Original Research

PREDICTION OF ESOPHAGEAL VARICES IN NON-ALCOHOLIC CIRRHOTIC PATIENTS WITH SERUM-ASCITES ALBUMIN GRADIENT: A CROSS-SECTIONAL STUDY

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ABSTRACT

Objective: Esophageal varices are a frequent and potentially life-threatening consequence of portal hypertension in cirrhotic patients. Although several noninvasive indicators have been investigated, evidence regarding the usefulness of the serum–ascites albumin gradient (SAAG) in non-alcoholic cirrhosis remains limited. The aim of our study was to determine the correlation between serum-ascites albumin gradient and esophageal varices in patients with ascites due to non-alcoholic cirrhosis and to identify an optimal cut-off for predicting varices.

Methods: This analytic cross-sectional design enrolled 250 individuals having cirrhosis and ascites at Gujranwala Medical College Teaching hospital Gujranwala. Measurement of Serum-ascites albumin and upper GI endoscopy were performed among the patients. Statistical analysis included ROC curve analysis, Youden's index, multivariate logistic regression, and independent t-test.

Results: Esophageal varices were present in 223 (89.2%) participants. Mean SAAG was raised in patients with varices than without varies (1.77±0.56 vs. 1.25±0.29 g/dl; p<0.001). An analysis with ROC curve, SAAG >1.6 g/dl predicted varices. Multivariate logistic regression confirmed serum-ascites albumin gradient >1.6 gm/dl as an independent predictor of varices (adjusted OR: 7.82; 95% CI: 2.89-21.14; p<0.001).

Conclusion: A SAAG value above 1.6 g/dl may serve as a useful noninvasive indicator for high risk of esophageal varices in cirrhotic patients who should undergo prompt endoscopic assessment. However, because of its poor negative predictive value, SAAG should not be used to exclude varices or replace endoscopic screening.

Keywords: Esophageal and Gastric Varices, Hypertension, Portal, Liver Cirrhosis, Serum-Ascites Albumin Gra dient, Cross-Sectional Studies.

INTRODUCTION

Hepatic Cirrhosis, a long-term, worsening disease, permanently damages the liver tissue, leading to extensive scarring and the growth of regenerative nodules. In Pakistan, chronic liver disease is very common, with more new cases and a high rate of hepatitis B and C [1] .

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Clinically significant portal hypertension is present in more than 60% of patients with cirrhosis, often revealed by the appearance of splenomegaly, ascites, and esophageal varices [2].

Studies have mentioned esophageal varices in 50–61% of cirrhosis cases [3,4] . In Pakistan, occurrence of 65% of any varices and 15% for large varices has been found [5]. The 2-year risk of first variceal bleeding is 25–35%, with a 20–30% per-bleed mortality rate [6,7]. Therefore, it is essential to identify and treat such patients.

Upper gastrointestinal endoscopy remains the gold standard investigation for esophageal varices

diagnosis; however, routine endoscopic screening is costly, invasive, and not always feasible in resource-limited healthcare settings. So, alternate methods such as platelet count–spleen diameter ratio, portal vein measurements, and the SAAG have been mentioned in studies [8,9,10]. This study aims to highlight the role of serum ascites albumin level in recognizing the need for endoscopy, with the objective of getting cheaper treatment. The objective of this study was to identify the correlation between serum-ascites albumin gradient and esophageal varices in patients with ascites due to non-alcoholic cirrhosis.

MATERIALS AND METHODS

Study Design and Setting: It was an analytic cross-sectional research conducted at Gujranwala Medical College Teaching hospital Gujranwala from May 2025 to Nov. 2025. Using a consecutive sampling technique, 250 patients presenting with both liver cirrhosis and ascites were selected. Based on 65% of expected prevalence of esophageal varices in patients, sample size was assumed with 95% confidence interval and 5% margin of error. A detailed history taken and physical examination was performed. Serum bilirubin, albumin, platelet count, coagulation profile, and RFTs, viral markers for chronic hepatitis B and C were performed. Ultrasonography was done for Cirrhosis and ascites. Diagnostic paracentesis performed and SAAG calculated. Esophageal varices were evaluated by fiber optic endoscopy of upper GI and graded as low grade (grade I-II) or high grade (grade III). Every participant gave written consent for the study. The study adhered to the Declaration of Helsinki."

Inclusion Criteria: Patients of age 18 to 60 years, showing ascites confirmed by clinical examination and Ultrasonography, with proved liver cirrhosis by ultrasound and willing to provide informed consent for participation were included in the study.

