Right Upper Quadrant (RUQ) Abdominal Ultrasound

I. Patient Preparation

a. NPO 6-8 hours prior to the exam for adults, adolescents and school-age children
b. NPO for 4 hours prior to the exam for children under the age of 5.

II. Equipment

a. Performed with real-time scanner using a sector or curved linear transducer with frequencies ranging from 3.5 MHz to 5.0 MHz, higher frequencies often necessary for children and infants. On occasion, large patients may require a lower frequency of 2.5 or 1 MHz.
b. Linear transducer with and without standoff pad may be necessary for additional superficial areas of concern or superficial intraperitoneal pathology.
c. Matrix x-plane and volumetric gray scale and/or power/color 3D evaluation can be employed.

III. Procedure Protocol

a. For **any** masses seen in any organ, use Power Doppler to assess for blood flow. All lesions should be demonstrated in gray scale with and without measurements, with imaging directed to evaluate the borders, echogenicity, size, mobility, through transmission, compressibility, vascularity as needed. Additional maneuvers such as Valsalva and compression should be employed if necessary.
b. Different patient positions (e.g., supine, oblique, prone, decubitus, standing, sitting) should be documented if needed to evaluate for mobility of intraabdominal mass (i.e., gallstones, fixed intraabdominal mass versus mobile intraabdominal mass) or to evaluate the abdominal wall (i.e., ventral abdominal hernia).
c. If any area cannot be visualized due to bowel gas or surgical removal, etc., please note on image "region of" or "fossa"
    i. Pancreas
        1. Image the pancreas in Sagittal and Transverse planes, taking images at the head, neck/uncinate process, body and tail or as much as can be seen.
        2. If the CBD can be seen at the head of the pancreas, take an AP measurement.
        3. Assess the peri-pancreatic region for any adenopathy, inflammation, pseudocyst or fluid. Image any abnormality. Orally administered water may afford better visualization of the pancreas.
    ii. Gallbladder
        1. Image the gallbladder neck, body and fundus in the Sagittal and Transverse planes with the patient supine and left lateral decubitus positions. The gallbladder may also be evaluated with the patient sitting up. **Note: You may image the parts of the GB in combination (ie. Neck/body or body/fundus together)
        2. The gallbladder wall thickness should be measured in the Transverse plane using an AP measurement.
        3. Assess for focal gallbladder tenderness (+Murphy's sign), gallstones (measure largest one), pericholecystic fluid and gallbladder polyps.
        4. Assess the area around the GB for any abnormality including pericholecystic fluid, inflammation, varices, and adenopathy.
    iii. Biliary Tree
        1. Image the bile duct anterior to the portal vein in the porta hepatis. Measure AP at the largest diameter. If the duct narrows after a dilation, measure both areas.

2. If duct is dilated, follow as far distal as possible. It may be necessary to turn patient to a LLD position. Evaluate for reason of dilation (pancreatic head mass, choledocholithiasis, etc.)
3. The intrahepatic and extrahepatic bile ducts should be evaluated for dilatation, wall thickening, intraluminal findings, pneumobilia, and other abnormalities. The intrahepatic ducts can be evaluated by obtaining views of the liver demonstrating the right and left branches of the portal vein. Doppler may be used to differentiate hepatic arteries and portal veins from bile ducts.

iv. Liver

1. Image the liver in the Sagittal (Longitudinal) and Transverse planes. Image the left lateral segment, left medial segment/caudate lobe, right anterior segment, right hepatic dome, right posterior segment/diaphragm, and right posterior segment/kidney in the longitudinal plane. Image the left lateral segment, left hepatic dome, left medial segment/caudate, right anterior segment/hepatic veins, right anterior segment/hepatic veins (with color), right hepatic dome in the transverse plane.
2. Assess the liver for echogenicity and size, using the right kidney for comparison. Measure the liver length using coronal right lobe ($\geq$ 17 cm is enlarged, although consider normal variant Riedel's lobe).
3. Evaluate the liver parenchyma for any focal or diffuse abnormalities.
4. Assess the major vessels of the liver, including the hepatic veins, main portal vein (see v.), and, if possible, the left and right branches of the portal vein.
5. An attempt should be made to demonstrate the right hemidiaphragm and the adjacent pleural space.

v. Portal vein

1. Evaluate the main portal vein with color and pulsed Doppler (normal monophasic waveform). Assess for direction of flow (hepatopetal is normal).

vi. Right Kidney

1. Image the right kidney in the Sagittal and Transverse planes, include the liver/right kidney interface.
2. Measure the kidney length (maximum elongated kidney at hilum) on the longitudinal image at the center. Measure the width and AP on the transverse mid pole image. Color Doppler should be used if any hypoechoic areas identified and/or if clinical concern for pyelonephritis (i.e., right flank pain).
3. Assess the kidney for any masses, hydronephrosis, calculi, or cysts. Assess the peri-renal area for any abnormalities, such as perinephric fluid, mass, adenopathy. The renal calyces and pelvis should be assessed.
4. Decubitus, prone, or upright positioning may provide better images of the right kidney. When possible, renal echogenicity should be compared to the adjacent liver. If the right kidney is poorly visualized, narrowing the sector width and adjusting the depth should be performed to better assess the right kidney.

vii. Right Adrenal Gland

1. The right adrenal gland is typically not visualized in adults, although should be evaluated in every patient with documentation of adrenal masses or thickened right adrenal gland if identified (usually located superior to the right kidney).
2. In infants and neonates, image and measure in Sagittal and Transverse planes
3. Assess for masses, hemorrhage, calcification, or other abnormality.