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## Case Report

# Embolization of an incomplete isolated right segmental hepatic duct injury (incomplete IRSHDI)-A case report ☆☆☆

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## ABSTRACT

Iatrogenic bile duct injuries remain a substantial problem in gastrointestinal surgery, especially if discovered later in the postoperative period. Herein, we report a case of an unusual bile leak following laparoscopic cholecystectomy consisting of an isolated right segmental hepatic duct injury of segment 5 together with an additional bile leak of a small duct connecting the gallbladder fossa with the common bile duct. We call this situation an incomplete isolated right segmental hepatic duct injury. Patient presented with infected biloma 2 weeks after laparoscopic cholecystectomy. After percutaneous drainage of the biloma and antibiotic therapy the complex biliary fistula was closed first with coil embolization of the small connection to the common bile duct and then with both antegrade and retrograde histoacryl embolization of the hereby created complete isolated right segmental hepatic duct injury in a single session. Patient was discharged the same day and recovered without complication or recurrence.

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## Introduction

Bile duct injuries during cholecystectomy are serious complications with potentially serious postoperative consequences for the patient in terms of morbidity, mortality and long-term quality of life, especially if not recognized intraoperatively [1].

In cases of simple and early detected bile leaks endoscopy with sphincterotomy and stent placement and/or percutaneous decompression is the treatment of choice. Isolated right segmental or sectoral hepatic duct injury (IRSHDI) with bile leak, also referred to as type C in the Strasberg classification of biliary injuries [2,3], is a rare but more serious complication compared to simple bile leaks and even compared to common

Abbreviations: CT, computed tomography; IRSHDI, isolated right segmental or sectoral hepatic duct injury; NBCA, n-butyl-2-cyanoacrylate; SVBD, subvesical (or supravvesical) bile duct.

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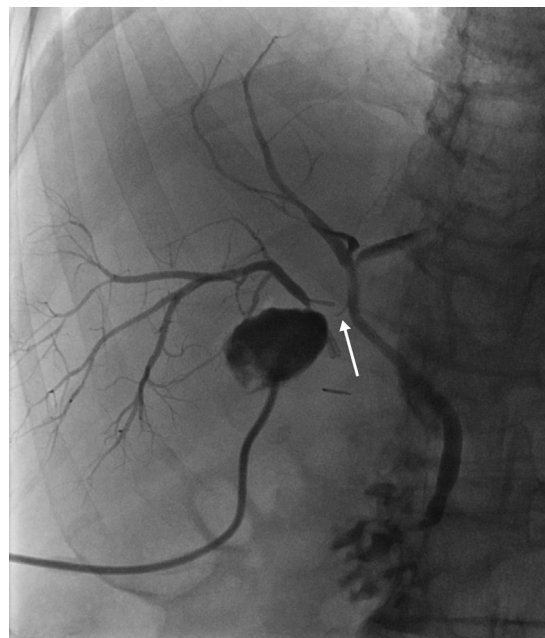


**Fig. 1 – CT: Axial contrast-enhanced image demonstrates fluid collection in the gallbladder fossa with thick enhancing wall suggestive of infected biloma.**

bile duct injury or transection [4–6]. IRSHDI occurs in case of different anatomic variations of large bile ducts in close proximity to the gallbladder fossa. Treatment opportunities of IRSHDI consist of surgical and non-operative procedures. However, simple non-operative treatments like endoscopic retrograde or percutaneous antegrade decompression often are not possible or do not work in IRSHDI [1,5]. There are only very few case reports describing effective treatment of IRSHDI by embolization [7].

## Case presentation

A 69-year-old man presented with mild abdominal and general symptoms as well as elevated inflammatory parameters in our hospital 16 days following laparoscopic cholecystectomy in an external clinic. Abdominal contrast-enhanced computed tomography (CT) showed a large subhepatic fluid collection in the gallbladder fossa with typical features of an infected biloma (Fig. 1). CT-guided percutaneous drainage was performed promptly, bacteriological diagnostic of specimen revealed *Escherichia coli* infection and antibiotic treatment was begun. Though inflammatory parameters returned to normal within a few days, drainage output persisted with up to 300 mL of bile fluid per day. On the 12th day of hospital stay, a fistulogram/sinogram demonstrated a biloma in the gallbladder fossa and the expected biliary fistula with filling of bile ducts of the whole segment 5, representing an IRSHDI, however together with a very small short-segmental communicating duct from the gallbladder fossa to the common bile duct and then with free flow of contrast medium into the duodenum (Fig. 2). After interdisciplinary discussion with surgeons and gastroenterologists, it was decided to try to embolize the complex biliary fistula. Two days later the 8.3-Fr drain was exchanged for a 6-Fr vascular sheath (Radifocus, Terumo) and the fistulogram was repeated. The 0.038 inch wire of the sheath was directed over the residual biloma into a lateral subsegmental bile duct of segment 5, which then was



