GUSI

GLOBAL
ULTRASOUND
INSTITUTE

GUSI POCUS POCKET GUIDE

(1) FAST (2) RENAL (3) GALLBLADDER (4) OB 1st Trim
(5) FOCUSED CARDIAC ECHO (6) PULMONARY (7) DVT

Extend your POCUS journey with a

VIRTUAL FELLOWSHIP

Faculty Development - Path to POCUS Credentialing

	POCUS Primer	POCUS Plus	POCUS Champion	POCUS Pro
# POCUS Exam Types	1	2	3	6
Hours of 1:1 Virtual Mentorship Tele-Ultrasound Sessions	3 hrs	8 hrs + 1 hr POCUS integration consult	9 hrs	18 hrs
POCUS Essentials Online Course 12-months Access	☑	☑	☑	☑ 16 mo access
Performance Dashboard & Metrics	☑	☑	☑	☑
Access to Scan Portfolio Image Archive and Review	☑	☑	☑	☑
# Precepted Scan Reviews by GUSI POCUS Expert	25	60	75	150
Lifetime Access Scan Portfolio Online Image Archive	☑	☑	☑	☑
Access to Pathology Gallery	☑	☑	☑	☑
Self-Paced QBank Assessments	☑	☑	☑	☑

GUSI GLOBAL ULTRASOUND INSTITUTE

POCKET GUIDE TO

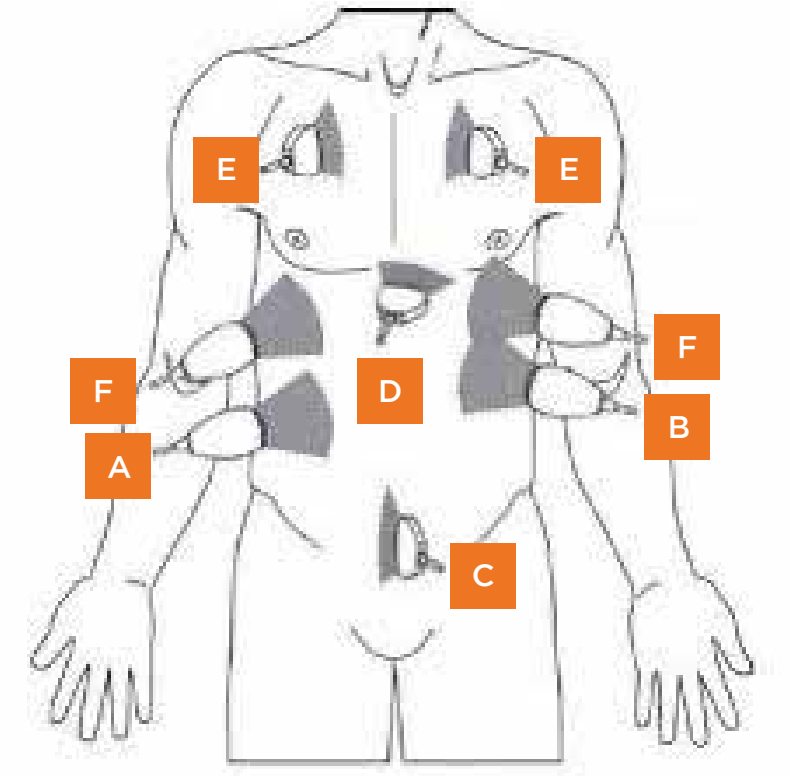
Focused Assessment with Sonography in Trauma (FAST)

DEEPIKA RAM

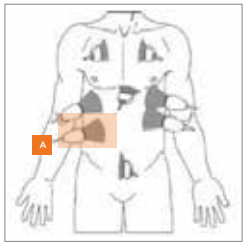
Uses	FAST: free fluid (FF) in abdomen (RUQ, LUQ, Pelvis)? pericardial effusion? E-FAST: pleural effusion/hemothorax? pneumothorax?
Probe	Curvilinear probe OR phased array probe
Orientation	Probe marker towards patient's head in coronal plane to patient's right sagittal plane
Position	Supine
Tips	• Start from RUQ (A) → LUQ (B) → pelvic view (C) → subcostal view (D) → mid clavicular views (E) → Bilateral Flanks (F) • **RUQ**: space between caudal edge of Liver and R. kidney most sensitive for free fluid • **LUQ**: knuckles to the bed
Signs	• **RUQ**: Look for free fluid between caudal liver edge and the R. kidney AND liver and diaphragm • **LUQ**: free fluid between spleen and kidney AND spleen/diaphragm • **PELVIC**: look for free fluid outside of bladder, between bladder/uterus, behind uterus • **SUBCOSTAL**: look for free fluid around heart, specifically between RV and liver

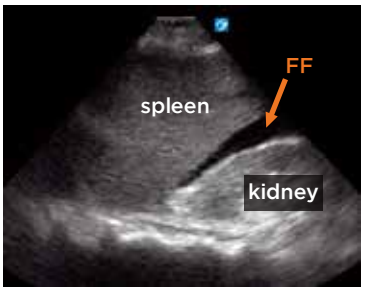
Tips

- Start from RUQ (A)→ LUQ (B)→ pelvic view (C)→ subcostal view (D) → mid clavicular views (E)→ Bilateral Flanks (F)
- **RUQ**: space between caudal edge of Liver and R. kidney most sensitive for free fluid
- **LUQ**: knuckles to the bed



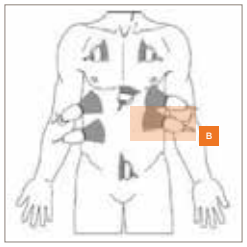
RIGHT UPPER QUADRANT (A)

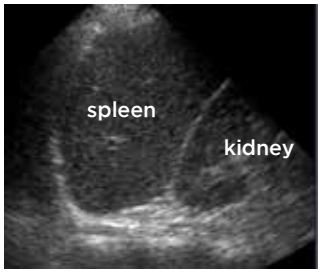




- Look between diaphragm and liver
- Look between liver and kidney (space known as **Morrison's Pouch**)

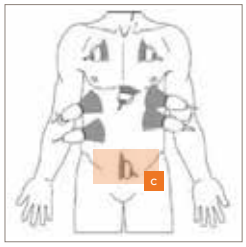
LEFT UPPER QUADRANT (B)



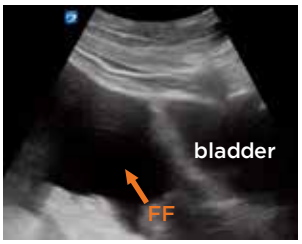


- Look between diaphragm and spleen
- Look between spleen and kidney

PELVIC (C)

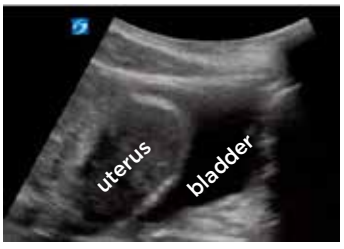


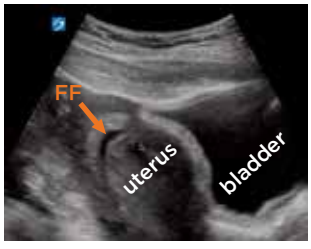
Transverse View



- Look for free fluid outside the bladder
- Don't mistake bladder for blood

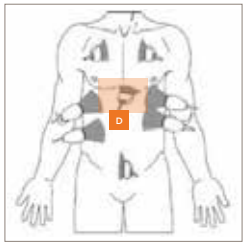
Sagittal View

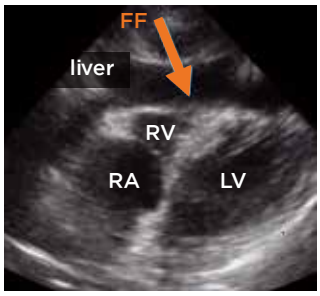




- Look for free fluid around the bladder
- Look in the recto-uterine pouch (aka Pouch of Douglas)

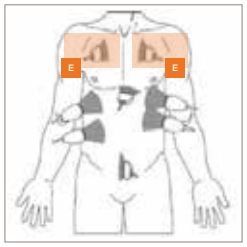
SUBCOSTAL (D)

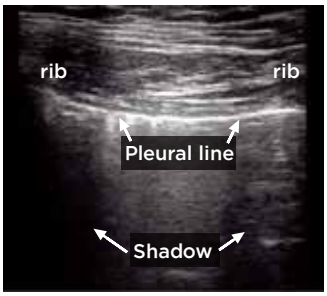


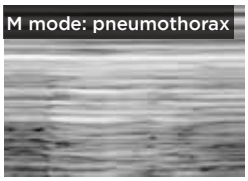


- Look for pericardial effusion between the liver and the right ventricle
- Probe: tilt just under xyphoid process (probe marker towards patient's right)

MIDCLAVICULAR (E)

