

Chapter 11

Management

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Management

Introduction

This chapter discusses the immediate management decisions for patients at risk for HCC who have undergone diagnostic imaging with multiphase CT or MRI or with contrast-enhanced ultrasound (CEUS).

Diagnostic imaging is often performed after a positive screening or surveillance test such as ultrasound or to characterize incidentally detected observations on imaging exams done for other purposes.

- For the distinction between screening/surveillance and diagnostic imaging see [Chapter 2, page 3](#).
- For the details about screening and surveillance see [Chapter 2, page 5](#).
- For management of patients after locoregional see [page 11-6](#).

Multidisciplinary management teams

To understand the management implications of issuing a radiology report with a LI-RADS diagnostic category, radiologists should recognize that they are part of a multidisciplinary team.

The integration of the radiologist within this team may be implicit (as part of routine clinical care) or formal (as a participant in regular multidisciplinary meetings or conferences).

Relevance of LI-RADS categories to diagnostic and treatment decision making

The use of LI-RADS category codes summarizing probabilities is useful for clinical care because it enables clear, precise, and unambiguous communication, potentially helping to guide diagnostic and management decisions.

Each LI-RADS category was created and defined so that it would have meaningful impact on decisions about diagnosis and treatment.



Management Options

Management options after a diagnostic test such as CT, MRI, or CEUS

Understanding the options following a diagnostic test provides the basis for assigning a LI-RADS category.

The potential options for next steps in diagnosis and management and their definitions are:

Return to routine surveillance

- Definition: Standard screening and surveillance modality with a standard time interval.
 - Comments: Reasonable option if diagnostic imaging is of adequate quality and shows no observations meriting further diagnostic workup.
-

Repeat diagnostic imaging

- Definition: Same modality and contrast agent; individualized time interval.
 - Comments: Reasonable option if diagnostic imaging was inadequate due to a resolvable technical limitation or if repeat diagnostic imaging with same modality and contrast agent is desired to assess stability. The time interval for repeat imaging is based on clinical, imaging, and other considerations.
-

Alternative diagnostic imaging method

- Definition: Different modality or different contrast agent; individualized time interval.
 - Comments: Reasonable option if alternative imaging may confer a diagnostic advantage in the radiologist's judgment. The time interval for alternative imaging is based on clinical, imaging, and other considerations.
-

Multidisciplinary discussion (MDD)

- Definition: Discussion of diagnostic (imaging-, biomarker-, tissue-based) and treatment options with multidisciplinary input.
- Comments: Reasonable option whenever multidisciplinary input is desired.



From LI-RADS Category to Management Decisions

The LI-RADS categories were developed so that each category should have significant impact on decisions about diagnosis and treatment. Many factors other than the imaging results influence the final diagnosis and guide the management plan. It may help to think of this as “layers of diagnostic thinking”, beginning with the imaging test itself and eventually arriving at a management decision based on all factors.

The LI-RADS category assignment for an individual observation is based on the combination of major and ancillary imaging features.

- It is not necessary for radiologists to blind themselves to other data, but the LI-RADS category should be based on imaging features and able to stand on its own.
-

A clinician’s estimated probability of HCC is informed by the LI-RADS category, but it also incorporates other factors such as circulating biomarkers and the patient’s pre-test probability of developing or having HCC.

- Example: a radiologist may assign LR-4 based on imaging findings, but a markedly elevated serum AFP level may permit non-invasive diagnosis of HCC with high certainty.
-

Decisions between basic management options do not necessarily follow directly from the LI-RADS category, or from a clinician’s estimated probability of HCC. Rather, the ultimate management decision follows from a clinical assessment that integrates all available medical information, including patient comorbidities; patient preference; observation size and location; number, sizes, and LI-RADS categories of additional observations (see below); and eligibility for liver transplantation.

- Example: a decision about whether to biopsy may be affected by risk factors such as coagulation disorders, or whether a patient most fears a procedure or a short delay in diagnosis, or whether biopsy confirmation of a small (< 20 mm) HCC would affect priority for liver transplantation.
-

As stated above, the presence of other observations can have an important influence. Most commonly, management decisions for a given patient are governed by the most worrisome observation(s), that is, the one(s) with the highest LI-RADS category.

Although a patient’s management does not follow directly from the LI-RADS category, the different categories do lead to different typical management decisions.

