International Journal of Science and Research (IJSR)
ISSN: 2319-7064
Impact Factor 2024: 7.101

Predictive Factors for Esophageal Varices in Cirrhotic Patients: A Six - Month Prospective Study

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Abstract: ***Esophageal varices, caused by portal hypertension due to cirrhosis, pose a significant risk of hemorrhage. This prospective study evaluated 106 cases at the Cambodia - China Friendship Preah Kossamak Hospital. Findings revealed cirrhosis was more prevalent in men (76.41%), with an average patient age of 52.5 years. Key etiologies included chronic alcohol consumption, hepatitis B, and hepatitis C. Significant predictors of variceal grading included platelet count, portal vein diameter, and spleen size, with all parameters showing statistical significance (p < 0.001). These results highlight the potential of non - invasive markers for risk stratification and early intervention in resource - limited settings.***

Keywords: Cirrhosis; Portal hypertension; Esophageal varices; Predictive factors; Non – invasive

1. Introduction

Cirrhosis of the liver refers to a progressive, diffusing, fibrosing, nodular condition disrupting the entire normal architecture of the liver. The majority of cases are attributed to excessive alcohol consumption, viral hepatitis, or nonalcoholic non fatty liver disease worldwide. Portal hypertension is a commonly observed outcome and a significant contributor to mortality in persons diagnosed with cirrhosis[1].

Esophageal varices are present in approximately one third of the patients at diagnosis of cirrhosis and incidence increases to 90% in 10 years[2]. The rate of progression from small to large varices is estimated to be 8 - 10% per year and the annual rate of esophageal hemorrhage is 5% for small varices and 15% for large varices[3, 4]. Annual risk of variceal bleeding among small and large varices is 5% and 15% respectively[5]. The six - week mortality rate among patients with index variceal bleeding is approximately 20%[6]. Risk of rebleeding without endoscopic intervention is almost 60% with an increased mortality rate (33%) [7].

Majority of cirrhotic patients are present late with advanced disease and most of them have large varices on their first screening[3].

The condition is distinguished by an elevation in portal venous pressure over ten mmHg. The hepatic structure experiences modifications that lead to an increased impediment to the passage of portal blood. As a result, this gives rise to decrease platelets count, the dilatation of the portal vein, enlargement of the spleen, and the formation of varices in the esophagus. Varices have the potential to induce hemorrhaging, and can give rise to other issues like ascites, hypersplenism and encephalopathy.

Aims

To determine the predictive factors of esophageal varices grading in cirrhotic patients at the Cambodia - China Friendship Preah Kossamak Hospital.

Objectives

1) To evaluate the noninvasive makers by using platelets values with esophageal varices grading.
2) To evaluate the portal vein diameters with esophageal varices grading.
3) To evaluate between the splenic size with esophageal varices grading.

2. Materials and Methods

The present study was carried out in the department of Hepato - Gastroenterology, Cambodia - China Friendship Preah Kossamak Hospital. The prospective study included 106 patients who were admitted during the period from 1st July to 31st December 2024. The data were analyzed using the mean and standard deviation (SD) or median, depending on the variable distribution. Statistical presentation and analysis were performed using Excel 365. Differences between the two groups with continuous data were assessed using a chi - square test, a Z test. A two - sided p - value of less than 0.05 was considered statistically significant.

Inclusion Criteria

- All patients who were clinically and para clinically diagnosed with decompensated cirrhosis.
- Age over or equal to 18 years.

- Esophageal varices grading by using esophagogastroduodenoscopy (EGD).

Exclusion Criteria

- Patients with variceal bleeding.
- Patient's re - hospitalization.

3. Results

Baseline characteristics included patients

106 decompensated cirrhotic patients with ascites, whose abdominal paracentesis were performed, were included in our study. Baseline characteristics of the enrolled cases are presented in *Table 1*. There were 81 males (76.41%) against 25 females (23.58%), with the male to female sex ratio was 3.24: 1.

Our patients were aged from 25 to 86 years with mean age was 52.50 ± 12.55 years. The patients dominantly came from Phnom Penh with total number of 21 patients (19.81%). And the two most commons etiologies of cirrhosis in our series were related to Alcohol (OH) and HBV infection, 30 (28.30%) and 26 (24.52%) respectively.

Based on the Child - Pugh score, patients with grades A, B and C were 20.75%, 45.28% and 33.96% respectively.

