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Case Report

Gastrointestinal and intraperitoneal bleeding due to multiple pseudoaneurysms postpartial pancreatectomy: A case report and literature review ☆,☆☆

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ABSTRACT

Postoperative pancreatic fistula, a significant complication following pancreaticoduodenectomy, can lead to the development of pseudoaneurysms, which in turn can result in hemorrhagic and septic complications. Here, we present the case of a 67-year-old male patient diagnosed with pancreatic head carcinoma who underwent partial pancreatectomy. Ten days postsurgery, the patient experienced hemorrhagic shock due to intraperitoneal bleeding. Emergency exploratory laparotomy and implantation of a stent in the common hepatic artery successfully stopped the bleeding. However, the patient later developed gastrointestinal bleeding, and no apparent source was detected during endoscopic examination. Two complex transcatheter arterial embolization procedures were performed, successfully stopping the bleeding. It is crucial to consider pseudoaneurysm in cases of suspected biliary and pancreatic leakage. This case also underscores the importance of a thorough vascular assessment prior to placing a coated stent, to prevent postoperative obstruction of catheter access to the responsible vessel. Additionally, embolization via the external path of the stent proved feasible.

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Introduction

Pancreatic surgery is recognized as a complex abdominal procedure. Notable advancements in surgical techniques and perioperative care have resulted in a perioperative mortality rate of less than 5% in high-volume centers [1,2]. However, postoperative pancreatic fistula remains a significant complication following pancreaticoduodenectomy, with an incidence ranging from 13% to 41%. This complication can lead to the development of pseudoaneurysms. The occurrence of pseudoaneurysms subsequent to pancreatic resection is relatively infrequent, with published rates generally citing below 5% [3-5]. However, upon the event of rupture and hemorrhage, the associated mortality is significantly elevated, with estimates ranging from 14% to 58% [4,6]. Additional complications of pancreatic surgery include pancreatic fistula, bile leakage, delayed gastric emptying, and postpancreatectomy hemorrhage (PPH), contributing to prolonged hospitalization. PPH, though less common, is a serious complication, occurring in 1% to 8% of all pancreatic surgeries. Notably, late PPH poses a particularly life-threatening risk, accounting for 11% to 38% of overall mortality [2,7]. This underscores the critical importance of vigilant postoperative monitoring and the prompt management of these potentially life-threatening complications. Angiography has proven to be an effective diagnostic tool for gastrointestinal hemorrhage, with a sensitivity ranging from 67% to 100%, and enables potential interventions [8].We recently encountered a complex case of massive intraperitoneal and gastrointestinal bleeding caused by pseudoaneurysms of the proper hepatic artery and the great pancreatic artery following partial pancreatectomy. In this report, we detail the successful treatment employing spring coil and gelatin sponge granule embolization.

Case presentation

A 67-year-old male was admitted to a local hospital for evaluation of symptoms indicative of increased bilirubin levels and jaundice. Subsequently, the patient was transferred to our hospital for further diagnostic evaluation. The patient presents with a 7-year medical history of hypertension, with the peak documented blood pressure reaching 150/100 mmHg. The patient's antihypertensive regimen includes the chronic administration of 1 tablet of Felodipine Extended-Release Tablets once daily, which has effectively maintained blood pressure within a target range of 130/80 mmHg. Furthermore, the patient has a 15-year history of lacunar stroke and is concurrently managed with a daily regimen of 1 enteric-coated aspirin tablet (Bayer Aspirin) for platelet aggregation inhibition and 1 tablet of Atorvastatin Calcium (Lipitor) once nightly for lipid-lowering therapy.