Exclusion Criteria

- Patients with previous or current treatment with beta-adrenergic receptor antagonists (propranolol, nadolol) for variceal prophylaxis, previous endoscopic treatment, portal vein thrombosis on ultrasonography, history of alcohol intake (any amount, as confirmed by patient history and family interview), patients already receiving diuretic therapy, presenting Ascites, splenomegaly, or thrombocytopenia due to non-cirrhotic causes such as hematological malignancies, myeloproliferative disorders, or tropical splenomegaly, Altered conscious level including hepatic encephalopathy (any grade) or septic shock, Co-morbid conditions that could affect SAAG including glomerulonephropathies, chronic renal failure, nephrotic syndrome, hypoalbuminemia due to protein-losing enteropathy or malnutrition, congestive heart failure, and tuberculous peritonitis, and Pregnancy or lactation were excluded from the selection criteria.

Statistical Analysis SPSS ver. 26 was used to analyze data. Independent t-test was used for group comparison. ROC analysis and Youden's index were used to identify the standard SAAG indicator for varices — the value that maximized diagnostic accuracy and positive and negative predictive values calculated. Multivariable logistic regression analysis was conducted to identify independent predictors of esophageal varices. A p-value less than 0.05 with two-tailed test was considered statistically significant.

RESULTS

Two hundred and fifty patients, mean age of 48.57 ± 12.42 years and 1.6:1 (154/96) male to female ratio, were enrolled for the study. Hepatitis C was the most common etiology, present in 223 (89.2%) patients which represent a significant predominance of HCV-related cirrhosis in this cohort. The mean serum ascites albumin gradient was 1.71 ± 0.55 gm/dl.

Upper GI endoscopy results among 223 (89.2%) patients are shown in Table 1 and Figure 1. Individuals with varices demonstrated significantly higher mean SAAG values than patients without varices (1.77 ± 0.56 gm/dl) than those with no varices (1.25 ± 0.29 gm/dl) ($p < 0.001$). Patients with varices had a mean SAAG that was 0.52 gm/dl higher than those without varices.

The remarkable diagnostic values of SAAG for indicating esophageal varices were seen by ROC curve analysis (AUC = 0.800; 95% CI: 0.655–0.946). Using Youden's index, the values were seen as in table 2. The negative predictive value was 17.9%, indicating that 82% of patients with SAAG ≤1.6 gm/dl still had varices on endoscopy.

Multivariate logistic regression confirmed that serum ascites albumin gradient greater than 1.6 gm/dl is an independent predictor of esophageal varices with an adjusted odds ratio of 7.82 (95% CI: 2.89-21.14; $p < 0.001$) (Table 3).

Table 1: Distribution of Esophageal Varices by Grade (n=250)

Variceal Grade	N	Percentage
No varices	27	10.8
Low-grade (Grade I-II)	138	55.2
High-grade (Grade III)	85	34.0

Table 2: Diagnostic Performance of SAAG for Predicting Esophageal Varices

Parameter	Value
Optimal cut-off (gm/dl)	1.6
Sensitivity (%)	65.5
Specificity (%)	86.0
Positive predictive value (%)	97.4
Negative predictive value (%)	17.9
Area under ROC curve (95% CI)	0.800 (0.655-0.946)

Table 3: Multivariate Logistic Regression for Predictors of Esophageal Varices

Variable	Adjusted OR	95% CI	P Value
SAAG >1.6 gm/dl	7.82	2.89-21.14	<0.001
Platelet count <100,000/mm³	2.68	1.18-6.09	0.018

