Case Report

ANNALS OF MEDICINE & SURGERY

OPEN

Usefulness of the hybrid technique of interventional radiology and endoscopic treatment for intestinal bleeding after pancreaticoduodenectomy: a case report

Nobutaka Chiba, MD, Yuri Nomura, MD, Minori Mizuochi, MD, Jun Sato, MD, Takeshi Saito, MD, Atsushi Sakurai, MD, Kosaku Kinoshita, MD*

Introduction and importance: In endovascular treatment of ruptured pseudoaneurysm after pancreaticoduodenectomy (PD) with gastrointestinal bleeding, treatment for vasospasm of the culprit vessel from haemorrhagic shock and subsequent reperfusion has not been determined before.

Case presentation: The authors hereby present you with a case of a 59-year-old man with unknown operative method upon arrival at the Emergecy room and who had hematemesis and collapse 6 months post-PD surgery.

Clinical discussion: An initial contrast-enhanced computed tomography (CT) revealed no obvious source of bleeding, so an upper gastrointestinal endoscope was performed. Rebleeding occurred during the examination, and interventional radiology was performed because haemostasis was difficult. Coil embolization was performed for leakage of contrast material from the gastroduodenal artery stump into the gastrointestinal tract. However, because the embolization was uncertain due to vasospasm of the common hepatic artery, endoscopic clipping of the perforation site was also performed to prevent rebleeding due to reperfusion after improvement of vasospasm. A CT scan 5 days later showed reperfusion of the coil-implanted vessel. No rebleeding or hepatic infarction occurred postoperatively.

Conclusion: In this case, the haemostasis by coil embolization was uncertain due to the presence of vasospasm, and clipping was used in combination with the procedure to prevent rebleeding.

Keywords: arterial haemorrhage, case report, endoscopic clip, haemorrhagic shock, interventional radiology, vasospasm

Introduction and importance

In pancreaticoduodenectomy (PD), arterial haemorrhage, which is a postoperative complication, is a life-threatening complication with a reported mortality rate of 10–60%[1]. The main cause of arterial haemorrhage is a ruptured pseudoaneurysm. Endovascular treatment (EVT) has recently become the first choice of treatment, and the survival rate has improved[2]. On the other hand, the success rate of haemostasis in EVT ranges from 63 to 100%, but the incidence of complications after treatment is reported to be 14–25%, the rebleeding rate is 37%, and the mortality rate is 0–14%[3]. Therefore, prevention of rebleeding after haemostasis of ruptured aneurysms is also important. Additionally, without information on the patient's history, the treatment of arterial haemorrhage of PD occurring 6 months after surgery may not be simple. We present a case in which a gastrointestinal haemorrhage with an unknown operative method was treated with two coils of haemostasis followed by endoscopic haemostasis using a gastrointestinal clip using the coils as landmarks, which was performed to prevent rebleeding because satisfactory coil embolization was difficult due to vasospasm of the common hepatic artery (CHA) caused by haemorrhagic shock. In addition, patient consent was obtained for the

HIGHLIGHTS

- In ruptured pseudoaneurysms with haemorrhagic shock, the culprit vessel diameter in the images may change over time.
- Coil embolization and stent-graft placement have been options for endovascular treatment of the common hepatic artery in the case of treatment for arterial bleeding after pancreaticoduodenectomy, but stent-graft placement is difficult in vasospasm of vessels.
- Coil embolization of the culprit vessel that has occurred vasospasm may result in reperfusion.

Division of Emergency and Critical Care Medicine, Department of Acute Medicine, Nihon University School of Medicine, Tokyo, Japan

N.C. and Y.N. contributed equally to this work.

Sponsorships or competing interests that may be relevant to content are disclosed at the end of this article.

