

## Balloon-Occluded Retrograde Transvenous Obliteration for Gastric Varices: A Feasibility Study

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### Abstract

**Purpose:** To evaluate the clinical feasibility of balloon-occluded retrograde transvenous obliteration (BORTO) for gastric varices.

**Methods:** BORTO was performed in 14 patients with gastric varices due to liver cirrhosis. The gastric varices were confirmed by endoscopy, and their feeding and draining veins were identified by contrast-enhanced computed tomography (CT) and angiography. A 6 Fr Simmons-shaped balloon catheter was inserted into the gastroduodenal shunt. The balloon was inflated, and 5% ethanolamine oleate iopamidol was infused slowly through the catheter. Patients were followed up with endoscopy and enhanced CT at 1 week, 1, 3, and 6 months after the procedure and every 6 months thereafter.

**Results:** The gastric varices completely disappeared in 12 of 14 patients and was partially resolved in the remaining 2 patients. Neither a recurrence nor an aggravation of gastric varices were found. No major complications were experienced.

**Conclusion:** BORTO is a safe and effective treatment for gastric varices.

**Key words:** Stomach, varices—Veins, therapeutic blockade—Angiography, technology—Endoscopy—Shunts, portosystemic—Liver, cirrhosis

Endoscopic injection sclerotherapy [2, 3], endoscopic variceal ligation [4], surgical treatment [5], and percutaneous transhepatic obliteration [6] are not presently regarded as definitive therapies for gastric varices. A transjugular intrahepatic portosystemic shunt (TIPS) [7] decreases portal pressure and treats esophageal and gastric varices, however, the incidence of improvement of gastric varices is low in TIPS [8]. Balloon-occluded retrograde transvenous obliteration (BORTO), reported in 1991 [9], is still under investigation as a new treatment for gastric varices. We have investigated the long-term clinical results of BORTO.