Table 1: Baseline characteristics of patients included

Characteristics		Variable	
Patients included			
Sex	Male	81 (76.41%)	Sex ratio 3.24: 1
	Female	25 (23.58%)	
Mean age		52.50 ± 12.55	
Geographic	Phnom Penh	21 (19.81%)	
	Provinces	85 (80.18%)	
Causes of Cirrhosis			
Mono cause	Hepatitis B	26 (24.52%)	
	Hepatitis C	16 (15.09%)	
	Alcohol	30 (28.30%)	
Multi causes	HBV - OH	23 (21, 69%)	
	HCV - OH	11 (10.37%)	
Child - Pugh score classification			
Child - Pugh	A	22 (20.75%)	
	B	48 (45.28%)	
	C	36 (33.96%)	

Association of platelet count with grade of esophageal varices

According to the study, the platelet count ranged from 23 to 294 giga/L. The mean platelet counts in grade I esophageal varices was recorded as 162 ± 7.739 giga/L about 3 cases, had the highest platelet counts among the study population, suggesting a lower risk of bleeding and less severe portal hypertension.

For grade II esophageal varices, the mean platelet count was 100 ± 4.806 giga/L in 29 cases, demonstrated a moderate reduction in platelet counts, indicating increased risk of variceal progression and potential bleeding.

The Grade II esophageal varices, the mean platelet count was 92.5 ± 2.566 giga/L in 74 cases, demonstrated a moderate reduction in platelet counts, indicating increased risk of variceal bleeding.

This *table 2* presents the association platelet count and the grades of EV in patients with liver cirrhosis. The data illustrates how the severity of esophageal varices correlates with platelet counts, with statistical significance ($p<0.001$).

Table 2: Correlation of platelet count and grade of esophageal varices

Grade of esophageal varices	Number	Mean of platelet count with SD	p - value
EV grade I	3	162 ± 7.739	(p < 0.001)
EV grade II	29	100 ± 4.806	
EV grade III	74	92.5 ± 2.566	

Association of Portal vein diameter (PVD) with grade of esophageal varices

According to the study, the PVD ranged from 8 to 16 mm, the mean PVD in grade I esophageal varices was determined to be 10mm ± 1.00 (means ± SD) in 3 cases. The recorded number in the EV grade II was 11mm ± 1.702 (means ± SD) in 29 cases, whereas the EV grade III was 13mm ± 1.360 (means ± SD) in 74 cases which is the largest number of all cases.

The *table 3* illustrates the association between PVD and EV grades, showing larger PVD correlates with higher grade varices. Statistical analysis applied on patients under study shows a positive correlation between portal vein diameter and grading of the esophageal varices and this correlation was found to be statistically significant ($p < 0.001$) thereby showing that when portal vein diameter increased, esophageal varices also increased in size.

Table 3: Correlation of portal vein diameter and grade of esophageal varices

Grade of esophageal varices	Number	Mean of PVD with SD (mm)	p - value
EV grade I	3	10 ± 1.0	(p < 0.001)
EV grade II	29	11 ± 1.702	
EV grade III	74	13 ± 1.360	

Association of spleen size (SZ) with grade of esophageal varices

Among the 106 patients with liver cirrhosis, spleen size was measured in 88 individuals. The analysis revealed a statistically significant correlation between spleen size and the grade of esophageal varices. The mean spleen size increasing progressively with the severity of varices: 6.35 ± 0.636 cm for grade I (2 cases) to 10.4 ± 2.923 cm in grade II (17 cases) and reaching to 13.4 ± 2.154 cm in grade 3 (69 cases). This association was found to be highly significant, with p - value of <0.001, as detailed in the accompanying table

Table 4: Correlation of spleen size and grade of esophageal varices

Grade of esophageal varices	Number	Mean of spleen size with SD in cm	p- value
EV grade I	2 (3 cases)	6.35 ± 0.636	p < 0.001
EV grade II	17 (29 cases)	10.4 ± 2.923	
EV grade III	69 (74 cases)	13.4 ± 2.154	

4. Discussion

Correlation of platelet count and grading of EVs

Our study identified a significant inverse relationship between platelet count and the grading of esophageal varices (EVs). Patients with grade III varices had a mean platelet count of 92.5 ± 25.667 × 10^3/mm^3, which was significantly lower than those with grade II (100 ± 48.068 × 10^3/mm^3) and grade I (162 ± 77.390 × 10^3/mm^3). This progressive decline in platelet count with increasing variceal grade highlights its potential as a key hematological maker for predicting variceal severity. The development of thrombocytopenia in cirrhotic patients is primarily attributed to hypersplenism caused by splenic pooling in congestive splenomegaly.

Many studies conducted previously to see the relationship of platelet count with esophageal varices concluded that lower platelet count is associated with large varices. These results are comparable with the study conducted in Egypt by El - Daly et al. in 2018 where platelet count was statistically significantly lower in patients of this study with EVs grades I, II, and III (100.5 ± 19.8, 65.2 ± 13.0, and 60.3 ± 14.1 × 103/mm3, respectively), a highly significant negative correlation between platelet count and EV grading ($p < 0.001$), supporting our finding[8].