**Corresponding author. Address: Division of Emergency and Critical Care Medicine, Department of Acute Medicine, Nihon University School of Medicine, 30-1 Oyaguchi-kamimachi, Itabashi-Ku, Tokyo 173-8610, Japan. Tel.: +813 397 28 111; fax: +813 596 48 037. E-mail: kinoshita.kosaku@nihon-u.ac.jp (K. Kinoshita).*

Annals of Medicine & Surgery (2024) 86:1135–1138

Received 23 October 2023; Accepted 6 December 2023

Published online 15 December 2023

http://dx.doi.org/10.1097/MS9.0000000000001628

publication of this article. This case report has been reported in line with the SCARE Criteria[4].

Case presentation

A 59-year-old man with hematemesis and collapse was brought to the Emergecy room. The patient's consciousness was clear, but his face and eyelid conjunctiva were pale. His blood pressure was 96/80 mmHg, and his pulse was 92 beats per min. He had a surgical scar in the midline of his abdomen, but he was ignorant of the details of his treatment. There was no current medication history. After administration of intravenous fluid, his blood pressure improved to 114/85 mmHg, and his pulse rate was 89 beats per min. Contrast-enhanced computed tomography (CT) showed hypodense areas in the stomach and in the free abdominal cavity on the inferior surface of the liver, but there was no contrast leakage. Therefore, he underwent upper gastrointestinal endoscopy. Many blood clots were found in the stomach. It was also found that he had undergone reconstructive surgery from the pyloric side and beyond. The surgical treatment was found to be a gastrojejunostomy by the Billroth II method. Attempts were made to identify the afferent or efferent loop, but the examination was interrupted because it was observed that a large amount of blood had flowed out distal to the jejunum on one side where the endoscope was inserted. The patient became hemodynamically unstable and was intubated. He immediately underwent an emergency interventional radiology (IVR) examination. A 4Fr catheter (shepherd hook type; Medikit, Inc.) and microcatheter (ASAHI Meister; ASAHI INTECC, Inc.) were placed into the coeliac artery via the femoral artery. The gastroduodenal artery (GDA) was severed, and there was leakage of contrast material from the site into the small intestine (Fig. 1A). Therefore, the cause of the gastrointestinal bleeding was determined to be small intestinal perforation. Since insertion of a microcatheter into the GDA was difficult, coil embolization of the CHA was planned. However due to vasospasm of the CHA, the artery diameter was almost the same size as that of the catheter (~1.3 mm). Therefore, haemostasis was achieved by embolization by using two coils (2 × 10 mm; Fibred Platinum Coils, 2 × 3 mm; VortX Diamond; Boston Scientific, Inc.) in the CHA proximal to the GDA stump (Fig. 1B). After haemostasis, his blood pressure improved to 105/58 mmHg, and his pulse rate was 113 beats per min. On the other hand, a contrast-enhanced CT performed immediately after arrival at the Emergecy room showed that the diameter of the CHA was ~2.7 mm (Fig. 1C). Therefore, endoscopic clipping was planned because of concerns about rebleeding due to reperfusion when the vasospasm improved. Because the length of the intestinal tract was unknown, a colonoscope was inserted orally. While confirming the coil embolization site with fluoroscopy, it was relatively easy to reach the blind extremity of the jejunum ~55 cm from the gastrojejunostomy site. An erosion and perforation were found ~10 cm from the blind extremity at the adoral end, and clipping (EZ Clip; Olympus, Inc.) was performed with clipping forceps. A small amount of bleeding occurred after clipping, which was assumed to be the perforated site (Fig. 1D). Five days later, a contrast-enhanced CT was performed. The coil remained in the CHA, but the CHA was able to get the contrast. No aneurysm was found at the site of bleeding (Fig. 2). The patient was later found to have undergone pancreaticoduodenectomy 6 months earlier for pancreatic cancer.

