Spleen
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SPLEEN

1) Other Names:

- N/A

2) Definition/Location:

- The spleen is a part of the reticuloendothelial system, which plays a role in the synthesis of blood proteins and is the largest single mass of lymphoid tissue in the body (Hagen-Ansert, p. 358, C1/P1/S1).
- Responsible for hematopoiesis (blood formation) during the initial part of fetal life and this function gradually decreases by the fifth or sixth month (Hagen-Ansert, p. 358, C1/P1/S2)
- Plays a important part in the defense of the body (phagocytosis), which is often affected by systemic disease processes and is rarely the primary site of disease (Hagen-Ansert, p. 358, C2/P1/S4)
- The spleen lies in the left hypochondrium and its long axis is along the shaft of the tenth rib, with its lower pole extending forward to the midaxillary line (Hagen-Ansert, p. 358, C2/P1/S1).
- It occupies the posterolateral section of the left upper quadrant, inferior and anterior to the diaphragm. It is located laterally to the: stomach (depending on its size it may be posterior to it), tail of the pancreas, left kidney, adrenal gland, and the splenic flexure of the colon (Tempkin, p. 123 "Location").
- The spleen is attached to the stomach and the left kidney by peritoneal ligaments (Hagen-Ansert, p. 358, C2/P1/S4).
- The spleen is an intraperitoneal organ covered with a protective peritoneum capsule over its entire extent except for a small area (bare area) at its hilum, where the vascular structures and lymph nodes are located (Hagen-Ansert, p. 358, C2/P1/S3).
- Vascular supply to the spleen :
  - Splenic Artery: forms the superior border for the pancreas, then divides into six branches once reaching the splenic hilum (Hagen-Ansert, p. 358, C2/P3/S1).
  - Splenic Vein: formed by multiple branches within the spleen and leaves the hilum to join the superior mesenteric vein (returns unoxygenated blood from bowel to form the main portal vein) (Hagen-Ansert, p. 358, C2/P4/S1).
  - Lymph vessels emerge from the splenic hilum, passes through other lymph nodes along the course of the splenic artery, and drain into the celiac nodes (Hagen-Ansert, p. 358, C2/P5/S1).
- The spleen is not essential to life (Tempkin, p. 123 "Physiology").

3) Ultrasound Appearance:

- Appears homogeneous in texture, very smooth and medium gray in color (Curry-Tempkin, p. 209, C1/P1/S1).

- Isoechoic or hypoechoic to the liver (Curry-Tempkin, p. 209, C1/P1/S3).
- Interspersed within the spleen are small vascular structures that are seen as branching, anechoic, and round or tubular. Closer to the hilum, the larger venous structures can be distinguished from the smaller arterial branches (Tempkin, p. 124 "Sonographic Appearance").

4) Normal Size Range(s):

- Size varies in different individuals and at different times it can vary for the same individual (Curry-Tempkin, p. 205, C2/P6/S1).
- The longest dimension from superior to inferior should be 8 - 13 cm (7 – 8 cm in CT) (Hagen-Ansert, p. 363, C2/P2/S2).
- The largest transverse image (anteriorposterior) dimension is 5cm to 8cm and less than 6 cm thick (Hagen-Ansert, p. 363, C2/P2/S2) & (Curry-Tempkin, p. 212, "Normal Measurements").
- If spleen measures more than 13 cm in adult patients or more than the normal length for a child, Splenomegaly may be diagnosed (Hagen-Ansert, p. 363, C2/P2/S5).

5) Pertinent Lab Data: (Curry-Tempkin, p. 212, "Laboratory Values")

- Hematocrit: Indicates the percentage of red blood cells per volume of blood.
  - Male: (Normal) 40% - 54%
  - Female: (Normal) 37% - 47%
  - Abnormally low hematocrit points to internal bleeding
- Bacteremia: The presence of bacteria with the blood system, also known as sepsis.
  - Symptoms: chills, fever, and possibly the presence of abscesses.
- Leukocytosis: An increase in the number of circulating leukocytes.
  - Above 10,000 per cu mm
  - Indicates an infection of the blood
- Leukopenia: An abnormally low number of leukocytes in the blood.
  - Below 5,000 per cu mm
  - May develop due to certain drugs, or to a bone marrow disorder
- Thrombocytopenia: An abnormal decrease in the number of circulation platelets.
  - Normal: 150,000 to 350,000 per cu mm
  - Decrease may be due to internal hemorrhage.

