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Diagnostic Utility of Splenoportal Index in Predicting the Severity of Esophageal Varices in Patients with Liver Cirrhosis: A Hospital-Based Cross-Sectional Study.

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Abstract

Background: Esophageal varices are among the most serious complications of portal hypertension in patients with liver cirrhosis and are associated with significant morbidity and mortality because of the risk of upper gastrointestinal bleeding. Upper gastrointestinal endoscopy is the gold standard for diagnosing and grading esophageal varices; however, it is invasive, expensive, and not universally available. Consequently, there is increasing interest in reliable non-invasive methods for identifying patients at high risk. The Splenoportal Index (SPI), a Doppler ultrasonographic parameter combining splenic size and portal vein velocity, has emerged as a potential predictor of portal hypertension and variceal severity. This study evaluated the relationship between SPI and the severity of esophageal varices in patients with liver cirrhosis. ***Objectives:***

1. To determine the occurrence of esophageal varices in patients with liver cirrhosis.
2. To evaluate the association between the Splenoportal Index and the severity of esophageal varices.

Materials and Methods: A hospital-based cross-sectional study was conducted among 42 consecutive patients diagnosed with liver cirrhosis and portal hypertension. After obtaining institutional ethics approval and written informed consent, demographic details, clinical history, laboratory investigations, ultrasonographic findings, and Doppler measurements were recorded. The Splenoportal Index was calculated using splenic measurements and mean portal vein velocity. All participants underwent upper gastrointestinal endoscopy for grading of esophageal varices. Statistical analysis was performed to determine the association between SPI and variceal severity, with a p-value <0.05 considered statistically significant. ***Results:*** The study included 42 patients with a mean age of 49.02 ± 14.12 years, with males accounting for 76.1% of the study population. Abdominal distension was the most common presenting symptom, and abnormal liver function tests were observed in most patients. Esophageal varices were equally distributed between small and large grades. A highly significant association was observed between increasing Splenoportal Index and the severity of esophageal varices ($p < 0.001$). In contrast, ultrasonographic liver morphology and liver function test abnormalities did not show a statistically significant association with variceal grade. ***Conclusion:*** The Splenoportal Index is a reliable, inexpensive, and non-invasive ultrasonographic marker for predicting the severity of esophageal varices in patients with liver cirrhosis. Incorporating SPI into routine Doppler ultrasonography may improve risk stratification and help prioritize patients for endoscopic screening, especially in resource-limited settings.

Keywords: Liver cirrhosis, Esophageal varices , Portal hypertension , Splenoportal Index , Doppler ultrasonography and Upper gastrointestinal endoscopy.

INTRODUCTION

Liver cirrhosis is a chronic, progressive disease characterized by diffuse hepatic fibrosis, regenerative nodule formation, and distortion of the normal hepatic architecture. It represents the final common pathway of a wide spectrum of chronic liver diseases and remains a major cause of morbidity and mortality worldwide. Progressive fibrosis increases intrahepatic vascular resistance, leading to portal hypertension, which is the principal mechanism responsible for the development of complications such as ascites, hepatic encephalopathy, splenomegaly, and esophageal varices. These complications significantly reduce quality of life and adversely affect long-term survival.1

Portal hypertension is the hallmark of decompensated cirrhosis and is associated with the formation of portosystemic collateral vessels. Among these collateral pathways, esophageal varices are of particular clinical importance because they carry a substantial risk of upper gastrointestinal bleeding. Variceal hemorrhage remains one of the most serious complications of cirrhosis and is associated with considerable mortality despite advances in medical and endoscopic therapy. The annual incidence of bleeding is estimated to be approximately 5% in patients with small varices and 15–20% in those with large varices, emphasizing the importance of early identification and risk stratification.2,3

Upper gastrointestinal endoscopy is considered the gold standard for the diagnosis and grading of esophageal varices. It provides direct visualization of the varices, enables accurate grading, and facilitates therapeutic interventions such as endoscopic variceal ligation. However, routine endoscopic screening for every patient with cirrhosis has several practical limitations. Endoscopy is invasive, requires trained personnel and specialized equipment, may not be readily available in resource-limited settings, and is often associated with patient discomfort and increased healthcare costs. These limitations have prompted researchers to identify reliable, non-invasive methods that can accurately predict the presence and severity of esophageal varices while reducing unnecessary endoscopic procedures.4