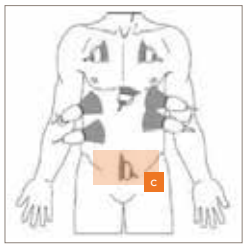






- Pleural line, made up of parietal and visceral pleura is bright, hyperechoic
- Normal lung function: pleura looks shimmering or like "ants marching on a log"
- ABSENCE of lung sliding indicates pneumothorax
- **M mode**: Norma pleural: sandy appearance, Pneumothorax: looks like barcode lines

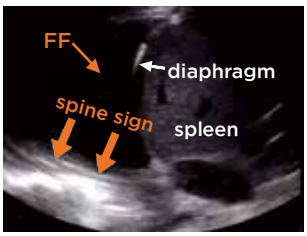
BILATERAL FLANK (F)



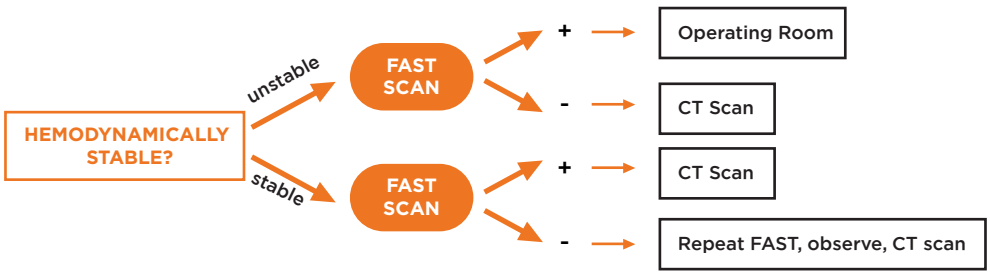
R Flank View (normal)

L Flank View (normal)

L Flank View (abnormal)



- Look above diaphragm for hemothorax
- Normal: no spine noted in pleural space
- Abnormal > **Spine sign**: absence of mirror artifact of liver, spine is viewed



GUSI GLOBAL ULTRASOUND INSTITUTE

POCKET GUIDE TO Renal

DEEPIKA RAM

Uses

Is there hydronephrosis? Twinkle sign present? Bladder volume?

Probe

Curvilinear probe

Orientation

Probe marker towards patient's head in coronal plane, to patients right in transverse plane.

Position

Patient supine

Tips

- R. Kidney: tilt probe towards bed as kidneys are retroperitoneal, view in transverse view;
- L. kidney: knuckles to bed when visualizing, view in transverse view
- Bladder - view in sagittal and transverse plane
- Compare R and L kidneys
- Angle inferior side of probe anteriorly to view entire kidney
- Identify kidney stones with sonographic shadow
- Slightly turn patient to get full kidney view
- To avoid rib shadowing, scan during END inspiration and more inferiorly

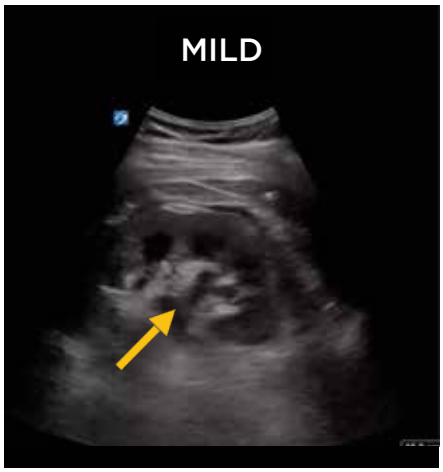
Signs

- Normal kidney: Hyperechoic center
- Hydronephrosis: hypoechoic center (looks like bear claw)
- **Twinkle sign:** constant stream of blue/red in color mode indicating uretero-vesicular junction (UVJ) obstruction.
- Calculate bladder volume: (L x W x H) x 0.75 - [>200 cc abnormal]

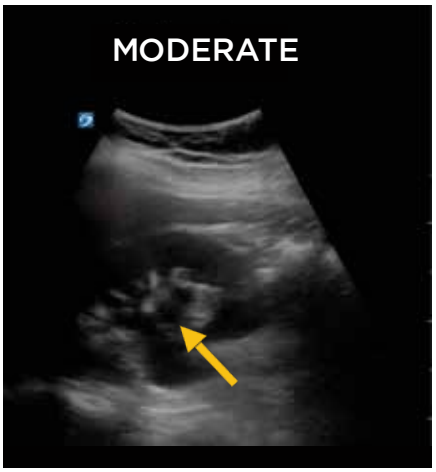
Normal

Hyperechoic center of kidney

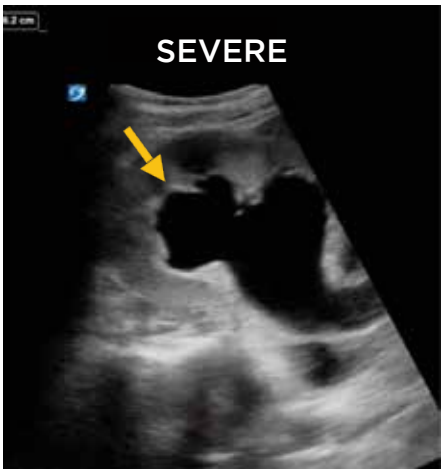
Hydronephrosis



Dilation of renal pelvis



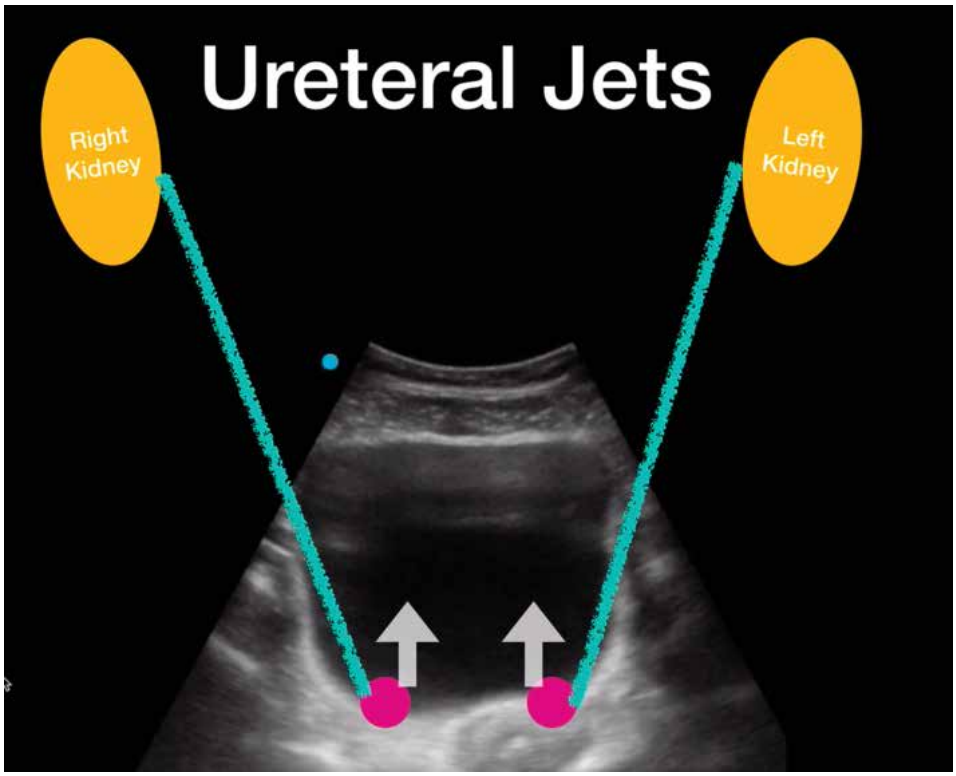
Dilation of renal pelvis and major calyces



Dilation of major/minor calyces; obliteration of renal cortex

Pitfalls

1. Hydrate patient if you suspect obstruction but there is no hydronephrosis.
2. Use color doppler to differentiate between renal vessels and mild hydronephrosis.
3. Don't confuse hydronephrosis for renal cysts, renal pyramids, or perinephric stranding.
4. Hydronephrosis doesn't always indicate a stone. Use the clinic picture to determine other differentials.



Ureterovesicular junction (UVJ) – pink dots

If a UVJ obstruction is present urine will constantly flow around the obstruction showing a blue/red color on doppler. This is known as **Twinkle Sign.**

GUSI GLOBAL ULTRASOUND INSTITUTE

POCKET GUIDE TO Gallbladder

DEEPIKA RAM

Uses

Are there gallbladder (GB) stones? Is there a sonographic Murphy's sign? GA wall thickening? Common bile duct (CBD) dilation?

Probe

Curvilinear probe

Orientation

Under/over rib, subcostal sweep (under rib), 7cm laterally from xyphoid; longitudinal view – probe marker towards patient's head.

