The Egyptian Journal of Hospital Medicine (October 2023) Vol. 93, Page 7508- 7514

Assessment of Right Lobe Size/Serum Albumin Ratio as A Non-Invasive Marker for Esophageal Varices in HCV Patients

Eman Mobarak Kamel, Tarek Maged Elsafty, Ahmed Ali Moenis, Salah Shaarawy Galal
Internal Medicine and Gastroenterology Department, Faculty of Medicine, Ain-Shams University, Egypt
***Corresponding author:** Salah Shaarawy Galal, **Mobile:** (+20) 01099422172, **E-mail:** salahshaarawy2013@gmail.com

ABSTRACT
Background: According to current guidelines, all patients with cirrhosis should have a screening endoscopy performed at the time of diagnosis in order to identify those who would benefit from primary prophylaxis and have varices that put them at high risk of bleeding. By identifying patients at highest risk for esophageal varices noninvasively, invasive study would only be necessary for those most likely to benefit.
Objective: Our study's objective was to ascertain the predictive efficacy of noninvasive indicators (Right lobe diameter/serum albumin ratio) in predict esophageal varices.
Patients and Methods: This is a cross-sectional study carried on 100 patients collected from the Hepatology Outpatient Clinics and from Hepatology and Gastroenterology Unit, Internal Medicine Department at Ain Shams University Hospital over 6-months period. All patients were divided into 3 groups: 30 patients with Child-Pugh A, 30 patients with Child-Pugh B, and 40 patients with Child-Pugh C.
Results: Our study showed by regarding platelet count, INR, serum albumin, liver size, liver size/serum albumin ratio that there was a significant difference among esophageal varices grades. Liver size/serum albumin ratio had non-significant diagnostic performance in differentiating esophageal varices grade-I from grade-0, and had significant moderate diagnostic performance in differentiating other esophageal varices grades from each other. Liver size/serum albumin ratio cutoff points had high specificity and PPV but low sensitivity and NPV in differentiating grade-I from grade-0, and had high sensitivity and NPV but moderate specificity and PPV in differentiating other grades from each other.
Conclusion: Our study stresses on the use of some of the non-invasive parameters in predicting the grade of esophageal varices in cirrhotic patients without submitting them to the invasive, time consuming and expensive procedure of endoscopy.
Keywords: Right Lobe Size, Serum Albumin Ratio, Esophageal Varices, HCV Patients.

INTRODUCTION
Worldwide, Egypt has the highest rate of hepatitis C virus (HCV) infection. Twelve million Egyptians, or 13% of the country's population, are thought to be affected with HCV [(1)]. One of the most significant liver-related comorbidities is esophageal varices, which eventually result in 20% mortality during the first attack. Predicting EVs was made easier by using 2D U/S [(2)]. Individuals with long-term HCV infection run the risk of serious liver problems. Additionally, extra-hepatic symptoms were reported by up to two-thirds of individuals with HCV infection [(3)].

According to extensive research, up to 30% of infected people may develop cirrhosis, which can result in HCC and end-stage liver failure [(4)]. Patients with cirrhosis should be screened for varices in order to start primary prophylaxis and stop variceal bleeding [(5)].

One of the cirrhosis consequences that characterises the advancement to the stage of decompensated cirrhosis is variceal haemorrhage, which can have a mortality rate of up to 40% based on the severity of the liver disease [(6)]. Patients at high risk for variceal haemorrhage should get primary prophylaxis. It has long been advised to do endoscopic screening for esophageal varices at the time of cirrhosis diagnosis in order to identify these individuals. Non-invasive techniques for variceal screening have been researched since many patients in the early stages of cirrhosis do not have esophageal varices and are consequently subjected to endoscopy needlessly [(7)].

Our study's objective is to ascertain the predictive efficacy of noninvasive indicators (Right lobe diameter/serum albumin ratio) in predict esophageal varices.

