RESCUE TEE EXAMINATION
PTE EXAM PREP 2019

January 2019

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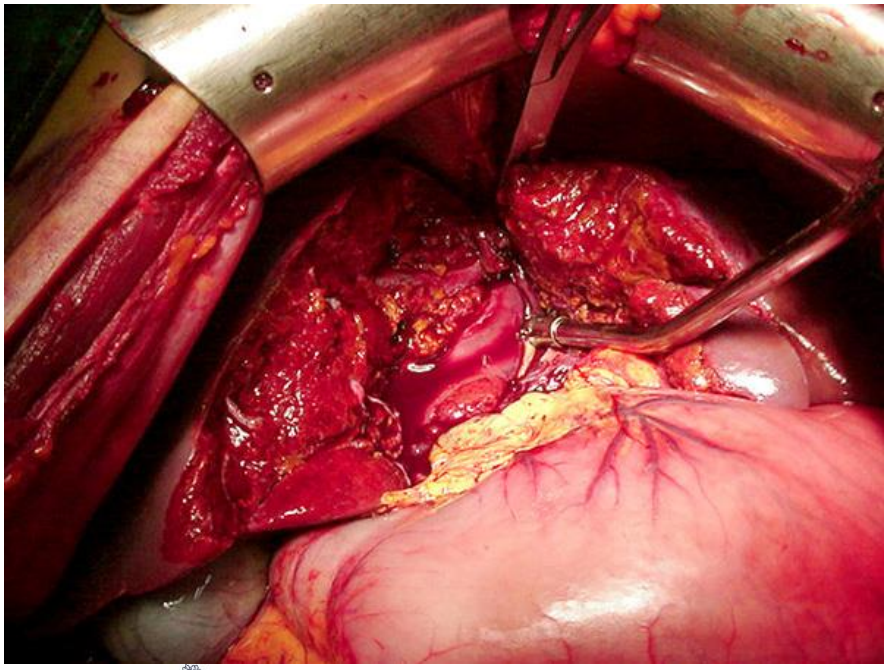
Disclosures

No Industry funding or affiliations

Case Description

- You are called urgently to the operating room by your colleague. A 56-year-old male is undergoing an emergency laparotomy for liver laceration following a motor vehicle collision. The patient's blood pressure has acutely dropped to 65/45, HR 125, and SpO_2 is 85%.

