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EDITORIAL

- 974 How to identify early complications in patients undergoing distal gastrectomy?
Tropeano G, Chiarello MM, Fico V, Brisinda G
- 982 Quality assessment of surgery for colorectal cancer: Where do we stand?
Morarasu S, Livadaru C, Dimofte GM
- 988 Emerging molecules, tools, technology, and future of surgical knife in gastroenterology
Kumar A, Goyal A
- 999 Carcinoembryonic antigen in the diagnosis, treatment, and follow-up of focal liver lesions
Dilek ON, Arslan Kahraman Dİ, Kahraman G
- 1008 Relationship between *Helicobacter pylori* infection and colorectal polyp/colorectal cancer
Liu Y, Yang DQ, Jiang JN, Jiao Y

MINIREVIEWS

- 1017 Near-infrared cholangiography with intragallbladder indocyanine green injection in minimally invasive cholecystectomy
Symeonidis S, Mantzoros I, Anestiadou E, Ioannidis O, Christidis P, Bitsianis S, Bisbinas V, Zapsalis K, Karastergiou T, Athanasiou D, Apostolidis S, Angelopoulos S
- 1030 Blastomas of the digestive system in adults: A review
Liu Y, El Jabbour T, Somma J, Nakanishi Y, Ligato S, Lee H, Fu ZY

ORIGINAL ARTICLE

Retrospective Study

- 1043 Single-center retrospective study of the diagnostic value of double-balloon enteroscopy in Meckel's diverticulum with bleeding
He T, Yang C, Wang J, Zhong JS, Li AH, Yin YJ, Luo LL, Rao CM, Mao NF, Guo Q, Zuo Z, Zhang W, Wan P
- 1055 Prognostic value of a nomogram model for postoperative liver metastasis of colon cancer
Cheng DX, Xu KD, Liu HB, Liu Y
- 1066 Computer-assisted three-dimensional individualized extreme liver resection for hepatoblastoma in proximity to the major liver vasculature
Xiu WL, Liu J, Zhang JL, Wang JM, Wang XF, Wang FF, Mi J, Hao XW, Xia N, Dong Q
- 1078 Research on the prognostic value of adjusting intraperitoneal three-dimensional quality evaluation mode in laparoscopic cholecystectomy patients
Zhou Y, Chen ZQ

- 1087** Construction of a predictive model for acute liver failure after hepatectomy based on neutrophil-to-lymphocyte ratio and albumin-bilirubin score

Li XP, Bao ZT, Wang L, Zhang CY, Yang W

- 1097** Predicting short-term thromboembolic risk following Roux-en-Y gastric bypass using supervised machine learning

Ali H, Inayat F, Moond V, Chaudhry A, Afzal A, Anjum Z, Tahir H, Anwar MS, Dahiya DS, Afzal MS, Nawaz G, Sohail AH, Aziz M

- 1109** Comparative analysis of two digestive tract reconstruction methods in total laparoscopic radical total gastrectomy

Dong TX, Wang D, Zhao Q, Zhang ZD, Zhao XF, Tan BB, Liu Y, Liu QW, Yang PG, Ding PA, Zheng T, Li Y, Liu ZJ

- 1121** Incidence of surgical site infection in minimally invasive colorectal surgery

Ni LT, Zhao R, Ye YR, Ouyang YM, Chen X

Observational Study

- 1130** Burden of gallstone disease in the United States population: Prepandemic rates and trends

Unalp-Arida A, Ruhl CE

Prospective Study

- 1149** Kuicolong-yu enema decoction retains traditional Chinese medicine enema attenuates inflammatory response ulcerative colitis through TLR4/NF- κ B signaling pathway

Han L, Tang K, Fang XL, Xu JX, Mao XY, Li M

SYSTEMATIC REVIEWS

- 1155** Quality-adjusted life years and surgical waiting list: Systematic review of the literature

de la Plaza Llamas R, Ortega Azor L, Hernández Yuste M, Gorini L, Latorre-Fragua RA, Díaz Candelas DA, Al Shwely Abduljabar F, Gemio del Rey IA

