Comparison Between Evendo Score and Baveno VII Criteria for Predicting Esophageal Varices in Cirrhosis Patients

Muhammad Begawan Bestari, Toni Baskoro**, Bachti Alisjahbana****

*Division of Gastroentero-Hepatology, Department of Internal Medicine, Faculty of Medicine Universitas Padjajaran/Dr. Hasan Sadikin General Hospital, Bandung

**Department of Internal Medicine, Faculty of Medicine Universitas Padjajaran/Dr. Hasan Sadikin General Hospital, Bandung

***Division of Tropical Infectious Disease, Department of Internal Medicine, Faculty of Medicine Universitas Padjajaran/Dr. Hasan Sadikin General Hospital, Bandung

Corresponding Author:

Muhammad Begawan Bestari. Division of Gastroentero-Hepatology, Department of Internal Medicine, Dr. Hasan Sadikin General Hospital. Jl. Pasteur No. 38 Bandung Indonesia. Phone: +62222038986 E-mail: begawanb@yahoo.com

ABSTRACT

Background: *The EVendo score and Baveno VII criteria are non-invasive methods in predicting the presence of esophageal varices in patients with cirrhosis. The EVendo score is more practical to use in daily practice than the Baveno VII criteria because it does not require a liver stiffness measurement. This study aims to compare the performance of the EVendo score with the Baveno VII criteria for predicting the presence of esophageal varices in patients with liver cirrhosis.*

Methods: *This study was diagnostic study with cross-sectional approach on cirrhosis patients who had previously undergone upper gastrointestinal endoscopy who had laboratory examination data and liver stiffness measurement values. Based on the existing data, calculation, and comparison of the diagnostic value of the EVendo score and the Baveno VII criteria were carried out. The research was conducted at dr. Hasan Sadikin based on patient data from April 2017 to May 2023.*

Results: *The Evendo score had a sensitivity of 80.5%, specificity 50%, PPV 84.6%, NPV 42.9%, positive likelihood ratio 1.61, and negative likelihood ratio 0.39. The Baveno VII criteria had a sensitivity of 95.1%, specificity of 25%, PPV 81.2%, NPV 42.9%, positive likelihood ratio 1.27, and negative likelihood ratio 0.2.*

Conclusion: *The results of this study show that the EVendo score and Baveno VII criteria have high sensitiviy but low specificity for predicting esophageal varices in patients with liver cirrhosis.*

Keywords: *Baveno VII criteria, esophageal varices, EVendo score*

ABSTRAK

Latar belakang: *Skor EVendo dan kriteria Baveno VII merupakan metode non invasif untuk memprediksi terdapatnya varises esofagus pada pasien sirosis. Skor EVendo lebih praktis digunakan pada praktik sehari-hari dibandingkan kriteria Baveno VII karena tidak membutuhkan alat pengukuran kekakuan liver. Penelitian ini bertujuan untuk membandingkan performa skor EVendo dengan kriteria Baveno VII untuk memprediksi adanya varises gastroesofagus pada pasien sirosis hepatis.*

Metode: *Penelitian ini merupakan penelitian analisis secara potong lintang pada pasien sirosis yang telah dilakukan endoskopi saluran cerna bagian atas serta memiliki data pemeriksaan laboratorium dan nilai*

pengukuran kekakuan liver. Perhitungan dan perbandingan nilai diagnostik skor EVendo dan kriteria Baveno VII berdasarkan data pasien di RSUP dr. Hasan Sadikin pada bulan April 2017 hingga Mei 2023.