Position

Patient supine and lateral decubitus

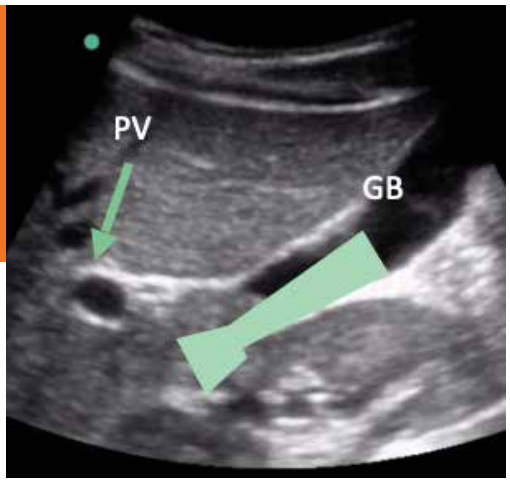
Tips

- Left Lateral Decubitus position bring liver and GB towards anterior wall and displaces bowel thus allowing for clearer view
- Deep held breath allows liver and GB to go below the costal margin
- Scanning above costal margin or from lateral aspect of liver, aiming medially can help find GB
- Locate the IVC and Portal vein, the GB is more superficial
- Fasting prevents bile ejecting from GB after a meal showing a contracted GB. Also prevents overlying bowel gas

Signs

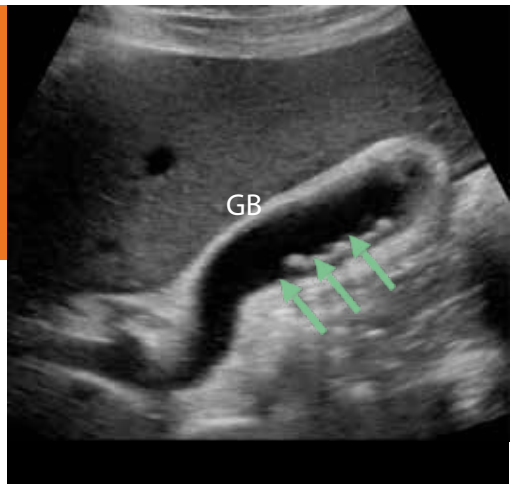
- Identifying GB: normal GB points towards portal vein in **"Exclamation sign."**
- **Exclamation sign:** definitively identifies the GB and distinguishes it from another loop of bowel which may resemble the GB.
- Normal GB: no stones, no thickening of GB wall, no pericholecystic fluid.
- Wall echo shadow sign: GB full of stones, huge shadow (see part of the wall and large shadow), no space for bile.
- GB polyp: little outpouching with NO shadowing.

Normal



GB an anechoic structure
- Liver on one side, bowel on other
- No stones, No thickening of GB wall, No pericholecystic fluid
- GB points towards portal vein (PV)
- GB + PV = Exclamation sign

Gallstones

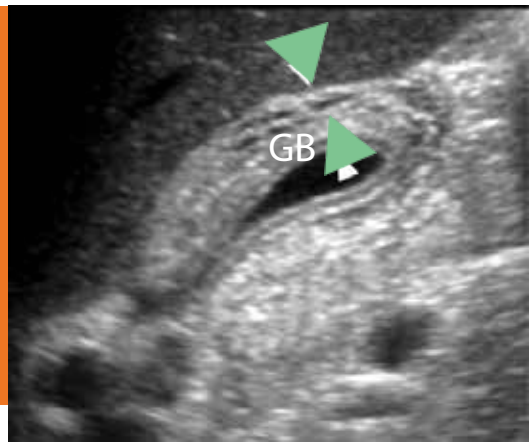


- Look in fundus, neck; symptomatic stones often at neck
- Shadowing noted / stones
- L. lateral decubitus position AND deep breath can help visualize

Sonographic Murphy's sign

- Good NPV at 95.2%
- Patient in lateral decubitus position
- Push probe along RUQ area
- Positive when probe pressure corresponds with fundus of GB

GB wall thickening

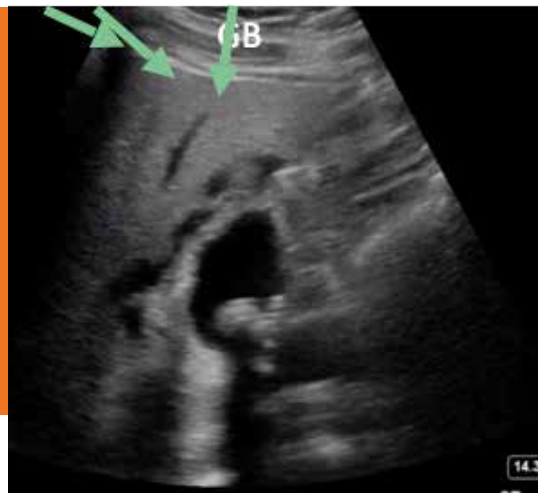


- Thickened if **>3-4mm**
- Distinguish contracted vs. thickened (postprandial, coffee)
- Wall thickening can also occur other disease states: CHF, ascites, Hepatitis, HIV, pancreatitis, etc.

Dilated CBD

- Get portal vein in **longitudinal position.** The CBD runs on **top.**
- **<6mm or 1/10** of patient's age is normal
- CBD does NOT have color flow on doppler

Pericholecystic fluid



- Anechoic wedges outside GB wall
- Seen best on anterior (liver side)

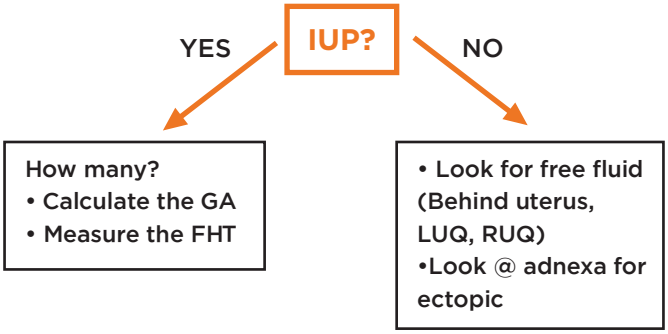
GUSI GLOBAL ULTRASOUND INSTITUTE

POCKET GUIDE TO

OB Trimester 1

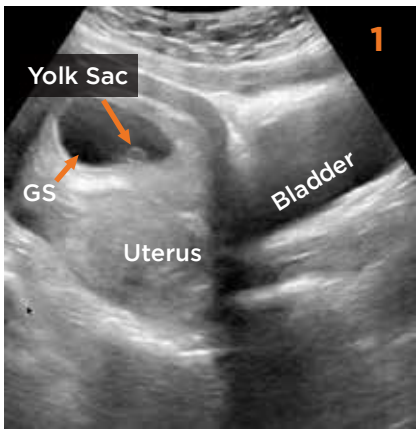
DEEPIKA RAM

Uses	Intrauterine pregnancy (IUP) present? If IUP: what is the gestational age (GA)? Heartbeat? Singleton? Adnexal masses? Gestational sac vs. Pseudosac?
Probe	Curvilinear probe OR intercavitary probe
Orientation	Sagittal (probe marker towards patient's head); Transverse (probe marker towards patient's right Curvelinear probe @ pubic symphysis
Position	Supine
Tips	• Scan low at pubic symphysis and rock into the pelvis • Fill bladder to improve visualization • Scan entire uterus • Use adequate gel with intracavitary probe • Identify uterine orientation (anteverted vs. retroverted uterus)
Signs	**IUP**: • Gestational sac in uterus [seen @ 4-5 weeks] • Yolk sac @ 5 weeks, gone at 10 weeks • Fetal pole (Crown Rump Length) @ 6 weeks, • Heart beat @ 5.5 – 6 weeks • Calculating Gestational age [3 ways]: 1) Gestational sac: calculate by measuring diameter in 3 planes {L x W x H) 2) Fetal pole: measure from head to rump, AVOID limb buds 3) Fetal biometry: measure individual parts (BPD, HC, AC, FL)



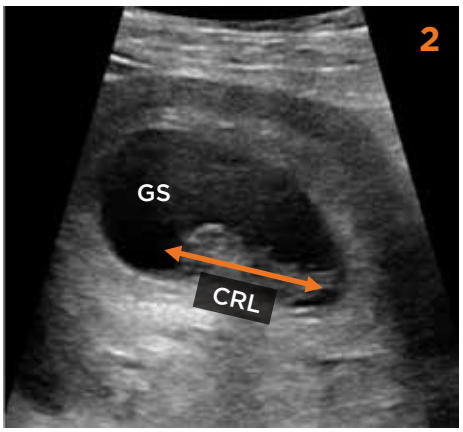
CALCULATING GESTATION AGE

Gestational Sac



- Measure width and height in saggital view AND width in transverse view

Fetal Pole



- From head to rump (CRL)
- Avoid limp buds
- Average of 3 measurements

FETAL BIOMETRY

- Measure individual parts to get the average GA
- **BPD:** Bi-parietal Diameter
- **HC:** Head Circumference
- **AC:** Abdominal Circumference
- **FL:** Femur Length

