Echo in sick pregnant patients: clinical vignettes

A Prof Sam Orde FCICM DDU FASE PhD
ICU specialist, Nepean Hospital, Sydney
Dept Medicine, University of Sydney

sam.orde@health.nsw.gov.au

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No relevant disclosures

Overview

Echo in sick pregnant patients

- Physiology in pregnancy
- Acute pathology
- Chronic pathology
- Management & communication
  - “Pregnancy Heart Team” approach

Physiology of pregnancy

Cardiovascular Physiology of Pregnancy

Monika Sanghavi, MD; John D. Rutherford, MB ChB, FRACP

Circulation September 16, 2014

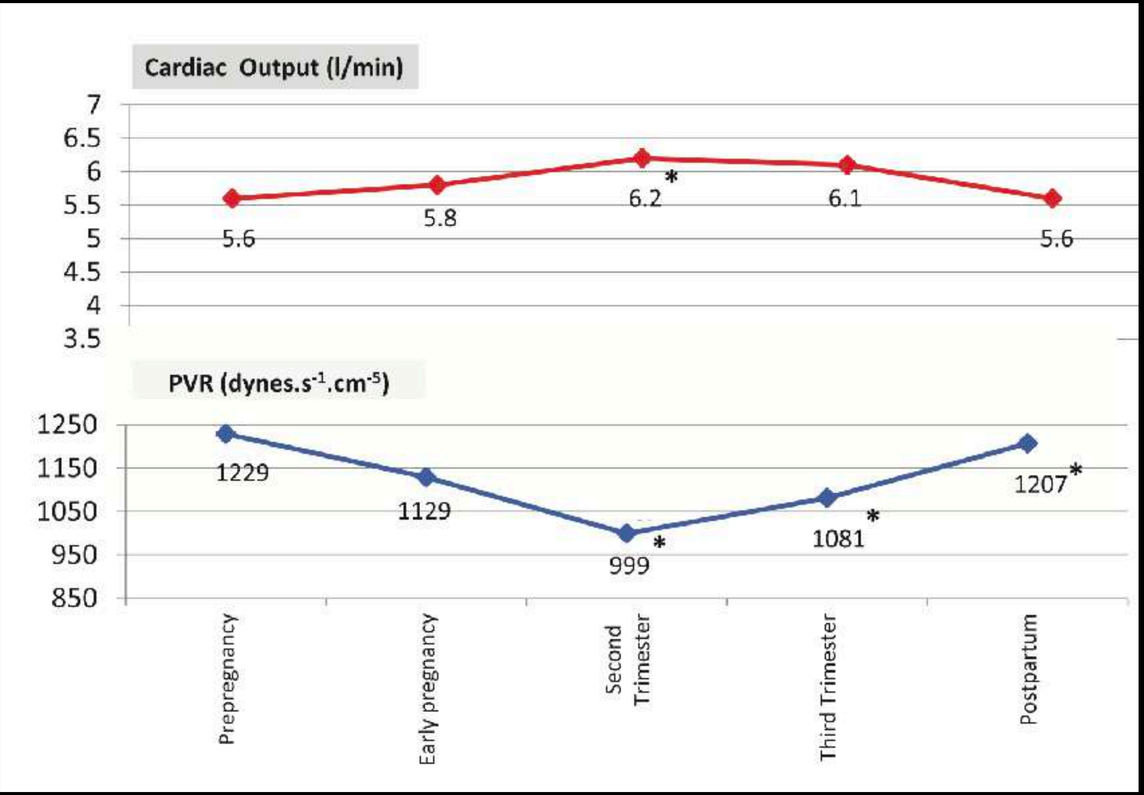


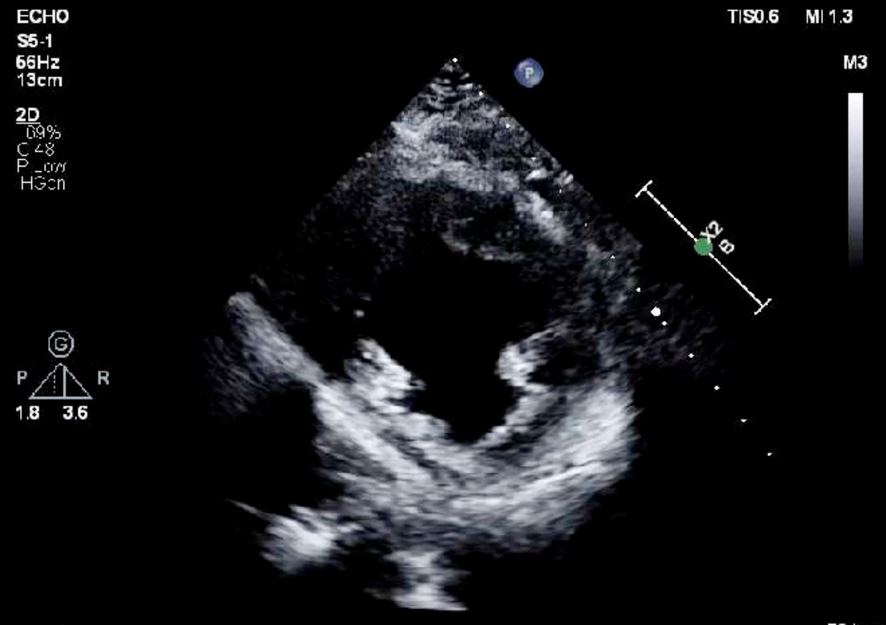
Table. Interrelationships of Changes in the Major Variables That Contribute to the Cardiovascular Changes in Pregnancy Compared With Preconception Values

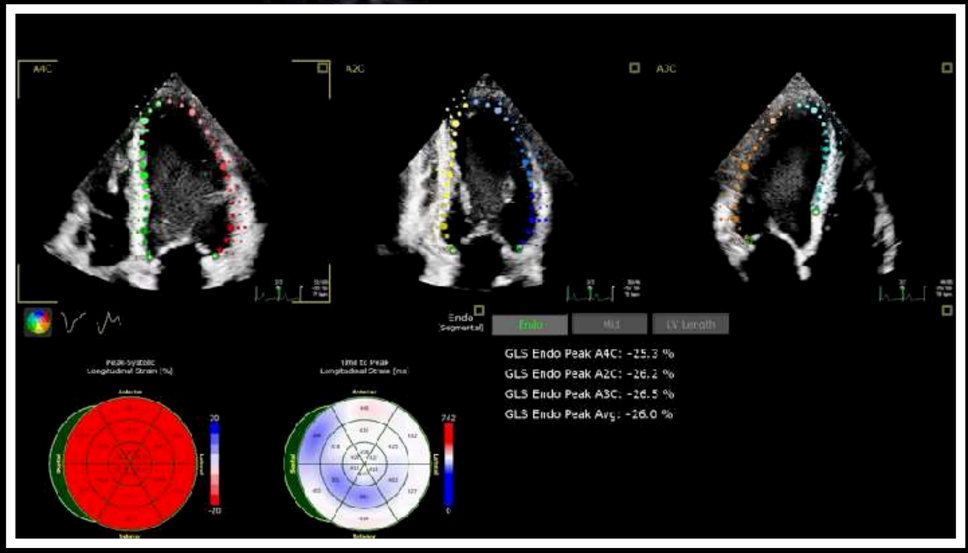
Preconception		Pregnancy			
Baseline		First Trimester	Second Trimester	Third Trimester	Labor
Hemodynamic	CO	↑	↑↑	↑↑	↑↑↑↑
	SVR	↓	↓↓	↓↓	
	HR	↑	↑↑	↑↑↑	↑↑↑↑
	BP	↓	↓	↔	(Pain)
Neurohumoral		↑ Sympathetic activity			
		↑ Estrogen/progesterone/relaxin			
Renin/angiotensin	Plasma volume*	↑↑	↑↑↑	↑↑↑↑	↑↑↑↑↑
RBC changes	RBC mass	↑	↑↑	↑↑	(Autotransfusion)
Structural changes	LV wall mass	↑	↑	↑	
	Chamber sizes	4-Chamber enlargement			
	Aorta	Increased distensibility			

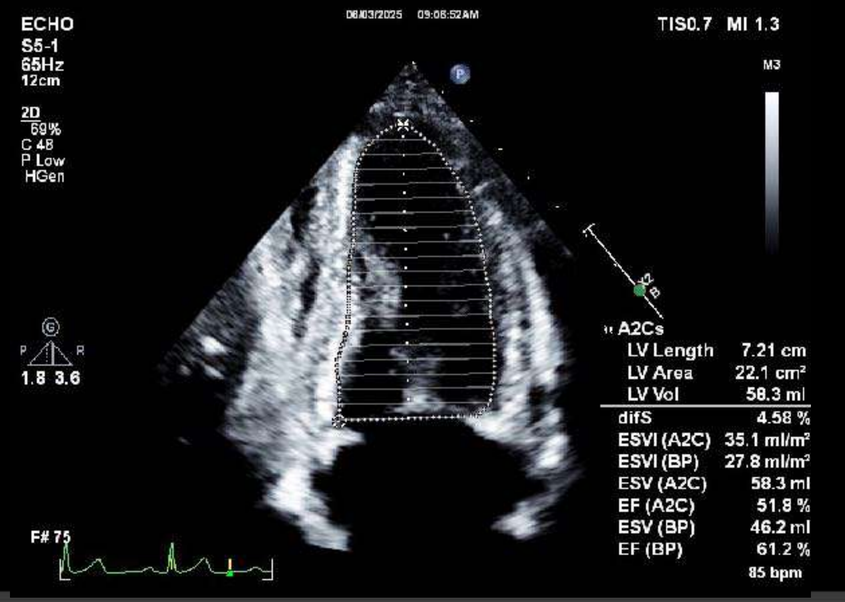
BP indicates blood pressure; CO, cardiac output; HR, heart rate; LV, left ventricular; RBC, red blood cell; and SVR systemic vascular resistance. ↑ and ↓ reflect relative changes in parameters from preconception values.

*The greater increase in plasma volume relative to the increase in RBC mass results in the physiological anemia of pregnancy.

Normal pregnant patient's heart



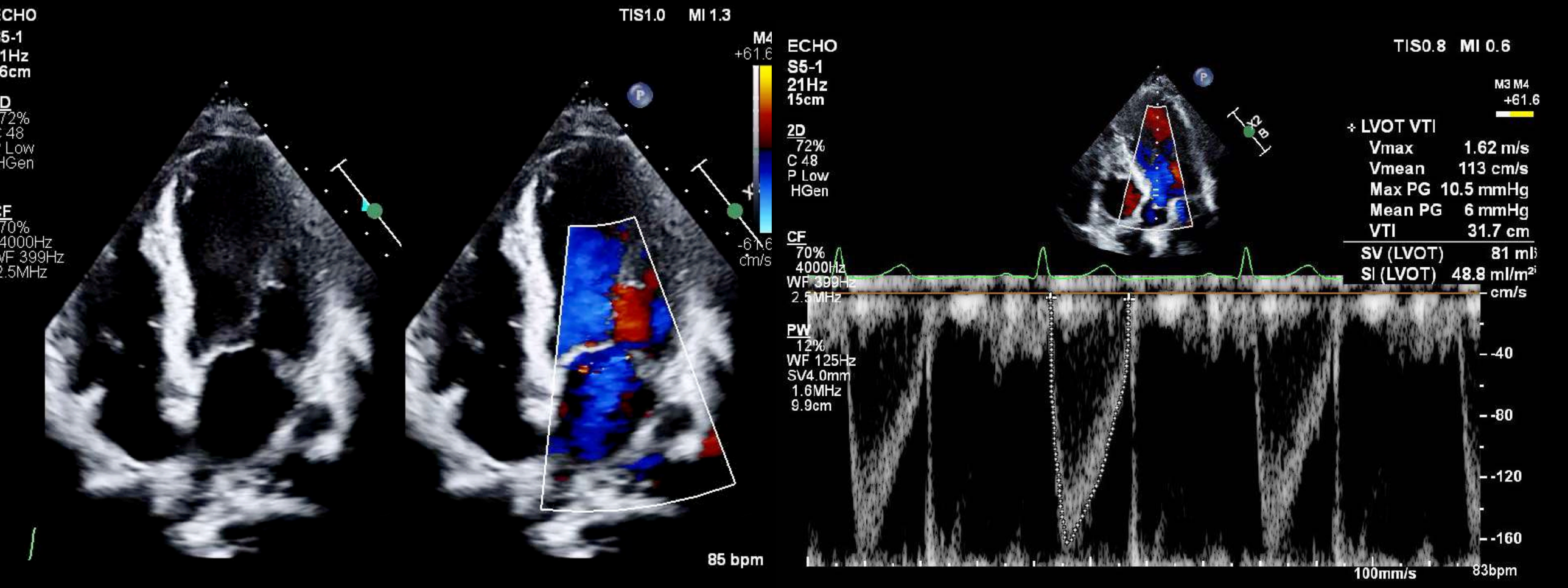




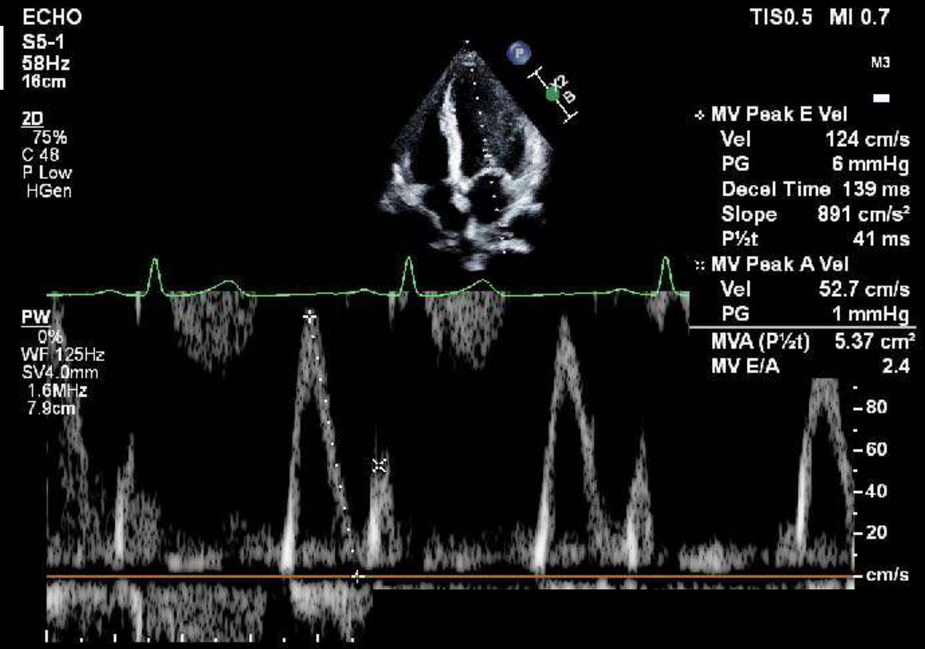
Thank you for excellent imaging Nepean monographers

