E-ISSN 2250-0944
ISSN 2250-1150
doi: 10.48047/ijprt/16.02.368

Research Article

Clinical and Laboratory Predictors of Esophageal Varices in Patients with Liver Cirrhosis: A Prospective Observational Study

Dr Shashikanth Patil[1], Dr Sneha Bharathi S Angadi[2], Dr. Shivaprasad Gaddikeri[3]

[1](MD General Medicine), senior resident General Medicine, Rajiv Gandhi Super specialty Hospital (OPEC)Raichur. (A unit of Rims, Raichur)
[2](MD Dermatology), Assistant Professor, Raichur institute of medical sciences, Raichur.
[3](MD General Medicine) Senior Resident, Dept of Cardiology Sanjay Gandhi Postgraduate Institute Of Medical Sciences
Corresponding Author: Dr Shashikanth Patil

Accepted Date: 26-07-2026

Abstract

Background

Esophageal varices are a major manifestation of portal hypertension in liver cirrhosis, which are associated with potentially life-threatening hemorrhage. Upper gastrointestinal endoscopy remains the reference investigation for the identification of varices but clinical, hematological, biochemical and ultrasonographic parameters, routinely available may provide useful information for the risk stratification. In the present study, we evaluated clinical and laboratory parameters associated with esophageal varices in patients with liver cirrhosis.

Methods

A prospective cross-sectional study was conducted in the Department of General Medicine, Navodaya Medical College and Research Center, Raichur, Karnataka between January 2022 and June 2023. A total of 100 patients with liver cirrhosis and portal hypertension aged 18–60 years were enrolled by simple random sampling. A pre-structured questionnaire was used to collect demographic and clinical information. Complete blood count, liver function tests, renal function tests and coagulation profile were done. Abdominal ultrasound and upper digestive endoscopy were performed. Participants were stratified by presence or absence of esophageal varices on endoscopy Laboratory and ultrasonographic parameters were compared between 2 groups .

Results

Among 100 participants, 50% had esophageal varices. Participants with varices had significantly lower hemoglobin (9.82±1.38 vs 11.54±1.27 g/dL; $p<0.0001$), platelet count (1.17±0.32 vs 1.49±0.44

lakh/mm^3; $p<0.0001$), and serum albumin (2.83±0.47 vs 3.27±0.36 g/dL; $p<0.0001$) than those without varices. They also had significantly higher total bilirubin (3.47±1.74 vs 2.69±1.14 mg/dL; $p=0.0093$), blood urea nitrogen (29.66±10.99 vs 21.80±4.23 mg/dL; $p<0.0001$), prothrombin time (14.95±1.47 vs 13.84±0.53 seconds; $p<0.0001$), and INR (1.13±0.11 vs 1.04±0.05; $p<0.0001$). AST did not differ significantly between groups (111.72±57.37 vs 111.14±48.32 U/L; $p=0.9565$). Splenomegaly on ultrasonography was strongly associated with esophageal varices ($\chi^2=16.1031$, $p=0.00006$).

Conclusion

Esophageal varices were significantly associated with lower hemoglobin, thrombocytopenia, hypoalbuminemia, higher bilirubin and BUN concentrations and prolonged PT/INR. Ultrasonographic splenomegaly was also significantly associated with the presence of varices. These routinely available parameters may be useful for non-invasive risk stratification of patients with cirrhosis but their individual predictive performance warrants further validation in larger prospective cohorts.

Keywords: liver cirrhosis; esophageal varices; thrombocytopenia; albumin; bilirubin; INR; splenomegaly; portal hypertension; non-invasive predictors.

Introduction:

Liver cirrhosis is a chronic progressive liver disease characterized by hepatic architectural distortion,

fibrosis and development of portal hypertension. Portal hypertension leads to the development of portosystemic collaterals, such as esophageal varices. Major complications of portal hypertension include ascites, splenomegaly and variceal hemorrhage.[1-3]

Esophageal varices are of clinical importance because these varices can rupture and cause severe upper gastrointestinal bleeding. Progression of liver disease is associated with an increased risk for development of varices. Thus, identification of patients at increased risk is an important component of cirrhosis management.[4] The standard investigation for direct visualization of esophageal varices is upper gastrointestinal endoscopy. However, endoscopy is invasive, can be uncomfortable, requires trained personnel and appropriate infrastructure and may need to be repeated during surveillance.[4,5]