The following pages summarize these typical management decisions. These are intended as a general guide, not as stringent or dogmatic rules. Clinical judgment should be used to tailor actual management decisions to individual patients.

Management Suggestions for Untreated Observations

The following management suggestions are intended as general guidance:

Non-treated observations:

LI-RADS Dx Category	Suggested Management
No observation	<ul style="list-style-type: none"> Return to routine surveillance at standard time interval (usually 6 months). Alternative multiphasic imaging (usually ≤ 6 months).
LR-NC	<ul style="list-style-type: none"> Repeat diagnostic imaging (suggested option in most cases if the technical limitation leading to a non-categorizable assignment can be resolved) (usually ≤ 3 months). Alternative diagnostic imaging (suggested option if imaging with alternative modality or alternative contrast agent is reasonably likely to confer diagnostic advantage) (usually ≤ 3 months). Multidisciplinary discussion (suggested option if no alternative imaging is appropriate).
LR-1	<ul style="list-style-type: none"> Return to routine surveillance at standard time interval (usually 6 months).
LR-2	<ul style="list-style-type: none"> Return to routine surveillance (suggested option in most cases) at standard time interval (usually 6 months). Repeat diagnostic imaging (suggested option if repeat diagnostic imaging is considered beneficial in the radiologists' judgment) (usually ≤ 6 months). MDD for individualized workup (suggested option if such discussion is likely to be beneficial in the radiologist's judgment).
LR-3	<ul style="list-style-type: none"> Repeat diagnostic imaging in 3-6 months (suggested option in most cases). Alternative diagnostic imaging in 3-6 months (suggested option if imaging with alternative modality or alternative contrast agent is reasonably likely to confer diagnostic advantage). MDD for individualized workup (suggested option if such discussion is likely to be beneficial in the radiologist's judgment or if such discussion is required for LR-3 by institutional guidelines).
LR-4	<ul style="list-style-type: none"> MDD for individualized workup and possible treatment (suggested option in most cases), which may include imaging, biopsy, or occasionally treatment without biopsy. Repeat or alternative diagnostic imaging in ≤ 3 months.
LR-5	<ul style="list-style-type: none"> MDD for staging and individualized treatment. Biopsy is not needed to confirm the diagnosis of HCC but may be obtained in some settings (e.g., for clinical trials requirements or molecular characterization).



Management Suggestions for Untreated Observations

The following management suggestions are intended as general guidance:

Non-treated observations (Cont'd):

LI-RADS Dx Category	Suggested Management
LR-M	<ul style="list-style-type: none"> MDD for individualized workup and staging. Biopsy should be considered for definitive diagnosis and individualized management informed by pathology diagnosis.
LR-TIV	<ul style="list-style-type: none"> MDD for individualized workup and staging. Biopsy should be considered if the tumor in vein is not definitely due to HCC (see Chapter 14, page 13) for determining the etiology of tumor in vein) and/or if tumor biomarkers suggest a non-HCC malignancy. If biopsy is obtained, then management should be informed by the pathology diagnosis.

MDD-Multidisciplinary discussion can be a formal meeting or an informal communication between the radiologist and the other specialists. See [Chapter 9](#) for more information regarding assessment of treatment response and TR categories.



Management Suggestions for Treated Observations

The following management suggestions are intended as general guidance:

Treated observations

LI-RADS treatment response category

Management Options

LR-TR Nonevaluable

- Repeat diagnostic imaging in ≤ 3 months (suggested option in most cases).
- Alternative diagnostic imaging in ≤ 3 months (suggested option if imaging with alternative modality or alternative contrast agent is reasonably likely to confer diagnostic advantage).
- Rationale for ≤ 3 -month follow up: the median tumor volume doubling time of recurrent HCCs after locoregional treatment is 82 days, thus necessitating a shorter follow-up interval of three months.

LR-TR Nonviable

LR-TR Equivocal

LR-TR Viable

- MDD for consensus management. Often includes retreatment.

MDD-Multidisciplinary discussion can be a formal meeting or an informal communication between the radiologist and the other specialists. See [Chapter 9](#) for more information regarding assessment of treatment response and TR categories.



Additional Considerations

Three management options merit further discussion and are described below.

