Endoscopic Management of Esophageal Varices and Variceal Hemorrhage

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Introduction

A varix (pl. varices) is an abnormally dilated vessel with a tortuous course. Esophageal varices are portosystemic collaterals. They form as a consequence of portal hypertension (a progressive complication of cirrhosis), preferentially in the submucosa of the lower esophagus. Acute variceal hemorrhage is a medical emergency. Approximately 40% of patients with cirrhosis are found to have esophageal varices on endoscopic evaluation [7], and approximately one-third of patients will experience variceal hemorrhage [37]. Historically, mortality after index hemorrhage in patient with cirrhosis has been reported up to 50%, with a 30% mortality rate associated with subsequent bleeding episodes [44]. More recent data suggest improvement in mortality with improvement in management, however still associated with 20% mortality risk at 6 weeks [8]. The risk of variceal hemorrhage is increased in large varices and in those that demonstrate stigmata of bleeding (Table 14.2 and Fig. 14.4), as well as in patients with high Child–Pugh scores, high variceal pressure, and previous episodes of variceal hemorrhage and in patients who continue to ingest alcohol [44]. The size of the varix is the single most important predictor of bleeding risk. Primary prophylaxis of varices should be considered in varices larger than 5 mm [19]. Esophageal varices are graded according to size and appearance (Table 14.1 and 14.2 and Figs. 14.1, 14.2, 14.3 and 14.4). Grade 1 (F1) varices are small, are straight, and flatten with distention of the esophagus (Fig. 14.1). Grade 2 (F2) varices are tortuous, comprise less than one-third of the lumen, and do not disappear with distention (Fig. 14.2). Grade 3 (F3) varices are tortuous and comprise greater than one-third of the lumen (Figs. 14.3 and 14.4; Table 14.2).

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Risk Assessment of Patients

Assessing the risk of variceal hemorrhage is essential to the proper treatment of esophageal varices. The treatment of varices should be considered in terms of preprimary prophylaxis, primary prophylaxis, secondary prophylaxis, and treatment of acute hemorrhage.

Preprimary Prophylaxis

The objective of preprimary prophylaxis is to prevent the development of varices in patients with portal hypertension who are yet to develop varices. Although treatment with nonselective beta-blocker is not recommended, the treatment of underlying liver disease may help to lower the development of varices [18, 30]. Additionally, in order to detect the development of varices, routine surveillance endoscopy should be performed every 2–3 years or annually in the setting of decompensated liver disease [25].

Primary Prophylaxis

The primary prophylaxis refers to prevention of first variceal hemorrhage in a patient with varices. Ideally, the risk

Practical Considerations

- Size of the varix is the single most important predictor of bleeding risk.
- Risk of hemorrhage increase with size, presence of stigmata, high Child–Pugh score, high variceal pressure, and previous history of bleeding.

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Table 14.1 Endoscopic grading of esophageal varices

F1	Small, straight varices
F2	Enlarged, tortuous varices that occupy less than one-third of the lumen
F3	Large, coil-shaped varices that occupy more than one-third of the lumen

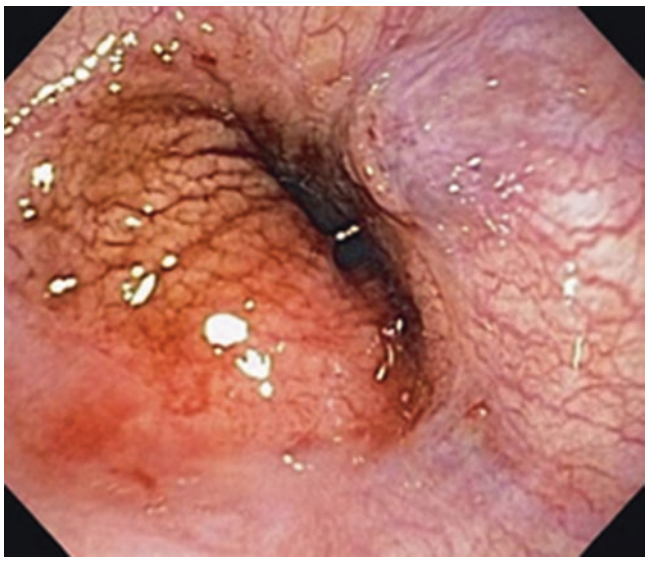

Fig. 14.1 An endoscopic view of grade 1 (F1) esophageal varices

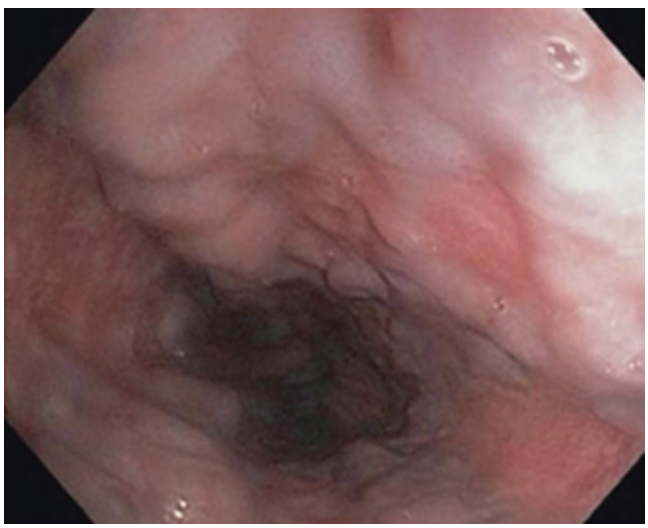

Fig. 14.2 An endoscopic view of grade 2 (F2) esophageal varices

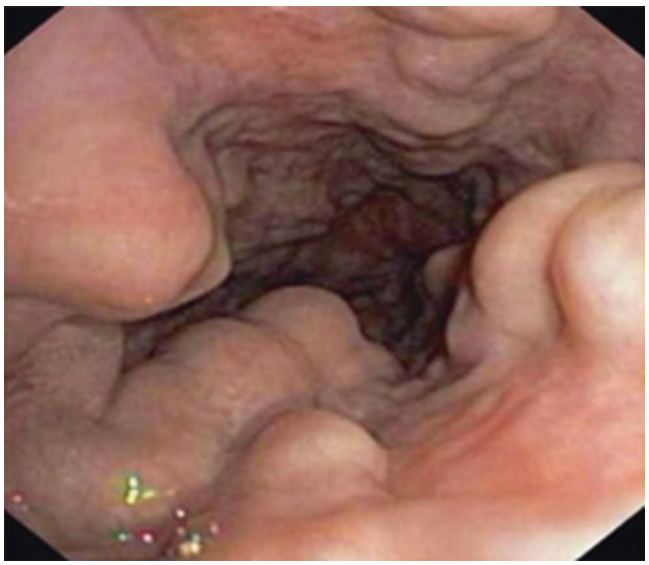

Fig. 14.3 An endoscopic view of grade 3 (F3) esophageal varices without stigmata of recent bleeding