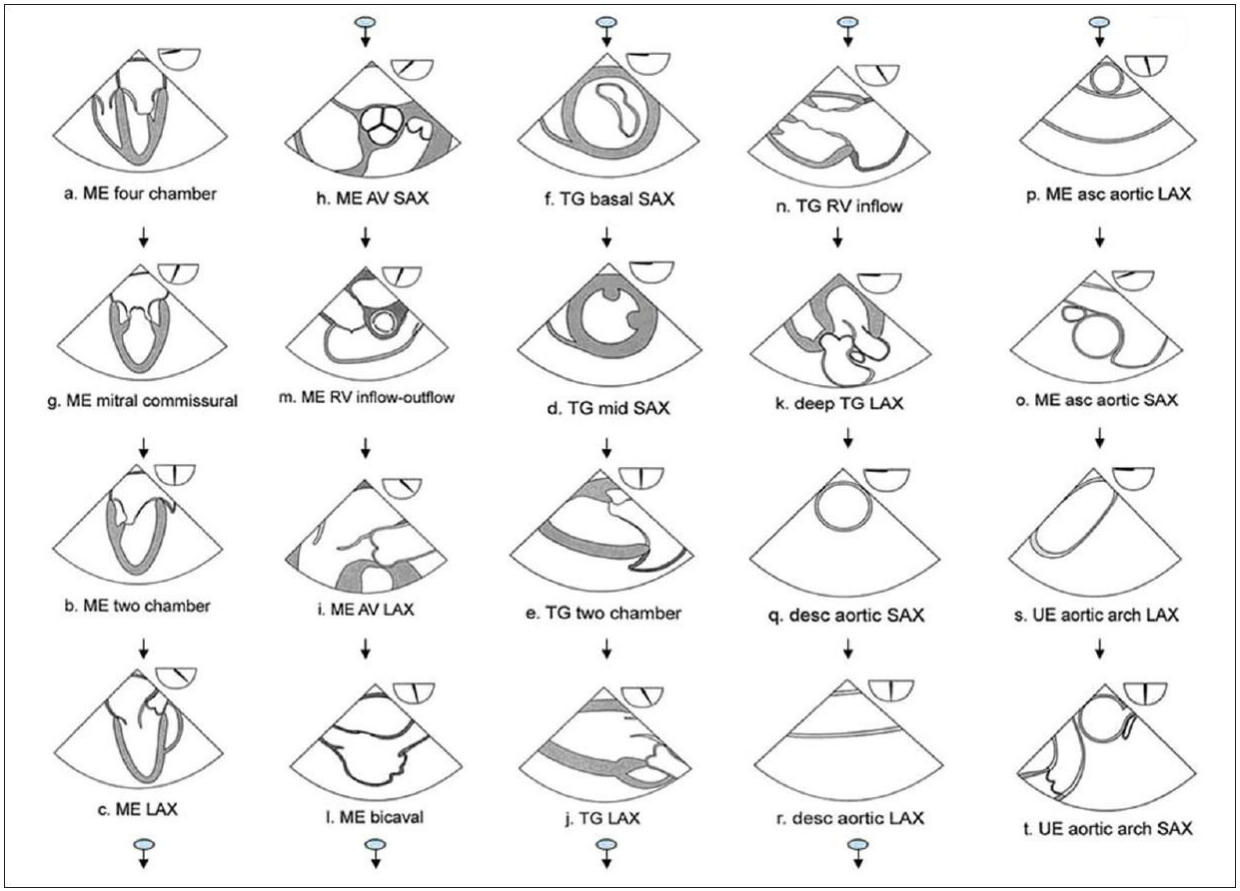


http://www.trauma.org/index.php/main/image/154/

Question 1:

What are the three most valuable views during rescue TEE?

Answer 1:



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Question 2:

What is your differential Diagnosis?

Answer 2:

1. Hypovolemic Shock
2. Distributive Shock
3. Cardiogenic Shock
4. Obstructive Shock

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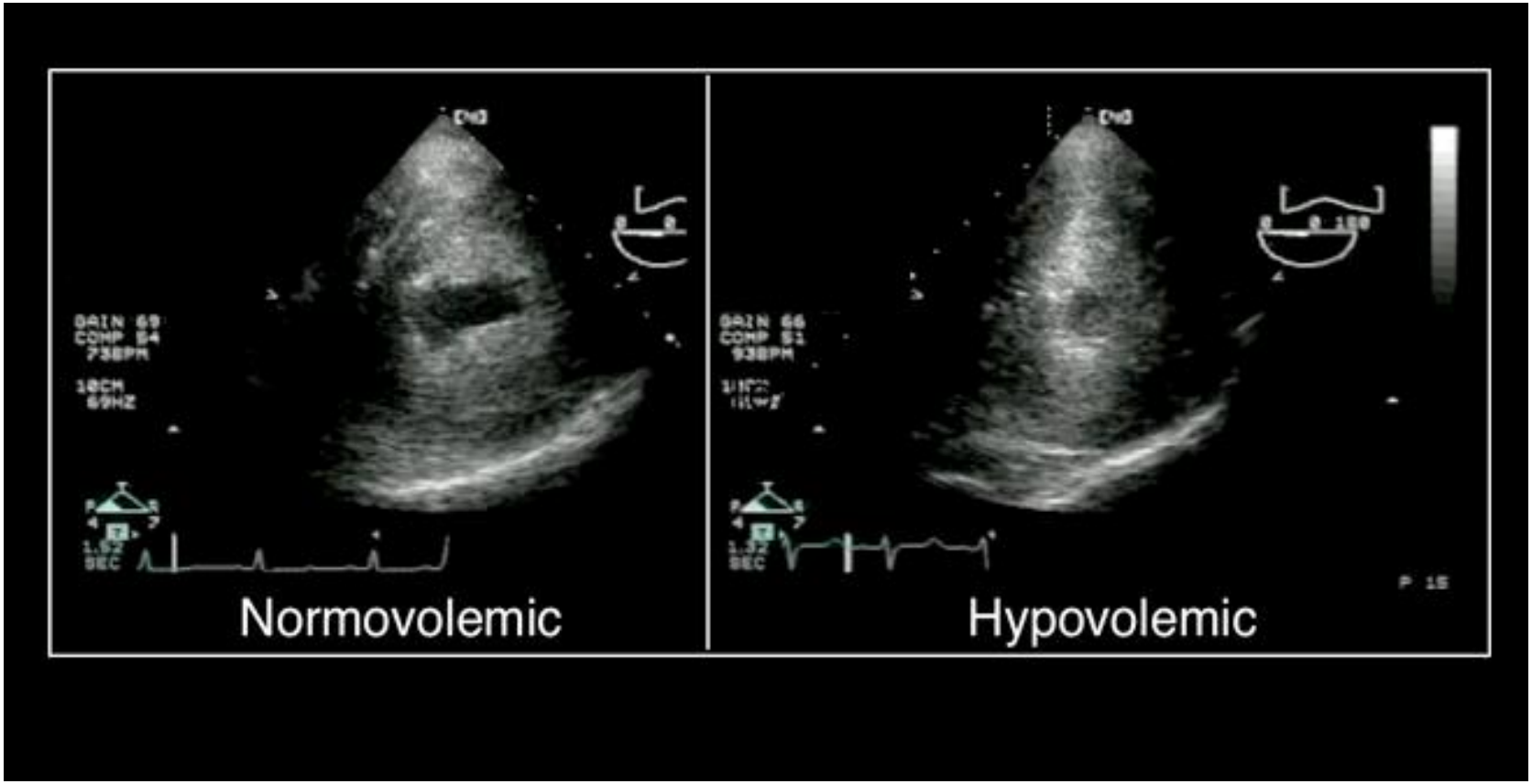
Question 3:

What are the TEE findings for hypovolemic shock?

