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Original Article

The bedside ABP criteria in comparison to Baveno VI criteria for esophageal varices screening in chronic hepatitis C patients

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Abstract: Objectives: Esophageal variceal (EVs) bleeding is common and preventable by screening endoscopy, which is diagnostic and therapeutic but invasive and costly. We aimed to compare albumin, bilirubin, platelet (ABP) criteria to Baveno VI criteria as noninvasive screening tools for EVs. **Methods:** A total of 661 patients were retrospectively evaluated. ABP parameters were defined as bilirubin ≥22 µmol/L, albumin ≤4 mg/dL, and platelets ≤114 ×10⁹/L. The Baveno VI criteria for positive EVs included Fibroscan ≥20 kPa and platelets ≤150 ×10⁹/L.
Results: Median age was 45 years. EVs were detected in 30.7% of patients. The Baveno VI criteria were fulfilled in 93.6% of EVs cases. Patients with EVs had a higher frequency of bilirubin ≥22 µmol/L, albumin ≤4 mg/dL, and platelets ≤114 ×10⁹/L than those without EVs. About 78.8% of EVs patients met ≥2 ABP parameters, while 77.3% of non-EVs patients met <2. Both criteria showed significant AUROC (p=0.001), higher with Baveno VI (0.871 vs. 0.833). Fulfilling both Baveno VI criteria had 93.6% sensitivity and 77.07% specificity. Meeting ≥2 ABP parameters showed 78.82% sensitivity and 77.29% specificity. Fulfillment of all 3 ABP criteria had 57.75% sensitivity and 67.42% specificity for large varices. Conclusion: The ABP criteria are a promising, simple, noninvasive bedside screening tool for EVs, especially when ≥2 parameters are met. Both Baveno VI and ABP criteria offer comparable, non-invasive alternatives for EVs screening

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Introduction

Portal hypertension (PH) is a frequent complication of liver cirrhosis. Portal hypertension may be complicated with esophageal varices (EVs) formation, ascites, hepatic encephalopathy, hepatopulmonary syndrome, and portopulmonary hypertension. PH is a result of splanchnic vasodilatation and increased intrahepatic resistance owing to mechanical fibrosis and increased vasoconstrictors .[1, 2]

EVs are the most common gastrointestinal varices. Then begin as a small one that enlarges over time especially if the etiology is not treated or the liver condition deteriorates. The most common complication is variceal bleeding, that is a serious event in patients with cirrhosis and is associated with high mortality and liver decompensation.[3, 4]

The American Association for the Study of Liver Diseases (AASLD) .[5], European Association for the Study of the Liver (EASL). [6] guidelines and Baveno VI criteria.[7] recommend screening for EVs using esophagogastroduodenoscopy (EGD), especially if the liver stiffness ≥20 kPa and the platelet count <150,000/mm^3. Liver stiffness measurement reflects the degree of liver fibrosis and hence cirrhosis. It can be measured noninvasively using Fibroscan which is a measurement of transient elastography. It is simple quick bedside maneuver that predicts the degree of fibrosis, need for screening endoscopy, and predicts impending decompensation or hepatocellular carcinoma. Unfortunately, Fibroscan is not available in all hospitals.[8]

Recently Kew and colleagues.[9] proposed new simple criteria based on routine investigations and can be done bedside. We aimed to compare the albumin, bilirubin, platelet (ABP) criteria to Baveno VI criteria for noninvasive screening of EVs.

Patients And Methods

This is a retrospective study (n=661) that was conducted at the National Liver Institute hospitals, Menoufia University and Faculty of Medicine, internal medicine department, Sohag University. All included patients had F4 fibrosis (≥12.5 kPa) by Fibroscan.[10, 11] This study was approved by the medical research ethics committee of the faculty of medicine, Sohag University (registration number: SOH-MED-15-10-6PD)

All patients had chronic hepatitis C as etiology of liver fibrosis/cirrhosis. Patients with other etiology, complicated with ascites, portal vein thrombosis or hepatocellular carcinoma, were excluded.

A full clinical examination and routine investigations were done. All patients underwent liver stiffness measurement using Fibroscan.[12] EGD was done to screen for EVs. EVs were discriminated into small and large varices.[13]

Criteria suggestive of EVs existence*:*

Baveno VI criteria.[7]: liver stiffness ≥20 kPa and the platelet count <150,000/mm^3.