These limitations have generated interest for non-invasive predictors. Platelet count, platelet-to-spleen diameter ratio, liver function parameters, and measures of hepatic synthetic dysfunction are some of the several clinical, hematological, biochemical and ultrasonographic parameters that have been investigated .Thrombocytopenia is of particular interest because portal hypertension can cause splenic sequestration of platelets and congestive splenomegaly. [5,6] Loss of albumin, high bilirubin and long prothrombin time/INR may be indicative of progression of hepatic synthetic and excretory function.[5,6]

Previous studies have suggested platelet count and platelet-spleen diameter ratio as possible predictors of the presence of esophageal varices especially in settings with limited access to endoscopy.[6] However, the usefulness of single routinely available parameters may vary depending on disease severity, etiology and patient characteristics.

Therefore, in this study we evaluated the readily available clinical, laboratory and ultrasonographic parameters in patients with liver cirrhosis and their association with the presence of esophageal varices.

Objective

To evaluate clinical, laboratory and ultrasonographic parameters associated with the presence of esophageal varices in patients with liver cirrhosis.

Materials and Methods

Study design and setting

This was a **hospital-based prospective cross-sectional study** conducted in the Department of General Medicine, Navodaya Medical College and Research Centre, Raichur, Karnataka.

The study was conducted over **18 months, from January 2022 to June 2023**. The study specifies a prospective cross-sectional design and simple random sampling technique.

Study population

Patients attending the General Medicine outpatient department or admitted to the General Medicine wards with a clinical diagnosis of liver cirrhosis were screened.

Inclusion criteria

Patients were included if they:

1. Were aged 18–60 years.
2. Had liver cirrhosis with portal hypertension.

Exclusion criteria

Patients were excluded if they:

1. Were unwilling to participate.
2. Were aged <18 or >60 years.
3. Had hepatocellular carcinoma detected by ultrasonography.
4. Were pregnant.
5. Had primary hematological disorders.
6. Had active gastrointestinal bleeding at admission.
7. Had received primary prophylaxis for variceal bleeding.
8. Had undergone previous variceal band ligation or transjugular intrahepatic portosystemic shunt.
9. Had a previous surgical intervention for portal hypertension.

Sampling and sample size

Simple random sampling was used. The calculated sample size was 98 after allowing for a 20% non-response rate, and the final study sample consisted of **100 participants**.

Clinical assessment

After obtaining written informed consent, demographic characteristics and detailed clinical history were recorded using a pre-structured questionnaire. Information regarding presenting symptoms, habits, comorbidities and previous blood transfusion or blood-product exposure was collected. All participants underwent general physical and systemic examination.

The recorded clinical variables included:

- anorexia;

- vomiting;
- fever;
- altered sensorium;
- pedal edema;
- jaundice;
- abdominal pain;
- abdominal distension;
- smoking;
- alcohol consumption; and
- relevant comorbidities.

Laboratory investigations

Venous blood samples were analyzed in the institutional laboratory. Investigations included:

- complete blood count;
- coagulation profile;
- liver function tests;
- renal function tests;
- viral markers including HBsAg, HIV and HCV;
- random blood glucose.

Abdominal ultrasonography and upper gastrointestinal endoscopy were also performed.

The principal laboratory variables evaluated in relation to esophageal varices were:

- hemoglobin;
- platelet count;
- total bilirubin;
- serum albumin;
- AST;
- BUN;
- prothrombin time; and
- INR.

Ultrasonographic assessment

Abdominal ultrasonography was performed as part of the study evaluation. Splenomegaly was recorded as present or absent. The association between ultrasonographic splenomegaly and endoscopically detected esophageal varices was subsequently assessed.

Endoscopic assessment

Upper gastrointestinal endoscopy was performed to identify esophageal varices. Participants were classified into two groups according to the presence or absence of esophageal varices:

- **Varices present:** 50 participants.
- **Varices absent:** 50 participants.

Outcome measures

Primary outcome

Presence of esophageal varices on upper gastrointestinal endoscopy.

Secondary variables

The following routinely available parameters were evaluated for their association with esophageal varices:

- hemoglobin;
- platelet count;
- bilirubin;
- albumin;
- AST;
- BUN;
- PT;
- INR; and
- ultrasonographic splenomegaly.

