MRI for HCC surveillance and reporting: LI-RADS

Donald G. Mitchell, M.D.
Thomas Jefferson University
Philadelphia, PA
Cirrhotic Nodules

Regenerative Nodule

“Atypical” Nodule

Hyperplastic Nodule

Dysplastic Nodule

Hepatocellular Carcinoma

Confluent Fibrosis

Hypertrophic Pseudotumor (Regional Regeneration)

Benign Enhancing Pseudonodule (AVF)
HCC: MRI features

- Hypo, Iso or Hyper on T1 & T2
  - T2 Bright is specific, not sensitive
- Copper = Bright T1
- Lipid in ~10%
- Marginated (Round or Lobulated)
  (prior to portal invasive)
- Capsule
- Internal Nodularity (mosaic)
- Rapid Enhancement & Washout
  - Delayed Hypointensity
- Multi-focal
  - Ambiguous term
  - Multiple focal primary HCC
  - Intrahepatic metastases (PV invasion)
Delayed hypointensity (washout pattern) improves specificity

Hyper-enhancing lesions not seen on other images: > 90% are benign

HCC Surveillance?

• High risk population: HBV, HCV, EtOH, NASH

• High cure rate for <3cm lesion
  » Chemo-embo, chemo-injection, RF ablation

• Transplant: *The only cure for whole liver*
  » Tumor priority points for HCC 2-5 cm

• Transplant denied
  » > 5 cm HCC; > 3 cm multiple HCCs; > 3 HCCs

• Sensitivity limitations
  » Sub-centimeter
  » Non-hypervascular

• Specificity limitations
  » Hypervascular benign & pseudo- lesions
**Imaging Criteria Sufficient for Dx**


**Incidental small HCCs detected in explant did not alter survival.**


**Small well-dif. HCC usually grows slowly**

166 cirrhotic patients had MRI-detected proven HCC (most with HCV)

21 patients (33 HCCs) had prior MRI (6 - 24 months)

29/33 initially considered benign nodules or indeterminate, or seen only retrospectively

Most seen only on HAP; none had washout

Diameter range 6-19 mm

Mean diameter doubling time = 856 days

All 33 HCCs satisfied criteria for cure
Hepatitis C: HCC Risk Categories
(TJU initial approach)

- **No lesion with high suspicion of HCC**
  - Patient is still at high risk
  - HCC surveillance (Serial US, annual MRI)
  - Tiny “UBOs” do not change this

- **Indeterminate/suspicious lesion**
  - F/U ~ 6 weeks - 3 months

- **Probable HCC**
  - Treat or biopsy if > 2 cm
  - F/U if smaller

- **HCC**
  - Treat, or list for transplant
Lesion Characterization in Chronic Liver Disease
(Work in Progress)

The following is for informational and educational purposes. Note that the imaging features specified are a suggested guide for categorization. Also, the risk estimates listed are used to communicate an impression based on the imaging findings, rather than a precise risk that can be objectively measured.

Lesion Categorization System

Category 1: No focal lesion suspicious for HCC (Risk Estimate <5%)
(Note: Since these features are not clinically significant, they do not necessarily have to be mentioned in the report.)

- **Imaging features**
  - No lesion demonstrated.
  - < 1 cm, transient arterial enhancing, and seen on the arterial phase images only.
  - < 1 cm, T1 hyperintense, and enhances similar to background liver.
  - < 1 cm nodular area of focal fatty or iron sparing without arterial enhancement in the setting of diffuse fatty liver.

- **Suggested Management**
  - Continue routine surveillance.

Category 2: Probably benign lesion (Risk Estimate 5 - 20%)

- **Imaging features**
  - Round transient arterial enhancing, 1 - 2 cm, and not visible on other sequences
  - Round, 1 - 2 cm, hypointense on delayed images, and isointense on other images.
  - New, < 1 cm T1 hyperintense, and enhances similar to background liver.

- **Suggested Management**
  - Short term (3 month) follow up, possibly with Eovist.

Category 3: Indeterminate lesion (Risk Estimate 21 - 70%)

- **Imaging features**
  - > 2 cm, T1 hyperintense, and enhances similar to background liver.

- **Suggested Management**
  - Short-term follow-up, biopsy or alternative imaging (e.g. angiography, US, Eovist-MRI, etc).
  - Indeterminate lesion should not be considered a diagnosis of HCC.

Category 4: Probable HCC (Risk Estimate 71 - 95%)

- **Imaging features**
  - As in category 3 below. Suboptimal image quality or other factors, at radiologist discretion, may decrease confidence.

- **Suggested Management**
  - Treat, biopsy or transplant. Consider alternative imaging (e.g. angiography, US, Eovist-MRI).

Category 5: HCC (Risk Estimate >95%)

- **Imaging features**
  - Hyperenhancement with either washout, T2 brightness or a delayed enhancing capsule.
  - A solid round mass that is T2 bright. The presence of any additional feature (i.e. enhancing capsule, washout, or enhancement) increases confidence that this is not confluent fibrosis.
  - Note that many HCCs have washout and other HCC features, but not T2 brightness. T2 brightness is specific but not extremely sensitive.
  - Multinodular texture (nodules-in-nodule) is an important confirmatory finding of HCC.