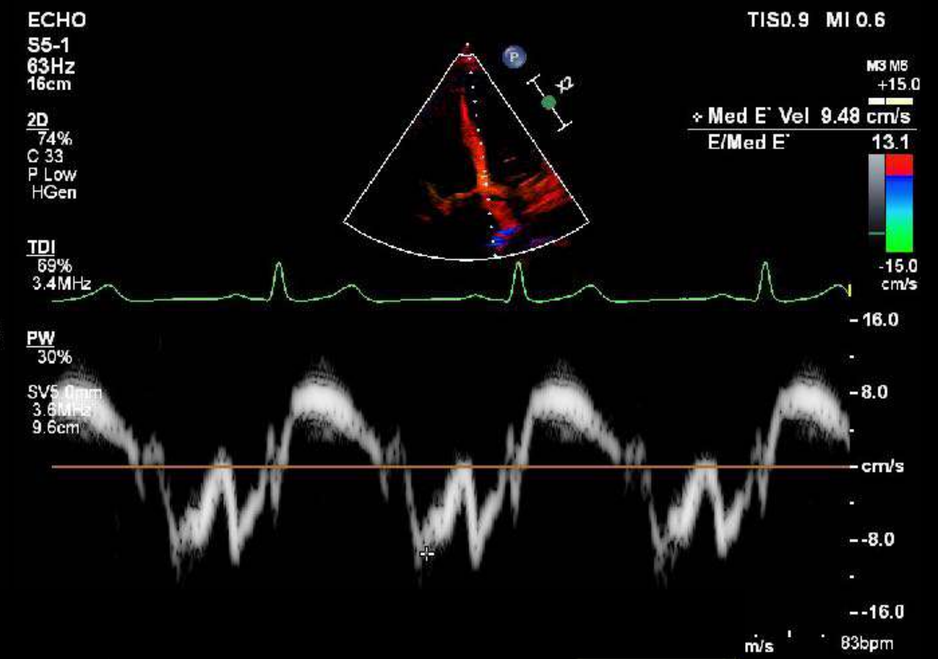
ECHO AUSTRALIA

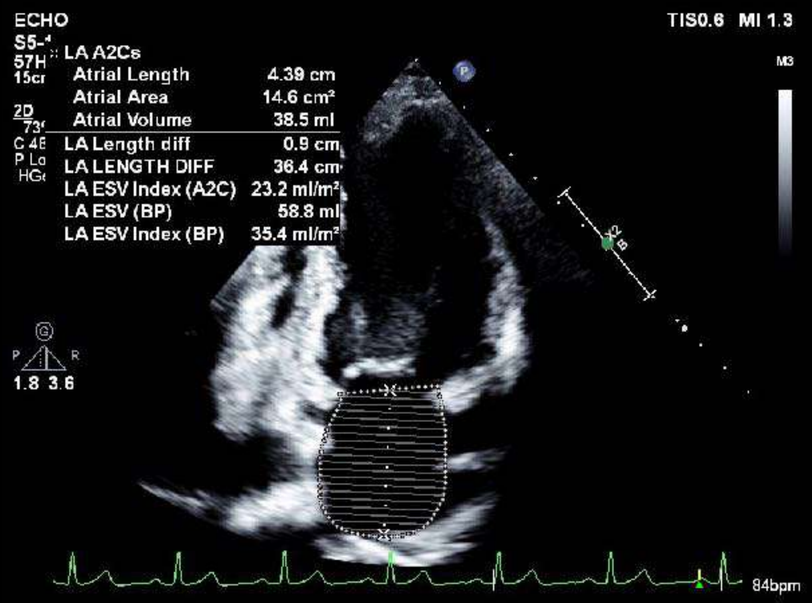
Normal pregnant patient's heart

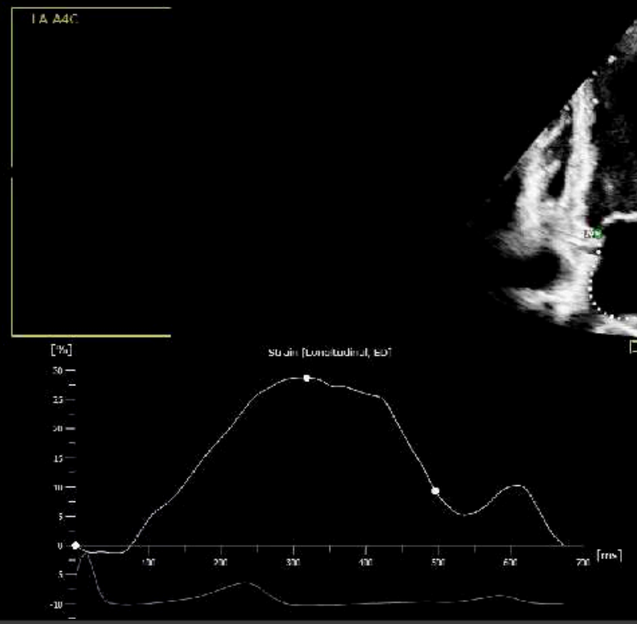


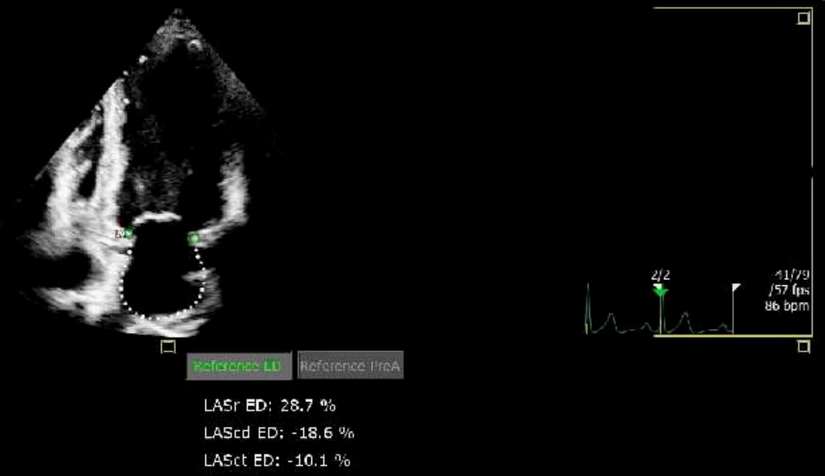
Normal pregnant patient's heart





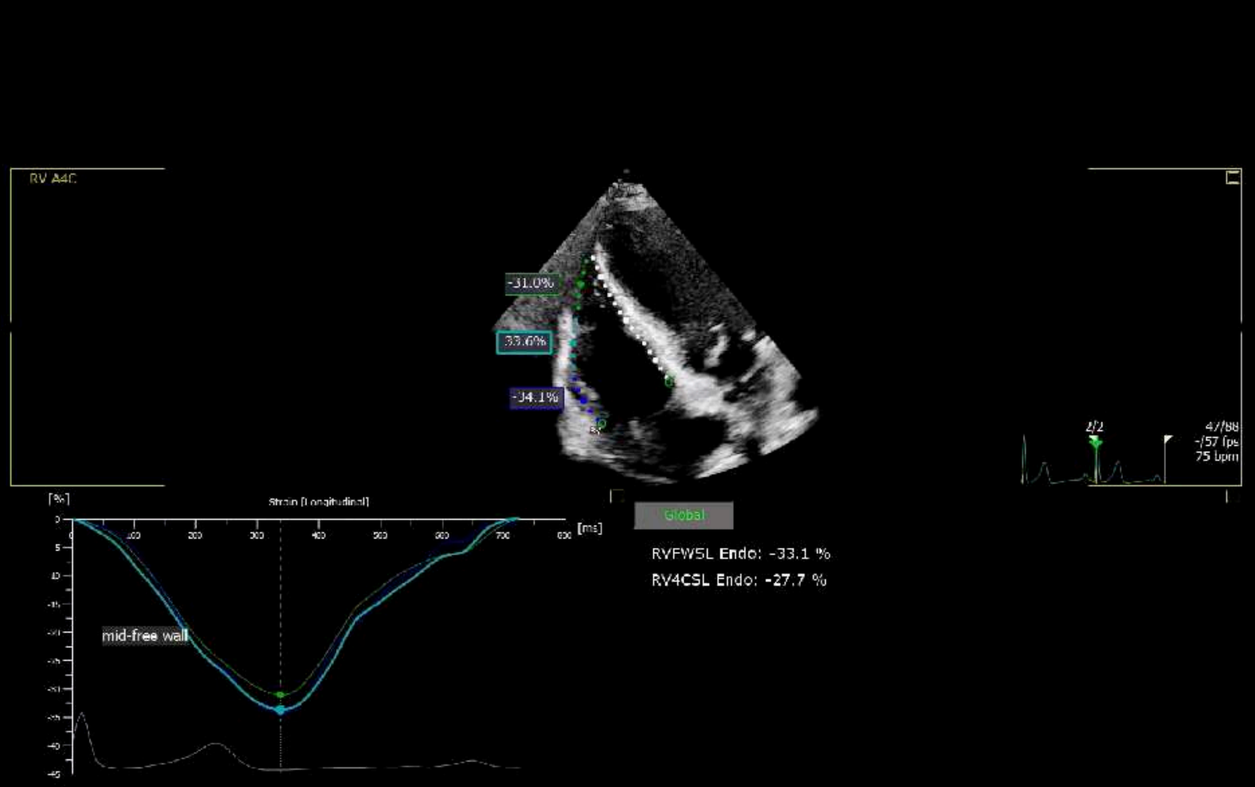


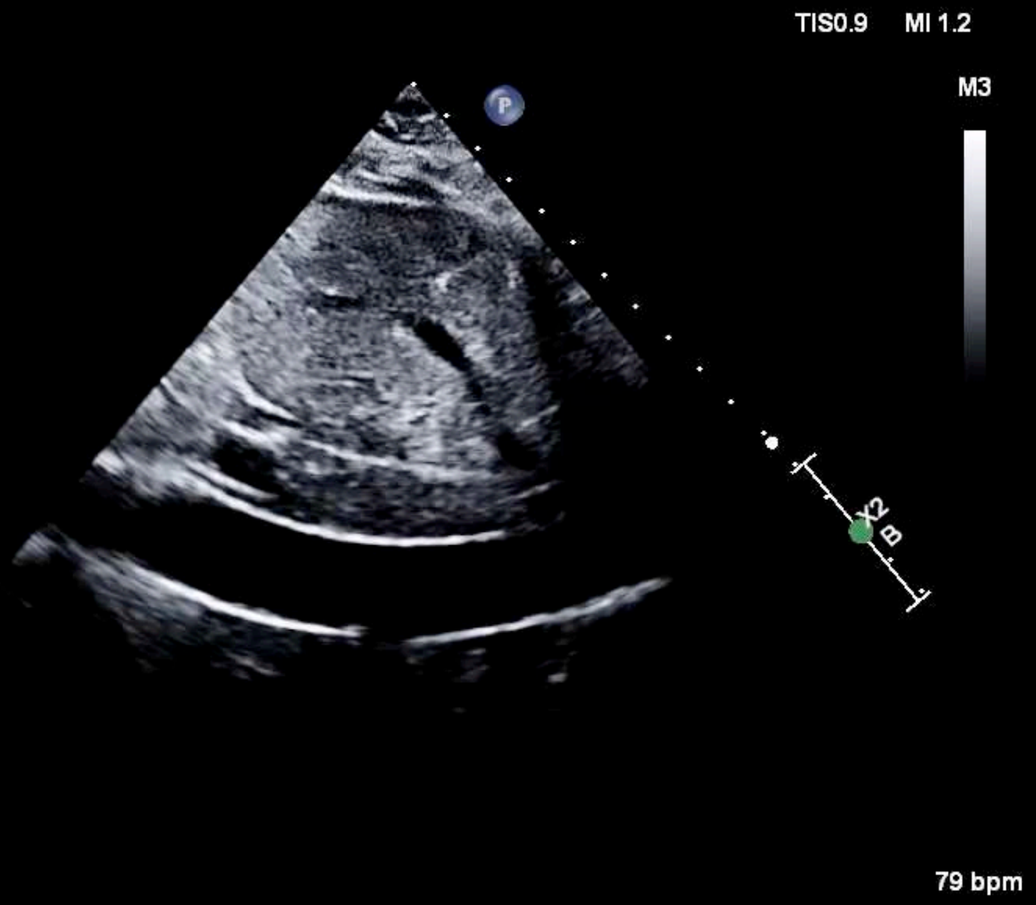




ECHO AUSTRALIA

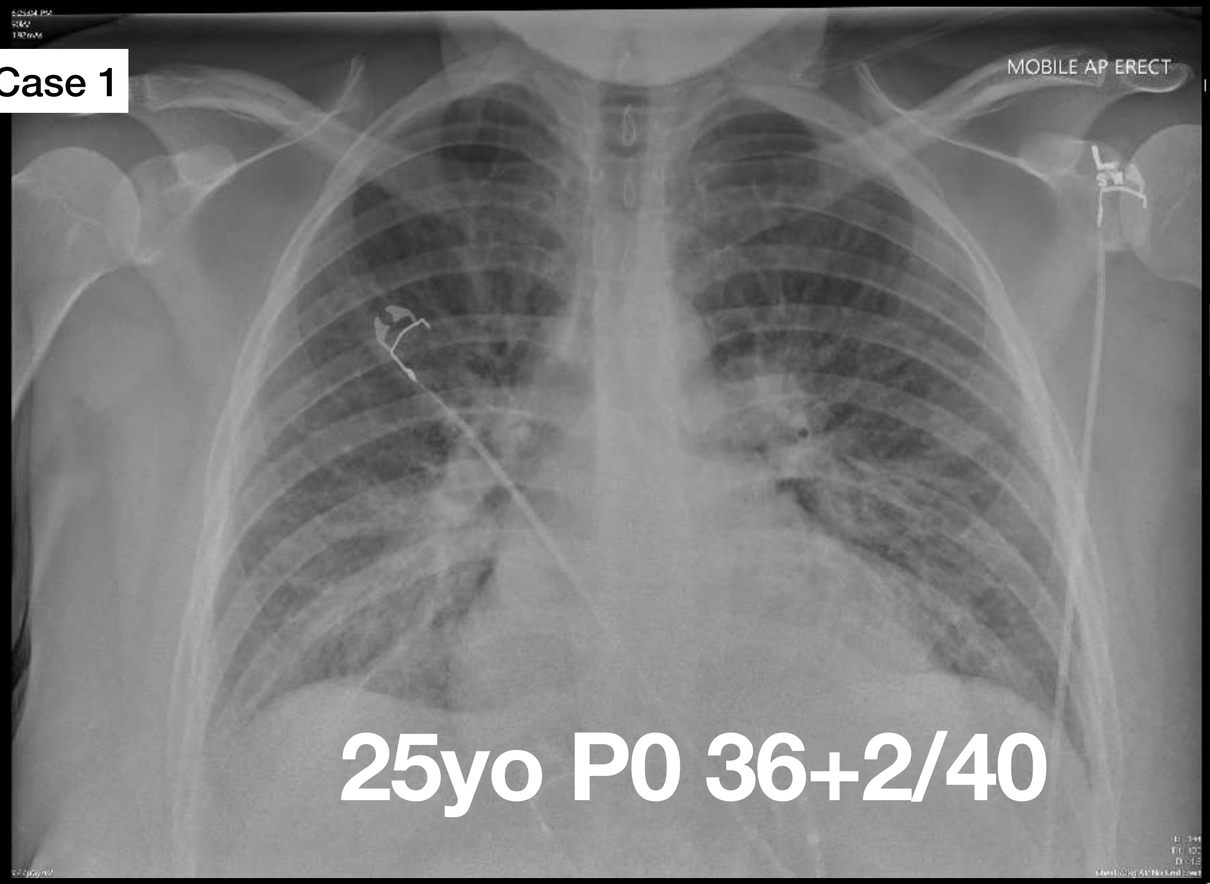
Normal pregnant patient's heart

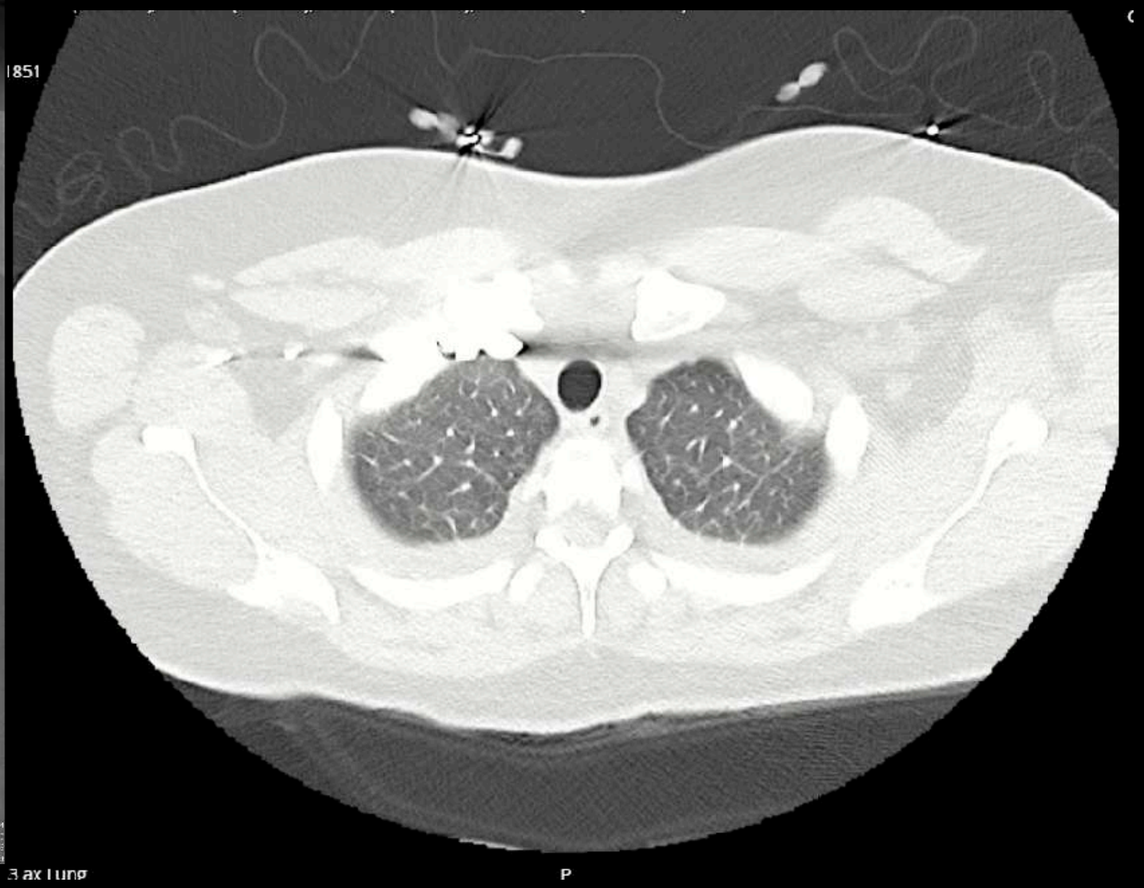




Pregnancy induced cardiac disease	Pregnancy with pre-existing cardiac disease
Peripartum cardiomyopathy Pulmonary embolism Aortic dissection Acute coronary syndrome Pre-eclampsia associated	Valvular heart disease Cardiomyopathies PAH Congenital heart disease

Case 1





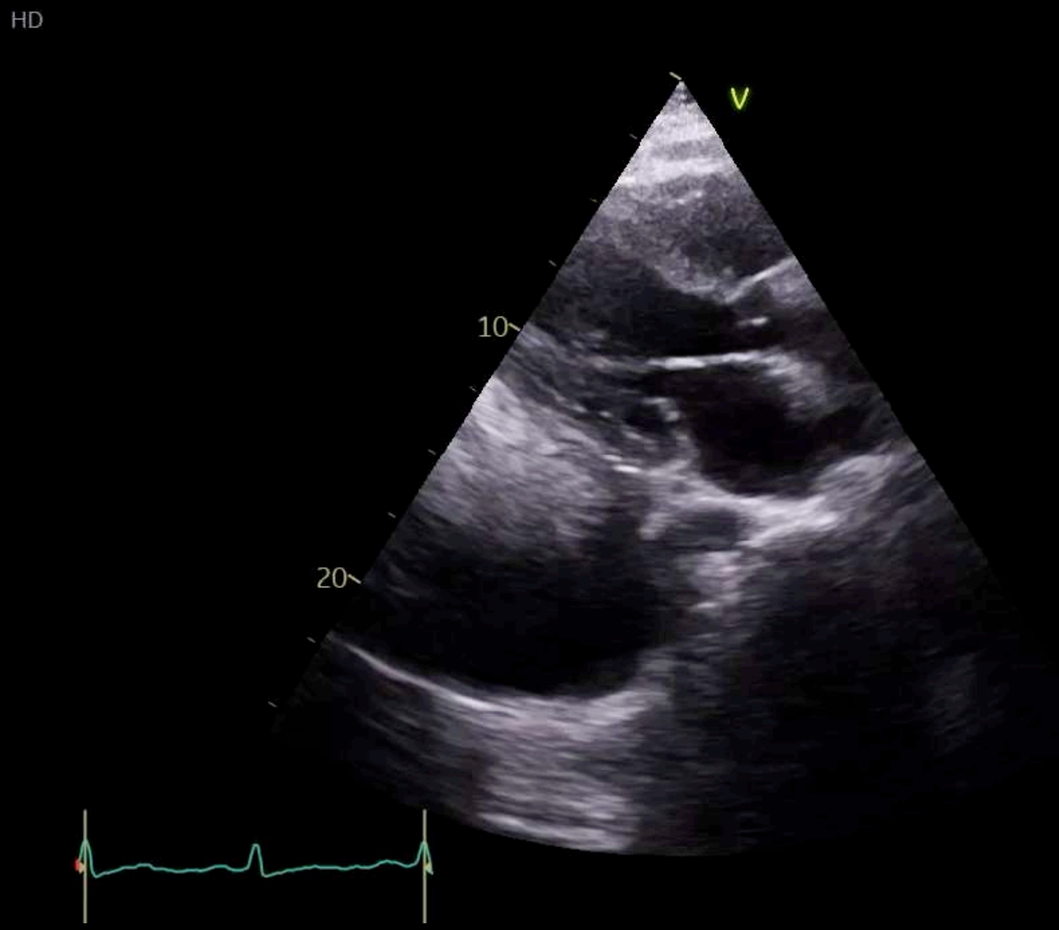
25yo P0 36+2/40

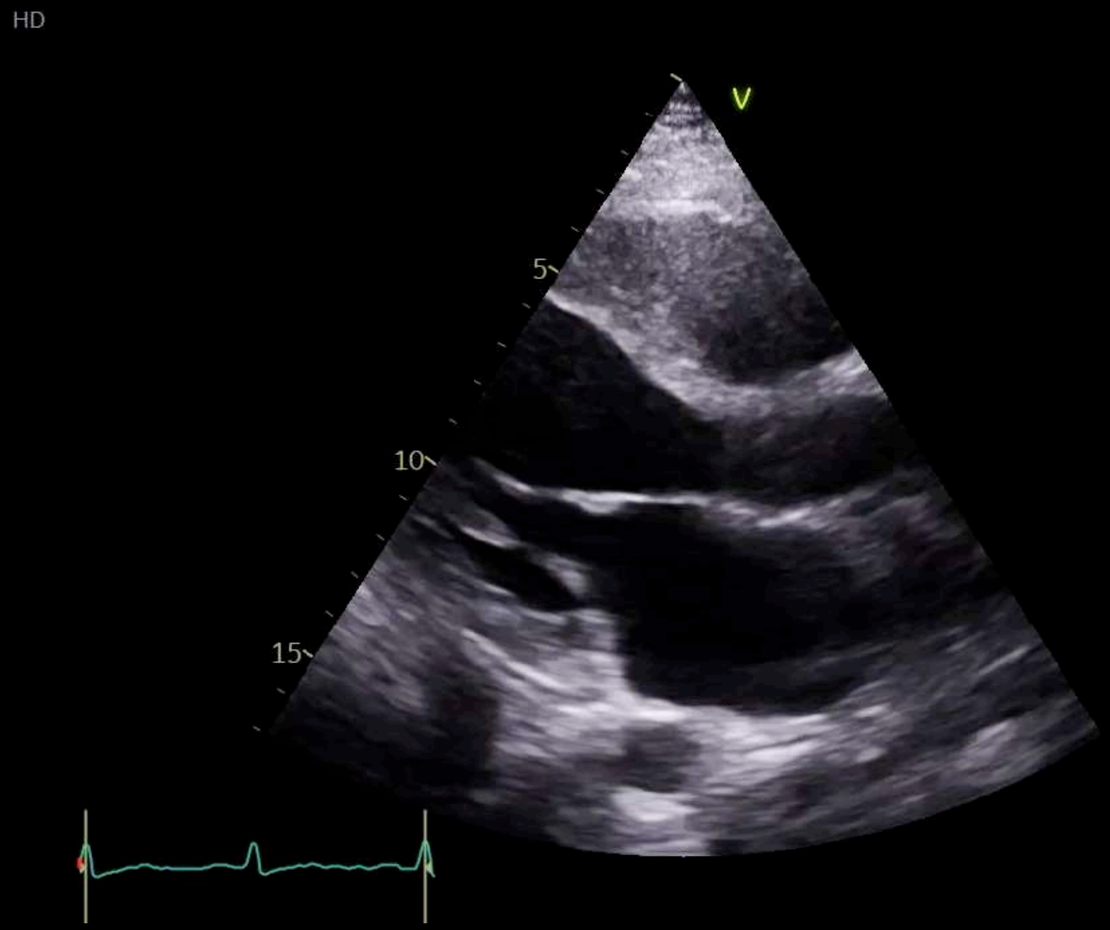
No PMH

Normal pregnancy up until 3 days ago => SOB++

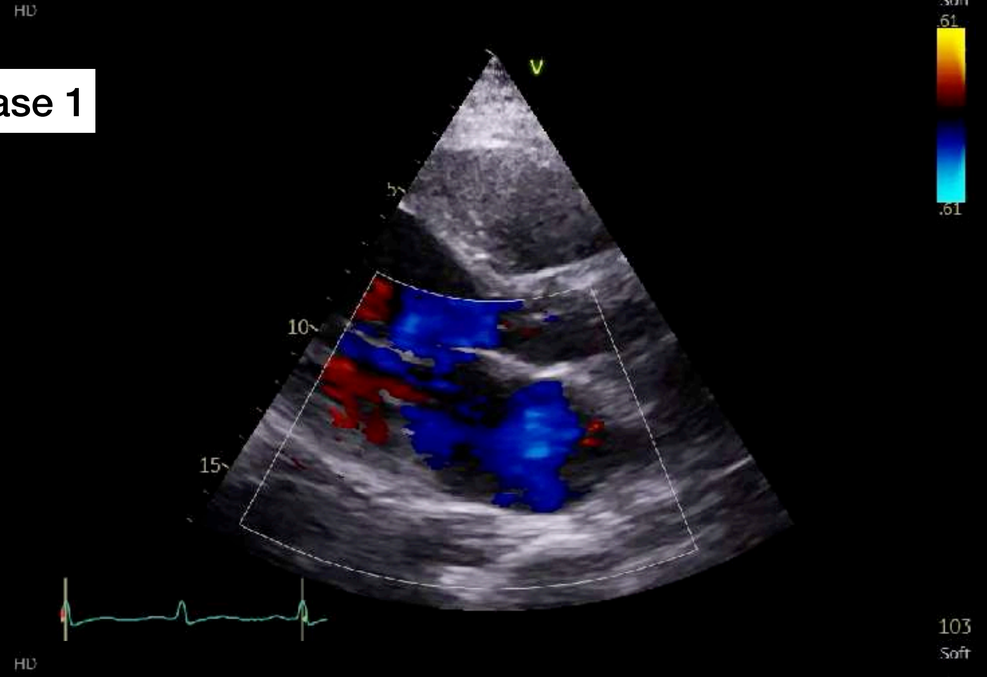
O/E: peripheral oedema, mild hypotension, normal lactate

