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The primary aim of World Journal of Gastrointestinal Endoscopy (WJGE, World J Gastrointest Endosc) is to provide scholars and readers from various fields of gastrointestinal endoscopy with a platform to publish high-quality basic and clinical research articles and communicate their research findings online.

*WJGE* mainly publishes articles reporting research results and findings obtained in the field of gastrointestinal endoscopy and covering a wide range of topics including capsule endoscopy, colonoscopy, double-balloon enteroscopy, duodenoscopy, endoscopic retrograde cholangiopancreatography, endosonography, esophagoscopy, gastrointestinal endoscopy, gastroscopy, laparoscopy, natural orifice endoscopic surgery, proctoscopy, and sigmoidoscopy.

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CASE REPORT

# Recognition and management of stent malposition in the portal vein during endoscopic retrograde cholangiopancreatography: A case report

Rui Wu, Feng Zhang, Hao Zhu, Ming-Dong Liu, Yu-Zheng Zhuge, Lei Wang, Bin Zhang

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### Abstract

#### BACKGROUND

Portal vein injury is an uncommon complication of endoscopic retrograde cholangiopancreatography (ERCP), for which stent malpositioning in the portal vein is very rare and can lead to fatal events. We report a case of biliary stent migration to the portal vein and a novel method for its safe removal under the guidance of portal angiography. Moreover, we reviewed the literature and summarized reports on the identification and management of this condition.

#### CASE SUMMARY

A 59-year-old woman with pancreatic cancer presented with abdominal pain and a high fever 20 days after the placement of two plastic biliary stents under the guidance of ERCP. Blood cultures and laboratory tests revealed sepsis, which was treated with antibiotics. A contrast-enhanced computed tomography scan revealed that one of the biliary stents in the main portal vein was malpositioned. To safely remove the stent, portal angiography was performed to visualize the portal vein and to allow the management of any bleeding. The two stents were removed without obvious bleeding, and an uncovered self-expanding metal stent was placed in the common bile duct for drainage. The patient had an uneventful 6month follow-up period, except for self-resolving portal vein thrombosis.

#### **CONCLUSION**

The combination of endoscopic and angiographic techniques allowed uneventful management of stent malposition in the portal vein.

Key Words: Endoscopic retrograde cholangiopancreatography; Stent malposition; Portal vein; Portal angiography; Case report



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**Core Tip:** Stent malpositioning in the portal vein is a very rare complication of endoscopic retrograde cholangiopancreatography and can be fatal. We report a case of stent migration into the portal vein and a novel method for its safe removal under the surveillance of portal angiography. After reviewing the literature, we summarized the characteristics of reported cases, including predisposing factors and manifestations of stent malposition in the portal vein, and other treatments, such as immediate stent removal, metal stent placement in the bile duct, urgent surgery, and covered stent placement in the portal vein.

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#### INTRODUCTION

Endoscopic retrograde cholangiopancreatography (ERCP) is widely used in the diagnosis and management of pancreaticobiliary diseases. Portal vein injury is a rare complication of ERCP that can occur at any step during or after the procedure, including cannulation, sphincterotomy, stent placement, and nasobiliary drainage[1-5]. Stent malpositioning in the portal vein is extremely rare and may lead to fatal complications such as venous air embolism and fatal hemorrhage. This report describes a case of biliary stent migration into the portal vein and a novel method for its safe removal under the guidance of portal angiography. After searching PubMed for previously reported cases, we reviewed the literature on the identification and management of this complication[3,4,6-12].

#### CASE PRESENTATION

#### Chief complaints

A 59-year-old woman suffered from abdominal pain and a high fever for 10 days.

#### History of present illness

Ten days prior, the patient suffered a sudden onset of fever (41.0 °C) and abdominal pain. A 6-day course of antibiotics consisting of cefoperazone, sulbactam and metronidazole was undertaken at the local hospital, but the symptoms did not improve. Before admission, the patient presented with a fever fluctuating between 37.5 °C and 39.0 °C with chills. She had no history of hematemesis, melena, nausea, vomiting, diarrhea, or dark urine.