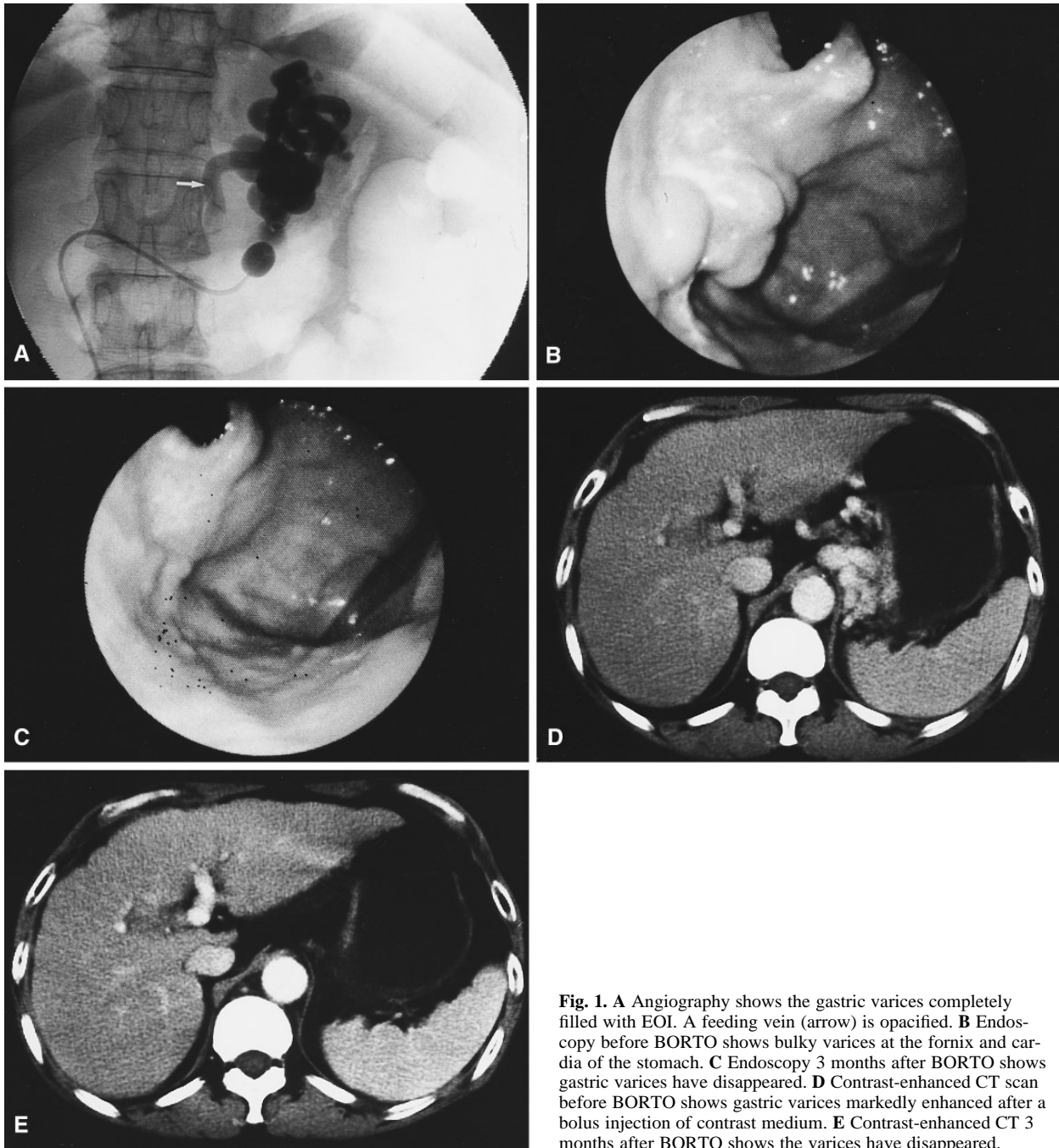
### Materials and Methods

Fourteen patients with gastric varices were treated with BORTO from July 1992 to December 1995. There were five men and nine women with a mean age of 62.6 years (range 52–74 years). In nine patients, the procedure was prophylactically performed. Tumor-shaped varices or growing varices were found in five patients, and varices with red color sign in four. Red color sign indicates a high risk of variceal bleeding [10]. Four patients had previous bleeding from gastric varices and were electively treated. One patient underwent emergency treatment for bleeding. All patients had liver cirrhosis—one in Child-Pugh class A [11], six in class B, and seven in class C.

A contrast-enhanced computed tomography (CT) scan and angiography were performed in all patients prior to the procedure in order to confirm the presence of the gastroduodenal shunt and measure the shunt diameter.

Under fluoroscopy, a 5 Fr C-shaped catheter was inserted into the left common iliac vein through the right femoral vein and a 0.035-inch guidewire was advanced into the left femoral vein. The 5 Fr catheter was exchanged for a 6 Fr Simmons-shaped balloon catheter with a balloon diameter of 1 or 2 cm (GVK1, Clinical Supply, Gifu, Japan). The balloon diameter was selected according to the shunt diameter. The balloon catheter was advanced into the left inferior phrenic vein, i.e., a draining vein of the gastroduodenal shunt, through the left renal vein. Under balloon occlusion of the gastroduodenal shunt, the left inferior phrenic venography was studied; draining veins, gastric varices, and feeding veins were confirmed. To decrease the risk of variceal rupture, digital subtraction angiography (DSA) was employed and 10–15 ml of contrast medium was carefully injected by hand. Ethanolamine ole-

The rupture of gastric varices results in a 55% mortality rate [1], because of their larger blood flow when compared with esophageal varices. Thus, prophylactic treatment of gastric varices in selected patients is in-



**Fig. 1.** **A** Angiography shows the gastric varices completely filled with EOI. A feeding vein (arrow) is opacified. **B** Endoscopy before BORTO shows bulky varices at the fornix and cardia of the stomach. **C** Endoscopy 3 months after BORTO shows gastric varices have disappeared. **D** Contrast-enhanced CT scan before BORTO shows gastric varices markedly enhanced after a bolus injection of contrast medium. **E** Contrast-enhanced CT 3 months after BORTO shows the varices have disappeared.

