

Doppler Evaluation of Esophageal Variceal Bleeding in Patients with Cirrhosis

Gyong-Hui Ri^{*}, Hak-Chol Ju, Gyang-Il Kim, Un-Gyong Ri, Un-Hua Ri

Pyongyang Medical College, Kim Il Sung University, Pyongyang, Democratic People's Republic of Korea

Email address:

ryongnam20@yahoo.com (Gyong-Hui Ri)

*Corresponding author

To cite this article:

Gyong-Hui Ri, Hak-Chol Ju, Gyang-Il Kim, Un-Gyong Ri, Un-Hua Ri. Doppler Evaluation of Esophageal Variceal Bleeding in Patients with Cirrhosis. *International Journal of Gastroenterology*. Vol. 1, No. 1, 2017, pp. 5-8. doi: 10.11648/j.ijg.20170101.15

Received: February 1, 2017; **Accepted:** March 30, 2017; **Published:** May 3, 2017

Abstract: Esophageal Varices develops by the changes in portal hemodynamics. So, characterizing both the qualitative and quantitative changes in hemodynamics in the portal system is important in patients with Esophageal Variceal Bleeding caused by liver cirrhosis. We undertook this study to investigate the discriminant for estimate of esophageal variceal bleeding by significant Doppler parameters. The purpose of our study was to evaluate the significant Doppler parameters in patients with cirrhosis and to make a discriminant for estimate of esophageal variceal bleeding, and to predict the dangers of bleeding. Significant differences were found in main portal vein diameter (MPVD), MPV velocity max (MPV Vmax), blood flow rate of MPV and spleen vein, MPV congestion index (MPVCI), Right Portal Vein Vmax (RPVVmax), reflux of MPV, flat pattern of MPV between control group, none of varices group, EVB positive group and EVB negative group. MPVD, MPVVmax in EVB(+) group were significantly higher than in EVB(-) group ($P < 0.01$). Any significant differences were not found in SV:MPV blood flow ratio between control group and no varices group. Significant differences were found in MPVCI, RPVVmax between no varices group and EVB(-) group, EVB(+) group and EVB(+) group. MPVCI in EVB(+) group were higher than the EVB(-) group ($p < 0.05$) and RPVVmax in EVB(+) group were lower than EVB(-) group. We had found the significant color and impulse Doppler parameters to evaluate the esophageal varices and predicted danger of esophageal variceal bleeding by discriminant. In the patient with portal hypertension caused by cirrhosis significant Doppler parameters for evaluation of esophageal varices were MPVD, MPVVmax, CI, SV/MPV, RPVVmax, reflux of MPV, flat pattern of EVB. We made discriminant by 7 parameters and predicted dangers of EVB. Reliability of discriminant was 90% and 91.2% respectively in EVB positive group, EVB negative group.

Keywords: Esophageal Variceal Bleeding, Doppler Evaluation, Portal Hemodynamics

1. Introduction

Cirrhotic portal hypertension has got complex course, from beginning of Esophageal Varices and one of the reason of death is Esophageal Variceal Bleeding. Esophageal Varices develops by the changes in portal hemodynamics [14, 15].

So, characterizing both the qualitative and quantitative changes in hemodynamics in the portal system is important in patients with Esophageal Variceal Bleeding caused by liver cirrhosis. We undertook this study to investigate the discriminant for estimate of esophageal variceal bleeding by significant Doppler parameters. [15, 16].

2. Purpose

The purpose of our study was to evaluate the significant Doppler parameters in patients with cirrhosis and to make a discriminant for estimate of esophageal variceal bleeding, and to predict the dangers of bleeding.

3. Patients and Method

The study group included patients with cirrhosis diagnosed on the basis of clinical, biochemical, endoscopic and sonographic findings. All of the patients had undergone liver biopsy, and the diagnosis had been verified histopathologically.

A control group of healthy volunteers with no liver diseases was also included. Informed consent was obtained from all individual participants included in the study.

