

**American College of Radiology**  
ACR Appropriateness Criteria®

**Clinical Condition:** Radiologic Management of Gastric Varices

**Variant 1:** Cirrhotic patient with active bleeding from large gastric varices exhibiting high flow by endoscopic Doppler ultrasound and a history of a wedge pressure of 20mmHg and a MELD score of 14. Three-phase contrast-enhanced CT demonstrates a large gastrosrenal shunt.

Treatment/Procedure	Rating	Comments
TIPS	8	
BRTO	7	
Endoscopic management (sclerosis or cyanoacrylate injection)	5	
<b>Rating Scale:</b> 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate		

**Variant 2:** Cirrhotic patient with an index bleed from large gastric varices exhibiting high flow by endoscopic Doppler ultrasound with a MELD score of 20. Three-phase contrast-enhanced CT demonstrates a large gastrosrenal shunt.

Treatment/Procedure	Rating	Comments
TIPS	5	
BRTO	8	
Endoscopic management (sclerosis or cyanoacrylate injection)	5	
<b>Rating Scale:</b> 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate		

**Variant 3:** Cirrhotic patient with small gastric variceal bleeding exhibiting slow flow by Doppler ultrasound and moderate ascites with a MELD score of 18. Contrast-enhanced MRI does not demonstrate a gastrosrenal shunt.

Treatment/Procedure	Rating	Comments
TIPS	8	
BRTO	4	
Endoscopic management (sclerosis or cyanoacrylate injection)	7	
<b>Rating Scale:</b> 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate		

**Variant 4:** Cirrhotic patient with large gastric varices exhibiting high flow by endoscopic Doppler ultrasound and a significant history of hepatic encephalopathy with a MELD score of 18. Contrast-enhanced MRI demonstrates a large gastrosrenal shunt.

Treatment/Procedure	Rating	Comments
TIPS	4	
BRTO	8	
Endoscopic management (sclerosis or cyanoacrylate injection)	6	
<b>Rating Scale:</b> 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate		

**Clinical Condition:** Radiologic Management of Gastric Varices

**Variant 5:** Cirrhotic patient with esophageal and gastric variceal bleeding (gastric varices considered high risk for endoscopic management/failed endoscopic management) with a MELD score of 13 and a history of hepatic wedge pressure of 22 mmHg. Three-phase contrast-enhanced CT demonstrates a small gastrosrenal shunt.

Treatment/Procedure	Rating	Comments
TIPS	8	
BRTO	5	
Endoscopic management (sclerosis or cyanoacrylate injection)	5	
<b><u>Rating Scale:</u></b> 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate		

**Variant 6:** Cirrhotic patient with gastric variceal bleeding large gastric varices exhibiting high flow by endoscopic Doppler ultrasound with a MELD score of 12 and a history of a hepatic wedge pressure of 10 mmHg. Contrast-enhanced MRI demonstrates a large gastrosrenal shunt.

Treatment/Procedure	Rating	Comments
TIPS	5	
BRTO	8	
Endoscopic management (sclerosis or cyanoacrylate injection)	6	
<b><u>Rating Scale:</u></b> 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate		

## RADIOLOGIC MANAGEMENT OF GASTRIC VARICES

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### **Summary of Literature Review**

#### **Introduction/Background**

Bleeding from gastric varices (GVs) is usually more severe and is associated with higher morbidity, transfusion requirements, and mortality compared to bleeding from esophageal varices (EVs) [1-3]. The approach to prevention of first bleed and rebleed from GVVs has remained empirical in the absence of large randomized trials. In the United States the majority of patients with GVVs have underlying portal hypertension rather than splenic vein thrombosis, although exclusion of the latter remains an essential early step in the evaluation [4]. Variceal bleeding is predominantly portal pressure driven rather than dependent on coagulopathy [5-10]. As a result, reducing portal pressure is the primary objective in managing these patients, along with encouraging the avoidance of over-aggressive volume/procoagulant resuscitation [11]. Intra-gastric balloons (eg, Sangstaken-Blakemore or Minnesota tubes) can be used to temporize bleeding GVVs and/or EVs.

