

Original Article

Clinical features and outcomes of gastric variceal bleeding: retrospective Korean multicenter data

Moon Young Kim^{1,25}, Soon Ho Um^{2,25*}, Soon Koo Baik^{1,25}, Yeon Seok Seo^{2,25}, Soo Young Park^{3,25}, Jung Il Lee^{4,25}, Jin Woo Lee^{4,25}, Gab Jin Cheon^{5,25}, Joo Hyun Sohn^{6,25}, Tae Yeob Kim^{6,25}, Young Suk Lim^{7,25}, Tae Hyo Kim^{8,25}, Tae Hee Lee^{9,25}, Sung Jae Park^{10,25}, Seung Ha Park^{10,25}, Jin Dong Kim^{11,25}, Sang Young Han^{12,25}, Chang Soo Choi^{13,25}, Eun Young Cho^{13,25}, Dong Joon Kim^{14,25}, Jae Seok Hwang^{15,25}, Byoung Kuk Jang^{15,25}, June Sung Lee^{16,25}, Sang Gyune Kim^{17,25}, Young Seok Kim^{17,25}, So Young Kwon^{18,25}, Won Hyeok Choe^{18,25}, Chang Hyeong Lee^{19,25}, Byung Seok Kim^{19,25}, Jae Young Jang^{20,25}, Soung Won Jeong^{20,25}, Byung Ho Kim^{21,25}, Jae Jun Shim^{21,25}, Yong Kyun Cho^{22,25}, Moon Soo Koh^{23,25}, and Hyun Woong Lee^{24,25}

¹Department of Internal Medicine and Cell Therapy and Tissue Engineering Center, Yonsei University Wonju College of Medicine, Wonju; ²Department of Internal Medicine, Korea University College of Medicine, Seoul; ³Department of Internal Medicine, Kyungpook National University College of Medicine, Daegu; ⁴Department of Internal Medicine, Inha University College of Medicine, Incheon; ⁵Department of Internal Medicine, Ulsan University College of Medicine, Gangneung; ⁶Department of Internal Medicine, Hanyang University Guri Hospital, Hanyang University College of Medicine, Guri; ⁷Department of Internal Medicine, Ulsan University College of Medicine, Seoul; ⁸Department of Internal Medicine, Gyeongsang National University College of Medicine, Jinju; ⁹Department of Internal Medicine, Konyang University College of Medicine, Daejeon; ¹⁰Department of Internal Medicine, Inje University College of Medicine, Busan; ¹¹Department of Internal Medicine, The Catholic University of Korea, College of Medicine, Seoul; ¹²Department of Internal Medicine, Dong-A University College of Medicine, Busan; ¹³Department of Internal Medicine, Wonkwang University College of Medicine, Iksan; ¹⁴Department of Internal Medicine, Hallym University College of Medicine, Chuncheon; ¹⁵Department of Internal Medicine, Keimyung University College of Medicine, Daegu; ¹⁶Department of Internal Medicine, Inje University College of Medicine, Goyang; ¹⁷Department of Internal Medicine, Soonchunhyang University Hospital Bucheon, Soonchunhyang University College of Medicine, Bucheon; ¹⁸Department of Internal Medicine, Konkuk University School of Medicine, Seoul; ¹⁹Department of Internal Medicine, Catholic University of Daegu College of Medicine, Daegu; ²⁰Department of Internal Medicine, Soonchunhyang University Hospital Seoul, Soonchunhyang University College of Medicine; ²¹Department of Internal Medicine, Kyung Hee University College of Medicine; ²²Department of Internal Medicine, Sungkyunkwan University College of Medicine, Seoul; ²³Department of Internal Medicine, Dongguk University College of Medicine, Goyang; ²⁴Department of Internal Medicine, Chung-Ang University College of Medicine, Seoul, Korea; ²⁵Korean Portal Hypertension Study Group

Background/Aims: While gastric variceal bleeding (GVB) is not as prevalent as esophageal variceal bleeding, it is reportedly more serious, with high failure rates of the initial hemostasis (>30%), and has a worse prognosis than esophageal variceal bleeding. However, there is limited information regarding hemostasis and the prognosis for GVB. The aim of this study was to determine retrospectively the clinical outcomes of GVB in a multicenter study in Korea.

