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## Case Report

# Percutaneous transvenous obliteration for duodenal variceal bleeding using micro-balloon catheter and n-butyl cyanoacrylate: A case report

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## ABSTRACT

Owing to heavy blood flow originating from the portal vein and the technical difficulties associated with hemostatic procedures, duodenal varix is associated with high mortality and a poor prognosis. Percutaneous transvenous obliteration (PTO) has been used effectively to treat duodenal varices by providing direct control of duodenal variceal bleeding. This report describes a patient who experienced duodenal variceal bleeding that was successfully managed by PTO using a micro-balloon catheter, which can occlude the proximal afferent vein of the duodenal varix. Moreover, this technique can offer a more effective injection of n-butyl cyanoacrylate by blocking the inflow and preventing any reflux associated with duodenal variceal bleeding.

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Keywords: Duodenum; Gastrointestinal hemorrhage; Hemostasis; Therapeutics; Varicose veins

## Introduction

Ectopic varix occurs outside of the gastroesophageal region, such as in the duodenum, jejunum, ileum, cecum, and colon. Among them, the duodenal varix is the most common ectopic varix, accounting for 40% of all ectopic varices.<sup>1</sup> Moreover, owing to the heavy blood flow originating from the portal vein and the technical difficulty associated with hemostatic procedures, duodenal varix is associated with high mortality and a poor prognosis; thus, it is important to diagnose and treat it quickly and effectively.<sup>2</sup> Although various therapeutic options exist, including endoscopy, radiologic, or surgical intervention, an optimal treatment has yet to be established, because the incidence of the disease is low and a randomized control study has yet to be conducted.<sup>3</sup>

Recently, radiological interventional approaches, such as the transjugular intrahepatic portosystemic shunt (TIPS) or percutaneous transvenous obliteration (PTO) have been widely used. However, TIPS can increase the risk of developing complications, such as hepatic encephalopathy, while because duodenal varix occasionally occurs at low-pressure gradients, compared to esophageal

or gastric varices, the use of only TIPS is not considered an effective treatment option.<sup>4,5</sup>

Additionally, PTO has been used effectively to treat duodenal varices by providing direct control of duodenal variceal bleeding through the use of coil and liquid embolic agents, such as n-butyl cyanoacrylate (NBCA).<sup>6,7</sup> However, if the angle of the afferent vein orifice is acute or the degree of variceal tortuosity is severe, conventional PTO may not effectively embolize the duodenal variceal bleeding. Therefore, to overcome these drawbacks, we temporarily occluded the proximal portion of the afferent vein of the duodenal varix by using a micro-balloon catheter, and then, embolized the duodenal varix in a patient with active duodenal variceal bleeding by using NBCA.

## Case Report

A 49-year-old man with alcoholic liver cirrhosis, who twice received transarterial chemoembolization for hepatocellular carcinoma 2 years prior, visited the emergency department of a nearby hospital to manage an ongoing hematochezia. At the time of the

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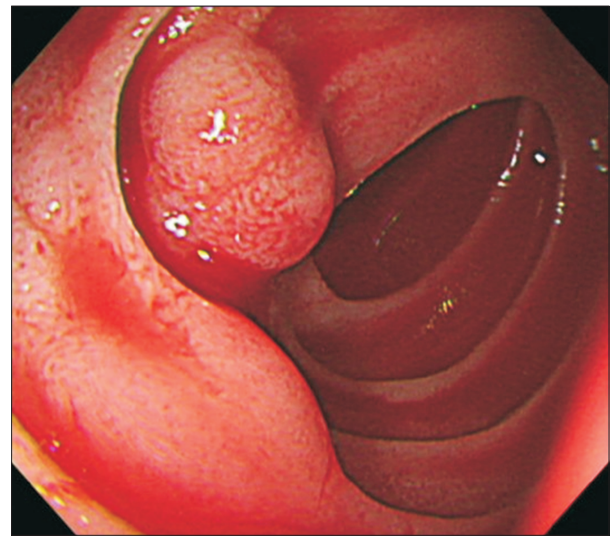


**Fig. 1.** (A, B) Dynamic computed tomography (CT) at the time of initial diagnosis. The portal phase of the dynamic CT shows a large dilated vasculature at the third portion of the duodenum, which is suggestive of duodenal varix (arrows) along with suspicious intraluminal contrast media extravasation (arrowheads).