#### History of past illness

She was diagnosed with unresectable pancreatic cancer 6 months prior and had a history of duodenal ulceration. She underwent ERCP for biliary drainage at the time of cancer diagnosis 6 months prior and has since received 4 months of immunotherapy, 5 months of chemotherapy and 50 Gy/10 F local radiotherapy. One month prior, she underwent ERCP for replacement of plastic biliary stents (an 8.5 F, 7 cm single external flap stent and a 7 F, 7 cm single pigtail stent), as shown in Figure 1.

#### Personal and family history

The patient's personal and family history was not significant.

#### Physical examination

Body temperature, 37.5 °C; blood pressure, 108/69 mmHg; heart rate, 98 beats/min; respiratory rate, 20 breaths/min. Physical examination revealed moderate tenderness in the right upper quadrant without rebound tenderness and a negative Murphy's sign.

#### Laboratory examinations

The relevant laboratory findings were as follows: White blood cell count, 11800/mm<sup>3</sup>; hemoglobin level, 9.00 g/dL; alanine aminotransferase level, 54.00 IU/L; total bilirubin level, 0.35 mg/dL; alkaline phosphatase level, 286.80 U/L; lactate dehydrogenase level, 327.00 U/L; and albumin level, 2.86 g/dL. The serum amylase level was normal. Blood culture revealed Eshcerichia hermannii and Enterococcus faecalis. Her C-reactive protein level was 212.90 mg/L, and her procalcitonin level was 2.90 ng/mL.



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Figure 1 Two plastic biliary stents (an 8.5 F, 7 cm single external flap stent and a 7 F, 7 cm single pigtail stent) from previous endoscopic retrograde cholangiopancreatography. A: X-ray images; B: Endoscopic images.

#### Imaging examinations

A contrast-enhanced computed tomography (CT) scan revealed a biliary stent in the main portal vein (Figure 2A and B).

#### FINAL DIAGNOSIS

The diagnosis was portal vein injury caused by biliary stent malposition and consequent sepsis.

#### TREATMENT

The patient's temperature returned to normal after imipenem treatment, according to the drug susceptibility test. After discussion with a multidisciplinary team, we decided to remove the stent endoscopically under the guidance of portal angiography. During the procedure, portal angiography was first performed to visualize the portal vein and its relationship to the stents. As shown in Figure 2C, the single pigtail stent separated from the single flap stent and migrated straight up the spine into the portal vein. The two stents were then carefully removed, and there was no obvious bleeding from the papilla. An uncovered self-expanding metal stent was then placed in the common bile duct for drainage. Finally, repeated portal angiography revealed no active bleeding (Figure 2D), and endoscopic nasobiliary drainage was performed.

#### **OUTCOME AND FOLLOW-UP**

After the procedure, the patient had a transient fever that did not recur. The patient did not complain of abdominal pain, melena, nausea or vomiting, and her amylase level after ERCP was normal. Four days after ERCP, a repeat contrastenhanced CT scan revealed portal vein thrombosis (Figure 3A), and the nasobiliary drain was removed. The patient did not receive anticoagulant therapy due to duodenal ulcers and fecal occult blood. The thrombus was noticeably reduced in size at the first month follow-up (Figure 3B) and was no longer present at the third month follow-up (Figure 3C). The patient continued to receive chemotherapy and experienced an uneventful 6-month follow-up period.

#### DISCUSSION

Portal vein injury is a rare complication of ERCP and can result in bleeding, sepsis, portal vein thrombosis and air embolism[13-18]. Among all types of portal vein injury, stent malpositioning into the portal vein is very rare and comparatively severe, with only a few cases reported in the literature (Table 1). Stent malpositioning tended to occur in patients



#### Table 1 Published case reports of endoscopic retrograde cholangiopancreatography-related stent malpositioning in the portal vein

