ABDOMINAL ULTRASOUND EXAMINATION

POLICY: Abdominal ultrasound will be performed with an order from a physician or other qualified clinical practitioner. The examination will be supervised and interpreted by a radiologist or other licensed practitioner who is qualified by reason of training to understand the normal anatomy, pathophysiology of the abdomen, and integration of ultrasound with other imaging techniques to optimize the probability of detecting disease.

PURPOSE: To assess the anatomy of the abdomen and document normal and abnormal structures therein.

INDICATIONS: Ultrasound of the abdomen is indicated for patients with signs, symptoms, and/or laboratory evidence of hepatic, biliary, pancreatic, splenic, and/or enteric disease. This examination is an appropriate study for patients with nonspecific abdominal complaints. Patients who, for historical reasons, are at risk for abdominal disease, even without signs, symptoms, or laboratory evidence, are also candidates for abdominal ultrasound examination.

PATIENT PREPARATION: Outpatients should be fasting for a minimum of eight hours prior to the exam. Non urgent inpatients should be fasting for at least six hours if possible. Emergency Room and acute patients can be examined without fasting. Patients should be instructed to take prescribed oral medication on their normal schedule with small sips of water. The preparation for patients receiving diabetic medication (oral or injectable) must be approved by the radiologist or nurse.

PROCEDURE: Each organ should be imaged in its entirety (e.g. long and transverse views) before imaging the next organ. When any measurement is performed, an image should be captured with and without measurements. The order of organ imaging will be (minimal number of images in parenthesis):

- Liver (14 images)
- Gallbladder/bile duct (7 images, 1 cine sweep)
- Right kidney (5 images)
- Pancreas (4 images)
- Aorta/IVC (6 images)
- Spleen (3 images)
- Left kidney (5 images)

LIVER:
- The liver should be examined to investigate the entire contour, size [1], intrahepatic vascular and ligamentous anatomy [2,3], and parenchymal pattern [4,5].
- The examination can be performed in supine or decubitus positions, with respiration suspended at a level that optimizes images of the desired anatomy.
- The anterior subcostal approach should be employed when it feasible to do so. An intercostal approach can be used as an alternate or supplementary window when necessary.
- **Minimal stored images should include:**
  - three sagittal views of the liver to the right of the porta hepatis, labeled *Liver Long*; images should include the maximal cephalocaudad length of the right lobe measured from the diaphragm to its inferior tip in a parasagittal plane, and the right kidney to allow comparison of the
relative echogenicity of the two organs

- one sagittal view of the liver to include the main portal vein in the porta
hepatis, labeled Liver Long
- one sagittal view of the liver to include the inferior vena cava, labeled
Liver IVC Long
- one sagittal view of the lateral segment of the left lobe, labeled Liver Long
- one transverse view of the left lobe to include the left lateral contour of
the liver and the fissure of the ligamentum teres, labeled Liver Trans
- one transverse view of the liver to include the venous confluence of
the hepatic veins and the inferior vena cava, labeled Liver Trans
- one transverse view of the liver to include the main portal vein in the
porta hepatis, labeled Liver Trans
- one transverse view of the liver to include color Doppler of a
longitudinal segment of the main portal vein, demonstrating patency
and direction of flow, labeled Liver MPV Trans
- three transverse views of the right lobe to demonstrate representative
views of the superior, middle, and inferior thirds of the right lobe,
including its lateral and posterior contours, labeled Liver Trans

- In the presence of cirrhosis, the patient is at risk for hepatocellular carcinoma
(HCC). Therefore, in a patient with chronic hepatitis (potentially undiagnosed
cirrhosis) or cirrhosis, the entire liver should be screened for the presence of
a liver mass which could represent HCC, and the following cines should be
obtained:
  - one sagittal cine of the entire right lobe of the liver, from the lateral right
margin through the porta hepatis, labeled Liver Long Rt-Lt
  - one transverse cine of the entire right lobe of the liver, from the dome through
the inferior margin, labeled Liver Trans Sup-Inf
  - one sagittal cine of the entire left lobe of the liver, from the porta hepatis
through the lateral left margin, labeled Liver Long Rt-Lt
  - one transverse cine of the entire left lobe of the liver, from the superior margin
through the inferior margin, labeled Liver Trans Sup-Inf
  - one image of the surface contour of the liver, obtained using linear transducer,
labeled Liver Surface Contour

BILIARY SYSTEM:

- The gallbladder should be examined to consider stones [6,7], wall thickness and
irregularities [8,9], pericholecystic structures, and tenderness to palpation with the
ultrasound transducer (Murphy’s Sign) [10].
- The gallbladder must be examined with the patient in at least two different positions to
assess the mobility of intraluminal objects (e.g. gallstones). In the presence of
gallstones, multiple positions should be employed in order to differentiate mobile
gallstones from gallstones lodged in the neck of the gallbladder.
- The intrahepatic branches of the bile ducts should be investigated in each lobe of the
liver, and the extrahepatic segment of the bile duct examined through its entire
course from the porta hepatis to the sphincter of Oddi [11,12], searching for
enlargement or intraluminal objects (e.g. stones).
- **Minimal stored images should include:**
  - two longitudinal views of the gallbladder with the patient in a position
that optimizes visualization of the gallbladder, labeled GB Long; images
should include the neck and fundus of the gallbladder, as well as the
gallbladder wall
  - one longitudinal cine of the gallbladder, labeled GB Long
• one longitudinal view of the gallbladder with the patient in a different position (e.g. exaggerated left lateral decubitus, upright, prone/kneeling) focused on the most dependent segment of the gallbladder, labeled GB LLD (or Upright, Prone, etc.)
• one transverse view with the patient in a position that optimizes visualization of the body of the gallbladder, labeled GB Trans
• two views of the extrahepatic bile duct at the point of its maximal luminal diameter, labeled Bile Duct; color Doppler may be utilized to isolate the bile duct from surrounding vessels; images should include a measured maximal diameter

