─Case Reports─

# Balloon-occluded Retrograde Transvenous Obliteration for Gastric Varices in a Child with Extrahepatic Portal Venous Obstruction

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## Abstract

Balloon-occluded retrograde transvenous obliteration (B-RTO) has been used successfully to treat gastric varices in adults. However, only a few case reports of B-RTO in children have been published. We describe a child who had gastric varices with extrahepatic portal venous obstruction (EHO). A 12-year-old boy presented to the pediatric clinic with anemia and tarry stools. He was referred to our department to receive additional treatment for gastric varices. Endoscopy revealed spurting bleeding from gastric varices, and emergent endoscopic injection sclerotherapy was performed. Angiography showed cavernous transformation of the portal vein, hepatofugal flow of the left gastric vein, gastric varices, and gastrorenal shunt. The gastric varices were not eradicated adequately with endoscopic sclerotherapy because of excessive regurgitant blood flow against the portal venous pressure. B-RTO combined with partial splenic embolization (PSE) was therefore performed. The gastric varices were completely eradicated with no complications. This is, to our knowledge, the first report describing the use of B-RTO combined with PSE in a child with EHO who had gastric fundal varices. B-RTO combined with PSE is not excessively invasive and is effective and safe for children. This procedure is therefore recommended for the treatment of gastric varices in children.
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**Key words:** Balloon-occluded retrograde transvenous obliteration, extrahepatic portal venous obstruction, partial splenic embolization

## Introduction

Extrahepatic portal venous obstruction (EHO) is an important cause of portal hypertension in children. It is associated with gastrointestinal bleeding, mainly from esophagogastric varices[1]. Outcomes in cases of EHO depend on the control of gastrointestinal bleeding from varices. Effective control of variceal bleeding with low morbidity is thus the main goal of treatment for EHO. Owing to advances in endoscopic therapy[2–7], esophageal varices can now be easily treated endoscopically, even in children. Compared with esophageal varices, however, gastric varices are more difficult to treat endoscopically[8].

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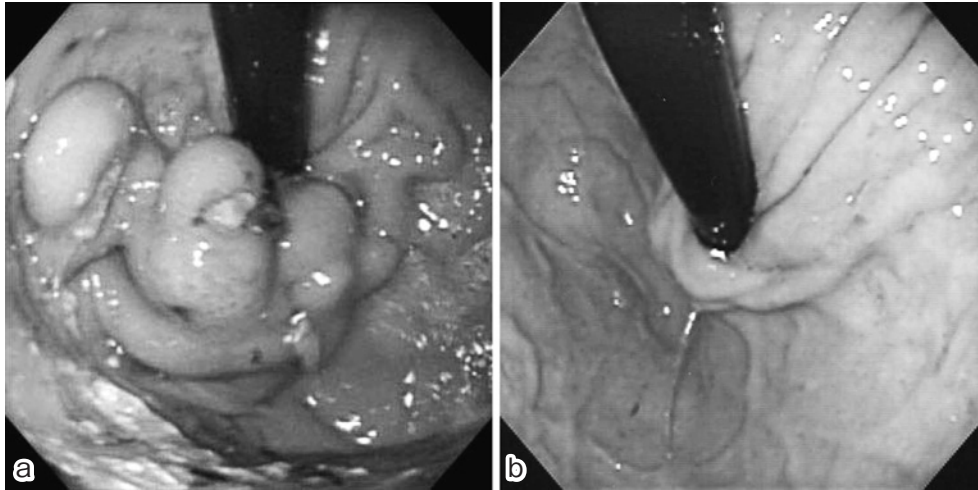Journal Website (http://www.nms.ac.jp/jnms/)

Fig. 1　Endoscopic examination revealed huge gastric fundal varices, with spilt glue at the rupture site. The varices showed a tense appearance (a). Endoscopic examination obtained 1 year after B-RTO combined with PSE revealed complete eradication of gastric varices (b).

Recently, balloon-occluded retrograde transvenous obliteration (B-RTO) has been used to successfully treat gastric varices in adults with liver cirrhosis[9–12]. However, only a few case reports of B-RTO in children have been published[13,14].

Partial splenic embolization (PSE) is a nonsurgical procedure developed to treat hypersplenism due to hepatic disease and thereby avoid the disadvantages of splenectomy. Various techniques for embolization, such as transportal obliteration and balloon-occluded retrograde transvenous obliteration, have been used to obliterate feeding veins of esophagogastric varices[15,16]. Collateral veins, including the feeding veins of esophagogastric varices, decrease portal hypertension. Obliteration of collateral veins therefore increases portal congestion and portal pressure, especially in patients with cirrhosis. PSE has been performed incrementally to reduce portal venous pressure to the level it was before the obliteration of collateral veins[12,17–23].

This is, to our knowledge, the first report to describe the use of B-RTO combined with PSE in a child with EHO who had gastric fundal varices.

