Balloon-Occluded Retrograde Transvenous Obliteration (BRTO): A Novel Method of Control of Bleeding from Post-Glue Ulcer over Gastric Varices. Report of Two Cases and Review of Literature

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Bleeding gastric varices (GV) are managed by cyanoacrylate glue injection with transjugular intrahepatic portosystemic shunt (TIPSS) as modality for treatment failure. Ulcer can form at the site of glue injection over GV and it can cause bleeding. Treatment approach for such bleed is not well described. Balloon-occluded retrograde transvenous obliteration (BRTO), TIPSS, and devascularization remain the treatment options in this scenario. BRTO is an endovascular procedure where a balloon catheter is inserted into a draining vein of GV, and the sclerosant can be injected into the varices through the catheter during balloon occlusion. BRTO has the benefit of increasing portal hepatic blood flow and can also be useful in patients who may not tolerate TIPSS. We report two cases where BRTO was done for control of bleeding from ulcers formed over previously injected GV.

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Gastric varices (GV) are seen in 17% patients with cirrhosis and cause severe upper gastrointestinal (UGI) bleed.¹ Treatment modalities for bleeding GV are cyanoacrylate glue injection and transjugular intrahepatic portosystemic shunt (TIPSS). Balloon-occluded retrograde transvenous obliteration (BRTO) has been used as a primary treatment for acute bleeding GV. Ulcer can form at the site of glue injection over GV and it can cause bleeding. The exact prevalence of such bleeding and treatment options is not well established. BRTO has been proposed as a possible treatment option in such situation. TIPSS and devascularization remain other therapeutic options in this scenario.

BRTO is an endovascular procedure where a balloon catheter is inserted into a draining vein of GV, and the sclerosant can be injected into the varices through the catheter during balloon occlusion. BRTO has been used for active GV hemorrhage, which was transiently treated by either endoscopic sclerotherapy or Sengstaken–Blakemore tubes, recent bleeding, and preventive GV obliteration in

patients who had never bled.² Reports of refractory variceal bleed treated with BRTO are rare.² We report two cases where BRTO was done for control of bleeding from ulcers formed over previously injected GV.

CASE 1

A 44-year-old male with Child–Pugh class B cirrhosis presented with UGI bleed. He had past history of glue injection for gastric variceal bleeding one month ago. At admission, the patient had tachycardia (pulse 116/min) and hypotension (BP 86/50 mmHg) pallor. He was resuscitated with crystalloid infusion and blood transfusion and terlipressin infusion was started. After hemodynamic stabilization, he underwent emergent UGI endoscopy which showed small esophageal varices with no stigmata of bleed with large deep white based ulcer over GV at the site of previous glue injection (Figure 1). There was no unsolidified area in the varices for further glue injection. There was ongoing bleeding as indicated by persistent tachycardia and requirement of blood transfusion. Options of TIPSS or BRTO were considered and CT angiography abdomen was done to assess patency of portal vein, hepatic veins, splenic vein, and presence of gastroduodenal shunt. CT showed patent portal and splenic veins and a large gastroduodenal shunt draining the gastric varix. Through right transfemoral venous route, selective cannulation of left renal vein was done and balloon-occluded catheter was placed in gastroduodenal shunt. Shunt venogram showed a large gastroduodenal shunt with two small collateral

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Abbreviations: BRTO: balloon-occluded retrograde transvenous obliteration; EVL: endoscopic variceal ligation; GV: gastric varices; TIPSS: transjugular intrahepatic portosystemic shunt; UGI: upper gastrointestinal
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Figure 1 Endoscopic image showing extruded glue cast from site of previously glued varix.

feeder from inferior phrenic vein and short gastric vein. Coil embolization (3 mm Hilal) of collateral feeders was done. After balloon occlusion, a mixture of air, sodium tetradecyl sulfate, and lipidol in the ratio of 3:2:1 was

injected in gastroduodenal shunt. The balloon was occluded for next 4 h (Figure 2). Post-procedure recovery was uneventful and at one month following BRTO follow-up, endoscopy showed healed ulcer with obliterated varix.