Hypovolemic Shock



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Hypovolemic Shock

- Most common cause of hemodynamic instability prompting rescue TEE
  - End systolic LV obliteration (kissing walls)
  - Rightward deviation of IAS
  - Small IVC (<1.2cm)
  - RWMA

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Hypovolemic Shock

Table 2 Normal values for 2D echocardiographic parameters of LV size and function according to gender

Parameter	Male		Female	
	Mean ± SD	2-SD range	Mean ± SD	2-SD range
LV internal dimension				
Diastolic dimension (mm)	50.2 ± 4.1	42.0–58.4	45.0 ± 3.6	37.8–52.2
Systolic dimension (mm)	32.4 ± 3.7	25.0–39.8	28.2 ± 3.3	21.6–34.8
LV volumes (biplane)				
LV EDV (mL)	106 ± 22	62–150	76 ± 15	46–106
LV ESV (mL)	41 ± 10	21–61	28 ± 7	14–42
LV volumes normalized by BSA				
LV EDV (mL/m^2)	54 ± 10	34–74	45 ± 8	29–61
LV ESV (mL/m^2)	21 ± 5	11–31	16 ± 4	8–24
LV EF (biplane)	62 ± 5	52–72	64 ± 5	54–74

BSA, body surface area; *EDV,* end-diastolic volume; *EF,* ejection fraction; *ESV,* end-stystolic volume; *LV,* left ventricular; *SD,* standard deviation.

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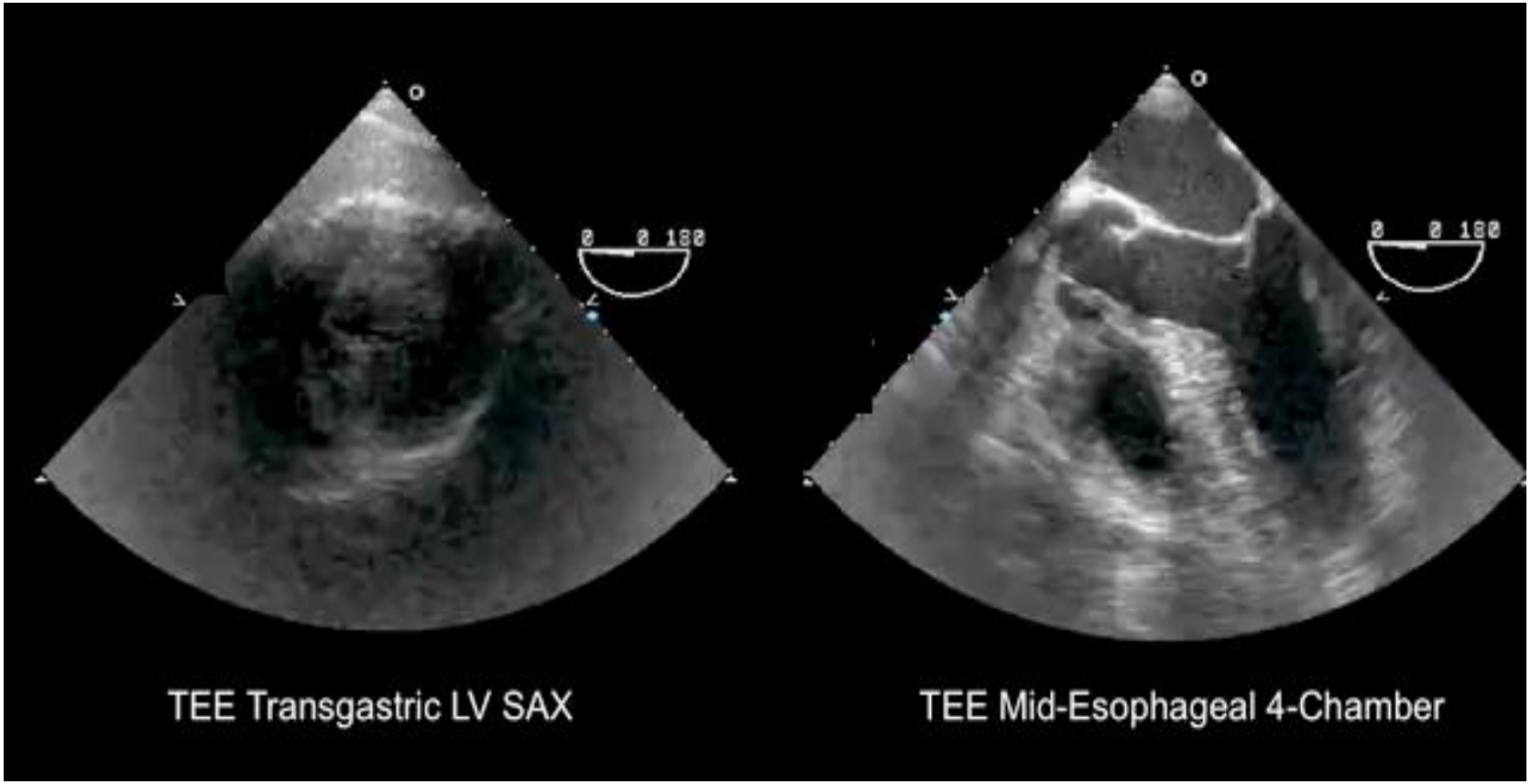
J Am Soc Echocardiogr 2015;28:1-39

Question 4:

What are the TEE findings for distributive shock?

