

Diagnostic Accuracy of Splenoportal Index for Detection of Esophageal Varices in Patients of Liver Cirrhosis

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Abstract

Background: To determine the diagnostic accuracy of splenoportal index for the prediction of esophageal varices in patients with cirrhosis

Methods: In this cross sectional study patients (n=75) having clinical and laboratory evidence of liver cirrhosis were selected. Sonographic findings of splenic index and portal vein velocity were correlated with the findings of endoscopic examination. P-value ≤ 0.05 considered as significant. Results were analyzed by creating 2 x 2 contingency tables which displayed the number of subjects who were positive on ultrasound and were also positive on endoscopy (true positives), who were ultrasound positive but were negative on endoscopy (false positives), who were ultrasound negatives but were positive on endoscopy (false negatives) and who were ultrasound negative and were also negatives on endoscopy (true negatives).

Results: Majority (65.0%) patients were males. Patients positive on ultrasound were 70.7% and patients positive on endoscopy were 72.0%. Sensitivity, specificity, positive predictive value, negative predictive value and accuracy were found to be 96.3%, 95.2%, 98.1%, 90.9% and 96% respectively.

Conclusion: Ultrasonography allows non-invasive and cost effective detection of esophageal varices in liver cirrhosis patients, with excellent accuracy.

Key words: Liver cirrhosis, Esophageal varices, Ultrasound, Endoscopy

but their prognosis is not good as those who have not developed varices. The median survival of compensated cirrhotic patients is greater than 12 years.² 25-35% is the risk of initial bleeding from varices in 2 years. The rate of variceal bleeding is even higher in those in whom the first bleeding episode occurs within 1 year of detection of varices.³ Therefore, portal hypertension in cirrhotic patients should be assessed during follow-up. Duplex ultrasound is a useful modality to use in outpatient departments for assessing the portal hypertension. Recently introduced parameters, the splenoportal index are more acceptable and measured by spleen length and portal vein velocity.⁴ As when the portal pressure increases in portal hypertension, it is noted that portal velocity is decreased and fluctuations disappear and become continuous. The spleen size can correlate good with portal haemodynamics. Splenoportal index proposes that the mean portal vein velocity and splenic index can help in prediction of esophageal varices in outpatient departments with sensitivity of 92% and specificity of 93%³ having a threshold volume of 3. Endoscopy is considered the gold standard for diagnosing oesophageal varices. However, endoscopy is a costly procedure and has low patient acceptance.¹ One of the interesting methods for gastroenterologist and the radiologists is doppler ultrasound of splenoportal system¹. The centrifugal flow develops when intrahepatic resistance increases causing decrease peak portal velocity with increasing cirrhotic damage to liver.⁵

Introduction

Cirrhosis is the end stage fibrosis damaging normal liver tissue.¹ Cirrhotic patients who have not yet developed major complications like variceal haemorrhage, ascites, spontaneous bacterial peritonitis, HCC, hepato-renal syndrome etc. are classified as having compensated cirrhosis. The patients with varices who not have developed bleeding are taken as having compensated cirrhosis

Patients and Methods

This cross sectional validation study was conducted in Department of Diagnostic Radiology, Holy Family Hospital, Rawalpindi. in collaboration with endoscopy unit, from February 2015 to August 2015. Using sensitivity & specificity sample size calculator, sample size was calculated, taking sensitivity 92%¹ and 93% specificity, expected prevalence 50% confidence level 95%, and precision required 8%. The sample size

calculated came out to be 75 keeping 95% confidence level. Clinically diagnosed cases of liver cirrhosis, both males and females aged 35 years to 80 years were selected. Patients with history of haematemesis, diagnosed cases other than liver cirrhosis eg. peptic ulcer, Mallory Weis tear, carcinoma of stomach, viral hemorrhagic fever etc were not considered. Diagnosed patients of esophageal varices due to diseases other than cirrhosis like Budd Chiari syndrome, schistosomiasis, patients having history of endoscopic variceal band ligation or sclerotherapy, surgery for portal hypertension, were also excluded. Endoscopy was performed in endoscopy unit of medicine. Sonographic findings of splenic index and portal vein velocity were then correlated with the findings of endoscopic examination. Effect modifiers like age and sex were controlled by stratification. Post stratification Chi-square test was applied. P-value ≤ 0.05 considered as significant. A 2×2 Table was constructed. The results were analyzed by creating 2×2 contingency tables which displayed the number of subjects who were positive on ultrasound and were also positive on endoscopy (true positives), who were ultrasound positive but were negative on endoscopy (false positives), who were ultrasound negatives but were positive on endoscopy (false negatives) and who were ultrasound negative and were also negatives on endoscopy (true negatives).

