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## Interventional Radiology

# Biliary obstruction necessitating choledochojejunostomy as a complication of endovascular coil erosion

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## ABSTRACT

We report the case of a 55-year-old patient presenting with biliary obstruction caused by coil migration from a recently performed embolization of a post-traumatic gastroduodenal artery pseudoaneurysm. Based on imaging findings, biliary drain placement was initially performed and the subsequent endoscopy demonstrated coil erosion into the common bile duct and duodenum, resulting in choledochoduodenal fistula. Choledochojejunostomy was thereafter performed to bypass the area of injury.

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## Introduction

Endovascular coil embolization of visceral pseudoaneurysms is a well-established, minimally invasive option for treating acute intraperitoneal hemorrhage related to post-traumatic visceral pseudoaneurysms. Nontarget embolization resulting in end-organ ischemia or systemic migration into terminal vascular beds is a known potential risk of the procedure [1]. Other reported complications include intraprocedural dissection, pseudoaneurysm rupture, embolism, access artery pseudoaneurysm, and, although rare, coil migration [2]. We report a case of biliary obstruction secondary to coil erosion after gastroduodenal artery (GDA) embolization.

## Case report

A 55-year-old man presented to interventional radiology for acute intraperitoneal hemorrhage following a rollover motor vehicle accident as the unrestrained driver in October 2016. Blood pressure at the scene was 70/30 mm Hg, with good response after a 500 mL bolus of normal saline. Blood pressure upon arrival to the emergency department was 106/59 mm Hg, with a heart rate of 86 beats/min. Relevant initial labs included a hemoglobin level of 13.0 g/dL, an elevated blood alcohol level of 300 mg/dL, and an elevated lipase level of 286 units/L.

The patient then underwent cross-sectional imaging, which demonstrated right C6-7 facet fractures, pseudoaneurysm of

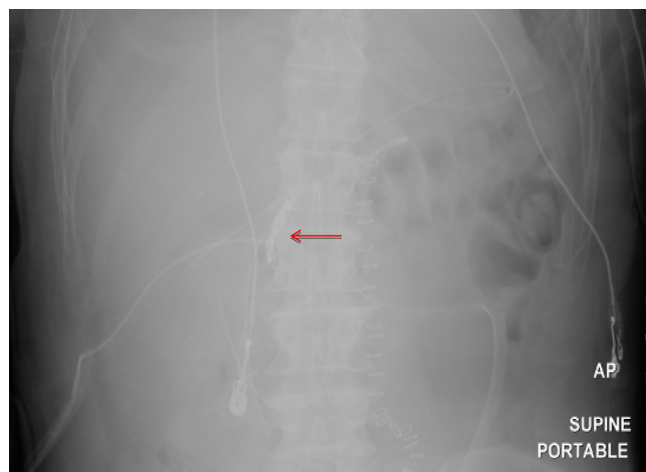
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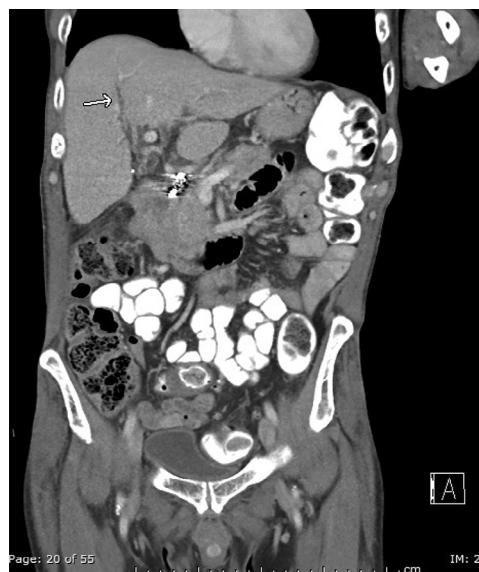
**Fig. 1 – AP supine radiograph of the abdomen demonstrates the coils (arrow) post embolization in an expected location. AP, anterior-posterior.**

the thoracic aorta at the isthmus with an associated mediastinal hematoma, bilateral pulmonary contusions, grade 3 liver laceration, and low-grade splenic laceration. A pseudoaneurysm arising from the GDA was seen with areas of active extravasation in the region of the pancreatic head, gallbladder, and multiple foci around the duodenal C-loop, suggesting pancreatic or mesenteric duodenal injury.

