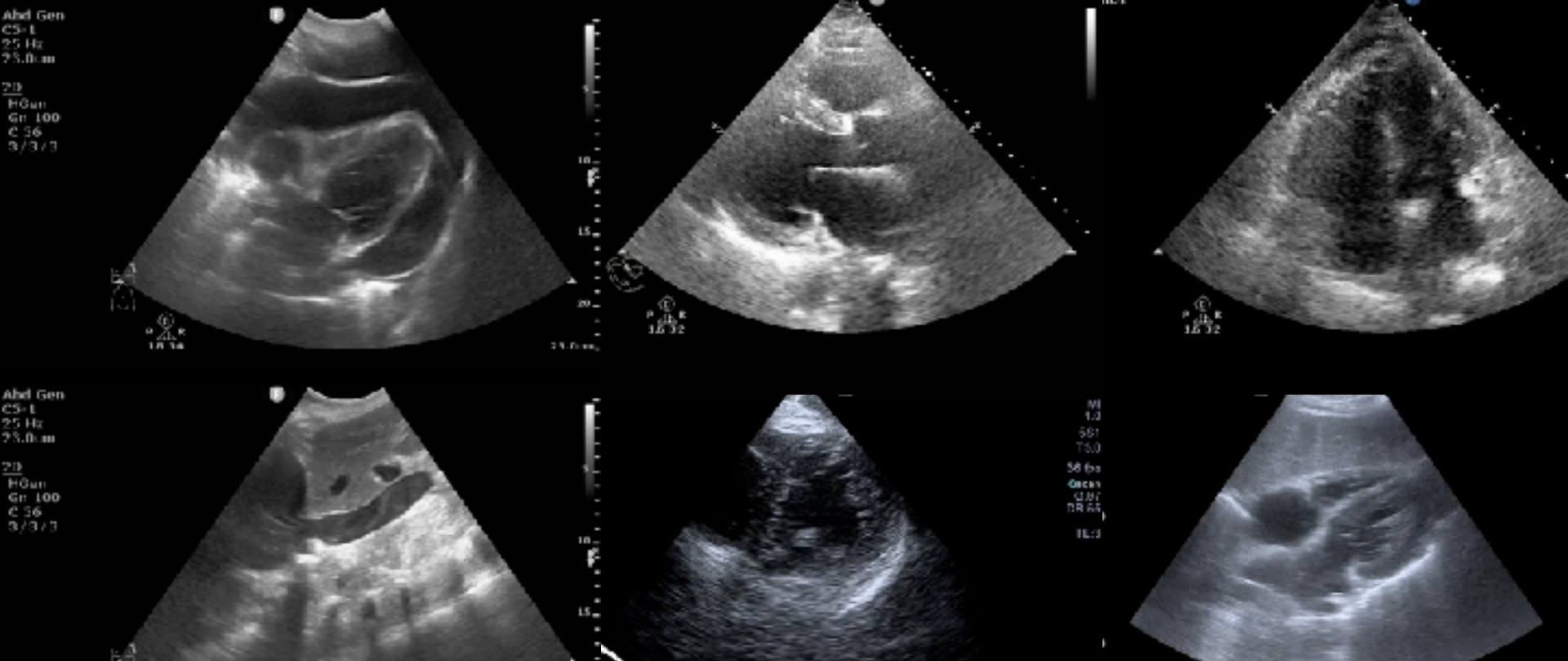




BASIC CARDIAC ECHO

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POCUSacademy.com

Resuscitative
急救復甦

Diagnostic
臨床診斷

Procedural
Guidance
處置導引

Symptom- or
Sign-Based
症狀導引

Therapeutic
輔助治療



Core Applications (2023 ACEP Emergency Ultrasound Guidelines)
15項急診超音波核心應用

陳國智醫師

Aorta

DVT

Trauma

Thoracic/Airway

Cardia/HD assessment

Procedural Guidance

US-guided NB

Testicular

Ocular

Skin & Soft tissue

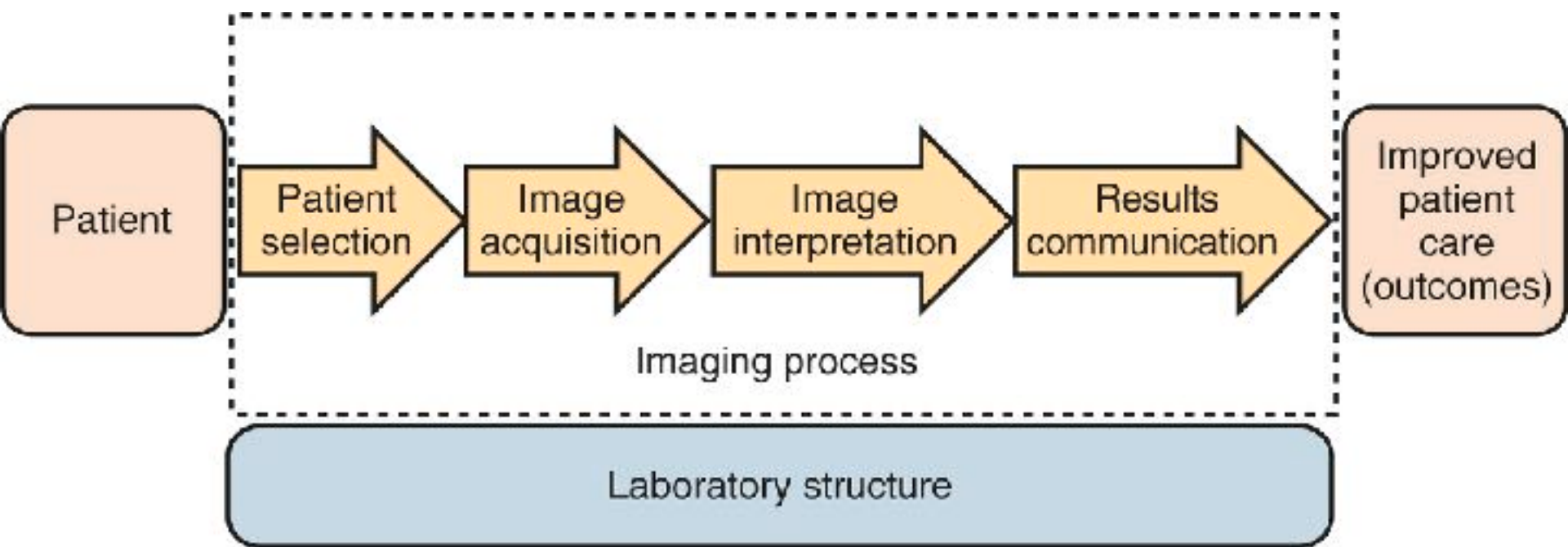
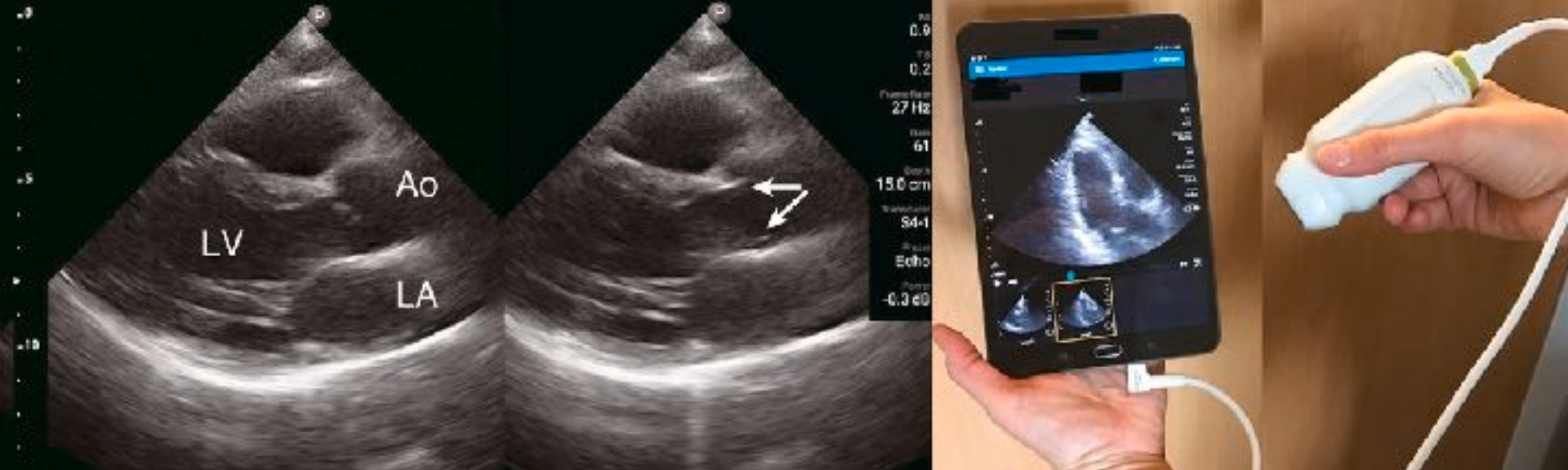
Hepatobiliary

Urinary tract

Pregnancy

Bowel

MSK



ASE practice guideline 2020

J Am Soc Echocardiogr. 2020 Apr;33(4):409-422.e4.

Table 1 Definitions of cardiac ultrasound categories

	UAPE	Cardiac POCUS	CCE	Limited echo	Comprehensive echo
Diagnostic expectations	"Routine" performance of a single imaging protocol to augment bedside examination	Focused exams with specific imaging protocols based upon suspicion of a specific disease (e.g., rule out tamponade)	Focused on a collection of specific views/findings pertinent to the care of the critically ill (e.g., cardiac output, fluid responsive)	Focused on previously delineated findings as a follow-up exam; limited imaging protocol applied to answer a specific question	Comprehensive, all findings, quantification; increasingly use advanced techniques
Application frequency	Frequent, daily, multiple physicians	Usually once, per disease, but more frequently if change in clinical status	On admission or change in clinical status, potentially frequently	As follow up to comprehensive echo; potentially multiple times over weeks to months	Once (per admission, change in clinical status)
Interpretation of findings	Presence or absence of ultrasound "signs" indicative of cardiac abnormality	Findings related to the diagnosis sought in protocol	Primary and incidental findings recorded in views	All findings, primary and incidental, recorded in limited views	All findings, primary and incidental recorded in comprehensive imaging
Quantification	Usually Absent	Optional	Typically	Typically	Mandatory
Indication	Physical exam	Clinical suspicion	Medical necessity	Medical necessity	Medical necessity
Documentation	Images not recorded (except for QA), findings reported in physical exam	Image archiving and formal reporting controversial	Images archived, formal report	Images archived on PACS, formal report	Images archived on PACS, formal report
Teaching required	Introductory and modest (weeks)	Modest (weeks to months)	Advanced (months)	Advanced (years)	Advanced (years)
Notes	Used "In the manner and intent" of cardiac physical examination	Similar to UAPE, but disease specific	Imaging protocols specific to issues in the critically ill; comparison to available prior studies as indicated	Reading all findings increases training burden. Comparison to available prior studies is standard practice. Must be able to convert to comprehensive at bedside	Completely evaluates all findings, regardless of referral question or incidental nature. Comparison to available prior studies is standard practice.

CCE, critical care echocardiography; PACS, Picture Archival and Communication System; POCUS, point of care ultrasound; UAPE, ultrasound assisted physical examination.

Adapted from: Kimura BJ. Point-of-care cardiac ultrasound techniques in the physical examination: better at the bedside. Heart 2017;103:987-994. <https://doi.org/10.1136/heart-2016-309915>.

	UAPE	Cardiac POCUS	CCE
Diagnostic expectations	"Routine" performance of a single imaging protocol to augment bedside examination	Focused exams with specific imaging protocols based upon suspicion of a specific disease (e.g., rule out tamponade)	Focused on a collection of specific views/findings pertinent to the care of the critically ill (e.g., cardiac output, fluid responsive)
Application frequency	Frequent, daily, multiple physicians	Usually once, per disease, but more frequently if change in clinical status	On admission or change in clinical status, potentially frequently
Interpretation of findings	Presence or absence of ultrasound "signs" indicative of cardiac abnormality	Findings related to the diagnosis sought in protocol	Primary and incidental findings recorded in views
Quantification	Usually Absent	Optional	Typically
Indication	Physical exam	Clinical suspicion	Medical necessity
Documentation	Images not recorded (except for QA), findings reported in physical exam	Image archiving and formal reporting controversial	Images archived, formal report
Teaching required	Introductory and modest (weeks)	Modest (weeks to months)	Advanced (months)
Notes	Used "in the manner and intent" of cardiac physical examination	Similar to UAPE, but disease specific	Imaging protocols specific to issues in the critically ill; comparison to available prior studies as indicated

急診心超三部曲

理學檢查

UAPE

快速判定

Cardiac POCUS

進階測量

CCE

UAPE-Quick check

C Nerve
C6-2
22 Hz
13.0cm

2D
Gen
Gn 60
C. 53
2/3/2

Base

LV

Apex



R
P R
2.0 6.0

13.0cm

UAPE-Quick check

Adult Echo
S4-1
77 Hz
15.0cm

2D
HGen
Gn 100
55
3/2/0
50 mm/s

Leg

Liver

Head

IVC

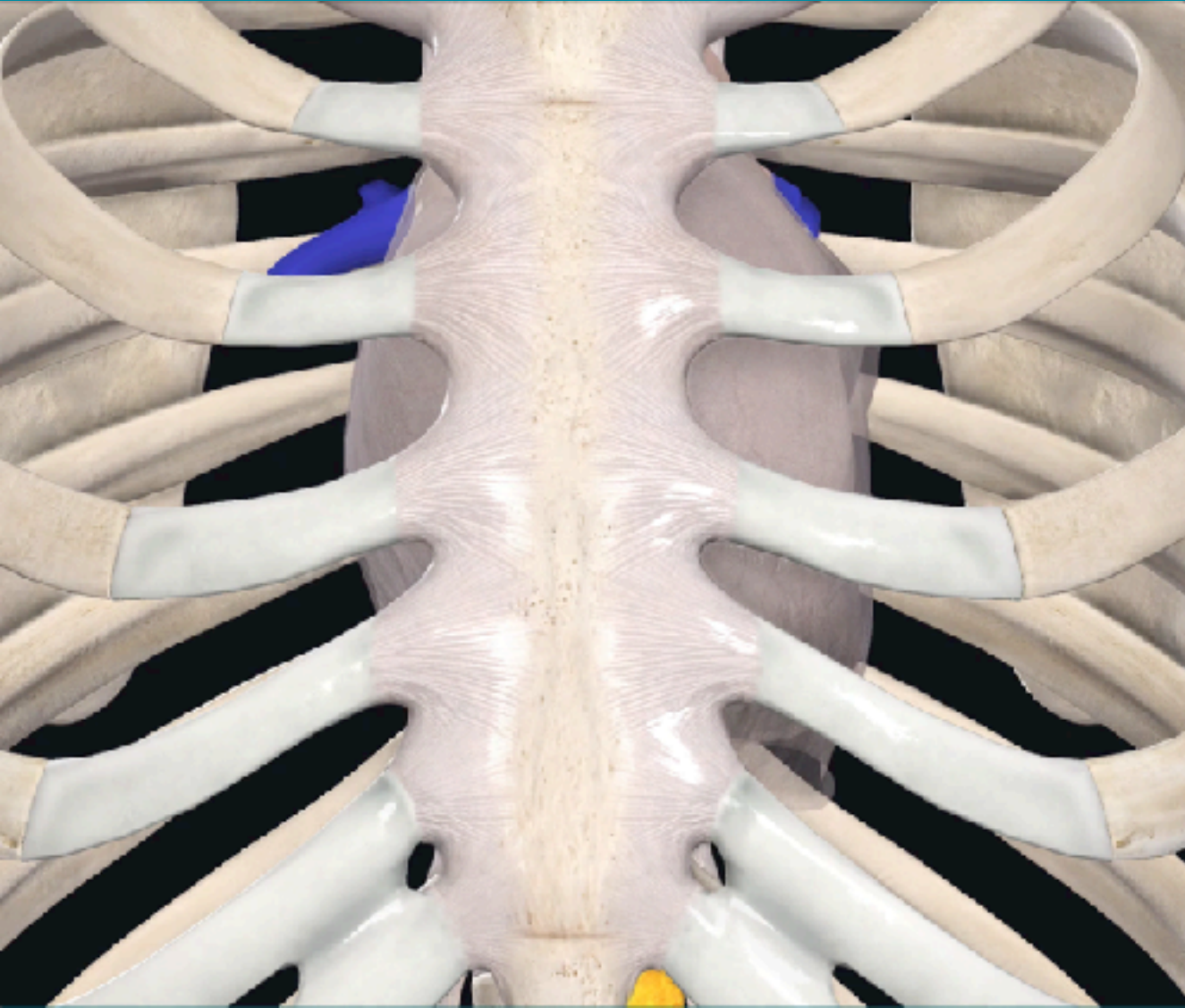
Diameter (1-2cm) / Variation (50%)

P R
1.7 3.1



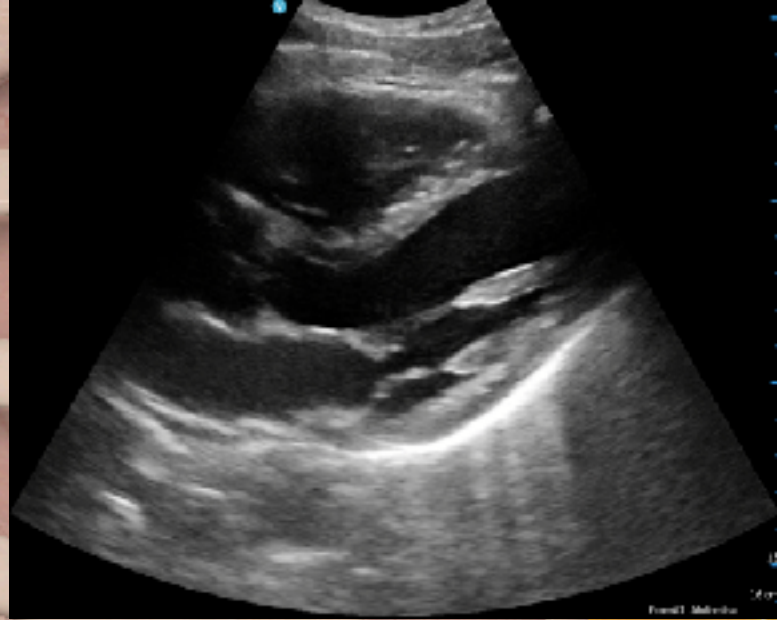
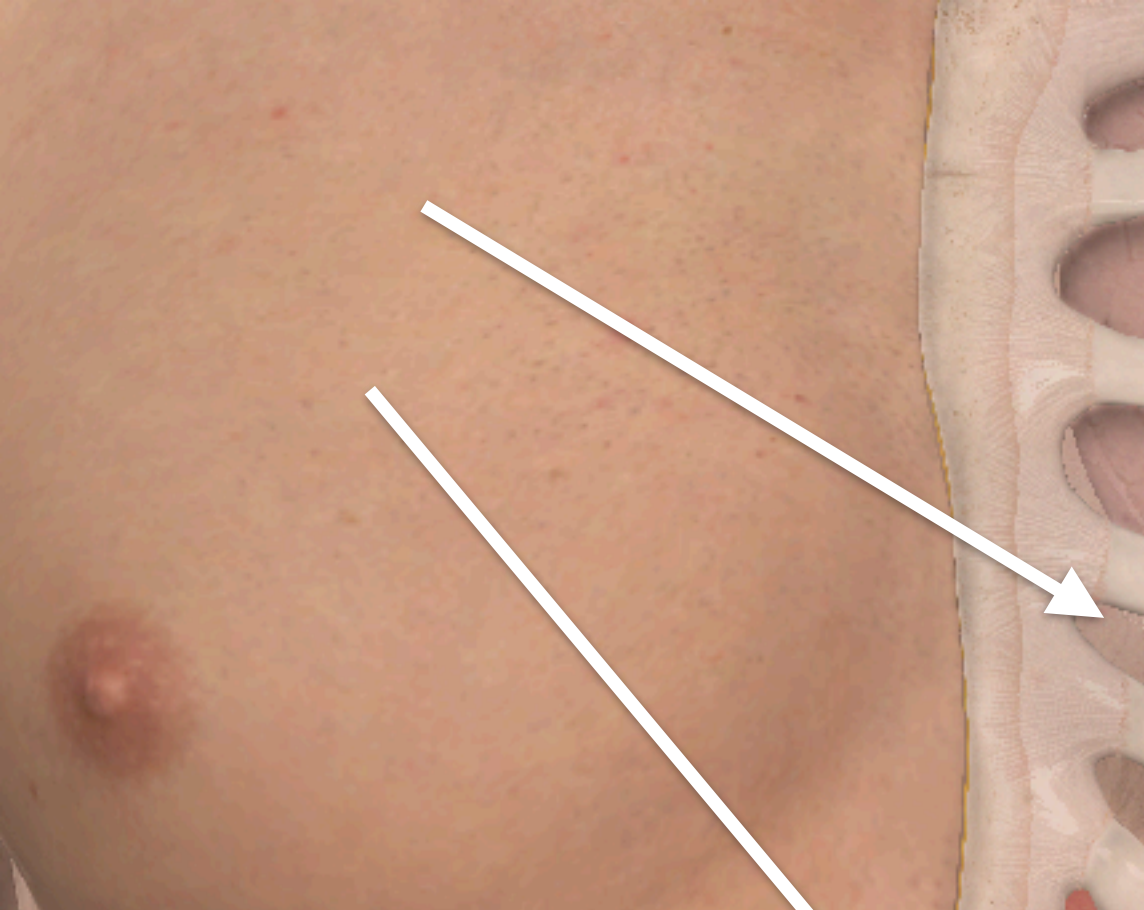
53
BPM

HEART

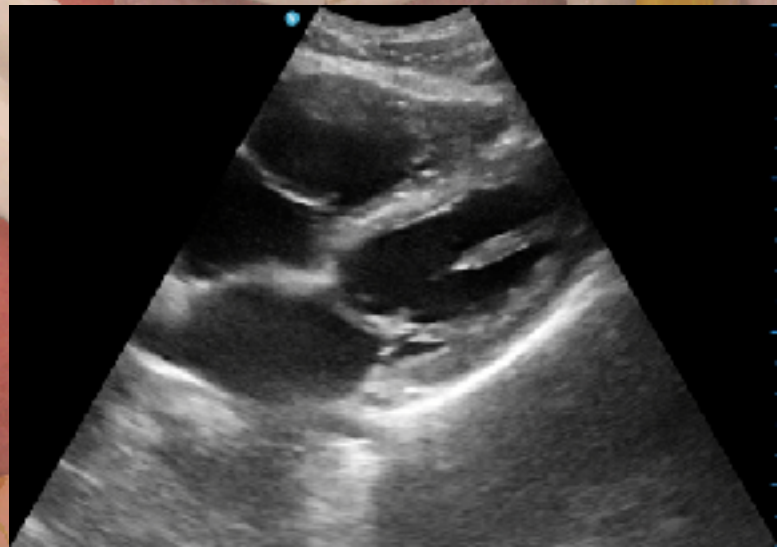
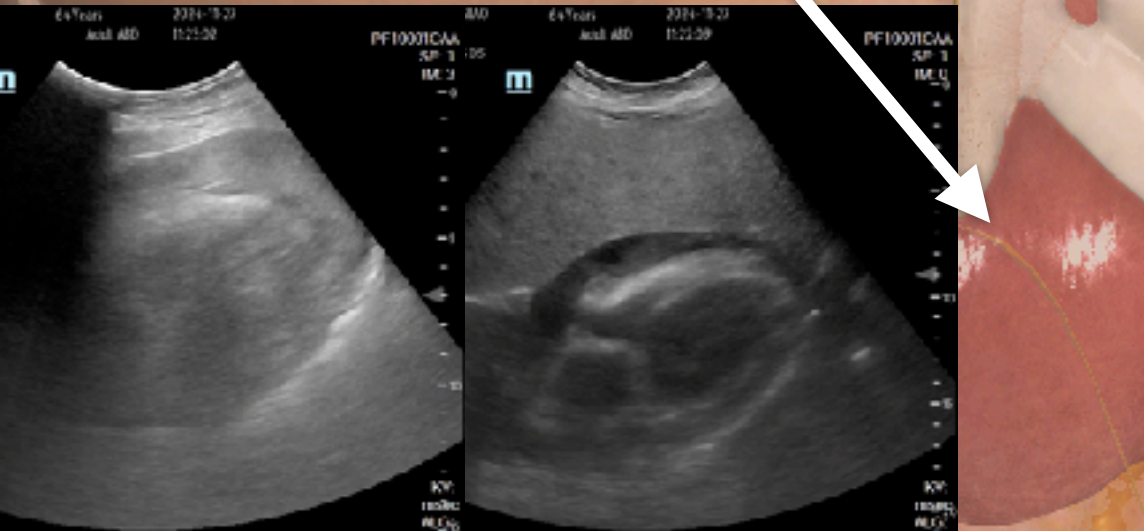


Arrest
Activity

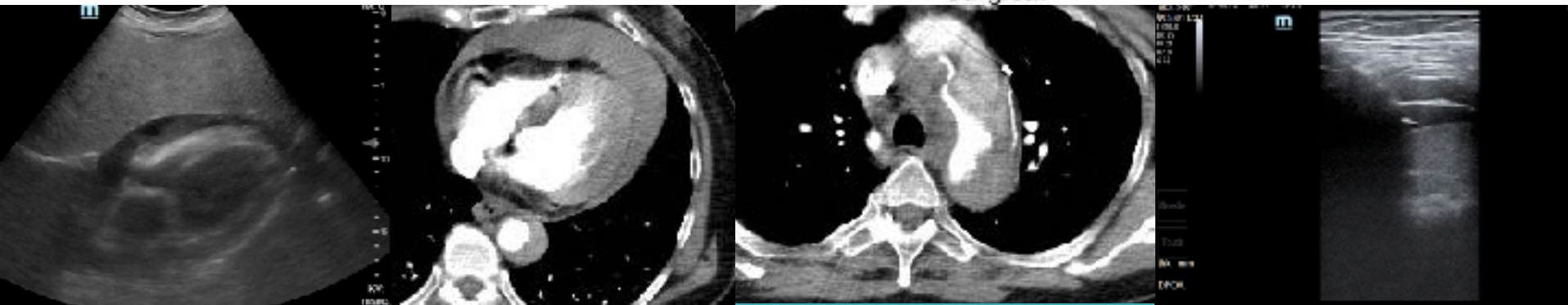
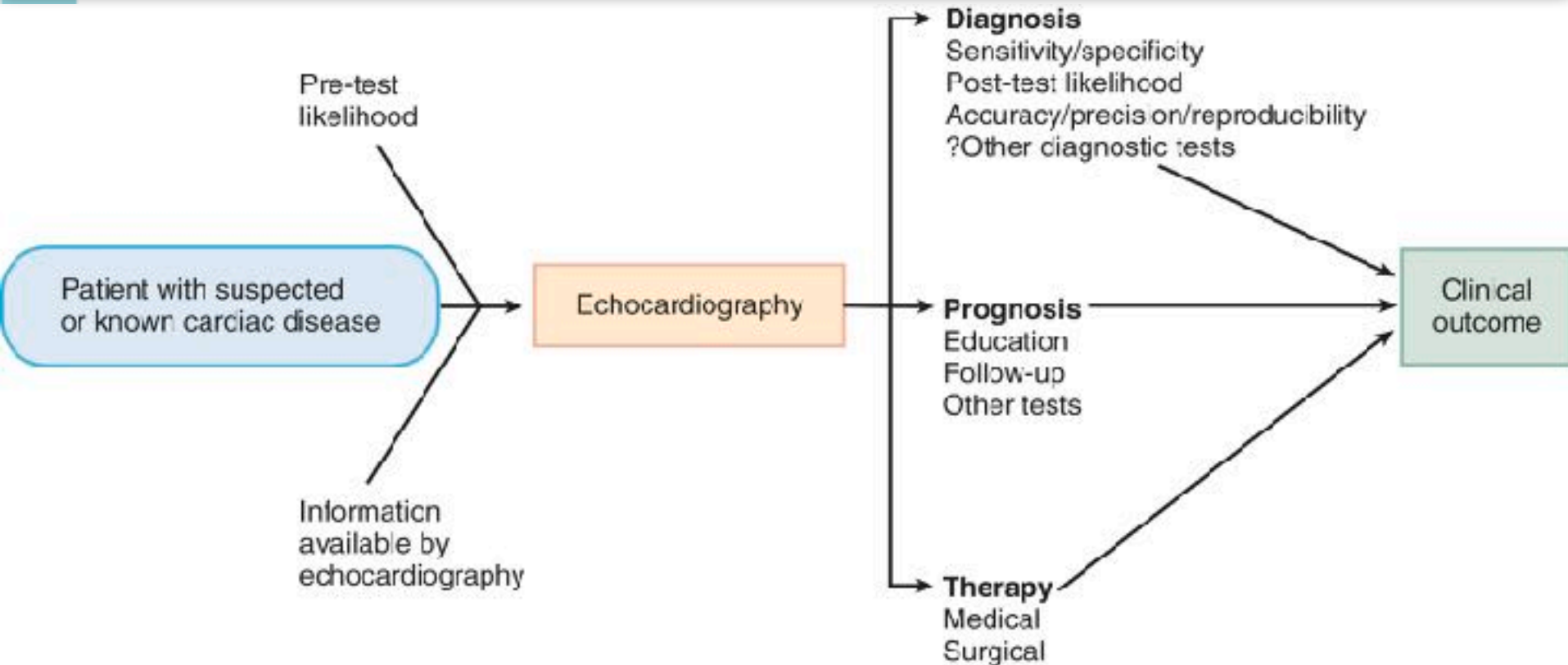
Shock
Effusion₈



HEMOPERICARDIUM



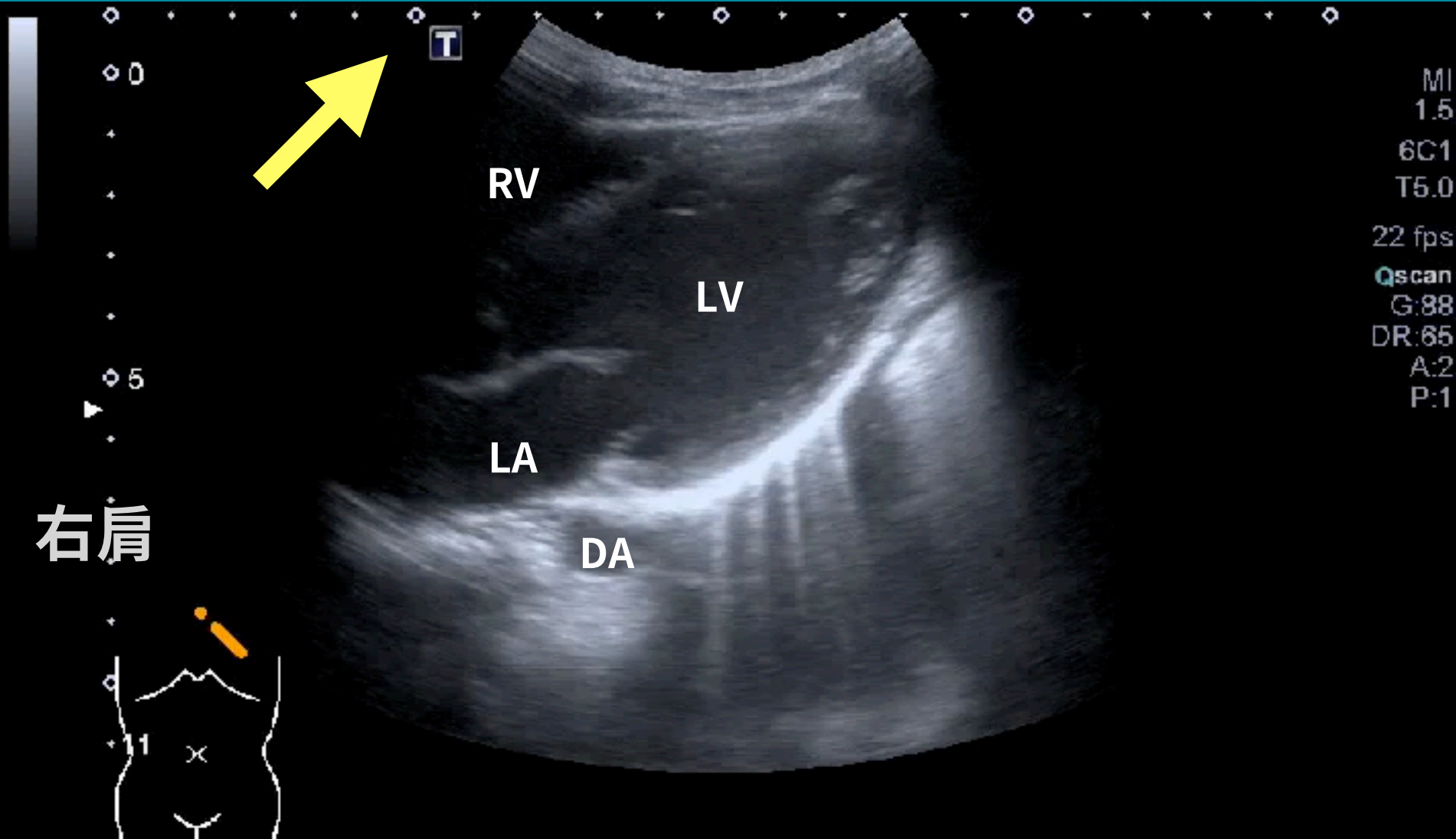
Impact of POCUS



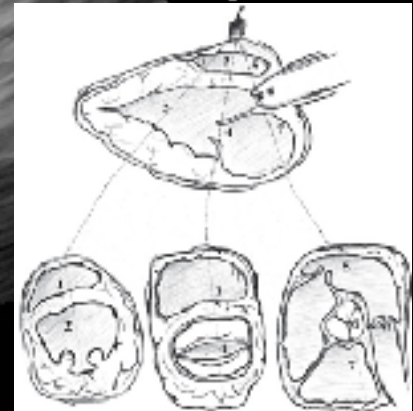
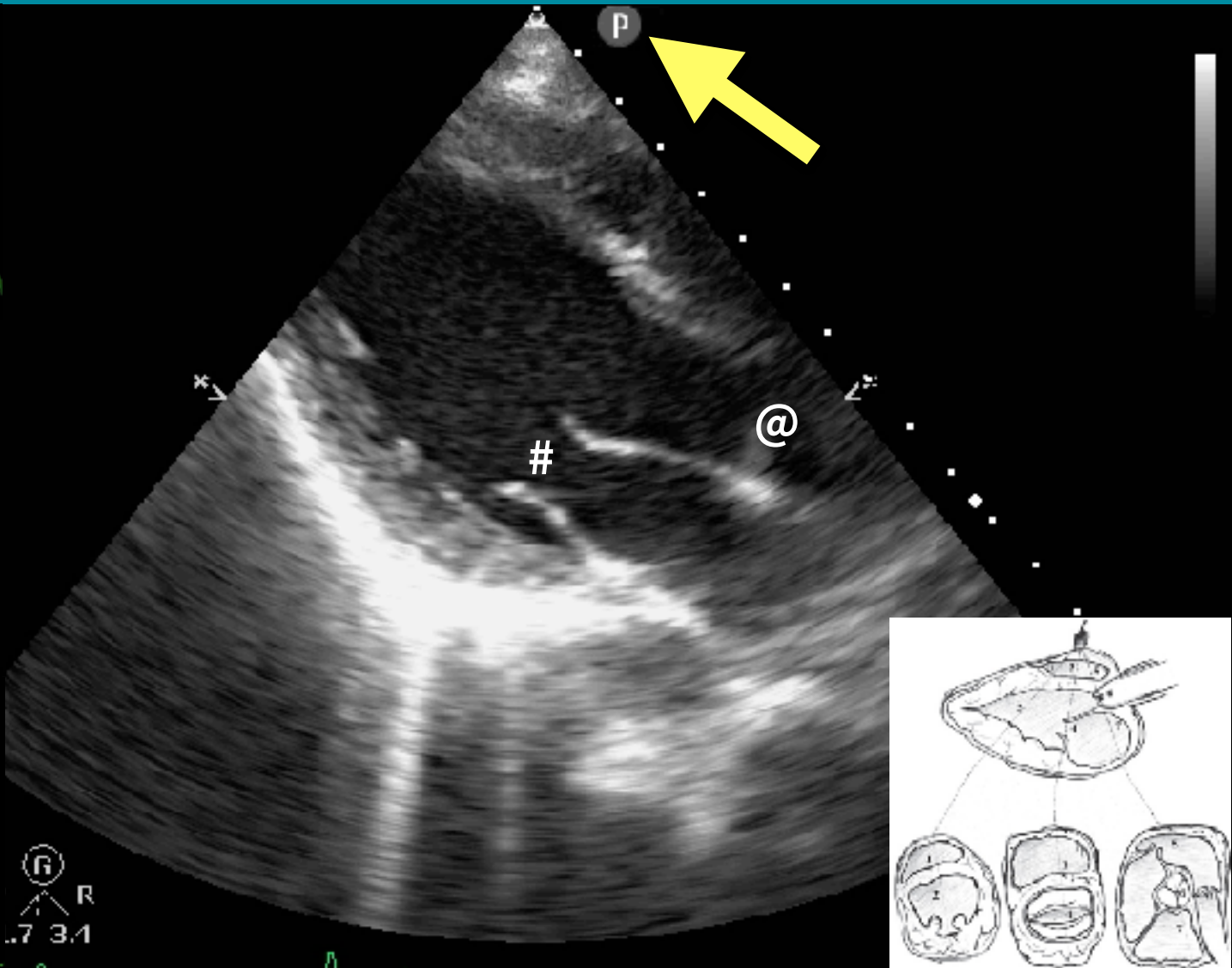
Cardiac US exam types

	Diagnostic Echocardiogram	PROCEDURAL GUIDANCE			Point of Care Echocardiography
		Cardiac Surgery	Interventional Procedures	Electrophysiology Procedures	
Purpose of imaging	Diagnose and measure disease severity, evaluate progression or response to therapy, integrate with clinical information and other imaging approaches	Comprehensive perioperative exam and/or procedure guidance (baseline data, measure results, detect complications)	Direct catheter and device positioning, evaluate procedure results, detect complications	Direct catheter and device positioning, detect complications	Immediate patient triage and management or monitoring cardiac parameters
Clinical setting	Any inpatient or outpatient location under the auspices of a structured echocardiography laboratory ²	Operating room	Interventional suite or hybrid operating room	Electrophysiology laboratory	Inpatient bedside, emergency department or outpatient clinic
Health care provider	Images recorded by cardiac sonographer and interpreted by cardiologist with expertise in echocardiography	Interventional echocardiographer or cardiac anesthesiologist with expertise in echocardiography	Interventional echocardiographer, interventional cardiologist, or anesthesiologist ³	Clinical cardiac electrophysiologist or anesthesiologist ³	Physician with limited training in echocardiography who provides direct care to the patient
Ultrasound modalities	All echocardiographic modalities as appropriate	TEE Epicardial	TEE ICE TTE	TEE ICE TTE	TTE, primarily 2D imaging and color Doppler
Documentation	Formal written report in medical record	Results integrated into anesthesiology procedure note	Results integrated into interventional procedure report	Results integrated into EP procedure report	Results reported in clinical progress note
Quality improvement	Long-term PACS storage of digital images documenting entire study	Long-term PACS storage of representative digital images	Optional long-term PACS storage of representative images	Optional long-term PACS storage of representative images	Images typically not recorded, although key images may be saved for CCI

PARASTERNAL LONG AXIS



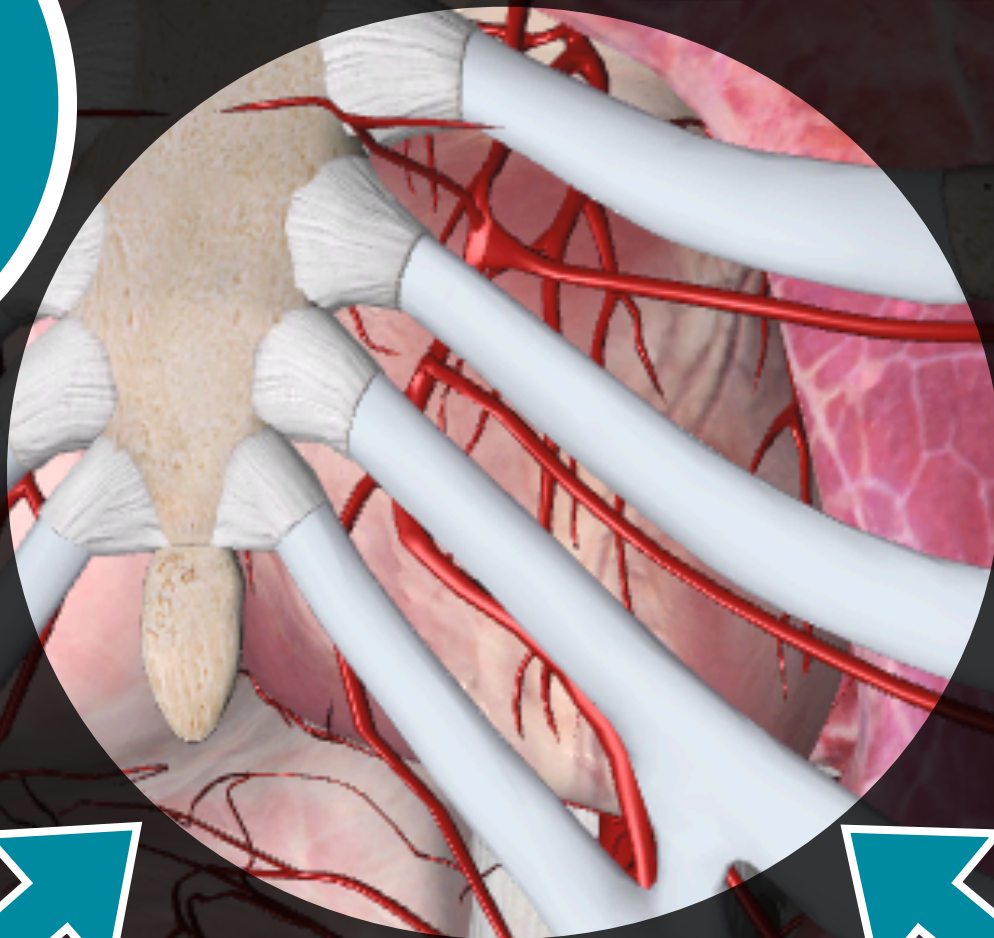
PARASTERNAL LONG AXIS



Parasternal



SPA



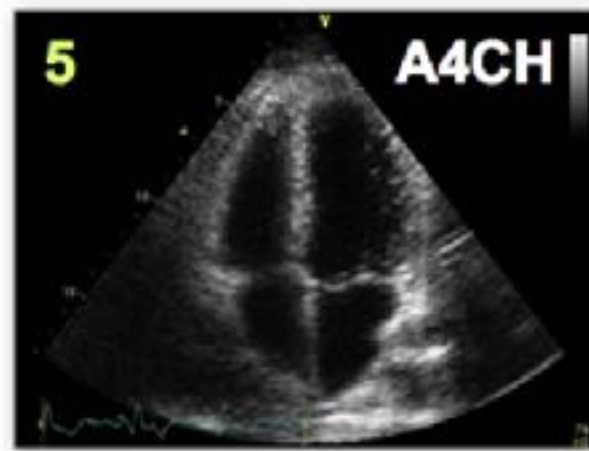
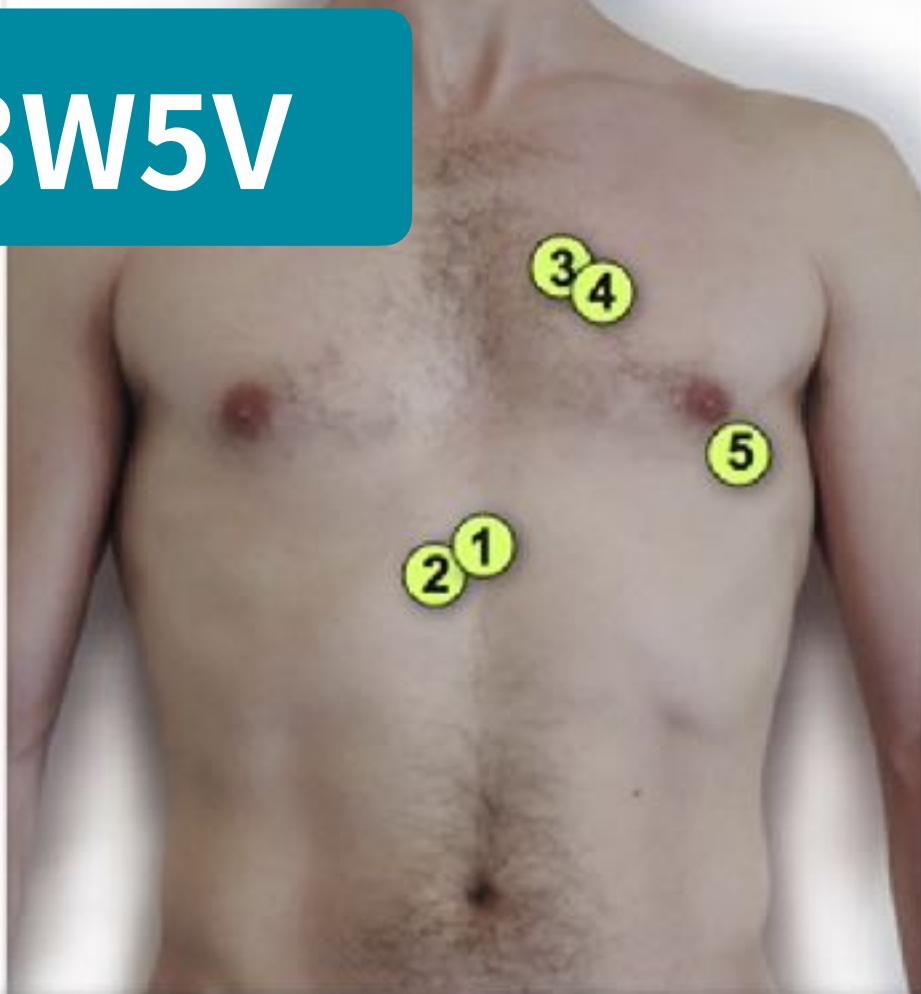
Subcostal

