Evaluation of Liver Lesions

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Individualized Approach

Not all Contrasted CT’s are Equal

- “With and Without contrast”
  - Uncontrasted
  - Venous phase
    - Best to detect metastatic disease

- Four phase CT
  - Uncontrasted
  - Arterial
  - Early Venous
  - Late venous
    - Best to characterize liver tumors

Baron RL. AJR 1994;163:323-331

Triple Phase Contrast

Hypervascular Tumors

Liver Tumors: HCC, FNH, some adenomas
Metastasis: Neuroendocrine tumors, renal cell, endometrial, melanoma, thyroid

Baron RL. AJR 1994;163:323-331
Hypovascular Tumors

Typical for metastatic lesions

Baron RL. AJR 1994;163:323-331

56 y/o male with Cirrhosis

No contrast
56 y/o male with Cirrhosis

Contrast, venous

56 y/o male with Cirrhosis

Arterial, bolus injection 4-5ml/sec
**Take Home Message:**
Always order a four phase contrasted CT scan when evaluating liver lesions!

**Assess Patient Risk**

<table>
<thead>
<tr>
<th>Low Risk</th>
<th>Average Risk</th>
<th>High Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;40</td>
<td>&gt;40</td>
<td>Any Age</td>
</tr>
<tr>
<td>No known malignancy</td>
<td>No known malignancy</td>
<td>Known primary malignancy</td>
</tr>
<tr>
<td>No liver disease</td>
<td>No liver disease</td>
<td>Cirrhosis</td>
</tr>
<tr>
<td>No symptoms</td>
<td>No symptoms</td>
<td>Chronic liver disease</td>
</tr>
</tbody>
</table>

Case Presentation

- 20 y/o female, no history liver disease
- Vague abdominal pain
- US: Hypoechoic liver mass, right lobe, 3.5cm
- Normal liver tests, negative hepatitis B and C

Individualized Approach

CT Scan, Triple Phase

No contrast

CT Scan, Triple Phase

Arterial phase
Focal Nodular Hyperplasia

- 2nd most common benign liver lesion
- ~ 1% of the population
- Female : Male 8:1
- Not related to birth control pills
- Radiologic characteristics
  - Hypodense in non-contrast exam
  - Hyperdense in arterial phase – central scar
  - Isodense in delayed phases

Kamel IR, et al. AJR 2006;186:1587-1596
FNH – Central Scar

FNH – If a Biopsy is done

- Always
  - Biopsy the lesion
  - Biopsy the uninvolved liver
- FNH looks like cirrhosis!
Hypervascular Lesions - DDx

- Focal nodular hyperplasia
- Hepatocellular carcinoma
- Hypervascular metastasis
  - Neuroendocrine tumors
  - Renal cell
  - Endometrial
  - Thyroid
  - Melanoma
  - Flash-filling hemangiomas

Fergusson J. J Gastroenterol Hepatol 2012;27:1772-1782

Hemangioma

- Most common benign lesion, 3-20% general population
- Hyperechoic on ultrasound
- Hypodense in non-contrast CT
- Peripheral → central filling with contrast
- <2cm may have "flash filling" in arterial phase

Flash-Filling Hemangioma

Hemangioma - MRI

T1-Weighted

T2-Weighted
Case Presentation

- 35 y/o female with kidney stones
- Abdominal ultrasound shows a hyperechoic 1.5 cm liver lesion
- Normal liver tests
- Negative viral serologies
- No liver-related symptoms

Individualized Approach

Hepatic Adenoma

- More common in females, related to OCP’s
- Benign with variable malignant potential
- Well circumscribed with no capsule
- No portal tracts, no bile ducts
- Risk of bleeding, remove if >5cm
- Imaging characteristics depend on histology
  - Fat content
  - Hemorrhage