Ref.	Gender, age	Indication for ERCP	Procedure	Stent	Clinical manifestation	Treatment	Follow- up	Outcome
Stableforth <i>et al</i> [6], 2011	Male, 73	Pancreatic cancer	PBS replacement	7-Fr, 10-cm straight	Consistent jaundice; Brisk bleeding after removal of the stent; Filling of the portal vein and rapid washout of contrast material; confirmed by CT	PBS left <i>in situ;</i> metal stent placement <i>via</i> PTC	2 months	No complications
Miloudi <i>et al</i> [7], 2011	Female, 60	Benign narrowing of the CBD after transplantation	PBS replacement	10-Fr, 10- cm	Difficult insertion of the new PBS; Fever and abdominal pain shortly after ERCP; Confirmed by abdominal ultrasound and CT	Surgery to remove the prosthesis, close the fistula, repair the portal vein, and develop hepatico-jejunal anastomosis	Several days	Uneventful
Leung <i>et al</i> [ <mark>8</mark> ], 2012	Female, 10	Recurrent pancreatitis	Pancreatic sphincterotomy, pancreatic stent placement	3-Fr, 6 cm, pigtail	Fever, abdominal pain, and elevated amylase; Confirmed by ultrasound and CT	Remove the stent by ERCP on the 3 <sup>rd</sup> postoperative day	3 months	Portal vein thrombosis gradually resolved
Dawwas <i>et al</i> [9], 2013	Male, 69	CBD stones	Difficult cannulation, biliary sphincterotomy, PBS placement	7-Fr, 4-cm, double pigtail	Bleeding after removal of previous stent, and faint, rapidly dissipating, biliary-like opacification on contrast injections	Abandon the procedure immediately	2 months	Gas and thrombosis in the portal vein gradually resolved
So et al[10], 2015	Male, 55	Hilar invasion of hepatocellular carcinoma	PBS replacement	NA	Recurrent melena and bacteremia; Exacerbated bleeding after removing the stent; Cholan- giography revealed leakage of contrast dye into the portal vein	Placing fully covered self-expandable metal stent in the bile duct	Several days	Recovering from recurrent bacteremia and bleeding
Russo <i>et al</i> [11], 2017	Female, 39	Acute cholangitis	Biliary sphincterotomy, failed sweeping of stones by a ballon, and PBS placement	7-Fr, 7-cm	Resistance on stent placement, bleeding upon stent deployment	PBS left <i>in situ</i> , emergent laparotomy to repair the injury and T-tube placement	Several days	Resolve from the surgery
João <i>et al</i> [ <mark>12</mark> ], 2022	Female, 60	Biliary anastomotic stenosis after liver transplantation	Difficult cannulation, biliary sphincterotomy, balloon dilation, PBS placement	Two 8.5-Fr, 9.0-cm	Spurting hemorrhage when removing the stent	Endoscopic removal of stent, percutaneous transhepatic fully covered self-expanded metal stent in the portal vein	1 month	Clinically stable, no bleeding relapse
Lin <i>et al</i> [ <mark>3</mark> ], 2023	Male, 34	CBD stones, cholangitis	Difficult cannulation, sphinc- terotomy, balloon dilation, PBS placement	7-Fr	Hemobilia upon inserting the stent; Confirmed by CT scan	Surgery: Cholecystectomy and CBD stones removement, endoscopic removal of stent	9 months	Uneventful
Taşar et al <b>[4]</b> , 2023	Female, 54	CBD stones, cholangitis	Difficult cannulation, sphinc- terotomy, stone extraction, PBS placement	10-Fr, 7-cm	Hemorrhage, fever and persistent jaundice; Confirmed by CT scan	Laparoscopic exploration with ERCP	Several months	Chronic portal thrombus

ERCP: Endoscopic retrograde cholangiopancreatography; PBS: Plastic biliary stent; CT: Computed tomography; CBD: Common bile duct; PTC: Percutaneous transhepatic cholangiography.

