Introduction to Primary Care Ultrasound

AAPA We Are Family Medicine Conference

Friday, February 3rd 2023

LEARNING OBJECTIVES

- Explain the basic employment of Handheld Ultrasound for Primary Care
- Describe the indications, contraindications, and limitations of Handheld Ultrasound in Primary Care Settings
- Discuss the ways that Handheld Ultrasound can be used to answer clinical questions at the bedside in Primary Care
- Review the use of Handheld Ultrasound for common pathologies encountered in primary care
- Demonstrate basic employment of Handheld Ultrasound

Disclosures

- Joseph Carter – I have no relevant relationships with ineligible companies* to disclose within the past 24 months
- Ben Olmedo - I have no relevant relationships with ineligible companies* to disclose within the past 24 months

LIMITATIONS

- User dependent – training and experience
- NOT a replacement for a formal ultrasound exam
- Battery Life

Contra Indications

When NOT to Use POCUS

- If You are uncertain of all or part of an examination or protocol
- If findings can not be correctly integrated into the clinical decision-making process
- TO REPLACE a formal exam
- As the ONLY modality for evaluation and gathering information for a clinical decision

Indications

When to Use Handheld Ultrasound

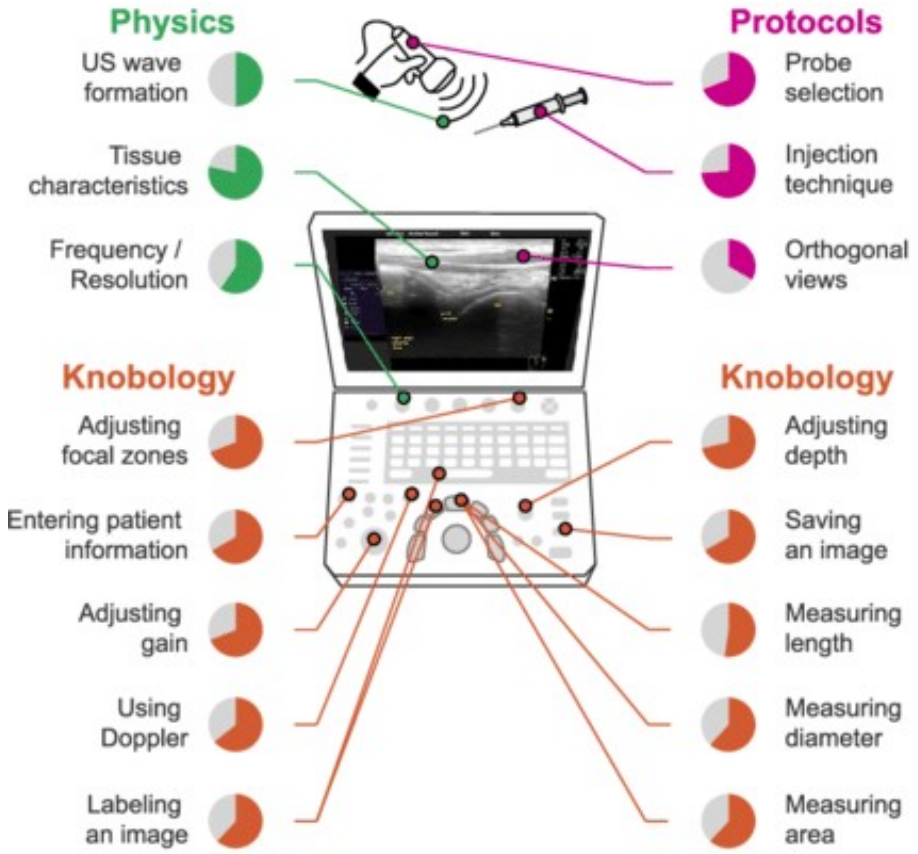
Questions Answered by Point-of-Care Ultrasonography That Are Applicable to Family Medicine

Use	Yes/No Question
Cardiac	Is there left ventricular systolic dysfunction? Is there left ventricular hypertrophy? Is there a pericardial effusion? Does the patient still have fluid overload?
Deep venous thrombosis (for a video of this test, see https://youtu.be/M0JmjOOg10M)	Is there a deep venous thrombosis?
Obstetric	Is there an intrauterine pregnancy? What is the fetal presentation? Is there a heartbeat? What is the gestational age?
Ophthalmologic	Is there a retinal detachment? Is there a vitreous hemorrhage?
Skin and soft tissue infections	Is there an abscess?
Thyroid	Is there a lesion on the thyroid?
Urologic	Is there hydronephrosis or evidence of nephrolithiasis? What is the postvoid residual volume?

** Editorial: Point-of-Care Ultrasonography in Family Medicine, August 15, 2018, Volume 98, Number 4 - www.aafp.org/afp

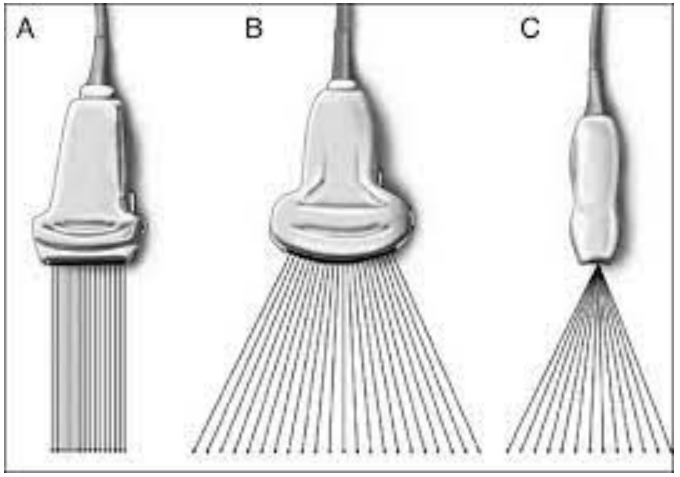
Ultrasound Basics

Knobology & Physics



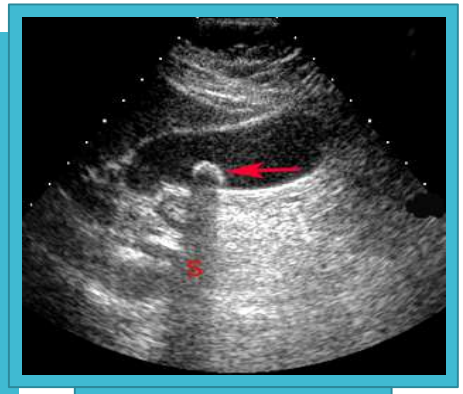
Ultrasound Basics

Knobology & Physics

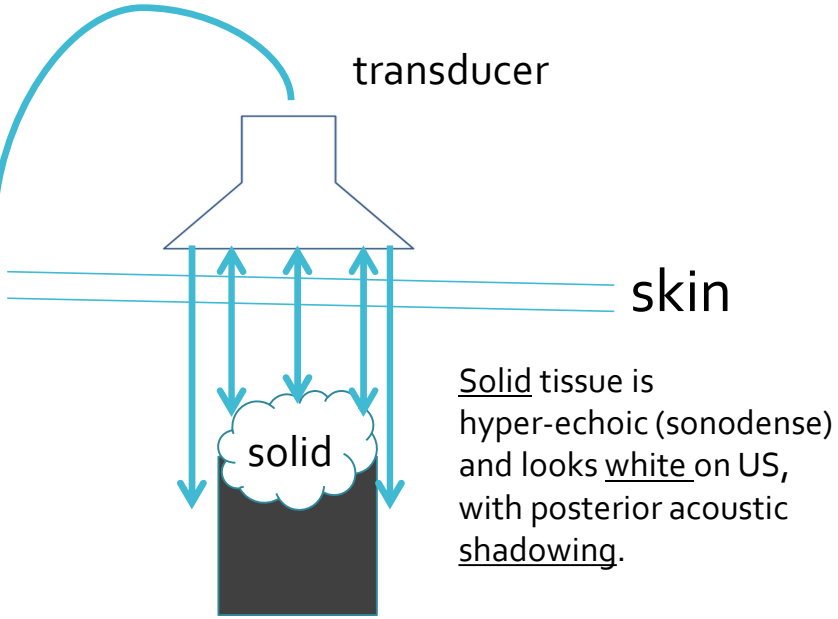


- Audible Sound: 20Hz – 20KHz
- **Diagnostic US: 2 – 20 MHz**
- (A) Linear US: 7-15 MHz
- (B) Abdominal US: 2-5 MHz
- (C) Cardiac US: 1-5 MHz

Pulse Echo Principle

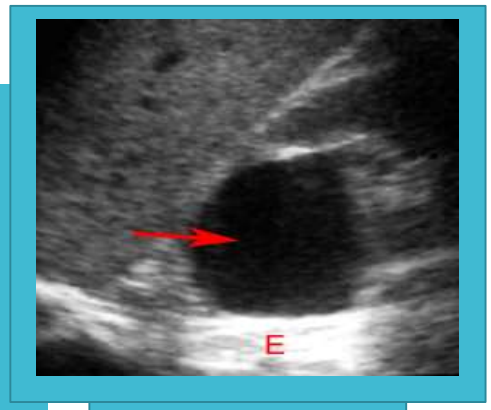


CPU

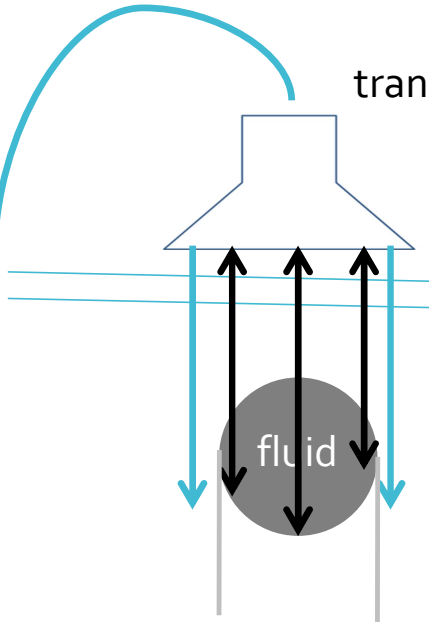


When sound waves encounter a solid object, they bounce off, are reflected back to the transducer, and are converted to electrical energy. This forms a white image with an acoustic shadow beyond it.