Adenoma - Ultrasound Appearance
Adenoma – Molecular & MRI Characterization

- **HNF-1α mutated adenoma**
  - Significant fat accumulation; homogenous
  - Moderate arterial enhancement, no enhancement in venous phase
  - Rare malignant transformation

- **B-catenin positive**
  - Heterogenous lesion, no fat
  - Higher malignant potential

- **Inflammatory Adenoma**
  - Strong arterial enhancement, persistent venous enhancement
  - Fat accumulation, heterogenous
  - Lower malignant potential


HNF-1α Inactivated Adenoma

- Low risk of malignancy, no need to biopsy
- Stop oral contraceptives, follow
- Resect if > 5cm
Inflammatory HCA

Clinical characteristics

- Patients tend to be overweight
- RUQ pain is more common
- Inflammatory markers increased
  - CRP & fibrinogen
  - Levels normalize with removal of tumor
- Uninvolved liver usually steatotic
- More likely to be multiple
- Lower malignant potential, biopsy needed

**β-Catenin Mutated HCA**

- Mildly hypointense in T1W, mostly isointense in T2W
- Strong hyperintensity in arterial phase
- "Wash-out" delayed venous (portal phase)

**Approach to Hepatic Adenoma**

- Imaging techniques suggesting an HCA diagnosis
- HHF1α, inactivated HCA
- Inflammatory HCA
- Unclear subgroup of HCA and/or doubt with HCC
- Nodule < 5 cm
- Surgical biopsy

Pathological screening:
- HCA: LFABP, β-catenin, OS, CRP, SAA
- Necessity: CD34, GPC3
- Search for β-catenin mutation if possible

Bioulac-Sage P. Hepatology 2009;50:481-489
Adenoma – If a Biopsy is Done....

- Biopsy lesion and uninvolved liver
- Stain biopsy of mass for
  - L-FABP (anti-liver fatty acid binding protein)
    - If negative, malignancy is rare
  - β-catenin
    - If positive nuclear staining – malignant potential high
  - SSA
    - If positive with negative β-catenin suggests inflammatory HCA, less potential for malignancy

Bioulac-Sage P. Hepatology 2007;46:740-748

Low Malignant Potential Adenoma

Adenoma – Negative for L-FABP – Low malignancy risk

Normal Liver

B-Catenin Positive Tumor


Individualized Approach

**Take Home Point**

Hepatocellular carcinoma can be accurately diagnosed by radiology

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**AASLD HCC Practice Guidelines**

Liver Mass

- > 1 cm
- 4-phase MDCT/ dynamic contrast enhanced MRI
  - Arterial hypervascularity by MRI versus delayed phase washout
    - Yes
    - No
  - Other contrast enhanced study (CT or PVT)
    - Yes
    - HCC
- Arterial hypovascularity by MRI versus delayed phase washout
  - Yes
  - No

Bruix J, Sherman M. Hepatology 2011;53:1020-1022
**Radiologic HCC Diagnosis - Caveats**

- Lesions 1 to 2cm in diameter may be difficult to characterize
- HCC <2cm do not get extra MELD points
- α-fetoprotein levels not reliable
  - Normal in 40% of HCC
  - Change over time more important than level
  - Not recommended to screen for HCC*
- Biopsy of “obvious” HCC may harm

*Bruix J, Sherman M. Hepatology 2011;53:1020-1022
HCC – 4 phase MRI, Gadolinium

Pre-Contrast
Arterial Phase
Portal Phase
Delayed Venous Phase

Ito K. Eur J Radiol 2006;58:186-199

CT - HCC

Pre-Contrast
Arterial Phase
Venous Phase

**Atypical Liver Mass – No “Wash-Out”**

### Summary

- Assess the patient’s risk
- Characterize the lesion with 4 phase CT/MRI
- Decide on further evaluation or monitoring
  - Monitor lesions ≤ 1 cm
- When in doubt
  - Biopsy
  - Biopsy both the lesion and the uninvolved liver
  - Special stains if adenoma suspected/diagnosed