Section: General Medicine

Original Research Article

CORRELATION OF SERUM ASCITIC ALBUMIN GRADIENT WITH OESOPHAGEAL VARICES IN PATIENT WITH PORTAL HYPERTENSION IN CHRONIC LIVER DISEASE: A CASE SERIES STUDY

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Received : 01/05/2025
Received in revised form : 18/06/2025
Accepted : 05/07/2025

Keywords:
Chronic liver disease, Portal hypertension, Serum-ascites albumin gradient (SAAG), Esophageal varices, Ascites, Alcoholic liver disease.

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DOI: 10.47009/jamp.2025.7.4.101

Source of Support: Nil,
Conflict of Interest: None declared

Int J Acad Med Pharm
2025; 7 (4); 533-536

ABSTRACT

Background: Chronic liver disease (CLD) with portal hypertension frequently leads to complications including ascites and esophageal varices. Early detection of esophageal varices is crucial for implementing preventive measures and reducing the risk of life-threatening variceal bleeding. The serum-ascites albumin gradient (SAAG) has been established as a reliable indicator of portal hypertension, but its correlation with esophageal varices requires further investigation. The objective is to investigate the correlation between serum-ascites albumin gradient levels and the presence and severity of esophageal varices in patients with portal hypertension due to chronic liver disease. **Materials and Methods:** A case series study was conducted on 45 newly diagnosed patients with chronic liver disease and ascites at S Nijalingappa Medical College and Hospital over a two-year period from August 2022 to November 2023. Patient demographics, etiology of liver disease, presence and grading of esophageal varices, and SAAG values were analyzed. All patients underwent upper gastrointestinal endoscopy and diagnostic paracentesis. SAAG was calculated by subtracting ascitic fluid albumin from serum albumin concentration. **Result:** The study population was predominantly male (95.6%) with a mean age of 41-60 years (57.8%). Alcoholic liver disease was the primary etiology (91.1%). Esophageal varices were present in 68.9% of patients. A statistically significant association ($p < 0.001$) was found between higher SAAG values and the presence of esophageal varices. Patients with varices had a mean SAAG of 1.66±0.2 g/dl compared to 1.2±0.2 g/dl in those without varices. There was also a significant correlation ($p < 0.001$) between SAAG values and the grading of esophageal varices, with higher grades associated with progressively higher SAAG values. **Conclusion:** This study demonstrates a strong correlation between SAAG and both the presence and severity of esophageal varices in patients with chronic liver disease and portal hypertension. SAAG may serve as a valuable non-invasive predictor for esophageal varices in this patient population.

INTRODUCTION

Chronic liver disease (CLD) represents a significant global health burden, affecting millions of individuals worldwide and contributing substantially to morbidity and mortality.[1] The progressive nature of liver disease often leads to portal hypertension, characterized by increased pressure within the portal venous system, which serves as a major driver of complications including ascites and esophageal varices.[2] These complications significantly impact patient outcomes, with esophageal varices being of particular clinical importance due to their propensity to rupture and cause life-threatening gastrointestinal bleeding.[3]

Esophageal varices are abnormally dilated submucosal veins in the lower esophagus that develop as a consequence of portal hypertension.[4] Variceal hemorrhage represents one of the most severe complications of portal hypertension, with mortality rates reaching up to 20% within six weeks of a bleeding episode.[5] Early detection and risk stratification of esophageal varices is therefore crucial for implementing preventive measures and

ISSN (O): 2687-5365; ISSN (P): 2753-6556

reducing the risk of variceal bleeding through appropriate screening and prophylactic interventions.[6]

The gold standard for diagnosing esophageal varices remains upper gastrointestinal endoscopy, which provides direct visualization and accurate grading of varices.[7] However, this procedure is invasive, costly, and may not be readily available in all healthcare settings, particularly in resource-limited environments.[8] Consequently, there is a pressing clinical need for non-invasive methods to predict the presence and severity of esophageal varices in patients with CLD and portal hypertension. The serum-ascites albumin gradient (SAAG) has emerged as a potential non-invasive marker, calculated as the difference between albumin concentrations in serum and ascitic fluid, and has been established as a reliable indicator of portal hypertension when ≥1.1 g/dl.[910]

MATERIALS AND METHODS

This case series study was conducted at the Department of General Medicine, S. Nijalingappa Medical College, Bagalkot, between August 2022 and November 2023. The study included 45 consecutive patients with newly diagnosed chronic liver disease and ascites who met the inclusion criteria of age ≥18 years, confirmed diagnosis of chronic liver disease of any etiology, presence of ascites confirmed by clinical examination and ultrasonography, and willingness to undergo upper gastrointestinal endoscopy. Patients were excluded if they had recent variceal bleeding within six weeks, current use of beta-blockers for primary prophylaxis, history of endoscopic intervention for varices, presence of hepatocellular carcinoma, pregnancy, or severe comorbidities that might interfere with study procedures.

