Solid Liver Masses

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Solid Liver Lesions

<table>
<thead>
<tr>
<th>Clinically Insignificant</th>
<th>Clinically Significant</th>
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<td>(work-up stops)</td>
<td>(work-up continues)</td>
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<tr>
<td>- Cavernous hemangioma</td>
<td>- Metastasis</td>
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<td>- FNH</td>
<td>- HCC</td>
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<td>- Focal fatty liver</td>
<td>- Adenoma</td>
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Represent almost 90% of all solid liver masses
In most cases you can reliably differentiate significant from insignificant by US imaging

Estimate of Mass Prevalence
Mayo Clinic US Exam

10,000 liver exams

2000 exams with lesions (20%)

1,000 cyst (10%)

1,000 solid (10%)

600 Malignant (6%)

400 Benign (4%)

Ultrasound features of typical hemangioma rarely overlap with appearance of metastasis, HCC or adenoma

Cavernous Hemangioma

- Most common benign liver lesion
- Incidence 4-7% at autopsy or imaging
- Asymptomatic lesion of no clinical significance
- Radiological importance
  - Differentiate from significant masses

Charboneau

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Liver Masses
Cavernous Hemangioma

Multiple, small blood filled spaces, separated by fibrous septations lined by endothelial cells

Typical Appearance:
- Homogeneous
- Hyperechoic
- Small < 3cm
- Sharp margin, often scalloped
- Solitary
- No hypoechoic halo

Junction of hemangioma with adjacent liver is sharp and one cell layer thick

Uncommon Sonographic Appearance

- Echogenic rim - Due to smaller vascular spaces at outer edge of the tumor seen in pathological specimen
- Hypoechoic center - caused by collagen scar

Farrell & Chaboneau et al JUM 2001
Uncommon Sonographic Appearance

**Cavernous Hemangioma**

- Echogenic rim - Due to smaller vascular spaces at outer edge
- Hypoechoic center - caused by collagen scar
- Lobulated border

- **Uncommon Sonographic Appearance**

  **Cavernous Hemangioma**

  - Echogenic rim - Due to smaller vascular spaces at outer edge
  - Hypoechoic center - caused by collagen scar
  - Lobulated border
  - Hypoechoic
  - Posterior enhancement - non-specific

- **Remember**

  - For many hemangiomas there is no change in acoustic enhancement
  - For some malignant masses there is acoustic enhancement

- **Cavernous Hemangioma**

  - Vascular lesions – CT / MRI
  - IV contrast
    - peripheral puddling
    - gradual centripetal fill in

- **Cavernous Hemangioma**

  - Flow is too slow to produce a Doppler shift
    - if see flow, ↑ concern for CA
Cavernous Hemangioma

- Fibrosis
- Thrombosis
- Hemorrhage
- Necrosis

Prevalence of CH

- Normal liver: 4-7%
- Cirrhotic liver: < 2%

Cavernous Hemangioma?

- High risk patient
  - H/O cancer
  - Cirrhosis

Any solid mass in a cirrhotic pt should be considered HCC until proven otherwise

Cavernous Hemangioma?

- Unusual features
  - Multiple in 20% of cases
  - Large

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Simulators of Cavernous Hemangioma

- Hyperechoic, but attenuate sound
- Hyperechoic, but has hypoechoic halo

 Colon
Neuroendocrine

Hypoechoic Halo – Exception!

- Neuroendocrine metastasis
- Extremely rare
  – Neuroendocrine 1/100,000 vs. CH 4000/100,000
- Patients usually symptomatic
- Patients usually have established diagnosis
- Almost always multiple & advanced when first detected

Benign vs. Malignant Liver Masses

- Value of hypoechoic halo (n=100)
- Halo presence – Malignant
- Halo absence – Benign
- Accuracy 87%

Werneck et al. ACR. Nov 1992

Increased awareness of value of halo
“You see what you look for and recognize what you know”

L.H. Garland, MD

- Higher resolution US systems
**Causes of Hypoechoic Halo**

- Histopathologically, has been shown to be caused by
  - An outer zone of proliferating malignant cells
  - Compression of adjacent liver
  - Vascular spaces – dilated sinusoids, or a fibrotic rim

**Hypoechoic Halo**

Role of Sonographer
- Document presence or absence
- Communicate to radiologist

**Peripheral hypoechoic halo is most evident during real-time exam**
Diagnostic Challenge

Liver Malignancy
“halo visibility depends on echogenicity of tumor”

Hyperechoic Tumor
Isoechoic Tumor
Hypoechoic Tumor

Visible halo
Visible halo
“No” Visible halo

Liver Malignancy
“halo visibility depends on echogenicity of tumor”

Mass With Halo
Hypoechoic Mass

Significant Mass
Metastasis, HCC, Adenoma, etc.