PATIENTS AND METHODS
Study Population:
This was a cross-sectional study carried on 100 patients, collected from the Hepatology Outpatient Clinics and Hepatology and Gastroenterology Unit, Internal Medicine Department at Ain Shams University Hospital over a 6-month period, after acquiring the approval from the Ethical Committee of Ain Shams University.

Patients were divided into 3 groups: 30 patients with Child-Pugh A. 30 patients with Child-Pugh B, and 40 patients with Child-Pugh C.

The following procedures were performed on all patients:
- Full medical history and clinical examination.
- Laboratory investigations: (AST, ALT, Bilirubin, Albumin, INR, Alpha fetoprotein, CBC).
- Abdominal ultrasonography and Doppler ultrasonography: these tests were carried out with the patient in a supine position following an overnight fast. The liver right lobe diameter (cm),

Received: 01/05/2023
Accepted: 02/07/2023

splenic bi-polar diameter (long axis) (cm), ascites, the presence of peri-portal thickening, the portal vein diameter (mm), and patency were the main points of interest.
- Upper GI endoscopy.

Inclusion criteria: Adult patients above 18 and below 60-years old with positive serum anti-HCV IgG antibodies.

Exclusion criteria:
- Patients under the age of eighteen.
- Patients who had prior variceal haemorrhage.
- Patients who had band ligation or endoscopic variceal sclerosis in the past.
- Patients who underwent prior surgery to insert a transjugular intrahepatic porto-systemic stent shunt or treat portal hypertension.
- Patients who were given medication as a major prophylactic measure against variceal haemorrhage.
- Patients had sonographic indications of one or more focal lesions in the liver.
- Patients identified by serum anti-schistosomal IgG antibody as having bilharzial liver disease.
- Pregnant women.

Ethical approval:
Ain Shams Medical Ethics Committee of the Ain Shams Faculty of Medicine gave its approval to this study. All participants gave written consent after receiving all information. The Helsinki Declaration was followed throughout the study's conduct.

Statistical Analysis:
MedCalc V. 15.8 was used for data entry, processing, and statistical analysis. We employed significance tests (Chi square, ANOVA, and Kruskal-Wallis). The data were given, and appropriate analysis was performed based on the kind of data (parametric and non-parametric) collected for each variable. P-values of less than 0.05 (5%) were deemed statistically significant.

RESULTS
Age (years) mean±SD of the studied cases was 52.1±4.2. Males were majority of cases. Table 1 also shows the laboratory and radiological findings of the studied cases.

Table (1): Demographic characteristics and laboratory and radiological findings among the studied cases

Characteristics		Mean±SD	Range
Age (years)		52.1±4.2	41.0–60.0
Sex	**Male (N, %)**	71	71.0%
	Female (N, %)	29	29.0%
Platelets (x10^3/mL)		119.5±29.5	
INR		1.9±0.3	
Albumin (gm/dL)		2.3±0.6	
Liver size (cm)		12.7±0.7	
Liver size/albumin ratio		5.7±1.2	
		N	**%**
Child grade	**Child-A**	24	24.0%
	Child-B	49	49.0%
	Child-C	27	27.0%

Table (2) shows that platelets were significantly different among esophageal varices grades; was highest in grade-0 and least in grade-IV.

Table (2): Comparison according to esophageal varices regarding platelets (x10^3/mL)

Findings	Grades	N	Mean±SD	P-value
Grades	**Grade-0**	21	146.7±11.0	**<0.001***
	Grade-I	23	134.3±17.7	
	Grade-II	28	121.8±23.2	
	Grade-III	17	93.3±15.2	
	Grade-IV	11	71.6±10.9	
Presence	**Absent**	21	146.7±11.0	**<0.001***
	Present	79	112.3±28.7	

*: Statistically significant

Table (3) shows that **INR** was significantly different among esophageal varices grades**;** was lowest in grade-0 and highest in grade-IV.