Another study also supported by Nemichandra et al. in 2015 in India observed significantly lower platelet count associated with high grade of varices with EVs grade I was 165.58 ± 37.90, grade II was 106.44 ± 25.78 and grade III was 85.514 ± 19.68, respectively ($p < 0.001$) [9]. The same results were obtained by Afsar A et al., conducted in Pakistan in 2020 reported that mean platelet count was significantly lower in patients with grades II and III (119.518 ±68.027 and 58.3 ± 34.188 mm^3, respectively) than in patients with grade I (213.884 ± 86.434 mm^3) ($p < 0.001$) [10].

This research demonstrated a strong negative correlation between mean platelet count and EV severity, aligning with the findings of Abbas et al. in 2024, among the patients, those with Grade III esophageal varices exhibited the lowest mean platelet count, recorded at 78.54 ± 24.14 × 10^3/mm^3, while in patients with no EVs had a higher mean platelet count of 173.70 ± 37.48 × 10^3/mm^3, These findings indicated a statistically significant difference in mean platelet counts across the various esophageal varices grades ($p = 0.000$) [11].

These findings are also in agreement with the findings of our local study, published in 2021, Panha U et al. at Khmer - Soviet Friendship Hospital reinforced these findings, showing that the majority of patients with platelet counts between 50–99 × 10^3/mm^3 had esophageal varices, while those with platelet counts >150 × 10^3/mm^3 were less likely to develop EVs ($P < 0.0001$). In terms of platelet count, the statistical analysis showed that most of the patients in study population in platelet group of 16 - 49 giga/l to platelet group 100 - 149 giga/l were found large EVs (p - value < 0.001) [12].

Consequently, all studies reaffirmed the inverse relationship between platelet count and EV severity. According to these findings, platelet count can be used to identify patients who may have large varices and need prophylactic endoscopic treatment to prevent upper GI bleeding rather than doing endoscopy in every patient with cirrhosis. This evidence further supports the use of platelet count as a key parameter in risk stratification and management planning for cirrhotic patients with esophageal varices. Early identification of thrombocytopenia can prompt timely interventions to reduce the risk of bleeding and associated complications.

Correlation of portal vein diameter and grading of EVs

In our present study, we observed a significant positive correlation between portal vein diameter (PVD) and the grading of esophageal varices (EVs). Specifically, the mean PVD values were 10 ± 1.0 mm for EV grade I varices, 11 ± 1.702 mm for grade II, and 13 ± 1.360 mm for grade III. The overall mean PVD across all grades was 12.5 ± 1.84 mm, with a range of 8–16 mm. This progressive increase in PVD with higher EV grades was statistically significant ($p < 0.001$), underscoring its utility as a non - invasive predictive marker for variceal severity and risk of bleeding.

Our findings align with the study by Peñaloza - Posada MA et al., which reported an average PVD of 12.8 ± 3.0 mm in patients with varices, with a statistically significant difference ($p < 0.01$) between variceal and non - variceal groups[13]. Further support for our findings came from Nouh AM et al. (2019), who documented that a mean PVD of 12.9 ± 2.45 mm was associated with an increased risk of bleeding varices[14].

Another study by Umar A et al. (2017) in Pakistan also supported this relationship, reporting that a portal vein diameter >12 mm was commonly observed in patients presenting with gastrointestinal (GI) bleeding. The mean PVD in these patients was 12.2 ± 0.3023 mm ($p = 0.005$), compared to patients without bleeding, whose dilated portal vein on ultrasound had a mean PVD of 10.9 ± 0.02 mm[15].

The relationship between PVD and variceal size is further corroborated by multiple studies. For instance, Bhattarai et al. (2017) in Nepal reported a mean PVD of 13.7 ± 1.06 mm, highlighting the high sensitivity and specificity of PVD in predicting the risk of variceal bleeding. Their study revealed a statistically significant positive correlation between variceal size and PVD ($p < 0.01$), emphasizing the strong association between portal vein diameter and the grades of EV[16].

The level of significance in our study was determined using Pearson's chi - square test ($p = 0.022$). Similarly, Yang LB et al. (2022) in China reported a mean PVD of 13.76 ± 2.48 mm among patients with varices and an increased risk of bleeding ($p < 0.05$) [17]. Likewise, Priyesh P et al. (2023) in India demonstrated a positive correlation between EV grading and PVD, with a mean PVD of 13.9 ± 2.5 mm for higher - grade varices (Grade III). Their findings suggest that PVD serves as a reliable non - invasive predictive marker, with a statistically significant positive correlation ($p = 0.0019$) between increased portal vein width and variceal size[18].