Hepatic Adenoma

• Rare benign tumor
• Hepatocytes
  – few Kupffer cells
  – no bile ducts
  – no capsule

Hepatic Adenoma

• Clinically significant
  – High association with spontaneous hemorrhage
  – Pain
  – Possible transformation to HCC
• Associated with
  – Women: BCP (dose & duration)
  – Men: anabolic steroids
  – Children: glycogen storage disease

Hepatic Adenoma

• If small
  – Homogeneous
  – Hypoechoic
**Hepatic Adenoma**

- Typical appearance is similar to other significant (malignant) masses
  - Heterogeneous
  - Hypoechoic
  - Peripheral halo

**Focal Nodular Hyperplasia**

- Second most common benign liver tumor
- Usually occurs in females (85%)
- More commonly detected today because of early phase (arterial) contrast material on spiral CT
- Like hemangioma, it is almost always clinically insignificant - Low risk of hemorrhage

**Role of Sonographer**

**Subtle Signs of A Liver Mass**
**Focal Nodular Hyperplasia**

- May have a color flow pattern of vessels radiating peripherally from a central feeding artery

**Hepatocellular Carcinoma**

- The most common primary malignancy of the liver
- Associated with chronic liver disease
  - Cirrhosis
  - Viral hepatitis B,C
- Major health problem in sub-Saharan Africa & Asia
  - High prevalence of hepatitis

**Hepatocellular Carcinoma**

US appearance depends on:

- Size of the mass
- Pathologic features
- Echogenicity of the surrounding liver

**Hepatocellular Carcinoma**

- Metastasis & multifocal HCC are indistinguishable
**Hepatocellular Carcinoma**

- Blood flow around the periphery & penetrating into the mass

*Tanaka’s “basket sign”*

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**HCC – Complications**

- High propensity for vascular invasion
  - PV > HV & IVC
  - Arterial-portal shunts
  - Tumor thrombus with arterial signals
- Necrosis, hemorrhage, infection
Liver Metastases

- The most common malignant liver lesion in North America
- The lungs & liver are the most frequent sites of distant metastatic disease

Liver Metastases

- Multiple (90%)
- Single
- Most are hypoechoic
  - Any size
  - Single / multiple
- Hyperechoic
Liver Metastases

- Multiple (90%)
- Single
- Most are hypoechoic
- Hyperechoic
- Calcified

Calcified Liver Metastases

- Colon
- Ovary
- Breast
- Stomach
- pancreas
- Melanoma
- Leiomyosarcoma
- Osteosarcoma
- Fibrolamellar HCC
- Calcified abscess & hematoma

Liver Metastases

- Multiple (90%)
- Single
- Most are hypoechoic
- Hyperechoic or Isoechoic
- Calcified
- Target appearance

Liver Metastases

- Multiple (90%)
- Single
- Most are hypoechoic
- Hyperechoic or Isoechoic
- Calcified
- Peripheral hypoechoic halo
- Target appearance
- Diffuse parenchymal infiltration

Liver Metastases – Complications

- Biliary duct obstruction
- Vascular invasion
- Necrosis
- Hemorrhage
- Infection

Scanning Techniques

Why this image is better?
How Would You Characterize This Mass?

- A. Hypoechoic
- B. Hyperechoic
- C. Isoechoic
- D. Anechoic
- E. Cystic
- F. Solid

Do you See Any Mass?

Fatty Liver

- Common
- Predisposing conditions:
  - Obesity, alcohol use, diabetes, idiopathic
- Pathology:
  - Fat deposition in hepatocytes
- Diffuse or focal
**Focal Fatty Liver**

- Geographic pattern
- Interdigitation of normal parenchyma
- No mass effect on vessels
- Solitary or multiple

**Focal Fatty Sparing**

- Focal area of normal liver echogenicity w/in otherwise diffusely echogenic liver
- Geographic - not round
- Vessels will penetrate
  - no mass effect
- May be mistaken for mass
  - confirm with CT/MR

**Focal Fatty Sparing - Common sites**

- Anterior to PH
- Near gallbladder
- Adjacent to left PV
- Adjacent to fissures
- Subcapsular
**Summary**

- Most cavernous hemangiomas are reliably differentiated from significant masses
  
  Homogeneous & Hyperechoic
  Solitary, Small < 3cm
  Sharp margin, often scalloped
  No hypoechoic halo

- **FNH** — most are
  - Homogenous, isoechoic, without halo
  - Confirmatory exam
    - CT, MR, RN, Biopsy

- **Adenoma**
  - Most appear as significant lesions and are not confused with cavernous hemangioma

- **Focal Fatty** — most appear as
  - Hyperechoic, geographic pattern
  - Hypoechoic, focal fatty sparing

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**Solid Liver Lesions**

**Clinically Insignificant** (work-up stops)
- Cavernous hemangioma
- FNH
- Focal fatty liver

**Clinically Significant** (work-up continues)
- Metastasis
- HCC
- Adenoma

Differentiate insignificant from significant mass by ultrasound criteria
Thank You