Ultrasonography is widely accepted as the first-line imaging modality for evaluating patients with chronic liver disease because it is safe, inexpensive, repeatable, and widely available. Conventional gray-scale ultrasonography allows assessment of liver morphology, splenic enlargement, portal vein diameter, and ascites, whereas Doppler ultrasonography provides functional information regarding portal venous blood flow, including flow direction and velocity. These Doppler parameters reflect the hemodynamic alterations associated with portal hypertension and have therefore gained importance as potential non-invasive markers for predicting esophageal varices.6

Among the various ultrasonographic parameters proposed, the Splenoportal Index (SPI) has emerged as a promising marker. The SPI integrates both anatomical and hemodynamic components of portal hypertension by combining splenic measurements with mean portal vein velocity obtained using Doppler ultrasonography. Increased portal pressure results in progressive splenic enlargement and a reduction in portal vein flow velocity. Since the SPI incorporates both of these pathological changes, it may provide a more comprehensive assessment of portal hypertension than individual ultrasonographic parameters alone.1,5

The pathophysiological basis of the Splenoportal Index is closely related to the progression of cirrhosis. Chronic hepatic injury activates hepatic stellate cells, resulting in excessive extracellular matrix deposition, regenerative nodule formation, and distortion of the hepatic vascular architecture. The consequent increase in intrahepatic resistance elevates portal venous pressure, causing splenic congestion, hypersplenism, and reduced portal vein velocity. These structural and hemodynamic changes become more pronounced with advancing portal hypertension and correlate with the development and progression of esophageal varices. By integrating splenic enlargement and portal venous flow velocity, the Splenoportal Index reflects the severity of these pathological changes.7-9

Several non-invasive markers, including platelet count, platelet-to-spleen diameter ratio, portal vein diameter, splenic size, and liver stiffness measurements, have been investigated as predictors of esophageal varices. Although these parameters demonstrate varying degrees of diagnostic utility, each has important limitations. The Splenoportal Index has attracted increasing attention because it combines morphological and hemodynamic variables into a single measurement, thereby potentially improving diagnostic performance. Previous studies cited in the thesis have demonstrated that higher SPI values are associated with the presence of large esophageal varices and may identify patients at increased risk of clinically significant portal hypertension.10

In developing countries such as India, where the burden of chronic liver disease continues to rise and access to endoscopic facilities may be limited, a simple, reproducible, and inexpensive screening tool could substantially improve patient care. Routine Doppler ultrasonography is already performed in many patients with cirrhosis for surveillance and evaluation of portal hypertension. Incorporating the Splenoportal Index into routine ultrasonographic assessment could facilitate early identification of patients requiring priority endoscopic evaluation while avoiding unnecessary invasive procedures in low-risk individuals. Such an approach may optimize resource utilization and improve clinical decision-making, particularly in resource-constrained healthcare settings.11

Despite encouraging evidence regarding the diagnostic performance of the Splenoportal Index, further validation in different clinical settings remains necessary. The present hospital-based cross-sectional study was therefore undertaken to evaluate the occurrence of esophageal varices in patients with liver cirrhosis and to determine the association between the Splenoportal Index and the severity of esophageal varices using upper gastrointestinal endoscopy as the reference standard. The findings of this study may contribute to the growing evidence supporting the use of SPI as a practical, non-invasive screening tool in the routine evaluation of patients with cirrhosis.12.

MATERIALS AND METHODS

Study Design and Setting

A hospital-based cross-sectional observational study was conducted in the Department of General Medicine, The Oxford Medical College Hospital and Research Centre, Yadavanahalli, Bengaluru, Karnataka, India. The study was carried out over a period of 18 months.

Study Population

The study included adult patients admitted to the Department of General Medicine with a diagnosis of liver cirrhosis and portal hypertension. A total of 42 patients fulfilling the eligibility criteria were enrolled after obtaining written informed consent.