Statistical analysis

Data were coded and entered into Microsoft Excel and a master chart was prepared. Continuous variables were summarized as mean and standard deviation, whereas categorical variables were expressed as frequencies and percentages. The study reports use of the *t* test and chi-square test for associations, with statistical significance defined as $p<0.05$. EPI software was used for statistical analysis.

. Results

Baseline characteristics

A total of 100 patients with liver cirrhosis and portal hypertension were included.

The mean age of the study population was **48.17±5.40 years**. Participants aged 41–50 years represented the largest age group (63%), followed by those aged >51 years (32%); 5% were aged <40 years. Men constituted 79% of the study population and women 21%.

Table 1. Baseline demographic characteristics

Characteristic	n (%)
Age group	
<40 years	5 (5)

41–50 years	63 (63)
>51 years	32 (32)
Sex	
Male	79 (79)
Female	21 (21)
Total	**100 (100)**

Mean age: 48.17±5.40 years

Clinical characteristics

The commonest presenting symptom was anorexia, reported in 100% of participants. Abdominal pain was reported by 95%, jaundice by 84%, vomiting by 83%, pedal edema by 58%, altered sensorium by 34%, abdominal distension by 30%, and fever by 15%.

Table 2. Presenting clinical features

Clinical feature	n (%)
Anorexia	100 (100)
Abdominal pain	95 (95)
Jaundice	84 (84)
Vomiting	83 (83)
Pedal edema	58 (58)
Altered sensorium	34 (34)
Abdominal distension	30 (30)
Fever	15 (15)

Overall laboratory profile

The mean hemoglobin concentration was **10.68±1.58 g/dL**, and 17% of participants had hemoglobin <9 g/dL. Thrombocytopenia was present in 73% of participants, with a mean platelet count of **1.33±0.42 lakh/mm³**.

The mean total bilirubin was **3.08±1.52 mg/dL**, albumin **3.05±0.47 g/dL**, AST **111.43±52.99 U/L**, BUN **25.73±9.19 mg/dL**, PT **14.40±1.24 seconds**, and INR **1.08±0.09**.

Table 3. Overall laboratory characteristics

Laboratory parameter	Mean ± SD
Hemoglobin, g/dL	10.68 ± 1.58
Platelet count, lakh/mm³	1.33 ± 0.42
Total bilirubin, mg/dL	3.08 ± 1.52
Albumin, g/dL	3.05 ± 0.47
AST, U/L	111.43 ± 52.99
BUN, mg/dL	25.73 ± 9.19
PT, seconds	14.40 ± 1.24

INR	1.08 ± 0.09

Association Between Laboratory Parameters and Esophageal Varices

Fifty participants had esophageal varices and 50 did not. Significant differences were observed for seven of the eight laboratory parameters evaluated.

