LIVER: Focal Benign and Malignant Disease

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Cystic Lesions

- Simple Cyst
- Caroli’s Disease
- Biliary Hamartomas
- AD Polycystic Kidney Disease

Complex Cystic Lesions

- Biliary Cystadenoma
- Abscess
- Cystic Met.
- Hydatid disease
- Organizing hematoma
- Post RF Ablation Cavity
Biliary Cystadenoma

• Benign and malignant cystic tumors of biliary origin may arise in the liver
• Multiloculated and can be filled with mucinous fluid.
• Mural nodules may be a component of some cysts
• High malignant potential. Which is directly related to the thickness of wall/sepatations and larger amounts of solid components
Evaluating Enhancing Liver Lesions

Outlines and Morphology
Homogeneous v. Heterogeneous Enhancement Pattern
Washout Pattern
Outlines and Morphology

Non-Cirrhotic

**FNH:** Can be homogeneous, although central scar in the majority; lobular contour

**Flash filling hemangioma:** Typically small, can be homogeneous, delayed retention of contrast. High signal on T2

**Adenoma:** Young female. History of oral contraceptive
- Presence of hemorrhage and lipid indicate the diagnosis

**Hypervascular Mets:** Primary cancer: thyroid, RCC, NET, pheochromocytoma. Multiplicity

**HCC:** Uncommon in the absence of cirrhosis.
- Hepatitis B can lead to HCC without cirrhosis
Hepatocellular Carcinoma (HCC)

- Most common primary malignant tumor.
- In cirrhosis is diagnosis of exclusion!

- AFP is usually elevated in advanced cases but is not used for screening under current AASLD guidelines.

- MR signal intensities vary greatly and no characteristic pattern exists for small tumors.

- Most HCCs show intense enhancement, although 10 – 15% are hypovascular
<table>
<thead>
<tr>
<th></th>
<th>HCC</th>
<th>Benign Nodule</th>
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<tbody>
<tr>
<td>AP Hyperintensity</td>
<td>84%</td>
<td>42%</td>
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<tr>
<td>T2 Hyperintensity</td>
<td>60%</td>
<td>16%</td>
</tr>
<tr>
<td>Washout</td>
<td>79%</td>
<td>65%</td>
</tr>
<tr>
<td>Hepatobiliary Delay Hypointensity</td>
<td>79%</td>
<td>51%</td>
</tr>
<tr>
<td>All 4 signs</td>
<td>42%</td>
<td>0%</td>
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<tr>
<td>≤ 1 sign</td>
<td>9%</td>
<td>64%</td>
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Kim TK, Radiology, 2011
Cirrhotic Liver Nodules

The majority of HCCs are believed to arise in a stepwise pattern

- Large HCC
- Small HCC
- HCC on Dysp. N.
- Dysp. N.
- Reg. N.
HCC Dx: AASLD CRITERIA

≥ 10 mm Liver Lesion, chronic liver disease
(AP hypervascularity & PV/EQ washout)

If atypical on CT or MR, recommends utilizing the other for possible characterization

< 10 mm
Repeat US every 3-6 months for 2 years

AFP NO LONGER USED FOR SCREENING

American Association for the Study of Liver Diseases (AASLD) Practice Guideline. 2010
Flash Filling Hemangioma

- Most common benign tumor and the 2nd most common tumor of the liver after metastasis.
- Usually hypointense on T1 and markedly hyperintense on T2.
- Flash filling hemangioma is atypical form for hemangiomas smaller than 2 cm.
Fibrolamellar Carcinoma

• Well-circumscribed focal lesion low signal on T1.
• High signal on T2-weighted images.
• Early heterogeneous post-contrast enhancement, which fades on subsequent images.

• A central radiating scar is seen in 80% of cases and has low signal on T2.
• Minimal or no enhancement on post-contrast. As a result, the scar is usually hypointense relative to the remainder of tumor.
Focal Nodular Hyperplasia: CT Findings

Often lobulated, in contrast to adenoma

Enhancement: 106/106 Hyperenhancing Arterial Phase

101 Enhanced Homogeneously
82/89 Isoattenuating on Delay

Central Scar: 62/124

40/62 Large Lesions
22/62 Small Lesions

1/124 Calcifications
1/124 Tumoral hemorrhage

Brancatelli et al, Radiology, 2001
Focal Nodular Hyperplasia: MR Findings

T1: Iso or mildly hypointense
T2: Iso or mildly hyperintense

Enhancement: Hyperenhancing arterial phase
Enhances homogeneously
Isoattenuating on delay

Central Scar: iso/hypointense T1
hyperintense T2 (84%)
Delay enhancement with Gadolinium

Mortele et al, AJR 2000
FNH: Physiologic Characterization

- Nuclear Medicine: Sulfur Colloid or HIDA scanning (Kupffer Cell uptake)

- T2 Effect: Ferrite (Kupffer Cell uptake) SPIO, USPIO
  - Minimal but possible uptake in adenoma, well differentiated HCC

- T1 Effect: MnDPDP; Gd-BOPTA and Eovist (Bile duct excretion);
  - Also retained in HCC
  - Adenoma typically washes out contrast on delay imaging
Nodular Regenerative Hyperplasia (NRH): Budd-Chiari Syndrome

