Tạp chí Sức khỏe và Lão hóa
Journal of Health and Aging
Published online at https://tcsuckhoelaohoa.vn

Original Article

VALUE OF GALLBLADDER WALL THICKNESS AND THE PLATELET COUNT-TO-GALLBLADDER WALL THICKNESS RATIO IN PREDICTING HIGH-RISK ESOPHAGEAL VARICES IN PATIENTS WITH CIRRHOSIS

Do Thanh Dong[1], Nguyen Thi Truc Ly[1], Phan Nhu Quynh[2], Nguyen Van Thuan[3,4], Tran Quoc Thang[5,*]

1. De Men Pediatric Clinic, Ho Chi Minh City, Vietnam
2. Department of Infection Control, Cho Ray Hospital, Ho Chi Minh City, Vietnam
3. Hoan My Research and Training Institute, Hoan My Medical Corporation, Ho Chi Minh City, Vietnam
4. FDCare Medical System, Ho Chi Minh City, Vietnam
5. Department of Internal Medicine, Faculty of Medicine, University of Health Sciences, Vietnam National University Ho Chi Minh City, Vietnam

** Corresponding author: Tran Quoc Thang, MD, MSc ✉ tqthang@uhsvnu.edu.vn*

ABSTRACT: Esophageal varices (EV) are a serious complication of cirrhosis, with 15–25% mortality when bleeding occurs. Endoscopy is the diagnostic gold standard but is invasive and costly. This study evaluated the correlation between gallbladder wall thickness (GBWT) and EV severity and the predictive value of GBWT and the platelet count-to-GBWT ratio (PLT/GBWT). This cross-sectional study included 72 patients aged ≥18 years with cirrhosis at Thong Nhat Hospital from December 2023 to October 2024. GBWT was measured by ultrasonography and EV by upper gastrointestinal endoscopy. Spearman correlation, ROC analysis, and the Youden index were used. Mean age was 61.1 ± 12 years, and 70.8% were male. EV and high-risk EV were present in 73.6% and 70.8% of patients, respectively. GBWT showed a moderate positive correlation with EV severity ($r = 0.64$; $p < 0.001$). The AUC for GBWT was 0.93 for EV (cutoff 5.12 mm; sensitivity 73.6%; specificity 100%) and 0.90 for high-risk EV (sensitivity 74.5%; specificity 95.2%). The corresponding AUCs for PLT/GBWT were 0.74 and 0.72. GBWT showed good predictive performance and higher AUCs than PLT/GBWT, suggesting potential utility for risk stratification and prioritization of endoscopy where advanced diagnostic resources are limited.

Keywords: gallbladder wall thickness, esophageal varices, cirrhosis, platelet count-to-gallbladder wall thickness ratio.

Received: 28/08/2026 Accepted: 22/09/2026 Published: 01/10/2026
Copyright: © Author(s). Published by *Journal of Health and Aging*.

1. INTRODUCTION

Cirrhosis is one of the most common chronic diseases worldwide and has many causes, including viral hepatitis, long-term alcohol use, and metabolic disorders (1). The disease severely affects quality of life and leads to many serious complications, of which esophageal varices (EV) are among the most dangerous (2). EV are a direct manifestation of portal hypertension, are common in patients with advanced cirrhosis, and can cause acute gastrointestinal bleeding with a mortality rate of 15% to 25%, particularly when they are not detected and treated promptly (1).

Detecting EV and stratifying their risk are important: this reduces mortality from bleeding, optimizes treatment strategies, reduces unnecessary endoscopies, and saves healthcare costs (3). Upper gastrointestinal endoscopy is still regarded as the gold standard for diagnosing EV (4). However, it is an invasive and costly procedure with a risk of complications, which makes it difficult to apply widely where healthcare resources are limited, especially at lower-level healthcare facilities.

According to the expanded Baveno VI recommendations, liver stiffness measurement with FibroScan combined with platelet count has proven effective for EV risk stratification and allows endoscopy to be avoided in a substantial proportion of patients (5). However, not every healthcare facility has FibroScan, so simpler and more widely available non-invasive tools are needed. Whereas methods such as spleen stiffness measurement require advanced equipment, ultrasonographic measurement of gallbladder wall thickness (GBWT) is a simple and common technique that can be performed at most healthcare facilities, and it has the potential to become a non-invasive tool to support the assessment and risk stratification of EV (6).