Eligibility Criteria

Inclusion Criteria

Patients satisfying all of the following criteria were included:

- Age ≥18 years
- Diagnosed with cirrhosis of the liver irrespective of etiology
- Willing to provide written informed consent for participation in the study

Exclusion Criteria

Patients with the following conditions were excluded:

- Acute or severe cardiac disease
- Acute or severe pulmonary disease
- Pregnancy
- Lactation

Sample Size

The sample size was calculated using the formula:
where:

- Confidence level (α) = 5%
- Expected prevalence (p) = 70%
- q = 30%
- Margin of error (d) = 20% of prevalence (14%)

Based on a previous study by Suraj Uppalapati et al., the calculated minimum sample size was 42 participants, all of whom were included in the present study.

Ethical Considerations

The study was initiated only after obtaining approval from the Institutional Ethics Committee of The Oxford Medical College Hospital and Research Centre, Bengaluru. Written informed consent was obtained from all study participants after explaining the objectives and procedures of the study in their preferred language. Confidentiality of patient information was maintained throughout the study.

Study Procedure

After recruitment, all participants underwent detailed clinical evaluation using a predesigned study proforma.
The following information was recorded:

- Demographic characteristics
- Anthropometric measurements
- Clinical history
- Treatment history
- Physical examination findings

All participants underwent routine laboratory investigations and radiological evaluation.
The following investigations were performed:

- Complete Blood Count (CBC)
- Liver Function Tests (LFT)
- Renal Function Tests (RFT)
- Electrocardiography (ECG)
- Ultrasonography of the abdomen
- Doppler ultrasonography

- Upper gastrointestinal (UGI) endoscopy

Ultrasonographic Assessment
All patients underwent abdominal ultrasonography after an overnight fast of approximately eight hours. Ultrasonography was performed to evaluate features suggestive of cirrhosis and portal hypertension.
Doppler ultrasonography was performed by a consultant radiologist to determine portal venous flow velocity and splenic measurements required for calculation of the Splenoportal Index (SPI).

Splenoportal Index
The Splenoportal Index (SPI) was calculated using Doppler ultrasonographic measurements.
The index incorporates:
- Splenic measurements obtained during ultrasonography
- Mean portal vein velocity obtained using Doppler ultrasound

Higher SPI values indicate increasing portal hypertension and were evaluated for their association with the severity of esophageal varices.

Endoscopic Evaluation
Upper gastrointestinal endoscopy was performed in all enrolled patients using a video endoscope.
Endoscopy was considered the reference standard for identifying the presence and severity of esophageal varices.
The findings were documented in the study proforma and categorized according to variceal severity for subsequent statistical analysis.

Outcome Measures
Primary Outcome
- Association between the Splenoportal Index (SPI) and the severity of esophageal varices detected by upper gastrointestinal endoscopy.

Secondary Outcomes
- Frequency of esophageal varices among patients with cirrhosis.
- Association between ultrasonographic findings and variceal severity.
- Association between liver function test abnormalities and variceal severity.
- Distribution of demographic and clinical characteristics among study participants.

These outcomes reflect the objectives stated in the thesis.

Statistical Analysis
Data were entered into Microsoft Excel and analyzed using IBM SPSS Statistics version 22.
Continuous variables were expressed as mean ± standard deviation (SD), whereas categorical variables were summarized as frequencies and percentages.

Associations between categorical variables were evaluated using the Chi-square test.
A p-value <0.05 was considered statistically significant.

The thesis reports a statistically significant association between SPI and variceal severity ($p < 0.001$), whereas the association between ultrasonographic findings and variceal severity was not significant ($p = 0.276$). The study also reports SPI diagnostic performance with 95.2% sensitivity, 90.4% specificity, 90.9% positive predictive value, and 95.0% negative predictive value.

RESULTS

Baseline Characteristics
A total of **42 patients** with liver cirrhosis and portal hypertension were included in this cross-sectional study. The mean age of the study population was **49.02 ± 14.12 years**.

The largest proportion of patients belonged to the **38–57-year age group (42.8%)**, followed by the **58–77-year group (30.9%)** and the **18–37-year group (26.1%)**. No participant was older than 78 years.