PET-CT revealed a malignant lesion in the pancreatic uncinate process, associated with extensive dilation of the pancreatic ductal system and abnormal glucose metabolism. Pathology from pancreatic puncture confirmed malignancy. The patient underwent a radical pancreatoduodenectomy and lysis of adhesions after receiving 4 cycles of neoadjuvant chemotherapy with FOLFIRINOX. Histopathological examination confirmed a diagnosis of moderately differentiated pancreatic adenocarcinoma. Postoperative biochemical profiling revealed elevated levels of procalcitonin at 0.77 ng/mL, suggestive of a potential inflammatory state. The Partial Thromboplastin Time (PTT) was prolonged, registering at 32.8 seconds, which may imply a hypercoagulable condition. The white blood cell (WBC) count was significantly elevated, reaching 23.0 × 10^9/L, with a neutrophil percentage of 91.4%. The hemoglobin concentration was measured at 116 g/L, and the red blood cell (RBC) count was within the normal range with a value of 3.90 × 10^12/L. The platelet count was 204 × 10^9/L, which is slightly below the reference interval. Furthermore, the High-Sensitivity C-Reactive Protein (hs-CRP) level was markedly elevated to 55.0 mg/L, reinforcing the presence of an ongoing inflammatory process.

Postoperatively, ertapenem at a dosage of 1 gram once daily was administered as a prophylactic measure to prevent infection, and frozen plasma transfusion was implemented to ameliorate coagulopathy. However, the culture of the drainage fluid revealed a significant presence of multidrug-resistant Enterococcus faecium. Consequently, the antimicrobial treatment was upgraded to tigecycline at a dosage of 50 milligrams twice daily, in accordance with the susceptibility profile and standard therapeutic guidelines.

On postoperative day 10, the patient presented with an abrupt evacuation of a substantial quantity of sanguineous fluid via the abdominal drain. Concurrent cardiovascular monitoring depicted hypotension, with a blood pressure reading of 85/51 mmHg, and a decreased heart rate of 51 beats per minute (bpm), which raised the suspicion of an intra-abdominal hemorrhagic event. Abdominal CTA showed localized exudate and encapsulated effusion around the bilioenteric anastomosis, without evidence of active hemorrhage. Emergency laparotomy revealed a 2 mm fistula on the anastomosis's right lateral wall, with bile leakage. Active bleeding from a damaged artery adjacent to the common hepatic artery was successfully controlled with clamping. Abdominal angiography was conducted to localize the bleeding, uncovering severe stenosis of the common hepatic artery. A 4*40 mm Armada balloon was utilized to dilate the stenotic segment, followed by the implantation of a 5*50 mm VIABAHN coated stent (Fig. 1). Postoperatively, the patient's vital signs were as follows: the heart rate was documented at 72 beats per minute, blood pressure was maintained at 136/67 mmHg, and the peripheral capillary oxygen saturation (SpO2) measured 98%.

On the ninth postoperative day following interventional surgery, the patient manifested signs of shock accompanied by hypotension. The patient's mean arterial pressure (MAP) reached a nadir of 50 mmHg, accompanied by a tachycardic rhythm with a heart rate of 130 beats per minute. An arterial blood gas (ABG) analysis indicated a hemoglobin concentration of 63 g/L, demonstrating a progressive decrease from prior assessments. Abdominal CTA identified an active hemorrhagic focus adjacent to the bilioenteric anastomosis and pseudoaneurysms involving the proper hepatic artery and a branch of the superior mesenteric artery. Furthermore, an aneurysm of the left gastric artery with a spindle shape was noted (Fig. 2). Immediate intervention involved embolization

