

# HIT M A P Rapid US in Shock & Hypotension

## Cardiac US

♥ In each of 4 main views: ask is view adequate & 5 Q's:

- 1 Beating? 2 Effusion? 3 LV size/fill/fxn? 4 RV size/fill/fxn? 5 Valves, etc.?

♥ Decide therapeutic mgmt after all 4 views— **are they LIV'N'?**

### 1. PSL- Parasternal Long

L parasternal border, probe indicator to R shoulder (11 o'clock), drag 2<sup>nd</sup> → 5<sup>th</sup> ICS until

♥ **adequate view:**

- See MV, AV, RV, longitudinal LV chamber.
  - Depth: desc. aorta, post. pericardium
  - LV chamber axis ~ horizontal, not foreshortened
- ♥ TIP: try rotating probe indicator ~20° → R humerus or chin

♥ **5 Q's:**

- 1 Beating?
- 2 Effusion? Look anterior & posterior: if yes, RV diastolic collapse?

*M mode: EPSS- RV size @ MV opening (peak of E wave)*

- 3 LV size/fill/fxn?

Global fxn: look or use *M mode*. nl EF is:

1. EPSS: anterior (top) MV leaflet almost hits septum

*M mode: thru distal ant. MV leaflet (<0.6cm)*

EPSS 2cm ≈ EF 30%

2. LV chamber fractional shortening > 30%

*M mode: just beyond MV leaflets*

Regional wall motion abnormality:

"SALI": Septal- Anterior-Lateral-Inferior

- 4 RV size/fill/fxn?

nl size = 1/2 RV, 1/2 LVOT, 1/2 LA

- 5 Valves, etc.? Obvious valve pathology, intra-cardiac clots...

♥ TRICKY! RV has trabeculae & moderator band

### 2. PSS – Parasternal short

Rotate probe 90° to left from PSL

♥ **Adequacy:** □ mid papillary level: *mushroom*

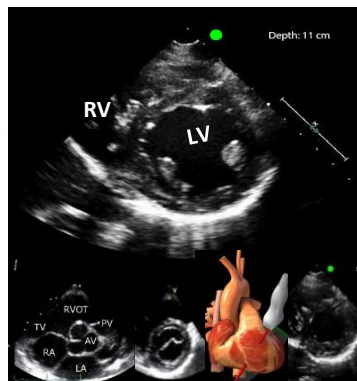
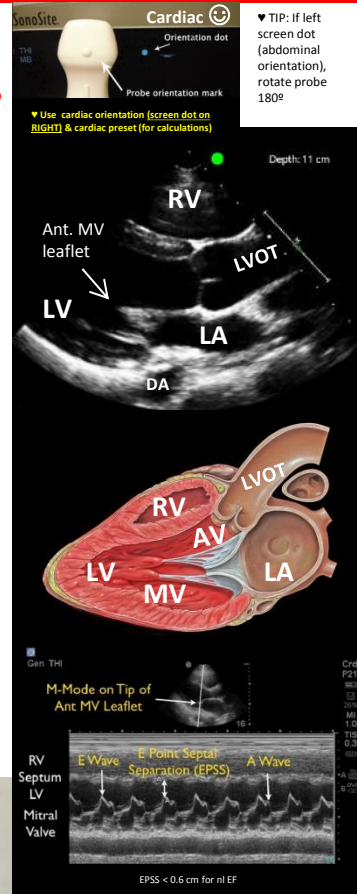
- 1 ? 2 ? 3 LV—nl EF >30% Δ in mushroom size

Regional wall motion abnormality: SALI

- 4 RV- v for septal flattening ("D") or bowing in

- 5 Tilt probe down to scan from base (AV) →

MV (fish mouth) → mid pap → apex (v for clot)



### 3. Apical 4 View

in 4<sup>th</sup> -5<sup>th</sup> ICS, indicator to L (3 o'clock)

Start laterally → ant chest wall, @ PMI

♥ **Adequacy:**

- septum is straight-ish
- see LV inner wall

- 1 ? 2 ? 3 LV size/fill/fxn?

Look at LV inner wall movement—

*If can't see but outer wall ok, inner wall probably ok*

- 4 RV size/fill/fxn?

