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Variceal Hemorrhage: Decompression, Obliteration, or Both?

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Abstract

Variceal hemorrhage is a morbid condition that frequently mandates the involvement of interventional radiology to achieve successful and sustained hemostasis. Primary image-guided therapies for variceal hemorrhage include a transjugular intrahepatic portosystemic shunt and transvenous obliteration. Knowledge of variceal pathophysiology and anatomy, current techniques, and the evidence supporting therapeutic selection is paramount to successful patient outcomes. The purpose of this review is to provide the reader a framework of the available literature on image-guided management of bleeding varices to assist in clinical management.

Keywords

- portal hypertension
- variceal hemorrhage
- transjugular intrahepatic portosystemic shunt
- balloon-occluded retrograde transvenous obliteration
- cirrhosis

Liver cirrhosis is a major cause of mortality globally, resulting in more than a million deaths worldwide in 2017.[1] In the United States, it is the 11th most common cause of death.[2] Cirrhosis is a heterogeneous disease subclassified into compensated and decompensated stages based on events such as variceal hemorrhage, ascites, and hepatic encephalopathy (HE). These decompensating events have a significant impact on patient survival with median survival exceeding 10 years in patients with compensated cirrhosis, compared with less than 2 years for patients with decompensated cirrhosis.[3] Gastroesophageal varices are very common, being encountered in 30 to 40% of patients with compensated cirrhosis and up to 85% of patients with decompensated cirrhosis.[3] Variceal bleeding is the direct consequence of portosystemic collaterals in patients with portal hypertension (pHTN) and is a leading cause of mortality in patients with decompensated cirrhosis.[4] Interventional radiologists (IRs) have a crucial role in the management of patients with variceal hemorrhage, as recognized by most major guidelines.[3,5] The primary IR therapies for variceal hemorrhage in the setting of pHTN include a transjugular intrahepatic portosystemic shunt (TIPS), which decompresses the varices through a reduction in the portosystemic gradient (PSG), and transvenous obliteration, which treats the varices directly using a combination of embolics and sclerosants. Each therapy has a long history of both technical and clinical success, but their application with regard to patients with gastroesophageal varices are not well defined in the available guidelines.[3,5] Moreover, there is emerging evidence supporting a combined approach of variceal decompression with obliterative techniques.[6,7] Thus, the goal of this review is to provide the reader a framework of the available literature on IR management of bleeding varices to assist in therapeutic selection.

Anatomic Considerations

Broadly, varices can be divided into esophageal, gastric, and ectopic. Even though the types of varices share the same

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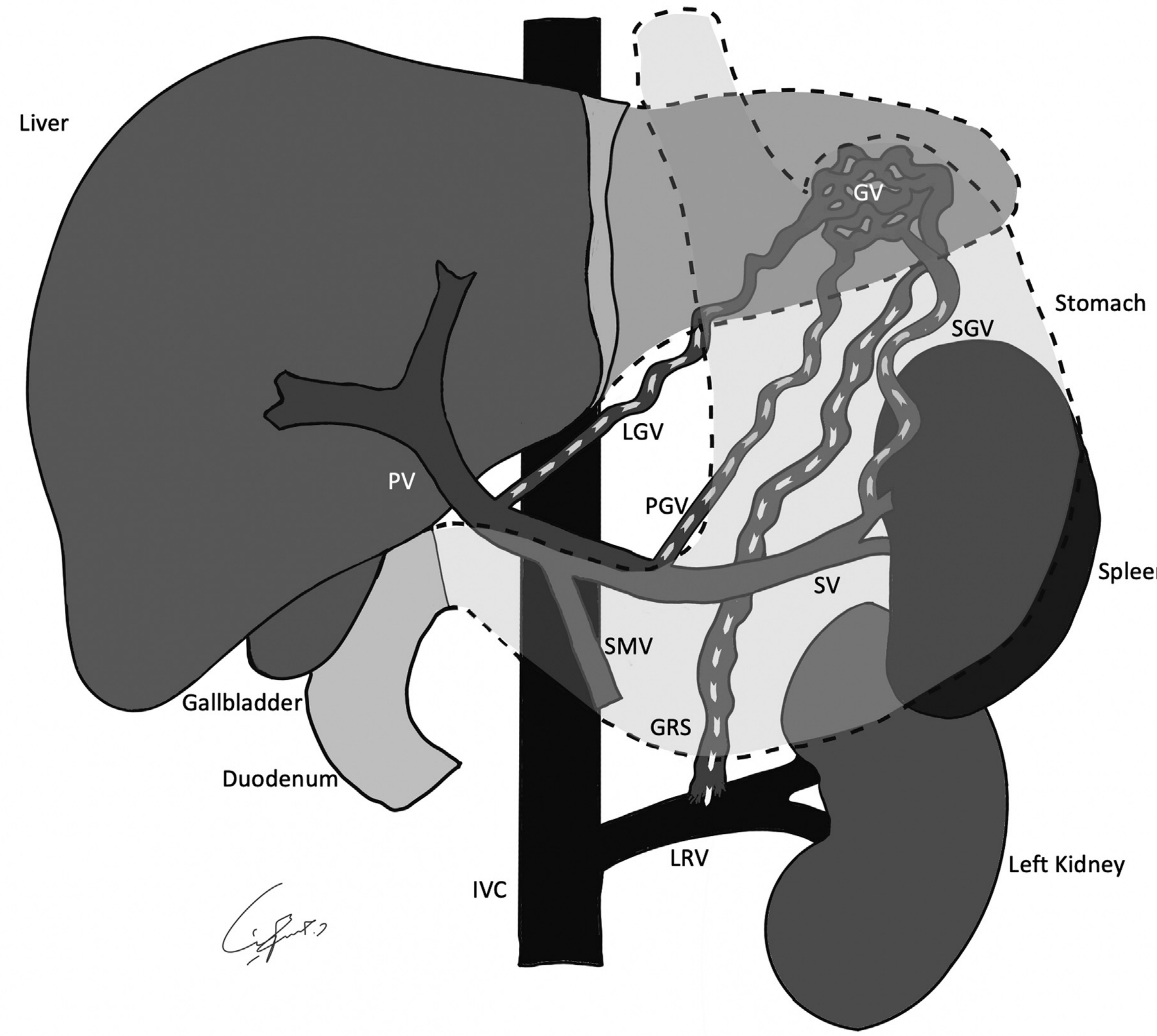

