

Anesthesia POCUS Pocket Guide

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Version 0.9

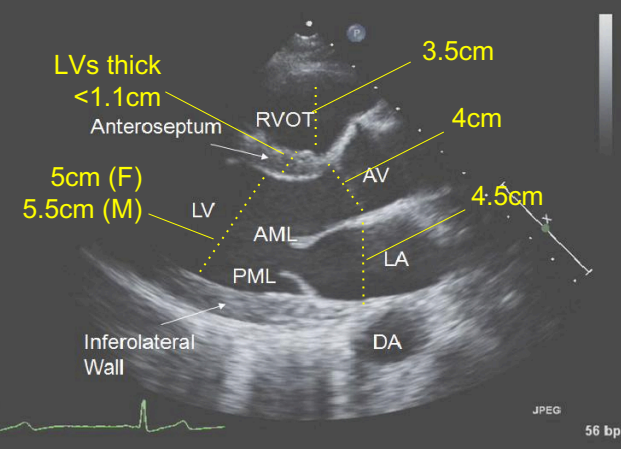


For interactive online TTE simulator & videos, go to pie.med.utoronto.ca

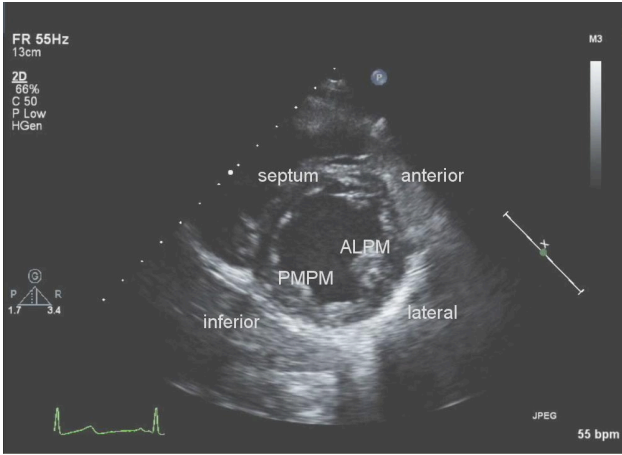
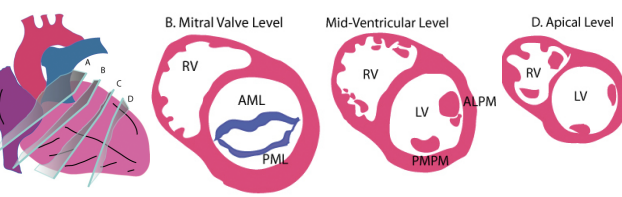
| Transducer Types & Applications | | | | |
|---------------------------------|--|--|--|---------------------------|
| Transducer type | Linear | Curvilinear | Phased array | Intracavitary |
| | | | | |
| Frequency range | 5-10 MHz | 2-5 MHz | 1-5 MHz | 5-8 MHz |
| Imaging depth | 9 cm | 30 cm | 35 cm | 13 cm |
| Footprint | | | | |
| Image | | | | |
| Applications | Arteries/veins Procedures Pleura Skin/soft tissues Musculoskeletal Testicles/hernia Eyes Breast | Gallbladder Liver Kidney Bladder Abdominal aorta Abdominal free fluid Uterus/ovaries | Heart Inferior vena cava Pleura Abdomen | Uterus/ovaries Pharynx |

Disclaimer: This card is intended to be educational in nature and is not a substitute for clinical decision making based on the medical condition presented. It is intended to serve as an introduction to terminology. It is the responsibility of the user to ensure all information contained herein is current and accurate by using published references. This card is a collaborative effort by representatives of multiple academic medical centers.

