UPMC | CHILDREN'S HOSPITAL OF PITTSBURGH

Pediatric Emergency Medicine Point-Of-Care-Ultrasound Handbook

For Questions, Contact:
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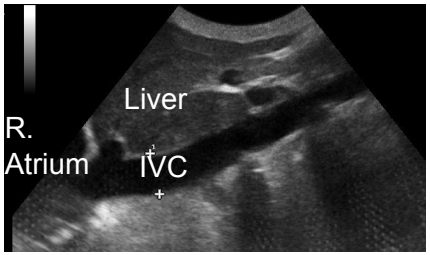
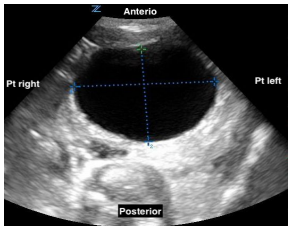
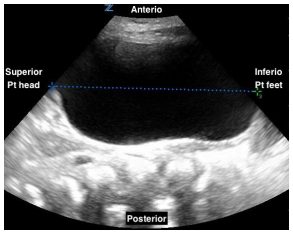
I. IVC



Probe:	Phased array
Orientation:	Patient supine Probe placed subxiphoid Transverse (indicator to pt's right) Longitudinal (indicator to pt's head)
Technique & Image Optimization:	1) Begin in transverse (indicator to pt's right) to visualize IVC and Aorta in cross section: **Aorta pulsates, is on pt's L.** **IVC does not pulsate, is on pt's R.** 2) Rotate 90 degrees (indicator to pt's head) to visualize IVC in longitudinal.
Recording requirements:	1) Visualize **IVC emptying into the right atrium** (otherwise, it may be the aorta not the IVC) 2) "Gestalt" measurement of IVC diameter collapsibility
Measurements / Diagnostic requirements:	Normal IVC: 50% collapse in diameter with respiratory variation **Plethoric IVC:** **no respiratory variation** → volume overload **Collapsed IVC:** **>50% collapse with inspiration** → hypovolemia

III. BLADDER VOLUME





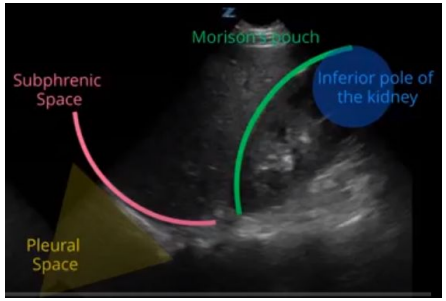
Probe:	Phased Array
Orientation:	Patient supine Probe over bladder, just superior to symphysis pubis, angled caudally towards feet Transverse (indicator to pt's right) Longitudinal (indicator to pt's head)
Technique & Image Optimization:	Decrease depth to focus on bladder
Recording requirements:	First, save video clips fanning through bladder in both transverse and longitudinal planes for completeness. 1) Freeze image in transverse plane 2) **Calculate → Bladder Vol → Set** 3) Place calipers to measure X axis 4) Save Image 5) Place calipers to measure Y axis 6) Save Image (w/X and Y axes shown) 7) Hit Freeze (to unfreeze) 8) Rotate probe 90° to longitudinal plane (indicator to pt's head) 9) Freeze image in longitudinal plane 7) Z axis calipers automatically appear, drop them horizontally by hitting **Set** 10) Save image (w/ Z caliper shown) 11) All three axis measurements appear in bottom right corner of screen 12) Volume is auto-calculated below measurements
Measurements / Diagnostic requirements:	Normal bladder capacity: (Age +2) x 30 = capacity (in ml) Newborn capacity = 20-30ml **Urinary retention:** scan for post void residual: **<6yrs: >30ml = retention** **>6yrs: >20ml = retention**