Fig. 1 Graphical representation of the efferent and afferent pathways for gastroesophageal varices. GRS, gastrorenal shunt; GV, gastric varices; IVC, inferior vena cava; LGV, left gastric vein; LRV, left renal vein; PGV, posterior gastric vein; PV, portal vein; SGV, short gastric vein; SMV, superior mesenteric vein; SV, splenic vein.

etiology and frequently coexist, understanding their anatomic and clinical features is important when selecting a therapeutic approach (►**Figs. 1** and **2**).

Esophageal varices are the most common, being present in approximately 50% of patients with cirrhosis, with higher frequency in patients with more advanced disease.[8] Esophageal varices may be supplied by the left gastric vein, posterior gastric vein, and short gastric veins with typical outflow into the superior vena cava via azygos and hemiazygos collaterals. The pattern of supply by the left gastric vein alone is seen in approximately 70% of patients.[9]

Gastric varices are the next most common, being encountered in approximately 20% of patients with cirrhosis.[10] The Sarin classification system is frequently used to subclassify gastric varices based on their appearance on endoscopy.[11] Based on this, gastric varices are classified as gastroesophageal varices, which always coexist with esophageal varices, and isolated gastric varices. Type I gastroesophageal varices (GOV1) are the most common (~75%) and are an extension of esophageal varices along the minor curvature of the stomach. These varices drain toward azygous and hemiazygos collaterals.[9,12] Type II gastroesophageal varices (GOV2) are the second most common type (~20%), representing an extension of esophageal varices into the gastric fundus. These varices drain both toward the azygous/hemiazygos collaterals as well as via the inferior phrenic vein into the left renal vein.[9,12] Isolated gastric varices are relatively uncommon, with type I isolated gastric varices (IGV1) being isolated to the fundus, while type II isolated gastric varices (IGV2) occur elsewhere in the stomach (e.g., body, antrum, or pylorus). IGV1 typically drain toward the systemic circulation via the left inferior phrenic vein into the left renal vein (80–85%) or, less frequently, into the inferior vena cava (10–15%). IGV2 are usually found in isolated ("sinistral") pHTN in the setting of splenic vein occlusion and are fed by short gastric veins and drain via other gastric veins into the portal vein.[12]

For the purposes of this review, ectopic varices will be defined as arising from any location other than the esophagus or stomach. These varices are uncommon, being responsible for bleeding in only 2 to 5% of cases.[10] Ectopic varices tend to occur in patients with occlusion of the portal venous