Discussion and conclusion

Arterial haemorrhage after PD has been reported to occur as early as 1 day after surgery[5], with a median time of 18 days after PD[6]. Early postoperative Sentinel bleeding has been proven to be useful as a method of recognizing arterial haemorrhage after PD[7]. Others have reported the usefulness of contrast-enhanced CT in the evaluation of ruptured pseudoaneurysms[8]. On the other hand, treatment of a ruptured pseudoaneurysm may not follow smoothly if the patient's history is not known. One reason is that ruptured pseudoaneurysms can cause either intraabdominal or gastrointestinal haemorrhage. In general, emergency endoscopy is the first choice for the treatment of gastrointestinal bleeding when hemodynamics are stable, and angiography is used in cases where haemostasis is difficult to achieve[9]. Therefore, if rebleeding occurs during endoscopy, the circulation may become unstable. Second, information from contrast-enhanced CT may be variable depending on the patient's systemic condition. It has been reported that persistent bleeding or worsening shock can cause vasospasm of the arteries[10].

Pseudoaneurysms after PD often occur in the GDA stump and HA[11]. If the bleeding site is in the GDA but is short and difficult to catheterize, as in the present case, EVT of the CHA is the treatment of choice. Coil embolization[7] and stent-graft placement[12] have been reported as options for EVT. When coil embolization is selected, complications such as hepatic infarction, liver failure, and liver abscess caused by hepatic ischaemia due to embolization have been reported[13,14]. To avoid these complications, the usefulness of stent-graft placement has been reported[11]. On the other hand, few institutions have stent grafts permanently installed, and these grafts require skilled experience and ample time for implantation[15]. In addition, it has been reported that placement is difficult in meandering, stenosis, and vasospasm of blood vessels[11]. Our institution does not always have stent grafts ready; even if they had, it would have been difficult to place a stent-graft because of the vasospasm.

Reperfusion of embolized vessels and rupture of aneurysms have been reported to occur even after successful coil embolization[16,17]. In addition, when vasospasm occurs, as in the present case, embolization is uncertain. In a previous case, rebleeding after embolization with N-butyl cyanoacrylate in a case of difficult coil embolization due to vasospasm was reported[18]. Rebleeding is a poor prognostic factor[19]. However, there are no reports of adequate treatment by reperfusion after release of vasospasm. If haemostasis is impossible with EVT, surgical treatment is considered[20]. However, aneurysms may go undetected because of residual haematoma or postoperative pancreatic surgery[21,22]. Therefore, we performed an additional haemostatic procedure by endoscopic clipping. Prophylactic embolization of the gastroduodenal artery in bleeding ulcers that had been successfully hemostatically treated endoscopically has been reported to decrease the recurrence rate[23]. In our patient, the endoscopic field of view was excellent because haemostasis was achieved by coil embolization. Although the bowel run was unknown, it was possible to reach the perforated area of the gastrointestinal tract using the coil as a landmark, and clipping could be performed.

The advantage of this technique is that coil embolization is considered temporary haemostasis, and the circulation is stabilized in a short time. The endoscopic field of view was also secured, and additional haemostasis could be achieved under direct visualization. In this case, there was no rebleeding, the occluded CHA was reopened, and no hepatic infarction was observed. If the aneurysm