Sonographic Examinations. All patients were examined after an overnight fast. All sonographic examinations were performed using a HDI-5000 SONO-CT Doppler ultrasound scanner equipped with a 3.5MHz curved-array transducer. For Doppler examinations, the vessel to be evaluated was visualized along its longitudinal axis, and the sampling gate was placed at the center of the vessel, Keeping the angle to less than 60 [1-7, 12-15]. The diameter of the MPV was measured from 1cm proximal to the hilum in the extrahepatic portion; the diameter of the RPV and LPV branches, from

2cm distal to the bifurcation of the MPV; and the diameter of the SV, from 1cm proximal to the splenic hilum in the extrasplenic portion. For all diameter measurements, enlarged B-mode images were used, and diameters were measured from the inner anterior wall to the inner posterior wall. [15].

4. Results

107 patients (36 women and 71 men) with cirrhosis were enrolled, 50 healthy volunteers (20 women and 30 men) served as the control group. Patients were grouped according to formation of esophageal varices into F₀, F₁, F₂, F₃.

Table 1. Sex and age composition of patients with cirrhosis according to formation of esophageal varices.

Division	Number of cases	Male	Female	15-19	20-29	30-39	40-49	50-59	60-
F ₀	20	16	4	1	1	3	6	8	1
F ₁	28	20	8	0	3	8	9	6	2
F ₂	27	17	11	0	2	8	10	5	2
F ₃	32	18	13	0	2	5	15	7	3
Sum	107	71	36	1	8	24	40	26	8
Mary	(100.0)	(66.4)	(33.6)	(0.9)	(7.5)	(22.4)	(37.4)	(24.3)	(7.5)

(): %

Patients with esophageal varices were 20, the remnant were divided into esophageal variceal bleeding positive groups(EVB+) and esophageal variceal bleeding negative group(EVB-) by following level.

<EVB+>; history of esophageal variceal bleeding, Esophageal varices of F₂, F₃, and red color sign positive(RC+)

<EVB->; none of history of esophageal variceal bleeding, varices of F₁, F₂ and RC(-)

Table 1 shows sex and age composition of patients with cirrhosis according to formation of esophageal varices. The age ranges between 40 and 49 were 40(37.4%), were the most largest group.

Table 2 shows sex and age composition of significant check patients of esophageal variceal bleeding discriminant. The patients with esophageal varices of age range of 40-49 were the most biggest, 14 cases (31,1%).

Table 3 summarizes the various doppler parameters in patient groups and control groups. Significant differences were found in main portal vein diameter(MPDV), MPV velocity(max), blood flow rate of MPV and spleen vein, MPV congestion index(MPVCI), Right Potal Vein Vmax(RPVVmax), reflux of MPV, flat pattern of MPV between control group, none of varices group, EVB positive group and EVB negative group.

MPVD, MPVVmax in EVB(+) group were significantly higher than in EVB(-) group (P<0.01). Any significant differences were not found in SV:MPV blood flow ratio between control group and no varices group. Significant differences were found in MPVCI, RPVVmax between no varices group and EVB(-) group, EVB(+) group and EVB(+) group. MPVCI in EVB(+) group were higher than the EVB(-) group (p<0.05) and RPVVmax in EVB(+) group were lower than EVB(-) group.

There were not reflux of MPV and flat pattern in control group and no varices group. But reflux of MPV in EVB(+), EVB(-) group were 12.3%, 40.0%, flat pattern of MPV were 42.1%, 86.7% respectively. Using previous 7 parameters, we made a discriminant to estimate the Esophageal variceal bleeding.

$$Y=2.53X_1-0.36X_2-6.46X_3-85.96X_4+0.08X_5-3.3X_6-0.28X_7+18.38$$

$Y \geq 0$: none of dangers of esophageal variceal bleeding

$Y < 0$: dangers of esophageal variceal bleeding

X₁: MPVD, X₂: MPVVmax, X₃: BF SV/MPV

X₄: MPVCI, X₅: RPVVmax X₆: reflux of MPV

X₇: flat pattern of MPV

(Positive of reflux of MPV: X₆=1

(Negative of reflux of MPV: X₆=0

(Positive flat pattern of MPV X₇=1

(Negative flat pattern of MPV X₇=0

Table 4 shows reliability of discriminant by Doppler sonographic parameters.