Distributive Shock



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Distributive Shock

- Examples
  - Sepsis/SIRS
  - Anaphylaxis
  - Neurogenic
- Very small LV cavity at end-systole, with normal end-diastolic values
- SVR = ((MAP-CVP)/CO)*80.0

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Question 5:

What are the TEE findings for cardiogenic shock?

Answer 5:

- Depends on the cause ☺

1. LV failure
2. RV failure
3. Myocardial ischemia
4. Aortic dissection/injury

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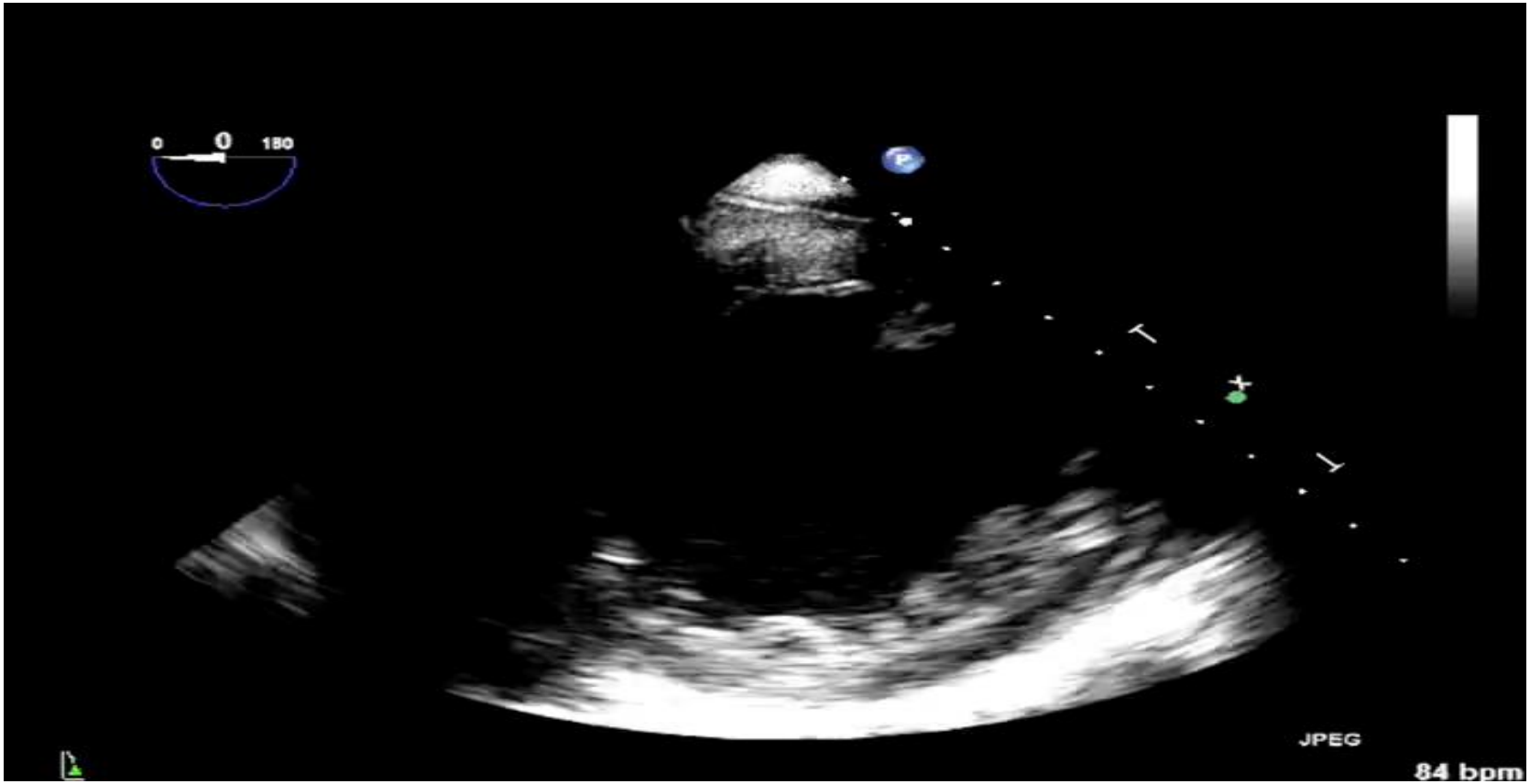
LV Failure