Methods: The data of 1,308 episodes of GVB (males:females=1062:246, age=55.0±11.0 years, mean±SD) were collected from 24 referral hospital centers in South Korea between March 2003 and December 2008. The rates of initial hemostasis failure, rebleeding, and mortality within 5 days and 6 weeks of the index bleed were evaluated.

Abbreviations:

EV, esophageal varix; GV, gastric varix; GOV1, gastro-oesophageal varix type 1; GOV2, gastro-oesophageal varix type 2; GV1, isolated gastric varix type 1; GV2, isolated gastric varix type 2; EVB, esophageal variceal bleeding; GVB, gastric variceal bleeding; EVL, endoscopic variceal ligation; EVO, endoscopic vascular obturation; BRTQ, balloon occluded retrograde transvenous obliteration; EIS, endoscopic injection sclerotherapy; TIPS, transjugular intrahepatic portosystemic shunt; BT, balloon tamponade; HBV, hepatitis B virus; HCV, hepatitis C virus; INR, international normalized ratio; PHG, portal hypertensive gastropathy; OR, odds ratio; CI, confidence interval

Corresponding author : Soon Ho Um

Department of Internal Medicine, Korea University College of Medicine, 73 Incheon-ro, Seongbuk-gu, Seoul 136-705, Korea
Tel. +82-2-920-6562, Fax. +82-2-953-1943
E-mail; umsh@korea.ac.kr

Received : Sep. 5, 2012 / Revised : Nov. 6, 2012 / Accepted : Jan. 20, 2013

Results: The initial hemostasis failed in 6.1% of the patients, and this was associated with the Child-Pugh score [odds ratio (OR)=1.619; $P<0.001$] and the treatment modality: endoscopic variceal ligation, endoscopic variceal obturation, and balloon-occluded retrograde transvenous obliteration vs. endoscopic sclerotherapy, transjugular intrahepatic portosystemic shunt, and balloon tamponade (OR=0.221, $P<0.001$). Rebleeding developed in 11.5% of the patients, and was significantly associated with Child-Pugh score (OR=1.159, $P<0.001$) and treatment modality (OR=0.619, $P=0.026$). The GVB-associated mortality was 10.3%; mortality in these cases was associated with Child-Pugh score (OR=1.795, $P<0.001$) and the treatment modality for the initial hemostasis (OR=0.467, $P=0.001$).

Conclusions: The clinical outcome for GVB was better for the present cohort than in previous reports. Initial hemostasis failure, rebleeding, and mortality due to GVB were universally associated with the severity of liver cirrhosis. (*Clin Mol Hepatol* 2013;19:36-44)

Keywords: Gastric variceal bleeding; Rebleeding; Mortality; Cirrhosis

INTRODUCTION

Gastric varices (GVs) are less common than esophageal varices (EVs), occurring in approximately 20% of patients with portal hypertension.¹ However, gastric variceal bleeding (GVB) is reportedly more severe, requires more transfusions, and has a higher mortality rate than the bleeding from EVs.^{1,2} GVB was hard to control before the 1990s, with relatively high failure rates of the initial hemostasis (>30%) being reported, and the frequency of rebleeding was up to 89% even after the successful hemostasis.³⁻⁵ However, since the beginning of this century, the development of various treatment modalities such as endoscopic variceal ligation (EVL), endoscopic variceal obturation (EVO), and balloon-occluded retrograde transvenous obliteration (BRTO) has resulted in higher success rates for the initial control of bleeding (>90%) as well as lower rates of rebleeding (20-30%) than was previously reported.^{6,7} In addition, the cumulative survival rate of one cohort at 6 years was reported to be 43%. Yet, the recent clinical data for GVB is still limited and rare especially in Korea.

The management of GV has some inherent difficulties. The inhomogeneity of GV demands various treatment methods and techniques that vary with the GV type. However, the treatment tends to be empiric, since consensus regarding the optimum treatment for GV has not been reached yet due to insufficient basic data on GVB.⁸ Therefore, the aim of this multicenter retrospective study was to elucidate the general characteristics of GVB and the clinical outcomes including rebleeding and mortality, as well as the treatment modalities currently used in Korea.