Pulse Echo Principle



CPU



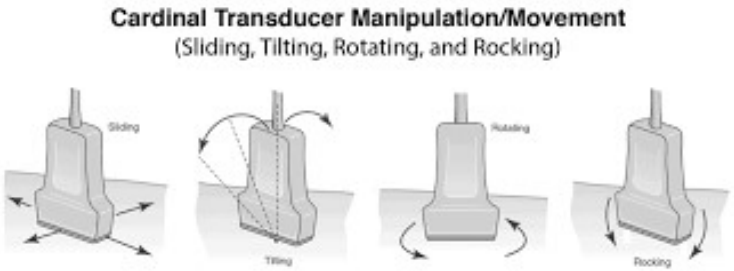
Fluid (liquid) is hypo-echoic (sonolucent) and looks dark on US, with posterior enhancement.

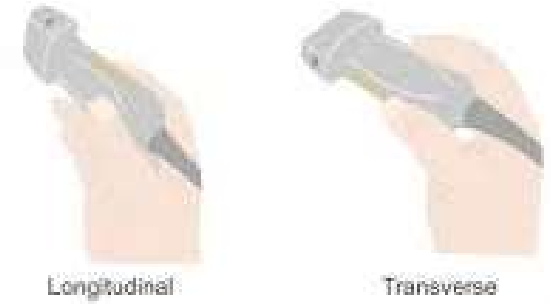
Fluid-filled cyst is dark, with posterior enhancement (white).

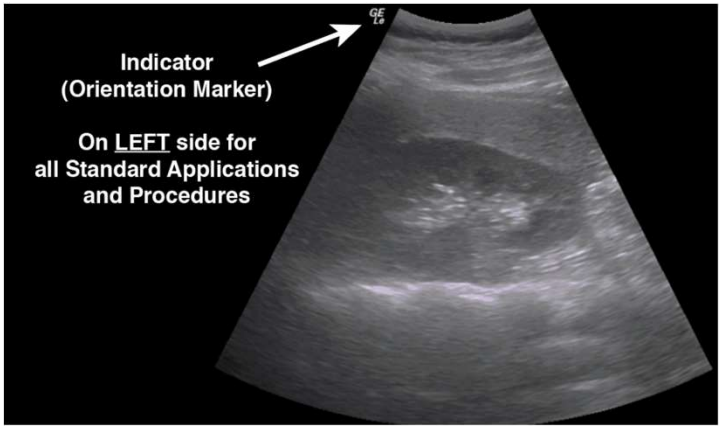
When sound waves encounter a structure containing fluid, they travel through it. (fluid = cyst, blood, bile, edema, etc.)

Then they encounter more dense tissue beyond it and are reflected back to the transducer. The image appears dark, with posterior enhancement (white).

Probe Orientation & Employment

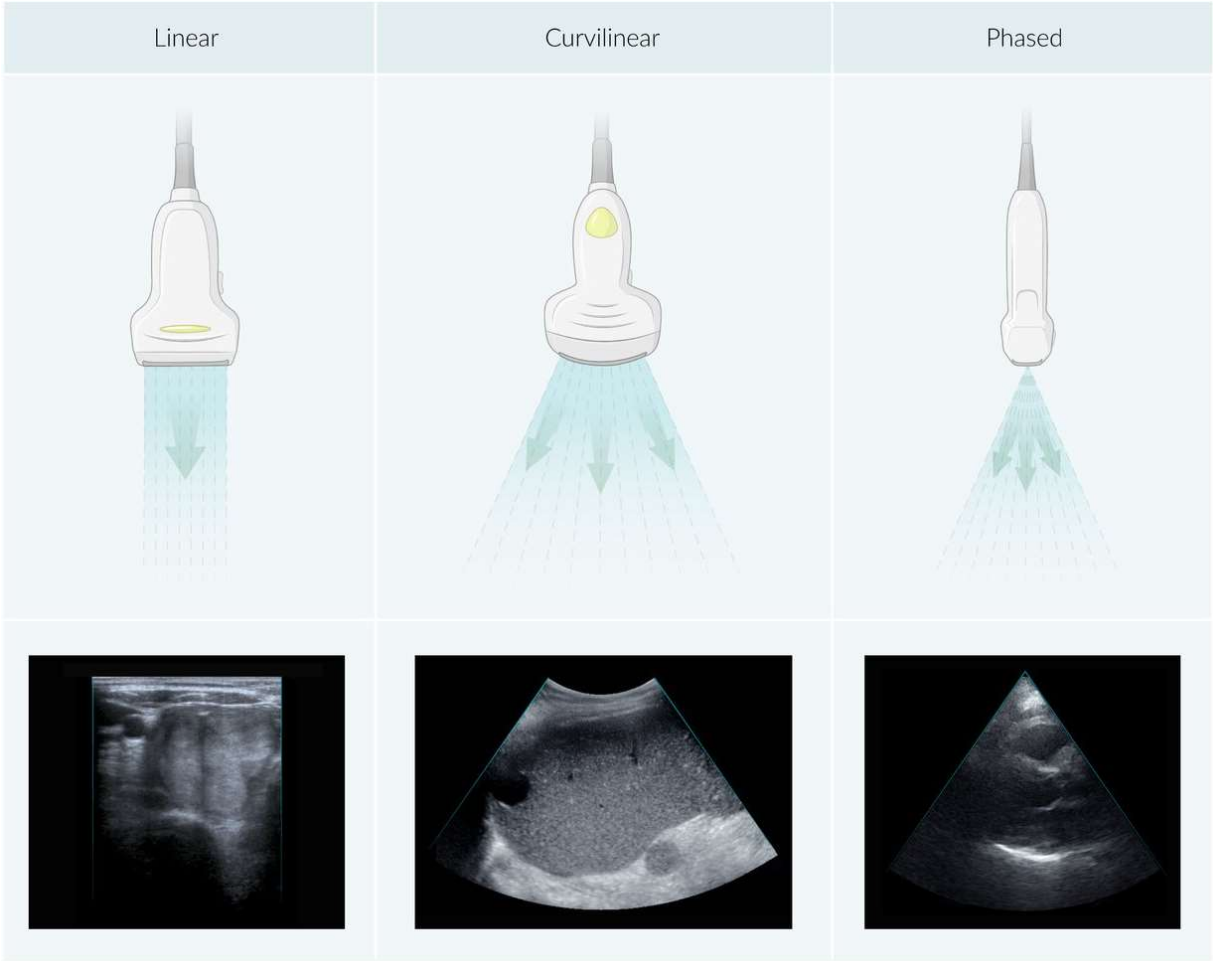






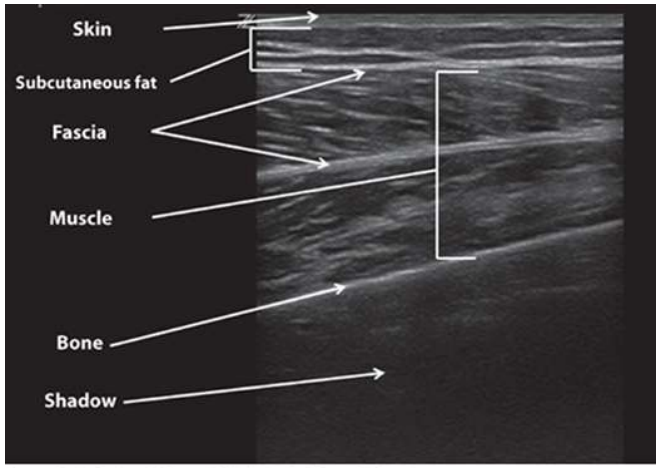
Putting it Together

Hands On

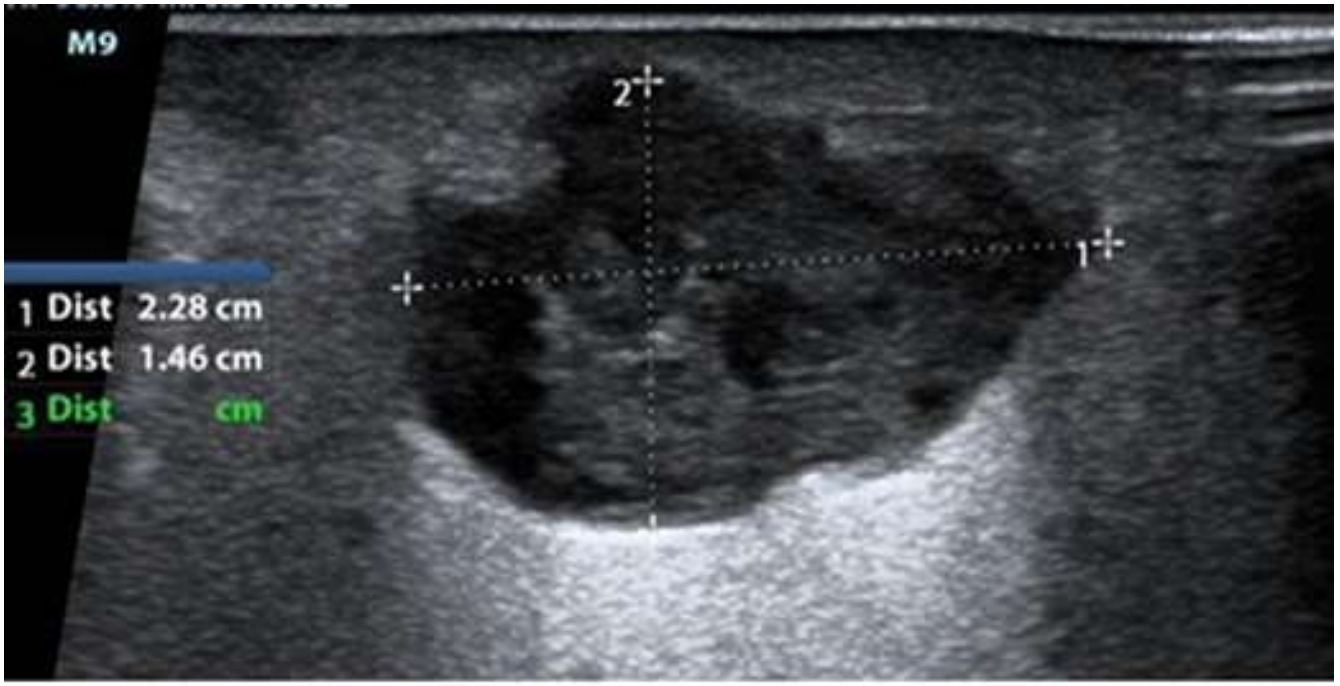


Skin & Soft Tissue

- Indications: Evidence of tissue infection, soft-tissue swelling, erythema, tenderness, or fluctuance.
- Except for very high BMI patients or when scanning the gluteal region, use a high-frequency linear probe.
- Use a probe cover if there is any concern for drainage from the lesion.