#### **Supportive Care**

A detailed discussion of the medical management of patients with gastric variceal bleeding is beyond the scope of this literature review [12]. However, it is important to emphasize that patients with gastric variceal bleeding represent a true medical emergency, and require extensive and close (often ICU) monitoring and medical attention. Care must be attentive to volume status and resuscitation, pharmacological therapy for portal hypertension, provision of antibiotics per the American Association for the Study of Liver Diseases (AASLD) guidelines [13] urgent or emergent endoscopy and endoscopic treatment when indicated.

#### **Endoscopy**

Conventionally, upper endoscopic examination is performed early to evaluate the source of bleeding following hematemesis or melena. Encountering a high-risk GV with recent bleeding or an actively bleeding cardiofundal varix presents the endoscopist with a difficult challenge. Conventional therapeutic approaches using sclerosants or banding are sometimes attempted, although studies have demonstrated a relatively high failure rate for acute control and an early rebleeding rate [14]. Jutabha et al [15] reported a comparative trial of sclerotherapy versus banding plus sclerotherapy in acute fundal variceal bleeders. The study was limited by small group size (6 and 11), but it showed a high rebleeding rates in both groups (33% and 45%), which were not statistically significant. This and similar studies demonstrated the significant morbidity associated with such endoscopic techniques and enforced the need for alternative approaches. Endoscopic band ligation for GV has shown more variable results in the control of active bleeding (45%-93%) and a relatively high (and sometimes catastrophic) rate of rebleeding (44%-54%) [16,17]. The actuarial 1- and 2-year rebleeding rates of GVVs after banding were 63% and 72%, respectively [17].

Cyanoacrylate injection is another endoscopic option resulting in variceal “obturation.” Its use emerged in Germany in the 1980s as a hemostatic agent for gastric variceal bleeding [18]. In the past three decades, cyanoacrylate injection has been established as a primary means of achieving gastric varix obliteration in many

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parts of the world, while its use in the United States continues to be limited. In the meantime, a number of series, including several comparative and randomized controlled trials, have emerged [19,20].

In an extended 2-year follow-up, a randomized controlled trial compared cyanoacrylate injection to band ligation, Tan et al [17] demonstrated a 27% rebleed rate in the cyanoacrylate group versus 72% rebleeding in the ligation group with no difference in long-term survival. In another randomized controlled trial, Lo et al [16] showed a 1-year rebleeding rate of 15% with cyanoacrylate versus 60% in the band ligation group and a significant survival advantage for the cyanoacrylate group, for the studied period. In a cohort study comparing cyanoacrylate to transjugular intrahepatic portosystemic shunt (TIPS), Mahadeva et al [21] demonstrated rebleeding rates of 30% and 15%, respectively (P=0.005). In addition, Mahadeva et al showed similar long-term survival between the groups but with a 50% cost reduction in the cyanoacrylate group. These results were similar from a cost analysis standpoint (comparing TIPS and cyanoacrylate injection) in a study by Procaccini et al [21-23]. However, in contrast to the study by Mahadeva et al, the cohort comparison study by Procaccini et al did not detect a difference in rebleeding (approximately 15%) or survival at 1 year (approximately 70%) between cyanoacrylate and TIPS, but it did show significantly higher morbidity in the TIPS group, mostly due to hepatic encephalopathy [23]. In a more recent randomly controlled trial of cyanoacrylate versus TIPS with a median follow-up of 33 months, Lo et al [24] reported a higher rebleeding rate from GV in the cyanoacrylate group (38%) compared to the TIPS group (11%), with no difference in survival. Additional endoscopic approaches have been reported, including thrombin injection. Intravariceal injection of thrombin has been shown to be effective in controlling active GV bleeding with a relatively good success rate of 75%-100% and a low rebleeding rate of 7%-25% [25-28]. While cyanoacrylate for managing GV appears somewhat more risky its use remains potentially useful in selected cases, because of the high blood flow through gastric variceal channels, which adds uncertainty to the optimal conditions for cyanoacrylate injection and risks mobilization of the material (possibly causing pulmonary embolism) [29-31]. Overall risk of embolization is estimated at only 1%-2%, but when it happens it can be severe [19]. Anecdotally, the current authors reserve cyanoacrylate as an option for patients not eligible for balloon-occluded retrograde transvenous obliteration (BRTO) due to vascular anatomy or other conditions.