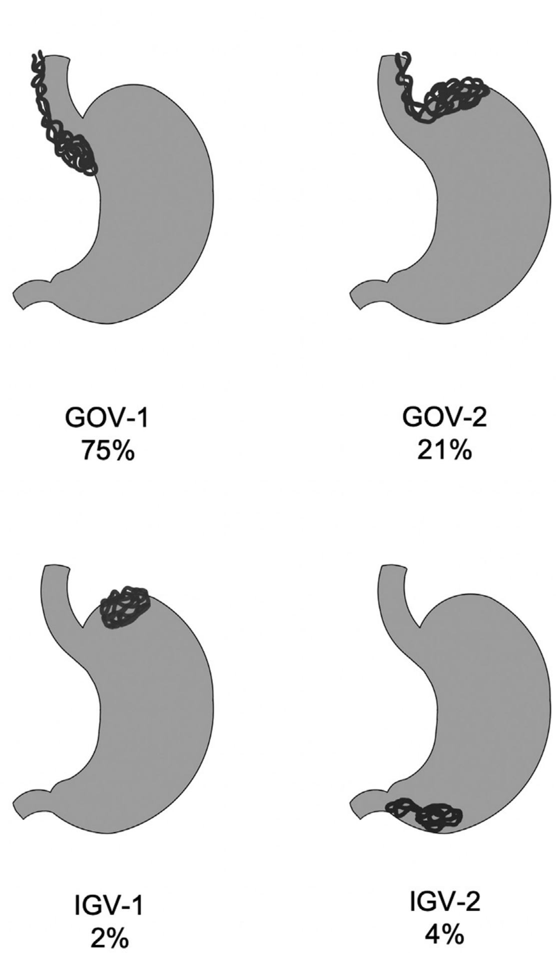

Fig. 2 Incidence of the types of gastroesophageal varices according to the Sarin classification.[11] Type I gastroesophageal varices are esophageal varices that extend into the lesser curvature of the stomach. Type II gastroesophageal varices are esophageal varices that extend into the gastric fundus. Type I isolated gastric varices are isolated gastric varices found in the gastric fundus. Type II isolated gastric varices are isolated gastric varices found in other locations of the stomach.

system, causing atypical collateral pathways to form. They can also be found in patients with prior abdominal surgeries or prior therapy for variceal bleeding. Typical locations for the development of ectopic varices include the small bowel, rectum, and peristomal vessels. Duodenal varices arise from collaterals formed between the portal vein or superior mesenteric vein and inferior vena cava.[13] Stomal varices occur due to the formation of collaterals in the stomal mucosa.[14] Rectal varices form secondary to collateral flow between the superior rectal veins, which are the tributaries of the inferior mesenteric vein, and middle and inferior rectal veins belonging to the iliac system. Distinguishing features from hemorrhoids are the location of the varices above the dentate line of the rectum and compressibility on endoscopy.[13] Other rare, atypical locations have been described, including biliary tract varices, usually seen in patients with portal vein thrombosis due to peribiliary collaterals,[15] vesical varices,[6] umbilical, cutaneous, reproductive tract, and intraperitoneal varices, such as splenorenal ligament varices.[13]

Gastroesophageal Varices without a Splenorenal Shunt

The following section will consider the management of esophageal varices and GOV1 gastroesophageal varices together, unless a distinction is made within the cited reference. Given the absence of a splenorenal shunt (SRS), these varices are most often managed by decompression via TIPS placement with or without embolization of the varices. The discussion of the literature is centered on the indications of primary prophylaxis (i.e., the patient has never had a variceal bleeding event), preemptive or "early" TIPS placement in patients with advanced liver disease after resolution of an acute bleeding event, and rescue interventions. Additionally, the term "balloon-occluded retrograde transvenous obliteration (BRTO)" will be used as a catch-all term when discussing transvenous obliteration techniques such as plug-assisted retrograde transvenous obliteration (PARTO) and coil-assisted transvenous obliteration (CARTO).

Primary Prophylaxis

Currently, nonselective β-blockers (NSBB) and endoscopic management are recommended as the first-line treatment for patients with esophageal varices and GOV1 who have never had a bleeding event.[3,5,16] NSBBs reduce the PSG but do not prevent the progression to high-risk varices, and some patients may be pharmaceutical nonresponders.[17,18] Endoscopic band ligation (EBL) acts locally on the varix but fails to address the underlying pHTN. NSBB and EBL are functionally equivalent with regard to bleeding and patient mortality; thus, therapeutic selection is largely driven by patient-specific factors and physician preference.[3,19] Image-guided therapies, including TIPS or TIPS combined with variceal embolization, are not currently recommended as therapies for primary prophylaxis. For example, the American Association for the Study of Liver Diseases (AASLD) cites increased rates of HE and reductions in overall survival.[20–24]