- Multidisciplinary discussion (see below)
- Biopsy (see below)
- Treatment as presumptive cancer without biopsy confirmation ([page 11-8](#))

Multidisciplinary discussion (MDD)

Although useful for optimizing individual patient management in select cases, MDD is not feasible for every patient and every LI-RADS observation.

Multidisciplinary discussion is encouraged for all LR-4, LR-5, LR-M, and LR-TIV observations:

- For LR-4, LR-M, and LR-TIV: MDD to guide additional workup and treatment.
- For LR-5: MDD to guide treatment.
- For observations that have been biopsied: MDD to review imaging and pathology findings and confirm imaging-pathology concordance. Depending on the pathology diagnosis, MDD may be desired to guide treatment.

MDD may be useful for some LR-NC, LR-2, and LR-3 observations, as well as for some observations with unusual imaging features that challenge LI-RADS categorization. Radiologists at their discretion should suggest MDD for such observations.

Biopsy

A decision to biopsy an observation should be made in the context of MDD with consideration of all relevant factors.

Indications for initial biopsy:

- LR-5 or LR-TIV if
 - Patient is being considered for clinical trial that requires biopsy confirmation
 - Histologic grading or molecular characterization is desired
 - Patient has elevated CA19-9 or CEA
 - Patient has extrahepatic primary malignancy
- LR-M (including targetoid observations and diffuse malignancy not meeting LR-5 criteria)
- Some LR-4
- Some LR-3
- Observation meets LR-5 imaging criteria but patient is outside the LI-RADS diagnostic population (see [Chapter 2](#))

Indications for repeat biopsy:

- Non-diagnostic prior biopsy
- Prior biopsy discordant with imaging, biomarkers, or other factors

Additional Considerations

Biopsy (Cont'd)

As seen above, biopsy usually is reserved for some LR-4, LR-M, and LR-TIV observations, although a multidisciplinary group could elect to biopsy LR-3 or LR-5 observations in special circumstances.

- Example of LR-5 that might be biopsied: cirrhotic patient with LR-5 observation and extrahepatic primary malignancy. Metastases to cirrhotic liver are rare, so even in patients with extrahepatic malignancy, a LR-5 is highly likely to be HCC. Nevertheless, biopsy may be performed to confirm.
-

Not all LR-4, LR-M, or LR-TIV observations need biopsy. Many may be managed without biopsy in the context of MDD.

- Example of LR-4 observation that might be managed without biopsy: cirrhotic liver transplant (LT) candidate with < 20-mm LR-4 nodule. Such a nodule, even if pathology confirmed to be HCC, would not provide LT exception points. Since biopsy may have limited value, a multidisciplinary group may elect to monitor the nodule's growth with imaging until size ≥ 20 mm. At that point, the observation may meet LR-5 criteria and, with size ≥ 20 mm, provide exception points.
-

Compared to other diagnostic systems that recommend biopsy for all "indeterminate lesions" (i.e., those that are not definitely benign and that do not meet HCC criteria), LI-RADS enables more selective use of biopsy, potentially reducing the frequency of unnecessary biopsies.

Including consideration for biopsy in a radiology report

A radiology report should avoid any language that would compel a clinician or MD group to perform biopsy or any invasive procedure. Nevertheless, it may be beneficial to suggest appropriate consideration for liver biopsy.

Sample phrases that might be used are:

- "Options for diagnostic workup include ____ and possibly biopsy."
 - "The distinction between HCC and ____ in this patient cannot be determined with imaging alone. If distinction would be helpful for patient management, biopsy may be considered."
 - "Biopsy may be necessary to distinguish between HCC and ____."
 - "...probably HCC. To establish a definite diagnosis, biopsy may be considered."
-

Treatment as presumptive cancer without biopsy confirmation

With caution and in special circumstances, a multidisciplinary group may elect to treat an observation as presumptive HCC without biopsy. Such a decision may be made if the probability of HCC is deemed sufficiently high based on imaging and other factors, and if biopsy or additional workup would subject the patient to unjustified risk or treatment delay.

Management and OPTN

LI-RADS categories can be used for OPTN staging.

The following rules apply:

Only LR-5, LR-TIV, and path-proven HCCs (and TR-viable) contribute to OPTN staging.

