2017 Liver Imaging Reporting and Data System (LI-RADS)

Using Ultrasound Screening for the High Risk Patient

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• None
Introduction

• Hepatocellular carcinoma (HCC) is a deadly epidemic
• Second-most common cause of cancer related death worldwide
• Significant risk factors:
  - Cirrhosis (except from vascular etiology, i.e. Budd Chiari)
  - Chronic hepatitis B infection
• Screening can detect HCC at an earlier potentially curable stage
  - Local therapy
  - Liver transplantation
  - Improved survival
Introduction

• **Ultrasound** screening has many advantages:
  - Widespread availability
  - Non-invasive
  - No ionizing radiation
  - Lower cost

• Sensitivity: 58-89%

• Specificity: >90%

• 19,200 subjects with hepatitis B or chronic hepatitis
  - 9757 randomized to screening (US and AFP)
  - 9443 randomized to control (no screening)
• 86 HCCs in the screening group
• 67 HCCs in the control group
• US screening detected:
  - More HCCs
  - At earlier stage
  - With improved survival
Societal Guidelines

• Unanimous support for screening ultrasound for HCC in high risk patients:
  - American Association for the Study of Liver Diseases (AASLD)
  - European Association for the Study of the Liver (EASL)
  - Korean Liver Cancer Study Group and the National Cancer Center (KLCSG-NCC)
  - Japanese Society of Hepatology (JSH)
  - Asian Pacific Association for the Study of the Liver (APASL)

• Initial screening at 6 month intervals
  - With tumor markers (JSH and APASL)
Technical Considerations

- NPO for 4-6 hours prior
  - Decrease bowel gas and improve visualization
- Position both supine and left lateral decubitus
  - Subcostal and intercostal acoustic windows may be used
- Use highest frequency that allows imaging entire depth of liver and diaphragm
Recommended Images

• Longitudinal Images:
  - Left lobe:
    • Left of midline
    • Midline (include aorta)
    • With IVC
    • With left portal vein
  - Right lobe:
    • With gallbladder
    • With right kidney
    • Include right hemidiaphragm
    • Far lateral
    • Main portal vein (grayscale and color)
    • Common duct at porta hepatis (including diameter measurement)
Recommended Images

• Transverse Images:
  - Left lobe:
    • Dome with hepatic veins
    • With left portal vein (check for umbilical vein)
    • Main portal bifurcation
  - Right lobe:
    • Dome with hepatic veins
    • With right portal vein
    • With main portal vein
    • With gallbladder
    • With right kidney
    • Near liver tip
Characteristics of Observations

• “Observation” preferred term for focal findings
  - Nonjudgmental - does not imply a level of suspicion

• Characterize size and echogenicity of observations not definitely benign

• Classically, HCC considered hypoechoic to background liver
  - Not true - HCC also may be iso- or hyperechoic
  - Therefore, echogenicity does not impact US LI-RADS categorization
Size is Everything

- **Size is critical** for both screening/surveillance and definitive diagnosis
- **Definitive diagnosis of HCC** can be made noninvasively using either of two similar systems:
  - Organ Procurement and Transplantation Network/United Network for Organ Sharing (OPTN/UNOS)
  - American College of Radiology (ACR)
- **1 cm size threshold** for both systems

**Observations below 1 cm cannot meet diagnostic criteria for HCC**
US LI-RADS Algorithm

- System only applies to patients at high risk for HCC
  - Cirrhosis
  - Hepatitis B
  - Prior HCC

- 3 imaging categories, based on:
  - Size
  - Definitely benign finding
  - New thrombus
US LI-RADS Algorithm

- **US-1:**
  - No observation
  - Definitely benign observation
- **US-2:**
  - Not definitely benign observation
  - Less than 1 cm size (not aggregate)
- **US-3:**
  - Not definitely benign observation
  - Greater than 1 cm size
  - New thrombus
US-1 Negative

- Observation with features that are **definitely benign**:
  - Cyst
  - Previously characterized finding