Preemptive or "Early" TIPS

Patients with acute variceal hemorrhage should get aggressive volume resuscitation in combination with antibiotics, vasoactive medications, and EBL.[3] Once the acute bleeding has been treated, decompression of the varices through TIPS placement can minimize the risk of recurrent hemorrhage, which is especially true for patients with advanced liver disease who are at increased risk of treatment failure and overall mortality.[25] The evidence supporting the placement of a preemptive TIPS in patients with advanced liver disease for esophageal or GOV1 variceal bleeding is based on randomized trials and a meta-analysis of these trials. For example, one trial randomized 63 patients to either EBL + NSBB or TIPS placement within 72 hours of controlling the acute gastroesophageal variceal bleeding.[26] The investigators found that TIPS was superior at preventing rebleeding at 1 year (EBL + NSBB: 50%; TIPS: 3%; $p < 0.001$). Patients randomized to TIPS also had a superior overall survival at 1 year (EBL + NSBB: 14%; TIPS: 39%; $p < 0.001$). A more recent trial randomized 58 patients to either TIPS placement or standard-of-care therapy after an acute gastroesophageal variceal bleeding event had subsided.[27] In this trial, none of the patients who were able to receive a TIPS within 72 hours developed rebleeding during the follow-up period compared with a rebleeding rate of 27.6% in the standard of care group ($p = 0.04$); however, overall survival at 1 year was not different between the groups while patients treated with TIPS did have higher rates of HE (46.1 vs. 20.7%, $p < 0.05$). Another multicenter, randomized trial found that TIPS placement was superior to EBL + NSBB therapy with regard to the development of variceal rebleeding (0 and 29%, $p = 0.001$) without differences in mortality, although patients treated with TIPS had higher rates of HE (35 vs. 14%; $p = 0.035$).[28] The largest trial to evaluate preemptive TIPS placement after an acute variceal hemorrhage randomized 132 patients to TIPS placement or EBL + NSBB in a 2:1 fashion.[29] In this study, transplantation-free survival was higher in patients receiving preemptive TIPS (TIPS: 86%; ESL + NSBB: 73%; $p = 0.046$). Finally, a recent meta-analysis found that patients undergoing preemptive TIPS had significantly lower all-cause mortality (relative risk [RR]: 0.64, 95% confidence interval [CI]: 0.52–0.79) and reduced incidence of failure to control bleeding (RR: 0.15, 95% CI: 0.07–0.29).[30] Ideally, in patients with advanced liver disease, a TIPS would be placed within 72 hours of controlling the initial variceal bleeding with EBL and NSBB therapy; however, there is evidence that a TIPS placed as far out as 5 days from the initial bleeding event is superior to continued medical and endoscopic management at preventing rebleeding.[31]

Embolization of the gastroesophageal varices can be performed in conjunction with TIPS placement (►**Fig. 3**). A prospective study of 95 patients treated with bare-metal stent TIPS demonstrated lower rebleeding rates if TIPS placement was combined with embolotherapy than TIPS alone (19 vs. 47%, $p = 0.02$).[32] A more recent meta-analysis including both covered and bare-metal stents found that TIPS with embolotherapy had a significantly lower incidence of rebleeding (OR: 2.02, 95% CI: 1.29–3.17, $p = 0.002$).[33] In a randomized, controlled trial of 106 patients, those treated with TIPS using covered stents with embolization had lower rebleeding rates at 6 months (6 vs. 20%, $p = 0.029$), although the authors attributed the lower cumulative rebleeding rates to increased shunt patency from covered stents rather than embolization.[34] Another recent study supported the use of decompression plus embolization over decompression alone in the setting of covered stents demonstrating reduced rebleeding rates at 12 months (3.8 vs. 13%, $p = 0.041$).[35] However, the combination of embolization plus decompression has not been shown to incur a survival benefit compared with decompression alone.[32–35]

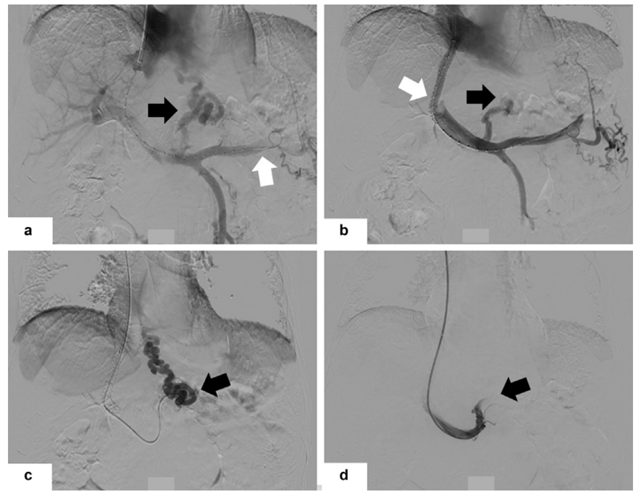

Fig. 3 Transjugular intrahepatic portosystemic shunt (TIPS) placement in a patient with a history of prior variceal hemorrhage from gastroesophageal varices. (**a**) Digital subtraction angiography (DSA) of the portal venous system from a transjugular approach with the catheter tip (white arrow) in the splenic vein shows large varices prior to shunt placement (black arrow). (**b**) DSA of the portal venous system after TIPS placement (white arrow) shows a reduction in the varices, although they are still present (black arrow). (**c**) DSA of the gastroesophageal varices after catheterization (black arrow). (**d**) DSA of the portal venous system after sclerosis and plug embolization shows no residual varices (black arrow).

Rescue or Salvage Therapy

Rescue or salvage therapy is when a TIPS is placed for variceal hemorrhage refractory to medical and endoscopic treatment, which can occur in up to 20% of cases.[3] These clinical scenarios typically include (1) patients with uncontrolled acute hemorrhage and (2) patients with preserved liver function (e.g., Childs–Pugh A) who experience a repeat, but controlled, variceal bleeding event despite adequate management with NSBB and/or EBL. For patients with acute, uncontrolled variceal hemorrhage, there is significant mortality (~95%), but, even though survival rates are low, there are no other accepted treatment alternatives.[36] As such, TIPS placement is recognized as standard of care therapy in this setting.[3,5,16] TIPS creation reduces the PSG, offloading pressure from the bleeding varix with a 90% bleeding cessation rate but variable survival rates.[36–38] The literature specifically addressing TIPS placement combined with embolotherapy in the emergent setting is lacking. Thus, operators are left to draw conclusions from existing data in other clinical scenarios. As such, it is the authors' clinical experience that performing embolization of esophageal or gastroesophageal varices at the time of TIPS placement has value in the rescue setting. This appears to be supported by the literature from preemptive TIPS placement discussed earlier.