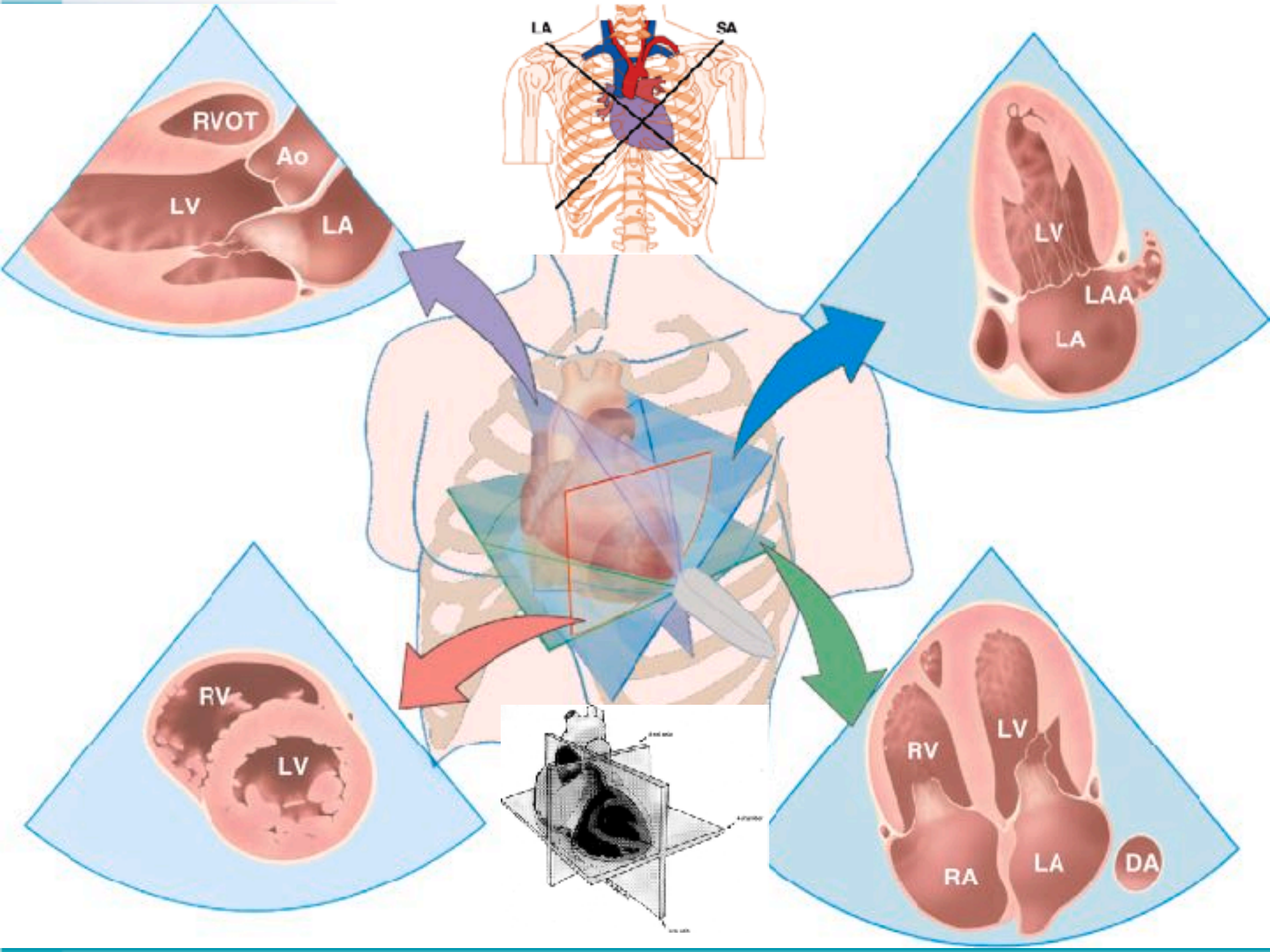


Apical



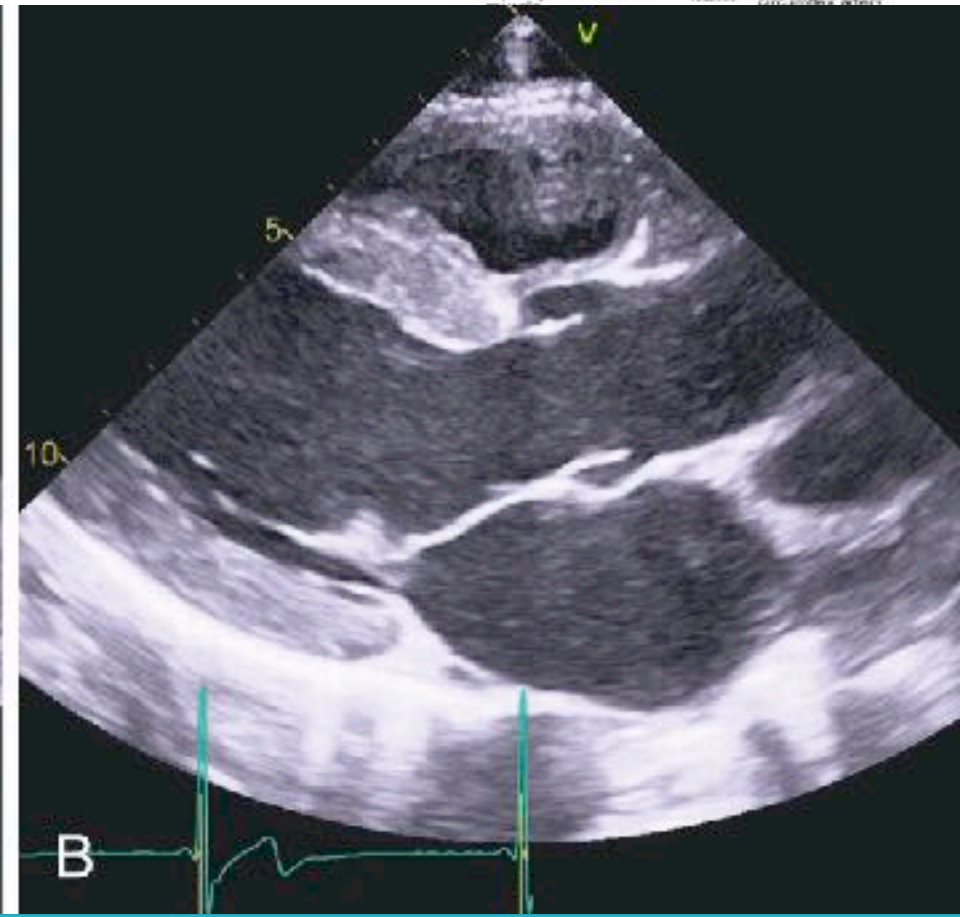
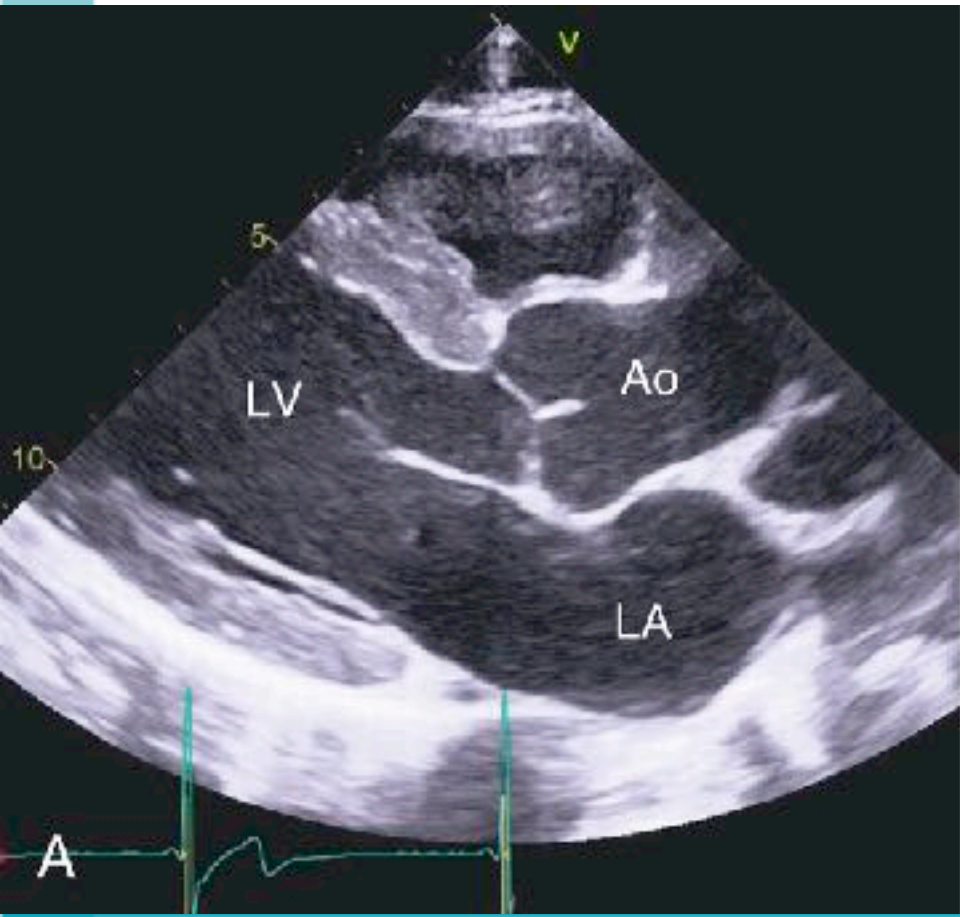
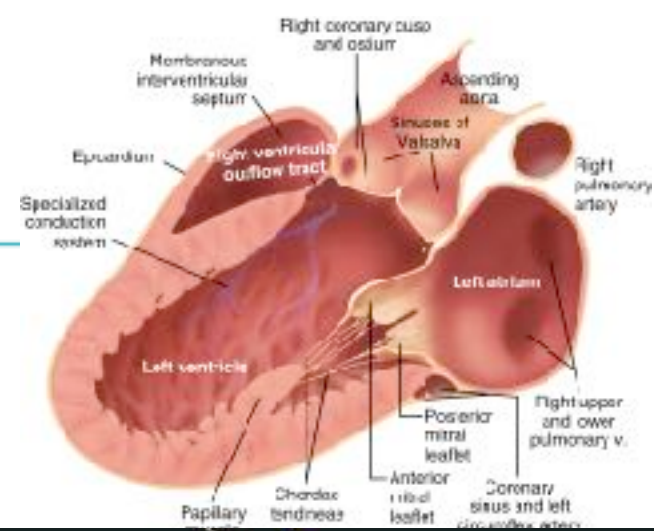
3W5V

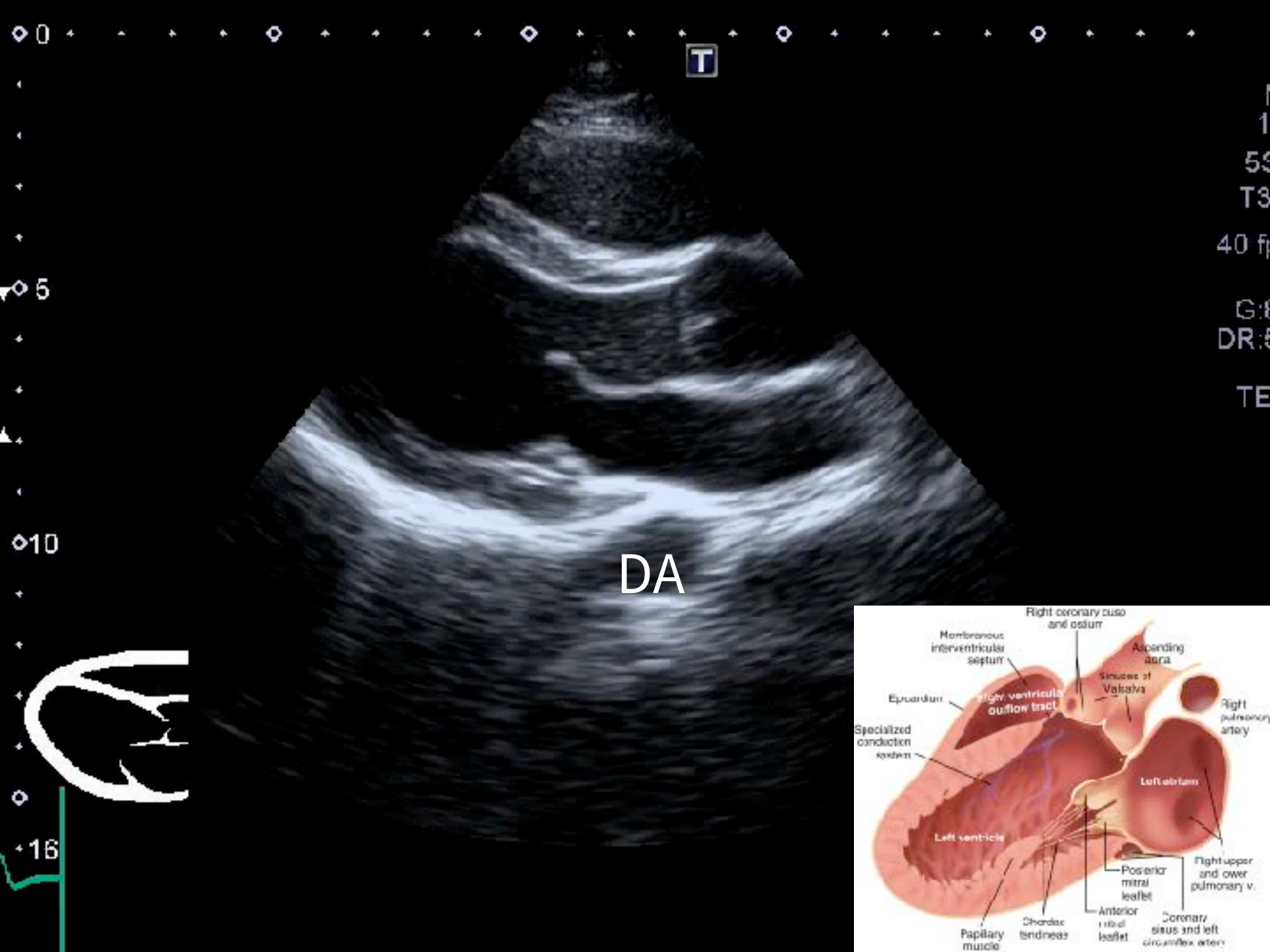




PSLA

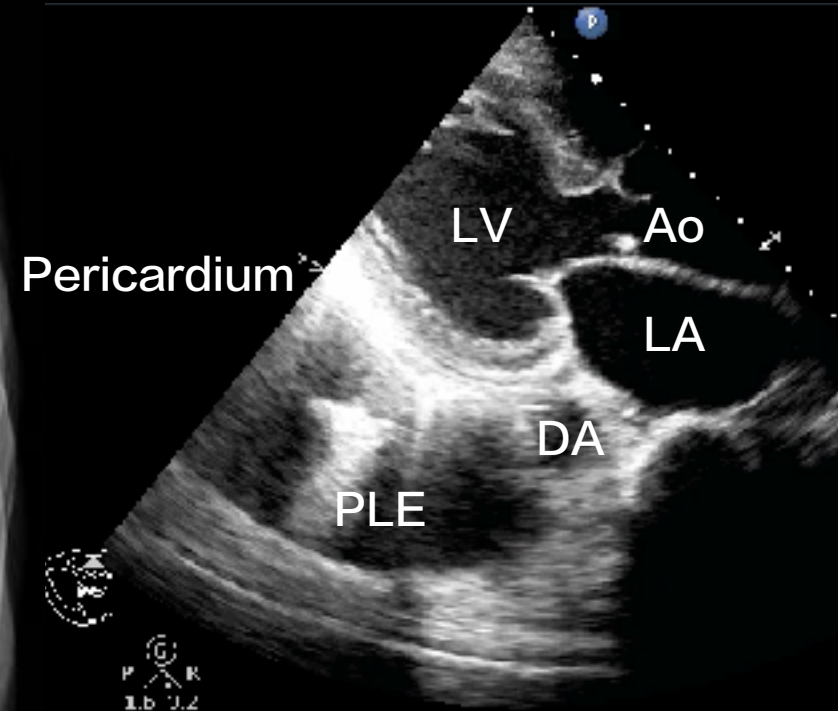
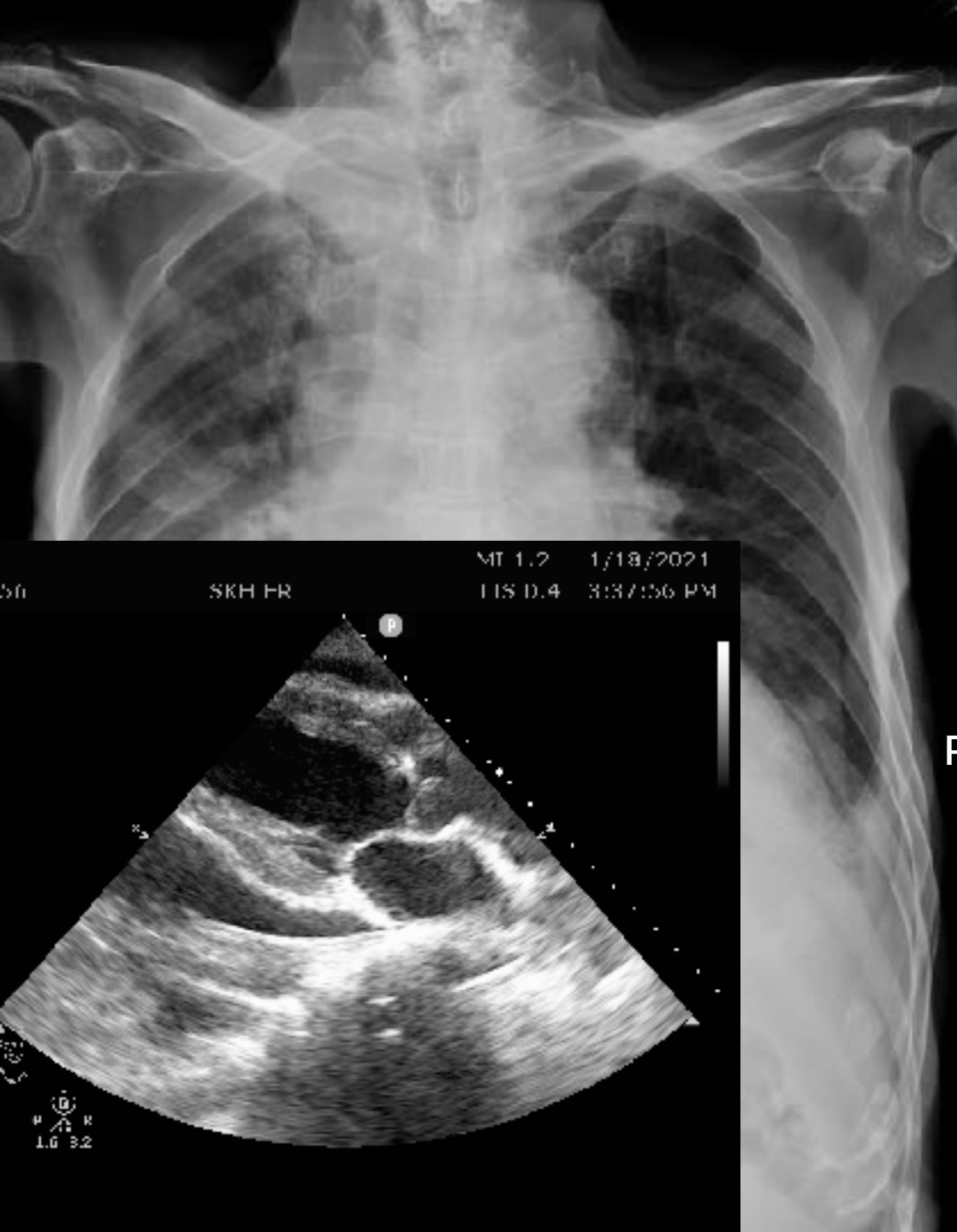
(R shoulder)



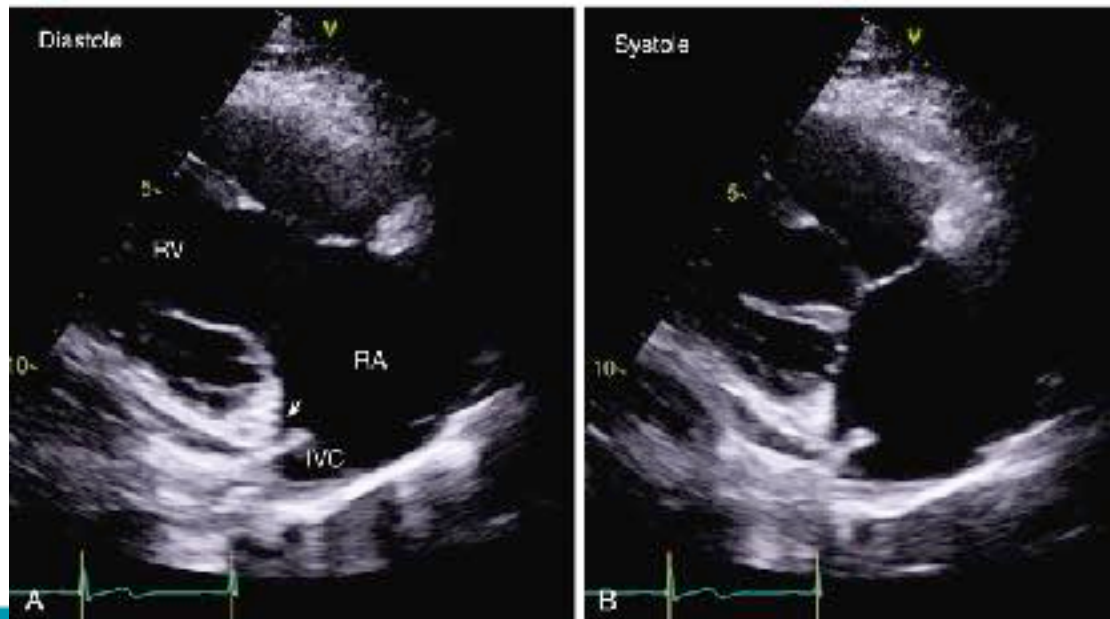
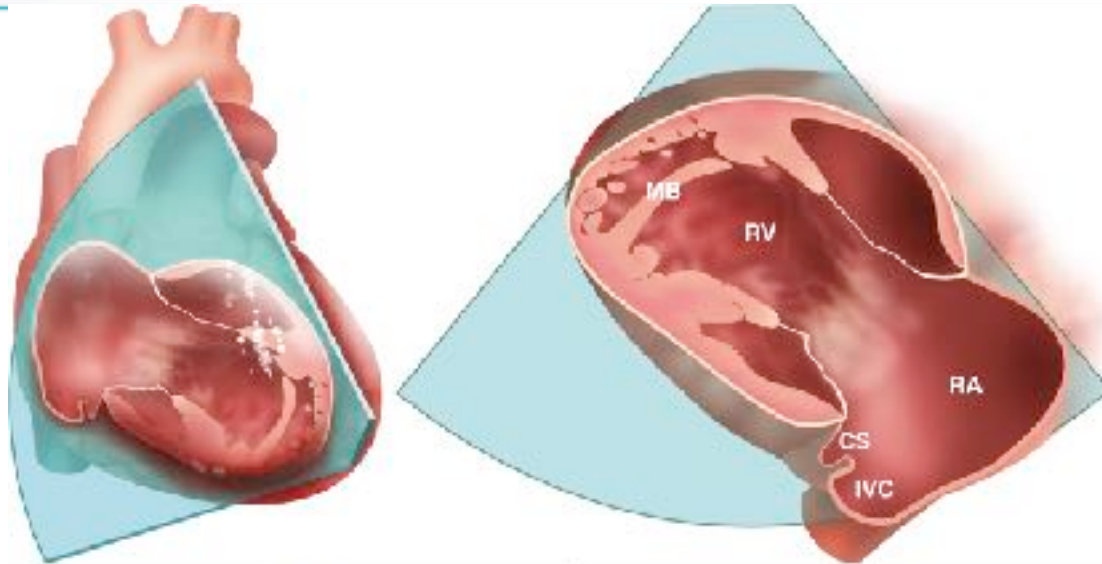


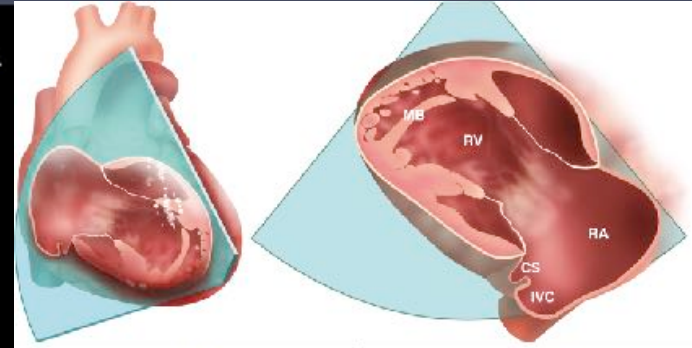
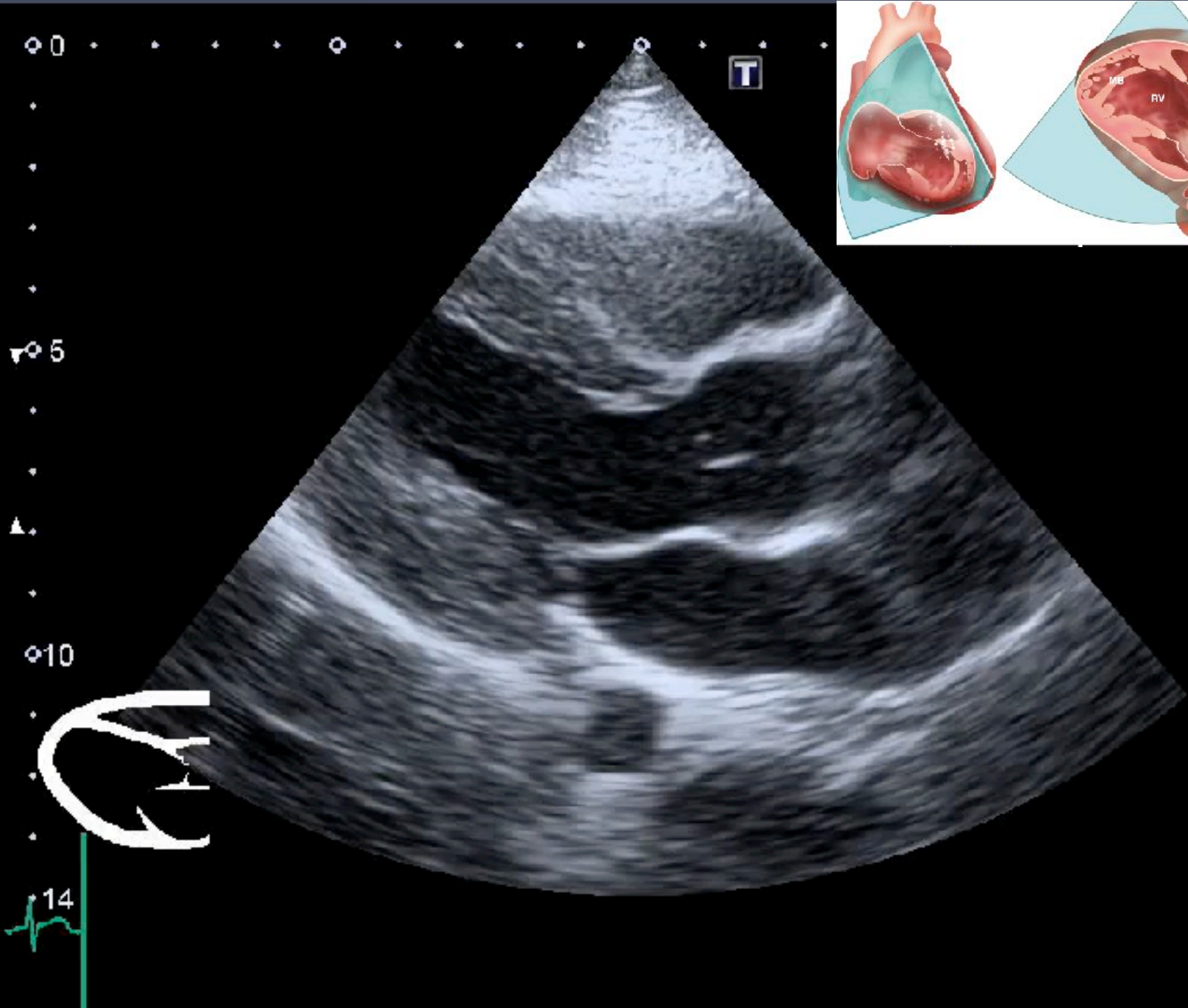
D aorta

Pericardial vs Pleural



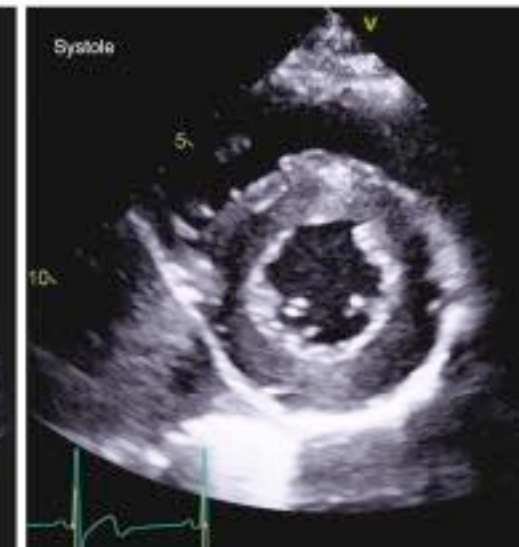
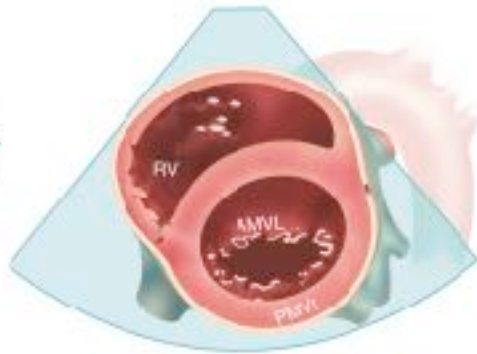
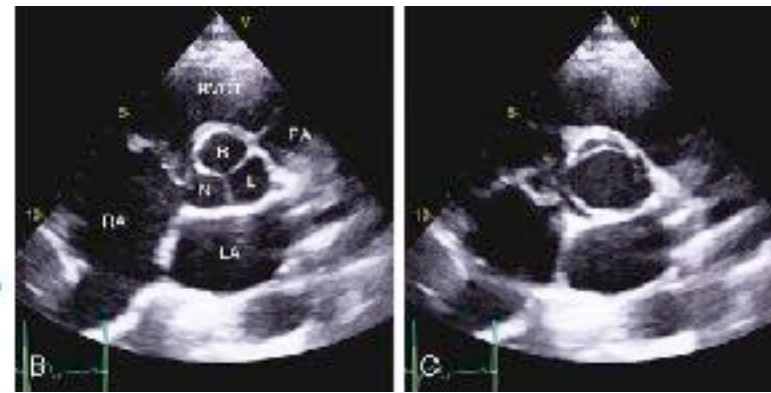
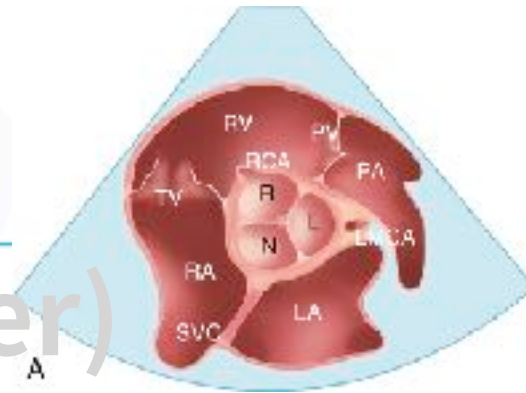
RV inflow view

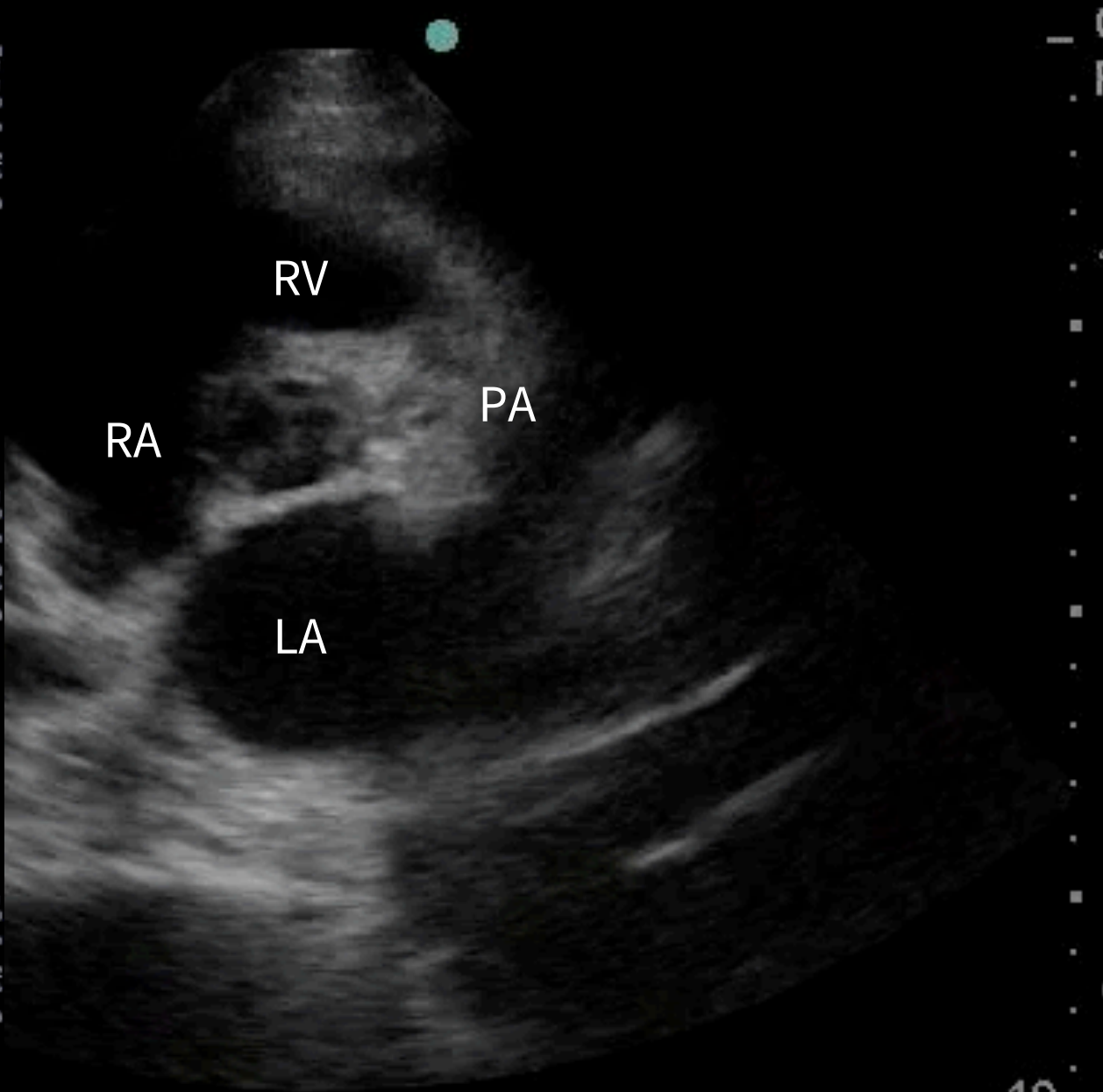
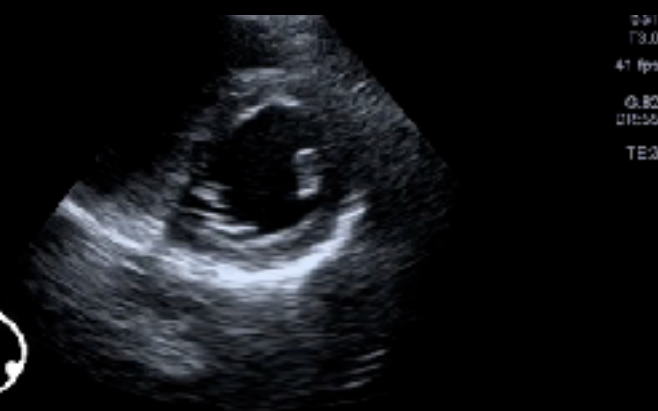
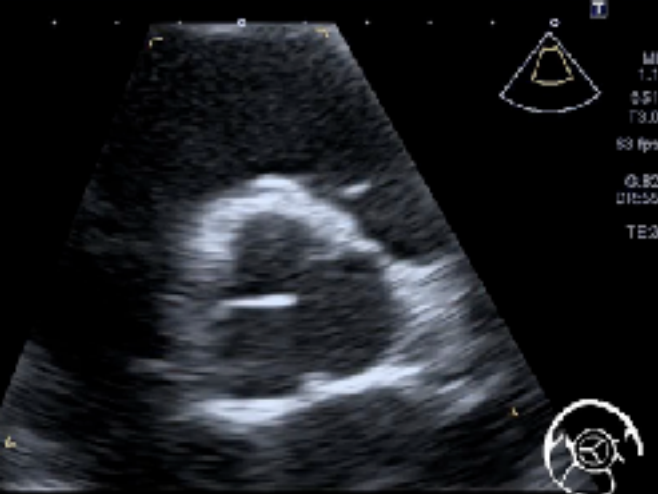




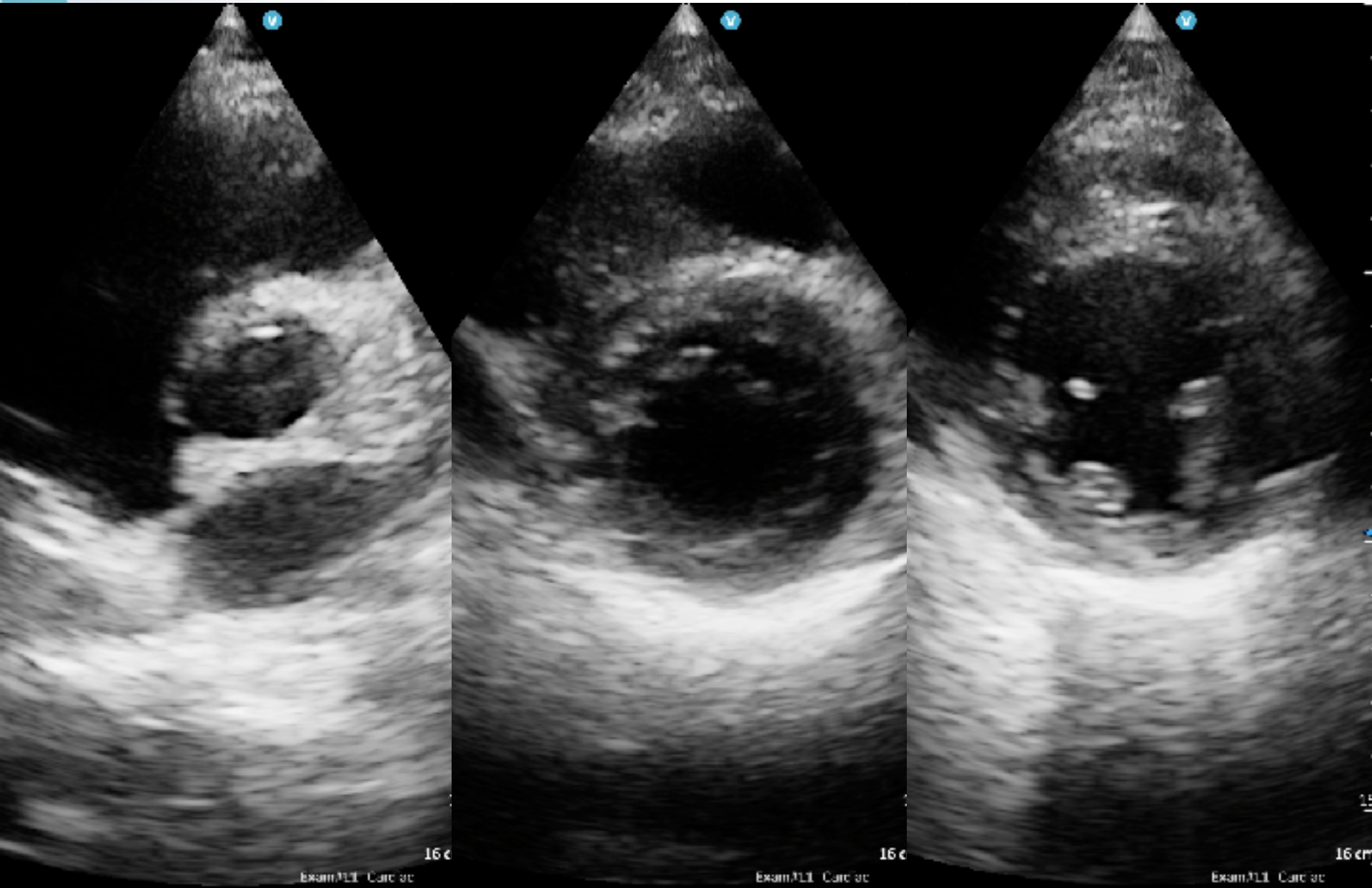
41
Q3
C
DR

PSSA (L shoulder)



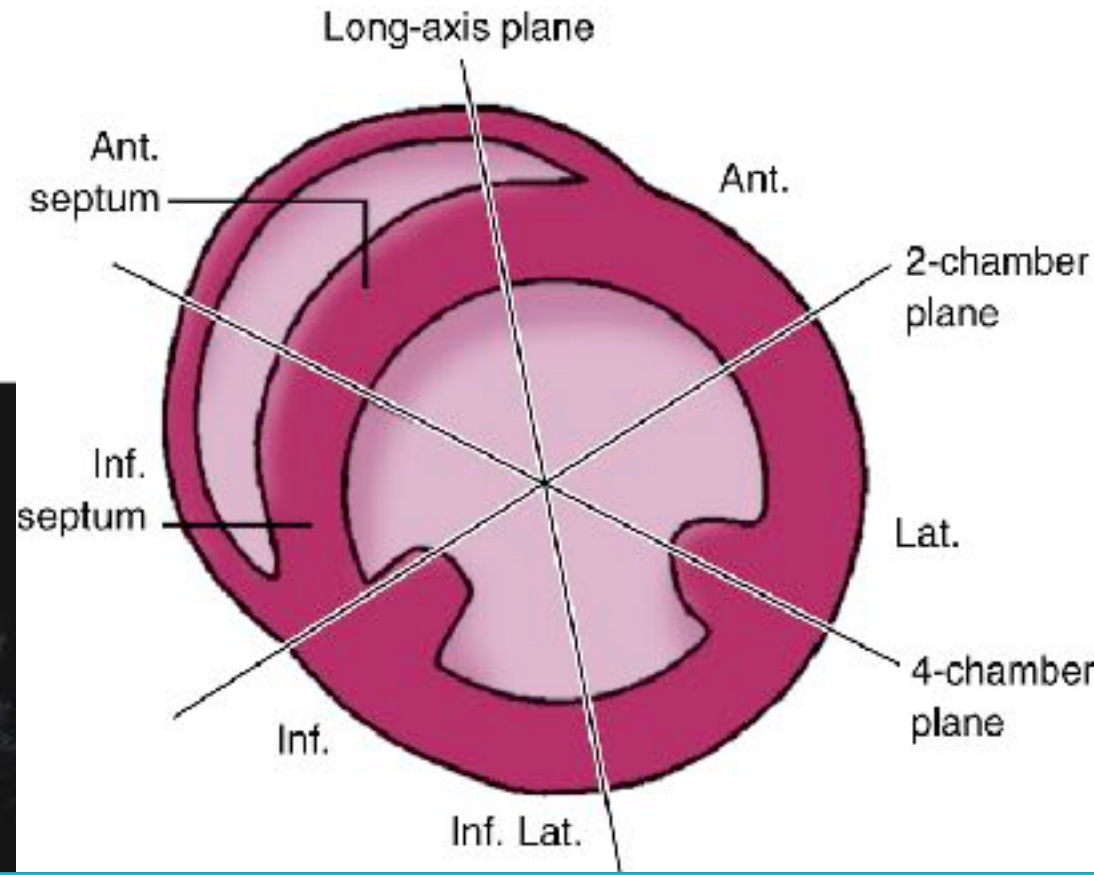
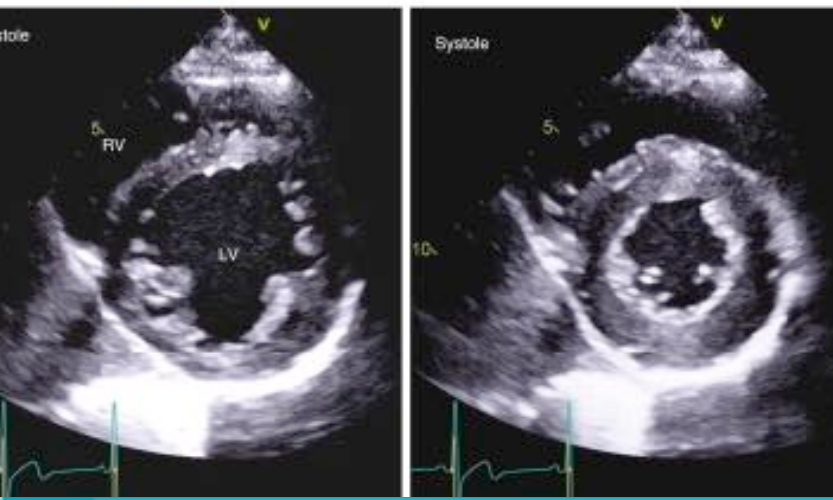
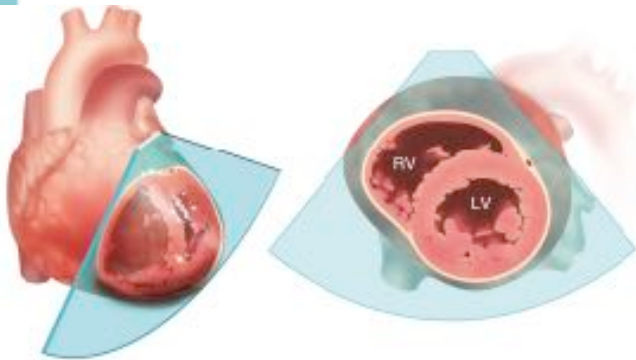