The patient was taken directly to the operating room for an exploratory laparotomy and endovascular aortic repair. Extensive electrocautery of the liver and cholecystectomy were performed. Mesenteric hematoma was seen with no signs of expansion. Extensive bleeding from a single vessel believed to be a branch of the portal vein near the junction of the head or body of the pancreas was seen, which was oversewn with 3-0 Prolene sutures (Ethicon) and hemoclips. No gross injury to the pancreas was noted. Endovascular thoracic aortic pseudoaneurysm repair utilizing a 26 mm × 10 cm GORE TAG stent (Gore) was performed. The patient was transfused with 6 units of packed red blood cells during the procedure and remained relatively hemodynamically stable with systolic pressures maintained in the low 100s mm Hg.

The immediate postoperative hemoglobin level was 9.7 g/dL, which downtrended to 5.8 g/dL the next morning. The patient remained hemodynamically stable; however, because of persistent hemoglobin drop, interventional radiology was consulted for suspicion of persistent extravasation from vascular injury to the GDA based on preoperative imaging.

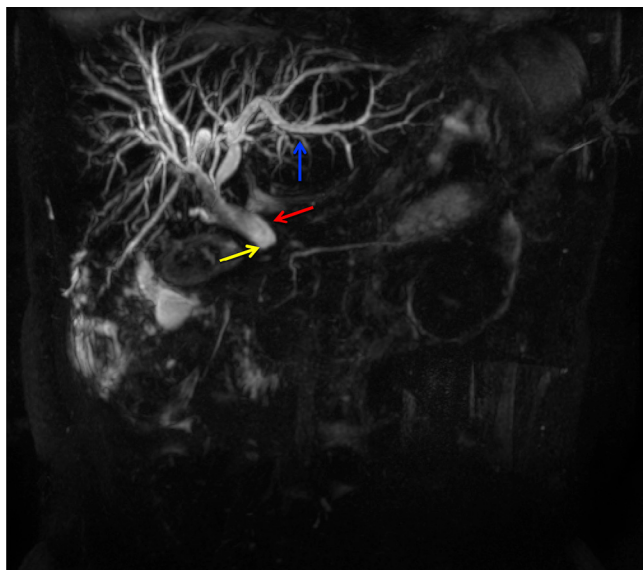
Utilizing standard technique to gain access, a 5-Fr SOS catheter was used to select the celiac artery. Selective angiography was performed, demonstrating a pseudoaneurysm off the proximal GDA adjacent to its origin at the common hepatic artery. A Renegade microcatheter (Boston Scientific) and a 0.016-inch Fathom microwire (Boston Scientific) were then used to select the GDA, where embolization was performed with 9 coils. No areas of active contrast extravasation were noted on postembolization angiography. Postembolization radiography demonstrated a tight coil pack in the GDA (Fig. 1). The patient remained hemodynamically stable post procedure with the hemoglobin appropriately responding to transfusion and rising



**Fig. 2 – Coronal computed tomography of the abdomen and pelvis with contrast from December 2016 demonstrates an artifact caused by the coils, which appear intact, with mild intrahepatic biliary duct dilatation (arrow).**

from 8.5 to 10.1 g/dL post procedure. The lipase level normalized to 34 units/L by day 3. Amylase levels 3 days after admission were elevated at 479 units/L but normalized to 79 units/L by day 6. By day 10, lipase and amylase levels had elevated again to 70 and 152 units/L, respectively, and then further increased to 100 and 207 units/L the next day. Subsequent lipase and amylase were not available for review. The patient's total bilirubin increased from 0.8 mg/dL on the day of admission to a peak of 7.3 mg/dL on day 9, but normalized by day 21. The patient was then discharged to an acute rehab facility 21 days after initial presentation.