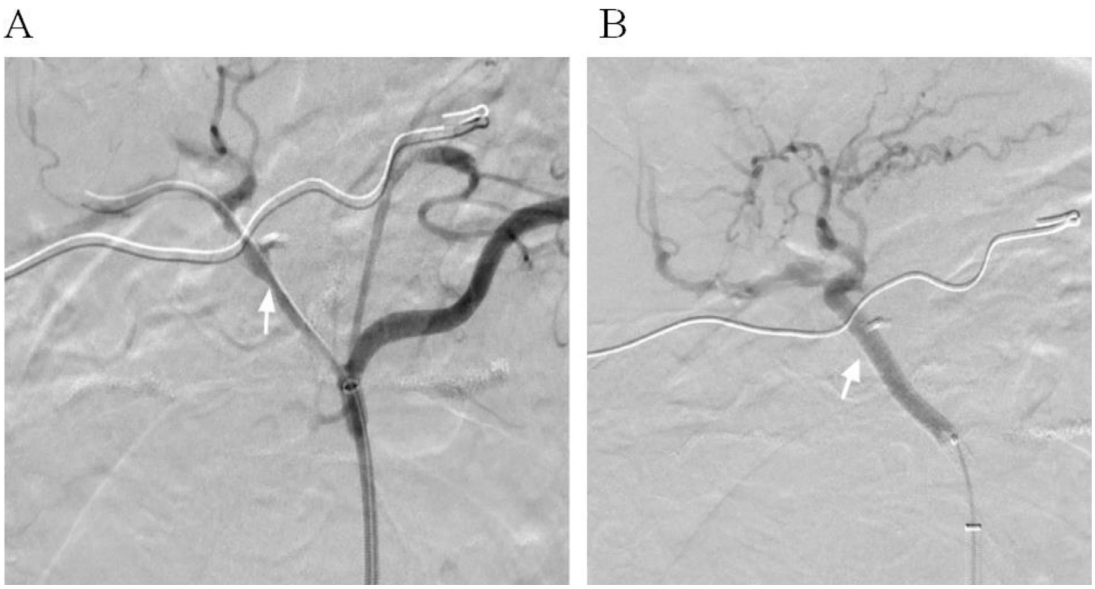

Fig. 1 – Pre- and poststent implantation images of common hepatic artery stenosis on postoperative day 10. (A) Preimplantation angiogram showing stenosis of the common hepatic artery (arrow). (B) Postimplantation angiogram demonstrating restoration of the common hepatic artery lumen after stent placement (arrow).