Skin & Soft Tissue



Source: C. M. Baston, C. Moore, E. A. Krebs, A. J. Dean, N. Panebianco:
Pocket Guide to POCUS: Point-of-Care Tips for Point-of-Care Ultrasound, 1st edition.
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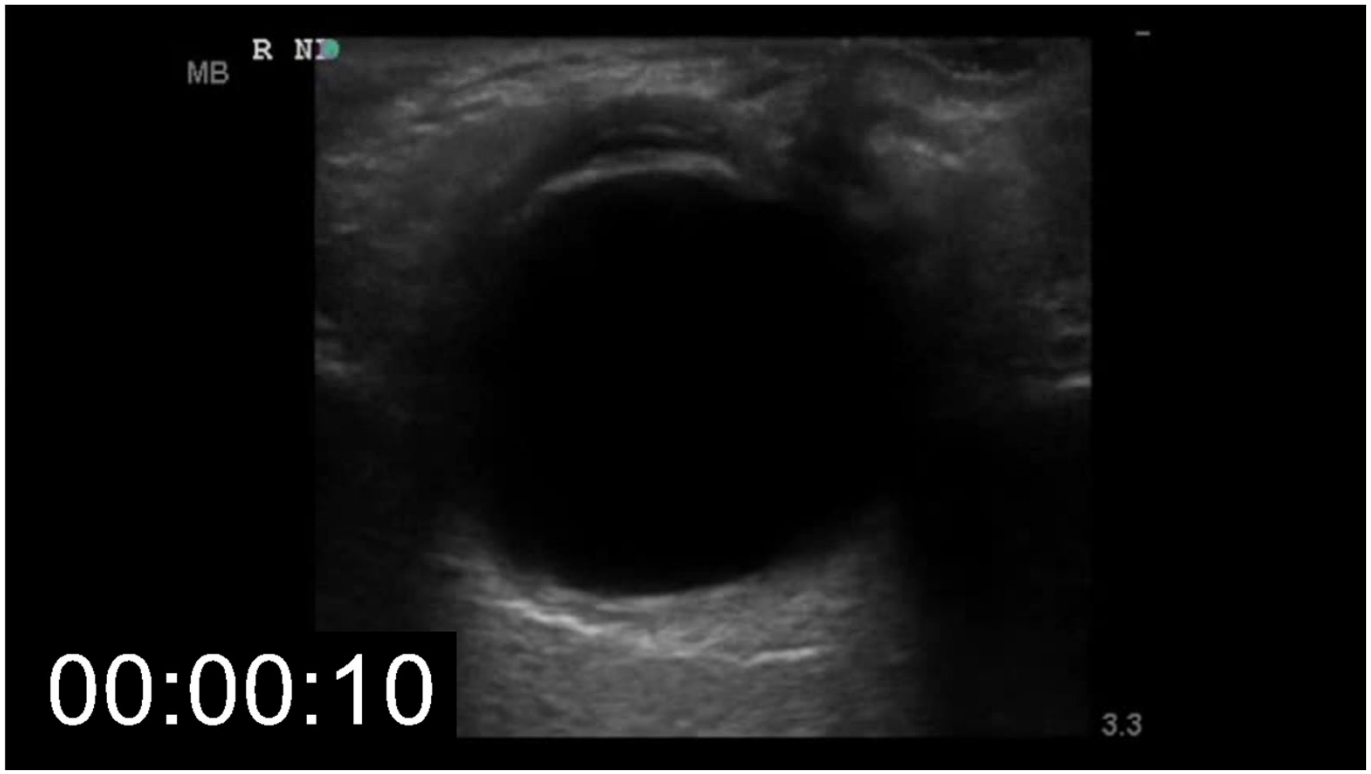
Ocular

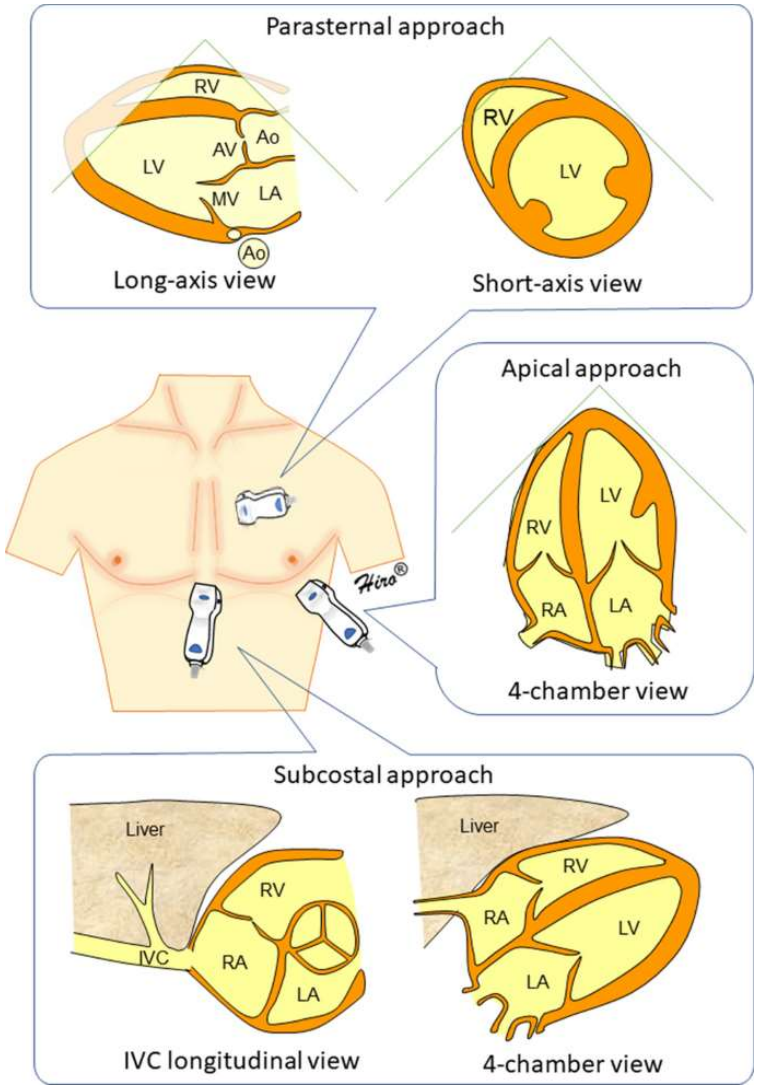
- Indications for exam: ocular trauma, sudden vision changes, concern for increased intracranial pressure or foreign-body.
- Probe selection: high-frequency linear probe.
- Use the ocular setting if available. In addition to image optimization, this preset reduces power to 50% to minimize the risk of retinal damage.

Ocular



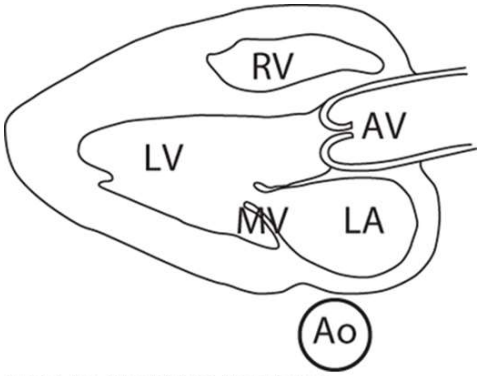
Ocular

Chest:
Cardiac



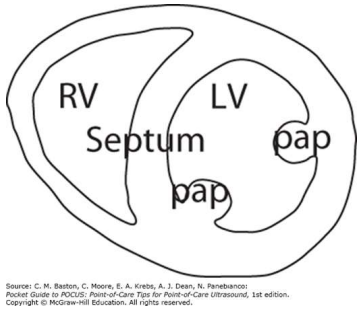
Chest:
Cardiac

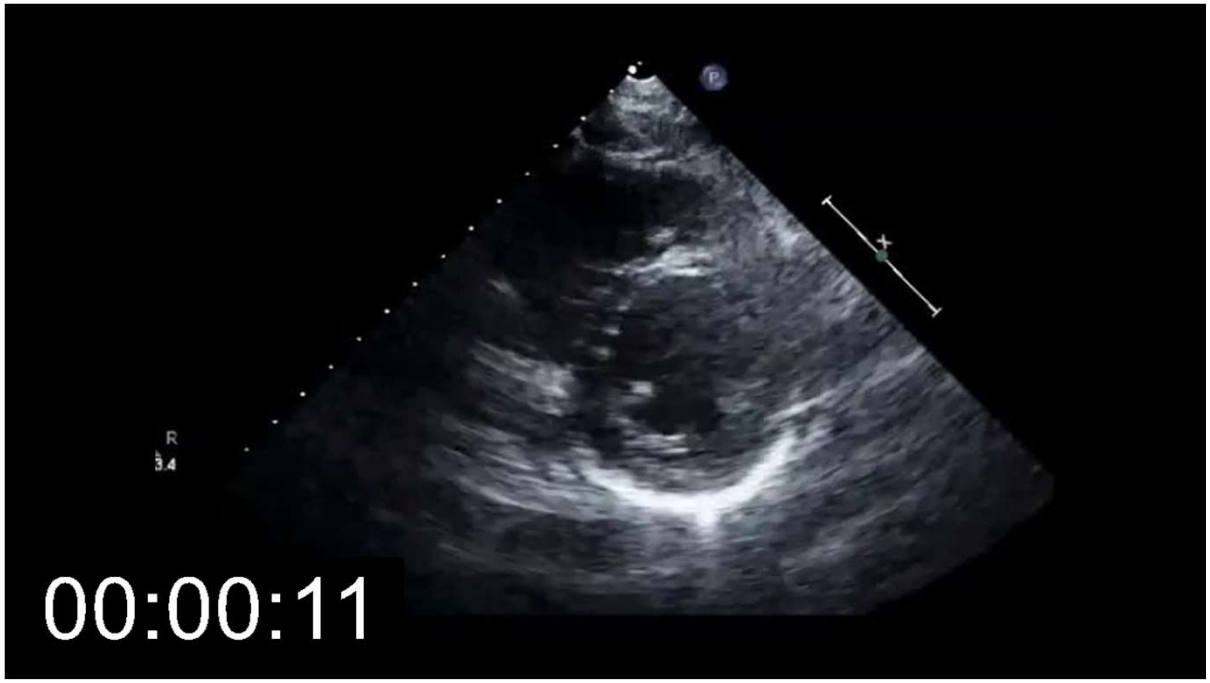
PARASTERNAL LONG-AXIS (PLAX)