### **TIPS and BRTO**

From an interventional radiology standpoint there is a controversy regarding the ideal management of GV [32-35]. In the United States and Europe the primary management is to decompress the portal circulation using TIPS. This is consistent with the long history of decompressive surgeries (surgical portosystemic shunts) that were well established prior to the advent of the TIPS procedure. In Japan and South Korea the primary management is to sclerosing them with the BRTO procedure. This is now changing, and there are at least 10 universities in the United States that perform the BRTO procedure. The spontaneous gastrosplenic/gastrorenal shunt (a portal decompressive shunt) is permanently occluded during the BRTO procedure [33,34,36], and thus there are varying degrees of aggravation of portal hypertension [37-40] which is contrary to the American decompressive ideology of portal hypertension management.

There are actually limited data in the literature that are specific to TIPS for GV [24,41-45]. Most (even more recent studies) amalgamate all varices (esophageal, gastric, or gastroesophageal), and one cannot glean the outcomes specific to patients with GV in these amalgamated studies. On the other hand, BRTO is a procedure that is specific to gastric variceal management, and there are more data showing the efficacy of the procedure (over 40 studies) [32-36,38]. From this standpoint alone, the TIPS procedure stands at a disadvantage.

There are five studies evaluating TIPS that specifically address patients with portal hypertension complicated by GV [24,41-45]. These five studies evaluate a total of 147 patients (range for individual studies: 12-35 patients). Two of these studies have intra-institutional comparisons with BRTO outcomes [43,44]. Two were published before the year 2000 and had a total of 60 patients with actively bleeding GV who had undergone TIPS created by bare stents [41,42]. In these two studies, the success of TIPS in controlling the active variceal bleeding was 94% (90%-96%). However, the 6-7-month and 12-month rebleeding rates were 26%-29% and 31%, respectively. The post-TIPS hepatic encephalopathy rate was 16% [41].

The four studies published in the last decade evaluated a total of 87 patients with GV who underwent a TIPS procedure [24,43-45]. However, all the TIPS were created with bare stents. The 12- and 24-month post-TIPS rebleed rates were 11% and 20%, respectively. The primary problem with all five of these studies is that the TIPS were created with bare stents and not stent grafts.

The use of stent grafts would probably make a significant difference considering that TIPS patency has improved from 30%-69% (bare stents) to 76%-92% (stent grafts) with the advent of the commercially available stent graft [46-57]. This is particularly true when considering that over 70% of gastric variceal rebleeding occurrences after TIPS have been associated with TIPS dysfunction (TIPS stenosis or thrombosis) [24].

The two studies that had intra-institutional comparison between BRTO and TIPS had a total of 85 BRTO cases and 40 TIPS cases [43,44]. Unfortunately, the study by Choi et al [43] had samples (BRTO: 8, TIPS: 13) that were too small for a statistical comparison. The rebleeding and encephalopathy rates for TIPS were 15% and 31%, respectively, and zero in both cases for BRTO [43]. The more significant study by Ninoi et al [44] had a larger sample (BRTO: 77, TIPS: 27). The 1-year rebleeding rate for TIPS was 20%, versus 2% for BRTO ( $P < 0.01$ ). Furthermore, the 1-, 3-, and 5-year survival rates after BRTO were better than those after TIPS ( $P = 0.01$ ): 96%, 83%, 76% versus 81%, 64%, 40%, respectively [44]. However, the improved survival for BRTO compared to TIPS limited to patients who were classified preprocedurally as Child-Pugh A. There was no difference in survival for patients who were classified as Child-Pugh B or C [44]. Overall, the percentage of patients in both studies who experienced hepatic encephalopathy after TIPS varied between 19%-31% [43,44].