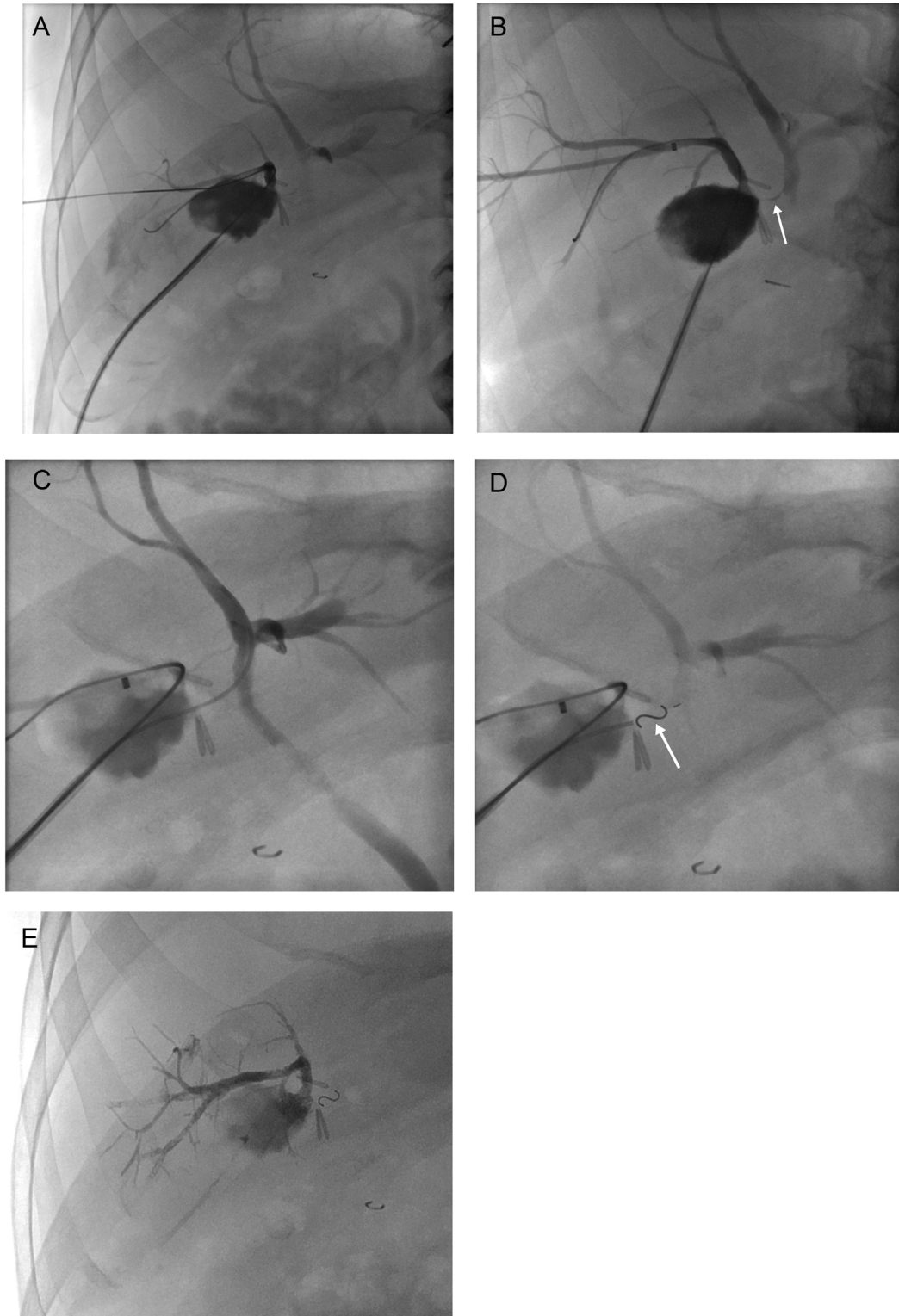
**Fig. 2 – Fistulogram: Injection of contrast medium via drain in gallbladder fossa demonstrates residual biloma with bile leak of segment 5 ducts together with another tiny bile duct connecting the gallbladder fossa with the common bile duct (arrow).**

