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Case Report

Coil embolization of a celiac artery pseudoaneurysm under balloon-assisted flow control: A case report ☆

Hirofumi Sekino, MD, PhD[a,*], *Shiro Ishii, MD, PhD*[a], *Teruhide Ishigame, MD, PhD*[b], *Tatsuya Ando, MD*[a], *Natsumi Kawamoto, MD*[a], *Yoshiki Endo, MD*[a], *Daichi Kuroiwa, MD*[a], *Hiroshi Ito, MD, PhD*[a]

[a] *Department of Radiology and Nuclear Medicine, Fukushima Medical University, Fukushima, Japan*
[b] *Department of Hepato-Biliary-Pancreatic and Transplant Surgery, Fukushima Medical University, Fukushima, Japan*

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ABSTRACT

Coil migration can occur when coil embolization is used for treating pseudoaneurysms associated with large arteries. The double microcatheter technique is useful for preventing coil migration; the balloon catheter can reduce blood flow and active bleeding upon balloon inflation, and can also compress the bleeding point and arrest bleeding temporarily. We report a case describing the management of a pseudoaneurysm with coil embolization using double microcatheters and a balloon catheter to control blood flow and prevent coil migration. A 73-year-old male patient presented with a pseudoaneurysm of the celiac artery arising from the splenic artery stump following surgery. Coil embolization of the pseudoaneurysm using a double microcatheter embolization technique with a balloon catheter was considered. A balloon catheter was inserted into the celiac artery and active bleeding was temporarily arrested with the inflated balloon. First, a microcatheter was inserted into the balloon catheter, and another microcatheter was placed in the celiac artery. An electrical detachable coil was inserted into the proximal common hepatic artery just distal to the pseudoaneurysm. The second electrically detachable coil was inserted while the first coil remained attached. After detachment of the second coil, additional electrically detachable coils were inserted for similar embolization. The balloon was gradually deflated. Finally, the first coil was detached and we confirmed absence of the bleeding. Our case report demonstrated that a balloon catheter can control the flow vessels, and the double microcatheter embolization technique with a balloon catheter is useful for coil embolization in high-flow or large vessels.

☆ Competing Interests: The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

* Corresponding author.
E-mail address: sekino@fmu.ac.jp (H. Sekino).

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Introduction

Coil embolization, which is one of the treatments considered for pseudoaneurysms, involves maintaining coils in both the proximal and distal vessels of the pseudoaneurysm. However, coil embolization of large arteries can be complicated by coil migration. Certain techniques, such as using a balloon to reduce arterial blood flow and the double microcatheter technique, can prevent coil migration [1]. Catheters with balloons can reduce blood flow and active bleeding by balloon inflation, and can compress the bleeding point directly and temporarily arrest the bleeding. We report a case of a pseudoaneurysm that was treated with coil embolization using double microcatheters and a balloon catheter to control blood flow and prevent coil migration.

Case presentation

The splenic artery was surgically excised during surgery for gastric cancer and intraductal papillary mucinous carcinoma (IPMC) of the pancreatic tail in a 73-year-old male patient. Fourteen days after the surgery, the physician noticed bleeding in the drainage tube, and an intra-abdominal hemorrhage was suspected. The patient's hemoglobin level decreased and contrast-enhanced CT was performed. CT revealed a pseudoaneurysm in the celiac artery arising from the splenic artery stump (Fig. 1). Enlargement of the pseudoaneurysm was observed and coil embolization was considered.

A 5-French (Fr) sheath (Radifocus Introducer IIH; TERUMO Co., Ltd., Tokyo, Japan) was inserted into the right femoral artery, and the celiac artery was selectively catheterized using a 5-Fr shepherd hook catheter 5-Fr shepherd hook catheter (SHC; Medikit Co., Ltd., Tokyo, Japan). Digital subtraction angiography (DSA) confirmed active contrast medium extravasation from the pseudoaneurysm in the celiac artery, which was presumed to have arisen from splenic artery transection (Fig. 2). Anomalous bifurcation of the left hepatic artery from the celiac artery was also observed. The celiac artery is a large