6) Common Pathologies:

- **Accessory Spleen**: A more common congenital anomaly which may be difficult to see if it is very small. Sonographic findings include a homogeneous pattern. The location varies from the diaphragm to the scrotum. Lesions may also be in the normal spleen (http://www.sonoworld.com).
- **Splenomegaly**: Most common pathology. Sonographic findings include an enlarged spleen with a long axis ≥ 13 cm. Also look for liver abnormalities (Hagen-Ansert, p. 365, "Table 11-1").
- **Splenic Abscess**: Uncommon, sonographic findings include a mixed echo pattern, thick or shaggy walls, anechoic appearance, poor definition of the lesion, irregular, ill-defined borders, may have internal septa, and increased to decreased transmission (Hagen-Ansert, p. 365, "Table 11-1").

- **Sickle Cell Anemia**: Presents different sonographically depending on the stage of the disease. Sonographic findings include an enlarged spleen at childhood which undergoes progressive infarction and fibrosis. It decreases in size until adulthood, where only a small mass of fibrous tissue may be found (autosplenectomy) (Hagen-Ansert, p. 368, C1/P1/S1).
- **Splenic Infarction**: Most common cause of focal splenic lesions.
  - **Acute**: Sonographic findings include a wedge-shaped hypoechoic area (Hagen-Ansert, p. 365, "Table 11-1").
  - **Chronic**: Sonographic findings include a wedge-shaped, echogenic area with the base pointing to the periphery (Hagen-Ansert, p. 365, "Table 11-1").
- **Splenic Trauma**: Most common injury due to blunt abdominal trauma. Splenomegaly will occur due to hematoma that may form later along the subcapsular area or internally (Hagen-Ansert, p. 365, "Table 11-1").
- **Splenic Cysts**: An asymptomatic pathology that has the following sonographic findings: solitary, anechoic, increased transmission, well-defined walls, and possible tissue compression (Hagen-Ansert, p. 365, "Table 11-1").

7) Patient Prep:

- None (Tempkin, p. 124, "Patient Prep").

8) Transducer (Probe) Frequency: (Tempkin, p. 124, "Transducer")

- 5.0 MHz for intercostal or lateral subcostal scanning approaches.
- 3.0 or 3.5 MHz for anterior or posterior scanning approaches.

9) Protocol: (Tempkin, p.127-129 "Requires Images")

- Longitudinal Images: (Left Lateral Approach)
  - Long axis image of the spleen.
  - Superior longitudinal image of the spleen to include the adjacent pleural space.
  - Inferior longitudinal image of the spleen to include part of the left kidney for parenchyma comparison.
- Transverse Images: (Left Lateral Approach)
  - Transverse image of the spleen to include both anterior and posterior margins.
  - Transverse image of the spleen to include the anterior margin and splenic hilum.
  - Transverse image of the spleen to include the posterior margin.

10) Image Reference:

- Hagen-Ansert, p. 360, Fig. 11-2
- Hagen-Ansert, p. 361, Fig. 11-4
- Hagen-Ansert, p. 362, Fig. 11-5
- Hagen-Ansert, p. 363, Fig. 11-6
- Hagen-Ansert, p. 364, Fig. 11-7
- Hagen-Ansert, p. 367, Fig. 11-11
- Hagen-Ansert, p. 368, Fig. 11-12
- Hagen-Ansert, p. 370, Fig. 11-17
- Hagen-Ansert, p. 371, Fig. 11-19

- Hagen-Ansert, p. 372, Fig. 11-20
- Hagen-Ansert, p. 373, Fig. 11-21

11) References:

- Curry, R.A. and Tempkin, B.B. (2004). Sonography: Introduction to normal structures and function (2nd ed.). St. Louis, MO: Saunders.
- Hagen-Ansert, S.L. (2006). Textbook of diagnostic ultrasonography (6th ed.)(Vol. 1). St. Louis, MO: Mosby.
- MedImageWorld L.L.C. (2002-2005). *Anomalies*. Retrieved June 28, 2006, from http://www.sonoworld.com/Sonoworld/Chapter/ShowBookChapter.aspx?bid=2&cid=12&PageId=3.
- Tempkin, B.B. (1999). Ultrasound scanning: Principles and protocols (2nd ed.). Philadelphia, PA: Saunders.