with cholangitis or tumors, probably due to tissue fragility caused by inflammation or tumor invasion. In the case of malignancy, combining chemotherapy or adding radiotherapy may also increase the fragility of the tissue. In these cases, difficult cannulation and sphincterotomy often accompany the procedure and therefore increase the risk of stent malpositioning into the portal system. Stents may enter the portal vein during the procedure or migrate into the portal vein days or months after the procedure. During ERCP, there are several signs that a stent may have been placed in the portal vein. First, the endoscopist may feel resistance when placing the catheter or stent. Second, the injected contrast material may



Figure 2 Contrast-enhanced computed tomography. A: Contrast-enhanced computed tomography (CT) image showing that a biliary stent had entered the main portal vein; B: Contrast-enhanced CT images of the reconstructed portal vein; C: The single pigtail stent separated from the single flap stent and migrated straight up the spine into the portal vein; D: Repeated portal angiography showed no contrast leakage after placement of the fully covered metal stent in the common bile duct.

rapidly flow toward the liver and disappear within seconds. Third, the stent appears "straight up" along the portal vein and parallel to the spine on X-ray. Figure 2A clearly shows the position of the migrated stent in relation to the other wellpositioned stent in the CBD. Finally, the aspiration of blood helps to confirm whether the cannula entered the portal vein. After ERCP, if stent malpositioning is not immediately detected during the procedure, patients may present with abdominal pain, fever, melena and unimproved jaundice. Abdominal ultrasound and CT usually help clinicians confirm the diagnosis. In this particularly rare case, the stent was correctly placed during the procedure and functioned normally for one month until it migrated to the portal vein. The patient presented with fever and abdominal pain, and the CT scan clearly showed the migration of the stent. It was reasonable to assume that the stent migrated after penetrating the fragile bile duct wall because of tumor growth, chemotherapy and radiotherapy. In addition, tension from the pigtail can easily cause perforation and induce stent migration.

The table shows several treatment options, including immediate stent removal, metal stent placement in the bile duct, emergency laparotomy and surgical repair, and the placement of a fully covered metal stent in the portal vein *via* a percutaneous or transjugular approach. In this case, the stents were removed endoscopically under the guidance of portal angiography. In the event of portal bleeding, covered, self-expanding metal stents could be delivered into the portal vein and expanded to close the fistula and stop the bleeding. This method was safer than direct endoscopic removal of the stent for timely management of bleeding and less invasive than surgery.

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Figure 3 Repeat contrast-enhanced computed tomography scan showing portal vein thrombosis. A: Portal vein thrombosis occurred after endoscopic retrograde cholangiopancreatography; B: The portal vein thrombus appeared significantly smaller at the one-month follow-up exam; C: The portal vein thrombus was no longer present at the three-month follow-up exam.

Of the cases that have been reported, few rare cases of fatal bleeding after stent migration to the portal vein or stent removal from the portal vein have been reported, and in most cases, this can be managed uneventfully. There are several explanations. First, the pressure in the portal vein (5-10 mmHg) is lower than that in the bile duct (10-15 mmHg), so blood cannot flow strongly against the pressure gradient[16]. Second, the formation of portal vein thrombosis can occlude the vessel and control bleeding. Third, the portal vein and common bile duct pass together within the hepatoduodenal ligament, and after stent removal, these tissues may shrink to seal the site of injury. However, portal hypertension, large French stents and coagulation disorders can increase the risk of fatal bleeding.

To avoid stent migration to the portal vein, endoscopists must proceed with caution in patients with cancer or cholangitis, especially if cannulation and sphincterotomy are difficult. The sensation of resistance when passing the catheter or stent, the rapid washing out of contrast agent, and the aspiration of blood will reveal portal vein injury, thus stopping the procedure without force is critical. If stent migration to the portal vein occurs, portal vein angiography or surgery can be considered, and the stent can be removed endoscopically to manage potentially fatal bleeding.

#### CONCLUSION

In conclusion, we report a case of stent migration into the portal vein after ERCP in a patient who presented with fever and abdominal pain after pancreatic cancer diagnosis. The combination of endoscopic and angiographic techniques allowed uneventful management. Literature was reviewed for reported cases in which this rare complication was identified and managed.

#### FOOTNOTES

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