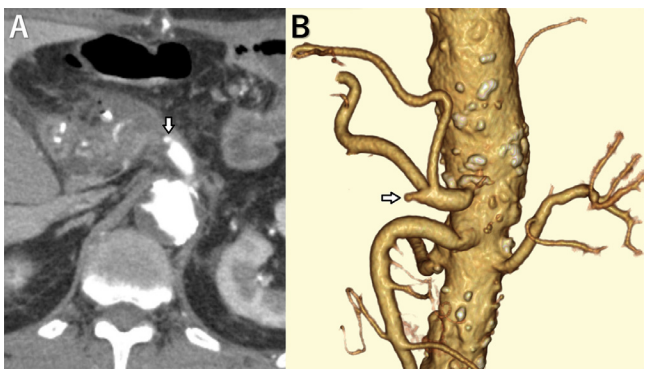

Fig. 1 – Contrast-enhanced CT image and volume rendering image just before interventional radiology (A, B) CT and volume rendering images show a pseudoaneurysm in the celiac artery arising from the splenic artery stump (arrow). A hematoma is observed around the pseudoaneurysm.

Fig. 2 – Digital subtraction angiography with celiac artery. Arrow indicates the pseudoaneurysm arising from the splenic artery stump. Extravasation is confirmed. Arrowhead demonstrates the left hepatic artery branching from the celiac artery.

vessel, and the flow rate was high. There was a risk of coil migration after coil embolization, so a balloon catheter was used to reduce the flow rate within the vessel. In addition, the double microcatheter technique was used to further prevent coil migration.

The shepherd hook catheter was replaced with a 5.2-Fr balloon catheter (Selecom MP CathetetII TERUMO Co., Ltd., Tokyo, Japan), and the balloon was inflated at the position of the contrast medium extravasation. Another 5-Fr sheath was inserted into the left femoral artery, and aortography was performed using a 4.2-Fr catheter (pigtail Goodman Co.,Ltd., Aichi, Japan). The contrast extravasation disappeared and active bleeding was temporarily arrested as a result of balloon inflation. Next, the pigtail catheter was replaced with a shepherd hook catheter, and the superior mesenteric artery was catheterized using the shepherd hook catheter. DSA was performed using an inflated balloon to occlude the celiac artery. The proper hepatic artery was identified by the collateral flow through the gastroduodenal artery (GDA). This confirmed that the hepatic artery could maintain blood flow through the GDA even upon coil embolization of the celiac arteries. The celiac and replaced left hepatic arteries were then embolized after consulting with the surgical team.

First, a 1.9-Fr microcatheter (Carnelian Si; Tokai Medical Products, Inc., Aichi, Japan) was inserted into the balloon catheter with the balloon inflated, and another shepherd hook catheter was used to selectively catheterize the celiac artery and insert another 1.9-Fr microcatheter (Excelsior 1018; Stryker Japan K.K., Tokyo, Japan) (Fig. 3). An electrically detachable coil (Target XL; Stryker Japan K.K., Tokyo, Japan) was inserted into the proximal portion of the common hepatic artery just distal to the site of injury. A second electrically detachable coil was inserted while the first remained attached. Before detaching the second coil, the balloon was deflated to demonstrate absence of coil migration. After the second coil was detached, additional electrically detachable coils were inserted more proximally to fully cover the pseudoaneurysm, while the first coil remained attached. When the electrically detachable

Fig. 3 – Fluoroscopic image showing the location of the balloon catheter. A 5-French (Fr) balloon catheter (arrow) was inserted into the celiac artery and the balloon was inflated at the position of the contrast medium extravasation. Another 5-Fr shepherd hook catheter (arrowhead) was inserted into the celiac artery. A 1.9-Fr microcatheter was inserted into each the balloon catheter and the shepherd hook catheter (black arrows).