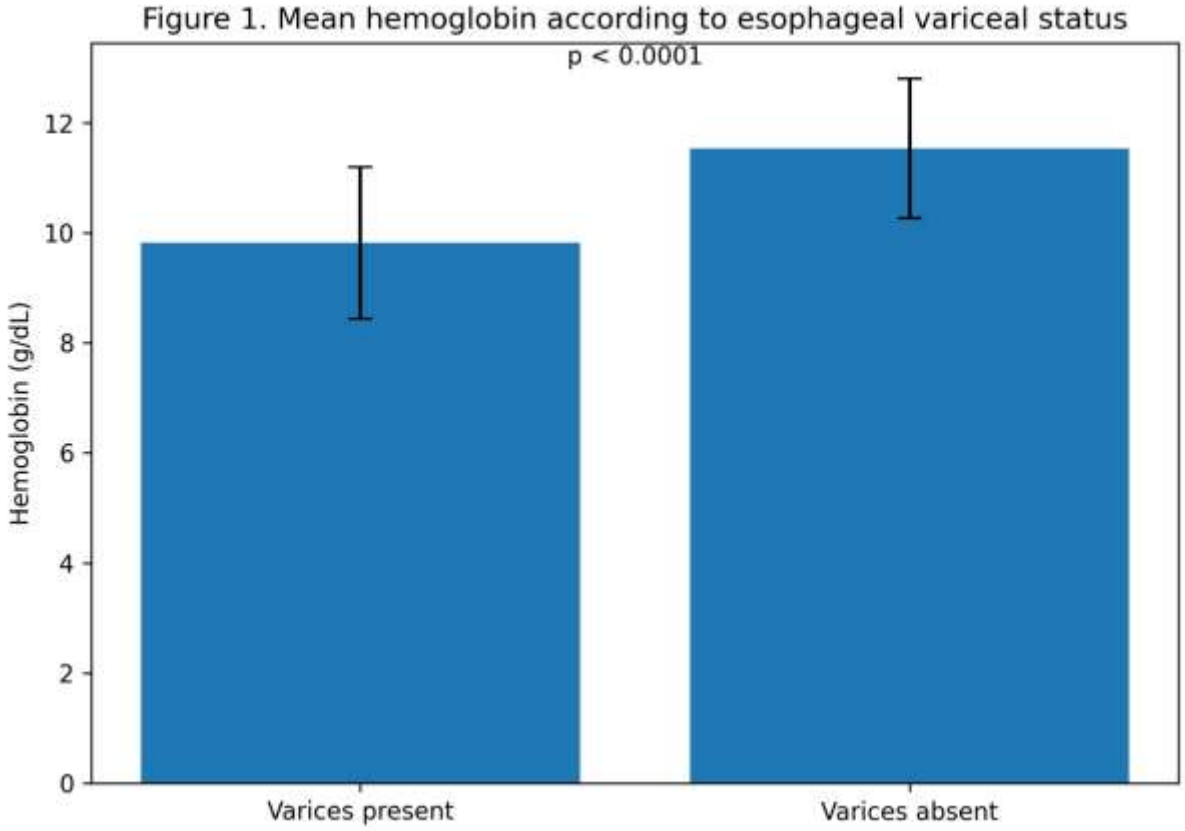
Participants with esophageal varices had significantly lower hemoglobin, platelet count and albumin levels and significantly higher total bilirubin, BUN, PT and INR values than participants without varices. AST did not differ significantly between the two groups.

Table 4. Comparison of laboratory parameters according to presence of esophageal varices

Laboratory parameter	Varices present (n=50)	Varices absent (n=50)	*p*-value
Hemoglobin, g/dL	9.82 ± 1.38	11.54 ± 1.27	<0.0001
Platelet count, lakh/mm³	1.17 ± 0.32	1.49 ± 0.44	<0.0001
Total bilirubin, mg/dL	3.47 ± 1.74	2.69 ± 1.14	0.0093
Albumin, g/dL	2.83 ± 0.47	3.27 ± 0.36	<0.0001
AST, U/L	111.72 ± 57.37	111.14 ± 48.32	0.9565
BUN, mg/dL	29.66 ± 10.99	21.80 ± 4.23	<0.0001
PT, seconds	14.95 ± 1.47	13.84 ± 0.53	<0.0001
INR	1.13 ± 0.11	1.04 ± 0.05	<0.0001