V. FAST

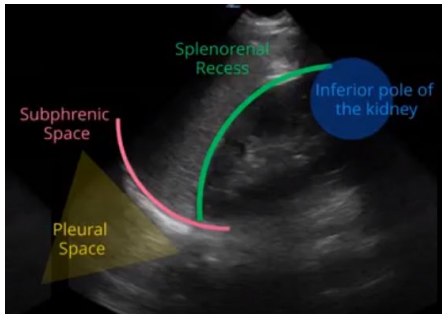
Probe:	Phased Array
Orientation:	Patient supine, scan in four views: 1) **RUQ** (indicator to pt's head, angled between ribs) 2) **LUQ** (indicator to pt's head, angled between ribs: more superior and posterior than in RUQ view) 3) **Subxiphoid** (indicator to pt's right, aim towards heart) - PSL view also acceptable if unable to obtain. 4) **Pelvis**: Transverse (indicator to pt's right) Longitudinal (indicator to pt's head)
Technique & Image Optimization:	Increase gain/depth in subxiphoid view Decrease gain in pelvis
Recording requirements:	1) **RUQ**: video clip fanning through RUQ showing 4 spaces: Pleural, Subphrenic, Hepatorenal (Morison's), Kidney inferior pole 2) **LUQ**: video clip fanning through LUQ showing 4 spaces: Pleural, Subphrenic, Splenorenal, Kidney inferior pole 3) **Subxiphoid**: video clip assessing for hemopericardium 4) **Pelvis**: two video clips, each fanning through the bladder **Transverse**: shows free fluid posterior to bladder **Longitudinal**: shows free fluid superior & posterior to bladder
Measurements / Diagnostic requirements:	Threshhold volumes of free fluid required for detection by POCUS: Approximately 600cc in the RUQ Approximately 100cc in the pelvis **Spine Sign:** Visualization of vertebral bodies in above the diaphragm. Not usually seen unless there is a fluid collection.