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LV Failure

- Qualitative: Eyeball

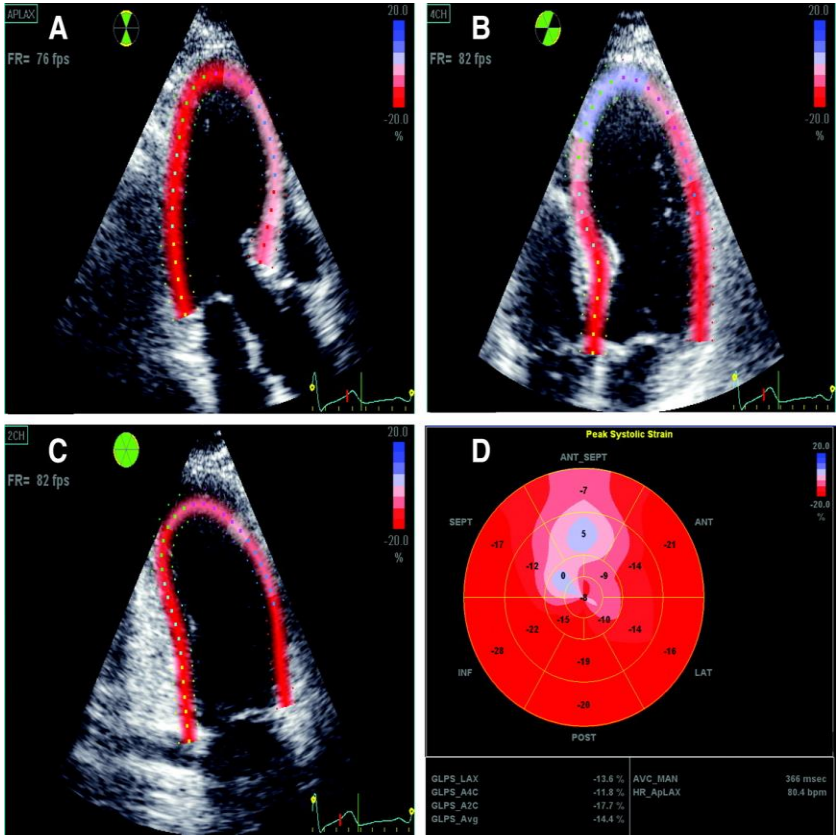
https://www.uptodate.com/contents/https://www.popsci.com/this-is-how-eyeball-tattoos-are-supposed-to-work

LV Failure

Summary LV Systolic Indices		Normal	Abnormal
FS (m-mode)	%FS=((100*(LVEDd-LVEDs))/LVEDs	>26-45%	<25%
FAC (2D)	%FAC=100*(EDA-EDS)/EDA	>40-60%	<40%
EF	%EF=100*(EDV-ESV)/EDV	>55%	<55%
MAPSE	Movement lateral annulus	12+/-2 mm	< 8 mm
MAV	S' velocity lateral annulus	>8cm/s	<5cm/s
MP Index		0.39+/- 0.05	>0.5
dP/dT	32mmHg/time	>1200mmHg/s	<800mmHg/s
VcF	FS/LVET	1.09+/- 0.3 circ/s	--

LV Failure

Strain



3D Quantification

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http://circimaging.ahajournals.org/content/3/1/15
http://www.signavitae.com/wp-content/uploads/2017/03/word-image-2.png

RV Failure

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RV Failure

- Qualitative: Eyeball

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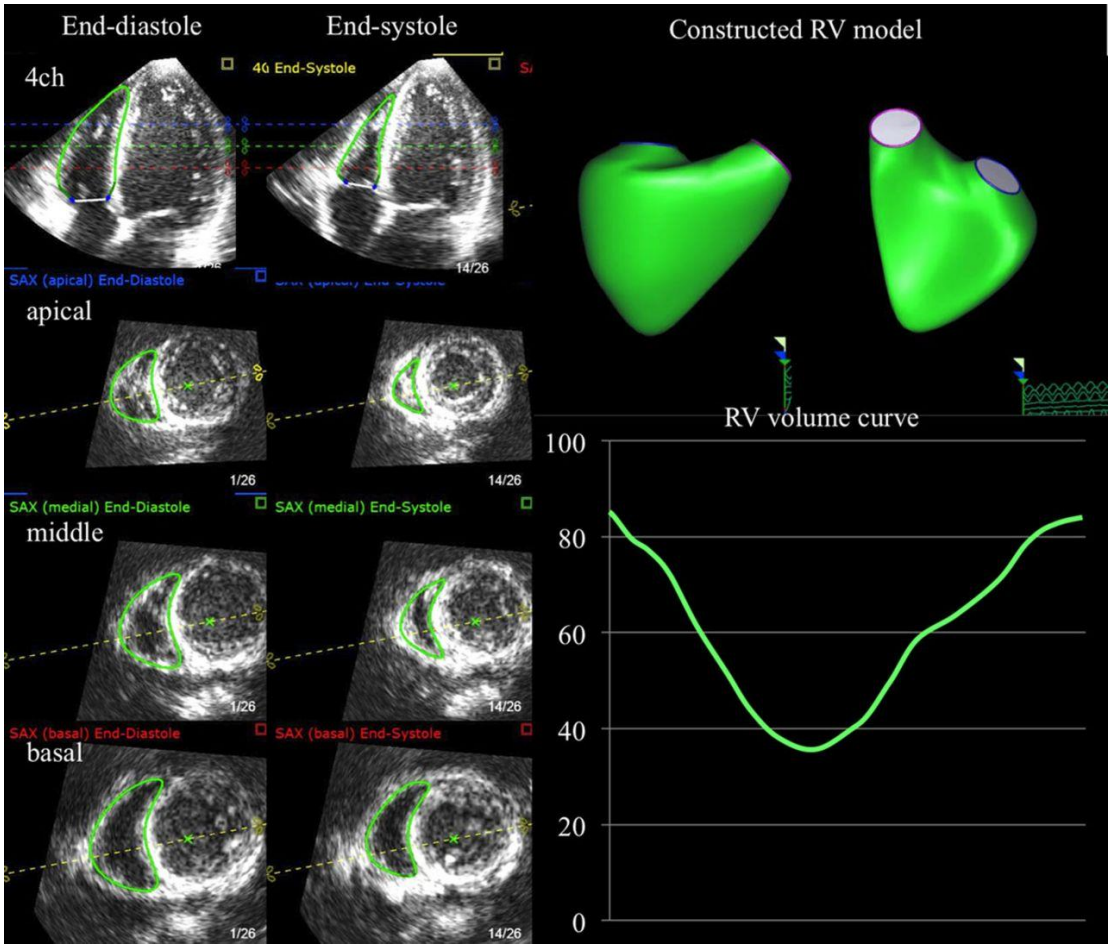
RV Failure