***Hasil:** Skor Evendo memiliki sensitivitas 80,5%, spesifisitas 50%, PPV 84,6%, NPV 42,9%, positive likelihood ratio 1,61, dan negative likelihood ratio 0,39. Kriteria Baveno VII memiliki sensitivitas 95,1%, spesifisitas 25%, PPV 81,2%, NPV 42,9%, positive likelihood ratio 1,27, dan negative likelihood ratio 0,2.*

***Simpulan:** Penelitian ini menunjukan skor EVendo dan kriteria Baveno VII memiliki sensitivitas tinggi namun spesifisitas rendah untuk memprediksi adanya varises esofagus pada pasien sirosis hepatis.*

***Kata kunci:** Kriteria Baveno VII, skor EVendo, varises esofagus*

INTRODUCTION

Variceal bleeding is one of the cirrhosis-related complications that arise in acute decompensated liver cirrhosis.[1] Liver cirrhosis is the 11th (2.2%) cause of mortality and the 15th cause of morbidity in the world.[2] The etiology of liver cirrhosis from the most common is hepatitis C virus (HCV) (48.2%), alcoholic liver disease (ALD) (19.9%), hepatitis B virus (HBV) (11.5%), cryptogenic (6.6%), nonalcoholic steatohepatitis (NASH) (6.3%), cholestasis disease (3.4%), autoimmune hepatitis (2.7%), congestive liver disease (0.4%), hereditary metabolic disease (0.2%), drug induced liver injury (0.06%), and other infectious diseases (0.01%).[3] A cross-sectional study on liver cirrhosis patients undergoing esophageal varices screening using endoscopy in Dr Cipto Mangunkusumo Hospital found that the prevalence of esophageal varices in patients with liver cirrhosis was 57.4%, which was categorized into small degree (23.6%) and large degree (33.8%). The largest proportion of liver cirrhosis patients with esophageal varices was comprised of patients with Child Pugh C score.[4]

Previously, screening esophagogastroduodenoscopy (EGD) for diagnosis of esophageal and gastric varices is recommended when a diagnosis of cirrhosis is made.5 However, a large percentage of patients undergoing screening, particularly those with compensated cirrhosis, do not have esophageal varices or have only small esophageal varices without high-risk features.6 Currently, Baveno VII consensus stated that patients with compensated cirrhosis who are on Non Selective Beta Blockers (NSBBs) for the prevention of decompensation do not need a screening endoscopy for the detection of varices since endoscopy will not change management. However, patients with compensated cirrhosis who are not candidates for initiating NSBBs (contraindication/ intolerance) for the prevention of decompensation should undergo an endoscopy for variceal screening if liver stiffness measurement (LSM) by transient elastography is ≥ 20 kPa or platelet count is ≤ 150x109/L.7

Baveno VII consensus for endoscopic screening is difficult to implement in every hospital because it requires transient elastography which is not yet available in every hospital. Recently, EVendo score was developed using a machine-learning algorithm to identify factors significantly associated with esophageal varices and varices needing treatment. The formula is consisted of readily available laboratory tests: hemoglobin (Hb), platelet counts, international normalized ratio (INR), level of AST, blood urea nitrogen (BUN), and presence of ascites. [6] This score is readily available using a published online calculator.[8] With a cutoff score of 3.90, the EVendo score has a sensitivity of approximately 95%, allowing providers to accurately avoid unneeded EGD.[6] To date, there has been no research in Indonesia that assesses the performance of the Evendo and Baveno VII consensus scores in predicting esophageal varices. This study aims to compare the performance of the EVendo score with the Baveno VII criteria for predicting the presence of esophageal varices in patients with liver cirrhosis.

METHODS

This study is a diagnostic study with a cross-sectional method. The study samples were cirrhosis patients at the Dr. Hasan Sadikin General Hospital in the period April 2017–May 2023. The inclusion criteria for this study included: (1) Age 18 years and over; (2) Diagnosed with cirrhosis; (3) An upper gastrointestinal endoscopy has been performed; (4) There are supporting examination results: hemoglobin, platelets, INR, BUN, AST, abdominal ultrasound, and LSM value. Exclusion criteria included: (1) Non cirrhotic portal hypertension; (2) Hepatocellular Carcinoma; (3) A splenectomy has been performed; (4) On hemodialysis therapy; (5) On anti-coagulant therapy; (6) Ascites.

In this study, sampling was performed using the consecutive sampling technique, namely, the order of arrival of patients who met the inclusion, and exclusion criteria were included as study subjects until the minimum sample size was met. For the purposes of this research, a diagnostic test sample size formula with sensitivity output is used. From the sample size calculation, the minimum sample size in this study was 49 patients.

