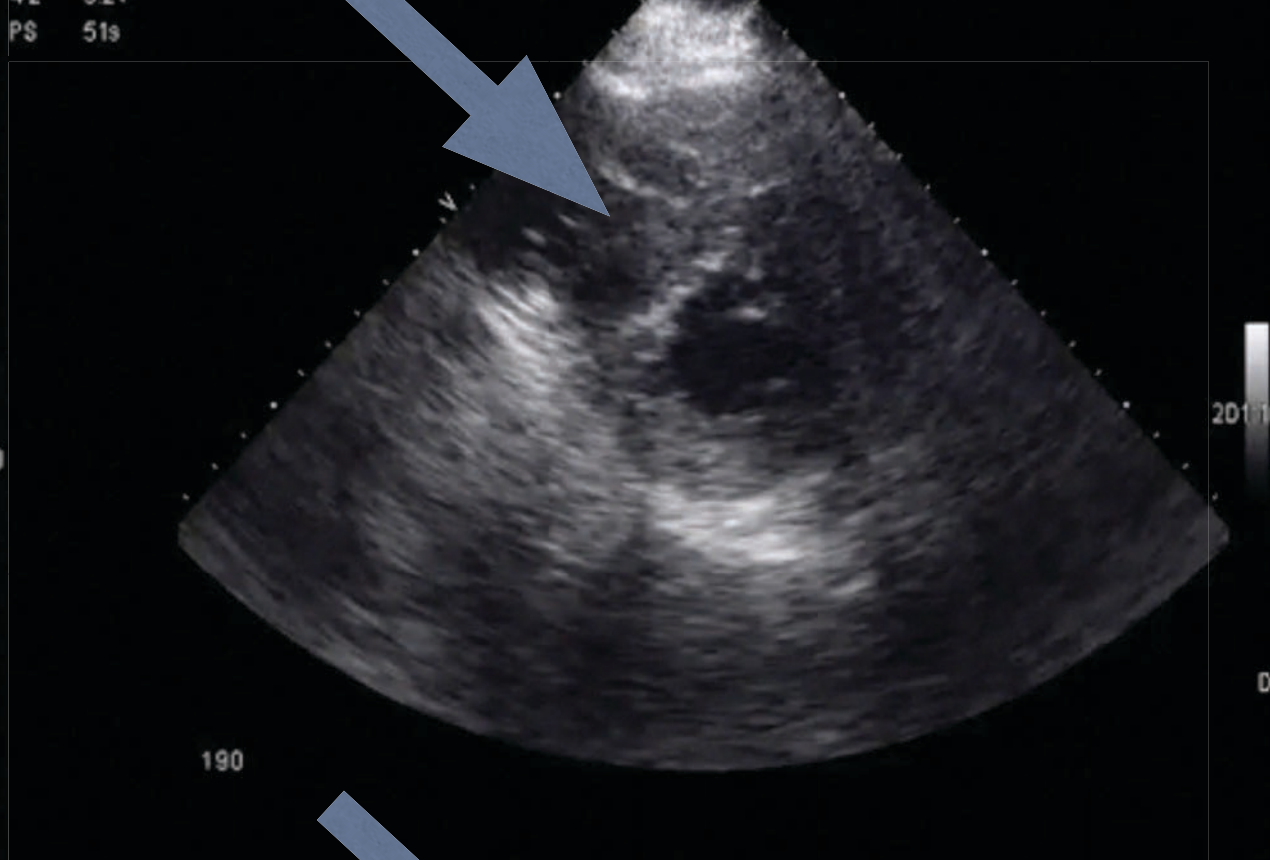
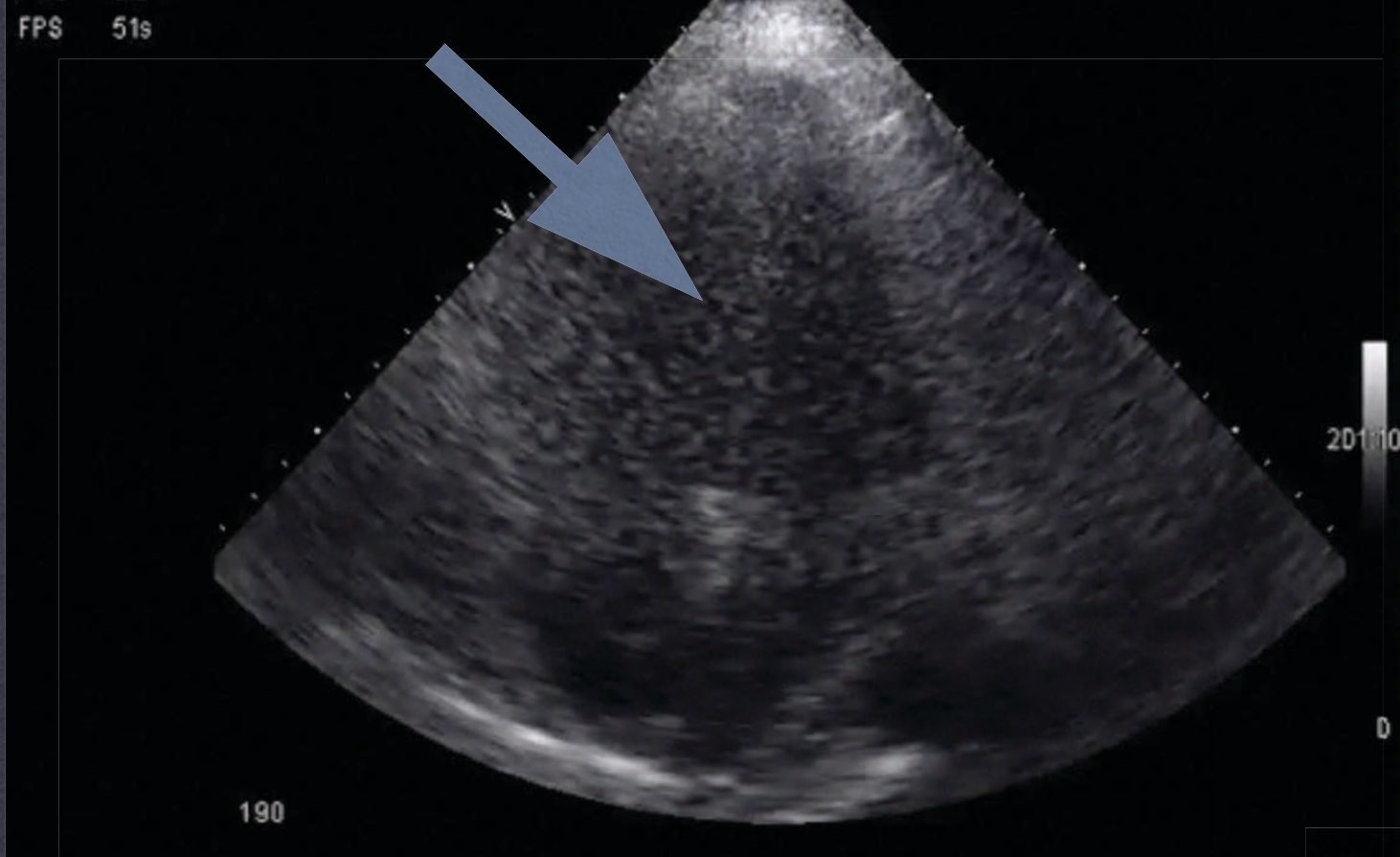
FEVG SIMPSON IDEALEMENT BIPLAN 4 ET 2 CAVITES

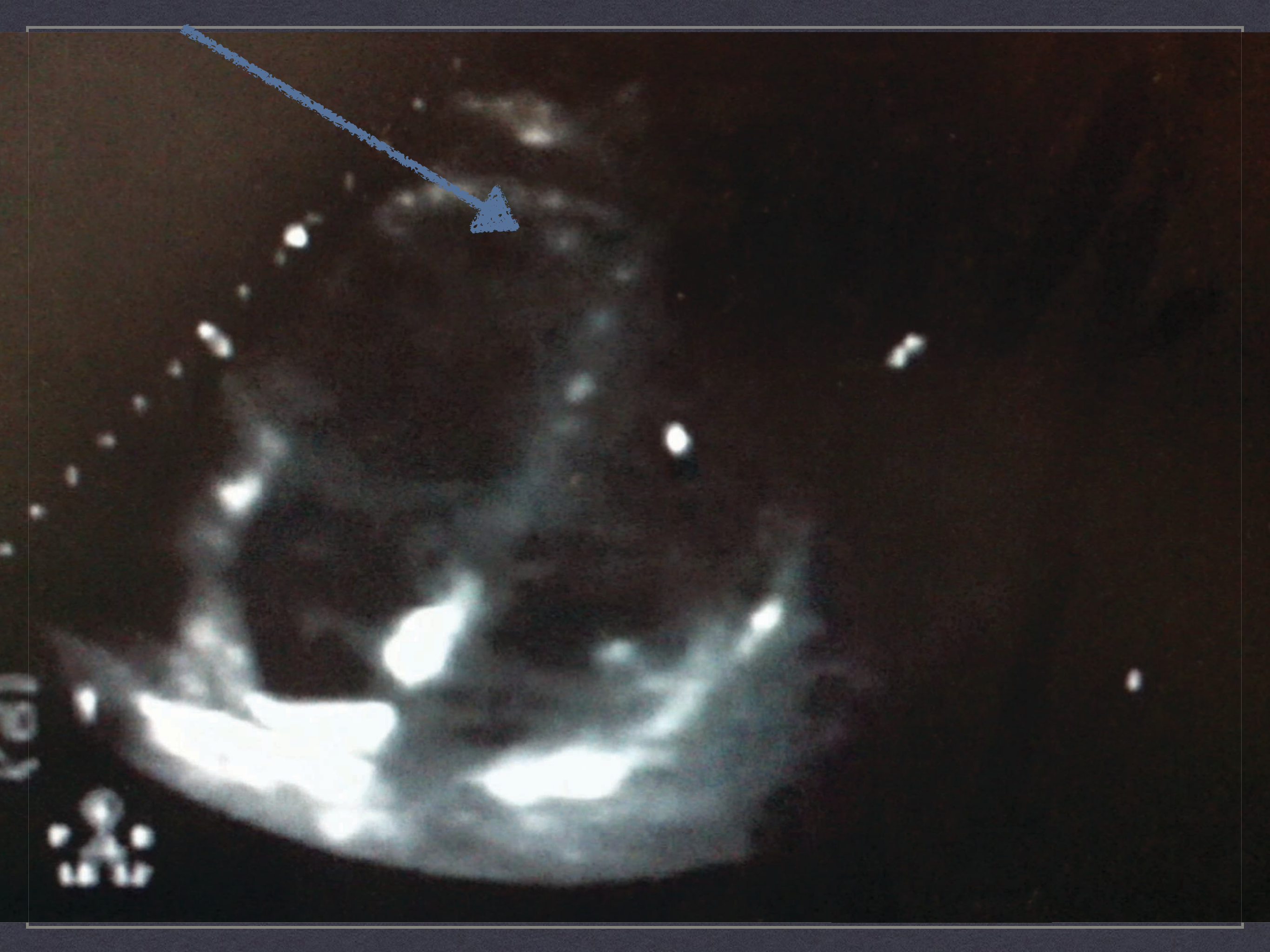
LE COEUR DROIT...