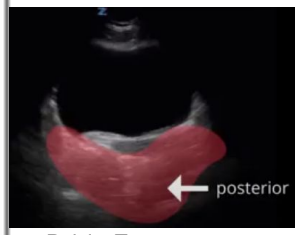
VI. FAST

RUQ

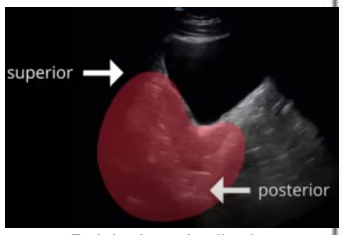


LUQ

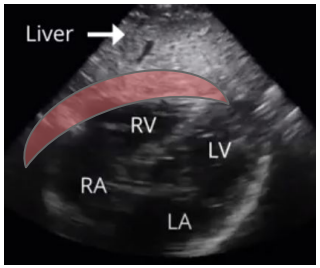




Pelvis: Transverse



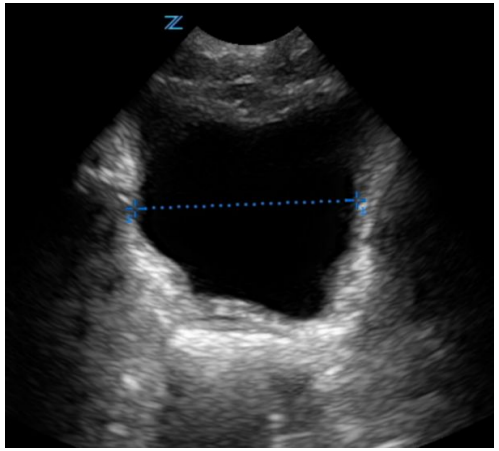
Pelvis: Longitudinal



Subxyphoid

Spine Sign

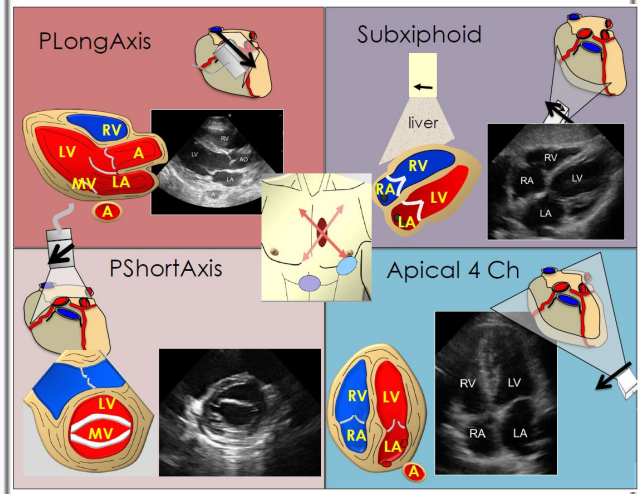
IV. BLADDER FOR URINE CATHETERIZATION



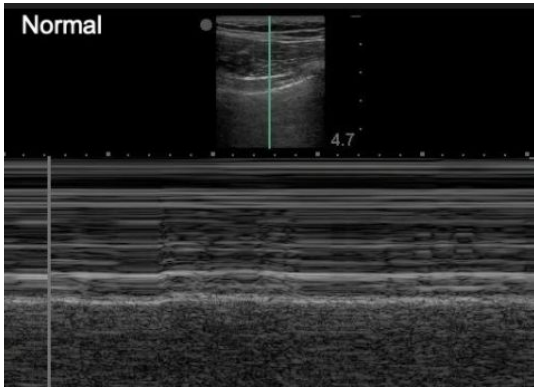
Probe:	Phased Array
Orientation:	Patient supine Probe over bladder, just superior to symphysis pubis Transverse (indicator to pt's right)
Technique & Image Optimization:	Decrease depth to focus on bladder
Recording requirements:	1) Video fanning through bladder in transverse view 3) Still image with single caliper shown at bladder's widest dimension
Measurements / Diagnostic requirements:	**<u>Sufficient for Bladder Catheterization:</u>** **>2cm in any dimension**

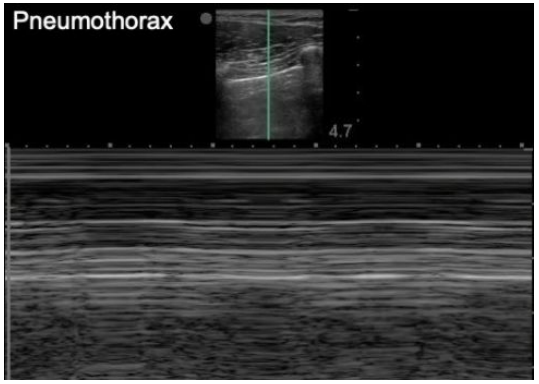
II. CARDIAC

Probe:	Phased Array
Orientation:	Patient supine, 4 views: 1) **Subxiphoid** (probe under subxiphoid area, indicator to pt's right, aim towards heart) 2) **Parasternal long axis** (probe just left of sternum at nipple line, indicator to L. hip) 3) **Parasternal short axis** (probe just left of sternum at nipple line, indicator to R. hip) [rotate 90 degrees from parasternal long position] 4) **Apical 4 chamber** (probe at PMI, indicator to pt's right)
Technique & Image Optimization:	Subxiphoid: optimize by flattening hand/probe down to chest Apical 4 chamber: optimize with patient in L. lateral decubitus
Recording requirements:	1) Video clip of cardiac movement in each of 4 views 2) Document presence of: A) **Pericardial effusion** B) **Ventricular systolic function:** normal, hyperdynamic, or depressed