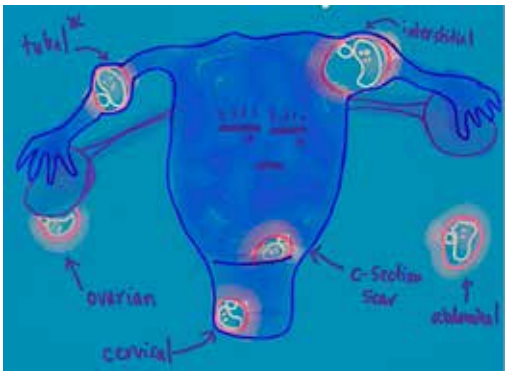
GESTATIONAL SAC VS. PSEUDOSAC

- **Pseudosac:** small amount of fluid that looks like GS but is actually fluid as aresult of ectopic. ~20% ectopics have a pseudosac

- Gestational Sac needs to meet **FEEDS CRITERIA**
- The more FEEDS CRITERIA met, more likely an early gestation pregnancy

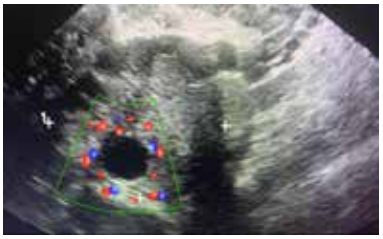
F – fundal location
E – Elliptal/rounded shape (not flame shape)
E – Eccentric to midline
D – Deciduation (echogenic ring around GS)
S – Size >4mm

ECTOPIC LOCATIONS



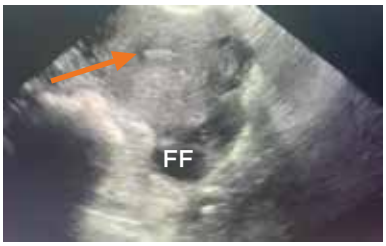
- Most commonly in fallopian tubes
- Can have "normal ultrasound" of uterus early on
- Can rule out only with normal IUP
- Look for free fluid! → Possible ruptured ectopic
- **Ring of Fire** → ring with color doppler around cysts or ectopic. If ring is distinct from ovary, look for ectopic
- Heterotopic pregnancy: intrauterine + simultaneous ectopic (common with IVF)

Ring of Fire

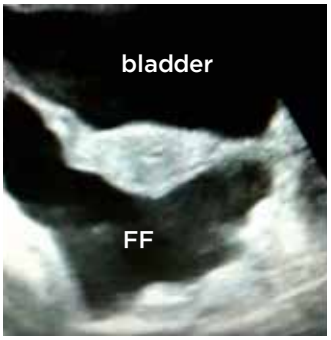


- Color doppler shows ring around ectopic/cysts
- If ring seen in ovary, it is likely a cyst. If seen outside ovary, look for an ectopic

Uterine Stripe



- Free fluid noted outside of the uterus



- Free fluid noted in uterus after ectopic rupture
- In transverse view of uterus

FAILED CRITERIA SUMMARY

DEFINITIVE FAILED IUP

- Mean sac diameter >25mm without embryo
- Crown rum length (CRL) >7mm without cardiac activity
- Absence of embryo with cardiac activity, >14 days after a scan showing GS without yolk sac OR >11 days with a yolk sac

SUGGESTIVE FOR FAILURE

- No fetal heart tones (FHTs) when you see embryo
- Amnion without embryo
- Yolk sac too big
- GS too small

GUSI GLOBAL ULTRASOUND INSTITUTE

POCKET GUIDE TO

Focused Cardiac Echo

DEEPIKA RAM

Uses

6 E's: Effusion present? Ejection Fraction? Equality (Right vs Left)? Entrance? Exit? Enlargement?

Probe

Phased array probe

Orientation

1. **Parasternal Long view**: probe indicator towards patient's right shoulder
2. **Parasternal Short view**: prob indicator towards patient's left shoulder
3. **Apical 4 chamber view**: probe marker towards patient's left axilla, L. lateral decubitus position
4. **Subcostal view**: probe marker towards patient's left; probe under sternum
5. **IVC view**: probe indicator towards patient's head

Position

Patient supine or left lateral decubitus

Signs

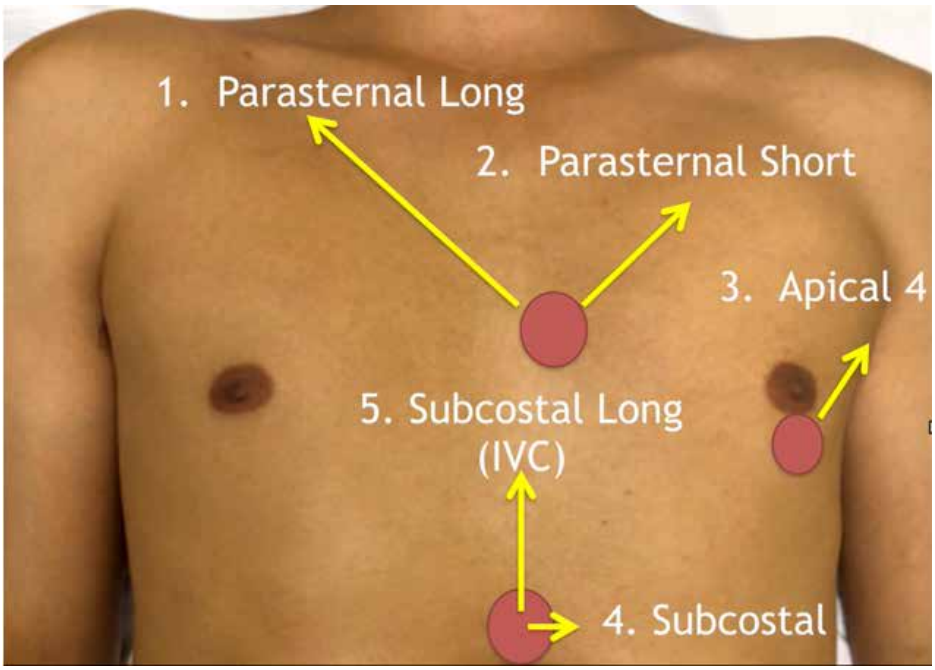
Effusion size is NOT correlated with cardiac tamponade

- Cardiac tamponade: R. atrial collapse, R. ventricular diastolic collapse, plethoric IVC, sonographic pulsus paradoxus
- "D sign" in Parasternal Short view: RV pushes into LV concerning for pulmonary embolism
- Left Atrial enlargement – diameter of LA > diameter of aorta

Tips

5 views (3 windows) – view photo A (next page):

1. **Parasternal Long**: visualizes the descending aorta. Helps to differentiate between pericardial and pleural effusions.
2. **Parasternal Short**: cross section of RV and LV, Can evaluate coronary artery distribution
3. **Apical 4 chamber view**: look for equality in left side to right side
4. **Subcostal View**: good view to locate an effusion between RV and liver as anechoic fluid collection
5. **IVC view**: identify using hepatic vein as landmark coming off IVC in the liver. Evaluate collapsibility.

