



## Coil-assisted retrograde transvenous obliteration for gastric varices in a Chinese case



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### ABSTRACT

Gastric varices are a major complication of portal hypertension in patients with liver cirrhosis and are associated with more massive bleeding events and higher mortality rate. Transjugular intrahepatic portosystemic shunt (TIPS) and balloon-occluded retrograde transvenous obliteration (BRTO) have been well documented as effective therapies for portal hypertensive gastric variceal bleeding. In China, TIPS are well accepted but BRTO is not well received due to the increase risk of complications associated with traditional BRTO. However, modified-BRTO, known as coil-assisted and plug-assisted retrograde transvenous obliteration (CARTO and PARTO, respectively), is receiving increased attention due to devoid of BRTO's shortcomings. No CARTO case from China has been reported in literature thus far. Here, we present a Chinese case of CARTO to treat gastric varices bleeding.

Gastric varices (GVs) accompanied by portal hypertension are one of the leading causes of death in patients with liver cirrhosis. Currently, treatment options include pharmacologic, endoscopic, surgical, and interventional approaches, with endoscopic variceal sclerotherapy as the first-line treatment. However, pharmacologic or endoscopic treatments are often difficult, particularly for a fundal GV with active bleeding. Transjugular intrahepatic portosystemic shunt (TIPS) and balloon-occluded retrograde transvenous obliteration (BRTO) are also widely used to manage GV. <sup>1,2</sup> In China, TIPS with and without embolization of the afferent shunt, aimed at relieving portal hypertension to treat bleeding GV caused by portal hypertension, are well received. However, the TIPS procedure does not always result in complete regression of the GV and can trigger hepatic encephalopathy. <sup>3,4</sup> In contrast, BRTO is not well received at all, mainly because of complications caused by the indwelling balloon catheter and sclerosing agent combination. Modified BRTO, known as coil-assisted and plug-assisted retrograde transvenous obliteration (CARTO and PARTO, respectively), is receiving increased attention for managing bleeding GV owing to acceptable clinical results and being devoid of BRTO's complications. <sup>2,5,6</sup> The use of CARTO in China has not yet been reported in the literature. Here, we present a Chinese case in which CARTO was used to treat GV bleeding caused by a spontaneous gastroduodenal shunt. (see [Figs. 1 and 2](#))

### Case report

The study was approved by the ethics committee of the First Affiliated Hospital of Zhengzhou University (2020-KY-421). A 59-year-old patient with a history of hepatitis B cirrhosis for 8 years was referred for GV bleeding. Preoperative triple-phase contrast-enhanced computed tomography (CT) showed isolated fundal GV with an efferent gastroduodenal shunt with a 13-mm diameter. The model for end-stage liver disease (MELD) score was 7.

The CARTO procedure was performed with moderate sedation. First, we achieved right common femoral venous access. A 10 Fr vascular sheath (Cook Inc., Bloomington, IN, USA) was placed in the inferior vena cava and left renal vein for stable access. Using two 5 Fr headhunter catheters (Cook Inc.) under the guidance of a 0.035 inch guidewire, the efferent shunt was accessed. Through the more proximally placed catheter within the efferent shunt, five interlock detachable coils (14 × 40 mm; Boston Scientific Co.) were deployed, and complete occlusion of the efferent shunt was confirmed with a venogram. Through the distally placed catheter, gelfoam slurry (two packs) mixed with a contrast agent was injected until the entire gastroduodenal shunt, varices, collaterals, and afferent feeding veins were in complete stasis. Finally, the catheters and sheath were removed. Throughout the procedure, the patient's blood pressure, pulse, electrocardiogram, and arterial oxygen saturation were