KIDNEYS:
• Examination of the kidneys should be performed to visualize the entire capsule. The kidneys should be imaged in a longitudinal and transverse planes (the transverse plane is perpendicular to the long axis). Observations should include the renal size [18,19,20], contour [21,22,23], intrinsic echogenicity of the kidneys [24], condition of the collecting structures [25], echogenicity of the kidneys relative to the liver and spleen [26,27], and perinephric spaces.
• Images of the kidneys should be sufficient enough to allow for assessment of the renal cortex, medulla (pyramids), and sinus.
  • If a renal cortical thickness is requested, measurements should be obtained at the superior, middle and inferior regions of the kidneys. The cortex should be measured at the thinnest point, from the peripheral surface of a renal pyramid to the renal capsule. The average value of these measurements should be reported.
• The kidneys should be examined in the orientation (e.g. sagittal, coronal) and patient position (e.g. prone, decubitus, or supine) that optimizes its visualization (e.g. supine, head of the bed angled slightly upright)
• In the presence of a dilated collecting system, the kidneys should be imaged after voiding the urinary bladder in order to demonstrate persistence of the dilatation.
• **Minimal stored images of the kidneys should include:**
  • two longitudinal views of each kidney with the maximal length measured, labeled Rt or Lt Kidney Long
  • one transverse view of the middle third of each kidney with the maximal anteroposterior and transverse diameters measured, labeled Rt or Lt Kidney Trans
  • one longitudinal view of the each kidney, with sufficient volume of liver or spleen, to allow comparison of the relative echogenicity of those organs to the kidneys, labeled Rt or Lt Kidney Long (if imaging of the liver and/or spleen has already satisfied this requirement, then additional images are not required)

PANCREAS:
• The pancreas should be examined to evaluate its entire contour [13.14], parenchymal pattern [15,16], intrapancreatic segment of the common bile duct, main pancreatic duct [17], and peripancreatic structures.
• The pancreas should be examined with the patient in a position that optimizes its visualization (e.g. supine, head of the bed angled slightly upright)
• The pancreas should be examined through any sonographic window that optimizes its visualization (e.g. left lobe of the liver, gallbladder, spleen and/or fluid distended stomach)
• **Minimal stored images of the pancreas should include:**
  • three transverse views of the pancreas, one focused on the body
anterior to the splenic vein, one focused on the head to include the intrapancreatic segment of the common bile duct, and one directed at the tail, labeled Pancreas Trans.

- one long axis view of the pancreatic head to include the intrapancreatic segment of the common bile duct, labeled Pancreas Trans (if imaging of the bile duct has already satisfied this requirement, then additional images are not required)

AORTA/RETROPERITONEUM:
- The entire length of the abdominal aorta and proximal few centimeters of the common iliac arteries should be visualized to evaluate their contour [28] and size [29,30,331,32,33,34]. They should also be evaluated for the presence or absence of intraluminal or surrounding masses. The proximal few centimeters of the celiac and superior mesenteric arteries should be visualized.
- The aorta/retroperitoneum should be examined with the patient in a position that optimizes visualization (e.g. supine, either lateral decubitus position) [35].
- The inferior vena cava should be visualized to evaluate its position, size, and the presence or absence of intraluminal or surrounding masses [36].
- **Minimal stored images of the aorta/retroperitoneum should include:**
  - one longitudinal view of the proximal third of the aorta, between the diaphragmatic hiatus and the superior mesenteric artery, measured in its maximal anteroposterior diameter (from adventitia to adventitia), labeled Aorta Long Prox
  - one longitudinal view of the middle third of the aorta, distal to the superior mesenteric artery and the aortic bifurcation, labeled Aorta Long Mid
  - one longitudinal view of the distal third of the aorta, to include the blunt end (representing the aortic bifurcation), measured in its maximal anteroposterior diameter (from adventitia to adventitia), labeled Aorta Long Dist
  - one sagittal view of the intrahepatic segment of the inferior vena cava, labeled IVC Long; (if imaging of the liver has already satisfied this requirement, then additional images are not required)

SPLEEN:
- The spleen should be investigated to consider its size [1], entire contour, and parenchymal pattern.
- The spleen should be examined with the patient in any position that optimizes its visualization (e.g. supine, right lateral decubitus, upright).
- **Minimal stored images of the spleen should include:**
  - two longitudinal views, labeled Spleen Long; images should include the maximal length measurement and the left kidney to allow comparison of the relative echogenicity of the two organs
  - one view orthogonal to the long axis view, labeled Spleen Trans;
  - if indicated, a volume measurement of the spleen may be obtained using three orthogonal dimensions: maximal length, height (perpendicular to the length) and width.

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