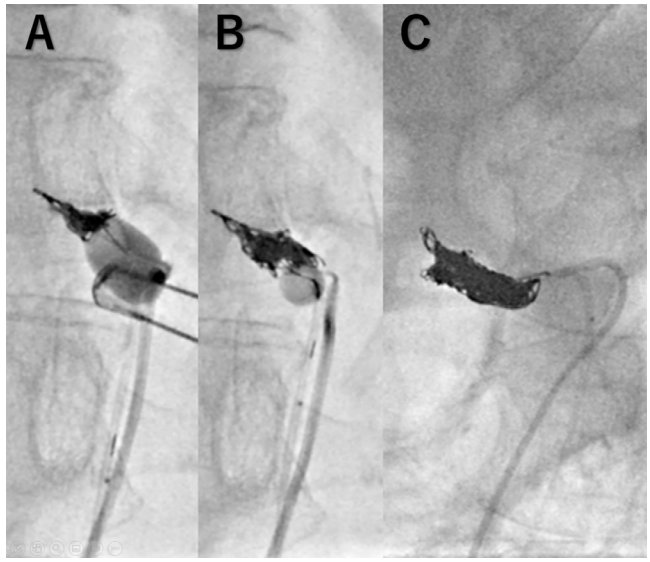

Fig. 4 – Fluoroscopic image showing the embolization procedure. (A) An electrically detachable coil was subsequently inserted into the distal portion of the pseudoaneurysm. The second electrically detachable coil was inserted while the first remained attached. (B) As the balloon was gradually deflated, some electrically detachable coils were similarly inserted to embolize while the first coil remained attached. (C) Finally, the first coil was detached, and the balloon catheter was retrieved with the balloon fully deflated.

coils were inserted at sites near the balloon, the coils were inserted as the balloon was gradually deflated. Finally, the first coil was detached and the balloon catheter was retrieved with the fully deflated balloon (Fig. 4). Aortography revealed absence of contrast extravasation from the celiac artery and maintenance of proper hepatic artery flow by collateral flow through the GDA. Fig. 5 showed the aortography. The patient's blood pressure stabilized, and the hemoglobin level and liver function improved after embolization.

Fig. 5 – Digital subtraction angiography after coil embolization. (A) Digital subtraction angiography of the SMA showed maintenance of proper hepatic artery flow by collateral flow through the GDA. (B) Aortography demonstrated the absence of contrast extravasation from the celiac artery.

Discussion

Visceral artery pseudoaneurysms (VAPAs), which have varied clinical features, are rare and often not initially suspected. The wall of a pseudoaneurysm is composed of fibrous or soft tissue rather than arterial tissue. Consequently, it demonstrates rapid enlargement and rupture. Some reports have shown that the incidence of pseudoaneurysm rupture varies from 2% to 80% based on the location, and mortality associated with rupture can reach 90% without treatment [2,3]. VAPAs are caused by trauma and inflammation, or can be iatrogenic. In this case, the splenic artery was resected during surgery for IPMC, which resulted in a postoperative pancreatic fistula and subsequent pseudoaneurysm arising from the resected part of the splenic artery. In recent years, transcatheter endovascular embolization has been the preferred treatment for VAPAs, with a higher success rate than surgery [2]. Various endovascular approaches for treating pseudoaneurysms, such as the covered stent, have been reported. As embolizing a major vessel can result in ischemic complications, covered stents are considered useful for managing pseudoaneurysms [4,5]. However, covered stents ready for immediate use were not available at our hospital. Moreover, because the celiac and common hepatic arteries vary in diameter, we deemed a covered stent inappropriate. Coil embolization, which is the most common treatment for pseudoaneurysms, involves embolization of the

proximal and distal vessels of the pseudoaneurysm, known as the isolation technique. Other treatment strategies include the sac packing technique, proximal embolization technique, and sandwich technique [2,6]. In this case, we decided to perform an isolation technique. However, coil migration should be prevented when performing proximal and distal vessel embolization.

The "double microcatheter embolization technique" or "double microcatheter single vascular access embolization technique" is useful for cases at risk of non-target embolization, large aneurysms, and situations where high flow increases the risk of coil migration [1]. The use of a guiding sheath and two microcatheters prevents migration of the detachable coils, which is useful for pulmonary arteriovenous malformations, wide-neck aneurysms, and high-flow renal arteriovenous fistulas [1]. In our case, we did not use a guiding sheath but instead used two long sheaths; however, the embolization technique was similar to that employed in the aforementioned study. A balloon catheter was used for flow reduction to assist embolization.

The double microcatheter method using a balloon catheter has two advantages. First, the double microcatheter method allows retention of the first coil during placement of subsequent coils, preventing coil migration by not detaching the first coil placed at the margin. The balloon-catheter combination allows blood flow control and makes it relatively easy to place the first coil. Second, the balloon can be inflated to compress the bleeding site. Sudden bleeding can be temporarily stopped, allowing more time for embolization.

Conclusion

A balloon catheter can control the vessel flow and provide temporary hemostasis. Double microcatheter embolization with a balloon catheter may be useful in preventing coil migration when embolizing high-flow or large vessels with detachable coils.

Patient consent

Patient has provided written, informed consent for this publication.

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