META-ANALYSIS

- 1165** Impact of different anastomosis methods on post-recurrence after intestinal resection for Crohn's disease: A meta-analysis

Wang ZZ, Zhao CH, Shen H, Dai GP

CASE REPORT

- 1176** Suspected coexistence of perianal necrotizing sweet syndrome in chronic myelomonocytic leukemia: A case report

Yu KQ, Li HX, Wu J

- 1184** Successful splenic artery embolization in a patient with Behçet's syndrome-associated splenic rupture: A case report

Zhu GZ, Ji DH

- 1189** Stercoral perforation of the cecum: A case report

Yu HC, Pu TW, Kang JC, Chen CY, Hu JM, Su RY

- 1195** Percutaneous transhepatic stenting for acute superior mesenteric vein stenosis after pancreaticoduodenectomy with portal vein reconstruction: A case report
Lin C, Wang ZY, Dong LB, Wang ZW, Li ZH, Wang WB
- 1203** Endoscopic treatment of bleeding gastric ulcer causing gastric wall necrosis: A case report
Li WF, Gao RY, Xu JW, Yu XQ
- 1208** Intermittent melena and refractory anemia due to jejunal cavernous lymphangioma: A case report
Liu KR, Zhang S, Chen WR, Huang YX, Li XG

LETTER TO THE EDITOR

- 1215** New frontiers in ectopic pancreatic tissue management
Covantsev S

ABOUT COVER

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Percutaneous transhepatic stenting for acute superior mesenteric vein stenosis after pancreaticoduodenectomy with portal vein reconstruction: A case report

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Abstract

BACKGROUND

Percutaneous transhepatic stent placement has become a common strategy for the postoperative treatment of portal vein (PV)/superior mesenteric veins (SMV) stenosis/occlusion. It has been widely used after liver transplantation surgery; however, reports on stent placement for acute PV/SMV stenosis after pancreatic surgery within postoperative 3 d are rare.

CASE SUMMARY

Herein, we reported a case of intestinal edema and SMV stenosis 2 d after pancreatic surgery. The patient was successfully treated using stent grafts. Although the stenosis resolved after stent placement, complications, including bleeding, pancreatic fistula, bile leakage, and infection, made the treatment highly challenging. The use of anticoagulants was adjusted multiple times to prevent venous thromboembolism and the risk of bleeding. After careful treatment, the patient stabilized, and stent placement effectively managed postoperative PV/SMV stenosis.

CONCLUSION

Stent placement is effective and feasible for treating acute PV/SMV stenosis after pancreatic surgery even within postoperative 3 d.

Key Words: Pancreaticoduodenectomy; Portal vein reconstruction; Portal vein stenosis; Portal vein stent; Case report

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Core Tip: Portal vein (PV)/superior mesenteric veins (SMV) stenosis/occlusion is an uncommon but severe complication after pancreatic surgery. Stent placement for acute PV/SMV stenosis within 3 d postoperatively was rarely reported. We reported a case showing that percutaneous transhepatic stent placement was an effective and feasible treatment for acute SMV stenosis on postoperative day 2 after the Whipple procedure and could relieve patients' symptoms. Complications after SMV stent placement, such as bleeding, infection, pancreatic fistula and bile leakage should be fully noticed and carefully managed, especially when considering their interactive effects. Anticoagulation was initiated for preventing stent thrombosis, but it increased risk of bleeding.

