

Available online at [www.sciencedirect.com](http://www.sciencedirect.com)

ScienceDirect

journal homepage: <http://Elsevier.com/locate/radcr>

## Interventional Radiology

# Percutaneous embolization of cystic duct stump leak following failed endoscopic management

Ahmed K. Abdel Aal MD, PhD, FSIR\*, David P. Jones MD, Jessica Caraway MD, Amr S. Moustafa MD, MSc, Sherif M. Moawad MD, MSc, Edgar S. Underwood MD

Department of Radiology, University of Alabama at Birmingham, 619 19th Street South, Birmingham, AL 35249, USA

### ARTICLE INFO

#### Article history:

Received 15 May 2017

Accepted 26 June 2017

Available online

#### Keywords:

Cholecystectomy

Cystic duct

Bile leak

Coils

### ABSTRACT

A case of a 79-year-old man, status post laparoscopic cholecystectomy with a drainage catheter placed at the gallbladder fossa is presented. The case was complicated postoperatively by abdominal pain and bilious discharge from the drainage catheter. Endoscopic retrograde cholangio-pancreatography demonstrated leakage through the cystic duct stump into the gallbladder fossa. Placement of a covered metal stent endoscopically failed to seal the leak. We performed percutaneous embolization of the cystic duct stump using a combination of coils and gelatin sponge through the drainage catheter in the gallbladder fossa. To our knowledge, this technique has not been previously described in the literature.

© 2017 the Authors. Published by Elsevier Inc. under copyright license from the University of Washington. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

## Introduction

Cystic duct leak is an uncommon but potentially serious complication following cholecystectomy [1]. Endoscopic treatment methods such as sphincterotomy, nasobiliary drain placement, and bile duct stenting are considered safe and effective first-line therapies [1]. Percutaneous interventions including cystic duct embolization have been performed with success with multiple embolic materials [2]. We present a case of successful percutaneous coil and particle embolization of cystic duct stump leak following complicated cholecystectomy and failed endoscopic management. To our knowledge, this technique has not been previously described in the literature.

## Case report

Brief reports are exempt from institution review board approval in our institution.

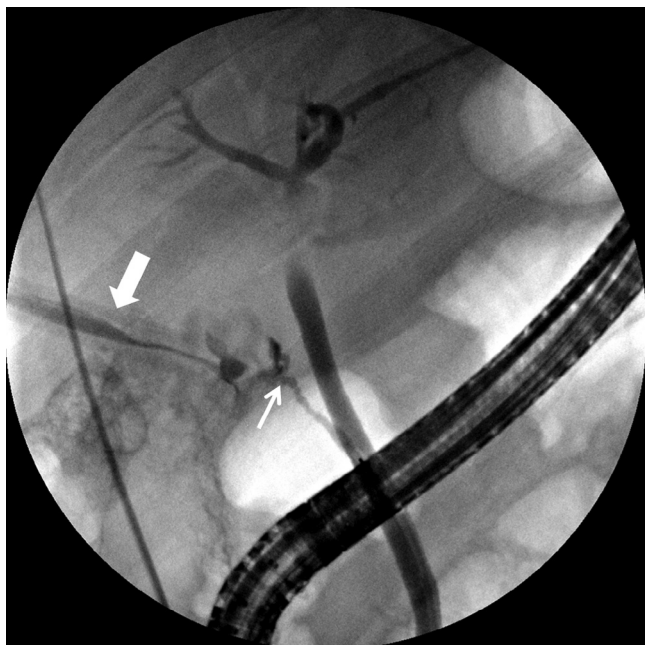
A 79-year-old man with history of complete heart block and multiple comorbidities presented to our institution with nausea, vomiting, diarrhea, and abdominal pain. On examination, the patient was found to have soft but distended abdomen with minimal tenderness to palpation at the right upper quadrant. Laboratory examinations were within normal range. Ultrasound and contrast enhanced computed tomography of the abdomen were performed and revealed a distended gallbladder and gallbladder wall thickening which was consistent with acute cholecystitis. A subphrenic and pericholecystic fluid

\* Corresponding author.

E-mail address: [akamel@uabmc.edu](mailto:akamel@uabmc.edu) (A.K. Abdel Aal).

<https://doi.org/10.1016/j.radcr.2017.06.013>

1930-0433/© 2017 the Authors. Published by Elsevier Inc. under copyright license from the University of Washington. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).



**Fig. 1 – Cholangiogram performed during ERCP demonstrates cystic duct stump leak (small arrow) with free flow of contrast into previously placed surgical drain (large arrow).**

collection and fluid tracking in between bowel loops raised the concern for acute gangrenous cholecystitis with perforation. The patient then underwent laparoscopic abdominal exploration and complicated cholecystectomy during which the necrotic portion of his gallbladder (dome and body of the gallbladder) was removed. Because complete removal of his gallbladder was felt to be unsafe at the time of surgery due to the severity of the inflammation, the viable gallbladder infundibulum was not surgically removed. A 24 French drainage catheter was left in the gallbladder fossa. His postoperative course was complicated by acholic stools, abdominal pain, tenderness, and persistent postoperative high bilious output of approximately 500–600 mL per day through the surgical drain, all consistent with cystic duct stump leak.