PSSA



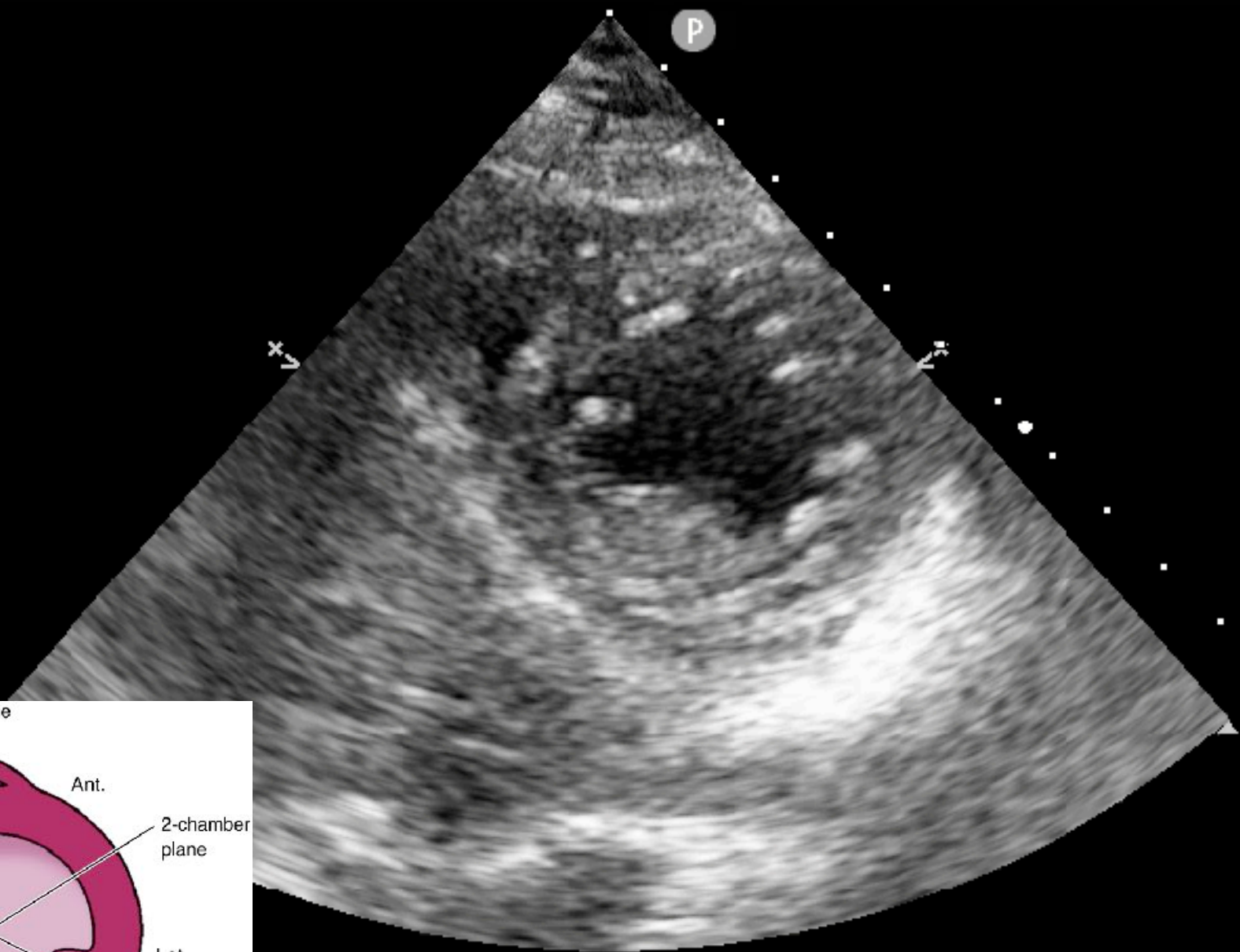
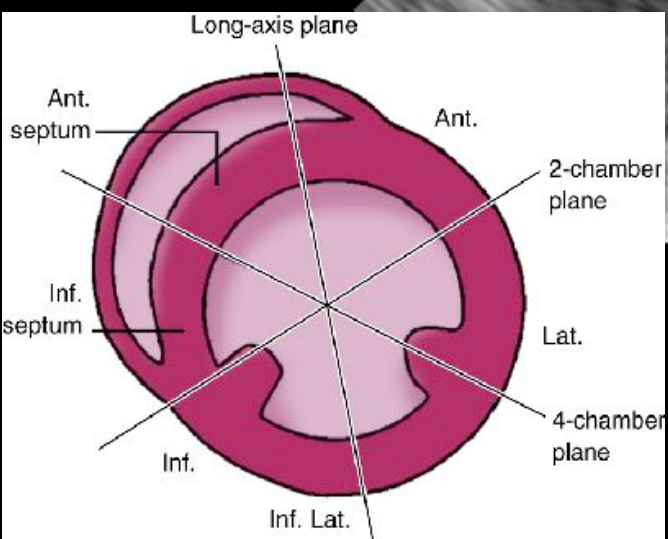
PSSA

Papillary muscle level: RWMA

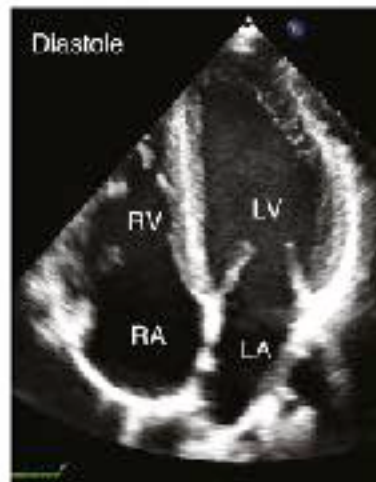
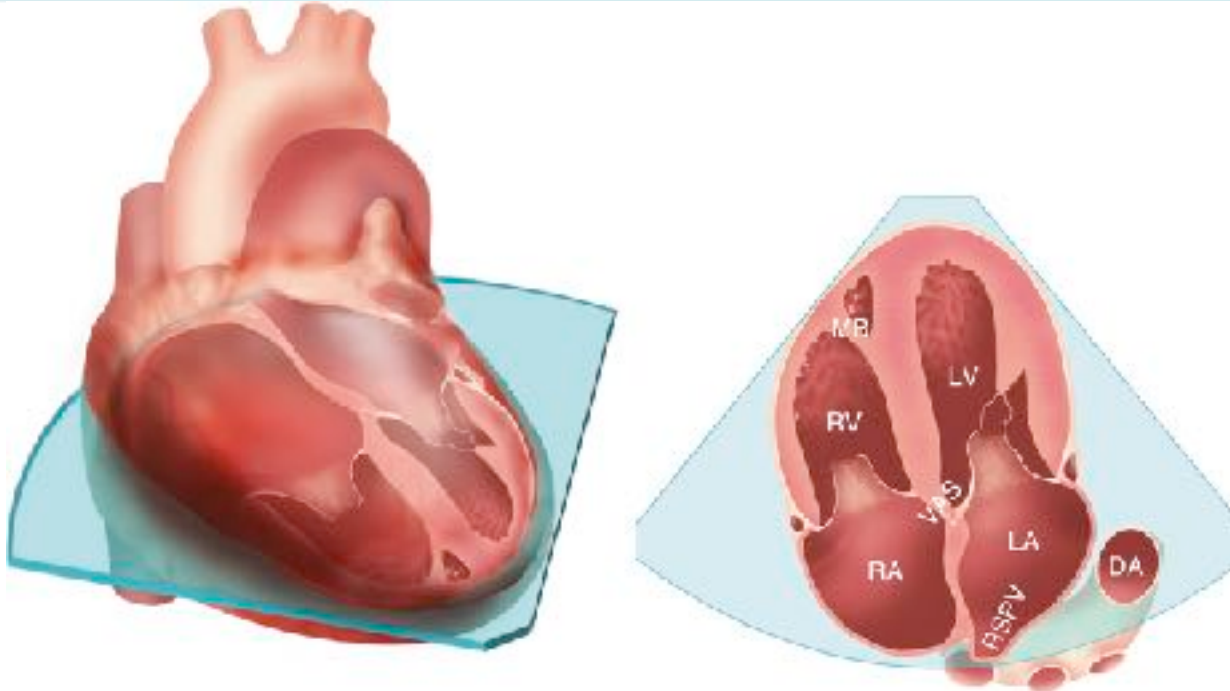


ult Echo
1
Hz
0cm

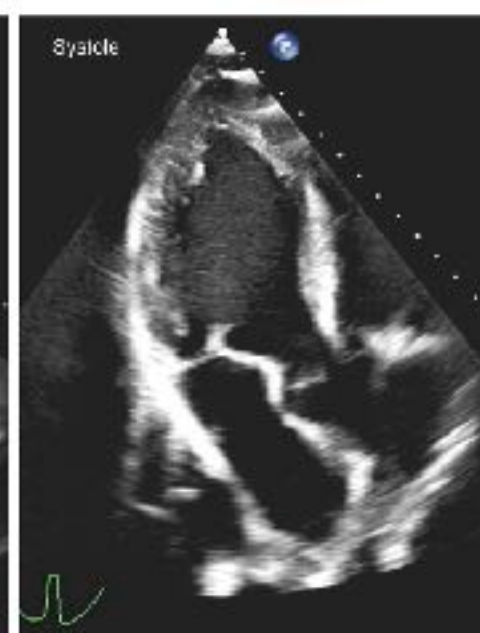
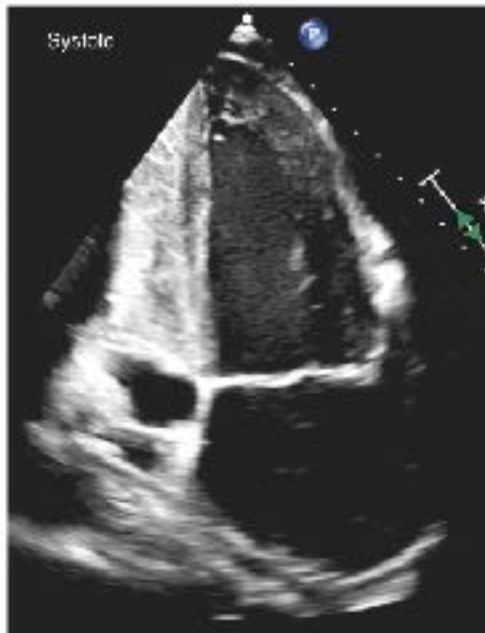
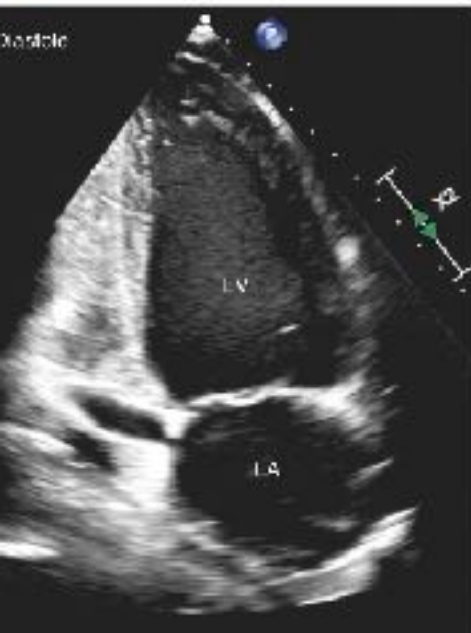
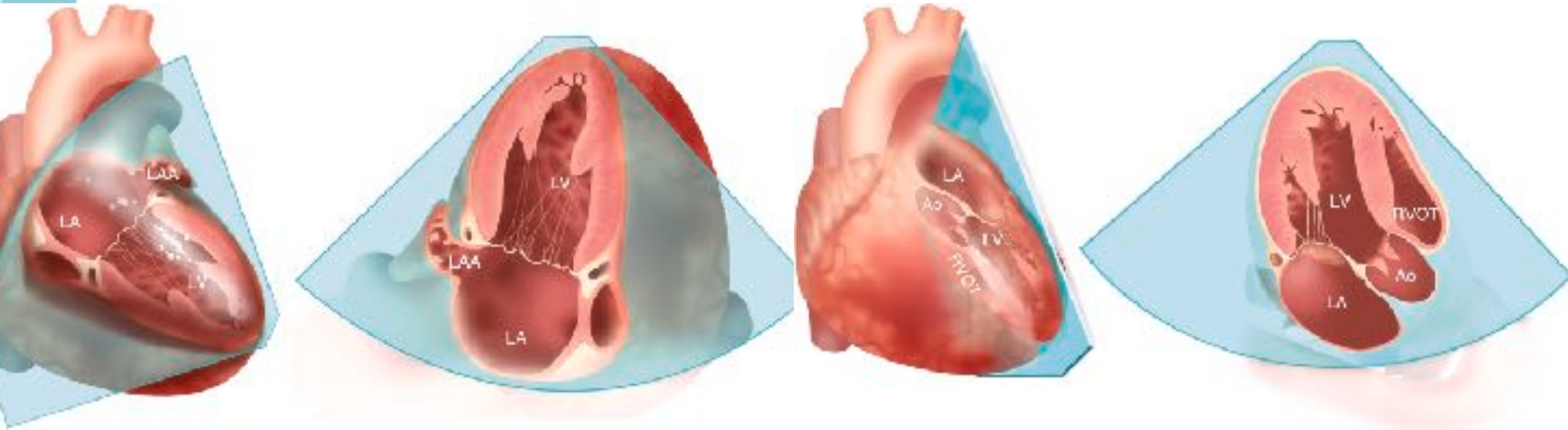
Gen
50
50
2/0

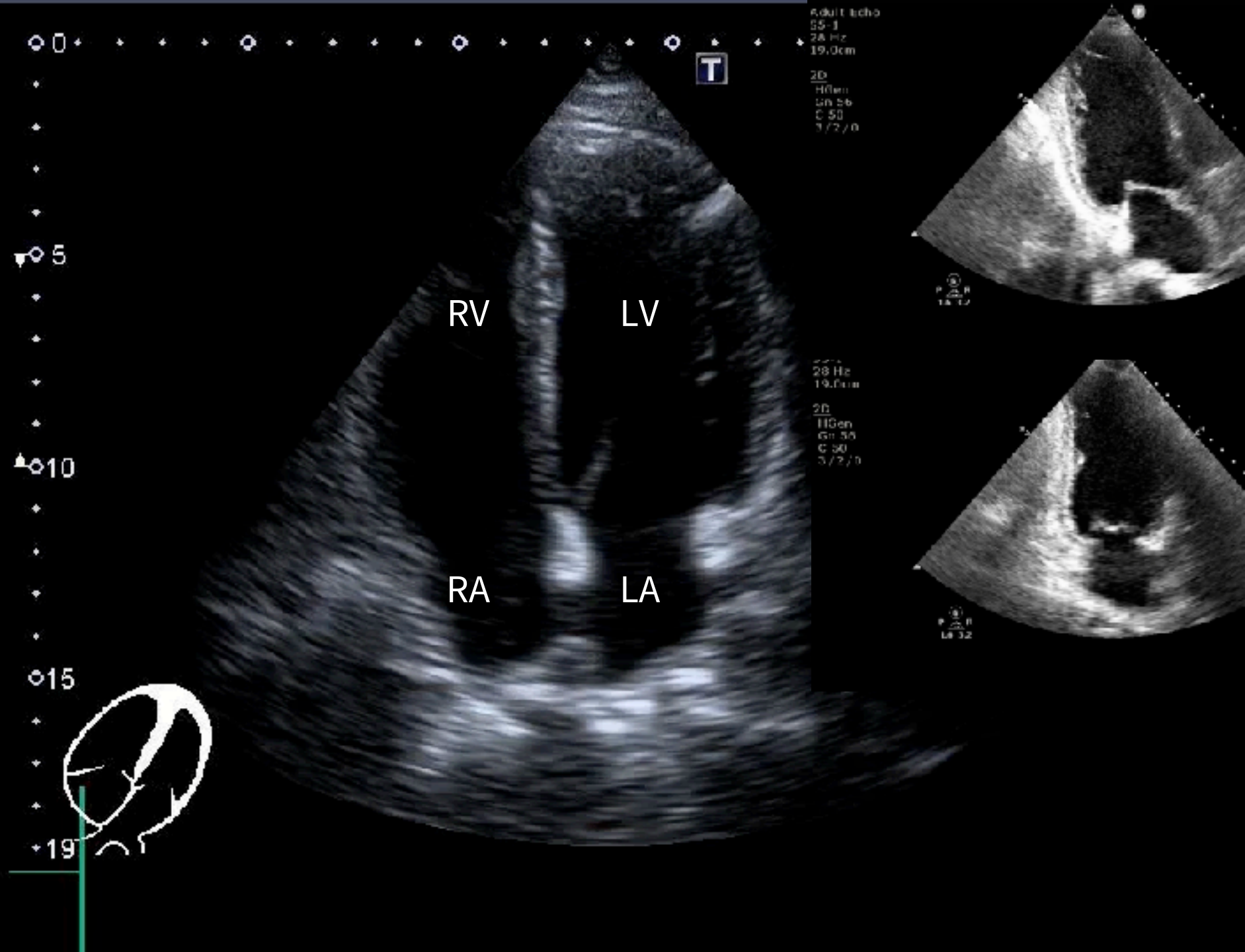


Apical 4 chamber view

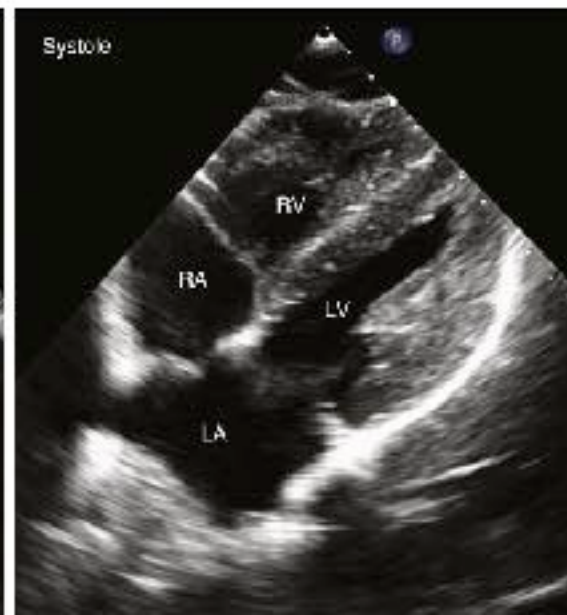
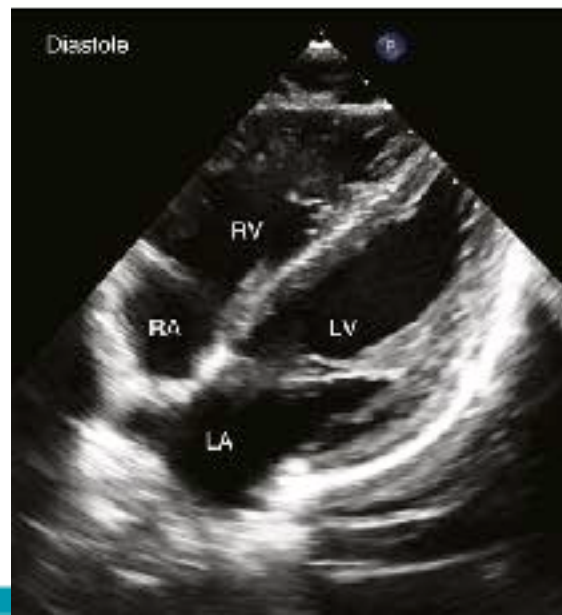
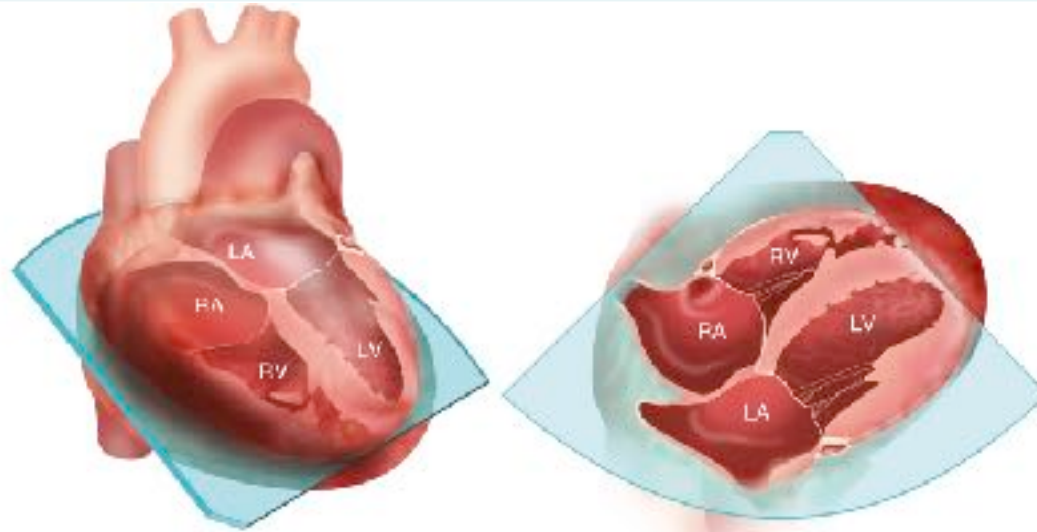


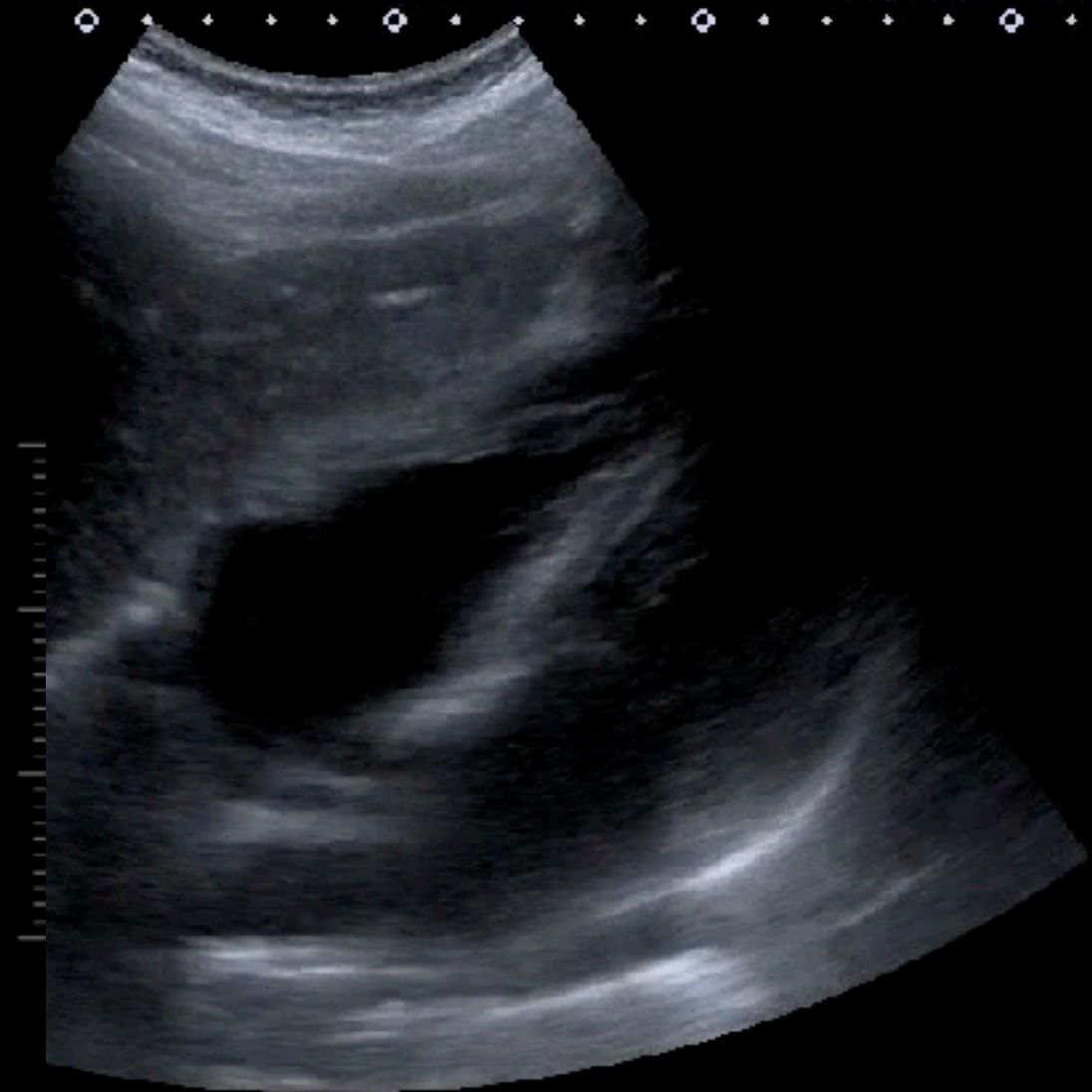
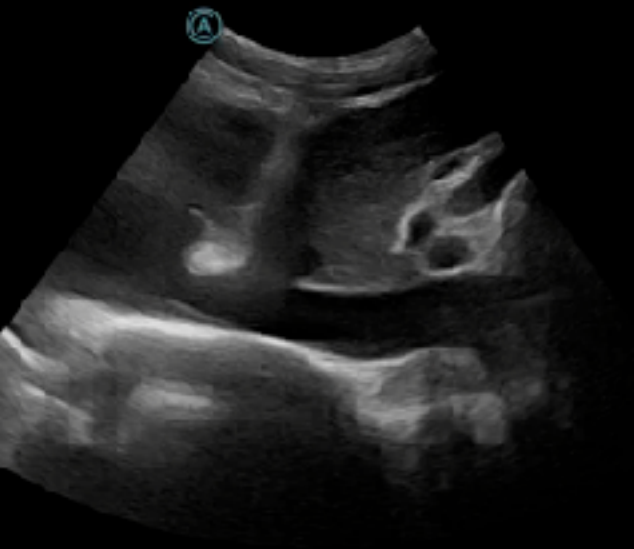
Apical 2 (60°)/3 (120°) chamber view



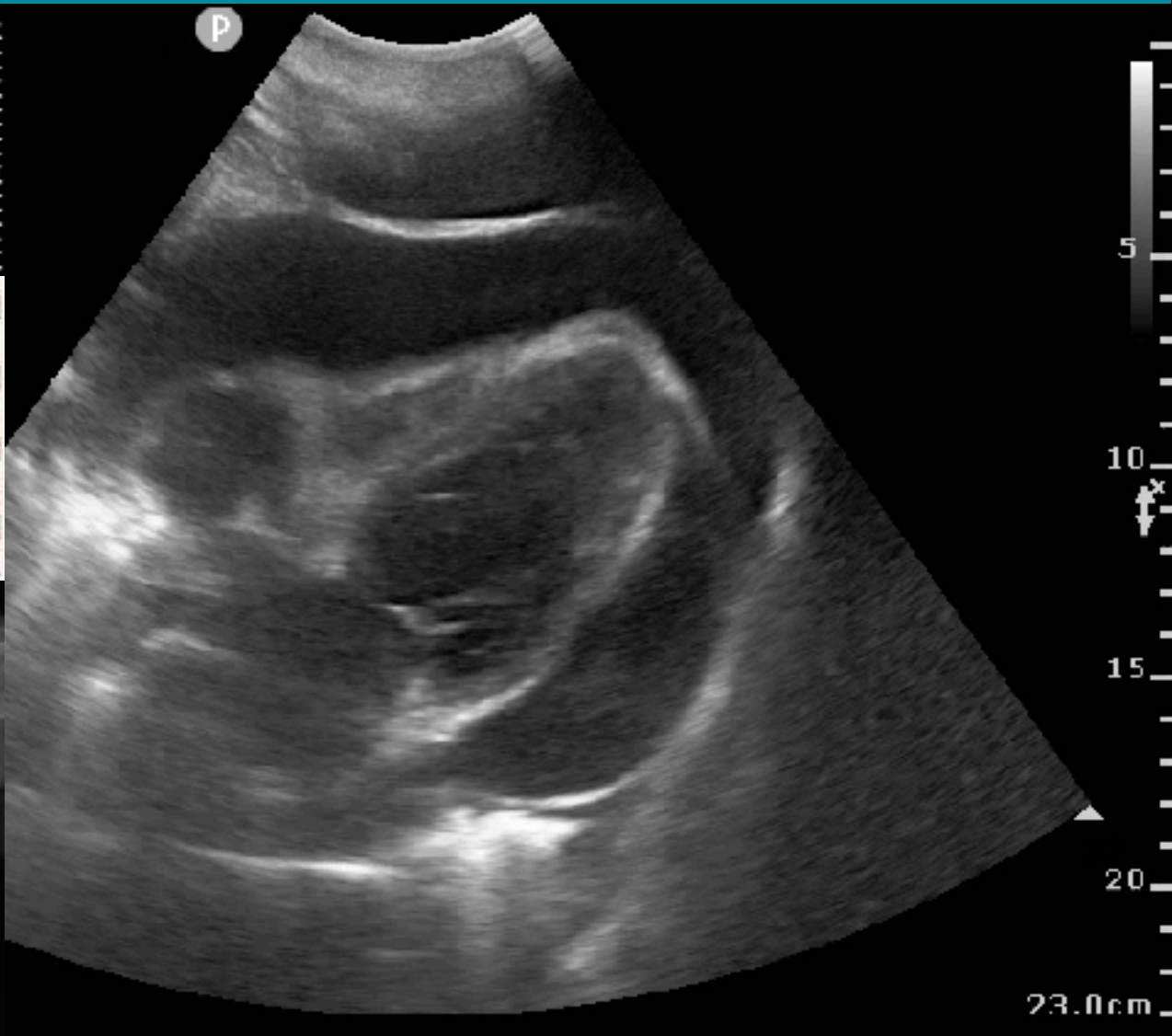


Subcostal 4 chamber

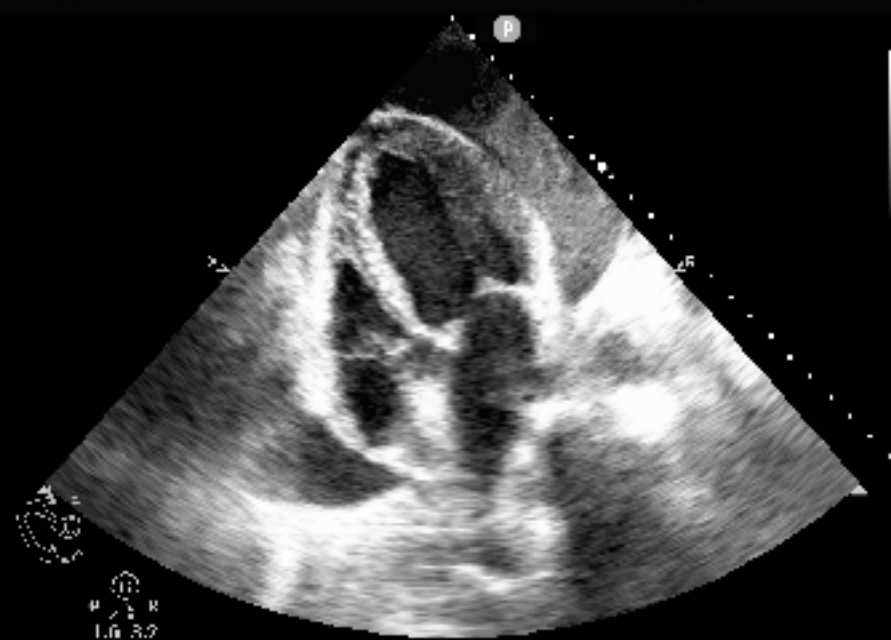




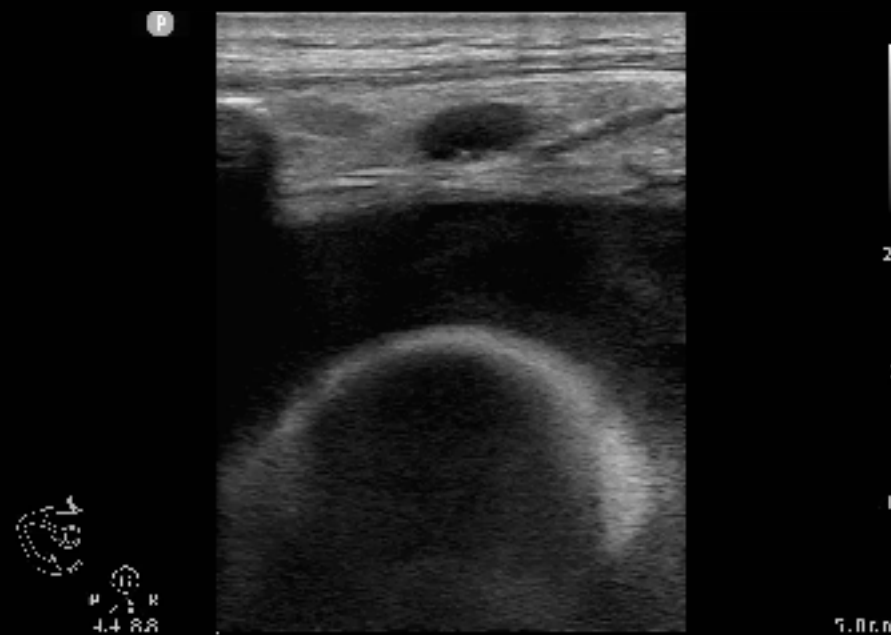
CARDIAC TAMPONADE



cho



cho



5.0 cm

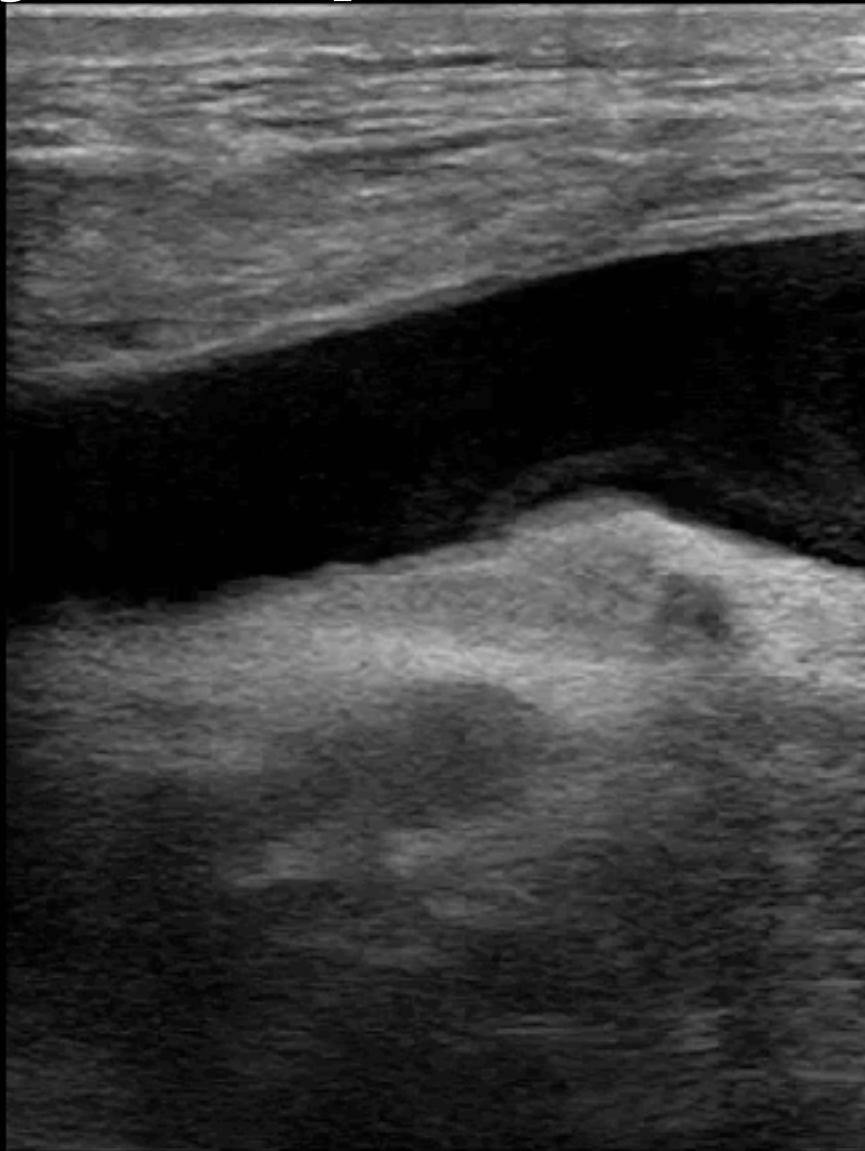
Step-by-step drainage

arterial
2-3
4 Hz
0cm

Q
Gen
in 66
41
/3/2

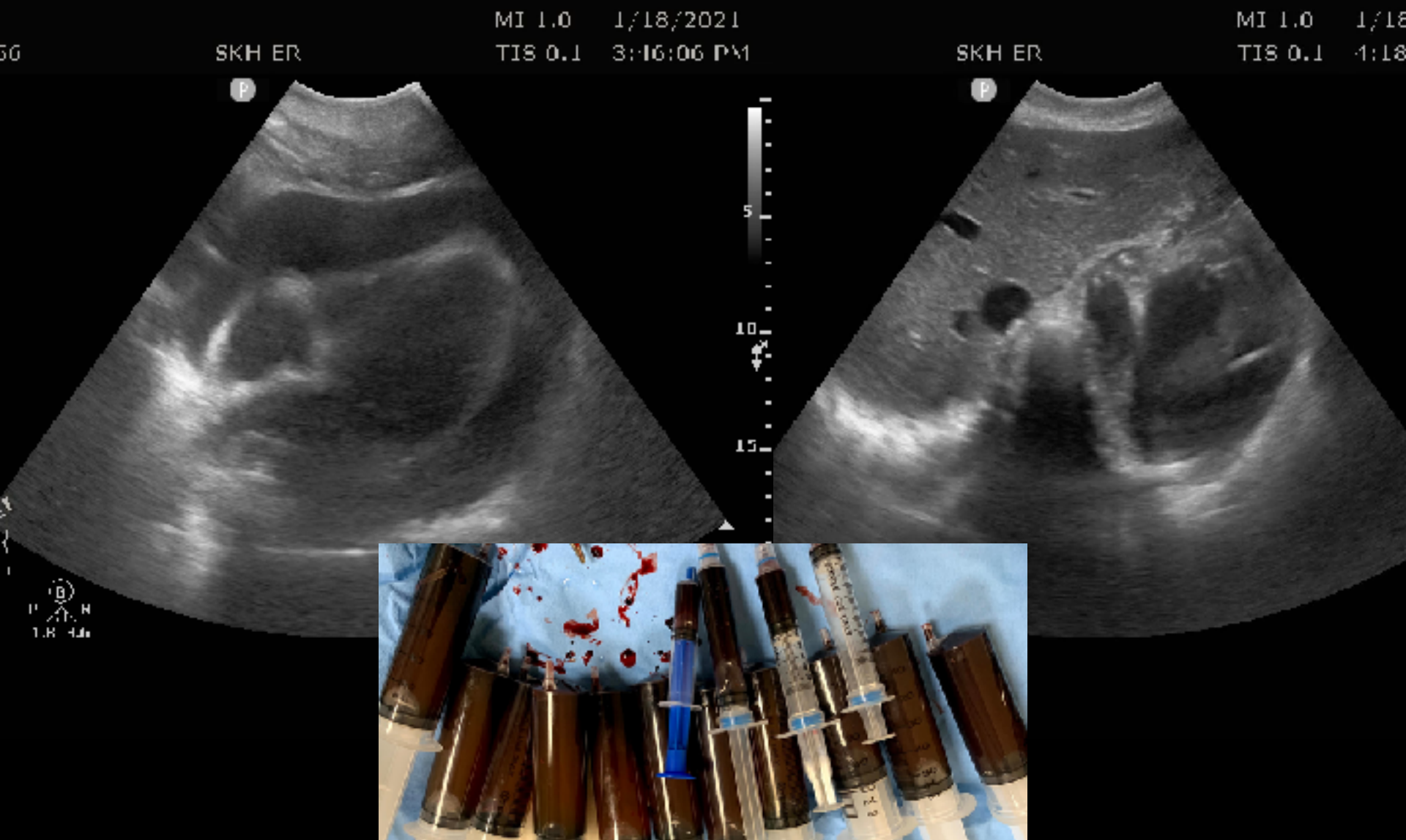


P G R
4.4 8.8

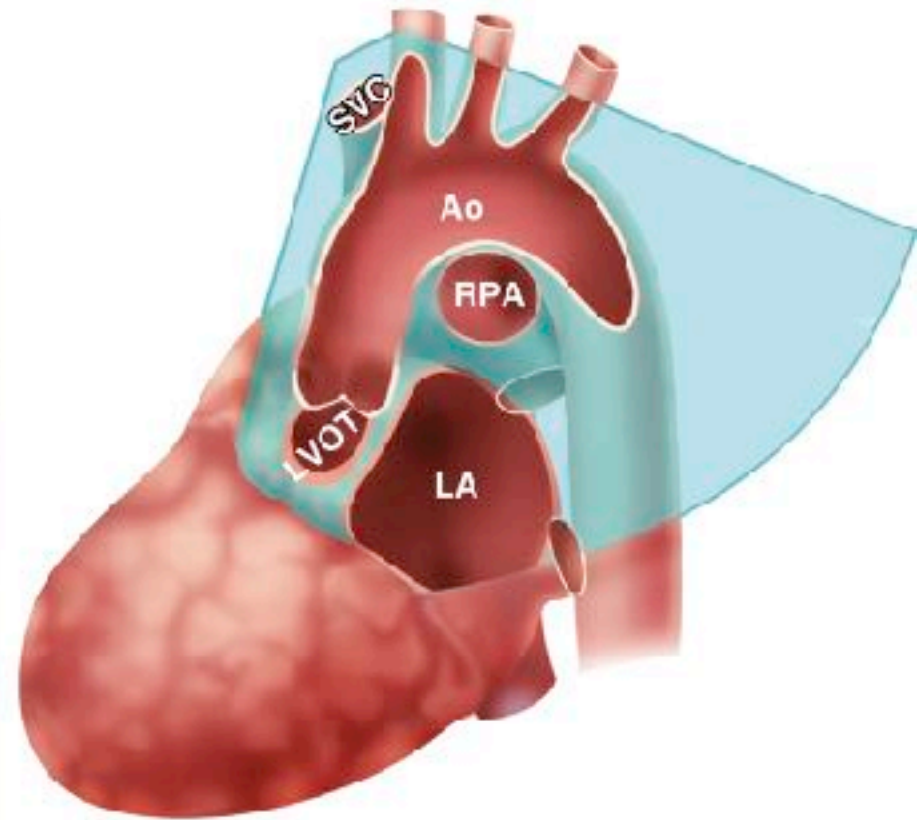
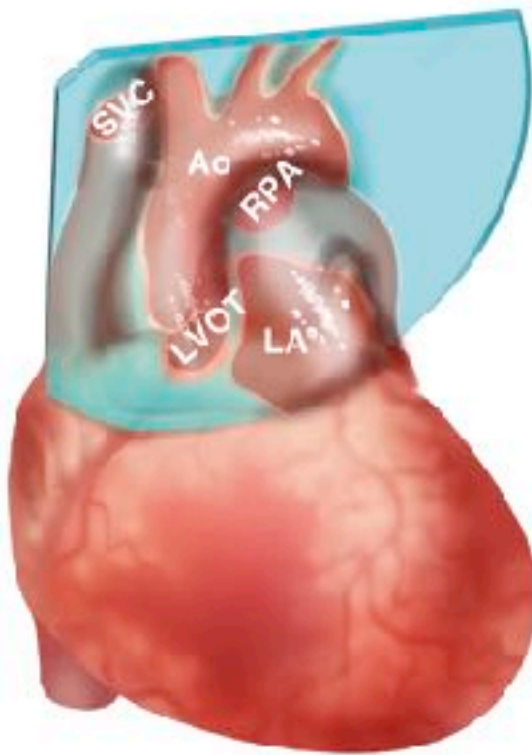