The ABP criteria .[9]: serum bilirubin ≥22 μmol/L, serum albumin ≤4 mg/dL and platelets ≤114 ×10^9/L.

Statistical Analysis

ta were statistically analyzed using IBM® SPSS® Statistics® version 21 for Windows (IBM Corporation, North Castle Drive, Armonk, New York, USA). All p-values are 2 tailed, with values <0.05 considered statistically significant. Data without normal distribution were analyzed using Mann-Whitney test. CHI-squared test (χ^2) was used for categorical variables analysis. The receiver operating characteristic (ROC) curve analysis was used for detection of the cutoff value of the proposed tests. An AUROC value of 0.90-1.0 indicated excellent, 0.80-0.89 good, 0.70-0.79 fair, 0.60-0.69 poor and 0.50-0.59 no useful performance for discrimination of the outcome under assessment. Comparison of the area under the ROC was done using DeLong method.

Results:

Patients who are having EVs (**Table 1**)

Table 1: Comparison of patients with and without esophageal varices.

		Varices		Total (661)	
		None	EVs		
		458 (69.3%)	203 (30.7%)		
		N (%)	N (%)	N (%)	
Age years	Med (IQR)	40 (17)	51 (9)	45 (16)	0.001
Sex	Female	131 (28.6%)	65 (32%)	196 (29.7%)	0.375
	Male	327 (71.4%)	138 (68%)	465 (70.3%)	
FibroScan kPa	<20	319 (69.7%)	1 (0.5%)	320 (48.4%)	0.001
	≥20	139 (30.3%)	202 (99.5%)	341 (51.6%)	
Platelets (10^9/L)	>150	308 (67.2%)	13 (6.4%)	321 (48.6%)	0.001
	≤150	150 (32.8%)	190 (93.6%)	340 (51.4%)	
Baveno IV	0 parameter	276 (60.3%)	1 (0.5%)	277 (41.9%)	0.001
	1 parameter	77 (16.8%)	12 (5.9%)	89 (13.5%)	
	2 parameters	105 (22.9%)	190 (93.6%)	295 (44.6%)	
Baveno IV	<2 parameters	353 (77.1%)	13 (6.4%)	366 (55.4%)	0.001
	2 parameters	105 (22.9%)	190 (93.6%)	295 (44.6%)	
Bilirubin µmol/L	<22	369 (80.6%)	88 (43.3%)	457 (69.1%)	0.001
	≥22	89 (19.4%)	115 (56.7%)	204 (30.9%)	
Albumin (mg/dL)	>4	284 (62%)	28 (13.8%)	312 (47.2%)	0.001
	≤4	174 (38%)	175 (86.2%)	349 (52.8%)	
Platelets (10^9/L)	>114	374 (81.7%)	54 (26.6%)	428 (64.8%)	0.001
	≤114	84 (18.3%)	149 (73.4%)	233 (35.2%)	
ABP Criteria	0 parameter	259 (56.6%)	8 (3.9%)	267 (40.4%)	0.001
	1 parameter	95 (20.7%)	35 (17.2%)	130 (19.7%)	
	2 parameters	58 (12.7%)	76 (37.4%)	134 (20.3%)	
	3 parameters	46 (10%)	84 (41.4%)	130 (19.7%)	
ABP Criteria	<2 parameters	354 (77.3%)	43 (21.2%)	397 (60.1%)	0.001
	≥2 parameters	104 (22.7%)	160 (78.8%)	264 (39.9%)	

, had statistically significant (p=0.001) higher percentage of having transient elastography ≥20kPa, platelets ≤150 $\times 10^9$/L and fulfilling the 2 criteria of Baveno VI criteria (93.6%). Moreover, they had also statistically significant (p=0.001) higher percentage of serum bilirubin ≥22 µmol/L, serum albumin ≤4 mg/dL and platelets ≤114 $\times 10^9$/L.

Fulfillment of 3 parameters of the ABP criteria was found in 41.4% of EVs patients and 37.4% fulfilled 2 parameters. So collectively 78.8% of esophageal varices patients fulfilled ≥2 parameters of the ABP criteria and 77.3% of patients without esophageal varices achieved <2 parameters.

