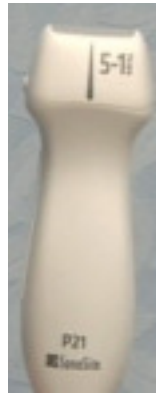


DIAGNOSTIC ULTRASOUND PRINCIPLES

I. Ultrasound Machine: Knobology

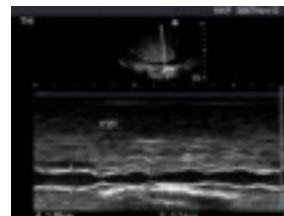
A. Probe

1. Linear (high frequency: pleura, deep veins, subQ)
2. Phased Array (low frequency: heart and abdomen)
3. Curvilinear (low frequency: abdomen)



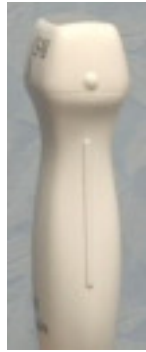
B. Mode

1. 2D Mode
 - a) structures converted to white dots on screen
 - b) dense structures appear white
2. M-Mode
 - a) Evaluate a single slice of anatomy over time
 - b) Useful for evaluating how moving structures change with time
 - c) Depth on Y axis, Time on X axis



C. Direction

1. Probe marker corresponds to blue marker on screen
2. Align probe so direction on screen matches direction on patient's body



D. Depth

1. Total cm depth in lower R corner
2. Dots and dashes represent intervals



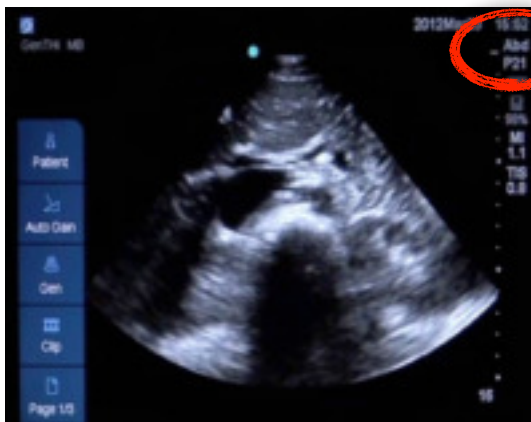
E. Gain

1. Represents brightness of images on screen
2. Increasing gain makes structures appear more dense (whiter) on screen



F. Exam Type

1. Computer presets to optimizes image for exam type
2. Choose exam to match study being performed
3. Setting exam type is different on each machine
4. Cardiac exam type reverses images on screen



Abdominal Preset
used to look at aorta

II. Cardiac Exam

A. Subxiphoid 4 Chamber View

1. Probe flat in subxiphoid space (hold like a club)
2. Indicator to patient's left



B. Parasternal Long Axis View

1. Probe in 4th-5th intercostal space to left of sternum
2. Probe perpendicular to chest
3. Indicator to the right shoulder



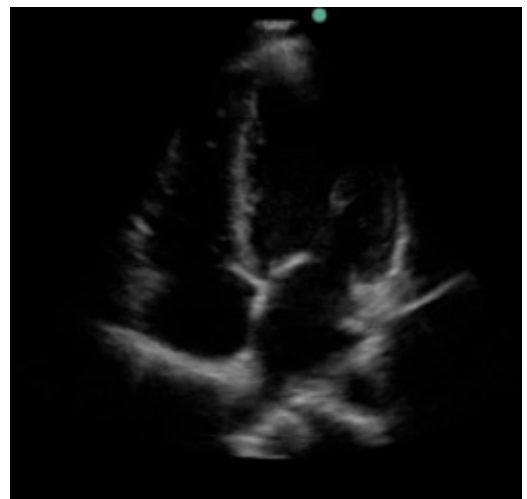
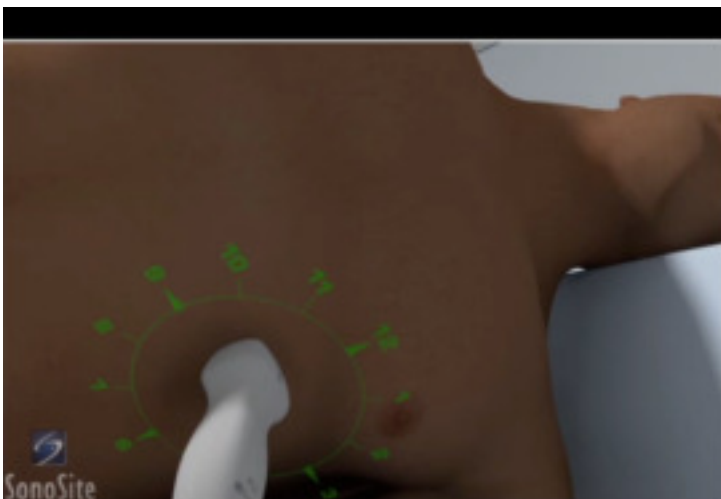
C. Parasternal Short Axis View

