

Original Article

## DIAGNOSTIC ACCURACY OF DOPPLER ULTRASONOGRAPHY FOR DIAGNOSING ESOPHAGEAL VARICES IN CIRRHOTIC PATIENTS

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**Objective:** To determine the diagnostic accuracy of doppler ultrasonography for diagnosing esophageal varices in cirrhotic patients taking endoscopic findings as gold standard.

**Material and Methods:** One hundred and thirty five patients fulfilling inclusion criteria underwent doppler ultrasound of abdomen for esophageal varices. This was followed by upper GI endoscopy in all patients. Data was analyzed for sensitivity, specificity, positive predictive values, negative predictive values and accuracy rate of doppler ultrasonography for diagnosing esophageal varices.

**Results:** Frequency of esophageal varices in cirrhotic patients on endoscopy was 62.22 % (n=84). Diagnostic accuracy of doppler ultrasonography for diagnosing esophageal varices in cirrhotic patients taking endoscopy as gold standard was recorded. Results showed that 51.85% (n=70) were true positive, 2.96% (n=4) false positive, 34.81% (n=47) true negative and 10.37% (n=14) false negative. Sensitivity, specificity, positive predictive value, negative predictive value, and accuracy rate were calculated as 83.33%, 92.16%, 94.59%, 77.05% and 86.67% respectively.

**Conclusion:** The diagnostic accuracy of Doppler Ultrasonography for diagnosing esophageal varices in cirrhotic patients' standard is high.

**Key words:** Cirrhosis, esophageal varices, diagnosis, ultrasonography, accuracy

### Introduction

Liver cirrhosis (LC) is the final evolutive stage of any chronic liver disease, which is prone to multiple complications because of portal hypertension.<sup>1,2</sup> Development of esophageal varices (EV) is the major complication that may occur in up to 60% of cirrhotic patients.<sup>6</sup>

Once esophageal varices develop, the annual risk of bleeding ranges from 10% to 30%.<sup>3</sup> Furthermore, the mortality rate of variceal bleeding still remains as high as 20%-35% in prospective studies. Although screening endoscopy for EV is recommended for all patients with established cirrhosis, these recommendations are not a result of evidence-based data, yet has proved to be cost-effective in patients with decompensated cirrhosis, cost-effectiveness remains elusive in patients with compensated cirrhosis.<sup>3,4</sup>

Early diagnosis of varices before the first bleed is essential as studies of primary prophylaxis clearly show that the risk of variceal hemorrhage can be reduced from 50% to about 15% for large EV.<sup>5</sup>

Color doppler ultrasonography has advantages over other techniques; it is a simple, noninvasive method, and can be used to calculate the portal vein diameter and portal pressure for diagnosis of EV.<sup>6</sup>

During literature search, we found a great variability in results. In one study portal vein diameter >13 mm had sensitivity of 45-50% and specificity of 100% for diagnosing EV, while another study portal vein diameter >13 mm by doppler ultrasound showed 76.5 % sensitivity and 80 % specificity for diagnosing EV.<sup>7</sup> We could not find any study conducted in local population and as positive predictive value depends on prevalence of disease, we want to conduct this study to generate results in our population.

### Materials and Methods

This research was conducted at Medical Unit III inpatient, Services Hospital, Lahore, Pakistan. It was a cross-sectional survey and 135 patients were enrolled. Inclusion criteria included both male and female diagnosed hepatitis B and C seropositive cirrhotic patients with ages between 20-60 years. Patients with non cirrhotic portal hypertension, hepatocellular carcinoma were excluded from the study. Informed consent was taken. Age, gender and biochemical parameters were recorded. Ultrasound examination by a single hospital radiologist was performed following the departmental protocols for EV including portal vein pressure, portal vein diameter and splenic length, and the presence

/absence of EV was recorded on the radiologist's report. This report was kept confidential until upper GI endoscopy was done. Both reports were evaluated for diagnostic accuracy of ultrasound.

Data was analyzed. Sensitivity, specificity, positive predictive value, negative predictive value and accuracy of Doppler Ultrasound for diagnosis of EV were calculated taking endoscopy as gold standard.