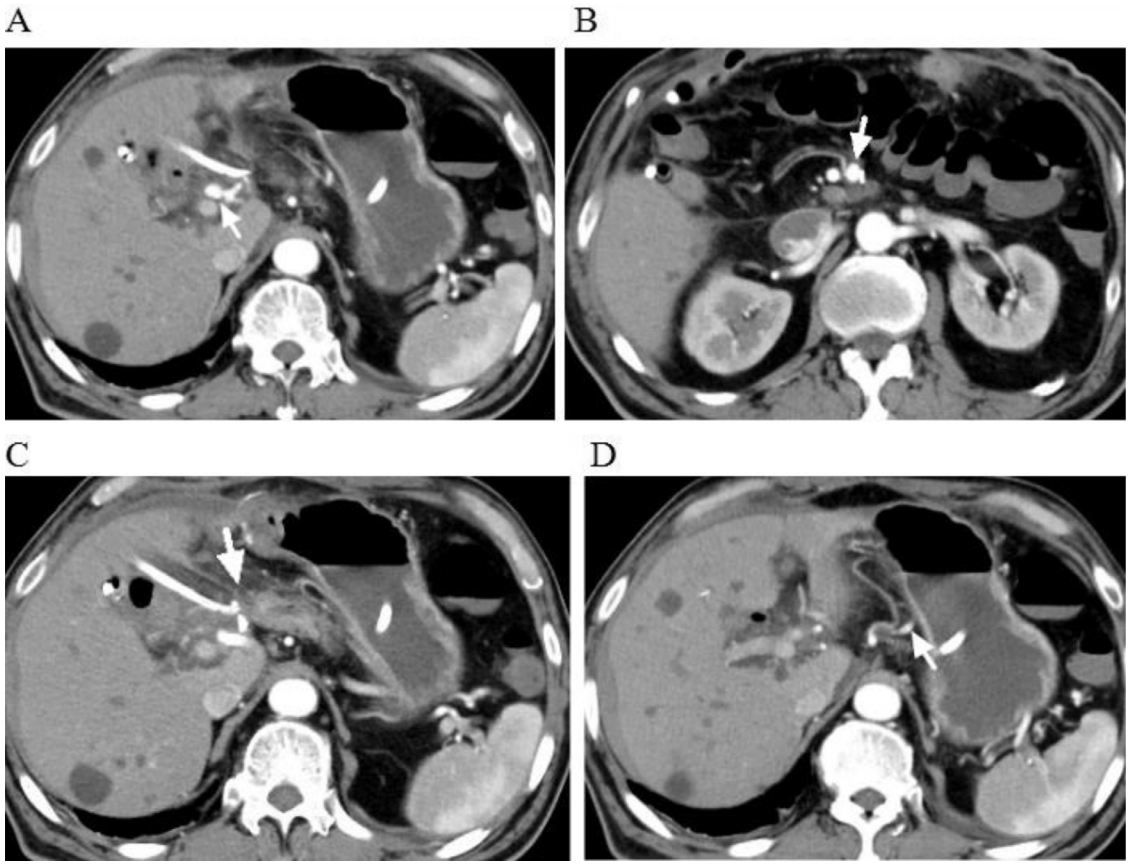

Fig. 2 – Abdominal enhanced computed tomography images on day 9 postfirst interventional surgery. (A) An 8 mm diameter proper hepatic artery pseudoaneurysm (arrow). (B) A 7 mm diameter superior mesenteric artery pseudoaneurysm (arrow). (C) High-density exudation in the perihilar region (arrow). (D) A spindle-shaped aneurysm of the left gastric artery, measuring 7 mm in diameter (arrow).

of the proper hepatic artery and the superior mesenteric artery. Angiography disclosed pseudoaneurysms involving the proximal branch of the superior mesenteric artery and the proper hepatic artery. The sizes of the pseudoaneurysms are 7 millimeters and 8 millimeters, respectively. The branch of the great pancreatic artery showed contrast agent extravasation, communicating with the right colonic artery branch. Additionally, the left gastric artery exhibited spindle-shaped dilation. The longitudinal diameter of the aneurysm is approximately 9 millimeters. Additionally, the common hepatic artery stent was observed to partially occlude the origin of the great pancreatic artery, the splenic artery. Despite several attempts, microwire intubation of the great pancreatic artery was unsuccessful. Ultimately, embolization with gelatin sponge granules and 2 spring coils each measuring 2 millimeters in diameter were performed on the bleeding right colic artery branch, followed by 7 mm and 8 mm detachable coil embolization of the pseudoaneurysm in the branches of the superior mesenteric artery and the hepatic artery proper based on the size of the pseudoaneurysm. Complete embolization of the pseudoaneurysm led to the cessation of contrast agent extravasation from the great pancreatic artery's branch (Fig. 3). However, a week later, the patient exhibited recurrent symptoms, including abdominal pain, melena, and hypotension. A follow-up angiography demonstrated recurrent contrast agent extravasation in a branch of the great pancreatic artery, indicating the need for another microcatheter superselective intervention. On this occasion, the microcatheter navigated the peri-stent space of the common hepatic artery and accessed the bleeding artery via the distal splenic artery (Fig. 4). Embolization using 2 spring coils each measuring 2 millimeters in diameter resulted in the cessation of contrast agent extravasation within the great pancreatic artery. The postoperative course was favorable, with an abdominal CT scan conducted 4 days postoperatively showing no evidence of new bleeding or extravasation. Significant absorption of the initial peritoneal exudate contributed to the patient's readiness for discharge. The patient is currently under follow-up at our hospital, with no signs of recurrent gastrointestinal bleeding noted during their most recent visit.