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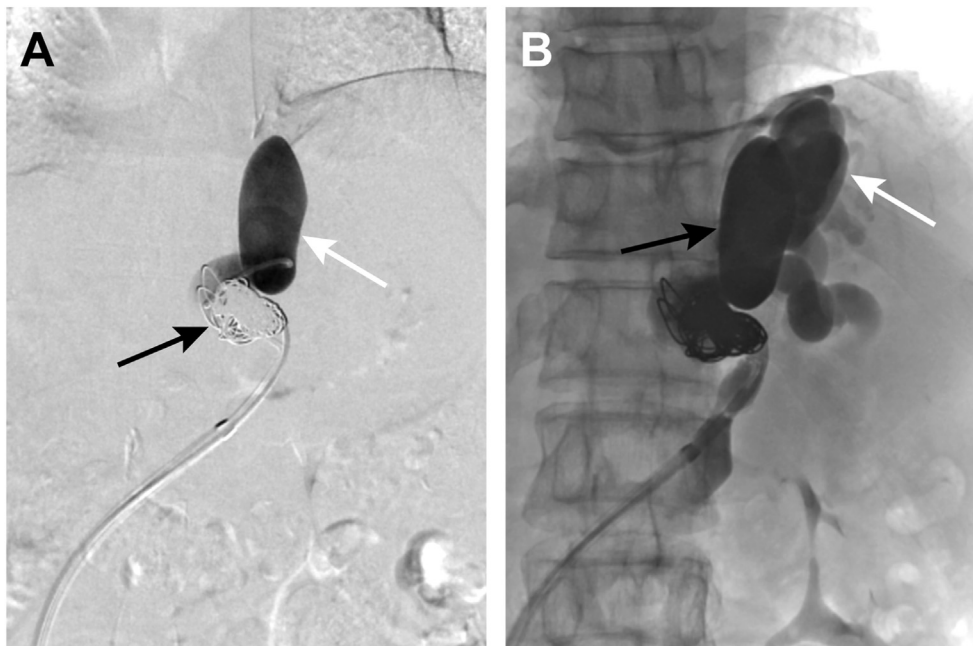
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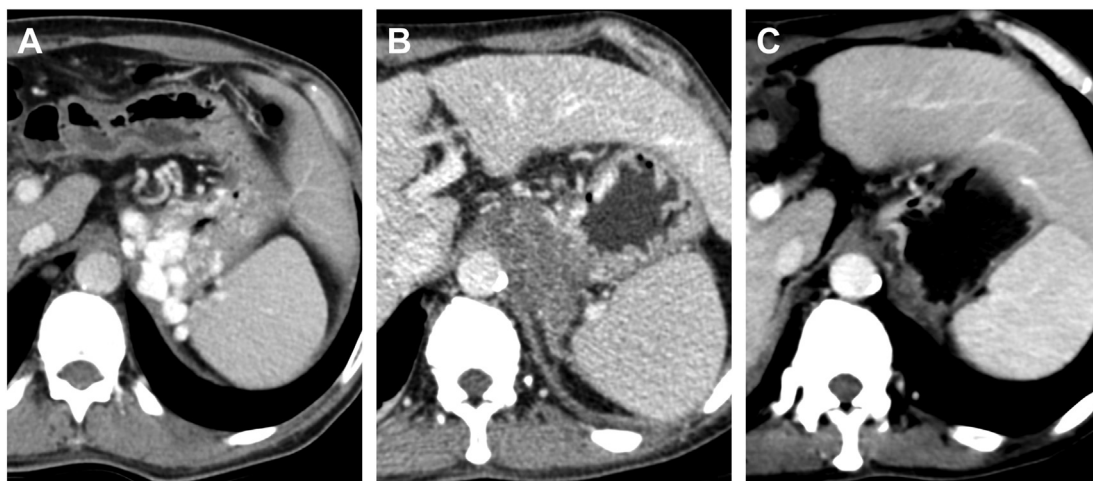
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**Fig. 1.** Fluoroscopic images of coil-assisted retrograde transvenous obliteration (CARTO). (A) A double catheter system with the proximal catheter is used for coil deployment, and the distal catheter is used for gelfoam injection and gastric variceal (GV) and gastrorenal shunt (GRS) venogram. GRS venogram after multiple detachable coils deployment (black arrow) shows complete stasis and opacification of GRS (white arrow) and no contrast agent through the coils. (B) Technically successful CARTO demonstrating complete stasis and opacification of GRS (black arrow) and GV (white arrow).