- 1) nl RV size: 1/2 RV, 2/3 LV

measure above open valves in diastole

- 2) RV fxn: look or *M mode*: lateral TV annulus moves ↑ ↓ 2 cm (TAPSE) . TAPSE <1 cm = bad RV

- 5 ?

### 4. Sub-xiphoid

**Long:** indicator to L, flatten

♥ **adequacy:** □ see LV, RV, post.

pericardium & ideally MV, TV

- 1 Beating? 2 Effusion? 3 LV size/fill/fxn?

- 4 RV size/fill/fxn? 5 Valves, etc.?

**Short:** indicator → head, fan to L

♥ **adequacy:** □ mid pap (but sideways!)

- 1 ? 2 ? 3 LV—nl EF >30% Δ in

mushroom size

Regional wall motion abnormality: SALI

- 4 RV— v for septal flattening ("D") or

bowing in ♥ TRICKY!: may see RVOT

- 5 fan R → L

### IVC US

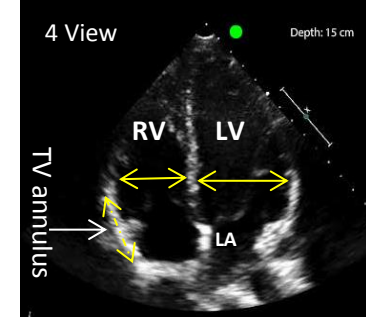
♥ Sub-xiphoid, indicator to head

♥ **Adequacy:** □ see hepatic vein, RA inlet

□ rotate probe to R (confirm not aorta)

♥ Measure IVC size just after hepatic vein or about 2 cm from RA inlet

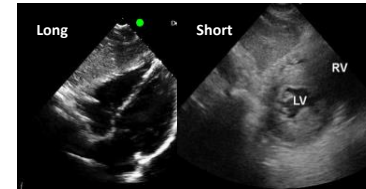
IVC size (mm)	Collapsibility index	RA pressure
<17	50%	5
>17	>50%	10
	<50%	15
	No collapse	20



**SIDEBAR: Velocity Time Integral**

**VTI:** 18-30 cm = CO of ~5L

1. From 4v., tilt probe up → 5 v.
- Or rotate indicator toward L shoulder/head 3 v.
- in 5v., US beam & LVOT flow must be < 20°
2. Add color doppler
3. Pulse doppler to LVOT flow (max blue)

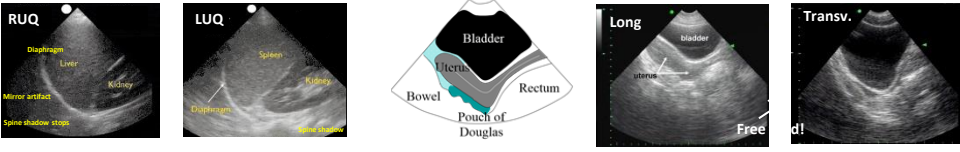


♥ IVC correlates w/ RAP/CVP.  
Caution use in isolation as surrogate for LV preload—look also at LV function

# Morrison's Pouch (FAST)

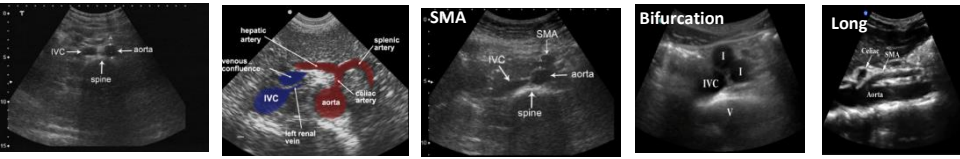
- Abdominal orientation (left screen dot) • Probe indicator toward head or to L
  - is there free fluid?
- RUQ** □ Diaphragm, liver, sup. & inf. pole of kidney
  - LUQ** □ diaphragm, splenic angle, entire kidney
  - Bladder, Transv. & Long.** □ ~5 cm depth below bladder □ fan thru entire bladder

Pleural effusion if 1) loss mirror artifact & 2) spine shadow continues beyond diaphragm