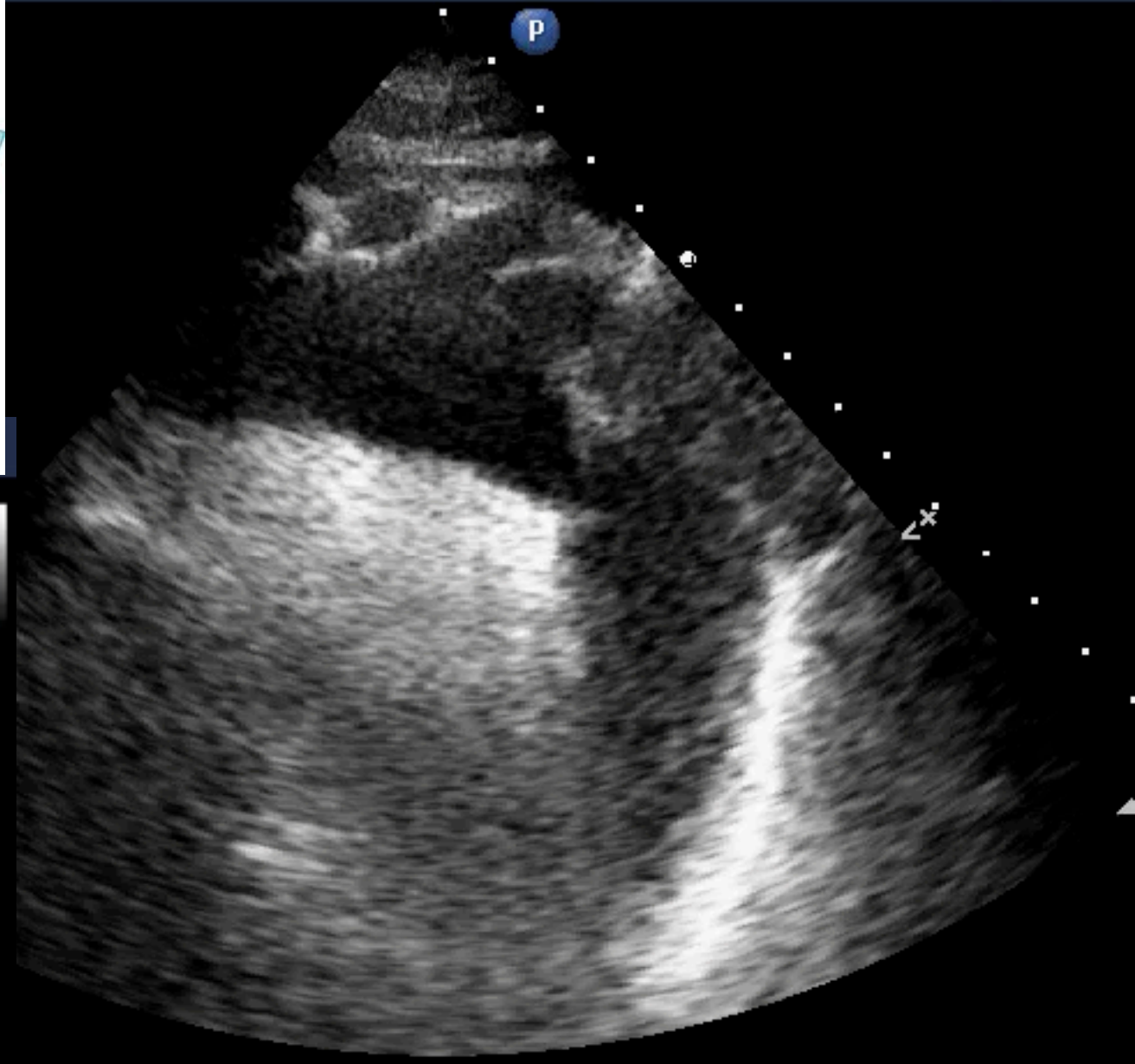
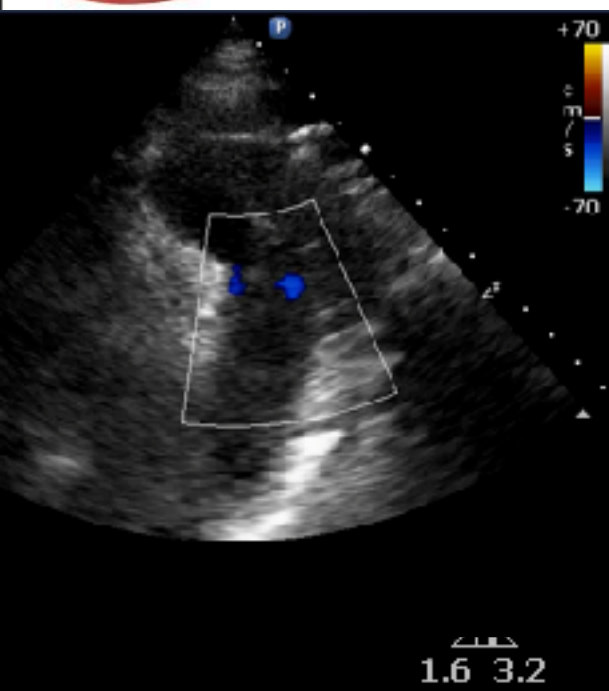
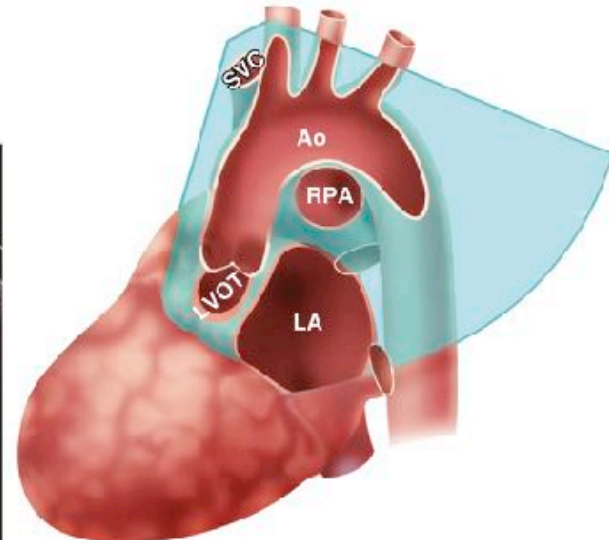
5.0cm

Monitor after drainage

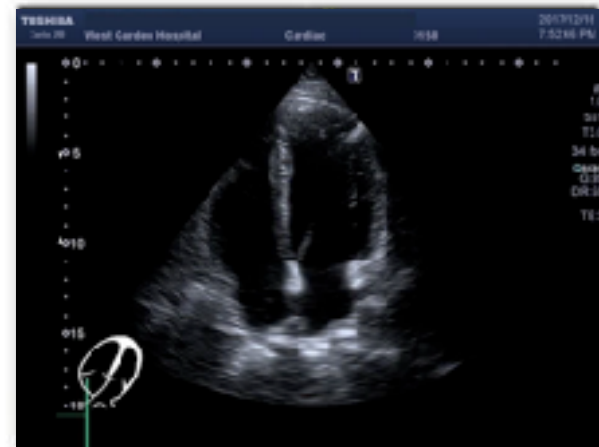
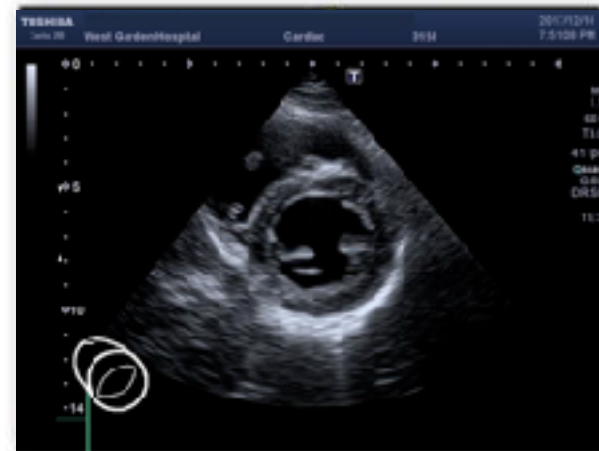
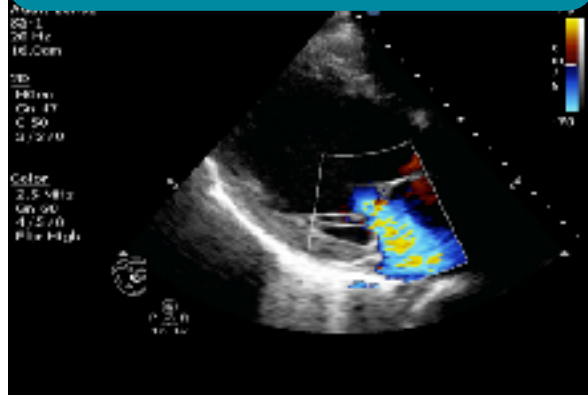


Suprasternal notch view





3W5V

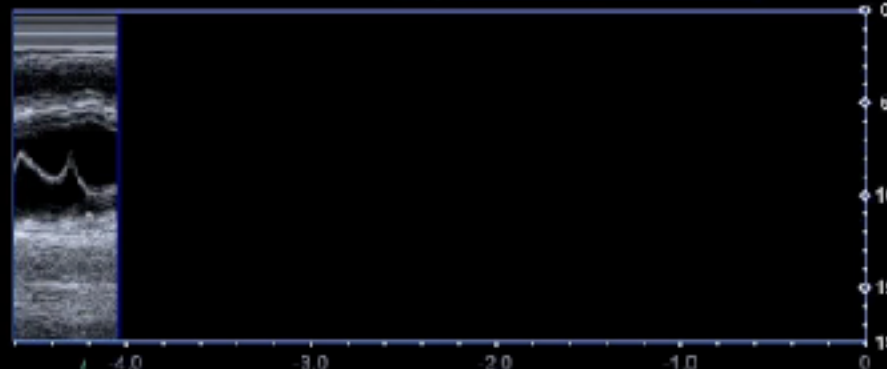


EPSS

6S1
G:91
DR:55
TE:3



6S1
T3.0
25 fps

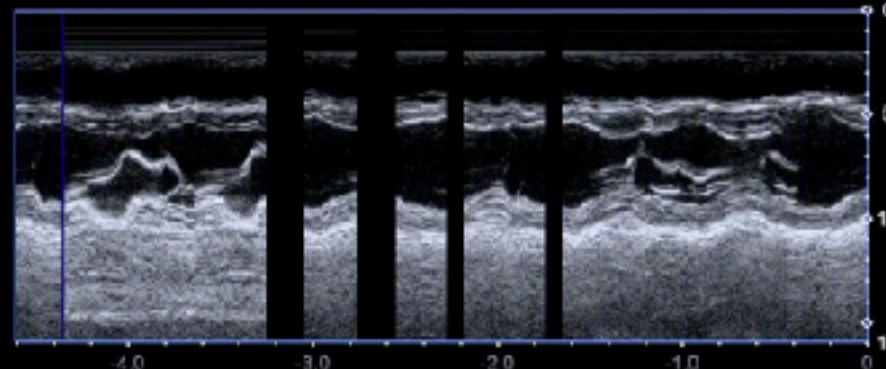


FS

6S1
G:92
DR:55
TE:3



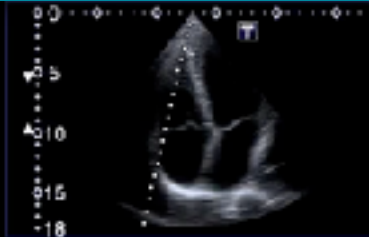
6S1
T3.0
32 fps



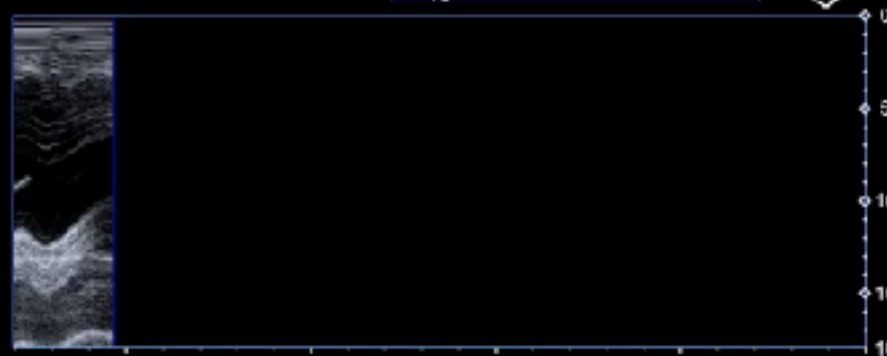
Cardiac POCUS - CCE

TAPSE

6S1
G:94
DR:55
TE:3



MI:1.5
6S1
T3.0
25 fps

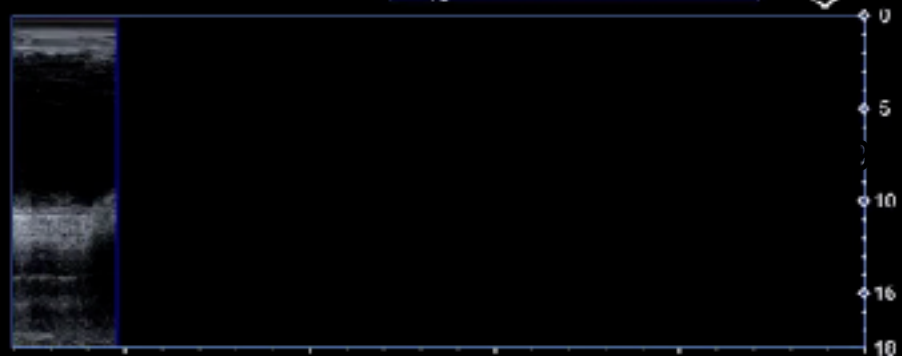


MAPSE

6S1
G:94
DR:55
TE:3

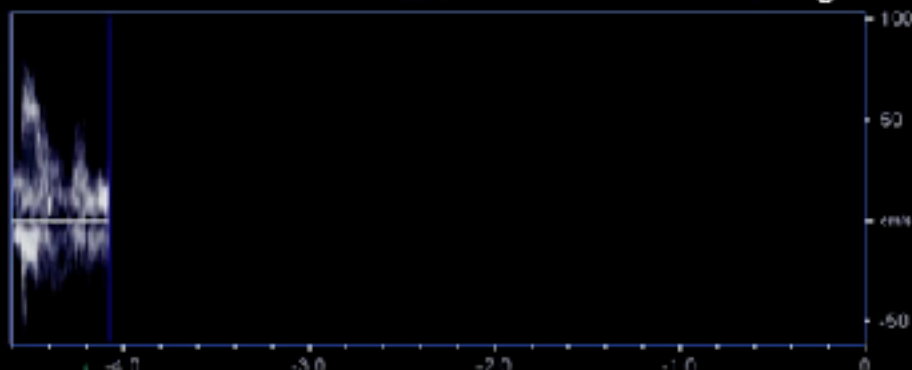


MI:1.5
6S1
T3.0
25 fps



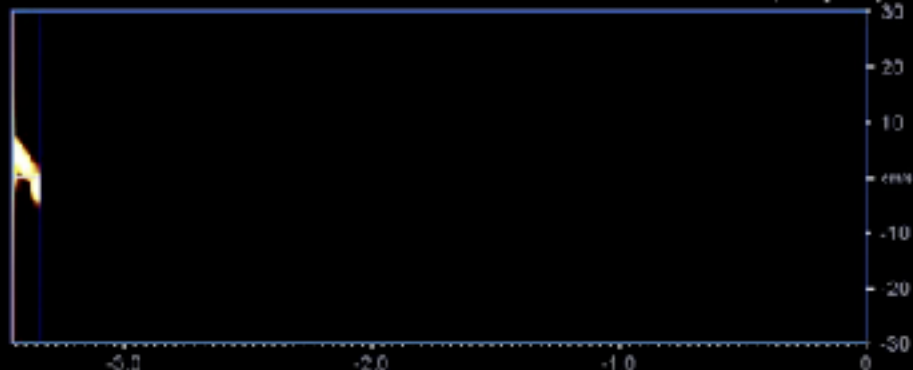
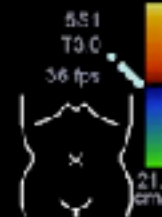
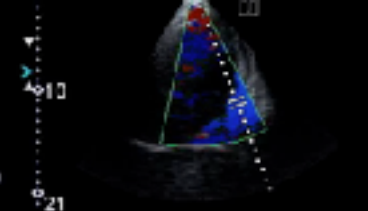
E/A

Qscan
G92
DR:55
TE:3
0° 3.0
9.0cm



TDI

Qscan
G96
DR:55
CF:2.5
G9:10
2.5h
T:0
0° 5.0
12.1cm



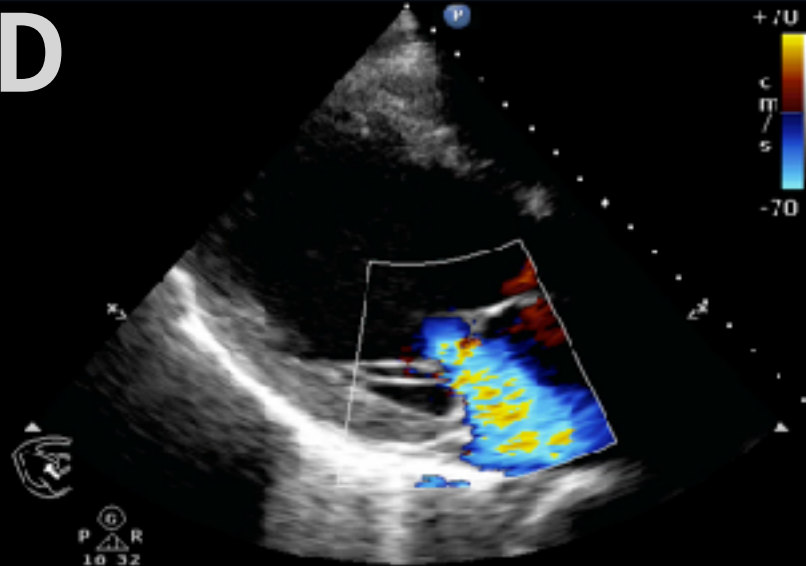
CCE

CD

adult body
S-1
0 Hz
6.0cm

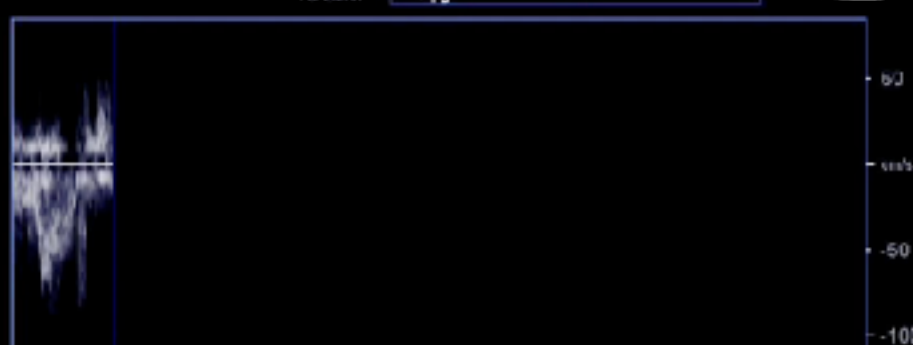
D
HGen
Gn 47
C: 50
3/2/0

color
2.5 MHz
Gn 60
4/5/0
Filtr High



VTI

Qscan
G93
DR:55
TE:3
0° 3.0
10.3cm



Goal of POCUS

Diagnostic Target	Goals of POCUS	Imaging Views	Limitations
LV size and function	- Estimate overall LV systolic function (normal, mildly, moderately, or severely reduced). - Estimate LV size (relative to size of aortic root).	- Parasternal long- and short-axis views of LV - Apical 4-chamber	- Quantitative measurement of LV ejection fraction is rarely possible. - Evaluation of regional wall motion requires considerable expertise but may be suggested by FoCUS findings.
RV size and function	- Estimate RV systolic function. - Detect RV dilation.	- Apical 4-chamber view - Subcostal view	Complex RV shape limits evaluation of size and systolic function.
Pericardial effusion	- Detect pericardial effusion. - Estimate effusion size (small, moderate, large).	- Parasternal - Apical - Subcostal	- Loculated effusions may be missed. - Tamponade physiology is a clinical diagnosis that should be considered for all moderate or large effusions.
Volume status	Evaluate central venous pressure.	IVC size and respiratory variation from subcostal view (RA pressure)	Unreliable in ventilated patients
Other	More complex anatomic and physiologic abnormalities may be suspected on a POCUS study.	All views	A diagnostic echocardiogram is recommended when regional wall motion abnormalities are a concern, to evaluate for aortic disease, valve stenosis, or regurgitation, or to estimate pulmonary pressures.

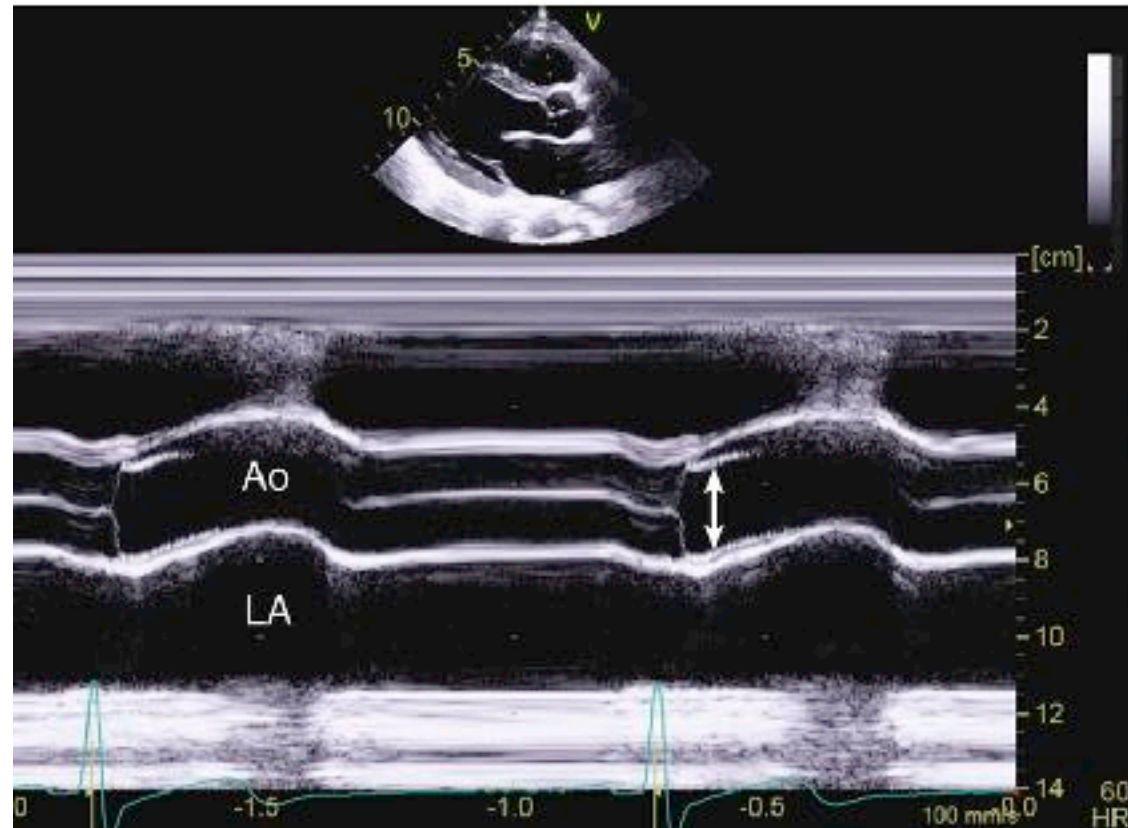
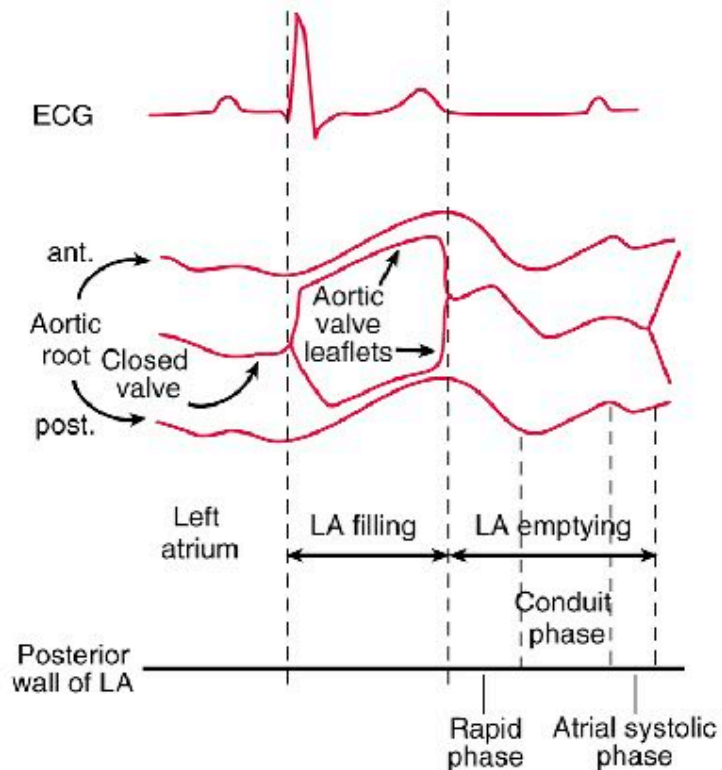
FoCUS, Focused cardiac ultrasound; IVC, inferior vena cava.

From McConaughy S, Otto CM: Focused cardiac ultrasound at the bedside. In Otto CM, editor: *The practice of clinical echocardiography*, ed 6, Philadelphia, 2022, Elsevier, pp 234–249.

Aortic valve & Left atrium (4cm)



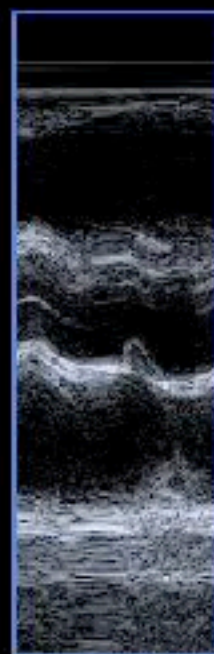
Aortic Valve and Left Atrial M-Mode



G:82
DR:55
TE:3



MI:1.5
5S1
T3.0
32 fps



-4.0

-8.0

-2.0

-1.0

0

5

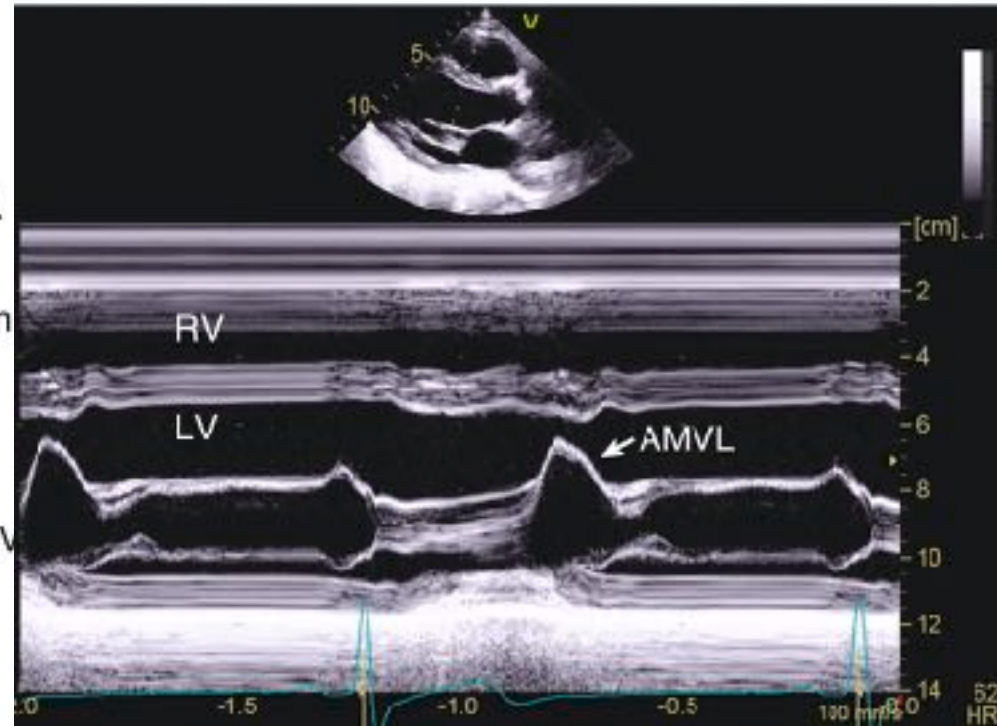
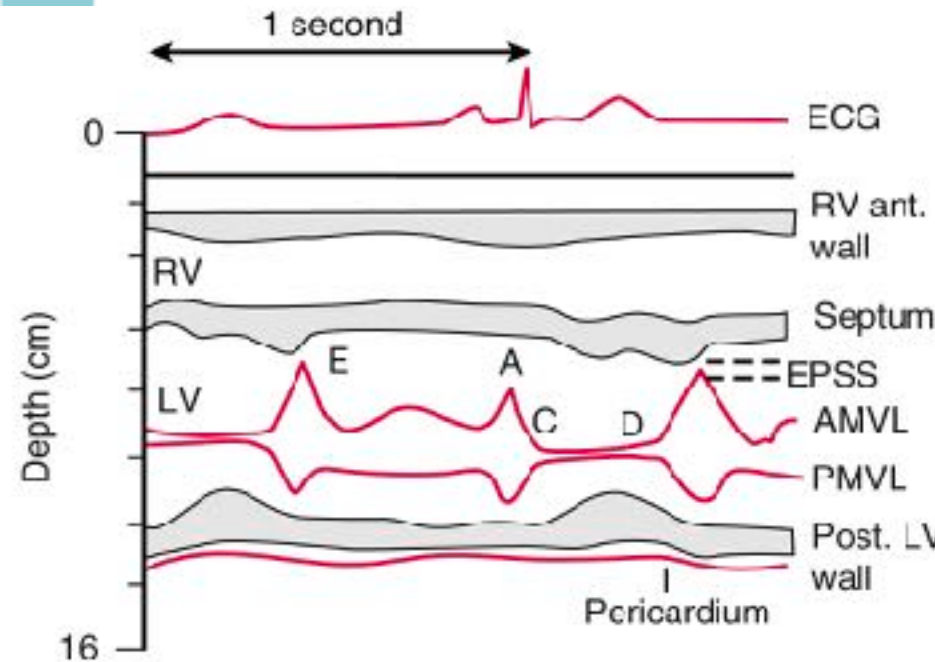
10

16

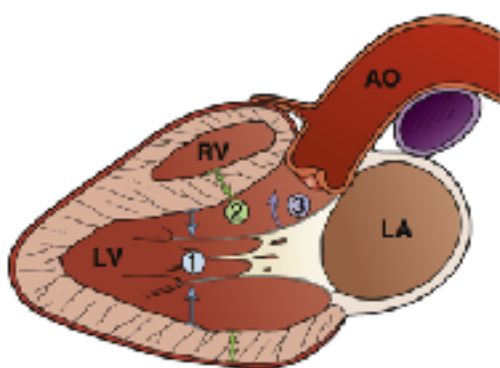
MG:77 /MDR:50 /T3.0

Mitral valve

EPSS: E-point to septal separation

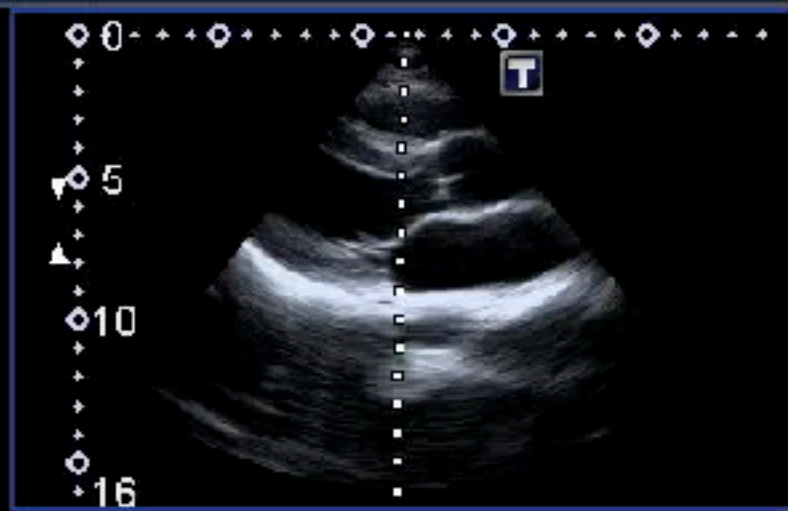


E-point septal separation $> 7\text{mm}$: LVEF $< 50\%$
 E-point septal separation $> 10\text{mm}$: LVEF $< 30\%$

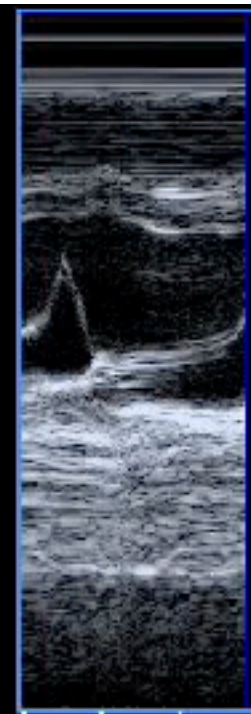


- 1 - Endocardial excursion
- 2 - Myocardial thickening
- 3 - Septal motion of anterior leaflet of mitral valve

G:82
DR:55
TE:3

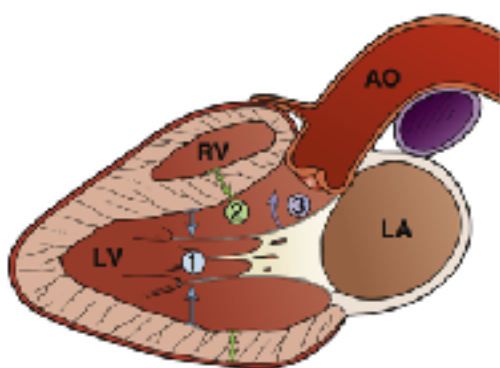


MI:1.5
5S1
T3.0
32 fps



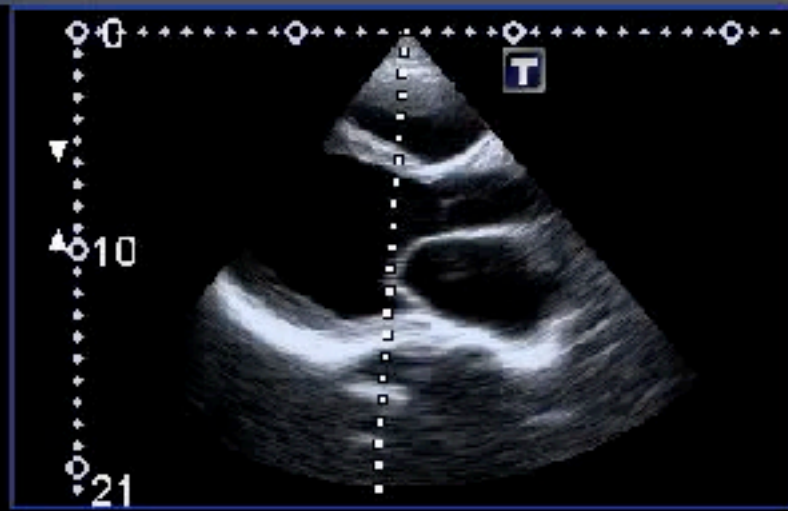
MG:77 / MDR:50 / T3.0



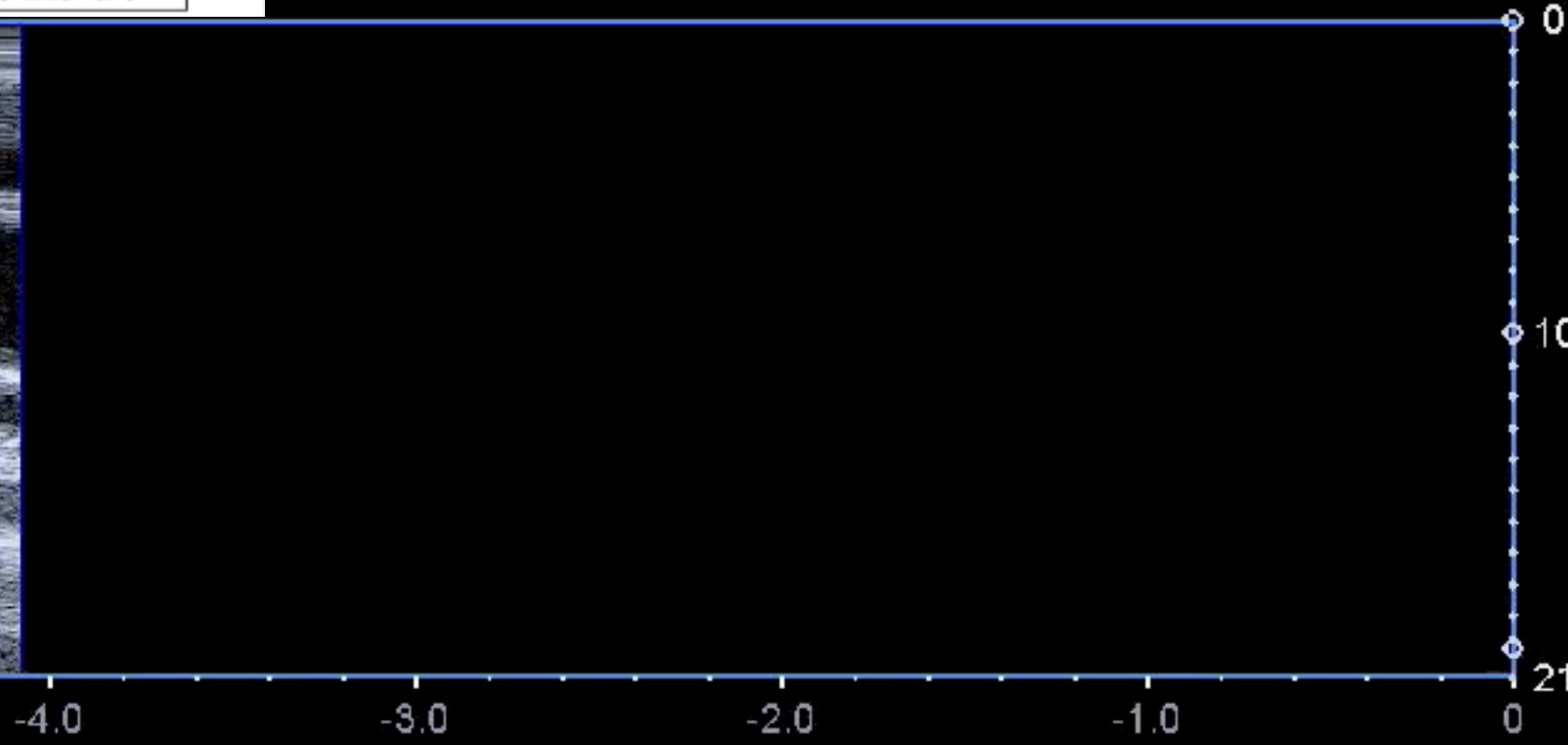


- 1 - Endocardial excursion
- 2 - Myocardial thickening
- 3 - Septal motion of anterior leaflet of mitral valve

Qscan
G:95
DR:55
TE:3



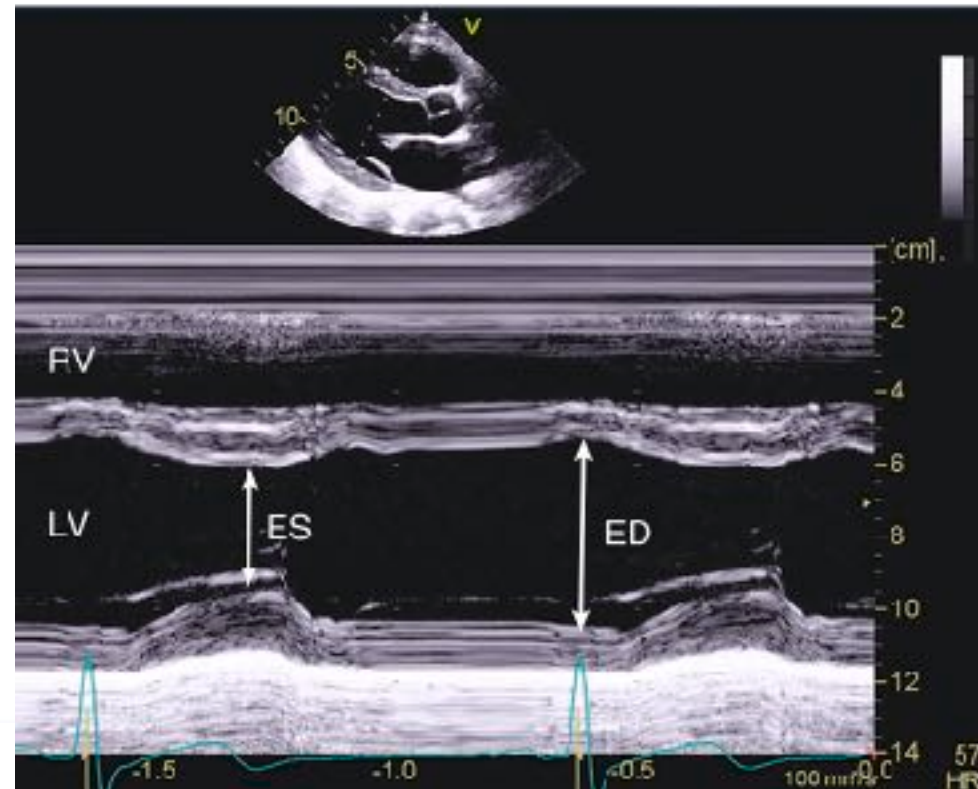
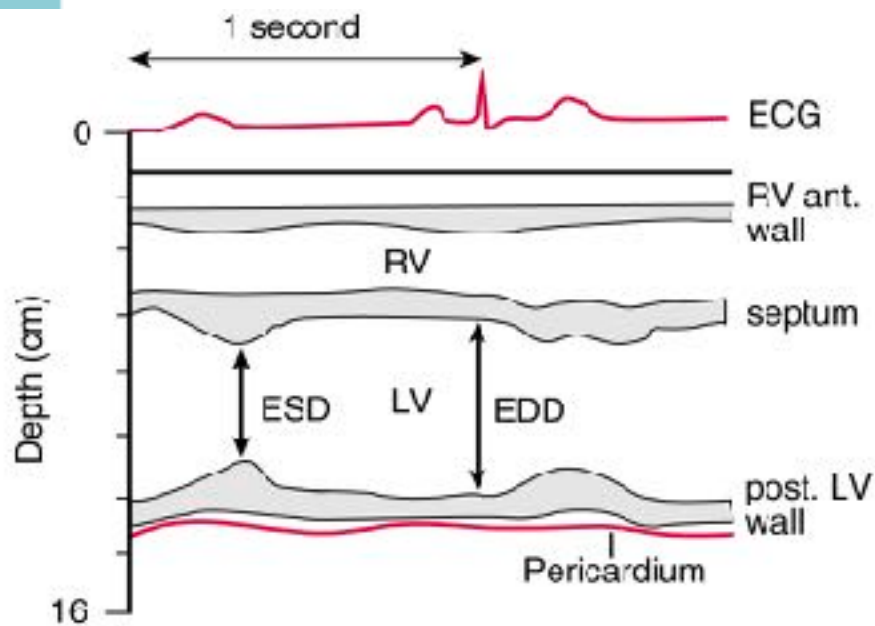
MI:1.5
5S1
T3.0
19 fps