**Results**

Age distribution of the patients showed that 43.71% (n=59) were between 20-40 years and 56.29% (n=76) between 41-60 years, and mean age was calculated as 41.22±8.63 years. **(Table No. 1)**

Gender distribution of the patients revealed that 57.78% (n=78) were male and 42.22 % ( n=57) females. **(Table No. 2)**

Frequency of esophageal varices in cirrhotic patients on endoscopy was 62.22% (n=84), while 37.78% (n=51) had no varices. **(Table No. 3)**

Diagnostic accuracy of Doppler ultrasonography for diagnosing esophageal varices in cirrhotic patients taking endoscopy as gold standard was recorded, which showed that 51.85%(n=70) were true positive, 2.96%(n=4) false positive, 34.81%(n=47) true negative and 10.37%(n=14) false negative. Sensitivity, specificity, positive

predictive value, negative predictive value, and accuracy rate was calculated as 83.33%, 92.16%, 94.59%, 77.05% and 86.67% respectively. **(Table No.4)**

**Table-1:** Age distribution (n=135).

Age in Years	Number	Percentage
20 - 40	59	43.71
41 - 60	76	56.29
Total	135	100
Mean±sd	41.22±8.63	

**Table-2:** Gender distribution (n=135).

Gender	Number	Percentage
Male	78	57.78
Female	57	42.22
Total	135	100

**Table-3:** Frequency of esophageal varices in cirrhotic patients (on endoscopy) (n=135).

Esophageal varices	Number	Percentage
Yes	84	62.22
No	61	37.78
Total	135	100

**Table-4:** diagnostic accuracy of doppler ultrasonography for diagnosing esophageal varices in cirrhotic patients taking endoscopic findings as gold standard (n=135).

Doppler ultrasonography	Endoscopic Findings		Total
	Positive	Negative	
Positive	A (True positive) 70 (51.85%)	B (False positive) 4(2.96%)	a+b 74(54.81%)
Negative	C (False negative) 14 (10.37%)	D (true negative) 47 (34.81%)	c+d 61(45.19%)
<b>Total</b>	<b>a + c 84 (62.22%)</b>	<b>b + d 51(37.78%)</b>	<b>135 (100%)</b>

*Sensitivity = a / (a + c) x 100=83.33% / Specificity = d / (d + b) x 100= 92.16% / Positive predictive value = a / (a + b) x 100 = 94.59%  
 Negative predictive value = d / (d + c) x 100 = 77.05% / Accuracy rate = a + d / (a + d + b + c) x 100 = 86.67%*

**Discussion**

Cirrhosis represents the end stage of progressive fibrosis, which destroys normal liver tissue and produce regenerative nodules. Variceal bleeding (which is a consequence of portal hypertension) is one of the most dreaded complications of cirrhosis. The risk of variceal bleeding is 25-40% in patients with cirrhosis.<sup>8-9</sup>

One of the methods of interest for gastroenterologists and radiologists is doppler ultrasound indices of spleno portal system, which shows extensive changes through cirrhosis and portal

hypertension.<sup>10</sup>

In our study, frequency of EV in cirrhotic patients on endoscopy was 62.22%(n=84), while diagnostic accuracy of Doppler ultrasonography for diagnosing esophageal varices in cirrhotic patients taking endoscopy as gold standard showed that 51.85%(n=70) were true positive, 2.96%(n=4) false positive, 34.81%(n=47) true negative and 10.37%(n=14) were false negative. Sensitivity, specificity, positive predictive value, negative predictive value, and accuracy rate were calculated as 83.33%, 92.16%, 94.59%, 77.05% and 86.67% respectively. This is in agreement with a study, which

Revealed that EV may occur in up to 60% of cirrhotic patients.<sup>6</sup>

Our findings were also in agreement with a study by Arulprakash Sarangapani and Co, where Portal vein diameter >13 mm by Doppler ultrasound showed 76.5% sensitivity and 80% specificity for diagnosing EV.<sup>7</sup> Our findings regarding specificity were more close with K. Khanna and workers who recorded 100%.<sup>8</sup>

Some other studies<sup>11-12</sup> revealed that portal vein diameter more than 13 mm represent portal hypertension with a specificity of 95-100%.

Liu et al<sup>13</sup> conducted a study on 383 cirrhotic patients with Child score A for diagnosing EVs with Doppler US. His results indicated that cutoff value of 3 for **SPI** have a sensitivity of 92%, specificity 93%, positive predictive value (PPV) of 91%, and negative predictive value (NPV) of 94% for diagnosing EVs. He concluded that this cut off had capability of diagnosing EVs in 92% of patients who did not have endoscopy, and therefore is a reliable index.<sup>14</sup>

Dib et al from France stated that although using noninvasive method for diagnosing EVs is logical and rational, but still endoscopy is the preferable and the most reliable method compared with other diagnostic methods<sup>15</sup>. Considering the facts in our study and with the help of other studies we can conclude that doppler ultrasound is a non-invasive technique, which is useful for the prediction of esophageal varices in cirrhotic patients in our population. However, our findings are primary and some other local studies on a larger scale are required to authenticate our findings.

## Conclusion

We concluded that the diagnostic accuracy of Doppler Ultrasonography for diagnosing Esophageal Varices in cirrhotic patients taking endoscopic findings as gold standard is high.

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