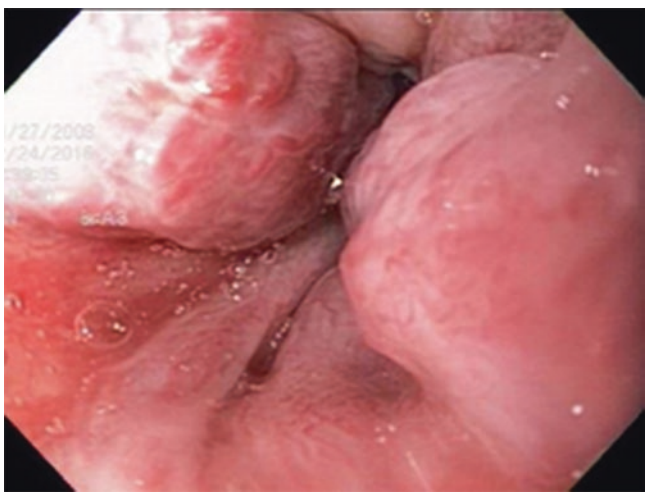

Fig. 14.4 An endoscopic view of grade 3 (F3) esophageal varices with stigmata of recent bleeding

Table 14.2 Endoscopic findings associated with an increased risk of hemorrhage

Longitudinal red streaks on the varices (red wale marks)
Cherry-colored spots that are flat and overlie varices
Raised, discrete red spots (hematocystic spots)

of hemorrhage in a patient with cirrhosis could be established by calculating the hepatic venous pressure gradient (HVPG, pressure difference in free and wedged hepatic vein), as bleeding is unlikely to occur at a pressure gradient less than 12 mm Hg. However, this procedure is invasive, costly, and not routinely performed. Clinical parameters such as platelet count and Child–Pugh score can be used to predict which patients will have large varices [11, 56]. However, it is generally recommended that all patients with cirrhosis undergo screening endoscopy. Patients should have a recent laboratory evaluation including hemoglobin, platelet count, and prothrombin time prior to endoscopic evaluation. Adequate intravenous access should be established, and the procedure should be performed by an

endoscopist experienced in assessment and ligation of varices. The size of the varices along with the presence of stigmata dictates the need for intervention. Varices <5 mm can be monitored with surveillance endoscopy, while those >5 mm are at higher risk of hemorrhage, and should be considered for ligation and/or medical management. Stigmata such as red wales or pigmented spots should also be considered to be signs of high risk for hemorrhage, and ligation should be performed.

A reduction of the HVPG by >20% or to <12 mm Hg can significantly reduce the incidence of an initial variceal hemorrhage [15]. More importantly, a reduction by >20% also reduces mortality in patients with esophageal varices [15, 29]. Nonselective beta-blockers such as propranolol and nadolol (nadolol has fewer systemic side effects than propranolol) lower HVPG and are the primary therapeutic interventions used for this purpose. These medications act by reducing splanchnic blood flow and portal pressure. They may also decrease the risk of developing ascites or spontaneous bacterial peritonitis, possibly by reducing portal pressure and decreasing bacterial translocation [32, 57]. Beta-blockers are initiated at a low dose and then slowly titrated to increasing doses in order to achieve a 25% reduction in resting heart rate. The vast majority of patients will experience some level of portal venous pressure reduction, but only 35% will attain the desired reduction of >20% [23]. Primary prophylaxis with nonselective beta-blockers results in a reduction in the risk of bleeding by approximately 40% [16, 45].

High-risk esophageal varices, such as those >5 mm in diameter or those demonstrating stigmata, should be considered for band ligation during endoscopy. This technique involves the use of a banding device, which attaches to the tip of an upper endoscope, and works by aspirating the varix into the banding chamber, where a rubber band is deployed around the vessel. This results in ligation or thrombosis of the vessel. Some studies have shown that band ligation is superior to beta-blockers in the prevention of hemorrhage [53, 60]. However, a more recent meta-analysis, which only used trials with adequate bias control, showed no difference in bleeding rates or mortality between those groups that underwent band ligation versus those treated with beta-blockers [27]. Band ligation often requires multiple endoscopic therapy sessions as patients must return every 2–4 weeks for repeat banding until the varices have been completely ligated. Thereafter, the patients will require continued surveillance as their varices frequently recur. Benefit from adding beta-blockers in patients who have undergone band ligation has not been well studied. One randomized study has shown combination therapy was not more effective than band ligation alone in preventing hemorrhage or death but less likely to cause recurrence [54].

Sclerotherapy utilizing agents such as ethanol, sodium morrhuate, ethanolamine oleate, or sodium tetradecyl sulfate, a previously preferred endoscopic technique for variceal ablation, have been supplanted by band ligation because ligation has a better safety profile and result in less long-term bleeding episodes. The overall benefit of sclerotherapy for treatment of esophageal varices has not been clearly demonstrated [59]. In fact, although sclerotherapy lowers subsequent bleeding episodes, it has been shown to increase mortality (the Veterans Affairs Cooperative Variceal Sclerotherapy) [31]. Thus, the band ligation should be favored over sclerotherapy for primary prophylaxis.

Surveillance endoscopy should be performed annually in patients with ongoing liver injury the setting of decompensated liver disease, whereas compensated liver disease with no varices should have repeat surveillance every 2 years [18].

Secondary Prophylaxis

Secondary prophylaxis refers to treatment of varices following an episode of hemorrhage.

Treatment in this group of patients is essential, as two-thirds will have a second episode of hemorrhage within 1 year [14]. As mentioned previously, large varix size, the presence of stigmata of recent bleeding, high variceal pressure, and severity of liver disease all increase rebleeding risk. A reduction of the HVPG by >20% results in a significant reduction in the recurrence of bleeding. Nonselective beta-blockers have been shown to decrease recurrent bleeding and improve survival at 2 years when used for secondary prophylaxis [3]. Similar to primary prophylaxis, the heart rate should be reduced by 25% or to a resting rate of 55. Long-acting nitrates may be added to beta-blocker therapy as they can further decrease portal venous pressure. However, these agents have not been shown to reduce mortality when used as monotherapy and can add to the side effect profile of medical management causing reduced patient compliance. One study showed a reduced incidence of rebleeding when medical management was compared to band ligation performed every 2–3 weeks, especially for those patients who had achieved >20% reduction in HVPG [9, 62]. The risk of complications for medical management remains lower than that of endoscopic management. However, other studies have found differing results when comparing endoscopic versus medical management, especially when treating patients with noncirrhosis-related portal hypertension [55]. More importantly, the combination of endoscopic ligation with medical management has recently been shown to decrease rebleeding rates when compared to single modality therapy [20, 28]. Sclerotherapy with sodium morrhuate or ethanolamine has been shown to be as effective as band ligation in controlling the initial bleeding episode. But, these agents were not shown to be as effective at preventing rebleeding episodes and had a much higher risk of complications [38]. Therefore, sclerotherapy should be avoided for secondary prophylaxis of hemorrhage. Variceal band ligation is performed every

2–3 weeks until obliteration of the varices is complete. This usually requires three to four sessions with subsequent surveillance endoscopy for the recurrence of varices, which commonly occurs.

