Transcatheter Embolotherapy: Posterior Pancreaticoduodenal Artery Aneurysm

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A 40-year-old male presented with severe hematemesis and shock status after several days of abdominal discomfort. Abdominal computed tomography (CT) and angiography showed a 1-cm-diameter aneurysm from the posterior pancreaticoduodenal artery. Transcatheter embolotherapy with platinum microcoils and complementary methods including gelatin sponge cubes, surgical glue mixture and intra-arterial infusion of vasopressin were performed. Complete embolotherapy was mandatory because of the shock status during angiography. Angiography after the embolization therapy showed minimal extravasation of contrast medium from the aneurysm. Elevation of hemoglobin from 5.1 g/dl before embolotherapy to 8.3 g/dl after embolotherapy on the same day and 10.1 g/dl on the next day was noted. The blood pressure raised from 61/31 mmHg up to 127/62 mmHg. However, the patient expired after a few days due to persistent metabolic acidosis and multiple organ failure. With the technical improvement of transcatheter embolotherapy and proper selection of microcoils and complementary devices, it is a promising approach to provide minimal invasiveness and most effectiveness.

Key words: Aneurysm; Arterial, Therapeutic embolization

Splanchnic aneurysms are uncommon with an incidence between 0.1-2% [1]. Among these, pancreaticoduodenal aneurysm accounts for 2% of splanchnic aneurysms [2]. Treatment is mandatory for the very high mortality rate associated with rupture [3]. Transcatheter embolotherapy can be achieved with proper selection of microcoils and complementary devices. Herein we present the clinical and imaging features of a patient with severe hematemesis receiving embolotherapy.

CASE REPORT

A 40-year-old male presented with severe vomiting of fresh blood after several days of abdominal discomfort. Upper gastrointestinal endoscopy revealed large amount of fresh blood spurting from the duodenum. The active bleeder could not be identified. Emergency operation was performed because of the unstable hemodynamic status and an ulcer with a bleeding point was found at the duodenum and was subsequently sutured.

After several days, he was admitted again presenting with hematemesis and tarry stool. Due to unstable hemodynamic status (BP 61/31 mmHg), abdominal CT with maximal intensity projection reconstruction (MIP) was performed which showed an aneurysm about 1-cm in diameter arising from posterior pancreaticoduodenal artery and stenosis of the celiac trunk (Fig. 1a, 1b). Superior mesenteric arterial angiography and selective pancreaticoduodenal arterial angiography were performed. A 1-cm sac-like aneurysm arising from the posterior pancreaticoduodenal artery was seen (Fig. 2a, 2b). The common and proper hepatic arteries showed opacification via collateral flows from superior mesenteric artery and the gastroduodenal artery (Fig. 3). The catheter was not able to be introduced into the celiac trunk due to stenosis of its orifice.

Superselective embolization of the aneurysm from posterior pancreaticoduodenal artery was performed first by inserting the catheter to the...
**Figure 1.** 
(a) Abdominal CT with maximal intensity projection (MIP) reconstruction showed an aneurysm (short arrow) about 1-cm in diameter arising from posterior pancreaticoduodenal artery (long arrow). 
(b) Abdominal CT with maximal intensity projection (MIP) reconstruction showed the stenosis of the celiac trunk (arrow).

**Figure 2.** Superior mesenteric arteriography showed the aneurysm (arrow) in the early (a) and late (b) phases.
Transcatheter embolotherapy: posterior PDA aneurysm

Platinum microcoils (0.018 in; Complex Helical Fibered Platinum Coil-18; Target Vascular, Fremont, CA) were deployed into the posterior pancreaticoduodenal artery (Fig. 4): 5 pieces of platinum microcoils (2 mm × 10 mm × 5 mm), 5 pieces of platinum microcoils (4 mm × 30 mm × 7 mm), 2 pieces of platinum microcoils (3 mm × 30 mm × 6 mm × 6 mm), and 1 piece of platinum microcoil (5 mm × 50 mm × 12 mm × 8 mm). The angiography after embolotherapy with platinum microcoils showed persistent extravasation of contrast medium from this aneurysm (Fig. 5) while the patient’s blood pressure was not measurable by the sphygmomanometer. At this time, we decided not to deploy the platinum microcoil anymore because the proximal end of the platinum microcoil was close to the bifurcation of a jejunal branch of superior mesenteric artery. In order to avoid coiling of the jejunal branch of superior mesenteric artery, we decided to use gelatin sponge (Gelfoam, Pharmacia and Upjohn) cubes for further management. Gelfoam cubes (1 × 1 mm each piece in size) were loaded into a syringe containing diluted contrast medium and

Figure 3. Pre-embolotherapy angiography showed a 1-cm sac-like aneurysm (short arrow) arising from posterior pancreaticoduodenal artery. The common and proper hepatic arteries (dotted arrows) were opacified via collateral flow from the superior mesenteric artery to the gastroduodenal artery (long arrow).