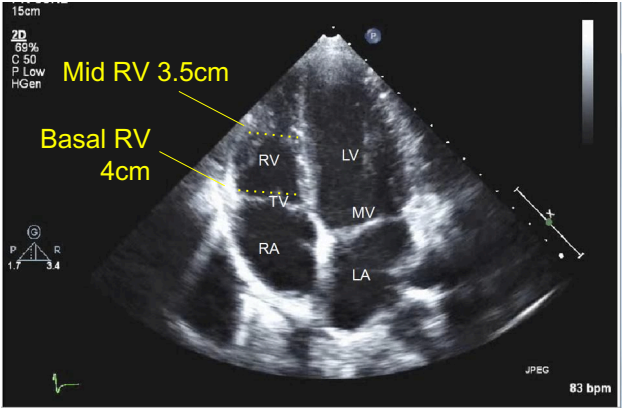
| Parasternal Long Axis (PLAX) <i>Beginner</i> | |
|--|---|
| Uses | - Quick look at LV and RVOT - Function/hypertrophy, effusion AV and MV gross function, LA and aortic root size - Concentric LVH = >1.1cm mid-septum |
| Tips | - RV is closest to chest wall/probe - View of RVOT not 'RV' - Shouldn't see apex of LV - Should see ant/post mitral leaflets (centered) and AV leaflets - This view is home base, always revert to PLAX view to reorient - FYI Underestimates MR |
| Position | - For most views, left (slightly) lateral (1 pillow behind pt's right flank), left arm up above head with HOB @10-20 degrees to open up rib spaces; inspiratory holds can help - Transducer @ 2nd-4th left intercostal space, pt's left of sternum; notch toward pt's right shoulder |



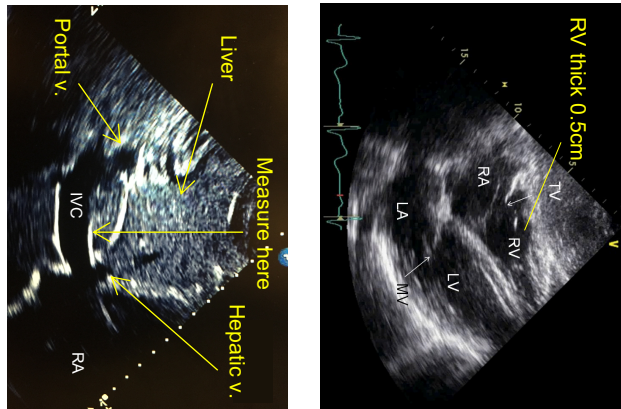
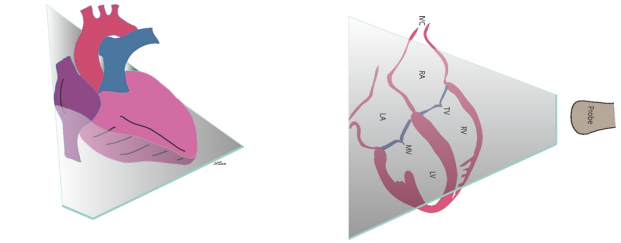
| Parasternal Short Axis (PSAX) <i>Beginner</i> | |
|---|---|
| Uses | - Limited look at regional wall motion abnormalities - LV filling (mid-papillary view; "kissing" papillary muscles can suggest underfilled LV) - RV:LV pressure - LV should be round; if inter-ventricular septum is flattened, creating a 'D' shape of the LV, this <i>suggests</i> RV pressure overload (not diagnostic) |
| Tips | - SALPI (septum, ant, lateral, post/inferior) - Don't evaluate RV sys function here - Mid-papillary view— should see around all sides of pap muscles |
| Position | - From PLAX, rotate 90 clockwise (notch toward pt's left shoulder); can turn w/R hand while bracing probe w/L hand - Start at 'fish mouth' view of MV (b), then mid papillary muscle view(c), then apex (d) - Can tilt up/down to apical/basal views; more of a tilt than a slide toward the apex |