Practical Considerations

- Most patients with cirrhosis should undergo diagnostic endoscopy to determine the presence and risk of bleeding.
- Patients with small varices should be treated with beta-blocker, medium-size varices should be treated with either beta-blocker or band ligation, and larger varices should be treated with band ligation.
- Variceal band ligation is performed every 2–3 weeks until obliteration of the varices is complete and usually requires three or four sessions.

Initial Management of Acute Variceal Hemorrhage

Presentation of variceal hemorrhage is seldom subtle, as patients often present with massive hematemesis with resulting tachycardia and hypotension (Fig. 14.5). Patients may also demonstrate signs of hepatic encephalopathy on presentation. Initial management should involve stabilization of the patient including preserving hemodynamic stability and airway patency. Adequate intravenous access should be established, and resuscitation with intravenous fluids and blood products should be initiated. Coagulation studies and platelet count must be obtained as soon as possible. Fresh frozen plasma transfusion may be considered for patients with elevated prothrombin times. Central venous pressure monitoring may assist in the management of fluid administration. Overenthusiastic fluid administration should be avoided, especially with normal saline as this may raise portal pressure and increase the risk of subsequent bleeding. Patients should be managed in an intensive care setting if possible. Endotracheal intubation should be strongly considered for airway protection as patients are at risk for aspiration in the setting of large volume bleeding, agitation, and the risk of the ensuing endoscopy. Pharmacologic therapy is integral for the cessation of hemorrhage. Somatostatin analogues such as octreotide reduce portal pressure by inhibiting release of glucagon and inducing splanchnic vasoconstriction.

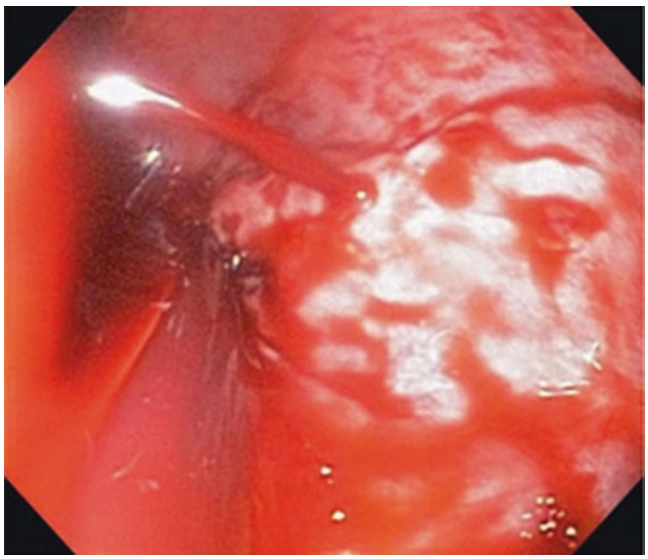

Fig. 14.5 An endoscopic view of active variceal hemorrhage in the esophagus

Pharmacologic therapy should be initiated in the emergency department. These agents control bleeding in up to 85% of patients and may be equivalent to endoscopic therapy for this purpose [17, 35, 58]. Therapy with octreotide can be continued for several days. However, the majority of the benefit is obtained within the first 24 h of treatment. Terlipressin, a vasopressin analogue with fewer systemic side effects than vasopressin, has been shown to be as effective as the somatostatin analogues in the control of active variceal hemorrhage [34]. Unfortunately, terlipressin is not available in the USA. Intravenous administration of a proton pump inhibitor is often utilized in order to raise the intragastric and intraesophageal pH and optimize coagulation capability. Antibiotic use (fluoroquinolone or third-generation cephalosporin) should be initiated on admission as this intervention has been shown to decrease infection risk, including the risk of spontaneous bacterial peritonitis as well as urinary tract infections and pneumonia, and reduce mortality [2, 6]. Early antibiotic use has also been shown to decrease the risk of future rebleeding [36].

Following interventions to achieve hemodynamic stabilization and management with octreotide, proton pump inhibitor, and antibiotics, more definitive therapy should be initiated with endoscopy, especially in those patients that continue to demonstrate evidence of continued bleeding. Endoscopy should be performed by an endoscopist experienced in management of variceal bleeding and in a controlled setting such as the intensive care unit. The patient must have adequate IV access prior to the procedure. Endoscopic therapy is effective in hemorrhage control in approximately 90% of cases. Variceal band ligation and sclerotherapy are equally efficacious in controlling variceal hemorrhage. However, band ligation is preferred as it causes fewer complications and has a lower incidence of rebleeding [41]. Unfortunately, the banding mechanism can interfere with visualization of an actively spurting vessel, necessitating the use of sclerotherapy, which allows the operator a full field of vision.

In some situations, medical management and endoscopic techniques are unsuccessful in controlling variceal hemorrhage. This situation generally necessitates the placement of a

Table 14.3 Items to be present for balloon tamponade placement

A tamponade tube kit (with the tube and clamps)
A manometer
Large-volume syringes
A traction/pulley system to maintain constant tension on the tube
Adequate suction

Sengstaken–Blakemore or Minnesota tube to control bleeding while a more definitive approach is pursued (Table 14.3). The Sengstaken–Blakemore tube has two balloons, one that inflates in the stomach and another that inflates in the esophagus. It has four lumens, one each for inflating the esophageal and gastric balloons, one for aspirating the stomach, and one for suctioning secretions in the esophagus. Prior to placement of a tamponade balloon, the patient should undergo endotracheal intubation if that has not already been performed. The physician managing the bleeding patient must confirm functioning balloons and suction ports prior to insertion. Following intubation, the tube is inserted, and the position is confirmed by auscultation, while air is insufflated into the gastric port. The position can also be established via endoscopic visualization. The gastric balloon is then inflated with 50–100 mL of air, and the position of the balloon is then confirmed radiographically. Once confirmation has been obtained, the balloon is then inflated with a total of 300–350 mL of air, and the apparatus is pulled upward and may be placed in traction. It is this external, upward traction that tamponades the bleeding varices. The position of the tube exiting the nostril (our preferred method) or the mouth should be marked for future reference. If bleeding is not controlled with this intervention, then the esophageal balloon should be inflated to approximately 25–35 mm Hg. Both the gastric and the esophageal balloons must be periodically deflated to avoid pressure necrosis of the mucosa. Balloon tamponade is very effective in hemorrhage control. But, unfortunately, it can cause severe complications, including ulceration, esophageal or gastric perforation, and aspiration. The tube should be considered only as a bridge to more definitive treatment and should be removed within 12–24 h of placement.