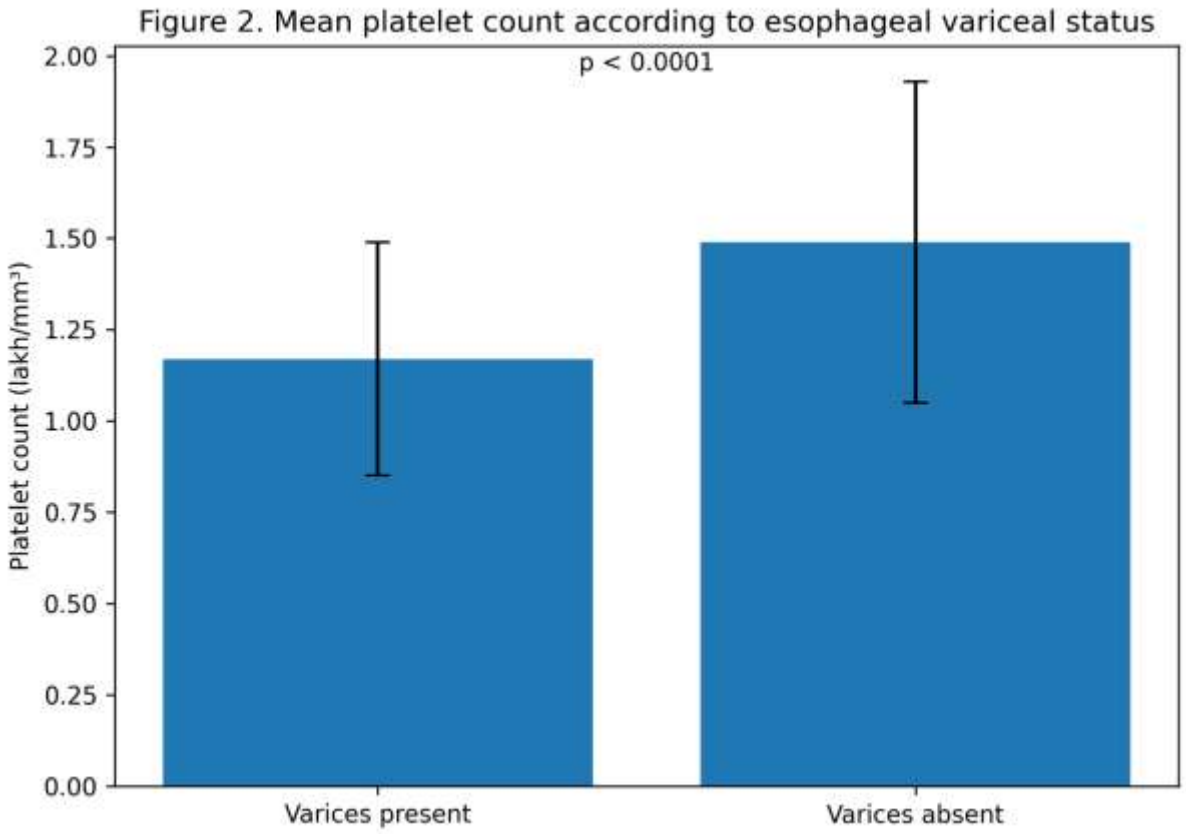
Significant at p<0.05.

Figure 1



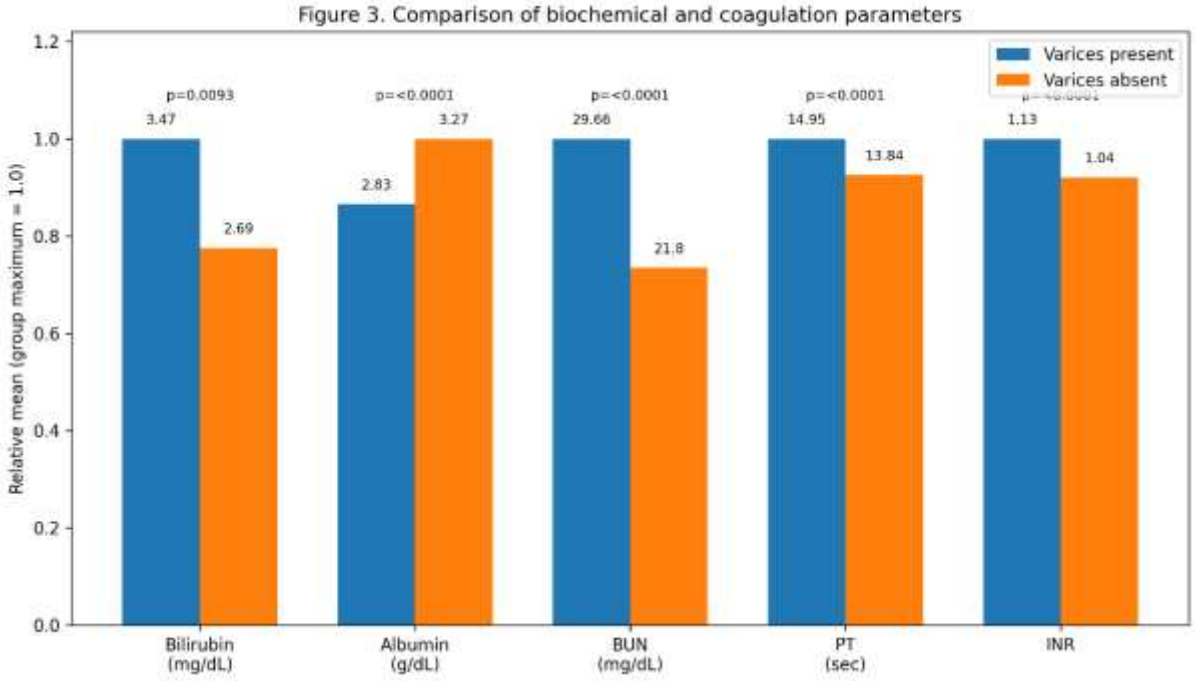
Data:
Hemoglobin: 9.82±1.38 vs 11.54±1.27 g/dL; $p<0.0001$.
Platelets: 1.17±0.32 vs 1.49±0.44 lakh/mm³; $p<0.0001$.