TIPS placement should also be considered in patients with preserved liver function (e.g., Childs–Pugh A) who experience a repeat, but controlled, variceal bleeding event despite adequate management.[3] These patients may undergo an elective, nonurgent TIPS placement to minimize further bleeding. A recent retrospective study was conducted on 126 hemodynamically stable, nonbleeding patients (last bleed: mean 35 days) who had experienced recurrent episodes of variceal bleeding.[39] When the TIPS group was compared with the endoscopic therapy group, recurrence

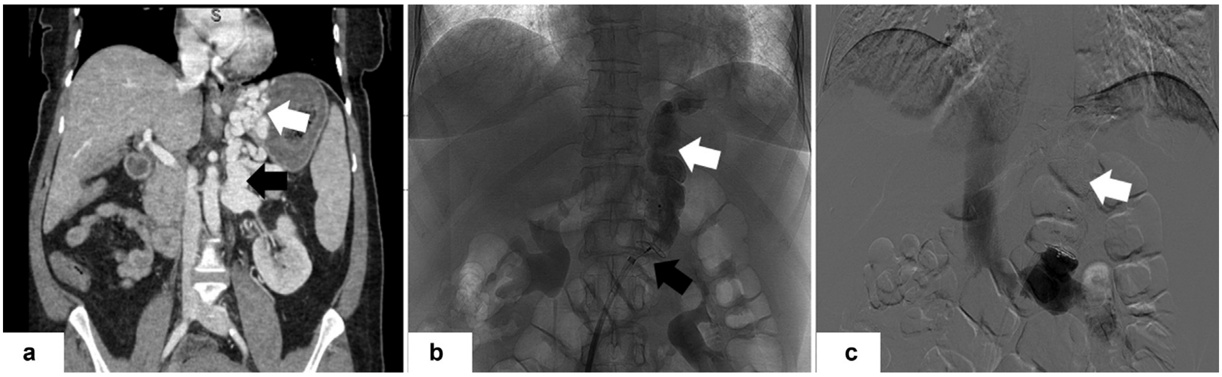

Fig. 4 Plug-assisted retrograde transvenous obliteration (PARTO) in a patient with isolated gastric varices without a history of hemorrhage. (**a**) Coronal reformat from a contrast-enhanced computed tomography examination showing a splenorenal shunt (black arrow) and large gastric varices (white arrow). (**b**) Fluoroscopic image from the PARTO procedure shows the sheath and occlusive plug within the shunt (black arrow) with radiopaque sclerosant in the gastric varices (white arrow). (**c**) Digital subtraction angiography of the splenorenal shunt after PARTO shows obliteration of the varices (white arrow).

of variceal bleeding was significantly less for patients undergoing TIPS placement (66.1 vs. 21.4%, $p < 0.001$), and endoscopic therapy was the only significant independent predictor of recurrent bleeding (OR: 7, 95% CI: 3.0–16.5, $p < 0.001$). Cumulative survival rates between the two groups were similar, but the incidence of death secondary to variceal bleeding was lower for the TIPS group (10 vs. 28.6%). These findings are in agreement with previous literature utilizing covered stents.[28] Older, conflicting data exist in this population where nonemergent TIPS procedures were performed using bare metal stents, but this is less relevant to modern practice.[40]

Varices with a Splenorenal Shunt

The following section will consider the management of GOV2 and IGV1 together, unless a distinction is made within the cited reference. Overall, it must be recognized that the literature separating various types of gastric and gastroesophageal varices is less robust, which means that fewer definitive conclusions may be drawn. Due to this, the discussion of the literature will be divided into two sections: prophylactic indications (i.e., the patient has never had a variceal bleeding event) and therapeutic indications (i.e., the patient had prior variceal bleeding or the patient has an active variceal bleeding event). Given the high rates of technical and clinical success associated with CARTO and PARTO for gastric varices,[41–44] the term BRTO will be used as a catch-all phrase to include all retrograde obliterative techniques.