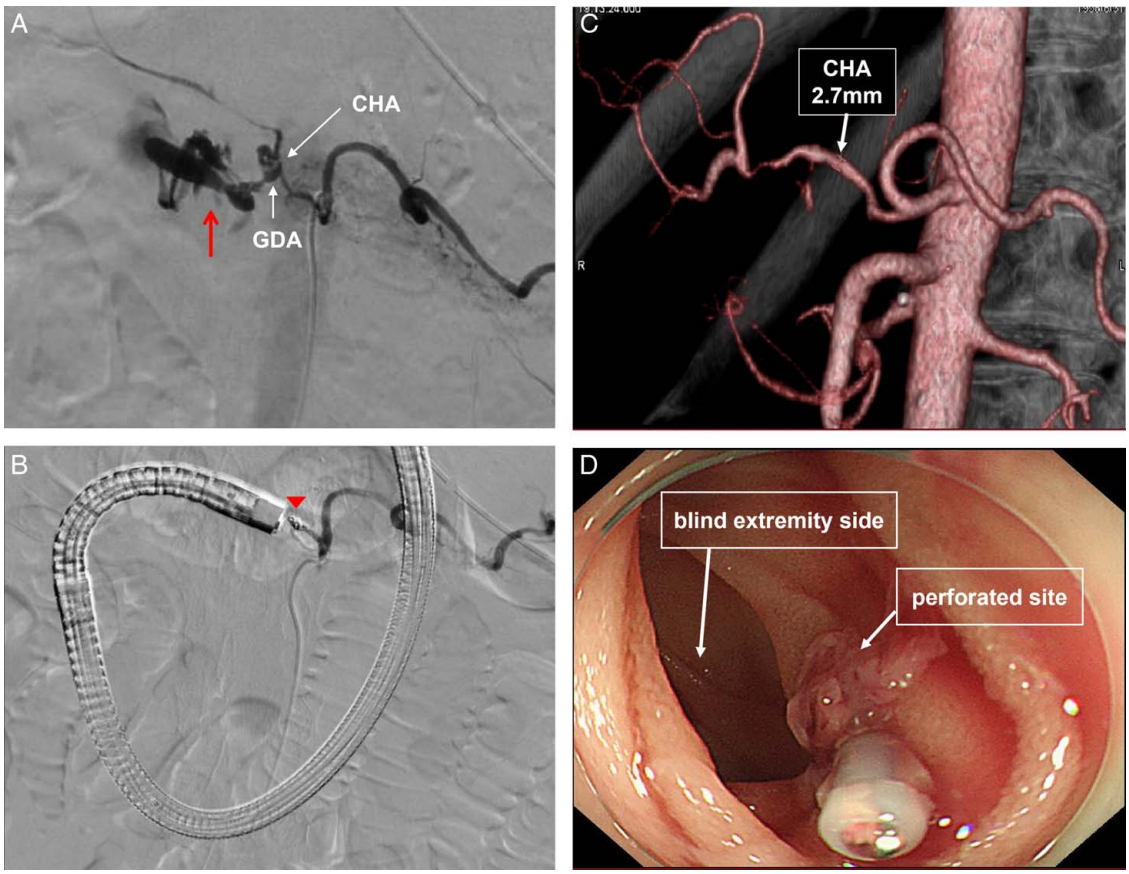

Figure 1. (A) The leakage of contrast material from the GDA into the small intestine (arrow). (B) Haemostasis was achieved by embolization of two coils (arrowhead). After haemostasis, it was relatively easy to reach the blind end of the intestine. (C) Contrast-enhanced computed tomography immediately after arrival at the ER showed that the diameter of the CHA was ~2.7 mm. (D) Erosion and perforation were found ~10 cm from the blind extremity at the adoral site, and clipping was performed. CHA, common hepatic artery; ER, emergecy room; GDA, gastroduodenal artery.

recurred, it was considered possible to treat the patient with stable circulation. On the other hand, the disadvantage is that at least two physicians, an IVR physician and an endoscopist, are needed for treatment. Second, this method can only be used for gastrointestinal haemorrhage. In addition, if the bleeding persists, the perforation cannot be clipped accurately. Therefore, temporary haemostasis by coil embolization and patient hemodynamic stability are necessary. Diagnostic digestive endoscopy delays adequate treatment in

