Contrast-enhanced Ultrasound (CEUS) Liver Imaging Reporting and Data System (LI-RADS) – a Review of Important Differences Compared to The CT / MRI System

Tae Kyoung Kim, MD, PhD, FRCPC
Professor, University of Toronto

The Contrast-enhanced Ultrasound (CEUS) Liver Imaging Reporting and Data System (LI-RADS) presents some notable distinctions compared to the CT/MRI system, primarily stemming from differences in image acquisition methods and the properties of contrast agents. Among a few contrast agents that are currently available, Sonovue/Lumason (Bracco Imaging, Milan, Italy) and Definity (Lantheus Medical Imaging, Billerica, MA, USA) are most commonly used. Sonazoid (Daiichi-Sankyo, GE Tokyo, Japan), which is actively used in Japan and Korea, enables additional liver evaluation in the Kupffer phase. Although Sonazoid is currently not included in CEUS LI-RADS, it is expected to be included in the future versions of CEUS LI-RADS. First, CEUS, with its real-time evaluation, is often more sensitive in detecting APHE in liver observations compared to CT or MRI. This is because CT or MRI may occasionally fail to demonstrate APHE due to arterial phase mistiming. Therefore, CEUS can be a reasonable next step for observations classified as LR-3 or LR-4 on CT/MRI LI-RADS when APHE is absent, as some of these nodules may be potentially upgraded to LR-5 if APHE is detected on CEUS. Second, washout patterns differ significantly in non-HCC malignancies between CEUS and CT/MRI due to different properties of the contrast agents. While almost all non-HCC malignancies exhibit early (< 60s) washout on CEUS with intravascular contrast agents, non-HCC malignancies such as intrahepatic cholangiocarcinoma may show progressive enhancement without washout in the delayed phase of CT/MRI. This is because contrast agents for CT/MRI tend to diffuse through the vascular endothelium and accumulate in the tissue interstitium. Consequently, the definition of LR-M (probably or definitely malignant but not specific for HCC) in CT/MRI LI-RADS differs from that in CEUS LI-RADS. It's crucial to understand the criteria for the LR-M category to avoid misdiagnosis of intrahepatic cholangiocarcinoma as hepatocellular carcinoma. In CEUS LI-RADS, LR-M is assigned based on criteria such as rim APHE, early washout (< 60 seconds), or marked washout

within the first 2 minutes. In contrast, LR-M in CT/MRI LI-RADS includes features like targetoid morphology, infiltrative appearance, marked diffusion restriction, and necrosis or severe ischemia. Third, the enhancing capsule in CT/MRI is seen in the portal venous or delayed phase and represents fibrous pseudocapsule, which is not visible on CEUS. Finally, CEUS can be safely used in patients with renal failure who are contraindicated for the use of CT/MRI contrast agents. This makes CEUS a valuable alternative imaging modality in this patient population. In summary, while CEUS LI-RADS shares similarities with CT/MRI LI-RADS, understanding the differences between the two systems is crucial for accurate diagnosis and classification of liver observations, particularly in cases where CEUS is utilized as an adjunct or alternative imaging modality.