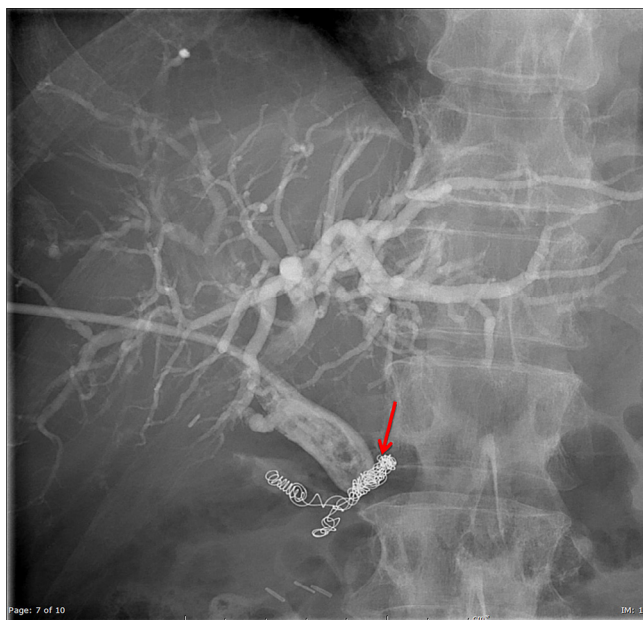
In December 2016, the patient returned for a computed tomography (CT) of the abdomen and pelvis (Fig. 2). This demonstrated embolization coils in an expected location of GDA and no vascular abnormalities. In April 2017, the patient presented to his primary care provider's office for a routine International Normalized Ratio check and was jaundiced. Labs noted the total bilirubin level to be 6.3 mg/dL, alkaline phosphatase of 993 units/L, alanine aminotransferase of 167 units/L, and aspartate aminotransferase of 209 units/L. International Normalized Ratio was also elevated to 10.0. The patient was admitted to an outside hospital for further workup. An ultrasound demonstrated a dilation of the common bile duct (CBD), with the soft tissue density concerning for debris versus mass. Magnetic resonance cholangiopancreatography reported moderate dilation of the intrahepatic bile ducts and the CBD, with truncation of the CBD just proximal to the pancreatic head concerning for cholangiocarcinoma (Fig. 3). CT of the abdomen and pelvis demonstrated a worsening of the intrahepatic biliary ductal dilatation. A percutaneous external biliary drain was placed, improving the patient's total bilirubin level to 3.1 units/L, which was then converted to an internal-external drain (Fig. 4). Endoscopic retrograde cholangiopancreatography (ERCP) was performed, which demonstrated no stones or mass;



**Fig. 3 – Coronal image from the magnetic resonance cholangiopancreatography performed in April 2017 demonstrates intrahepatic (red arrow) and extrahepatic (blue arrow) duct dilatations with abrupt truncation of the common bile duct (yellow arrow).**

however, the GDA coils had eroded into the CBD with the tip coiled in the duodenum, consistent with a choledochoduodenal fistula.

The patient was then transferred to our institution for further management. Hepatobiliary surgery was consulted, who recommended a Roux-en-Y choledochojejunostomy. An



**Fig. 4 – Percutaneous transhepatic cholangiography demonstrates splaying of the coils with an abrupt truncation (red arrow) of the common bile duct and no contrast identified within the small bowel.**

incision was made in the CBD and the prior biliary drain was clamped off. The remaining distal pigtail end was removed, and it was noted that the distal end had caught the embolization coil on the way out. This finding confirmed the clinical suspicion of a functional obstruction caused by a migrated coil. Because of the risk of bleeding, the distal aspect of the coil was transected at the distalmost aspect that could be visualized and sent to pathology as a gross specimen. The patient performed well after the procedure and was discharged home 5 days thereafter. Follow-up lab values performed 3 months after the surgery demonstrated a normalization of the total bilirubin level to 0.6 mg/dL, as well as previously elevated liver function tests.

## Discussion

Visceral artery aneurysms (VAAs), which include both true aneurysms and pseudoaneurysms, are rare, with a reported incidence of 0.01% to 0.2% on routine autopsy [3,4]. Causes of visceral artery pseudoaneurysms include inflammatory changes, infection, vasculitis, or procedurally related iatrogenic trauma, with the most common cause attributed to blunt or penetrating trauma [2,3]. Splenic and hepatic artery aneurysms are reported as the most common VAAs, with pseudoaneurysms involving the GDA relatively rarer, with a reported incidence of approximately 1.5% mostly attributable to pancreatitis [2,3].