Figure 2



Data:
Total bilirubin: 3.47±1.74 vs 2.69±1.14 mg/dL; *p*=0.0093.
Albumin: 2.83±0.47 vs 3.27±0.36 g/dL; *p*<0.0001.

Figure 3



Data:
BUN: 29.66±10.99 vs 21.80±4.23 mg/dL; *p*<0.0001.

PT: 14.95±1.47 vs 13.84±0.53 seconds; $p<0.0001$.
INR: 1.13±0.11 vs 1.04±0.05; $p<0.0001$.

5. Association Between Splenomegaly and Esophageal Varices

Ultrasonographic splenomegaly was present in **54 participants**. Among these, 37 had esophageal varices and 17 did not. Among the 46 participants without splenomegaly, 13 had varices and 33 did not.

Thus, the proportion of patients with varices was substantially higher among those with splenomegaly. The association was statistically significant ($\chi^2=16.1031$, df=1, $p=0.00006$).

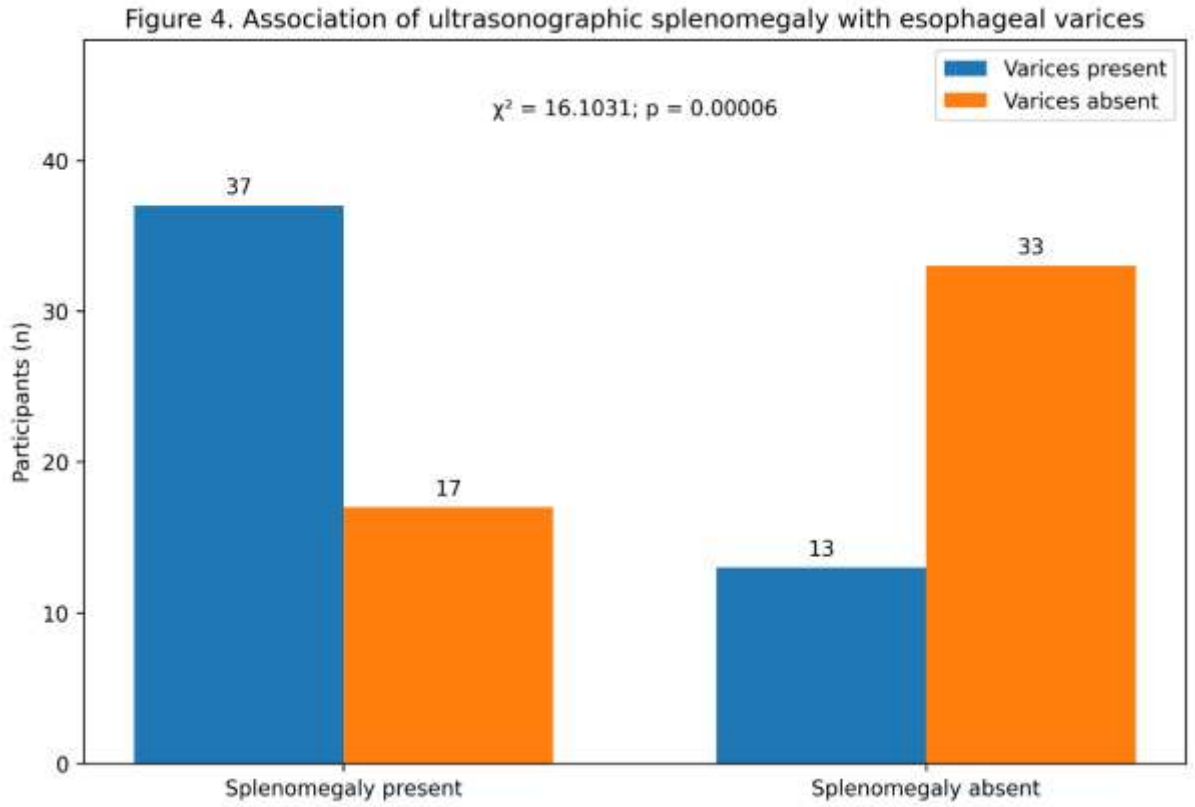
Table 5. Association between ultrasonographic splenomegaly and esophageal varices