Endoscopic retrograde cholangio-pancreatography (ERCP) was performed 4 days following his surgery and demonstrated leak at the cystic duct stump (Fig. 1). A 10 French, 9-cm plastic stent was placed in the common bile duct. Throughout the following 2 weeks, the patient's clinical status remained the same, with persistence of his signs and symptoms. Therefore, a repeat ERCP was performed which again showed bile leak at the cystic duct stump. Sphincterotomy was successfully attempted, and the previously placed plastic stent was removed and replaced by an 8-mm × 80-mm covered self-expanding stent graft which was placed in his common bile duct (Fig. 2). His 24 French gallbladder fossa surgical drain was downsized at 5 weeks postoperatively to 18 French as the drained fluid went down from 600 mL/day to 150 mL/day. The patient's bilious output from the surgical drain and the acholic stools persisted thereafter.

Because of failed endoscopic management for 2 months following his complicated cholecystectomy, Interventional Radiology was consulted for potential treatment. After reviewing the



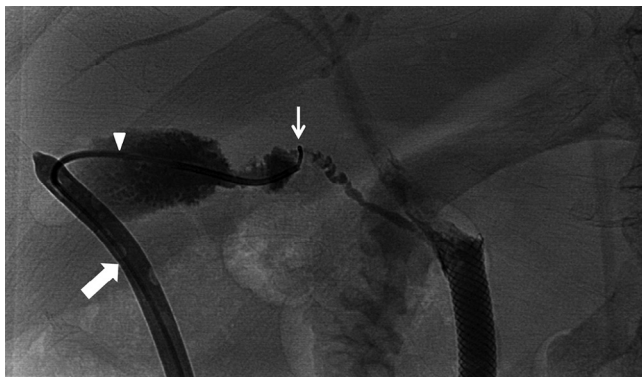
**Fig. 2 – Cholangiogram performed during ERCP demonstrating placement of 8 mm × 80 mm self-expanding stent graft (small arrow) within the common bile duct to exclude the cystic duct origin.**

patient's clinical presentation and imaging, we decided to offer the patient a nonstandard minimally invasive treatment for his cystic duct stump leak, and the patient consented to the procedure.

The patient was then taken to the angiography suite and contrast was injected through the preexisting 18 French drainage catheter in the gallbladder fossa, demonstrating communication with a gallbladder remnant and the cystic duct (Fig. 3). A hydrophilic guidewire and 4 French angled catheter (Berenstein, Cook, Bloomington, IN) were advanced through the drain and gallbladder remnant and negotiated into the cystic duct stump. A 2.4 French microcatheter (Progreat, Terumo, Tokyo, Japan) was advanced through the 4 French catheter into the cystic duct stump (Fig. 4). Several detachable microcoils



**Fig. 3 – Nonsubtracted image following injection of contrast through preexisting gallbladder fossa drainage catheter demonstrating the pseudo-gallbladder (large arrow) communicating with a patent cystic duct (small arrow).**

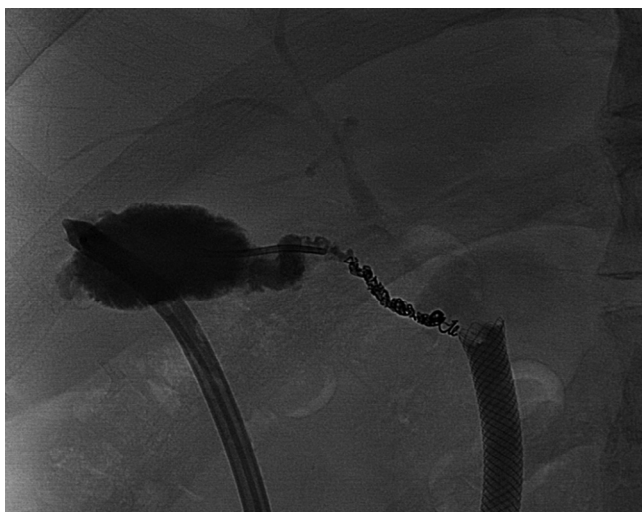


**Fig. 4 – Nonsubtracted image demonstrating a coaxial system consisting of a 2.4 French microcatheter (small arrow) inserted through a 4 French diagnostic catheter (arrowhead) which was introduced through the 18 French drainage catheter in the gallbladder fossa (large arrow). The tip of the microcatheter is in the proximal cystic duct.**

(Concerto, Medtronic, Sunnyvale, CA) were then deployed and tightly packed within the cystic duct. Multiple absorbable gelatin sponge particles (Surgifoam, Ethicon, Somerville, NJ) were also administered into the cystic duct through the microcatheter.