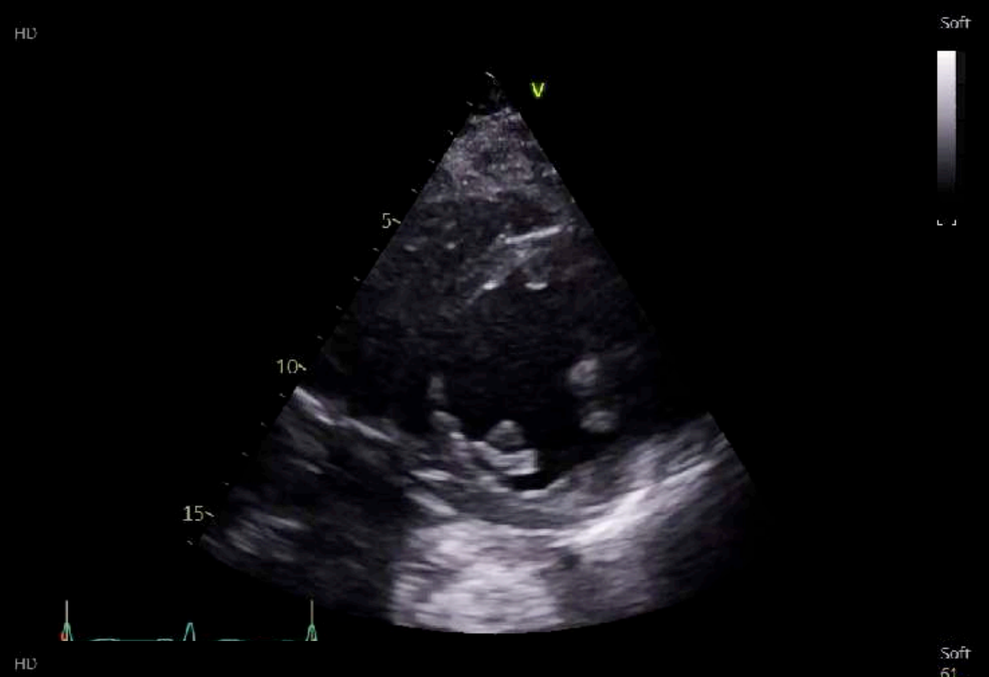
Case 1

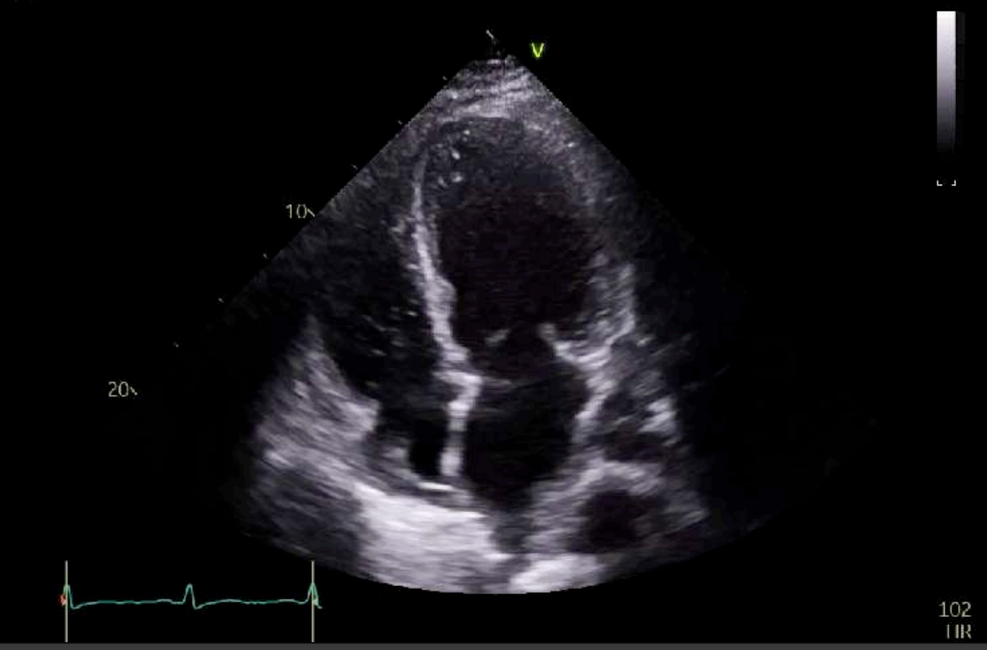


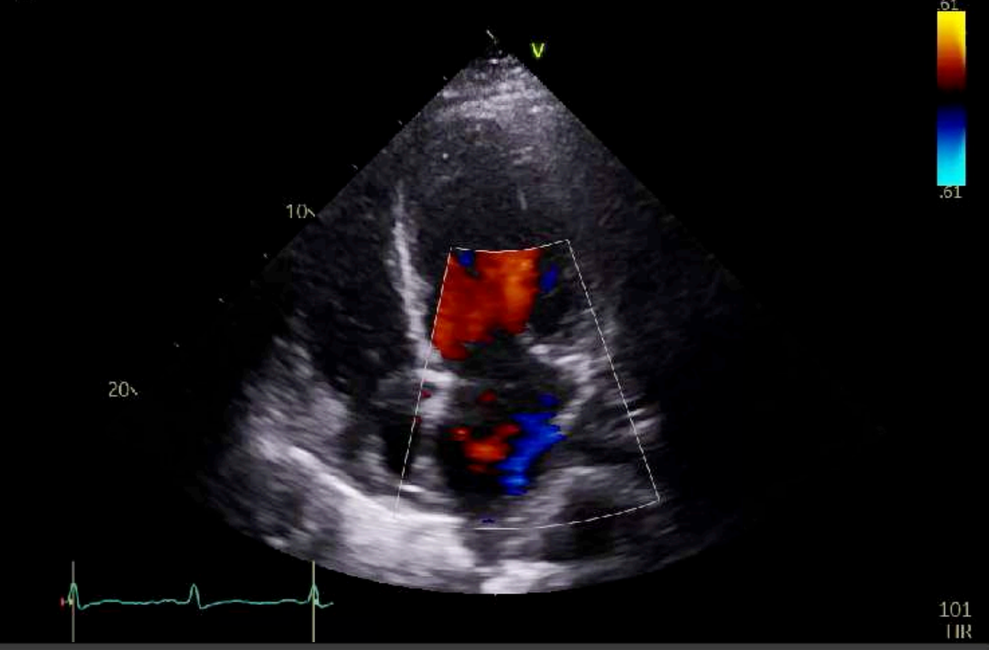


Case 1





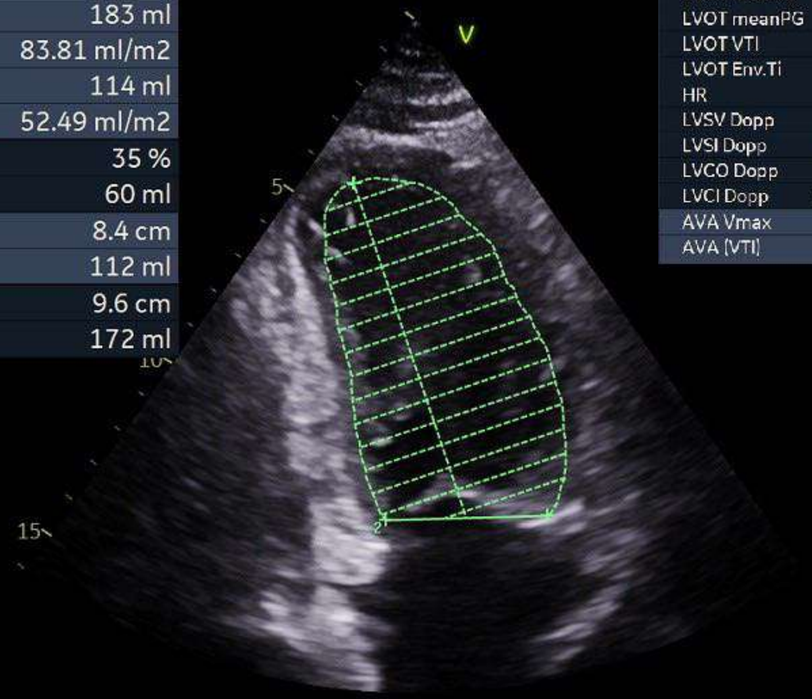




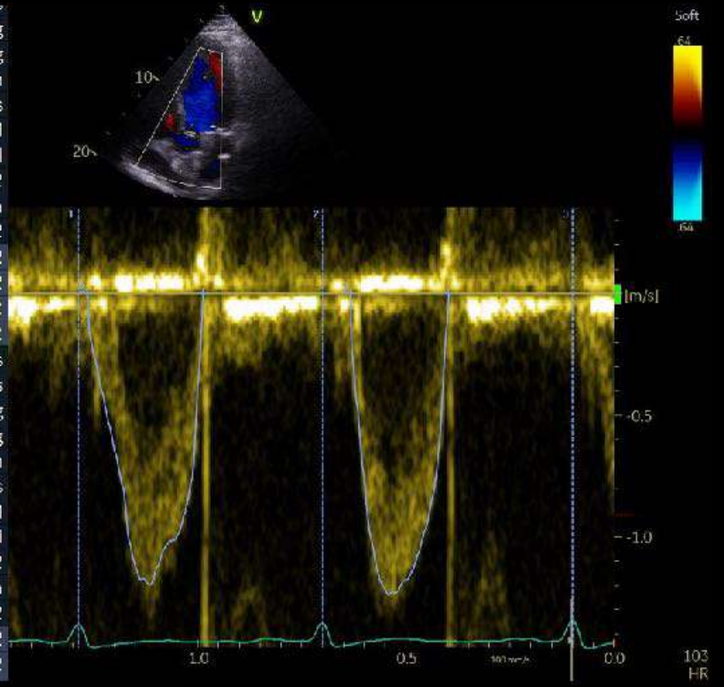
ECHO AUSTRALIA

Case 1

EF Biplane	37 %
LVEDV MOD BP	183 ml
LVEDVInd MOD BP	83.81 ml/m2
LVESV MOD BP	114 ml
LVESVInd MOD BP	52.49 ml/m2
LVEF MOD A2C	35 %
SV MOD A2C	60 ml
2 LVLs A2C	8.4 cm
LVESV MOD A2C	112 ml
1 LVLd A2C	9.6 cm
LVEDV MOD A2C	172 ml



LVOT maxPG	6.17 mmHg
LVOT meanPG	3.77 mmHg
LVOT VTI	21.5 cm
LVOT Env.Ti	236 ms
HR	100 BPM
LVSV Dopp	82 ml
LVSI Dopp	37.83 ml/m2
LVCO Dopp	8.25 l/min
LVCI Dopp	3.78 l/minm2
AVA Vmax	3.3 cm2
AVA [VTI]	3.8 cm2
AVAI (VTI)	1.734 cm2/m2
AVAI Vmax	1.512 cm2/m2
2 LVOT Vmax	1.20 m/s
LVOT Vmean	0.80 m/s
LVOT maxPG	5.75 mmHg
LVOT meanPG	3.02 mmHg
LVOT VTI	22.3 cm
LVOT Env.Ti	278 ms
HR	102 BPM
LVSV Dopp	85 ml
LVSI Dopp	39.19 ml/m2
LVCO Dopp	8.73 l/min
LVCI Dopp	4.01 l/minm2
AVA Vmax	3.2 cm2
AVA [VTI]	3.6 cm2



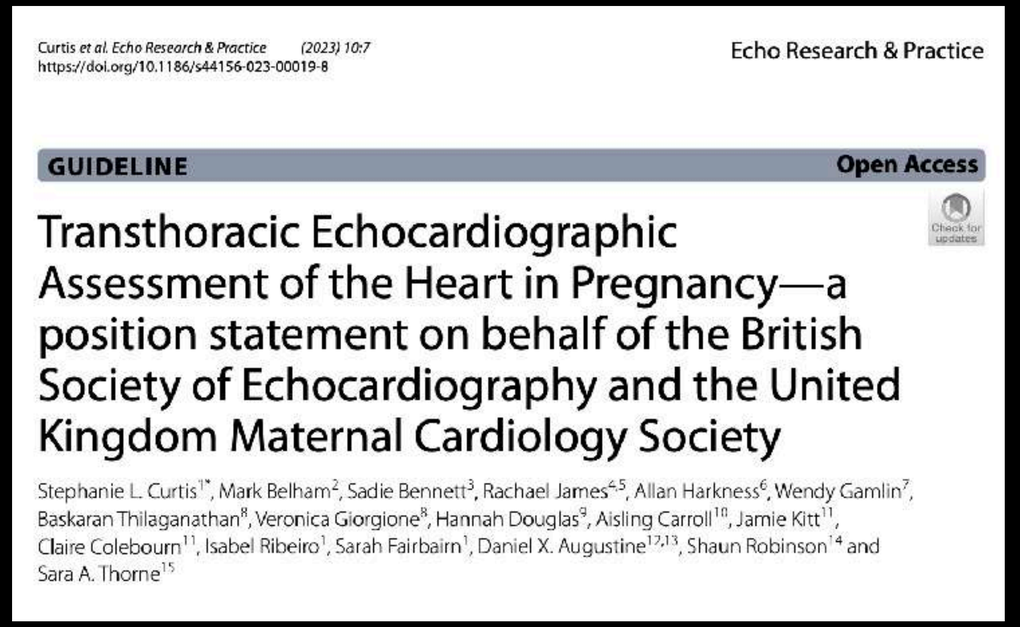
Case 1

Impression = Possible peri-partum cardiomyopathy

? Acute (diagnosis of exclusion)

Peri-partum cardiomyopathy

- **Diagnosis** = LVEF <45% +/- LV dilation. Dx exclusion.
  - End of pregnancy / 5 months post partum (66%)
- **Management** = r/v Hx: MDT (O&G, Cardiology, ICU)
  - Fluid overload & thrombus frequent
  - Consider delivery
- **Prognosis** = 50% ongoing LVEF impaired (FU needed)
  - 30-50% recurrence with subsequent pregnancies



Curtis et al. Echo Research & Practice (2023) 10:7
https://doi.org/10.1186/s44156-023-00019-8

Echo Research & Practice

GUIDELINE Open Access

Transthoracic Echocardiographic Assessment of the Heart in Pregnancy—a position statement on behalf of the British Society of Echocardiography and the United Kingdom Maternal Cardiology Society

Stephanie L. Curtis[1*], Mark Belham[2], Sadie Bennett[3], Rachael James[4,5], Allan Harkness[6], Wendy Gamlin[7], Baskaran Thilaganathan[8], Veronica Giorgione[8], Hannah Douglas[9], Aisling Carroll[10], Jamie Kitt[11], Claire Colebourn[11], Isabel Ribeiro[1], Sarah Fairbairn[1], Daniel X. Augustine[12,13], Shaun Robinson[14] and Sara A. Thorne[15]

European Heart Journal (2011) 32, 3147–3197
doi:10.1093/eurheartj/ehr218

ESC GUIDELINES

ESC Guidelines on the management of cardiovascular diseases during pregnancy

The Task Force on the Management of Cardiovascular Diseases during Pregnancy of the European Society of Cardiology (ESC)

Endorsed by the European Society of Gynecology (ESG), the Association for European Paediatric Cardiology (AEPC), and the German Society for Gender Medicine (DGesGM)