CAVITES DROITES

Signes échocardiographiques: IVD

- * HTAP
- * **Dilatation cavités droites** : de l'OD, du VD et de l'AP, raccourcissement du Tacc
- * Hypokinésie VD, surtout de la paroi libre, et respectant la pointe (à l'inverse de l'HTAP chronique)= signe de Mc CONNEL
- * **Anomalies de la cinétique septale**: septum aplati voire paradoxal, bombement du septum dans le VG en systole, majoré en inspiration en ventilation spontanée, en expiration en ventilation mécanique
- * Augmentation du diamètre de la VCi, perte de la modulation respiratoire, S/D des VSH < 1
- * +/- thrombus intra-cavitaire OD ou VD , ou thrombus proximal de l'AP (ETO ++)

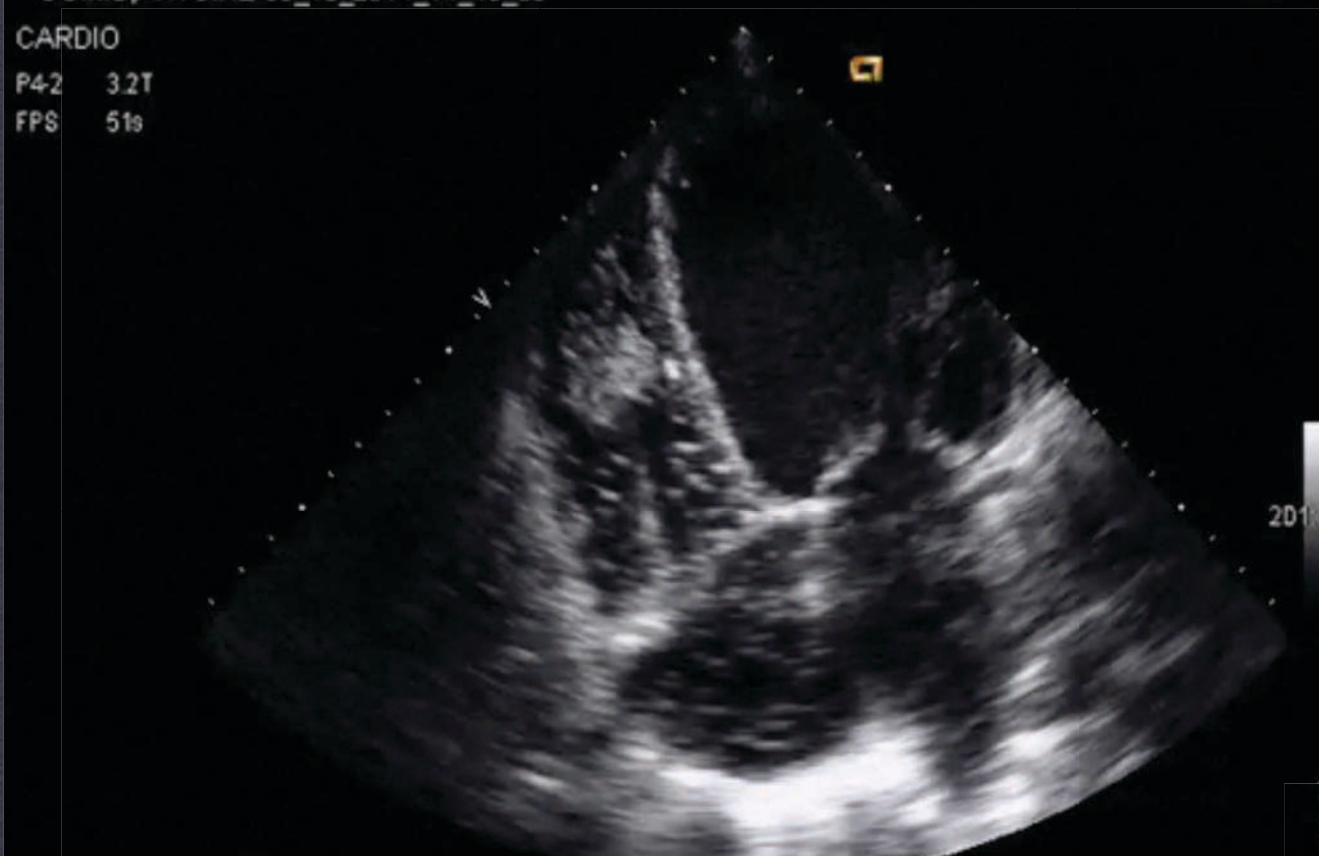




CARDIO

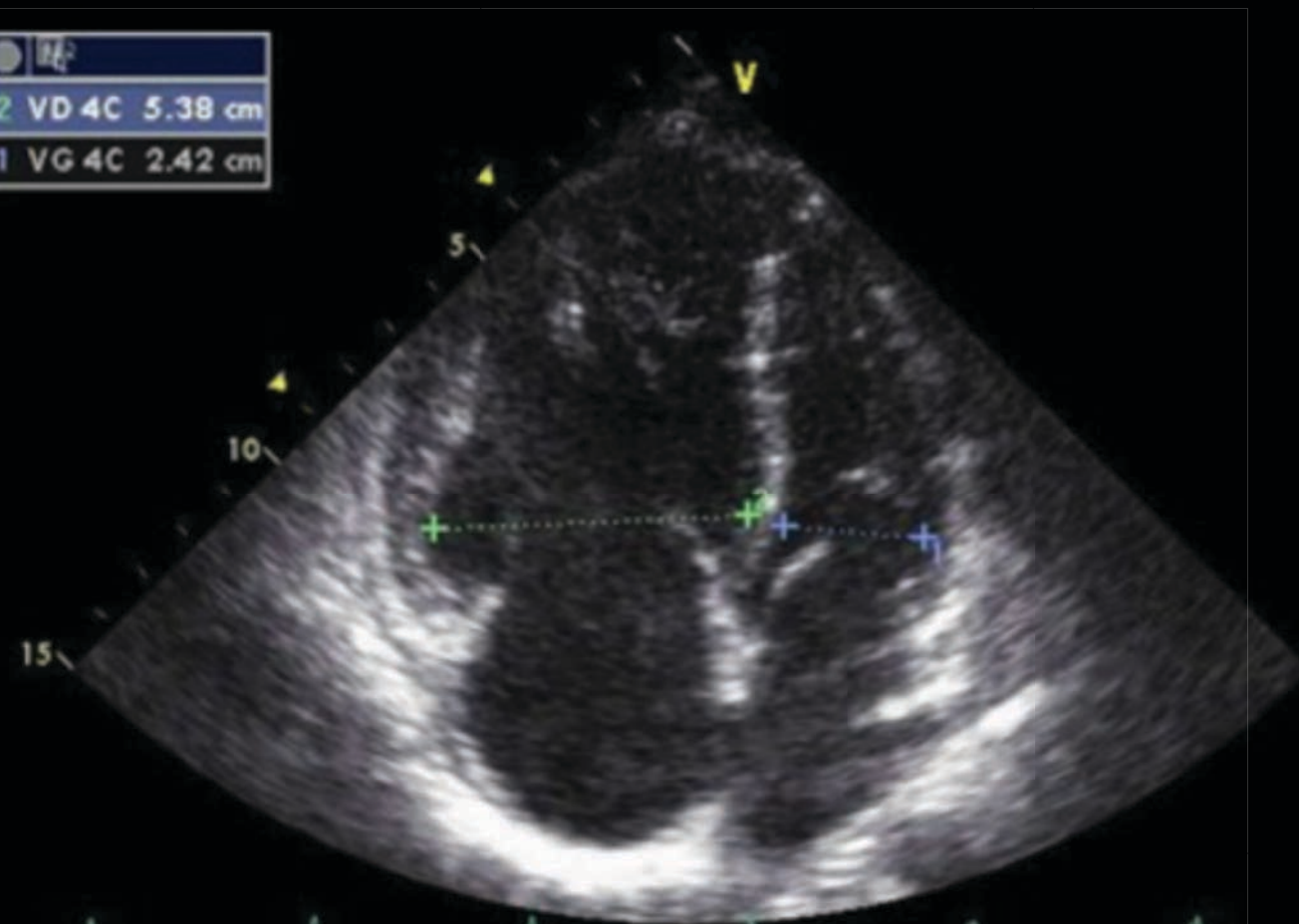
P42 3.2T

FPS 51s



74
2 VD 4C 5.38 cm
1 VG 4C 2.42 cm

75
HR



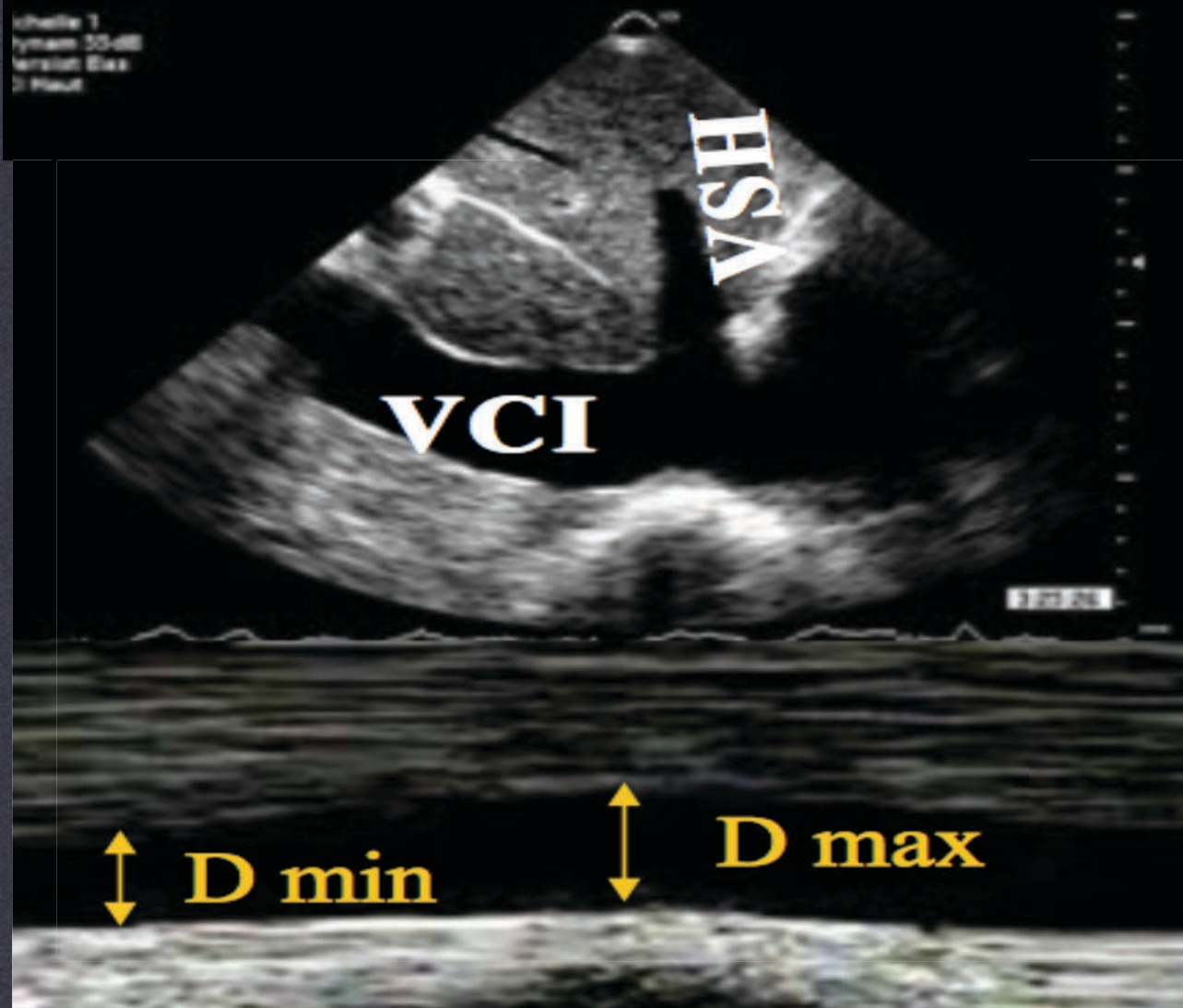
chelle 1
tympan 33-48
sensibil 80s
haut

C/

P4

FPS

41s



20110

0

20 56/1/27

MI 0.9 TIS 0.4 TIB 0.4 Tx 100%



S = aspiration du sang
par le mouvement
antérieur de l'anneau lors
de la contraction
ventriculaire

D = remplissage passif du
VD

Ar diastolique = reflux de
sang lors de la
contraction atriale.