The transjugular intrahepatic portosystemic shunt (TIPS) procedure should be considered in the remaining 10% of patients in whom endoscopic control of variceal hemorrhage is not possible. In this procedure, a shunt is created by an interventional radiologist between the hepatic and portal vein with an expandable metal stent through the liver parenchyma, under fluoroscopic guidance. TIPS is effective in controlling hemorrhage from both esophageal and gastric varices. It has a lower short-term mortality rate than surgical shunts and provides equally efficacious portal decompression. Unfortunately, approximately one quarter of patients develop hepatic encephalopathy following placement of TIPS. The procedure also markedly increases the 30-day mortality of patients with elevated Child–Pugh scores or advanced MELD (Model for End-Stage Liver Disease) scores [10]. Surgical shunts are also a consideration in situations where TIPS is not feasible or not available. Surgical shunting should also be considered when definitive therapy is sought for treatment of varices not amenable to endoscopic therapy in patients who are not liver transplant candidates. Emergency shunt surgery is extremely effective in arresting hemorrhage and preventing rebleeding. However, it is associated with up to 50% mortality rate [49, 64]. Unfortunately, most of the patients die of liver failure and complications of surgery, despite achievement of hemostasis.

In patients who are not candidates for TIPS (Child–Pugh score > 14) or in centers where TIPS is not readily available, use of self-expandable metal stents (SEMS) is gaining rapid attention. The SEMS can be used without endoscopic or radiological assistance, can achieve rapid hemostasis, and can carry low side effect profile. In 2006, Hubmann and colleagues reported a study of 20 patients with refractory esophageal variceal bleeding (not responding to initial endoscopic therapy). Hemostasis was achieved in 100% of the patients [33]. A recent meta-analyses of five studies reported high success rate to achieve hemostasis and low adverse events associated with use of SEMS [51]. In a most recent randomized control trial [22], efficacy of balloon tamponade was compared with the SEMS in 28 patients with refractory esophageal variceal bleeding. The control of bleeding was higher (85% vs. 47%) and transfusion requirements (2 vs. 6 units of packed red cells) and adverse events were lower (15% vs. 47%) in the esophageal stent group compared to the balloon tamponade group. Thus, SEMs could be a viable and perhaps a better alternative in patients with refractory variceal bleeding.

Practical Considerations

Initial management of acute variceal hemorrhage should include:

- Initial resuscitation of bleeding patient.
- Correction of coagulation and platelet count.
- Avoid overenthusiastic fluid administration.
- Management in the intensive care unit.
- IV octreotide, proton pump inhibitor, antibiotics.
- Low threshold for intubation and ventilation.
- Upper endoscopy should be performed for diagnosis and treatment within 12 h of presentation.
- The use of balloon tamponade is decreasing due to risk of rebleeding and major complications. It should be considered as a temporary measure only until more definitive treatment is available.
- A transjugular intrahepatic portosystemic shunt (TIPSS) is a good alternative when endoscopic treatment and pharmacotherapy fail.

Several endoscopic therapies are available for the management of acute variceal hemorrhage: endoscopic variceal band ligation (EVL), injection sclerotherapy, argon plasma coagulation, detachable endoloops, and snares.

Endoscopic Variceal Band Ligation

The basic principle of ligation of varices is that elastic bands are used to strangulate a varix, causing thrombosis, inflammation, and necrosis and finally sloughing of the overlying mucosa. There are some drawbacks to this technique. The endoscope has to be withdrawn and loaded with a banding cylinder, which obviously takes several minutes, and can be costly in the setting of acute hemorrhage. Second, although the cylinder is transparent, it can reduce the viewing field, which makes visualization of the bleeding site difficult, especially with a vigorously bleeding vessel. Therefore, it is important to survey the upper gastrointestinal tract thoroughly initially for the presence and the grade of varices, exclude any other cause for bleeding (Fig. 14.6), and measure the distance of the varices in relation to gastroesophageal junction and incisors prior to attaching the cylinder to the endoscope. There are no absolute restrictions on coagulation parameters that precludе performing variceal ligation, although in patients with active bleeding, attempts should be made to improve the coagulation status [61]. When the decision has been made to pursue EVL, the endoscope is withdrawn and the banding device is affixed to the end of the endoscope before reintubation of the endoscope.

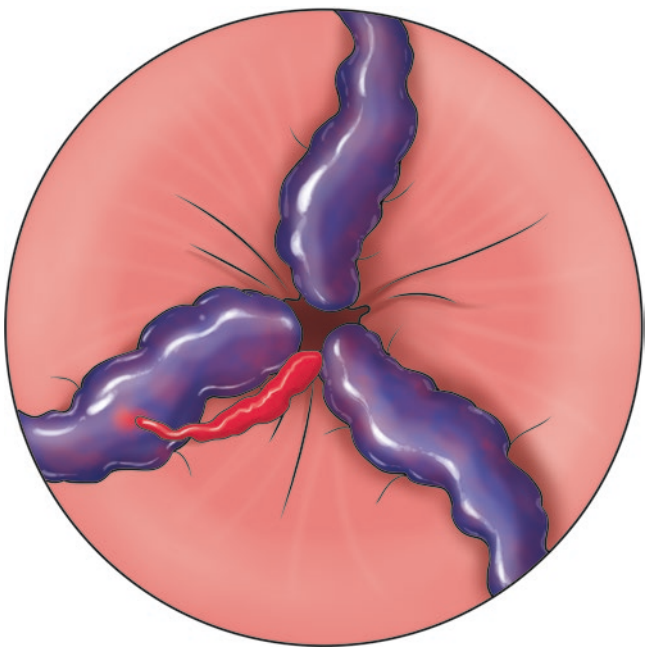

Fig. 14.6 An artist's depiction of a bleeding esophageal varix

Endoscopic variceal band ligation is more effective than sclerotherapy with greater control of hemorrhage, lower rebleeding, and lower adverse events but without differences in mortality [63].

Technique

The banding device consists of a transparent cylinder preloaded with elastic bands, which can be attached to the tip of the endoscope. Trigger threads traverse through the biopsy channel and wind around the trigger wheel. The endoscope is advanced and positioned in such a way that the tip of the endoscope faces tangentially to the varix, as close to the gastroesophageal junction or the most distal point of the variceal column as possible.