The Baveno VI criteria did not discriminate the size of the EVs (**Table 2**).

Table 2:Comparison of Baveno IV and ABP criteria in patients with esophageal varices.

		Varices Size		Total	
		Small	Large		
		N (%)	N (%)	N (%)	P value
Sex	Female	45 (34.1%)	20 (28.2%)	65 (32%)	0.388
	Male	87 (65.9%)	51 (71.8%)	138 (68%)	
Baveno IV	0 parameter	1 (0.8%)	0 (0.0%)	1 (0.5%)	0.677
	1 parameter	7 (5.3%)	5 (7.0%)	12 (5.9%)	
	2 parameters	124 (93.9%)	66 (93.0%)	190 (93.6%)	
ABP Criteria	0 parameter	8 (6.1%)	0 (0%)	8 (3.9%)	0.001
	1 parameter	30 (22.7%)	5 (7%)	35 (17.2%)	
	2 parameters	51 (38.6%)	25 (35.2%)	76 (37.4%)	
	3 parameters	43 (32.6%)	41 (57.7%)	84 (41.4%)	

On the contrast, patients with large varices fulfilled 2 parameters (35.2%) and 3 parameters (57.7%) of the ABP criteria (p=0.001).

As demonstrated in **Table 3**,

Table 3: Receiver operating characteristic (ROC) curve analysis of Baveno IV and ABP criteria in patients with and without esophageal varices and small versus large varices

Esophageal varices									
	Cutoff	AUR	95% CI	Sen	Sp	PPV	NPV	P value	P#
ABP criteria	≥2	0.833	0.80 - 0.86	78.82	77.29	60.6	89.2	0.001	0.003
Baveno VI	2	0.871	0.84 - 0.89	93.6	77.07	64.4	96.4	0.001	
Large varices									
	Cutoff	AUR	95% CI	Sen	Sp	PPV	NPV	P value	P#
ABP criteria	3	0.665	0.59 - 0.73	57.75	67.42	48.8	74.8	0.001	
Baveno VI		0.505	0.43 - 0.57					0.801	

AUC, area under receiver operating characteristic curve; CI, confidence interval; Sen, Sensitivity; Sp, Specificity; PPV, positive predictive value; NPV; negative predictive value; P#, DeLong.

both the Baveno VI criteria and ABP criteria had statistically significant (p=0.001) good area under the receiver operating characteristic curve, 0.871 (0.84 - 0.89) and 0.833 (0.80 - 0.86) respectively.

Fulfilling the 2 criteria of the Baveno VI had 93.6% sensitivity and 77.07% specificity for the presence of EVs **(FIGURE 1)**. Fulfilling the ≥2 criteria (2-3) of the ABP criteria had 78.82% sensitivity and 77.29% specificity for the presence of EVs **(FIGURE 1**).On comparison of the two criteria using the DeLong method; Baveno VI criteria had statistically significant (p=0.003) higher area under the receiver operating characteristic curve (0.871 vs. 0.833).

For discrimination of large varices, Baveno VI criteria were not significantly associated with presence of large sized varices (p=0.801). The ABP criteria had statistically significant (p=0.001) area under the receiver operating characteristic curve. The fulfillment of the 3 parameters had 57.75% sensitivity and 67.42% specificity for the presence of large varices.

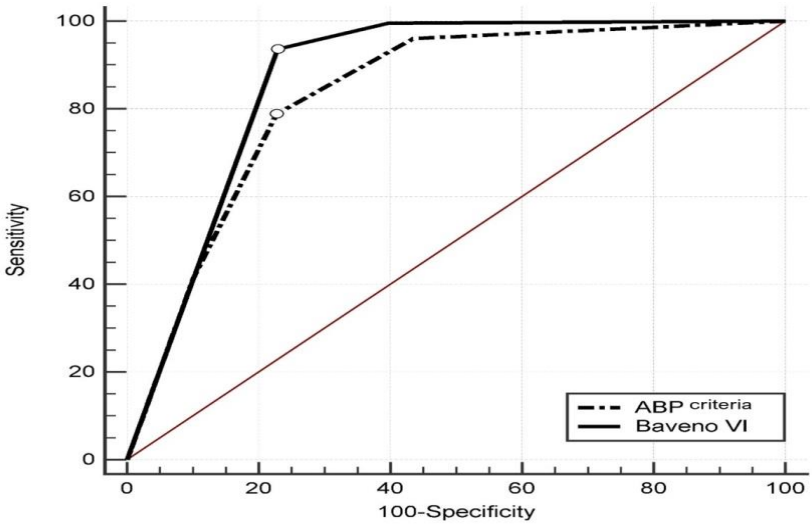

Figure 1: receiver operating characteristic (ROC) curve analysis of Baveno VI criteria and ABP criteria in patients with and without esophageal varices.