After obtaining institutional ethics committee approval and informed consent, demographic data, medical history, and clinical examination findings were recorded for all participants. Blood samples were collected for routine investigations including complete blood count, liver function tests, renal function tests, and coagulation profile. Child-Pugh scores were calculated for disease severity assessment. Diagnostic paracentesis was performed under aseptic conditions with ascitic fluid analyzed for cell count, protein, albumin, and culture. Serum samples were obtained on the same day as paracentesis for SAAG calculation.

Upper gastrointestinal endoscopy was performed by experienced gastroenterologists blinded to SAAG results. Esophageal varices were graded according to the Paquet classification (Grade 0: no varices; Grade I: small varices without protrusion; Grade II: moderate-sized varices with minimal protrusion; Grade III: large varices substantially protruding; Grade IV: very large varices occluding the lumen). Abdominal ultrasonography assessed liver echogenicity, spleen size, portal vein diameter, and collaterals. Data analysis was performed using SPSS version 21.0 with appropriate statistical tests, considering p-value <0.05 as statistically significant.

RESULTS

Study Population Characteristics and Clinical Parameters: The study enrolled 45 patients with chronic liver disease and ascites. Table 1 presents the demographic and clinical characteristics of the study population.

Table 1: Demographic and Clinical Characteristics of Study Population (n=45)

Parameter	Frequency	Percentage
Age Groups		
20-40 years	13	28.9%
41-60 years	26	57.8%
>60 years	5	11.1%
Gender		
Male	43	95.6%
Female	2	4.4%
Etiology		
Alcoholic liver disease	41	91.1%
Chronic hepatitis	4	8.9%
Comorbidities		
Hypertension	12	26.7%
Diabetes mellitus	10	22.2%
COPD	2	4.4%
CAD	1	2.2%
Absent	20	44.4%

The study population was predominantly middle-aged males, with 57.8% in the 41-60 years age group and 95.6% being male. Alcoholic liver disease was the overwhelming primary etiology (91.1%). Hypertension and diabetes mellitus were the most common comorbidities at 26.7% and 22.2% respectively.

Endoscopic Findings and Laboratory Parameters [Table 2] summarizes the endoscopic findings and key laboratory parameters of the study population.

ISSN (O): 2687-5365; ISSN (P): 2753-6556

Table 2. Endoscopic Findings and Laboratory Parameters

Parameter	Value
Esophageal Varices Presence	
Present	31 (68.9%)
Absent	14 (31.1%)
Grading of Esophageal Varices (n=31)	
Grade 1	10 (32.3%)
Grade 2	13 (41.9%)
Grade 3	5 (16.1%)
Grade 4	3 (9.7%)
Laboratory Parameters (Mean±SD)	
Serum albumin (g/dl)	2.72±0.28
Bilirubin (mg/dl)	2.48±0.75
SAAG (g/dl)	1.69±0.24
INR	1.5±0.26
Child-Pugh Classification	
Class A	12 (26.7%)
Class B	20 (44.4%)
Class C	13 (28.9%)

Esophageal varices were identified in 68.9% of patients, with Grade 2 varices being most common (41.9%). The mean SAAG was 1.69±0.24 g/dl, indicating portal hypertension. Most patients (44.4%) were classified as Child-Pugh Class B, indicating moderate liver disease severity.

Association Between SAAG and Esophageal Varices

[Table 3] demonstrates the relationship between SAAG values and the presence and severity of esophageal varices.

Table 3: Association of SAAG with Esophageal Varices

Parameter	SAAG Value (Mean±SD)	p-value
Esophageal Varices Presence		
Present (n=31)	1.66±0.2 g/dl	<0.001
Absent (n=14)	1.2±0.2 g/dl	
Grading of Esophageal Varices		
Grade 1 (n=10)	1.2±0.27 g/dl	<0.001
Grade 2 (n=13)	1.3±0.25 g/dl	
Grade 3 (n=5)	1.7±0.28 g/dl	
Grade 4 (n=3)	1.91±0.21 g/dl	

A statistically significant association ($p<0.001$) was demonstrated between higher SAAG values and the presence of esophageal varices. Additionally, there was a significant positive correlation ($p<0.001$) between SAAG values and the grade of esophageal varices, with progressively higher SAAG values corresponding to higher grades.