> Valeurs normales:

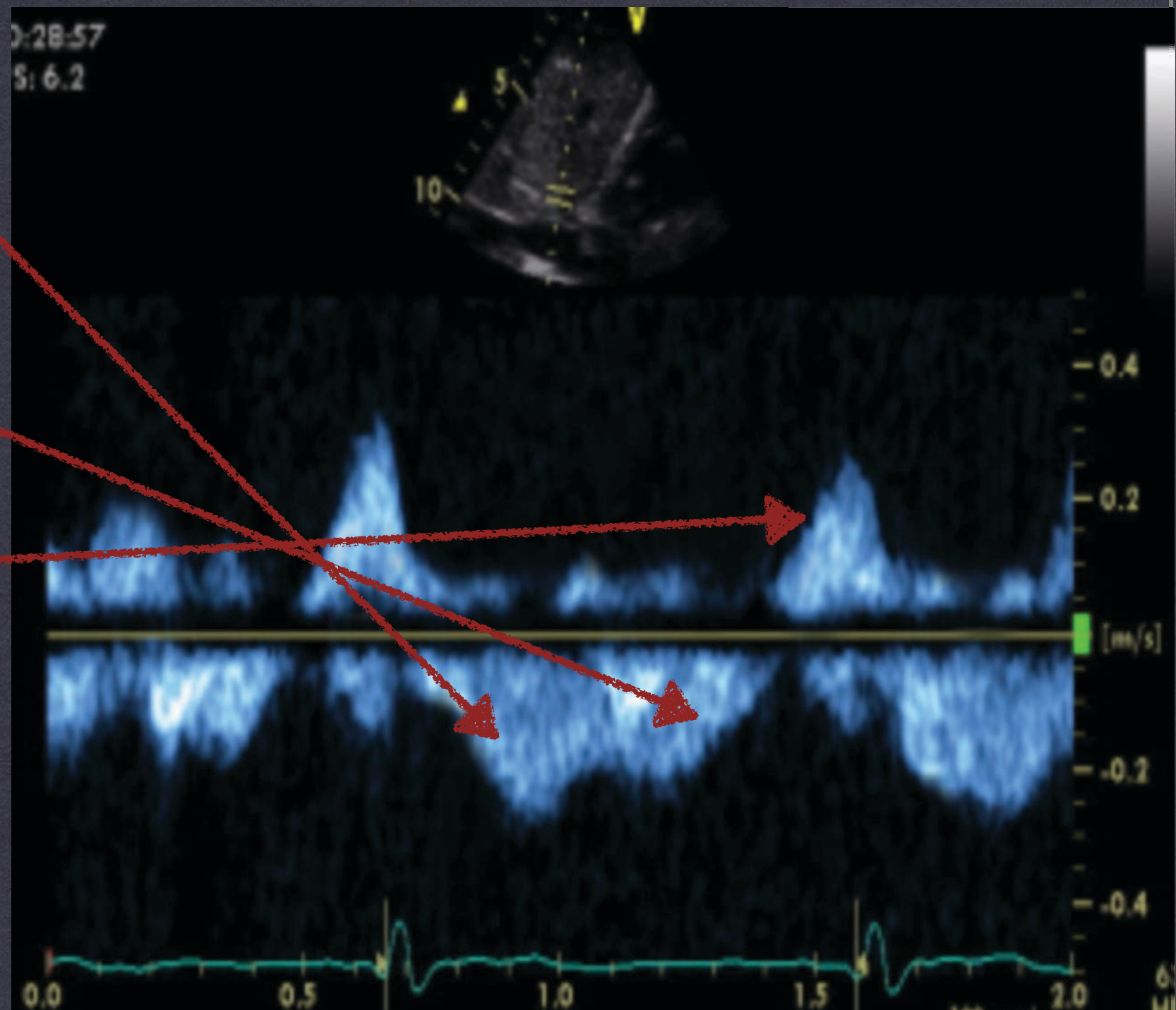
$S/D > 1$

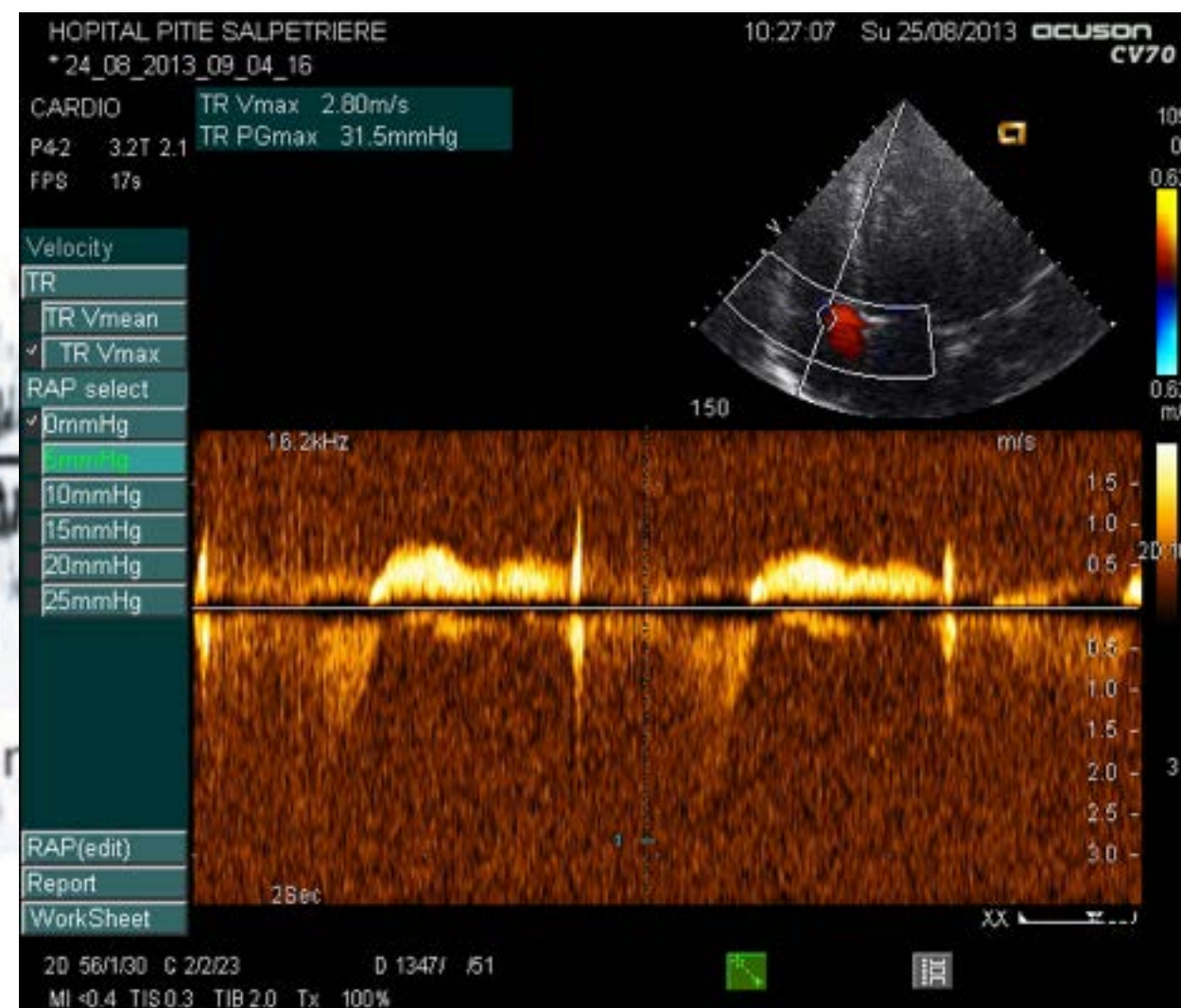
> Fraction Systolique FS
 $= \text{ITVs} / (\text{ITVs} + \text{ITVd})$

Dysfonction VD:

$\text{FS} < 55\% = \text{POD} > 8$
mmHg

$S < D$

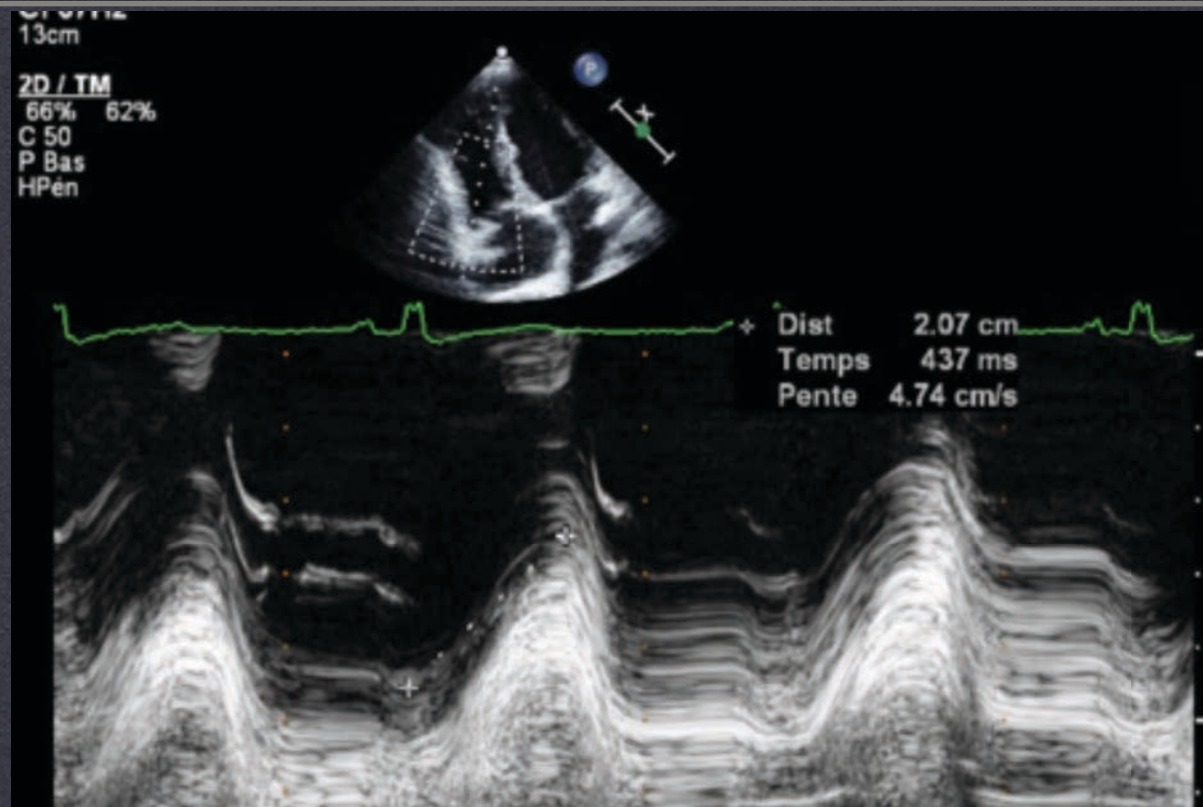




Syst PAP = Right ventricular systolic pressure
(in absence of pulmonary outflow obstruction)

$$RVSP = 4v^2 + RAP^*$$

*ESC guidelines. *Eur Heart J* 2004.