It is better to treat the varix below (a location in the esophagus distal) to the bleeding point. The suction should be turned to "maximum or high." The varix is then suctioned into the banding chamber, which gives rise to "complete red out or blue out" (caused by close approximation of the mucosa overlying the varix within the ligating chamber to the lens on the tip of the endoscope), indicating that an adequate amount of tissue has been captured by the device (Fig. 14.7). Once the varix has completely filled the chamber during suctioning (Fig. 14.8), a single band (or possibly two) is fired using the trigger wheel. Successful deployment of the band on to the varix causes a knuckle in the varix (Fig. 14.9). The band, left in this location (Fig. 14.10), will then cause thrombosis and ligation of the vessel. The endoscopist should proceed with banding of other varices in a circumferential pattern spiraling gradually up.

With regard to prophylactic banding, one study demonstrated that applying more than six bands per session

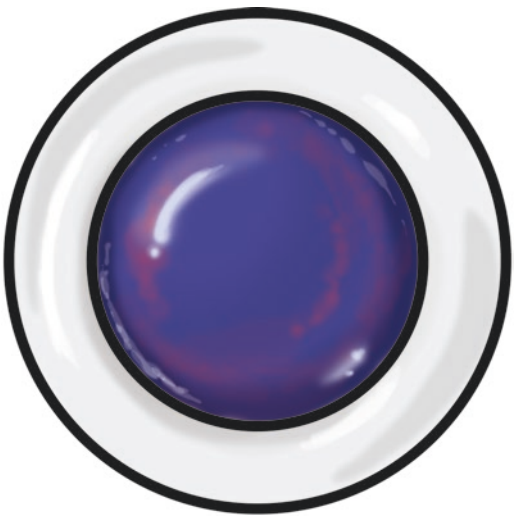

Fig. 14.7 "Blue-out" during band ligation of an esophageal varix

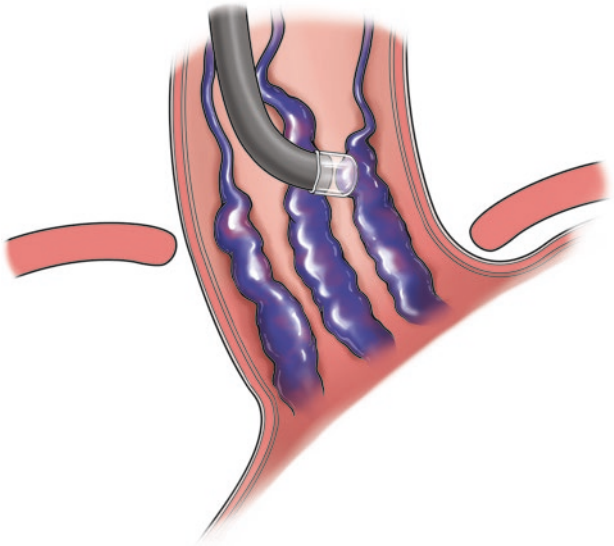

Fig. 14.8 An artist's depiction of suction of an esophageal varix into the cap of a band ligator

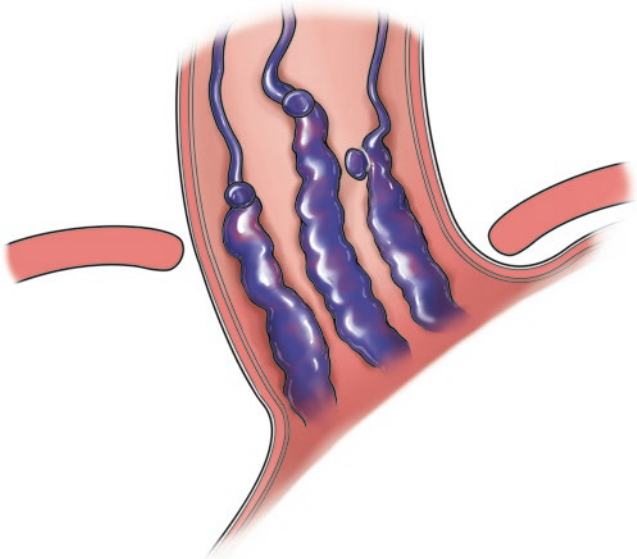

Fig. 14.9 An artist's depiction of a successful banding of esophageal varices

prolonged endoscopy time and did not reduce the total number of sessions required to obliterate visible varices [48]. Thus, prophylactic banding should generally be limited to six or fewer band ligations per session. The complications associated with band ligation include ulceration and stricture formation (Table 14.4). The banding kits come with different numbers of bands currently ranging from four to ten. The choice of which to use depends on the situation; more bands are required for acutely bleeding patients than for those undergoing elective re-banding [13].

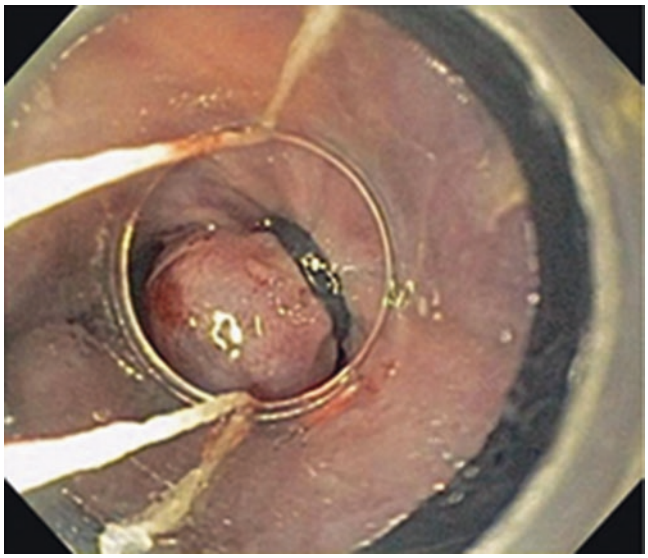

Fig. 14.10 An endoscopic view of band just placed on an esophageal varix using a band ligator

Table 14.4 Items to be present for endoscopic banding

Banding kit
Transparent cylinder loads with four, six, or ten bands
Trigger cord
Loading wheel
Loading catheter
Irrigation adapter
Suction should be turned to maximum or high prior to suctioning the varix into the cylinder

Injection Therapy

We describe this technique if one has to perform in emergency (the technique is going out of current practice). The sclerosants of choice are generally either 5% ethanolamine oleate or 5% sodium morrhuate. It is always advisable to keep a tamponade balloon readily available (Sengstaken–Blakemore) during sclerotherapy.

Technique

All injection devices consist of a fine needle with a beveled edge at the tip of a plastic tube, the proximal end of which has a luer lock (Table 14.5). It may help to orientate oneself within the esophagus and to grade the varices before therapy. It is advisable to inject the most distal varices first so that bleeding will not obscure the field of view of more proximal uninjected varices.

With the patient lying in the left lateral position, a drop of water or sclerosant from the tip of the needle or the catheter protruding from the biopsy channel will fall "down" to the left.