In Vietnam, however, data on the value of GBWT and the platelet count-to-GBWT ratio (PLT/GBWT) for assessing EV in patients with cirrhosis are limited. This study was therefore conducted to add evidence on the value of these simple, accessible non-invasive indices in a population of patients with cirrhosis in Vietnam, with three objectives: (1) to determine the correlation between GBWT and EV grade; (2) to determine the value of GBWT in predicting EV and high-risk EV; and (3) to determine the value of the PLT/GBWT ratio in predicting EV and high-risk EV.

2. SUBJECTS AND METHODS

2.1. Study design

Cross-sectional study.

2.2. Study period and setting

The study was conducted from December 2023 to October 2024 at the Department of Gastroenterology and the Gastroenterology Outpatient Clinic, Thong Nhat Hospital, Ho Chi Minh City.

2.3. Study population

The target population was patients aged ≥18 years diagnosed with cirrhosis. The sampling population was patients with cirrhosis who attended the outpatient clinic or were admitted for treatment at the study site during the study period.

Inclusion criteria were age ≥18 years, a diagnosis of cirrhosis, having undergone esophagogastroduodenoscopy, and consent to participate in the study.

Exclusion criteria were a previous diagnosis of gastrointestinal bleeding from ruptured EV or previous prophylactic treatment for variceal bleeding; primary liver cancer; a history of gallbladder disease (acute or chronic cholecystitis with or without gallstones, cholecystectomy, or gallbladder cancer); a condition causing thrombocytopenia or previous platelet transfusion; and acute liver injury within the previous 6 months that could affect hepatobiliary biochemical tests.

2.4. Sample size

Sample size was calculated separately for each study objective, and the largest was chosen as the minimum sample size of the study.

2.4.1. Sample size for the correlation objective

The sample size for assessing the correlation between gallbladder wall thickness (GBWT) and the grade of esophageal varices (EV) was calculated using the formula:

$$N \geq 3 + \left[\frac{Z_{1-\alpha/2} + Z_{1-\beta}}{\frac{1}{2}\ln\left(\frac{1+r}{1-r}\right)} \right]^2$$

Where:

N: minimum sample size;

r: expected correlation coefficient;

α: probability of type I error;

β: probability of type II error;

Z: quantile of the standard normal distribution.

With α = 0.05, β = 0.05, and an expected correlation coefficient r = 0.63 based on the study by Shehata et al. (11), the minimum sample size was: N ≥ 27

2.4.2. Sample size for the area under the ROC curve objective

The sample size for estimating the area under the ROC curve (AUROC) was calculated using the formula:

$$n = \frac{Z_{\alpha/2}^2}{d^2} \times \left[0{,}0099e^{-A^2/2}\left(6A^2 + 16\right)\right]$$

where: A = √2 × Φ^{-1}(AUROC)

Where:

n: minimum number of subjects required per group, assuming approximately equal numbers of patients with and without the outcome;

AUROC: expected area under the ROC curve;

Φ^{-1}(AUROC): inverse of the cumulative standard normal distribution function;

$Z_{\alpha/2}$ = 1.96 for a 95% confidence level;

d: allowable absolute error of the AUROC estimate, set at d = 0.10.

For GBWT, the expected AUROC was 0.86 based on the meta-analysis by Elgenidy et al. (10). Substituting into the formula, the minimum number of subjects required per group was approximately 36 patients, giving: N = 36 × 2 = 72 patients

For the PLT/GBWT ratio, the expected AUROC was 0.864 based on the study by Tsaknakis et al. (9). The estimated minimum sample size was approximately 35 patients per group, giving approximately: N = 35 × 2 = 70 patients

Thus, the minimum sample size was 27 patients for the correlation objective, 72 patients for the AUROC objective for GBWT, and 70 patients for the AUROC objective for the PLT/GBWT ratio. We chose the largest of these, 72 patients, as the minimum sample size.

2.5. Study variables

The main variables included demographic characteristics (age, sex), etiology of cirrhosis, clinical characteristics (ascites, hepatic encephalopathy), laboratory characteristics (platelet count, INR, albumin, total bilirubin, Child-Turcotte-Pugh [CTP] score), GBWT, the PLT/GBWT ratio, EV status (presence or absence, and grade according to the Japan Gastroenterological Endoscopy Society classification: grade 1, grade 2, grade 3), and high-risk EV.