punctured with the 21G needle of an Accustick-Set (Boston Scientific), the 6-Fr Accustick-sheath was placed (Figs. 3A and B). From the 6-Fr vascular sheath a 2.7-Fr microcatheter (Progreat, Terumo) was navigated through the small communicating bile duct into the central bile system (Fig. 3C). The communicating duct was embolized by deploying a single 2 mm 0.018 inch fibered coil (Figure 8-18 coil, Boston Scientific) with a coil pusher (Fig. 3D). A control-injection of contrast agent over the vascular sheath showed no more opacification of the central bile ducts. Having thus isolated the former incomplete isolated bile duct injury, the now prepared “classic” IRSHDI was embolized with n-butyl-2-cyanoacrylate (NBCA). In each case about 1 mL of a 1:3 mixture of NBCA (Histoacryl, Braun) and ethiodized oil (Lipiodol, Guerbet) was injected first over the vascular sheath and then over the Accustick-sheath while slowly withdrawing and then removing the sheath (Fig. 3E).

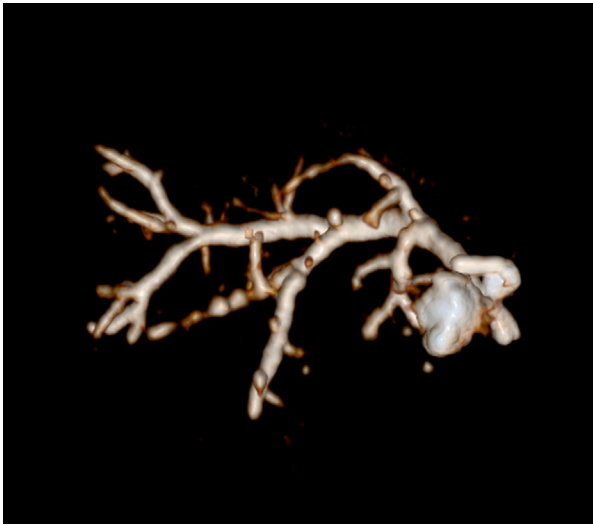
Patient was discharged the same day. A planned control-CT 6 days later on an outpatient basis showed the NBCA-cast completely filling segment 5 bile ducts with parts of the gallbladder fossa (Fig. 4) and no complication. At 3-month follow-up, patient is doing well with no indication of recurrence.

## Discussion

In the last few years, the view has increasingly gained ground that the historical and ill-defined term “ducts of Luschka” should be abandoned and replaced by the term “subvesical bile ducts” (SVBD) or supravvesical bile ducts [8,9]. SVBD are found in more than 20 percent of human fetuses [10]. Schnell-



**Fig. 3 – Fluoroscopic images of embolization: (A)** A 0.038-inch wire inserted over 6-Fr sheath in gallbladder fossa into peripheral segment 5 duct and percutaneous transhepatic access to the duct with 21G needle and 0.018-inch wire. **(B)** Result with both retrograde and antegrade access with 6-Fr sheaths and again visualization of the small connecting bile duct to the common bile duct (arrow). **(C)** A 2.7-Fr microcatheter advanced through the 6-Fr sheath in the gallbladder fossa via the tiny connecting bile duct into common bile and segment 8 bile duct. **(D)** Deployed 0.018-inch figure-8 coil in the connecting bile duct (arrow). **(E)** Final result after coil embolization of the connecting bile duct and gluing of segment 5 ducts and parts of gallbladder fossa from both antegrade and retrograde access with histoacryl-lipiodol emulsion.