PATIENTS AND METHODS

Patients and data collection

Participants were drawn from a consecutive series of 1308 cirrhotic patients admitted for hematemesis and/or melena due to GVB (as confirmed by endoscopic evaluation) at 24 medical centers distributed throughout Korea between January 2003 and December 2008. The medical records of the enrolled patients were reviewed to obtain the necessary demographic, clinical, laboratory, treatment, and follow-up data. Patients who were combined with malignancy including hepatocellular carcinoma were excluded. The therapeutic methods of hemostasis for GVB and the development of rebleeding or death related to GVB were also reviewed. The diagnosis of cirrhosis was based on a previous liver biopsy or on compatible clinical, laboratory, and imaging findings. In addition, time intervals from hospital admission to the start of each therapy, such as administration of the vasoactive agent administered or endoscopy, were reviewed. All patients were followed up to the time of death or 42 days after the hospital admission.

In the analysis, the therapeutic modalities were divided into two groups; endoscopic variceal ligation (EVL), endoscopic variceal obturation (EVO) and balloon-occluded retrograde transvenous obliteration (BRTO) vs. endoscopic injection sclerotherapy (EIS) transjugular intrahepatic portosystemic shunt (TIPS), balloon tamponade and no therapy. The reason of this grouping is that the former is generally accepted as standard therapy, on the contrary to this, the latter is considered as salvage or bridge therapy.

The sizes of the EVs were classified according to the criteria of Beppu et al.⁹ GV was classified as gastroesophageal varices

(GOVs), either associated with EVs along the lesser curvature (GOV1) or along the fundus (GOV2), and isolated gastric varices (IGVs), which are present in isolation in the fundus (IGV1) or at ectopic sites in the stomach or the first part of the duodenum (IGV2), as determined using the criteria of Sarin et al.¹ GOV2s and IGV1s were also analyzed as 'fundal varices.' The size of each GV was classified as small (≤ 5 mm), medium (6-9 mm), or large (≥ 10 mm). The hepatic function of patients at admission was estimated according to the Child-Pugh's score.^{10,11} The ethics committee of each hospital approved the protocol.

Definitions

The following definitions were based on recommendations from the Baveno II, III, and IV consensus workshops and previous literature:¹²⁻¹⁷

1. Time zero of the bleeding episode: the time of admission to the first hospital to which the patient was taken.

2. Acute GVB: a lesion actively bleeding or with an adherent clot, white nipple, or presence of a single lesion on the GVs without other potential sources of bleeding or EVs.

3. Index bleeding: bleeding was defined as active if a spurting or oozing lesion was seen on endoscopy, or if fresh blood was regurgitated via the gastric tube when endoscopy was not allowed.

4. Success of initial hemostasis: the acute bleeding episode was considered finished at the beginning of the first 24-hr bleeding-free interval with no hematemesis, stable hemoglobin concentration without blood transfusions, and stable hemodynamic conditions (absence of systolic blood pressure or a reduction of 20 mmHg or more, and an increase in heart rate of 20 beats/min or more).

5. Rebleeding: any occurrence of hematemesis or hemoglobin drop with fresh melena after initial hemostasis has been achieved.

Treatment outcomes were assessed in accordance with the failure to initial hemostasis of index bleeding, rebleeding, and death within 5 days (early) and 42 days (late) from the index bleeding. For the analysis of mortality, death within 42 days (6 weeks) of GVB was defined as a GVB-related death.¹²⁻¹⁸

Statistical analysis

The results are expressed as mean \pm SD values. Categorical variables were analyzed with a Pearson's chi-square test. Noncategorical variables were compared with independent *t*-tests, ANOVA.

A multivariate analysis for factors associated with the failure of initial hemostasis, rebleeding, and mortality were conducted using binary logistic regression analysis. The factors with $P < 0.1$ in univariate analyses were included in multivariate analyses using enter method. All tests were two-tailed, and the level of statistical significance was set at $P < 0.05$. Statistical analyses were performed with SPSS for Windows, version 12.0 (SPSS, Chicago, IL, USA).

RESULTS

Characteristics of the cohorts

The general characteristics of the cohort at admission are summarized in Table 1. The age of the patients was 55.0 \pm 11.0 years (range, 16-87 years), and 81.2% (n=1,062) were male. Liver cirrhosis was caused by alcohol in 46.1%, hepatitis B virus in 34.4%, hepatitis C virus in 6.7%, both alcohol and the virus in 7.1%, autoimmune hepatitis in 0.5%, cryptogenic in 2.9%, and others in 2.3% of the cohort. A previous history of endoscopic treatment due to EV bleeding was noted in 364 of the 1308 patients (27.8%). The type of GV was GOV1 in 781 patients (59.7%), GOV2 in 378 patients (28.9%), IGV1 in 119 patients (9.1%), and IGV2 in 30 patients (2.3%).