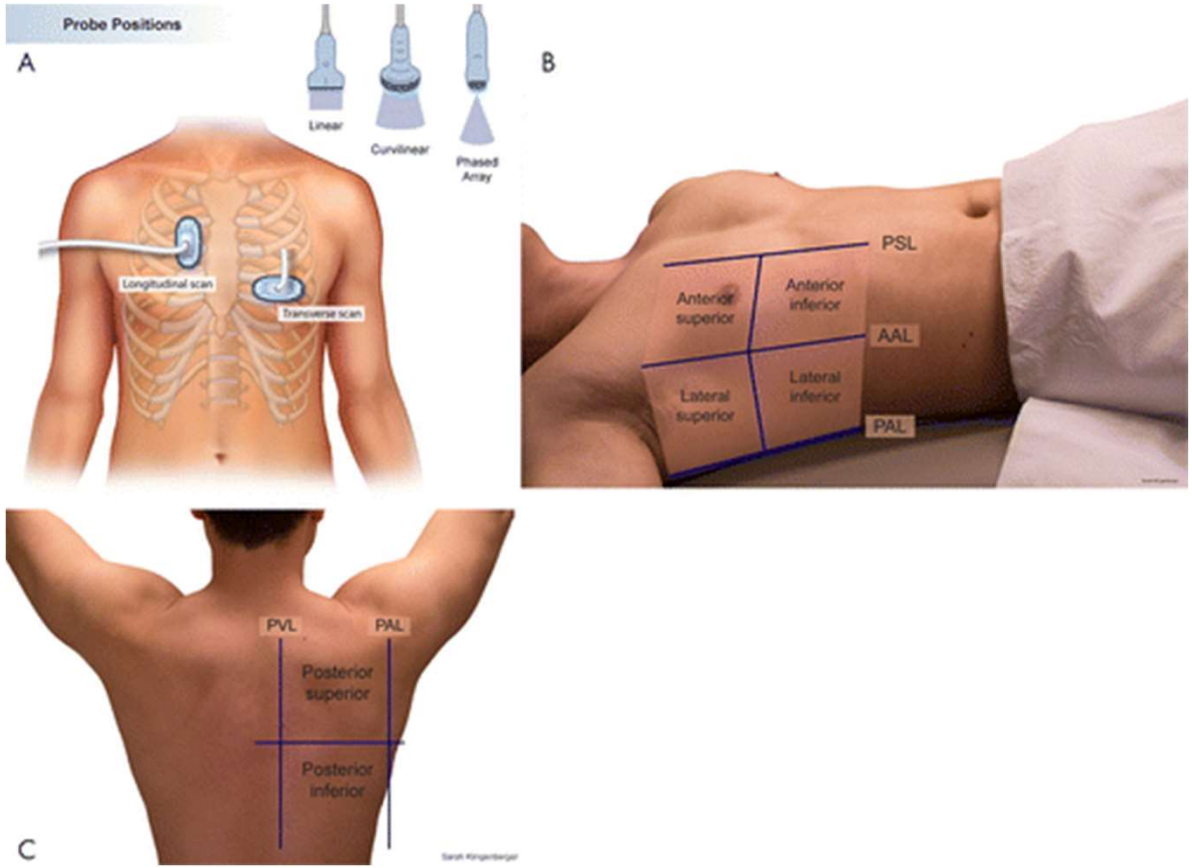
Chest:
Cardiac

PARASTERNAL SHORT AXIS (PSSA)



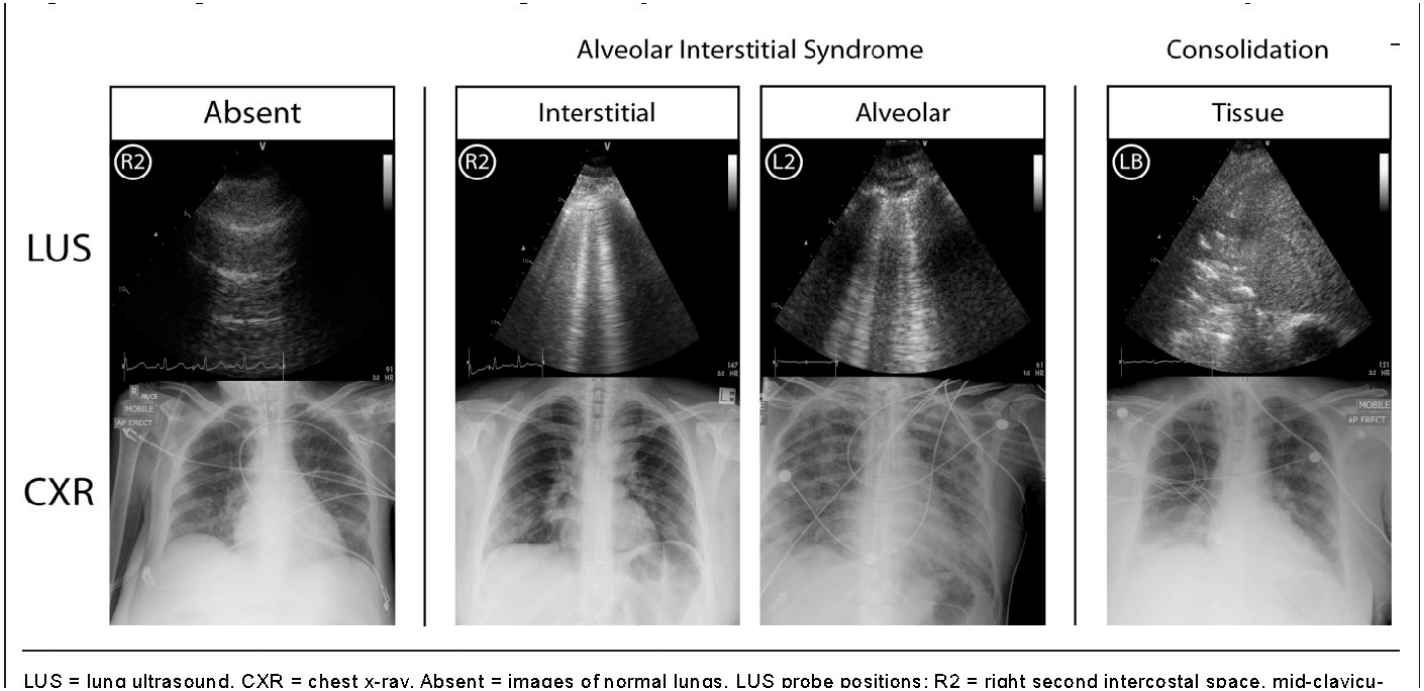


Chest:
Lungs


Probe Positions
A
Linear
Curvilinear
Phased Array
Longitudinal scan
Transverse scan
B
PSL
Anterior superior
Anterior inferior
AAL
Lateral superior
Lateral inferior
PAL
PVL
PAL
Posterior superior
Posterior inferior
C

Chest:
Lungs

Consolidation on Ultrasound vs. X-ray



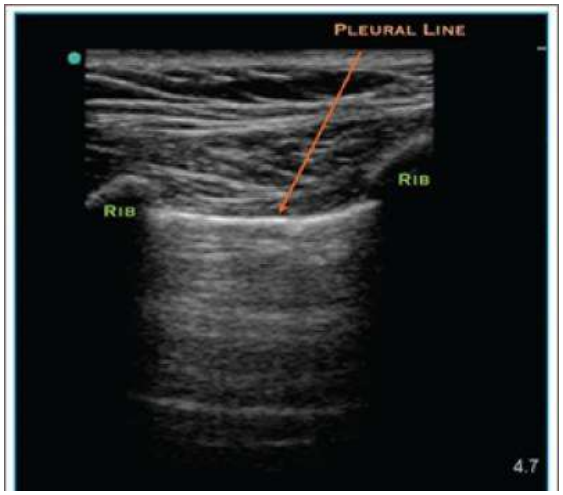
LUS = lung ultrasound, CXR = chest x-ray, Absent = images of normal lungs, LUS probe positions: R2 = right second intercostal space, mid-clavicu-

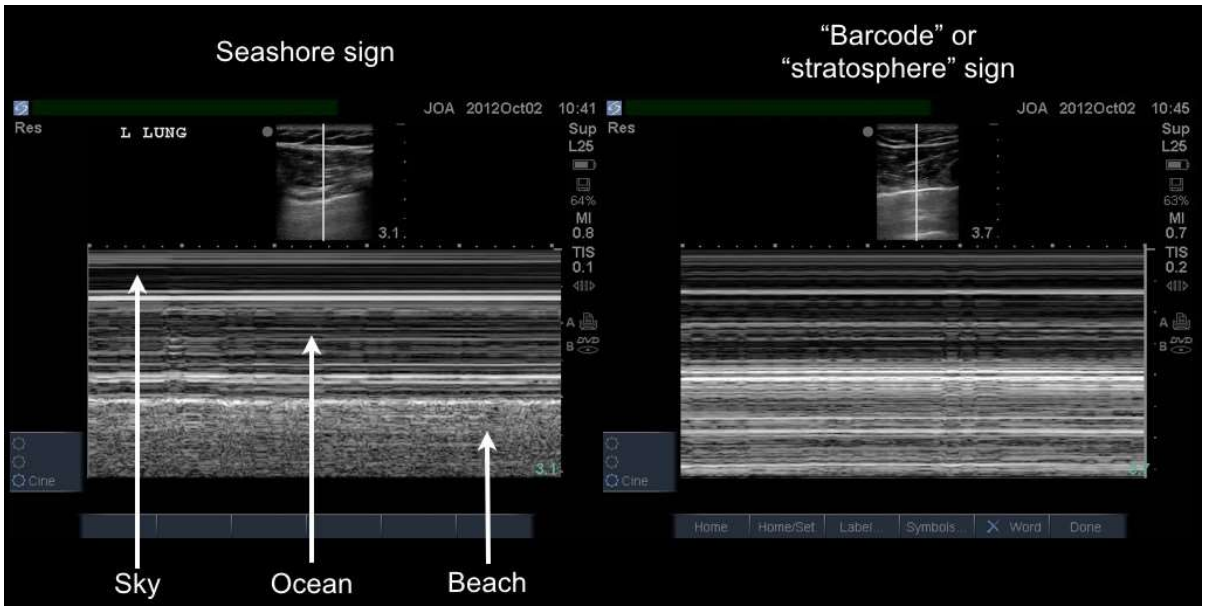
Chest:

Lungs

Pneumothorax

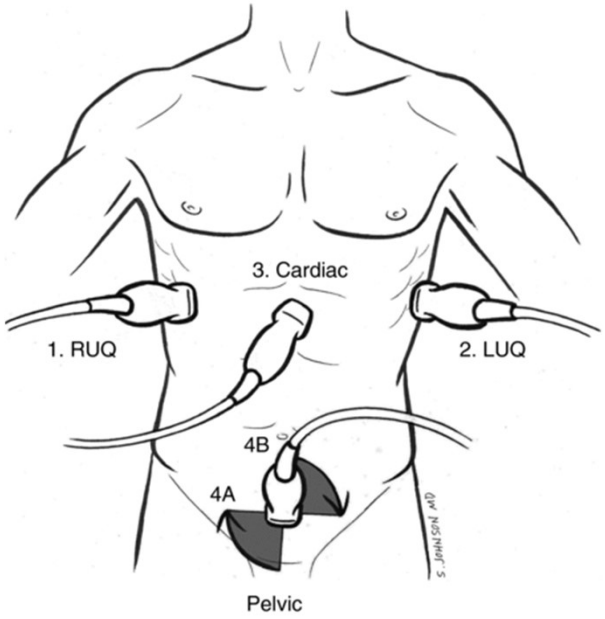
Seashore vs. Barcode Signs



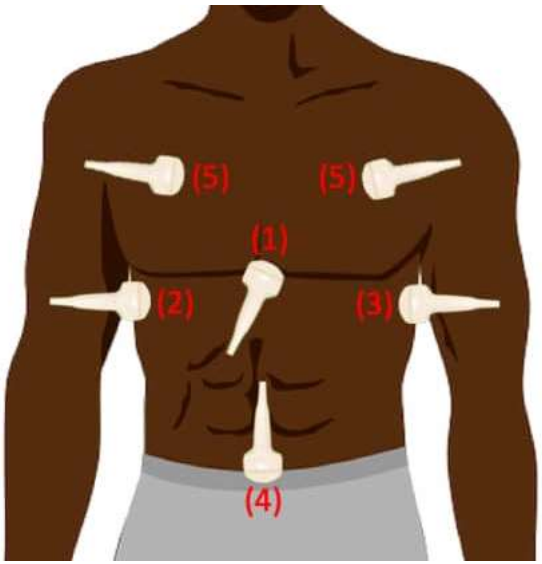


Abdomen: FAST vs. FAFF

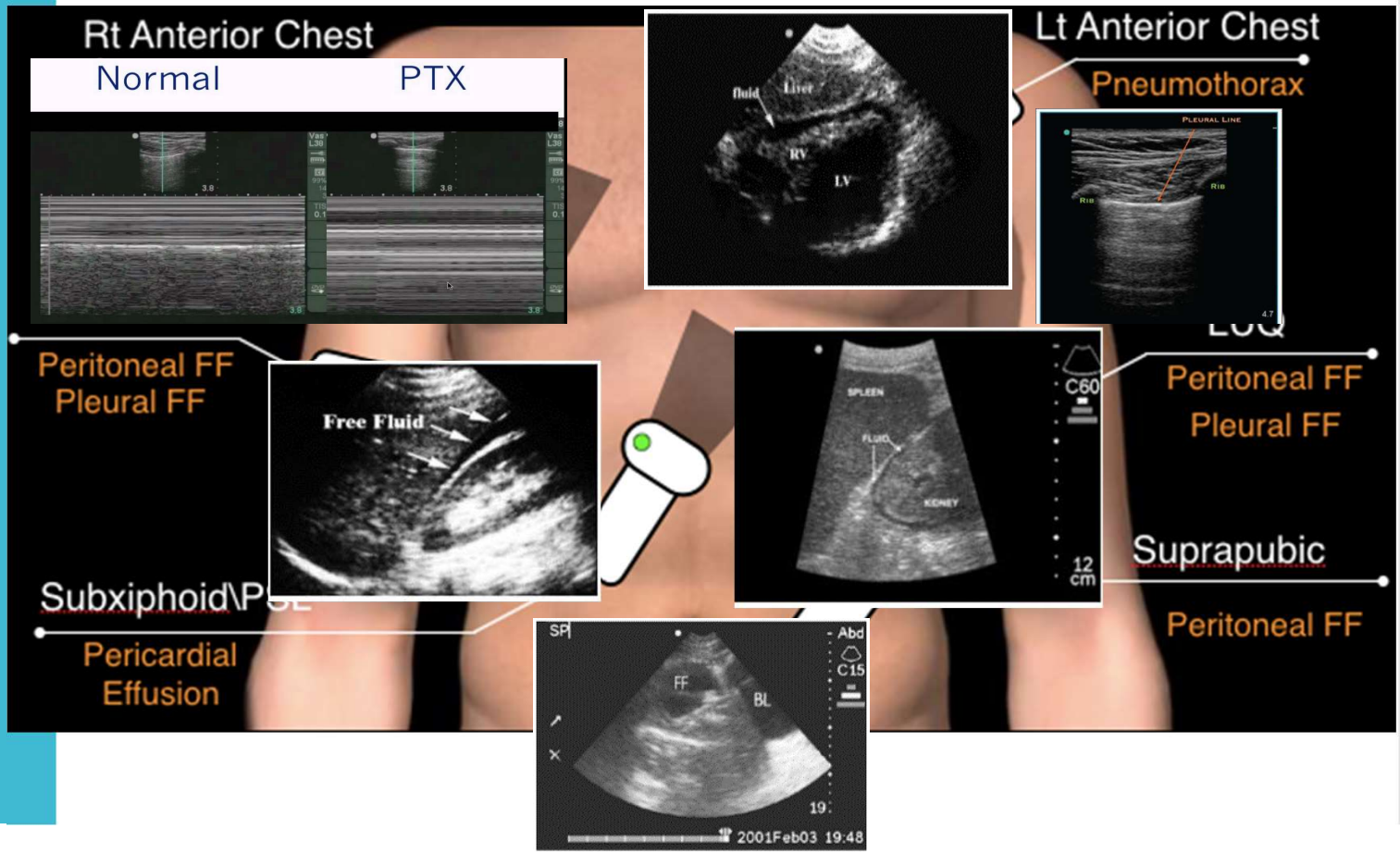
FAST vs FAFF



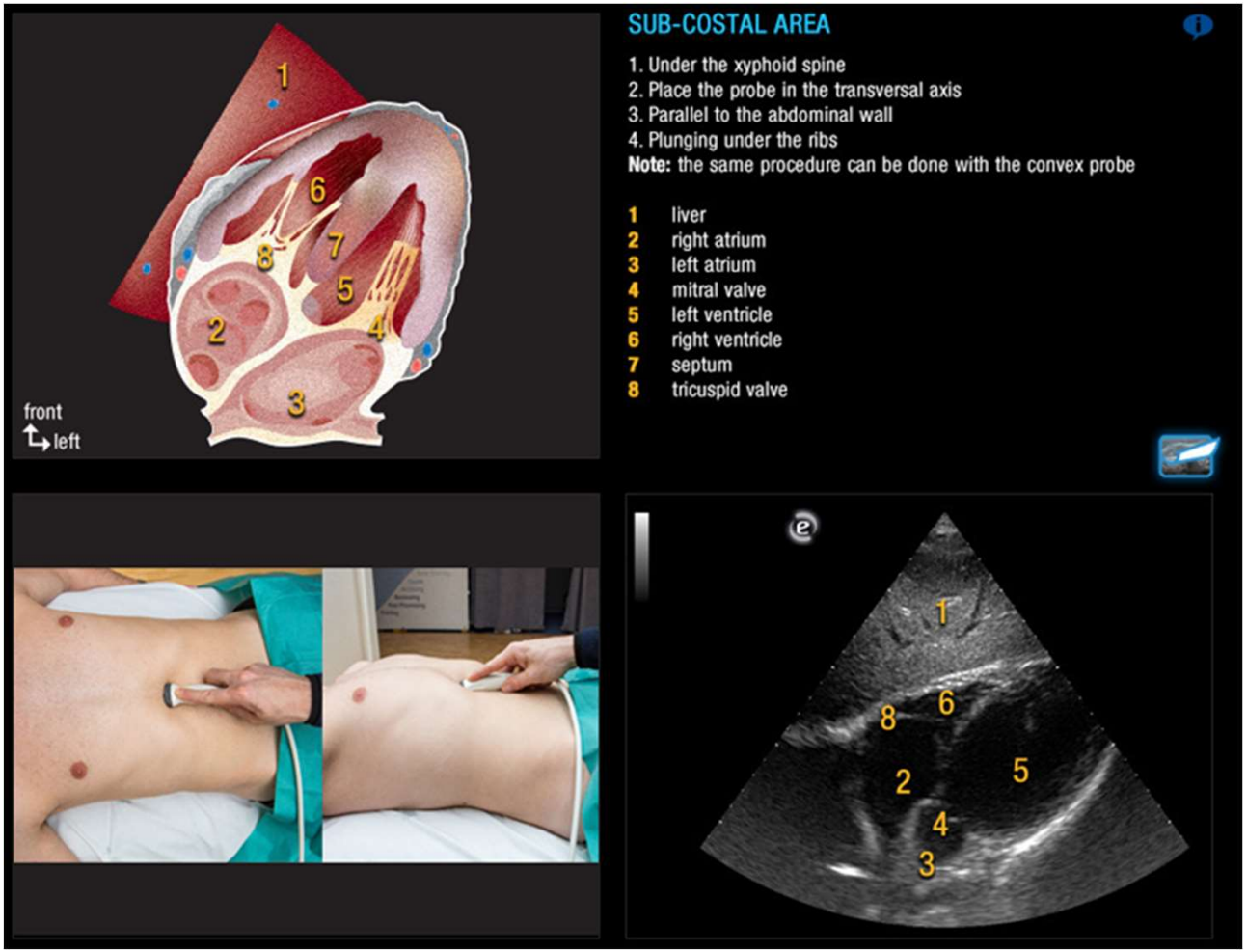
"Extended" or E-FAST



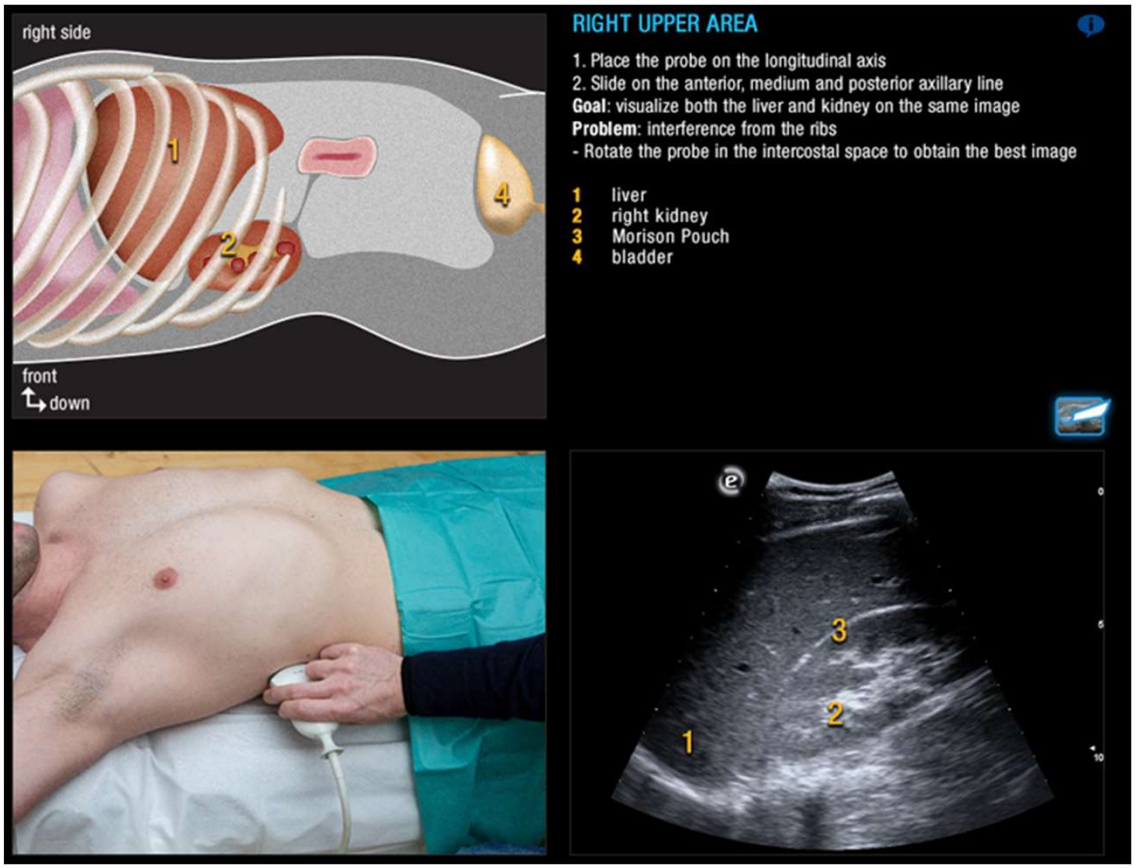
Abdomen: E-FAST



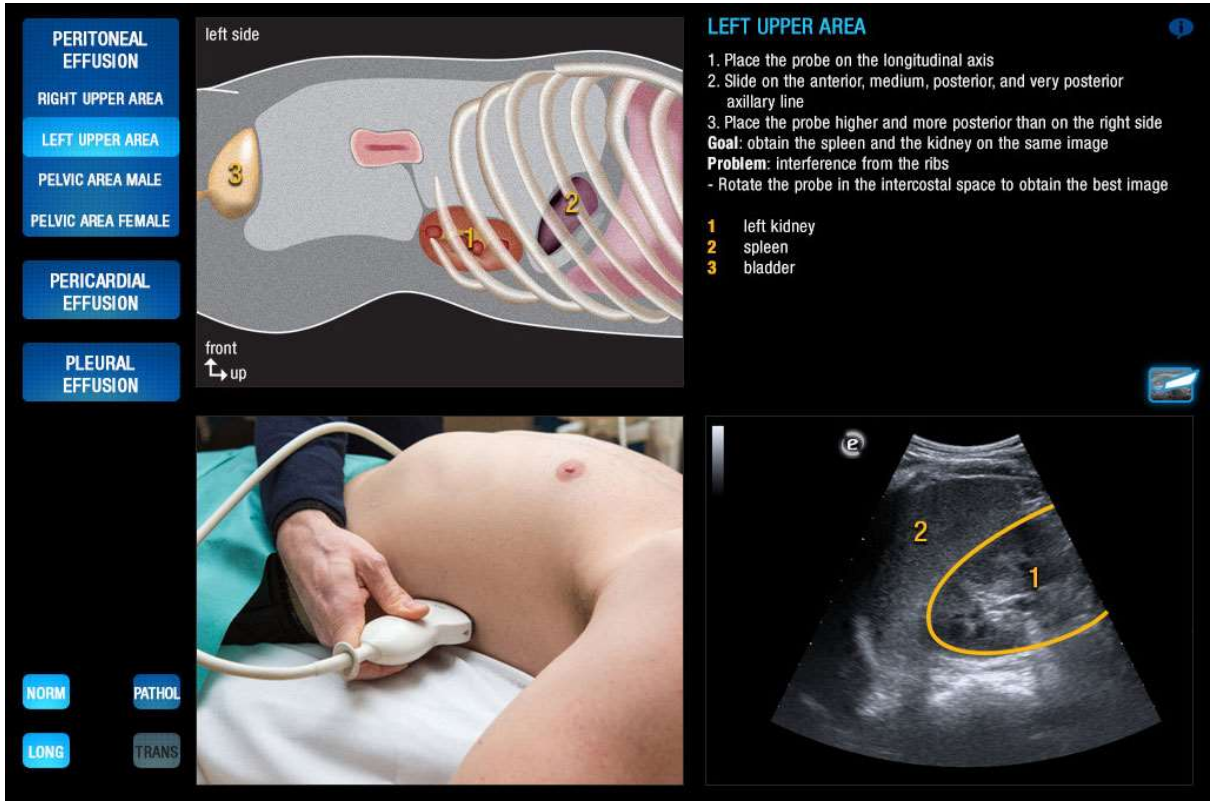
E – FAST: Sub-Xyphoid Cardiac



Abdomen: RUQ

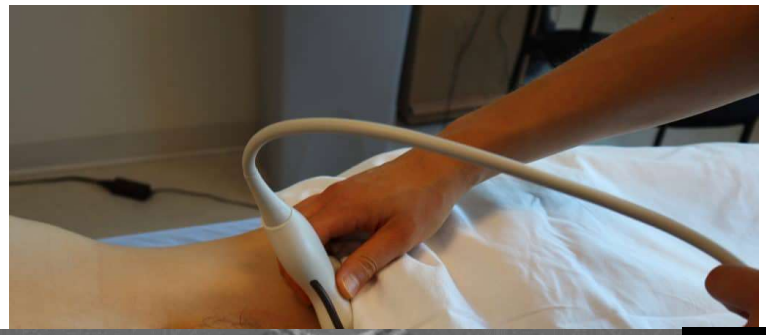

right side
1
2
4
front
down
RIGHT UPPER AREA
1. Place the probe on the longitudinal axis
2. Slide on the anterior, medium and posterior axillary line
Goal: visualize both the liver and kidney on the same image
Problem: interference from the ribs
- Rotate the probe in the intercostal space to obtain the best image