Table (3): Comparison according to esophageal varices regarding INR

Findings	Grades	N	Mean±SD	P-value
Grades	**Grade-0**	21	1.6±0.2	**<0.001***
	Grade-I	23	1.7±0.2	
	Grade-II	28	1.9±0.3	
	Grade-III	17	2.2±0.2	
	Grade-IV	11	2.4±0.2	
Presence	**Absent**	21	1.6±0.2	**<0.001***
	Present	79	2.0±0.3	

*: Statistically significant

Table (4) shows that **serum albumin** was significantly different among esophageal varices grades**;** was highest in grade-0 and lowest in grade-IV.

Table (4): Comparison according to esophageal varices regarding serum albumin (gm/dL)

Findings	Grades	N	Mean±SD	P-value
Grades	**Grade-0**	21	3.0±0.3	**<0.001***
	Grade-I	23	2.8±0.7	
	Grade-II	28	2.0±0.2	
	Grade-III	17	1.8±0.2	
	Grade-IV	11	1.7±0.1	
Presence	**Absent**	21	3.0±0.3	**<0.001***
	Present	79	2.2±0.6	

*: Statistically significant

Table (5) shows that **Child grade** was significantly different among esophageal varices grades**; Child-C** was lowest in grade-0 and grade-I and highest in grade-IV.

Table (5): Comparison according to esophageal varices regarding child grade

Findings	Grades	Child-A	Child-B	Child-C	P-value
Grades	**Grade-0**	10 (47.6%)	11 (52.4%)	0 (0.0%)	**<0.001***
	Grade-I	8 (34.8%)	15 (65.2%)	0 (0.0%)	
	Grade-II	6 (21.4%)	17 (60.7%)	5 (17.9%)	
	Grade-III	0 (0.0%)	6 (35.3%)	11 (64.7%)	
	Grade-IV	0 (0.0%)	0 (0.0%)	11 (100%)	
Presence	**Absent**	10 (47.6%)	11 (52.4%)	0 (0.0%)	**<0.001***
	Present	14 (17.7%)	38 (48.1%)	27 (34.2%)	

*: Statistically significant

Table (6) shows that **liver size** was significantly different among esophageal varices grades**;** was highest in grade-0 and lowest in grade-IV.

Table (6): Comparison according to esophageal varices regarding liver size (cm)

Findings	Grades	N	Mean±SD	P-value
Grades	**Grade-0**	21	13.4±0.2	**<0.001***
	Grade-I	23	13.0±0.6	
	Grade-II	28	12.5±0.6	
	Grade-III	17	12.2±0.4	
	Grade-IV	11	12.0±0.3	
Presence	**Absent**	21	13.4±0.2	**<0.001***
	Present	79	12.5±0.6	

*: Statistically significant

Table (7) shows that **liver size/serum albumin ratio** was significantly different among esophageal varices grades**;** was lowest in grade-0 and highest in grade-IV.

Table (7): Comparison according to esophageal varices regarding liver size/serum albumin ratio

Findings	Grades	N	Mean±SD	P-value
Grades	**Grade-0**	21	4.4±0.5	**<0.001***
	Grade-I	23	4.9±1.0	
	Grade-II	28	6.3±0.4	
	Grade-III	17	6.7±0.5	
	Grade-IV	11	7.3±0.3	
Presence	**Absent**	21	4.4±0.5	**<0.001***
	Present	79	6.1±1.1	

*: Statistically significant

Table (8) shows that **liver size/serum albumin ratio** had non-significant diagnostic performance in differentiating esophageal varices grade-I from grade-0, and had significant moderate diagnostic performance in differentiating other esophageal varices grades from each other.

Table (8): Diagnostic performance of liver size/serum albumin ratio in differentiating esophageal varices grades.

Grades	AUC	SE	P-value	95% CI	Cut off
Grade I from grade 0	0.598	0.093	0.264	0.416−0.780	≥5.3
Grade II from grade I	0.916	0.038	**<0.001***	0.842−0.990	≥5.7
Grade III from grade II	0.741	0.084	**0.007***	0.576−0.905	≥6.5
Grade IV From grade III	0.853	0.070	**0.002***	0.715−0.991	≥7.2

*: Statistically significant

Table (9) shows that **liver size/serum** albumin ratio cutoff points had high specificity and PPV but low sensitivity and NPV in differentiating grade-I from grade-0, and had high sensitivity and NPV but moderate specificity and PPV in differentiating other grades from each other.