Discussion

Esophageal variceal bleeding is a dangerous complication of PH that is associated with increased mortality. Primary prevention of bleeding can be done by screening for EVs and then variceal eradication endoscopically or at least giving nonselective beta blockers [2, 4]

EGD is the gold standard for EVs detection and eradication by band ligation or sclerotherapy. [2]The drawbacks that are being invasive, costly, bothersome and the risk of complications increases with using conscious sedation .[14]

Moreover, many patients had negative yield and no varices could be detected. [2]

To avoid unnecessary endoscopy, clinical, laboratory and radiological data that are suggestive of PH will guide the hepatologist to request endoscopy. In the past, splenomegaly, thrombocytopenia <150,000/mm^3 or platelet

count/spleen diameter mm ratio <909 were predictive for the presence of EVs.[15]

The radiological presence of cirrhosis, dilated portal vein, splenic vein and splenomegaly are suggestive for EVs presence. The advent of transient elastography (liver stiffness) measurement was a breakthrough. High value of liver stiffness is more associated with EVs presence.[16]

The Baveno VI criteria [7] reported that if liver stiffness <20 kPa and the platelet count >150,000/mm^3, there is very low probability of having high-risk varices, and so no need of endoscopy. The Baveno VI criteria are adopted in many centers. Recently spleen stiffness measurement and new formula for liver status as the ALBI and PALPI criteria were studied.[1]

Spleen stiffness measurement (FibroSpleen) is also promising.[17, 18]

The liver stiffness measurement using Fibroscan is a simple noninvasive bedside diagnostic test of liver fibrosis and represent wider examined area than liver biopsy.[12, 19]On the other hand, many hospitals do not have the machine, the machine is expensive and need frequent calibration and maintenance.[19]

Recently Kew and colleagues [9] proposed a new simple criteria based routine investigations and can be done bedside. The multivariate analysis found that serum albumin, bilirubin and platelets are predictive of varices. The serum bilirubin ≥22 µmol/L, serum albumin ≤4 mg/dL and platelets ≤114 $\times 10^9$/L are predictive of esophageal varices. Kew and colleagues did not report how many parameters of the three ones should be positive.

In our study, we validated the Kew et al ABP criteria.[9], compared it to Baveno VI criteria and computed how many parameters should be positive.

Almost patients with EVs (93.6%) fulfilled the 2 criteria of Baveno VI criteria for varices presence. They had also higher percentage of having serum bilirubin ≥22 µmol/L, serum albumin ≤4 mg/dL and platelets ≤114 $\times 10^9$/L.

Fulfillment of 3 parameters of the ABP criteria was found in 41.4% of EVs patients and 37.4% fulfilled 2 parameters. About 77.3% of patients without EVs achieved <2 parameters.

Fulfilling the 2 criteria of the Baveno VI had 93.6% sensitivity and 77.07% specificity for the presence of EVs. Fulfilling the ≥2 criteria (2-3) of the ABP criteria had 78.82% sensitivity and 77.29% specificity for the presence of EVs. Baveno VI criteria had higher AUROC than ABP criteria.

Baveno VI criteria could not discriminate the size of varices but achieving the 3 ABP criteria parameters is more associated with large varices although the AUROC was not significant for discrimination performance.

Conclusion:

The ABP criteria are a promising simple noninvasive bedside screening test for esophageal varices especially when achieving ≥2 ABP parameters. Baveno VI criteria and ABP criteria are a comparable alternative for esophageal varices screening.

Ethics Declarations

Ethics approval and consent to participate

- A written informed consent was obtained from all participants.

Consent for publication

- Informed consent to publish patient's data was signed by all participants prior to the beginning of the research.

Competing interest

- The authors declare no competing interests.

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