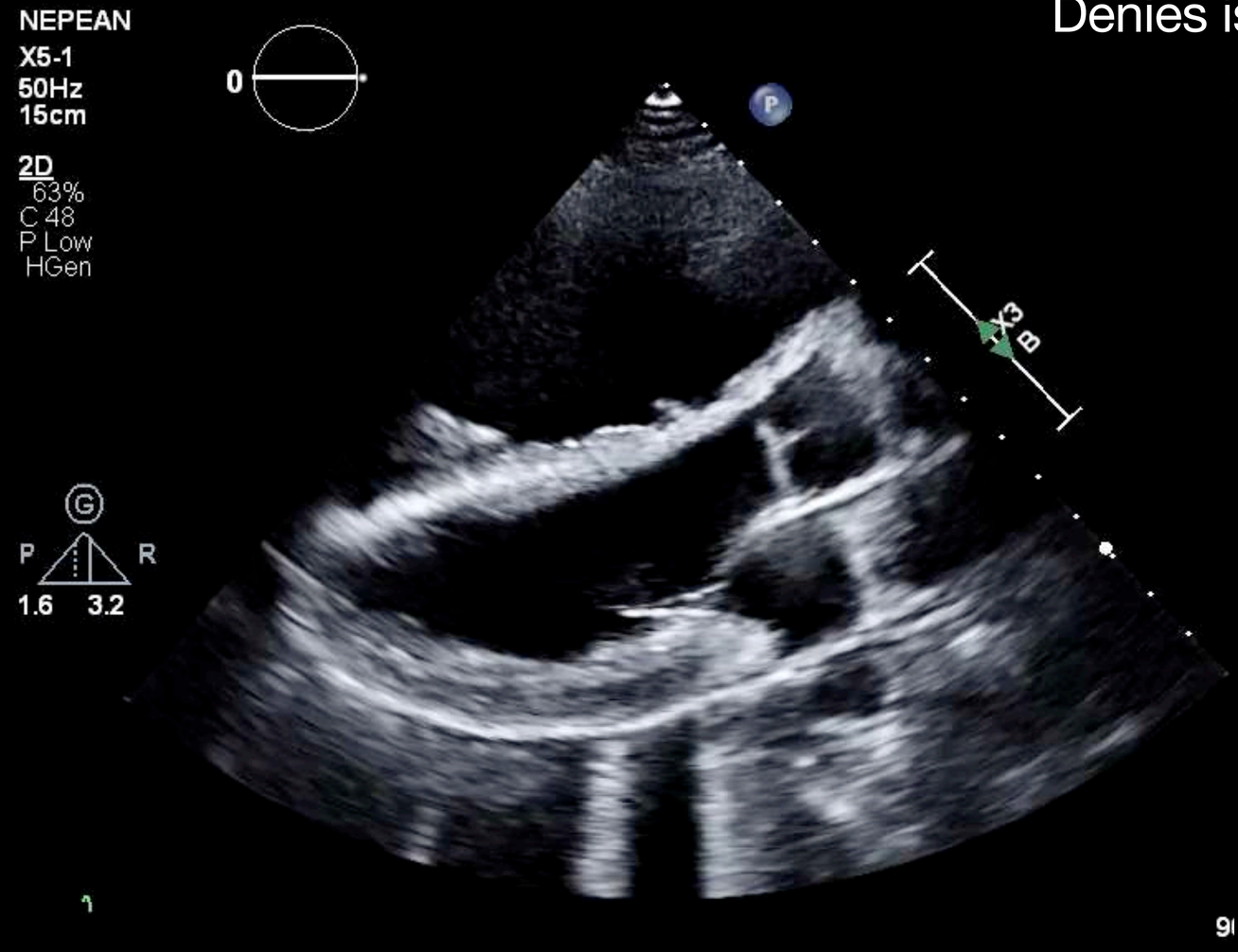
Case 2

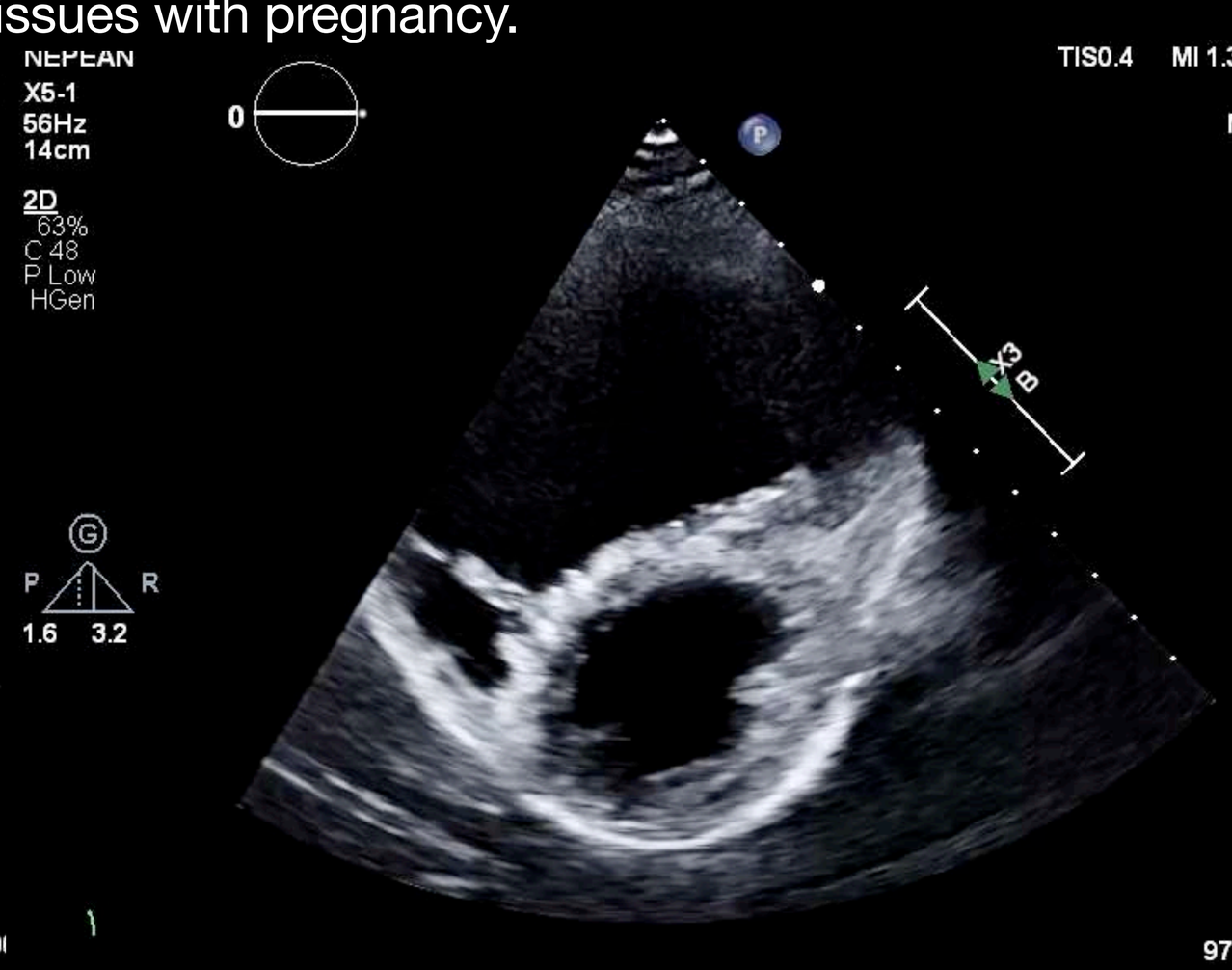
25yo G2P0 32/40

Refugee. Poor English. No PMH

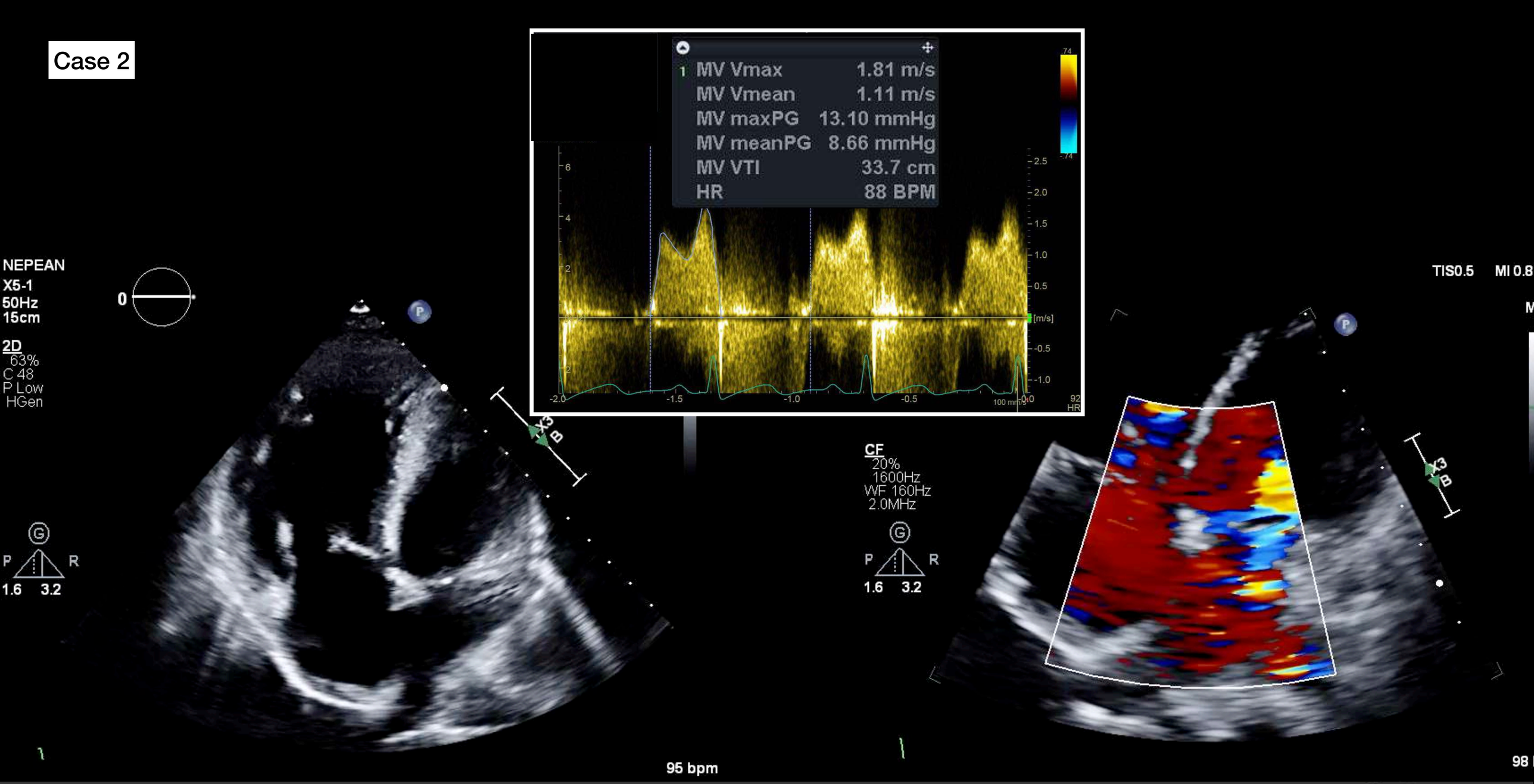
ED = Short of breath ++. No chest pain

Denies issues with pregnancy.

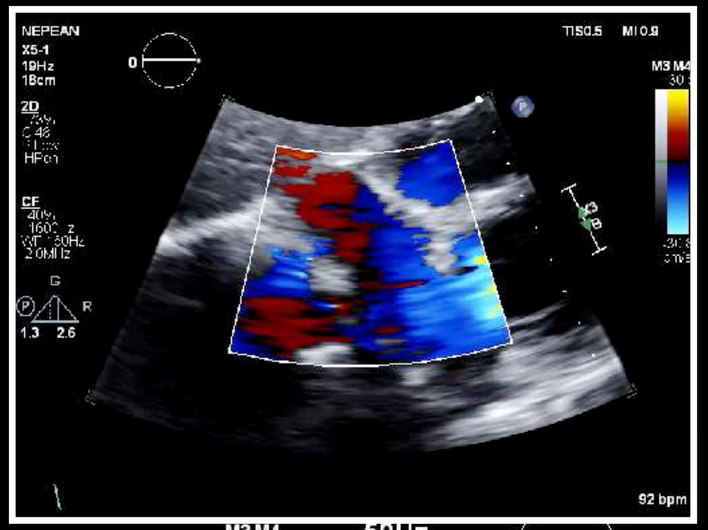




Case 2


MV Vmax 1.81 m/s
MV Vmean 1.11 m/s
MV maxPG 13.10 mmHg
MV meanPG 8.66 mmHg
MV VTI 33.7 cm
HR 88 BPM
NEPEAN
X5-1
50Hz
15cm
2D
63%
C 48
P Low
HGen
1.6 3.2
CF
20%
1600Hz
WF 160Hz
2.0MHz
1.6 3.2
TIS0.5
MI 0.8
95 bpm

Case 2



NEPEAN
X5-1
21Hz
14cm

2D
65%
C 48
P Low
HGen

CF
33%
3200Hz
WF 320Hz
2.0MHz

PW
18%
WF 150Hz
SV3.0mm
1.6MHz
4.7cm

M3 M4
+61.6

RVOT VTI
Vmax 90.8 cm/s
Vmean 57.4 cm/s
Max PG 3 mmHg
Mean PG 2 mmHg
VTI 13.5 cm

-61.8
cm/s

-40
cm/s
--40
--80
--120
--160

50Hz
14cm

2D
57%
C 48
P Low
HPen

PW
38%
WF 150Hz
SV3.0mm
1.6MHz
9.8cm

TIS0.7 MI 0.7
M3

LVOT VTI
Vmax 0.8 m/s
Vmean 57.8 cm/s
Max PG 3 mmHg
Mean PG 2 mmHg
VTI 12.9 cm

DSI 0.9
AV VR 0.84
AVA (VTI) 2.85 cm²
SV (LVOT) 41 ml
AVA (Vmax) 2.65 cm²
SV (LVOT) INDEX 27.2 ml/m²
AVA(VTI)/BSA 1.89

--40
--80
--120

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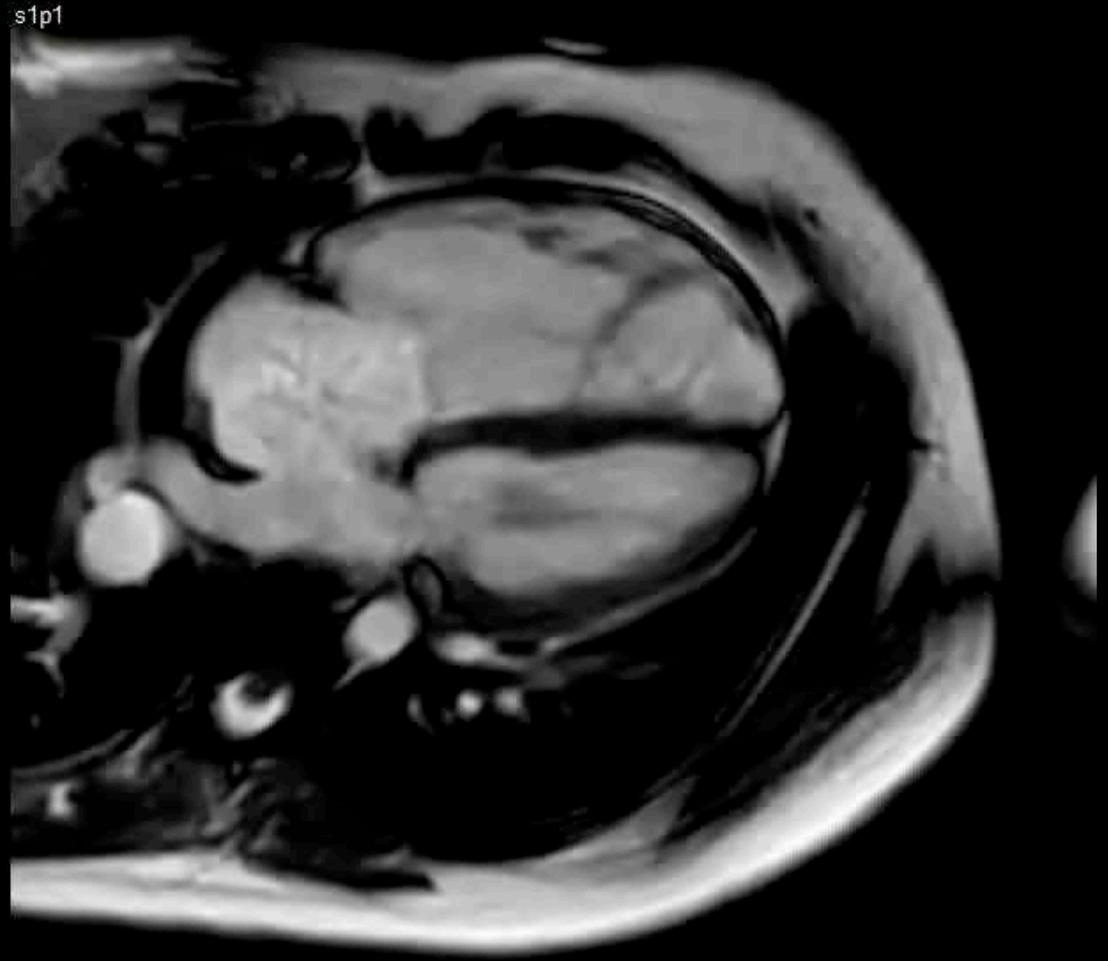
Case 2

Impression = ASD with mitral stenosis

= Chronic conditions

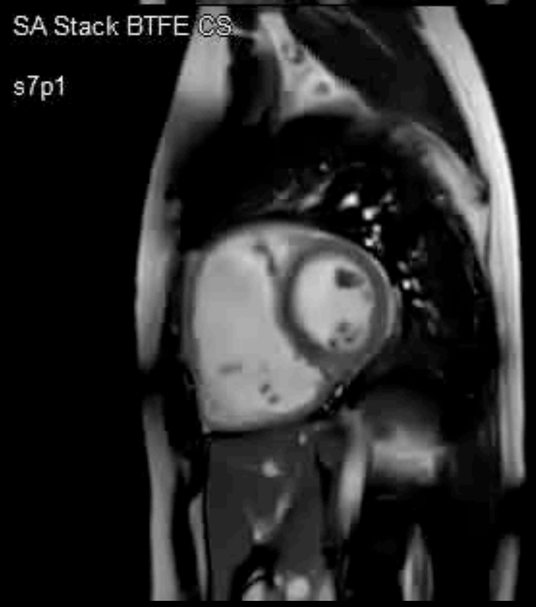
Case 2


4Ch sBTFE_BH
s1p1

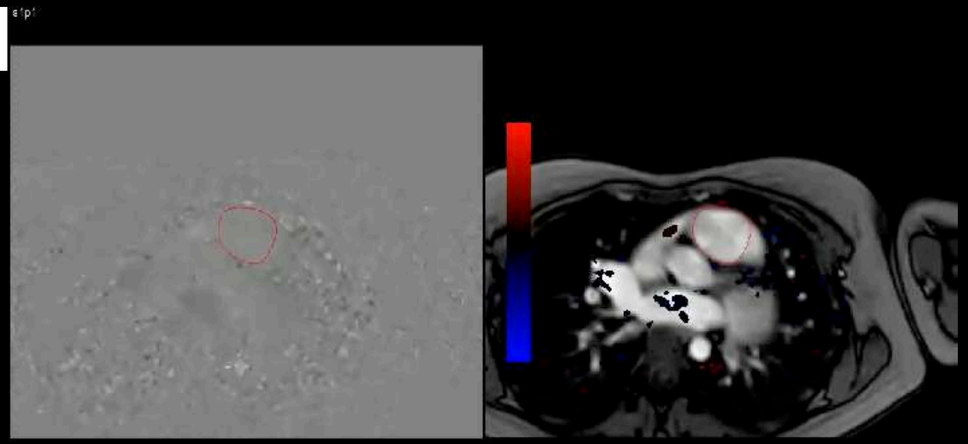

SA Stack BTFE CS
s10p1


SA Stack BTFE CS
s9p1


SA Stack BTFE CS
s8p1

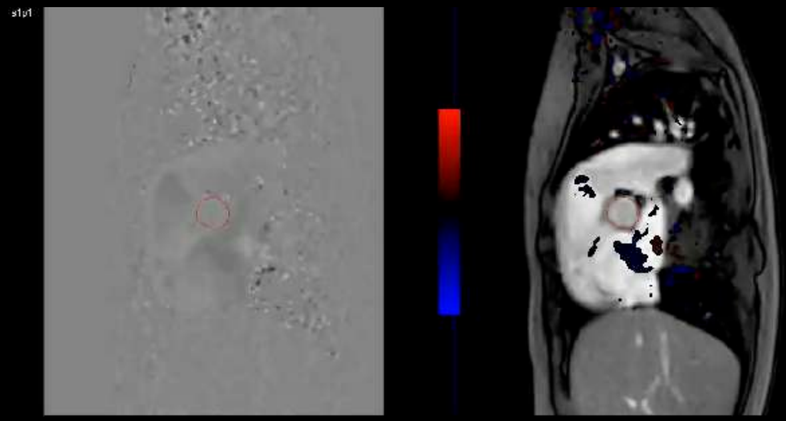

SA Stack BTFE CS
s7p1

Case 2

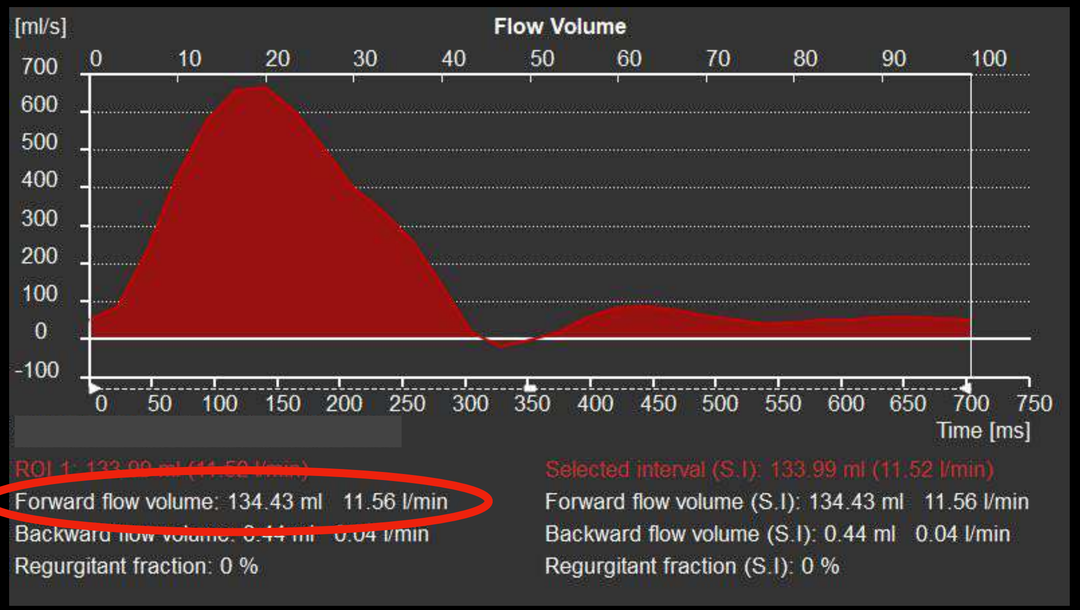


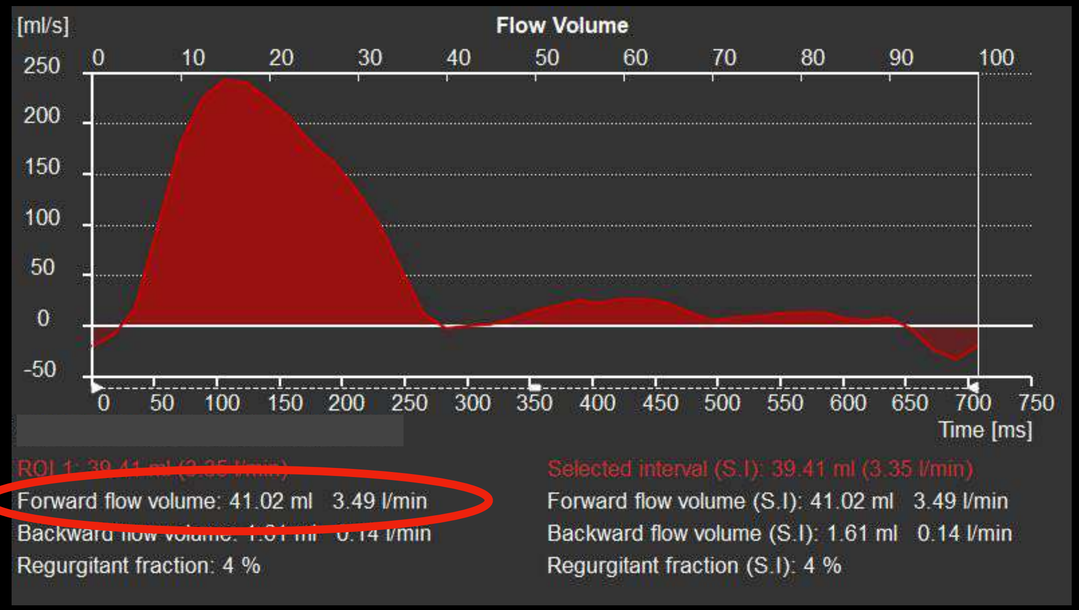
Qp

3:1



Qs

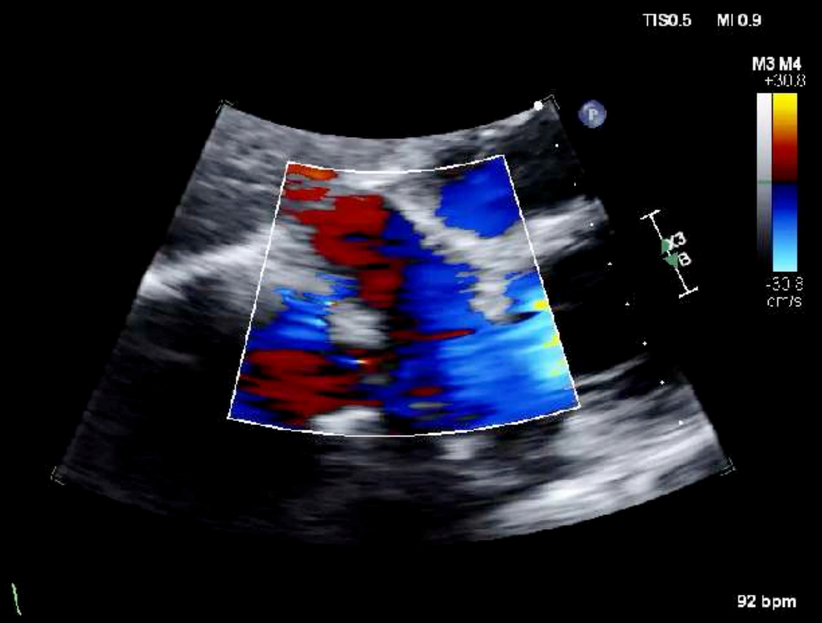




ECHO AUSTRALIA

ASD & mitral stenosis

- **Risks** = bad mix MS (=>PAH) + ASD; arrhythmias
- **Management** (MDT) = keep SR, diuresis, steroids, bed rest
  - Risk pre-eclampsia and small baby
  - Try to get to 34 weeks gestation (??)
  - Prophylactic anticoagulation / avoid DVT
  - ??Urgent CS / PHT worsens / monitor with echo
  - ASD closure post delivery / recovery