**Fig. 4 – Follow-up CT: Image in volume rendering technique. Biliary-tree cast with sufficient filling of segment 5 bile ducts and parts of gallbladder fossa after embolization with histoacryl-lipiodol (projection comparable to Fig. 2).**

dorfer et al. have attempted to categorize SVBD through a comprehensive literature review [8]. They divided SVBD into 4 types:

Aberrant right segmental or sectorial bile ducts near the gallbladder with a superficial course along the gallbladder fossa (type 1); accessory bile ducts, usually arising from segment 5 or 8, rather small, coursing superficially along the gallbladder fossa and draining into the common bile duct or rarely into the cystic duct (type 2); the cholecystohepatic or hepatocholecystic duct that connects the segment 5 or a right sectorial duct directly with the gallbladder or the cystic duct (type 3); and small or network-like aberrant bile ducts in the peri-hepatic connective tissue of the gallbladder fossa draining into intra- or extrahepatic bile ducts (type 4).

Our patient presented with a complex bile leak. The main bile leak to the gallbladder fossa measuring about 2.5 mm in diameter had the appearance of a “classic” IRSHDI of segment 5 (type C in the Strasberg classification), the additional small communicating duct with an unusual course to the central bile system measuring about 0.5 mm in diameter had its origin in the gallbladder fossa as well and could be classified as Strasberg type A injury. This postoperative situation leaves room for 2 interpretations: It may be presumed that our patient originally had an anatomical variant with 2 types of SVBD, namely one type 1 or type 3 and one type 2 SVBD in the Schnelldorfer categorization with both of them having been injured. Alternatively, the 2 bile ducts mentioned initially were parts of a single bile duct which was injured with both subtotal transection and partial occlusion. Whatever the case may be, we call the resulting combined bile leak an “incomplete IRSHDI.”

Treatment of IRSHDI is controversial. Most authors argue that IRSHDI with biliary leakage will ultimately never close spontaneously as it is a relative high-output fistula and cannot drain anywhere else [1,11], whereas Colovic stated that bile leaks from IRSHDI should be followed for several weeks

as there is a 50% chance of spontaneous closure, depending on the size of the fistula [12]. Established surgical treatment options of IRSHDI are bilioenteric anastomosis, namely Roux-en-Y biliary-enteric anastomosis to the segmental or sectorial duct [4,5] or even resection of the affected liver segments. Non-operative reconstructive options are percutaneous or endoscopic or in this way combined procedures to reconnect the isolated duct with the common bile duct. These non-operative procedures, if at all possible, usually are complex and technically demanding. They also require a subsequent long-term drainage to enable potential healing of the injured duct and involve a high degree of risk of strictures or obstruction of the thus treated bile segment [4,5]. Treatment in the latter way was not considered reasonable in our patient due to unfavorable anatomical conditions.

Percutaneous embolization or sclerotherapy of bile leaks from IRSHDI are viable options, especially in cases where only one liver segment is involved, as postinterventional atrophy of the treated segment is the only imminent negative effect, not accompanied by relevant impairment of liver function and in any case adequate to restore normal liver function [12,13]. However, sclerotherapy is rather time-consuming as it usually requires repeated treatment sessions [14–16].

The complex bile leak of our patient, as a whole not to be categorized in the Strasberg or Schnelldorfer classification, made embolization a bit tricky. First of all coil-embolization of the small connecting bile duct was done to prevent subsequent spillage of NBCA glue into the common bile duct and thus transformed the situation from an “incomplete” into a “classic” IRSHDI. The classic IRSHDI itself was initially closed central nearby the gallbladder fossa by embolization with NBCA via retrograde approach. Then the peripheral bile ducts of segment 5 were embolized via single antegrade approach with some kind of pressure-injection of NBCA to create, as far as possible, a complete biliary-tree cast. Particularly important in the latter context was emptying of the bile ducts of segment 5 as much as possible and flushing of the Accustick-sheath with 5%-glucose solution as little as possible before pressure-injection of NBCA.

## Conclusion

We present an unusual postcholecystectomy bile leak, not to be classified in the conventional schemes. The complex biliary injury of what we call an incomplete IRSHDI could be managed with percutaneous embolization effectively, hardly time-consuming, relative simply and with the use of everyday material. Thus, reoperation or other lengthy or repetitive procedures could be avoided.

## Author contributions

All authors attest that they meet the current International Committee of Medical Journal Editors (ICMJE) criteria for authorship.



## Ethics human rights

The authors declare that the work described has been carried out following the Declaration of Helsinki of the World Medical Association revised in 2013 for experiments involving humans.

## Patient consent

The patient provided informed consent to participate in the case report titled, “Embolization of an incomplete isolated right segmental hepatic duct injury (incomplete IRSHDI)—a case report” and have their data published. Only non-identifiable images were used in this submission.

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