Results

Out of seventy five patients majority (65.0%) patients were males with the mean age of 51.3 years \pm 9.2 SD and 35.0% (n=26) were females with mean age of 53.7 years \pm 9.8 SD. Results of ultrasound showed that 70.7% patients were positive and 29.3% were negative (Table 1; Figure 1-4). Endoscopy results showed that 72.0% of patients were positive and 28.0% were negatives (Table 3). In overall study population 69.3% were true positives, 26.7% were true negatives, 1.3% were false positives and 2.7% were false negatives (Table 3).

Table I: Cross-tabulation of ultrasound and endoscopy results

Ultrasound	Endoscopy findings		Total
	Positive	Negative	
Positive	52(true positives)	1(false positives)	53
Negative	2(false negatives)	20(true negatives)	22
Total	54	21	75

Sensitivity: 96.3%; Specificity: 95.2% ; Positive Predictive Value: 98.1%; Negative Predictive Value: 90.9% ; Over all Accuracy : 96%

Table 2: Cross-tabulation of ultrasound and endoscopy results in males

Ultrasound	Endoscopy findings		Total
	Positive	Negative	
Positive	32(true positives)	1(false positives)	33
Negative	2(false negatives)	14(true negatives)	16
Total	34	15	49

Sensitivity: 94.1%; Specificity: 93.3% ; Positive Predictive Value: 96.7%; Negative Predictive Value: 87.5% ; Over all Accuracy: 93.9%

Table 3: Cross-tabulation of ultrasound and endoscopy results in females

Ultrasound	Endoscopy findings		Total
	Positive	Negative	
Positive	20 (true positives)	0 (false positives)	20
Negative	0 (false negatives)	6 (true negatives)	6
Total	20	6	26

Sensitivity(using equation 1):100%; Specificity(using equation 2): 100%; Positive Predictive Value (using equation 3): 100%; Negative Predictive Value (using equation 4): 100% ; Over all Accuracy (using equation 5): 100%

Table 4: Cross-tabulation of ultrasound and endoscopy results in 35-55 year age group

Ultrasound	Endoscopy findings		Total
	Positive	Negative	
Positive	34(true positives)	1(false positives)	35
Negative	1(false negatives)	11(true negatives)	12
Total	35	12	47

Sensitivity (using equation 1): 97.14%; Specificity (using equation 2): 91.66% ; Positive Predictive Value (using equation 3): 97.14%; Negative Predictive Value (using equation 4): 91.66%; Over all Accuracy (using equation 5): 95.74%

Table 5: Cross-tabulation of ultrasound and endoscopy results in 56-80 years age group

Ultrasound	Endoscopy findings		Total
	Positive	Negative	
Positive	18(true positives)	0(false positives)	18
Negative	1(false negatives)	9(true negatives)	10
Total	19	9	28

Sensitivity (using equation 1): 94.74%; Specificity (using equation 2): 100%; Positive Predictive Value (using equation 3): 100%; Negative Predictive Value (using equation 4): 90% ; Over all Accuracy (using equation 5): 96.43%

In females (n=26), 20 were true positives, 06 were true negatives, there was no false positives and false negatives were found in female (Table 4). Sensitivity, specificity, positive predictive value, negative predictive value and accuracy in females were found to be 100%. In age group 56-80 years (n=28), 18 were true positives, 9 were true negatives, 0 were false positives and 1 was false negative (Table 5).