Figure 4. Transcatheter embolotherapy of the aneurysm revealed the tip of the distal microcoil (short arrow) in the outflow segment of the vessel. The proximal microcoil was in the lumen of the aneurysm due to its wide neck (long arrows).

Figure 5. Post-embolotherapy angiography with microcoils showed extravasation of the contrast medium (short arrows) from the aneurysm. There was a distance from the proximal end of microcoil (long arrow) to bifurcation of the vessel.
Transcatheter embolotherapy: posterior PDA aneurysm

were injected into the coil mesh under fluoroscopic monitoring for clogging the flow. After Gelfoam cubes were injected into the coil mesh, the repeated angiography revealed extravasation of contrast medium from the aneurysm. Due to unstable condition of the patient, we decided to clog the residual bleeding with 1.5 ml mixture of N-Butyl cyanoacrylate (NBCA) (Histoacryl-Blue; Braun, Melsungen, Germany) and Lipiodol (Fig. 7) on the ratio of 1 to 3 placing the tip of microcatheter proximal and close to the microcoil after flushing the microcatheter and injecting syringes with a dextrose solution to prevent premature polymerization. After administration of surgical glue mixture, the angiography revealed partial extravasation of the surgical glue mixture and minimal residual extravasation of contrast medium (Fig. 6). The inflow segment was not completely occluded. Local intra-arterial vasopressin (20U/1ml/amp) infusion with the catheter tip in the proximal end of posterior pancreaticoduodenal artery (Fig. 7) for 10 minutes at a rate of 0.4 U/min was performed in the angiography room to ensure complete occlusion due to unstable vital sign. After infusion, arteriography was not performed because of persistent decrease of blood pressure and shock status. The catheter was kept in place for continuous infusion of vasopressin in ward. The dose was reduced to one half after an infusion of 12 hours (BP 92/62 mmHg), and an infusion of saline was done after an additional 12 hours (BP 106/68 mmHg).

After embolotherapy, the hemodynamic status of the patient was improved evidenced by rising of hemoglobin from 5.1 g/dl before embolotherapy to 8.3 g/dl on the same day after embolotherapy and 10.1 g/dl on the next day. The blood pressure raised up to 127/62 mmHg. However, the patient expired after a few days due to persistent metabolic acidosis and multiple organ failure.

**DISCUSSION**

Splanchnic aneurysms are uncommon, which
include splenic, hepatic, superior mesenteric, gastric and gastroepiploic, celiac, ileocolic and pancreaticoduodenal arteries [4] in a decreasing order, and with an incidence between 0.1-2% [1]. Among these, aneurysms of pancreaticoduodenal artery account for 2% [2]. The underlying causes may be atherosclerosis, pancreatitis, fibroplasia, trauma or congenital anomalies [5, 6, 7]. Increased blood flow from superior mesenteric artery to pancreaticoduodenal artery is another speculated factor due to stenosis of the celiac trunk in 27% of cases of pancreaticoduodenal artery aneurysms [8] as in our patient.

The symptoms of splanchnic aneurysms may be nonspecific or asymptomatic. The first manifestation is often shock due to rupture [5]. Treatment is mandatory for the very high mortality rate associated with rupture [3]. Spontaneous thrombosis of a ruptured aneurysm is rare but has been described in the literature [9]. Transcatheter arterial embolization is considered the first choice of treatment because of its less invasiveness compared with surgical resection [10].

