

Diagnostic Accuracy of Splenic Index Measured on Ultrasound for Noninvasive Diagnosis of Esophageal Varices Keeping Endoscopy as Gold Standard

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ABSTRACT

Background: End stage chronic liver disease results in the growth of fibrous tissue, the disruption of hepatic architecture, and the formation of nodules, which interfere with liver function and contribute to portal hypertension. Esophageal varices might arise when blood flow through liver is impeded, most typically by scar tissue in the liver caused by liver disease. For high-risk EV diagnosis, endoscopy is the gold standard, but is not available at most health centres in our nation. In individuals at high risk of esophageal varices, performing endoscopies on a yearly or biannual basis can be difficult. We wish to conduct a noninvasive investigation to gather local evidence and to confirm the accuracy of splenic index determined by ultrasonography in detection of EVs.

Objective: To find out diagnostic accuracy of splenic index measured by Ultrasound for noninvasive diagnosis of esophageal varices keeping endoscopy as gold standard.

Material & Methods: It was cross sectional study done in Department of Medicine, Mayo Hospital, Lahore. July 2021 to March 2022 marked the beginning and end of the nine-month research period in this case study. After meeting the inclusion criteria 215 patients were enrolled. Patients were undergone ultrasonography for assessment of liver texture & spleen size. Splenic Index was calculated. Afterwards, patient undergoes endoscopy assessment by researcher himself. Patient was labeled positive or negative for EVs. All data was assessed and patient was confirmed as positive or negative for EVs.

Results: The mean age of the patients was 51.80 years, 84(44.2%) patients were male and 106(55.8%) patients were females. The sensitivity, specificity, PPV, NPV and diagnostic accuracy of USG for detection of esophageal varices was 92.98%, 88.16%, 92.17%, 89.33% & 91.05% taking endoscopy as gold standard. Cut off value for splenic index was 800 cm³.

Conclusion: From the findings of this study we may concluded that splenic index measured by Ultrasound for noninvasive diagnosis of esophageal varices is a useful tool with high diagnostic accuracy keeping endoscopy as gold standard.

Keywords: Diagnostic Accuracy, Ultrasound, Splenic Index, Endoscopy, Esophageal varices

INTRODUCTION

Once chronic liver disease has progressed far enough to cause cirrhosis, there is a disruption in the liver's normal function and the development of portal hypertension as a result.¹ Micronodular alterations (less than a centimetre in diameter) due to alcohol are the most common cause of cirrhosis. Another prevalent cause is hepatitis, which culminates in macronodular cirrhosis (size of nodules between 1 and 5cm).² The most common consequence of liver cirrhosis is portal hypertension. An early symptom of portal hypertension is a rise in esophageal varices, which are the most clinically significant.^{2,3} Submucosal veins in the lower esophageal region, known as esophageal varices, are dilated and enlarged.⁷ There are on average 60 to 80 percent of the EVs in patients with liver cirrhosis who are admitted to the hospital. Every year, 25 to 35 percent of patients with cirrhosis have upper gastrointestinal bleeding.¹⁰

Varices are present in 30% of cirrhotic individuals at the time of diagnosis; this number rises to 90% after 10 years. Small varices have a 5-percent chance of bleeding in the first year, while large varices have a 15-percent chance. In children with chronic liver disease, portal hypertension is prevalent.¹¹ Males are more likely than females to suffer from this condition. Patients with esophageal varices are 50% more likely to develop bleeding. Variceal haemorrhage has a mortality incidence of 10% to 20% in the first six weeks after the occurrence.¹² Imaging tools such as CT scanning, MRI, magnetic resonance angiography, and endoscopic ultrasonography now substantially the evaluation of portal hypertension and varices in the oesophagus.¹⁸ It is feasible to identify the velocity and direction of flow in the portal venous system using duplex Doppler ultrasonography, and this imaging modality can also be used to determine the portal vein's patency. Both the size and echotexture of the liver are well-documented by using ultrasound imaging. Contrary to popular belief, standard ultrasonography cannot reliably detect and diagnose esophageal varices.¹⁹

Endoscopy: Consensus recommendations for streamlined two-size classifications: Small \leq 5mm and Large $>$ 5mm. Varices are classified according to JRSPH guidelines. F1 tiny varices: a slightly raised vein above the mucosal membrane of the oesophagus, F2 medium varices – just 33% of the oesophagus lumen is covered by convoluted veins and F3 large varices take up more than a third of the lumen.