visit, the mental status was stupor, while the laboratory findings presented a hemoglobin level of 3.6 g/dL, which rose to 9.8 g/dL after 8 units of packed red blood cells, albumin levels of 3.6 g/dL, bilirubin of 1.8 g/dL, an international normalized ratio of 1.89. His Child-Pugh score was 6 (Child-Pugh Class A). Next, a dynamic computed tomography (CT) scan was performed and revealed cirrhotic liver and duodenal varix at the third portion of the duodenum, which is suggestive of bleeding focus (Fig. 1). An emergent esophagogastroduodenoscopy (EGD) was performed, which identified active variceal bleeding, although endoscopic hemostasis was impossible due to the poor endoscopic visual field (Fig. 2). Subsequently, the patient was transferred to our hospital for further treatment.

At the time of the visit to our emergency department, the mental status was alert, but the patient presented continuous hematochezia. The patient's blood pressure was low at 73/51 mmHg, although it stabilized after IV hydration. Repeat EGD was performed and visualized tortuous vasculature along the wall of the third portion of the duodenum, which is suggestive of duodenal varix with hematoma, although no definite active bleeding was noted. Endoscopic hemostasis was not performed because the bulging venous structure was large, meaning further bleeding could be encouraged. Thereafter, the patient's hematochezia persisted, meaning a request was made to the interventional radiology department for an embolization.

We decided to perform PTO rather than retrograde transvenous obliteration due to no definite mesocaval shunt on previous CT. Thus, percutaneous transhepatic puncture of the right posterior portal vein was performed. A 21-gauge Chiba needle (Cook Medical) was used to puncture the right posterior portal vein, and a 5-F vascular sheath (Terumo) was inserted into the portal system. After placing the vascular sheath at the main portal vein, a jejunal branch of the superior mesenteric vein and an afferent vein of the duodenal varix were selected by using a 5-F Kumpe catheter (Cook Medical). After the selective venogram confirmed the pre-procedural CT scan result of a duodenal varix with an active contrast extravasation into the duodenum, a 2.0-F micro-balloon catheter (Optimo PB; Tokai Medical Products, Inc.) was introduced into the proximal afferent vein of the duodenal varix. The micro-balloon was inflated at the proximal afferent vein and contrast media was injected into the duodenal varix to identify the entire duodenal variceal vasculature and the existence of collaterals. Before injecting NBCA (Histoacryl; B. Braun), 5% dextrose solution (5DW) was injected to prevent premature polymerization and then NBCA and lipiodol® (Guerbet) mixture in a ratio of 1:3 was also injected through the micro-balloon catheter. The injected NBCA filled the duodenal varix and extravasated into the duodenal lumen, which was noted as a probable bleeding site.



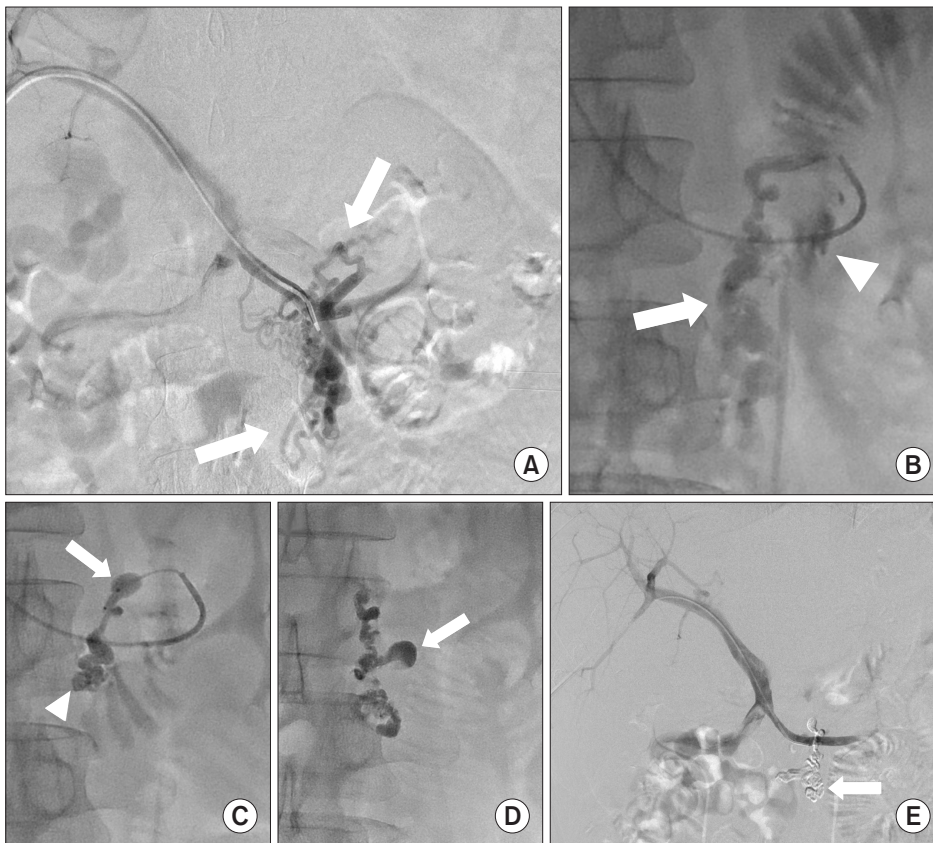
**Fig. 2.** Emergent esophagogastroduodenoscopy revealed varices in the third portion of the duodenum beyond the ampulla with hematoma and active bleeding.