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INTRODUCTION

Portal vein (PV) or superior mesenteric vein (SMV) stenosis can occur as a postoperative complication and has been widely reported after liver transplantation surgery[1,2]. PV/SMV stenosis can also be a complication of pancreatic surgery, such as pancreaticoduodenectomy (PD)[3,4]. The incidence of PV stenosis is reported to be 9%-30%[4,5] and is higher with PV resection during surgery[6], causing significant symptoms, including abdominal pain, gastrointestinal bleeding, and ascites[7,8]. SMV stenosis with clinical manifestations, including refractory ascites, gastrointestinal bleeding, and congestive bowel infarction, has been reported less frequently[9]. In patients with severe symptoms, PV/SMV stenting may be used to reestablish blood flow[10]. Previous studies have shown that PV/SMV stenting is typically performed after 1 month postoperatively, but rarely within 3 d, possibly due to concerns about re-stenosis or bleeding. Only one case-series report reported an instance of PV/SMV stenting within 3 d of pancreatic surgery[11], but without detailed clinical characteristics and outcomes. Generally, there is a lack of experience with treatment of postoperative PV/SMV stenosis within 3 d. Here, we present a case of a patient with acute postoperative PV/SMV stenosis treated with PV/SMV stenting on postoperative day (POD) 2. To the best of our knowledge, this is the first report on stent placement, management of anticoagulation usage, and complications after stenting for acute PV/SMV stenosis after pancreatic surgery with PV reconstruction within POD 3.

CASE PRESENTATION

Chief complaints

Two years after transverse colon cancer surgery, four months since finding pancreatic head mass.

History of present illness

A 65-year-old woman underwent PD with PV and SMV resection and reconstruction using an autologous great saphenous vein patch for a pancreatic head mass. She underwent radical resection for laparoscopic colorectal cancer 2 years before PD, and the pathological diagnosis was moderately differentiated adenocarcinoma of the transverse colon, pT4-aN0M0, stage IIb. After colorectal cancer surgery, the patient underwent four courses of XELOX chemotherapy. At 18 postoperative months (POMs) after colorectal cancer surgery, positron emission tomography/computed tomography (CT) revealed a 1.8 cm × 1.7 cm mass in the pancreatic head with a maximum standardized uptake value (SUVmax) of 4.5. Enhanced CT found a mass with low enhancement that caused SMV violation and stenosis (Figure 1). Considering the previous history of colorectal cancer, it was difficult to discriminate the mass from primary pancreatic cancer or metastasis of recurrent colorectal cancer. Endoscopic ultrasound pathology was used but it only characterized the mass as an adenocarcinoma and could not reach a clear diagnosis.

History of past illness

The patient had a history of hypertension, diabetes mellitus, and stroke.

Personal and family history

The patient had no positive findings in personal and family history.



Figure 1 Computed tomography shows that superior mesenteric vein is violated by the mass in the pancreatic head (arrows). A: Above the superior mesenteric vein; B: The superior mesenteric vein is violated by the mass; C: Below the superior mesenteric vein.

Physical examination

No jaundice in the patient's skin and sclera. Courvoisier's sign (-), bowel sounds 3 times per minute, and rectal examination (-).

Laboratory examinations

No significant laboratory examinations were found for the patient.

Imaging examinations

The imaging examinations were shown in history of present illness section.

FINAL DIAGNOSIS

During PD surgery, the mass was confirmed to violate the SMV; therefore, 3 cm of the SMV was resected, and 5 cm of the autologous great saphenous vein was used to reconstruct the SMV. The beginning of the jejunum (length: 20 cm) was also resected after the first jejunal vein was disrupted. On POD 1, the drainage volume of the operative gravity drain placed close to the biliary-enteric anastomosis was 2800 mL, and the patient's bowel sounds were absent. Ultrasonography revealed intestinal edema and enhanced CT revealed SMV stenosis (Figure 2). Therefore, PV angiography was performed and SMV stenosis confirmed.

TREATMENT

Percutaneous transhepatic stent placement was performed to reestablish blood flow in the PV (Figure 3). Heparin was administered after stent placement to prevent thrombosis with an activated partial thromboplastin time (APTT) goal of 35–40 s, which was 1.5 times of the patient's baseline level before surgery [12] (Figure 4). On POD 7, thrombosis formation was found in right peroneal vein; therefore, we tested the activity of antithrombin to evaluate heparin's anticoagulant activity. The activity of AT-III was 67%, suggesting an increased risk of developing abnormal thrombosis and impaired sensitivity to heparin, since heparin functions through antithrombin. Fresh frozen plasma was transfused to rescue sensitivity to heparin. Gastrointestinal bleeding was observed on POD 9; therefore, the dose of heparin was decreased. On POD 10, the heparin was replaced with low molecular weight heparin (LMWH) (Figure 4). On POD 22, the patient experienced bleeding from the drainage tube, hematochezia, and hematemesis. The patient was treated with transfusion, and LMWH was changed to a very low dose of heparin, with an APTT goal of 25–30 s, and finally to rivaroxaban 10 mg qd. Bleeding gradually disappeared at POD 26.