## Aorta

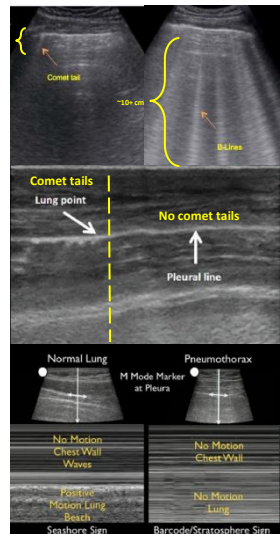
- Abdominal orientation (left screen dot) • Probe indicator to left
- Start below xiphoid process. Apply steady, firm pressure
- Adequacy:** □ Aorta anterior to spinal shadow
- Scan from proximal aorta to iliac bifurcation
- Transv: measure aortic diameter from outer wall to outer wall (nl < 3 cm)



## Pneumothorax

- Adequacy:** □ see rib shadow & pleura
- ~5 cm depth linear probe □ ~10 cm depth ab probe
- R & L Apical Views:** • TIP! Turn gain down
- Probe indicator to head
- Ant. mid-clavicular line, 2<sup>nd</sup>-3<sup>rd</sup> ICS

- Look for
- Lung slide** (comet tails = z lines) w/ each breath
  - B lines** = line extending down ~10 cm depth. Multiple B lines suggestive of lung pathology- edema, pneumonia, DAH, etc. (1 or 2 ok)
  - Lung pulse** = shimmering pleura w/ ea heart beat
- If 0/3 present, POSSIBLE PTX but...



- If see **lung point sign**, likely PTX
- TIP! Unsure? Use linear probe, apply m-mode
  - A lines = horizontal lines have NO significance
- RUQ, LUQ views:** ab probe, same as FAST

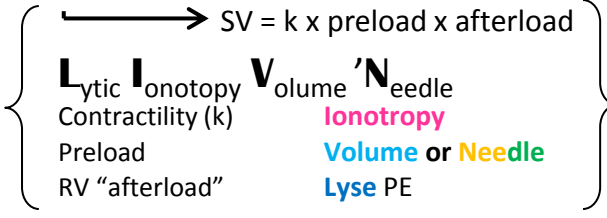
# Are they LIV'N?

Symptomatic hypotension?

$$MAP = HR \times SVR \times SV$$

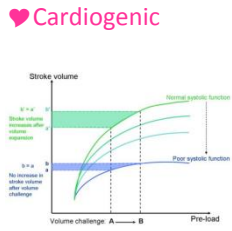
- Start IVF bolus
- Shock tachy/Pace brady arrhythmias
- Vasopressors

**How to use LIV'N:**  
 Must first fix HR & SVR.  
 Then US to determine type of shock & LIV'N intervention → do you now lyse, add inotropy to vasopressors, give more volume, or needle decompress?

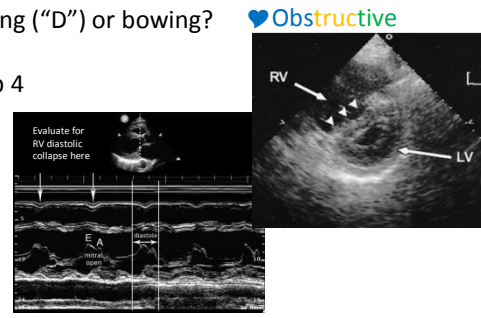


♥♥♥ Use clinical context/pretest probability. Reassess after intervention ♥♥♥

- Is LV fxn nl or hyperdynamic (EF>70%)  
 YES → Not cardiogenic shock, cont. to step 2.  
 NO → If decreased EF, consider **cardiogenic shock** & **Stopping IVF**, adding **inotropy** (after vasopressors!)  
 \*Difficult to cont & assess for RV strain (PE) if chronic CHF (LV may not be hyperdynamic because baseline poor function)\*



- Is LV hyperdynamic?  
 YES → **cont IVF** → step 3
- Is RV big? Is there septal wall flattening ("D") or bowing?  
 YES → consider **PE** if acute  
 NO → RV is nl or small, cont. to step 4
- Is there RV diastolic collapse?  
 YES → Is there pericardial effusion?  
 YES → **consider tamponade**  
 NO → **consider PTX**  
 NO → cont to step 5



- If small/nl RV & hyperdynamic LV, then either **hypovolemic** or **distributive shock** & cont **IVF**, **vasopressors**  
 ♥ Consider where pt is on Frank-Starling Curve  
 ♥ May use  $\Delta SV = \Delta VTI$  to quantify resuscitation

♥ **Hypovolemic**  
 ♥ **Distributive**