EV were considered high-risk if any one of three conditions was met: large EV (grade 2 or 3); grade 1 EV with red color signs; or grade 1 EV in patients with CTP-B or CTP-C cirrhosis (12).

GBWT was measured in millimeters with a grayscale ultrasound probe (Hitachi Arietta 50) with the patient fasting, close to the time of endoscopy (within 24 hours or no more than 6 months). Measurements were taken at two or more sites not obscured by bowel gas, in two positions (supine and left lateral decubitus), and the mean value was used. GBWT was measured by three sonologists who had agreed on a standardized measurement protocol before the study. At the time of GBWT measurement, the sonologists were not given and did not view the patients' esophagogastroduodenoscopy results.

The PLT/GBWT ratio was calculated as platelet count (K/μL) divided by GBWT (mm). Platelet counts obtained at the same time as endoscopy and ultrasonography were preferred; when these were unavailable, the most recent result within 6 months was used.

2.6. Statistical analysis

Data were analyzed with R software (version 4.4.1). Quantitative variables are described as mean ± standard deviation and qualitative variables as frequency and percentage. The correlation between

GBWT and EV grade was assessed with the Spearman correlation coefficient. The discriminative ability of GBWT and the PLT/GBWT ratio was assessed with the area under the ROC curve (AUC) and its 95% confidence interval; the optimal cutoff was determined by the highest Youden index (J = sensitivity + specificity − 1). The AUCs of GBWT and the PLT/GBWT ratio were compared using DeLong's test for two correlated ROC curves; the AUC difference is presented with its 95% confidence interval. Statistical significance was set at $p < 0.05$.

2.7. Research ethics

The study was conducted after patients gave consent to participate; patient information was kept confidential and used only for research purposes. The study was approved by the Biomedical Research Ethics Committee of Thong Nhat Hospital (decision No. 127/2023/BVTN-HĐYĐ, dated December 20, 2023).

3. RESULTS

3.1. General characteristics of the study sample

We enrolled 72 patients with cirrhosis who met the inclusion criteria. The demographic, clinical, laboratory, and endoscopic characteristics of the study population are summarized in **(Table 1)**. Mean age was 61.1 ± 12 years, and the 50–60-year age group was the largest. Men predominated, accounting for 51/72 patients (70.8%), with a male-to-female ratio of 2.4/1.

Table 1. General, clinical, laboratory, and endoscopic characteristics of the study population (n = 72)

Characteristic	Value
Age, years	61.1 ± 12.0
Sex, n (%)	
Male	51 (70.8)
Female	21 (29.2)
Etiology of cirrhosis, %	
Hepatitis B	30.6
Hepatitis C	15.3
Alcohol	45.8
Other	9.7
Ascites, n (%)	
None	36 (50.0)
Grade 1	9 (12.5)
Grade 2–3	27 (37.5)
Child–Turcotte–Pugh score	8.7 ± 2.2
Child–Turcotte–Pugh class, n (%)	
CTP-A	10 (13.9)
CTP-B	39 (54.2)
CTP-C	23 (31.9)
Laboratory findings	
Platelet count, K/μL	99.4 ± 62.9
Total bilirubin, μmol/L	66.0 ± 84.2
INR	1.7 ± 0.6
Albumin, g/L	27.8 ± 6.2
Esophageal varices, n (%)	
No varices	19 (26.4)
Grade 1	22 (30.6)
Grade 2	30 (41.7)
Grade 3	1 (1.4)
Any EV	53 (73.6)
High-risk EV, n (%)	51 (70.8)

*Data are presented as mean ± SD or n (%) unless otherwise indicated.

Abbreviations: CTP, Child–Turcotte–Pugh; INR, international normalized ratio; EV, esophageal varices.

Regarding etiology, alcohol was the most common cause of cirrhosis (45.8%), followed by hepatitis B virus (30.6%) and hepatitis C virus (15.3%); viral hepatitis accounted for 45.9% in total. Other causes (undetermined, non-alcoholic fatty liver disease, etc.) accounted for 9.7%.

Clinically, 50% of patients had no ascites, 12.5% had grade 1 ascites, and 37.5% had grade 2–3 ascites. The mean CTP score was 8.7 ± 2.2; CTP-B was the most common class (54.2%), followed by CTP-C (31.9%) and CTP-A (13.9%). In the high-risk EV group, CTP-B and CTP-C were more frequent (56.9% and 37.3%) than in the low-risk group (47.6% and 19.0%).