ate (Oldamin, Grelan Pharmaceutical Co., Tokyo, Japan) was mixed with contrast medium, resulting in 5% ethanolamine oleate iopamidol (EOI), a sclerosant. The gastroduodenal shunt was occluded using the balloon catheter, and EOI was infused slowly and intermittently so as not to cause retrograde flow into the portal vein. This infusion was continued until the gastric varices completely filled with EOI (Fig. 1A). Although the maximum recommended volume of EOI, according to the manufacturer's instruction, is 20 ml, greater doses were required to treat large gastric varices. EOI was aspirated through the catheter after 30 min. To prevent renal damage due to EOI-induced hemolysis, 4000 units of haptoglobin was administered intravenously during and after the infusion of EOI in all patients.

The status of gastric and esophageal varices was evaluated using an enhanced CT scan and endoscopy at 1 week, 1 month, 3 months, and 6 months after BORTO and every 6 months thereafter. When BORTO was not effective after 1 week, the balloon occlusion time was increased to 6 or 24 hr and BORTO was repeated.

## Results

The first BORTO procedure was not effective in 6 of 14 patients; four of these had large varices and two had

**Table 1.** Patient data and endoscopic evaluation of the gastric varices

Patient no.	Age/Sex	Indication	Gastric varices (form, <sup>a</sup> location, <sup>b</sup> sign <sup>c</sup> )		Outcome	Follow-up (months)
			Pre-BORTO	Post-BORTO		
1	60 F	Elective	F2; c, f; RC+	F0	Complete disappearance	36
2	62 F	Prophylactic	F3; c, f	F0	Complete disappearance	36
3	71 F	Prophylactic	F3; f	F0	Complete disappearance	18
4	69 F	Elective	F3; c, f	F0	Complete disappearance	24
5	69 F	Prophylactic	F3; f	F0	Complete disappearance	30
6	63 F	Elective	F2; f; RC+	F0	Complete disappearance	24
7	59 F	Prophylactic	F3; c, f	F0	Complete disappearance	30
8	58 F	Prophylactic	F3; c, f; RC+	F0	Complete disappearance	36
9	52 F	Prophylactic	F3; c, f; RC+	F1, c	Partial resolution	24
10	62 M	Prophylactic	F3; f; RC+	F0	Complete disappearance	18
11	59 M	Prophylactic	F3; c, f	F1, c	Partial resolution	12
12	52 M	Emergent	F3; f; RC+	F0	Complete disappearance	18
13	74 M	Prophylactic	F2; f; RC+	F0	Complete disappearance	18
14	67 M	Elective	F2; f; RC+	F0	Complete disappearance	12

<sup>a</sup> F0 = no varicose appearance; F1 = straight and small-calibered varices; F2 = moderately enlarged, beady varices; F3 = markedly enlarged, nodular, or tumor-shaped varices

<sup>b</sup> c = cardia; f = fornix

<sup>c</sup> RC+ = red color sign

two different draining veins. Five of the six patients required a second BORTO, and the remaining one required a third. In four patients with large varices, the balloon occlusion time was increased to 6 hr in the second BORTO, and to 24 hr in the third. The mean volume of EOI was 30.3 ml (range 11–60 ml).

After all BORTO procedures were completed, thrombosis of the gastric varices was detected in 12 of 14 patients on enhanced CT. The gastric varices completely disappeared 3–6 months after the BORTO procedure (Fig. 1B–E). The gastric varices partially resolved in the remaining two patients who had residual small varices at the cardia of the stomach. In all patients no recurrence or aggravation of gastric varices was observed for the duration of follow-up (mean 24 months, range 12–36 months) (Table 1). Esophageal varices with red color sign appeared in 2 of 14 patients after a mean time of 18 months. The varices were treated by endoscopic injection sclerotherapy and/or endoscopic variceal ligation.

