Application of Ultrasound Liver Elastography to the Diagnosis and Monitoring of Liver Disease

CME Credits

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It is clinically important to assess the degree of hepatic injury in addition to the clinical diagnosis of underlying liver diseases. Fibrotic deposits represent the response of liver tissue to damage, and the degree of hepatic fibrosis is an important prognostic indicator and therapeutic target in liver diseases. Invasive liver biopsy has been the golden standard for the assessment of the degree of hepatic fibrosis with hazard. Non-invasive assessments have been widely used to assess the degree of hepatic fibrosis instead of liver biopsy. Ultrasound elastography has been the recent interest for the clinical assessment of hepatic fibrosis. Ultrasound elastography technology involves the use of a machinery to generate shear waves in the vicinity of hepatic tissue and then the monitoring the propagation of the shear waves. A mild external force can also be applied to the liver tissue for the monitoring of degree of strain. Then ultrasound devices can calculate the speed of the shear waves and the degree of strain, and convert these data into ultrasound images to determine the elasticity of the liver tissue. Current elastography determining shear wave speed include Transient Elastography (TE), Acoustic Radiation Force Imaging (ARFI), Point Shearwave Elastography (SWE), and Two-dimensional SWE[1,2] [Figure 1].

Various researches have shown a good correlation between the hepatic elasticity and the degree of hepatic fibrosis; therefore, elastography is widely used in the clinical assessment of hepatic fibrosis. Recent reports indicate that ultrasound elastography is helpful in the diagnose cirrhosis and severe hepatic fibrosis with a high level of accuracy. However, ultrasound elastography is only moderately accurate in the assessment of mild-to-moderate hepatic fibrosis. In our studies, the accuracy of TE was as high as 90% and 93% in the diagnosis of cirrhosis in patients having chronic hepatitis B and C. The studies from the China Medical University, Taiwan, showed that the accuracy of ARFI was 83% in the diagnose cirrhosis in patients having chronic hepatitis C.[3,4] All current international guidelines recommend the use of ultrasound elastography to assess the degree of hepatic fibrosis.[5,6] Apart from chronic hepatitis B and C, ultrasound elastography has also been used to assess the degree of hepatic fibrosis in other chronic liver diseases such as alcoholic liver disease, nonalcoholic fatty liver, primary cholestatic liver disease, and primary sclerosing cholangitis. However, it is necessary to adjust the values of elasticity with factors including food intake, hepatic inflammation, bile duct blockage, heart failure, and other relevant factors during the interpretation of degree of hepatic fibrosis.

The screening of gastric and esophageal varices is clinically important for the prevention of high risk hemorrhage. However, the gastroscopic examination is invasive and is poorly tolerated by patients. Therefore, it is reasonable to use some non-invasive screening methods instead. The earlier researches proved a positive correlation between hepatic elasticity and portal hypertension; and portal hypertension was correlated with the occurrence of gastric and esophageal varices in cirrhotic patients. Our data show that a cut-off value of 21 kPa can effectively eliminate the need for gastroscopic examination in cirrhotic patients.[7] Whereas recent international guidelines recommended a TE elasticity of 20 kPa and platelet count of 150,000 as threshold values.[5,6] Patients having less hepatic elasticity and higher indicates platelet count than the recommended values are not required to take invasive gastroscopic examination. Therefore, the use of ultrasound elastography can reduce the number of invasive gastroscopic examination by 20%-30%. Furthermore, 3%-5%

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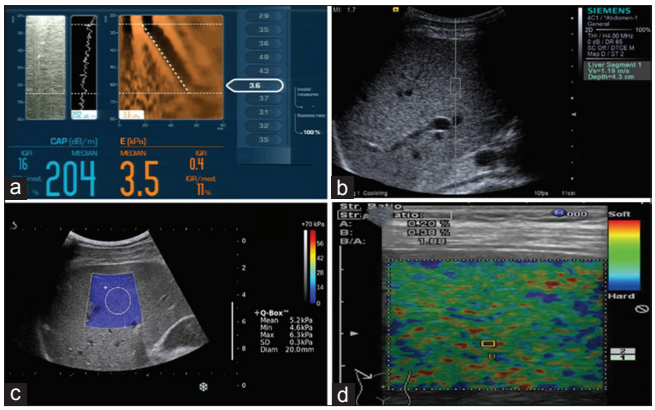

Figure 1: Ultrasound liver elastography: (a) transient elastography. (b) Acoustic radiation force impulse. (c) Two-dimensional shear-wave elastography. (d) Strain-based elastography

of cirrhotic patients having high risk gastric and esophageal varices do not need preventive treatment against hemorrhage.[8]

The major benefit of noninvasive ultrasound elastography is that the examinations can be readily repeated; a method helpful for the long-term monitoring. Follow-up ultrasound elastography had been studied for the role of antiviral therapy on the chronic viral hepatitis. In the initial stage of antiviral therapy, the rapid improvement of liver elasticity was mainly attributed to the resolution of hepatic necrosis and edema; whereas the long-term improvement indicated the reduction of hepatic fibrosis in response to the discontinued hepatic injury under antiviral therapy. Our follow-up data among patients with chronic viral hepatitis B and C showed that patients had higher values of hepatic elasticity before antiviral therapy. It is interesting that patients with obesity and diabetes mellitus also had higher values of hepatic elasticity before antiviral therapy; but, they had only less improvement of liver elasticity during or after antiviral therapy. The hepatic elasticity of some patients with much more obesity were even worse during or after antiviral therapy.

Earlier reports for long-term series ultrasound elastography suggested that patients with higher hepatic elasticity were much more likely to develope liver cancer, portal hypertension, gastric and esophageal varices or hemorrhage, hepatic decompensation, and mortality.[9,10] Thus, ultrasound elastography is helpful in the prediction of prognosis. Non-invasive ultrasound elastography will be much more widely used clinically in the future.

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Conflicts of interest

There are no conflicts of interest.

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