Initial hemostasis

Pharmacologic treatments using vasoactive agents were applied in 87.6% of the entire cohort as an initial hemostatic method as soon as possible before endoscopic or other interventional therapies were instituted. These vasoactive agents were administered for 70.9 \pm 33.5 hours at standard doses. Among the vasoactive agents, terlipressin was the most frequently used (50.3%), followed in order by somatostatin (37.2%), octreotide (11.4%), and vasopressin with or without nitrate (1.1%) (Fig. 1).

Endoscopic, radiologic, or other interventional treatments were performed in 1,211 of the 1,308 episodes (92.6%) for initial hemostasis or for prevention of a rebleeding of the index bleed. The treatment included endoscopic variceal ligation (EVL; n=553, 42.3%), EVO (n=484, 37.0%), BRTO (n=60, 4.6%), EIS (n=52, 4.0%), TIPS (n=37, 2.8%), and balloon tamponade (n=25, 1.9%). Ninety-seven patients (7.4%) experienced spontaneous hemostasis and did not receive any treatment (Fig. 2).

The failure rate of the initial hemostasis was 6.1% (80/1308 patients). There was no significant association between failure of

Table 1. General characteristics and clinical outcomes of the cohort (n=1,308).

Characteristic		
Age (yr)		55.0±11.0 (16-87)
Sex (males:females)		1062 (81.2):246 (18.8)
Etiology	Alcohol abuse	603 (46.1)
	HBV	450 (34.4)
	HCV	87 (6.7)
	Alcohol and virus	93 (7.1)
	Autoimmune	7 (0.5)
	Cryptogenic	38 (2.9)
	Others	30 (2.3)
	Serum albumin (g/dL)	
Total bilirubin (mg/dL)		2.9±4.2 (0.4-48.1)
Prothrombin time (INR)		1.6±0.6 (0.7-8.2)
Platelet count (10 ³ /mm ³)		100.8±64.3 (12.0-510)
Creatinine (mg/dL)		1.1±0.7 (0.4-12.2)
Child-Pugh's score		8.4±2.0 (5-15)
Child-Pugh class	A	219 (16.7)
	B	715 (54.7)
	C	374 (28.6)
EV size	F0	150 (11.5)
	F1	358 (27.4)
	F2	500 (38.2)
	F3	300 (22.9)
GV type	GOV1	781 (59.7)
	GOV2	378 (28.9)
	IGV1	119 (9.1)
	IGV2	30 (2.3)
GV size	Small (≤5 mm)	241 (18.4)
	Medium (6-9 mm)	521 (39.8)
	Large (≥10 mm)	546 (41.7)
PHG	None	597 (45.6)
	Mild	354 (27.3)
	Severe	357 (27.1)
Splenomegaly	No	356 (27.2)
	Yes	952 (72.8)
EVB-endoscopic treatment history	No	944 (72.2)
	Yes	364 (27.8)
Initial hemostasis failure rate		80 (6.1)
Rebleeding rate	Overall	151 (11.5)
	Early [*]	76 (5.8)
	Late [†]	75 (5.7)
Mortality rate	Overall	135 (10.3)
	Early [*]	73 (5.6)
	Late [†]	62 (4.7)

Data are mean±SD (range) or n (%) values.

EV, esophageal varix; EVH, esophageal variceal bleeding; GOV1, GVs associated with EVs along the lesser curvature; GOV2, GVs associated with EVs along the fundus; GV, gastric varix; HBV, hepatitis B virus; HCV, hepatitis C virus; IGV1, isolated GVs present in isolation in the fundus; IGV2, isolated GVs present in isolation at ectopic sites in the stomach or the first part of the duodenum; INR, international normalized ratio; PHG, portal hypertensive gastropathy.

^{*}Early, defined as within 5 days of the index bleeding; [†]Late, defined as from the 6th day to 6 weeks after the index bleeding.