- Multiple nodules (often > 10)
- 0.5 to 7.0 cm diameter
- Homogeneous or heterogeneous imaging appearance
- Prevalence at imaging: 25%

Vilgrain et al, Radiology 1999; 210:443
Peripheral Washout
Metastatic Deposit

- Peripheral washout is a specific sign of malignancy
- Described for carcinoid, breast, colon and gastric ca
- Peripheral hypointense rim relative to center of the lesion
- Best seen 10 min. after administration contrast
Delayed Enhancement
Cholangiocarcinoma

- Most common biliary tumor and 2nd primary malignant hepatic tumor in adults
- Classified as intrahepatic; peripheral, hilar intrahepatic and extrahepatic.
- Hypointense on T1 & hyperintense on T2
- Initial peripheral enhancement & delayed concentric filling
Cholangiocarcinoma: Clues on CT

- Overlying capsular retraction
- Delayed contrast enhancement
- Proximal biliary obstruction
- Presence of PSC
Hemangioma

- Incidence: 20% of the general adult population
- Most common benign tumor and the 2nd most common tumor of the liver after metastasis
- Hypointense on T1 & markedly hyperintense on T2
- Early peripheral nodular with progressive centripetal enhancement on subsequent phases
Markedly Bright T2 differential

- Cyst
- Hemangioma
- Cystic tumor (necrotic tumor)
- Neuroendocrine solid tumors
- GIST
- Angiosarcoma
Hypervascular Metastases

-Metastasis is commonest cause of malignant lesion.

-Liver is 2nd site for metastasis after regional LN.

-NET, RCC, breast, melanoma, thyroid, pheo and carcinoid are the most common primaries.

- Best seen on the arterial phase of enhancement. Most of lesions have high signal intensity on T2.
Hypovascular Metastases

- Metastases is most common cause of malignant liver lesion.
- Liver is 2nd site for metastasis after regional LNs
- Colon, lung, prostate, and TCC are common primaries
- Low T1, high T2 and minimal contrast enhancement
Sarcoidosis

- Granulomatous systemic disease of unknown etiology involve numerous sites, including liver
- Hypointense on all sequences, hypoenhancing relative to the background liver
- Most conspicuous on T2 fat-saturated images & early-phase gadolinium-enhanced T1
Lesions containing fat at imaging
(Macroscopic vs. Intracellular)

- Lipoma
- Angiomyolipoma
- Metastasis (malignant teratoma, liposarcoma)
- HCC with fatty metamorphosis
- Adenoma
- Focal fatty infiltration
Focal fatty infiltration

- Important to be differentiate from focal hepatic lesion containing intracellular lipid
- Characteristic signal loss of out of phase compared to in-phase
- Lack of surrounding mass effect; Often anatomic (segment or lobar) distribution
- Normal traversing vessels allow distinction from lipid containing tumor such as HCC or adenoma
HEPATOCELLULAR ADENOMA

• Monoclonal Hepatic Neoplasm
  – Risk Factors: Oral contraceptives; Glycogen Storage Disease; Obesity

• Varied Imaging Appearances
  – Most hypervascular; some with washout, some with persistent enhancement
  – Some with fatty elements
  – Some with fibrous capsule

• Varied Biological Behavior
  – Many associated with Oral Contraceptives; Some not
  – Some spontaneously bleed, some not
  – Rare malignant degeneration
HEPATOCELLULAR ADENOMA

- Common (30 – 35%); often called “Steatotic HCA”
  - TCF1 mutation
  - Fatty acid synthesis and impaired transport, results in excessive accumulation of lipids.
- Imaging
  - Vascular with no delayed enhancement
  - Heterogeneous appearance with tumoral steatosis
- Biological Behavior
  - Propensity to hemorrhage if > 5cm
  - No risk of malignant degeneration
HCA: Interleukin 6 Signal Transducer (IL6ST) Gene Mutation

- Most common (40 – 55%); often called “inflammatory HCA”
  - 60% IL6ST mutation; remainder show STAT 3 activation without mutations
  - Seen in association with diffuse hepatic steatosis (and obesity) and elevated serum inflammatory markers (C-reactive protein)

- Infiltrates, dystrophic vessels with sinusoidal dilatation

- Imaging
  - Vascular with persistent enhancement
  - ↑ T2 signal

- Biological Behavior
  - Propensity to hemorrhage; Small risk of malignant degeneration
HCA: B-Catenin Activation

• Uncommon (10-18%)
  – Risk factors include Glycogen Storage Disease, male hormone administration
  – Seen in men and women.

• Characterized by multiple other chromosomal and genetic alterations, resulting in higher risk of malignant transformation

• Imaging -- often nonspecific
  – Vascular enhancement with washout
  – Uncommon for tumoral steatosis

• Biological Behavior
  – Highest risk of malignant degeneration
DDX: Calcified Liver Masses

- Metastatic tumor
  - Mucin-producing neoplasm: ovary, stomach, colon, breast
- Primary malignant
  - Intrahepatic cholangiocarcinoma
  - Fibrolamellar HCC
- Others—benign, infectious, vascular