Splenomegaly on USG	Varices present	Varices absent	Total
Present	37	17	54
Absent	13	33	46
Total	**50**	**50**	**100**

$\chi^2=16.1031$; df=1; p=0.00006

From these data, the proportion with varices was **68.5% (37/54)** among patients with splenomegaly compared with **28.3% (13/46)** among those without splenomegaly.

Figure 4



Discussion

The present study assessed the routinely available clinical, laboratory and ultrasonographic parameters in patients with liver cirrhosis and their association with endoscopically detected esophageal varices. Half of the study population had esophageal varices. The main findings were associations of varices with lower hemoglobin, lower platelet count and albumin and higher bilirubin, BUN, PT and INR. Ultrasound

showed that splenomegaly was also strongly associated with varices.

The 50% prevalence of esophageal varices in this cohort reflects the high burden of portal hypertensive complications in patients with cirrhosis. This was compared with earlier cohorts where the prevalence was between 43% to 80%, reflecting differences in disease etiology and severity.

Varices esophagus and hemoglobin

Hemoglobin was significantly lower in patients with esophageal varices (9.82±1.38 vs 11.54±1.27 g/dL; p<0.0001) Several mechanisms may contribute to the development of anemia in advanced cirrhosis, including chronic blood loss, nutritional deficiency, hypersplenism and impaired hematological homeostasis . The present finding demonstrates an association between lower hemoglobin concentration and presence of varices, although causality cannot be established due to the cross-sectional design.

It is important to point out that the current study did not assess whether anemia was specifically associated with prior or occult variceal hemorrhage. Consequently, the association should be interpreted as a marker of disease burden rather than a causal association of varices with the anemia.

Thrombocyte count

Thrombocytopenia was one of the most significant associations with esophageal varices. Mean platelet count was 1.17±0.32 lakh/mm³ in patients with varices versus 1.49±0.44 lakh/mm³ in patients without varices (p<0.0001).

Thrombocytopenia is a well-known hematologic manifestation of cirrhosis and portal hypertension and may be partly due to splenic sequestration in the setting of splenomegaly. The study also reports that 73% of the total cohort had thrombocytopenia.

The results are also consistent with earlier work cited in the study. Lelisa et al. reported low platelet count and platelet to spleen diameter ratio as important non-invasive predictors of esophageal varices in patients with cirrhosis.

Albumine

Serum albumin was significantly lower in participants with esophageal varices (2.83±0.47 vs. 3.27±0.36 g/dL; p<0.0001). Albumin is a marker of hepatic synthetic function and nutritional and systemic status. Reduced albumin in patients with varices might be a marker of more advanced hepatic dysfunction.

However, this association should be interpreted with caution as albumin is not specific for portal hypertension. Serum albumin is also affected by nutritional status, systemic inflammation and other clinical factors.

Bilirubin

Total bilirubin concentrations were significantly higher in patients with esophageal varices than in those without varices (3.47±1.74 vs. 2.69±1.14 mg/dL; p=0.0093). Higher bilirubin may be a marker of impaired hepatic excretory function and more advanced liver disease .

The bilirubin finding, along with lower albumin and prolonged coagulation parameters, suggests that patients with varices in this cohort were more likely to have higher hepatic dysfunction.

BUN

BUN was significantly higher in patients with esophageal varices (29.66±10.99 vs 21.80±4.23 mg/dL; p<0.0001). BUN is one of the variables included in the EVendo score, but it was evaluated separately as a routinely available laboratory parameter in this manuscript.

The association may reflect the increased systemic disease burden of participants with varices; however, BUN is influenced by factors other than portal hypertension and liver dysfunction. Hence, its use as a sole diagnostic marker for the esophageal varices needs further evaluation.

Prothrombin time and international normalized ratio (INR)

There was a marked increase in PT and INR in patients with varices. Mean PT was 14.95+1.47 seconds among patients with varices compared to 13.84+0.53 seconds among those without (p<0.0001). The corresponding INR values were 1.13±0.11 and 1.04±0.05 respectively (p<0.0001).