Adjusted for age and serum albumin

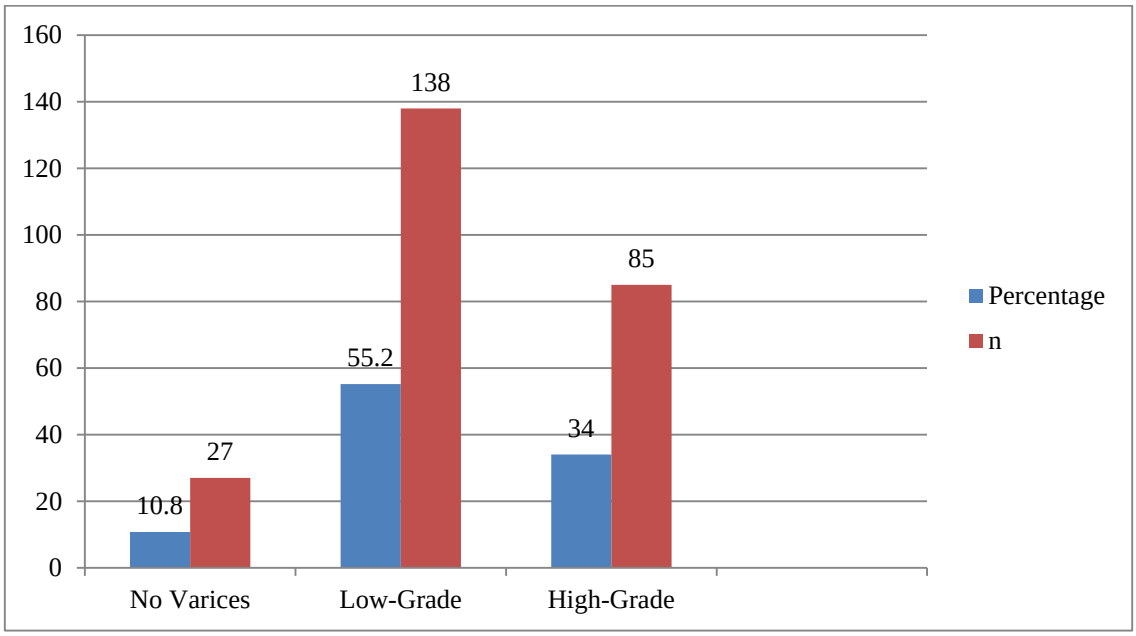

Figure 1: Distribution of Esophageal Varices by Grade (n=250)

DISCUSSION

Diagnostic paracentesis has attained great importance in the diagnosis of ascitic patients. This study was designed to determine the correlation of serum ascites albumin gradient with esophageal varices and to identify an optimal cut-off value for clinical use.

Most patients included in this study had SAAG values greater than 1.1 g/dl, supporting the established relationship between raised SAAG and portal hypertension. Similar findings have been reported in earlier studies evaluating the association between SAAG and esophageal varices in cirrhotic populations [9].

An important observation of the current study was the identification of a SAAG threshold above 1.6 g/dl as a significant predictor of esophageal varices. The ROC curve analysis yielded good identification results. The higher chances of esophageal varices at SAAG >1.6g/dl, with a 97.4% positive predictor seen in our results aligns with the literature on SAAG as a predictor of varices [9].

However, despite its strong positive predictive value, SAAG showed poor ability to exclude varices because the negative predictive value remained very low. This finding suggests that a low SAAG value cannot safely rule out the presence of esophageal varices. Consequently, endoscopic assessment should still be considered in patients with lower SAAG measurements, particularly when other clinical indicators of portal hypertension are present.

It was also found by multivariate logistic regression that serum ascites albumin level > 1.6 gm/dl retained its status as an independent predictor for esophageal varices even after factoring in platelet count, age, and serum albumin. The adjusted odds ratio was 7.82. It indicated that patients with a serum ascites albumin level >1.6 were nearly eight times more likely to have varices than those with lower gradient levels. This finding is supported by the de Franchis Baveno VII consensus, which emphasizes the use of combined non-invasive parameters for risk stratification [3].

The significant positive predictive value seen with SAAG > 1.6 g/dl indicated its clinical importance. In many low-resource healthcare settings, routine endoscopic screening may be difficult because of financial limitations, lack of equipment, or restricted specialist availability. Under such circumstances, SAAG measurement may provide a simple and economical method for identifying patients who are more likely to harbor esophageal varices and therefore require priority referral for endoscopic assessment. Although SAAG cannot replace endoscopy, it may assist clinicians in stratifying risk and optimizing the use of limited healthcare resources. The Baveno VII consensus supports the use of non-invasive parameters for risk stratification before endoscopic screening [3].

Limitations: The present study has certain limitation which should be acknowledged. It was a single-centerd study limiting the generalizability to other populations and healthcare settings. The cross-sectional design did not permit the evaluation of longitudinal changes in SAAG or future progression of varices. The participants in our study mostly had HCV related liver disorder, while missing other causes (alcoholic or non-alcoholic). Also the observed prevalence of varices (89.2%) was substantially higher than the 65% used for sample size calculation, suggesting possible selection bias toward more severe disease. Lastly, the low negative predictive value (17.9%) precludes using SAAG ≤1.6 gm/dl as a criterion to avoid endoscopy.

CONCLUSION

Serum-ascites albumin level >1.6 gm/dl was independent indicator of esophageal varices among non-alcoholic cirrhosis patients (adjusted OR: 7.82). At a positive predictive value of 97.4%, suggesting it may help identify patients preferred for endoscopic screening. However, due to the low negative predictive value (17.9%) and potential selection bias, SAAG ≤1.6 gm/dl cannot rule out varices reliably, and all such patients should still undergo endoscopic evaluation according to current clinical practice guidelines.

Ethical Approval: Ethical approval was obtained f rom the Institutional Review Board (IRB) of Fronti er Medical and Dental College, Abbottabad (Ref N o.: FMDC/IRB/2025/039).

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