1. Probe in 4th-5th intercostal space to left of sternum
2. Probe perpendicular to chest
3. Indicator to left shoulder



D. Apical 4 Chamber View

1. Probe at point of maximal impulse
2. Indicator to left axilla
3. Probe tilted toward right shoulder



III. Volume Status using Inferior Vena Cava

A. Probe Position

1. Phased array probe in cardiac exam type
2. Position probe perpendicular to skin high in subxiphoid space
3. Slide probe to right until IVC visualized

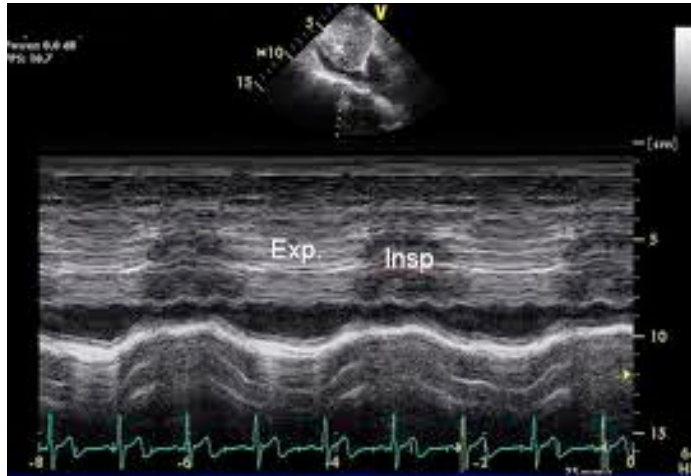


B. Measuring IVC

1. 2D mode: measure diameter of IVC inferior to confluence with common hepatic vein



2. M-Mode: measure respiratory variation of IVC inferior to confluence with common hepatic vein



3. Estimating CVP:

IVC Diameter	Respiratory Change	Estimated CVP
< 1.5 cm	Total Collapse	<5 cmH ₂ O
1.5-2.5 cm	>50% Collapse	6-10 cmH ₂ O
1.5-2.5 cm	<50% Collapse	11-15 cmH ₂ O
>2.5 cm	<50% Collapse	15-20 cmH ₂ O
>2.5 cm	No Change	>20 cmH ₂ O

IV. FAST EXAM: ABDOMEN

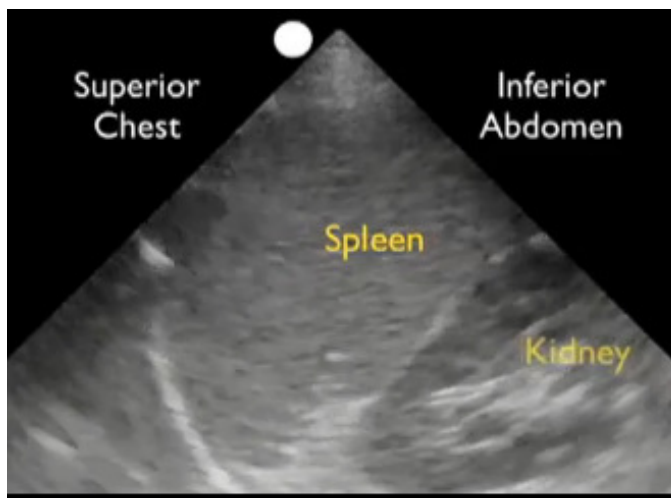
A. Right Upper Quadrant View

1. Anterior to Midaxillary line
2. Probe indicator cephalad
3. 10th to 11th interspace
4. Evaluate Morrison's pouch and R pleural space