Table (9): Diagnostic characteristics of liver size / serum albumin ratio cutoff points in differentiating esophageal varices grades

	Value	**95% CI**	**Value**	**95% CI**
	Grade-I from grade-0 ≥5.3		**Grade-II from Grade-I ≥5.7**	
Sensitivity	47.8%	26.8%–69.4%	100.0%	87.7%–100.0%
Specificity	95.2%	76.2%–99.9%	73.9%	51.6%–89.8%
Diag. accuracy	70.5%	54.8%–83.2%	88.2%	76.1%–95.6%
Youden's index	43.1%	20.7%–65.4%	73.9%	56.0%–91.9%
PPV	91.7%	61.5%–99.8%	82.4%	65.5%–93.2%
NPV	62.5%	43.7%–78.9%	100.0%	80.5%–100.0%
LR+	10.04	1.42–71.29	3.83	1.93–7.63
LR-	0.55	0.37–0.82	0.00	0.00–0.00
LR	18.33	2.10–160.35	>100.0	>100.0–>100.0
Kappa	0.421	0.190–0.652	0.757	0.579–0.934
	Grade-III from Grade-II ≥6.4		**Grade-IV from Grade−III ≥7.2**	
Sensitivity	100.0%	80.5%–100.0%	100.0%	71.5%–100.0%
Specificity	67.9%	47.6%–84.1%	88.2%	63.6%–98.5%
Diag. accuracy	80.0%	65.4%–90.4%	92.9%	76.5%–99.1%
Youden's index	67.9%	50.6%–85.2%	88.2%	72.9%–100.0%
PPV	65.4%	44.3%–82.8%	84.6%	54.6%–98.1%
NPV	100.0%	82.4%–100.0%	100.0%	78.2%–100.0%
LR+	3.11	1.82–5.33	8.50	2.31–31.25
LR-	0.00	0.00–0.00	0.00	0.00–0.00
LR	>100.0	>100.0–>100.0	>100.0	>100.0–>100.0
Kappa	0.615	0.407–0.822	0.855	0.663–1.047

Table (10) shows that there was significant moderate agreement between endoscopy and liver size/serum albumin ratio regarding esophageal varices grades.

Table (10): Agreement between endoscopy and liver size/serum albumin ratio regarding esophageal varices grades

Liver size/ serum albumin ratio	**Endoscopy grades**					**Total**
	0	**I**	**II**	**III**	**IV**	
0	20 (62.5%)	12 (37.5%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	**32**
I	1 (12.5%)	5 (62.5%)	1 (12.5%)	1 (12.5%)	0 (0.0%)	**8**
II	0 (0.0%)	6 (22.2%)	18 (66.7%)	3 (11.1%)	0 (0.0%)	**27**
III	0 (0.0%)	0 (0.0%)	9 (37.5%)	11 (45.8%)	4 (16.7%)	**24**
IV	0 (0.0%)	0 (0.0%)	0 (0.0%)	2 (22.2%)	7 (77.8%)	**9**
Kappa	**0.505**		**P-value**		**<0.001***	

DISCUSSION

The study was applied on 100 cases: 71 males and 29 females. The mean age of the studied cases was 52.1±4.2 years, of a range from 41.0 to 60.0 years old.

Regarding the mean platelets, it was found to be 119.5±29.5 $x10^3$/mL, mean INR was 1.9±0.3, mean serum albumin level was 2.3±0.6 gm/dL, mean liver size was 12.7±0.7 cm and mean liver size/albumin ratio was 5.7±1.2.

Among the study population, 24% were of Child-A score, 49% were of Child-B score, and 27% were of Child-C score.

Esophageal varices were detected in 79% of the studied cases; with grade-0 in 21%, grade-I in 23%, grade-II in 28%, grade-III in 17% and grade-IV in 11.0% of the cases. When comparing between different age groups or between genders, regarding the frequency and the grading of esophageal varices, no significant difference was detected.