Case 3

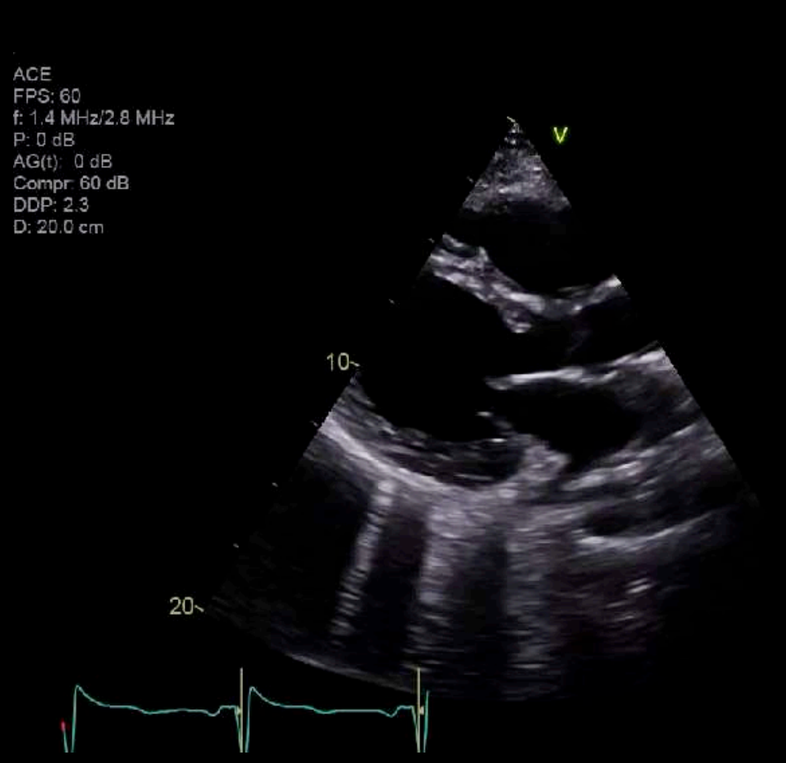
36yo G6P5

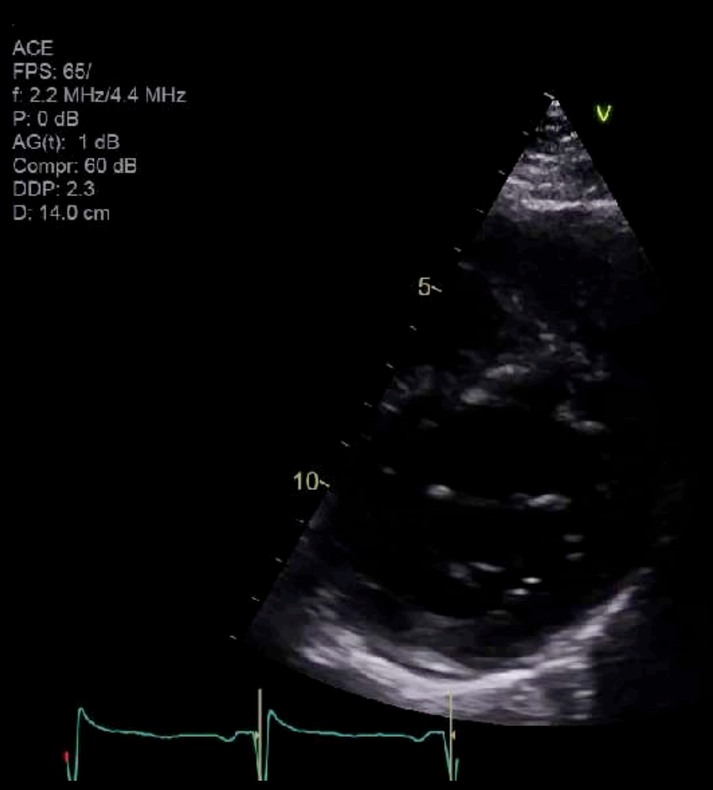
PMH = lots of babies

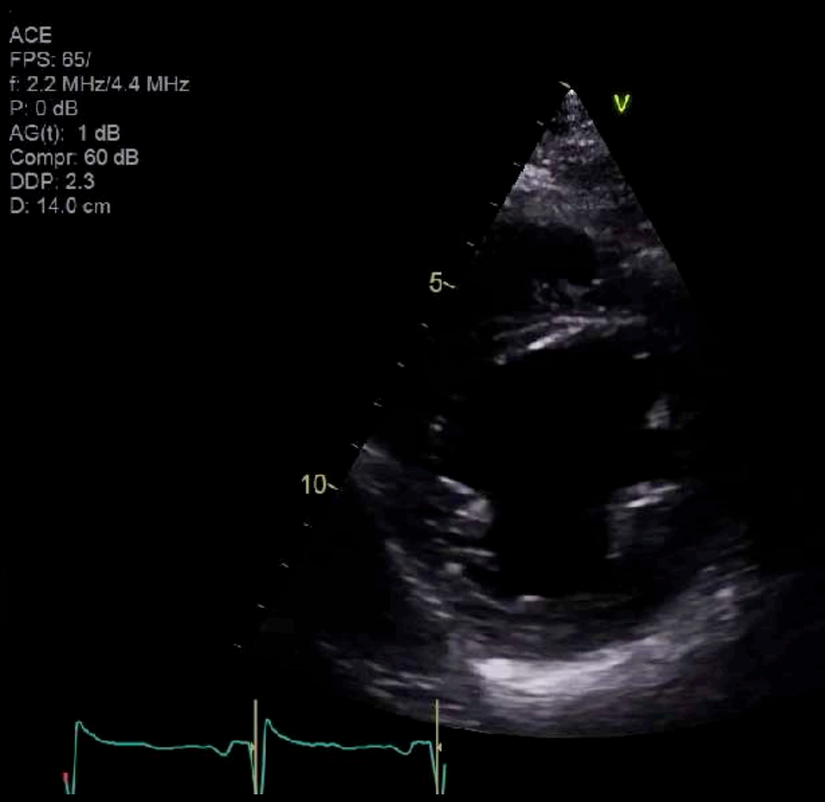
Nausea, dizzy, GCS drop on mobilising = MET call

ECG T wave inversion laterally; Trop 759

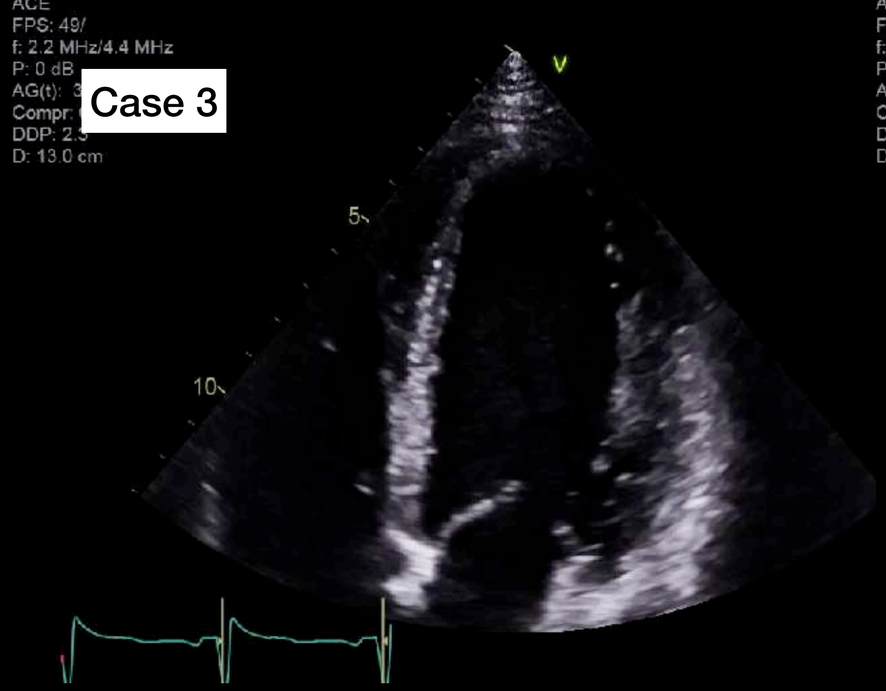
Imp = NSTEMI



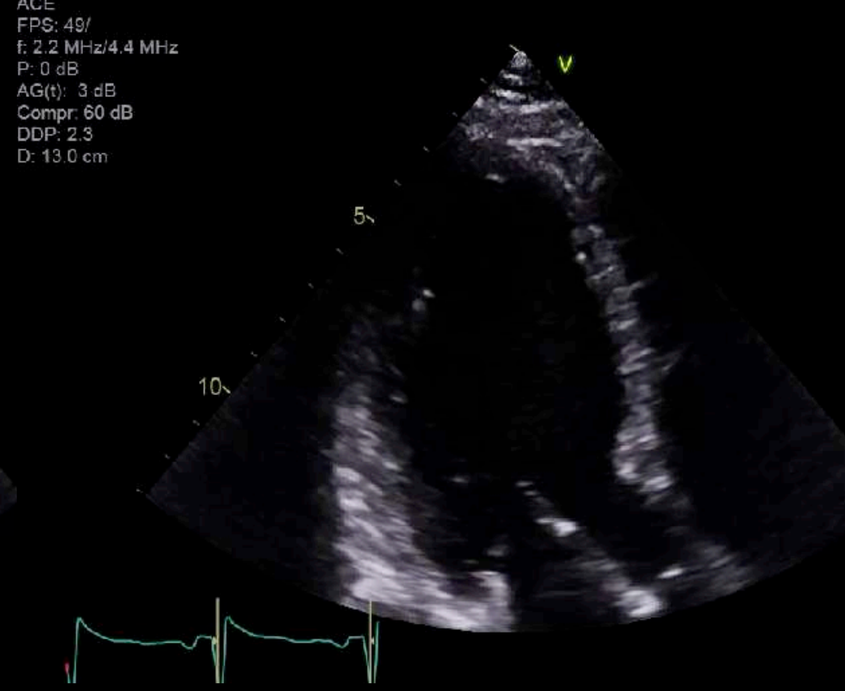


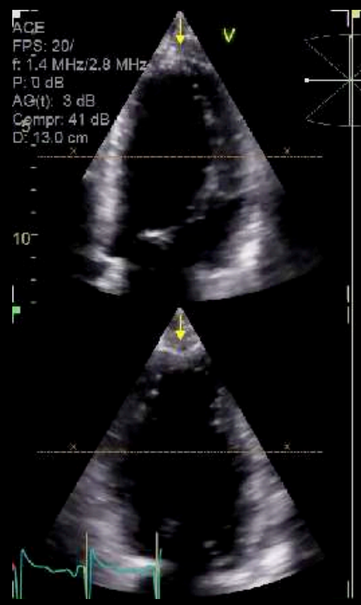


Case 3

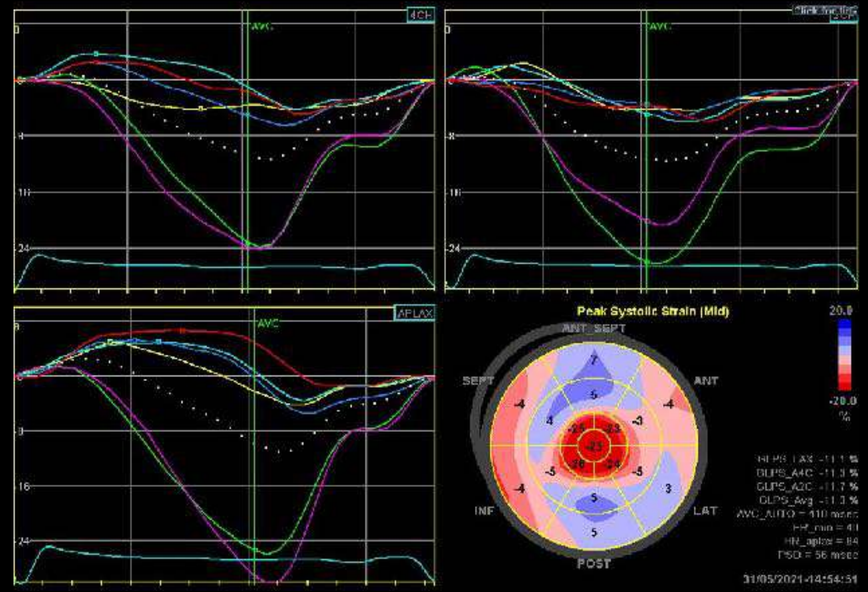

ACE
FPS: 49/
f: 2.2 MHz/4.4 MHz
P: 0 dB
AG(t): 3
Compr:
DDP: 2.3
D: 13.0 cm


ACE
FPS: 49/
f: 2.2 MHz/4.4 MHz
P: 0 dB
AG(t): 3 dB
Compr: 60 dB
DDP: 2.3
D: 13.0 cm


ACE
FPS: 49/
f: 2.2 MHz/4.4 MHz
P: 0 dB
AG(t): 3 dB
Compr: 60 dB
DDP: 2.3
D: 13.0 cm

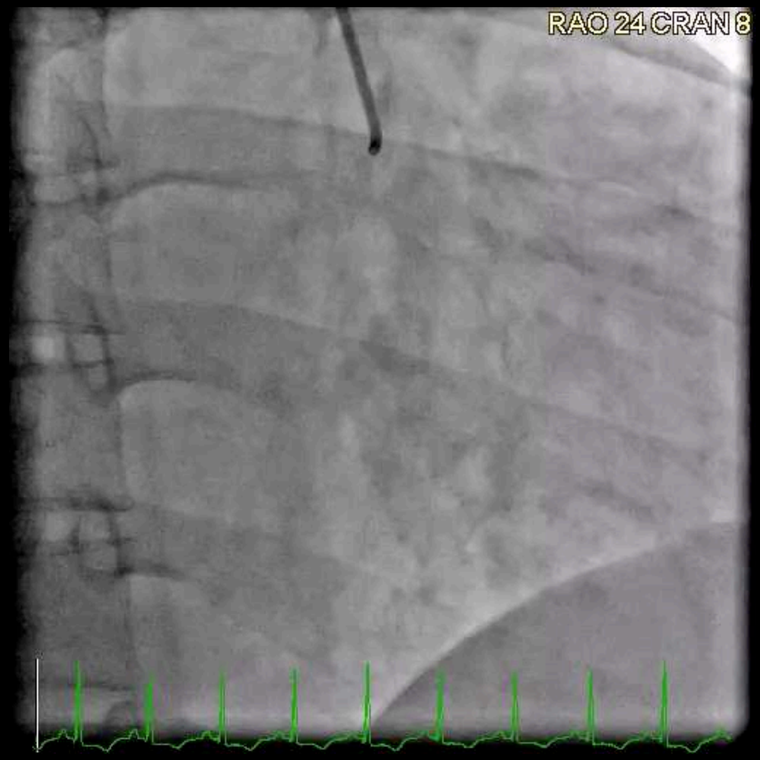

ACE
FPS: 20/
f: 1.4 MHz/2.8 MHz
P: 0 dB
AG(t): 3 dB
Compr: 41 dB
D: 13.0 cm

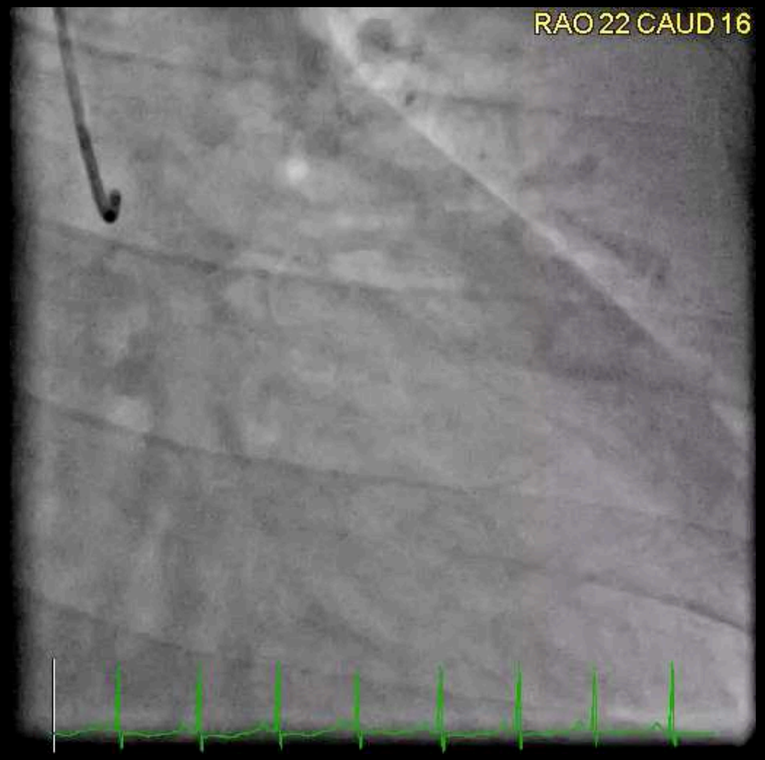

Soft
2 cm
HR 86

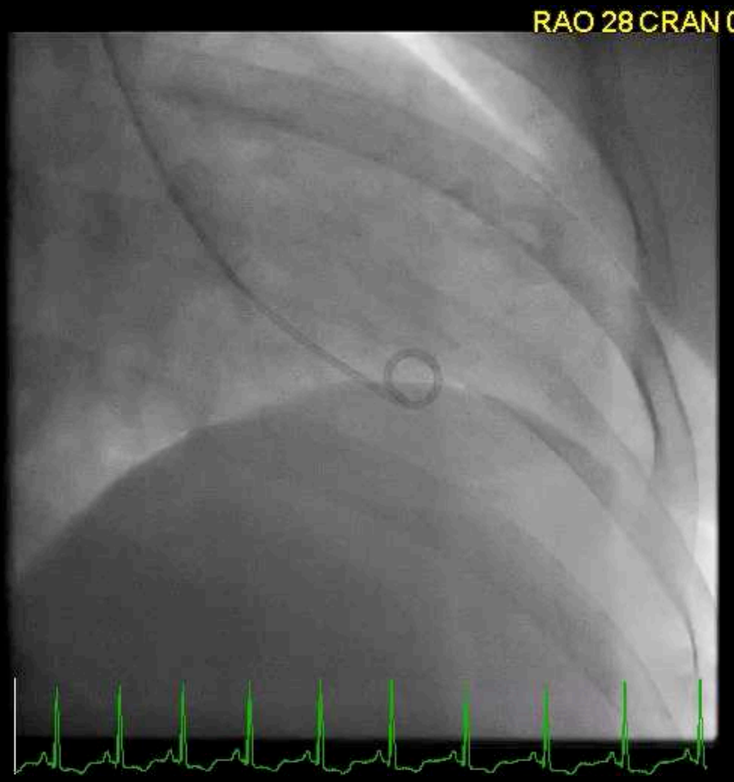

4CH
AVC
APLAX
Peak Systolic Strain (Mid)
ANT SEPT
ANT
SEPT
LAT
INF
POST
20.0
-20.0
%

Case 3

Angio = normal coronaries







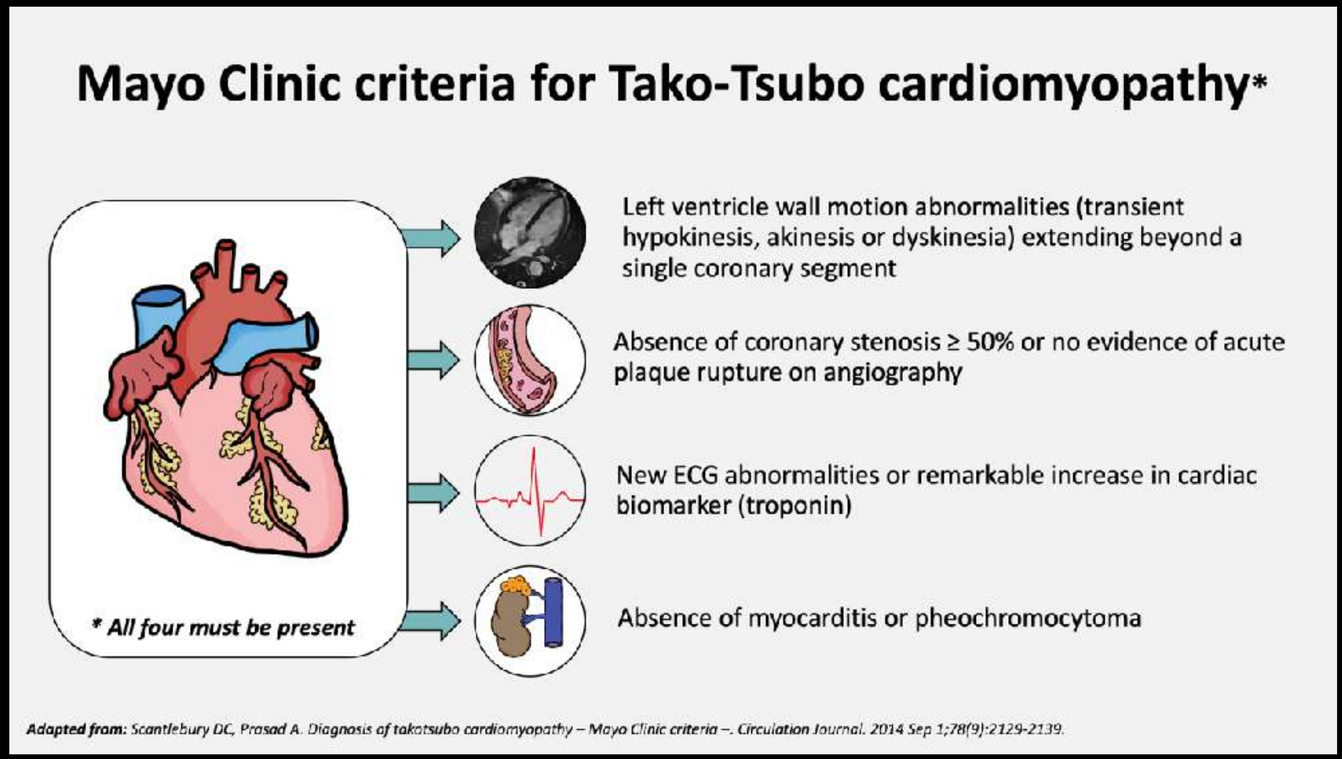
Case 3

Impression = Takotsubo cardiomyopathy

? Reverse Takotsubo / mid-ventricle variant / early recovery?