One of the theories about the lower effectiveness of TIPS in reducing the rebleed rate of patients with GVs compared to those with EVs is that there is a higher likelihood of having a diminished portal pressure ( $< 12$  mmHg) in patients with GVs (most likely due to the presence of a decompressive gastrosplenic/splenorenal shunt). In that setting, the traditional hemodynamic endpoint of the TIPS procedure (reducing the portosystemic gradient to  $< 12$  mmHg) is already in existence. Thus, creating TIPS in these patients to further reduce the portosystemic gradient probably will not have a hemodynamic effect on the gastric variceal system (the GV in addition to the associated decompressive gastrosplenic/splenorenal shunt). Another theory that is complementary to the "low portal pressure theory" is that TIPS has only a limited effect on so-called left-sided portal circulation [58-60].

Overall, the technical success rates of BRTO for patients with gastrosplenic/splenorenal shunts and GVs range from 79%-100% (average:  $> 90\%$  technical success rate) [32,35,36,44,61,62]. Procedural complications, when mentioned, include gross hematuria (15%-100% of BRTO cases) with hemoglobinuria-induced renal failure described in up to 4.8% of cases. Pulmonary embolism occurs in 1.5%-4.1% of cases (symptomatic in 1.4%-2.5% of cases). Anaphylaxis to ethanolamine oleate (up to 5%), cardiac arrhythmias (up to 1.5%), and rapidly declining hepatic function (up to 5%-7%) have also been described. The 30-day mortality rates range from zero to 4.1%, and the most common cause of death is progressive hepatic failure [32,35,36,61-75].

The aggravation of nongastric (esophageal or duodenal) varices appears to be a major problem in the long run and is reflective of increasing portal hypertension following BRTO [32,35,36,61-64,66,67,69,70,72,75]. It varies widely, probably depending on the degree of pre-BRTO prophylactic banding and the post-BRTO vigilance, documentation, and thoroughness of follow-up endoscopy [76]. However, in four studies evaluating 160 patients who had undergone BRTO and had continuous endoscopic follow-up post-BRTO, the esophageal variceal aggravation rates (expressed as a Kaplan-Meier analysis) at 1, 2, and 3 years were: 27%-35%, 45%-66%, and 45%-91%, respectively [35,64,65,77]. In another two studies evaluating 117 patients with BRTO, the percentage of patients with aggravated EV was 30%-68%, and the percentage of patients who had bleeding EV was 17%-24% (36%-57% of those with aggravated EV went on to have bleeding) [61,63]. Again, one can argue that the percentage of esophageal variceal bleeding may be significantly reduced by greater vigilance with endoscopic follow-up and more aggressive endoscopic therapy (esophageal banding and/or sclerotherapy). Other complications reflective of increased portal hypertension following BRTO include the development of portal hypertensive gastropathy (occurs in 5%-13%), ascites (occurs in 0%-44%), and hydrothorax/pleural effusion (occurs in zero-8%) [64,65,68,71,73,74].

The rebleeding rate following BRTO depends on how it is presented [69]. In most studies, gastric variceal rebleed rates of patients who had undergone a successful BRTO procedure that range between zero and 20% (all studies except one had a gastric rebleed rates under 10%) [32,35,36,44,61-66,68,69,71,74,78-80]. However, when factoring in an intent-to-treat basis for the results, the gastric variceal rebleed rates are zero to 31.6% [32,35,36,44,61-66,68,69,71,74,78-80]. Many studies do not clearly state what, if any, is the global rebleed rate from: gastric, esophageal, duodenal varices, or as portal hypertensive gastropathy [32,35,36,44,62-66,68,69,71,74,78-80]. In three clearly reported studies evaluating a total of 141 patients who had undergone a BRTO procedure, the gastric variceal rebleed rate of successful BRTO procedures, the intent to treat gastric variceal rebleed rate, and the global (all types of varices) variceal rebleed rates were: 3.2%-8.7%, 10%-20%, and 19%-31%, respectively [61-63]. Conceptually and to provide some perspective, these results can be compared to

the latest four studies evaluating a total of 87 patients who underwent a TIPS procedure for GV bleeding and who had a 12-24 month global rebleed rate of 11%-20% [24,43-45]. This highlights the importance of subsequent surveillance endoscopy in either approach to GV, but particularly following BRTO.