Table 14.5 Items to be present for endoscopic injection

Injector
Sclerosant
Syringes
Goggles
Experienced nurse
Sengstaken–Blakemore tube

If this point is considered to be 6 o' clock on a clockface, then the varices can be recorded around the clock. Similarly, a small pool of secretions may also serve the same purpose. We generally record the varices and their grades just above the gastroesophageal junction and approximately 5 cm proximally. The lower 5 cm is the most common site of bleeding, and, therefore, it is here that the injections should be placed. This area is also rich in large perforating vessels, which feed the varices from the periesophageal plexus of veins [42]. "Red blebs" are very thin areas, which are prone to bleeding and, therefore, should not be injected directly. No attempt should be made to inject ulcers and thrombosed varices on follow-up endoscopy as further ulceration and bleeding may occur.

Various techniques for injection have been endorsed throughout the literature. While some investigators advocate intravariceal injection, others advocate paravariceal injection, in order to cause fibrosis around the vessel and avoid systemic complications from the sclerosant. Others advocate a combination approach. It is difficult to determine which approach is most effective as many "intravariceal" injections may result in paravariceal injections.

Intravariceal Injection

Large varices are easier to inject, and, therefore, it is reasonable to choose the largest varix nearest to the 6 o'clock position, just above the gastroesophageal junction. The injector with its needle properly retracted is advanced through the biopsy channel and is advanced into the field of view. The needle is then pushed out and positioned between 30° and 45°. This is achieved by manipulating the tip of the endoscope. The injector is then inserted into the varix, and the sclerosant is injected (Fig. 14.11). Bulging and blanching are the signs of extravasation, which should be avoided. An experienced nurse can detect an intravariceal injection from the lower resistance felt on compressing the syringe plunger. In spite of taking extreme caution, extravasation may still go undetected, and, therefore, it is advisable that no more than 2 mL of sclerosant be injected at any one site. On withdrawal of the needle, a little bleeding may occur. Our practice is to insert the needle into the variceal column followed by injection of the sclerosant. After the injection, we maintain sufficient pressure on the varix for at least 15 s and then gradually withdraw the needle while maintaining pressure with the catheter tip for at least another 15 s. The catheter is gradually released watching for any evidence of bleeding (Fig. 14.12). If any signs of bleeding appear, the catheter is firmly applied to the varix and it is reinjected. If the varices are large, further, more distal injections within a 5 cm zone may be required. The needle is carefully withdrawn into the sheath before removing the injection catheter from the biopsy channel.

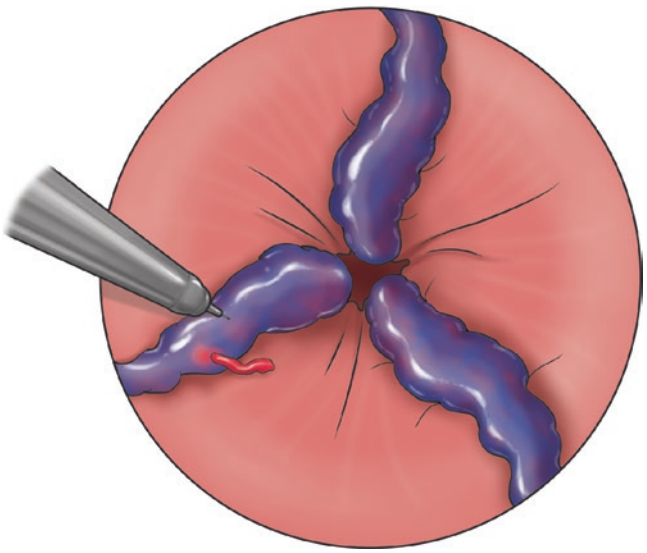

Fig. 14.11 An artist's depiction of intravariceal injection of sclerosant into an esophageal varix

Paravariceal Injection

Paravariceal injections of sclerosants produce fibrosis without ulceration or thrombosis of the varices. Small volumes of sclerosants are injected superficially adjacent to the variceal columns (Fig. 14.13). The injections are done more obliquely and superficially than for variceal thrombosis. Injections should begin just above the gastroesophageal junction and proceed in a spiral manner, up the esophagus, causing a uniform edematous sheath surrounding the variceal columns in the distal part of the esophagus (Fig. 14.14). Some endoscopists inject into the varices to cause thrombosis and make injections adjacent to and over the surface of the varices for added effect.

Endoscopic sessions are repeated every 1–3 weeks, and it may require six to eight sessions before obliteration of the varices is complete. Sclerotherapy has been associated with ulceration, esophageal perforation, esophageal stricture, portal vein thrombosis, and pulmonary embolism.

Practical Considerations

- Endoscopic variceal ligation works by capturing all or part of a varix within a band, resulting in occlusion from thrombosis.
- Cumulative data from a number of studies suggest that band ligation is preferred over sclerotherapy primarily due to greater control of hemorrhage, lower rebleeding, and lower adverse events.

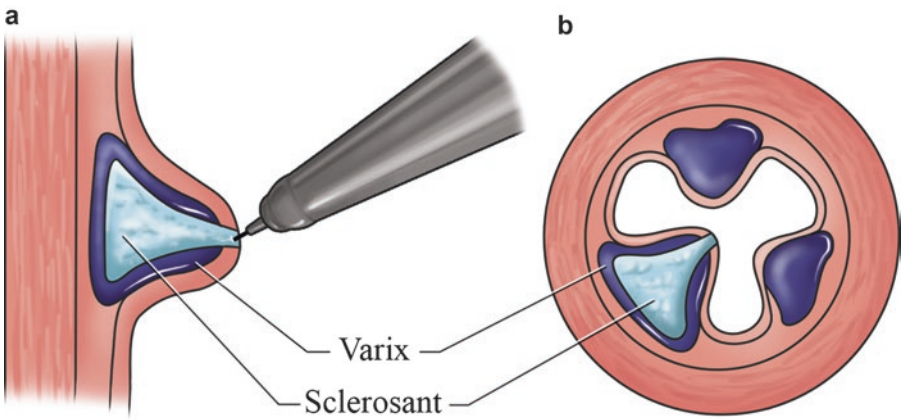

Fig. 14.12 An artist's depiction of an esophageal varix after intravariceal injection of a sclerosant (**a**) Linear view; (**b**) Sectional view