Hematologic and biochemical tests showed abnormalities reflecting impaired liver function in most patients: mean platelet count 99.4 ± 62.9 K/μL (84.7% below the normal range), mean total bilirubin 66.0 ± 84.2 μmol/L (77.8% elevated), mean INR 1.7 ± 0.6 (73.6% elevated), and mean albumin 27.8 ± 6.23 g/L (90.3% decreased).

3.2. Presence and risk stratification of esophageal varices

EV were present in 53/72 patients (73.6%; 95% CI: 62.7–82.3). Grade 2 EV accounted for 41.7%, grade 1 for 30.6%, and grade 3 for 1.4%; 26.4% of patients had no EV. No grade 1 EV with red color signs were observed. High-risk EV were found in 51/72 patients (70.8%; 95% CI: 58.8–80.7) **(Table 1)**.

3.3. Correlation between gallbladder wall thickness and esophageal variceal grade

GBWT tended to increase with EV grade. Spearman correlation analysis showed a positive correlation between GBWT and EV grade (r = 0.64; p < 0.001) **(Chart 1)**.

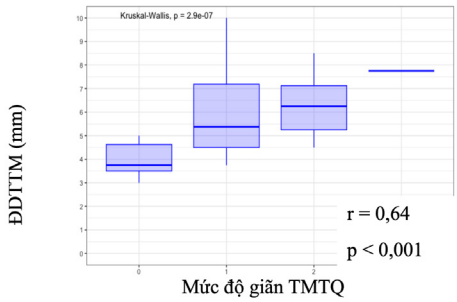


Chart 1. Distribution of gallbladder wall thickness by esophageal variceal grade in patients with cirrhosis

3.4. Value of gallbladder wall thickness in predicting esophageal varices

The area under the ROC curve (AUC) of GBWT for predicting the presence of EV was 0.93 (95% CI: 0.87–0.98). At the optimal cutoff of 5.12 mm, sensitivity was 73.6%, specificity 100%, positive predictive value (PPV) 100%, and negative predictive value (NPV) 57.6%. For high-risk EV, the AUC of GBWT was 0.90 (95% CI: 0.82–0.98); at the same cutoff of 5.12 mm, sensitivity was 74.5%, specificity 95.2%, PPV 97.4%, and NPV 60.6% **(Table 2)**.

Table 2. Predictive value of gallbladder wall thickness and the platelet count-to-gallbladder wall thickness ratio for esophageal varices and high-risk esophageal varices

Outcome	Index	AUC (95% CI)	Optimal cutoff	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)
EV	GBWT	0.93 (0.87–0.98)	≥ 5.12 mm	73.6 (61.7-85.5)	100.0 (100-100)	100.0	57.6
	PLT/GBWT	0.74 (0.61–0.86)	< 15.2 (K/μL)/mm	64.2 (51.2-77.1)	84.2 (67.8-100)	91.9	45.7
High-risk EV	GBWT	0.90 (0.82–0.98)	≥ 5.12 mm	74.5 (62.5-86.5)	95.2 (86.1-100)	97.4	60.6
	PLT/GBWT	0.72 (0.59–0.85)	< 15.2 (K/μL)/mm	64.7 (51.6-77.8)	81.0 (64.2-97.7)	89.2	48.6

3.5. Value of the platelet count-to-gallbladder wall thickness ratio in predicting esophageal varices

The AUC of the PLT/GBWT ratio for predicting EV was 0.74 (95% CI: 0.61–0.86). At the optimal cutoff of <15.2 (K/μL)/mm, sensitivity was 64.2%, specificity 84.2%, PPV 91.9%, and NPV 45.7%. For high-risk EV, the AUC was 0.72 (95% CI: 0.59–0.85), with a sensitivity of 64.7%, specificity of **81.0%**, PPV of 89.2%, and NPV of 48.6% at the same cutoff **(Table 2)**.

3.6. Comparison of gallbladder wall thickness and the platelet count-to-gallbladder wall thickness ratio

GBWT had higher discriminative ability than the PLT/GBWT ratio for predicting the presence of EV, with AUCs of 0.93 and 0.74, respectively. DeLong's test showed an AUC difference of 0.19 (95% CI: 0.08–0.30; p < 0.001), indicating a statistically

significant difference (Chart 2). Similar results were found for high-risk EV, with AUCs of 0.90 for GBWT and 0.72 for PLT/GBWT; the AUC difference was 0.18 (95% CI: 0.08–0.28; p < 0.001) (Chart 3).