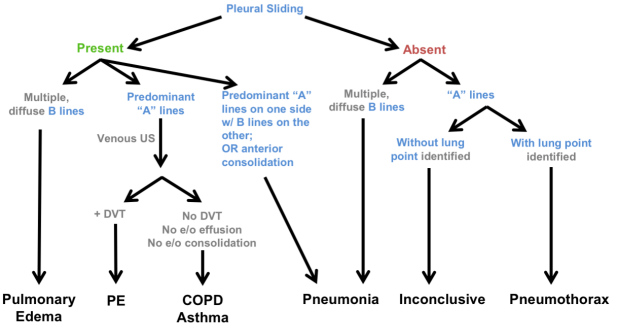
| Apical 4 Chamber (A4C) <i>Beginner</i> | |
|--|--|
| Uses | - Limited look at chamber sizes & function , evaluation for air ; caution with estimating RV size here (see advanced TTE 102) - Can be adjunct to evaluate line placement (wire in RA) |
| Tips | - Very easy to foreshorten (if LV is round or not in center of view, then likely you are off axis) - Look for TV and MV leaflets in same view - RV should be approximately <70% LV; should end before LV apex <i>and</i> be narrower at apex - In this view, the RV lies anterior and caudal relative to the LV (make sure probe oriented correctly) |
| Position | - From PSAX, observe the direction of the apex (=PMI) - Start at PMI (usually just inferior to the nipple, mid clavicular line) with notch toward pt's Left shoulder; angle slightly toward sternal notch; LV should be centered - Can be difficult view to obtain unless pt nearly in left lateral position ; inspiratory hold can be helpful too |



| Subcostal <i>Beginner</i> | |
|---------------------------|---|
| Uses | - IVC size ~ volume status ; best look at RV ; LV systolic function, effusion ; abdominal aorta, PFO - Best septal & RV wall thickness assessment |
| Tips | - Often get all info f/ 4Cv; especially good in ventilated & COPD - Orient by tracing RA to IVC; Measure IVC ~2cm proximal to RA - IVC view ~happy sperm whale (IVC = smile; liver = head; portal vein on end= eye) - -ASE 2010 Guidelines IVC diameter: ≤2.1cm + collapses >50% w/ sniff = nl RAP ~0-5 mmHg >2.1 + <50% collapse w/sniff = RAP 10-20 mmHg <i>Lang et al, J Am Soc Echocardiogr 2015</i> |
| Position | - -4 chamber view ; below xiphoid, probe flat on abd; notch right ; -IVC view : probe perpendicular to abd, beneath xiphoid, indicator toward pt's head; tilt medial/lateral to see IVC and aorta; caud/ceph to see heart; usually liver easiest to ID - Bend pt legs to relax abd; consider deep breath and hold |



| Pulmonary Ultrasound | |
|----------------------|--|
| Uses | - Pneumothorax, consolidation, edema, effusion |
| Tips | <ul style="list-style-type: none"> - Probe Selection: 4 to 12MHz can be used - High frequencies - better for superficial evaluation (lung sliding/pneumothorax, comets) - Low frequencies – better for deep evaluation (consolidation, pleural effusion) |
| Position | Err on the side of looking at more rather than fewer points; 3-4 per side, anterior and dependent areas |



CONSOLIDATION

- Early PNA may only see B lines
 - With increased consolidation may see lung appear more like liver = 'hepatization'
 - May see air bronchograms
 - Shred sign

EFFUSION

- Look in dependent areas
 - May see 'spine sign' (will only see spine below an effusion, not aerated parenchyma)
 - Look for >1.5cm pocket ideally in rib space above and below thora site

Pulmonary Ultrasound

NORMAL LUNG

Rib shadow
 Pleural line
 "A" lines

EDEMA

"B" Lines

A Lines:

- Horizontal, regularly spaced hyperechoic lines
- Reverberations of pleural line @equal intervals; Motionless
- Represent subpleural air (can be normal=alveolar or abnormal=ptx)

B Lines ("comet tail"):

- Vertical narrow-based, hyperecho lines, move with breathing, erase A lines, f/pleural line to edge of field
- Result of small water-rich parenchyma surrounded by alveoli/air
- Increase in number, density w/lost aeration (edema, nl in dependent lung)
- Decrease w/increased aeration (emphysema, hyperinflation)
- Presence = rule out ptx
- 7mm apart = interstitial edema
- 3mm apart = alveolar edema

Z lines (not shown):

- Normal or pneumothorax
- Short, vertical, look like B line but not reaching the distal edge of the screen, don't erase A lines and don't move w/pleural sliding

NORMAL LUNG

Pleural line 2D = "ants marching" lung sliding
 Mmode Static structures "sky"
 Mmode Normal lung "beach sand"

PNEUMOTHORAX

Pleural line - 2D = no lung sliding
 Mmode Static structures "sky"
 Mmode static no lung "bar code"