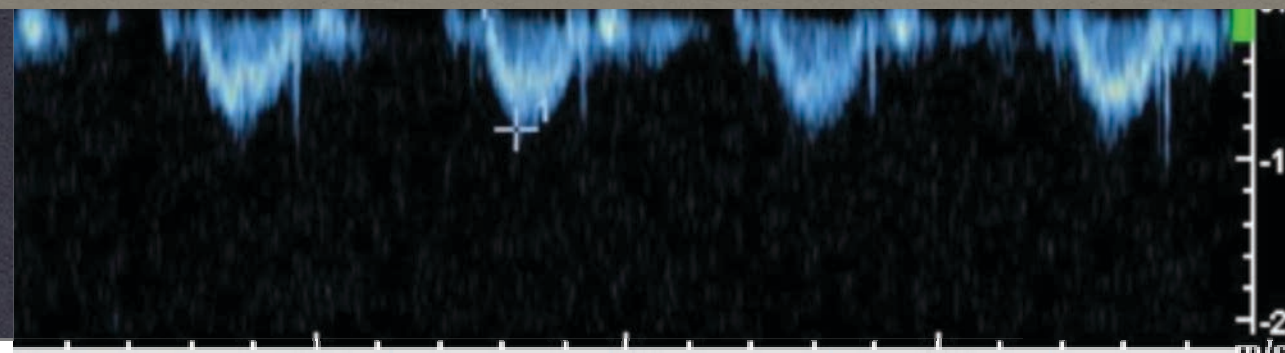


- * TAPSE (*tricuspid annular plane systolic excursion*) : déplacement longitudinal de la partie latérale de l'anneau tricuspideen (normal : 15-25 mm) en mode TM
- * Vélocité systolique (S) de l'anneau tricuspideen au Doppler tissulaire - est possible d'avoir un bon alignement avec l'anneau tricuspideen pour mesurer sa vélocité de déplacement systolique longitudinal au Doppler tissulaire $V_{max} < 12 \text{ cm/s}$

TACC EN ETT?



CPA = $\text{STDVD/VG} > 60\%$
+ PAPs > 60 mmHg
+ Tacc < 60 ms



Tacc (Msec)	60	80	90	100	110
PAPs (mmHg)	52	43	38,5	34	29,5



INDEX FCT DIASTOLIQUE

> DOPPLER MITRAL ET DTI

> V PROPAGATION ONDE MITRALE

Doppler Mitral

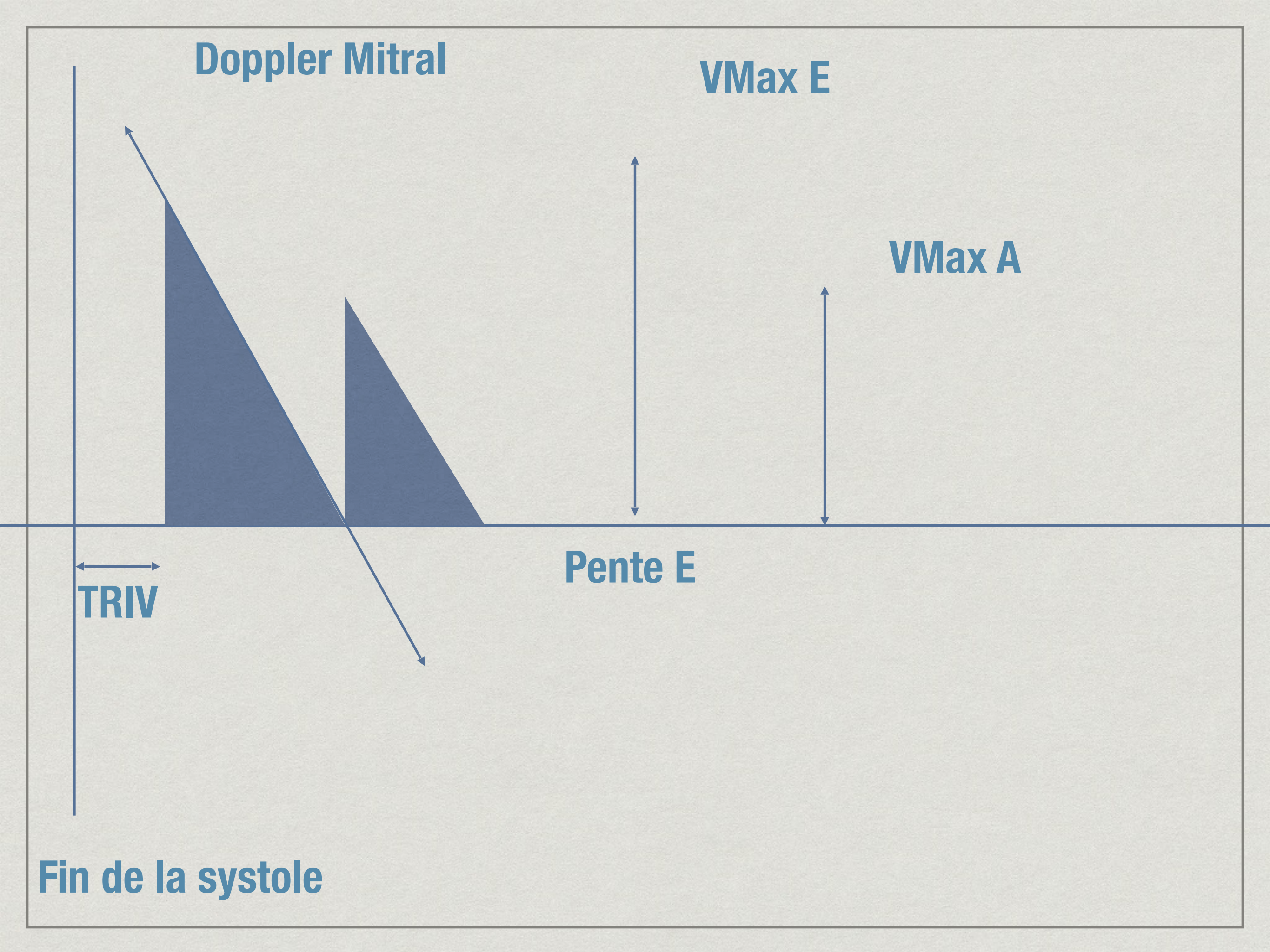
VMax E

VMax A

Pente E

TRIV

Fin de la systole



HOPITAL PITIE SALPETRIERE

* 24_08_2013_09_04_16

10:23:21 Su 25/08/2013 **acuson**
CV70

CARDIO
P42 3.2T 2.1
FPS 62s

MV E pt 1.04m/s
MV A pt 0.55m/s
Dec Time 216ms
Dec Slope 4.77m/s²
MV PHT 64ms
E/A 1.88
A/E 0.53
MVA(PHT) 3.44cm²
E/Ea(l) 6.51

Velocity

Mitral Valve

✓ MV E pt

✓ PHT

✓ MV A pt

A Dur

MV VTI

LVOT VTI

LVOT diam

MVA(Trace)

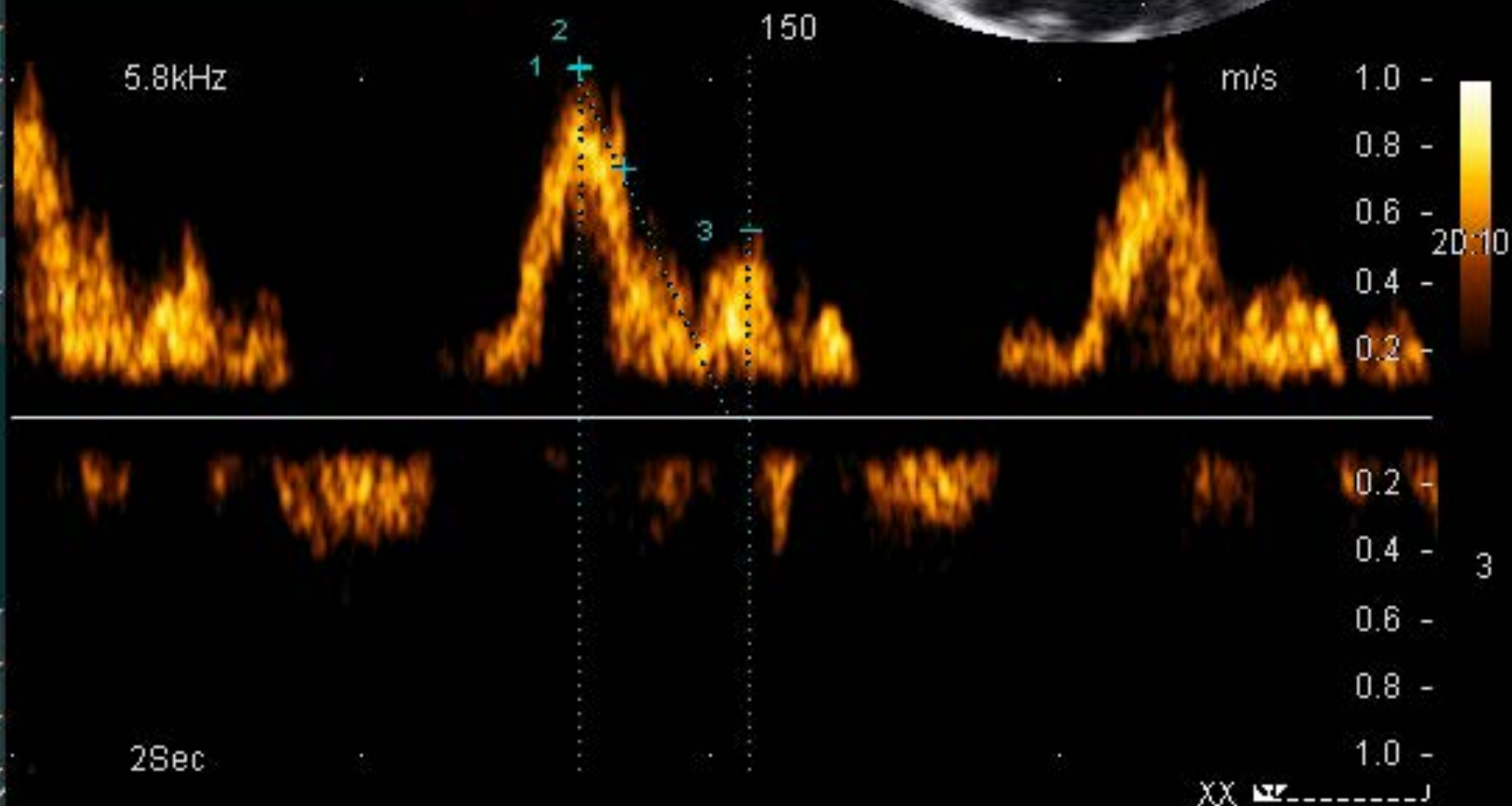
MVA(Trace)

HR(edit)

Report

WorkSheet

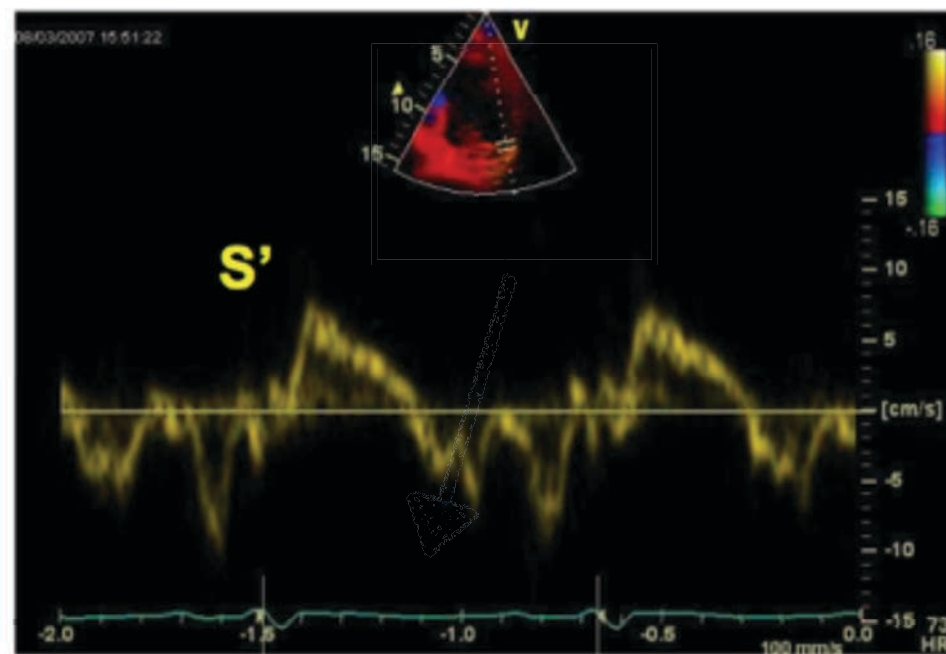
1/2



2D 56/1/30

D 193/ 2.4/39

MI 0.4 TIS 0.6 TIB 3.2 Tx 100%



Septum	9.5±1.4 cm/s
Paroi Antérieure	10.2 ±2.0
Paroi latérale	11.0 ±1.9
Paroi inférieure	10.5 ±1.4
Moyenne	10.3 ±1.4cm/s