By regarding patients' platelets count in comparing between the grades of esophageal varices, there was a significant difference among the grades of the esophageal varices; which was the least in grade-IV (71.6±10.9), followed by grade-III (93.3±15.2), then grade-II (121.8±23.2), grade-I (134.3±17.7) and the highest in grade-0 (146.7±11.0).

In a study by **Abbasi and his colleagues** [(8)], which was applied on 102 cirrhotic patients at Jinnah Postgraduate Medical Centre, Karachi in 2008, it was concluded that: the severity of thrombocytopenia increased as the degree of esophageal varices rose, and there was a strong inverse association between the grade of esophageal varices and the thrombocyte count. This finding is in concordance with our study.

On the other hand, a study by **Qamar and colleagues** [(9)], was done on 213 participants in a randomized, double-blind, placebo-controlled study of a nonselective beta-blocker used to prevent gastro-esophageal varices who had compensated cirrhosis and portal hypertension but no gastro-esophageal varices. In this study: annual esophago-gastro-duodenoscopy (EGD) and annual hepatic venous pressure gradient (HVPG) measurements were done. Platelet count was obtained every 3 months, this study found that platelet count assessments, whether cross-sectional or longitudinal, are insufficient noninvasive indicators for GEV.

The conditions that patients in the study by **Qamar and his colleagues** [(9)] were subjected to, are different from those our patients were subjected to; for instance: a medication was prescribed to decrease portal hypertension, while our patients were not necessarily on medications. This can explain that despite all patients were subjected to the same conditions in each study, the results are contradicted, which can be blamed on different factors, such as the frequency of EGD and the medication given and the varied study design. The primary limitation of platelet count in predicting esophageal varices is that it may be influenced by factors other than portal hypertension from liver cirrhosis; a problem that was addressed by **Giannini *et al.*** [(10)] by introducing a non-invasive test based on platelet count/spleen diameter ratio, which surprisingly produced similar results.

By regarding the patients' serum albumin levels, there was a significant correlation between the grade of the esophageal varices and the serum albumin level. Which was the lowest in grade-IV (1.7±0.1) followed by grade-III (1.8±0.2), then grade-II (2.0±0.2), then grade-I (2.8±0.7) and the highest in grade-0 (3.0±0.3)

Khan and colleagues [(11)] found in 2014 that low serum albumin can be utilised as a noninvasive method for diagnosing esophageal varices in 220 patients with chronic liver failure from Lahore. This result was reached after discovering that the prevalence of esophageal varices differed significantly between groups with and without low blood albumin levels. As 42 patients out of 133 (31.5%) had esophageal varices in the low serum albumin level group, whereas only 7 patients out of 87 (8%) had esophageal varices in the normal albumin level group ($p<0.01$, significant).

Although we used different method as we categorized patients into five groups according to their esophageal varices grading, while in the aforementioned study by **Khan and colleagues** [(11)]**,** they only categorized them into two categories; one with varices and other without varices, but it is still possible comparing the results of both studies viewing the abundance of esophageal varices in patients with low serum albumin level as a sign of severity on its own.

Budiyasa and colleagues [(12)] reached in a retrospective study the same conclusion, in 2008, the research included 61 patients with liver cirrhosis who underwent EGD at Sanglah Hospital. They concluded that blood albumin levels in patients with liver cirrhosis can predict the existence and severity of EV. They discovered a negative relationship between serum albumin levels and the degree of EV ($p = 0.000$). The fact that we used the same method for grading our patients as to the degree of the EV, adds to the weight of the combined evidence of the two studies. Even with a mild difference in the specification of the grading, it is still comparable as the differences between the grades in both systems are very close.

On the contrary, a study that was conducted by **Demirel and colleagues** [(13)], that correlated between albumin levels in the serum and ascites and esophageal varices in 45 patients with non-alcoholic cirrhosis. That study concluded that there was no correlation between serum levels of albumin ($p=0.7$) and degree of the esophageal varices. This contradiction with our study might be related to the difference in sample sizing, 100 patients in our study versus 45 patients in their study.