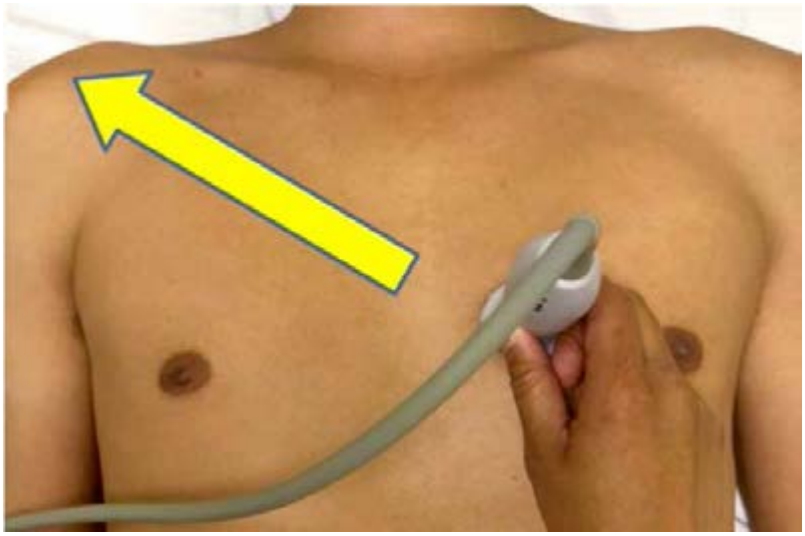


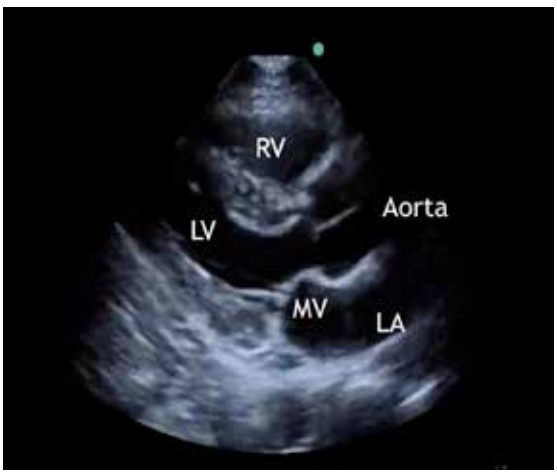
PARASTERNAL LONG VIEW

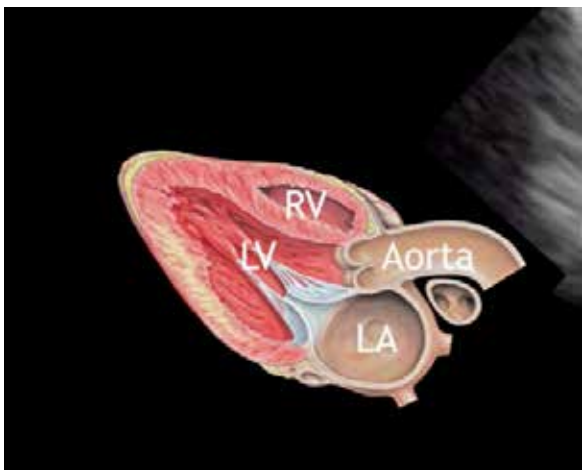
- 3rd-5th intercostal space left of sternum
- Good view to evaluate effusion, ejection fraction and equality
- RV – Aorta – LA: should all be about the same size in this view
- EJECTION FRACTION:
    - Mitral valve (MV) leaflets touching septum wall during diastole = normal EF
    - Myocardial thickening during systole
    - Shortening of the LV diameter during systole
- End point septal separation – distance between anterior leaflet of mitral valve and interventricular septum Can use EPSS to quantify EF:

EF = 75 – [2.5 x EPSS in mm]

** EPSS <1cm = EF >40% **

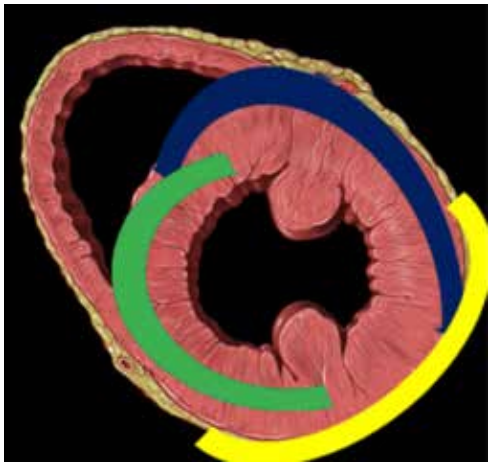


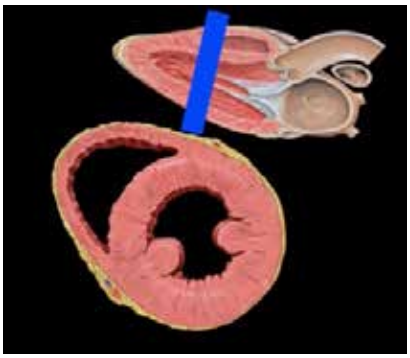


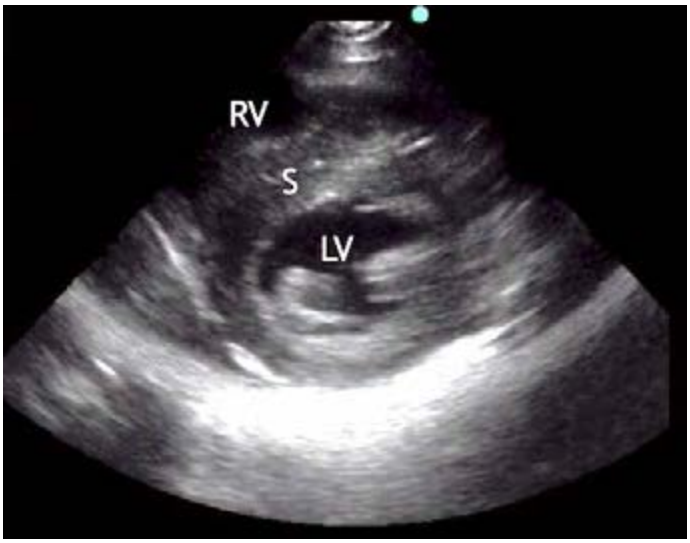


PARASTERNAL SHORT VIEW

- Visualize RV adjacent to the LV. LV has thicker walls. Septum (S) separates the RV/ LV
- Evaluate the heart at the level of the papillary muscles
- Visualize wall motion abnormalities.
    - Anterior septal wall: corresponds with the Left Anterior Descending (LAD) distribution [blue]
    - Inferior septal/inferior wall: corresponds with R. circumflex artery (RCA) distribution [green]
    - Anterior lateral/inferior lateral: L. Circumflex artery (LCA) distribution [yellow]
- "D sign": RV pushes into LV concern for pulmonary embolism

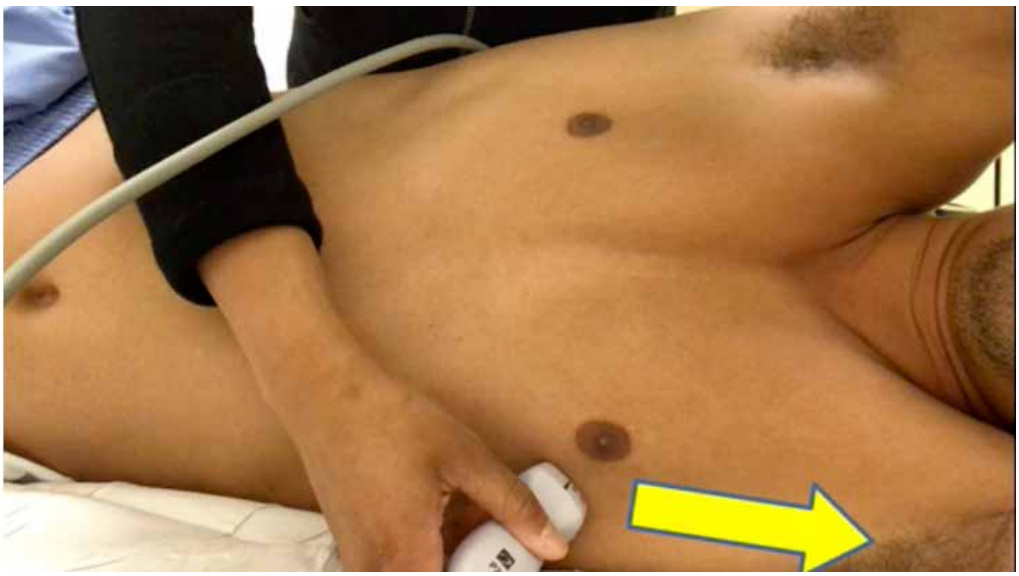


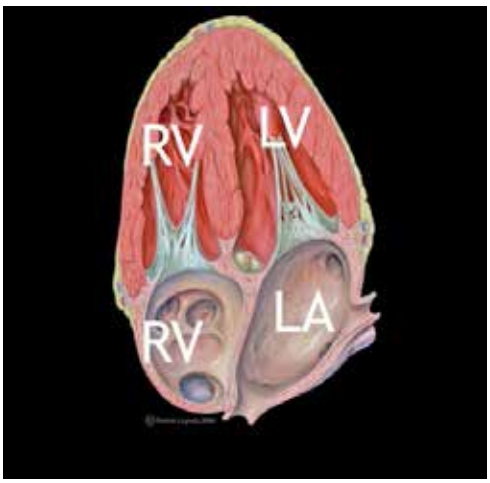


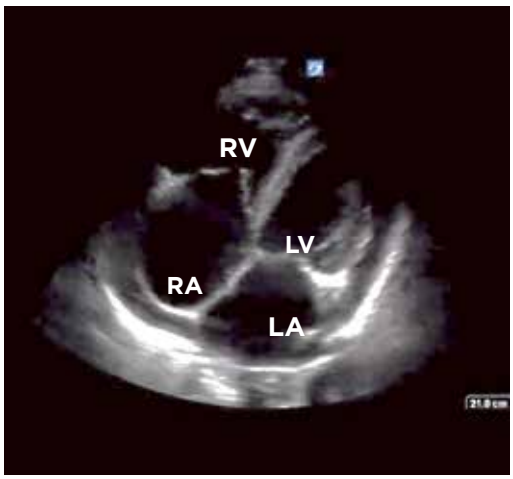


APICAL 4 CHAMBER VIEW

- Patient in L. lateral decubitus position
- Probe at Point of maximal impulse (PMI) at 5th intercostal space
- LV is longer than RV (RV ~ 70% of LV)
  * if RV same size or > than LV, likely RV heart strain
- Good view to see effusion, evaluate EF and chamber equality
- Moderator band in apex of RV