The choice of embolotherapy with platinum microcoils is based on our experience of the microcoils and the nature of the blood vessel to be occluded. Percutaneous embolotherapy of pancreaticoduodenal artery aneurysms can be achieved with microcoils by packing the lumen of aneurysm itself or isolation of the inflow and outflow segments of the vessel [10]. Proper selection of number and size of microcoils by the diameter and flow rate of aneurysm, and morphology of the aneurysm neck reduce the complication of microcoil dislocation or bowel ischemia. The 0.018-inch microcoils can be delivered through 3 French microcatheters using coaxial catheter system. The inner microcatheter is advanced distal to the aneurysm and withdrawn during deployment to allow the first portion of the first coil to anchor in a branch preventing coil migration. It should be noticed not to over-coiling the branches proximal to the aneurysm by spare a segment from the proximal end of microcoil to the origin of the branch feeding the aneurysm.

Gelfoam is water-insoluble powder or gelatin sponges packaged as sterile sheets. It forms artificial clot by the aid of platelet aggregation. Its absorption depends on the amount, location of use, and degree of saturation with blood ranging from 7 to 21 days [11, 12]. Radiopaque contrast medium should be mixed with Gelfoam before injection. Because the cut pieces tend to float on in the contrast medium-filled syringe, the tip of the syringe should be pointed up when injection.

NBCA undergoes polymerization when it is in contact with ions in the blood. Adding Lipiodol to NBCA is for the purpose of radiopacity and prolongation of polymerization time of NBCA. The volume of NBCA is usually less than Lipiodol [13]. On the one hand, the risk of distal embolization by washing away of NBCA is increased if the polymerization time is too short. The proportion of NBCA to Lipiodol was reported from 1:1 to 1:4 [14]. Polymerization times were reported 7.5 to 11.5 seconds by the mixture of NBCA and Lipiodol at a mixture ratio of 1:3 to 1:4 [15] and 4.7 seconds by the mixture of NBCA and Lipiodol at a mixture ratio of 1:2 [16]. Quickly withdraw of the microcatheter from the target vessel is mandatory.

Initial intra-arterial vasopressin infusion for 20 minutes at a rate of 0.2 U/min followed by repeated arteriography is performed [17]. The infusion rate of vasopressin should not exceed the maximum of 0.4 U/min [18]. The dose of vasopressin is reduced to one half after an infusion of 6-12 hours, and only an infusion of saline or 5% dextrose and water is infused after an additional 6-12 hours [18]. Vasopressin reduces the splanchnic arterial pressure at the arterial or capillary levels facilitating formation of a hemostatic plug in the bleeding vessel [18].

There is increased risk of ischemic damage of liver and spleen after interrupted retrograde perfusion of the common hepatic artery and the splenic arteries in the situation of additional occlusion of celiac trunk [5]. Superior mesenteric artery angiography for further evaluation the severity of ischemic damage of liver and spleen after completion of embolization should be performed which is not done in this case.

Post-embolotherapeutic imaging with ultrasonography and CT scan are suggested within the first week after the embolization procedure for confirming either the incomplete packing of the aneurysm or recanalization by a new feeding artery [19].

In conclusion, pancreaticoduodenal aneurysm presents with nonspecific symptoms but high risk of mortality while rupture after which emergent managements are often required. With the improvement of transcatheter embolotherapy using microcoils and complementary methods such as Gelfoam, surgical glue mixture and intra-arterial infusion of vasopressin properly and carefully, it is a promising approach to provide minimal invasiveness and most effectiveness.
REFERENCES


經導管栓塞治療術：後胰臟十二指腸動脈瘤

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一位四十歲男性在腹部不舒服之後幾天開始吐血及呈現休克狀態。腹部電腦斷層及血管攝影發現一個直徑一公分大小從後胰臟十二指腸動脈長出的動脈瘤。於是使用白金微線圈，和輔助的方法包括凝膠海綿、組織黏膠和淋皮道造影液的混合物，以及動脈內升壓劑輸注經導管作栓塞治療。因為在血管攝影當中呈現休克狀態，完全地加以栓塞是必須的。栓塞治療後的血管攝影發現只有微量的造影液從動脈瘤溢出。血紅素從栓塞前的5.1克/分生上升到治療後的8.3克/分生，隔天再上升到10.1克/分生。血壓從61/31毫米汞柱上升到127/62毫米汞柱。然而，這位病人幾天後因持續的代謝性酸中毒及多發性器官衰竭逝世。隨著經導管栓塞治療術的進步及微線圈及輔助工具適當的選擇，它可以提供最小的侵入性及最大的功效。

關鍵詞：動脈瘤：栓塞治療術