Prophylaxis

Similar to gastroesophageal varices, less invasive therapies including NSBB and endoscopy are currently recommended as first-line therapy for patients with gastric varices without hemorrhagic complication by the AASLD and European Association for the Study of the Liver (EASL).[3,5] Conversely, the Korean Association for the Study of the Liver (KASL) recommendations do allow for BRTO as a strategy for primary prophylaxis for patients with GOV2 and IGV1, citing a high technical success rate and the possibility of improving hepatic function by redistributing blood flow back toward the portal vein (►**Fig. 4**).[16,41,45,46] The cumulative risk for bleeding from gastric varices has been shown to be 23.2 to 44% over a 5-year period,[47,48] suggesting that some patients may benefit from prophylactic therapy. For instance, a nonrandomized, prospective trial assigned 17 patients with fundal gastric varices to BRTO, while another 17 patients were treated with standard medical therapy.[49] The investigators demonstrated that bleeding rates (BRTO: 17%; control: 61%; $p = 0.01$) and overall survival (BRTO: 39%; control: 22%; $p = 0.04$) were improved in patients receiving the prophylactic therapy. Later, a retrospective cohort study examined the effects of an untreated SRS on patient survival.[50] Here, investigators divided 59 patients into one of three groups: patients without a SRS, patients with an untreated SRS, and patients with a SRS treated by BRTO. They found that patients without a SRS and patients with a SRS treated by BRTO lived significantly longer and had improved liver function than patients with an untreated SRS. Finally, a meta-analysis of over a thousand patients treated with BRTO for gastric varices found that the technical success rate was 96.4%, clinical success rate was 97.3%, and major complication rate was 2.6%, although it should be noted that both prophylactic BRTO and BRTO performed in the setting of acute bleeding were included in the analysis.[45] However, the study does provide evidence for the safety and efficacy of BRTO without the alterations to liver functions and incidence of HE seen with TIPS placement. As such, obliterative techniques can be considered in the prophylactic setting, especially in patients who may be at high risk for future bleeding events.[16]

Therapeutic

As with gastroesophageal varices, patients with gastric variceal hemorrhage should receive volume resuscitation, antibiotics, vasoactive medications, and possibly endoscopic management as first-line therapy.[51] Given the aforementioned high rates of mortality associated with uncontrolled variceal hemorrhage, every effort should be made to temporize to the bleeding and stabilize the patient prior to beginning an image-guided intervention. In some situations, balloon tamponade can control bleeding while the patient is being resuscitated and/or transferred to the interventional or endoscopic suite. TIPS placement in the setting of bleeding gastric varices has been associated with high (>90%) technical and clinical success rates.[52] Some authors suggest that operators must achieve a lower PSG when creating the TIPS for gastric varices than for esophageal varices and that variceal embolization may be required to prevent rebleeding.[53,54] There is one randomized trial comparing TIPS placement to EBL for patients with bleeding gastric varices.[55] In this trial, 72 cirrhotic patients with bleeding gastric varices were randomized to either TIPS placement ($n = 35$) or EBL ($n = 37$) after controlling the acute hemorrhagic event. Rebleeding in the gastric varices was higher in the EBL group (38%) than in the TIPS group (11%; $p = 0.014$), although overall survival at 33 months was similar. Importantly, there were no differences in major complication rates between the two groups.[55] Therefore, TIPS placement is favored over repeated EBL therapy for gastric varices after controlling the initial bleed in patients who can tolerate shunt creation. With regard to BRTO, one retrospective cohort study evaluated 27 patients with either high-risk gastric varices or gastric variceal hemorrhage treated with endoscopic N-butyl-2-cyanoacrylate (NBCA) injection ($n = 14$) versus those treated with BRTO ($n = 13$).[56] Patients treated with BRTO did have lower rebleeding rates (15.4 vs. 71.4%; $p < 0.01$) with an improved overall survival. Finally, a multicenter, retrospective evaluation of BRTO in 183 cirrhotic patients with bleeding gastric varices found that approximately 50% of patients with follow-up endoscopy had complete obliteration of their gastric varices and another 31 patients had marked reduction in their gastric varices.[57] In this study, the estimated bleed-free rate at 3 years was approximately 75%, most of which occurred in esophageal varices. Consequently, both decompressive and obliterative techniques can be considered for patients with bleeding gastric varices.

When deciding whether to proceed with TIPS placement, TIPS placement with variceal embolization, BRTO, or TIPS placement with BRTO for bleeding gastric varices, multiple factors need to be considered (►**Fig. 5**). For example, BRTO has a theoretical advantage over TIPS creation in patients with compromised liver function or preexisting HE since obliteration does not divert portal flow away from the hepatic parenchyma. Yet, BRTO can worsen esophageal varices and ascites in certain patients. Furthermore, BRTO could