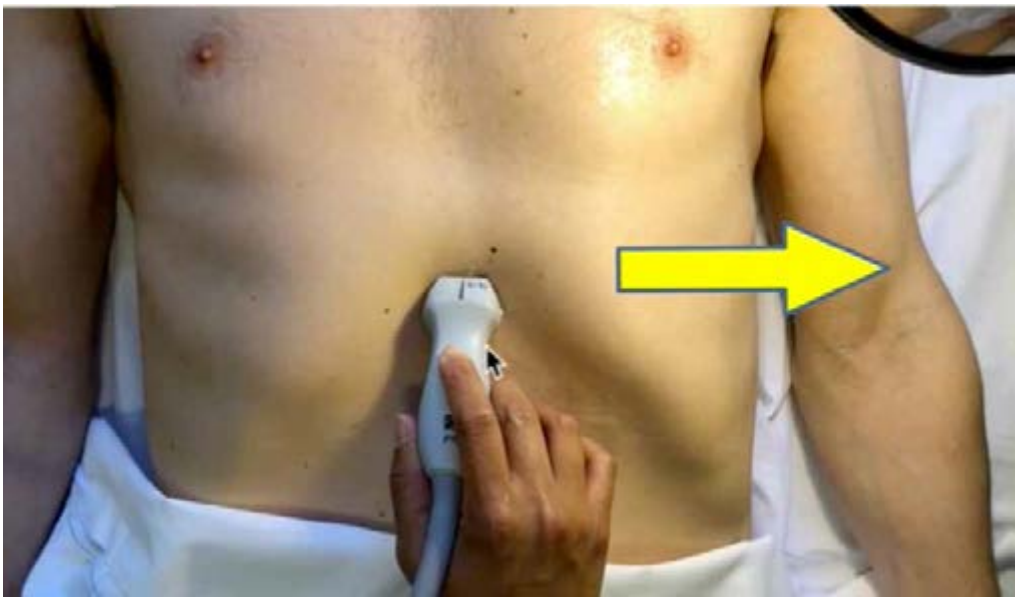


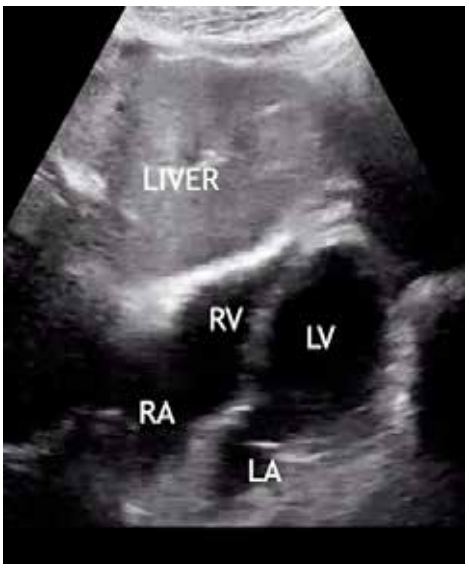


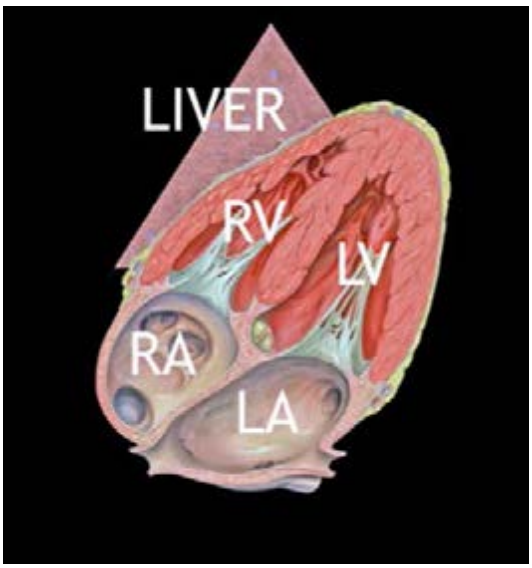


SUBCOSTAL VIEW

- Under xyphoid process
- Indicator pointing to patient's left
- Evaluate for pericardial effusion between RV and Liver. Look for Hypoechoic stripe.
- Liver acts as a sonographic window and allows for a good, clear view of the heart.

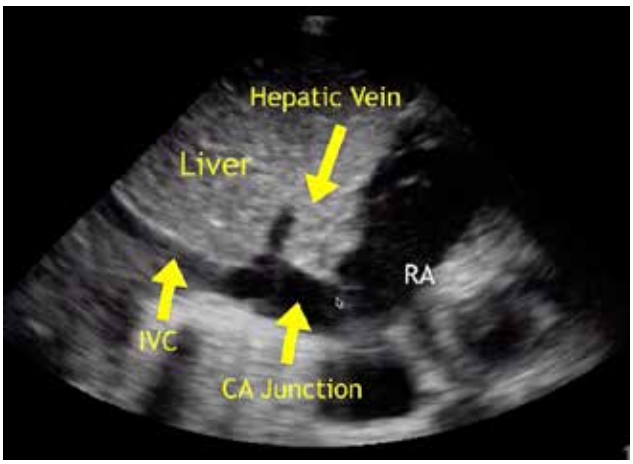






IVC VIEW

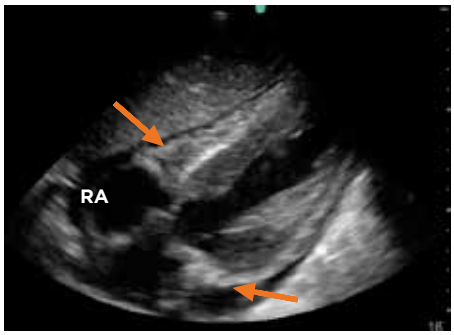
- Rotate probe marker from subcostal view to point to patient's head
- Identify IVC and determine
    1. collapsibility w/ respiration [>50% is normal]
    2. size > 2.1 cm = enlarged
- If fluid overloaded, IVC has minimal collapsibility aka "Plethoric IVC"

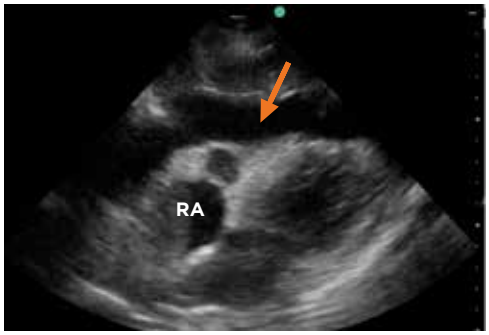


IVC Diameter and Collapse (%)	Central Venous Pressure (mean) (mm Hg)
Normal: ≤2.1 and >50%	0–5 (mean 3)
IVC findings other than those seen with normal or high	5–10 (mean 8)
High: >2.1 and <50%	10–20 (mean 15)