By regarding patients' INR, there was significant difference between the different esophageal varices' grades. It was the highest in grade-IV; with a mean of 2.4±0.2, followed by grade-III; with a mean of 2.2±0.2, then grade-II; with a mean of 1.9±0.3, then grade-I; with a mean of 1.7±0.2, and was the lowest in grade-0; with a mean of 1.6±0.2.

The World Gastroenterology Organization guide that was submitted (2014) stated that an INR score of > 1.5 was predictive of varices, which are more likely to be found in cirrhotic individuals. However, it only commented on the correlation with regard to the existence or lack of varices, but didn't specify if this correlation varies with the esophageal varices' different grades [14].

Regarding liver size, there was a significant difference among esophageal varices grades; where it was the lowest in grade-IV; with a mean of 12.0±0.3 cm, followed by grade-III; with a mean of 12.2±0.4 cm, then grade-II; with a mean of 12.5±0.6 cm, then grade-I; with a mean of 13.0±0.6 cm, and the highest in grade-0; with a mean of 13.4±0.2 cm.

There was a significant difference among esophageal varices grades regarding liver size/serum albumin ratio, where it was the highest in grade-IV; with a mean of 7.3±0.3, followed by grade-III; with a mean of 6.7±0.5, then grade-II; with a mean of 6.3±0.4, then grade-I; with a mean of 4.9±1.0, and was the lowest in grade-0; with a mean of 4.4±0.5.

In a study by **Akram and his colleagues** [15], they studied the sensitivity, specificity, and accuracy of the right hepatic lobe diameter/albumin concentration ratio as non-invasive indicators of the existence of esophageal varices and big varices in 160 individuals. The mean right liver lobe size/albumin concentration ratio in grade 0 patients was 4.35±0.15, while the mean values for grade I, grade II, grade III, and grade IV esophageal varices by upper GI endoscopy were 5.03± 0.61, 6.01±0.12, 6.59±0.04, and 7.22±0.36, respectively. The right hepatic lobe size/albumin concentration ratio has an 86.89% sensitivity and a 78.95% specificity. With a diagnosis accuracy of 85%, the positive predictive value was 92.98% (95% confidence interval [CI] = 86.64% - 96.91%) and the negative predictive value was 65.22% (CI = 49.75% - 78.64%).

The study **Akram and his colleagues** [15] reached to the same conclusion as ours, which is that although endoscopy remains the gold standard for diagnosing esophageal varices, doctors can limit the use of endoscopy by using the right liver lobe size/albumin concentration ratio to identify patients who are more likely to develop esophageal varices and to help select patients who require more frequent endoscopies.

Regarding the diagnostic performance of liver size/serum albumin ratio in differentiating between esophageal varices grades, it had a non-significant diagnostic performance in differentiating between esophageal varices grades I and 0, but it had a significant moderate diagnostic performance in differentiating other esophageal varices grades.

In determining the diagnostic characteristics of liver size/serum albumin ratio cutoff points in differentiating esophageal varices grades, it was found that Liver size/serum albumin ratio cutoff points had high specificity and PPV but low sensitivity and NPV in differentiating grade-I from grade-0, and had high sensitivity and NPV but moderate specificity and PPV in differentiating other grades from each other.

The harmonization between the liver size/serum albumin ratio and endoscopy regarding esophageal varices grades was examined, and a significant moderate agreement was found between endoscopy and liver size/serum albumin ratio regarding esophageal varices grades.

Research conducted on 111 cirrhotic patients by **Laeeq and colleagues** [16] indicated that the left liver lobe diameter/albumin ratio is a stronger predictor of esophageal varices than the right liver lobe diameter/albumin ratio in individuals with liver cirrhosis. The cirrhotic group had a greater left lateral segment-to-total liver volume ratio (LLS/TLV) than the healthy control individuals; hence, expansion of the left lateral segment in virus-induced cirrhosis patients is complete in Child-Pugh class A and B patients. As a result, the absolute volume of the left lateral segment and its percentage to total liver volume are greater than in the control group. In contrast, in Child-Pugh class C patients, expansion of the left lateral segment is relative due to overall liver shrinking. As a result, when both right liver lobe size and albumin decrease, the RLLD/albumin ratio becomes less trustworthy, although the LLLD/albumin ratio remains valid.