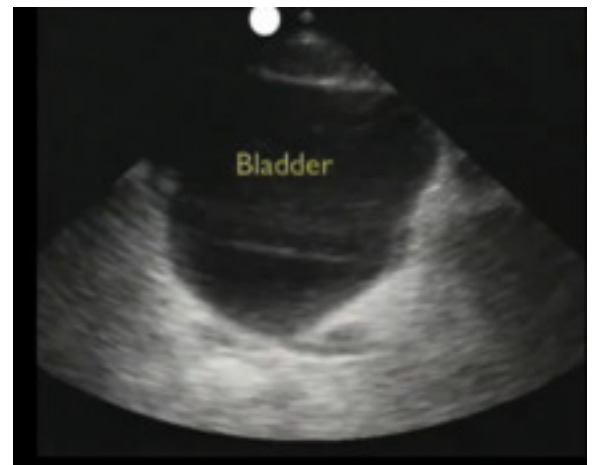
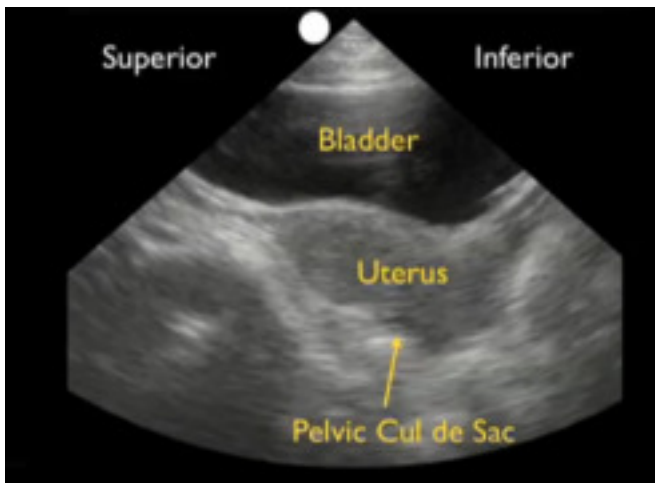
B. Left Upper Quadrant View

1. Midaxillary to posterior axillary line
2. Probe indicator cephalad
3. 9th to 10th interspace
4. Evaluate between spleen and diaphragm and L pleural spac



C. Pelvic View

1. Probe in midline in suprapubic space
2. Indicator to right for transverse view
3. Indicator cephalad for sagittal view
4. Evaluate spaces between uterus/bladder, uterus/rectum (female) and retrovesicular space (male)
5. Free fluid has sharp edges and does not move with pressure
6. Decompressed bladder in trauma patient may indicate bladder injury

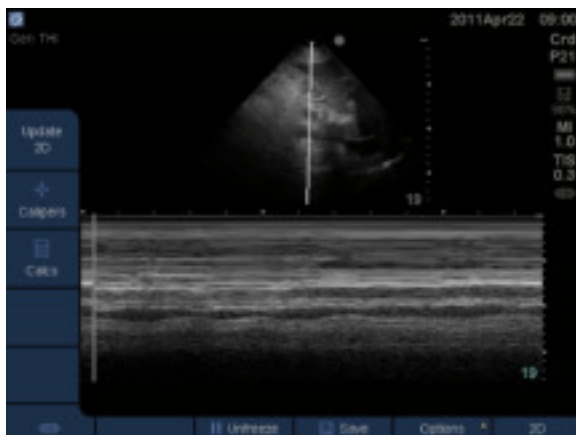


V. E-FAST: PLEURA

- A. Use linear transducer
- B. Hold probe perpendicular to ribs (indicator cephalad)
- C. Start just inferior to clavicle in midclavicular line
- D. Scan 3 locations anteriorly and 2 locations laterally

