2D Shear Wave Elastography of Liver in Patients with Primary Extrahepatic Portal Vein Obstruction

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Aims: **To evaluate liver stiffness (LS) in patients of primary extrahepatic portal vein obstruction (EHPVO) using 2D shear wave elastography (SWE) and compare it with healthy volunteers.** ***Methods:*** **Fifty patients (mean age: 22.4 years) of EHPVO and 25 healthy volunteers were included in the study. Liver function tests and viral markers were done in both groups and endoscopy in EHPVO group, followed by ultrasonography and SWE of liver. Liver elastography was done with patients/volunteers in supine position through right intercostal space. The LS for right lobe of liver was recorded in kilopascals. Three such measurements were taken and the mean of both groups were compared. The variables were also correlated with mean LS using Pearson's correlation coefficient in EHPVO group.** ***Results:*** **There was no significant difference in the mean LS in patients of EHPVO (5.96 kPa) and healthy volunteers (5.47 kPa) (P = 0.093). There was no significant correlation between LS with duration of symptoms, hematemesis, esophageal varices, total bilirubin, serum alkaline phosphatase and aspartate aminotranferase levels in EHPVO group.** ***Conclusion:*** **SWE of liver may be used as a simple additional tool in the diagnosis of patients of EHPVO who show LS values similar to normal liver. (J Clin Exp Hepatol 2017;7:23–27)**

Liver Fibrosis

Primary extrahepatic portal vein obstruction (EHPVO) is an idiopathic vasculopathy characterized by occlusion of main and/or right & left branches of portal vein with resultant development of collaterals.[1] There may be associated obstruction of intrahepatic portal vein, splenic vein and superior mesenteric vein. EHPVO leads to pre-hepatic portal hypertension and is the most common cause of gastrointestinal bleeding in children.[2] Diagnosis is usually by ultrasonography (USG) with color Doppler which shows portal vein replaced by multiple collaterals at porta with or without chronically thrombosed intrahepatic portal, splenic and superior mesenteric veins along with enlarged caudate lobe, prominent hepatic fissures and mild coarsening of parenchymal architecture.[3] However, secondary portal vein thrombosis with chronic changes may be seen in up to 25% of patients with cirrhosis of liver and differentiation from EHPVO based on USG and color Doppler may be difficult as vascular and liver morphological changes appear similar.[4] Laboratory tests and imaging with computed tomography (CT) scan may occasionally help in this differentiation, but invasive and risky liver biopsy may be needed in difficult cases.[3,5–8] Liver function is normal and liver fibrosis is rarely seen in EHPVO and hence absence of fibrosis in biopsy specimen favors a diagnosis of EHPVO.[5,6] There is thus a need for a non-invasive technique which can detect the presence or absence of liver fibrosis and thus differentiate EHPVO from cirrhosis when hepatic morphological changes are similar.

Ultrasound elastography (USE), including 2D shear wave elastography (SWE) is a simple non-invasive technique developed to assess tissue stiffness.[9–12] The role of USE in patients with EHPVO has not been well evaluated with only one study describing the role of transient elastography in the evaluation of liver and spleen stiffness.[13] Although, data is available on the role of SWE in assessment of LS in patients of chronic liver disease,[14,15] there is no data in the literature on its role in patients of EHPVO. Since liver function is usually normal in EHPVO and there is no parenchymal fibrosis, USE, which measures liver fibrosis, must show liver stiffness (LS) similar to healthy adults. Thus we aimed to assess the LS of patients with EHPVO using SWE and compare it with healthy volunteers.

METHODS

This prospective study was performed after obtaining approval from Institute Ethics Committee and informed consent from all patients. All consecutive patients of clinically suspected EHPVO, during the period August 2013 to November 2014, were included in the study. Twenty-five

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healthy volunteers were also included in the study after obtaining informed consent.

A total of 56 patients of suspected EHPVO were initially evaluated clinically followed by laboratory tests and upper gastrointestinal endoscopy (UGIE). Blood investigations included serum bilirubin, alkaline phosphatase (ALP), alanine trasaminase (ALT), aspartate transaminase (AST), serum albumin, platelet count and HBsAg and anti-HCV antibodies (markers of hepatitis B and hepatitis C viruses respectively). UGIE was done in all for assessing the presence and grade of esophageal varices, presence of red color sign (RCS), lesser curve extension of the varices, portal hypertensive gastropathy (PHG) and fundal varices. Bleeding varices were treated at the same time. Twenty-five non-diabetic healthy volunteers without any history of past or present illness were evaluated with blood tests only and UGIE was not done. All patients and volunteers with positive hepatitis viral markers and volunteers with fatty liver were excluded from evaluation. Subsequently, USG including SWE was done in both groups within 3 days.