- Resume routine (q 6 months) ultrasound screening
US-1 Negative

Resume routine (q 6 months) ultrasound screening
US-2 Subthreshold

- Observation with features that are not definitely benign
- Observation(s) are less than 1 cm
- Short term (3-6 months) follow-up ultrasound
US-3 Positive

- Observation with features that are not definitely benign
- Observation(s) are 1 cm or larger
- New thrombus

- Further characterization with multiphase CT or MRI
US-3 Positive

Further characterization with multiphase CT or MRI
Other Considerations

• Both extrinsic and intrinsic factors can impact US sensitivity
  • **Extrinsic:**
    - Large body habitus
    - Rib shadows or bowel gas
    - Inability to suspend respiration
    - Overlying bandages
  • **Intrinsic:**
    - Increased sound attenuation due to steatosis or fibrosis
Visualization Score

• Adequacy of liver visualization may affect sensitivity

• **Three visualization categories** included in US LI-RADS:
  - Visualization A: no or minimal limitations
  - Visualization B: moderate limitations
  - Visualization C: severe limitations
Visualization A

- No limitations
- Unlikely to impact sensitivity
- Entire liver visualized
Visualization A

- Minimal limitations
- Unlikely to impact sensitivity
- Liver visualized in near entirety
Visualization B

- Moderate limitations
- May decrease sensitivity
- **Heterogeneous liver**
- Modest sound attenuation
- Small portions of liver not visualized
Visualization B

- Moderate limitations
- May decrease sensitivity
- Heterogeneous liver
- Modest sound attenuation
- Small portions of liver not visualized
Visualization C

- Severe limitations
- Significantly lower sensitivity
- Marked heterogeneity
- Substantial sound attenuation
- Large (>50%) portions of liver not visualized
Visualization C

- Severe limitations
- Significantly lower sensitivity
- Marked heterogeneity
- Substantial sound attenuation
- Large (>50%) portions of liver not visualized
Visualization C

- Severe limitations
- Significantly lower sensitivity
- Marked heterogeneity
- Substantial sound attenuation
- Large (>50%) portions of liver not visualized
Future Work

• Visualization score is subjective
• No management recommendations made based on visualization score
• How should we screen Visualization C?
  - CT?
  - MR?
  - CE US?
• Standardized structured reports will help us research answers
Structured Reporting

FINDINGS:

Liver:
  Visualization Score: [...]  
  Morphology/Parenchyma/Contour: [...]  
  Liver observation(s): [...]  
  Main portal vein: patent  
  Bile ducts: No intrahepatic ductal dilatation. Common duct diameter is [...] at the porta hepatis.  
  Gallbladder: Present, with no stones or wall thickening.

Spleen: [...]  

Ascites: [...]
Structured Reporting

IMPRESSION:

1. [Assessment of cirrhosis and portal hypertension]
2. [Description of liver observations] US-LIRADS Screening/Surveillance Category: [.....]
3. Visualization score: [.....]
4. [Other]
Structured Reporting

REFERENCE:

US LI-RADS categories:

US Category:
  US 1 - Negative: No evidence of HCC
  US 2 - Subthreshold: Observation detected that may warrant short-interval US surveillance. Observation < 10 mm in diameter, not definitely benign
  US 3 - Positive: Observation detected that may warrant multi-phase contrast-enhanced imaging. Observation >= 10 mm in diameter or new thrombus in vein

Visualization Score:
A. No or minimal limitations: Limitation if any are unlikely to meaningfully affect sensitivity
B. Moderate limitations: Limitations may obscure small masses
C. Severe limitations: Limitations significantly lower sensitivity for focal liver lesions.
Proven survival benefit from US screening in high risk patients

Standardization in US utilization, reporting, and management has multiple advantages:
- Improve communication with patients and referring physicians
- Unify screening and surveillance algorithms
- Improve patient outcomes
- Supply quantitative data for future research

2017 US LI-RADS is version 1.0

Much more to come in the future!
Thank You

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