Amy Kule, MD (akule@lumc.edu)

Renal/Bladder Ultrasound Workshop

Workshop:

Location: SSOM, L71

Pre-Workshop Assignment:

- Review Dr. Kule's recorded lecture on LUMEN
- Watch Kidney and Bladder Ultrasound Scanning: (2:43) https://www.youtube.com/watch?v=B6odqSbUK0U

Session Details:

- Groups will rotate every 30 minutes (group assignments and schedule to be distributed ahead of time)
- ~7 minutes will be allotted per station across 4 stations
- Station rotation will be Station A → B → C → D → A
- 3-4 students per group
- Bring copy of lecture PowerPoint and session handout to the workshop to be used as reference

Workshop Assignment:

1. Complete assigned tasks as designated for each station
2. Submit group answers at station completion via Google Forms (links will be on iPad home page)

LEARNING OBJECTIVES

- Demonstrate appropriate probe selection and placement to perform an ultrasound scan of the kidneys and bladder.
- Perform a basic ultrasound scan of the kidneys and bladder.
- Review key anatomic structures of the renal and bladder system.
- Demonstrate an understanding of basic renal physiology concepts through point of care ultrasound.
- Collaborate with peers by actively engaging in educational tasks.
- Demonstrate professional behavior with peers, faculty, and standardized patients.

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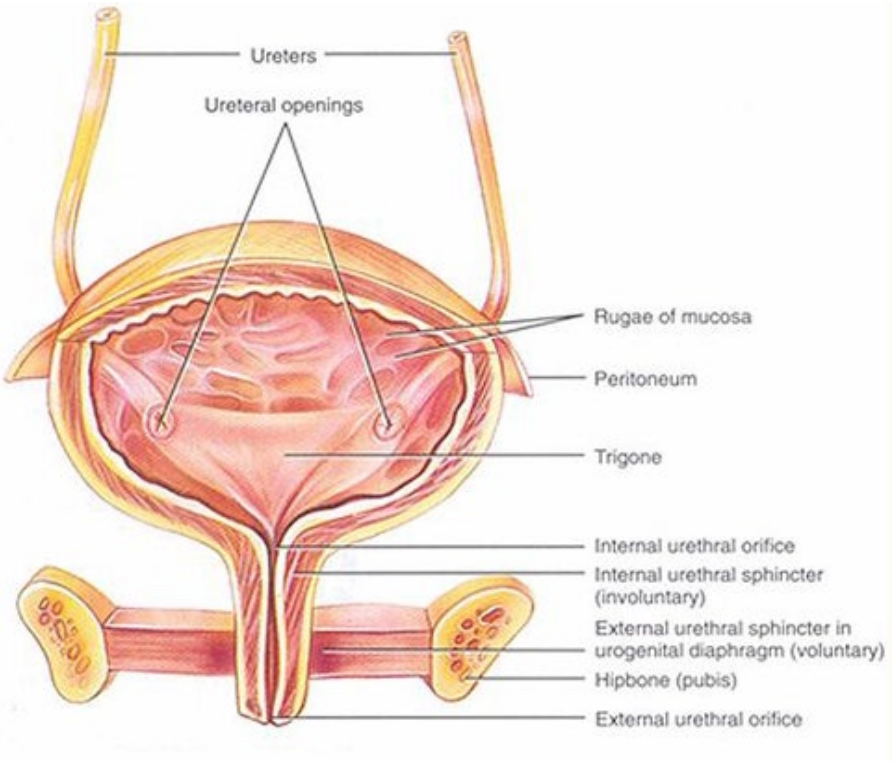
BLADDER ULTRASOUND

Bladder Anatomy



Credit: http://www.rudyard.org/wp-content/uploads/2014/06/human-bladder-anatomy.jpg