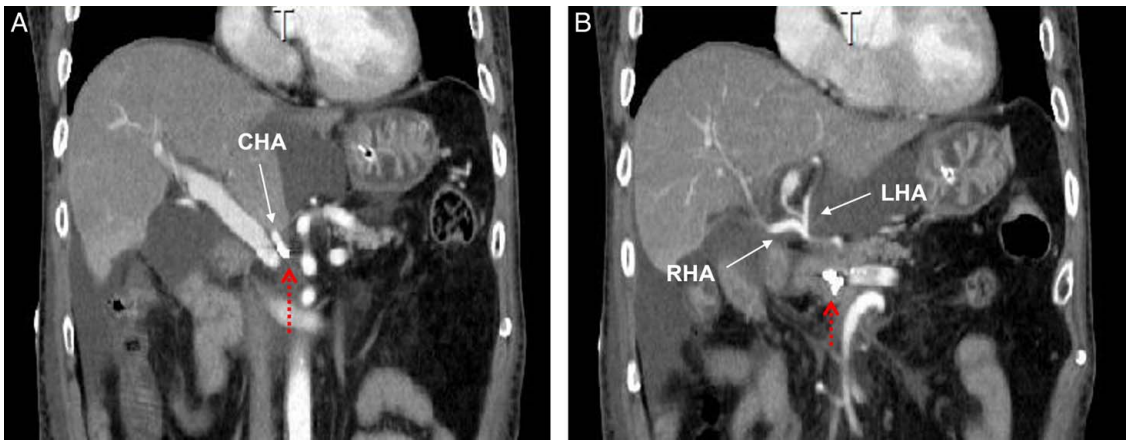

Figure 2. Five days later, a contrast-enhanced computed tomography showed that the coil (dashed arrow) remained in the CHA, but the CHA (A), the LHA and RHA (B) was contrasted. CHA, common hepatic artery; LHA, left hepatic artery; RHA, right hepatic artery.

hemodynamically unstable patients because of pseudoaneurysm rupture[24]. In this case, haemostasis by coil embolization was uncertain due to vasospasm, and clipping was used in combination with the procedure to prevent rebleeding. Although no rebleeding was observed after reperfusion in the short term, a long-term follow-up was not conducted to determine the recurrence of rebleeding and aneurysm and the need for antiplatelet agents for the remaining coil. Therefore, more experience and investigation with the use of more studies, including evaluating the reproducibility of treatment, are needed.

Ethical approval

The study is exempt from ethical approval in our institution.

Consent

Written informed consent was obtained from the patient for publication of this case report and accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal upon request.

Source of funding

The study did not receive any funding.

Author contribution

N.C., M.M., and J.S.: data collection and study concept or design; N.C. and Y.N.: writing the manuscript; T.S., A.S., and K.K.: review and editing the manuscript. All authors have read and approved the manuscript.

Conflicts of interest disclosure

The authors declare that they have no conflicts of interest.

Research registration unique identifying number (UIN)

1. Name of the registry: not applicable.
2. Unique identifying number or registration ID: not applicable.
3. Hyperlink to your specific registration (must be publicly accessible and will be checked): not applicable.

Guarantor

Dr Kosaku Kinoshita.

Availability of data and materials

The datasets used and/or analyzed during the current study are available from the corresponding author upon reasonable request.

Provenance and peer review

Not commissioned, externally peer-reviewed.