Takotsubo Cardiomyopathy

- Long term MACE similar to ACS
- Prognosis worse with:
  - Physical triggers
  - Severe LV dysfunction
  - Cardiogenic shock
  - Delayed recovery
- Management = supportive.
- FU needed



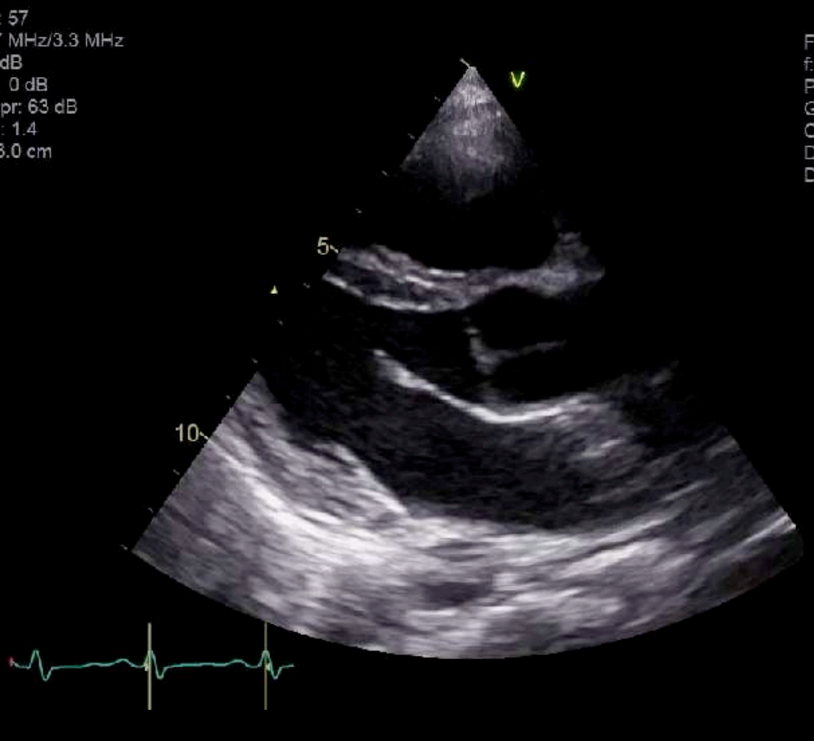
Uribarri et al (2019) = Short and long term prognosis with Takosubo CMP; JAHA
Vassiliki et al (2020) = Long term injury after Takotsubo syndrome; EHJ

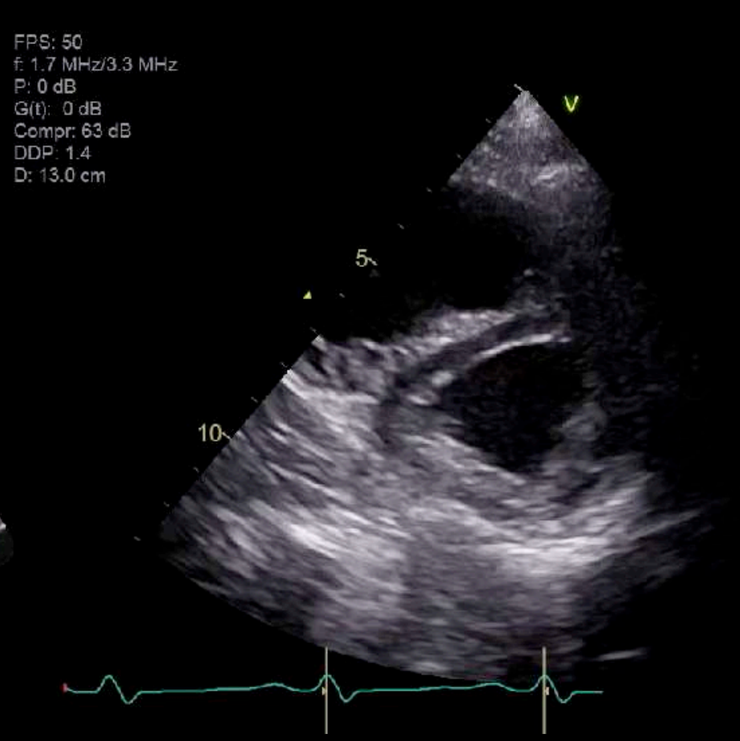
Case 4

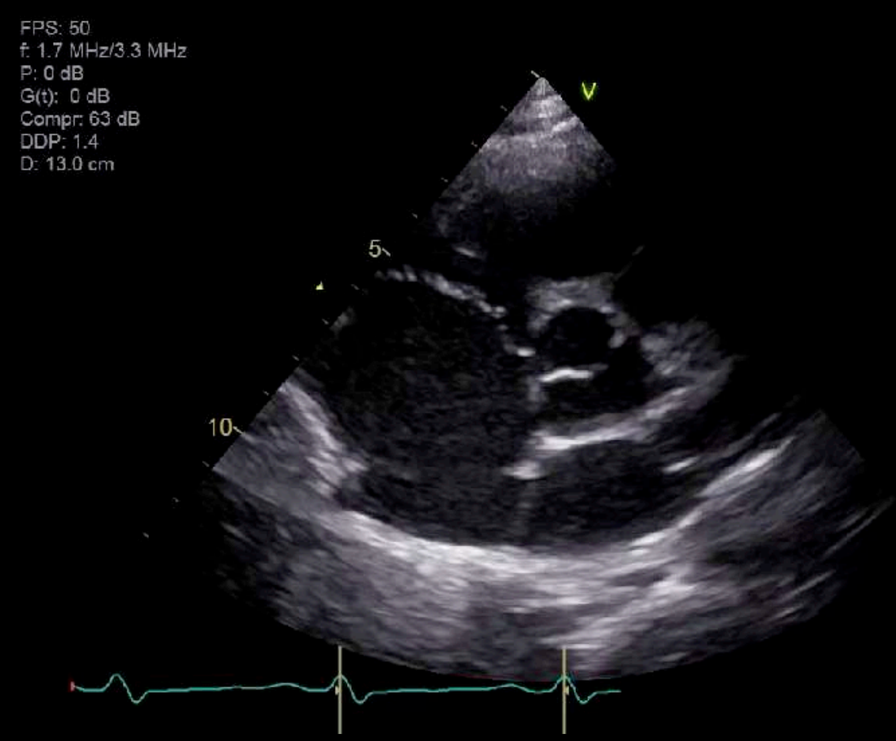
30yo G4P1 25/40

PMH: Hashimoto’s disease, asthma

- SOB for 2 weeks, 20m exercise tolerance
- Worsening. No chest pain.
- Peripheral oedema
- Sats 92% on room air OA to ED







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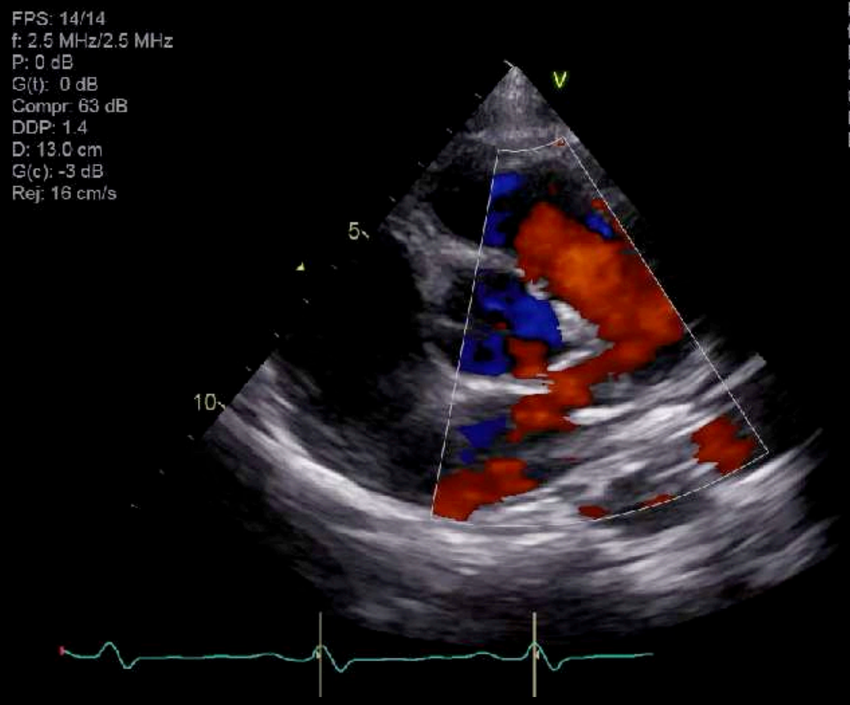
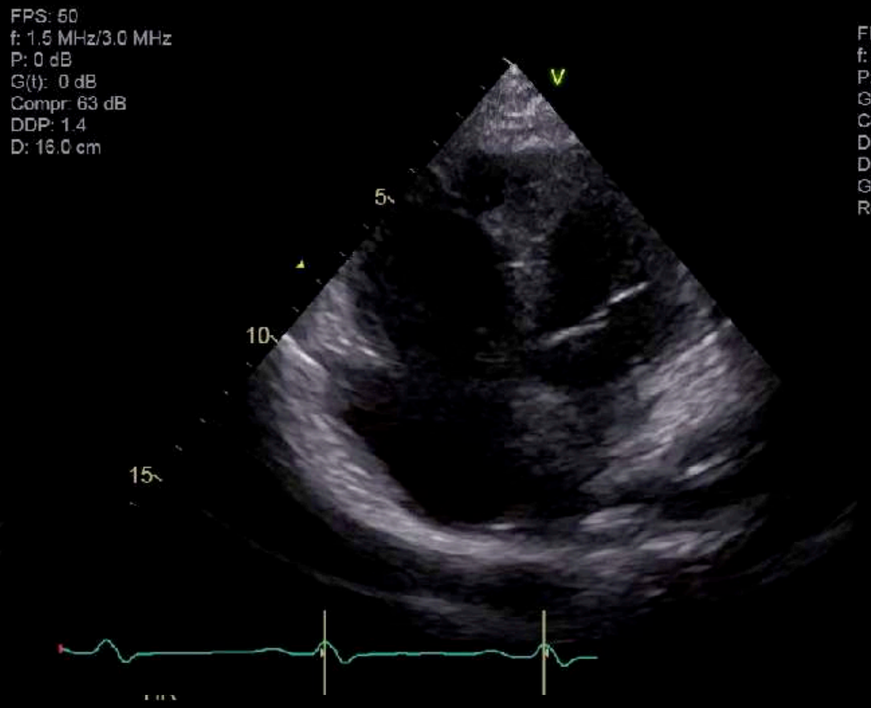
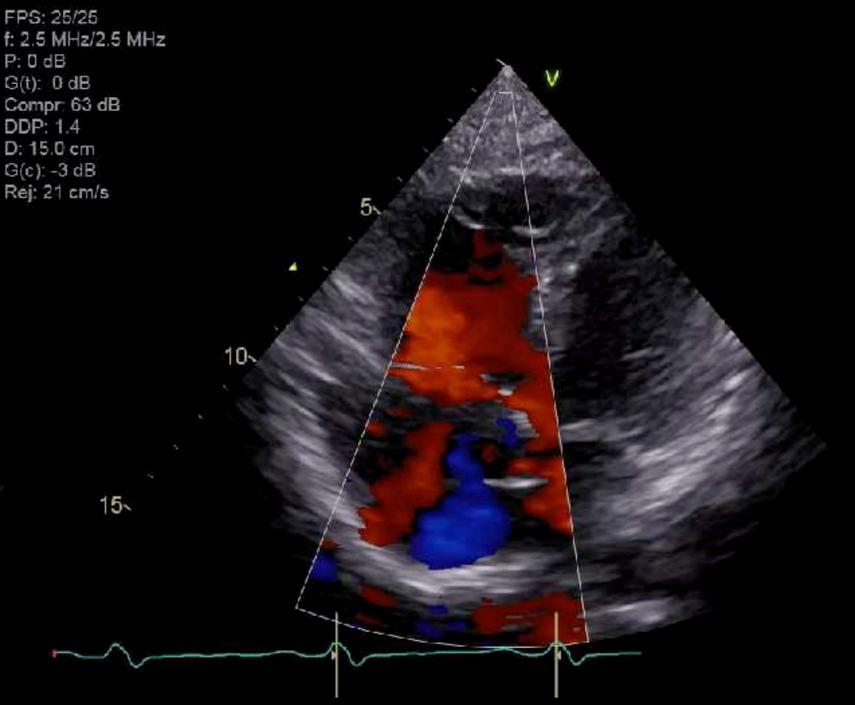
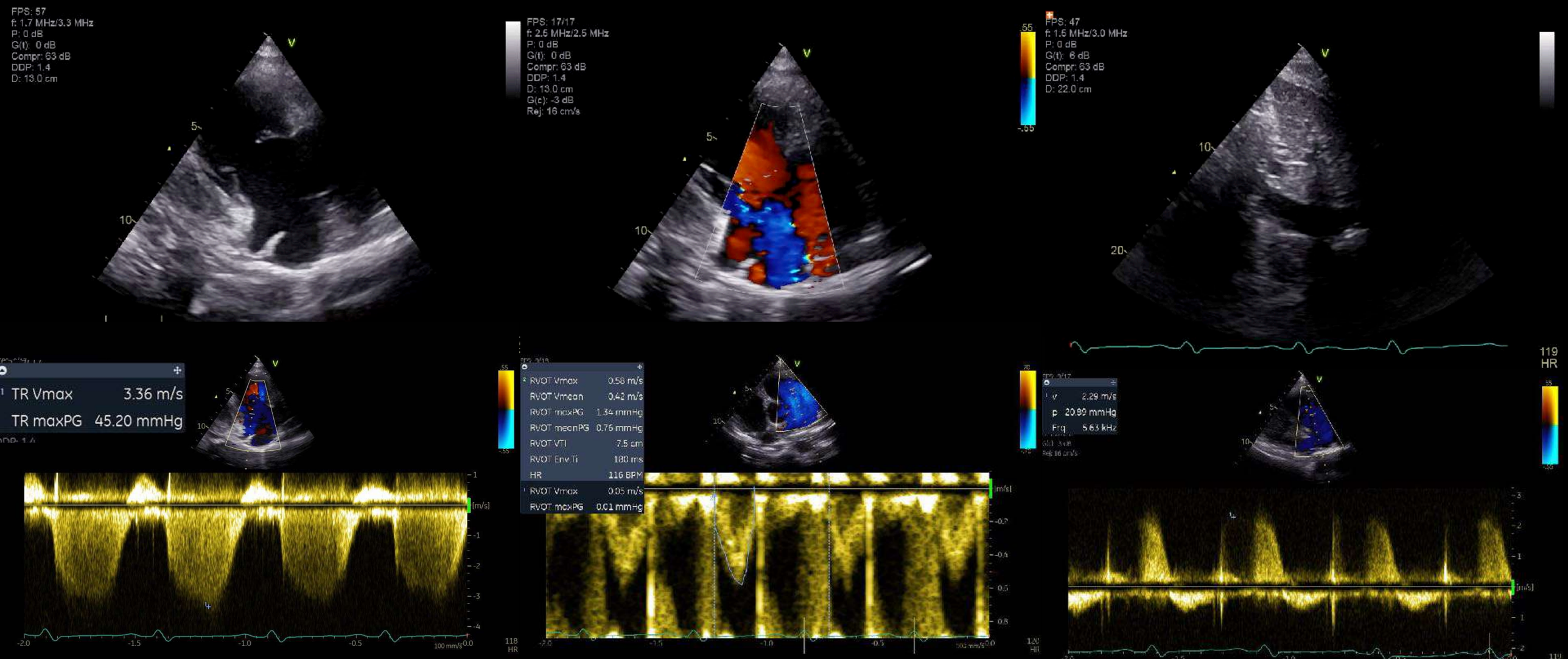
Case 4