All complications were transient; mild hemolysis and hematuria for 1 or 2 days (11 of 14 patients), blood pressure rise (range of maximum systolic pressure, 180–230 mmHg) during infusion of EOI (8 of 14), mild fever for a few days (13 of 14), nausea (6 of 14), mild abdominal pain (5 of 14), and a small amount of ascites (1 of 14). No major complications were observed.

## Discussion

Gastric varices with red color sign, tumor-shaped varices, and growing varices indicate a high risk of vari-

ceal bleeding. The rupture of gastric varices results in a 55% mortality rate [1], therefore, these high-risk patients should receive prophylactic treatment.

At present, sclerotherapy using cyanoacrylate [12] and endoscopic variceal ligation [4] are performed for the treatment of gastric fundic varices. However, the direct injection of cyanoacrylate into the varices under endoscopy may be accompanied by the serious problem of multiple organ embolisms due to dispersion of sclerosant into the systemic circulation [13], and ulceration and/or bleeding at the puncture site. Endoscopic variceal ligation has a high incidence of recurrent gastric varices [14]. Endoscopic sclerotherapy cannot be performed in gastric fundic varices in a large number of patients. Surgical treatment and percutaneous transhepatic obliteration are invasive [5, 6].

TIPS is a well-known treatment for esophageal and gastric varices. However, the improvement rate of gastric varices after TIPS is only 63% [8]. In a clinical study of TIPS, major complications such as intraabdominal bleeding and migration of the stent into the pulmonary artery were observed in 15 of 100 patients. In addition, stenosis or occlusion of the shunt was evident in 31 of 93 patients and 10 of these had variceal rebleeding [15]. Catchpole [16] points out some problems that can occur with TIPS: technical failure (10%), obstruction or stenosis of the shunt (9%–52%), hepatic encephalopathy (15%–20%), and multiple organ failure due to bleeding. Some patients with portal hypertension have a spontaneous portosystemic shunt through the renal vein. TIPS in these patients may cause hepatic encephalopathy due to the increased shunt volume. Hepatic encephalopathy after TIPS can be treated by BORTO [17].

In our study, gastric varices completely disappeared in 12 of 14 patients and partially resolved in the remaining 2 patients. No recurrence or aggravation of gastric varices was observed for the duration of follow-up (mean 24 months). All complications were transient. In a clinical study of BORTO, gastric varices disappeared in 49 of 51 patients and recurrence of gastric varices was found in only 1 patient. No major complications such as renal failure, pulmonary infarction, or liver failure were observed [18]. These results agree with our clinical study.

Fundic varices are not always connected to the left renal vein through a portosystemic shunt. In order for BORTO to be applicable, the patients must have a gastrosplenic shunt, which should be confirmed with enhanced CT before BORTO. In our study, esophageal varices with red color sign appeared in 2 of 14 patients after a mean follow-up time of 18 months. This was thought to occur because of the development of other collateral veins induced by the occlusion of the gastrosplenic shunt. The presence of esophageal varices should therefore be checked every 6 months after BORTO.

An approach through the jugular vein has also been reported [19]. However, we recommend the femoral vein approach because of safety, simplicity, and ease of catheter manipulation.

In four patients with large gastric varices, prolongation of balloon occlusion achieved thrombosis of the varices. The balloon occlusion time should therefore be increased for large varices.

To prevent EOI-related complications, the recommended total volume used should be less than 20 ml, according to the manufacturer's instruction. However, larger volumes of EOI were often needed for large gastric varices. A concurrent use of absolute ethanol and EOI was proposed as a technique of reducing the EOI volume [19]. However, we cannot monitor the movement of ethanol, which has strong toxicity, under fluoroscopy. We routinely removed as much EOI as possible through the catheter to prevent major complications. Haptoglobin was intravenously administered as a counteragent to prevent renal failure [20].

BORTO was effective in all patients for decreasing the size of the gastric varices. In addition, the procedure was simple and safe. BORTO may have a role in the management of gastric varices.

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