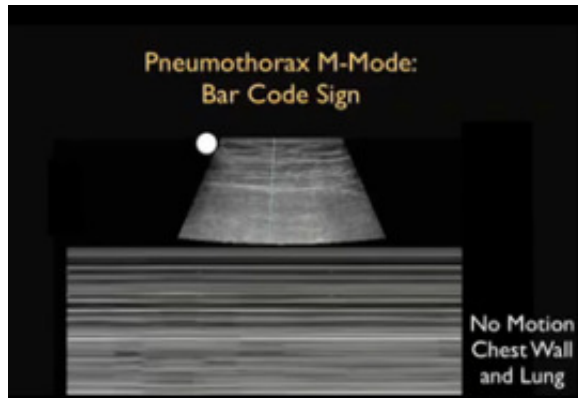


- E. Normal Findings (non pneumothorax)
 1. Sliding Sign
 2. Comet Tails
 3. Seashore sig



F. Abnormal Findings (pneumothorax)

1. Lack of sliding sign
2. Lack of comet tails
3. Barcode sign

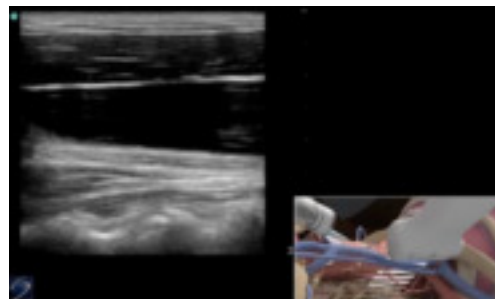
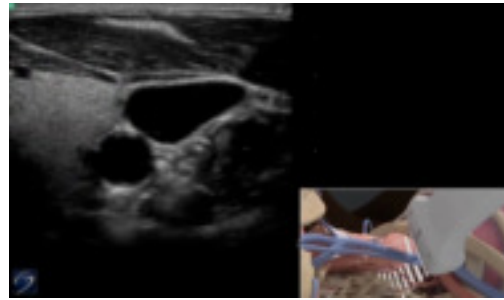


VI. Ultrasound Guided Vascular Access

- A. Prepare for central line placement
 1. Complete complete pre-procedure elements of central line insertion bundle
 2. Prepare ultrasound probe
 - a) nonsterile gel on probe
 - b) with assistant, place sterile ultrasound sheath
 - c) sterile gel outside of sheath

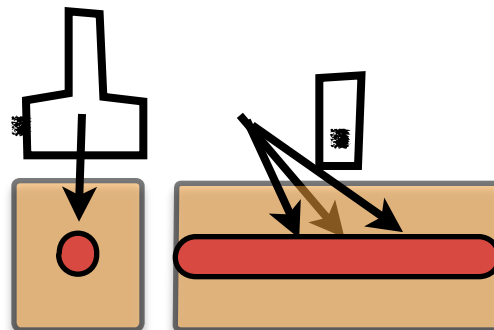
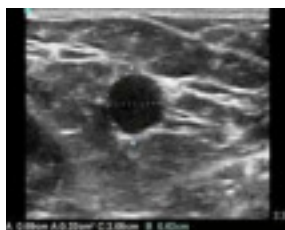


3. Visualize vessel in transverse and longitudinal view



4. If cannulating in transverse view:

- Puncture skin at distance from probe that is equal to depth of vessel
- Advance at 45 degree angle to skin
- Watch for ring down artifact at anterior wall of vessel as needle advances
- Too shallow or too deep will prevent visualization



5. If cannulating in longitudinal view:
- Puncture skin adjacent to midpoint of short axis of probe
 - Advance at 45 degree angle to skin
 - Take care to keep needle directly in line with probe
 - Visualize needle as it advances under probe
 - Slight angulation to one side or another will prevent visualization