Diagnosis rate of EVB positive group and EVB negative group were 90.0%, 91.2% respectively.

5. Discussion

Evaluating the splenic hemodynamic is very important in patients with cirrhosis.

The presense of extensive fibrosis and numerous regenerative nodules replacing the normal liver parenchyma is characteristic of cirrhosis. [8, 9, 10].

Two principal mechanisms –elevated vascular resistance, which is an initiating factor, and increased portal blood inflow, which plays an important role in maintaining a chronic portal hypertensive state-have been reported to be involved in the development of portal hypertension

secondary to cirrhosis. [4, 14, 15].

Portal blood flow changes are generally the result rather than the cause of hepatic dysfunction and structural changes. [5, 11, 13].

Various quantitative doppler parameters (portal flow velocity, blood flow rate, and CI) have been evaluated in the literature for diagnosing and grading the severity of cirrhosis. [8, 9, 10].

However, there was no case using the discriminant by these parameters.

So, we have made discriminant by these parameters to evaluate the danger of esophageal variceal bleeding rapidly

and clearly.

In Conclusion, We had found the significant color and impulse Doppler parameters to evaluate the esophageal varices and predicted danger of esophageal variceal bleeding by discriminant. In the patient with portal hypertension caused by cirrhosis significant Doppler parameters for evaluation of esophageal varices were MPVD, MPVVmax, CI, SV/MPV, RPVVmax, reflux of MPV, flat pattern of EVB. We made discriminant by 7 parameters and predicted dangers of EVB. Reliability of discriminant was 90% and 91.2% respectively in EVB positive group, EVB negative group.

Table 2. Sex and age composition of significant check patients of esophageal variceal bleeding discriminant.

e	Number of cases	male	Female	15-19	20-29	30-39	40-49	50-59	60
EVB (+)	14	9	5	0	0	4	6	3	1
EVB (-)	31	21	10	2	5	8	8	6	2
SUMMARY	45 (100.0)	30 (66.7)	15 (33.3)	2 (4.4)	5 (11.1)	12 (26.7)	14 (31.1)	9 (20.0)	3 (6.7)

()-%

Table 3. Predictable index of Esophageal Variceal Bleeding by Color and Impulse Doppler Ultrasonography.

e	Unit	Normal (n1=50)	With no varices (n2=20)	EVB(-) (n3=57)	EVB(+) (n4=30)
MPVD	Cm	1.01±0.01	1.18±0.04**1	1.36±0.03**2	1.52±0.03***3
MPV Vmax	cm/s	26.13±0.7	19.7±0.98***1	15.9±0.54**2	13.7±0.61**3
SV/MPV		0.49±0.03	0.54±0.06	0.78±0.05**2	1.12±0.07***3
MPVCI		0.03±0.001	0.06±0.007***1	0.09±0.006**2	0.15±0.001*3
RPV Vmax	cm/s	21.89±0.66	16.3±0.93**1	14.3±0.42*2	12.8±0.43**3
Reflux MPV		0	0	12.3()**2	40.0()**3
Flat pattern MPV		0	10.0()	42.1(**2)	86.7()**3

***1; p<0.001 **1; p<0.01 *1; p<0.05 (comparison normal with no variceal group)

**2; p<0.001 **2; p<0.01 *2; p<0.05 (comparison EVB(-)group with no variceal group)

***3; p<0.001 **3; p<0.01 *3; p<0.05 (comparison EVB(-) with EVB(+)) () ; %

Table 4. Reliability of discriminant by Doppler sonographic parameters.