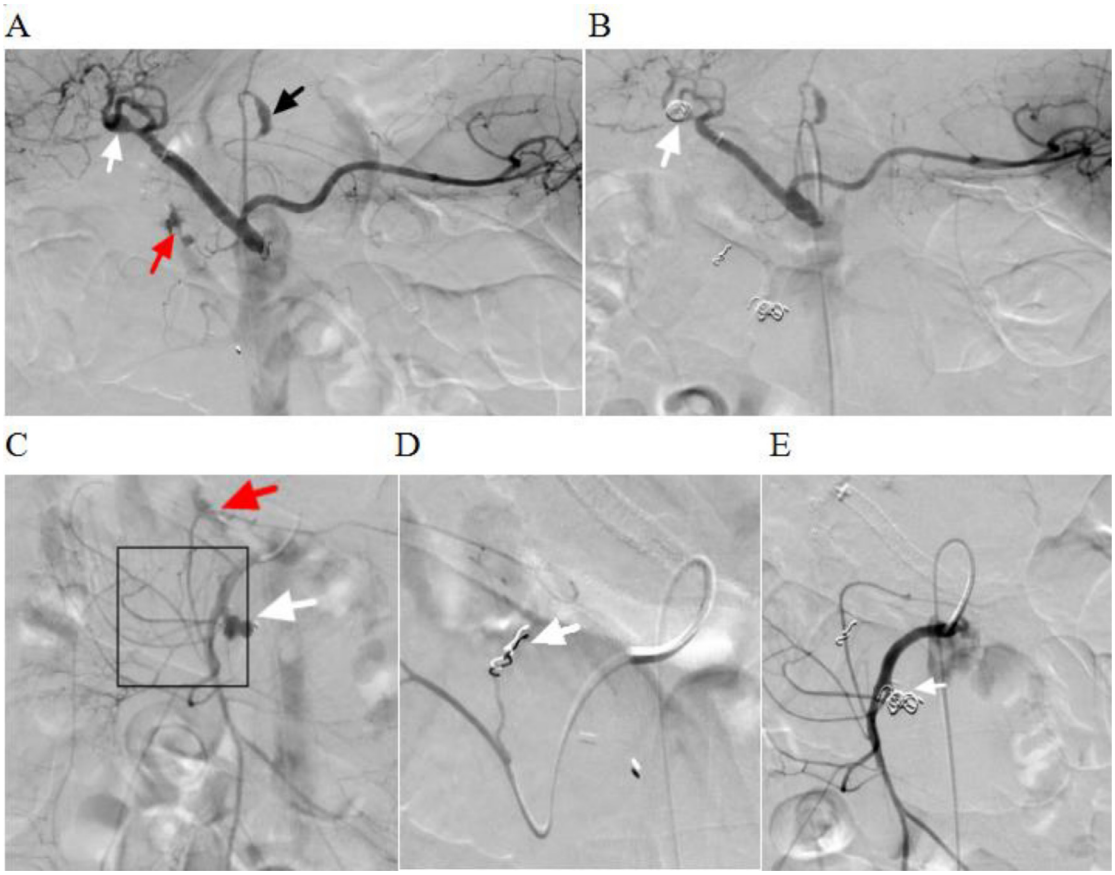

Fig. 3 – Pre- and postendovascular treatment images of proper hepatic artery and superior mesenteric artery branch lesions (9 days postfirst interventional surgery). (A) An 8 mm pseudoaneurysm of the proper hepatic artery (white arrow) and a 9 mm fusiform aneurysm of the left gastric artery (black arrow). Extravasation of contrast agent in the branch of the great pancreatic artery (red arrow), indicating communication with the branch of the right colonic artery. (B) Embolization of the proper hepatic artery pseudoaneurysm using spring coils (arrow). (C) A 7 mm pseudoaneurysm of the superior mesenteric artery branch (arrow). The right colonic artery branch shows contrast agent extravasation (red arrow). (D) Locally enlarged view from Figure C (black box), showing the resolution of extravasation following coil embolization of the right colonic artery branch (arrow). (E) Embolization of the superior mesenteric artery branch pseudoaneurysm using spring coils (arrow).

