Balloon-Occluded Retrograde Transvenous Obliteration (BRTO) of Gastric Varices

- Patients with cirrhosis of the liver can develop gastric or gastroesophageal varices, which can bleed and become life threatening
- Gastric varices pose unique management challenges, as endoscopic therapies are limited
- Balloon-occluded retrograde transvenous obliteration (BRTO) is a treatment option for gastric varice at high risk of bleeding
- The BRTO is recommended for patients with gastrorenal shunts

Gastric varices are a complication of increased portal pressure and are typically associated with cirrhosis of the liver. Over time, as they increase in size, the vessel walls become thinner, and wall tension increases. If the wall tension exceeds its elastic limits, the varices bleed. This is a life-threatening event, with an estimated 30-50% mortality for the first episode. Management of acute gastric variceal hemorrhage requires a multidisciplinary approach including medical and interventional management. After the first episode, bleeding has a 60–80% chance of recurring within one year.

In the United States, the primary approach to prevent re-bleeding is the use of a transjugular intrahepatic postosystemic shunt (TIPS) to decompress the portal circulation. Endoscopic treatment with tissue adhesives has also been used with success, but tissue adhesives have not been FDA-approved for this purpose.

An alternative procedure, balloon-occluded retrograde transvenous obliteration (BRTO), which was developed in Japan more than 20 years ago, has recently been recognized as advantageous in some cases. For example, TIPS may not be completely effective in diverting flow from a large gastrorenal shunt, especially when the portosystemic gradient (PSG) is low. Compared to TIPS, BRTO maintains favorable hemodynamics, which helps preserve liver function. Patients with a poor hepatic reserve (with a score of 17-19 or greater as estimated by the model for end-stage liver disease, MELD) have been shown to do poorly after TIPS. In one study, patients showed improvements in hepatic function after BRTO that lasted 6-12 months and returned to baseline after three years. In addition, encephalopathy, which can occur in 16-31% of patients after TIPS, is not associated with BRTO. The re-bleed rate after a successful BRTO procedure has been reported to be <10%, compared to 26-31% after TIPS.

Indications for BRTO
BRTO is only suitable for patients with appropriate anatomy for the procedure and generally requires a gastro-renal shunt. It is recommended for patients whose gastric varices have bled in the past and are at high risk of rupture, although its use as a primary prophylaxis is controversial and not currently recommended. It is suitable for patients with portosystemic shunts causing encephalopathy and for patients who are not candidates for TIPS because of a high MELD score.
**Figure 1.** Coronal CT of a 58-year-old male with alcoholic cirrhosis who presented with melena. **(A)** shows left renal vein (red arrow) and gastrorenal shunt (orange arrow) and **(B)** shows gastric varices (blue arrows), indicating suitable anatomy for BRTO.

**Figure 2.** BRTO procedure. **(A)** Catheter opacification via left renal vein shows gastrorenal shunt (orange arrow), gastric varices (blue arrow), and inflated balloon (red arrow). **(B)** Infusion of sclerosant (blue arrow) and coiling of outflow (orange arrow). **(C)** Final injection of contrast agent shows patency of left renal vein (blue arrow) after balloon let down and no flow into gastrorenal shunt or gastric varices.
Figure 3. Comparison of CT images before (left) and after (right) BRTO procedure. **(B)** Blue arrows on axial images indicate gastric varices before treatment (**A**) and their absence after treatment. Coronal images in **(C)** show varices (blue arrow) before treatment. **(D)** shows artifact from coils (orange arrow) in post-treatment CT.

**Contraindications**
Contraindications for BRTO of gastric varices include portal vein occlusion, refractory ascites, and the presence of high-risk esophageal varices. BRTO is not suitable for esophageal or gastro-esophageal varices. However, if esophageal varices have been successfully treated endoscopically, BRTO may be used subsequently to occlude gastric varices.

**BRTO Procedure**
BRTO is a procedure that uses a sclerosing agent to occlude blood flow through a spontaneous portosystemic shunt, typically a gastrorenal shunt. Before the procedure can be performed, a CT examination is necessary to assess the vascular anatomy of the varices (Figure 1). If the anatomy is deemed suitable for BRTO, a balloon catheter is introduced under fluoroscopic guidance into the shunt from the systemic venous side, and the balloon is inflated to block the outflow of the varices (Figure 2). At Mass General, a sclerosant (3% sodium tetradecylsulfate (Sotradecol) combined with a radiopaque oil, lipiodol, and air to make a foam) is slowly introduced into the varix. Thirty to 50 minutes later, the outflow is coil-embolized and as much as possible of the remaining sclerosant is aspirated via the catheter before deflating the balloon and withdrawing the catheter. After the procedure, variceal blood flow is assessed with follow-up imaging using CT or MR venography, or endoscopic ultrasound (Figure 3).
Outcome
Technical success, defined by complete obliteration of the varix, has been reported to be 73-100%, based on 15 studies that included a total of 621 patients. In some cases, it is necessary to repeat the procedure to achieve complete obliteration.

Technical failures can occur when the shunt cannot be catheterized, cannot be occluded, or cannot be opacified.

Minor complications commonly include epigastric and back pain, and transient hemoglobinuria. Portal venous pressures will increase after BRTO. BRTO leads to aggravation of esophageal varices in 30-68% of cases and worsening ascites in 42% of cases. Pulmonary embolism, cardiac arrhythmia, anaphylaxis, portal hypertensive gastropathy, worsening esophageal varices, duodenal varices, worsening ascites, and bacterial peritonitis have also been reported.

Scheduling
BRTO procedures are performed by radiologists in the Division of Interventional Radiology on the Mass General main campus in Boston. Appointments can be made through ROE (inside Partners network) or ROE Portal (outside Partners network) or by calling 617-724-XRAY (9729).

Further Information
For further information on BRTO, please contact Suvranu Ganguli, MD, Interventional Radiology, Department of Radiology, Massachusetts General Hospital, at 617-726-8315.

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References