There was a clear male predominance, with **32 (76.1%)** males and **10 (23.8%)** females, indicating that cirrhosis and portal hypertension were more frequently encountered among men in the study population.

Table 1. Baseline Demographic Characteristics

Variable	Number (n=42)	Percentage
Mean age (years)	49.02 ± 14.12	—
18–37 years	11	26.1
38–57 years	18	42.8
58–77 years	13	30.9
Male	32	76.1
Female	10	23.8

Clinical Presentation

Abdominal distension was the **most frequent presenting complaint**, occurring in **100%** of patients. Pain abdomen was reported in **66.6%**, while **52.3%** had a previous history of jaundice. The predominance of abdominal distension was statistically significant (**p < 0.001**), reflecting the high prevalence of ascites in patients with advanced cirrhosis and portal hypertension.

Table 2. Presenting Clinical Features

Clinical Feature	Number	Percentage
Abdominal distension	42	100
Pain abdomen	28	66.6
Previous jaundice	22	52.3

Blood Transfusion Requirement

Among the study participants, **15 patients (35.7%)** required blood transfusion during the course of illness, whereas **27 (64.2%)** did not. The proportion of patients who did not require transfusion was significantly greater (**p = 0.048**).

Ultrasonographic Findings

On abdominal ultrasonography, **nodular liver surface** was the commonest finding (**40.4%**), followed by **coarse echotexture (33.3%)** and **volume redistribution (26.1%)**. However, these ultrasonographic morphological findings did not demonstrate a statistically significant association with the severity of esophageal varices (**p = 0.276**).

Table 3. Ultrasonographic Findings

USG Finding	Number	Percentage
Nodular surface	17	40.4
Coarse echotexture	14	33.3
Volume redistribution	11	26.1

Distribution of Esophageal Varices

Upper gastrointestinal endoscopy demonstrated an **equal distribution** of esophageal varices. **Twenty-one patients (50%)** had small varices, while the remaining **21 (50%)** had large varices. There was no statistically significant difference in the proportion of small and large varices within the study population (**p = 1.000**).

Table 4. Endoscopic Distribution of Esophageal Varices

Variceal Grade	Number	Percentage
Small varices	21	50
Large varices	21	50

Liver Function Tests

Abnormal liver function tests were observed in **37 patients (88.0%)**, whereas only **5 patients (11.9%)** had normal biochemical parameters. The predominance of abnormal liver function tests was statistically significant (**p < 0.001**), indicating advanced hepatic dysfunction in the study population.

Table 5. Liver Function Test Status

LFT Status	Number	Percentage
Abnormal	37	88.0
Normal	5	11.9

Association Between Splenoportal Index and Esophageal Varices
The Splenoportal Index showed a **highly significant association** with the severity of esophageal varices (**p < 0.001**).

All patients with **SPI <4** had only **small esophageal varices**. Conversely, **all patients with SPI >6** had **large esophageal varices**. Among patients with an SPI between **4 and 6**, small varices predominated, with only one patient demonstrating large varices.
These findings indicate a progressive increase in variceal severity with increasing SPI values, supporting SPI as a reliable non-invasive marker for predicting clinically significant esophageal varices.

Table 6. Association Between Splenoportal Index and Variceal Severity

Splenoportal Index	Small Varices n (%)	Large Varices n (%)
<4	10 (100)	0 (0)
4–6	11 (91.7)	1 (8.3)
>6	0 (0)	20 (100)

Chi-square test: p <0.001

Association Between Ultrasonographic Findings and Variceal Severity
Although patients with a nodular liver surface were more likely to have large esophageal varices than those with coarse echotexture or volume redistribution, the association between ultrasonographic liver morphology and variceal severity was **not statistically significant (p = 0.276)**. These findings suggest that liver morphology on conventional ultrasonography alone cannot reliably predict the severity of esophageal varices.