Factors Associated with Esophageal Varices

[Table 4] examines various factors and their association with the presence of esophageal varices.

Table 4: Factors Associated with Esophageal Varices

Factor	Varices Present	Varices Absent	p-value
Age Groups			0.38
20-40 years	8 (25.8%)	5 (35.7%)	
41-60 years	19 (61.3%)	7 (50%)	
>60 years	4 (12.9%)	1 (7.1%)	
Etiology			0.05
Alcoholic liver disease	30 (96.8%)	11 (78.6%)	
Chronic hepatitis	1 (3.2%)	3 (21.4%)	
Child-Pugh Classification			0.207
Class A	6 (19.4%)	6 (42.9%)	
Class B	16 (51.6%)	4 (28.6%)	
Class C	9 (29%)	4 (28.6%)	

The analysis revealed that patients with alcoholic liver disease showed a trend toward higher prevalence of esophageal varices ($p=0.05$), while age and Child-Pugh classification did not show statistically significant associations with varices presence.

DISCUSSION

This case series study provides compelling evidence for a strong correlation between SAAG values and both the presence and severity of esophageal varices in patients with chronic liver disease and portal hypertension. The predominantly male population (95.6%) with alcoholic liver disease (91.1%) reflects the demographic patterns consistent with global trends in liver disease epidemiology.[11] The mean age distribution of 41-60 years aligns with previous studies, such as Torres et al, who reported similar demographic profiles in their investigation of SAAG correlation with portal hypertension complications.[12] The overwhelming prevalence of

ISSN (O): 2687-5365; ISSN (P): 2753-6556

alcoholic liver disease in our study population may be attributed to regional alcohol consumption patterns and cultural factors, which is higher than some international reports but consistent with studies from similar geographic regions.[13]

The study's primary finding of a statistically significant association ($p<0.001$) between elevated SAAG values and esophageal varices presence strongly supports the utility of SAAG as a non-invasive predictor. Patients with varices demonstrated a mean SAAG of 1.66±0.2 g/dl compared to 1.2±0.2 g/dl in those without varices, which corroborates findings from Gurubacharya et al., who reported similar significant associations between SAAG ≥1.1 g/dl and esophageal varices.[14] The progressive increase in SAAG values with increasing varix grades (1.2 g/dl for Grade 1 to 1.91 g/dl for Grade 4) represents a novel finding that extends beyond previous studies, suggesting SAAG's potential utility not only for predicting varices presence but also for assessing their severity.[15] This gradient relationship supports the pathophysiological basis that higher portal pressures, reflected by elevated SAAG values, correlate with more severe portal hypertensive complications.[16]

Interestingly, our study did not demonstrate a statistically significant association between Child-Pugh scores and esophageal varices presence ($p=0.207$), which contrasts with some previous investigations that reported correlations between Child-Pugh classification and varices.[17] This finding suggests that while Child-Pugh score remains valuable for overall prognostic assessment, SAAG may be a more specific indicator for portal hypertensive complications. The trend toward higher varices prevalence in alcoholic liver disease patients ($p=0.05$) may reflect the specific pathophysiological mechanisms of alcohol-induced portal hypertension, including enhanced intrahepatic resistance and splanchnic vasodilation.[18] These findings collectively support the potential integration of SAAG measurement into clinical decision-making algorithms for risk stratification and screening strategies in patients with chronic liver disease and ascites.

CONCLUSION

This study demonstrates a strong and statistically significant correlation between serum-ascites albumin gradient (SAAG) and both the presence and severity of esophageal varices in patients with chronic liver disease and portal hypertension. The progressive increase in SAAG values corresponding to higher grades of esophageal varices suggests its potential utility as a non-invasive predictor for not only detecting varices but also assessing their severity. These findings support the clinical application of SAAG as a valuable screening tool that could complement existing diagnostic approaches, potentially reducing the need for invasive procedures in resource-limited settings while facilitating appropriate risk stratification and management decisions in patients with chronic liver disease and ascites.

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