

Is Doppler Ultrasonography Useful in Assessing Risk of Variceal Bleeding?

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Background/Aims: Prediction of variceal bleeding has been based on the large variceal size and the red color sign observed during endoscopy. By comparing the characteristic hemodynamic features of Doppler ultrasonography between liver cirrhosis patients with and without variceal bleeding, we aimed to evaluate the usefulness of Doppler ultrasonography in assessing the risk of variceal bleeding. **Methods:** One hundred patients with liver cirrhosis were divided into two groups: variceal bleeding group and non-variceal bleeding group. The diameter, mean velocity, and blood flow volume of the portal vein and splenic vein were measured in patients with and without variceal bleeding. The resistive index and pulsatility index of splenic artery, which have been known to reflect portal hypertension, were also measured in both groups. **Results:** In univariate analysis, we found that the values of the diameter and blood flow volume of the portal vein, and the diameter, mean velocity and blood flow volume of the splenic vein, and the size of spleen were significantly increased in the group with variceal bleeding. However, multivariate analysis (multiple logistic regression analysis) showed no significant independent value for the group with variceal bleeding. **Conclusions:** There is no single hemodynamic characteristic on Doppler ultrasonography which can assess the risk of variceal bleeding in patients with liver cirrhosis. It is likely that variceal bleeding is affected not by a single hemodynamic factor but by complex hemodynamic features of the portal system. (**Kor J Gastroenterol 2000;36:515 - 521**)

Key Words: Liver cirrhosis, Variceal bleeding, Portal hypertension, Doppler ultrasonography

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1 70%가 , 30% 1. .12 1998 2 1998 9 .34 가 가 100 , 46 A , 가 가 54 B .56 51.6 ± 11.1 , B , C , 가 가 (Table 1). .79 가 가 2. 가 Aloka SSD-1700

Table 1. Clinical Characteristics of the Study Subjects

Characteristics	A Group (n=46)	B Group (n=54)
Age (year)	50.5 ± 10.5	52.5 ± 11.6
Sex (M:F)	41:5	44:10
Etiology of cirrhosis		
Alcohol	67.4% (31/46)	53.7% (29/54)
HBV or HCV	19.6% (9/46)	33.3% (18/54)
Combined	10.9% (5/46)	9.3% (5/54)
Others	2.2% (1/46)	3.7% (2/54)
Child class		
A	30.4% (14/46)	25.9% (14/54)
B	41.3% (19/46)	37.0% (20/54)
C	28.3% (13/46)	37.0% (20/54)
Varix on endoscopy*	100% (46/46)	83% (45/54)
Esophageal	87% (40/46)	72% (39/54)
Fundal	2.2% (1/46)	0% (0/54)
Both	10.9% (5/46)	11.1% (6/54)
Variceal bleeding history	+	-

HBV, hepatitis B virus; HCV, hepatitis C virus.

* P<0.01

가 sample volume

5 ,

3 [Cross section area (cm²)= π (radius/2)²

1) [Blood flow volume (ml/min)=cross section area \times mean velocity \times 60] (Fig. 1A).

2)

Fig. 1. Measurement of portal and splenic venous flow. Doppler ultrasonography shows that portal venous velocity is 14.7 cm/s and flow is calculated as 560.8 ml/min in a patient without variceal bleeding (A), and splenic venous velocity is 38.2 cm/s and flow is calculated as 1799.2 ml/min in a patient with variceal bleeding (B).

(Fig. 1B). (time velocity wave) .
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(resistive index:
peak systolic velocity-minimum diastolic velocity/
3) peak systolic velocity) (pulsatility index:
peak systolic velocity-minimum diastolic velocity/
mean velocity) (Fig. 2).
sample volume



Fig. 2. Measurement of splenic arterial resistance. Doppler ultrasonography shows that splenic resistance index and pulsatility index are each 0.788, 1.650 in a patient with variceal bleeding (A), higher than those of 0.674, 1.136 in a patient without variceal bleeding (B).

