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Specialty : Abdomen

Lecture Title : Quantitative Liver Ultrasound: Current Status and Challenges

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Ultrasound is the most widely used imaging modality for the liver because it is accessible, portable, inexpensive, and repeatable. Yet conventional B-mode ultrasound remains fundamentally qualitative. It can suggest diffuse liver disease, but it cannot reliably quantify disease burden, detect subtle change over time, or provide the biomarker-based assessment increasingly demanded in the era of metabolic dysfunction-associated steatotic liver disease (MASLD). This gap has driven the evolution of quantitative liver ultrasound, a group of techniques designed to extract measurable tissue information rather than relying solely on visual interpretation. In current practice, ultrasound elastography is the most mature component of this field and is now embedded in noninvasive fibrosis assessment pathways. Ultrasound-based liver fat quantification is advancing rapidly through attenuation-, backscatter-, and radiofrequency-derived approaches, many of which are increasingly evaluated against MRI proton density fat fraction rather than conventional grayscale ultrasound. A newer frontier is the assessment of viscoelasticity and inflammatory activity through shear-wave dispersion and related biomarkers, particularly in MASLD and metabolic dysfunction-associated steatohepatitis. The central issue for the next phase of development is no longer technical feasibility alone. Rather, the field must establish standardization across platforms, robust quality control, biologically meaningful interpretation, clinically actionable thresholds, and reliable longitudinal response criteria. Quantitative liver ultrasound should therefore be viewed not as a single technology, but as a family of biomarker strategies at different stages of maturity. Its future lies in multiparametric integration: combining fibrosis, steatosis, inflammation, and hemodynamic information into a practical bedside phenotype that can guide triage, monitoring, and increasingly, treatment decisions.