All LR-5 and LR-TIV observations contribute to OPTN staging except:

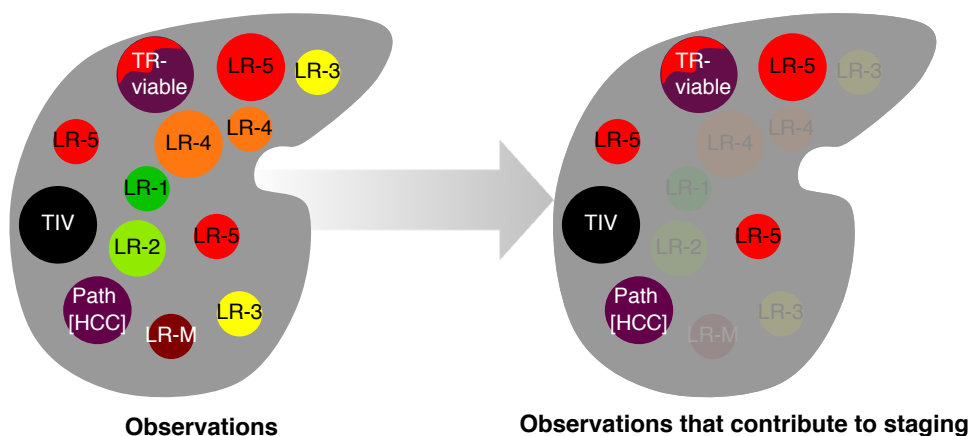
- 10-19 mm observation with APHE, nonperipheral WO, no TG and no enhancing “capsule”. These are categorized LR-5, but do not contribute to OPTN staging
- LR-TIV contiguous with a targetoid parenchymal mass. This may represent a non-HCC malignancy with macrovascular invasion. If biopsied and proven pathologically to be HCC, it then contributes to OPTN staging (Stage T4b or OPTN Class X).

LR ≤ 4 observations (untreated or treated) do not contribute to staging.

- If they are biopsied and proven pathologically to be HCC, they then contribute to staging.

LR-M does not contribute to staging although most LR-M observations should be biopsied.

- If they are biopsied and proven pathologically to be HCC, they then contribute to staging.



* Note that 10-19 mm observation with APHE, nonperipheral WO, no TG and no enhancing “capsule” are categorized LR-5, but do not contribute to staging

Management and OPTN

Conversion from LI-RADS Category to OPTN Class

Conversion from LI-RADS categories to OPTN classes is important for liver transplantation candidates being considered for HCC priority points.

- Conversion applies only for LR-5 (with exclusion as below), LR-TIV due to HCC, and path-proven HCC.
- There is no corresponding OPTN Class for LR-NC, LR-1, LR-2, LR-3, LR-4, 10-19 mm LR-5 with APHE and WO only (i.e. no TG and no enhancing “capsule”), LR-M, or LR-TIV due to non-HCC malignancy.

The conversion can be challenging because OPTN classification sometimes applies to individual observations and sometimes to the overall stage.

Table below summarizes the conversion:

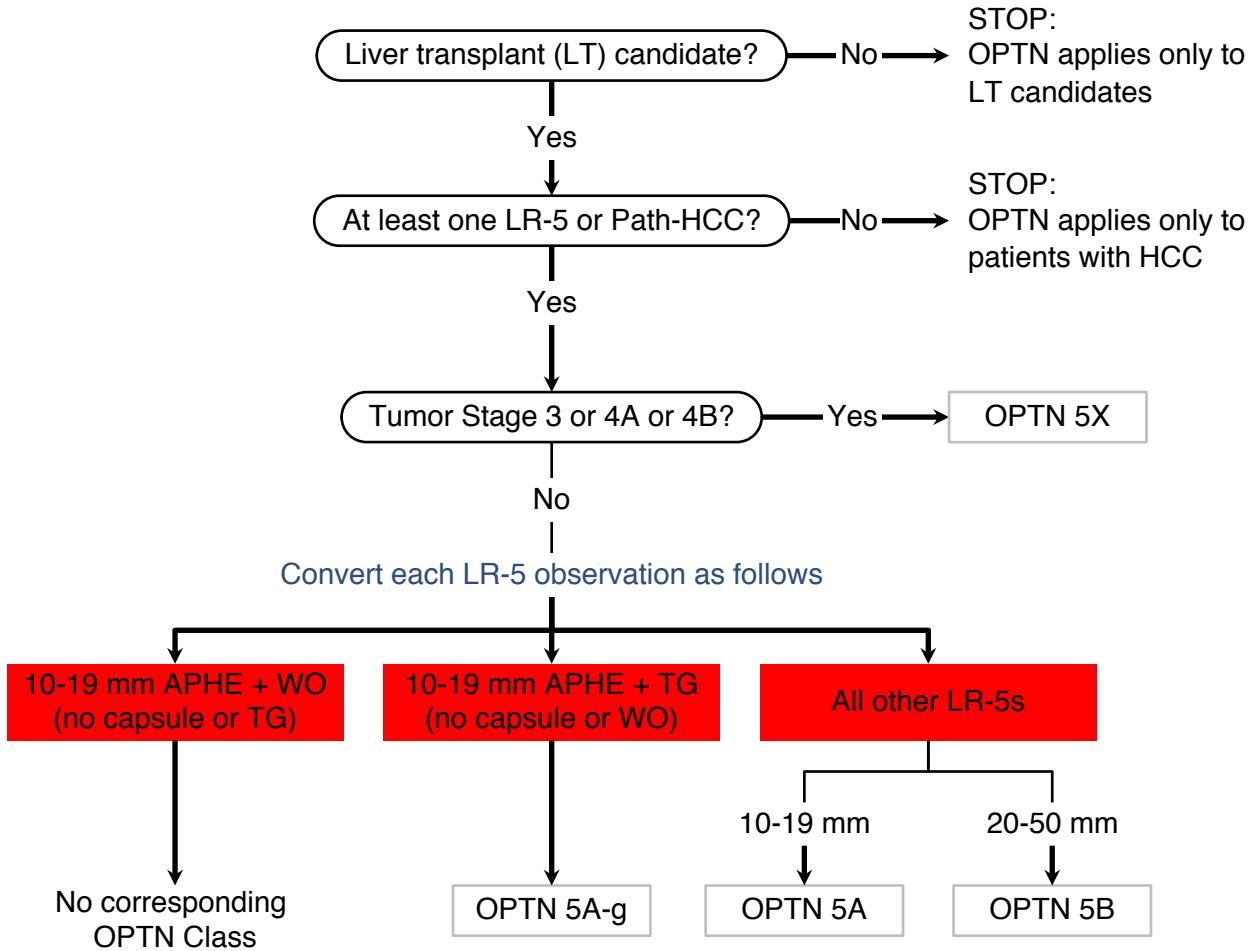
OPTN Stage	Definition	OPTN Class
0	No HCC	None
1	One HCC < 20 mm	<ul style="list-style-type: none"> • OPTN 5A-g if HCC has APHE and TG only • OPTN 5A if HCC has APHE and ≥ 2 additional major features (WO, C, TG)
2	One HCC ≥ 20 mm and ≤ 50 mm, OR two or three HCCs, all ≤ 30 mm	<ul style="list-style-type: none"> • OPTN 5A-g if HCC is 10-19 mm and has APHE and TG only • OPTN 5A if HCC is 10-19 mm and has APHE and ≥ 2 additional major features (WO, C, TG) • OPTN 5B if HCC is 20-50 mm
3	One HCC > 50 mm, OR two or three HCCs, at least one > 30 mm	OPTN 5X
4	4A. Four or more HCCs, regardless of size 4B. HCC + TIV	OPTN 5X

Where HCC is defined as path-proven HCC or LR-5 with exception of 10-19 mm LR-5 with APHE and “washout” as only major feature

Imaging features are relevant only for imaging-diagnosed HCCs and not for path-proven HCCs

Management and OPTN

Conversion from LI-RADS Category to OPTN Class (Cont'd)



Do not convert LR-NC, LR-1, LR-2, LR-3, LR-4, LR-M – no corresponding OPTN Class

LR-TIV is converted to OPTN-5X

Management and OPTN

LI-RADS and OPTN: Reporting Considerations

All path-proven HCCs, LR-5s, LR-Ms, LR-TIVs, and should be reported with the following information:

- Size or size of the viable tumor, if treated
- Major features used for categorizing

All path-proven HCCs and, with the exception of 10-19 mm APHE with “washout” as the only additional major feature, all LR-5s can be converted to OPTN Classes.

LR-TIV should be reported because it is a contraindication to liver transplantation and may require additional workup to determine the etiology (see [Chapter 14, page 13](#)).