This might give some insight for future work in correlating liver size to esophageal varices grade, since in our study whole liver size was assessed.

Another prospective study by **Awad and his colleagues** [17] in Ain Shams university, was conducted on and the study found a statistically significant difference (p-value of 0.007) between the control and study subgroups regarding the right lobe of the liver/albumin ratio in 30 patients with liver cirrhosis and 30 patients who underwent upper gastrointestinal endoscopy for causes other than liver cirrhosis. Based on these findings, physicians can benefit from using the right liver lobe/serum albumin ratio to limit endoscopic screening to patients who have a high probability of esophageal varices. This study was also in agreement with our study.

When correlating between the presence or absence of esophageal varices and patients' Child score, the Child-B had the highest frequency of esophageal varices as present in 48.1% of the cases, then followed by Child-C as esophageal varices present in 34.2% of cases, and finally Child-A as esophageal varices present in 17.7% of cases.

On correlating the grade of esophageal varices with patients' Child score, there was a significant difference between the esophageal varices' grades.

Child-C was the lowest in grade-0 and grade-I; with a mean of 0.0%, followed by grade-II; with a mean of 17.9%, then grade-III; with a mean of 64.7%, and shows the highest in grade-IV; with a mean of 100%. Child-B was lowest in grade-IV; with a mean of 0.0%, followed by grade-III; with a mean of 35.3%, then grade-0; with a mean of 52.4%, then grade-II with a mean of 60.7%, and highest in grade-I; with a mean of 65.2%. Child-A was lowest in grade-III and grade-IV; with mean of 0.0%, followed by grade-II; with a mean of 21.4%, then grade-I; with a mean of 34.8%, and highest in grade-0; with a mean of 47.6%.

A cross-sectional study was done by **Sumon and colleagues** [18] in Bangladesh, which comprised 37 patients in order to assess the relationship between various esophageal varices grades and Child-Pugh classes of liver cirrhosis patients. The study found a statistically significant positive relationship, with higher esophageal varices grades being observed in the more advanced Child-Pugh classes (p value 0.001). This was in harmony with our findings.

Similar cross-sectional study by **Shrestha and colleagues** [19], included 97 patients, reached the same conclusion that; children in classes B and C who have cirrhosis have big varices with a red colour indication and are more likely to haemorrhage. As a result, routine screening is advised to check for varices and, depending on the results, preventive therapy should be used to lower the incidence of bleeding and lower the fatality rate.

CONCLUSION

Our study showed that there was significant moderate agreement between endoscopy and liver size/serum albumin ratio regarding esophageal varices grades. Our study stresses on the use of some of the non-invasive parameters in predicting the grade of esophageal varices in cirrhotic patients without submitting them to the invasive, time consuming and expensive procedure of endoscopy.

It should be mentioned that endoscopy is the gold standard for esophageal varices diagnosis. Non-invasive approaches may also assist physicians avoid the need of endoscopy by identifying patients who require more regular endoscopies and identifying patients at higher risk for the development of esophageal varices.