1 liver
2 right kidney
3 Morison Pouch
4 bladder
1
2
3

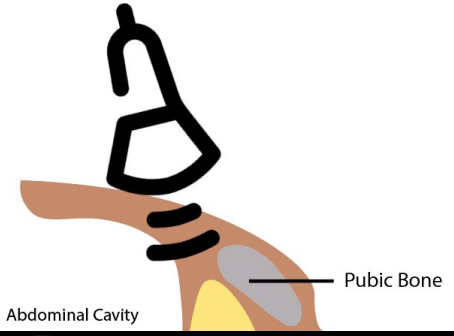
Abdomen: LUQ

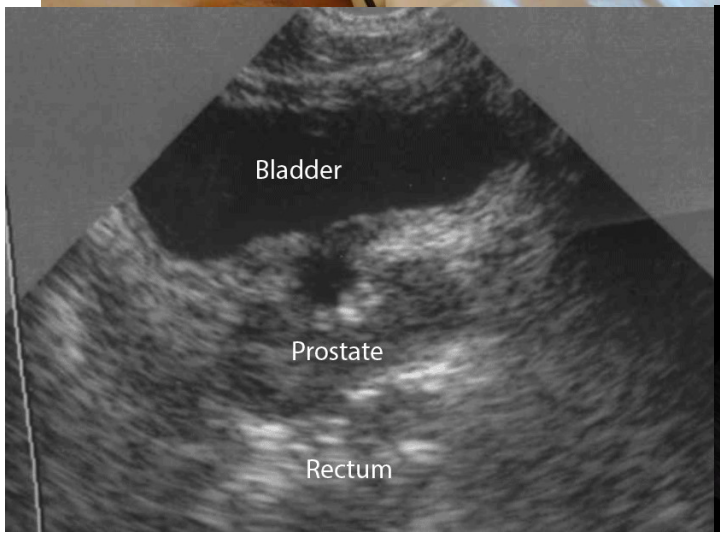

PERITONEAL EFFUSION
RIGHT UPPER AREA
LEFT UPPER AREA
PELVIC AREA MALE
PELVIC AREA FEMALE
PERICARDIAL EFFUSION
PLEURAL EFFUSION
NORM
PATHOL
LONG
TRANS
left side
front
up
3
2
1
LEFT UPPER AREA
1. Place the probe on the longitudinal axis
2. Slide on the anterior, medium, posterior, and very posterior axillary line
3. Place the probe higher and more posterior than on the right side
Goal: obtain the spleen and the kidney on the same image
Problem: interference from the ribs
- Rotate the probe in the intercostal space to obtain the best image
1 left kidney
2 spleen
3 bladder
2
1