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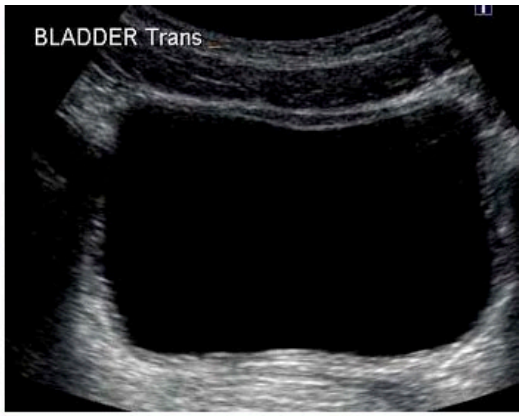
Bladder Ultrasound Scanning

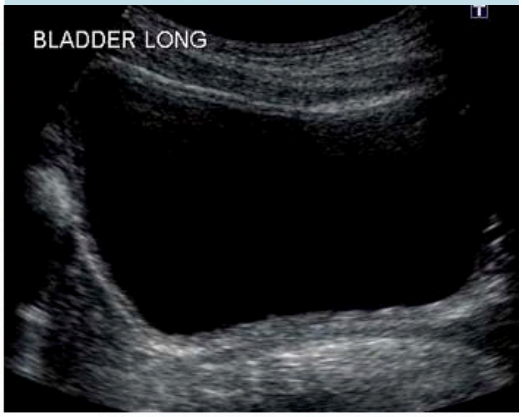
Probe Selection:
- Curvilinear (preferred)
- Phased array

Patient Positioning and Preparation:
- Supine
- A fuller bladder is easier to visualize

1. Bladder Scanning Technique:
   - Place the probe initially in transverse orientation (probe marker towards patient's right) above the pubic symphysis.
   - As the bladder sits within the pelvic cavity, aim the beam slightly towards the patient's feet.
   - Rotate the probe 90 degrees and scan in longitudinal orientation (probe marker towards patient's head).
   - As the bladder is a fluid-filled structure, it will appear anechoic.



Transverse Scan Plane | *Transverse Bladder Image*



Longitudinal Bladder View | *Longitudinal Bladder Image*

http://www.ultrasoundpaedia.com/normal-bladder/

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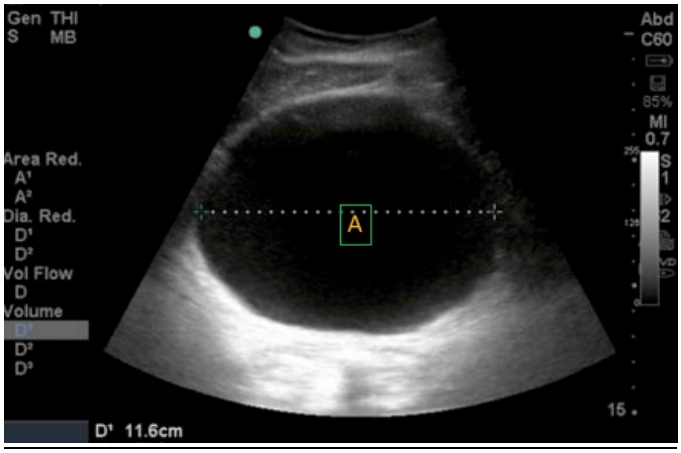
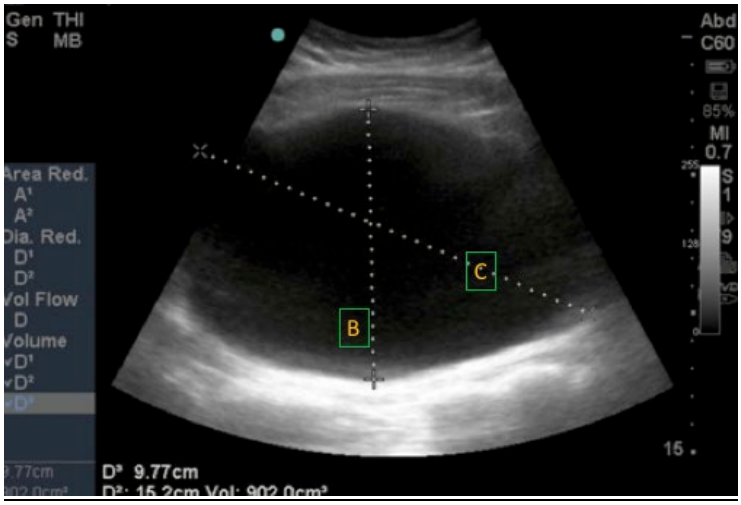
2. Calculating Bladder Volume:

- Obtain a **transverse** view of the bladder. **Fan** through the bladder and **freeze** when the bladder size is at its maximum. Using the ultrasound machine calipers, measure the bladder at its widest **width**. Note the width measurement (A).



- Unfreeze the image.
- Obtain a **longitudinal** view of the bladder. **Fan** through the bladder and **freeze** when the bladder appears at is maximum size. Measure the maximum bladder **height** using the ultrasound calipers. Note the height measurement (B).
- While remaining in longitudinal view, measure the maximum bladder length. It will be an oblique line. Note the length measurement (C).



- Calculate bladder volume using the formula **Width x Height x Length x 0.52**.

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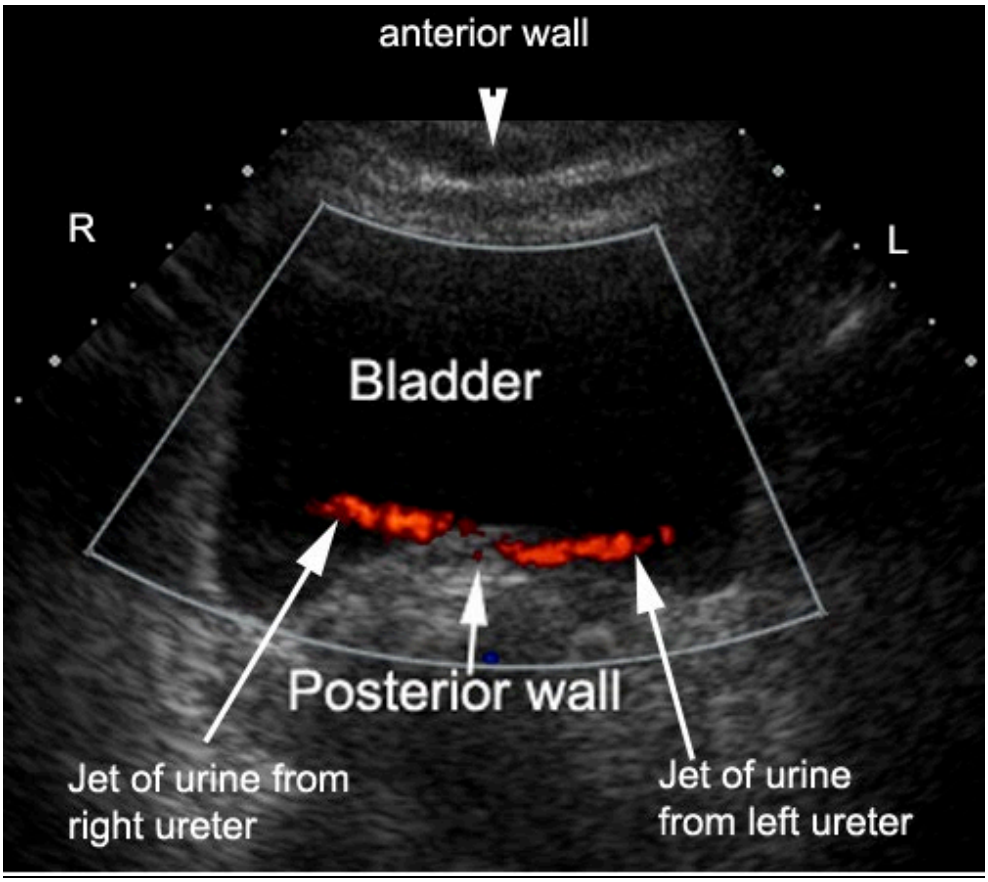
3. Ureteral Jets:

- Scan the bladder in **transverse** orientation.
- Turn on **Color Doppler mode** and move the box to the posterior bladder where the ureteral vesicular junction is located.
- Ureteral jets are intermittently visualized as urine enters the bladder.