Esophagoduodenoscopy was carried out by Olympus GIF H 170/190 Endoscope. Liver stiffness measurement was measured by FibroScan® 502 serial F00734 (Echosen, Paris, France) using M probe. Hemoglobin and platelet measuremet was analyzed by Sysmex XN 1500. International Normalized Ratio was analyzed by Stago Sta Compact. Blood Urea Nitrogen and AST was analyzed by Abbott alinity chemistry analyzer. Ascites examination was done by physical examination or Logiq S7 Expert Ultrasound.

The research was carried out after obtaining ethical approval from the Health Research Ethics Committee, Faculty of Medicine, Universitas Padjajaran and Dr. Hasan Sadikin Hospital Research Ethics Committee No. LB.02.01/X.6.5/122/2023. Data collection from medical records was carried out after the patient gave informed consent. Data collection was obtained from medical records of patients who were diagnosed with liver cirrhosis and met the inclusion criteria. Patients who met the exclusion criteria were excluded from the study. Patients who entered as research subjects had their medical records taken which included Hb, platelet count, INR, AST, BUN, ascites, LSM, and EGD data. Data in this study were analyzed statistically using SPSS version 25.0 and Analyse- It version 5.80.2.

The diagnostic test value of the EVendo score and Baveno VII criteria for predicting esophageal varices is assessed by measuring sensitivity, specificity, positive predictive value, negative predictive value, and positive and negative likelihood ratios. Hypothesis testing of diagnostic test performance from the Evendo score and Baveno VII criteria to predict esophageal varices using the McNemar-Mosteller exact test of equality with a value of $p < 0.05$ indicating the difference in sensitivity/specificity is not equal to 0 (not equal) while $p \geq 0.05$ indicates a difference sensitivity/specificity is equal to 0 (equal).

RESULTS

Research to determine the comparison of the EVendo score with the Baveno VII criteria in predicting esophageal varices in patients with liver cirrhosis at the dr. Hasan Sadikin Bandung General Hospital from April 2017 to May 2023 has been done. The research subject consisted of 178 patients. 106 patients who do not have full examinations data, one patient with hepatocellular carcinoma and 18 patients had ascites were excluded, so the total number of patients analysed was 53 patients.

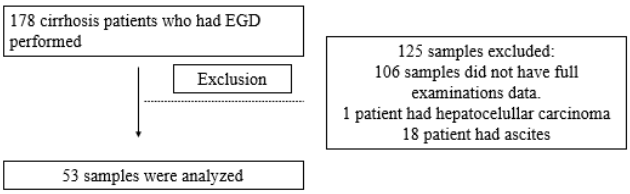

Figure 1. Flow of Research Sample Recruitment

BASIC CHARACTERISTICS

The basic characteristics of research subjects in patients with esophageal varices can be seen in **table 1**. In this study, there were 53 research subjects with an average age of 52.5 years. Most of the subjects of this research were men, 38 subjects (71.7%). Subjects with esophageal varices were 41 (77.36%) subjects while subjects without esophageal varices were 12 (22.64%) subjects. **Table 1** shows the significant characteristics between subjects with esophageal varices compared to subjects without esophageal varices, those are platelets and fulfill Baveno VII criteria. The average platelet value in the group of subjects with esophageal varices was 118000 x 10^3/mm3 which was significantly lower than subjects without esophageal varices 191500 x 10^3/mm3). Baveno VII criteria were fulfilled in 39 (95.12%) subjects with esophageal varices and 10 (75%) subjects without esophageal varices. The etiology of cirrhosis in the subjects of this study was as follows: hepatitis B virus (HBV) in 35 (64.8%) subjects, hepatitis C virus (HCV) in 13 (24.1%) subjects, non-alcoholic fatty liver disease (NAFLD) in 4 (7.4%) subjects, and auto immune hepatitis in 1 (1.9%) subjects.