BRTO of GV involves the transvenous sclerosis of GV via a spontaneous gastroduodenal shunt [34,35,44,47,61,62,65-67,69-73,75-78,81,82]. A consequence of the BRTO procedure is the occlusion (sclerosis) of this spontaneous gastroduodenal shunt [33,34,47,62]. TIPS is known to increase the Model for End Stage Liver Disease (MELD) score because the newly established shunt diverts blood flow away from the liver [76,77,81,83]. Conversely, BRTO is closure of a spontaneous hepatofugal shunt, potentially diverting blood flow towards the liver [61,65,68-70]. However, BRTO has been known to sometimes aggravate splenomegaly, EV, ascites, and hydrothorax as discussed above. On the other hand, it is controversial whether the Child-Pugh score remains unchanged or improves after BRTO [33,68,71]. However, the majority of authors conclude that if the Child-Pugh score improves initially in the first 6 to 9 months after BRTO, it then returns to pre-BRTO baseline levels [32,68]. Thus, BRTO (unlike TIPS) preserves hepatic function in the long term [32,68]. Thus the greatest advantage of BRTO over TIPS is its preservation of hepatic function and its reduction in the risk of hepatic encephalopathy. In fact, one of the emerging indications for BRTO is encephalopathy with the presence of a gastroduodenal or gastrosplenohepatic shunt [32,36,65,71,75,81,82,84]. In five studies evaluating a total of 35 patients with encephalopathy there was resolution or significant reduction in encephalopathy in all patients [32,36,65,71,84]. Moreover, the actuarial survival rate after BRTO is impressive. The 1-, 2-, 3-, and 5-year survival rates range from 83%-98%, 76%-79%, 66%-85%, and 39%-69%, respectively [32,61,63-65,77,78,82]. Obviously, the greatest determinant of survival is the patient's hepatic reserve [32,63,78,82].

### Summary

- The ideal management of gastric varices is largely uncharted and requires a multidisciplinary approach.
- Patients with bleeding gastric varices have numerous variability in baseline stability, baseline liver reserve and other associated morbidities; and their management should be multidisciplinary and on a case-by-case basis.
- Institutions with unique experience and teams (interventional and gastrointestinal) with particular procedural skill sets are required to provide the full scope of available procedures.
- Procedural techniques that can be used, individually or concomitantly, for the management of gastric varices include: endoscopic banding and glue injection, transjugular intrahepatic portosystemic shunt (TIPS) creation or balloon-occluded retrograde transvenous obliteration (BRTO).
- BRTO is an effective procedure for the management of gastric varices and is a viable alternative to TIPS in unique clinical and anatomical settings.

### Supporting Documents

- [ACR Appropriateness Criteria® Overview](#)
- [Evidence Table](#)

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The ACR Committee on Appropriateness Criteria and its expert panels have developed criteria for determining appropriate imaging examinations for diagnosis and treatment of specified medical condition(s). These criteria are intended to guide radiologists, radiation oncologists and referring physicians in making decisions regarding radiologic imaging and treatment. Generally, the complexity and severity of a patient's clinical condition should dictate the selection of appropriate imaging procedures or treatments. Only those examinations generally used for evaluation of the patient's condition are ranked. Other imaging studies necessary to evaluate other co-existent diseases or other medical consequences of this condition are not considered in this document. The availability of equipment or personnel may influence the selection of appropriate imaging procedures or treatments. Imaging techniques classified as investigational by the FDA have not been considered in developing these criteria; however, study of new equipment and applications should be encouraged. The ultimate decision regarding the appropriateness of any specific radiologic examination or treatment must be made by the referring physician and radiologist in light of all the circumstances presented in an individual examination.