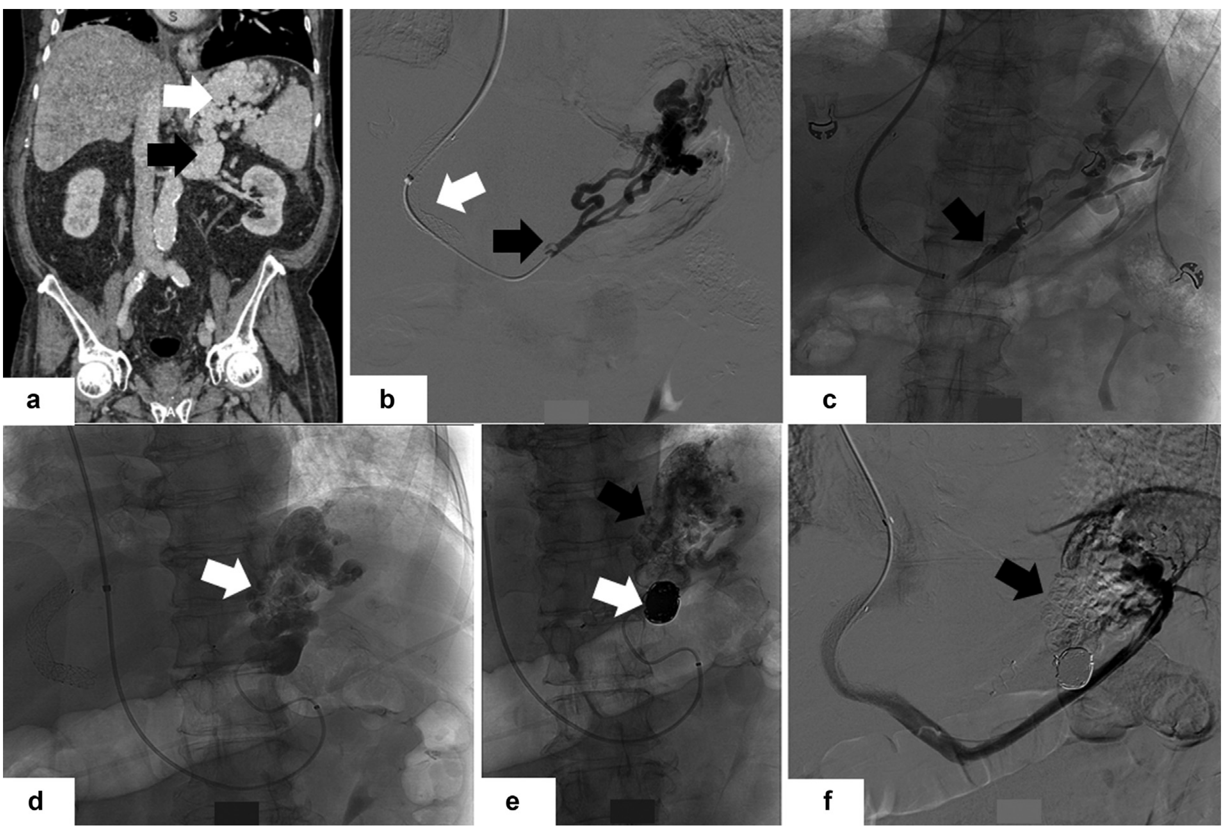

Fig. 5 Combination of decompression and obliteration in a patient with a history of bleeding gastroesophageal varices. (**a**) Coronal reformat from a contrast-enhanced computed tomography examination showing a splenorenal shunt (black arrow) and large gastric varices (white arrow). (**b**) After anterograde catheterization of the gastric varices from a transjugular intrahepatic portosystemic shunt (TIPS) access (white arrow), digital subtraction angiography (DSA) demonstrates the gastric varices (black arrow). (**c**) Radiograph obtained after sclerosant and plug deployment (black arrow) within the gastric varices from an anterograde approach. (**d**) Radiograph obtained during retrograde transvenous obliteration from a jugular approach shows contrast within gastric varices. (**e**) Radiograph obtained during retrograde transvenous obliteration from a jugular approach shows coils occluding the shunt (white arrow) and radiopaque sclerosant within the varices (black arrow). (**f**) DSA of the portal venous system after TIPS placement, anterograde embolization with sclerosis, and retrograde transvenous obliteration demonstrates that the varices no longer fill with contrast.

preclude future endovascular access to other gastric varices that might develop. Thus, the operator must incorporate physiologic and anatomic factors into their decision as randomized, prospective trials are lacking. One retrospective cohort study compared patients with isolated gastric varices treated with either TIPS placement ($n = 27$) or BRTO ($n = 25$) with regard to complications and rebleeding rates.[58] Investigators found no differences between the groups in rebleeding rates, complications, and overall survival. Patients treated with TIPS placement, however, did have higher rates of HE (22 vs. 0%; $p = 0.01$). Another early, single-center, retrospective cohort analysis compared clinical outcomes in patients with bleeding gastric varices treated with TIPS placement ($n = 27$) or BRTO ($n = 23$).[59] This small study did not reveal statistically significant differences in technical success, major complications, HE, or incidence of rebleeding. Nonetheless, it should be noted that no patients in the BRTO group experienced HE or rebleeding during the study period. One of the largest retrospective cohort studies evaluating TIPS placement and BRTO for bleeding gastric varices included 142 patients, 95 of who underwent BRTO.[60] Contrary to earlier studies, patients in this cohort treated with BRTO experienced less rebleeding at both 1 and 3 years ($p = 0.006$) in addition to improved overall survival ($p = 0.026$). Moreover, treatment with TIPS was found to be an independent predictor of rebleeding on multivariate analysis. Similarly, a recent meta-analysis of patients receiving therapy for gastric varices included 308 patients and 127 patients treated with BRTO and TIPS creation, respectively.[61] In this analysis, BRTO was associated with a lower likelihood of rebleeding (BRTO: 10.6%; TIPS: 18.7%; $p = 0.027$) and HE (BRTO: 0%; TIPS: 23.1%; $p < 0.001$) but did increase rates of ascites. An earlier meta-analysis also demonstrated lower rebleeding rates with BRTO than with TIPS for patients with gastric variceal hemorrhage.[62] These findings suggest that BRTO may be a less invasive and more effective therapy than TIPS creation for patients with gastric variceal hemorrhage.[63,64]