Qscan:90 / MDR:50 / T3.0

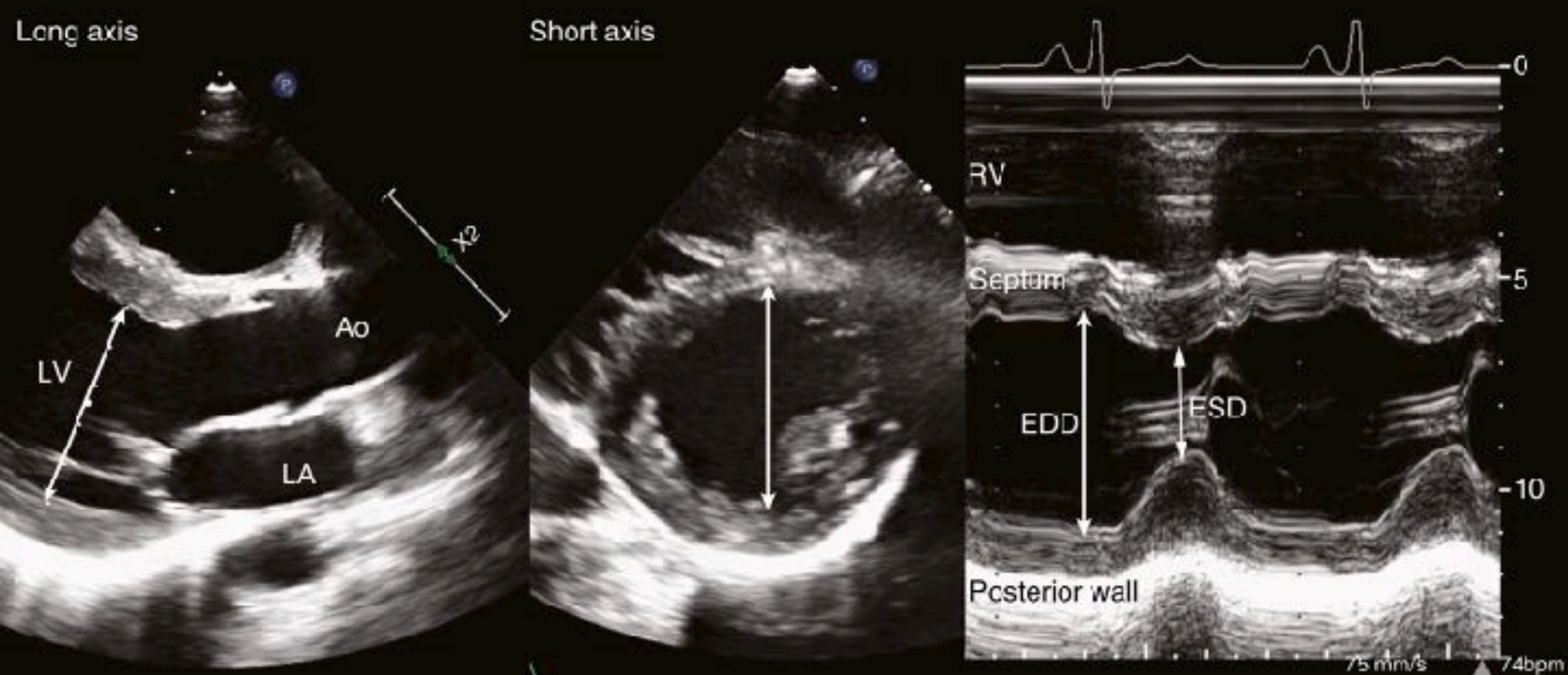
Left ventricle dimension

$EF \sim 2FS / RV \text{ free wall motion}$



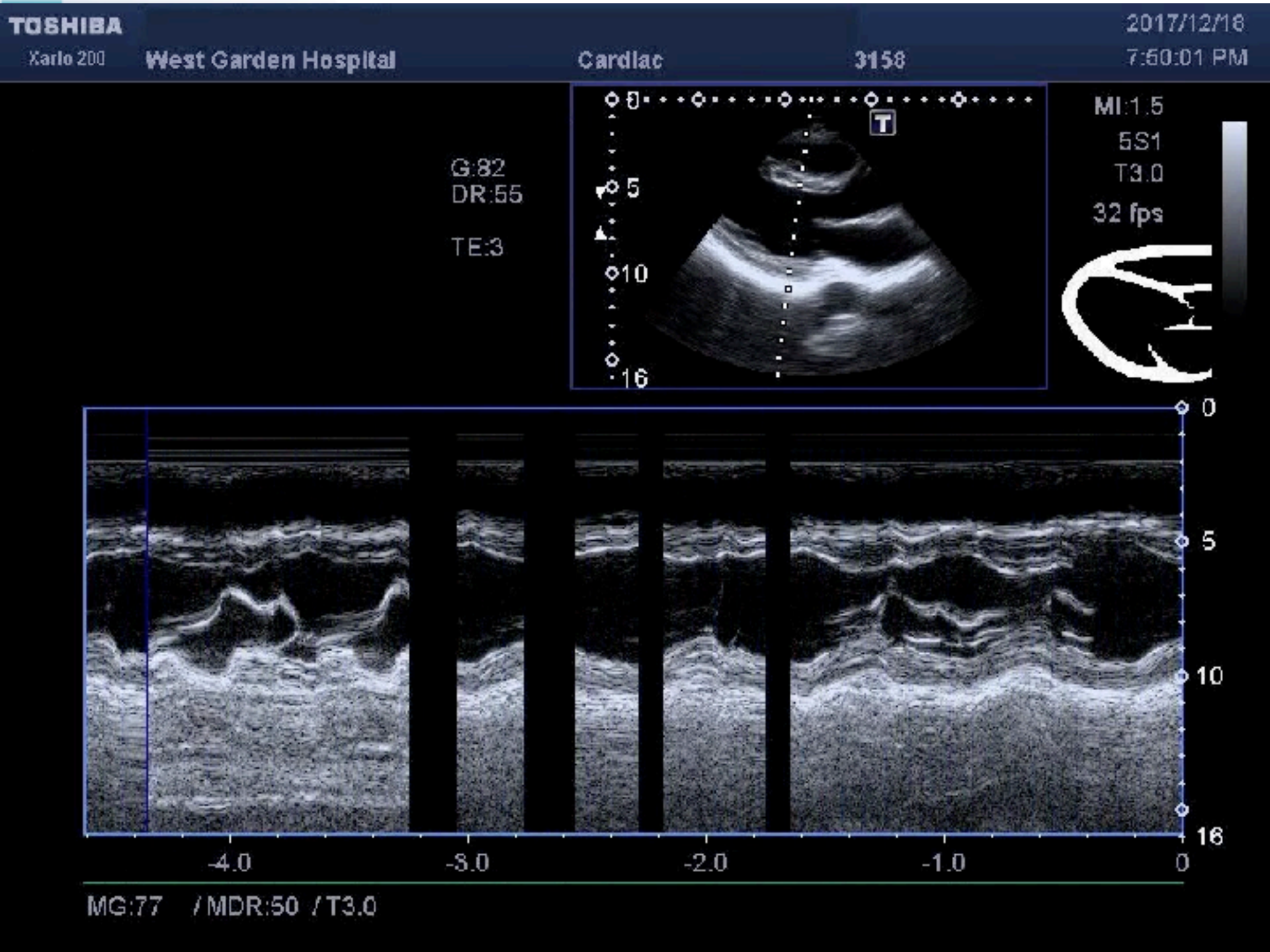
FS: fractional shortening

$(LVIDd - LVIDs) / LVIDd * 100\% (25 \sim 45\%)$



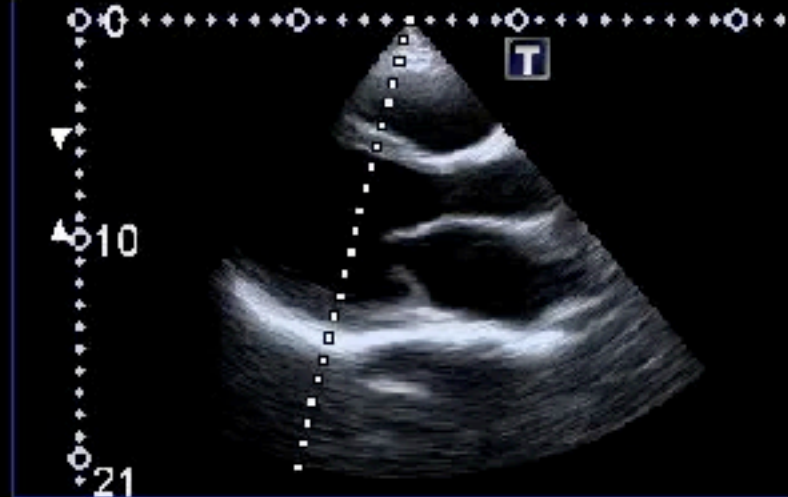
要垂直LV







Qscan
G:95
DR:55
TE:3



MI:1.5
5S1
T3.0
19 fps



-4.0

-3.0

-2.0

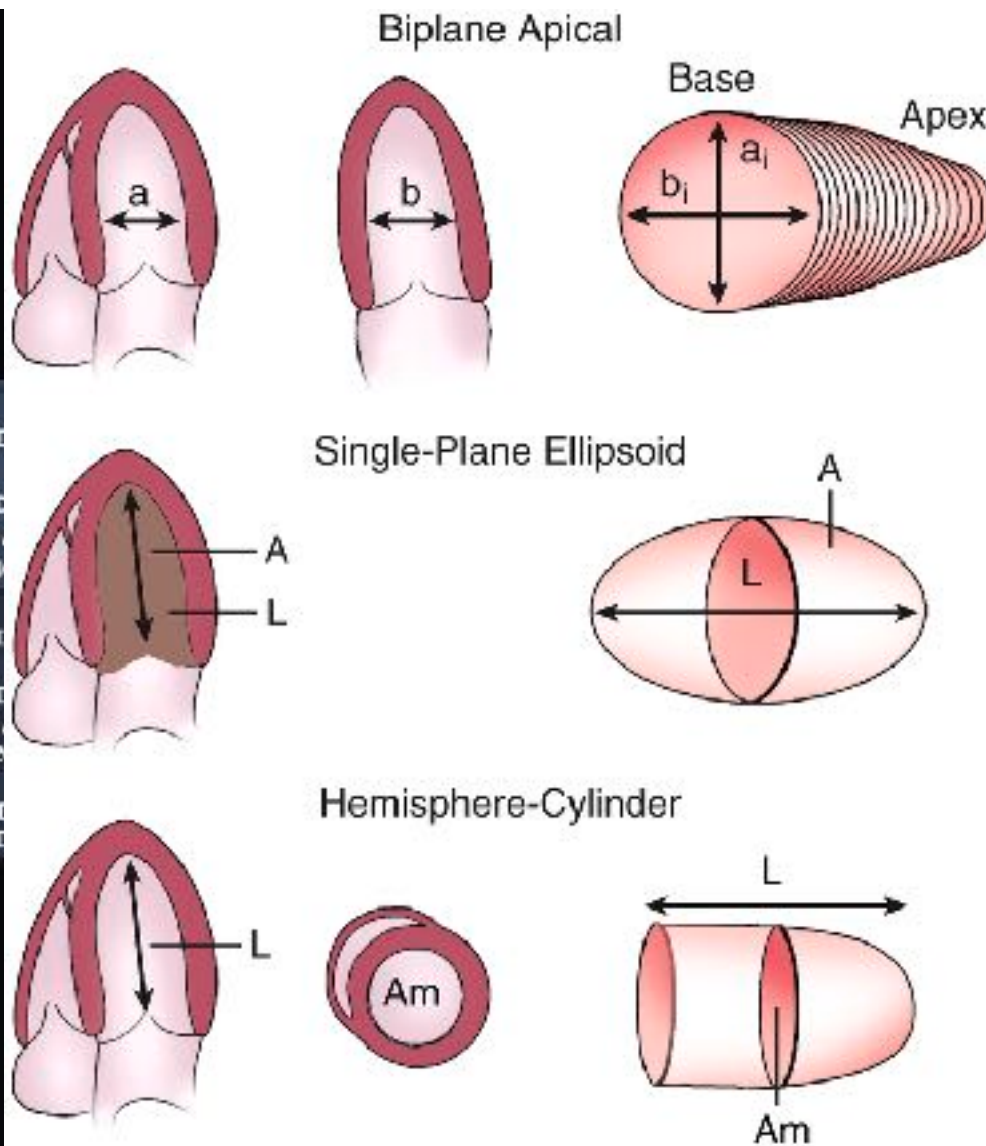
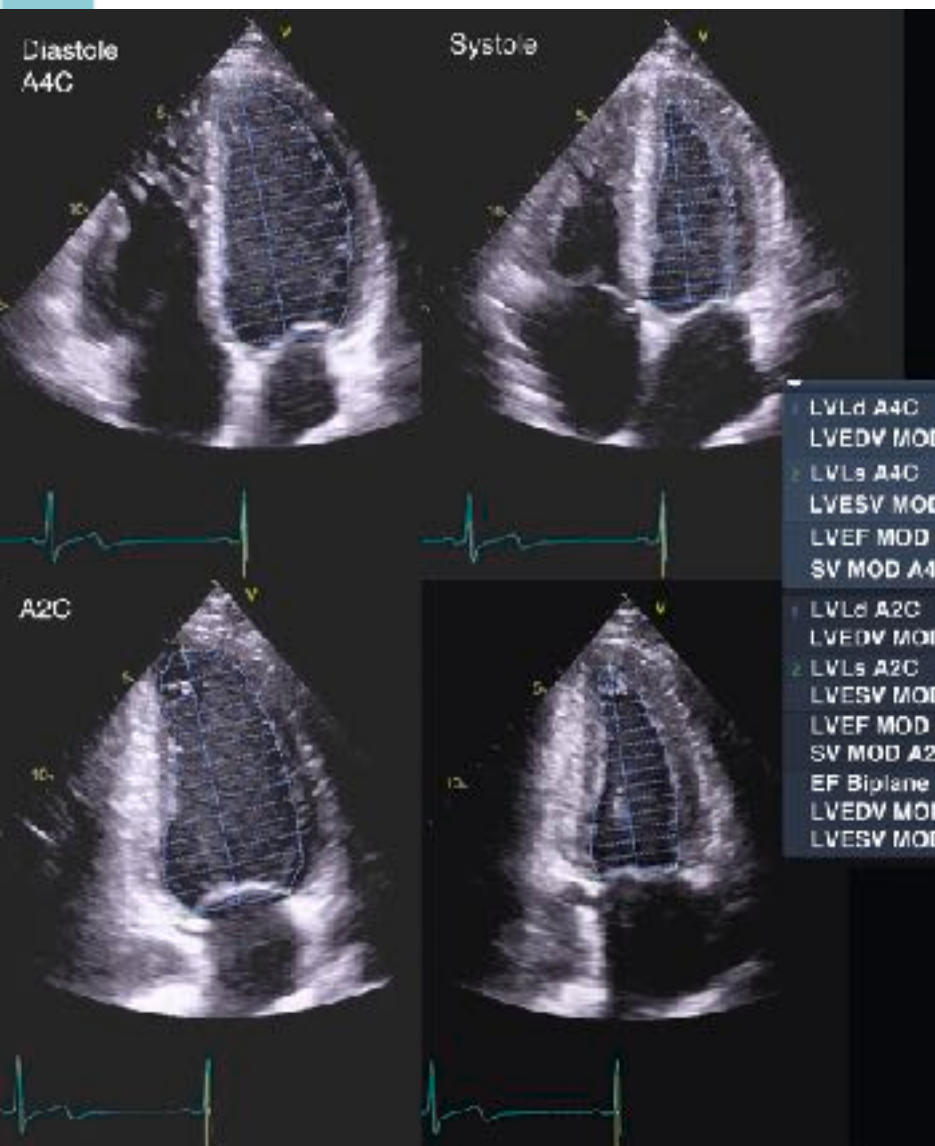
-1.0

0

Qscan:90 / MDR:50 / T3.0

2D LV

Volume calculation (ER耗时)

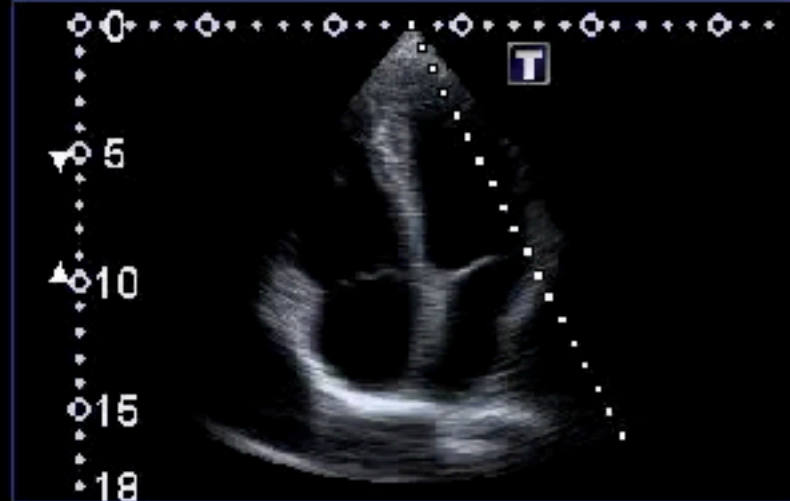


MAPSE

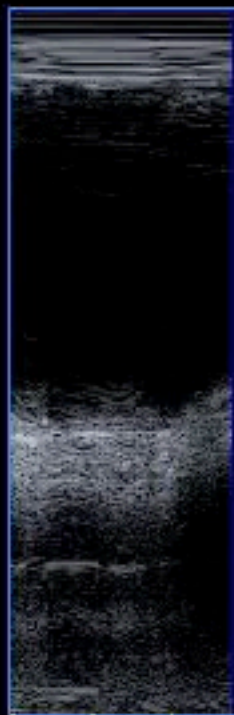
Mitral annular plane
systolic excursion
12-15 mm

> 10 : preserved LV
< 8 : EF < 50%

Qscan
G:94
DR:55
TE:3



MI:1.5
5S1
T3.0
25 fps

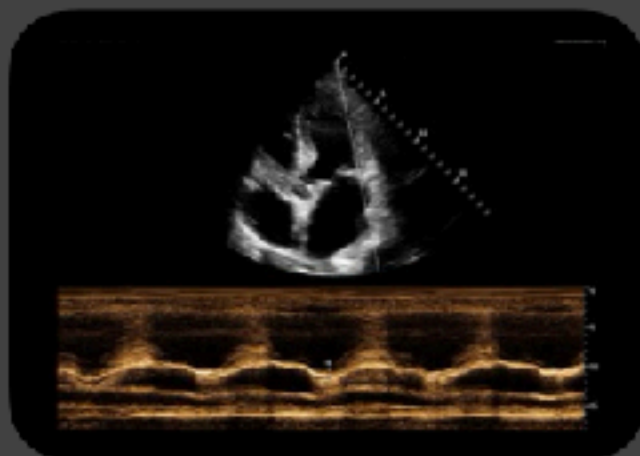


Qscan:89 / MDR:50 / T3.0



1
5
8

MAPSE



RESULTS

	Sensitivity	Specificity	+LR	-LR
MAPSE	42%	89%	3.9	0.65

Inter-rater reliability of MAPSE was 96.7%.

When EPSS, MAPSE, & visual estimation were all abnormal, MAPSE was 94% specific.

QUESTION

Does an emergency physician (EP) measured MAPSE predict a decreased LVEF compared to reference comprehensive echo?

METHODS

Single center, prospective observational cohort. Convenience sample of ED patients with expected acute heart failure. Comprehensive echo done within past 12 months or 3 months after ED visit.

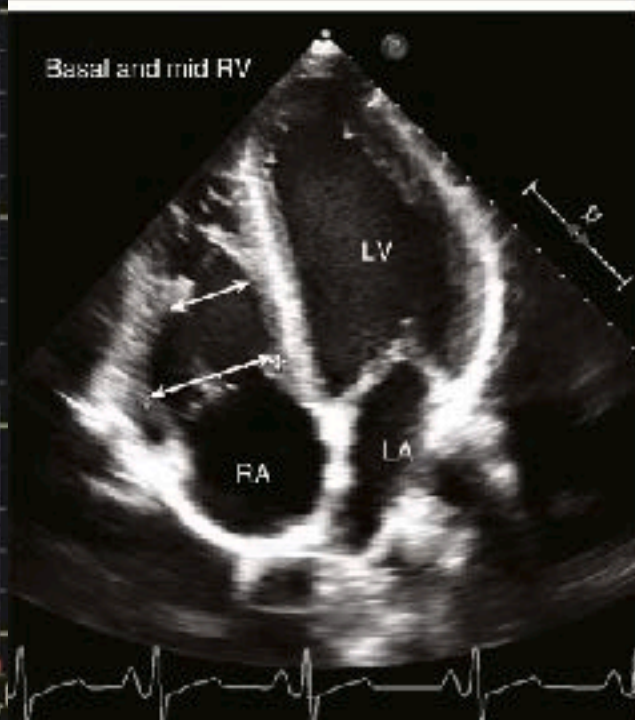
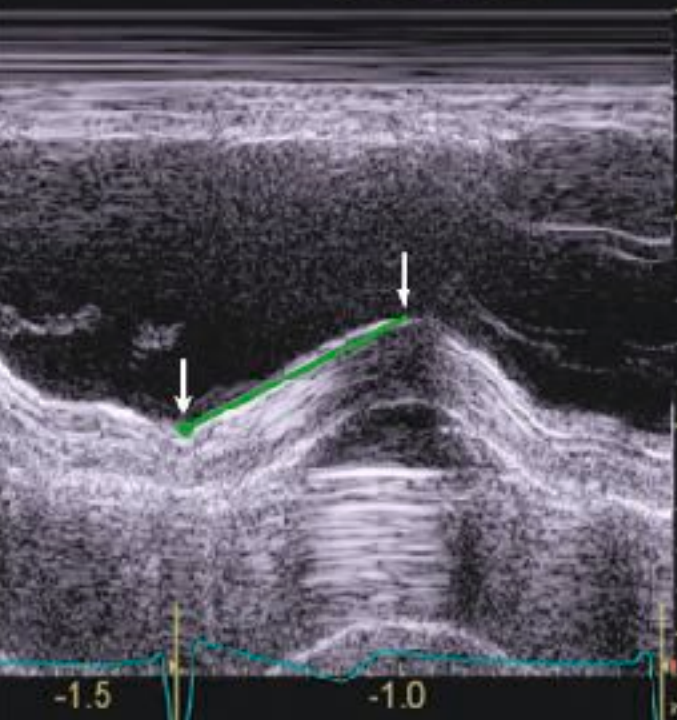
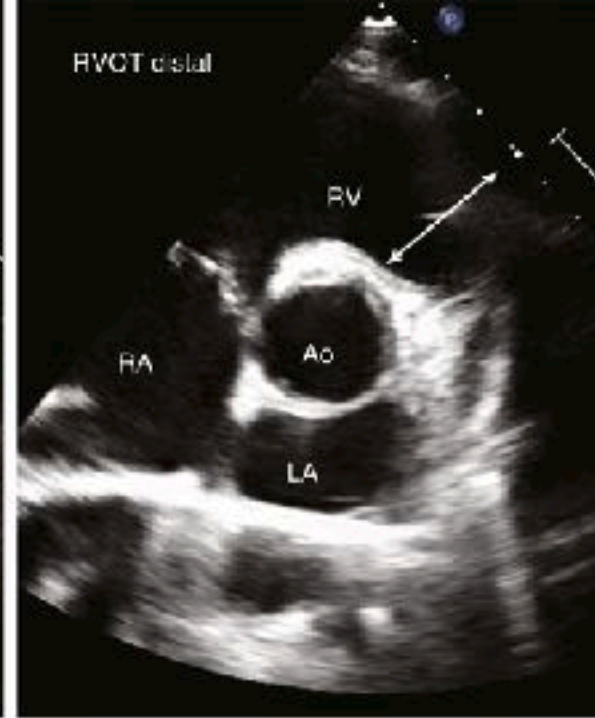
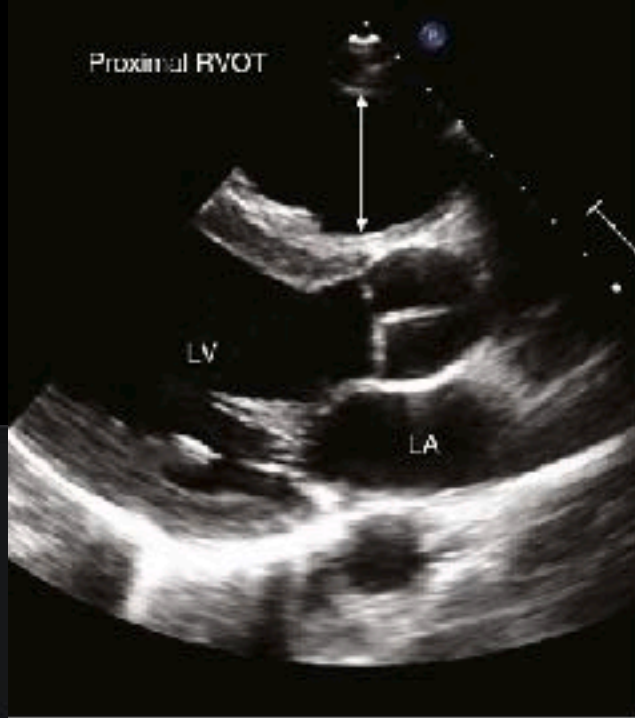
1° outcome: Performance of EP measured MAPSE <8mm for detecting <50% LVEF on comprehensive echo

2° outcomes: Inter-rater reliability, test performance compared to EPSS and visual estimation, correlation with cardiac biomarkers.

N=61

TAPSE

Tricuspic annular plane
systolic excursion



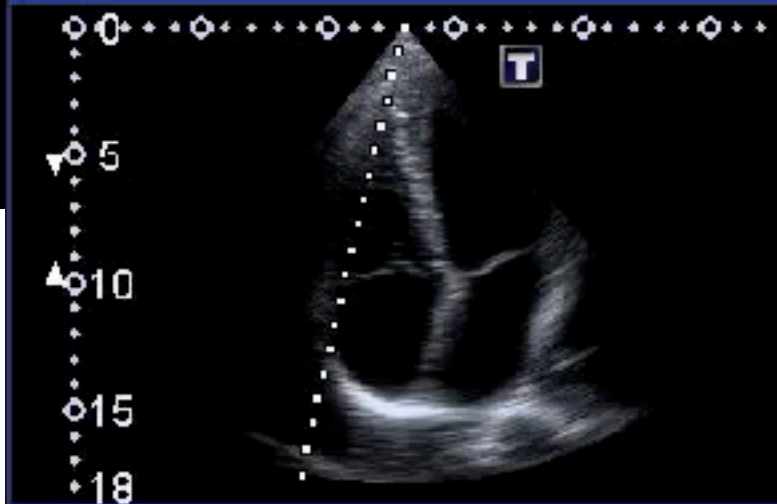
TAPSE

Qscan
G:94
DR:55

Abnormal Cutoff

TAPSE < 17 mm

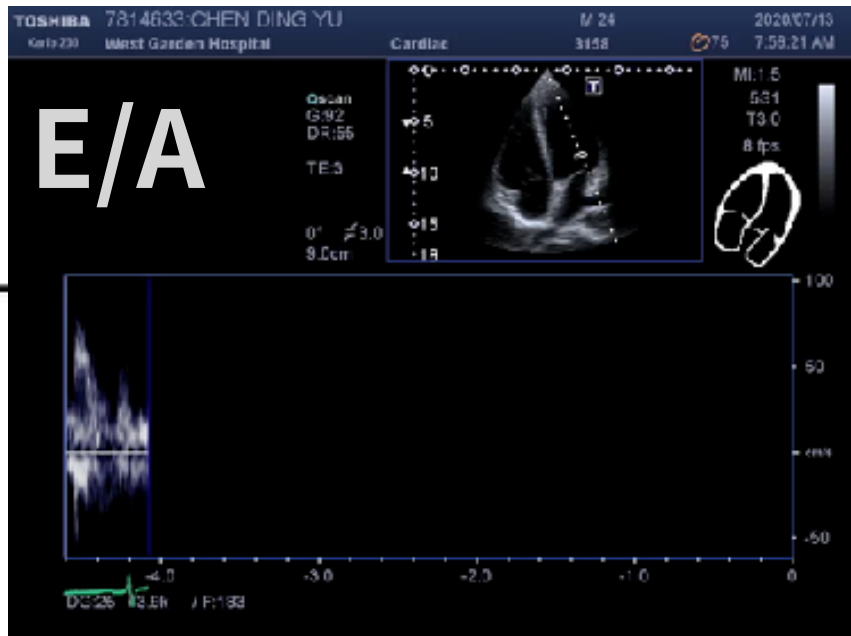
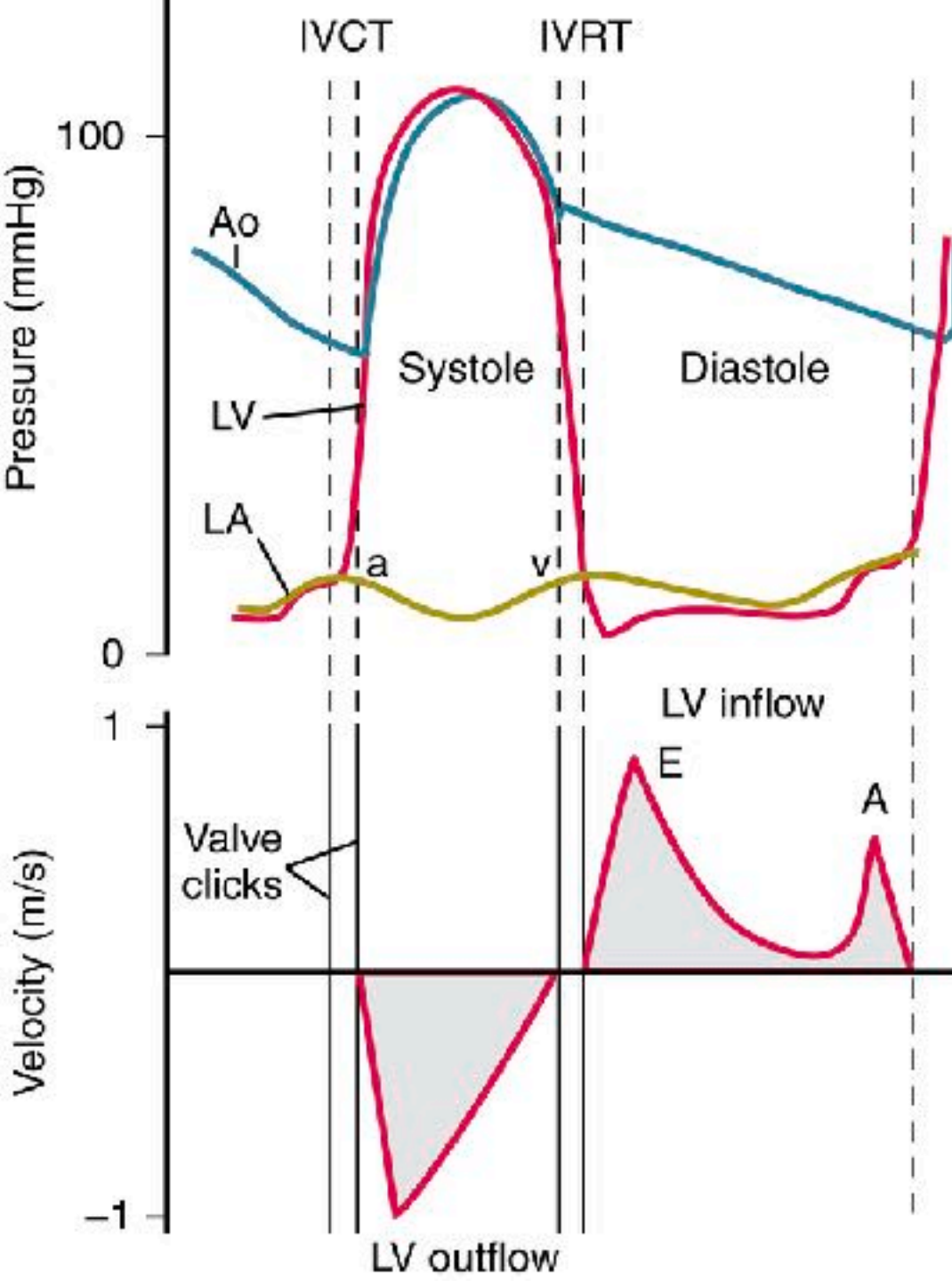
CARDIOSERV
INSPIRING EXCELLENCE IN IMAGING

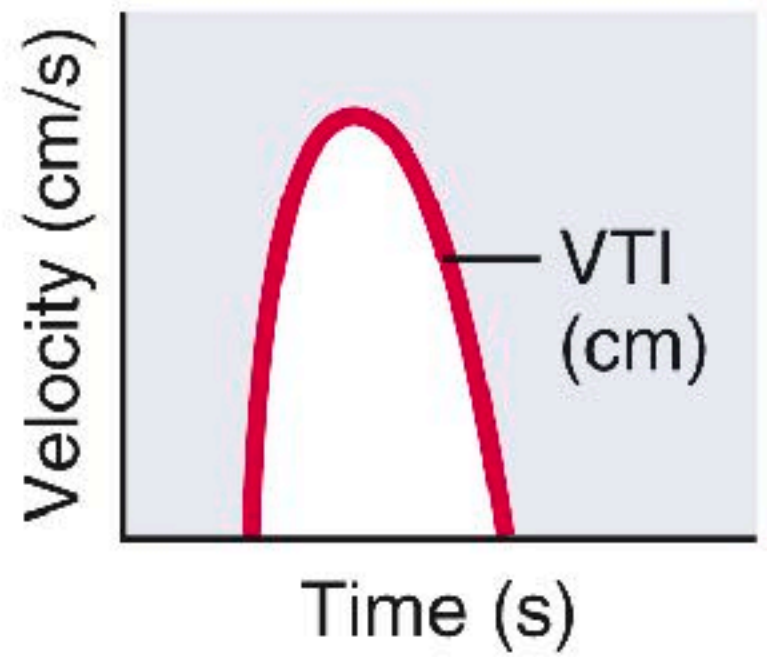
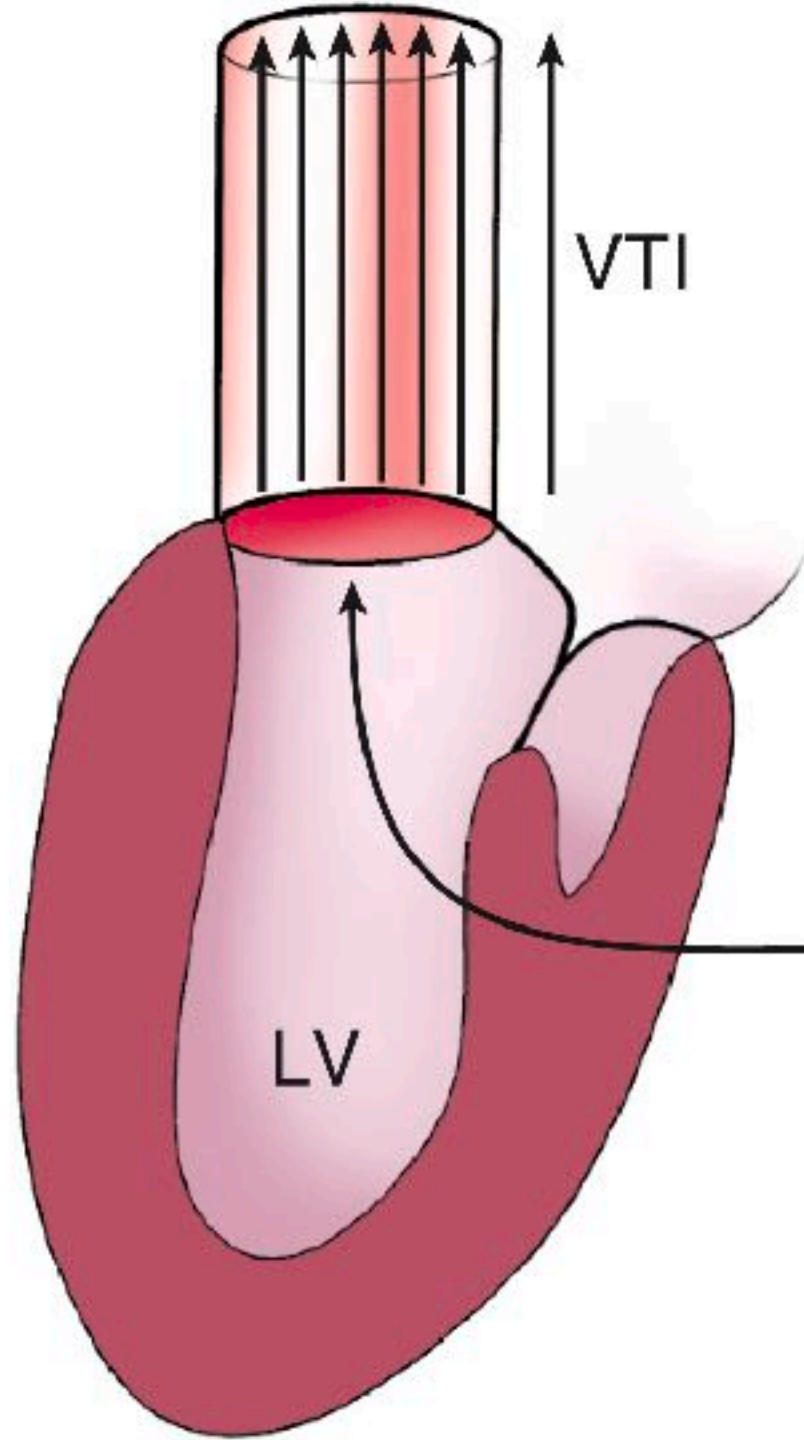


MI:1.5
5S1
T3.0
25 fps



Qscan:89 / MDR:50 / T3.0

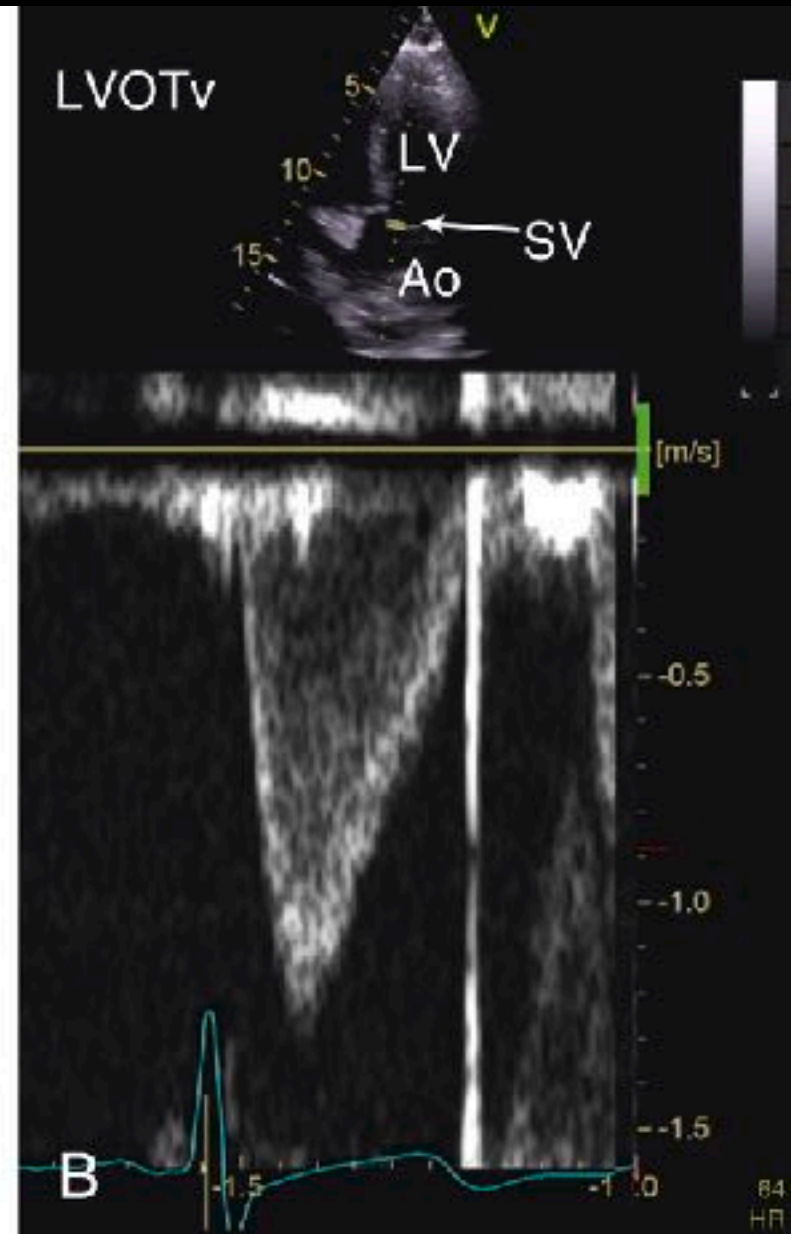
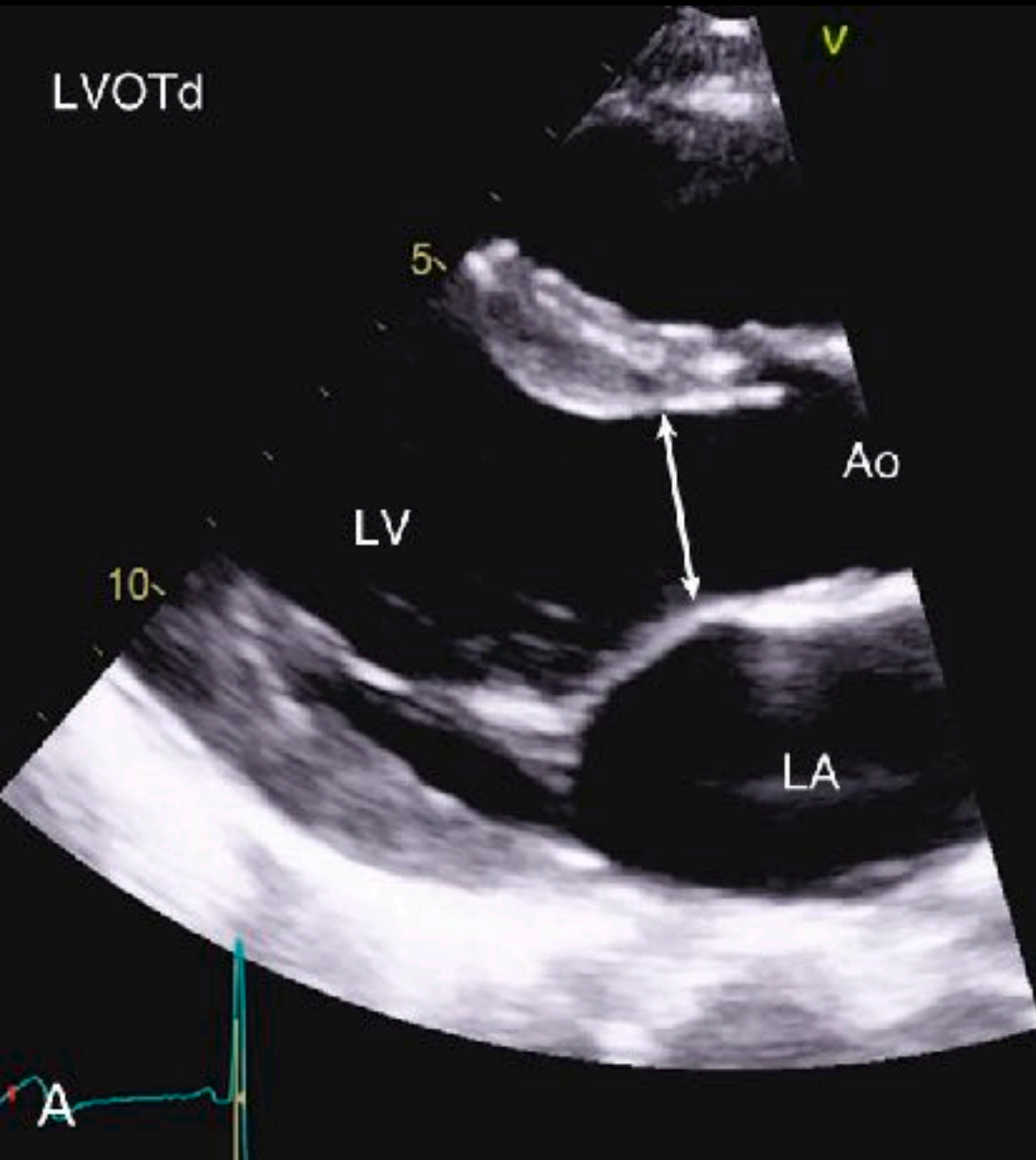




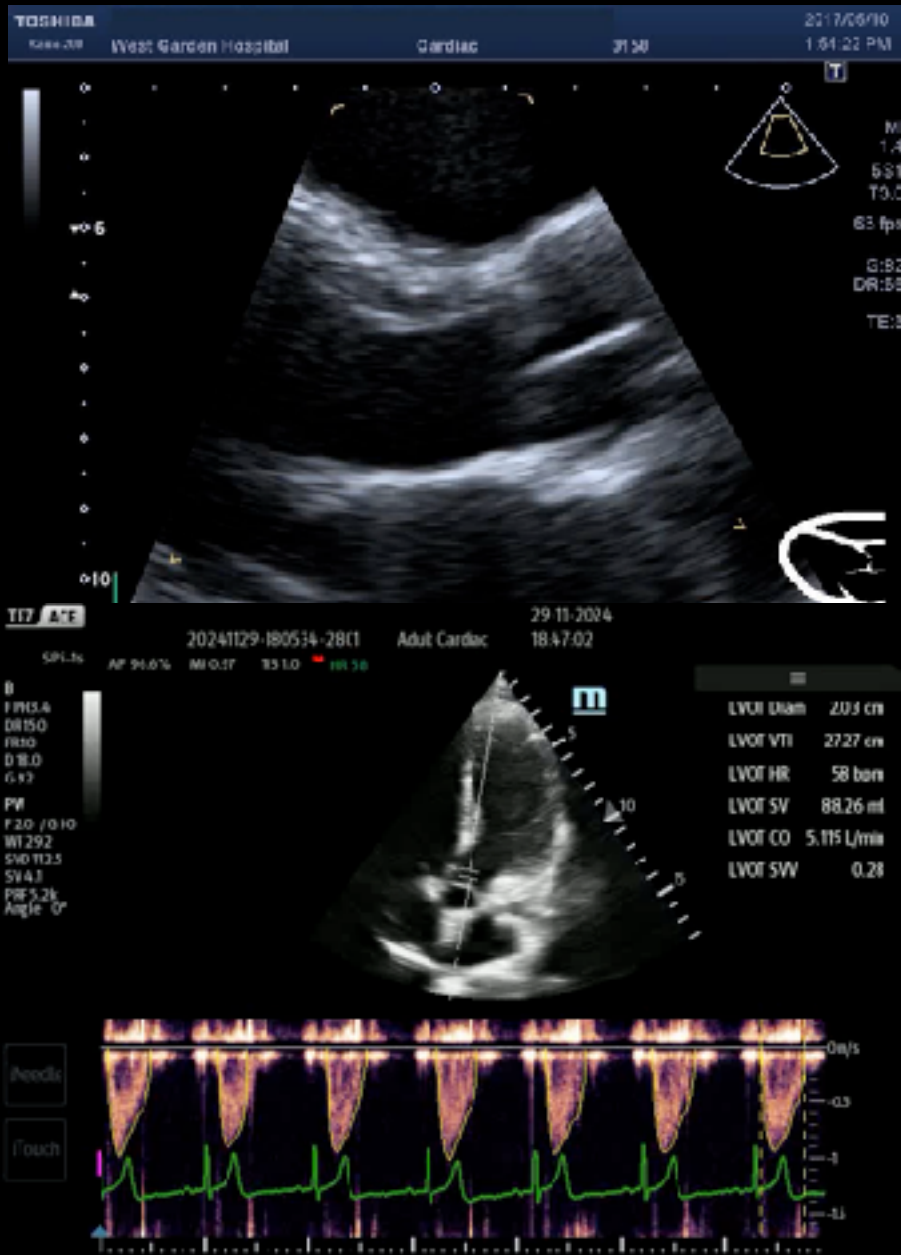
$$CSA \text{ (cm}^2\text{)} = 3.14 \text{ (D/2)}^2$$

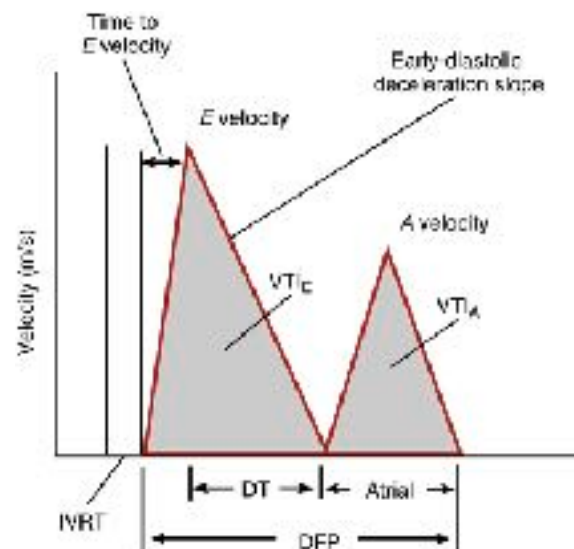
$$SV = CSA \times VTI$$

$$CO = SV * HR = (CSA * VTI) * HR$$



$$CO = SV * HR = (CSA * VTI) * HR$$

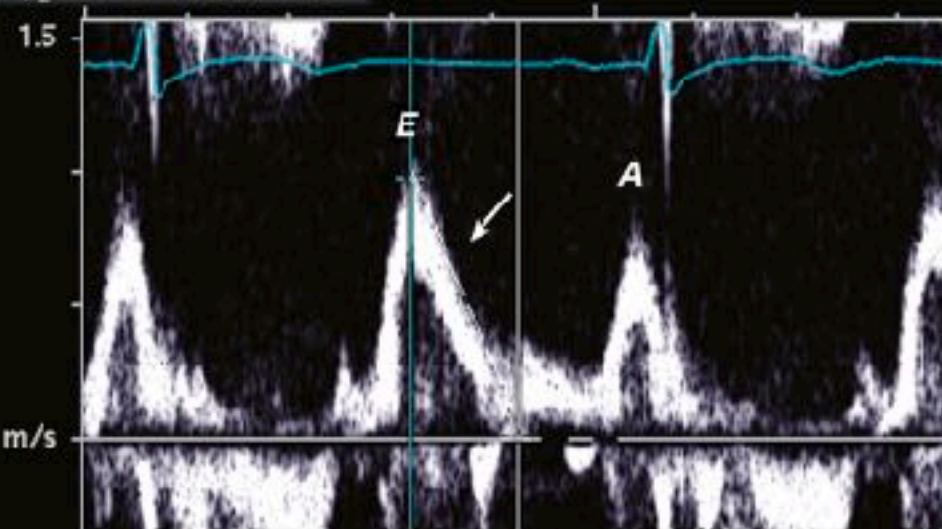




40dB 3 +/-1/0/1
PW Depth= 66mm
PW Gate= 2.5mm
PW Gain= 9dB



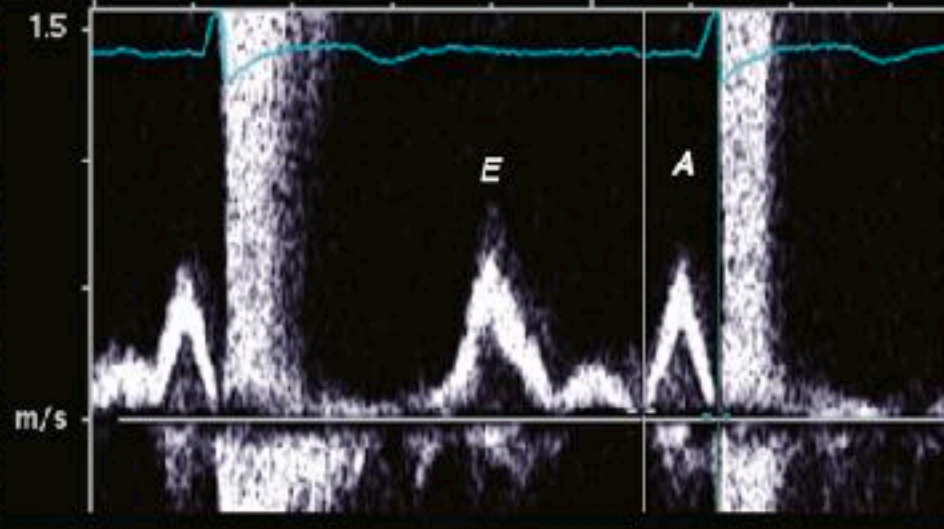
MV DT = 209 msec
P $\frac{1}{2}$ Time = 60 msec



