EFSUMB Journal Club – Number 4

The EFSUMB Journal Club regularly shares with EFSUMB members selected relevant ultrasound-related publications, providing values and critiques of the work.

Contributors for this issue: Prof. Giovanna Ferraioli

Winner of the EFSUMB "Best Published Paper", awarded at EUROSON 2024 in Naples, Italy

Noninvasive Staging of Hepatic Steatosis Using Calibrated 2D US with Liver Biopsy as the Reference Standard

https://pubs.rsna.org/doi/10.1148/radiol.220104

From Radiology, March 2023

Gert Weijers, Isabelle D. Munsterman*, Johan M. Thijssen, Hans Kuppeveld, Joost P. H. Drenth, Eric T. T. L. Tjwa**, Chris L. de Korte***

Background: Accumulation of lipid in the liver (i.e. hepatic steatosis) is the basis of non-alcoholic fatty liver disease (NAFLD). Asymptomatic steatosis can lead to non-alcoholic steatohepatitis and downstream complications.

Purpose: To assess the diagnostic performance of calibrated US (CAUS) as a method for detection and staging of hepatic steatosis in comparison with liver biopsy.

Materials and Methods: Two-dimensional US images in 223 consecutive patients who underwent US-guided liver biopsy from May 2012 to February 2016 were retrospectively analyzed by 2 observers using CAUS. CAUS semiautomatically estimates echo-level and texture parameters, with particular interest in the residual attenuation coefficient (RAC), which is the remaining steatosis-driven attenuation obtained after correction of the beam profile. Data were correlated with patient characteristics and histologically determined steatosis grades and fibrosis stages. The data were equally divided into training and test sets to independently train and test logistic regression models for detection (>5% fat) and staging (>33% and >66% fat) of hepatic steatosis by using area under the receiver operating characteristic curve (AUC) analysis.

Results: A total of 195 patients (mean age, 50 years ± 13 [SD]; 110 men) were included and divided into a training set (n = 97 [50%]) and a test set (n = 98 [50%]). The average CAUS interobserver correlation coefficient was 0.95 (R range, 0.87–0.99). The best correlation with steatosis was found for the RAC parameter (R = 0.78, P <.01), while no correlation was found for fibrosis (R = 0.14, P = .054). Steatosis detection using RAC showed an AUC of 0.97 (95% CI: 0.94, 1.00), and the multivariable AUC was found to be 0.97 (95% CI: 0.95, 1.00). The predictive performance for moderate and severe hepatic steatosis using RAC was 0.93 (95% CI: 0.88, 0.98) and 0.93 (95% CI: 0.87, 0.98), respectively.

Conclusion: The calibrated US parameter residual attenuation coefficient detects and stages steatosis accurately with limited interobserver variability, and performance is not hampered by the presence of fibrosis.

Strengths:

- The findings of this study are based on a substantial and comprehensive body of prior research, as the authors have previously evaluated the feasibility of the calibrated US protocol in an animal model and in a pilot study involving 14 patients.
- The study included a substantial number of patients with diverse etiologies of liver disease and a reasonable range of steatosis grades at histology, which allowed for a comprehensive analysis of the data.
- The CAUS software is designed to compensate for the normal depth-dependent behavior of the ultrasound beam, which is a key advantage of this technology.
- The CAUS software will be made available for investigational research purposes upon request once it has been fully developed. Thereby, the findings of the study may be validated in independent studies conducted by other research groups.
- The findings of the study provide further confirmation that the stages of fibrosis have no impact on the quantitative estimation of liver fat content when using ultrasound-based algorithms.

Weaknesses

- The prevalence of patients with non-alcoholic steatohepatitis (NASH) in the sample with fatty liver disease (FLD) is exceedingly high (55/66, 83.3%), rendering the sample unrepresentative of NAFLD cohorts, in which the NASH prevalence is about 25%, or the general population that may undergo ultrasound examination for suspected NAFLD.
- The thickness of the superficial tissue layers, specifically the distance between the skin and liver capsule, is not reported. It is important to note that body mass index is an imperfect parameter for evaluating the local thickness of subcutaneous fat, specifically the area where B-mode images are obtained. It is uncertain whether this could have affected the results.
- A direct comparison with commercially available package software for ultrasound fat quantification using PDFF as reference would have increased the strength of the findings.
- Lack of external validation.
- Retrospective study.

Potential contributors to EFSUMB Journal Club are highly appreciated. Please refer to admin@efsumb.org if you are willing to participate as author for an upcoming issue.