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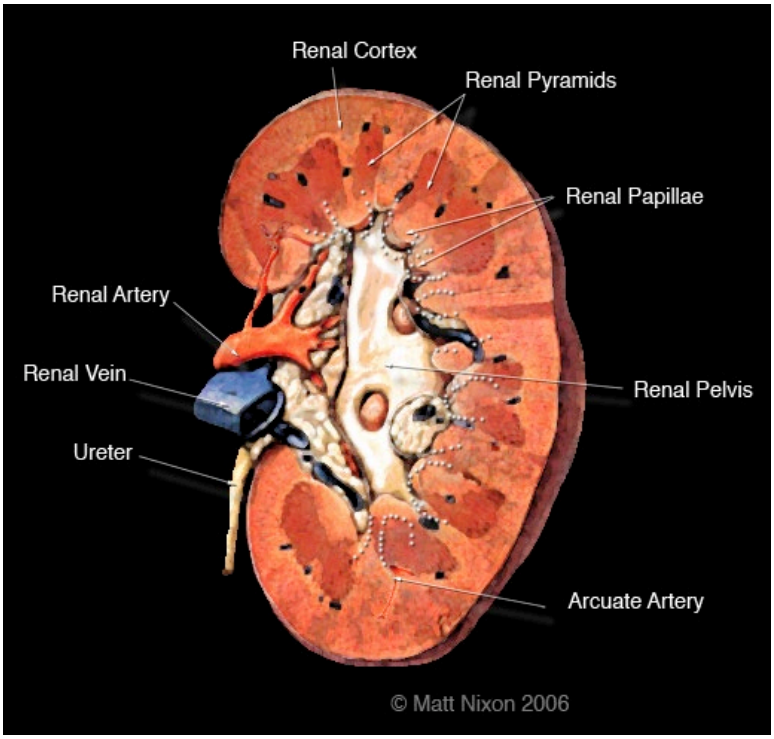
RENAL ULTRASOUND

Renal Anatomy



Renal Ultrasound Scanning

Probe Selection:
- Curvilinear
- Phased array

Patient Positioning and Preparation:
- Supine
- Consider lateral decubitus for a posterior approach

1. Renal Scanning Technique:
   - To obtain views of the right kidney, place the probe in the coronal orientation in the right lower intercostal space in the mid-axillary line. The right kidney lies below the liver in the retroperitoneal space.
   - To view the left kidney, place the probe again in a coronal orientation, but in the left lower intercostal space in the posterior axillary line. The left kidney lies below the spleen.
   - Compared to the right, the left kidney is positioned more cephalad (about 2-8 cm) and more posterior. Therefore, the ultrasound probe may be resting almost on the level of the bed to obtain views of the left kidney.