Table 7. Ultrasonographic Findings and Esophageal Variceal Severity

USG Finding	Small Varices n (%)	Large Varices n (%)	p-value
Coarse echotexture	8 (57.1)	6 (42.9)	
Nodular surface	6 (35.3)	11 (64.7)	**0.276**
Volume redistribution	7 (63.6)	4 (36.4)	

Summary of Major Findings
- Forty-two patients with cirrhosis were enrolled.
- The mean age was **49.02 ± 14.12 years**, with a predominance of middle-aged males.
- Abdominal distension was the commonest presenting symptom.
- Abnormal liver function tests were present in **88%** of patients.
- Endoscopy demonstrated an equal distribution of small and large esophageal varices.
- **The Splenoportal Index showed a strong and statistically significant association with variceal severity (p <0.001).**
- Conventional ultrasonographic liver morphology was **not significantly associated** with the severity of esophageal varices.

DISCUSSION
Esophageal varices are one of the most important consequences of portal hypertension in patients with liver cirrhosis and represent a major cause of upper gastrointestinal bleeding, morbidity, and mortality. Early identification of patients at risk of developing large varices is essential for timely prophylactic therapy and prevention of life-threatening hemorrhage. Although upper gastrointestinal endoscopy remains the gold standard for diagnosing and grading esophageal varices, its invasive nature, cost, and limited availability in resource-constrained settings have prompted the search for reliable non-invasive screening methods. The present study evaluated the utility of the Splenoportal Index (SPI), a Doppler ultrasonographic parameter, as a predictor of esophageal variceal severity in patients with cirrhosis.2

The present study included 42 patients with cirrhosis of the liver and portal hypertension. The mean age of the study population was 49.02 ± 14.12 years, with the majority of patients belonging to the 38–57-year age group. This finding is consistent with the natural history of chronic liver disease, where complications of portal hypertension generally become clinically apparent during middle age following years of progressive hepatic fibrosis. The observed age distribution is also comparable to previous Indian studies evaluating non-invasive predictors of esophageal varices, which reported that cirrhosis predominantly affects middle-aged adults.

A marked male predominance (76.1%) was observed in the present study. Similar findings have been reported in previous studies evaluating portal hypertension and esophageal varices. The higher prevalence among males may reflect greater

exposure to etiological factors such as alcohol-related liver disease and chronic viral hepatitis, both of which remain important causes of cirrhosis in India. The predominance of male patients observed in this study is therefore in agreement with published epidemiological data on chronic liver disease.2,3

Among the presenting symptoms, abdominal distension was observed in all patients, making it the most common clinical manifestation. This finding reflects the high prevalence of ascites in patients with clinically significant portal hypertension and decompensated cirrhosis. More than half of the patients also reported abdominal pain and a previous history of jaundice, indicating advanced hepatic dysfunction. These observations are consistent with the established clinical manifestations of cirrhosis, in which portal hypertension contributes to ascites while progressive hepatocellular dysfunction results in jaundice and other features of liver failure.4,5

The present study demonstrated that 88% of patients had abnormal liver function tests, reflecting advanced liver disease. However, liver function abnormalities were not significantly associated with the severity of esophageal varices. This finding suggests that although liver function tests are useful in assessing hepatic dysfunction, they are poor predictors of portal hypertension and variceal grade. The severity of varices depends primarily on portal venous hemodynamics rather than biochemical liver injury alone. Similar observations have been reported in previous studies, where conventional laboratory parameters showed limited value in predicting clinically significant esophageal varices.

Conventional ultrasonography identified nodular liver surface, coarse echotexture, and volume redistribution as the predominant imaging findings. Although these features are characteristic of cirrhosis, the present study found no statistically significant association between ultrasonographic liver morphology and the severity of esophageal varices ($p = 0.276$). This observation emphasizes that structural changes detected on gray-scale ultrasonography alone cannot accurately reflect the degree of portal hypertension. Portal hypertension is a dynamic hemodynamic process, and morphological abnormalities may not parallel the severity of portal venous pressure.

The principal finding of this study was the highly significant association between the Splenoportal Index and the severity of esophageal varices ($p < 0.001$). Patients with SPI values below 4 consistently had only small varices, whereas all patients with SPI values greater than 6 had large esophageal varices. These findings indicate a progressive increase in variceal severity with increasing SPI values and strongly support the use of SPI as a non-invasive marker of clinically significant portal hypertension.