There is no other way to accurately diagnose EVs but using an upper gastro-intestinal endoscope (EGD). The strongest clinical predictor of bleeding is the size of the varices determined by GI endoscopy. 7% of patients with varices less than or equal to 5mm in diameter will experience bleeding within the next two years, while 30% of patients with varices larger than or equal to 5mm in diameter will experience bleeding within the next two years.³

Role of Splenic Index on Ultrasound: Maximal length, projected height and maximum thickness are all factors that contribute to the splenic index.⁴⁵ It was originally thought that the spleen index (cm²) could be calculated using the formula: a (cm) x b (cm), where a represents the cross-sectional image's maximum vertical diameter.⁴⁶ Splenic index is assessed by L x W x T (length x width x thickness) on ultrasonography. Between 120 to 480 cm³ is considered normal.⁴⁷

MATERIAL AND METHODS

It was a cross sectional study which was held in Department of Medicine, Mayo Hospital, Lahore. Duration of Study was 9 months from July 2021 to March 2022 after approval of synopsis. Pilot study was conducted to get the reference value for sample size calculation. A total of 190 participants who met the study's requirements were enrolled via the outpatient department at Mayo Hospital Lahore's Department of Medicine. Patients have to complete a written consent form before participating in the study. The patient's name, age, sex, BMI, and cirrhosis duration were all recorded in the patient's medical file. Using ultrasonography, doctors were able to gauge a patient's liver texture and spleen size. Splenic index was calculated with the formula L x W x T

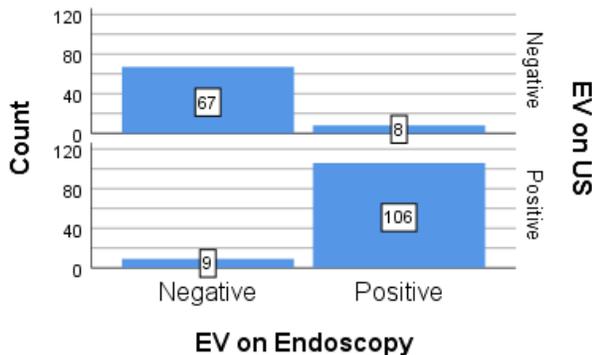
(where L is length W is width and T is thickness) by ultrasound & results were recorded.⁴⁸ After that, the researcher performs an endoscopy on the patient. The presence or absence of EVs was determined for the patient. There was a thorough review of the patient's medical history and the results were either positive or negative for EVs.

RESULTS

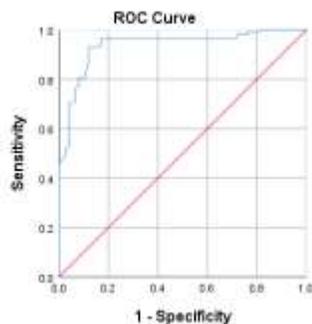
A total of 190 patients took part in this investigation. The patients' mean age was 51.8±8.97 yr with minimum and maximum ages of 30 & 75 years respectively. Males comprised 44.2% of the patients in this study, while females comprised 55.8% of the patients. Among the patients, the male-to-female ratio was 0.79:1. The patients in our study had cirrhosis for an average of three years 21.61±12.57 months with minimum and maximum duration of 5 & 72 months respectively. In this study the mean splenic index measured on USG was 784.25±363.48 cm³ with minimum and maximum values of 100 & 1868 cm³ respectively. This study results showed that on ultrasonography the EVS was found positive in 115(60.5%) patients and it was found negative in 75(39.5%) patients. According to this study on endoscopy the EVS was found positive in 114(60.0%) patients and it was found negative in 76(40.0%) patients.

