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LIVER ELASTOGRAPHY: CLINICAL SIGNIFICANCE AND OUR EXPERIENCE

Radiodiagnosis

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ABSTRACT

INTRODUCTION: Chronic liver disease and cirrhosis affect millions of peoples worldwide, cause range from alcoholism, hepatitis B and hepatitis C and hepatotoxic drugs. Unfortunately, Chronic liver disease and cirrhosis have long latent period before their clinical presentation. The gold standard for assessment of liver fibrosis is biopsies which is not only expensive, painful and have potential for complications. They often need to be repeated for assessment of progression or resolution. Further liver biopsies rely on small tissue sample which can also yield inadequate results. By early detection of patients at risk of developing liver cirrhosis, we may be able to stop, delay and possibly revert progression of disease and reduce complications. Easy to do, noninvasive procedure and easily repeatable, liver elastography provides quantitative data to assess tissue stiffness which is virtual biopsy.

The introduction of liver elastography is invaluable to reduce the requirement for liver biopsy, to allow for follow-up of patients undergoing new antiviral therapy with chronic liver disease, and to allow for preoperative assessment of those with liver cancer for optimal selection of therapy options.

Grey scale sonographic evaluation of liver morphology for the prediction of the presence and status of cirrhosis is invaluable but subjective[1,2,3]. Furthermore, it is not uncommon to have normal appearing liver even with quite advanced disease. Historically, therefore, diagnosis and staging of liver cirrhosis have been performed based on invasive liver biopsy. At histology, liver fibrosis is graded from METAVIR stage F0, indicating a normal liver, through to METAVIR stage F4, indicating cirrhosis[4,5,6]. Patients with METAVIR stage F2 and F3 are felt to have clinically important fibrosis necessitating special attention and referral to hepatology service as these patients are at risk for portal hypertension, liver failure, and development of HCC.

This article reviews the clinical significance of liver elastography, its advantage over gray scale ultrasonography and our experience.

KEYWORDS

Liver elastography, liver fibrosis, point shear wave elastography.

What the clinician needs to know

Cirrhosis is the end stage of chronic liver disease from any etiology and results from progressive fibrin deposition. Fibrosis stage Metavir 4 is the only fibrosis stage independently associated with liver-related mortality[7].The survival at 150 months for F4 disease is 55% [7].Cirrhosis consists of at least two distinct clinical stages compensated cirrhosis and decompensated cirrhosis. Decompensated cirrhosis is easily diagnosed, as these patients present with variceal hemorrhage, ascites,encephalopathy, and/or jaundice. Compensated cirrhosis does not have the previously mentioned complications. The median survival for compensated cirrhosis > 12 years while in decompensated cirrhosis is < 2years[8,9,10]. The advantage of elastography is to identify patients with compensated cirrhosis at an earlier stage so patients can be treated to prevent progression to decompensated cirrhosis. Compensated cirrhosis can be further classified as patients with varices or without varices. The 1-year mortality with no varices is 1% while with varices 3% [11, 12,13]. In patients with pre-cirrhotic disease, the stiffness value can be used to monitor the patient's fibrosis to determine progression of disease or when the fibrosis reaches a level where antivirals (in case of Hepatitis C) are indicated.

The treatment strategy of cirrhotic patients with focal hepatic lesions i.e. hepatocellular carcinoma can also be assessed through elastography. The patients with less marked fibrosis may be subjected for hepatic resection and patients with advanced hepatic fibrosis should be evaluated for liver transplantation because of poor hepatic reserve and functional capacity[14]. Patients who are being evaluated for hepatic lobar resection, portal vein embolization and transhepatic biliary drainage for cholangiocarcinoma, biliary stricture and carcinoma gall bladder, should also be evaluated for assessment of liver fibrosis because regenerative capacity of residual liver is inversely proportional to hepatic fibrosis.

History and evolution of Elastography

Introduced in 1991, elastography is another non-invasive technique for evaluating the elastic properties of soft tissue either quantitatively or qualitatively[15]. The elastography of the liver is theoretically not easy to determine compared with that of superficial organs because the liver is located deep and under the rib cage. Nevertheless, various techniques of ultrasound (US) Elastography have been developed for repeatedly measuring hepatic fibrosis. From a technical standpoint, two types of US elastography for the measurement of liver stiffness are under development: shear wave based elastography and real-time tissue elastography.

Fibroscan is another non-invasive methodology to evaluate hepatic fibrosis, wherein a mechanical wavelength of low amplitude is propagated to the liver. An ultrasound signal measures the hepatic propagation of the mechanical wave through the hepatic parenchyma and allows an estimation of its stiffness. The degree of fibrosis is correlated to the degree of liver stiffness. Although this test is non-invasive and painless, it is limited in its ability to be used in patient with high BMI (>30kg/m2) and in patients with ascites (contraindicated as values cannot be obtained). In addition, being a completely blind test, liver parenchyma evaluation for visualization of focal lesions and parenchymal changes is not possible.