The pathophysiological basis of these findings is well explained by the hemodynamic changes that occur during the progression of cirrhosis. Progressive hepatic fibrosis increases intrahepatic vascular resistance, resulting in elevated portal venous pressure. This causes splenic congestion and splenomegaly together with a reduction in portal vein blood flow velocity. Because the Splenoportal Index combines splenic measurements with portal vein velocity, it reflects both structural and functional consequences of portal hypertension. Consequently, increasing SPI values correlate closely with worsening portal hypertension and the development of large esophageal varices.

The findings of the present study are in agreement with previous investigations cited in the thesis. Harbin et al.4 first described the Splenoportal Index as a Doppler-derived parameter for evaluating portal hypertension and demonstrated a strong relationship between SPI and portal venous pressure. Subsequent studies confirmed that increasing portal hypertension is associated with reduced portal vein velocity and increasing splenic size, both of which contribute to elevated SPI values.

Similarly, Mittal et al.6 reported significantly higher SPI values among patients with large esophageal varices than among those with small or absent varices. Baik et al.5 further demonstrated that SPI possesses good sensitivity and specificity for predicting clinically significant varices, supporting its usefulness as a non-invasive screening tool. The findings of the present study closely parallel these observations by demonstrating a highly significant relationship between SPI and variceal severity.

Indian studies summarized in the thesis have also supported the clinical usefulness of the Splenoportal Index. Sharma et al.7 reported progressively increasing SPI values with worsening grades of esophageal varices and concluded that SPI may be incorporated into routine clinical evaluation, particularly in resource-limited healthcare settings. The present study strengthens this evidence by demonstrating similar findings in a South Indian tertiary-care population.

Strengths of the Study

The present study has several important strengths. First, it evaluated the Splenoportal Index (SPI), a simple Doppler ultrasonographic parameter that combines splenic measurements with portal vein velocity, allowing simultaneous

assessment of the structural and hemodynamic changes associated with portal hypertension. This makes SPI a practical non-invasive marker for predicting the severity of esophageal varices.

Second, upper gastrointestinal endoscopy, the accepted reference standard for diagnosing and grading esophageal varices, was performed in all study participants. This enabled direct comparison of SPI with endoscopic findings and strengthened the validity of the observed association.

Third, all participants underwent a standardized clinical evaluation, laboratory investigations, ultrasonographic examination, Doppler assessment, and endoscopy using a predefined study protocol. This helped minimize variability in data collection and improved the consistency of measurements across the study population.

Finally, the study addresses an important clinical problem in regions where routine endoscopic screening may be limited by resource availability. Because Doppler ultrasonography is widely available and relatively inexpensive, incorporation of SPI into routine evaluation has potential practical value, particularly in tertiary-care hospitals serving large numbers of patients with chronic liver disease.

Limitations

The present study also has certain limitations that should be considered when interpreting the findings.

The study was conducted at a single tertiary-care teaching hospital, and therefore the results may not be directly generalizable to all patient populations or healthcare settings. The sample size was relatively small (42 patients), which may have limited the precision of estimates and reduced the ability to evaluate subgroup differences. Because the study used a cross-sectional design, it evaluated the association between SPI and the severity of esophageal varices at one point in time. It could not determine whether SPI predicts future outcomes such as first variceal bleeding, recurrent hemorrhage, disease progression, or mortality. The study focused on the relationship between SPI and endoscopic variceal grading and did not assess other non-invasive markers in a comparative manner. Therefore, the relative performance of SPI compared with other predictive indices could not be determined from this study alone.

Clinical Implications

The findings of the present study have several important clinical implications.