An increased PT/INR may be a marker of hepatic dysfunction due to decreased hepatic synthesis of coagulation factors. INR, however, should not be taken as a direct measure of portal pressure. In the present study its association with varices is more accurately considered as a marker of overall disease severity.

AST

AST did not show a significant difference between participants with and without varices (111.72±57.37 vs 111.14±48.32 U/L; p=0.9565) unlike the other laboratory parameters.

This is an important finding as it shows not all biochemical markers of hepatocellular injury are useful predictors of varices. AST is a marker of hepatocellular injury and not a direct marker of portal hypertension. The lack of association in this cohort therefore is consistent with the distinction between markers of liver injury and markers of hepatic dysfunction or portal-hypertensive consequences.

Enlarged spleen

Ultrasound splenomegaly was strongly associated with esophageal varices. Of the patients with splenomegaly, 37 of 54 (68.5%) had varices compared with 13 of 46 (28.3%) patients without splenomegaly. The association was highly statistically significant ($\chi 2 = 16.1031$; p=0.00006).

This is biologically plausible as portal hypertension is associated with splenic congestion and enlargement, and hypersplenism can cause

thrombocytopenia. The presence of splenomegaly and thrombocytopenia along with esophageal varices further adds to the significance of these easily approachable markers of portal-hypertensive disease.

Clinical importance

The results suggest that several parameters available during routine assessment of cirrhosis are associated with the presence of esophageal varices.

More particularly, the combination of:

• low platelet count,
• hypoalbuminemia,
• high bilirubin,
• Prolonged PT/INR and
• Ultrasonographic splenomegaly may be useful in identifying patients with a greater likelihood of having varices.

However, association does not imply diagnostic accuracy sufficient for individual patient decision making. This study did not develop a new multivariable predictive model and the available study analysis does not provide adjusted odds ratios, regression coefficients, confidence intervals or an independently derived composite score. These parameters should therefore currently be considered risk markers rather than validated alternatives to endoscopy.

Strengths

Strengths of the study include:

1. Recruitment of future participants.
2. Inclusion and exclusion criteria clearly defined.
3. Assessment of some commonly available laboratory parameters.
4. Ultrasonographic assessment of splenomegaly included.
5. Direct comparison of patients with and without esophageal varices detected by endoscopy.
6. Objective laboratory measurements in lieu of solely clinical subjective assessment.

Conclusion

In this prospective hospital-based cohort of patients with liver cirrhosis, the presence of esophageal varices was significantly associated with lower hemoglobin, platelet count and serum albumin and with higher total bilirubin, BUN, PT and INR. There was no significant difference in AST between patients with and without varices. Ultrasonographic splenomegaly was also strongly related to presence of esophageal varices.

These findings suggest that routinely available hematological, biochemical and ultrasonographic parameters may give useful information for non-invasive risk stratification of patients with cirrhosis. However, before these individual parameters can be used to determine whether endoscopic assessment can be safely deferred, larger, multicenter studies incorporating multivariable modeling and formal diagnostic-performance analysis are needed.

References

1. Asrani SK, Devarbhavi H, Eaton J, Kamath PS. Burden of liver diseases in the world. *J Hepatol*. 2019;70:151-171.
2. Heidelbaugh JJ, Bruderly M. Cirrhosis and chronic liver failure: part I. Diagnosis and evaluation. *Am Fam Physician*. 2006;74(5):756-762.
3. Meseeha M, Attia M. Esophageal varices. In: *StatPearls* [Internet]. Treasure Island (FL): StatPearls Publishing; 2023.
4. Garcia-Tsao G, Abraldes JG, Berzigotti A, Bosch J. Portal hypertensive bleeding in cirrhosis: risk stratification, diagnosis, and management: 2016 practice guidance by the American Association for the Study of Liver Diseases. *Hepatology*. 2017;65(1):310-335.
5. Bangaru S, Benhammou JN, Tabibian JH. Noninvasive scores for the prediction of esophageal varices and risk stratification in patients with cirrhosis. *World J Hepatol*. 2020;12(11):908-918.
6. Lelisa G, Chanie Y, Conjeevaram H, Desalegn H. Non-invasive predictors of esophageal varices in patients with cirrhosis: a cross-sectional study in Ethiopia. *MJH*. 2023;2(2):1-7.