Pancreatic fistulas and bile leakage were also found after stent placement, which was inferred to be a result of the resolution of intestinal edema after re-establishment of PV blood flow. A pancreatic fistula was diagnosed by a daily drainage volume of 100–200 mL nearby the pancreaticojejunal anastomosis (Figure 5), and the drainage fluid was cloudy as rice water with rising amylase. Bile leakage was diagnosed using Atrovirens drainage fluid with a high level of direct bilirubin. Proton pump inhibitors and enzyme inhibitors were administered, and the drainage tubes were carefully adjusted. The pathological diagnosis was adenocarcinoma with moderate differentiation, and immunohistochemical analysis suggested that the mass may have originated from the colon.

OUTCOME AND FOLLOW-UP

The patient experienced several episodes of infection and fever (Figure 6). During the first week after surgery, septic shock occurred, which probably originated from pancreatic fistula, bile leakage, damage to intestinal barrier function, and

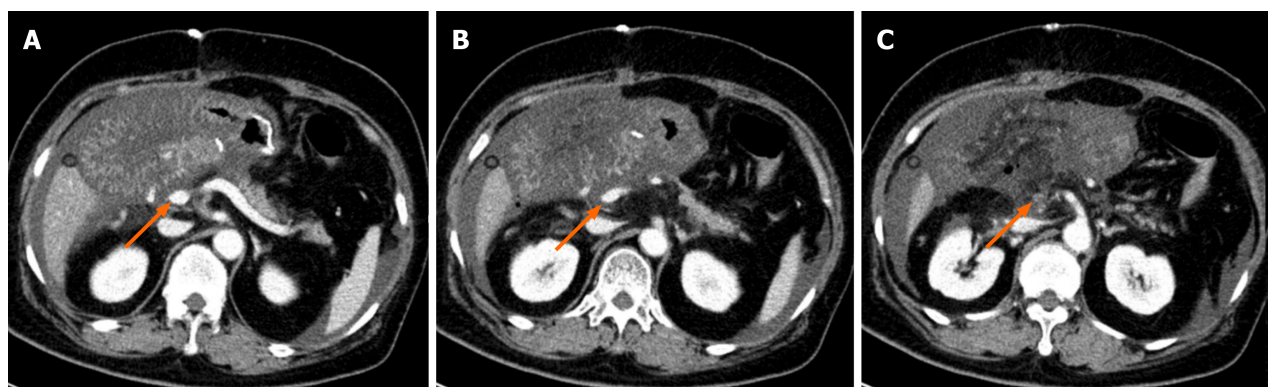


Figure 2 Computed tomography shows stenosis of the superior mesenteric vein in the region of the anastomosis (arrows). A: Above the stenosis site; B: Stenosis of the superior mesenteric vein; C: Occlusion of the superior mesenteric vein.