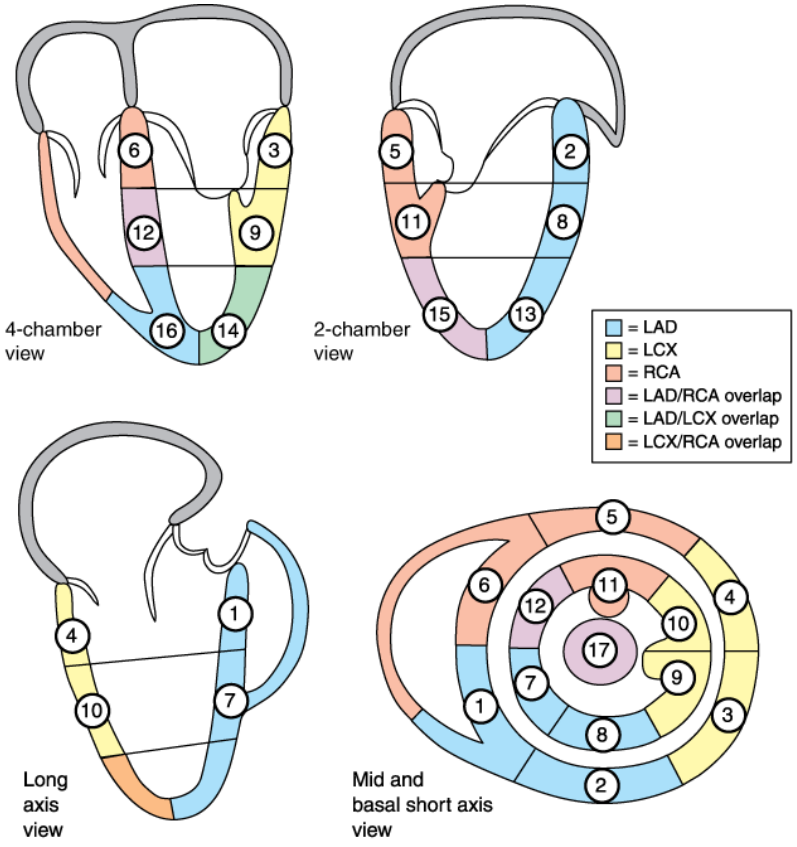
Summary RV Systolic Indices		Normal	Abnormal
FAC (2D)	%FAC=100*(EDA-EDS)/EDA	>35-60%	<35%
TAPSE		16-30 mm	<16 mm
TVPAV	S' posterior TV annulus (TG LAX)	10-19cm/s	<10cm/s
MAV	dP/dT	>8cm/s	<400mmHg/s
IVA		2.2-5.2m/s^2	<2.2 m/s^2

RV Failure



http://circimaging.ahajournals.org/content/10/2/e005384

Myocardial Ischemia



Source: Longnecker DE, Brown DL, Newman MF, Zapol WM: *Anesthesiology, 2nd Edition*: www.accessanesthesiology.com

Wall motion	Endocardial motion	Endocardial thickening
Normal	Normal	>30%
Hypokinesia	Decreased	10-30%
Severe hypokinesia	Minimal	<10%
Akinesia	None	None
Dyskinesia	Outward 'bulging' in systole	Thinning during systole