CASE 2

This patient was a 65-year-old male patient with ethanol related cirrhosis. He was Child-Pugh class A and had hepatocellular carcinoma (no portal vein involvement), Barcelona Clinic Liver Cancer—stage C for which the patient had undergone transarterial chemoembolization 3 months back. The patient has history of glue injection for gastric variceal bleed one month back. He presented with massive bout of hematemesis. On presentation, the patient had tachycardia (pulse 110/min), pallor, and orthostatic hypotension. UGI endoscopy showed GV with gastric ulcer and active ooze. His previous CT angiography abdomen done 3 months back showed a gastroduodenal shunt feeding GV. BRTO was offered as a salvage therapy and cannulation of gastroduodenal shunt with balloon-occluded

Figure 2 (a, b) Contrast-enhanced computed tomography in axial and coronal section reveals markedly tortuous varices in and around the wall of stomach with varices draining in to splenic vein (arrows). (c) Balloon-occluded retrograde venogram with occlusion of the lieno-renal shunt (arrow) after embolization of two of the afferent veins (arrowheads). (d) Minimum intensity projection CT images after embolization of the lieno-renal shunt shows ethiodized oil cast in the varices (arrow).

catheter was done and air, sodium tetradecyl sulfate, and lipidol in the ratio of 3:2:1 was injected in gastroduodenal shunt completely filling the varices. The balloon was kept occluded for next 4 h. Post-procedure recovery was uneventful and at 2 months following BRTO follow-up, endoscopy showed healed ulcer with obliterated varix.

DISCUSSION

GV have a lower bleeding rate than esophageal varices,^{3,4} but once ruptured, GV tend to bleed profusely as they have greater blood flow compared with esophageal varices. The cumulative risk for bleeding from gastric fundal varices is 16%, 36%, and 44% at 1, 3, and 5 years, respectively.⁵ Also, mortality associated with gastric variceal hemorrhage is much higher (45–55%)¹ as compared to mortality rate associated with esophageal variceal hemorrhage (6–15%).^{6,7} Endotherapy for esophageal varices has high rate of technical success (87–100%) and a lower incidence of major complications.⁸ Ruptured GV have a high rate of rebleeding post-therapy 7–65%.^{1,6} Acute gastric variceal bleed is managed by cyanoacrylate glue injection. Endoscopic variceal ligation (EVL) is not used for GV because rebleeding rate of EVL is significantly higher than that of endoscopic obliteration using cyanoacrylate (54% *vs* 31%). TIPSS is used as a primary treatment or rescue therapy if variceal bleed is not controlled by cyanoacrylate glue. The success rate of TIPSS for control of gastric variceal bleeding is 90–96%. However, rebleeding rates have ranged from 20% to 30%.⁹ After glue injection for GV, there is erosion of overlying mucosa with extrusion of glue cast over time. Early extrusion, within 1 week, is seen in 12.1% and is associated with early rebleeding in half of these patients (6.2%) with late rebleeding, 2–18 months after injection in only 8.1%.¹⁰ Data comparing different endoscopic, interventional radiologic, and surgical treatment modalities for the management of rebleeding from GV are scanty and no consensus has been reached regarding the optimal management strategy for this condition.

BRTO is a minimally invasive treatment for GV, with a high success rate and a low recurrence rate.¹¹ BRTO has been used for active gastric variceal hemorrhage, which has been transiently treated by either endoscopic sclerotherapy or Sengstaken–Blakemore tubes, and preventive GV obliteration in patients who had never bled.² An essential prerequisite for BRTO is demonstration of a gastroduodenal or gastroduodenal shunt, which is found in 85% of patients with GV. Under fluoroscopic guidance, a balloon catheter is inserted into the outlet of the gastroduodenal or gastroduodenal shunt through a sheath placed in the right femoral vein. Venography is performed with an injection of 10–15 mL contrast medium *via* the inflated balloon catheter, which prevents backflow, and GV are slowly filled with a sclerosant (Figure 3). Ethanolamine oleate is the predominant and traditional sclerosant agent used in the BRTO