**Fig. 2.** Contrast-enhanced portal-venous phase axial computed tomography images of gastric varices in (A) pre-CARTO (pre-coil-assisted retrograde transvenous obliteration) with huge transmural gastric variceals (GVs) in the gastric fundus with a recent history of acute upper gastrointestinal bleeding, (B) Three-day post-CARTO demonstrating non-enhancing/hypo-enhancing gastric fundal wall consisted with completely thrombosed GV, and (C) 3-month post-CARTO demonstrating complete disappearance of GV with normal gastric fundal enhancement/anatomy.

monitored and remained stable.

A triple-phase contrast-enhanced CT of the abdomen 3 days post-procedure showed a successful complete obliteration of the efferent shunt, GV, and afferent feeding veins. No thrombosis in the portal system, renal vein, or inferior vena cava was detected. The patient showed no signs of complications and was discharged uneventfully.

During the 3-month follow-up, the patient showed no recurrence of variceal hemorrhage, laboratory test results were normal, and contrast-enhanced CT showed continued complete obliteration of the GV.

### Discussion

BRTO has been adapted for the management of GV bleeding. BRTO has high efficacy in stopping acute GV bleeding and has been shown to have a significantly lower rebleeding rate than TIPS or endoscopic treatment.<sup>1,2</sup> However, BRTO requires the use of an indwelling occlusive

balloon inflated for hours with injection of sclerosing agents such as ethanolamine oleate or sodium tetradecyl sulfate, resulting in lengthy procedure times additional hospital resources and logistics (e.g., intensive care unit bed, additional patient transport, additional interventional radiology suite time, and staff) and the innate complications associated with balloons (e.g., balloon rupture). Sclerosing agents are also associated with some of the serious complications of BRTO, including pulmonary edema, disseminated intravascular coagulation, portal vein thrombosis, severe renal dysfunction, and anaphylactic reaction.<sup>5</sup> Therefore, in China, BRTO has not been adopted as the main treatment for bleeding GV owing to the aforementioned complications. In addition, commonly used sclerosing agents are not available.

Modified BRTO procedures, CARTO and PARTO, have the same effectiveness as conventional BRTO, which has been confirmed by Lee and colleagues<sup>5,6</sup> and have become the standard of care at many institutions for the treatment of GV. Modified BRTO has several

advantages. First, using a coil or vascular plug instead of a balloon for vascular occlusion avoids some of the complications (balloon rupture) and difficulties associated with indwelling balloon catheters.<sup>5</sup> Second, using gelfoam slurry as the embolic material instead of sclerosing agents reduces some of the previously reported serious complications associated with BRTO with sclerosing agents, including death, pulmonary embolism, pulmonary edema, portal vein and/or splenic vein thrombosis, renal vein thrombosis, renal failure, and anaphylactic reaction.<sup>5</sup> Third, modified BRTO does not require selective embolization of the collateral veins in most cases. Fourth, the techniques are less invasive than TIPS, with the benefit of improved hepatic function. Lastly, gelfoam is inexpensive and readily available. The present case had a satisfactory outcome with complete obliteration of the GVs without any complications. Considering this case and a review of the literature, we believe that modified BRTO would be a good treatment option for GV bleeding caused by portal hypertension in China in the future.

In conclusion, we report a Chinese case of portal hypertensive GV bleeding treated using CARTO with a coil and gelfoam slurry. Advantages of this technique include avoiding indwelling balloon catheters and complications related to sclerosant use. CARTO may have great potential to be widely accepted for the treatment of bleeding GVs in China.

#### Ethics approval and consent

The study was approved by the ethics committee of the First Affiliated Hospital of Zhengzhou University (2020-KY-421). The study was conducted according to the principles of the Declaration of Helsinki. Written informed consent was obtained from the patient for publication of this case report and any accompanying images.

#### Declaration of competing interest

The authors of this manuscript declare no relationships with any companies, whose products or services may be related to the subject matter of the article.

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