USG was done on Aixplorer ultrasound machine (Supersonic Imagine, Aix-en-Provence, France) with SC6-1 convex transducer, after overnight fast. Gray scale and color Doppler evaluation were done initially followed by elastography. On gray scale USG, liver size and echotexture, biliary radicles, spleen size and ascites were evaluated and on Doppler study, splenic vein, portal vein or cavernoma, superior mesenteric vein, left renal vein and collaterals were assessed. A diagnosis of EHPVO was made based on clinical, laboratory and USG results. SWE of liver was performed through the intercostal space with patient in supine position and right arm abducted. The SWE box was placed on the right lobe of liver about 1.5–2 cm deep to the capsule and in an area free of vessels (Figure 1).[15] With the patients' breath held for 3–5 s, the image was frozen when there was homogeneous color filling. Then a circular region of interest (ROI)—Q box—of size 1 cm diameter was placed on the most homogeneous area within the SWE box to obtain quantitative information of tissue elasticity in kilopascals (kPa) (Figure 1). The measurements were considered reliable when the standard deviation (SD) was less than 10% of the mean LS or when the SD was less than 1 kPa as suggested by the manufacturer. Three such acquisitions were recorded for each patient and average value was noted. Similar evaluation of liver was performed in healthy volunteers. In patients of EHPVO who underwent shunt surgery, liver biopsy was done at surgery and the histopathological results were recorded.

Statistical evaluation of the results was done using SPSS 17 software (SPSS Inc, Chicago, USA). Descriptive statistics was used to summarize characteristics of each study group including mean and standard deviation. Intra-class correlation co-efficient was used to test the reliability of SWE. Comparison of the mean LS in patients of EHPVO and healthy volunteers was done using student t test. Correlation of clinical, blood and endoscopic parameters with LS was done using Pearson correlation coefficient. A *P*-value of less than 0.05 was considered significant.

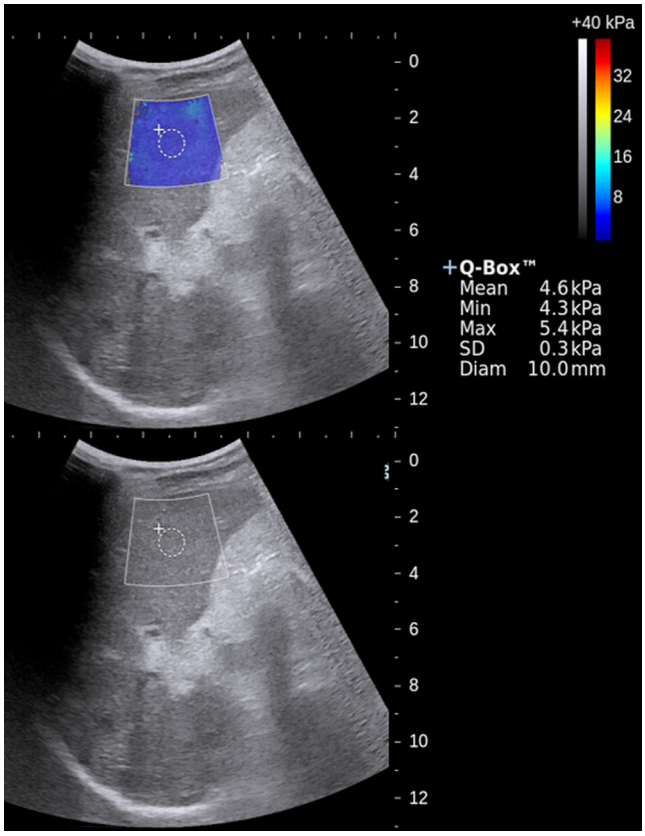

Figure 1 Ultrasonography image of right lobe of liver with SWE and Q box for measurement of liver stiffness.

RESULTS

A total of 56 patients of EHPVO were evaluated with SWE. Six patients were excluded (previous shunt surgery – 1; positive HBsAg – 1; non-availability of blood investigation – 1; failed elastography – 3 [unable to hold breath consistently in 2 patients and inability to obtain homogeneous color filling in the SWE box in 1 patient]). Finally fifty patients (mean age: 22.4 years; age range: 13–50 years; 24 males, 26 females) were included in the analysis. The demographic characteristics of the study group is described in Table 1. Twenty five healthy volunteers (mean age: 26.6 years; age range: 18–40 years; 18 males, 7 females) were also included in the study. The liver showed widened fissures and enlarged caudate lobe in all patients. Coarse echotexture was seen in 23 (46%) patients. In 47 patients (94%), both intra and extrahepatic portal vein segments were replaced by collaterals and cavernoma. In remaining 3 patients, two had recanalized portal vein and one had a prominent collateral at porta. The splenic and superior