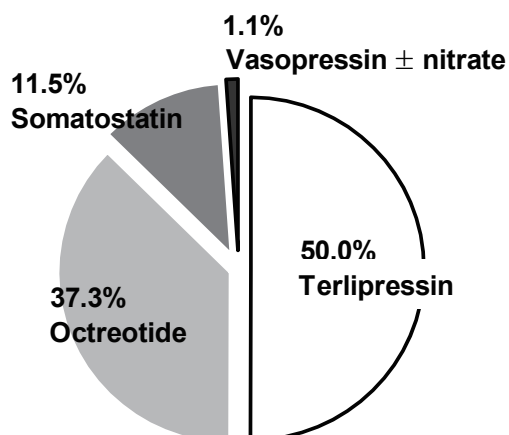


Figure 1. Type of intravenous vasoactive agents applied to treat the initial acute gastric variceal bleeding (GVB) among the entire cohort.

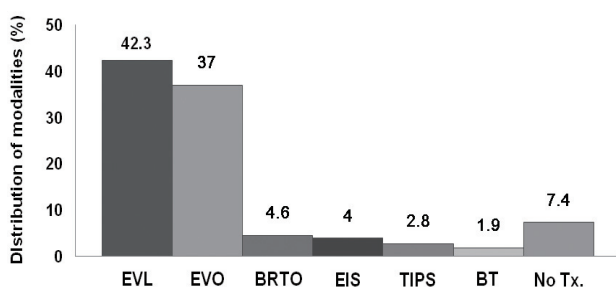


Figure 2. Type of nonpharmacologic treatment modalities that were applied to control the initial acute GVB. Endoscopic variceal ligation (EVL) and endoscopic variceal obturation (EVO) were the predominantly applied modalities. BRTO, balloon-occluded retrograde transvenous obliteration; EIS, endoscopic injection sclerotherapy; TIPS, transjugular intrahepatic portosystemic shunt; BT, balloon tamponade; No Tx., no treatment.

hemostasis and the type of GV, with failure occurring in 55 (7.1%), 21 (5.5%), 3 (2.5%), and 1 (3.3%) of cases of GOV1, GOV2, IGV1, and IGV2, respectively ($P=0.207$). In addition, the subanalysis revealed that with the exception of just one case of IGV2, the initial failure rate did not differ between GOV1 (cardiac varix; $n=55$, 7.1%) and GOV2+IGV1 (fundal varix; $n=24$, 4.8%; $P=0.121$). The Child-Pugh score ($P<0.001$) and the modality of nonpharmacologic treatments for the initial hemostasis were significantly related to the failure of the initial hemostasis. The failure rates for Child-Pugh classes A, B, and C were 0.5%, 3.5%, and 14.4%, respectively ($P<0.001$). The initial hemostasis failure rate was lower in patients treated with EVL, EVO, and BRTO than in those treated with EIS, TIPS, balloon tamponade and no therapy ($P<0.001$; Table 2, Fig. 3). However, the initial treatment failure rate of GOV1 bleeding did not differ significantly among EVL, EVO, and BRTO

($P=0.466$).

The application of vasoactive agents and the type thereof did not affect the outcome of initial hemostasis in the entire cohort ($P=0.722$ and 0.360 , respectively). In multivariate analysis with logistic regression analysis, the Child-Pugh's score (odds ratio [OR]=1.619, 95% confidence interval [CI]=1.437-1.823) and the modality of the initial hemostasis (EVL, EVO, and BRTO vs. the others; OR=0.221, 95% CI=0.131-0.371) were significantly associated with initial hemostasis failure (Table 2).

Rebleeding

The overall rebleeding rate was 11.5% (151/1308 patients). Early rebleeding within 5 days of the index bleeding occurred in 5.8% (76 patients), and late rebleeding from the 6th day to the end of 6 weeks of the index bleeding occurred in 5.7% (75 episodes) of the entire cohort. The rebleeding rate did not differ significantly with the GV type: 10.8% (84/781) of those with GOV1, 12.5% (62/497) of those with fundal varices, and 16.7% (5/30) of those with IGV2 ($P=0.240$). The application of vasoactive agents and the type thereof did not affect the development of rebleeding in the entire cohort ($P=0.598$ and 0.869 , respectively). However, significant correlations with rebleeding were obtained for previous EVL history ($P=0.002$), the size of the GV ($P=0.032$), and Child-Pugh score ($P<0.001$). The rebleeding rate was 5.0%, 10.9%, and 16.6% for Child-Pugh classes A, B, and C, respectively ($P<0.001$). In addition, the use of EVL, EVO, or BRTO as an initial hemostasis modality was associated with a significantly lower rebleeding rate ($P=0.033$). In multivariate analysis, previous EVL history (OR=1.781, 95% CI=1.246-2.546), Child-Pugh's score (OR=1.159, 95% CI=1.068-1.258), and the modality of the initial hemostasis (EVL, EVO, or BRTO; OR=0.619, 95% CI=0.406-0.944) were significantly associated with rebleeding (Table 3).