The microcatheter was then removed and injection of contrast through the 4 French catheter revealed occlusion of the cystic duct stump with no evidence of contrast passage to the common bile duct (Fig. 5). A 10 French drainage catheter (Skater, Argon, Athens, TX) was then advanced through the preexisting 18 French catheter into the gallbladder fossa for continued drainage.

The patient returned for follow-up in the surgery clinic 2 weeks following embolization of his cystic duct stump. He reported mild right upper quadrant discomfort but no bilious output from the drain following embolization. A nonenhanced computed tomography of the abdomen was performed, which demonstrated resolution of the prior collection in the gallbladder fossa. His drain was removed at that time. Patient was evaluated again in the



**Fig. 5 – Nonsubtracted image demonstrating occlusion of the cystic duct following embolization using several coils and particle.**

surgery clinic 6 weeks later at which time he reported no abdominal pain and his abdomen was soft, nontender, and nondistended on examination with normal bowel sounds.

## Discussion

Postoperative bile leak has been reported to occur in 0.3%-2.7% of patients following laparoscopic cholecystectomy [3]. The cystic duct stump has been shown to be the most common site of post-cholecystectomy bile leakage [1,4]. Common manifestations of leakage are persistent bilious output through a surgical drain and abdominal pain.

ERCP is typically performed for the diagnosis and treatment of patients with suspected bile leak. Cholangiogram can classify the leaks into low-grade and high-grade according to the timing of visualization of the leak during fluoroscopy [5]. Leaks are classified as low-grade if the leak is identified only after complete intrahepatic biliary system opacification. Leaks observed before intrahepatic opacification are classified as high-grade. Endoscopic management is considered first-line therapy for both low-grade and high-grade leaks [6].

Endoscopic sphincterotomy and transpapillary stent placement aim to lower the transpapillary pressure gradient. The gradient reduction facilitates bile flow through the papilla, promoting passive leak healing. Nasobiliary drain placement also facilitates healing by bile diversion. Fully covered self-expanding metal stents have been used successfully for high-grade leaks and coverage of the cystic duct origin [6].

When endoscopic management is ineffective or technically not feasible, percutaneous interventions can be performed. Biliary drain placement via a percutaneous transhepatic route can divert bile and promote passive healing similar to nasobiliary drain placement. Percutaneous cystic duct embolization has been performed with success and has been proposed as an alternative management strategy to endoscopy when direct access to the focus of leak is available [2,7,8].

Vascular coils, *n*-butyl cyanoacrylate, and micropledgets have all been utilized as embolic agents [2,8]. When metallic coils are used, they must be tightly placed together, given the extravascular placement and lack of thrombus formation [7].

## Conclusion

We report a case of successful percutaneous coil and particle embolization of a cystic duct stump leak following cholecystectomy and failed endoscopic management. In patients with an established access to the bile leak such as a biloma drain, this approach may represent an effective alternative treatment option.

## REFERENCES

- [1] Singh V, Singh G, Verma G, Gupta R. Endoscopic management of postcholecystectomy biliary leakage. *Hepatobiliary Pancreat Dis Int* 2010;9:409–13.
- [2] Doshi T, Mojtahedi A, Goswami G, Andrews RT, Godke B, Valji K. Persistent cystic duct stump leak managed with

- hydrocoil embolization. *Cardiovasc Intervent Radiol* 2009;32:394–6.
- [3] Ahmad F, Saunders RN, Lloyd GM, Lloyd DM, Robertson GS. An algorithm for the management of bile leak following laparoscopic cholecystectomy. *Ann R Coll Surg Engl* 2007;89:51–6.
- [4] Thomas H, Joga K, Amin AL, Daniel T. Post-cholecystectomy cystic duct stump leak: a preventable morbidity. *J Dig Dis* 2009;10:207–12.
- [5] Sandha GS, Bourke MJ, Haber GD, Kortan PP. Endoscopic therapy for bile leak based on a new classification: results in 206 patients. *Gastrointest Endosc* 2004;60:567–74.
- [6] Nawaz H, Papachristou GI. Endoscopic treatment for post-cholecystectomy bile leaks: update and recent advances. *Ann Gastroenterol* 2011;24(3):161–3.
- [7] Oliva VL, Nicolet V, Soulez G, Falardeau M, Daloze P, Abou Jaoude M, et al. Biloma developing after laparoscopic biliary surgery: percutaneous management with embolization of biliary leaks. *J Vasc Interv Radiol* 1997; 8:469–73.
- [8] Wahaibi AA, AlNaamani K, Alkindi A, Qarshoubi IA. A novel endoscopic treatment of major bile duct leak. *Int J Surg Case Rep* 2014;5(4):189–92.