References

[1] Hasegawa T, Ota H, Matsuura T, *et al*. Endovascular treatment of hepatic artery pseudoaneurysm after pancreaticoduodenectomy: risk factors associated with mortality and complications. J Vasc Interv Radiol 2017;28:50–9.
[2] Fujii Y, Shimada H, Endo I, *et al*. Management of massive arterial hemorrhage after pancreatobiliary surgery: does embolotherapy contribute to successful outcome? J Gastrointest Surg 2007;11:432–8.
[3] Carr JA, Cho JS, Shepard AD, *et al*. Visceral pseudoaneurysms due to pancreatic pseudocysts Rare but lethal complications of pancreatitis. J Vasc Surg 2000;32:722–30.
[4] Agha RA, Franchi T, Sohrabi C, *et al*. The SCARE 2020 guideline: updating consensus Surgical CAse REport (SCARE) guidelines. Int J Surg 2020;84:226–30.
[5] Rumstadt B, Schwab M, Korth P, *et al*. Hemorrhage after pancreatoduodenectomy. Ann Surg 1998;227:236–41.
[6] Adam G, Tas S, Cinar C, *et al*. Endovascular treatment of delayed hemorrhage developing after the pancreaticoduodenectomy procedure. Wien Klin Wochenschr 2014;126:416–21.
[7] Tien YW, Wu YM, Liu KL, *et al*. Angiography is indicated for every sentinel bleed after pancreaticoduodenectomy. Ann Surg Oncol 2008;15:1855–61.
[8] Blanc T, Cortes A, Goere D, *et al*. Hemorrhage after pancreaticoduodenectomy: when is surgery still indicated? Am J Surg 2007;194:3–9.
[9] Tasu JP, Vesselle G, Herpe G, *et al*. Postoperative abdominal bleeding. Diagn Interv Imaging 2015;96:823–31.
[10] Tarrant AM, Ryan MF, Hamilton PH, *et al*. A pictorial review of hypovolaemic shock in adults. Br J Radiol 2008;81:252–7.
[11] Kameda Y, Hori T, Yamamoto H, *et al*. Fatal arterial hemorrhage after pancreaticoduodenectomy: how do we simultaneously accomplish complete hemostasis and hepatic arterial flow? World J Hepatol 2021;13:483–503.
[12] Kaw LL Jr, Saeed M, Brunson M, *et al*. Use of a stent graft for bleeding hepatic artery pseudoaneurysm following pancreaticoduodenectomy. Asian J Surg 2006;29:283–6.
[13] Ding X, Zhu J, Zhu M, *et al*. Therapeutic management of hemorrhage from visceral artery pseudoaneurysms after pancreatic surgery. J Gastrointest Surg 2011;15:1417–25.
[14] Gwon DII, Ko GY, Sung KB, *et al*. Endovascular management of extrahepatic artery hemorrhage after pancreatobiliary surgery: clinical features and outcomes of transcatheter arterial embolization and stent-graft placement. Am J Roentgenol 2011;196:W627–34.
[15] Pedersoli F, Isfort P, Keil S, *et al*. Stentgraft implantation for the treatment of postoperative hepatic artery pseudoaneurysm. Cardiovasc Intervent Radiol 2016;39:575–81.
[16] Carr SC, Pearce WH, Vogelzang RL, *et al*. Current management of visceral artery aneurysms. Surgery 1996;120:627–33.
[17] Sessa C, Tinelli G, Porcu P, *et al*. Treatment of visceral artery aneurysms: description of a retrospective series of 42 aneurysms in 34 patients. Ann Vasc Surg 2004;18:695–703.
[18] Ishikawa M, Kakizawa H, Yamasaki W, *et al*. Recanalization after successful occlusion by transcatheter arterial embolization with N-butyl cyanoacrylate for traumatic splenic artery injury. Hiroshima J Med Sci 2011;60:87–90.
[19] Ai M, Gao DZ, Lu GM, *et al*. Abdominal rebleeding after transcatheter arterial embolization for ruptured pseudoaneurysms associated with severe acute pancreatitis: a retrospective study. Videosurgery Miniinv 2021;16:83–90.
[20] Chaer RA, Abularrage CJ, Coleman DM, *et al*. The Society for Vascular Surgery clinical practice guidelines on the management of visceral aneurysms. J Vasc Surg 2020;72:3S–39S.
[21] Obara H, Matsubara K, Inoue M, *et al*. Current management strategies for visceral artery aneurysms: an overview. Surg Today 2020;50:38–49.
[22] Shukla AJ, Eid R, Fish L, *et al*. Contemporary outcomes of intact and ruptured visceral artery aneurysms. J Vasc Surg 2015;61:1442–7.
[23] Mille M, Huber J, Wlasak R, *et al*. Prophylactic transcatheter arterial embolization after successful endoscopic hemostasis in the management of bleeding duodenal ulcer. J Clin Gastroenterol 2015;49:738–45.
[24] Choi SH, Moon HJ, Heo JS, *et al*. Delayed hemorrhage after pancreaticoduodenectomy. J Am Coll Surg 2004;199:186–91.