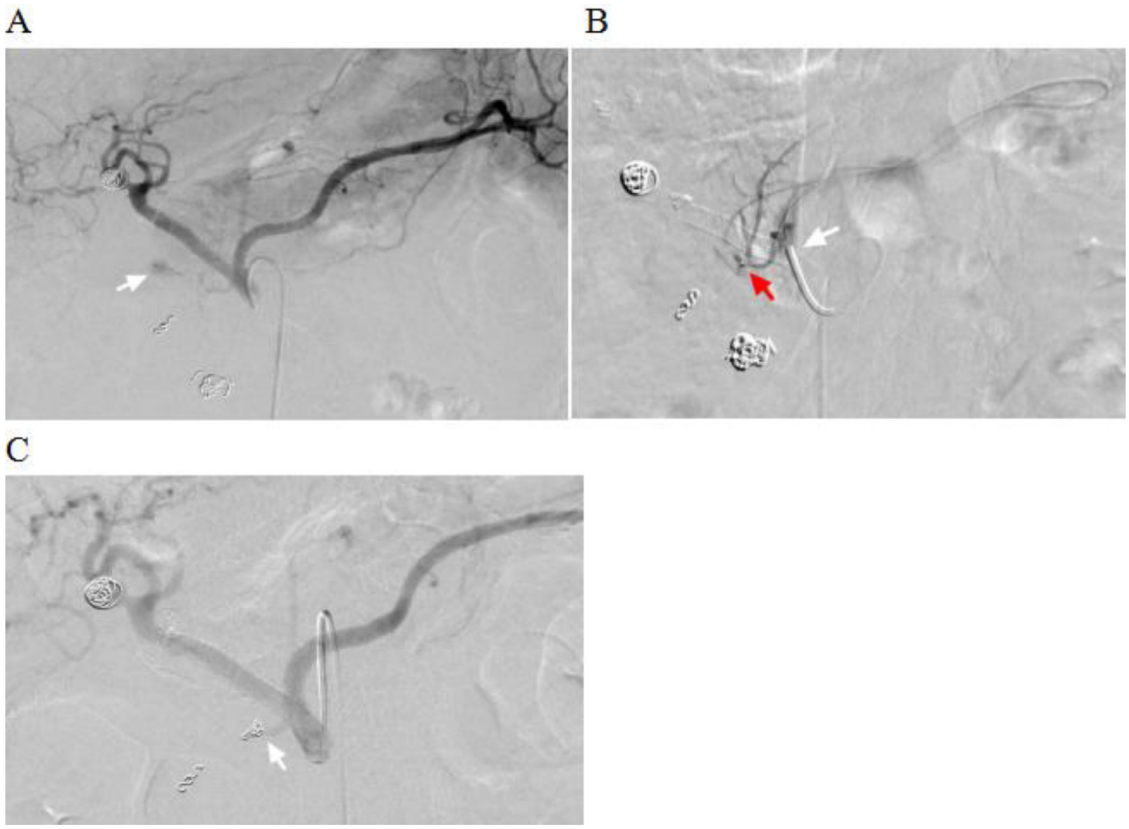

Fig. 4 – Pre- and postendovascular treatment images of great pancreatic artery branch lesions (1 week postsecond interventional surgery). (A) Extravasation of contrast agent in the great pancreatic artery branch (arrow). (B) The main catheter tip positioned between the stent and vessel wall (white arrow). The microcatheter navigates through the splenic artery loop to access the affected blood vessel (red arrow). (C) Resolution of extravasation following coil embolization of the great pancreatic artery branch (arrow).

Discussion

PPH, a severe complication postpancreatic surgery, is associated with high mortality rates. The primary cause of postoperative bleeding following pancreatic surgery is often the emergence of pseudoaneurysms from the common hepatic artery, its tributaries, or the gastroduodenal artery stump [9]. Pseudoaneurysm formation after pancreatic surgery is typically associated with the presence of an intra-abdominal abscess or a pancreatic fistula [2,7,10]. Moreover, mechanical injury during surgery and recurrent pancreatitis may also contribute to pseudoaneurysm formation [1]. In this instance, no evidence of peripancreatic exudation was observed on abdominal CT scans, while multiple pseudoaneurysms were localized adjacent to the bilioenteric anastomosis. Thus, we attribute the formation of these pseudoaneurysms primarily to bile leakage and vascular wall damage sustained during surgical procedures.

Pseudoaneurysms frequently present with discomfort, pain, or occult bleeding, termed sentinel bleeding, and are observed in about 60% to 80% of patients with PPH [4,11]. Prompt management of sentinel bleeding is crucial to prevent massive hemorrhage. In the early stages of PPH, the presence of small amounts of blood in the nasogastric or abdominal drain tubes is indicative of sentinel bleeding and can be readily identified. For ruptured pseudoaneurysms, immediate intervention is mandatory, with options including laparotomy or endovascular treatment. However, performing laparotomy during hemorrhagic shock may lead to serious complications. Consequently, endovascular treatments, including stent graft placement and transcatheter arterial embolization, are typically the first line of temporary hemorrhage control, with urgent surgery reserved for cases refractory to endovascular intervention. A retrospective review documented a 72.5% success rate for embolization in a series of 40 patients [12]. In this specific case, exploratory laparotomy was warranted due to ongoing abdominal bleeding and a 2 mm leak at the bilioenteric anastomosis site, which were not amenable to intravascular intervention. Neglecting to address this issue could potentially lead to recurrent abdominal bleeding.

