



Editorial

ARFI Elastography in Chronic Hepatitis B Virus Infection—The Sources of Variations

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India has a huge burden of hepatitis B virus (HBV) infection. With an overall prevalence of 3.7% (CI of 3.17–4.24), India is estimated to have around 40 million HBV carriers.^{1,2} Of them 15 to 20% will develop complications of chronic hepatitis B virus infection, which ranges from liver fibrosis, cirrhosis, liver failure, and hepatocellular carcinoma. Detection and treatment of early fibrosis in chronic HBV infection can prevent progression to cirrhosis in 25 to 30% of them. Treatment is often necessary for patients with grade 2 (F2) fibrosis and above. Thus, an accurate method of estimating liver fibrosis is very important. Liver biopsy, the gold standard for confirmation of liver fibrosis is invasive, and procedure-related complications occur in 6% of patients undergoing liver biopsy.³ Moreover, liver fibrosis being a heterogenous and non-uniform process, biopsy is prone to sampling error. Several non-invasive serological tests and imaging techniques have been developed since the 1990s and are now widely accepted in clinical practice.

Imaging techniques including FibroScan, acoustic radiation force impulse (ARFI) elastography, and magnetic resonance (MR) elastography are used for estimating liver fibrosis. FibroScan is a one-dimensional transient elastography technique used at the clinical point of care. ARFI elastography, being a technique integrated with a conventional ultrasound machine can be performed during a routine ultrasound examination of the abdomen. It uses short-duration acoustic push pulses travelling along the ultrasound beam to displace the tissue within a region of interest. The speed of propagation of the shear waves is proportional to the density and elasticity of the tissue and is expressed qualitatively as shear wave velocity (SWV) in meters/second (m/s). Since there is no need for external compression, the operator dependency is reduced. Direct visualization of the region of interest compensates for the shortcomings of FibroScan; has significantly lower unsuccessful measurements; is less sensitive to high body mass index and ascites;

and has superior diagnostic accuracy.⁴ MR elastography on the other hand is an elegant technique which had the largest liver tissue coverage and is least prone to sampling errors and technical failures. However, in terms of cost, availability, health resource allocation, and training requirements, ARFI elastography offers the best trade-offs for screening and follow-up of patients with chronic HBV-infected patients in our country.

Given the potential of ARFI elastography in our clinical setting, the work by Bui et al published in this issue of IJRI is very relevant. The authors compare ARFI elastography with FibroScan in chronic hepatitis B virus infection and report a high agreement of 92% between the two modalities.⁵ This finding is in line with the evidence available from previous work.⁴ They also provide a cut-off of 1.37 m/s for detecting significant fibrosis (\geq F2) and 1.70 m/s for detecting cirrhosis.⁵

Some key aspects related to ARFI of the liver that we need to bear in mind as we read this article are as follows:

- i) ARFI values within the liver are variable due to inherent heterogeneity in the liver stiffness. SWV values are higher in the parenchymal close to the liver capsule due to age-related fibrosis of superficial liver parenchyma. Thus, SWV is measured 2 cm deeper than the capsule. Higher values are also seen in the left lobe, which might partly be due to the influence of cardiac pulsations. In chronic liver disease, the higher stiffness of the left lobe might reflect the differences in the rate of disease progression between both the liver lobes.
- ii) ARFI values of the liver are often obtained from the right lobe through the intercostal space. This is because the fibrosis grades from liver biopsy, which is the reference standard are from the right lobe of the liver. Since subcostal measurements are prone to more mechanical compression than the intercostal

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approach, the SWV measurements are higher for the subcostal approach. A median of at least ten successful measurements gives the representative SWV. It is important to assess the ratio of interquartile range to median SWV to assess the quality of measurements and less than 25–30% is desirable for reliable results.

- iii) SWV measurements are prone to variability based on the physical, physiological, anatomical, and geometrical factors. For example, the use of higher frequency probes returns lower SWV. Measurements obtained from a closer source to target distance and from ROI parallel to the ultrasound source are higher.⁶ Rapid breathing can increase the variability of measurements. Though measurements are usually obtained during quiet breathing, we might have to request breath hold from anxious patients to increase the consistency of measurements.
- iv) The values of SWV have not been standardised for different etiologies of chronic liver disease. Based on the etiology, SWV cut-off for a particular grade of fibrosis may vary. For example, SWV is typically higher for the grade of fibrosis in patients with chronic hepatitis C when compared with those with chronic hepatitis B virus infection.⁷
- v) ARFI is useful for the follow-up of patients with chronic HBV infection and helps in avoiding repeated liver biopsies. However, we need to bear in mind the effects of the waxing and waning nature of inflammation in chronic HBV infection; the effect of viral counts, and the duration of anti-viral therapy on liver stiffness and thus the SWV measurements. Longitudinal follow-up studies have shown a significant decrease in shear wave velocity measurements both in patients with significant fibrosis and cirrhosis.⁸ We should however

note that this change was noted only after 32 months of antiviral therapy.⁹

- vi) Lastly, the literature is unclear if different imaging techniques can be used interchangeably to follow up patients with chronic HBV infection. With the available evidence, choosing the same method for follow-up appears to be more reliable.

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