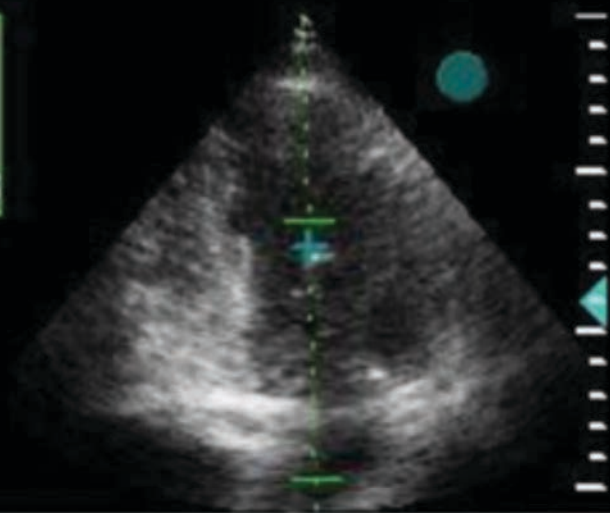
Ea ou
E'

Aa ou
A'

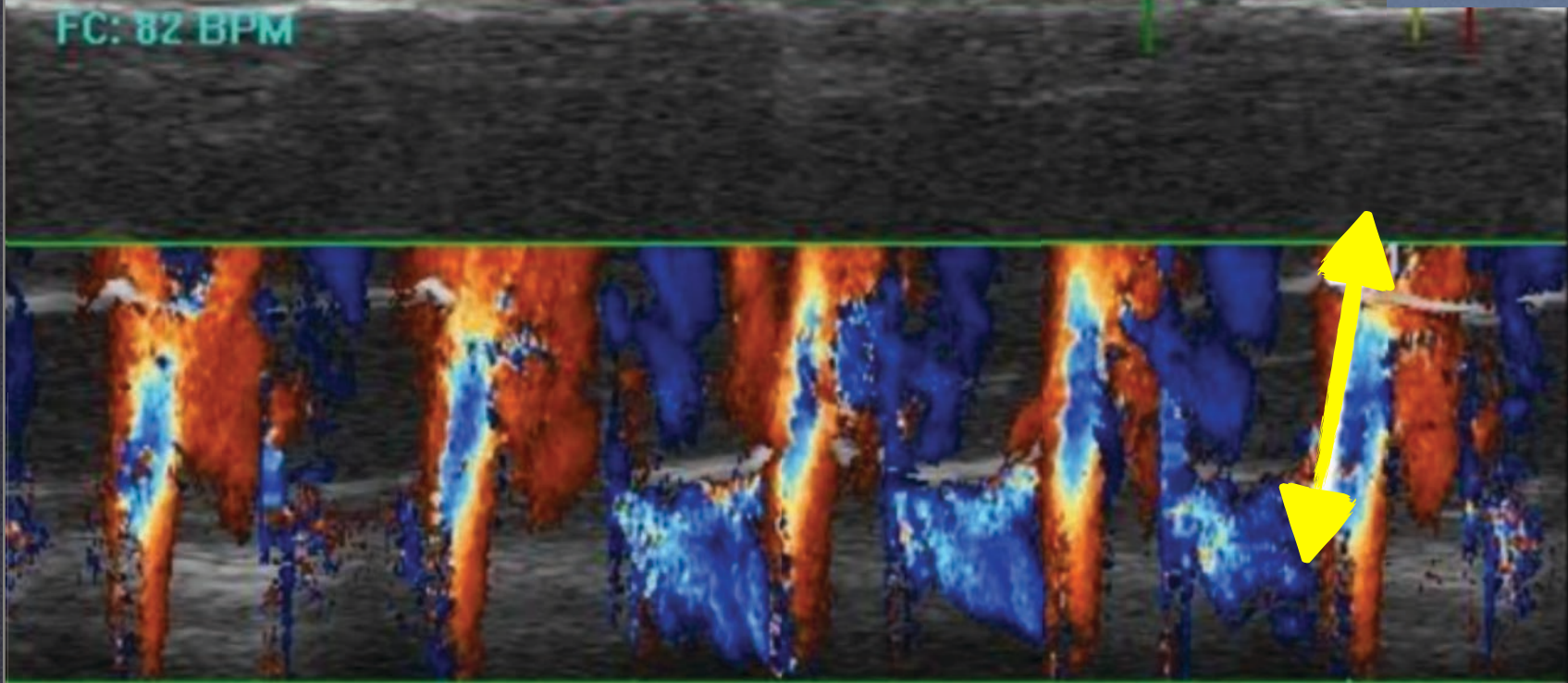
Tighe DA et al. Influence of age on assessment of diastolic function by doppler tissue imaging Am J Cardiol 2003;91(2):254-7

PROPAGATION ONDE MITRALE

1 Profond.= 4.08 cm
Temps = 80 msec
Pente = 51.19 cm/s



FC: 82 BPM



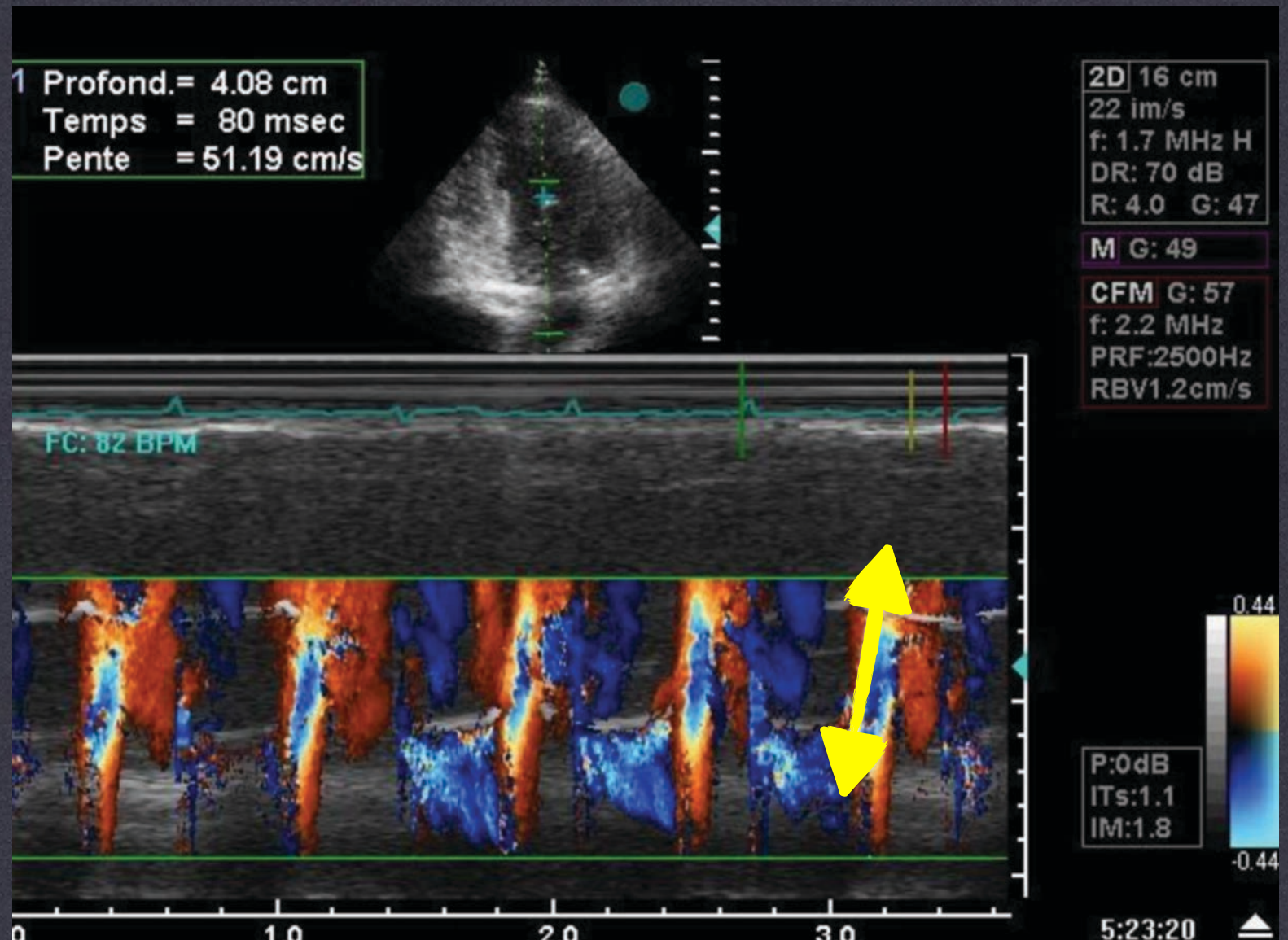
P:0dB
ITs:1.1
IM:1.8

0.44

-0.44

- * DCouleur
- * TM transmitral
- * Régler la limite supérieure du spectre de vitesse couleur à 50-75% du pic de E pour générer un aliasing (en pratique 40-50)
- * Pente du premier > 4 cm du premier

PROPAGATION ONDE MITRALE



Normales: avant 50 ans $> 55\text{cm/s}$; après 50 ans $> 45\text{ cm/s}$
Diminue en cas de troubles de la relaxation / $V_p < 45\text{ cm/s}$
 $E/V_p > 2,5$ signe des pressions de remplissage gauches
hautes

