



TECHNICAL NOTE / *Technical*

Balloon-occluded retrograde transvenous obliteration using a dual venous access and sheath system



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KEYWORDS

Portal hypertension;
Gastric varices;
Balloon-occluded
retrograde
transvenous
obliteration (BROTO);
Dual venous access
and sheath technique

Bleeding from gastric varices due to portal hypertension can have fatal consequences with a mortality rate of up to 45% [1]. When initial endoscopic therapies such as band ligation or sclerotherapy fail to treat bleeding or bleeding reoccurs, endovascular techniques may be used to treat the underlying cause. Balloon-occluded retrograde transvenous (BROTO) has recently gained attention in the Western world as a treatment option for isolated gastric varices [2]. While BROTO has been frequently performed in Asia during the last two decades, it is a relatively new procedure in the Western world. Given the relative lack of experience and specialized catheters available in Japan, the technique for BROTO is still evolving and can be technically challenging. The purpose of this technical note was to illustrate a dual venous access and sheath technique for BROTO, which mirrors specialized balloon catheters developed in Japan that are not available in the United States to overcome the technical difficulties of BROTO.

Technical description

A 38-year-old man with cirrhosis secondary to alcoholic hepatitis with history of prior gastrointestinal bleeding presented to the emergency department with melena for 4 days. Initial hemoglobin level was 6.4 g/dL. The patient was resuscitated with packed red blood

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cells. Upper endoscopy revealed gastric varices in the fundus of the stomach but the exact bleeding site could not be localized. The patient was thus referred to the interventional radiology service for BRTO. The right internal jugular vein (RIJV) was accessed using a 21-G needle under real-time ultrasound guidance [3]. A 45-cm 5-F Pinnacle Destination® (Terumo Medical Corporation; Somerset, NJ, USA) vascular sheath was placed into the RIJV, to be used as the "sclerosant sheath". Subsequently, access was obtained into the right external jugular vein (REJV). A 45-cm 6-F vascular sheath was placed into the REJV, to be used as the "occlusion" sheath. The left renal vein was catheterized using a 5-F Cobra catheter (Cook Medical; Bloomington, IN, USA) through the occlusion sheath. The left adrenal vein and gastrosplenic shunt were then catheterized using a stiff Glidewire® (Terumo Medical Corporation) hydrophilic coated guide wire which was advanced into the central portion of the enlarged gastro-splenic shunt. The occlusion sheath was then advanced into the left adrenal vein. A Python® occlusion balloon catheter (Applied Medical, Rancho Santa Margarita, CA, USA) was then placed into the left adrenal vein. Subsequently, the Cobra catheter and guide wire were used to select the gastro splenic shunt through the sclerosant sheath. Over a stiff guide wire, the sclerosant sheath was now also advanced into the left adrenal vein. A retrograde venogram was performed via this sheath, which demonstrated several phrenic collaterals. Selective catheterization and coil embolization of phrenic venous collateral branches with Concerto® coils (Covidien, ev3 Endovascular Inc., Plymouth, MN, USA) was performed to prevent non-target treatment with sclerosant.

The occlusion balloon catheter was inflated up to 11 mm. Balloon-occluded venogram demonstrated a type B gastric varix and successfully occluded phrenic collaterals (Fig. 1). Through the sclerosant sheath, a 3-F Progreat® (Terumo Medical Corporation) microcatheter and microwire were used to catheterize the distal aspect of the gastric varix. A sclerosing mixture of room air, 3% sodium tetradecyl sulfate, and ethiodized oil mixed in a 3:2:1 ratio, respectively, was injected via the microcatheter through the microcatheter in the "sclerosant sheath" under fluoroscopic guidance into the gastro-varix complex. A total of 9 cm³ of the sclerosant was used. Spot radiograph shows no non-target systemic migration. The occlusion catheter was secured to the skin and left in place for 3 hours [4]. Spot images of the abdomen were obtained at 30-minute intervals to confirm that the balloon catheter was still in place and inflated. After 3 hours, the balloon tamponade was taken down and the microcatheter was removed. Repeat venography performed at the proximal left renal vein revealed no flow into the gastrosplenic shunt and a patent left renal vein.

Discussion

In the United States, transjugular intrahepatic portosystemic shunt (TIPS) creation is effective in treating refractory esophageal varices and has also traditionally been used to decompress the portal-venous system after a recurrent gastric variceal bleed [5,6]. However, TIPS does not target specific varices and should not be used in patients with poor

hepatic reserve [2]. Tripathi et al. demonstrated that gastric varices tend to rebleed at low portal pressure gradients much less than 12 mmHg, which is commonly used as an endpoint for successful TIPS creation [7].

Most gastric varices occur in conjunction with a large gastrosplenic shunt [8]. Obliteration of the shunt using BRTO has been standard of care in the Eastern world for treatment of gastric varices [9]. BRTO is thought to preserve liver function and avoid hepatic encephalopathy associated with TIPS. [5] Control of active gastric variceal bleeding is reported in 91–100% of patients [10]. Techniques vary amongst operators with respect to catheters, balloons, sclerosant mixtures, and adjunct coil embolization and plug use. In Japan, single-angled balloon catheters are specifically designed to access and occlude the gastrosplenic shunt. These catheters are not available in the United States [11]. Lack of utilization of BRTO in the United States may be due to lack of familiarity with the procedure and/or fear of worsening portal hypertension [9,12].

However, BRTO has been gaining popularity in the United States for the treatment of gastric varices due to rapid control of variceal hemorrhage without an increase in hepatic encephalopathy. [2] Most operators gain venous access via the jugular or femoral vein approach. An access sheath is placed in the renal vein and the gastrosplenic shunt is accessed coaxially. A balloon occlusion catheter is used to obstruct the shunt. A microcatheter is usually advanced via the occlusion balloon catheter, or alongside it, and sclerosant is delivered through it [10]. However, BRTO can be technically challenging due to acute angles between the renal vein and the shunt. We illustrate herein a slight modification to the standard BRTO utilizing a dual venous access and sheath system to occlude the shunt via one sheath and deliver sclerosant via the other.

Technical success with BRTO has been reported between 79–100% [10]. Technical failures are classified into 4 categories. Type I failure results from inability to access the shunt or sclerosant extravasation. The use of microcatheters to deliver the sclerosant may help achieve targeted embolization. Introducing a coaxial microcatheter through the balloon catheter is often difficult, as many of the balloon occlusion catheters do not have the inner diameter to easily allow microcatheter advancement while maintaining adequate positioning. If necessary, the microcatheter can be placed through the introducer sheath alongside the balloon occlusion catheter [11]. Our dual access and sheath system using a separate "sclerosant" sheath through a separate access allows for better control of the microcatheter used to deliver the sclerosant into the gastric variceal complex (Fig. 2). The angle between the left renal vein and IVC is generally acute (or near acute) which makes a coaxial system difficult to handle especially with a long sheath. In our experience, navigating a microcatheter through a sheath alongside an occlusion catheter may pose technical difficulties, especially in tortuous and angled vessels. Placing a microcatheter in a second adjacent sheath allows for better maneuverability of the microcatheter in the tortuous gastrosplenic shunt. At our institution, we meticulously review the preprocedural contrast enhanced computed tomography (CT) scan to evaluate the angle and determine which access to obtain (jugular vs. femoral). Dual access can be achieved with two sheaths in

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