COMPARISON OF THE PERFORMANCE OF THE EVENDO SCORE WITH THE BAVENO VII CRITERIA IN PREDICTING ESOPHAGEAL VARICES

Table 2 shows that the EVendo score has high sensitivity in predicting esophageal varices, which is 80.5%, but low specificity 50%. The EVendo score has a high positive predictive value, which is 84.6%, but a low negative predictive value 42.9%. The positive likelihood ratio value of the EVendo score is 1.61 and the negative likelihood ratio is 0.39.

Table 1. Characteristics of Cirrhosis Patients Undergoing Esophagoduodenoscopy

Characteristic	Esophageal varices		p value
	Present n=41 (77.36%)	Not present n=12 (22.64%)	
Age (year), mean (SD)	51.61 ±12.01	55.58 ±11.77	0.32
Gender			
Male, n (%)	31 (75.6%)	7 (58.3%)	0.24
Female, n (%)	10 (24.4%)	5 (41.7%)	
AST (U/L), median (IQR)	39 (29.50-66)	40.50 (25.25-52)	0.87
Hb (mg/dl), mean (SD)	10.28±3.78	12.46 ±1.85	0.06
Platelets (103/mm^3), median (IQR)	118000 (84000-258750)	191500 (105250-258750)	0.02*
INR, median (IQR)	1.14 (1.06-1.24)	1.08(0.99-1.46)	0.91
BUN (mmo/L), median (IQR)	12.1 (9.1-21,9)	9.4 (7.3-13)	0.06
LSM (kPA), median (IQR)	26 (15.75-29.15)	22.3 (14.9-36.65)	0.47
EVendo score, mean (SD)	5.52 ±2.42	5.05 ±2.49	0.53
Fulfill Baveno VII criteria (%)	39 (95.12%)	10 (75%)	0.04*

AST: Aspartate Aminotransferase, BUN: Blood Urea Nitrogen, Hb: Hemoglobin, INR: International Normalized Ratio, IQR: Interquartile Range, LSM: Liver Stiffness Measurement, SD: Standard Deviaton

Table 2. Diagnostic Test for EVendo Score in Esophageal Varices Prediction

	Esophageal varices		Diagnostic Test Characteristic	EVendo score
	Present	Not present	Sensitivity (CI 95%)	80.5% (65.1%-91.2%)
			Specificity (CI 95%)	50% (21.1%-78.9%)
EVendo score > 3.9	33	6	Positive predictive value (CI 95%)	84.6% (75.4%-90.8%)
			Negative predictive value (CI 95%)	42.9% (24.4%-63.5%)
EVendo score ≤ 3.9	8	6	Positive Likelihood Ratio (CI 95%)	1.61 (0.8-2.9)
			Negative Likelihood Ratio (CI 95%)	0.39 (0.17-0.9)
			Accuracy (CI 95%)	73,6% (59.7%-84.7%)

Table 3. Diagnostic Test for Baveno VII Criteria in Esophageal Varices Prediction

	Esophageal varices		Diagnostic Test Characteristic	Baveno VII criteria
	Present	Not present	Sensitivity (CI 95%)	95.1% (83.5%-99.4%)
			Specificity (CI 95%)	25% (5.5%-57.2%)
Fulfil Baveno VII criteria	39	9	Positive predictive value (CI 95%)	81.2% (75.6%-85.8%)
			Negative predictive value (CI 95%)	60% (22%-88.8%)
Not fulfil Baveno VII criteria	2	3	Positive Likelihood Ratio (CI 95%)	1.27 (0.91-1.77)
			Negative Likelihood Ratio (CI 95%)	0.2 (0.04-1.04)
			Accuracy (CI 95%)	79.2% (65.9%-89.1%)

Table 3 shows that Baveno VII criteria has high sensitivity in predicting esophageal varices, which is 95.1%, but low specificity 25%. The Baveno VII criteria has a high positive predictive value, which is 81.2%, but a low negative predictive value 60%. The positive likelihood ratio value of the Baveno VII criteria is 1.27 and the negative likelihood ratio is 0.2

The diagnostic accuracy of these two diagnostic tools is quite high, where the Evendo score accuracy is 73.6% and the Baveno VII criteria is 79.2. Analysis of equality for the sensitivity and specificity of the EVendo score compared to the Baveno VII criteria for predicting esophageal varices using the McNemar-Mosteller exact test with a value of $p = 0.014$ for sensitivity and a value of $p = 0.179$ for specificity. These results shows that the specifity of the EVendo score and the Baveno VII criteria are equal but the sensitivity are not equal.