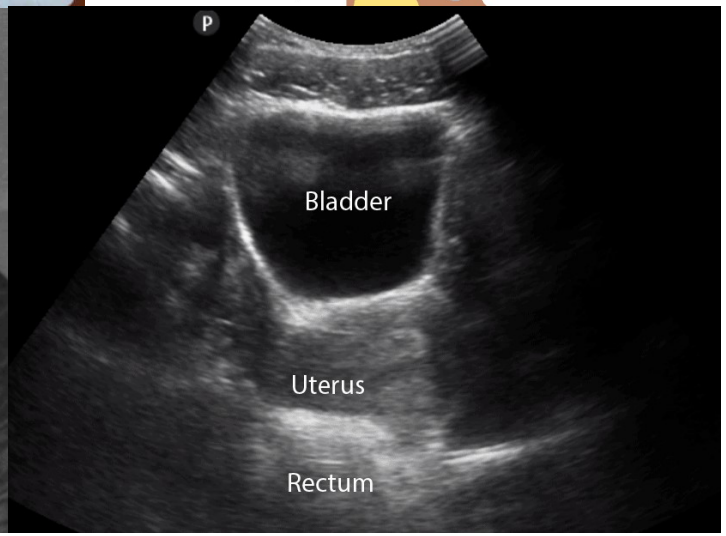
E – FAST: PELVIS TRANSVERSE

Abdomen: Pelvic Transverse

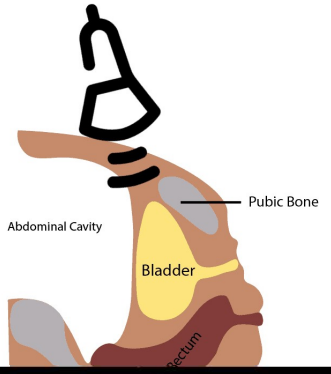


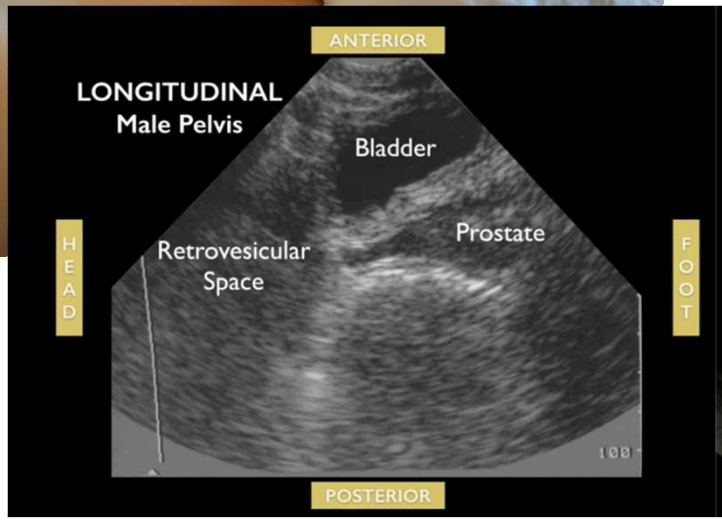


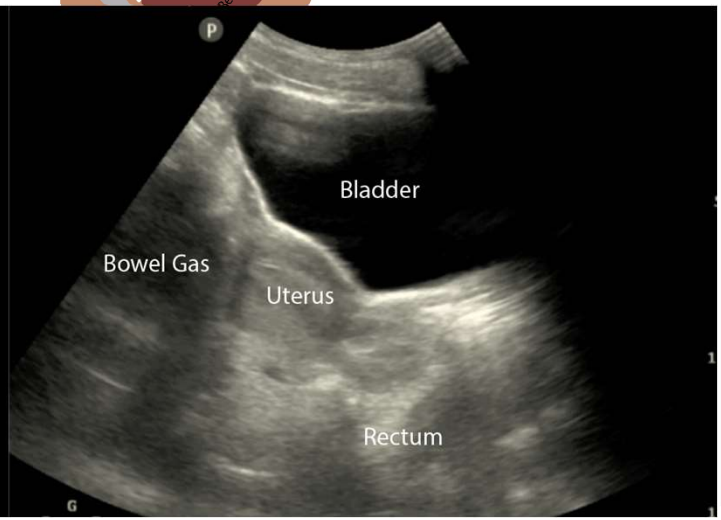




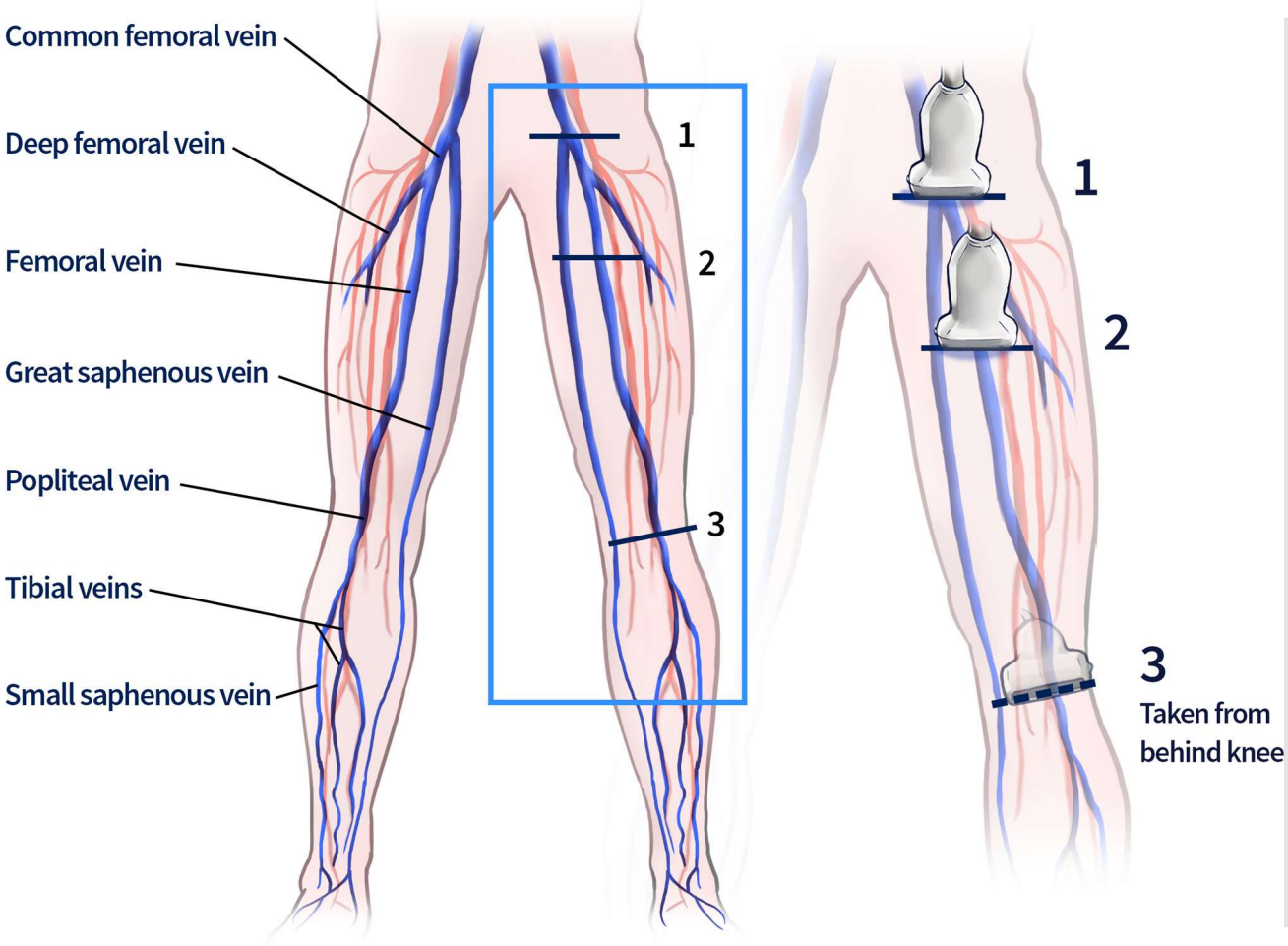
Abdomen: Pelvis Longitudinal







DVT Screen – Limited Vascular Compression



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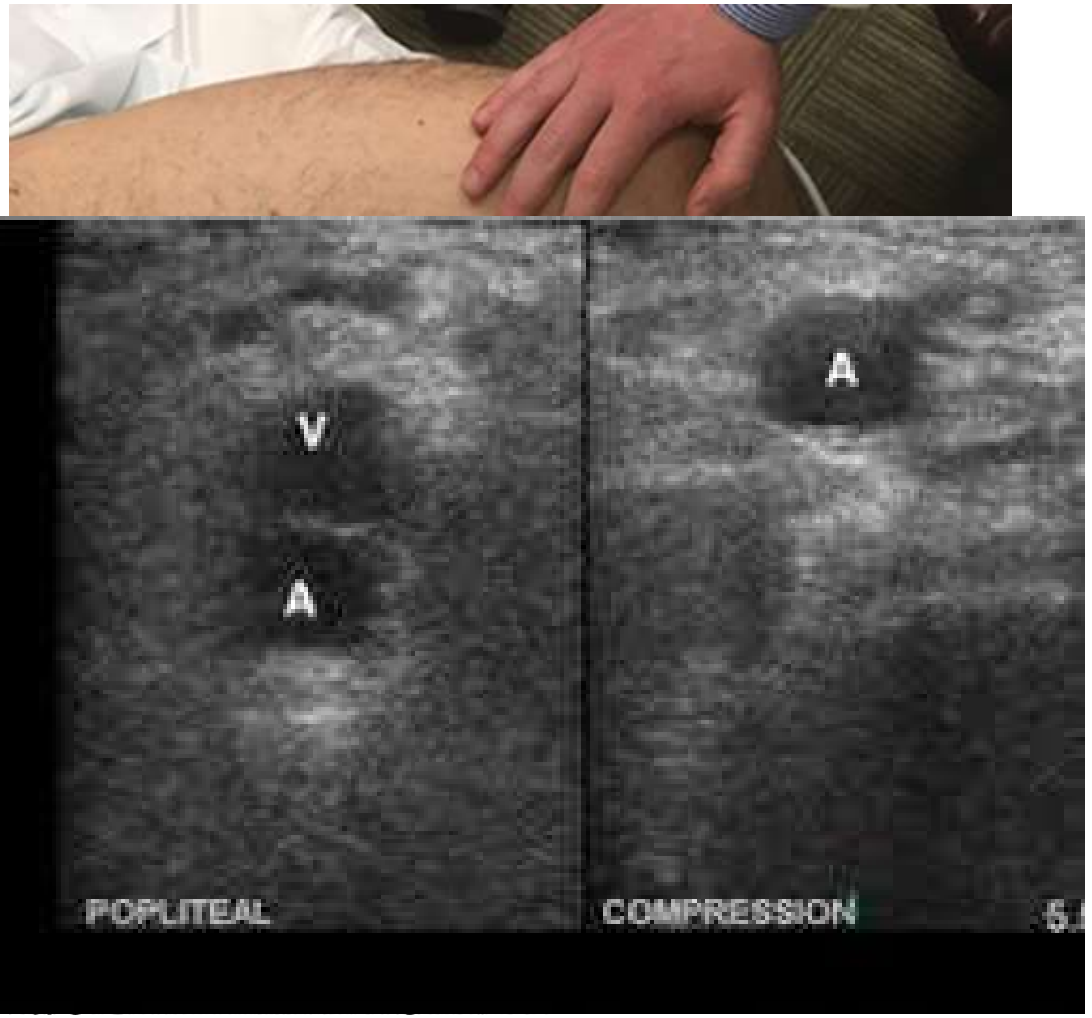
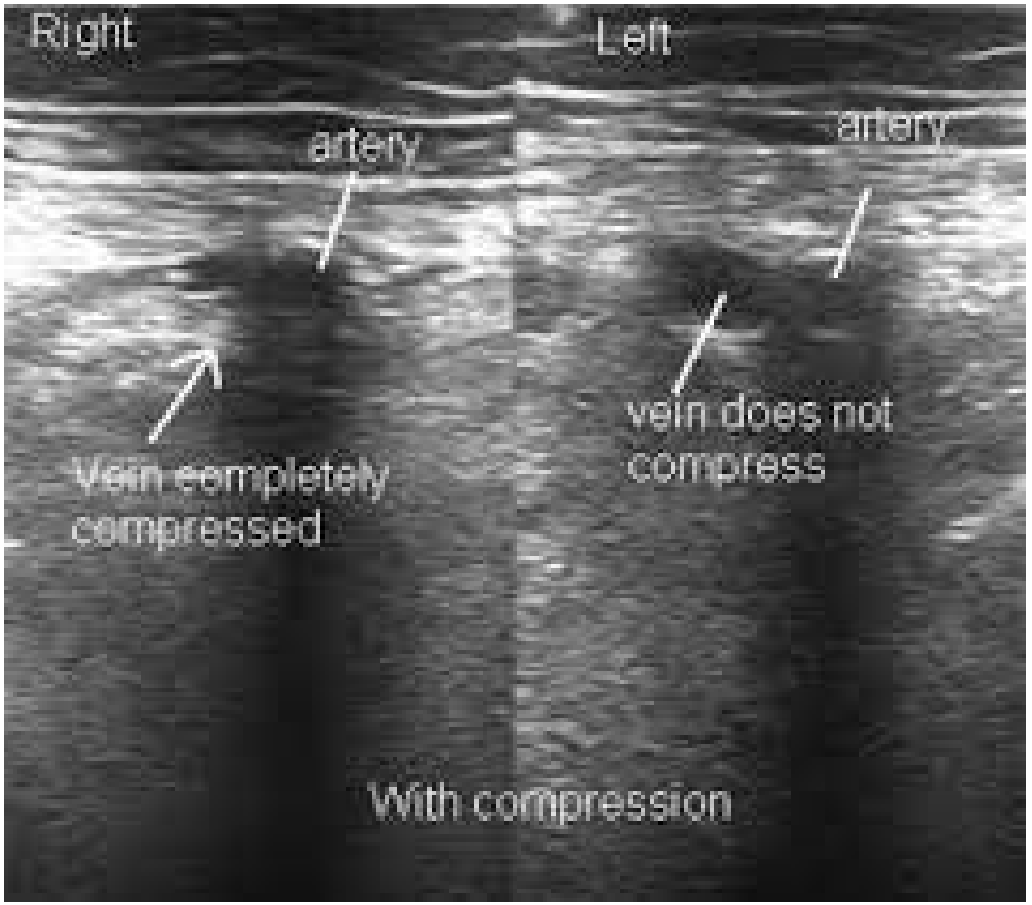


