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MULTIPARAMETRIC ASSESSMENT OF HEPATIC STEATOSIS IN NON-ALCOHOLIC FATTY LIVER DISEASE: AN INTEGRATED APPROACH USING TRANSIENT ELASTOGRAPHY, COMPUTED TOMOGRAPHY, AND MAGNETIC RESONANCE IMAGING

Nigora M. Djuraeva
MD, PhD, DSc,
Behruz I. Urinov
MD
MR and CT diagnostics department,
Republican Specialized Scientific-Practical Medical Center for Surgery named after academician V. Vakhidov, Tashkent, Uzbekistan

Non-alcoholic fatty liver disease (NAFLD) is among the most prevalent chronic liver conditions worldwide, affecting over 25% of the adult population according to WHO data. Accurate quantification of hepatic steatosis remains a clinical challenge, as no single imaging modality provides sufficient sensitivity and specificity across all degrees of fat accumulation.

Objective: To evaluate the diagnostic performance of a multiparametric imaging approach — combining transient elastography (TE), CT-based liver-to-spleen attenuation index (LAI), and MRI protocols (T1 DIXON and MR Spectroscopy) — for the quantitative assessment of hepatic steatosis in NAFLD patients.

Materials and Methods: The study was conducted at the MR and CT Department of the Republican Specialized Center of Surgery named after academician V. Vakhidov (Tashkent, Uzbekistan) on a 640-slice CT scanner Aquilion One Genesis (Canon, Japan) and a Siemens MRI system with the LiverLab protocol. A total of 175 patients were enrolled: 95 with confirmed NAFLD (study group) and 80 without hepatic steatosis (control group). Transient elastography was performed using the Fujifilm ARIETTA 65 (SWE technology) with assessment of the ATT index. Native low-dose CT was performed with ROI-based measurement of liver and spleen density to calculate the LAI index and visceral fat volume. MRI evaluation included T1 DIXON (INPHASE/OUTPHASE) and single-voxel MR Spectroscopy (H-MRS).

Results: TE-based ATT values demonstrated clear gradation across steatosis grades: S1 — mean ATT 0.657±0.019, S2 — 0.698±0.012, S3 — 0.837±0.025. CT LAI index reliably identified steatosis in the native phase only, with values shifting from positive (+3.8±0.32 HU for mild steatosis) to markedly negative (−20.7±0.3 HU for severe steatosis), while spleen density remained within reference range. MRI T1 DIXON quantified liver fat at 12.3%±0.02% for S1, 19.6%±0.31% for S2, and 36.6%±0.08% for S3. H-MRS confirmed hepatic steatosis in 86.3% of cases. A strong inverse correlation was established between CT LAI and MRI DIXON T1 fat fraction values (Pearson r = −0.816), confirming concordance between methods.

Conclusion: The multiparametric approach combining TE-ATT, CT-LAI, and MRI LiverLab protocols provides comprehensive, non-invasive quantification of hepatic steatosis in NAFLD across all severity grades. Each modality contributes complementary information, and their integration improves diagnostic accuracy, supports treatment monitoring, and may reduce the need for liver biopsy in the majority of patients.