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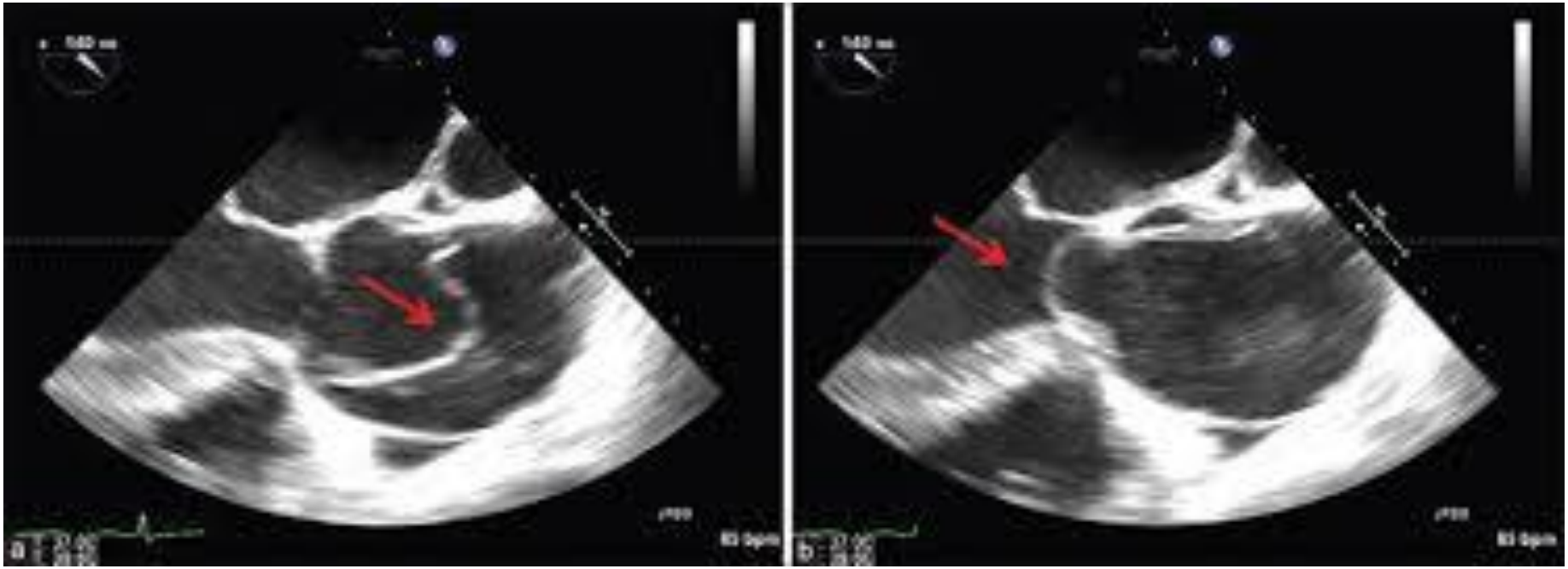
www.accessanesthesiology.com
http://medind.nic.in/aad/t09/i2/aadt09i2p174.htm

Aortic Dissection



http://www.annals.in/article.asp?issn=0971-9784;year=2015;volume=18;issue=2;spage=227;epage=230;aulast=Thunberg

Aortic Dissection

	True lumen	False lumen
Size	Large in aortic root & ascending Ao.Small in descending Ao.	Small in aortic root & ascending Ao. Large in descending Ao
Configuration	Round or oval	Crescentic
Flap curvature	Concave	Convex
Doppler signal **Timing of signal**	Dense Systolic	Sluggish Out of phase
Thrombus	Rare	Common
Cob webs* ***Intimal remnants**	Never	100% specific
Outer wall calcification	Very specific	Absent
Side branches	Common	Equally common

www.drsvenkatesan.com

https://drsvenkatesan.com/2009/03/24/the-aortic-dissection-what-you-wanted-to-know-about-true-and-false-lumen/aortic-dissection-table/

Aortic Dissection

- Complications
  - Pericardial/pleural effusions
  - Regional/global LV dysfunction
  - Aortic insufficiency (60%)

Question 6:

What are the TEE findings for obstructive shock?

Answer 6:

- Depends on the cause ☺

1. Cardiac tamponade
2. Pulmonary embolism
3. Pneumo/hemothorax

Cardiac Tamponade

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Cardiac Tamponade

- Qualitative: Eyeball

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Cardiac Tamponade

- Collapse of intracardiac chambers:
  - RA systolic collapse (>1/3 systole)
  - RV diastolic collapse
- IVC dilatation without respiratory variation (>20mm)
- Respiratory increase in inter-ventricular independence (exacerbated)
- Respiratory variation in diastolic filling
  - MV E Velocity (>25%) TV E Velocity (>40%)