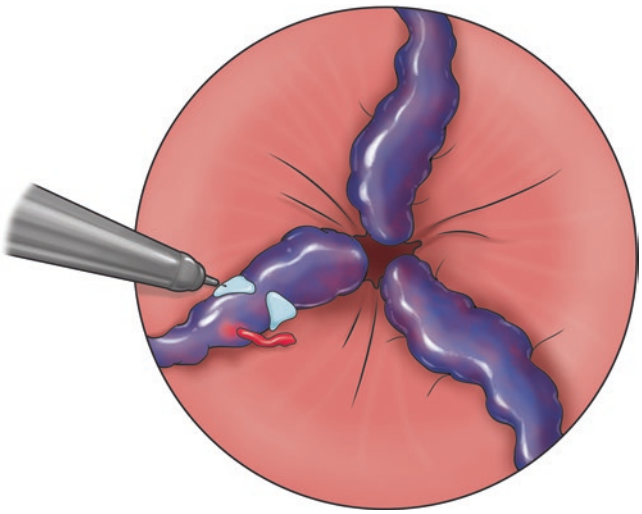

Fig. 14.13 An artist's depiction of an esophageal varix for paravariceal injection of a sclerosant

Combination of Band Ligation and Sclerotherapy

Combination treatment may hasten variceal eradication. Some endoscopists inject smaller volumes of sclerotherapy agents immediately after banding just proximal to the band ligation sites. Venous stasis above the banded site may enhance the effect of therapy. Others prefer injecting the sclerosant between the banded sites. It should be remembered that these approaches may not be superior to band ligation alone [21, 26, 39, 50]. Moreover, complications and mortality with combination therapy have been found to be higher than with band ligation or sclerotherapy alone [5, 40, 50].

Argon Plasma Coagulation

Argon plasma coagulation (APC) utilizes argon gas to conduct a high-frequency electrical current to produce coagulation that is only a few millimeters deep, without tissue contact by the probe. Several studies have demonstrated that APC may reduce the rebleeding rate of esophageal varices following effective band ligation therapy [24, 43]. Further studies should be performed before this procedure is performed in routine practice.

Gastric Varices

Gastric varices are found with advanced portal hypertension and are the source of hemorrhage in approximately 10% of patients with variceal bleeding. Gastric varices (GOV) are classified according to location and continuity with esophageal varices. GOV1 extend from the esophagus a short distance past the GE junction. GOV2 are in continuity with esophageal varices and extend into the fundus. IGV1 are isolated varices in the fundus, and IGV2 are isolated varices that occur in the body or antrum of the stomach. Gastric fundal varices are less likely to bleed than those found in other locations, but the magnitude of blood loss is comparatively more severe to esophageal variceal hemorrhage (Table 14.6, Figs. 14.15 and 14.16) [52].

The initial management of gastric variceal bleeding is similar to that of esophageal variceal bleeding and should include hemodynamic stabilization, adequate IV access, central venous pressure monitoring, consideration of endotracheal intubation, and intravenous administration of octreotide, a proton pump inhibitor, and antibiotics (either a fluoroquinolone or a third-generation cephalosporin). Unfortunately, large randomized controlled trials pertaining to endoscopic management of gastric varices do not exist. Band ligation in the stomach can be complicated by large ulcerations because of the mucosa overlying the vessel being banded. Sclerotherapy utilizing ethanolamine oleate or sodium morrhuate for gastric varices is often ineffective and, because it requires larger amounts of sclerosants than esophageal sclerotherapy, can often lead to complications. Treatment with cyanoacrylate has been shown to effectively control bleeding.

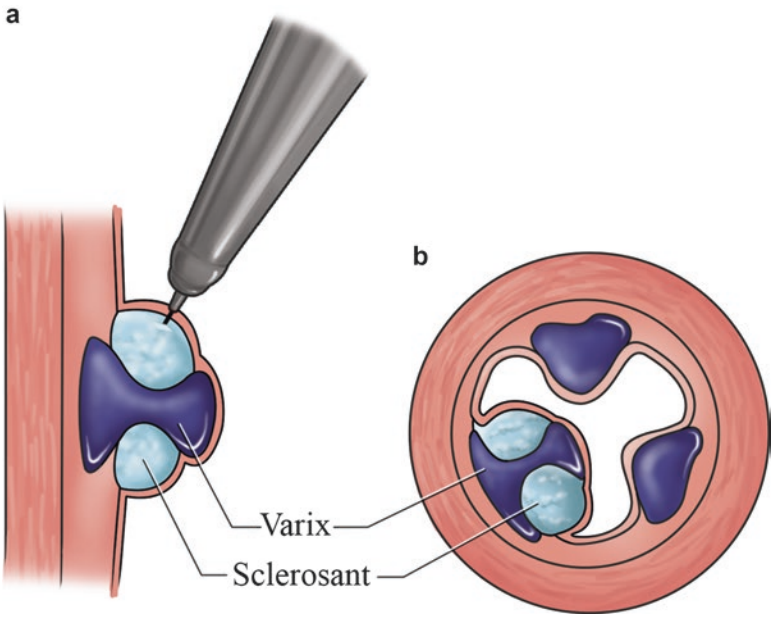

Fig. 14.14 An artist's depiction of a cross-sectional view of an esophageal varix for paravariceal injection of a sclerosant (**a**) Linear view; (**b**) Sectional view

Table 14.6 Endoscopic grading of gastric varices

GOV1	Gastroesophageal varices along the lesser curvature of the stomach
GOV2	Gastroesophageal varices along the greater curvature of the stomach
IGV1	Isolated gastric varices in the fundus
IGV2	Isolated gastric varices at other loci in the stomach

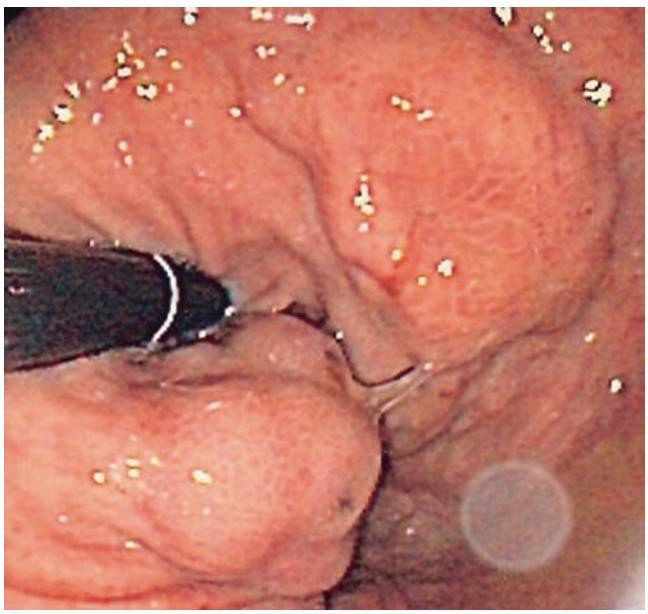

Fig. 14.15 An endoscopic view of gastric varices

However, this treatment has been shown to cause ulceration, bacteremia, and embolic disease. Cyanoacrylate is not currently approved for treatment in the USA and, therefore, is