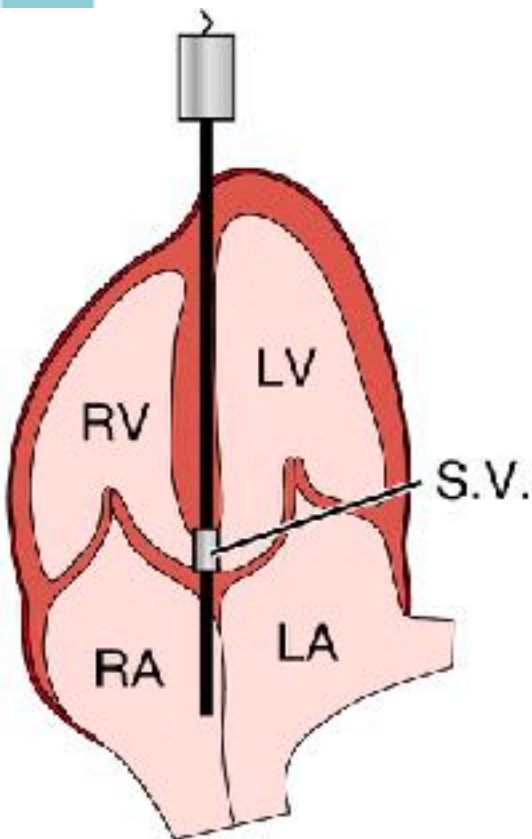
40dB 3 +/-1/0/1
PW Depth= 82mm
PW Gate= 2.5mm
PW Gain= 9dB



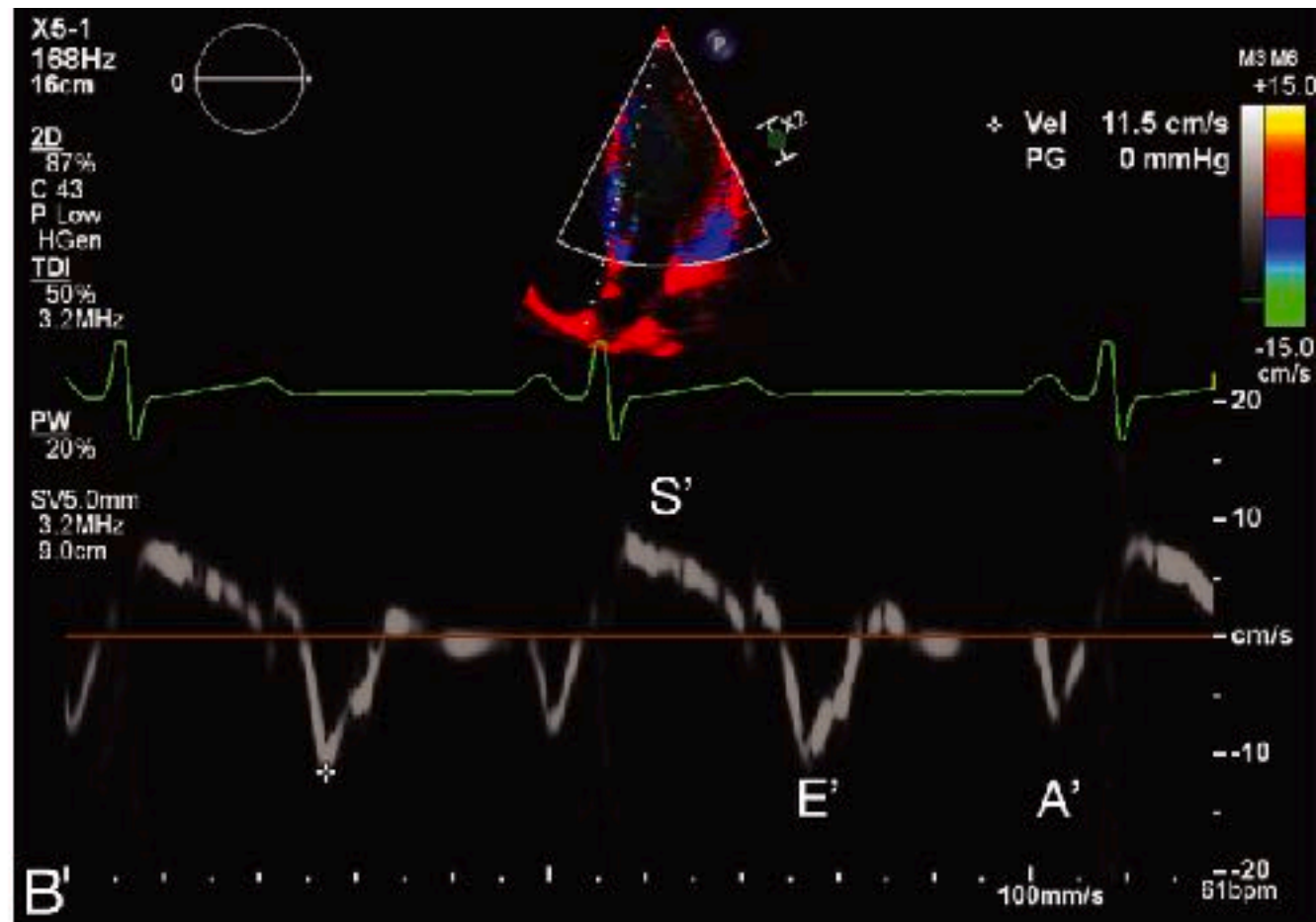
MV A Dur = 150 msec



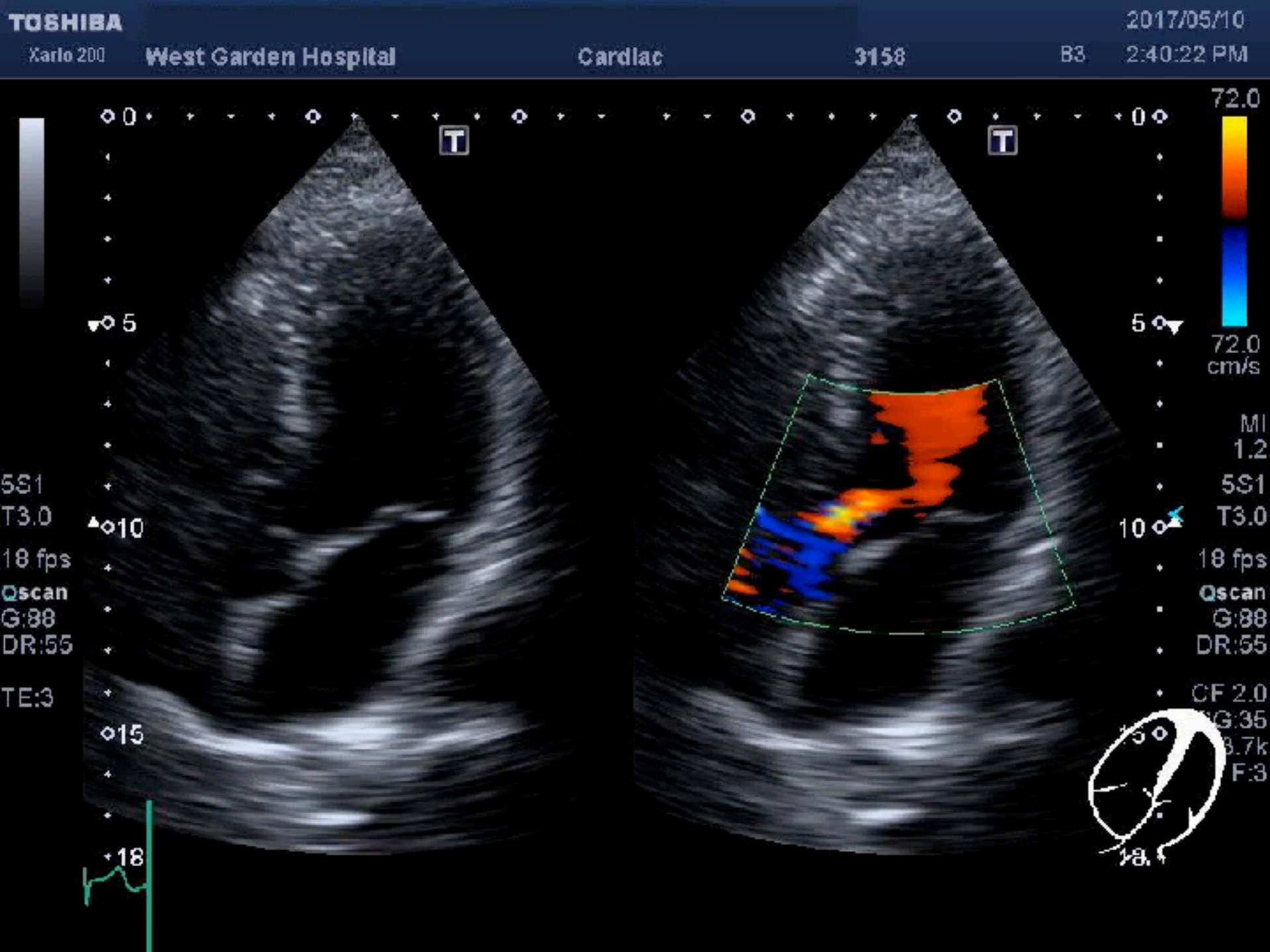
Tissue Doppler imaging



A



B'



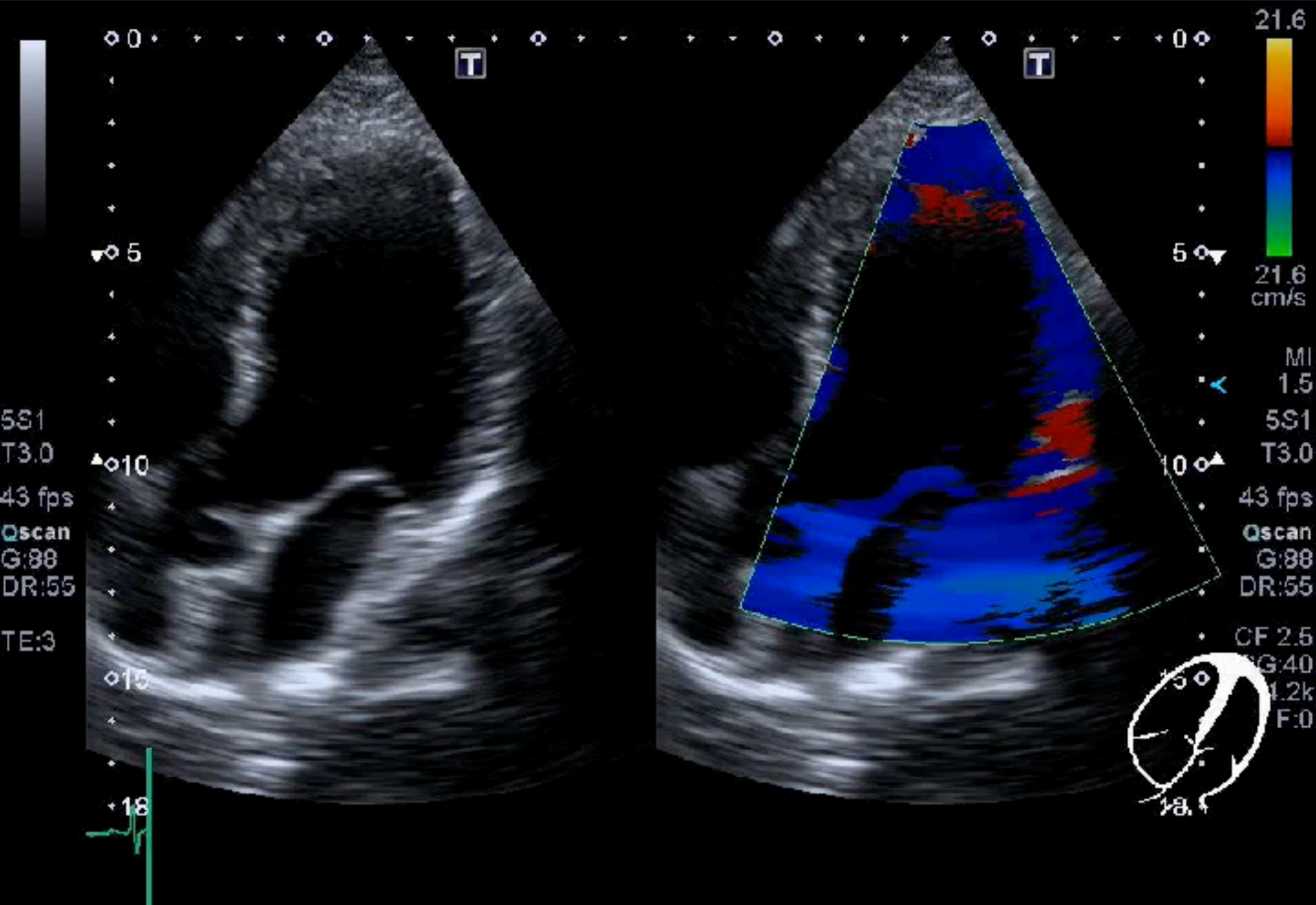




TABLE 7.4 Classification of Diastolic Dysfunction (Key Measures Highlighted)

	Normal	Mild (Grade I)	Moderate (Grade II)	Severe* (Grade III)
Pathophysiology		↓ Relaxation and normal LVEDP	↓ Relaxation and ↑ LVEDP	↓ Compliance and ↑↑ LVEDP
E/A ratio [†]	≥0.8	<0.8	>0.8 to <2.0 [‡]	≥2.0
Valsalva ΔE/A		<0.5	≥0.5	≥0.5
DT (ms)	150–200	>200	150–200	<150
E' velocity (cm/s)	≥10	<8	<8	<5
E/E' ratio	≤10	≤10	10–14	>14
IVRT (ms)	50–100	≥100	60–100	≤60
PV S/D	≈1	S > D	S < D	S ≪ D
PV _a (m/s)	<0.35	<0.35 [§]	≥0.35	≥0.35
a _{dur} /A _{dur} (ms)	<20	<20 [§]	≥30	≥30
LA volume index	<34 mL/m ²	Mildly enlarged	Moderately enlarged	Severely enlarged

*An additional grade of irreversible severe dysfunction is characterized by the absence of a decrease in E velocity with the strain phase of the Valsalva maneuver.

[†]Only the yellow rows are included in the American Society of Echocardiography guidelines, plus consideration of tricuspid regurgitant jet velocity. In the absence of other causes for elevated pulmonary pressures, a tricuspid regurgitant velocity of greater than 2.8 m/s is consistent with moderate to severe LV diastolic dysfunction.

[‡]E/A with the Valsalva maneuver is <1.

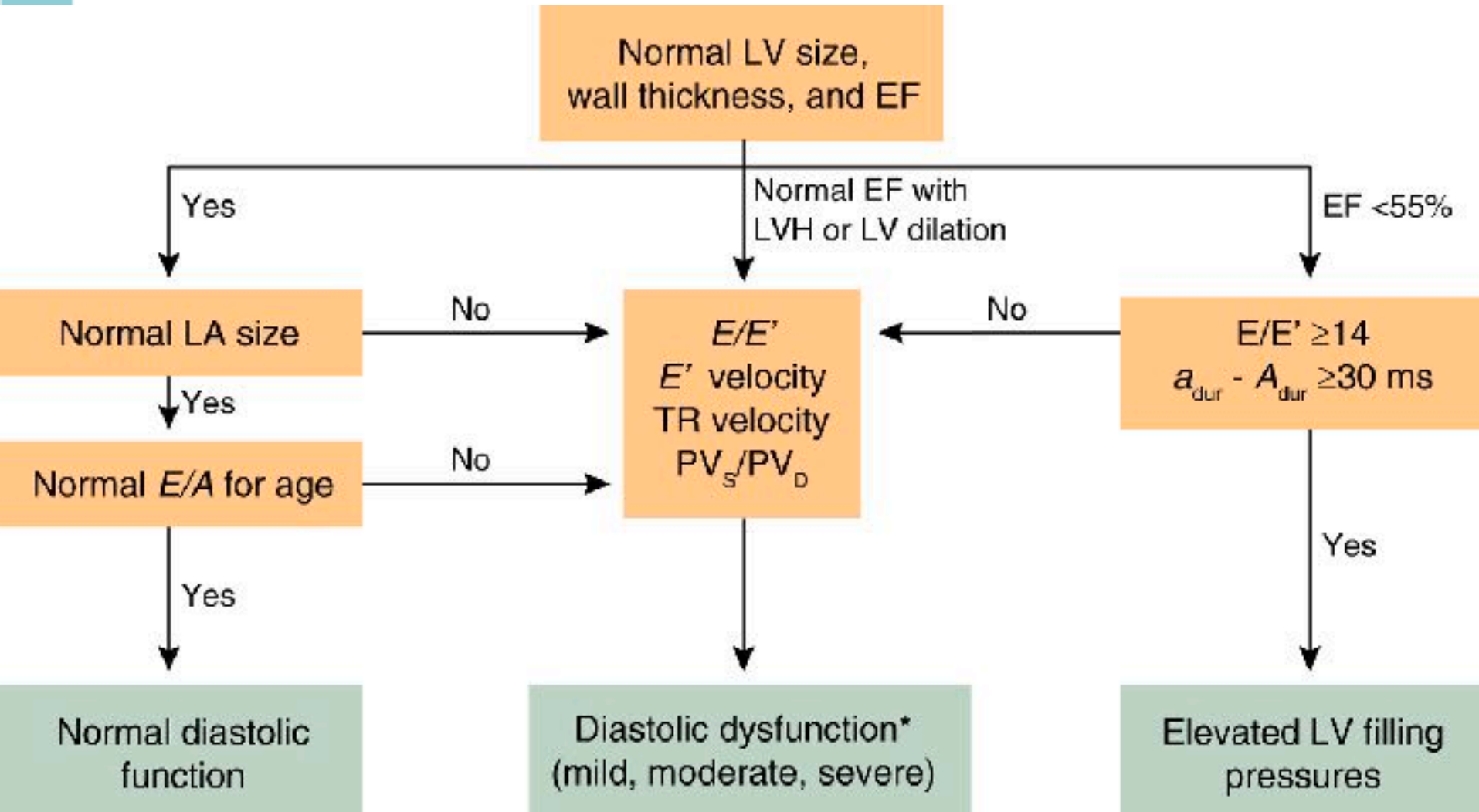
[§]Pulmonary vein a duration and velocity may be increased if filling pressures are elevated.

A, Late diastolic ventricular filling velocity with atrial contraction; DT, deceleration time; E, early diastolic peak velocity; E', early diastolic tissue Doppler velocity; IVRT, isovolumic relaxation time; LVEDP, LV end-diastolic pressure; PV, pulmonary vein.

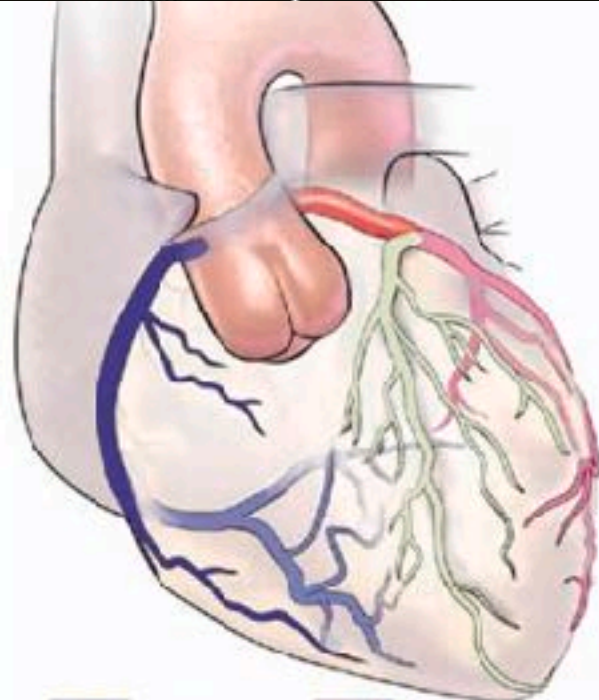
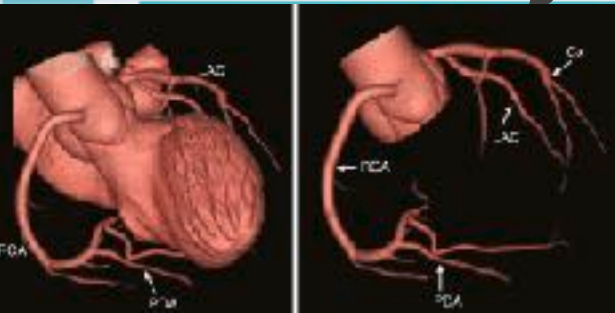
Data from Nagueh SF, Smiseth OA, Appleton CP, et al: [ASE guidelines], *J Am Soc Echocardiogr* 29:277–314, 2015; Rakowski H, Appleton C, Chan KL, et al: [Canadian consensus guidelines], *J Am Soc Echocardiogr* 9:736–760, 1996; Yamada H, Goh PP, Sun JP, et al: [Canadian consensus guidelines], *J Am Soc Echocardiogr* 15:1238–1244, 2002; Redfield MM, Jacobsen SJ, Burnett JC Jr, et al: Burden of systolic and diastolic ventricular dysfunction in the community: appreciating the scope of the heart failure epidemic, *JAMA* 289:194–202, 2003; Lester SJ, Tajik AJ, Nishimura RA, et al: Unlocking the mysteries of diastolic function: deciphering the Rosetta Stone 10 years later, *J Am Coll Cardiol* 51:679–689, 2008.



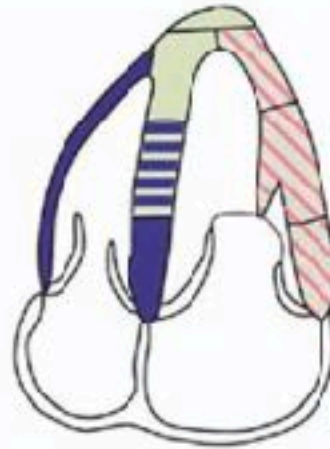
Diastolic dysfunction approach



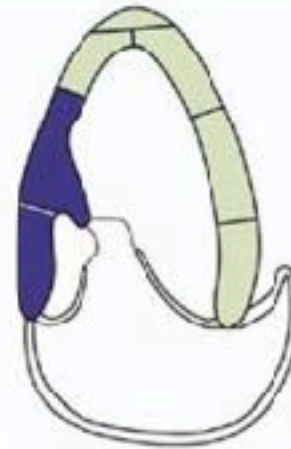
Coronary artery & Segments



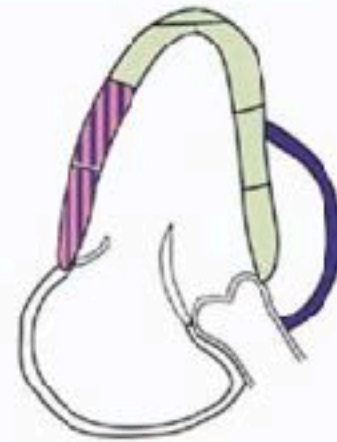
① Four Chamber



② Two Chamber



③ Long Axis



④ Base



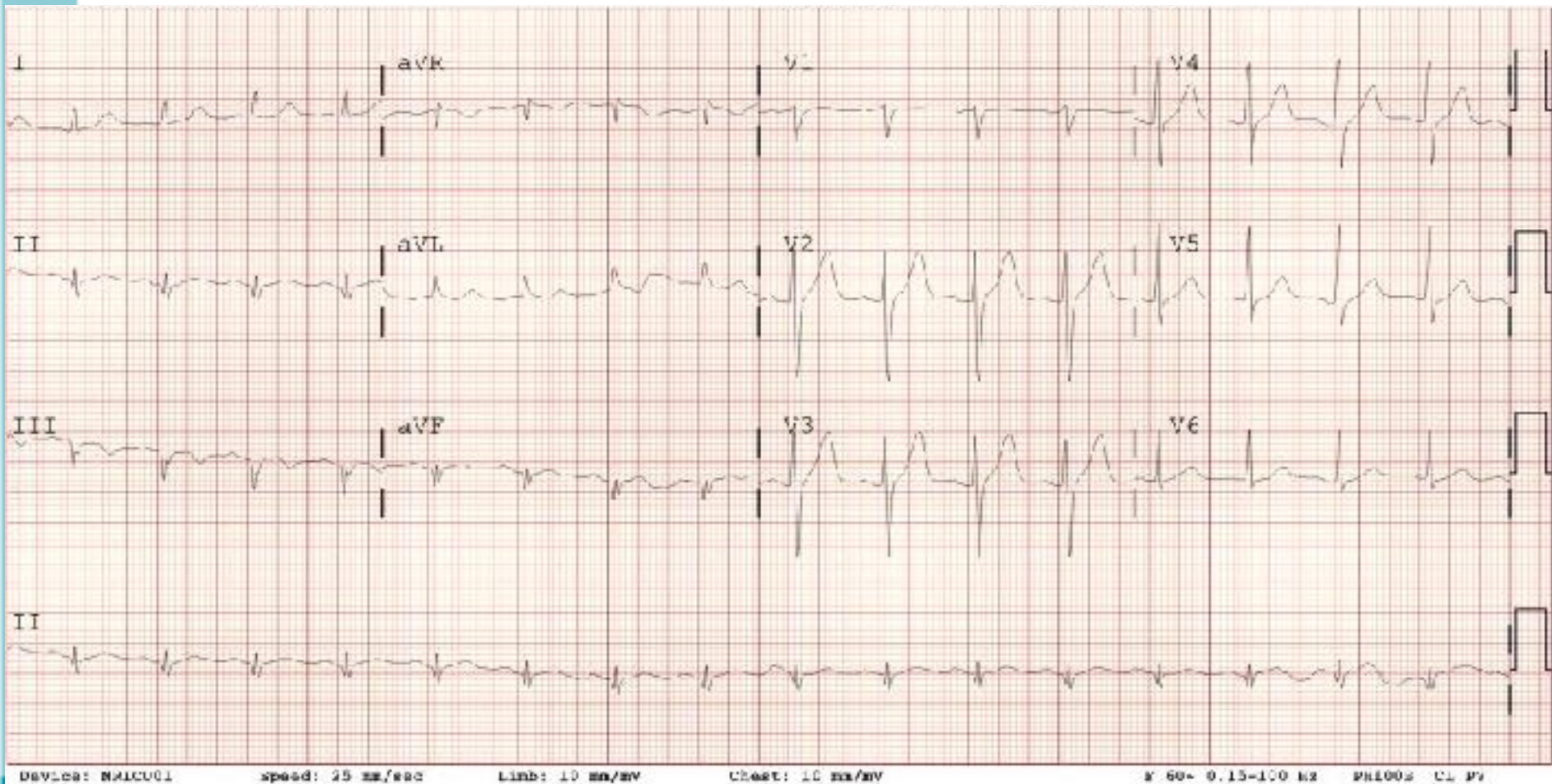
⑤ Mid



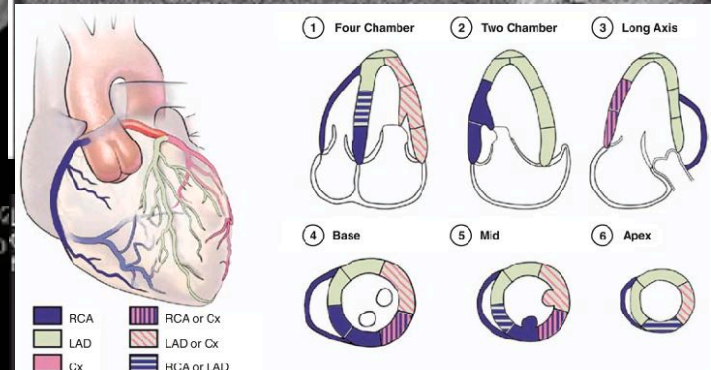
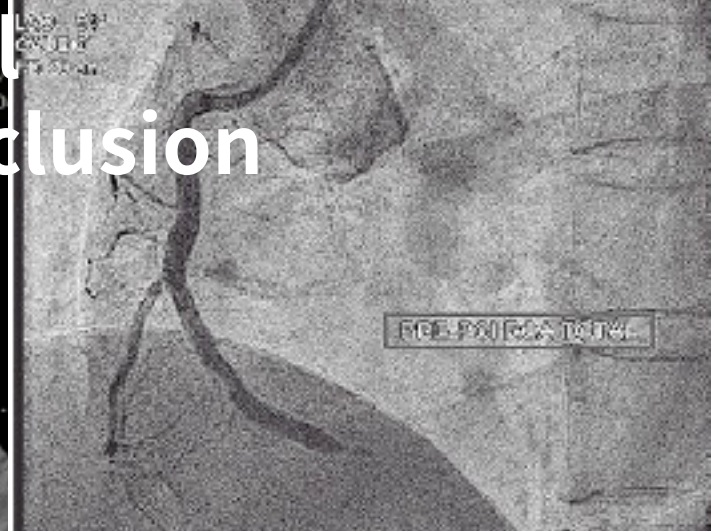
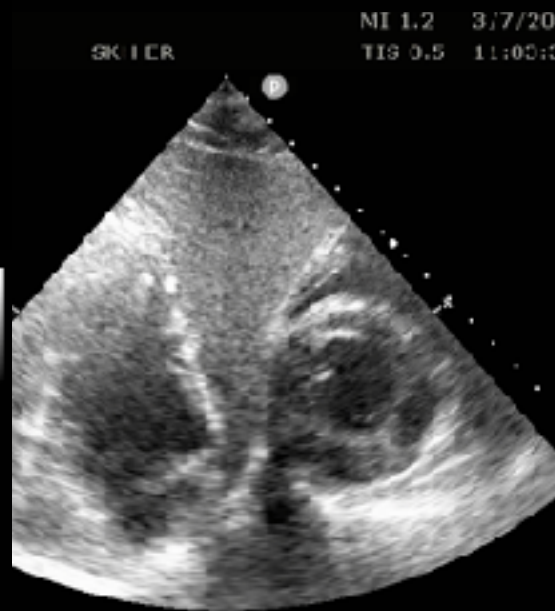
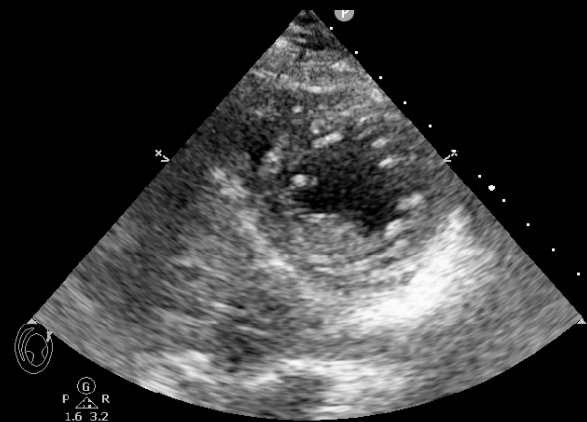
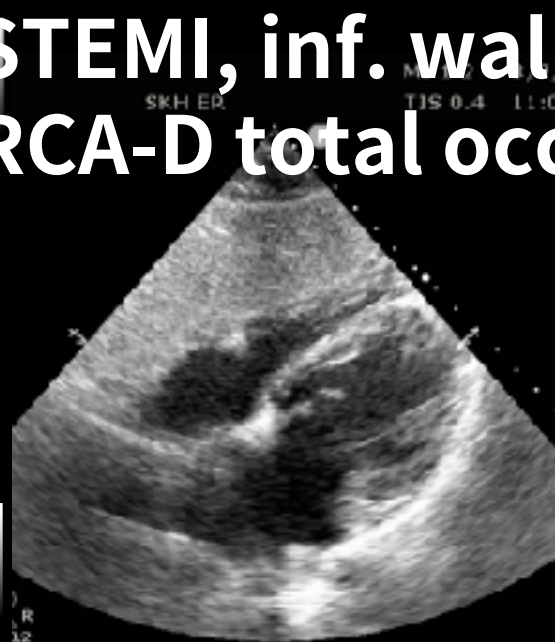
⑥ Apex



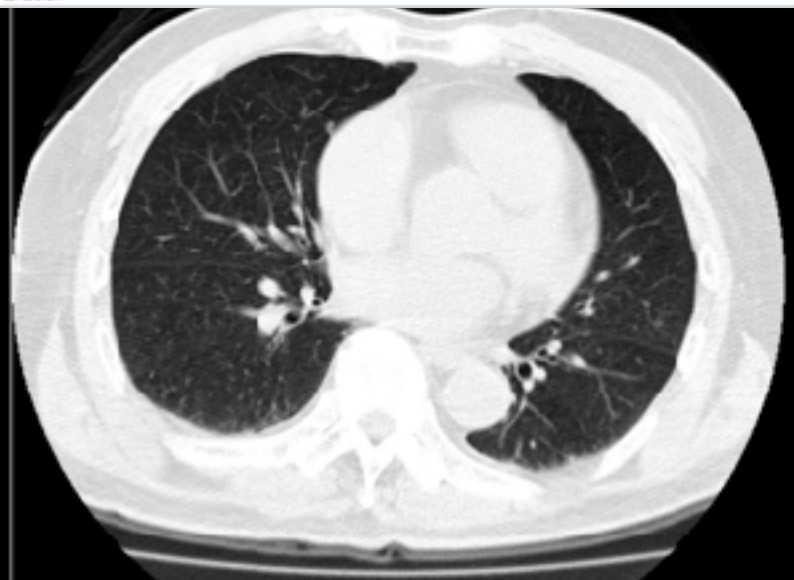
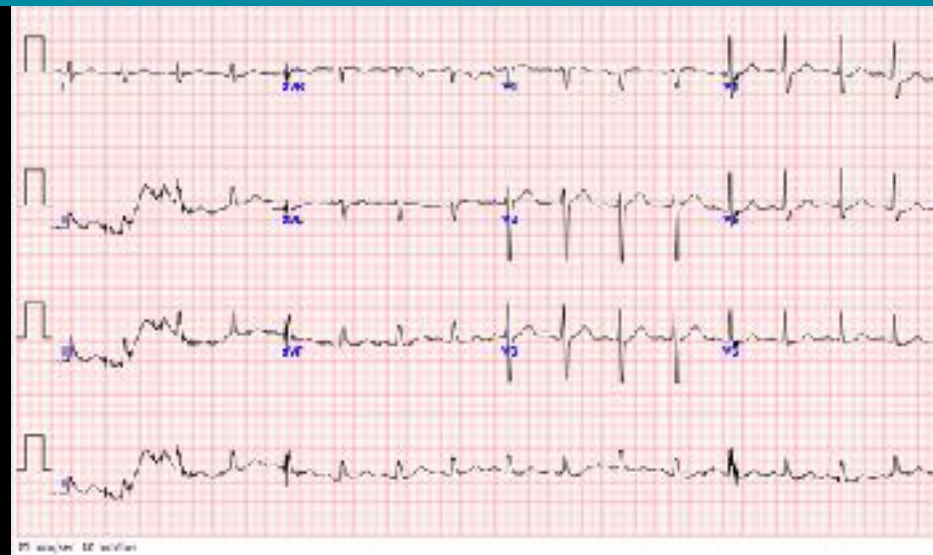
**39M,
chest pain & cold sweating**



STEMI, inf. wall RCA-D total occlusion



76M, Dyspnea & desaturation



76M, Dyspnea & desaturation



PSLA

D sign

McConnell's sign

Pulmonary infarction

Wedge shaped



呼吸喘看肺—心—靜

肺栓塞看靜—心—肺 4.9cm





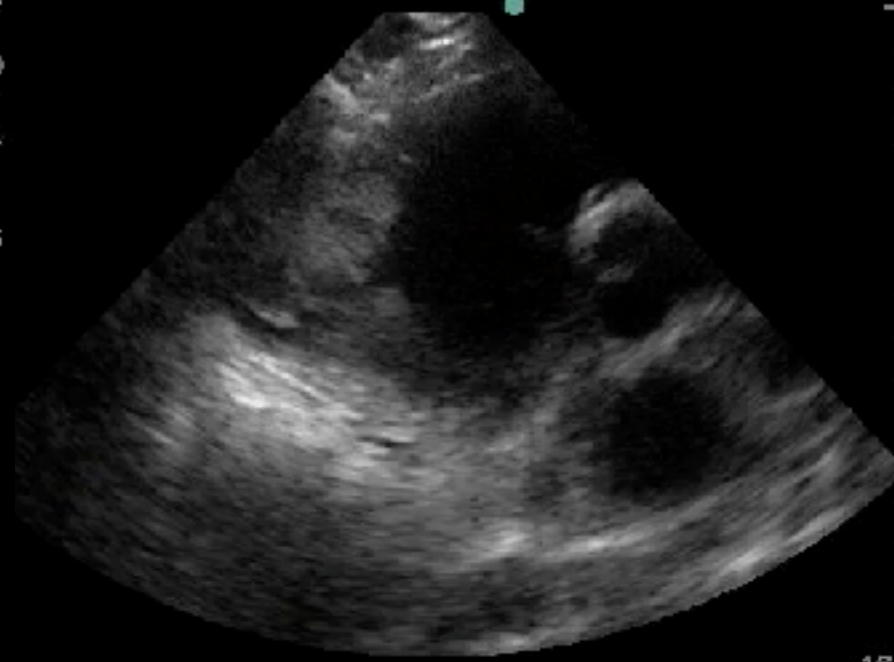
43M, interstitial lung dx, SOB 土長轉回





19

P21
40%
MI
0.9
TIS
0.7



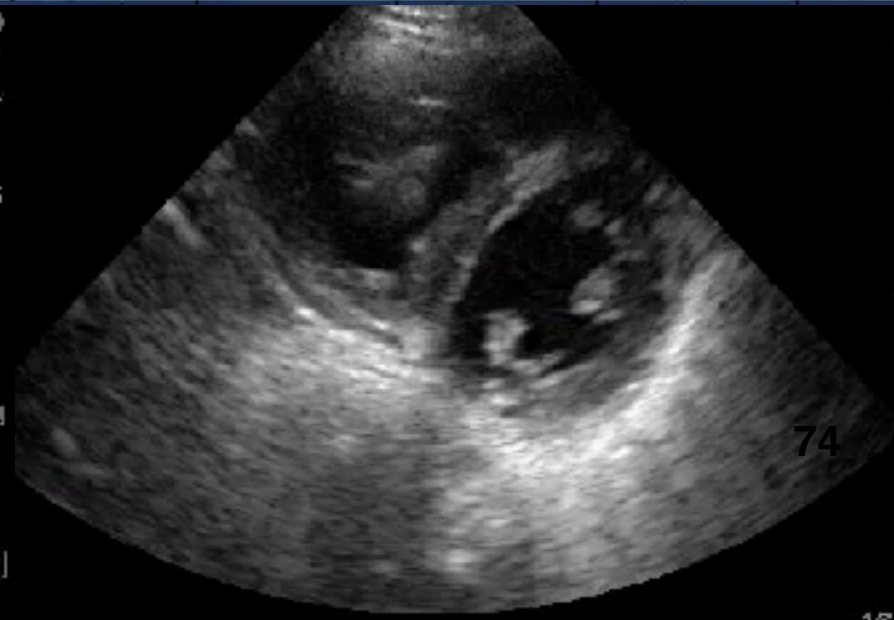
16

Depth Freeze Save Options Mode Depth Freeze Save Options Mo



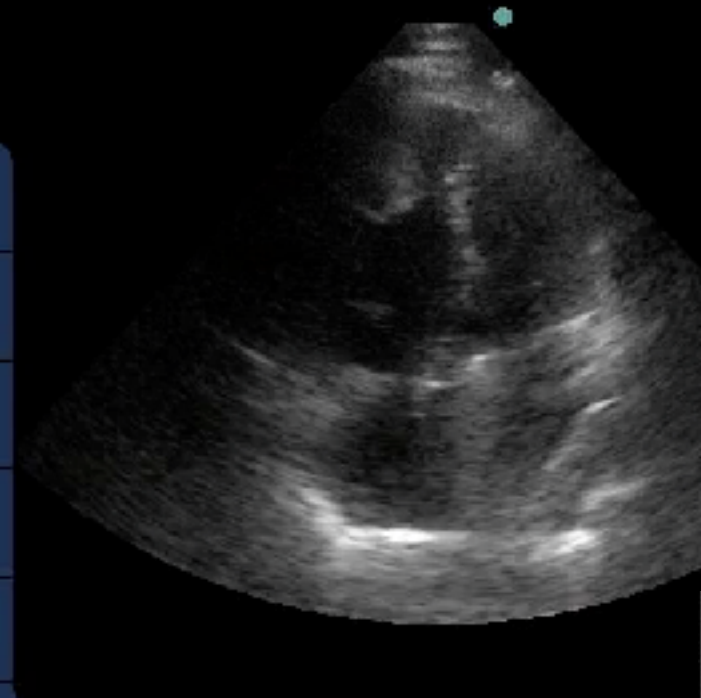
19

40%
MI
0.9
TIS
0.7

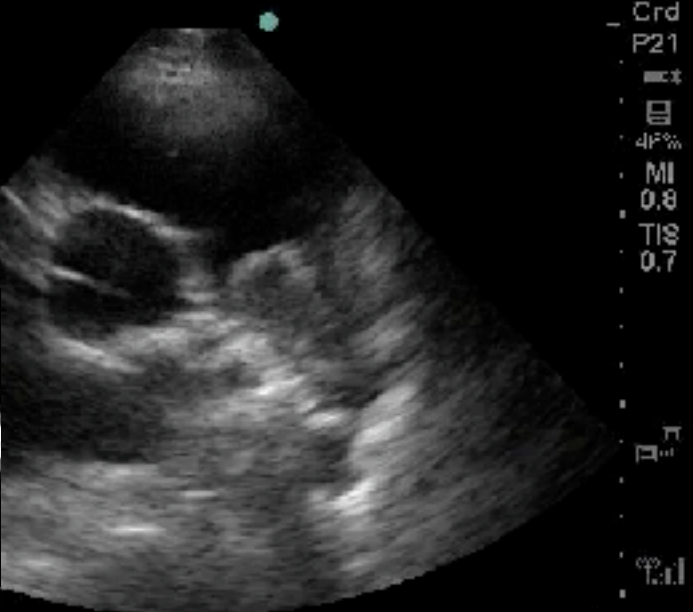


74

16



Crd
P21
MI
0.8
TIS
0.7



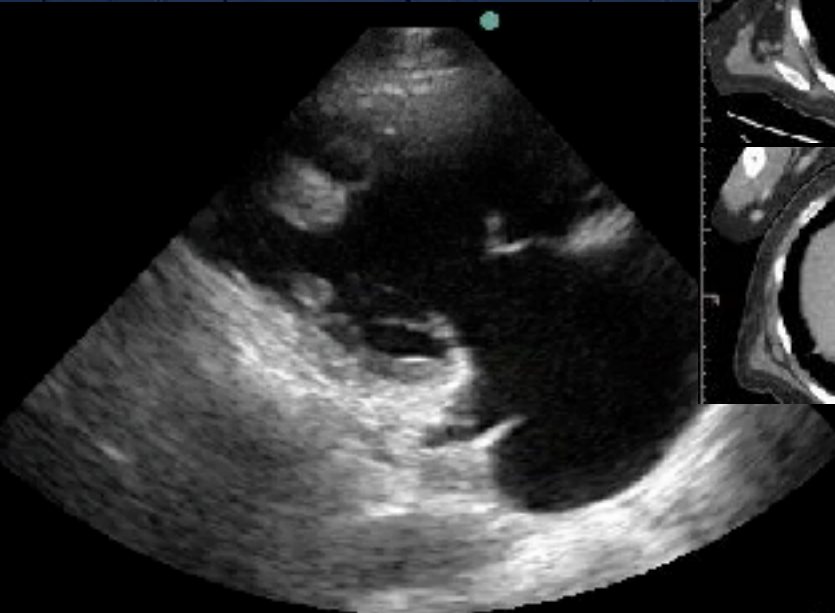
16

Depth, Freeze, Save, Options



Depth, Freeze, Save, Options, Mode

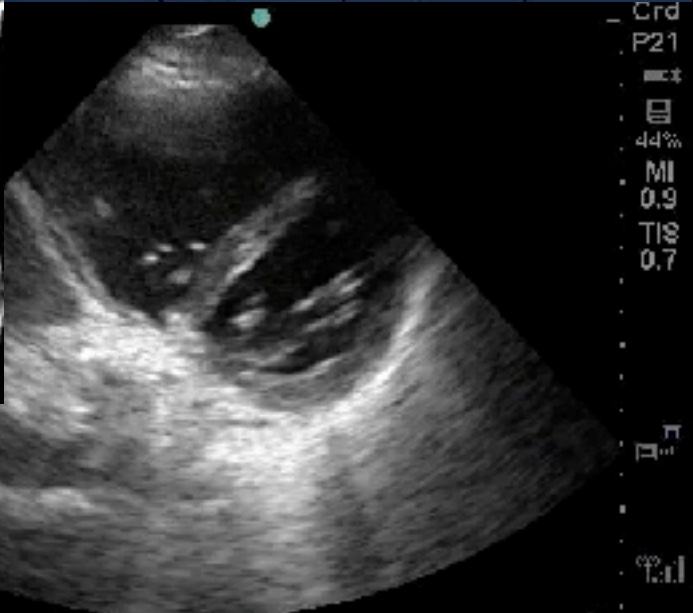
Crd
P21
MI
0.9
TIS
0.7



16

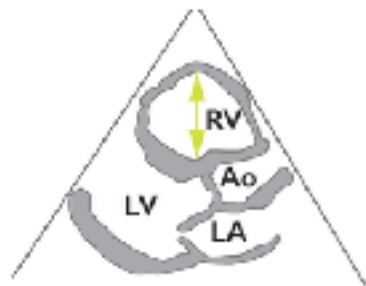


175

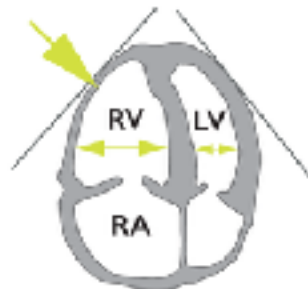


19

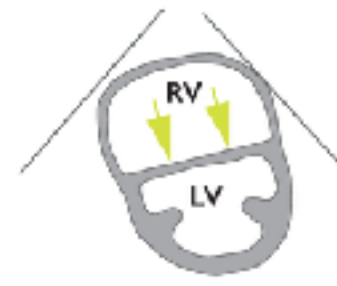
60 / 60 rule : 94% specific for PE



A. Enlarged right ventricle, parasternal long axis view



B. Dilated RV with basal RV/LV ratio >1.0 , and McConnell sign (arrow), four chamber view



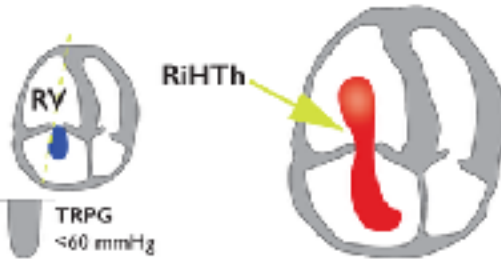
C. Flattened intraventricular septum (arrows) parasternal short axis view