Pulmonary Embolism

https://depts.washington.edu/anesth/education/
nity/tee/tee_2003_2.shtml

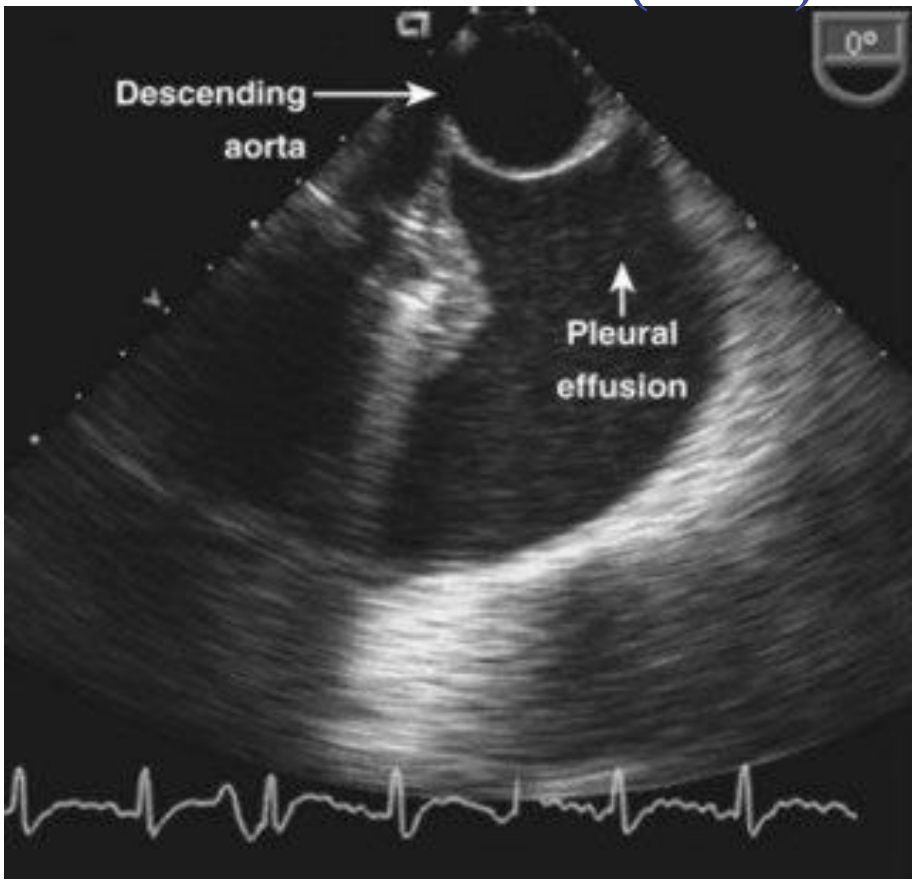
Pulmonary Embolism

- Direct:
  - Direct visualization – uncommon

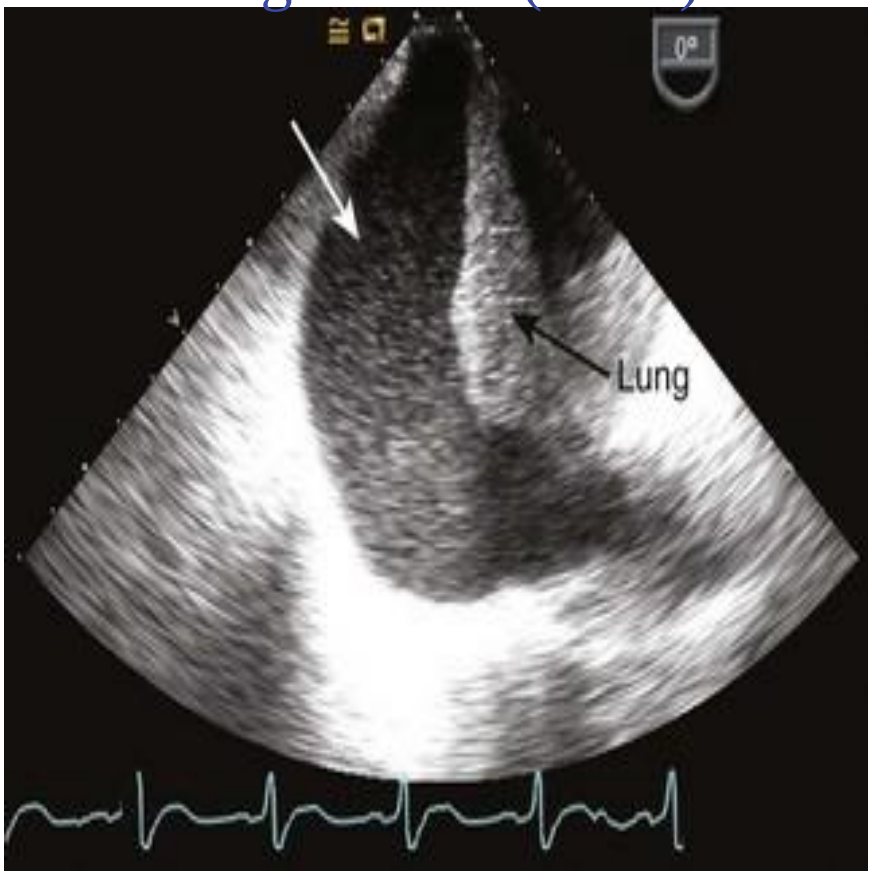
- Indirect:
  - RV dysfunction
  - McConnell's sign – hypokinetic RV free wall sparing apex
  - TR (mod/severe) – 50%
  - IAS gows to left – 98%

Pneumo/hemothorax

Left sided (Aorta)



Right Sided (Liver)



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https://clinicalgate.com/pericardial-disease-2/

Question 7:

What is the efficacy of rescue TEE?

Answer 7:

- Depends ☺

- Changed management in 60% of cases
- Changed management in in most cases
- Working diagnosis in 80% of cases
- High correlation with autopsy (meep)

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