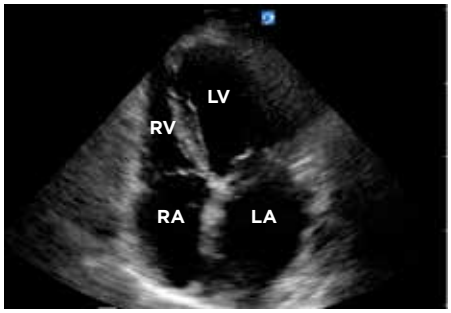
CARDIAC PATHOLOGY

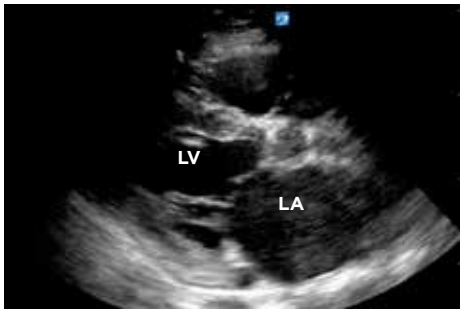
Pericardial Effusion



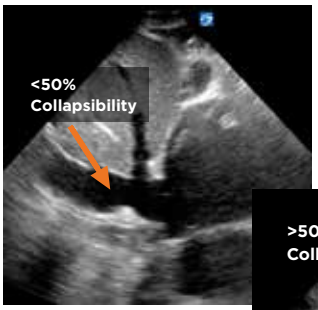


Dilated Left Atrium

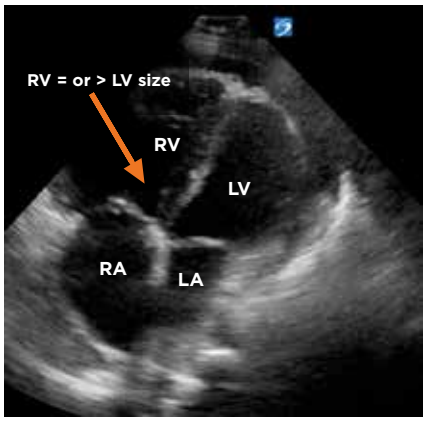




Plethoric IVC



Right Heart Strain



GUSI GLOBAL ULTRASOUND INSTITUTE

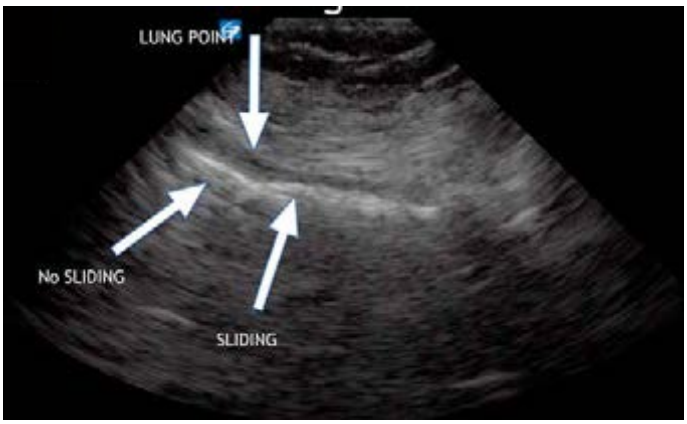
POCKET GUIDE TO
Pulmonology

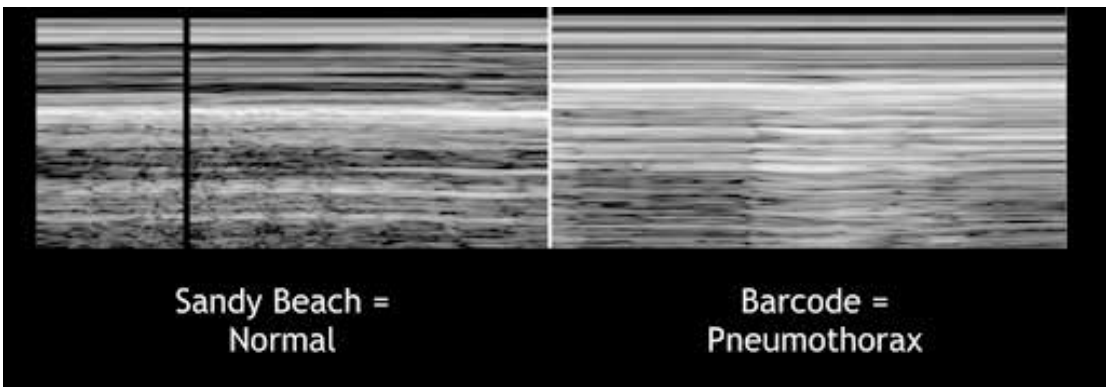
DEEPIKA RAM

Uses	Lung sliding? A lines? B lines? Consolidation? Effusion?
Probe	Phased array probe
Orientation	Midclavicular line, probe marker towards patient's head
Position	Supine
Tips	• Hold probe like pencil, anchor with 4th/5th fingers • Start at the midclavicular line. Move inferiorly and laterally: examine anterior axillary, mid axillary posterior axillary, above diaphragm and posterior ribs as well
Signs	1. PRESENCE lung sliding = RULES OUT Pneumothorax 2. A lines = Aerated lung 3. B lines = Fluid 4. Consolidation in lung seen as hepatization (similar echogenicity as liver) 5. Effusion: hypoechoic fluid collection

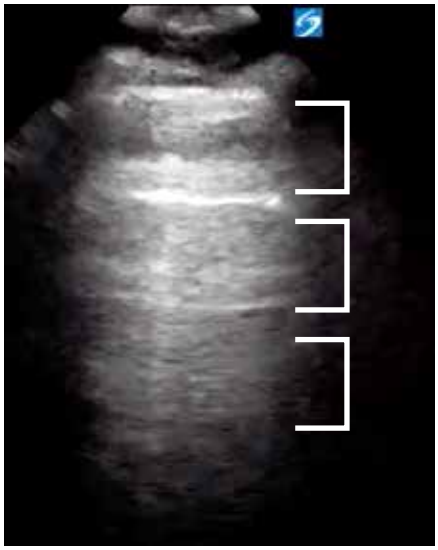
LUNG SLIDING

- Shimmering noted as visceral and parietal pleura rub/slide against each other
- Shimmering can look similar to “ants marching on a log”
- **PRESENCE** of lung sliding **RULES OUT** pneumothorax in that area of lung
- **NO** lung sliding indicates pneumothorax w/ a few exceptions (ARDS, pleurodesis, pulmonary fibrosis, malignancy)
- M-mode normally shows a sandy beach visual pattern whereas a pneumothorax shows a barcode sign in M mode
- Look for lung point: where Pneumothorax ends/lung has re-expanded



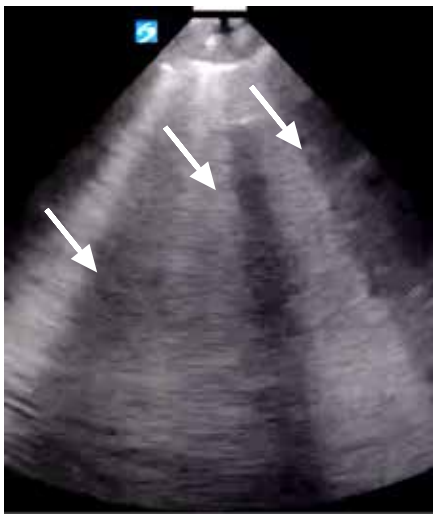


A LINES



- Reverberation of sound waves from the pleura
- Reverberation artifact of the pleural line A lines
- Bright, horizontal, **equidistant** lines
- **A lines = Aerated lung**
- Note: presence of A lines doesn't rule out all pathology and can still indicate conditions where lungs are still aerated such as asthma, COPD and pulmonary embolism

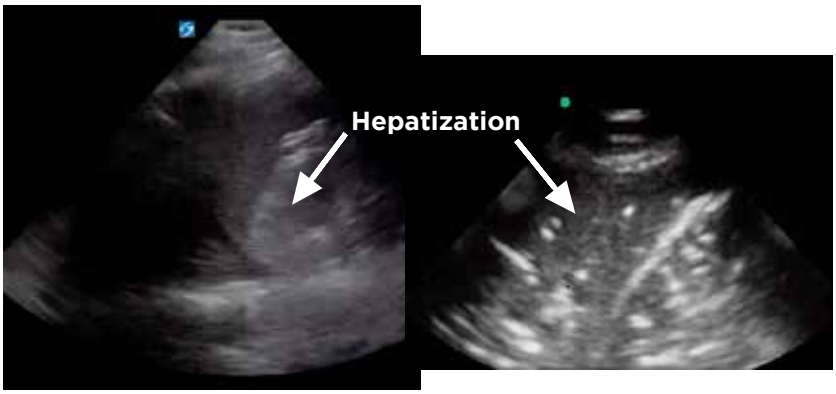
B LINES



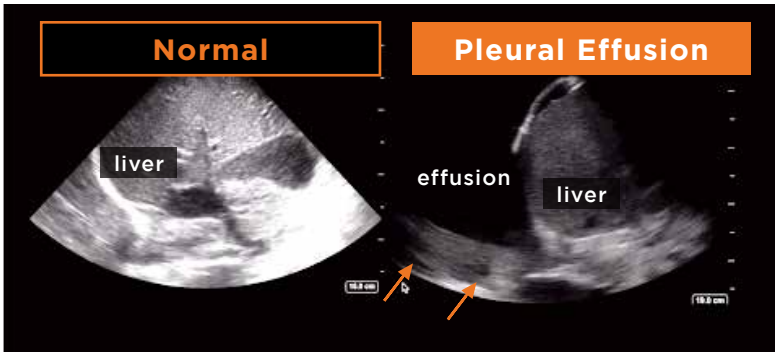
- Fluid transmits sounds waves which create **vertical** hyperechoic artifact that descends from the pleura
- B lines need to be viewed for a depth of 18 cm
- the lines moves side to side with respiration
- B lines signal the presence of edema
- Don't confuse for **comet tails** (only go 1-2cm in depth)
- **B lines = Fluid**
- Examples: CHF, Pneumonia, pulmonary contusion, fibrosis

CONSOLIDATION

- When alveoli are filled with fluid and compressed, lungs look like a solid organ ... this visualization is known as "**hepatization**"
- The consolidation has a similar echogenicity to the liver



PLEURAL EFFUSION



- Viewed best at lung bases at diaphragm
- Look for hyperechoic area above the diaphragm
- Transmitted sound waves through the fluid wil also show the distal structures such as the spine aka "**spine sign**"

	Pneumonia	CHF	COPD	PE	Pneumothorax
Lung Sliding	+	+	+	+	-
A lines	+/-	-	+	+	+
B lines	+ (Focal)	+ (Bilateral)	-	-	-
Consolidation	+	-	-	-	-
Effusion	+/-	+/-	-	-	-

GUSI GLOBAL ULTRASOUND INSTITUTE

POCKET GUIDE TO

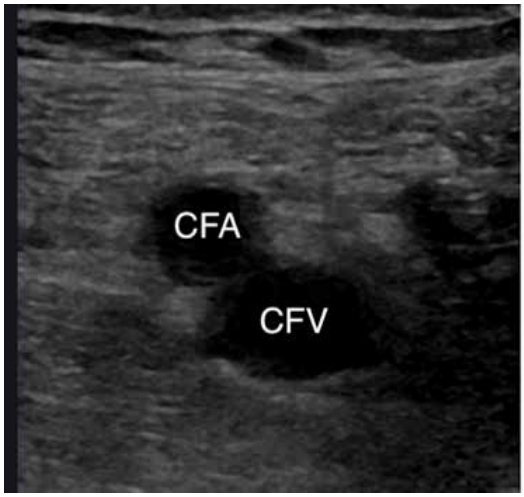
Deep Vein Thrombosis (DVT)