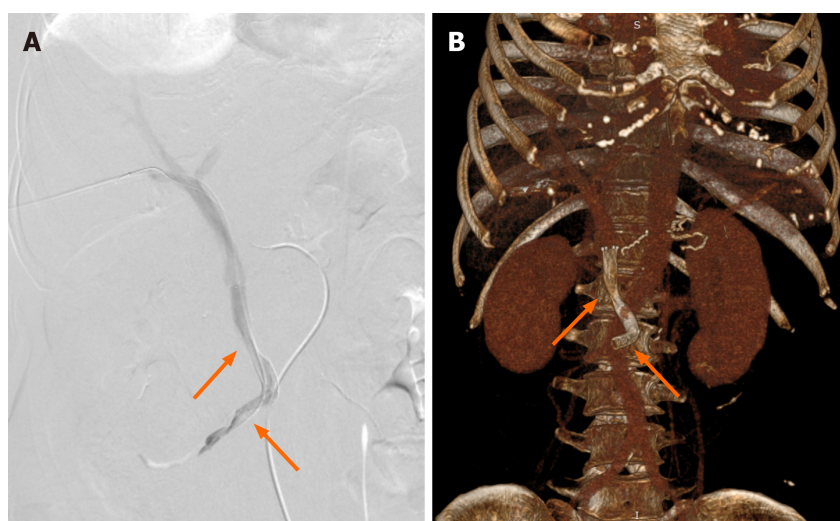


Figure 3 Percutaneous transhepatic direct portography showing improved stenosis after placement of two stents (arrows). A: Digital subtraction angiography of portal vein; B: Volume rendering images showing stents in superior mesenteric vein/portal vein. Stent parameters: Upper arrow: 8 mm × 50 mm, coated; lower arrow: 8 mm × 60 mm, uncoated.

translocation of gut bacteria. Retrograde infection from the drainage tubes also aggravated the infection. Intermittent fever was found in the whole POM 1, with peak temperature 37.8–38.5 °C. Blood and sputum cultures were negative and drainage cultures were positive for *Pseudomonas aeruginosa*, *Enterococcus faecium*, and *Acinetobacter baumannii*. Antibiotic use was adjusted several times according to drug susceptibility test results. The patient was finally discharged from the hospital 2 months after surgery. The patient did not present any abdominal symptoms related to PV/SMV stenosis after surgery for 8 months.

DISCUSSION

Pancreatectomy combined with PV resection and reconstruction was used to treat advanced pancreatic cancers that invaded the portal and SMVs[13,14]. However, there were no standardized guidelines on the choice of reconstruction mode, including primary repair, autologous grafting, or synthetic grafting[3,15]. Primary repair is technically easy but might result in high tension for long segmental resections. Autologous grafting requires a suitable length and caliber, and frequently used materials include the great saphenous vein, femoral vein, external iliac vein, umbilical vein patch, parietal peritoneum, and falciform ligament[16–19]. Synthetic grafting is convenient but more likely to result in thrombosis and has a lower patency[15]. Thus, we chose the great saphenous vein as the graft material.

Acute PV stenosis following PD was a rare but severe complication. There were few reports on its management, and the reported treatments included early systematic anticoagulation, surgical repair, and percutaneous transhepatic PV stent placement[20–23]. Early systematic anticoagulation was the first-line treatment for PV thrombosis; however, the failure rate could be as high as 62%[22,23], especially in patients with complications such as ascites. Surgery is typically not performed because severe adhesions at the surgical site would make surgical repair difficult[22,23]. Percutaneous transhepatic PV stent placement is preferred for PV stenosis after hepatic transplantation surgery[24,25]; however, its use

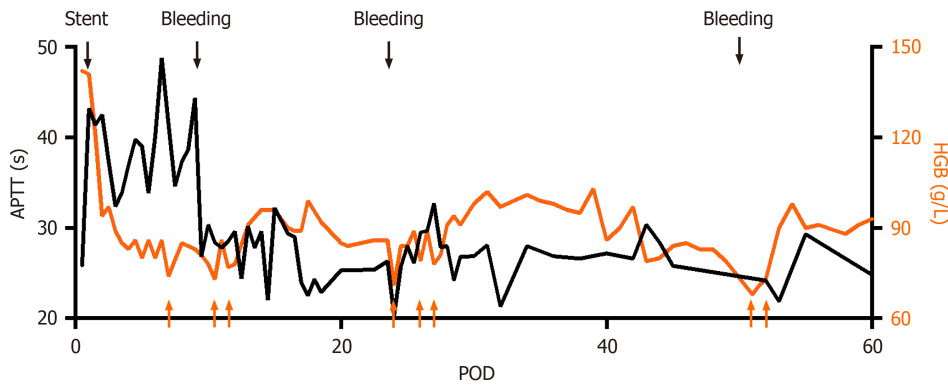


Figure 4 Activated partial thromboplastin time and hemoglobin profiles after surgery. Black arrows indicate stent placement or bleeding, and anticoagulation goal is therefore adjusted. Orange arrows indicated red blood cell transfusion due to anemia. APTT: Activated partial thromboplastin time; HGB: Hemoglobin; POD: Postoperative day.