FAST/eFAST

Uses

- Rapidly identify "free fluid", PTX with eFAST, hydro

Tips

- **Probe Selection:** use low frequency curvilinear or phased array "cardiac" probe
 - "Knuckles to the gurney" to get LUQ/RUQ views

Position

Depends on view: Mid-axillary line (or posterior to mid-ax line) for RUQ/LUQ view, just below xyphoid for subcostal, 2-3cm above pubis for suprapubic.
Indicator notch: towards pt's head if sagittal/longitudinal, to pt's right if transverse

Views:

1. RUQ/Perihepatic
 2. Cardiac: sub-xyphoid / subcostal OR parasternal long
 3. LUQ/parasplenic
 4. Suprapubic/Pelvic
 5. Thoracic/PTX

NORMAL RUQ

- If no pleural effusion, will see liver reflection where lung parenchyma = 'mirror sign' (see effusion in the image to the left)

ABNORMAL RUQ

- Free fluid

eFAST Algorithm

FAST SCAN

Unstable

Stable

Positive

Negative

Negative

Positive

OR

Other sources/ repeat

CT vs Re-Examine

CT

*** Best validated for *unstable* blunt trauma patients

NORMAL LUQ

ABNORMAL LUQ

NORMAL PELVIC

ABNORMAL PELVIC

| DVT US | |
|----------|--|
| Uses | - Suspected DVT/PE (when radiology not readily available or CTPE contraindicated) |
| Tips | Probe Selection: linear/vascular probe Compression technique: Hold the transducer in a transverse position, perpendicular to the skin surface - At each point described below, apply firm, downward pressure to achieve complete collapse of the vein (study is positive if vein does not collapse with compression; utilize doppler to confirm flow) |
| Position | -hip should be slightly flexed + externally rotated and the knee flexed at about 20-30 deg |

NORMAL CFV w/o COMPRESSION



All patients should have a formal DVT study to confirm findings when feasible

Levels for evaluation
 # of points/sensitivity vary (consider 5-7 points)

1. Level of common femoral vein
2. Level of sapheno-femoral junction
3. Just below sapheno-femoral junction
4. Level of the proximal superficial femoral vein
5. Mid SFV
6. Distal SFV
7. Proximal popliteal vein

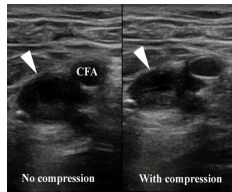
NORMAL CFV w/ COMPRESSION



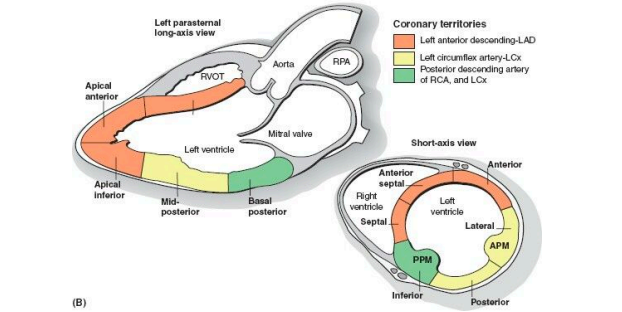
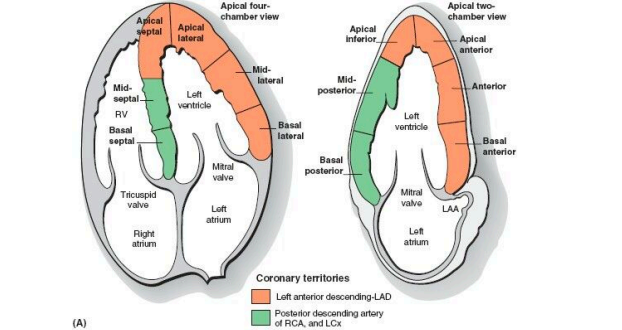
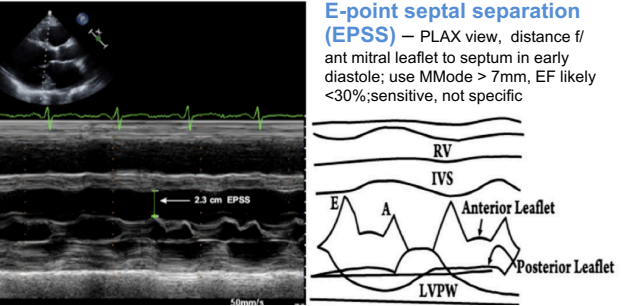
Anatomy