REFERENCES

1. **Kamal S, Abdelhakam S (2018):** Hepatitis C in Egypt. Hepatitis C in Developing Countries. Academic Press, pp. 41-56. https://doi.org/10.1016/B978-0-12-803233-6.00005-9
2. **Abdel-Aty M, Fouad M, Sallam M *et al.* (2017):** Incidence of HCV induced—esophageal varices in Egypt: Valuable knowledge using data mining analysis. Medicine, 96(4): e5647. doi: 10.1097/MD.0000000000005647
3. **Mölleken C, Ahrens M, Schlosser A *et al.* (2019):** Direct-acting antivirals-based therapy decreases hepatic fibrosis serum biomarker microfibrillar-associated protein 4 in hepatitis C patients. Clinical and Molecular Hepatology, 25(1): 42-51.
4. **Frerichs R, Keim P, Barrais R *et al.* (2012):** Clinical microbiology and infection: the official publication of the European Society of Clinical Microbiology and Infectious Diseases. Clin Microbiol Infect., 18(6): 158-63.
5. **Tseng Z, Olgin J, Vittinghoff E *et al.* (2018):** Prospective countywide surveillance and autopsy characterization of sudden cardiac death: POST SCD Study. Circulation, 137(25):2689-700.
6. **Jakab S, Garcia-Tsao G (2019)**: Evaluation and management of esophageal and gastric varices in patients with cirrhosis. Clin Liver Dis., 24(3):335-350.
7. **Mattos Â, Schacher F, Neto G *et al.* (2019):** Screening for esophageal varices in cirrhotic patients–non-invasive methods. Annals of Hepatology, 18(5): 673-678.
8. **Abbasi A, Butt N, Bhutto A *et al.* (2010):** Correlation of thrombocytopenia with grading of esophageal varices in chronic liver disease patients. J Coll Physicians Surg Pak., 20(6):369-72.
9. **Qamar A, Grace N, Groszmann R *et al.* (2008):** Platelet count is not a predictor of the presence or development of gastroesophageal varices in cirrhosis. Hepatology, 47(1):153-9.
10. **Giannini E, Botta F, Borro P *et al.* (2003):** Platelet count/spleen diameter ratio: proposal and validation of a non-invasive parameter to predict the presence of oesophageal varices in patients with liver cirrhosis. Gut, 52(8):1200-5.
11. **Khan J, Rabbani A, Ali S *et al.* (2016):** Frequency of esophageal varices and comparison of serum albumin levels with and without esophageal varices in patients presenting with chronic liver disease. Pakistan Journal of Medical and Health Sciences, 10(1):127-29.
12. **Budiyasa D, Ariawan Y, Mariadi I *et al.* (2011):** Correlation between serum albumin level and degree of esophageal varices in patients with liver cirrhosis. Indonesian Journal of Gastroenterology, Hepatology, and Digestive Endoscopy, 12(1):23-27.
13. **Demirel U, Karincaoğlu M, Harputluoğlu M *et al.* (2003):** Two findings of portal hypertension: evaluation of correlation between serum-ascites albumin gradient and esophageal varices in non-alcoholic cirrhosis. Turk J Gastroenterol., 14(4):219-22.
14. **LaBrecque D, Khan A, Sarin S *et al.* (2014):** Esophageal varices. World Gastroenterol Organ Glob Guide, 1:4.
15. **Akram M, Soomro M, Magsi M (2019):** The right liver lobe size/albumin concentration ratio in identifying esophageal varices among patients with liver cirrhosis. Middle East Journal of Digestive Diseases, 11(1): 32-37.
16. **Laeeq S, Luck N, Wadhwa R *et al.* (2014):** Left liver lobe diameter albumin ratio as a predictor of esophageal varices in patients with cirrhosis: A preliminary report. Journal of Translational Internal Medicine, 2(4):164-67.
17. **Awad E, Yousry W, Hasan H *et al.* (2020):** Assessment of right liver lobe size/serum albumin ratio as a new non-invasive predictor for the presence of oesophageal varices in Egyptian patients with HCV related liver cirrhosis. The Egyptian Journal of Hospital Medicine, 81(5): 2016-2025.
18. **Sumon S, Sutradhar S, Chowdhury M *et al.* (2013):** Relation of different grades of esophageal varices with Child-Pugh classes in cirrhosis of liver. Mymensingh Medical Journal, 22(1): 37-41.
19. **Shrestha A, Khadka D, Shrestha R (2018):** Correlation of grading of esophageal varices with Child Turcotte Pugh Class in patients of liver cirrhosis. Journal of Nepalgunj Medical College, 16(2): 50-53.