To prevent adhesion between the micro-balloon catheter and the NBCA cast, after waiting for approximately 30 seconds to allow the NBCA cast to solidify, a prompt deflation of the micro-balloon catheter was performed. After an angiographic confirmation of the complete stasis of the blood flow into the duodenal varix, the vascular sheath and the catheter were removed by tract embolization using two 0.035-inch Nester® Embolization Coils (Cook Medical) (Fig. 3).

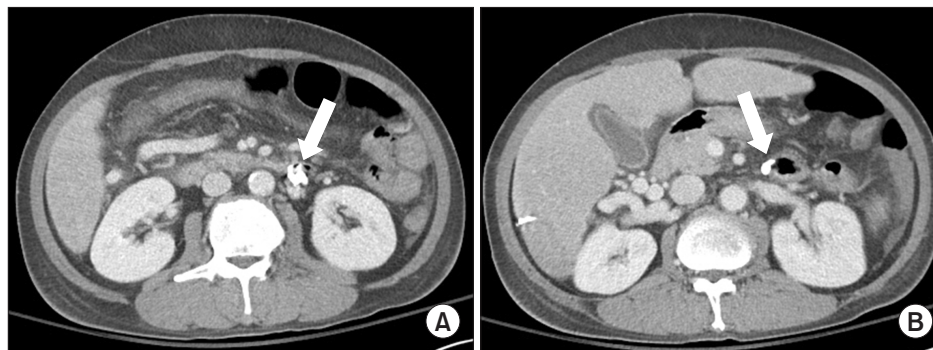
Thus, we successfully treated the duodenal varices using a micro-balloon catheter and NBCA along with a transhepatic approach. The day after the PTO, the hematochezia had stopped and a contrast-enhanced abdomen CT revealed successful obliteration of the duodenal variceal vasculature without any definite complications (Fig. 4). After 6 days, an EGD was performed, which illustrated that there was no hematoma, and that the varix has reduced in size. NBCA cast from the dilated vasculature to the duodenal lumen was seen, probably previous bleeding in this area (Fig. 5). The written informed consent was obtained from all patients.

## Discussion

PTO using an NBCA is a prompt and effective method for achieving hemostasis in cases of duodenal variceal bleeding. Although endoscopic treatment has the advantage of being non-



**Fig. 3.** Percutaneous transhepatic obliteration was successfully performed using a micro-balloon catheter and n-butyl cyanoacrylate (NBCA). (A) Under fluoroscopic guidance, selective venography was performed at the superior mesenteric vein and showed duodenal varix (arrows) with hepatofugal flow. (B) After successfully selecting the afferent vein of the duodenal varix, venography showed duodenal varix (arrow) with contrast media extravasation into the duodenum (arrowhead). (C) Micro-balloon catheter (arrow) was placed at the proximal portion of the afferent vein of the duodenal varix and inflated to occlude blood flow from the portal system. NBCA was injected into the duodenal varix slowly (arrowhead). (D) Single-shot image after the NBCA injection showed some glue was extravasated into the duodenal lumen, probable bleeding focus (arrow). (E) Post-embolization venography showed complete obliteration of duodenal varices without complications (arrow).



**Fig. 4.** (A, B) Computed tomography scan obtained 1 day after percutaneous transhepatic obliteration. The complete obliteration of duodenal varices (arrows) was seen without complication on axial view.