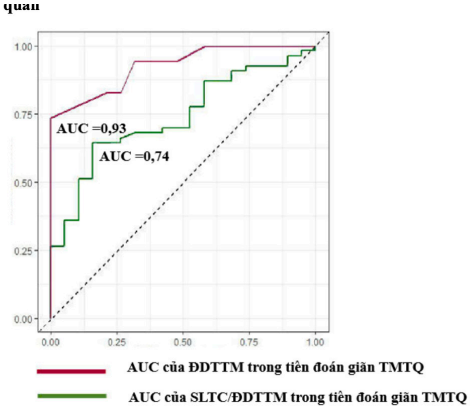


Chart 2. Comparison of the areas under the curve of gallbladder wall thickness and the platelet count-to-gallbladder wall thickness ratio for predicting esophageal varices

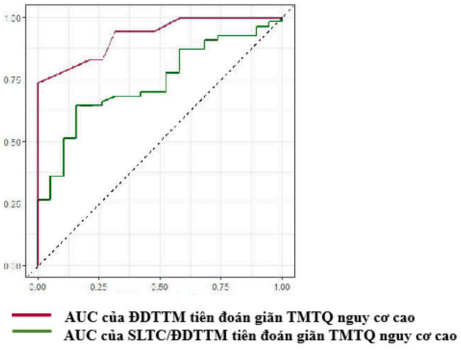


Chart 3. Comparison of the areas under the curve of gallbladder wall thickness and the platelet count-to-gallbladder wall thickness ratio for predicting high-risk esophageal varices

4. DISCUSSION

4.1. Characteristics of the study sample

The mean age of 61.1 ± 12 years in this study is consistent with the 20–30-year natural course from chronic hepatitis to cirrhosis and is similar to that reported in domestic studies, such as that of Nguyen Huy Hoang (60.3 ± 10.3 years), and in international studies in the same field (13). Men predominated in this study (70.8%), as in the studies of Do Huy, Duong Quoc Phong, and Tsaknakis et al., which reported male proportions of 65%, 67%, and 74%, respectively (9, 14, 15).

Of note, the main cause of cirrhosis in this study was alcohol (45.8%), unlike many international studies and some domestic studies in the same region (such as those of Duong Quoc Phong and Do Huy), in which hepatitis B virus predominated (14, 15). This difference may reflect the characteristics of patients attending an end-of-line referral hospital. It also suggests that the pathogenesis of alcohol-related portal hypertension may affect GBWT differently from other chronic causes, a factor to consider when interpreting the results.

4.2. Correlation between gallbladder wall thickness and esophageal variceal grade

We found a moderate, statistically significant positive correlation between GBWT and EV grade (Spearman r = 0.64; p < 0.001), with a linear trend of increasing GBWT across variceal grades. This is consistent with the pathophysiological mechanism described in the literature: portal hypertension causes venous congestion of the gallbladder, leading to edema and thickening of the gallbladder wall, and it is also the direct cause of EV (8). This correlation is close to the value of r = 0.63 reported by Shehata et al. (11).

4.3. Value of gallbladder wall thickness in predicting esophageal varices

GBWT showed very good diagnostic value for predicting the presence of EV (AUC = 0.93) and good value for predicting high-risk EV (AUC = 0.90), with the same optimal cutoff of 5.12 mm for both outcomes. At this cutoff, specificity and PPV were very high (95–100%), indicating that a patient with GBWT ≥ 5.12 mm is very likely to have EV or high-risk EV; this is useful for identifying patients who should be prioritized for endoscopy. However, the moderate NPV (57.6–60.6%) indicates that GBWT below this cutoff is not sufficient to fully exclude EV, so it should not be used alone to decide to defer endoscopy in all patients.

Compared with international studies, our results are within the range of, or higher than, some previous reports. Afifi et

al. reported that a GBWT cutoff of ≥3.95 mm had a sensitivity of 92% for predicting large EV (16), whereas Elgenidy et al., in a meta-analysis of 12 studies, reported a pooled AUC of approximately 0.86 for GBWT in predicting the presence of EV (10). Differences in cutoffs and accuracy between studies may result from differences in the etiology of cirrhosis (alcohol versus viral), disease severity (prevalence of ascites and CTP class), GBWT measurement protocol (position, number of measurements, and timing relative to endoscopy), and study population characteristics.