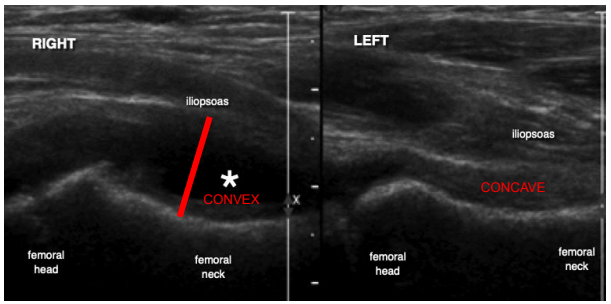
VII. PNEUMOTHORAX





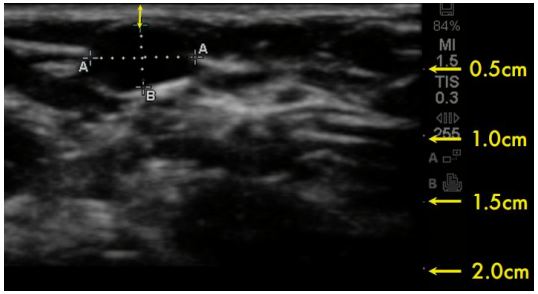
Probe:	Linear (L10-5 “yellow”) or Phased Array in larger patient
Orientation:	Patient supine Probe overlying anterior chest at midclavicular line (avoid heart on L. side) Longitudinal (indicator to pt’s head)
Technique & Image Optimization:	Decrease depth to focus on just the pleural line
Recording requirements:	1) Scan downwards from clavicle to liver on R. and spleen on L. 2) Video clips pausing between ribs at each pleural space 3) Document presence or absence of **lung sliding** at each space **M-mode** (optional): **Sandy beach/Seashore sign** (Sliding = no PTX) **Barcode sign** (No sliding = PTX)

IX. HIP EFFUSION

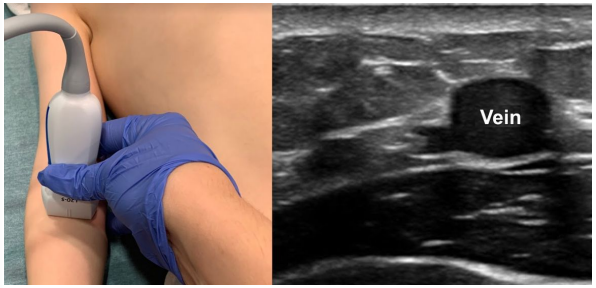


Probe:	Linear (L10-5 “yellow”)
Orientation:	Patient supine Hip externally rotated Knee slightly flexed Probe overlying femoral neck (indicator to pt’s umbilicus) Image is longitudinal through hip joint
Technique & Image Optimization:	Adjust gain and depth Fan or scan medially/laterally to obtain correct plane
Recording requirements:	1) Still image with calipers measuring from: **Anterior surface of femoral neck** to **posterior surface of iliopsoas** 2) Still image of contralateral (unaffected) hip for comparison
Measurements / Diagnostic requirements:	Hip effusion defined as: 1) Either **>5mm** of effusion on affected side 2) Or **>2mm difference** in joint space between affected and unaffected sides Also document presence of: 1) **Bulging** or **Convex** joint capsule 2) **Thickened** synovium

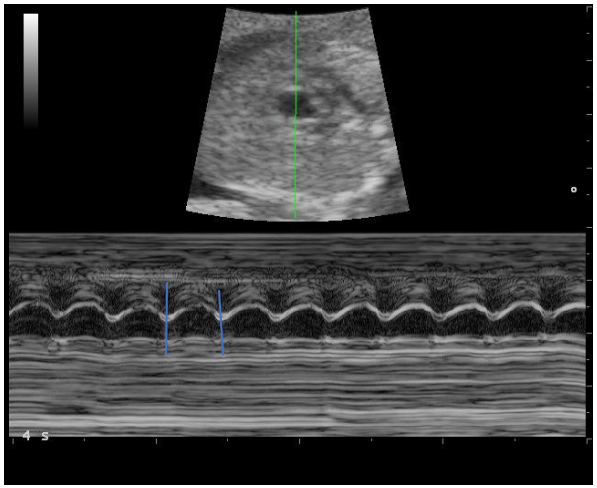
XI. VASCULAR ACCESS



Probe:	Linear (L10-5 “yellow” or L20-5 “blue” depending on size, location)
Orientation:	Patient supine Probe transverse to vein (indicator to pt’s right)
Technique & Image Optimization:	Visualize vein in cross section at point of its largest diameter
Recording requirements:	1) Still image of vein prior to cannulation 2) Save image with text stating if IV placement was successful **Do NOT need to save image of actual catheter in vein**
Measurements / Diagnostic requirements:	Ideal vessels are: **Large diameter** **Superficial** Do not attempt vessels >1.5cm deep