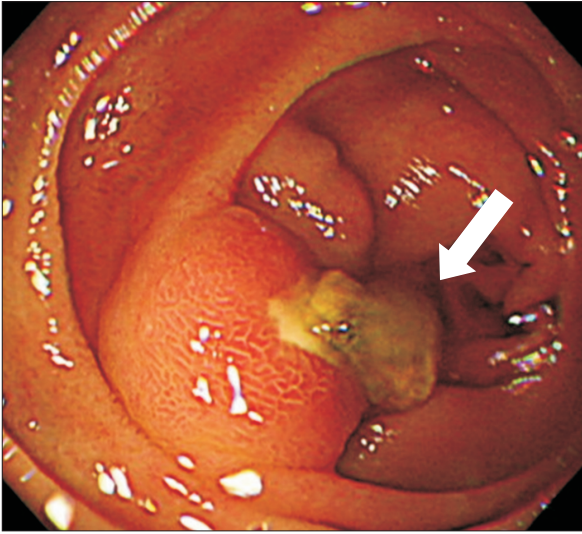
invasive and directly identifying and treating bleeding areas, it has also some limitations, such as poor visual fields and difficulty accessing the duodenal varix because of massive bleeding. In addition, endoscopic ligation can cause a wide defect and a high risk of re-bleeding.<sup>8</sup> Surgical treatments, such as variceal ligation, variceal excision, splenorenal shunting, and partial duodenectomy were used, yet postsurgical mortality was high at 30%, meaning such methods are not commonly used.<sup>1</sup> PTO using NBCA can effectively occlude the varix, including the far distal portion from the afferent vein. This is due to its characteristics as a liquid embolic material, which remains effective regardless of the patient’s coagulopathy status.<sup>9</sup>

However, when performing transvenous embolization for varix embolization using an antegrade approach, NBCA is highly dependent on the person performing the operation since its behavior is difficult to predict. The polymerization time of NBCA varies depending on the ratio of NBCA and lipiodol in the mixture, leading

to changes in polymerization time and increased iodized oil concentration, which generates a buffer that delays the contact with the blood and prolongs the polymerization time.<sup>10</sup> This can lead to problems, such as proximal embolization occurring before it has reached the bleeding site of the varix, or reflux or distal migration through efferent vessels.

However, NBCA injection in the afferent vein of the varix under the inflation of a micro-balloon catheter can be used to possibly prevent reflux of the embolic materials and enhance the complete obliteration of the whole varix. According to Hamaguchi et al,<sup>11</sup> micro-balloon catheters may allow efficient control of NBCA delivery for a longer injection time without reflux. The inflated balloon seals the artery, thereby creating a condition of flow arrest. Since the arterial flow has been arrested, it is possible to fill the desired location with 5DW and deliver the NBCA cast accurately without any reflux or proximal embolization.<sup>11</sup>

Balloon occlusion cannot completely prevent reflux of the



**Fig. 5.** Esophagogastroduodenoscopy (EGD) performed 6 days after percutaneous transhepatic obliteration. EGD revealed decreased size of the duodenal varix without hematoma or active bleeding and extravasated glue cast through the bleeding focus of the duodenal varix (arrow).

embolic material, and there is a possibility of catheter adhesion caused by NBCA, especially using a micro-balloon catheter, which has a larger adhesion area compared to a micro-catheter. A reflux induction possibility of approximately 25% has been reported for highly viscous NBCA mixtures prior to reaching their targets.<sup>11</sup> In our case, we successfully performed the embolization without reflux occurring by mixing the NBCA and iodized oil at a ratio of 1:3 (25%). Furthermore, approximately 30 seconds was allowed for the NBCA cast to solidify to prevent catheter adhesion, which provided sufficient time prior to deflating the balloon. Subsequently, by promptly deflating the balloon, we were able to successfully complete the procedure without catheter adhesion.

Here, we report the case of a patient with active duodenal variceal bleeding, which was successfully treated using a micro-balloon catheter and NBCA. The micro-balloon catheter can occlude the proximal afferent vein of the duodenal varix and it can offer a more effective injection of the NBCA by blocking the inflow and preventing reflux in the duodenal variceal bleeding area.

## Funding

None.

## Data Sharing Statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.

## Conflicts of Interest

No potential conflict of interest relevant to this article was reported.

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