LE PERICARDE

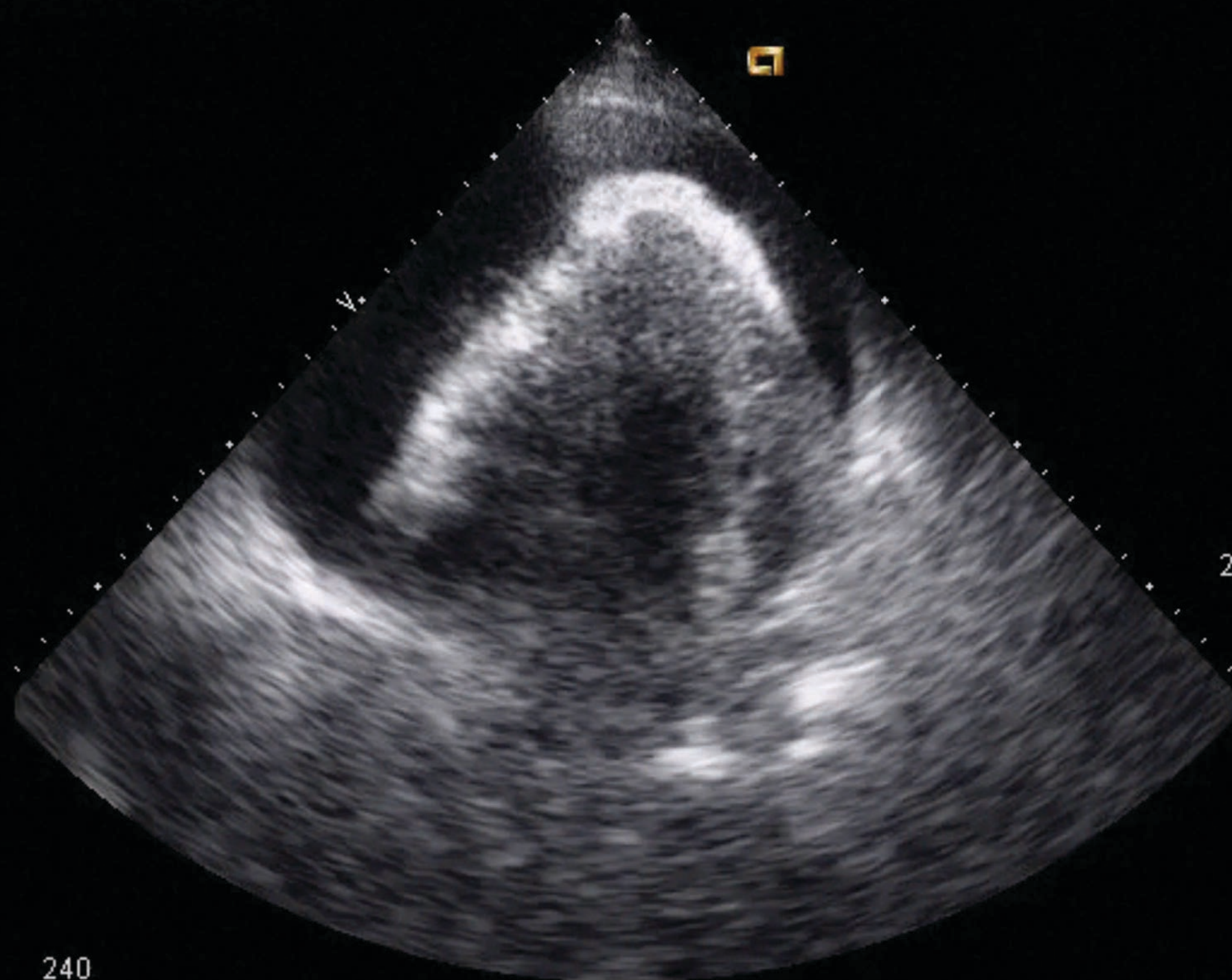
SERVICE DE REANIMATION
ERNST 17_04_2010_10_43_33

11:05:12 Sa 17/04/2010 ACUSON
CV70

CARDIO DIFF

P42 3.0T

IPS 41s



201:10

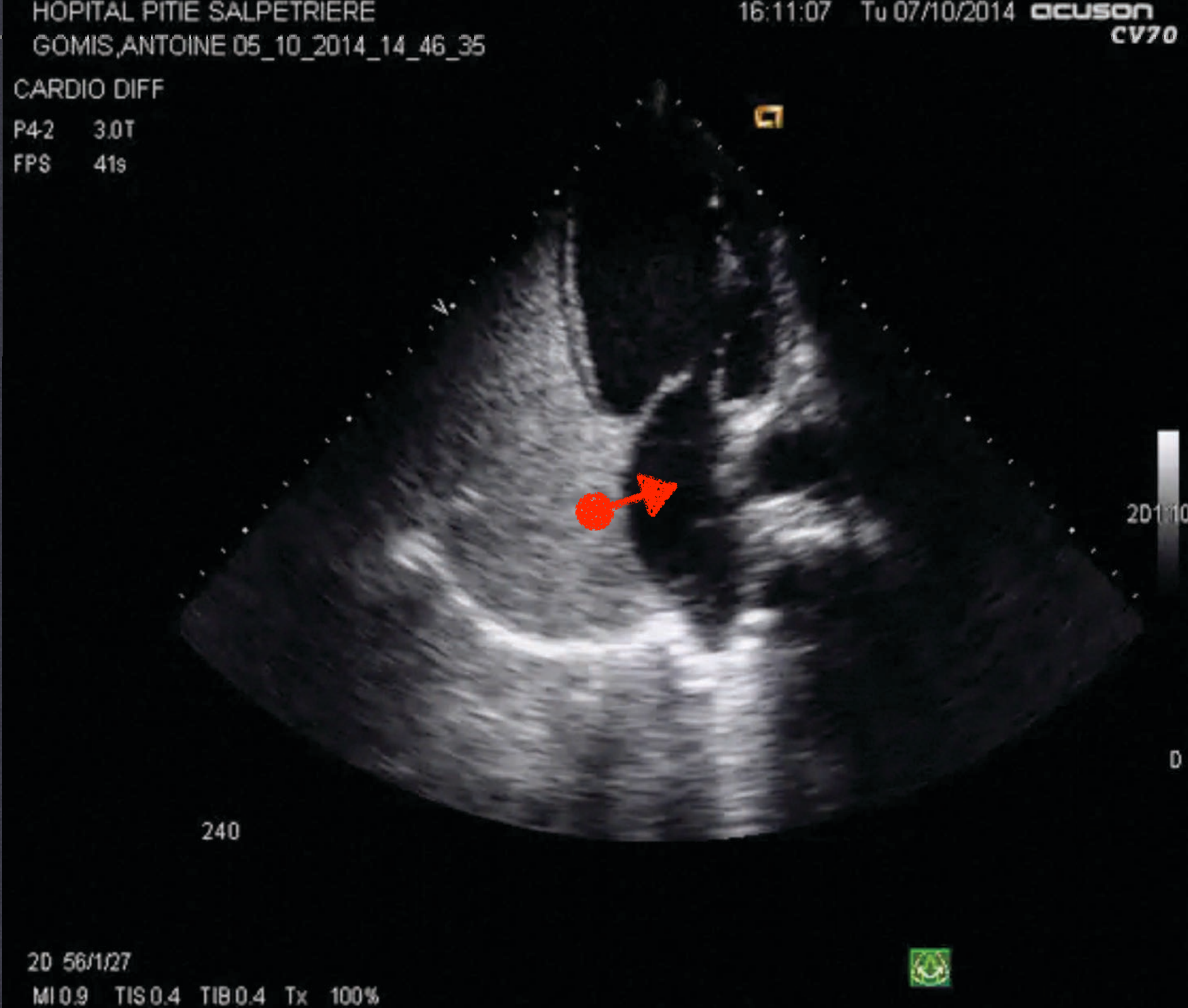
D

240

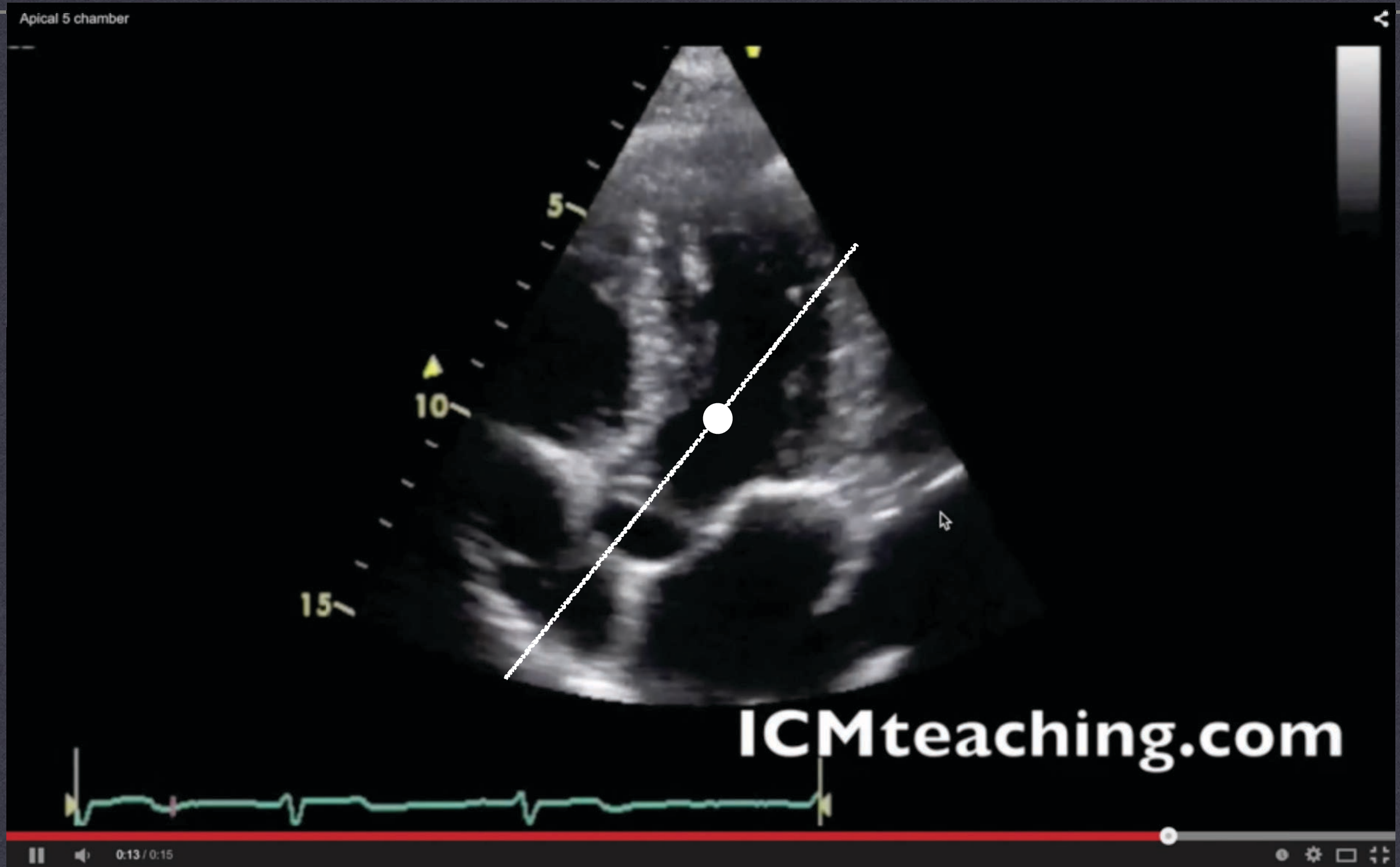
2D 56/1/26



IM 0.9 ITM 0.4 ITO 0.4 Tx 100%



**TEST AUX BULLES FOP +/-
SENSIBILISATION**



5 CAVITES

HOPITAL PITIE SALPETRIERE

* 24_08_2013_09_04_16

10:25:15 Su 25/08/2013 **acuson**
CV70

CARDIO

P42 3.2T 2.1

FPS 62s

LVOT VTI 23.4cm

LVOT Vmax 1.23m/s

LVOT Vmean 0.66m/s

LVOT PGmax 6.0mmHg

LVOT PGmean 1.7mmHg

VTI(Auto)

Aortic Valve

AV VTI

✓ LVOT VTI

LVOT diam

IVRT

AVA(Trace)