Mortality

The overall mortality caused by GVB was 10.3% (135/1308 patients). Early deaths within 5 days of the index bleeding occurred in 5.6% of the cohort (73/1308 patients), and late deaths during days 6-42 after the index bleeding occurred in 4.7% (62/1308 patients). The mortality did not differ significantly between cases of GOV1 bleeding (11.0%, 86/781) and fundal variceal bleeding (9.9%, 49/497; $P=0.576$). There were no cases of mortality among those with IGV2 bleeding. The mortality was lower among patients treated with either EVL, EVO, or BRTO than those treated

Table 2. Factors related to initial hemostasis failure

Univariate analysis			
Parameter	<i>P</i>		
Previous EVL history*	0.038		
GV type [†]	0.121		
GV size [‡]	0.130		
Child-Pugh's score	<0.001		
Vasoactive agent applied	0.722		
Kind of vasoactive agent	0.360		
Modality of nonpharmacologic treatments [§]	<0.001		
Multivariate analysis			
Parameter	OR	<i>P</i>	95% CI
Previous EVL history*	0.564	0.083	0.300-1.058
Child-Pugh's score	1.619	<0.001	1.437-1.823
Modality of nonpharmacologic treatments [§]	0.221	<0.001	0.131-0.371

P-values of univariate analysis were obtained by two sample *t*-test, ANOVA or chi-square test.

P-values of multivariate analysis were obtained by binary logistic regression analysis.

*Yes vs. No; [†]GOV1 vs. GOV2+IGV1; [‡]F2 and F3 vs. F1; [§]EVL, EVO, and BRTO vs. the others; ^{||} Adjusted for age and sex.

EVL, endoscopic variceal ligation; GV, gastric varix; OR, odds ratio; CI, confidence interval; GOV1, GVs associated with EVs along the lesser curvature; GOV2, GVs associated with EVs along the fundus; IGV1, isolated GVs present in isolation in the fundus; EVO, endoscopic variceal cular obturation; BRTO, balloon-occluded retrograde transvenous obliteration.

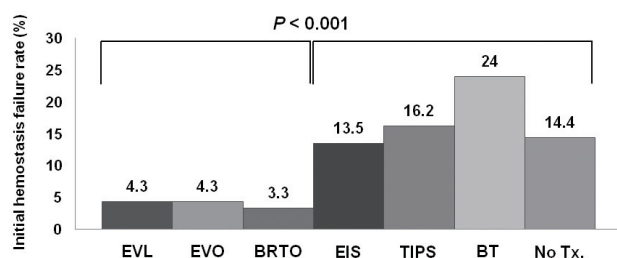


Figure 3. Comparison of initial hemostasis failure rates according to the initial nonpharmacologic treatment modality applied (EVL, EVO, and BRTO vs. the others). The failure rate was significantly lower for EVL, EVO, and BRTO than for the other modalities, and did not differ among EVL, EVO, and BRTO.

with EIS, TIPS, or balloon tamponade ($P=0.002$), although the outcome did not differ significantly among the EVL, EVO, and BRTO groups ($P=0.625$; Fig. 4). There was also a significant relationship between Child-Pugh's score and mortality ($P<0.001$; Table 4): the mortality rate was 0%, 5.3%, and 25.9% for those with Child-Pugh class A, B, and C, respectively. Multivariate analysis revealed a significant relationship between mortality and the both Child-Pugh's score (OR=1.795, 95% CI=1.621-1.988) and modality of the initial hemostasis (EVL, EVO, BRTO vs. the others;

OR=0.467, 95% CI= 0.292-0.746; Table 4).

DISCUSSION

While the knowledge and treatment modalities for GVs have improved, little remains known about the general characteristics of GVs and GVB. We thus dependent upon the data from two decades ago.¹ In Korea, one study reported the cumulative incidence rates of GVB as 4.8%, 19.9% and 23.2% at 1, 3 and 5 years after diagnosis and overall survival rates in patients with gastric varices were 88.6%, 53.2% and 37.2% at 1, 5 and 10 years respectively.¹⁷ However, little has been known about the clinical outcome of GVB in Korea. The study presented here analyzed a consecutive series of 1,308 cases of GVB that occurred in patients with liver cirrhosis during the past 6 years, collected from 24 medical centers distributed throughout South Korea. Thus, despite being performed retrospectively, this study can provide recent, representative information regarding the clinical features and treatment outcomes of GVB in this country.