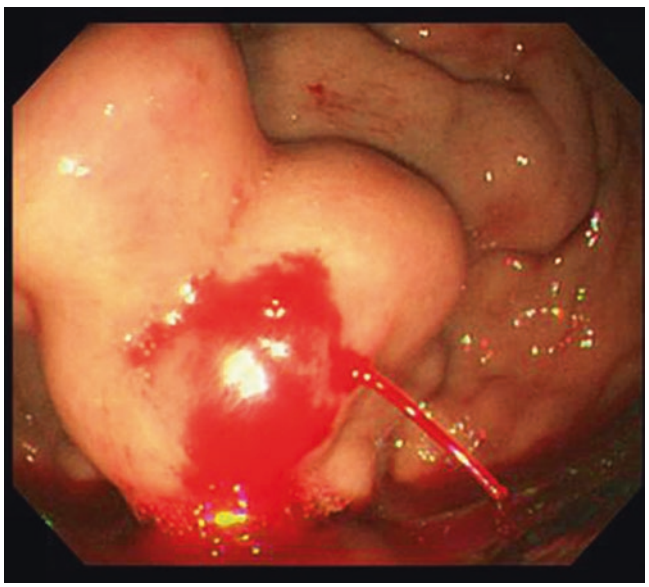

Fig. 14.16 An endoscopic view of an actively bleeding gastric varix

not discussed in detail here. Thrombin injections (approximately 1000 IU) have also been shown in small trials to effectively control bleeding from gastric varices in up to 90% of patients and decrease rebleeding rates to 20% at 6-week follow-up, without any reported adverse effects [46, 47, 65]. Several sessions of therapy are generally required. The use of a detachable snare with simultaneous sclerotherapy and O-ring ligation was recently reported in the literature to achieve hemostasis of gastric variceal hemorrhage in eight out of eight patients with a 97% resolution of gastric varices in 35 patients for whom it was used for primary or secondary prophylaxis of bleeding [66]. A Linton–Nachlas tube can

temporarily halt bleeding, while a more definitive treatment is pursued in those patients who continue to bleed. The Linton–Nachlas tube has a larger gastric balloon than the Sengstaken–Blakemore tube and, thus, causes more effective tamponade of gastric variceal bleeding. Endoscopic ultrasound-guided coiling and cyanoacrylate injection are in the experimental phase. These techniques are reported to achieve >90% obliteration of the gastric fundal varices [4]. However, it is a high-risk procedure, which is only available at selected centers and requires special skills. Balloon-occluded retrograde transvenous obliteration (BRTO) has been used for bleeding gastric varices. It involves occluding blood flow by inflation of a balloon catheter within a draining vessel, followed by instillation of a sclerosant proximal to the site of balloon occlusion. BRTO has shown good long-term bleeding control. However, technical failure occurs in approximately 10% of cases and may increase portal pressure leading to the development or worsening of esophageal varices, ascites, and systemic venous thrombosis [1, 12]. TIPS or surgical shunting are highly effective in controlling gastric variceal bleeding. Devascularization, as described by Sugiura and Futagawa, is a final option for the control of bleeding varices. Similar to esophageal varices, nonselective beta-blockers should be considered for primary and secondary prophylaxis in order to decrease the HVPG (Fig. 14.17).

Follow-Up

Following endoscopic therapy, patients will require close follow-up as complications are a well-known aspect of current therapy. Patients undergoing sclerotherapy are at risk for ulceration, bleeding, chest pain, and perforation. Band ligation can induce ulcers, bleeding, and strictures. Patients who undergo obliteration of varices for primary or secondary prophylaxis will need endoscopic sessions every 2–3 weeks, until obliteration is complete, and then subsequent surveillance endoscopies to monitor for recurrence of disease. Patients who are initiated on nonselective beta-blockers will need to gradually increase their dose every 5 days in order to achieve a 25% reduction from baseline heart rate or a resting heart rate of 55/min. Patients will need to be monitored for bradycardia and hypotension and should be counseled on compliance, as these agents can cause unpleasant side effects such as fatigue, wheezing, gastrointestinal symptoms, and impotence.

It is beyond the scope of this chapter to discuss the relative costs of various treatment modalities; however, with increasing cost constraints, physicians dealing with variceal hemorrhage should be aware of the cost-effectiveness of different treatments with consideration of their level of expertise and the availability of different therapeutic options.

Practical Considerations

- Endoscopic treatment of bleeding gastric varices with injection of the tissue adhesive cyanoacrylate (if available) is more effective and less invasive than TIPS procedure.
- TIPS placement is an alternative in areas where cyanoacrylate is not available.

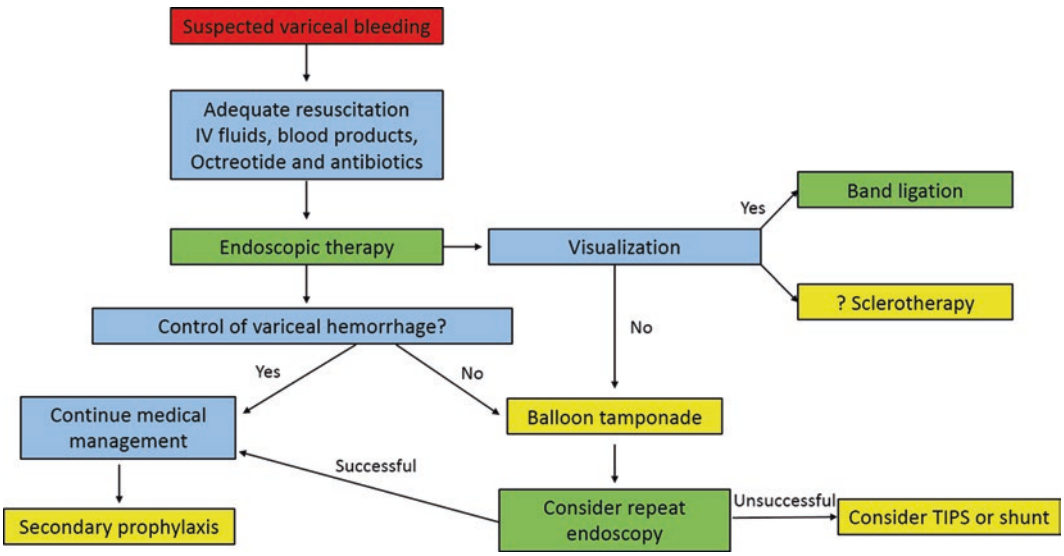

Fig. 14.17 An algorithm for the management of variceal hemorrhage

Conclusions

- The management of varices can be categorized into prepprimary prophylaxis, primary prophylaxis, secondary prophylaxis, and management of acute hemorrhage.
- Current therapeutic endoscopic modalities now offer outcomes superior to previous treatment methods, and new options for prophylaxis and management of acute hemorrhage appear imminent.
- Regardless of technological advances, the foundation of hemorrhage management remains rooted in the medical stabilization of the patient prior to the endoscopic therapy.

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