Stent graft replacement therapy is superior to transcatheter arterial embolization in maintaining hepatic perfusion [1]. Accordingly, following the resolution of anastomotic leakage and hemostasis, we performed an endovascular intervention that addressed the common hepatic artery stenosis and ruled out other bleeding sources.

Inadequate vascular assessment during the procedure resulted in the choice of an overly long coated stent, which obscured the splenic artery's opening, preventing catheter ac-

cess to the culpable vessel, the great pancreatic artery, during the second intervention. However, the imaging revealed a distinct pathway to the splenic and culprit vessels, this finding fostered optimism for the feasibility and success of future interventional procedures. Consequently, a meticulous preoperative vascular evaluation is essential for the success and safety of interventional surgical procedures. It is a critical step, as minor oversights at this stage have the potential to escalate into substantial postoperative complications.

In the third interventional procedure, we endeavored to navigate through the splenic artery, utilizing the space between the stent and vessel wall. This process was intricate, necessitating a route from the splenic artery's distal end to the pancreatic artery for pseudoaneurysm embolization. The initial 2 procedures provided valuable insights, inspiring innovative approaches during the third intervention that facilitated the resolution of this challenging case.

Upon conducting a thorough literature review, we identified reports that describe the utilization of stents for the management of pseudoaneurysms. The reported techniques commonly encompass the direct implantation of covered stents onto the segment of the vessel affected by the aneurysm. Alternatively, some cases involve the preliminary embolization of the pseudoaneurysm using coils, followed by the strategic placement of a stent [13-15]. In our comprehensive literature review, we discovered a solitary case report that paralleled our own interventional surgical methodology. This case detailed the embolization of a pseudoaneurysm utilizing the interstitial space between the vascular wall and a deployed covered stent. After the implantation of

2 stents, there was still a relatively large filling of the pseudoaneurysm due to a lack of sealing at the proximal edge of the stent [16]. Consequently, the manipulation of the guidewire through the interstitial space to engage the pseudoaneurysm is manageable. However, in our case, the establishment of a conduit was notably more challenging due to the intimate apposition of the vascular wall against the exterior surface of the stent, thereby amplifying the intricacy of the procedure. This scenario appears to be rare, potentially linked to the vessel's inherent condition. Moreover, the degree of adherence between the blood vessel and stent is likely to influence the surgical success rate. For example, excessive attachment between the vascular wall and stent can impede catheter passage, even if the guide wire accesses the splenic artery. In the third interventional procedure, relaxation of the vascular wall and stent provided a window for our microcatheter to navigate the pathway between them. However, the proximity of the responsible vessel's opening to the splenic artery posed a challenge, as tension of the catheterin hindered it entry into the vessel. Consequently, we created a loop at the splenic artery's distal end, reapproached the proximal end, and successfully cannulated the responsible vessel, facilitating precise embolization.

Conclusion

We reported a complex case of gastrointestinal and intraperitoneal bleeding due to pseudoaneurysms of the proper hepatic artery, a branch of the superior mesenteric artery, and the great pancreatic artery following partial pancreatectomy. Pseudoaneurysm should be considered in cases where pancreatic or biliary leakage is suspected. Endovascular treatment is crucial for the immediate management of PPH. Our case highlights the importance of a thorough preoperative vascular evaluation to prevent intraoperative catheter obstruction and ensure access to the affected vessel. Furthermore, we were able to achieve hemostasis through embolization using an extra-stent pathway. This methodology presents a novel therapeutic avenue for interventional radiologists who are likely to face analogous clinical challenges in their future practice.

Author contributions

All authors contributed to either the conception, operation, or data collection. The operation was performed by Zhen Tao,Bing Yang and Heshan Zhou, and the corresponding intraoperative images were provided by them. Material preparation, data collection were performed by Tao Zhen, Xiaoxi Fan, and Dacheng Hu. The first draft of the manuscript was written by Tao Zhen, and all authors commented on previous versions of the manuscript. Tao Zhen contributed to the final manuscript and supervised all the data. All authors read and approved the final manuscript.

Ethics approval

Ethical approval to report this case was obtained from Hangzhou First People's Hospital.

Patient consent

Written informed consent for publication of their details was obtained from the patient.

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