A statistically significant association between the Splenoportal Index and the severity of esophageal varices suggests that SPI may serve as a useful screening and risk-stratification tool in patients with liver cirrhosis. Patients with higher SPI values were more likely to have large esophageal varices, supporting its potential role in identifying individuals who should undergo early endoscopic evaluation. Since Doppler ultrasonography is routinely performed during the evaluation and follow-up of patients with cirrhosis, calculation of SPI does not require additional invasive procedures or expensive equipment. Incorporating SPI into routine ultrasonographic assessment may therefore improve clinical decision-making without substantially increasing healthcare costs. n hospitals where endoscopic resources are limited, SPI may assist clinicians in prioritizing patients for endoscopy based on the likelihood of clinically significant varices. Such an approach could optimize utilization of endoscopic services while reducing unnecessary invasive procedures in lower-risk patients. However, SPI should be considered an adjunct to, rather than a replacement for, endoscopic evaluation until further validation studies establish standardized cut-off values and confirm its performance across different populations. This reflects the role investigated in the present study rather than a recommendation to replace current standards of care.

Future Directions

Future research should focus on validating the findings of the present study in larger, multicenter cohorts representing different etiologies and stages of liver cirrhosis.

Prospective longitudinal studies are needed to determine whether the Splenoportal Index can predict clinically important outcomes such as first variceal hemorrhage, recurrent bleeding, hepatic decompensation, and mortality.

Further studies comparing SPI with other established non-invasive predictors, including platelet-based indices, spleen stiffness measurements, liver stiffness measurements, and composite predictive models, would help define its relative clinical utility.

Evaluation of standardized SPI cut-off values in diverse patient populations may facilitate broader clinical application and improve consistency in patient selection for endoscopic screening.

CONCLUSION

The present hospital-based cross-sectional study demonstrated a highly significant association between the Splenoportal Index and the severity of esophageal varices in patients with liver cirrhosis. Increasing SPI values were associated with progressively severe esophageal varices, whereas conventional ultrasonographic findings and routine liver function test

abnormalities did not show a significant association with variceal grade. These findings indicate that the Splenoportal Index is a simple, inexpensive, and non-invasive Doppler ultrasonographic parameter that may assist in identifying patients at increased risk of large esophageal varices. Because SPI can be calculated during routine abdominal Doppler ultrasonography, it has the potential to support clinical risk stratification and help prioritize patients for upper gastrointestinal endoscopy, particularly in settings where endoscopic resources are constrained. While the results are encouraging, they should be interpreted in the context of the study's sample size and single-center design. Larger prospective multicenter studies are warranted to validate these findings and further define the role of the Splenoportal Index in the routine evaluation of patients with cirrhosis. An important advantage of the Splenoportal Index is that it can be calculated during routine Doppler ultrasonography without requiring additional investigations or increasing healthcare costs. Since abdominal ultrasonography is already recommended for surveillance in patients with cirrhosis, the calculation of SPI requires only splenic measurements and portal vein velocity, both of which are routinely obtained during Doppler examination. Therefore, SPI represents a practical and cost-effective adjunct to standard ultrasonographic assessment.

The clinical implications of the present study are significant. In many hospitals, particularly in developing countries, routine endoscopic screening for every patient with cirrhosis is difficult because of limited endoscopic facilities and financial constraints. The Splenoportal Index may therefore serve as an effective triaging tool for identifying patients who are most likely to harbor large esophageal varices and who should be prioritized for endoscopic evaluation and primary prophylaxis. Such an approach may improve resource utilization while reducing unnecessary invasive procedures among low-risk patients. Despite these encouraging findings, the study has certain limitations. The sample size was relatively small (42 patients) and the study was conducted at a single tertiary-care center, which may limit the generalizability of the findings. Additionally, because of its cross-sectional design, the study could evaluate only the association between SPI and variceal severity and could not assess longitudinal outcomes such as future variceal bleeding, mortality, or progression of portal hypertension. Larger multicenter prospective studies are therefore required to validate the optimal SPI cut-off values and determine their prognostic significance. Overall, the present study demonstrates that the Splenoportal Index is a reliable, simple, inexpensive, and non-invasive predictor of esophageal variceal severity. Compared with conventional ultrasonographic findings and routine liver function tests, SPI showed superior correlation with endoscopic grading of esophageal varices. These findings support the incorporation of SPI into routine Doppler ultrasonographic evaluation of patients with cirrhosis to facilitate early identification of high-risk individuals requiring endoscopic screening and preventive management.

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