Untreated observation without pathologic proof in patient at high risk for HCC

- If cannot be categorized due to image degradation or omission → LR-NC
- If definite tumor in vein (TIV) → LR-TIV
- If definitely benign → LR-1
- If probably benign → LR-2
- If probably or definitely malignant but not HCC specific (e.g., if targetoid) → LR-M

Otherwise, use CT/MRI diagnostic table below

- If intermediate probability of malignancy → LR-3
- If probably HCC → LR-4
- If definitely HCC → LR-5

### CT/MRI Diagnostic Table

<table>
<thead>
<tr>
<th>Arterial phase hyperenhancement (APHE)</th>
<th>No APHE</th>
<th>APHE (not rim)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Observation size (mm)</td>
<td>&lt; 20</td>
<td>≥ 20</td>
</tr>
<tr>
<td>Count major features:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• “Washout” (not peripheral)</td>
<td>None</td>
<td>LR-3</td>
</tr>
<tr>
<td>• Enhancing “capsule”</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Threshold growth</td>
<td>One</td>
<td>LR-3</td>
</tr>
<tr>
<td></td>
<td>≥ Two</td>
<td>LR-4</td>
</tr>
</tbody>
</table>

Observations in this cell are categorized LR-4, except:
- LR-5g, if ≥ 50% diameter increase in < 6 months (equivalent to OPTN 5A-g)
- LR-5us, if “washout” and visibility at screening ultrasound (per AASLD HCC criteria)

If unsure about the presence of any major feature: characterize that feature as absent
What’s New in LI-RADS® v2017?

New algorithms:
- US Screening and Surveillance
- CEUS Diagnosis
- CT/MRI Treatment Response Assessment

New or revised categories for CT/MRI LI-RADS:
- LR-NC (new)
- LR-TIV (previously LR-5V)

Threshold growth definition modified

New explicit criteria for LR-M

Updated algorithmic display for CT/MRI LI-RADS

New list-view displays to supplement algorithmic displays

Ancillary features are now optional and their use is clarified

New ancillary feature favoring malignancy: ultrasound visibility

Name change for ancillary feature: distinctive rim → nonenhancing capsule

Improved schematic diagrams, new time-intensity curves

New FAQs

Clarifies:
- Distinction between non-rim arterial phase hyperenhancement (major feature of HCC) vs. rim arterial phase hyperenhancement (feature of LR-M)
- Distinction between nonperipheral “washout” (major feature of HCC) vs. peripheral “washout” (feature of LR-M)
- Distinction between enhancing “capsule” (major feature of HCC) vs. nonenhancing “capsule” (ancillary feature favoring HCC)
- That ancillary features favoring malignancy include some favoring malignancy in general and others favoring HCC in particular
- That CT/MRI LI-RADS can be used in liver transplant candidates with HCC
- Categorization of tumor in vein and malignancy with infiltrative appearance

Why is This Update Needed?

As new evidence emerges and based on feedback from users, LI-RADS evolves to better meet clinical, educational, and research needs. LI-RADS v2017 is the next step in this evolution.
## CT/MRI LI-RADS® v2017

### Apply in patients at high risk for HCC, namely those with:

- Cirrhosis OR
- Chronic hepatitis B viral infection OR
- Current or prior HCC

| Includes adult liver transplant candidates and recipients posttransplant |

### Do not apply in patients:

- Without the above risk factors
- < 18 years old
- With cirrhosis due to congenital hepatic fibrosis
- With cirrhosis due to a vascular disorder such as hereditary hemorrhagic telangiectasia, Budd-Chiari syndrome, chronic portal vein occlusion, cardiac congestion, or diffuse nodular regenerative hyperplasia

### Apply for multiphase exams performed with:

- CT or MRI with extracellular contrast agents (ECA) OR
- MRI with hepatobiliary contrast agents (HBA)

### Do not assign LI-RADS categories for observations:

- That are path-proven malignancies OR
- That are path-proven benign lesions of non-hepatocellular origin such as hemangiomas
CT/MRI LI-RADS® v2017 Categories

**Diagnostic Categories**

- **LR-NC**: Not categorizable (due to image omission or degradation)
- **LR-1**: Definitely benign
- **LR-2**: Probably benign
- **LR-3**: Intermediate probability of malignancy
- **LR-M**: Probably or definitely malignant, not necessarily HCC
  - **LR-4**: Probably HCC
  - **LR-5**: Definitely HCC
- **LR-TIV**: Tumor in vein

**Treatment Response Categories**

- **LR-TR Nonevaluable**: Treated, Response not evaluable (due to image omission or degradation)
- **LR-TR Nonviable**: Treated, Probably or definitely not viable
- **LR-TR Equivocal**: Treated, Equivocally viable
- **LR-TR Viable**: Treated, Probably or definitely viable
Step 1. Apply CT/MRI LI-RADS® Diagnostic Algorithm

Untreated observation without pathologic proof in patient at high risk for HCC

- If cannot be categorized due to image degradation or omission → LR-NC
- If definite tumor in vein (TIV) → LR-TIV
- If definitely benign → LR-1
- If probably benign → LR-2
- If probably or definitely malignant but not HCC specific (e.g., if targetoid) → LR-M