The natural history of GVB differs from that of EV bleeding.

Table 3. Factors related to rebleeding

Univariate analysis			
Parameters	<i>P</i>		
Previous EVL history*	0.002		
GV type [†]	0.434		
GV size [‡]	0.369		
Child-Pugh score	0.002		
Vasoactive agent applied	0.598		
Kind of vasoactive agent	0.869		
Modality of nonpharmacologic treatments [§]	0.033		
Multivariate analysis			
Parameter	OR	<i>P</i>	95% CI
Previous EVL history*	1.781	0.002	1.246-2.546
Child-Pugh score	1.159	<0.001	1.068-1.258
Modality of nonpharmacologic treatments [§]	0.619	0.026	0.406-0.944

P-values of univariate analysis were obtained by two sample *t*-test, ANOVA or chi-square test.

P-values of multivariate analysis were obtained by binary logistic regression analysis.

*Yes vs. No; [†]GOV1 vs. GOV2+IGV1 vs. IGV2; [‡]F2 and F3 vs. F1; [§]EVL, EVO and BRTO vs. the others; ^{||}Adjusted for age and sex.

EVL, endoscopic variceal ligation; GV, gastric varix; OR, odds ratio; CI, confidence interval; GOV1, GVs associated with EVs along the lesser curvature; GOV2, GVs associated with EVs along the fundus; IGV1, isolated GVs present in isolation in the fundus; EVO, endoscopic variceal obturation; BRTO, balloon-occluded retrograde transvenous obliteration.

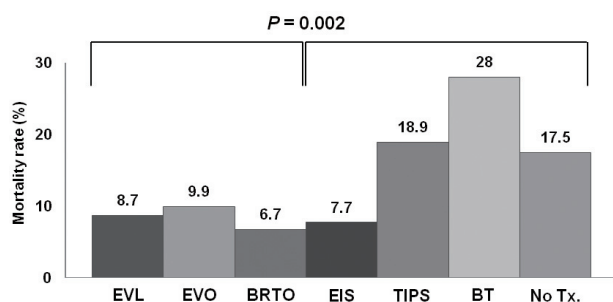


Figure 4. Comparison of mortality rates according to the initial nonpharmacologic treatment modality applied (EVL, EVO, and BRTO vs. the others). The mortality rate was significantly lower for EVL, EVO, and BRTO than for the other modalities, and did not differ significantly between EVL, EVO, and BRTO.

Although the risk of bleeding from a GV is lower than that from an EV, once bleeding has occurred, the transfusion requirements and the risk of mortality are greater for GVB.^{1,18} The mortality from the first GVB was reported as high as 20% within 6 weeks of the index bleeding and among the type of GV, GOV2s frequently bled and were associated with high mortality.¹⁻³ However, in the present study, the overall mortality rate was half of that, at 10.3%, and it did not differ between cardiac and fundal varices. This reduction in mortality may be at least partly attributable to the reduction in the initial hemostasis failure and rebleeding rates

due to advancements in endoscopic and radiologic interventional treatments, as well as to some severe cases possibly having been dead upon their arrival at the hospital (and thus not included in our cohort). Of note, even though the success rate of the initial hemostasis was similar to that reported recently, the rebleeding rate in the present study (11.5%) was much lower than that reported in recent studies (20-30%).^{6,7,19,20}

There are various therapeutic options available for the treatment of GVB, including EVL, EIS, EVO, TIPS, BRTO, and balloon tamponade. EVO has emerged as a particularly effective initial treatment for GVB, and especially in cases of fundal varices.^{5,21,22} In the present study, EVL, EVO, and BRTO were associated with a lower initial hemostasis failure, rebleeding, and mortality rate compared to the other therapeutic modalities. In addition, no significant difference was observed regarding these clinical outcomes between EVL and EVO in cases of GOV1. However, these findings should be interpreted with caution because of the retrospective design of this study and the uneven distribution of cases among the different types of modality. Furthermore, EIS or balloon tamponade might have been applied in worse clinical situations and levels of preparation compared with EVL or EVO. A large-scale prospective trial is required to confirm these data. In addition, although BRTO, TIPS and balloon tamponade are generally not considered as initial