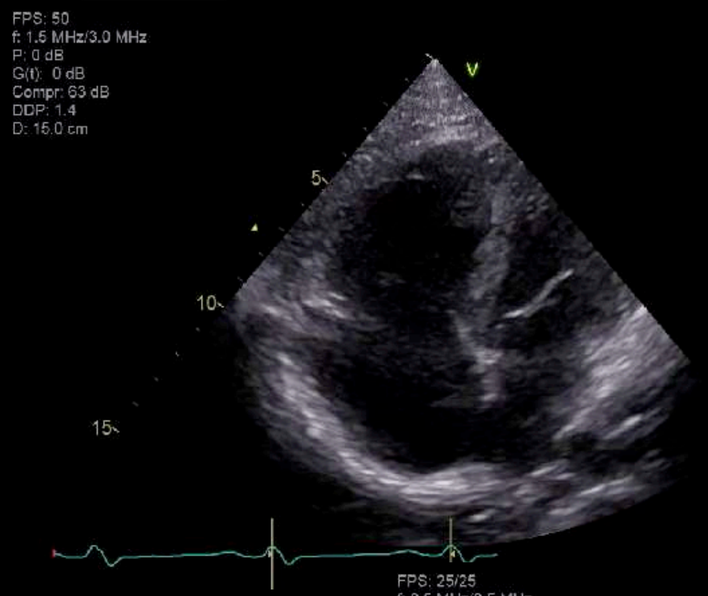


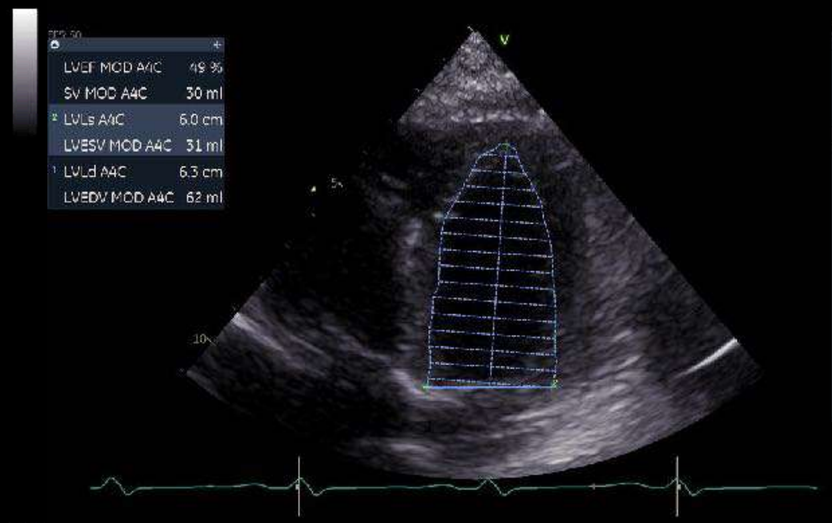
Case 4

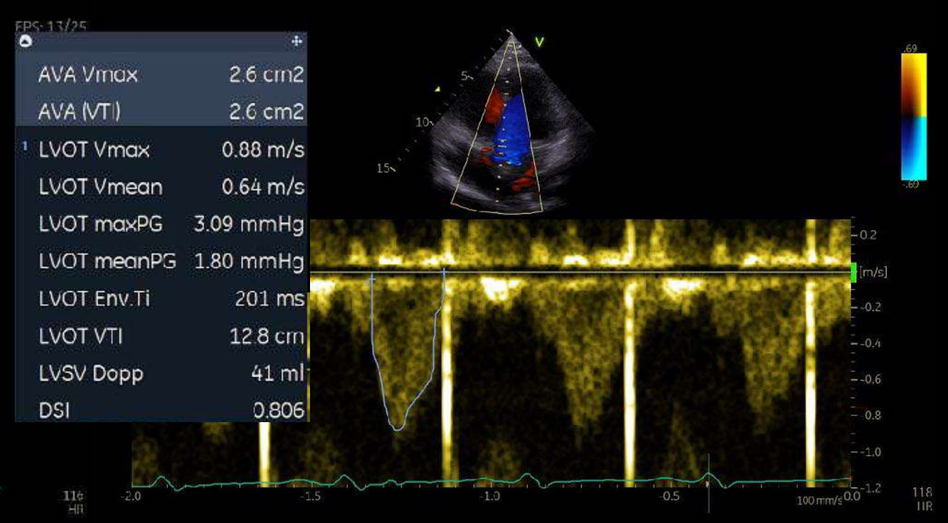


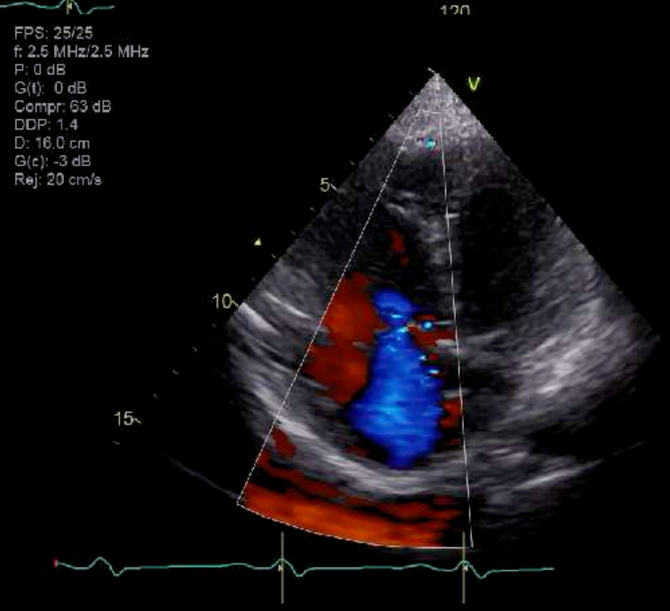
Estimated PAP = 60/25

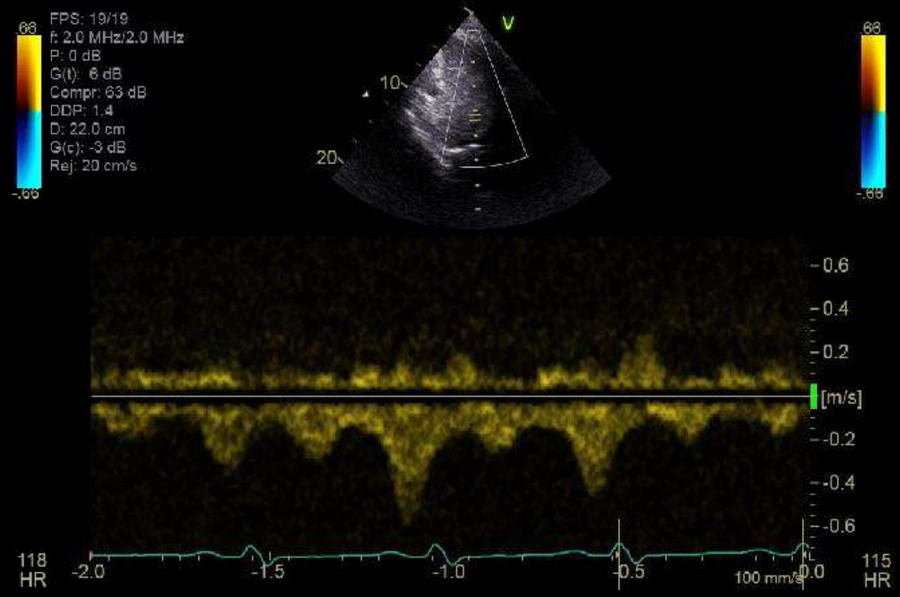
Case 4











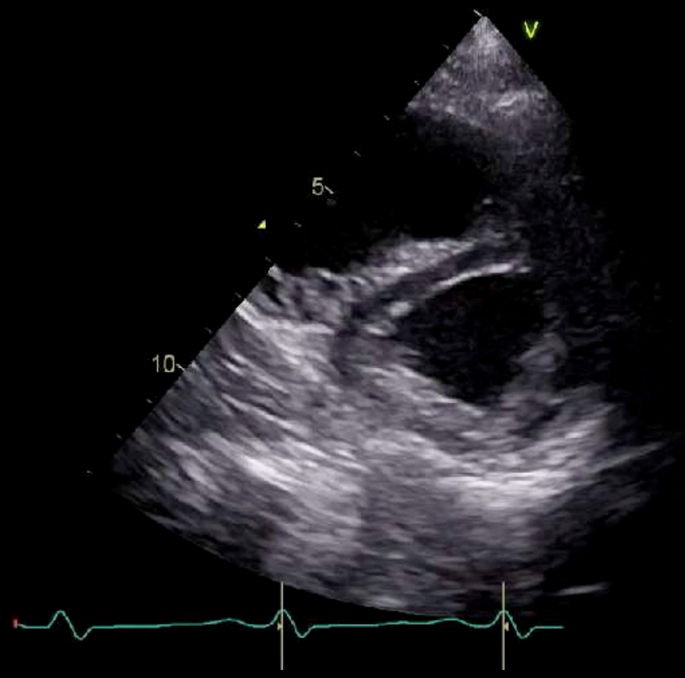
Case 4

Impression = Chronic pulmonary hypertension

? Secondary to autoimmune condition

Chronic pulmonary hypertension

- Maternal death risk (reduced SVR and overloaded CVS system)
- No safe PAP cut-off
- Management plans = risky delivery!!
  - Maintain circulating volume. Prophylaxsis vs DVT
  - Avoid hypotension, acidosis, hypoxia, hypercarbia
  - ?? iv prostacyclin / aerosolised iloprost
- Delivery = Avoid anaesthesia if possible (GA risk)
- FU ? Cause and long term treatment



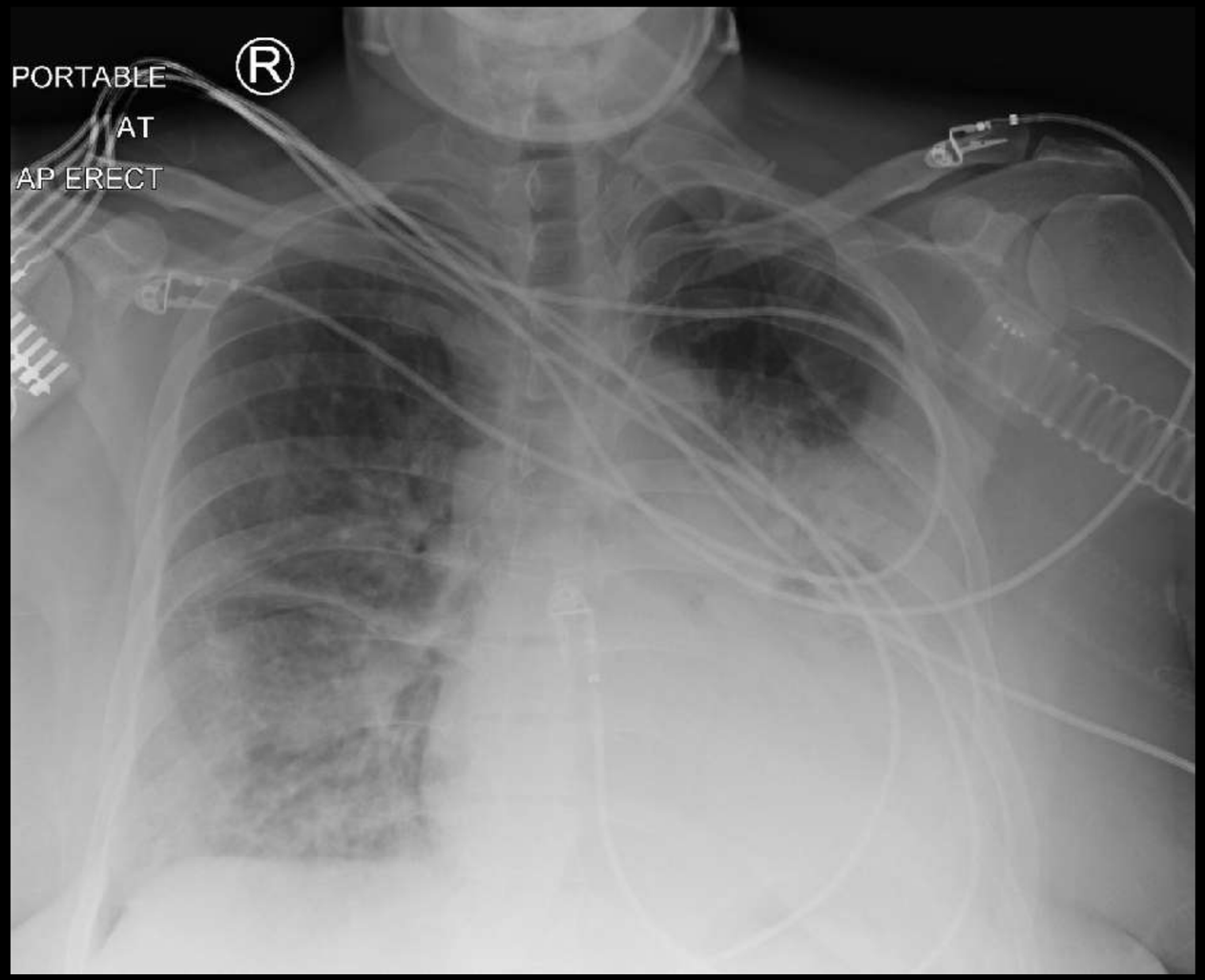
Case 5

41yo F G8/P6 29/40 COVID +ve (unvaccinated)

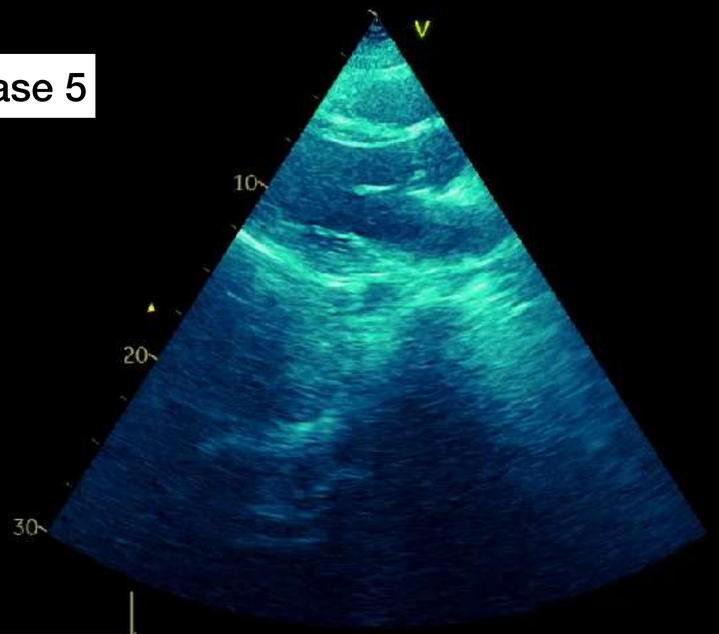
Hs: asthma, obesity

increasingly oxygen requirements => ICU for NIV

Day 1

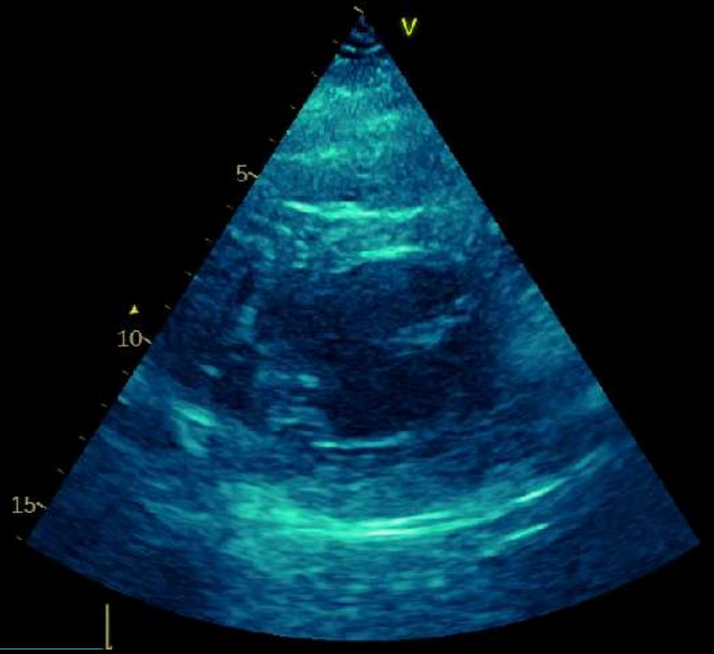


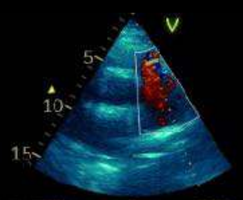
Case 5



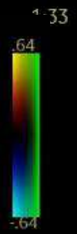
Day 1

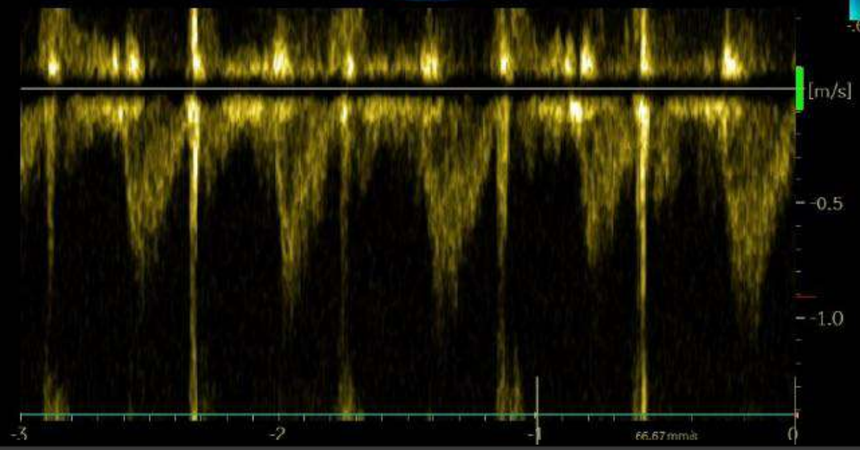
NB: no TR of note

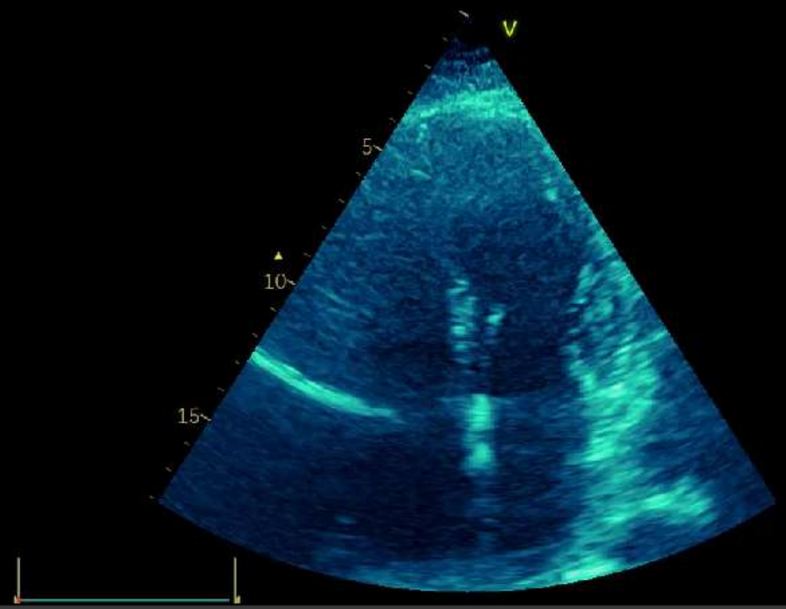




Pul AT 95msec







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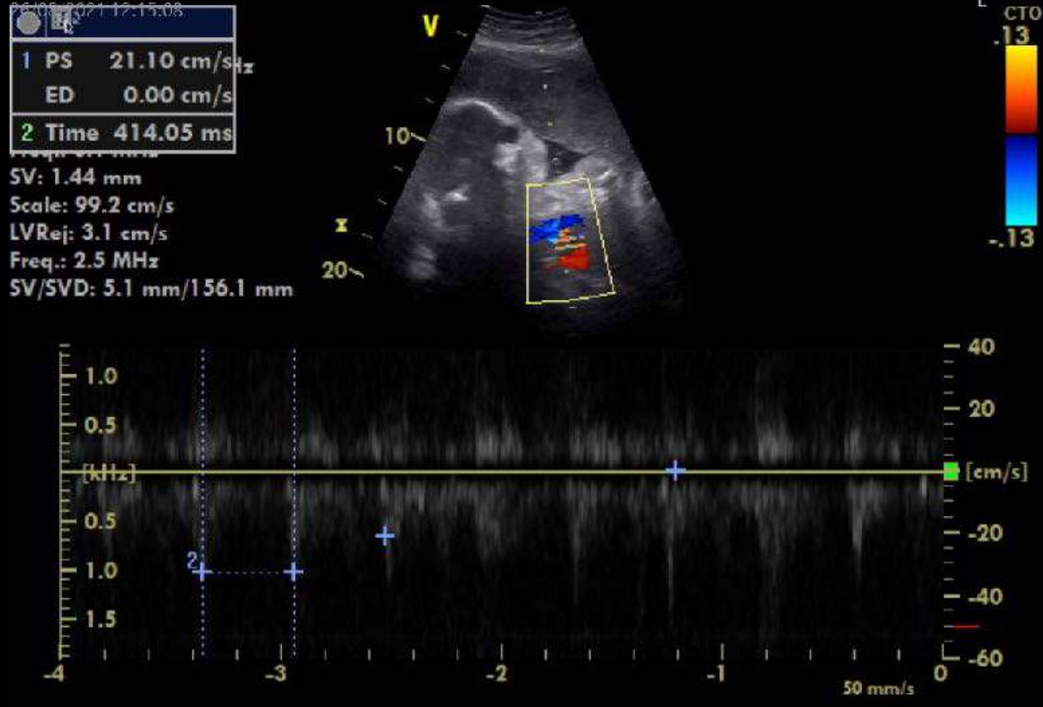
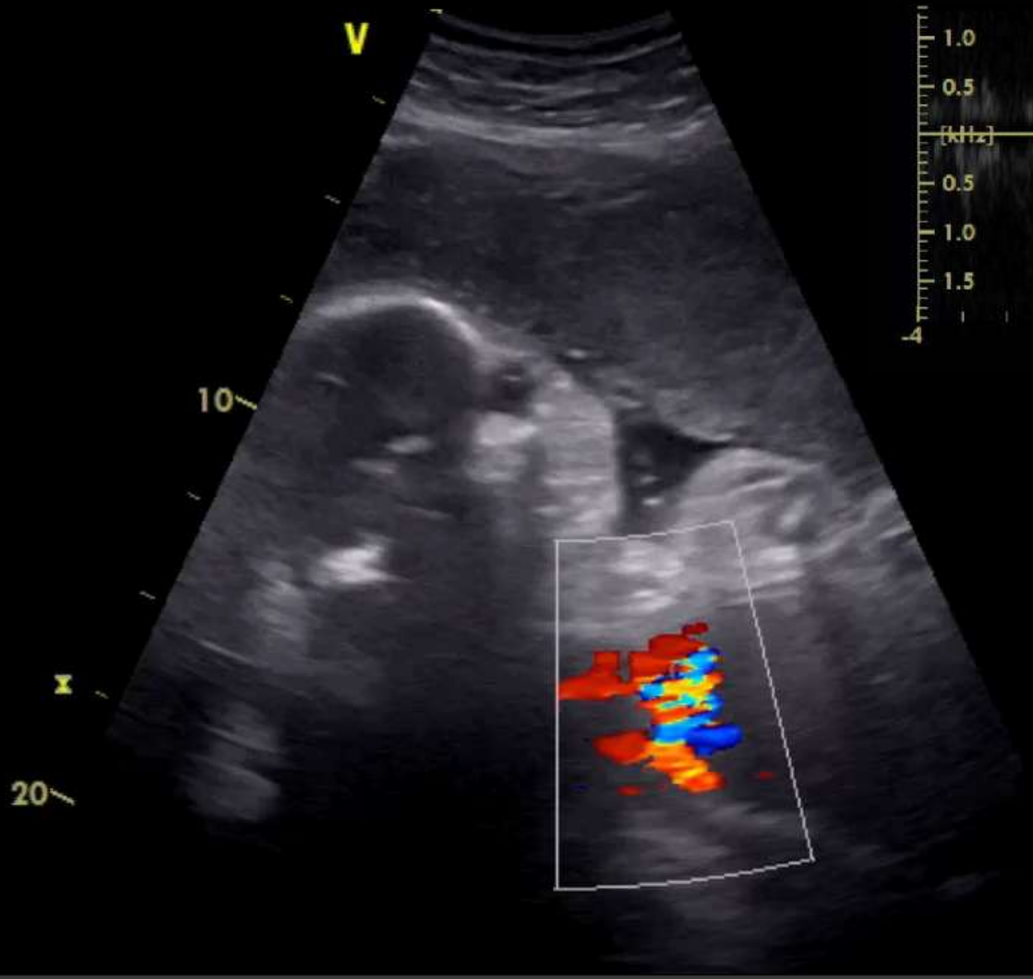
Case 5