Division	Number of cases	Correct diagnosis	Missed diagnosis
EVB(+)	30	27(90.0)	3(10.0)
EVB(-)	57	52(91.2)	5(8.8)

()-%

References

- [1] Cosar S. et al. Doppler and Gray—Scale Ultrasound Evaluation of Morphological and Hemodynamic Changes in Liver Vasculature in Alcoholic Patients, *Eur—J—Radiol* 54(3), 393~402, 2005.
- [2] Djenic S. S. et al.; Doppler Hemodynamic Study in Evaluation of Liver Metastases, *Acta—Chir—Iugosl* 54(2), 9~12, 2007.
- [3] Fabio Piscaglia et al.; Value of Splanchnic Doppler Ultrasound in the Diagnosis of Portal Hypertension, *Ultrasound in Med. & Biol.* 27(7), 893~899, 2001.
- [4] Hao. J. et al.; Hemodynamic Analysis of Esophageal Varices in Patients with Liver Cirrhosis using Color Doppler Ultrasound, *World—J—Gastroenterol* 11(29), 4560~4565, 2005.
- [5] Li X. et al.; A Randomized Controlled Study of Liqustrazine in Combination with Propranolol for Prevention of Recurrent Esophageal Varices Bleeding, *Zhonghua—Gan—Zang—Bing—Za—Zhi* 8(2), 99~101, 2000.
- [6] Li Z. X. et al.; Noninvasive Evaluation of Hepatic Fibrosis in Children with Infant Hepatitis Syndrome, *World—J—Gastroenterol* 12(44), 7155~7215, 2006.
- [7] Lopez Mendez E. et al.; Renal Hemodynamics and its Correlation with the Child—Pugh Stage in Cirrhotic Patients and Their Controls, *Rev—Gastroenterol—Mex* 71(3), 302~309, 2006.
- [8] Marineo G. et al.; Biophysics and Clinical Practice for Regenerative Processes in Cirrhosis of the Liver/of Liver Cirrhosis Assisted by Delta—S Entropy Variation Systems, *Minerva—Gastroenterol—Dietol* 52(4), 365~435, 2006.
- [9] Moon D. B. et al.; Application of Intraoperative Cine—Protogram to Detect Spontaneous Portosystemic Collaterals Missed by Intraoperative Doppler Exam in Adult Living Donor Liver Transplantation, *Liver—Transpl* 13(9), 1279~1363, 2007.
- [10] Orban Schiopu A. M. et al.; The effect of a Combined Treatment with Propranolol and Isosorbide—5—mononitrate on Doppler Ultrasound Parameters in Patients with Cirrhosis and Portal Hypertension, *Rom—J—Gastroenterol* 14(2), 123~130, 2005.
- [11] P. A. Mc. Cormick et al.; Improving Prognosis Following a First Variceal Haemorrhage Over Four Decades, *Gut An International Journal of Gastroenterology and Hepatology* 49(5), 5, 2001.

- [12] Panarace M. et al.; Transrectal Doppler Sonography for Evaluation of Uterine Blood Flow Throughout Pregnancy in 13 cows, *Theriogenology* 66(9), 2113~2122, 2006.
- [13] Peng Zhi Hai et al.; The application of prostaglandin E1 indirect portal vein angiography and color Doppler ultrasound in patients with post—devascularization portal hypertension, *Journal of Tongji medical university* 15(3), 154~157, 1995.
- [14] R. Robles et al.; Surgery for Esophageal Varix Bleeding in Cirrhotic Patients During the Era of Liver Transplants, *Transplantation Proceedings* 31(6), 2386~2387, 1999.
- [15] Ramazan Kutlu et al.; Quantitative Doppler Evaluation of the Splenoportal Venous System in Various Stages of Cirrhosis, *Journal of Clinical Ultrasound* 30(9), 537~543, 2002.
- [16] Wood MM, Romine LE, Lee YK, et al. Spectral Doppler signature waveforms in ultrasonography: a review of normal and abnormal waveforms. *Ultrasound Q* 2010; 26:83.