These findings consistently demonstrate that an increased PVD is indicative of the severity of portal hypertension and variceal progression. Variability in PVD values across studies may stem from differences in sample size, population demographics, and measurement techniques. Nevertheless, the consistent trend of increasing PVD with higher EV grades

underscores its universal applicability as a reliable, non - invasive tool for assessing the risk of variceal bleeding.

Correlation of spleen size and grading of EVs

In our study, spleen size (measured in centimeters) was positively correlated with the grading of esophageal varices. Patients with esophageal varices grade III had a mean spleen size of 13.4 ± 2.154 cm, compared to smaller spleen sizes in patients with lower - grade varices. The p - value for the correlation between spleen size and grades of esophageal varices was $p < 0.001$, indicating a highly statistically significant relationship. This suggests that the increase in spleen size is strongly associated with the progression of esophageal varices.

These findings align with the study by Umar A et al., which reported that a splenic size >13 cm was found in patients presenting with gastrointestinal (GI) bleeding. The mean splenic diameter in these patients was 14.5 ± 2.39 cm ($p < 0.001$) [15]. In contrast, patients without GI bleeding had splenomegaly, with a mean splenic diameter of 13.08 ± 2.35 cm. The study demonstrated an increase in spleen size with the progression of esophageal varices from small to large grades. The level of significance was determined using Pearson's chi - square test ($p = 0.001$),

highlighting that variceal size correlates with portal hypertension severity. This underscores the potential of spleen size as a predictive marker for esophageal varices in patients with chronic liver disease.

Studies from other regions have also reported comparable results. A study from Egypt in 2011 by Serag E et al. demonstrated that the mean spleen size in the variceal group was 15.0 ± 2.371 cm. For high - grade varices (grade III), the mean spleen size was 16.60 ± 14.136 cm. Both spleen diameter and variceal grade showed a significant correlation with the presence and severity of varices ($p = 0.007$) [19].

Similarly, Bhattarai S et al. reported that the average spleen size in patients with varices was 15.367 ± 1.210 cm. Patients with large varices had an average spleen size of 15.50 ± 1.04 cm, with the difference being statistically significant ($p < 0.001$) [16]. Another study by Peñaloza - Posada MA et al. in Mexico (2016) found that the mean spleen diameter in patients with large varices was 13.6 ± 2.9 cm, while in the small varices group, it was 12.2 ± 2.4 cm[13]. This difference was statistically significant ($p < 0.01$), confirming the trend of increasing spleen size with higher variceal grades.

In contrast, a study by Priyesh Patel et al. found that the average spleen size in Grade I esophageal varices was 13.917 ± 2.715 cm. For Grade II, the mean size was 13.688 ± 1.814 cm, while for Grades III and IV combined, it was 14.276 ± 2.349 cm. Their data analysis revealed no statistically significant positive association between spleen size and variceal grades ($p = 0.3157$) [18].

Despite this inconsistency, the majority of studies support the idea that spleen size correlates significantly with varices. This reinforces the potential of both PVD and spleen size as reliable and independent predictors of varices in cirrhotic patients. Such parameters could aid in early stratification and timely intervention, particularly in resource - limited settings where access to endoscopy may be restricted, potentially reducing the need for routine endoscopic evaluations.

5. Conclusion

The conclusion can be rephrased for better clarity and impact: "This study identified significant correlations between platelet count, portal vein diameter, spleen size, and esophageal varices grading in cirrhotic patients. These findings highlight the utility of non - invasive markers in predicting variceal severity and guiding timely interventions, especially in resource - limited settings. Public health initiatives and routine screenings are recommended to prevent life - threatening complications.

6. Recommendation

To population:

- To reduce alcohol consumption and consume a balanced diet rich in fruits and vegetables and exercise regularly.
- Vaccinate against hepatitis B in newborns and those who are not immunized.
- Undergo routine screening or follow up regularly for liver health and associated complications, particularly for individuals with known risk factors for liver disease.
- Avoid using medications without a prescription.

To physicians:

- Educate patients about lifestyle changes to prevent liver cirrhosis and its complications.
- Promote non - invasive diagnostic methods for early detection of esophageal varices and liver cirrhosis.
- Emphasize the importance of regular follow - ups and surveillance for varices, especially in high - risk patients.
- Develop local guidelines for utilizing these markers to prioritize patients for endoscopic evaluation.

To health authorities:

- Increase awareness about cirrhosis risk factors, particularly alcohol abuse and viral hepatitis, through public health campaigns.
- Strengthen preventive measures, such as vaccination for hepatitis B and education on safe practices to reduce hepatitis C transmission.
- Conduct training programs for healthcare providers on the use and interpretation of non - invasive markers.
- Explore additional parameters that could enhance the predictive accuracy for EV severity.

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