Both surgical and endovascular approaches may be used to treat VAAs; however, endovascular coil embolization of VAAs involving hepatic, splenic, renal, or pancreaticoduodenal arteries is preferred [3]. Although the technical success of percutaneous transcatheter coil embolization is reported at rates of up to 92%, serious complications such as arterial emboli or thrombosis leading to organ infarction, infection, intraprocedural dissection, pseudoaneurysm rupture, access site pseudoaneurysm, and coil migration have been reported [2,3,5].

For example, several authors have described cases of coil migration from the GDA to the duodenum after arterial embolization for bleeding ulcers or iatrogenic trauma to the GDA after a surgical resection of bile duct carcinoma [6-9]. In the former case, the patient presented with recurrent gastrointestinal bleeding related to coil migration to the base of the ulcer [7], whereas the patient in the latter case remained asymptomatic [8]. GDA coil migration into the stomach has also been reported, including migration into the gastric antrum following a prophylactic embolization of the GDA before transarterial chemoembolization [10], as well as into the gastric pylorus in a patient with a history of chronic pancreatitis [5]. Both patients presented with abdominal pain 10-12 months after embolization [5,10].

Although coil migration resulting in biliary obstruction has been previously reported, most of these cases involved coils placed in the right hepatic artery in the setting of pseudoaneurysm formation related to complications from cholecystectomy, liver transplantation [11-13], or percutaneous placement of an internal or external biliary drain [14]. In these cases, the migrated coils causing biliary obstruction were removed percutaneously from the CBD [14], surgically with a

biliary-enteric revision [12], and endoscopically with a papillary balloon dilation and extraction of coils [13].

In our case, biliary obstruction was secondary to coil erosion from the GDA into the duodenum and migration into the CBD, resulting in a choledochoduodenal fistula. As the patient presented with painless jaundice 6 months after his trauma, the initial leading diagnosis was thought to be malignancy, with ultrasound and MRI findings most suggestive of cholangiocarcinoma. In retrospect, however, CT performed 2 months after his trauma demonstrated mild intrahepatic biliary duct dilation and dilation of the CBD to 1.2 cm. The mechanism we suspect for this complication could be related to persistent frank leakage of pancreatic enzymes from pancreatic trauma, subclinical alcoholic pancreatitis, given the patient's history, or a combination of both, which would have further diminished the integrity of the vascular wall even after embolization. This hypothesis is supported by the waxing and waning amylase and lipase throughout the patient's post-op course, and would not be unexpected, given the previously reported coil migration in the setting of chronic pancreatitis [5].

Had coil erosion into the CBD rather than malignancy been suspected, it is possible that decompression would have been limited to external biliary drainage; as the converted internal drain was later noted to have caught a coil at the distal tip of the pigtail, it is possible that the abrupt manipulation of the tube during internal conversion could have further dislodged the remaining coil pack in the GDA and resulted in a catastrophic bleed. Indeed, massive hemobilia was reported as the presenting symptom in a patient with prior biliary surgery who developed a GDA pseudoaneurysm that had eroded into the CBD [15]. In this case, a direct connection between the GDA pseudoaneurysm and CBD predisposed the coils to migrate through the previously eroded CBD but was successfully treated with endoscopic coil extraction during ERCP [15]. In our patient, despite a choledochoduodenal fistula, ERCP failed, precluding the possibility of endoscopic removal and necessitating an open choledochojejunostomy for coil retrieval and repair.

Although our case highlights the potential for a significant additional intervention after coil embolization, minimally invasive endovascular treatment is often still the preferred method for managing VAAs [3]. Although complications from embolization can typically occur in the short term, such as intraprocedurally with vessel dissection or nontarget embolization resulting in ischemia [2,5], our case highlights the idea that coil migration and erosion should at least be considered in patients with a history of visceral artery coil embolization presenting with jaundice, recurrent hemorrhage, or nonspecific abdominal pain, nausea or vomiting months or even years after their endovascular treatment [7,13,14].

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