Table 4. Factors related to mortality

Univariate analysis			
Parameter		<i>P</i>	
Previous EVL history*		0.303	
GV type [†]		0.576	
GV size [‡]		0.077	
Child-Pugh's score		<0.001	
Vasoactive agent applied		0.405	
Kind of vasoactive agent		0.249	
Modality of nonpharmacologic treatments [§]		0.002	
Multivariate analysis			
Parameter	OR	<i>P</i>	95% CI
GV size [‡]	1.557	0.133	0.873-2.776
Child-Pugh's score	1.795	<0.001	1.621-1.988
Modality of nonpharmacologic treatments [§]	0.467	0.001	0.292-0.746

P-values of univariate analysis were obtained by two sample *t*-test, ANOVA or chi-square test.

P-values of multivariate analysis were obtained by binary logistic regression analysis.

*Yes vs. No; [†]GOV1 vs. GOV2+IGV1 vs. IGV2; [‡]F2 and F3 vs. F1; [§]EVL, EVO, and BRTO vs. the others; ^{||}Adjusted for age and sex.

EVL, endoscopic variceal ligation; GV, gastric varix; OR, odds ratio; CI, confidence interval; GOV1, GVs associated with EVs along the lesser curvature; GOV2, GVs associated with EVs along the fundus; IGV1, isolated GVs present in isolation in the fundus; EVO, endoscopic variceal obturation; BRTO, balloon-occluded retrograde transvenous obliteration.

therapy of GVB, in Korea as we showed in this study, they have been applied as the primary hemostatic method for GVB in some centers. Unexpectedly, some clinicians hesitated to apply prompt EVO because of its invasiveness and potential risk of complication and they preferred to apply BRTO or TIPS instead whenever it is possible (data was not shown).

In general, it is known that EVL is associated with higher hemostasis failure and rebleeding rates in GVB compared to EVO, since GVs tend to be larger and deeper than EVs.^{19,20} EVL clinical data stratified according to GV type are lacking. In the present study, the control of bleeds from GOV1s (which are linked with EVs) using EVL yielded similarly good results with regard to initial hemostasis and mortality compared to EVO, irrespective of the GV size. This result may have been influenced by advancements in endoscopic equipment and the EVL technique. Therefore, bleeding from a GOV1 just below the gastroesophageal junction would be a good candidate for management with EVL.

GVs have a high rebleeding rate (20-90%), especially in cases of fundal varices.^{3-5,23} This may be attributable to incomplete obliteration and mucosal injury, respectively.^{4,24} Larger fundal varices with greater blood flows may be responsible for the low eradication rates. However, these data are based on the old studies in which sclerotherapy employed tetradecyl sulfate, alcohol, or bucrylate.²⁵ Data regarding rebleeding or mortality for the therapeutic

modalities that have recently been developed are very limited. In particular, there are few data related to the GV type. In the present study, the overall GV rebleeding rate was just 11.5%, with no difference between cardiac (GOV1) and fundal varices. Advances in endoscopic and radiologic interventions may be responsible for this decrease in the rebleeding rate relative to other studies. Technical improvements in the EVL with multiband equipment and EVO using N-butyl-2-cyanoacrylate (Histoacryl) may have been responsible for the remarkable improvement in the clinical outcome of GVB to levels similar to that of EVs.²⁶

Finally, among the many related factors, the Child-Pugh's score was significantly associated with all clinical outcomes, including initial hemostasis failure, rebleeding, and mortality, irrespective of the GV type or size. This suggests that the only important factor in predicting the prognosis of GVB is the severity of cirrhosis. However, since this study was conducted retrospectively, this limitation has to be considered in the interpretation of results, and well designed prospective studies are needed.

In summary, we have shown that the treatment outcome of GVB has improved dramatically in recent years, and that the most important factor determining the clinical outcome of GVB is the severity of cirrhosis. Not only were initial hemostasis and rebleeding strongly associated with Child-Pugh's score, but so also was mortality, regardless of the GV type and size.

Acknowledgements

This study was supported by a grant of the Korea Healthcare technology R&D Project, Ministry of Health and Welfare, Republic of Korea. (A102065).

Conflicts of Interest

The authors have no conflicts to disclose.

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