Bedside Sono for DVT https://sinaiem.org/foam/bedside-sono-for-dvt-will-it-ever-see-the-light-of-day/

DVT Screen – Limited Vascular Compression

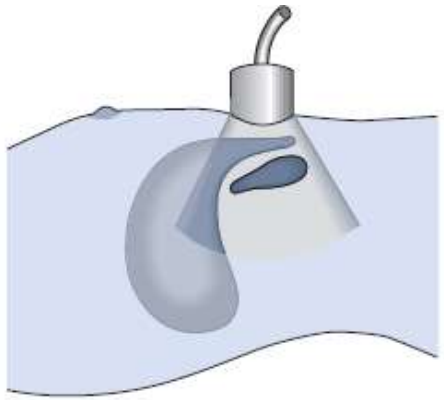


Medscape – DVT Bedside Ultrasonography https://emedicine.medscape.com/article/1362989-overview

Extra Credit

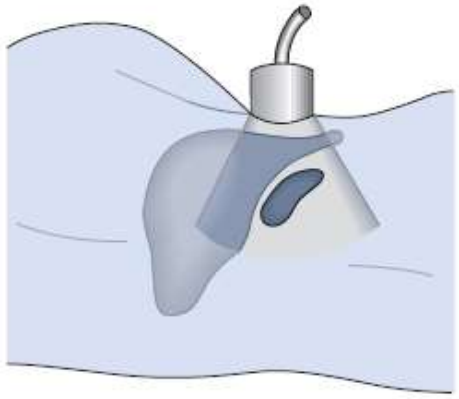
Abdomen: Gallbladder

a Upper abdominal longitudinal scan of the gallbladder (Gb).



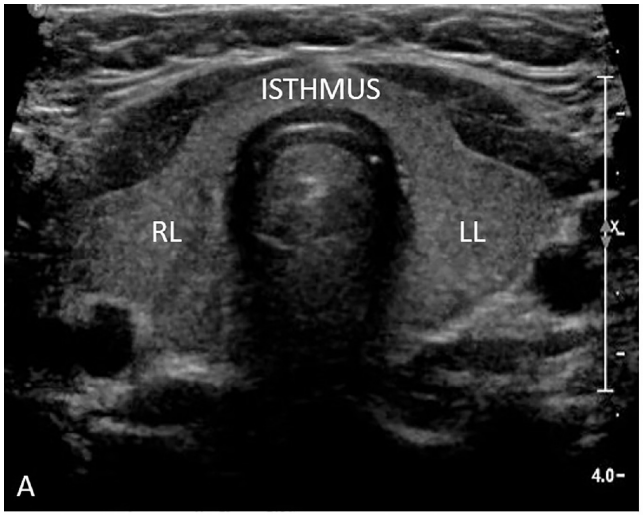
b Diagram showing the transducer placement for image *a*.

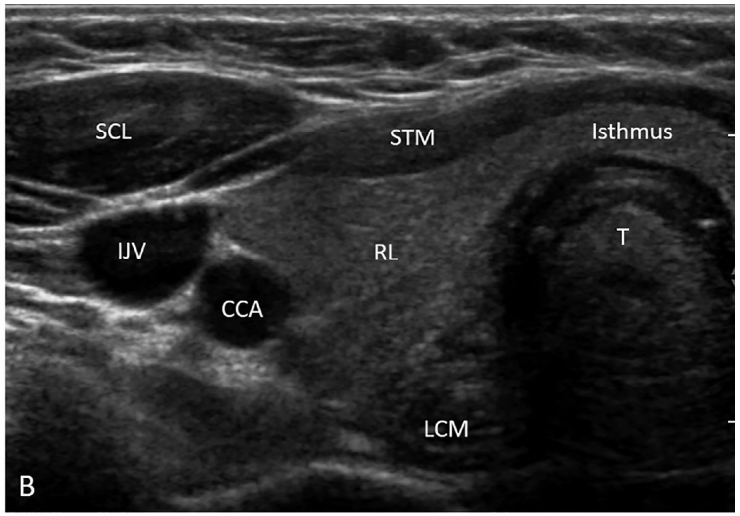
c Intercostal flank scan of the gallbladder.



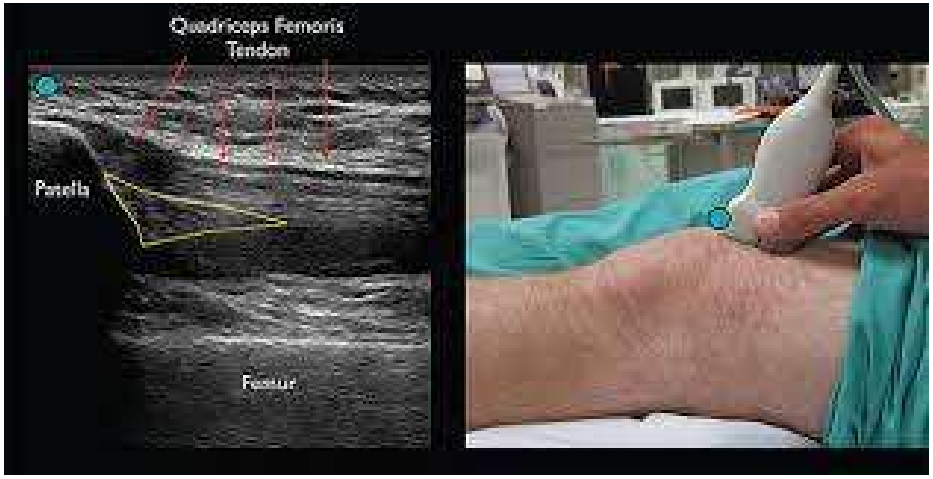
d Transducer placement for the intercostal scan. The diagram shows the view from the posterior aspect.

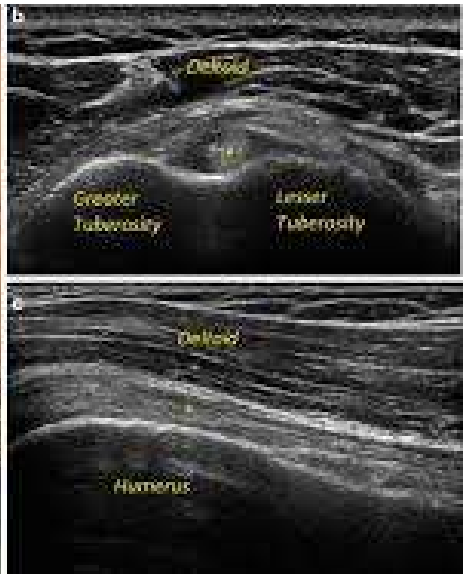
Extra Credit Neck – Thyroid, IJ





Extra Credit: MSK





Summary

- Explain the basic employment of Handheld Ultrasound for Primary Care
- Describe the indications, contraindications and limitations of Handheld Ultrasound in Primary Care Settings
- Discuss the ways that Handheld Ultrasound can be used to answer clinical questions at the bedside in Primary Care
- Review the use of Handheld Ultrasound for common pathologies encountered in primary care
- Demonstrate basic employment of Handheld Ultrasound

QUESTIONS ? ??

- FEEDBACK?

References

- American Academy of Family Physicians. Point of Care Ultrasound: Recommended Curriculum Guidelines for Family Medicine Residents. AAFP Reprint No. 290D. Developed 12/2016 by Contra Costa Family Medicine Residency Program, Martinez, CA & Updated 09/2021 by Baylor University Medical Center Family Medicine Residency, Dallas, TX.
- Shen-Wagner, J. & Deutchman, M. Point-of-Care Ultrasound: A Practical Guide for Primary Care. American Academy of Family Physicians. November/December 2020.
- Borneman, P. & Barreto, T. Editorial: Point-of-Care Ultrasonography in Family Medicine. American Academy of Family Pysicians, American Family Physician, Volume 98, Number 4, August 15, 2018.
- Baston, C., Morre, C., Krebs, E. et al. Pocket Guide to POCUS: Point-of-Care Tips for Point-of-Care Ultrasound. McGraw-Hill Education, Inc., 2019. Book ISBN: 978-1-260-14252-5.