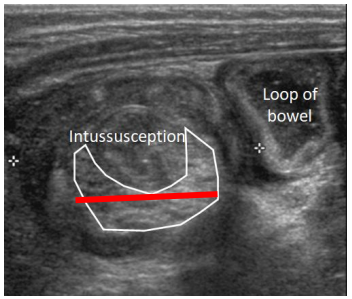


XII. FETAL HEART RATE

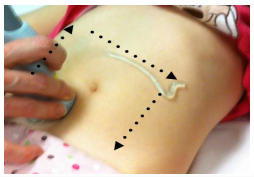


Probe:	Phased Array
Orientation:	Patient supine Probe overlying suprapubic area - scan along fetal trunk until heartbeat located Longitudinal or transverse
Technique & Image Optimization:	Change exam to "OB" under phased array probe exam list
Recording requirements:	1) Press "calc" and select "FHR" 2) Press M-mode button 3) Use mouse/trackpad to place line over beating heart 4) Press M-mode button again 5) Use track ball to place line over beginning of a valley 6) Press select and then move the second line over the next valley to the right of the 1st **Machine will auto calculate FHR**

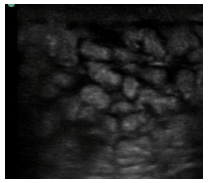
X. INTUSSUSCEPTION



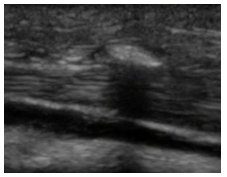
Probe:	Linear (L10-5 "yellow")
Orientation:	Patient supine 1) Begin in transverse, probe at right inguinal area. Visualize R. iliac vessels and psoas muscle (indicator to pt's right) 2) Scan ascending colon up to the liver, rotate 90° (indicator to pt's head) 3) Scan transverse colon across to splenic flexure, then rotate 90° (indicator to pt's right) 4) Scan descending colon until visualizing L. iliac vessels 5) May then repeat scanning of RLQ/RUQ for completeness
Technique & Image Optimization:	Use **graded compression** technique to displace bowel gas
Recording requirements:	1) Video clips of ascending, transverse, descending colon 2) Still transverse image: **Target sign** (intussusceptum inside intussuscipiens) 3) Still longitudinal image: **Sandwich or pseudokidney sign**
Measurements / Diagnostic requirements:	Ileocolic intussusception is: **Fixed** and **non-peristaltic** **Usually > 3cm in diameter** **Usually right-sided** Smaller and/or left-sided location suggests small bowel-small bowel intussusception



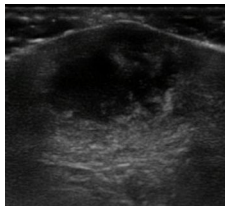
VIII. SOFT TISSUE



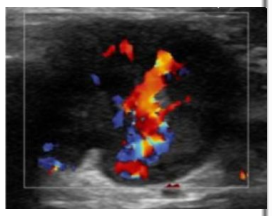
Cellulitis w/Cobblestoning



Foreign Body w/shadowing



Abscess w/Post. Enhancement



Lymph Node

Probe:	Linear (L10-5 "yellow" or L20-5 "blue" depending on size, location)
Orientation:	Probe oriented longitudinally then transverse to lesion
Technique & Image Optimization:	Adjust gain Adjust depth to show deeper bone/muscle Move area of interest to screen center
Recording requirements:	1) Video clip showing deeper landmark for localization (w/ increased depth) 2) Video clip in transverse 3) Transverse still image w/ X&Y calipers 4) Video clip in longitudinal 5) Longitudinal still image w/Z caliper For <u>Cellulitis</u>, document presence of: 1) **Thickened or hyperechoic** dermis 2) **Cobblestoning** 3) Also save image/clip of contralateral or unaffected area for comparison For <u>Abscess</u>, document presence of: 1) **Posterior acoustic enhancement** 2) "**Squish sign**" with compression (video) 3) **Color power doppler** (video) to differentiate from lymph nodes (which have internal blood flow) in appropriate anatomic areas (e.g. axilla, groin, neck) For <u>Foreign body</u>, document presence of: 1) **Posterior shadowing** 2) **Reverberation artifact** (metal, glass) 2) Still images of FB in transverse and longitudinal dimensions 3) Calipers showing length/width of FB