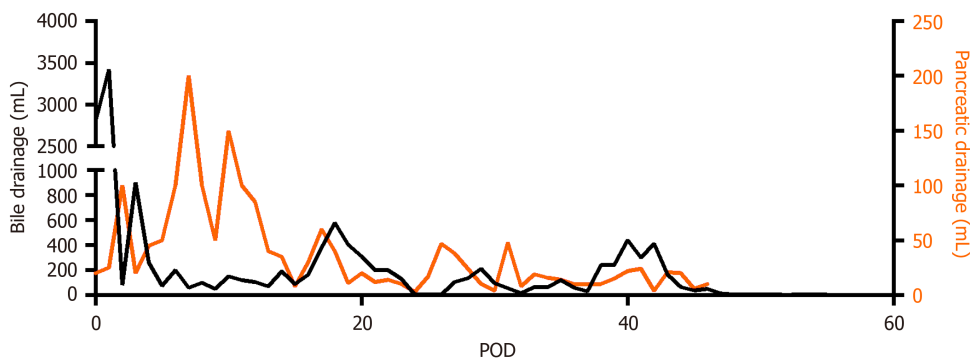


Figure 5 The postoperative drainage volume of two operative drains placed close to the bilioenteric anastomosis and the pancreaticojejunal anastomosis respectively. POD: Postoperative day.

after pancreatic surgery was rare, especially within 3 PODs. For this patient, we chose to place a stent to re-establish blood flow instead of performing anticoagulation because the occlusion blocked anticoagulation drugs. The reported patency rate was 66.7%-80% [7,8,11,14] for PV stenting after pancreatic surgery. However, these patency rates could not be directly adopted in our case, since the majority of reported cases concerned surgeries conducted > 30 d. Moreover, in those studies, only a small proportion of patients received PV reconstruction during surgery. Therefore, our case was more vulnerable to thrombosis formation. However, due to our successful management, the patient did not present any abdominal symptoms related to PV/SMV stenosis after surgery for 10 months, and CT scan revealed patent stents.

In this patient, two stents were placed, one coated and one uncoated. The uncoated stent was intended for the preservation of blood supply of SMV branches, protecting the blood supply for both key anastomoses. After the stent placement, four complications were observed: Pancreatic fistula, bile leakage, infection, and bleeding. The pancreatic fistula and bile leakage were caused by the resolution of intestinal edema, which caused abdominal infection. Damage to intestinal barrier function and the translocation of gut bacteria worsened the infection. Bleeding was caused by the pancreatic fistula, bile leakage, infection, and wound corrosion. Anticoagulation results in intractable bleeding; however, it was initiated with the aim of preventing stent thrombosis. These complications created a vicious cycle that complicated the whole treatment. We carefully evaluated the risks of bleeding and thrombosis and adjusted the anticoagulation protocol with an APTT goal initiated as 35-40 s and actively adjusted it based on drainage, bleeding, and hemoglobin values. It is important that patients exhibiting heparin dose-resistance should be identified and subjected to additional evaluations, including factor levels, antithrombin activity, platelet count, and fibrinogen levels. Proton pump inhibitor drugs were administered and non-steroidal anti-inflammatory drugs avoided. Infection treatment was adjusted according to the drug susceptibility test. Furthermore, enteral nutrition was continuously administered from POD 14 through the jejunal nutrition tube, which largely helped in the recovery of intestinal function and repair of the intestinal mucosa, and thereby may played an important role in breaking the cycle.