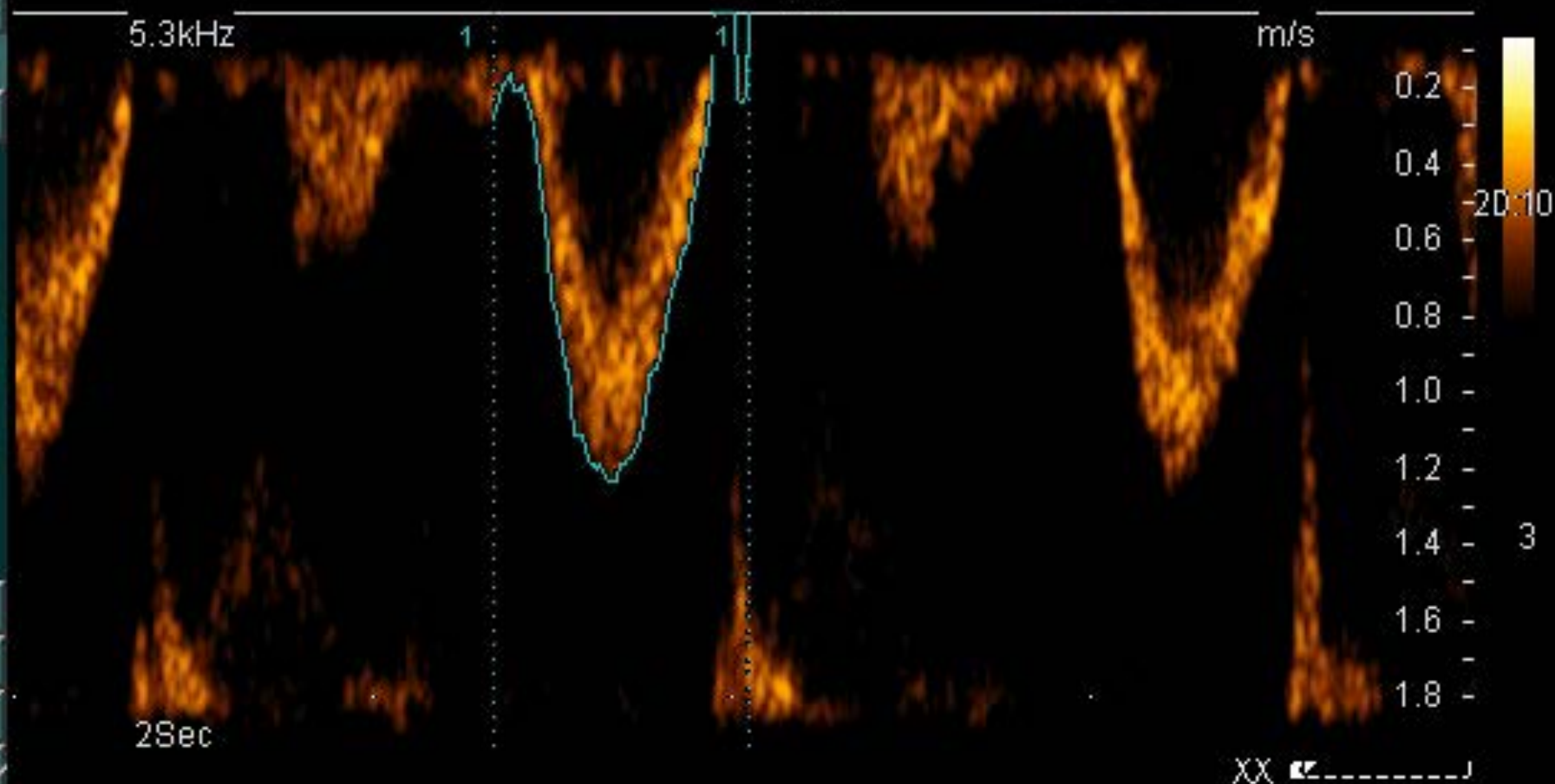
AV Area

HR(edit)

Report

WorkSheet

1/2



2D 56/1/30

D 176/ 2.4/39

MI 0.4 TIS 0.7 TIB 3.0 Tx 100%



$$Fc \times ITV \times Sao \left(\pi D^2/4 \right).$$

COUPE 2 CAVITÉS

PAROI INFÉRIEURE

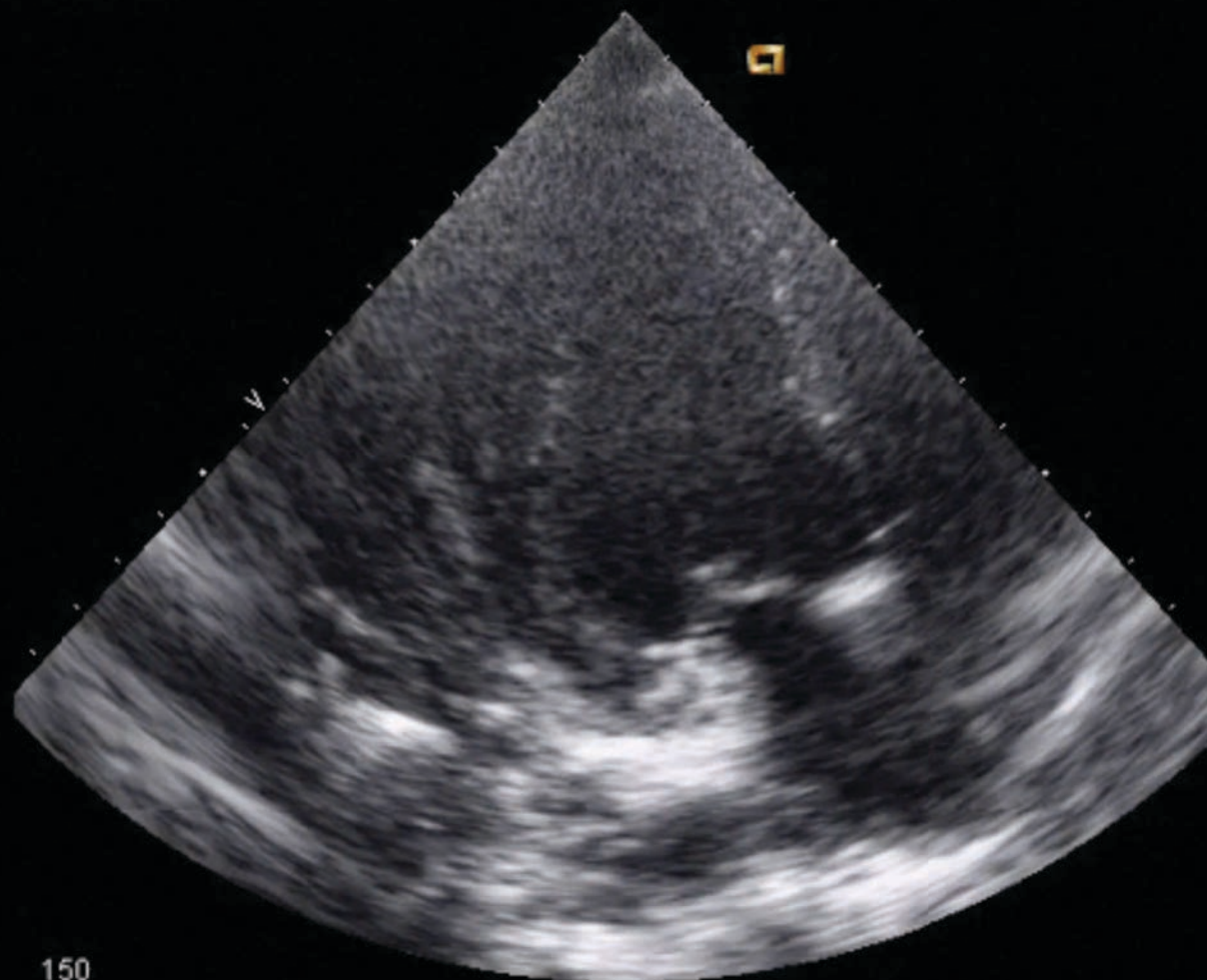
HOPITAL PITIE SALPETRIERE
* 24_08_2013_09_04_16

