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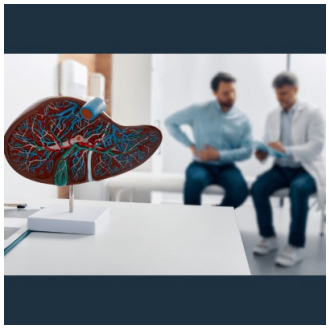
Study Investigates New Correlations for US & MRI Detection of Liver Disease



The prevalence of paediatric chronic liver disease is increasing, with non-alcoholic fatty liver disease being the most common cause. The progression of most chronic liver diseases involves fibrosis, cirrhosis, and eventual liver failure. While liver biopsy is the gold standard for diagnosis, imaging techniques like shear-wave elastography (SWE) and MR elastography show promise in detecting fibrosis. MRI proton density fat fraction (PDFF) is used to quantify hepatic steatosis. US manufacturers are developing quantitative techniques, but their diagnostic performance and relationship with MRI measures are not well-established. A recent study published in *Radiology* aimed to determine the associations between quantitative ultrasound (US) and MRI measures of liver disease in children, adolescents, and young adults and assess the ability of US measures to detect abnormal liver stiffening and steatosis as defined by MRI.

Participants characteristics

The study involved 44 participants (23 male, 21 female) with various liver diseases. One female participant was excluded due to MRI discomfort. Technical issues led to data exclusion for NLV and hepatorenal index in two participants, and one participant's MR elastography data was unanalyzable due to high liver iron content. Some attenuation and hepatorenal index measurements were also excluded due to technical inadequacy. The most common liver disease causes were Fontan-associated liver disease, known fatty liver disease, and autoimmune liver disease. Participants' demographic data and MRI/US measures are detailed. Mean age was 16 years, mean BMI was 21.9 kg/m2, mean liver shear stiffness with GRE MR elastography was 3.3 kPa, and mean liver PDFF was 5.6%. Liver shear stiffness and PDFF were higher in male participants compared to female participants.

Evaluation of Quantitative MRI and US in Paediatric Chronic Liver Disease

Quantitative MRI and US are increasingly important tools for assessing liver disease, but there's limited data comparing these modalities, particularly regarding newer US techniques. This study addresses this gap by evaluating the diagnostic performance of quantitative US in children with chronic liver disease, using MRI as a reference standard. In the study sample, US-assessed liver shear-wave speed (SWS) and shear-wave dispersion correlated strongly and positively with liver shear stiffness measured by MR elastography. SWS emerged as the only independent predictor of abnormal MRI liver shear stiffness (>2.8 kPa), with a cutoff of 1.56 m/sec predicting abnormal liver stiffness with high accuracy. Additionally, US acoustic attenuation moderately correlated with MRI proton density fat fraction (PDFF), and normalized local variance showed a moderate negative correlation with MRI PDFF. Median acoustic attenuation was identified as the sole independent predictor for abnormal liver fat (>5%), with a cutoff of more than 0.55 dB/cm/MHz predicting abnormal MRI PDFF with moderate accuracy. These findings highlight the potential of quantitative US in assessing liver disease in children and provide valuable insights for clinical practice.

Promising correlations: US liver SWS proves effective in detecting liver shear stiffness

The study highlights a significant correlation between US liver shear-wave speed (SWS) and shear-wave dispersion, prompting further discussion. Shear-wave dispersion in US is believed to indicate tissue viscosity, a distinct but related characteristic to tissue stiffness. Some suggest that changes in viscosity could reflect inflammation, potentially aiding in distinguishing inflammation from fibrosis in liver disease. However, our study observed a correlation between liver SWS and shear-wave dispersion. Further research is necessary to determine whether shear-wave dispersion sufficiently differs from liver SWS to serve as a useful complementary imaging marker and whether its diagnostic performance varies depending on the disease. Additionally, the study reveals a moderate to high positive correlation between US liver shear-wave speed (SWS) and MRI liver shear stiffness, which contrasts with prior research. These disparities could stem from technique variances, US manufacturer differences, or our study's narrower participant inclusion criteria based on BMI.

Findings regarding the positive association between US attenuation coefficient and MRI proton density fat fraction (PDFF) align with existing literature. Paige et al. reported a similar correlation strength in adults, while D'Hondt et al. established an attenuation coefficient threshold for predicting MRI PDFF greater than 5% in paediatric patients. A meta-analysis also showed promising sensitivity and specificity of the attenuation coefficient for detecting any grade of steatosis in adults. However, there are limited prior data for normalised local variance (NLV). Bae et al.

reported its effectiveness in predicting histopathologic steatosis grades in adults, but its performance was weaker in our study sample.

Despite these findings, our study had limitations, including a small sample size leading to wide confidence intervals, lack of liver biopsy findings as a reference standard, and usage of only one US system and one MRI system. Additionally, our recruitment approach may have impacted the strength of associations between US and MRI measures of liver fat due to the relatively low frequency of steatosis in our sample. US liver SWS proves effective in predicting liver shear stiffness greater than 2.8 kPa with a high area under the receiver operating characteristic curve (AUC) of 0.95 (95% CI: 0.84, 0.99), while US liver attenuation serves to predict liver PDFF greater than 5% with an AUC of 0.75 (95% CI: 0.60, 0.87). Further research is necessary to validate these findings and assess the predictive performance of these US measures across various US system manufacturers.

Source: **Radiology**

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