4.4. Value of the platelet count-to-gallbladder wall thickness ratio

Contrary to our initial expectation that adding a hematologic factor might improve predictive ability, GBWT alone had significantly higher discriminative ability than the PLT/GBWT ratio for both the presence of EV (AUC 0.93 vs 0.74) and high-risk EV (AUC 0.90 vs 0.72), as confirmed by DeLong's test (both $p < 0.001$). This finding differs from that of Tsaknakis et al., in whose study the PLT/GBWT ratio had better predictive performance than either parameter alone (9).

This difference may be explained by the characteristics of the study population: our sample had a fairly high proportion of patients with severe cirrhosis (CTP-B and CTP-C, 86.1%), and the prevalence of ascites was as high as 50%. In patients with advanced cirrhosis, thrombocytopenia is common at all risk levels, which may reduce the discriminative ability of the platelet count component and thus the performance of the PLT/GBWT ratio. Meanwhile, the denominator (GBWT) may increase because of confounders other than portal hypertension itself, such as hypoalbuminemia and ascites, which cause nonspecific gallbladder wall edema. As a result, the PLT/GBWT ratio varies less consistently than GBWT alone in a population of severely ill patients. This suggests that the value of the PLT/GBWT ratio may depend largely on the severity profile of the study population and needs further validation in different populations before wide application.

Although the sensitivity and NPV of the PLT/GBWT ratio were not high, its specificity and PPV at the optimal cutoff (15.2 (K/μL)/mm) were fairly good (81.0% and 89.2% for high-risk EV), indicating that this index may still have a supporting role in identifying high-risk patients who need endoscopy, especially when combined with other factors such as liver stiffness or portal venous hemodynamic parameters.

4.5. Clinical implications and limitations

Overall, our results show that GBWT measured by abdominal ultrasonography, a simple, widely available, and low-cost technique, has good value for predicting EV and high-risk EV in patients with cirrhosis and had higher discriminative ability than the PLT/GBWT ratio in this sample. Because the 5.12 mm cutoff gives high specificity and PPV, GBWT could be used as a tool to support risk stratification and prioritization of endoscopy, particularly at facilities with limited access to advanced non-invasive assessment methods.

This study has several limitations that should be considered when interpreting the results. First, the interval between ultrasonographic measurement of GBWT and endoscopy and blood sampling was not uniform across patients, because GBWT is not routinely measured on abdominal ultrasonography and the frequency of endoscopy and ultrasonography varies with EV grade. Second, factors such as ascites and hypoalbuminemia can increase GBWT nonspecifically, especially in a study population with a high proportion of decompensated cirrhosis. Because of the limited sample size, we did not perform multivariable or subgroup analyses by these factors; therefore, the extent to which they affect the discriminative performance of GBWT cannot be determined. Larger studies should evaluate the value of GBWT after stratification by degree of decompensation and by factors that may affect gallbladder wall thickness. Third, the sample of 72 patients from a single center may limit the generalizability of the results to other patient populations, particularly those with a different distribution of cirrhosis etiology or disease severity. Fourth, the optimal cutoffs were determined and evaluated in the same sample without internal or external validation, so diagnostic performance may be overestimated.

5. CONCLUSIONS

Gallbladder wall thickness has a moderate, statistically significant positive correlation with the grade of esophageal varices. It is a non-invasive tool with good value for predicting esophageal varices in general and high-risk esophageal varices, with very high specificity and positive predictive value. By contrast, the platelet count-to-gallbladder wall thickness ratio had lower discriminative ability than gallbladder wall thickness alone in this sample.

GBWT has potential as a tool to support risk stratification and prioritization of endoscopy, particularly at facilities with limited access to advanced non-invasive assessment methods. The PLT/GBWT ratio may provide additional information but had lower predictive performance than GBWT in this sample. Multicenter studies with larger samples and standardized measurement protocols are needed to confirm these findings.

REFERENCES

[1] Ginès P, Krag A, Abraldes JG, Solà E, Fabrellas N, Kamath PS. Liver cirrhosis. Lancet. 2021;398(10308):1359–76. Epub 20210917. doi: 10.1016/s0140-6736(21)01374-x. PubMed PMID: 34543610.

[2] Tapper EB, Parikh ND. Diagnosis and Management of Cirrhosis and Its Complications: A Review. JAMA. 2023;329(18):1589–602. doi: 10.1001/jama.2023.5997.