D. Distended inferior vena cava with diminished inspiratory collapsibility, subcostal view



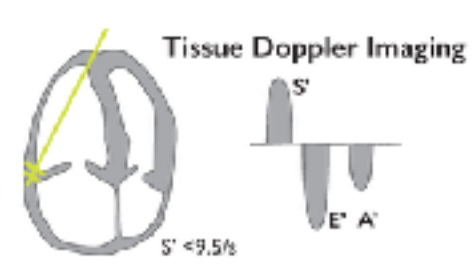
E. 60/60 sign: coexistence of acceleration time of pulmonary ejection <60 ms and mid-systolic "notch" with mildly elevated (<60 mmHg) peak systolic gradient at the tricuspid valve



F. Right heart mobile thrombus detected in right heart cavities (arrow)

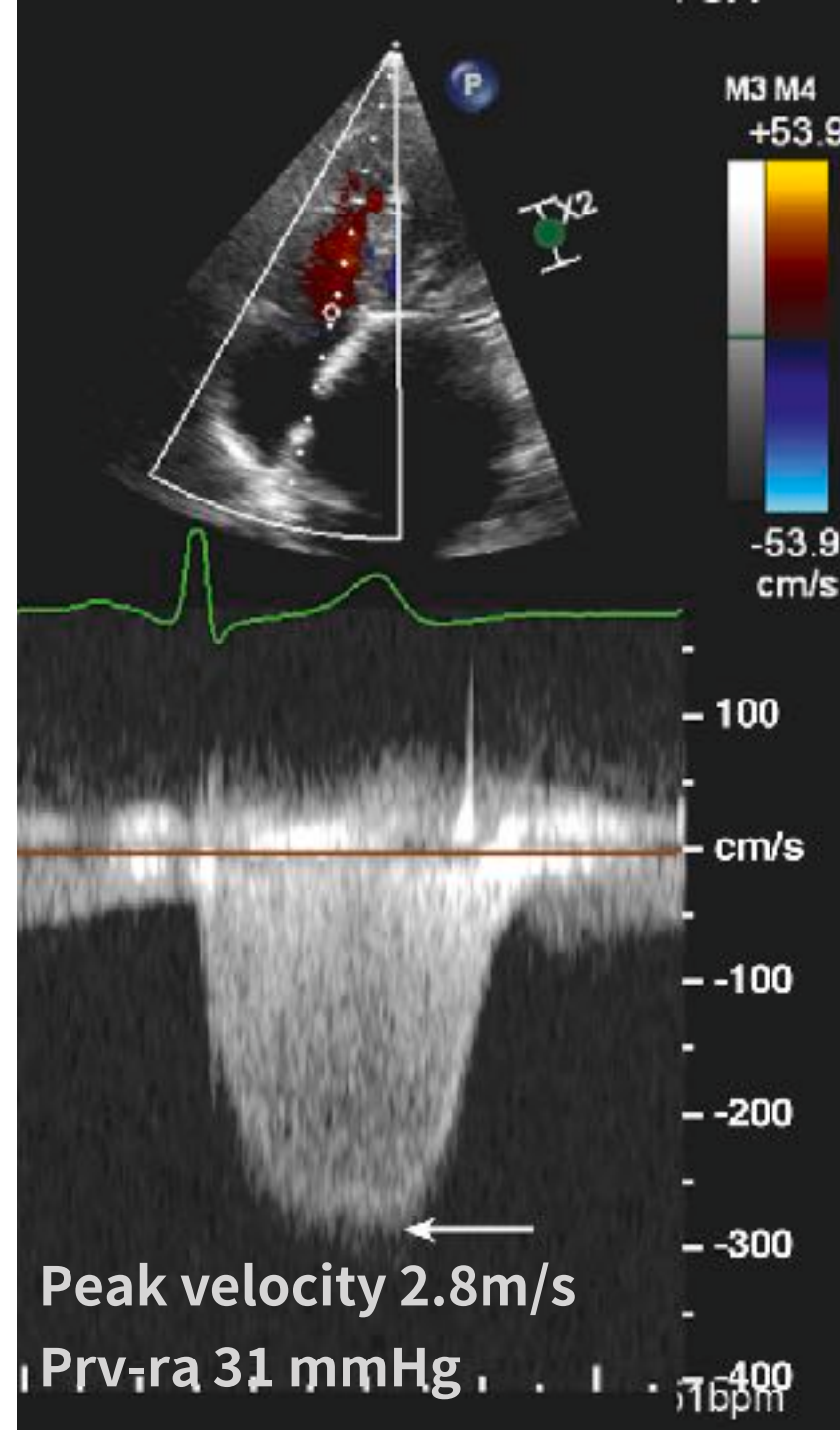
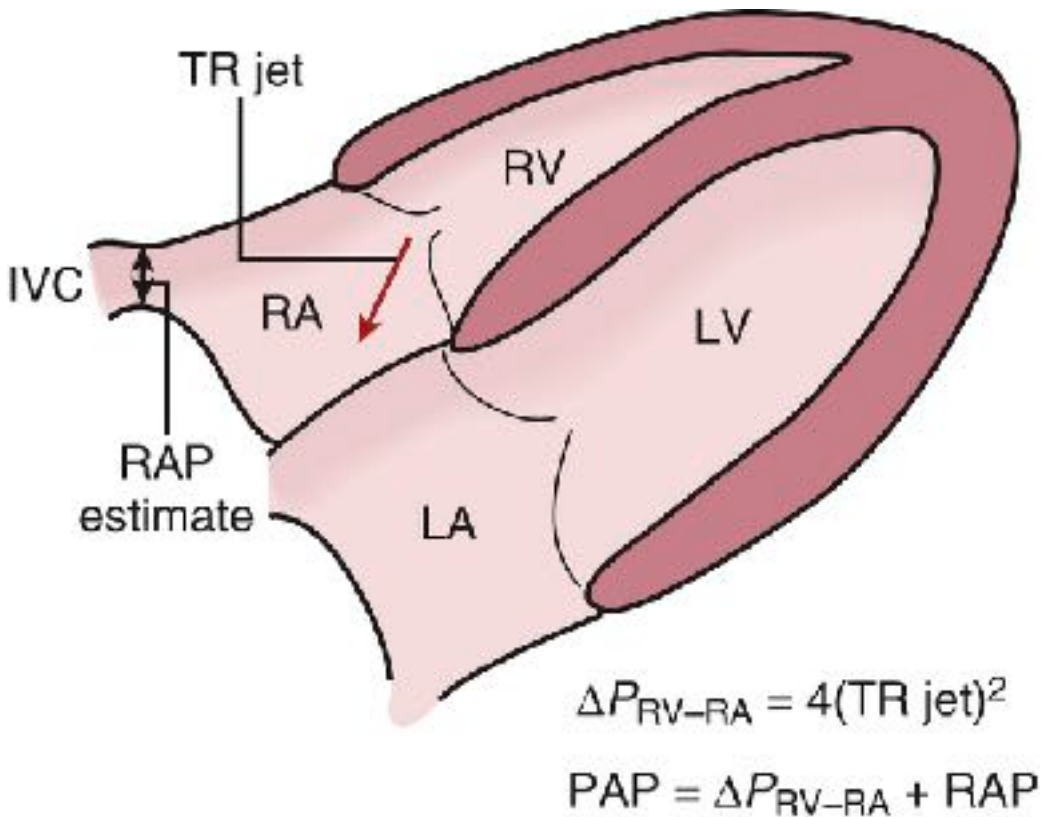


G. Decreased tricuspid annular plane systolic excursion (TAPSE) measured with M-Mode (<16 mm)



H. Decreased peak systolic (S') velocity of tricuspid annulus (<9.5 cm/s)

Pulmonary artery pressure Measurement



$$PAV = 31 + 5 = 36 \text{ mmHg}$$

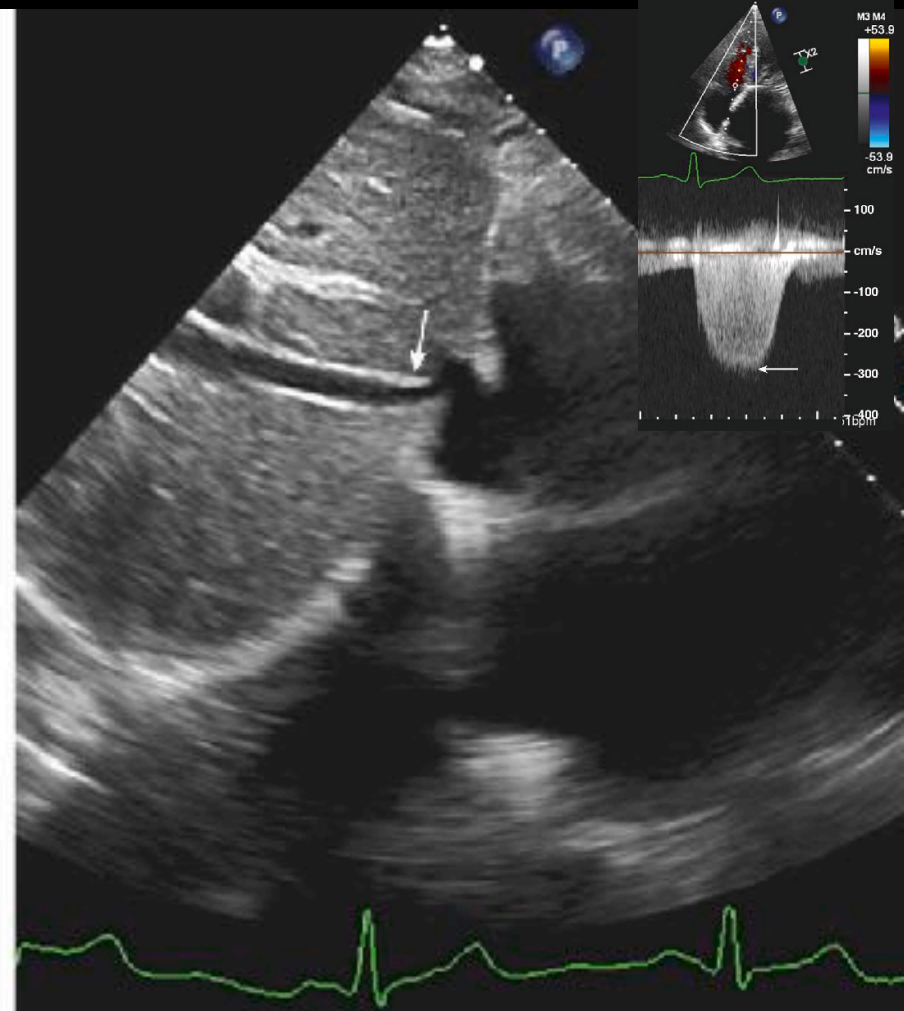
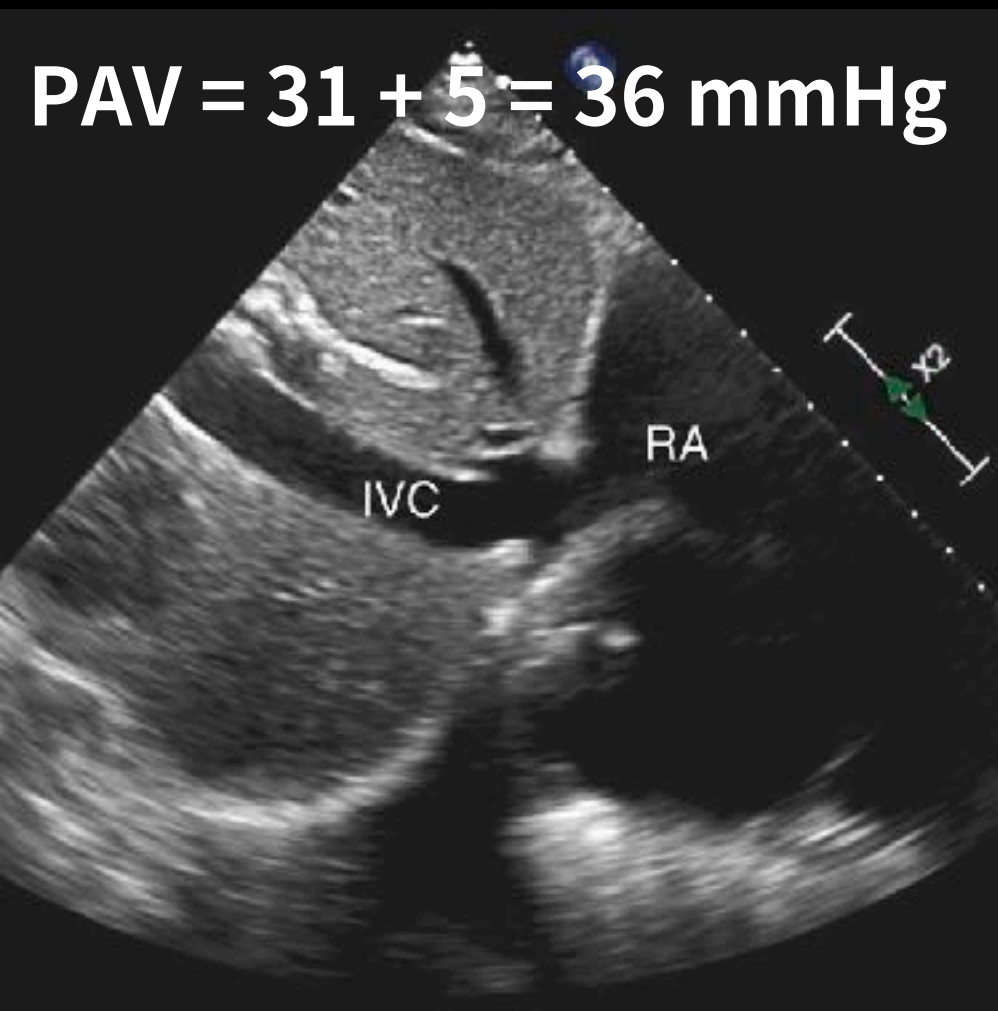
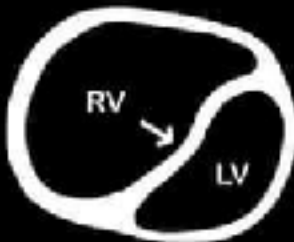
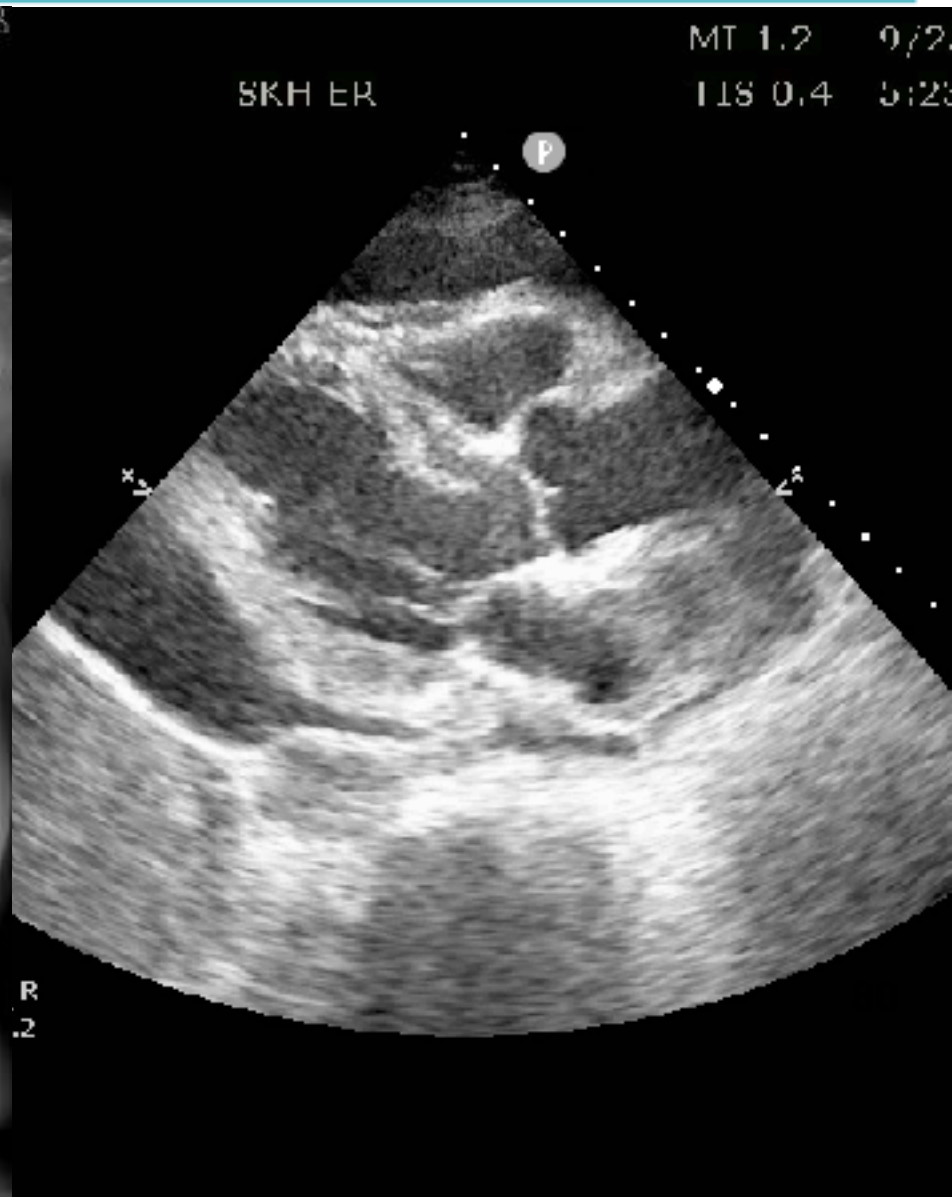


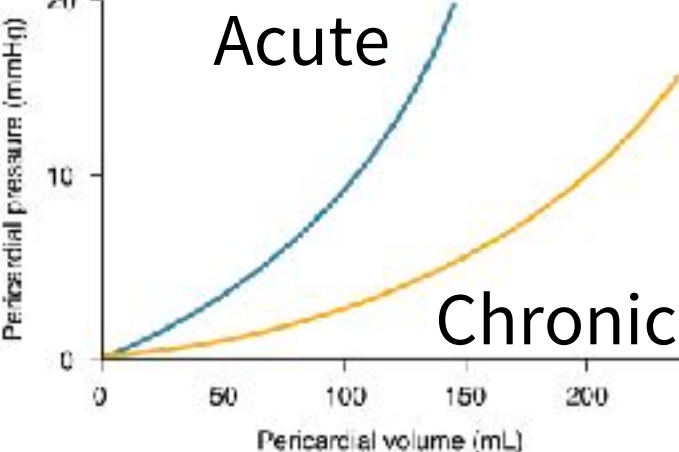
TABLE 6.6 Estimation of Right Atrial Pressure

		RA PRESSURE ESTIMATE	
IVC Diameter ⁺	Change With Sniff	Range Estimate [†]	ASE Guidelines [‡]
Normal (≤2.1 cm)	Decrease > 50%	0–5 mmHg	3 mmHg
Normal (≤2.1 cm)	Decrease ≤ 50%	5–10 mmHg	8 mmHg [‡]
Dilated (>2.1 cm)	Decrease > 50%	10–15 mmHg	
Dilated (>2.1 cm)	Decrease ≤ 50%	15–20 mmHg	15 mmHg

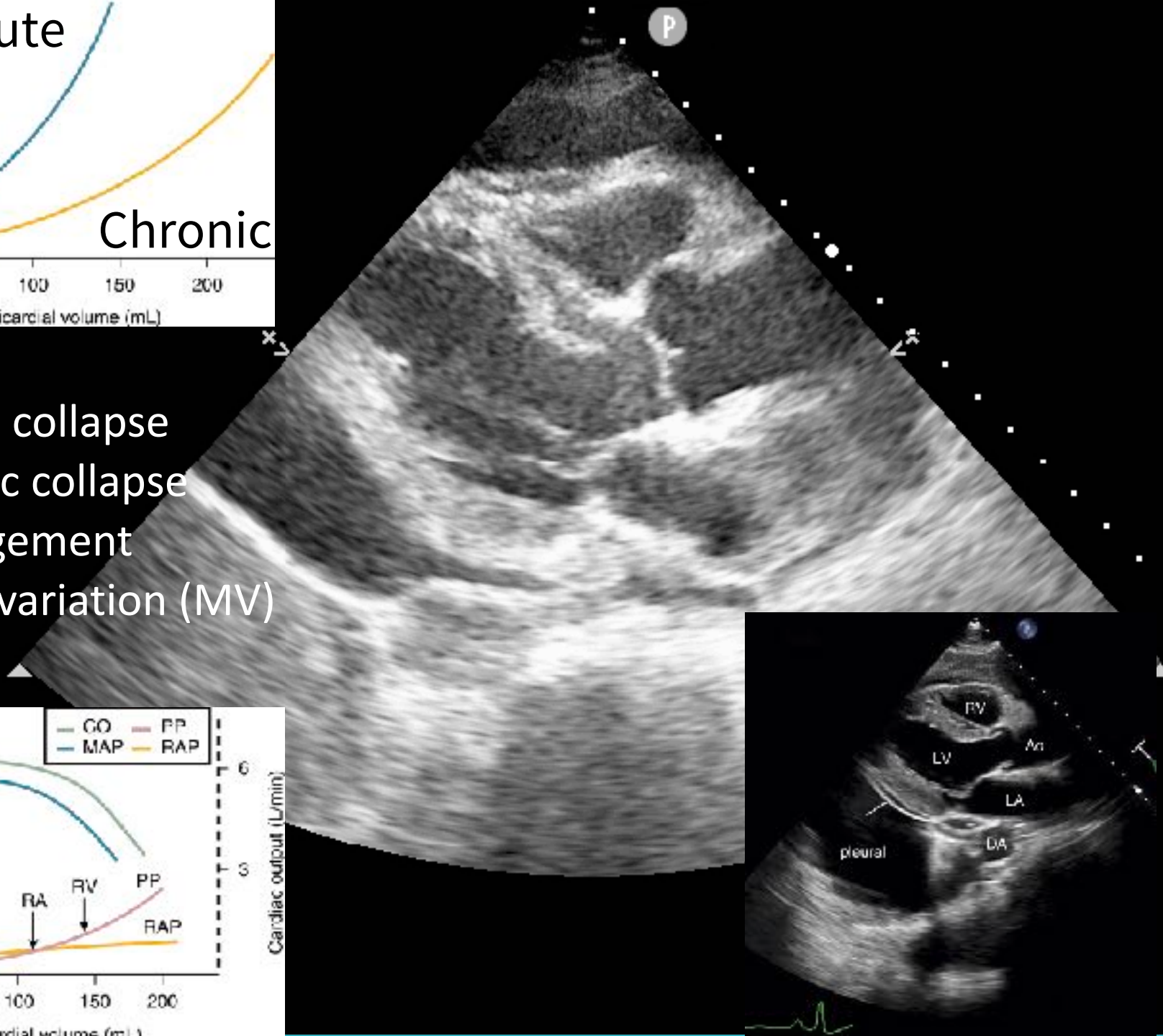
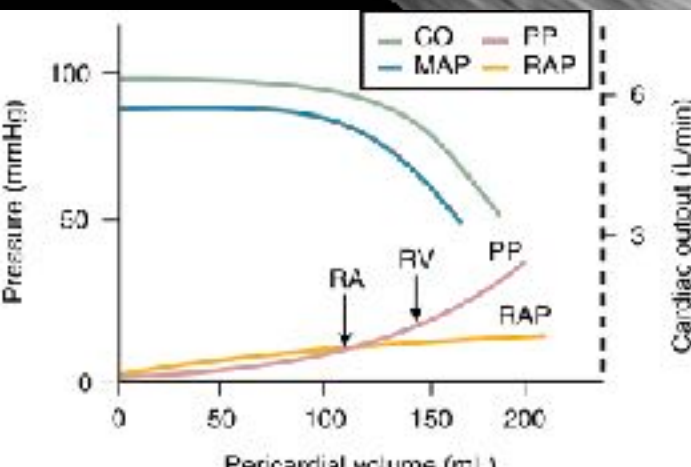
Increased RV:LV Size Ratio	Abnormal Septal Motion	McConnell's Sign	Tricuspid Regurgitation
			
Elevated Pulmonary Artery Systolic Pressure	Decreased TAPSE	Decreased S'	
 $PASP = (4 \times TRV_{max}^2) + RAP > 35 \text{ mmHg}$	 $< 17 \text{ mm}$	 $< 9.5 \text{ cm/s}$	
Pulmonary Artery Mid-Systolic Notching	60/60 Sign	Speckle Tracking: Decreased Free Wall Strain	
 $(4 \times TRV_{max}^2) < 60 \text{ mmHg}$	 $PAAT < 60 \text{ ms}$	 $< -20\%$	

70F, dyspnea





RA systolic collapse
 RV diastolic collapse
 IVC engorgement
 Resp flow variation (MV)





Adult Echo
S5-1
28 Hz
19.0cm

2D
HGen
Bn 50
C 50
3/2/0

MI 1.
TIS 0

SKILL

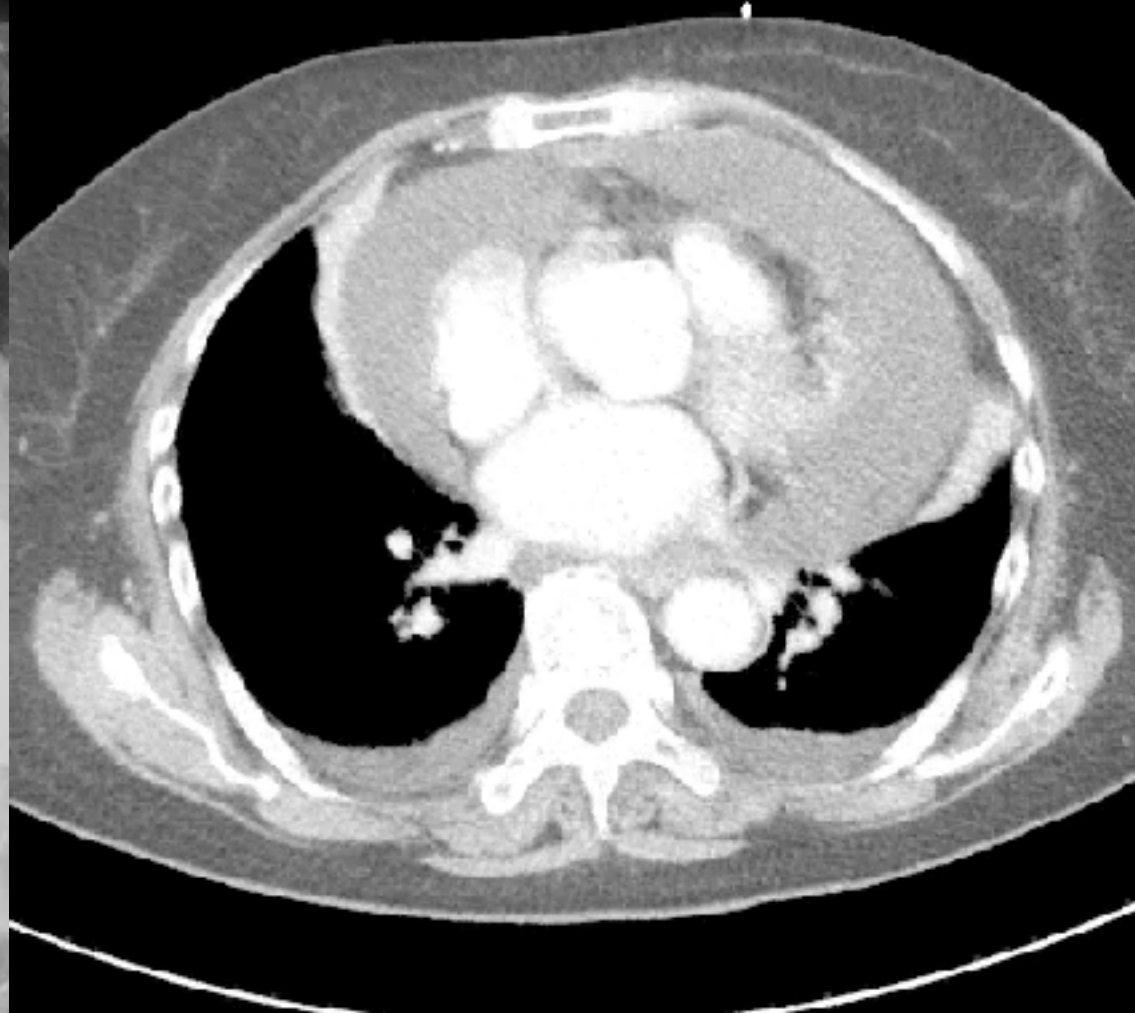
205

82

P
R
1.6 3.2

P
R
1.6 3.2

CT scan for evaluation



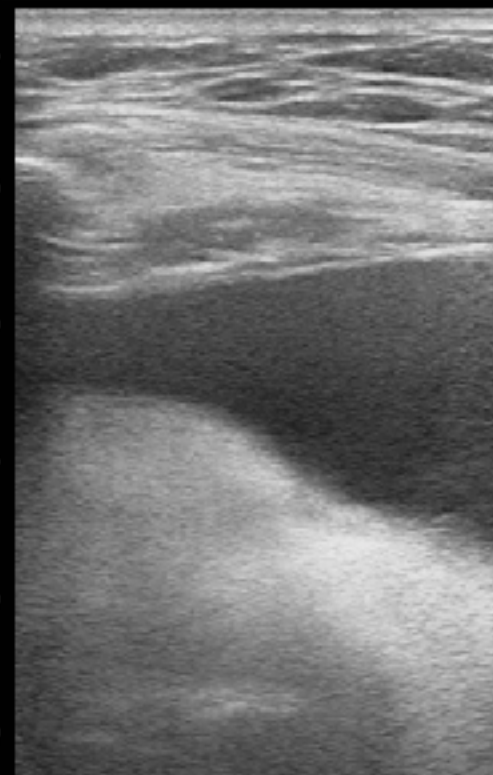
BKH ER

MI 1.0 9/25/2020
TIS 0.2 5:27:46 PM



SKH FR

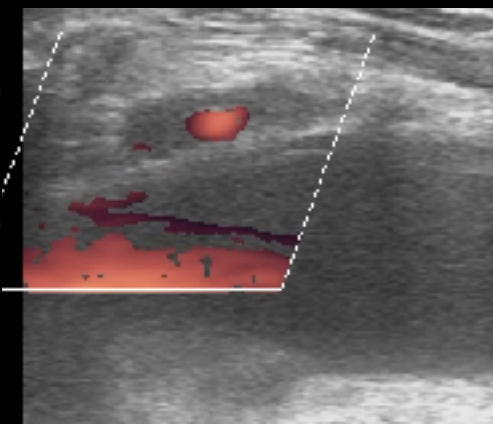
MI 1.1 9/25/2020
TIS 0.2 5:28:24 PM



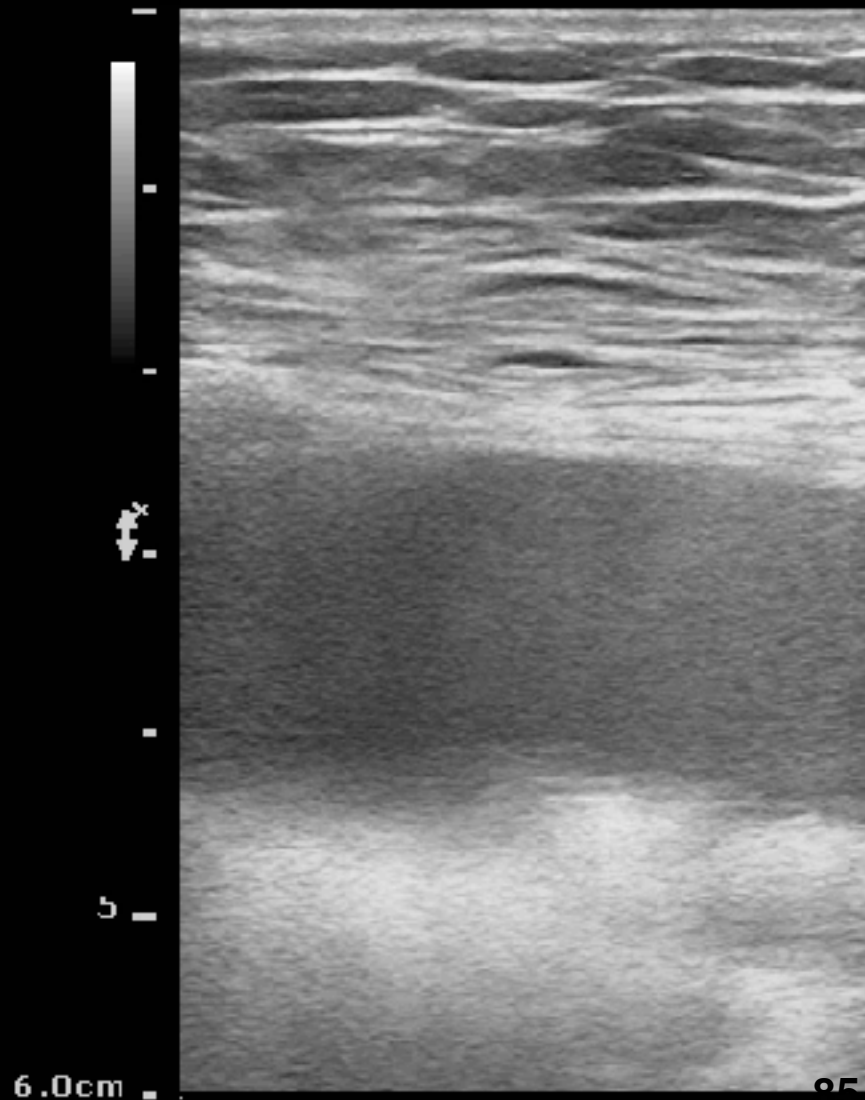
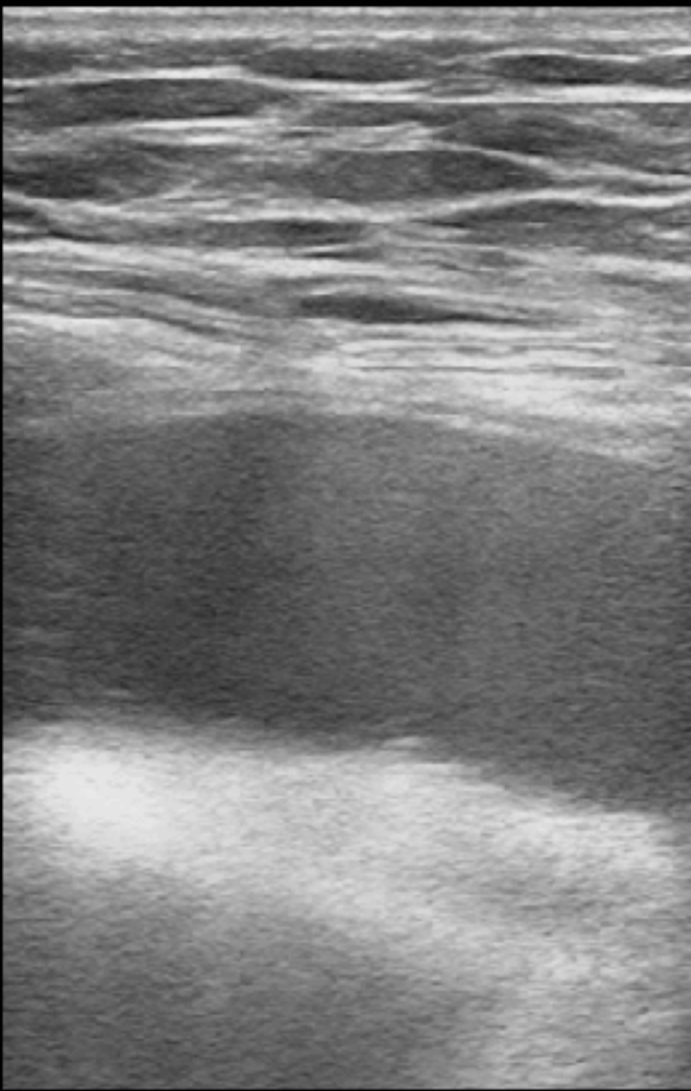
0.0cm

避開Internal thoracic artery

8.0cm



SKI 利用心肌長針施打局部麻醉，同時掌握入針角度和路線 MI 1. TIS 0



CVC引導硬針置放



MI 1.2

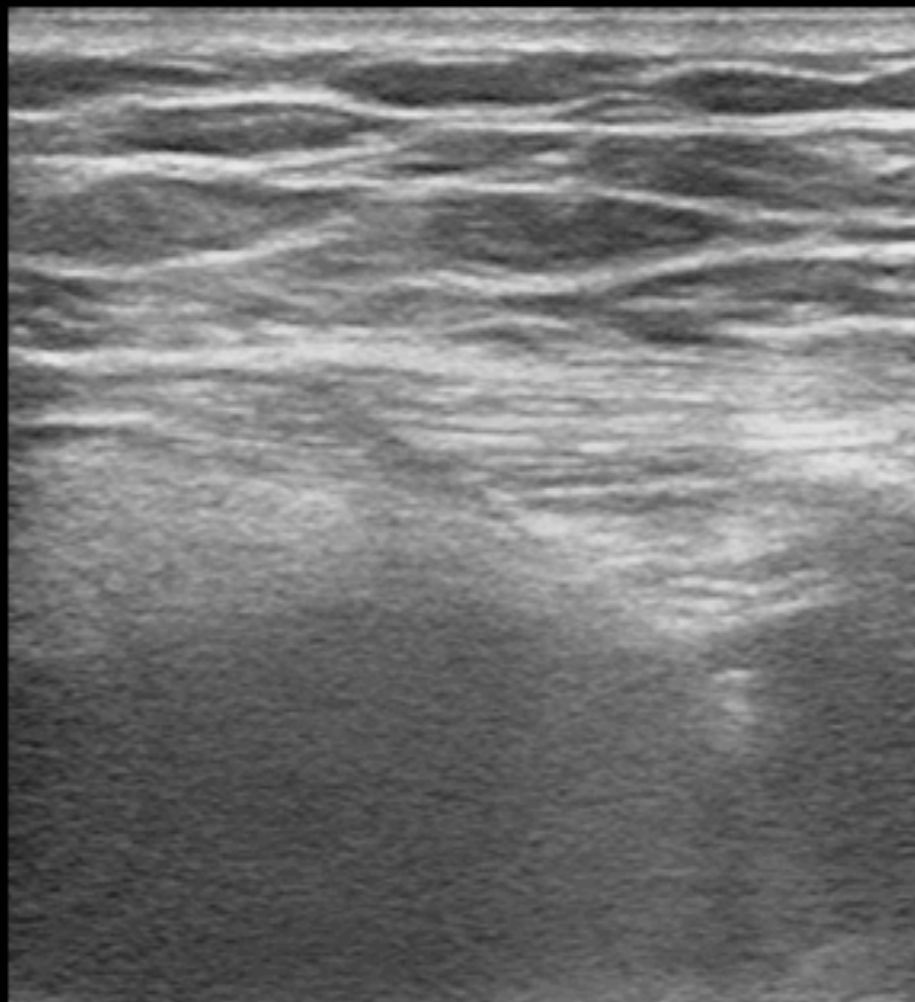
9/25/2020

SKH ER

TIS 0.2

5:49:45 PM

P



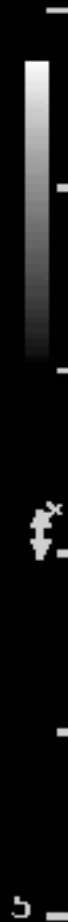
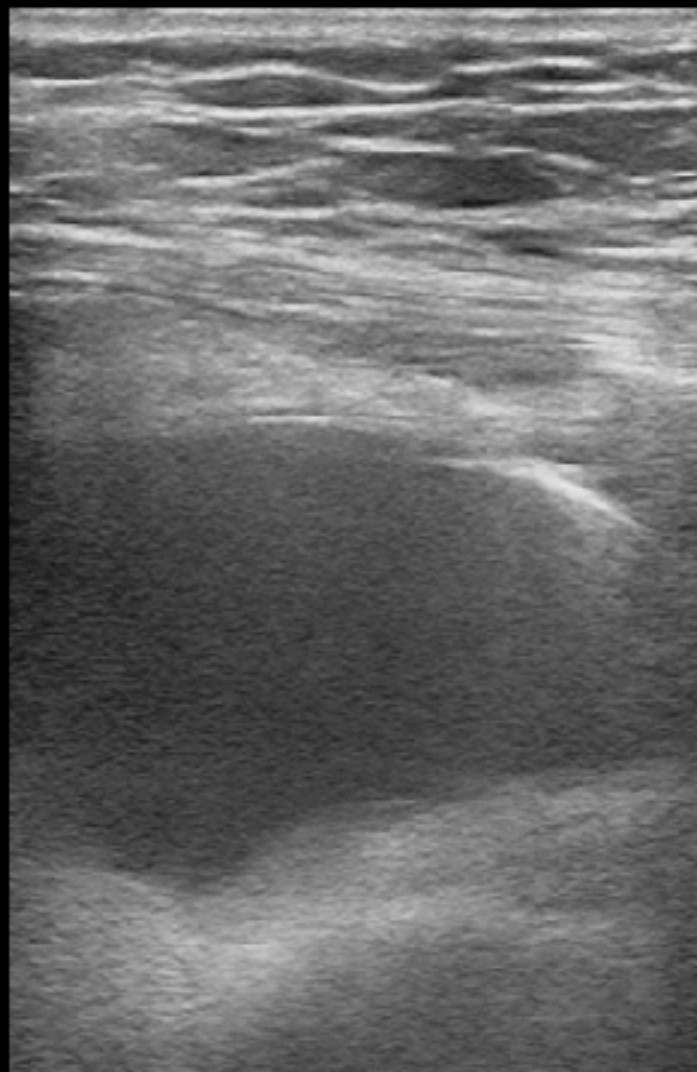
依序放入導線和CVC