Otherwise, use CT/MRI diagnostic table below

- If intermediate probability of malignancy → LR-3
- If probably HCC → LR-4
- If definitely HCC → LR-5

CT/MRI Diagnostic Table

<table>
<thead>
<tr>
<th>Arterial phase hyperenhancement (APHE)</th>
<th>No APHE</th>
<th>APHE (not rim)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Observation size (mm)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt; 20</td>
<td>LR-3</td>
<td>LR-3</td>
</tr>
<tr>
<td>≥ 20</td>
<td>LR-3</td>
<td>LR-3</td>
</tr>
<tr>
<td>&lt; 10</td>
<td>LR-3</td>
<td>LR-3</td>
</tr>
<tr>
<td>10-19</td>
<td>LR-3</td>
<td>LR-4</td>
</tr>
<tr>
<td>≥ 20</td>
<td>LR-3</td>
<td>LR-5</td>
</tr>
</tbody>
</table>

Count major features:
- None: LR-3, LR-3, LR-3, LR-3, LR-4
- One: LR-3, LR-4, LR-4, LR-4, LR-5
- ≥ Two: LR-4, LR-4, LR-4, LR-5, LR-5

Observations in this cell are categorized LR-4, except:
- LR-5g, if ≥ 50% diameter increase in < 6 months (equivalent to OPTN 5A-g)
- LR-5us, if “washout” and visibility at screening ultrasound (per AASLD HCC criteria)

If unsure about the presence of any major feature: characterize that feature as absent
Step 2. Optional: Apply Ancillary Features (AFs)

Ancillary features may be used at radiologist discretion for:
- Improved detection, increased confidence, or category adjustment

For category adjustment (upgrade or downgrade), apply ancillary features as follows:

One or more ancillary features favoring malignancy: upgrade by 1 category up to LR-4
(Absence of these ancillary features should not be used to downgrade)

One or more ancillary features favoring benignity: downgrade by 1 category
(Absence of these ancillary features should not be used to upgrade)

If there are conflicting AFs (i.e., one or more favoring malignancy and one or more favoring benignity):
Do not adjust category

Ancillary features cannot be be used to upgrade to LR-5

### Ancillary features favoring malignancy

- Favoring malignancy in general, not HCC in particular
  - US visibility as discrete nodule
  - Subthreshold growth
  - Restricted diffusion
  - Mild-moderate T2 hyperintensity
  - Corona enhancement
  - Fat sparing in solid mass
  - Iron sparing in solid mass
  - Transitional phase hypointensity
  - Hepatobiliary phase hypointensity

- Favoring HCC in particular
  - Nonenhancing “capsule”
  - Nodule-in-nodule
  - Mosaic architecture
  - Blood products in mass
  - Fat in mass, more than adjacent liver

### Ancillary features favoring benignity

- Size stability > 2 yrs
- Size reduction
- Parallels blood pool
- Undistorted vessels
- Iron in mass, more than liver
- Marked T2 hyperintensity
- Hepatobiliary phase isointensity

If unsure about presence of any ancillary feature: characterize that feature as absent
Step 3. Apply Tiebreaking Rules if Needed

If unsure about presence of TIV, do not categorize as LR-TIV

If unsure between two categories, choose the one reflecting lower certainty

Step 4. Final Check

After Steps 1, 2, and 3 –
Ask yourself if the assigned category seems reasonable and appropriate

If YES: You are done, move on the next observation (if any).
If NO: Assigned LI-RADS category may be inappropriate, so reevaluate.
Step 1. Apply LI-RADS® CT/MRI Treatment Response Algorithm

Treated observation

If treatment response cannot be evaluated due to image degradation or omission → LR-TR Nonevaluable

Otherwise, use CT/MRI treatment response table

If probably or definitely not viable → LR-TR Nonviable

If equivocally viable → LR-TR Equivocal

If probably or definitely viable → LR-TR Viable

CT/MRI Treatment Response Table

<table>
<thead>
<tr>
<th>Response Category</th>
<th>Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>LR-TR Nonviable</td>
<td>• No lesional enhancement OR • Treatment-specific expected enhancement pattern</td>
</tr>
<tr>
<td>LR-TR Equivocal</td>
<td>Enhancement atypical for treatment-specific expected enhancement pattern and not meeting criteria for probably or definitely viable</td>
</tr>
<tr>
<td>LR-TR Viable</td>
<td>Nodular, masslike, or thick irregular tissue in or along the treated lesion with any of the following: • Arterial phase hyperenhancement OR • Washout appearance OR • Enhancement similar to pretreatment</td>
</tr>
</tbody>
</table>
Step 2. Measure Viable Tumor Size

Size of equivocally, probably, or definitely viable tumor

Longest dimension through enhancing area of treated lesion, not traversing nonenhancing area

Step 3. Apply Tiebreaking Rule if Needed

If unsure between two categories, choose the one reflecting lower certainty as illustrated below

Step 4. Final Check

After Steps 1, 2, and 3 -
Ask yourself if the assigned response category seems reasonable and appropriate

If YES: You are done, move on the next observation (if any).
If NO: Assigned LI-RADS category may be inappropriate, so reevaluate.