[3] Kaplan DE, Ripoll C, Thiele M, Fortune BE, Simonetto DA, Garcia-Tsao G, et al. AASLD Practice Guidance on risk stratification and management of portal hypertension and varices in cirrhosis. Hepatology. 2024;79(5):1180–211. Epub 20231023. doi: 10.1097/hep.0000000000000647. PubMed PMID: 37870298.

[4] Vidili G, Arru M. Non-invasive tools for the prediction of esophageal varices in cirrhosis: Can advanced ultrasound techniques spare endoscopy? Journal of Clinical Ultrasound. 2022;50(3):364–6. doi: https://doi.org/10.1002/jcu.23176.

[5] Augustin S, Pons M, Maurice JB, Bureau C, Stefanescu H, Ney M, et al. Expanding the Baveno VI criteria for the screening of varices in patients with compensated advanced chronic liver disease. Hepatology. 2017;66(6):1980–8. Epub 20171030. doi: 10.1002/hep.29363. PubMed PMID: 28696510.

[6] Emara MH, Zaghloul M, Amer IF, Mahros AM, Ahmed MH, Elkerdawy MA, et al. Sonographic gallbladder wall thickness measurement and the prediction of esophageal varices among cirrhotics. World J Hepatol. 2023;15(2):216–24. doi: 10.4254/wjh.v15.i2.216. PubMed PMID: 36926231; PubMed Central PMCID: PMC10011914.

[7] Bremer SCB, Knoop RF, Porsche M, Amanzada A, Ellenrieder V, Neesse A, et al. Pathological gallbladder wall thickening is associated with advanced chronic liver disease and independent of serum albumin. Journal of Clinical Ultrasound. 2022;50(3):367–74. doi: https://doi.org/10.1002/jcu.23077.

[8] Saverymuttu SH, Grammatopoulos A, Meanock CI, Maxwell JD, Joseph AE. Gallbladder wall thickening (congestive cholecystopathy) in chronic liver disease: a sign of portal hypertension. Br J Radiol. 1990;63(756):922–5. doi: 10.1259/0007-1285-63-756-922. PubMed PMID: 2268760.

[9] Tsaknakis B, Masri R, Amanzada A, Petzold G, Ellenrieder V, Neesse A, et al. Gall bladder wall thickening as non-invasive screening parameter for esophageal varices - a comparative endoscopic - sonographic study. BMC Gastroenterol. 2018;18(1):123. Epub 20180802. doi: 10.1186/s12876-018-0852-5. PubMed PMID: 30071840; PubMed Central PMCID: PMC6090930.

[10] Elgenidy A, Afifi AM, Jalal PK. Gallbladder Wall Thickness as a Non-Invasive Marker for Esophageal Varices: A Systematic Review and Meta-Analysis. J Clin Exp Hepatol. 2023;13(3):509–17. Epub 20220930. doi: 10.1016/j.jceh.2022.09.004. PubMed PMID: 37250888; PubMed Central PMCID: PMC10213855.

[11] Shehata NM, Abdelaziz AA, Abd El Megid M, Hafez YM. Evaluation of the gallbladder wall thickening as a non-invasive predictor of esophageal varices in cirrhotic patients. Journal of Advances in Medicine and Medical Research. 2021;33(12):1–9.

[12] Reiberger T, Püspök A, Schoder M, Baumann-Durchschein F, Bucsics T, Datz C, et al. Austrian consensus guidelines on the management and treatment of portal hypertension (Billroth III). Wiener klinische Wochenschrift. 2017;129(3):135–58. doi: 10.1007/s00508-017-1262-3.

[13] Hoàng NH. Value of the EVENDO score and the platelet count-to-spleen diameter ratio in predicting high-risk esophageal varices in patients with cirrhosis [in Vietnamese]. Vietnam Medical Journal. 2023;528:71–9.

[14] Huy Đ. Value of the EVendo score in predicting esophageal varices in patients with cirrhosis [in Vietnamese] [Residency thesis]. Ho Chi Minh City: University of Medicine and

Pharmacy at Ho Chi Minh City; 2022.

[15] Phong DQ. Value of ElastPQ in predicting large esophageal varices in patients with cirrhosis [in Vietnamese]. Ho Chi Minh City Journal of Medicine. 2020;25(2):7.

[16] Afifi MAE, Rizk M, Hussein A. Gall bladder wall thickness as non-invasive predictor of oesophageal varices in cirrhotic patients. Zagazig University Medical Journal. 2022;28(1):54–62.