CONCLUSION

This case showed a successful example of using percutaneous transhepatic stent placement for treating acute SMV stenosis after Whipple surgery. The effectiveness of stenting has been validated by PV angiography. Although severe complications occurred after this procedure, such as bleeding, infection, pancreatic fistula and bile leakage, our treatment

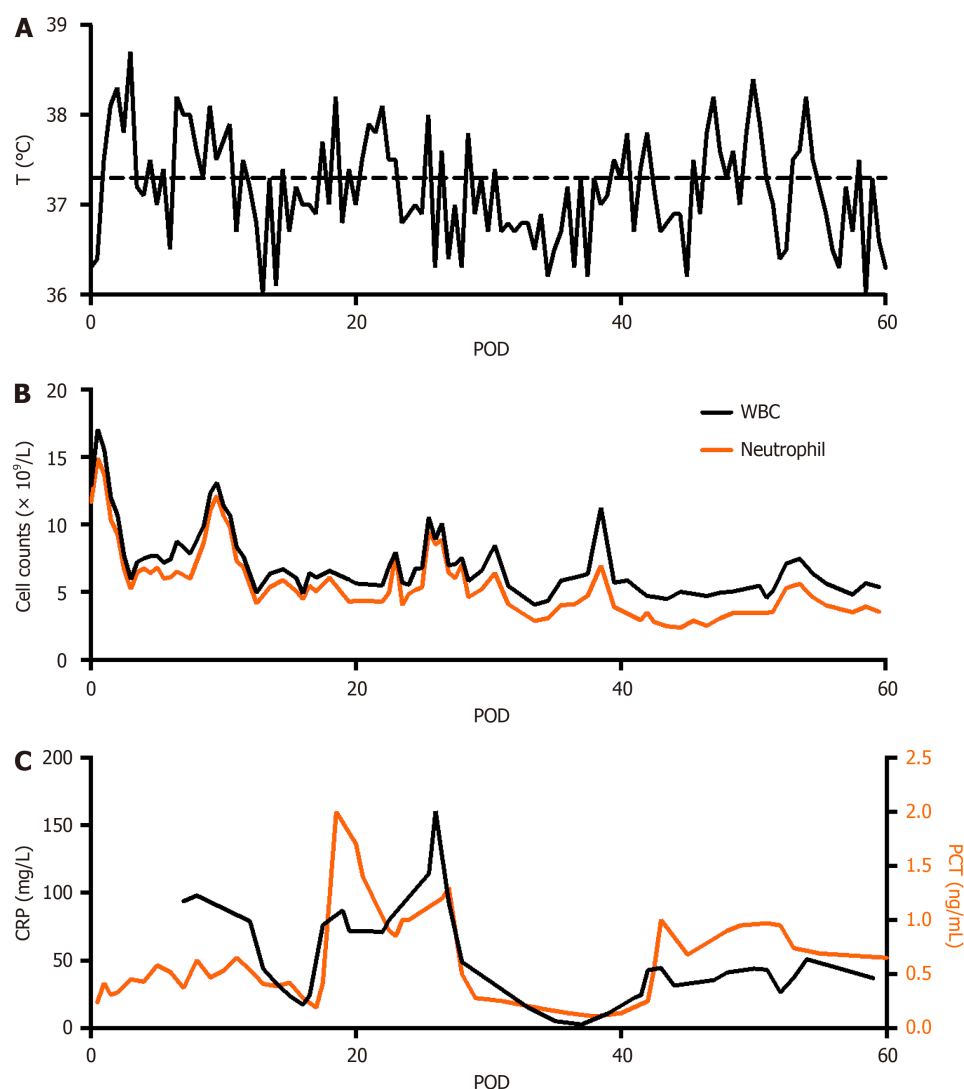


Figure 6 Temperature, white blood cell and neutrophil, and inflammatory markers profiles after surgery. A: Temperature; B: White blood cell and neutrophil; C: Inflammatory markers. WBC: White blood cell; PCT: Procalcitonin; POD: Postoperative day; CRP: C-reactive protein.

was successful in relieving the patient's symptoms. This is the first report on stent placement, management of anticoagulation usage, and complications after stenting for acute PV/SMV stenosis after pancreatic surgery with PV reconstruction within postoperative 3 d.

FOOTNOTES

Co-first authors: Chen Lin and Zi-Yan Wang.

Author contributions: Lin C and Wang WB designed the study; Lin C and Wang ZY collected the data and wrote the paper; Wang ZY performed the data analysis; Lin C, Dong LB, and Wang WB performed the surgery; Wang ZW performed the percutaneous transhepatic stent placement; Dong LB and Li ZH were the surgical residents of the patient.

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