**Case Report**

In June 2004, a 12-year-old boy presented to a pediatric clinic with a 1-day history of nausea and tarry stools. Gastrointestinal endoscopy revealed bleeding gastric fundal varices. Cyanoacrylate glue was injected intravariceally, and hemostasis was achieved. He was then referred to our hospital for further evaluation and treatment of gastric fundal varices. This episode of gastric variceal bleeding was the first for the patient. He has been in good health and had no history of direct injury to the vessel, umbilical vein catheterization, abdominal sepsis, neonatal sepsis, or liver disease.

Endoscopic examination revealed huge gastric fundal varices with spilt glue at ruptured sites. The varices were at risk for rebleeding (**Fig. 1a**). Doppler ultrasonography showed cavernous transformation of the portal vein and severe splenomegaly. Computed tomography with contrast enhancement of the abdomen revealed gastric varices, which were drained by a large gastrorenal shunt (**Fig. 2**). Gastric fundal varices due to EHO were diagnosed. B-RTO combined with PSE was considered the treatment of choice. The gastric varices were apparently not eradicated by endoscopic therapy alone because of excessive regurgitant blood flow against portal venous pressure.

We performed B-RTO plus PSE with the patient under general anesthesia. Initially, angiography was performed to confirm the gastric varices and gastrorenal shunt (**Fig. 3a**). A 6-French catheter
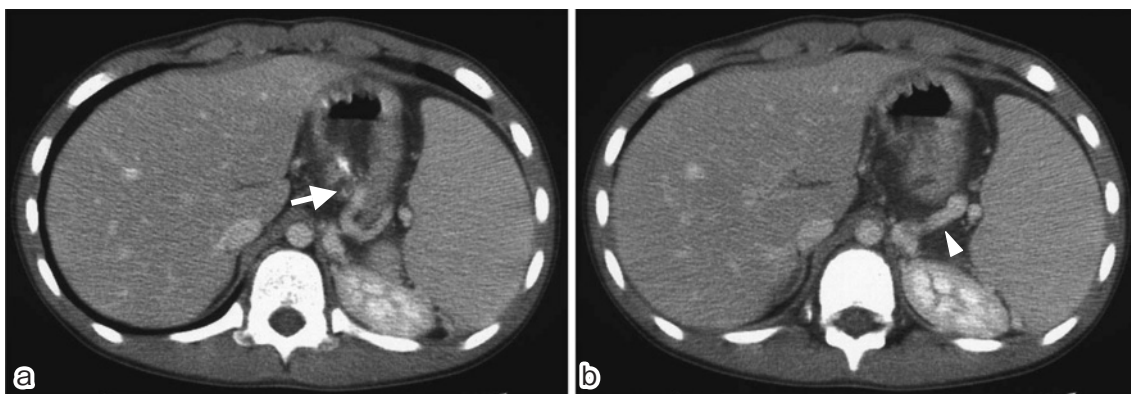
Fig. 2  Contrast-enhanced abdominal computed tomography revealed gastric varices (**arrow**) (a) and a large gastrorenal shunt (**arrowhead**) draining the varices (b).
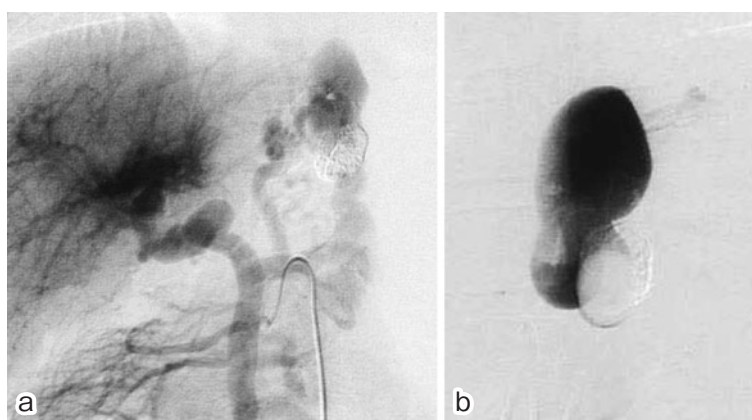


Fig. 3  Superior mesenteric arterial portography showed that gastric varices were supplied by the left gastric vein and drained into the gastrorenal shunt (a). Gastric varices were obliterated by 17 mL of 5% ethanolamine oleate iopamidol, injected in a retrograde manner during balloon occlusion (b).

with a 20-mm-diameter balloon (Selecon MP Catheter; Clinical Supply, Gifu, Japan) was inserted into the gastrorenal shunt via the femoral vein. During balloon occlusion of outflow vessels, retrograde venography was performed to evaluate the hemodynamics of the gastric varices and collateral veins. The sclerosant, 5% ethanolamine oleate iopamidol, was prepared by mixing equal volumes of 10% ethanolamine oleate (Oldamin; Takeda Pharmaceutical, Tokyo, Japan) and iopamidol (Iopamiron; Bayer Schering Pharma, Osaka, Japan). A total of 17 mL of the sclerosant was slowly injected into the varices (**Fig. 3b**).

Subsequently, the femoral artery approach was used for superselective catherization of the splenic artery. The catheter tip was placed as distally as

possible in either the hilum of the spleen or in an intrasplenic artery. Embolizaion was achieved by injecting absorbable gelatin sponge fragments (Gelfoam; Pfizer Japan Inc., Tokyo, Japan) soaked in antibiotic. Care was taken to preserve the distal pancreatic branches of the splenic artery. PSE was performed incrementally while the portal pressure was monitored. The portal venous pressure fell to the level before B-RTO.