Sensitivity, specificity, positive predictive value, negative predictive value and accuracy in females were found to be of 94.74%, 100%, 100%, 90% and 96.43% respectively



Figure 1. A patient with splenic index 12.6cm x 5.9cm in a cirrhotic patient.



Figure 2. Reduced Portal vein velocity of 8.3 cm /sec in a same patient with cirrhosis.



Figure 3. Cirrhotic patient with splenomegaly having splenic index 13cm x 5.5 cm .



Figure 4. Portal vein velocity is reduced to 8.1 cm /sec in the same patient with liver cirrhosis.

Discussion

Liver cirrhosis and portal hypertension affect liver vasculature flow. Non-invasive methods can help in diagnosing esophageal varices in cirrhotic patients.⁶ Hepatic blood flow has been investigated using Color Doppler Ultrasonography in liver disease patients, especially with portal hypertension.⁷ Doppler ultrasound is a good tool, to assess portal venous

system as portal dynamics reverse in cirrhotic patients⁸. Portal blood flow is affected by errors in Doppler measurements including phase of respiration, observer variability and collateral pathways.^{9,10} Most of the time, endoscopy for esophageal varices is advised to patients who can bleed. Indirect pointers of portal hypertension like portal vein diameter, ascites, mean velocity of portal vein, can be useful. Among them, length of spleen is an independent predictor.¹¹ Fibrosis have been tested, besides, several direct or indirect blood markers. In multivariate analysis, platelet count is a good predictor of esophageal varices. Few other predictors could be: bilirubinemia, splenomegaly, Fibrotest, but these data require validation.¹² Results of present study are similar with the already published data on the same subject. Liu CH, et found that multivariate logistic regression analysis showed splenic index and mean portal vein velocity can help in the prediction of varices in training set. They concluded that splenoportal index is a useful noninvasive index which can help in the predicting esophageal varices. Plestina S et al found that patients having variceal red signs on endoscopy, had higher values of portal diameter, blood flow volume, cross-sectional area, and congestion index than patients without the red signs, while platelet-to-spleen ratio and perfusion pressure gradient were lower.¹⁴ Difference in Ultrasonographic parameters values among groups of patients were less obvious with different variceal sizes: only the cross-sectional area, blood flow volume and diameter were different with significance. The mean blood flow velocity have no dependence on endoscopic red signs and variceal size.¹⁴

Kayacetin E, et al concluded that increased congestion indexes and decrease blood flow in portal vein is related to liver function impairment.¹⁵ According to Mahmoud HS, et al portal vein CI and splenoportal index are good predictors of oesophageal varices, and could decrease the burden on endoscopy unit.¹⁶ Kim MY, et al concluded that HVPG was in correlation with liver cirrhosis severity, risk of variceal bleeding, presence of ascites in cirrhotic patients.¹⁷ Mittal P, et concluded that doppler study is an excellent modality for characterizing and detecting portal hypertension in cirrhosis.¹⁸ Bolognesi M et al found that splenic impedance indices are increased in patients with liver cirrhosis.¹⁹ In a study by Iwao T et al portal vein velocity was lower and hepatic arterial pulsatility index was higher in patients than in controls.²⁰ They concluded that liver vascular index is a highly sensitive and specific

doppler ultrasound parameter in diagnosing portal hypertension and cirrhosis. Silkauskaite, et al proposed that with new ultrasound methods and contrast agents, are more precise liver vascular study can be obtained, which was previously obtained achieved only with CEPT. ^{21,22}

Akhavan Rezaayat K, et al found that none of study variables were accurate enough for esophageal varices presence in cirrhotic patients.²³ Some of the splenoportal doppler indices are useful in diagnosing esophageal varices, but more research and evaluation is necessary. ^{24,25} Prediction of oesophageal varices by non-invasive methods can increase compliance and would help to restrict endoscopy only to those who have a high probability of esophageal varices.

Conclusion

Splenoportal index is a good parameter that allows non-invasive and cost effective detection of esophageal varices in cirrhotic patients, with excellent accuracy. Sensitivity, specificity, PPV, NPV and accuracy were 96.3%, 95.2%, 98.1%, 90.9% and 96% respectively in this study.

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