10:31:08 Su 25/08/2013 ACUSON

CARDIO

P42 3.2T

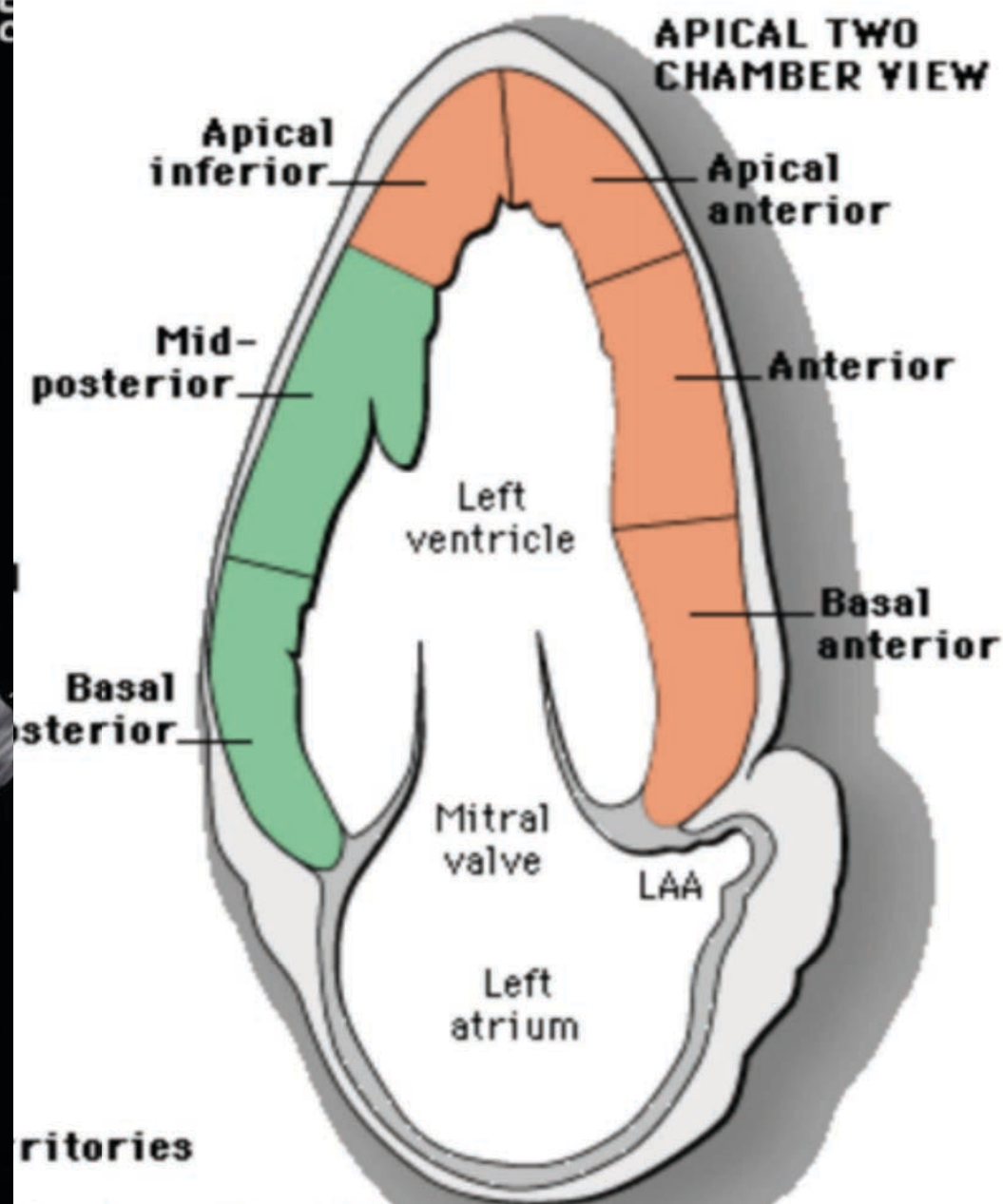
FPS 62s



150

2D 56/1/30

MI 0.8 TIS 0.3 TIB 0.3 Tx 100%



COUPE SOUS COSTALE

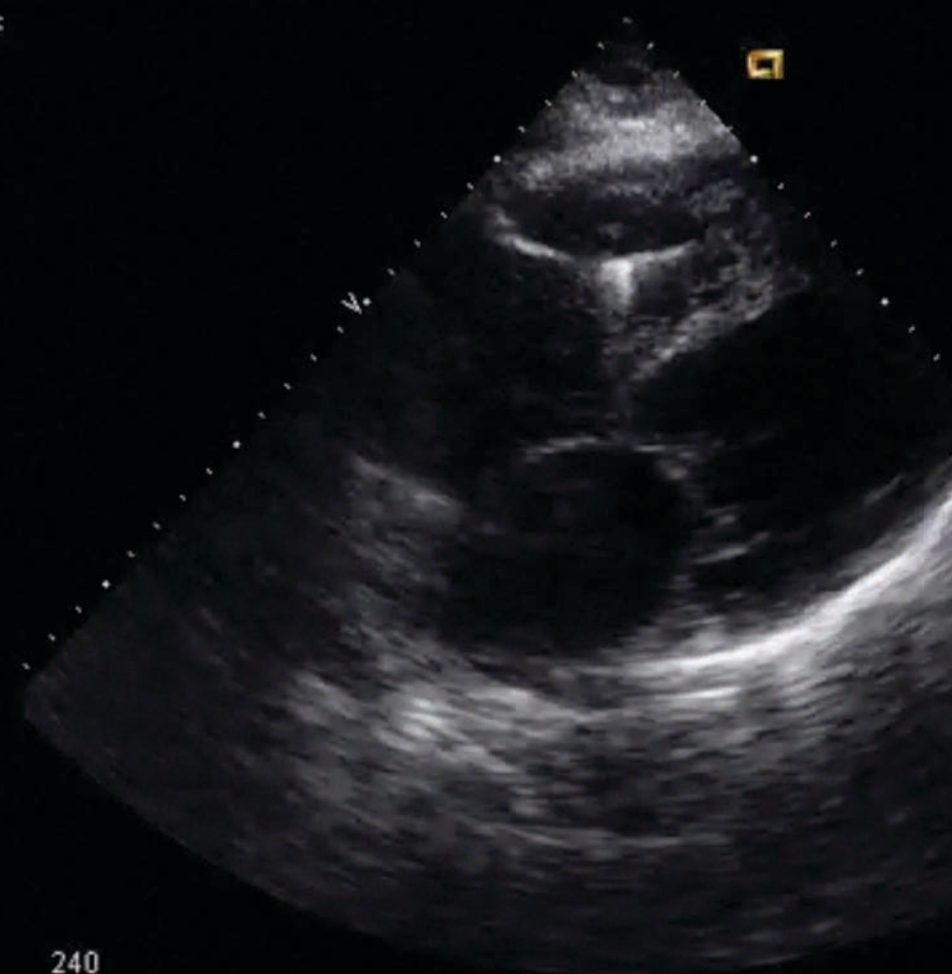
PARFOIS LA SEULE ACCESSIBLE
ALIGNEMENT DIFFICILE MAIS ÉPANCHEMENT PK+
VCI-FLUCTUATION?

HOPITAL PITIE SALPETRIERE
GOMIS,ANTOINE 05_10_2014_14_46_35

16:08:39 Tu 07/10/2014 acuson
CV70

CARDIO DIFF

P42 3.0T
FPS 41s



240

2D 56/1/27

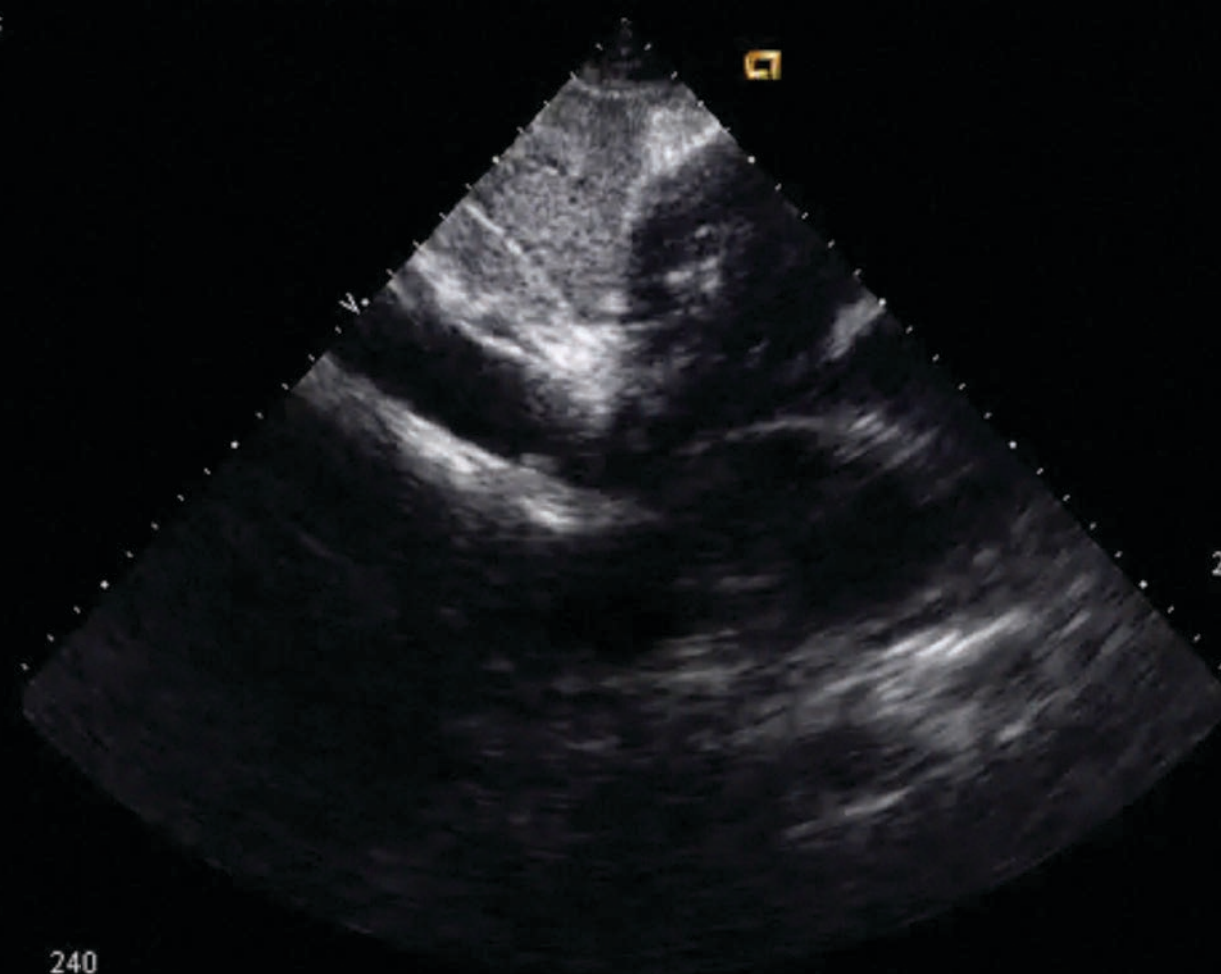
MI 0.9 TIS 0.4 TIB 0.4 Tx 100%

HOPITAL PITIE SALPETRIERE
GOMIS,ANTOINE 05_10_2014_14_46_35

16:10:12 Tu 07/10/2014 acuson
CV70

CARDIO DIFF

P42 3.0T
FPS 41s



201110

D

240

2D 56/1/27

MI 0.9 TIS 0.4 TIB 0.4 Tx 100%

Foie G

Epanchement péricardique

30.110

0

120

DES CRITERES DE PRECHARGE DEPENDANCE? VC

VS

index de **collapsibilité** de la VCI = $(D_{\max} - D_{\min}) / D_{\max}$
> 50%

VM hors réglages « extrêmes »

Diam de la VCI < 10-12 mm $\Rightarrow$ PVC < 10-12 mmHg

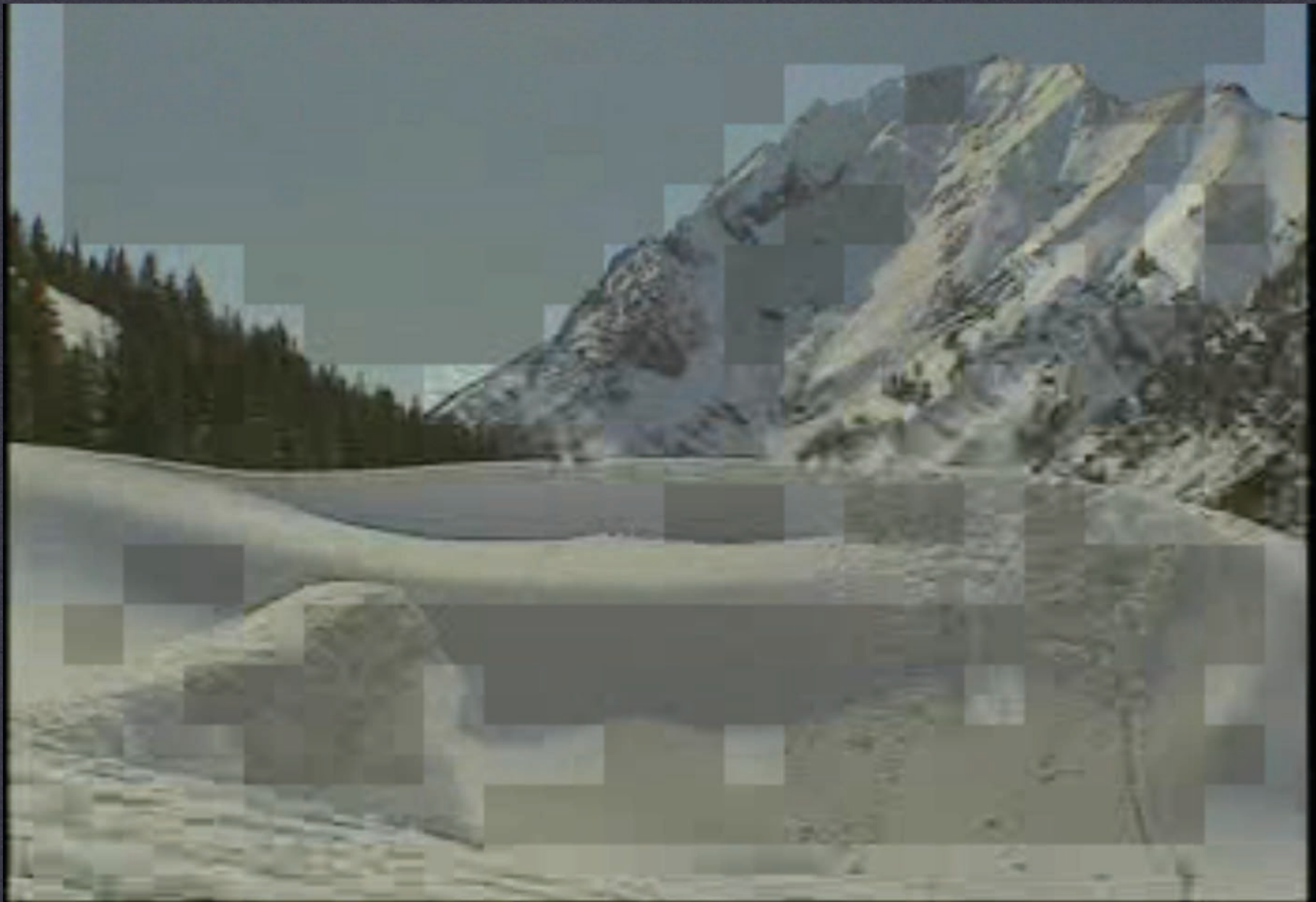
index de **collapsibilité** de la VCS = $(D_{\max} - D_{\min}) / D_{\max}$
> 36%

variations respiratoires du diamètre de la VCI $D_{\max} / (D_{\max} + D_{\min}) / 2 > 13\%$

DES CRITERES DE PRECHARGE DEPENDANCE? VG

- * Hypercinésie
- * $STSVG < 5\text{cm}^2/\text{m}^2$ (N = 7 à 17) > collapsus teleS
- * Evaluation de la réponse au remplissage (remplissage vasculaire, levée d'une pause inspiratoire en VM ou manoeuvre de Müller en VS)
- * Fluctuation type delta PP ITVCCAo /Flux mitral





A VOS SONDES!