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Mini Review

Can Ultrasound Elastography Predict Esophageal Varices in Hepatic Disease?

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Abstract

Portal hypertension in cirrhosis is a consequence of raised intrahepatic venous resistance, induced vasoconstriction, endothelial dysfunction and vasodilatation in splanchnic circulation. Increased splenic tissue stiffness in PH is a consequence of passive venous congestion, tissue & lymphoid hyperplasia and fibrogenesis.

Upper Gastrointestinal Endoscopy (UGIE) remains a gold-standard technique till date not only for diagnosis but also for its management.

Keywords: Gastrointestinal endoscopy; Esophageal varices; Hepatic fibrosis

Introduction

Chronic hepatitis especially type-C is the commonest cause of Hepatic Fibrosis (HF) [1]. HF leads to cirrhosis which is a common cause of hepatic dysfunction leading to Portal Hypertension (PH) and subsequent Esophageal Varices (EV).

Portal hypertension in cirrhosis is a consequence of raised intrahepatic venous resistance, induced vasoconstriction, endothelial dysfunction and vasodilatation in splanchnic circulation [2]. This raised intrahepatic venous pressure forms the basis of pharmacological management of PH and its accurate measurement requires an invasive procedure, available at limited centres [3].

Esophageal varices are a common complication and cause of morbidity in PH [3]. The incidence of EV varies between one-third in compensated to two-thirds in decompensated cases of PH with new EV appearing in a tenth of these patients [4]. Once esophageal varices develop, they gradually enlarge at the rate of 10% to 20% per year before finally rupturing or bleeding [3,4]. Upper Gastrointestinal Endoscopy (UGIE) remains a gold-standard technique till date not only for diagnosis but also for its management [5]. But UGIE has the disadvantage of being an invasive & expensive technique besides its limited availability and inability to time diagnosis & management simultaneously. Because of the above inevitable reasons, there is a strong need for a non-invasive technique that can not only predict the presence or absence of EV but also their grade and hence the risk of rupture. Such a technique can help in accurate timing of UGIE for reducing associated morbidity & mortality.

Ultrasound Elastography (USE) is a recently developed technique that can non-invasively assess tissue stiffness as in hepatic fibrosis and hence can aid in providing an insight in to developing PH [3,4]. This technique is not only simple and time-efficient but can also examine much larger hepatic parenchymal volume compared to hepatic biopsy.

Since splenomegaly in PH develops prior to development of EV and is associated with increased splenic parenchymal tissue stiffness, hence it has been postulated that USE assessment of splenic stiffness might be a sensitive technique in predicting the presence and grading of EV. Increased splenic tissue stiffness in PH is a consequence of passive venous congestion, tissue & lymphoid hyperplasia and fibrogenesis [6,7].

Several studies in recent medical literature have advocated the use of hepatic and splenic elastography in accurate prediction of presence and severity of EV in patients with PH with variable degrees of sensitivity and specificity [3-6]. Colecchia et al in their study revealed significantly higher Stiffness Measurement Values (SMV) of liver and spleen in patients with clinically significant PH than those with preclinical disease [8]. The same study revealed significant correlation of SMV of liver and spleen with hepatic venous pressure gradient with cut-off values of 25 kPa and 55 kPa respectively for presence of EV [8].

Technique & Interpretation of ultrasound elastography

Hepatic and splenic stiffness measurements are taken with patient in supine posture and with 6 hours to 8 hours fasting as changes in SMV are noted with change in posture and non-fasting state [9,10]. Success rate of measurements is calculated by dividing the total number of valid measurements with total number of measurements. The results may be expressed as kilo-Pascals (kPa) or velocity of shear-wave velocity in m/sec; latter is superior measurement as the formula for calculating the former involves the square of velocity of shear-wave resulting in squaring of the error as well. The Interquartile Range (IQR) which is an index of intrinsic variability of Stiffness Measurement Values (SMV) corresponds to the difference of SMV containing 50% of valid measurements between 25th-75th percentiles. The median value is considered as the final SMV for parenchymal stiffness.

Only results with at least 10 valid measurements, at least 60% success rate and an IQR to median ratio of <0.3 should be considered reliable [1].

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Discussion

Patients of PH with EV usually have higher SMV of liver and spleen than those without varices [3,11-15]. This also holds true for IQR values. Furthermore, portal & splenic vein diameter and longitudinal splenic span are also significantly higher in patients of PH with varices than those without varices [3].

Patients with higher grade of EV reveal higher splenic vein diameter and SMV of spleen than those with lower grades [3,11-13,15]. Also, there is no significant difference in portal vein diameter, longitudinal splenic span and SMV of liver among patients with lower and higher grade of EV.

Chin et al in their study revealed lowering of SMV of spleen in post-hepatic transplantation patients with SMV of spleen being a sensitive predictor of presence of EV in such patients [16].

Majority of the USE studies in medical literature have quoted the cut-off SMV of liver and spleen for predicting EV between 18-30 kPa and 43-56 kPa respectively [3,8,12-15].

However, very few studies revealed no significant difference in SMV of liver & spleen in patient with EV / large EV and those without / low-grade EV [17,18].

Conclusion

Esophageal Varices can be detected with higher sensitivity, specificity, positive predictive value, negative predictive value and accuracy by stiffness measurement values of spleen in comparison to that of liver with splenic values being useful indicator of the grade of esophageal varices as well. In fact, stiffness measurement values of splenic parenchyma are the single most significant factor in non-invasive prediction of esophageal varices in patients with portal hypertension secondary to hepatic disease. Hence, ultrasound elastography should be considered as part of routine management protocol in all hepatic disease patients.

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