Table 1: Validity of ultrasonography taking endoscopy as gold standard for detection of esophageal varices

EVS	Endoscopy		Total
	Positive	Negative	
USG	Positive	106	115
	Negative	8	75
Total	114	76	190



Endoscopy was the gold standard for determining USG's sensitivity, specificity, PPV, NPV, and diagnostic accuracy in detecting esophageal varices. These values were 92.98%, 88.16%, 92.17%, 89.53%, and 91.05%, respectively.



Graph 1: ROC - Curve

Area Under the Curve				
Test Result Variable(s): Splenic index measured on USG				
Asymptotic 95% Confidence Interval				
Area	Std. Error	Asymptotic Sig.	Lower Bound	Upper Bound
.928	.018	.000	.902	.973

ROC curve shows a better performance of ultrasound having 94% AUC with P-value = 0.000 < α = 0.05.

Table 2: Cross-tabulation between EV on US, EV on Endoscopy and Group duration in years

Group duration in years			EV on Endoscopy		Total
			Negative	Positive	
<1	EV on US	Negative	23	2	25
		Positive	0	13	13
	Total		23	15	38
≥1	EV on US	Negative	28	4	32
		Positive	3	25	28
	Total		31	29	60
≥2	EV on US	Negative	9	1	10
		Positive	3	43	46
	Total		12	44	56
≥3	EV on US	Negative	2	1	3
		Positive	1	20	21
	Total		3	21	24
≥4	EV on US	Negative	3	0	3
		Positive	2	3	5
	Total		5	3	8
≥5	EV on US	Negative	1	0	1
		Positive	0	2	2
	Total		1	2	3
≥6	EV on US	Negative	1		1
		Positive	1		1
	Total		1		1
Total	EV on US	Negative	67	8	75
		Positive	9	106	115
	Total		76	114	190

This table shows results in patients which have duration of cirrhosis less than 1 year, 23 were negative and 13 were positive. Results in patients which have duration of cirrhosis more than 2 years, 43 were positive. Results in patients which have duration of cirrhosis more than 3 years, 20 were positive.

DISCUSSIONS

Patients with cirrhosis have a higher chance of getting esophageal varices, which impact 50-61 percent of persons with the illness, according to research. People with varices commonly have bleeding from the hematemesis, however may be other factors at play. One-third of re-bleeding incidents end in death; the rate of re-bleeding is as high as 70%. It's hardly surprising, then, that researchers are working to create a device that can detect esophageal varices early on.⁷⁹

We conducted a non invasive study for diagnosis of esophageal varices in cirrhotic patients in which splenic index on ultrasound and endoscopic results were compared. 190 patients were enrolled in this study. The cut off value of splenic index on ultrasound was 800 cm³. The study results showed sensitivity of 92.98%, specificity of 88.16%, PPV of 92.17%, NPV of 89.53% and diagnostic accuracy of 91.05%. ROC curve was plotted and it showed a better performance of ultrasound having 94% AUC with P value = 0.000 < α = 0.05.

Endoscopy, the gold standard for EV diagnosis, is not readily available in the majority of healthcare facilities. To diagnose esophageal varices in high-risk individuals, endoscopy is difficult to provide once or twice per year. Also, endoscopy is intrusive, unpleasant, expensive, and can spread infections. All of these things together lead to a decrease in compliance. Literature shows that noninvasive approaches for esophageal varices detection yielded a variety of findings. Ultrasound splenic index

measurement accuracy for EV detection is important to us, so we plan a noninvasive investigation to verify that. In comparison to spleen diameter, the Splenic Index is thought to be more accurate because it takes into account the spleen's maximal W, L, and T. The use of this strategy of using non invasive methods would necessarily lower the cost of management of cirrhotic patients. So based on the present study, it was found that simple non invasive technique may be used as a reliable predictor for the diagnosis of esophageal varices in cirrhotic patients.

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