Hepatocellular Carcinoma: Sonographic Signs, Clinical Symptoms, and Differential Diagnosis

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Anatomical Location and Physiological Function of the Liver:

- Largest organ; located in right hypochondrium; separated into right, left, and caudate lobes
- Hepatic Veins: intersegmental, divide the right and left lobe in half; non-echogenic walls
- Portal Veins: intrasegmental; covered by Glisson’s Capsule allowing for echogenic walls/borders. Part of the portal triad (hepatic artery, portal vein, and common hepatic duct)
- Caudate lobe: lies on the posterior-superior surface and receives branches from both the right and left portal veins

- Metabolism:
  - Carbohydrates: converts glucose into glycogen and stores this; when glucose is needed breaks down glycogen into glucose.
    - Liver abnormalities: can lead to hypoglycemia or hyperglycemia due to glucose synthesis and glycogen storage
  - Fats: dietary fats converted into lipoproteins and transported throughout the body. Conversely, stored fats can be transported to the liver and converted into glucose/other substances for energy
- Proteins: produces albumin for transportation of molecules. Also primary source of proteins necessary for blood coagulation (fibrinogen, prothrombin, and factors V, VII, IX, & X)

- **Digestion:** excretes bile which helps with the digestion of fats

- **Storage:** for iron and certain vitamins

- **Detoxification:** ammonium is broken down to nontoxic urea; medications and foreign chemicals broken down

**Hepatocellular Carcinoma:**

- Also known as hepatoma

- Most common primary malignancy of the liver
  - Incidence in US: 5 out of every 100,000 people
  - More Common in men

- Etiology: Alcoholic Cirrhosis and Hepatitis B/C
  - Africa/Southeast Asia: Chronic Hepatitis B/C and aflatoxin exposure (from food)

- Pathogenesis:
  - Cirrhosis: 80% of patients with cirrhosis develop HCC
  - Chronic Hepatitis B infection
  - Hepatocarcinogens in foods (artificial sweeteners, colorings and preservatives added to food)

**Other body systems, blood vessels, etc. HCC affects:**

- HCC commonly invades venous structures (i.e. portal veins or hepatic veins)
  - Budd-Chiari syndrome: thrombosis of the hepatic veins or IVC
- **Clinically:** presents with abdominal pain, massive ascites, jaundice, and hepatomegaly
- **Sonographically:** enlargement of caudate lobe with atrophy of right lobe; enlarged veins in acute cases and chronically veins not visible; abnormal Doppler flow patterns
- Portal vein thrombosis: increase of portal venous pressure or hepatic venous gradient commonly caused by patients with pre-existing cirrhosis
  - **Sonographically:** hepatofugal flow with collateral pathways (coronary and esophageal veins); ascites; and hepatosplenomegaly
- Abnormal LFT’s; 70% of patients have increased alphafetoprotein levels

**Pre-existing factors leading to HCC:**

- **Cirrhosis:** chronic degenerative disease of the liver parenchyma
  - Most commonly caused by alcohol abuse; also seen from nutritional deprivation, hepatitis, or infections
  - **Clinical Symptoms:** nausea, flatulence, ascites, light-colored stools, weakness, abdominal pain, jaundice, and varicosities
  - **Sonographic Signs:** increased attenuation/echogenicity; decreased vascular markings; hepatosplenomegaly; ascites; caudate lobe hypertrophy; portal vein hypertension with abnormal Doppler flow patterns
• **Hepatitis**: inflammation of the liver parenchyma for various reasons
  
  • Hepatitis B: spread through infected blood, semen, or other body fluids
  • Hepatitis C: passed through contaminated blood (specifically with shared needles)
    • **Clinically**: loss of appetite, nausea, vomiting, fatigue, jaundice
    • **Sonographic Signs**:
      • Acute: slight increase in echogenicity, GB wall thickened, hepatosplenomegaly
      • Chronic: coarse parenchyma, decreased brightness of portal triad, and fibrosis

**Clinical Symptoms and Sonographic Signs Leading to HCC:**

• **Clinically**:
  
  • History of cirrhosis, palpable mass, hepatomegaly, appetite disorder, ascites, and fever

• **Sonographically**:
  
  • Solitary mass, multiple nodules throughout the liver, or diffuse infiltrative masses in the liver
  • Hypoechoic, isoechoic, or hyperechoic
  • **Halo sign** surrounding lesion
  • Chaotic vascular flow; internal flow to mass
• Tumor may present with a focal lesion, an invasive lesion with necrosis and hemorrhage, or poorly defined lesion

**Differential Diagnosis:**

• **Abscess:**
  • Clinically: WBC would be increased, abnormal LFT's, and anemia may be present.
  • Sonographically: may be hyperechoic, hypoechoic, or complex. Fluid level may be present and mass is round or oval with irregular walls

• **Hemangioma:** benign, congenital tumor consisting of large, blood-filled cystic spaces
  • Most common benign tumor of the liver; more common in females
  • Enlarge slowly and undergo degeneration, fibrosis, and calcifications
  • Clinically: no symptoms or RUQ pain
  • Sonographically: hyperechoic with acoustic enhancement. May become more heterogenous as they undergo fibrosis

• **Adenoma:** tumor of glandular epithelium in which the cells of the tumor are arranged in a recognizable glandular pattern
  • Common in females on oral contraceptives
  • Clinically: RUQ pain when mass bleeds
  • Sonographically: Hyperechoic with a central echogenic area caused by hemorrhage. Solitary or multiple; fluid may be present

• **Metastases:** most common form of neoplastic involvement of the liver
  • Primary sites are the colon, breast, and lung.
Sonographically: typical to have multiple nodes throughout both lobes of the liver. Three common patterns are: well-defined hypoechoic mass, well-defined echogenic mass, and diffuse distortion of the normal homogenous pattern without a focal mass.

Artifacts and Pitfalls Associated with this Type of Imaging/Disease:

- Properly adjust TGC, gain, and depth to include the entire liver to the diaphragm
- Based off of pathology found, use Color Doppler to help to further prove likeliness of malignancy
- Roll patient to be able to view liver better if gas/ribs cause problems
- Patient intolerance and body habitus can cause problems
- Reverberation artifact from gas and diaphragm
- Gas/bowel, ribs, inability to aid with breathing
- Pitfalls: no color flow in hepatic veins may not be due to thrombus. May be obscured by a scarred and shrunken cirrhotic liver (remember cirrhosis many times leads to HCC)
- Pitfalls: fat infiltration may cause areas of increased and decreased echogenicity versus a mass
- Pitfalls: ligamentum teres may be mistaken for a mass
- Patients inability to hold breath causing shadowing and masses not visualized