Some operators may prefer to create a TIPS and perform BRTO in patients with gastric variceal bleeding. The combined approach provides the benefits of each procedure while avoiding some of the untoward effects. TIPS placement lessens the aggravation of esophageal varices, the increase in ascites, and the development of ectopic varices that can be encountered after BRTO due to reductions in the PSG. Likewise, obliteration of the gastric varices redirects portal flow to the liver, which could reduce the incidence and/or severity of HE and improve stent patency. There are few studies comparing patients with gastric varices who were treated with either TIPS + BRTO or TIPS alone. One retrospective cohort study compared nine patients who had TIPS created either prior to or at the same time as BRTO to 27 patients who had BRTO only.[65] At 6, 12, and 24 months, recurrent bleeding occurred in 9, 9, and 21% of patients, respectively, treated with BRTO. No patients treated with TIPS + BRTO experienced rebleeding at any time point in the follow-up period. A more recent retrospective cohort study compared 18 patients treated with TIPS + BRTO to 22 patients treated with TIPS alone for gastric variceal hemorrhage.[7] The combined approach resulted in higher rates of variceal eradication (92 vs. 47%; $p = 0.01$) and lower rates of variceal rebleeding (0 vs. 23%; $p = 0.056$). The investigators did not find any significant differences between the groups with respect to ascites, HE, or future esophageal variceal bleeding.[7] Even though the evidence is scant, these series suggest that a combined approach of decompression plus obliteration may decrease rebleeding rates in patients with gastric variceal bleeding. Certainly, consideration must be given to the patient's overall functional status and Model for Endstage Liver Disease (MELD) scores prior to creating the shunt.

For patients with a suitable anatomy, an anterograde transvenous obliterative (BATO) approach can be considered.[66] The anterograde approach to gastric varices is accomplished through either a percutaneous transhepatic puncture directly into the portal system or a transjugular intrahepatic puncture into the portal system. Once access into the portal system has been established, the varices can be sclerosed or embolized depending on operator preferences. One retrospective cohort study evaluated 74 cirrhotic patients with gastric variceal bleeding who were treated with either TIPS placement ($n = 31$) or percutaneous transhepatic variceal embolization (PTVE).[67] The authors reported no significant differences between the groups in rebleeding or overall survival. Patients treated with PTVE did experience significantly less HE than those with TIPS shunts ($p < 0.0001$). A recent retrospective study of 15 patients with gastric varices who were treated with TIPS placement and BATO showed a 100% technical success rate with complete regression of the varices and no cases of rebleeding during the follow-up period.[68] Finally, Gaba described a hybrid technique for isolated gastric varices combining both anterograde and retrograde transvenous access to the varices.[69] In this technique, sclerosant is instilled into the varix under both inflow and outflow vascular occlusion. The authors treated six patients with 100% technical success.

Ectopic Varices

Bleeding ectopic varices are relatively rare, with mostly case reports and case series available in the literature, which makes the choice of optimal treatment approach challenging due to the lack of high levels of evidence. Management is best performed with a multidisciplinary approach, as accessibility via either endoscopic or endovascular approaches should be considered. Endoscopic capabilities have significantly improved with the advent of push-, single-, and double-balloon endoscopy, with reports describing successful endoscopic treatment of varices in challenging locations.[70,71] Endoscopic management usually involves band ligation, sclerotherapy, or injection of NBCA glue. Despite these advances, IR is often consulted for the management of ectopic varices. In these situations, decompression via TIPS placement, percutaneous embolotherapy or sclerotherapy, or endovascular embolotherapy or sclerotherapy could be considered. Some authors have suggested that obliterative therapy is a necessary management strategy, even in the presence of a functioning TIPS,[13,72] which corresponds to our institutional experience.

Conclusion

Variceal hemorrhage is a morbid condition that frequently mandates the involvement of IR to achieve successful and sustained hemostasis. TIPS placement continues to be the mainstay of therapy for patients with bleeding esophageal and GOV1. Obliterative therapies, with or without a decompressive TIPS, allow for successful management of other forms of gastroesophageal varices and ectopic varices. Knowledge of variceal pathophysiology and anatomy in addition to an individualized, multidisciplinary, and patient-centered approach is key to successful outcomes.

Disclosures

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Conflict of Interest

None declared.

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