Table 2. Comparison of Doppler Ultrasonographic Values between Groups with or without Bleeding

Variables		A Group	B Group	p-value
Portal vein	Diameter (cm)	1.11 ± 0.27	0.99 ± 0.19	0.020
	Mean velocity (cm/sec)	12.29 ± 4.38	12.49 ± 3.77	0.825
	Volume flow rate (ml/min)	780.28 ± 532.66	582.19 ± 261.11	0.042
Splenic vein	Diameter (cm)	0.80 ± 0.36	0.58 ± 0.27	0.002
	Mean velocity (cm/sec)	18.05 ± 7.35	13.94 ± 6.62	0.010
	Volume flow rate (ml/min)	657.39 ± 641.28	306.70 ± 386.83	0.004
Splenic artery	Resistive index	0.68 ± 0.01	0.66 ± 0.01	0.168
	Pulsatility index	1.17 ± 0.21	1.13 ± 0.26	0.451
Spleen size (cm)		14.88 ± 2.97	12.70 ± 2.09	0.000
Variceal bleeding history		+	-	

Table 3. Results of Multivariate Analysis of Selected Variables for Variceal Bleeding

Variables	B	S.E.	Significance
Portal vein diameter	-1.394	2.191	0.525
Portal vein flow	0.001	0.001	0.278
Splenic vein diameter	-2.614	3.607	0.469
Splenic vein velocity	0.005	0.071	0.946
Splenic vein flow	0.004	0.003	0.269
Spleen size	0.180	0.186	0.332

B, regression coefficient.

4) mean ± S.D. , 2. ml/min 가 . 가 .

A B Student's t-test A B 0.80 ± 0.36 cm, 0.58 ± 0.27 cm A

(multiple logistic regression analysis) A 18.05 ± 7.35 cm/sec B 13.94 ± 6.62 cm/sec A SPSS ver 7.5 . 657.39 ± 641.28 ml/min B 306.70 ± 386.83 ml/min 가 A 1. B 14.88 ± 2.97, 12.70 ± 2.09 A

1. A 3. 1.11 ± 0.27 cm B 0.99 ± 0.19 cm A B 780.28 ± 532.66 ml/min B 582.19 ± 261.11 0.68 ± 0.01, 0.66 ± 0.01 A B

0.26 (Table 2). 1.17 ± 0.21, 1.13 ± .14 가

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(Table 3).

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1. Graham DY, Smith JL. The course of patients after variceal hemorrhage. *Gastroenterology* 1981;80:800-809.
2. Grace ND, Bhattacharya K. Pharmacologic therapy of portal hypertension and variceal hemorrhage. In: Gitlin N, ed. *Clinics in liver disease*. Volume 1:1, Philadelphia: WB Saunders, 1997:59-75.
3. Lay CS, Tsai YT, Teg CY, et al. Endoscopic variceal ligation in prophylaxis of first variceal bleeding in cirrhotic patients with high-risk esophageal varices. *Hepatology* 1997;25:1346-1350.

4. Sarin SK, Guptan RK, Jain AK, Sundaram KR. A randomized controlled trial of endoscopic variceal band ligation for primary prophylaxis of variceal bleeding. *Eur J Gastroenterol Hepatol* 1996;8:337-342.
5. Beppu K, Inokuchi K, Koyanagi N, et al. Prediction of variceal hemorrhage by esophageal endoscopy. *Gastrointest Endosc* 1981;27:213-218.
6. Lebec D, Fleury PD, Rueff B, Nahum H, Benhamou JP. Portal hypertension, size of esophageal varices, and risk of gastrointestinal bleeding in alcoholic cirrhosis. *Gastroenterology* 1980;79:1139-1144.
7. Patriquin H, Lafortune M, Burns PN, Dauzat M. Duplex doppler examination in portal hypertension: technique and anatomy. *AJR* 1987;149:71-76.
8. , , , , , . Metoclopramide : . 1994;13:81-85.
9. , , , , , . (Pulsatility Index) . 2000;19:71-76.
10. Medhat A, Iber FL, Dunne M, Baum R. Ultrasonographic findings with bleeding and nonbleeding esophageal varices. *Am J Gastroenterol* 1988;83:58-63.
11. Nelson RC, Sherbourne GM, Spencer HB, Chezmar JL. Splenic venous flow exceeding portal venous flow at doppler sonography: relationship to portosystemic varices. *AJR* 1993;161:563-567.
12. Schmassmann A, Zuber M, Livers M, Jäger K, Jenzer HR, Fehr HF. Recurrent bleeding after variceal hemorrhage: predictive value of portal venous duplex sonography. *AJR* 1993;160:41-47.
13. , , , . 2000;35:466-474.
14. Bolognesi M, Sacerdoti D, Merkel C, et al. Splenic doppler impedance indices: influence of different portal hemodynamic conditions. *Hepatology* 1996; 23:1035-1040.