DISCUSSION

The main outcome of this study is a comparison of the performance of the EVendo score with the Baveno VII criteria in predicting esophageal varices. The EVendo score has a sensitivity of 80.5% and a specificity of 50% while the Baveno VII criteria has a sensitivity of 95.1%, a specificity of 25%. The results of the analysis of both tests with McNemar-Mosteller exact test show that that the specifity of the EVendo score and the Baveno VII criteria are equal but the sensitivity are not equal. In research conducted by Alswat et al., an EVendo score ≤3.90 can identify cirrhosis patients without esophageal varices with a sensitivity of 82% and a specificity of 57%. [9] The results of this study are quite different from the research conducted by Alswat al. because the sample in this study were fewer patients without esophageal varices and there was no exclusion of samples with a previous history of gastrointestinal bleeding.

Another study that was conducted by Jan et al. in a Pakistani population with newly diagnosed cirrhosis shows that the EVendo score has a diagnostic accuracy of 86.76% in predicting esophageal varices higher than Aspartate Transaminase to Platelet Ratio (APRI) and Platelet count to Splenic Diameter.[10] According to a different study by Chittajallu et al., in a cohort of patients with hepatocelullar carcinoma, the EVendo score accurately predicted varices needing treatment with 100% NPV.[11] In a study by Farkas et al., it was demonstrated that an EVendo score of 3.90 or above showed 100% sensitivity, 15.8% specificity, 34.7% positive predictive value, and 100% negative predictive value.[12]

The variables in EVendo score that are strongly related to elevated portal pressure and fibrosis were those that were most predictive in the random forest classifier.[6] When the hepatic venous pressure gradientt (HVPG) is > 10 mm Hg, it is known to frequently lead to lower platelet counts and ascites.[13] An increased INR and AST have been linked to deteriorating liver function and fibrosis in previous models.[14, 15] A lower BUN could indicate decreased hepatic urea synthesis brought on by progressive fibrosis, while a lower hemoglobin could be indicative of subclinical bleeding from portal gastropathy.[6]

In this study, EVendo score has high sensitivity but low specificity in predicting esophageal varices so that in health care centers that do not yet have transient elastography, EVendo score can be used as an initial esophageal varices screening tool so further screening can be carried out with EGD. This research has several limitations that can affect the research results. Limitations in this research include: (1) The sample in this study included patients with a previous history of gastrointestinal bleeding, so this would increase the number of samples who had esophageal varices; (2) The samples in this study were not stratified based on the severity of hepatic cirrhosis with Child Pugh scores so that the number of samples with compensated and decompensated cirrhosis was uneven. (3). This research is limited to one hospital (single center) with a limited number of patients.

We suggest that: (1) Further research was carried out on Child Pugh A cirrhosis patients without a previous history of upper digestive tract bleeding so that they could assess the performance of the EVendo score and Baveno VII criteria for detecting esophageal varices in liver cirrhosis patients from the time the disease was discovered. (2). Research can be carried out with a larger number of samples and from various hospitals (multi centers) so can obtain samples with various etiologies of cirrhosis. (3) Further research can be carried out to assess the performance of the EVendo score in patients with upper gastrointestinal bleeding in the emergency department to differentiate whether there is variceal or non-variceal bleeding before upper gastrointestinal endoscopy is performed so that initial pharmacological management can be done accordingly.

EVendo score can be used as an initial non-invasive examination tool to predict the presence of esophageal varices in cirrhosis patients in hospitals who do not have liver stiffness measurement tools. An Evendo score > 3.9 can predict esophageal varices so that screening with EGD can be carried out and primary prophylaxis is given to prevent variceal bleeding.

CONCLUSION

The results of this study show that the EVendo score and Baveno VII criteria have high sensitiviy but low specificity for predicting esophageal varices in patients with liver cirrhosis.

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