The balloon remained inflated for 24 hours to occlude the outflow of the varices and was removed after we confirmed thrombosis of the varices with retrograde venography. There were no intraoperative or postoperative complications. Endoscopic examination 1 year after B-RTO combined with PSE revealed complete eradication of

the gastric varices, without the appearance of esophageal varices (**Fig. 1b**).

## Discussion

EHO is the most common cause of portal hypertension in children[1,3,4]. The precise etiology of EHO is unknown in most cases. Predisposing factors include direct injury to blood vessels, rare congenital anomalies of the portal vein, and systemic causes, such as neonatal sepsis, abdominal sepsis, dehydration, multiple exchange transfusions, and hypercoagulable states[1]. Our patient had none of these predisposing factors; the underlying etiology is thus unknown.

Approximately 90% of children with EHO present with variceal bleeding; 70% to 75% of these patients will have further episodes[24]. Variceal bleeding contributes substantially to mortality and morbidity in children with EHO, with mortality rates of 5% to 9%[4]. Variceal bleeding is thus an important determinant of survival in children with EHO, and effective control leads to long-term survival.

Gastric varices are present in 61% to 68% of children with EHO. The incidence of isolated gastric varices is about 2%[1,24,25]. As compared with esophageal varices, gastric varices are associated with less frequent bleeding but greater severity and a higher mortality rate[26]. The development of improved techniques for endoscopic sclerotherapy[34] and band ligation[5,6] has facilitated the treatment of esophageal varices, even in children. In contrast, the endoscopic treatment of gastric varices remains challenging[8], and its effectiveness is controversial[16]. Although many recent developments have improved outcomes in patients with gastric varices, consensus has yet to be reached concerning the optimal treatment. Gastric varices have been treated with a broad range of techniques, including pharmacotherapy, balloon tamponade, endoscopic procedures, interventional radiologic treatment, and surgery[16].

Some endoscopic treatments have achieved hemostasis in more than 90% of patients with gastric varices, but eradication and rebleeding rates remain unsatisfactory[27,28]. It is difficult to treat gastric varices with gastrorenal shunt by means endoscopic injection therapy without balloon occlusion, because an endoscopic approach is difficult, and the rapid intravariceal blood flow precludes the injection of sufficient sclerosant[9].

Transjugular intrahepatic portohepatic shunt (TIPS) is widely accepted as a portal decompression therapy for gastric varices[29–31]. However, the response rate of gastric varices to TIPS is only 50% to 63%, lower than that for esophageal varices. These poorer results may be attributed to the fact that the portal pressure gradient is lower in patients who have gastric varices with gastrorenal shunt. Moreover, reported complications of TIPS in children include shunt obstruction[32], encephalopathy[33], and septic shock[34].

The role of surgical treatment remains a matter of debate. Recent studies have reported rebleeding rates of 7% to 27%, operative mortality rates of 0% to 5%, and shunt thrombus rates of 7% to 13%[6]. We therefore do not consider operative management the therapy of choice for children.

B-RTO has been performed widely for adults with gastric varices in Japan[10,11,22], following the report by Kanagawa et al.[9]. In Japan, B-RTO is recognized as a safe and effective treatment for gastric varices with gastrorenal shunt. In adults, eradication or reduction rates have ranged from 87% to 100% with recurrence rates of 0% to 11.1%[9–11]. Outcomes in children have remained disappointing[13,14]. However, if the shunt is large enough and a catheter appropriate for the shunt is used, B-RTO can be performed even in children. B-RTO for gastric varices has two clinically significant effects: eradication of the gastric varices themselves and obliteration of the unified portosystemic shunt[16]. The latter is related to most of the benefits and adverse effects of B-RTO. Possible adverse effects include transient ascites, pleural effusion, and the worsening of esophageal varices. These adverse effects may be due to elevation of portal pressure in response to occlusion of the portosystemic shunt. We have reported previously[19] that obliteration of portosystemic shunts increases the portal venous pressure in all patients, because portosystemic shunt drainage reduces portal hypertension, and obliteration of the

portosystemic shunt leads to portal congestion and increased portal venous pressure.

We have obtained good results using PSE to treat gastric varices, esophageal varices, and encephalopathy[16,19,23]. In particular, PSE can reduce portal venous pressure and lead to good long-term outcomes. In the present case, we performed PSE incrementally while monitoring the portal venous pressure to reduce the pressure to the level before B-RTO. The gastric varices were completely eradicated, with no complications, such as esophageal varices, portal hypertensive gastropathy, or ascites. We believe that PSE helped prevent the portal venous pressure from increasing after obliteration of the portosystemic shunt. PSE is a supplemental treatment designed to prolong the effect of B-RTO[19,22].

Because few reports have described B-RTO in children, long-term outcomes are uncertain. However, B-RTO combined with PSE is effective and safe and not highly invasive in children. B-RTO combined with PSE is therefore recommended for the management of gastric varices in children.

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