DEEPIKA RAM

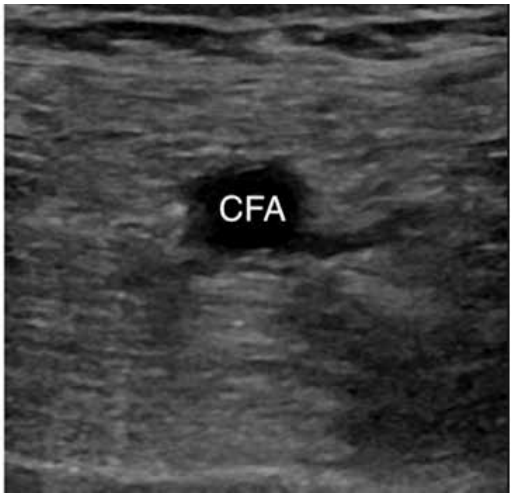
Uses	Evaluate presence of DVT
Probe	Linear probe, Curvelinear probe (for difficult body habitus)
Orientation	Probe marker to patient's right
Position	Prone, Hip slightly flexed, externally rotated, knee partially flexed
Tips	• Recognize anatomy (e.g. recognize artery from vein) • Adequate exam: when opposite sides of vein touch w/ compression • If needed, use free hand to push leg upward toward probe • View popliteal vein from posterior knee

Considerations	• Do the deep veins from groin to knee compress?
	• Compression at 3 branch points?
	  • Saphenous
	  • Deep Femoral
	  • Popliteal

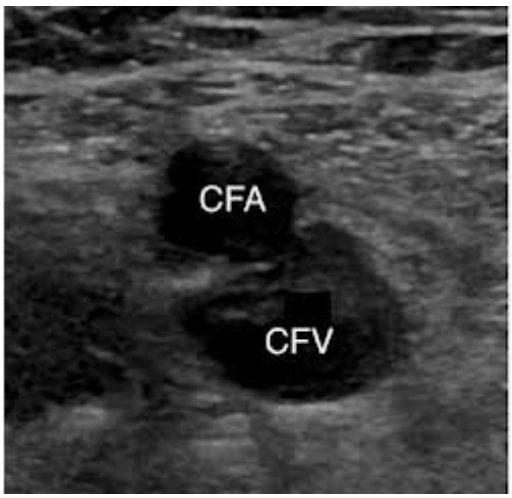
No Compression



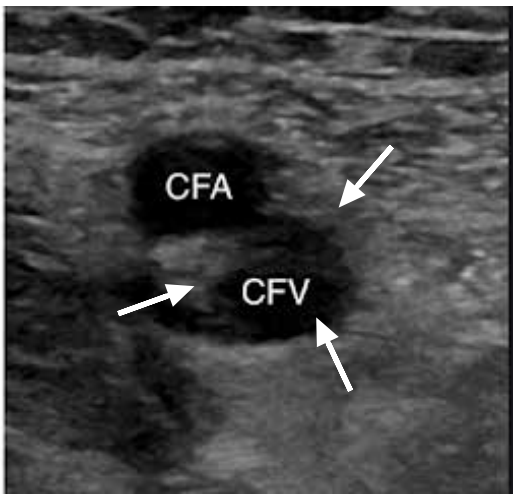
Compression



No Compression



Compression



Groin: Saphenous, Deep Femoral

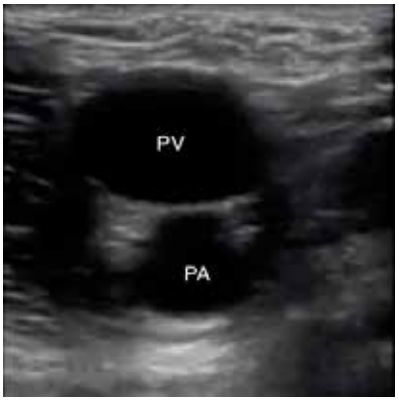
- Great Saphenous vein - takes off **Medially**
- Deep Femoral vein - takes off **Laterally**, caudal to saphenous

Thigh: Common Femoral Vein (CFV)

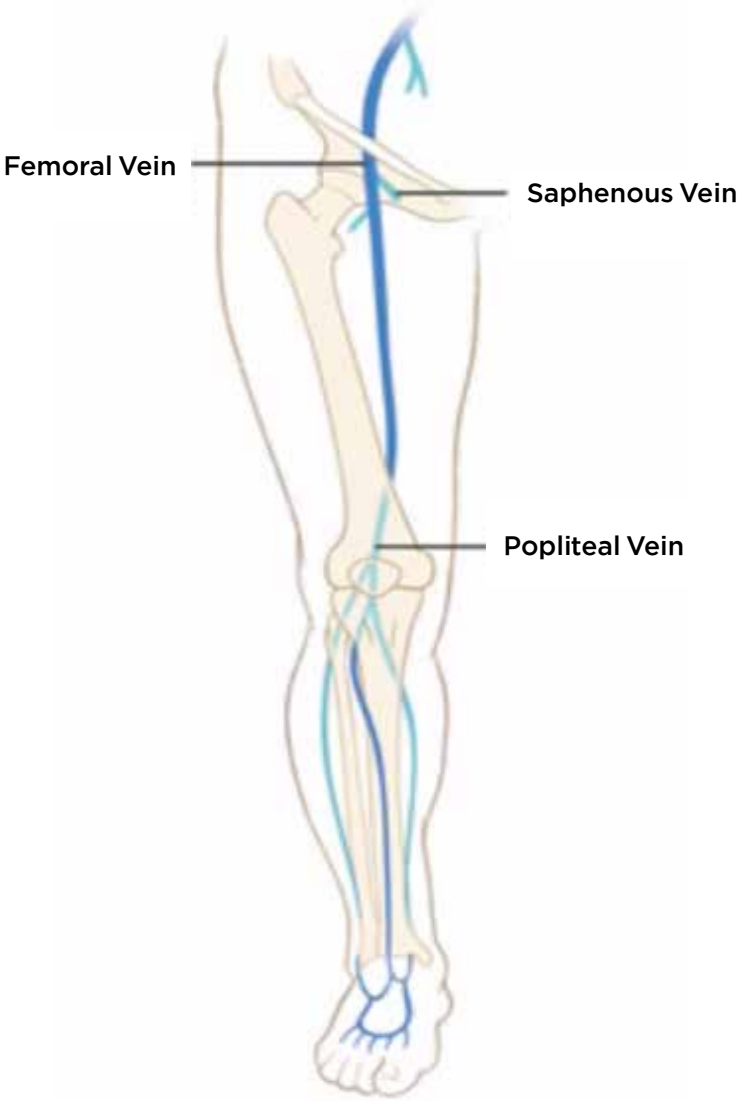
- Compress every 2cm

Knee: Popliteal vein

- Popliteal vein sits **above** artery
- "POP on TOP"



CFA	Common Femoral Artery
CFV	Common Femoral Vein
GSV	Great Saphenous Vein
DFV	Deep Femoral Vein
FV	Femoral Vein
PV	Popliteal Vein
PA	Popliteal Artery



NOTES:

GUSI OFFERS A VARIETY OF HIGH YIELD, CLINICALLY RELEVANT POCUS PROGRAMS, ALIGNED WITH ACGME GUIDELINES

Something for Everyone

In Person Workshops

At our home or yours, eligible for CME, clinically oriented, immersive and engaging. High yield didactic and hands-on scanning experience

POCUS Fellowship

Teleultrasound Mentorship to develop POCUS champions

Scan Review (QA)

Integrated platform
Scan portfolio
Rapid upload software
Scan review services

Structured Learning Platform

Online learning with Performance Dashboard and Metrics. Over 140 topics, 50+ hours, assignable lectures, trackable, asynchronous

COMPETENCY **CONFIDENCE** **CREDENTIALING** **QUALITY**

Online Learning

POCUS Essentials Basics
Musculoskeletal
Pediatrics
POCUS for Physical Therapists
OB GYN
Critical Care

GUSI POCUS Education Options

Self-Paced Online Courses
In-Person Scanning Workshops
Virtual Mentorship Fellowships

GUSI POCUS In-Person Workshops

1 Day or 2 Days
80% Hands-On Scanning
Hosted at our place or yours

Learn more:

admin@globalultrasoundinstitute.com
www.globalultrasoundinstitute.com
(510) 761-6624

Suggested donation:
Medical students and residents: $5 and up.
Attendings: $15 and up.

All proceeds will go towards funding POCUS training for clinicians in low resource settings

venmo

@gusi-pocus

Visit our website

www.globalultrasoundinstitute.com

Essentials course

https://globalultrasoundinstitute.com/essentials-course/