LR-M usually prompts biopsy, the results of which may affect transplant eligibility.

LR-4s should be reported.

There is high likelihood they represent HCC, and their presence may suggest multifocal HCC.

LI-RADS and OPTN: Caveats

Not all LR-5s are recognized by OPTN as Class 5:

10-19 mm observations with APHE and nonperipheral WO as the only additional major feature (i.e. no TG and no enhancing “capsule”) are categorized LR-5. These observations do not count as OPTN 5 and therefore do not contribute to staging.

OPTN and LI-RADS populations are not identical:

OPTN

LI-RADS

Applies to all transplant candidates

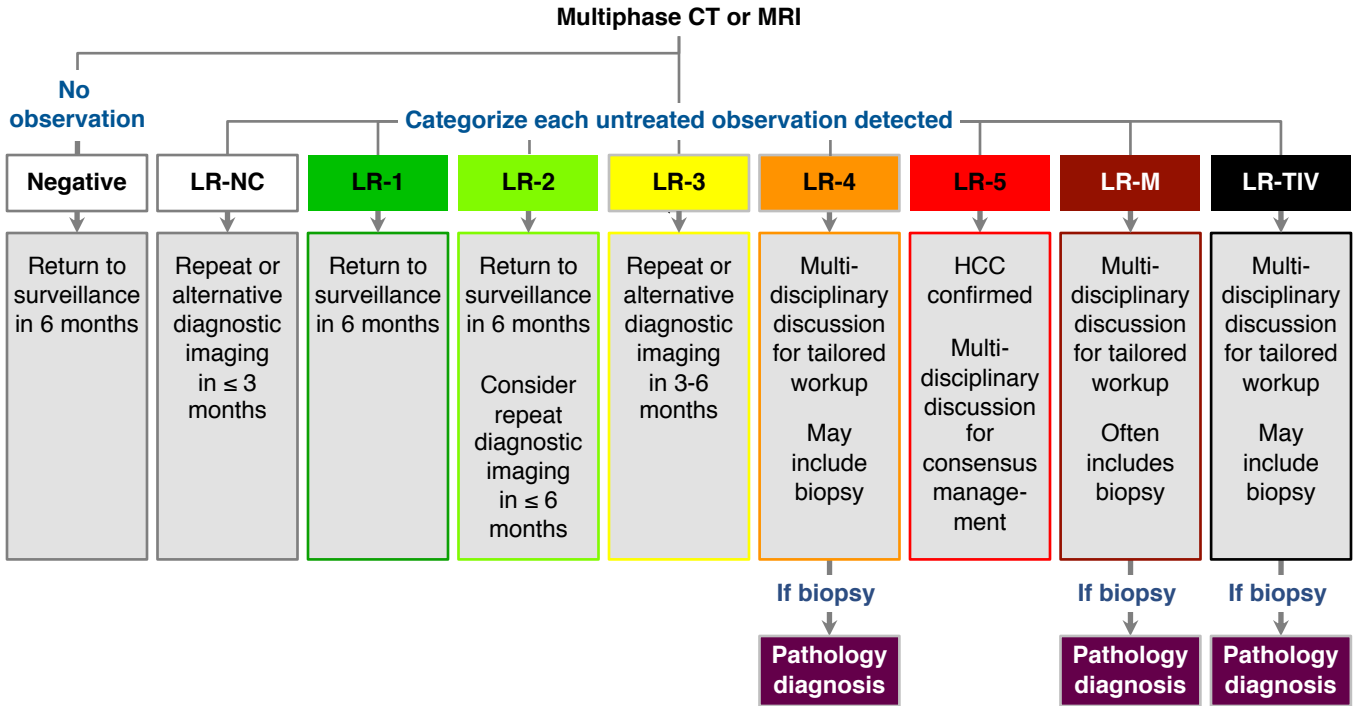
Applies only to transplant candidates meeting eligibility criteria (see [Chapter 2](#))

Implication: OPTN may be applied in some transplant candidates for whom LI-RADS is not recommended due to incomplete validation of imaging for noninvasive diagnosis of HCC. This includes pediatric patients and vascular causes of cirrhosis.

Summary of CT/MRI LI-RADS®-Based Management

Below are suggested diagnostic options and time intervals.

Untreated observations



Treated observations