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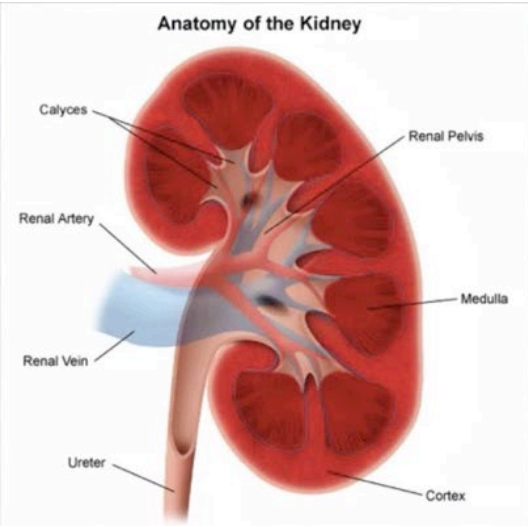
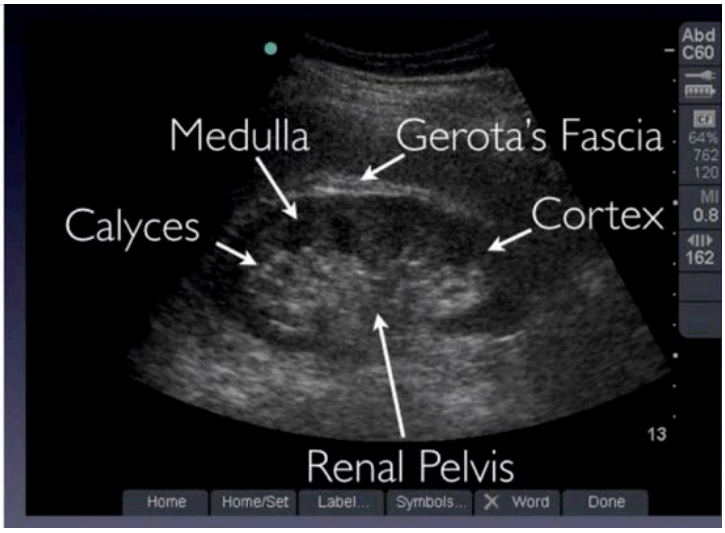
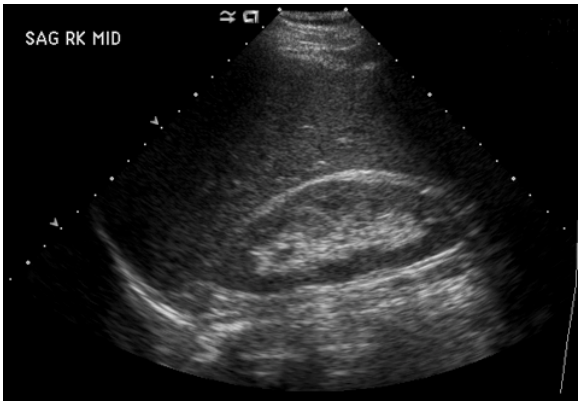
- Rock and fan the probe to scan through the entire kidney. Rotate the probe 90 degrees to obtain a transverse view of the kidneys.
- Consider angling the probe slightly oblique (probe marker towards the bed) to avoid rib shadow artifact.
- Instructing the patient to take and hold a deep breath can bring the kidney caudally into view.

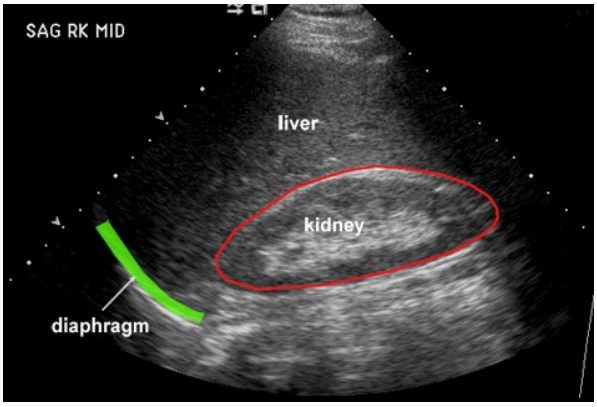
- On longitudinal view, the kidney appears football shaped, whereas on transverse view it appears C-shaped.
- Gerota's fascia and perinephric fat surrounds the kidney, which is seen as hyperechoic on ultrasound
- The periphery is made up of the renal cortex and pyramids/medulla, which appear grainy and hypoechoic compared to the renal capsule
- The central area (renal sinus) consists of the calyces, renal pelvis and renal sinus fat. This will appear hyperechoic on ultrasound





Sagittal (longitudinal) view of the right kidney





Transverse view of the right kidney