1. CFV CFA
 2. CFV CFA
 3. CFV SFA
 4. SFV DFV
 5. PV PA

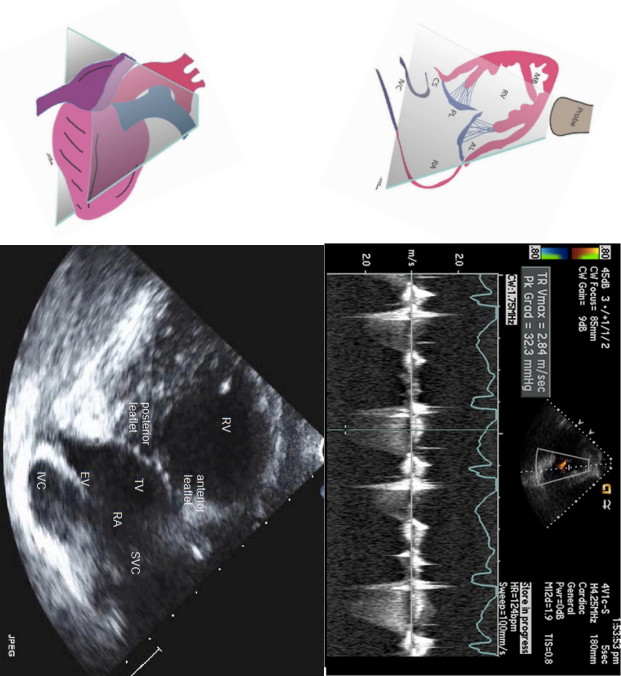
DVT OF CFV



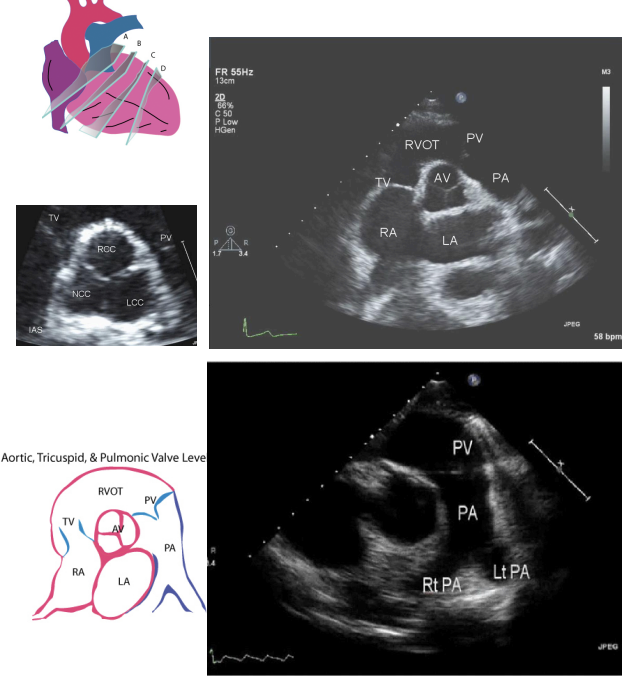
Misc



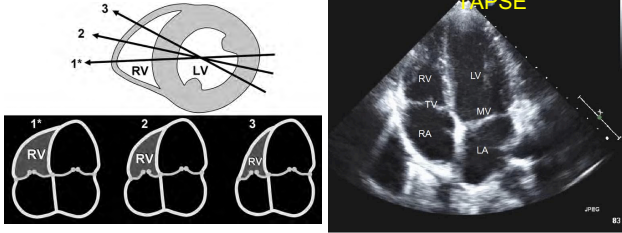
| Parasternal Long Axis (PLAX) | Advanced |
|------------------------------|---|
| Uses | - TV, CW of TR to estimate PASP (though not best view for this); PA diameter, Pulmonary VTI (PW PV) - EPSS (LV function) – see box to left |
| Tips | - Only small movement from PLAX view needed - PASP = $4V^2 + RAP$ - Pericardial effusions tend to be anterior to descending aorta, pleural effusion tends to be posterior; should be seen throughout cardiac cycle - May see eustachian valves (EV) – fetal flow from IVC/RA to LA |
| Position | - RV Inflow view : standard PLAX view, tilt transducer to aim toward pt's right hip - PV view – f/PLAX aim toward pt's L shoulder (look up), may see PA bifurc |