Figure 3 Upper image shows cardiofundal varices with spontaneous splenorenal shunt. Lower image shows occlusion balloon catheter placed from femoral vein. Following balloon occlusion sclerosant is injected into the gastric varix. IVC, inferior vena cava; LRV, left renal vein; PV, portal vein; SV, splenic vein.

procedure; however, it is not available in some regions. Here, we used sodium tetradecyl sulfate foam to obliterate the shunt. Sodium tetradecyl sulfate has been used previously for obliteration of large spontaneous lienorenal shunt in patients with severe recurrent hepatic encephalopathy with good success.¹¹

The cumulative gastric variceal rebleeding rate at 1 year was 20% in patients who underwent TIPS compared with 2% in patients who underwent BRTO.⁸ The 5-year survival rate after BRTO is reported to be 85%,¹² whereas that for TIPS has been reported to be 51%.⁹ Use of emergency

BRTO (within 24 h of UGI bleed) for bleeding GV was studied in 17 consecutive patients. Gastrorenal or gastrocaval shunts were found in all of the 17 patients with complete thrombosis of the GV being achieved with the first BRTO in 10/17 patients and in 6/17 patients with second BRTO performed next day, and the remaining patient had incomplete thrombosis of the varices. None of the patients experienced rebleeding.¹³ However, considering that BRTO takes more time to prepare and perform utilization of BRTO in the setting of active, GV bleeding should be reserved for patients who failed to achieve hemostasis endoscopically. Reports of refractory variceal bleed treated with BRTO are rare.²

In the two cases described above, both patients had bleeding from ulcers formed over previous glue injection site and there was no further scope of endotherapy. Both these cases were managed by emergency BRTO. There is very little information in literature on management of bleeding from post-glue ulcer site. Hence, BRTO is an attractive modality for management in this situation.

In patients with failed endotherapy, active bleeding from the GV continues during the procedure and hence 5% EOI may be unable to control the bleeding, because it will leak into the gastric lumen preventing it from accumulating in the GV. In such situations, cyanoacrylate and coils can be useful. The coils serve as a scaffold to trap the cyanoacrylate preventing pulmonary embolism.¹⁴

BRTO has few relative contraindications. These include severe uncorrected coagulopathy, splenic vein thrombosis (segmental portal hypertension), portal vein thrombosis (where the gastrorenal shunt is the only outflow), ascites, and uncontrolled esophageal variceal bleeding. BRTO is not suitable for GV that lack a main draining vein, as they cannot be catheterized. Moreover, GV that have a direct connection with the coronary vein and esophageal varices are also difficult to treat using BRTO. Uncontrolled esophageal variceal bleeding can be considered a contraindication to BRTO where it is performed alone. A combined TIPSS and BRTO can be performed or a TIPSS with trans-TIPSS balloon-occluded antegrade transvenous obliteration can be performed.

BRTO significantly increases the portal systemic pressure gradient and the bleeding rates of coexisting esophageal varices.¹⁵ Risk factors identified for worsening of esophageal varices after BRTO are presence of esophageal varices, higher Child-Pugh class, and higher resistance index assessed by endoscopic color Doppler ultrasonography before BRTO.¹⁶ Worsening of esophageal varices was seen in 27% of patients at 1 year and 58% at 3 years.⁴ Therefore, esophageal varices should be followed every 6 months after BRTO. Worsening of ascites and hydrothorax has been seen post-BRTO. Some of these patients require post-BRTO TIPSS for management.¹⁷

CONCLUSION

BRTO is a minimally invasive treatment for GV with a high success rate and a low recurrence rate. In case of persistent bleeding from post-glue ulcer over GV, BRTO provides an effective and safe option.

CONFLICTS OF INTEREST

The authors have none to declare.

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