Point shear wave Elastography (SWE) is conducted with the patient in supine position and right arm fully abducted, so as to obtain a good inter-costal window. Alternately, the patient can also be put in a left lateral decubitus position. The ROI is placed at the optimal location, avoiding vessels and keeping it at least 2 cms below the Glisson's capsule. Patient is advised to breathe normally and hold breath in mid inspiration, once the optimal location for ROI is identified. Society of Radiologists in Ultrasound recommends measurements to be taken from segment 7 and 8 of the liver. Ideally 8-10 readings are advised to be obtained. The average of these reading is considered as the final value of liver stiffness, which can be represented either in m/s or Kpa units. Fasting for 4–6 hours is recommended prior to scan.

Healthy volunteers and patient in age group of >20 & < 70 Years were included. Subjects unable to hold breath for 10 second were excluded.

ELASTOGRAPHY AND OUR EXPERIENCE

We have used elastography in over 1000 cases over a period of 18 months (from August 2017 to January 2019)using Philips Affinity 70 ultrasound machine with ElastPQ software used for assessment liver stiffness. Mean value of 10 readings were calculated and was classified in various stages as described in table 1.

Table 1.

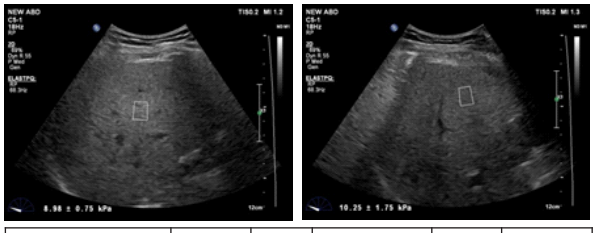
Normal	Metavir F0	2.0 -4.5 Kpa
Normal - Mild Fibrosis	Metavir F0 - F1	4.5 -5.7 Kpa
Mild - Moderate Fibrosis	Metavir F2 – F3	5.7 - 12.0 Kpa
Moderate - Severe Fibrosis	Metavir F3 - F4	12 - 21 Kpa
Severe Fibrosis	Metavir F4	> 21 Kpa

This technique has helped us in improving and enhancing our ability to provide a definite and a better diagnosis. An important change that we have noticed is that once we had a fatty liver of any grade on grey scale sonography and we tried elastography in almost all these patients to further evaluate superimposed fibrosis, we observed that on reporting the ultrasound result as fatty liver versus informing that it is leading to fibrotic changes leads to significant change in the response of the patient to the report. With a more detailed report with Elastography findings, the report is taken with concern and patient show eagerness to comply with their treatment and modify their lifestyle especially alcoholics.

CASE STUDIES

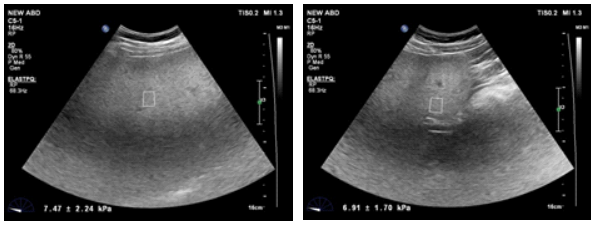
We want to present two cases in which patients were alcoholics, had severe fatty liver, however no gray scale feature of portal hypertension / cirrhosis. The serum billirubin was within normal limits, however SGOT & SGPT were deranged, we advised liver elastography, patients came back to us for the same. The elastography reports for both of them revealed mild to moderate fibrosis and after getting elastography report we saw a significant change in the response of the patient to the report and also a positive feedback from our physician about patients compliance, life style modification and awareness.

Case 1: 35 Years / M



Average Liver stiffness (Kpa)	SGOT	SGPT	S. Billirubin	Direct	Indirect
10.45	116.1	111.3	0.89	0.32	0.57

Case 2: 26 Years/ M



Average Liver stiffness (Kpa)	SGOT	SGPT	S. Billirubin	Direct	Indirect
8.23	46.1	79	0.60	0.20	0.40

CONCLUSION

Elastography is a useful but underutilized modality in the evaluation of patients with diffuse liver diseases. SWE provides a high degree of accuracy in identifying and categorizing patients with varying degree of liver fibrosis and their follow up. The results are comparable with those of Transient Elastography, which is the first available technique and the most widely accepted method for noninvasive assessment of liver fibrosis. In addition, ultrasound based SWE provides additional information with respect to the disease process such as – surface nodularity of liver, focal hepatic lesions, presence / absence of ascites, portosystemic collaterals, portal hypertension, etc. Since we have started this protocol we have found it to be quite helpful not only in reporting of severity of fibrosis in known hepatic parenchymal disease, but also in raising concern about the existence of unsuspected hepatic fibrosis, leading to early detection and treatment.

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