Day 1





ECHO AUSTRALIA

Case 5

Strep pneumonia LLL

NIV support high

Deterioration evening D2

Work of breathing ++

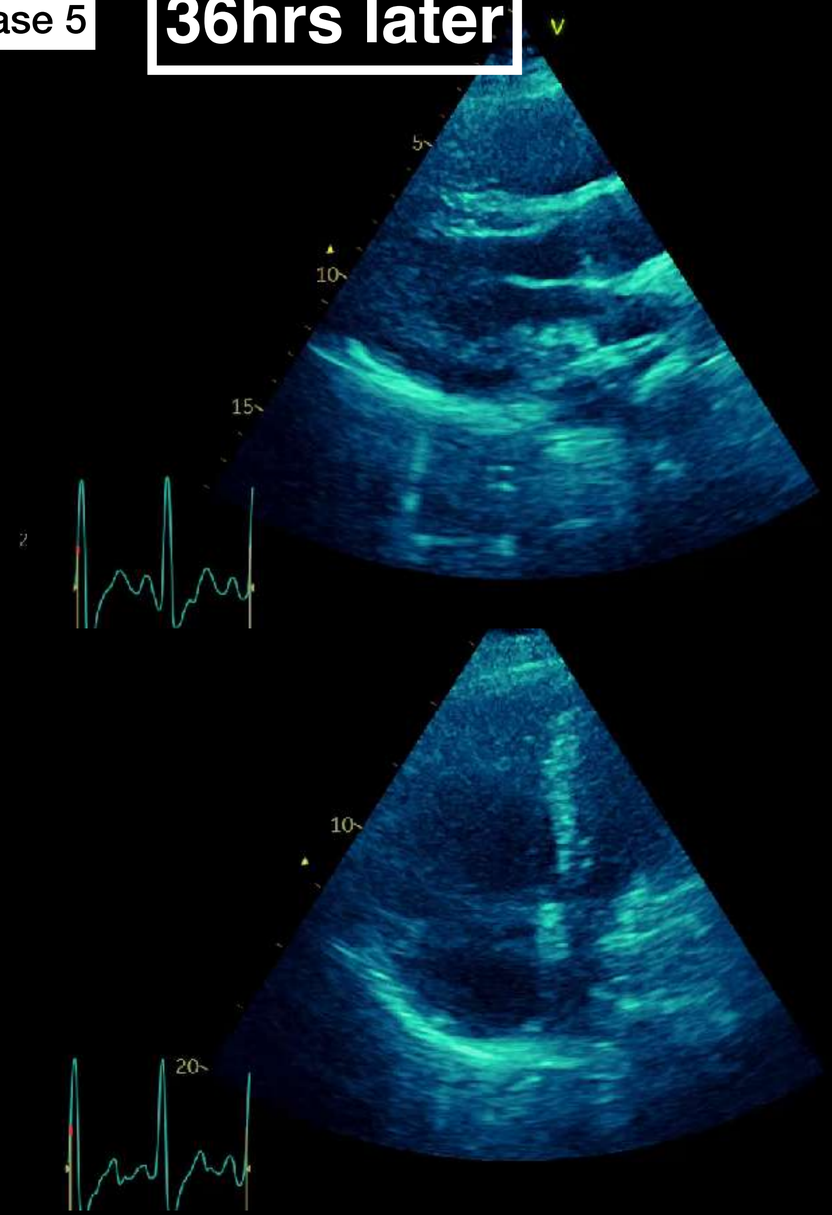
Intubation

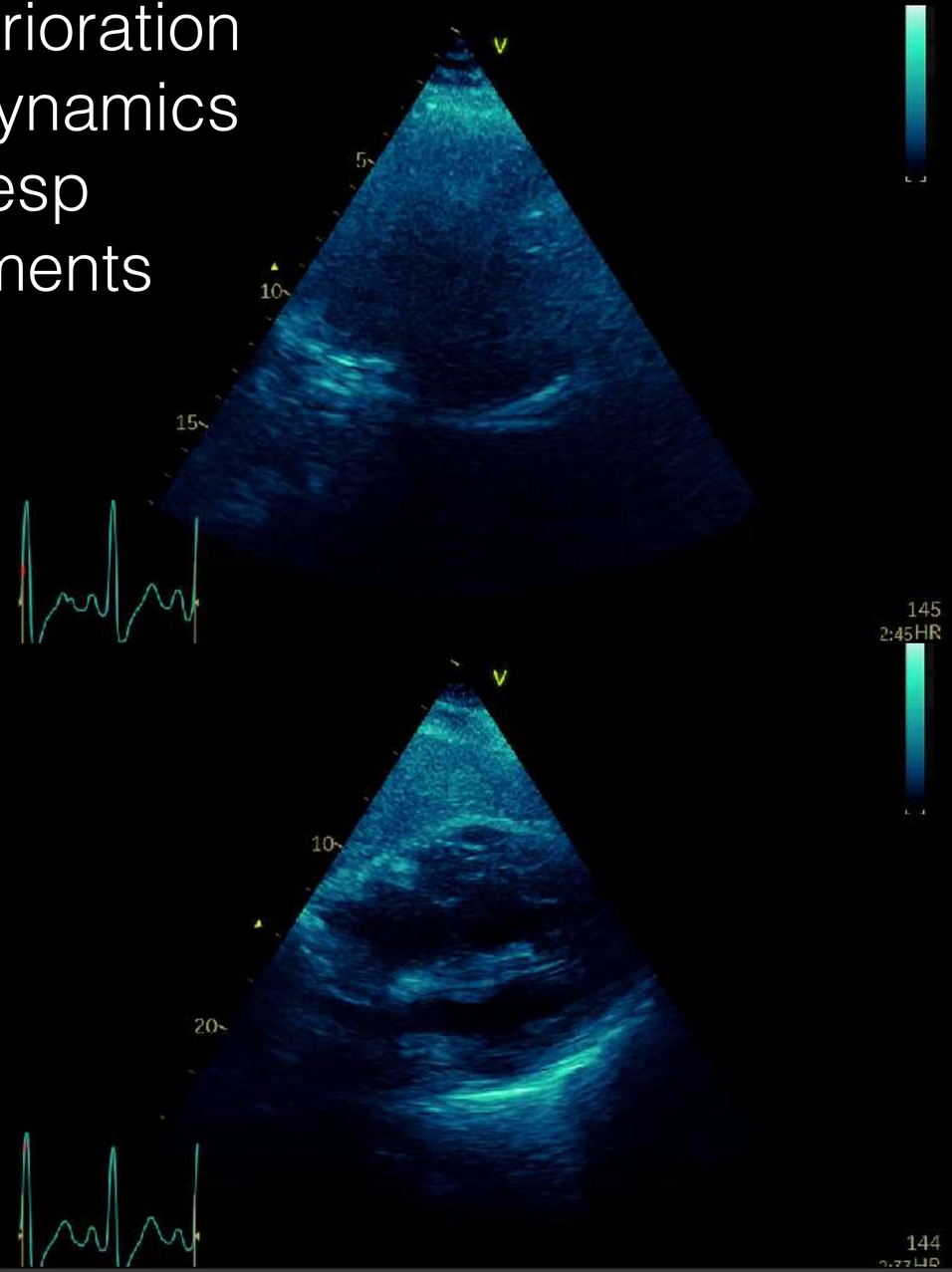
=> maxed conventional mechanical ventilation
=> ? NO / ? ECMO
=> urgent CS in unit (baby ok)

Case 5

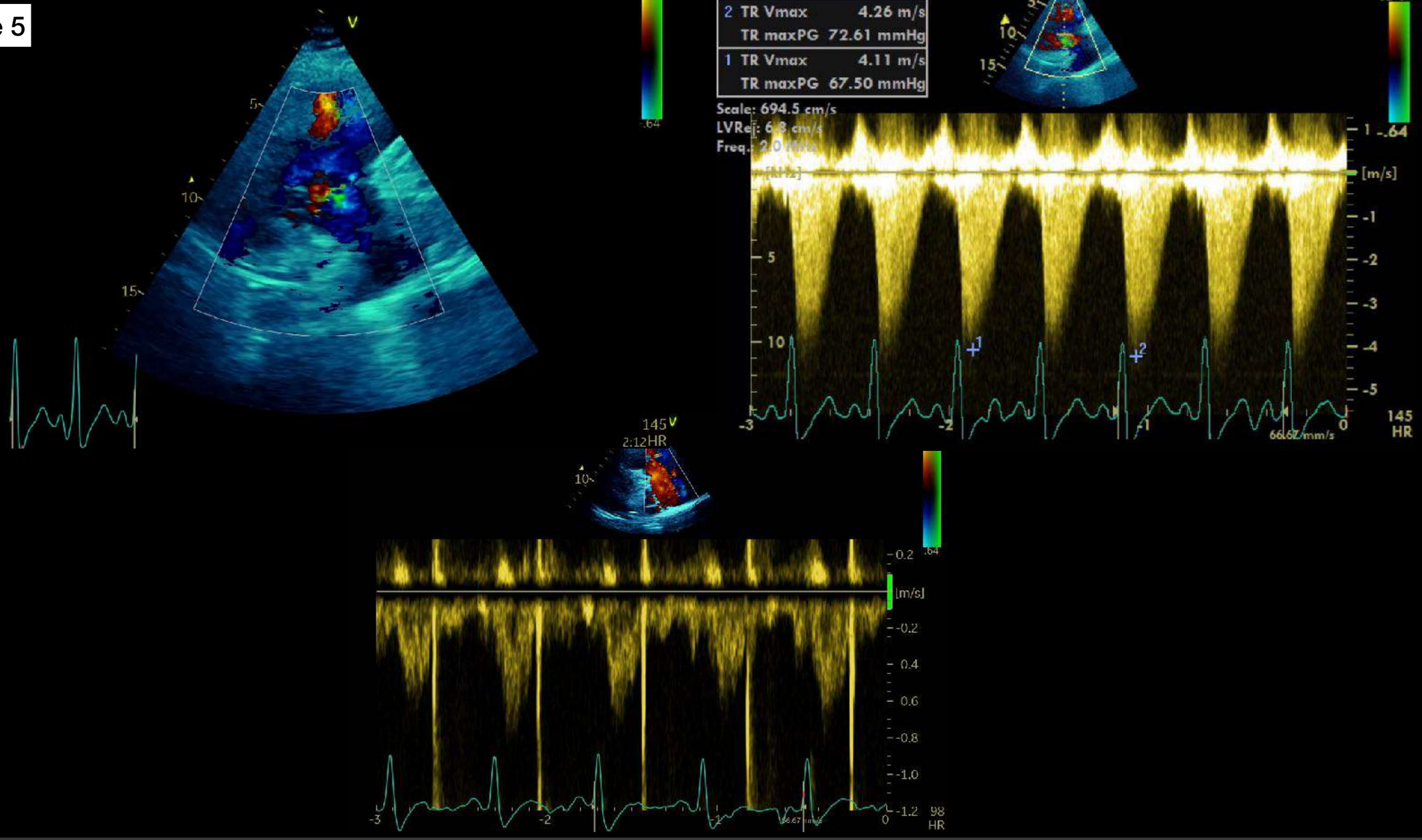
36hrs later

Acute deterioration in haemodynamics and resp requirements



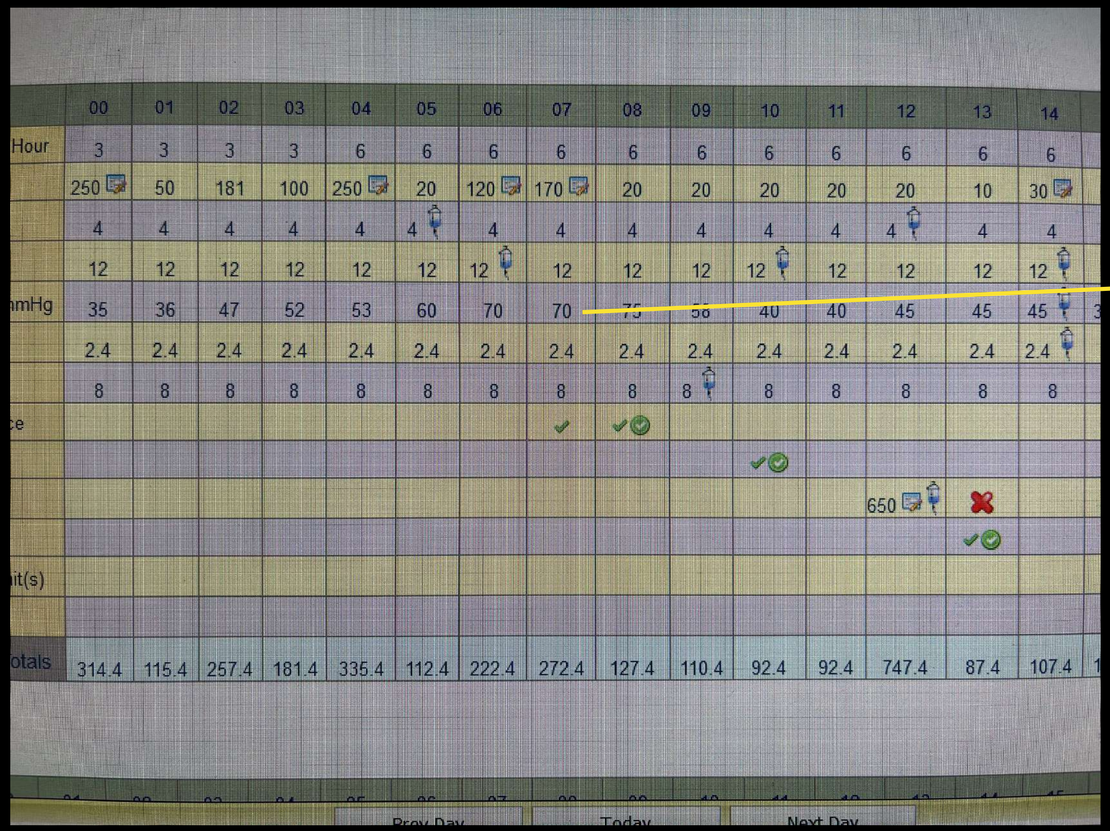


Case 5


2 TR Vmax 4.26 m/s
TR maxPG 72.61 mmHg
1 TR Vmax 4.11 m/s
TR maxPG 67.50 mmHg
Scale: 694.5 cm/s
LVRej: 6.8 cm/s
Freq: 2.0 MHz
CTO
.64
-.64
[m/s]
145
HR
145
2:12HR
98
HR

Case 5

Case 5



	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14
Hour	3	3	3	3	6	6	6	6	6	6	6	6	6	6	6
	250	50	181	100	250	20	120	170	20	20	20	20	20	10	30
	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12
mHg	35	36	47	52	53	60	70	70	75	56	40	40	45	45	45
	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4
	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8
ce															
													650		
it(s)															
otals	314.4	115.4	257.4	181.4	335.4	112.4	222.4	272.4	127.4	110.4	92.4	92.4	747.4	87.4	107.4

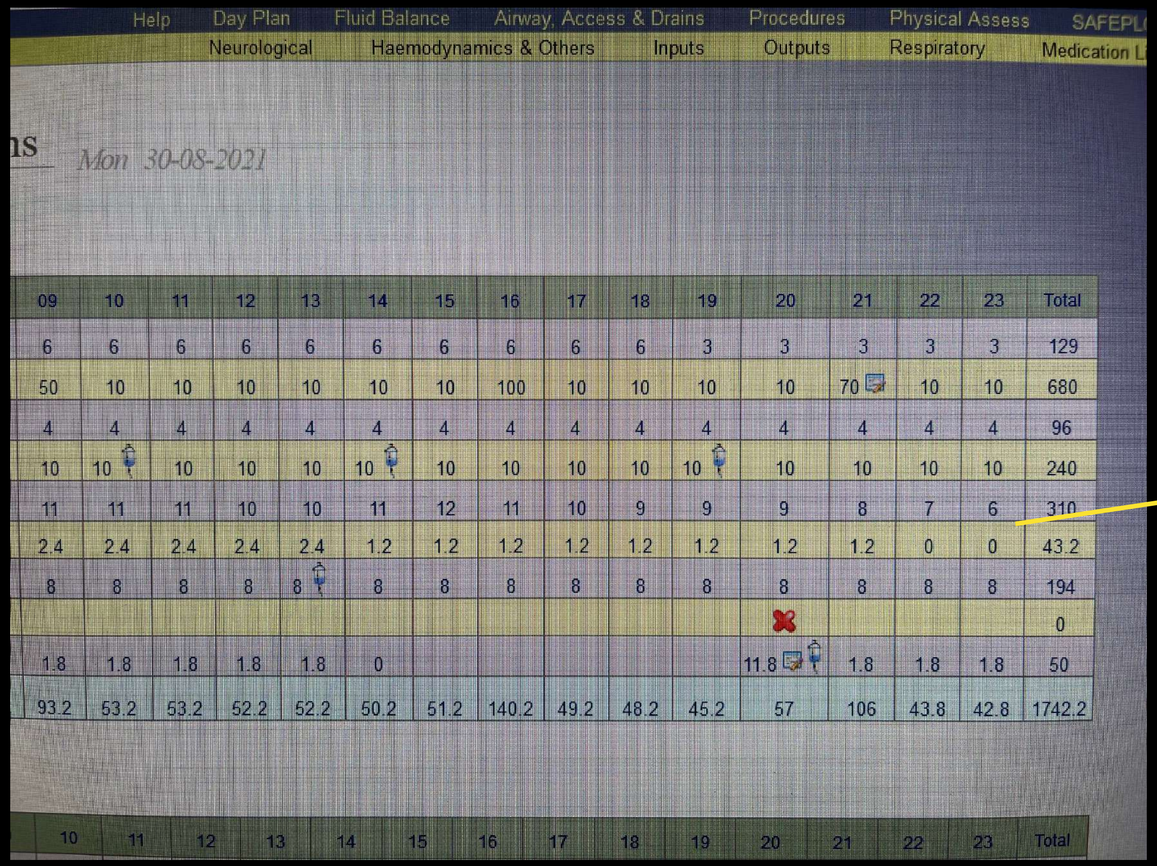
Prev Day | Today | Next Day

Double strength noradrenaline and vasopressin

D/W ECMO team / O&G / ICU / anaesthetics / ID

Decision made for thrombolysis

Case 5



09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	Total
6	6	6	6	6	6	6	6	6	6	3	3	3	3	3	129
50	10	10	10	10	10	10	100	10	10	10	10	70	10	10	680
4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	96
10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	240
11	11	11	10	10	11	12	11	10	9	9	9	8	7	6	310
2.4	2.4	2.4	2.4	2.4	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	0	0	43.2
8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	194
															0
1.8	1.8	1.8	1.8	1.8	0						11.8	1.8	1.8	1.8	50
93.2	53.2	53.2	52.2	52.2	50.2	51.2	140.2	49.2	48.2	45.2	57	106	43.8	42.8	1742.2

10	11	12	13	14	15	16	17	18	19	20	21	22	23	Total

~24 hours post thrombolysis vasopressors weaned

Case 5

- 3 weeks later d/c ICU
- Weak ++
- Dialysis dependent
- Heparin infusion
- d/c from hospital ~7 weeks later
- Mum and baby did well!

Conclusion

Echo in sick pregnant patients

- Integrate history & exam with echo findings
- Determine acute vs chronic
- Management with Pregnancy Heart Failure team
    - O&G, Cardiology and Intensive Care +/- others
- Good communication with patient & family essential

Thank you very much for listening

YouTube = Echo at Nepean

sam.orde@health.nsw.gov.au