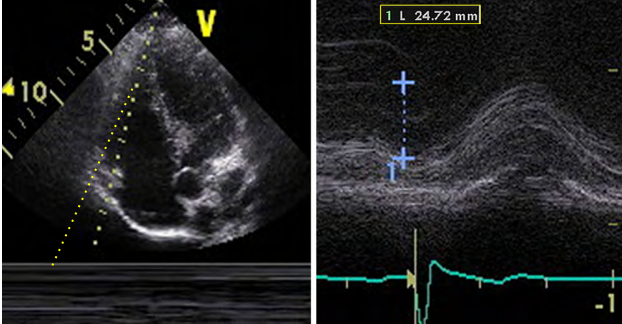
| Parasternal Short Axis (PSAX) | Advanced |
|-------------------------------|---|
| Uses | - CW of TV (PASP) , PV, RVOT , Aortic leaflets , PA , pulm VTI - Can also look for PFO |
| Tips | - Sometimes lung over PV, ask pt to exhale -May move transducer toward pt's right shoulder to obtain view - May not see valve well, but try color doppler - Good view for CW across TV to estimate PASPs - PASP – CW on TV; $4v^2$; TR velocity > 2.8 m/s ~36mmHg if n/ RAP - 'snail view' - Pulmonary VTI – PW proximal to PV (14-16 @HR80) if low suggests low CO (if not tachy) |
| Position | -Start from PLAX → PSAX, then angle up toward pt's right shoulder; \pm slide up one rib space or slide 1cm down toward apex -Further angulation toward pt's chin or simply moving up one rib space or rotate cw/ccw may show ' pants view ' of the PA |



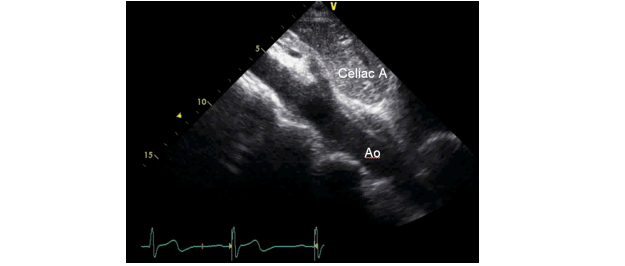
| Apical 4 Chamber (A4C) | Advanced |
|------------------------|---|
| Uses | TAPSE , RV function , tamponade (caution), PASP |
| Tips | -Small angle changes can affect appearance of RV (see 1-3 below; goal =#2) -Caution with foreshortening -May see moderator band in RV (prevents overdistension, carries part of RBB); Crista terminalis near RAA |
| Position | - From PSAX, observe the direction of the apex (=PMI) - Start at PMI (usually just inferior to the nipple, mid clavicular line) with notch toward pt's Left shoulder; angle slightly toward sternal notch; LV should be centered -Can be difficult view to obtain unless pt nearly in left lateral position ; inspiratory hold can be helpful too |



Tricuspid annular plane systolic excursion (TAPSE)
>1.6cm ~good RV systolic function (caution w/ this measurement)



| Subcostal | Advanced |
|-----------|---|
| Uses | - Abd aorta, celiac, IVC |
| Tips | -IVC measurements can vary with pt position; ?significance if positive pressure vent -Continuous IVC flow n/ = suction -Normal Abdominal aorta width at subcostal view = ~2cm diameter -With subcostal 4CV, can put doppler color across inter-atrial septum for ASD/PFO |
| Position | - 4CV – see front of card - Lateral IVC view – can see IVC from far lateral if midline incision etc - Aorta view – once found IVC w/typical midline technique, scan to pt's left by tilting probe; can often see celiac take off |



| Suprasternal | Advanced |
|--------------|---|
| Uses | Aortic arch dissection, Right PA |
| Tips | -If RPA is smaller than aorta, filling pressures likely normal |
| Position | -Have pt look up and left; place transducer in suprasternal notch with indicator pointed to 14:00; tilt probe up and down |