- **Management**
  - Treat or transplant. Biopsy is not needed.
Report of a National Conference on Liver Allocation in Patients with Hepatocellular Carcinoma in the United States

Elizabeth A. Pomfret,1 Kenneth Washburn,3 Christoph Wald,2 Michael A. Nalesnik,4 David Douglas,5 Mark Russo,6 John Roberts,7 David J. Reich,8 Myron E. Schwartz,9 Luis Mieles,10 Fred T. Lee,11 Sander Florman,12 Francis Yao,7 Ann Harper,13 Erick Edwards,13 Richard Freeman,14 and John Lake15

LIVER TRANSPLANTATION 16:262-278, 2010

SPECIAL ARTICLE
<table>
<thead>
<tr>
<th>OPTN Class</th>
<th>Description</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Incomplete or technically inadequate study</td>
<td>Repeat study is required for adequate assessment; automatic priority MELD points cannot be assigned on the basis of an OPTN class 0 classified imaging study.</td>
</tr>
<tr>
<td>1</td>
<td>No evidence of HCC on good-quality, appropriate surveillance examination</td>
<td>Typically, surveillance would continue according to the routine practice at the respective transplant center.</td>
</tr>
<tr>
<td>2</td>
<td>Benign lesion(s) or diffuse parenchymal abnormality with no dominant focal lesion</td>
<td>Typically, the need for any further imaging would be determined on a clinical basis according to the routine practice at the respective transplant center (MRI preferred over CT).</td>
</tr>
<tr>
<td>3</td>
<td>Abnormal scan, indeterminate focal lesion(s), not currently meeting radiological criteria for HCC</td>
<td>Typically, follow-up imaging would be performed in 6-12 months (MRI preferred over CT).</td>
</tr>
<tr>
<td>4</td>
<td>Abnormal scan, intermediate suspicion for HCC (meets some radiological criteria for HCC and could represent HCC)</td>
<td>Consider short-term follow-up in 3 (maximum diameter of lesions ≥ 2 cm) to 6 months (maximum diameter of lesions &lt; 2 cm), with MRI preferred over CT or biopsy. Imaging follow-up should be considered if biopsy is negative or not possible.</td>
</tr>
<tr>
<td>5</td>
<td>Meets radiological criteria for HCC</td>
<td>Patient may be eligible for automatic priority MELD points on the basis of this imaging study. Please refer to definitions for class 5 criteria.</td>
</tr>
</tbody>
</table>
LIRADS (Liver Imaging Reporting and Data System)

• Sponsored by the ACR and in collaboration with UNOS (United Network for Organ Sharing).

• A new method of categorization of liver findings in patients with end stage liver disease.

• LI-RADS categories allow radiologists to stratify lesions according to the level of concern for HCC and suggest strategies for follow up and management.

• LIRADS aims to achieve standardization in technique, interpretation, and workup recommendations.

LI-RADS (Liver Imaging Reporting and Data System)

Category 1: Definitely Benign

Criteria
- Imaging features diagnostic of a benign entity (see Table 1 for examples) OR
- Definitive disappearance in absence of treatment.

Category 2: Probably Benign

Criteria
- Imaging features suggestive of a benign entity (see Table 2 for examples) OR
- Stable imaging features ≥ 2 years AND no increase in diameter for ≥ 2 years AND does not meet criteria for LI-RADS 1 or 4 or 5 OR
- Probable disappearance in absence of treatment OR

Note - Do not classify as LI-RADS 1 or 2 if observations that have one or more ancillary features that favor the diagnosis of HCC.

Category 3: Intermediate Probability for Hepatocellular Carcinoma

Criteria
- An observation that does not meet unequivocal criteria for LI-RADS 1, 2, 4, or 5 (see Table 3 for specific criteria) OR
- An observation that meets criteria for LI-RADS 4 or 5 with stable imaging features for ≥ 2 years AND no increase in diameter for ≥ 2 years

Category 4: Probably Hepatocellular Carcinoma

Criteria
A. <20mm
- Masslike, arterial-phase hyperenhancement, with only one Additional Major Feature (see below) OR
- Masslike, arterial-phase hyperenhancement or hyperenhancement, with two Additional Major Features (see below) OR
- Probable tumor within lumen of vein (see Table 6)
B. ≥ 20mm or greater
- Masslike, arterial-phase hyperenhancement, with no Additional Major Feature (see below) OR
- Masslike, arterial-phase hyperenhancement or hyperenhancement, with one or two Additional Major Features (see below)

Category 5: Definitely Hepatocellular Carcinoma

Criteria
A. ≥ 10 & <20 mm
- Masslike, arterial-phase hyperenhancement, with 2 Additional Major Features (see below) OR
- Definite tumor within lumen of vein (see Table 6)
B. ≥ 20 mm
- Masslike, arterial-phase hyperenhancement, with 1 or 2 Additional Major Features (see below) OR
- Definite tumor within lumen of vein (see Table 6)
1. MRI is an effective method for evaluating patients identified as high risk for HCC.

2. Standardized reporting of HCC and possible HCC can greatly facilitate communication and reduce confusion.

3. The TJU system was pioneered as a method for standardized reporting of HCC, but this has been replaced by the ACR-sponsored LI-RADS.