MI 1.2 9/25/2020

TIS 0.2 5:51:39 PM

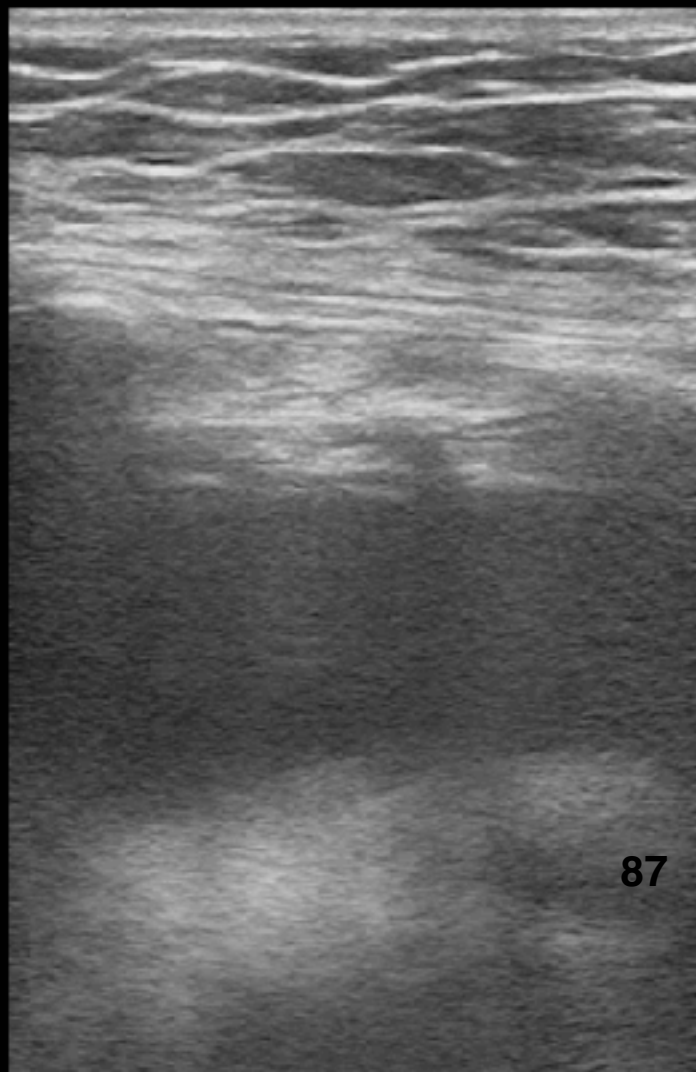
SKH ER



SKH ER

MI 1.2

TIS



Trace CVC catheter

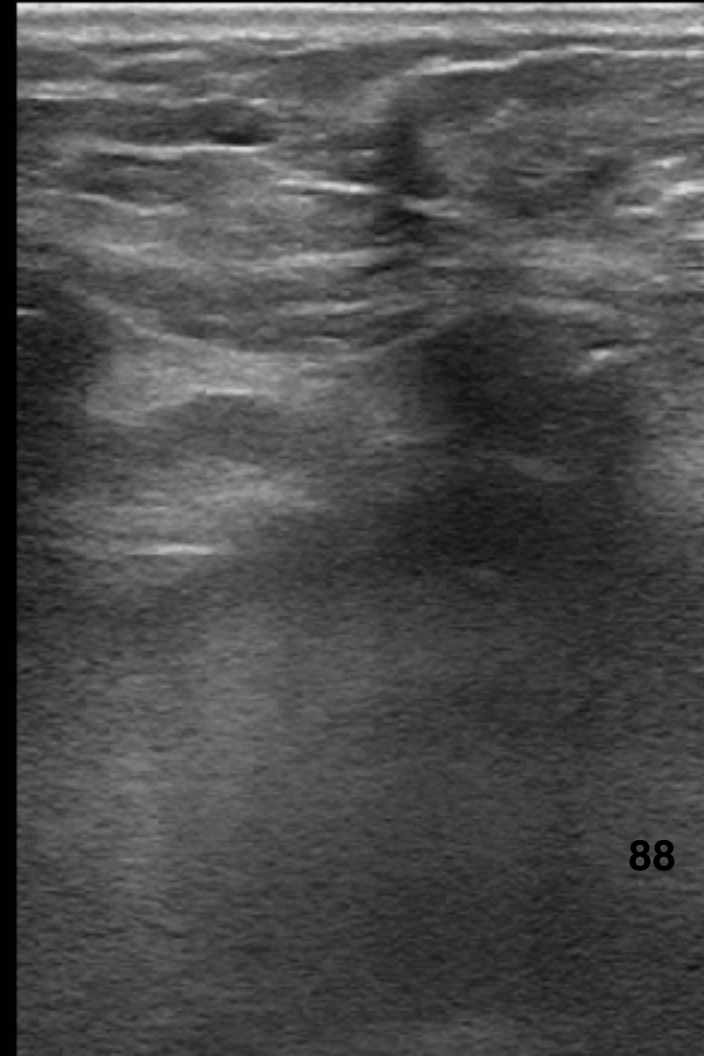
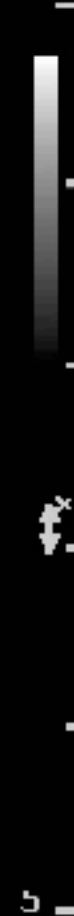
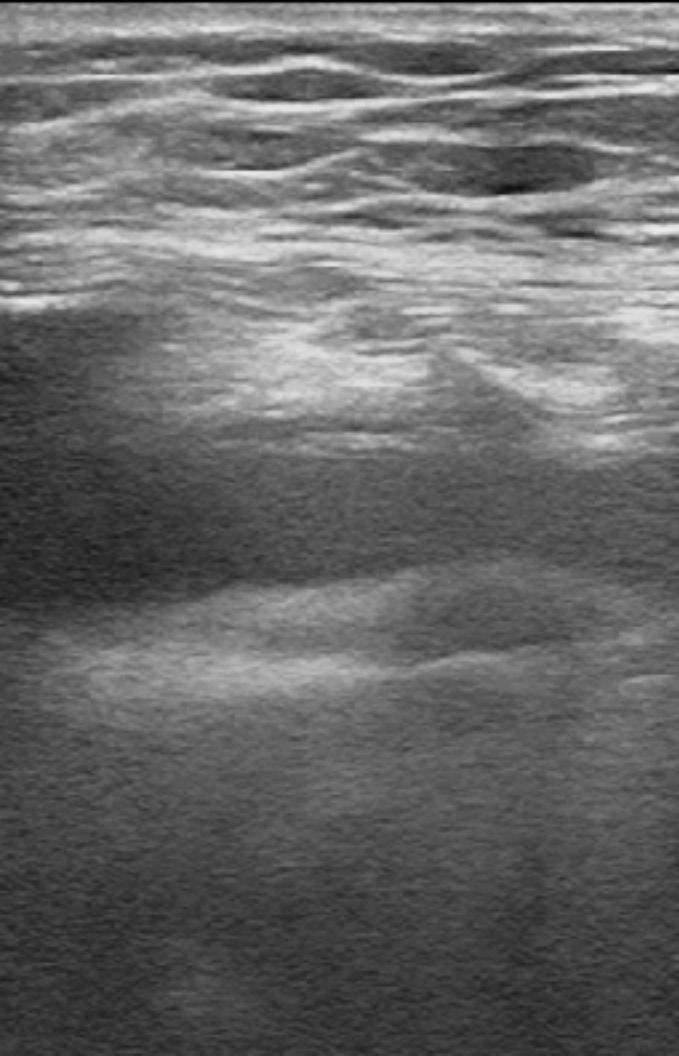


MI 1.2 9/25/2020
TIS 0.2 5:53:55 PM

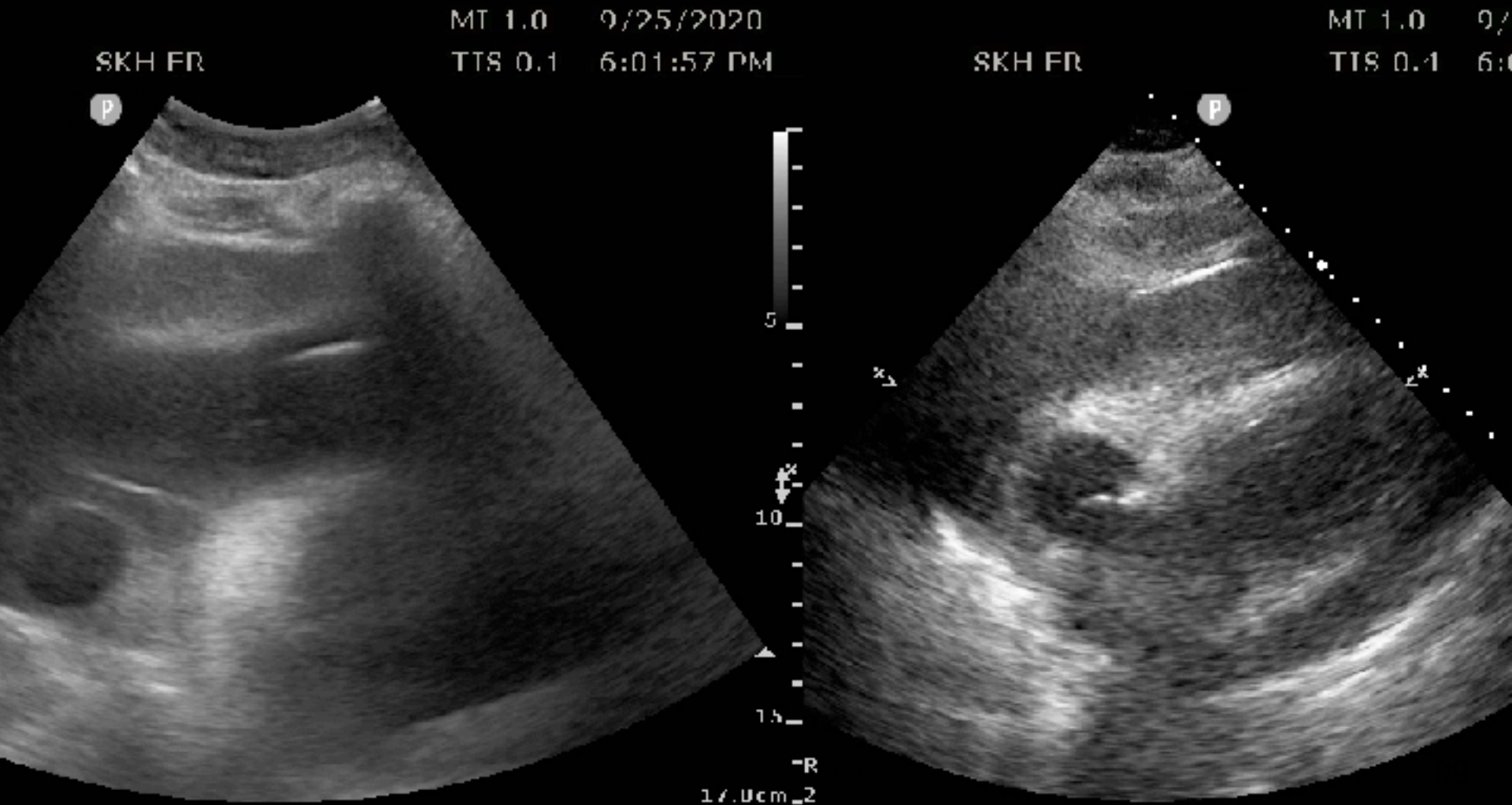
SKH ER

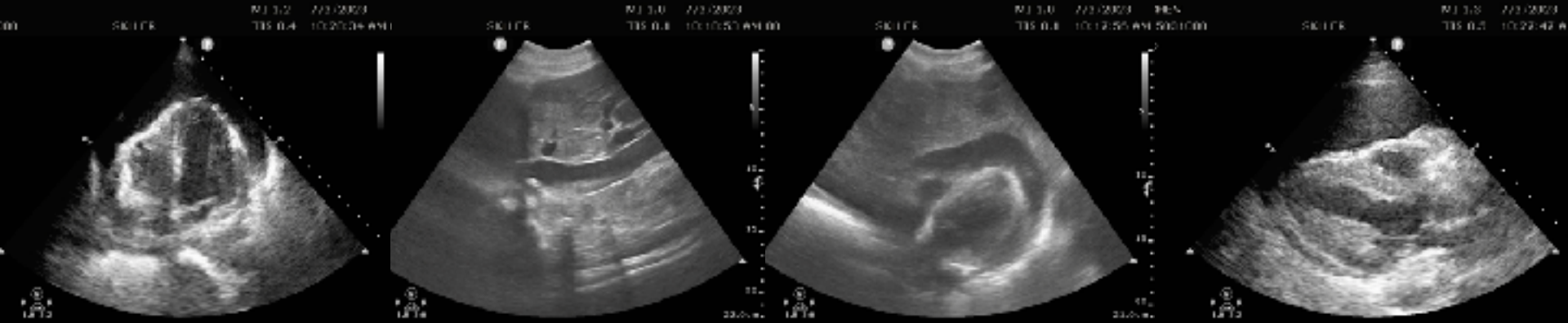
SKH ER

MI 1.2
TIS 0.2



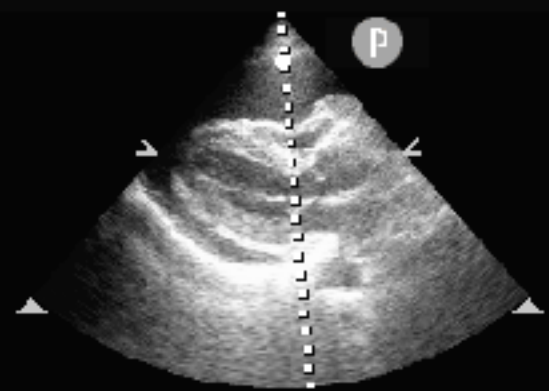
CVC catheter visible





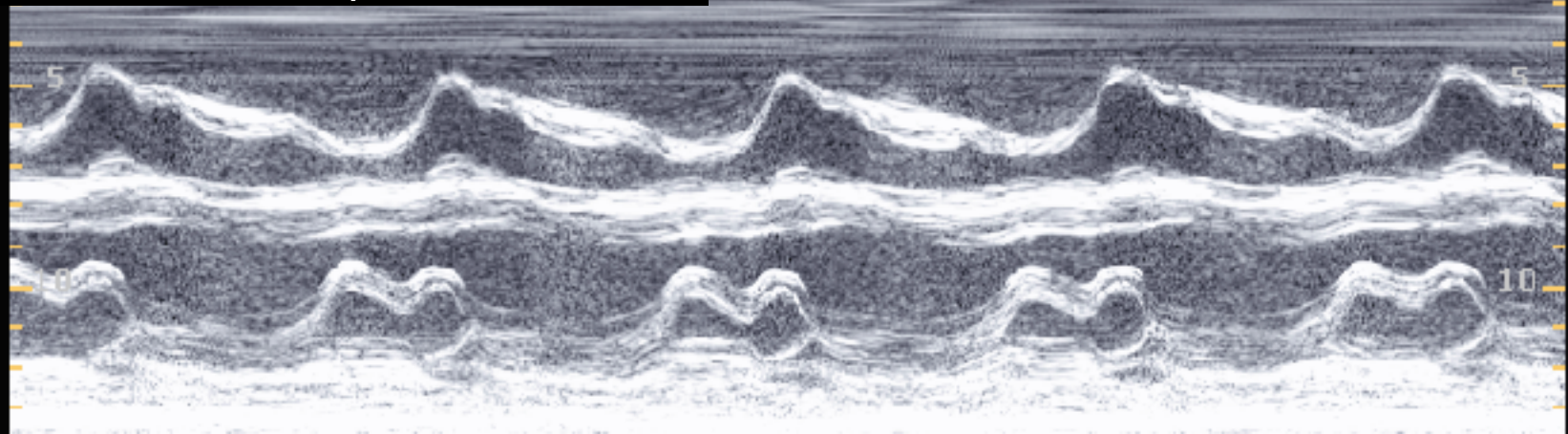
Adult Echo
S5-1
23 Hz
20.0cm

2D
HGen
Gn /1
C. 50
3/2/0



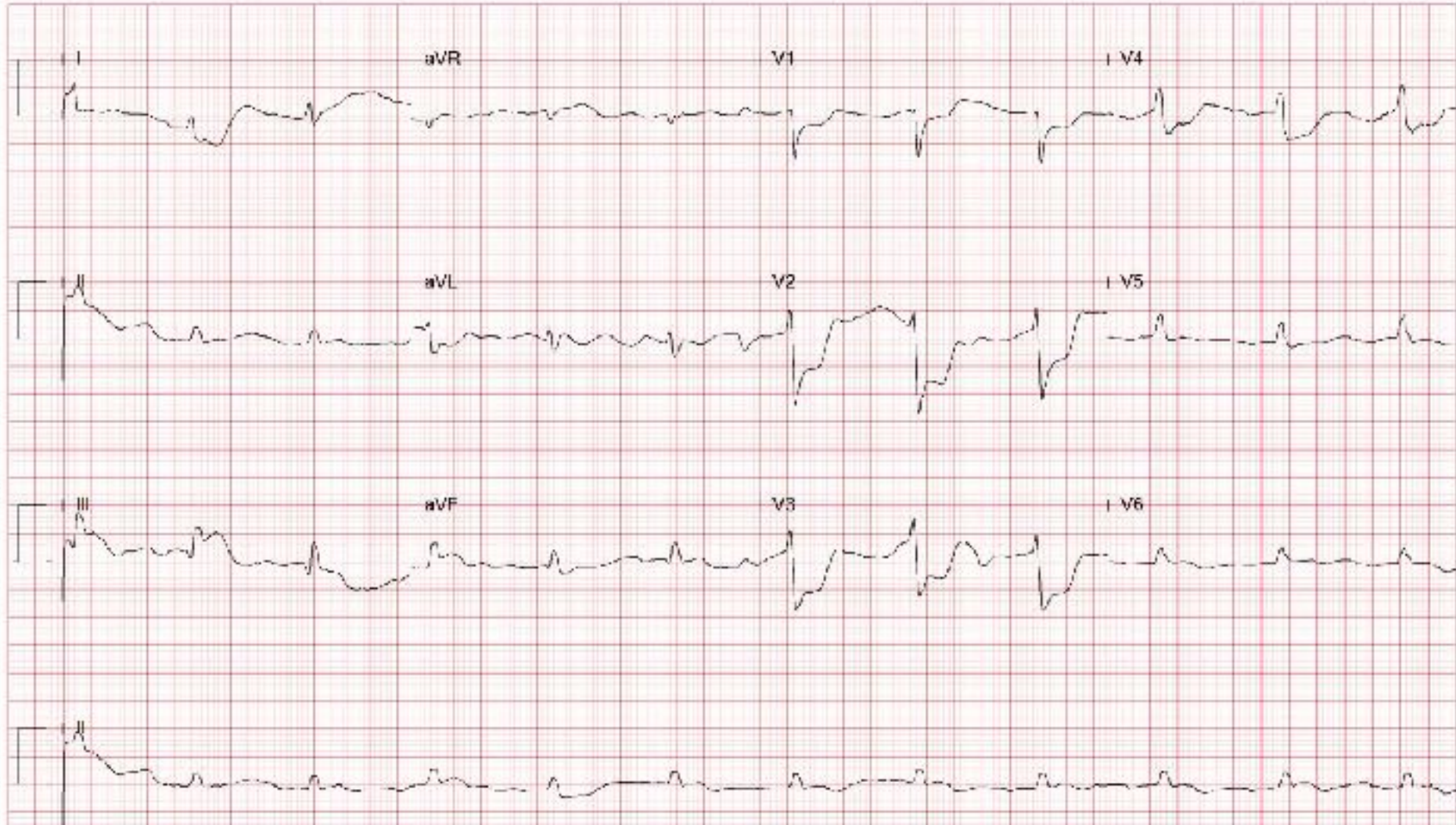
EF : 1~2cm
IVC: 1~2cm / resp variation 50%)

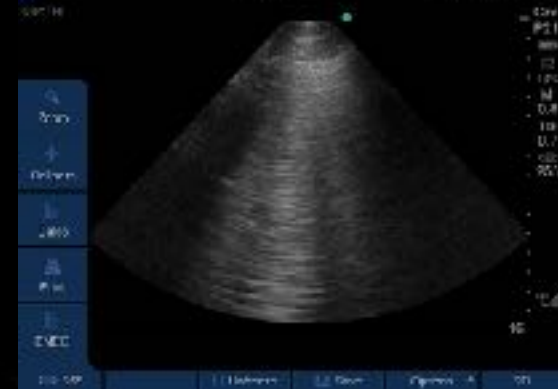
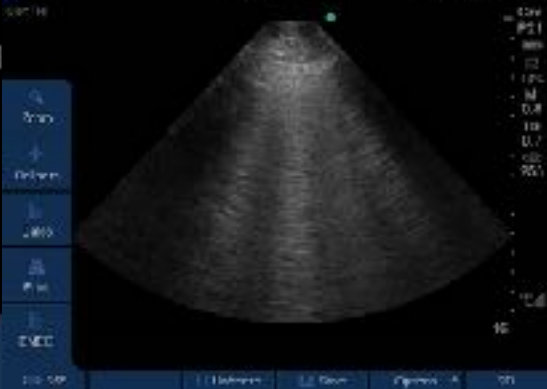
M-mode
3/3
75 mm/s



55M, Chest pain 2H, 119
BT 36; RR 18
SpO2 95% ; BP 80/59

個案





atient

o Gain

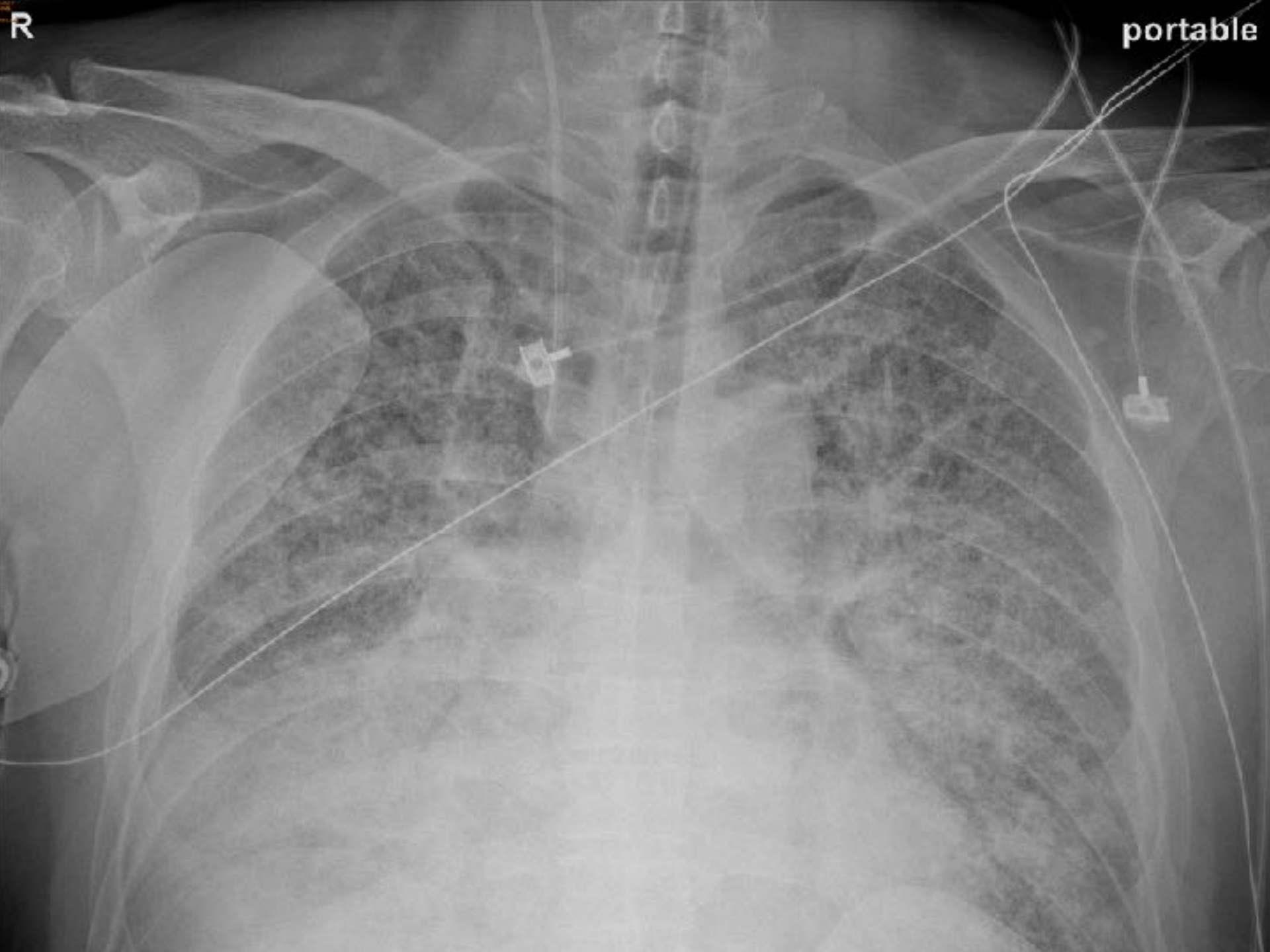
Gen

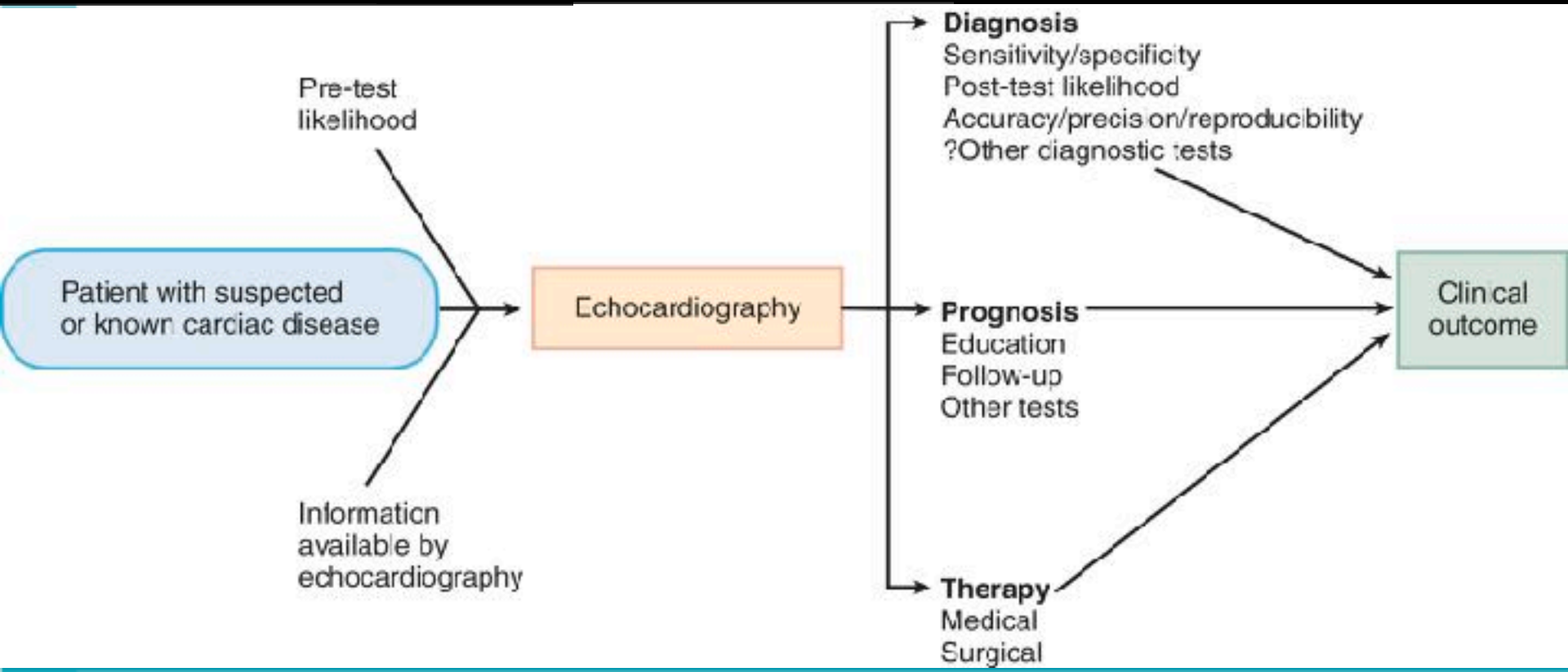
Clip

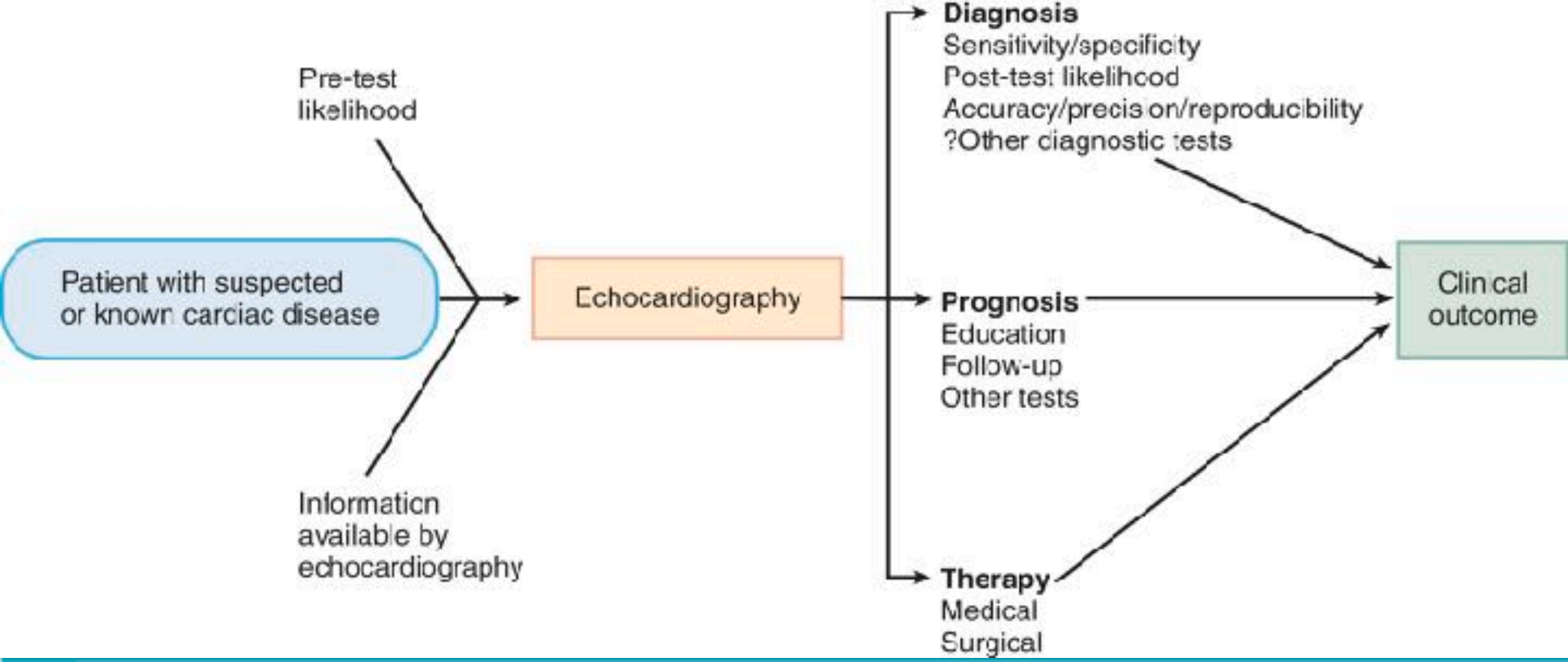
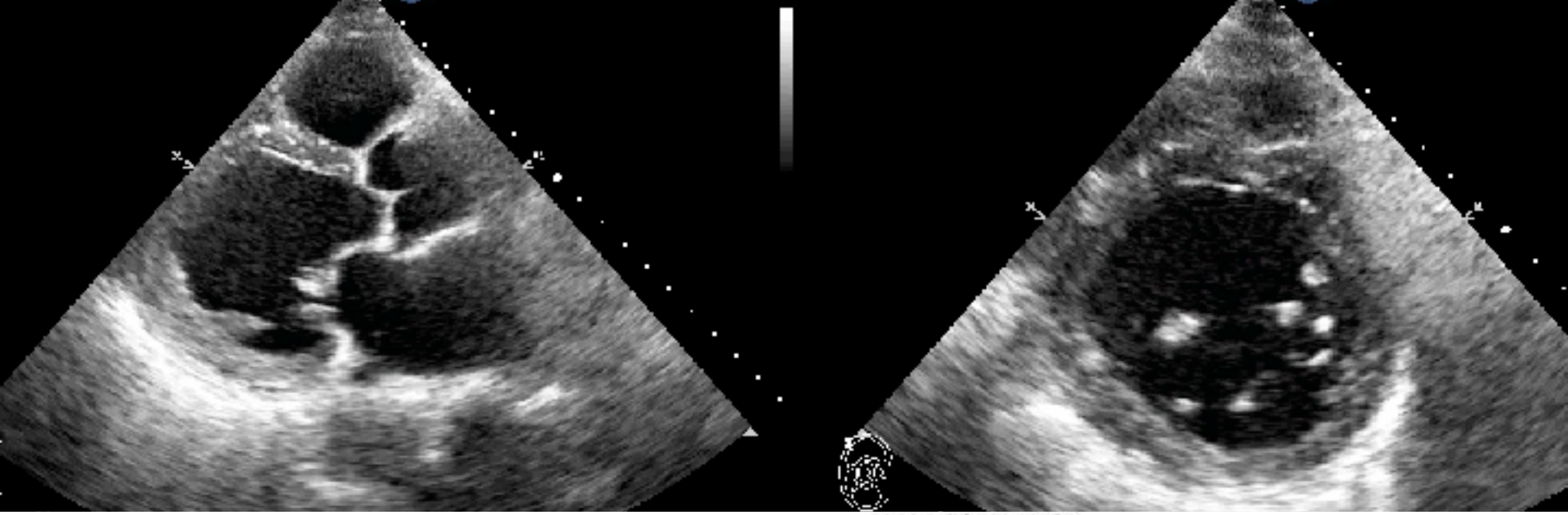
ge 1/3

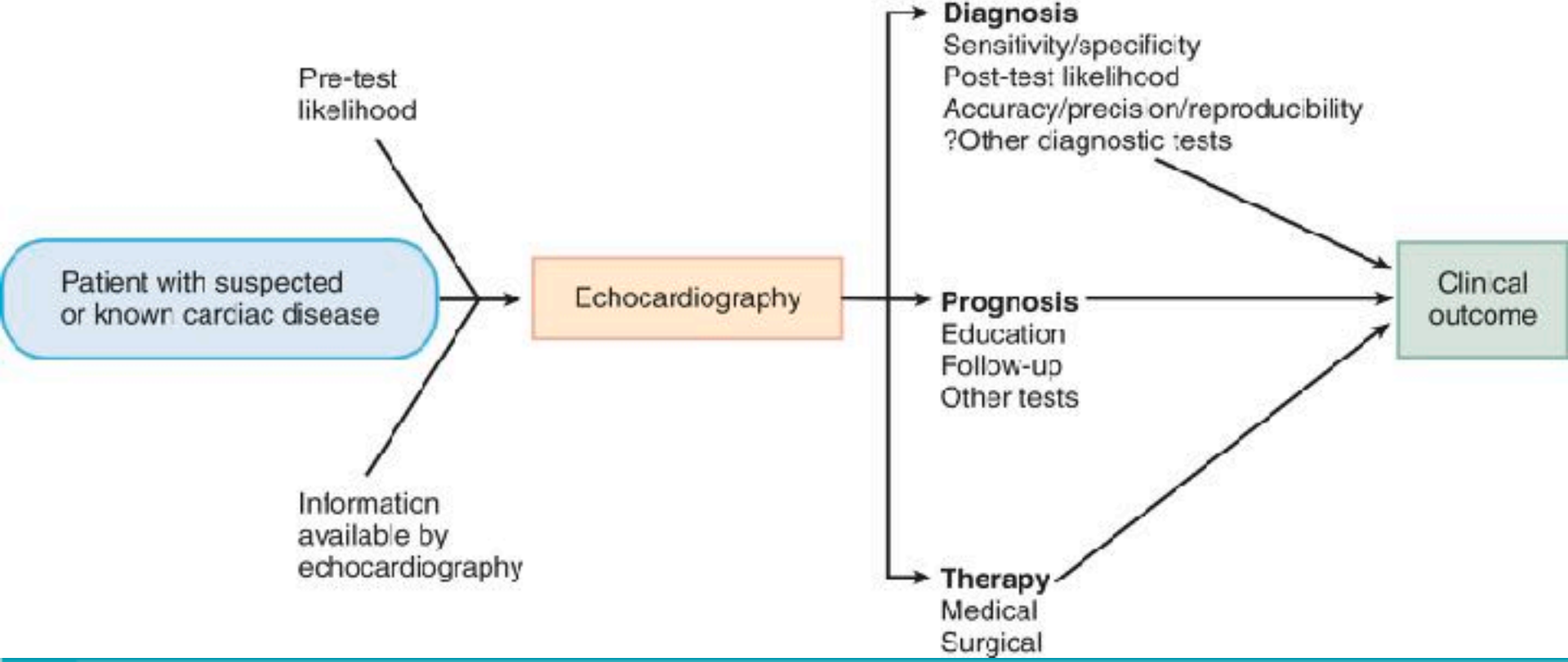
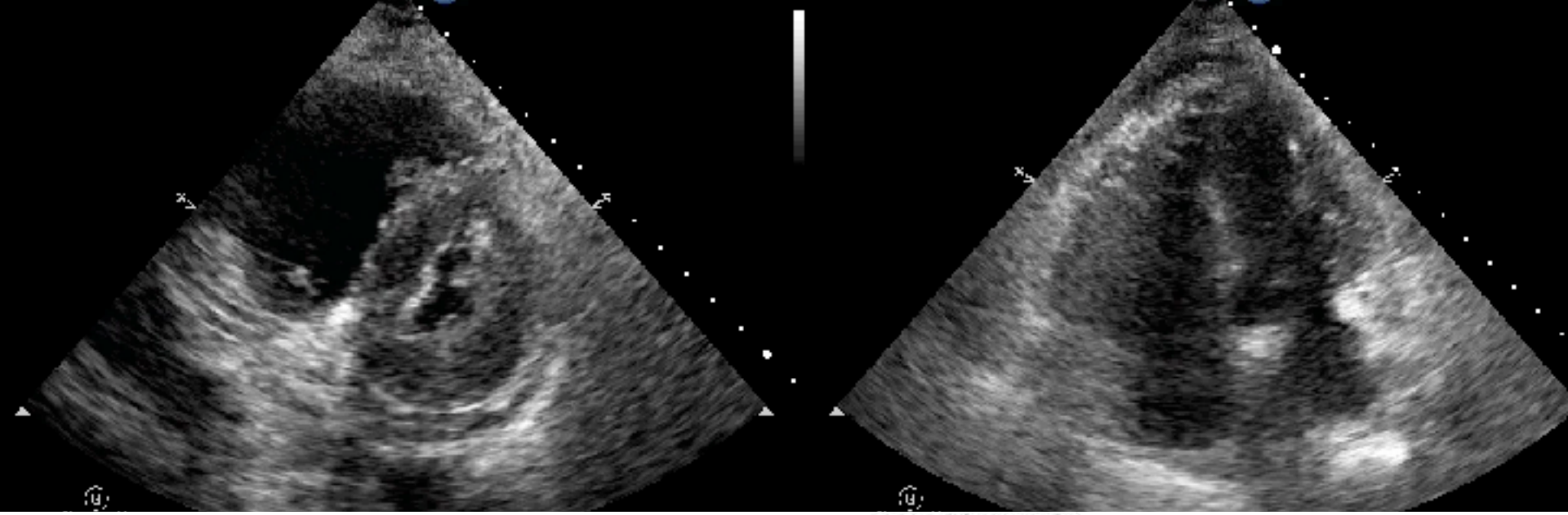
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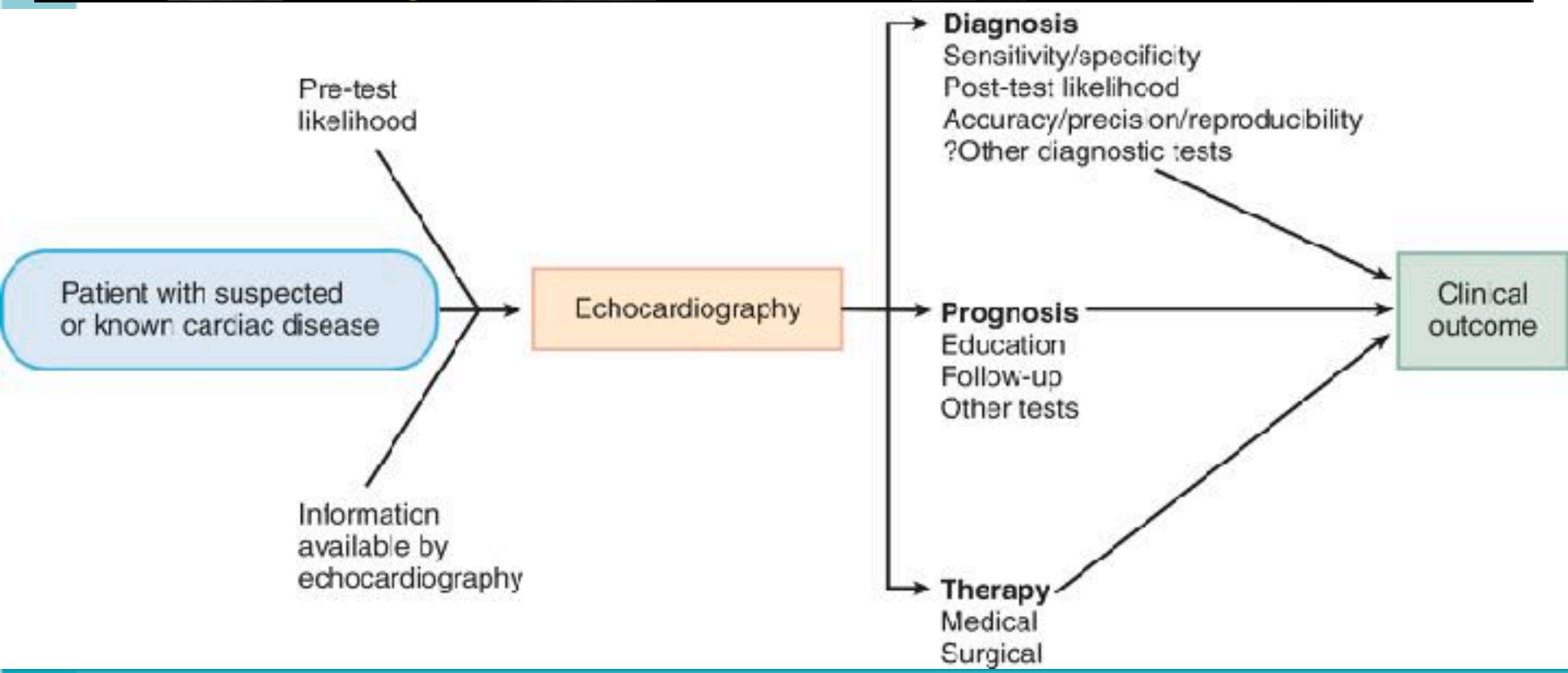
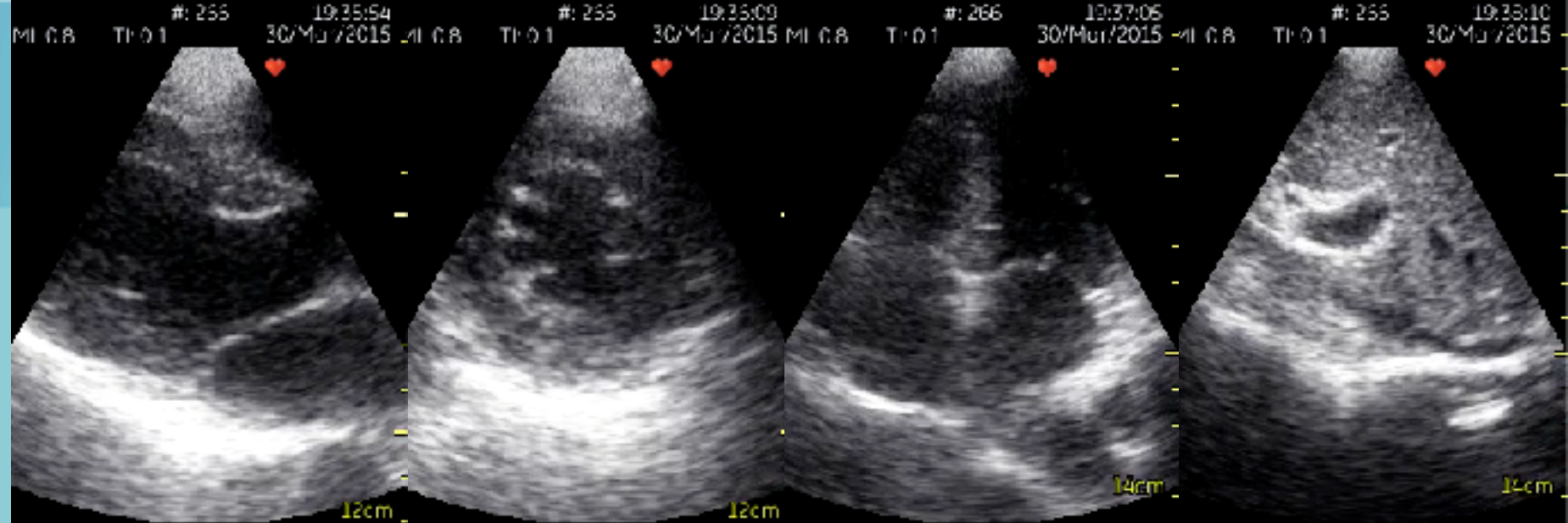
portable

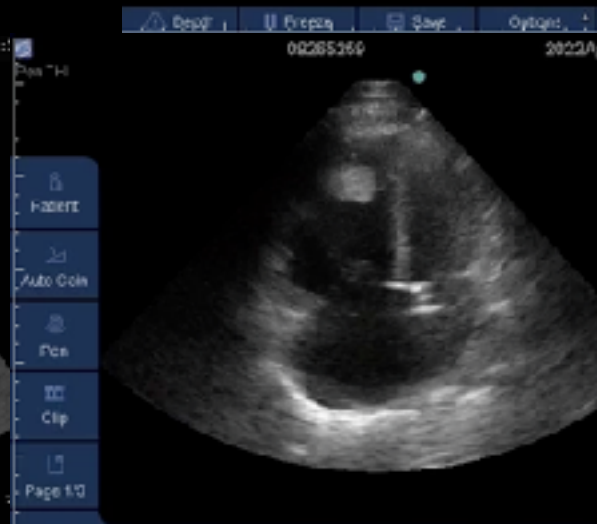
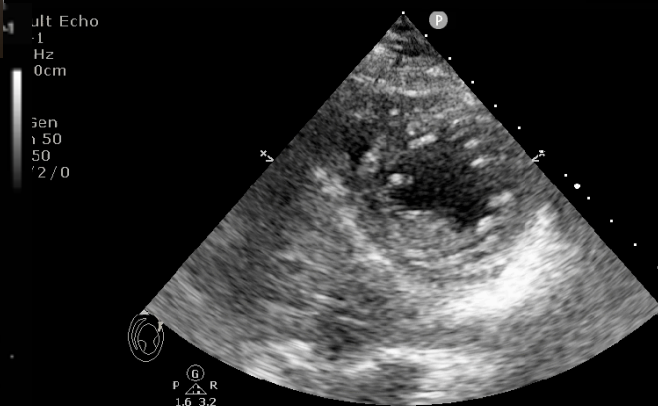
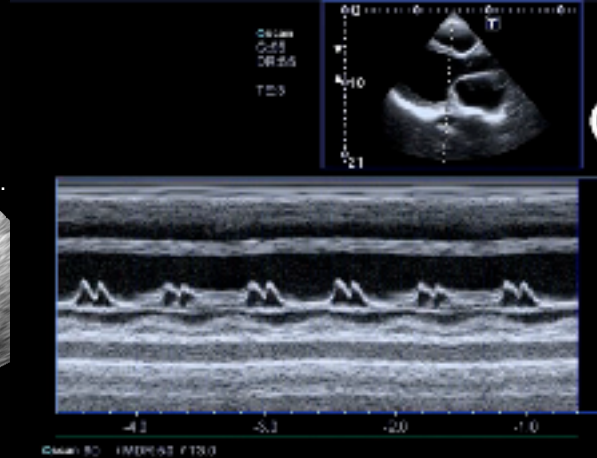












POCUS FOR CARDIAC ECHO

Parasternal	Subcostal	Apical/Supra
PSLA	S4C	A4C / A5C
PSSA	S2C	E/A & VTI
Aortic root	IVC	MAPSE/TAPSE
EPSS	Abdominal aorta	Aortic arch