

Right Posterior Sectoral Bile Duct Iatrogenic Injury: Report Of Four Cases

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1. Abstract

1.1. Background: An aberrant right posterior sectoral duct (RPSD) draining segments 6 and 7 of the liver in an atypical way occurs in around 4-8% of patients. Iatrogenic RPSD injuries are reported in 6 up to 9% of all iatrogenic bile duct injuries (BDI) related to cholecystectomy (CHL).

1.2. Methods: Of the total of 46 patients with iatrogenic BDIs treated by our surgical team between 2002 and 2021, we identified four cases (8.7%) of isolated or combined RPSD injury (Strasberg type C – n=2 and type E5 – n=2) sustained during laparoscopic CHL (n=3) or liver resection (n=1).

1.3. Results: None of the presented injuries of the aberrant RPSD were recognized during the primary procedure, resulting in subsequent multistage and very difficult endoscopic and/or surgical treatment.

1.4. Conclusion: Early identification of an iatrogenic aberrant RPSD injury allows for effective planning of all steps of the subsequent treatment

that should be performed expeditiously in experienced hepatobiliary (HPB) centers.

2. Keywords:

Aberrant bile ducts, Iatrogenic bile duct injury, Bile duct reconstruction, Hepaticojejunostomy, Hepatopancreaticobiliary surgery

3. Introduction

Right posterior segmental duct draining segments 6 and 7 of the liver in an atypical way occurs in around 4-8% of patients [1,2]. Its possible iatrogenic injuries were classified according to the Strasberg classification as type B, C or E5 (combined). RPSD injuries are reported to occur in <1 per one thousand CHL. Given their rare incidence combined with a variety of available treatment options, the most effective therapy for this type of BDI remains unclear [1,3]. However, regardless of the type of iatrogenic BDI, the best treatment outcomes have been reported from tertiary hepatobiliary centers, where patients are still transferred at a late stage following unsuccessful management attempts undertaken at primary institutions [4,5]. Frequently, misdiagnosis and/or improper initial treatment of this potentially “minor” type of BDI may trigger a cascade of serious, including life-threatening, complications [6].

4. Case Series

Between the years 2002 and 2021, we performed bile duct reconstructions in 46 patients who suffered from different iatrogenic BDIs. Herein we describe four selected cases (8.7%) of isolated and/or combined RPSD injury sustained during laparoscopic CHL (n=3) or liver resection (n=1). None of the patients with iatrogenic injury of RPSD had any coexisting lesions of hepatic arteries or the portal vein.

5. Results

5.1. Case 1: An anomalous RPSD entering the common hepatic duct just above the stump of the cystic duct and a short stricture (location of laparoscopic clip) including both the hepatic duct and the RPSD at the level of their junction was detected (variant of Strasberg type E5) in a 58-year-old female who underwent laparoscopic CHL (2004) (Figure 1). The long-standing ineffective treatment performed in a primary center consisted of multiple endoscopic stenting of the stricture. Eight years after CHL (2012), due to persistent recurrent cholangitis, a double-barrel hepaticojejunostomy (HJ) connecting separately aberrant RPSD and common hepatic duct (CHD) with Roux-Y limb of jejunum (Figure 2) was done in a HPB center. However, due to proceeding of liver fibrosis

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induced by multiannual recurrent cholangitis occurring regardless of the patent blio-enteric anastomosis, the patient underwent cadaveric Piggy-Back liver transplantation a year later (2013).

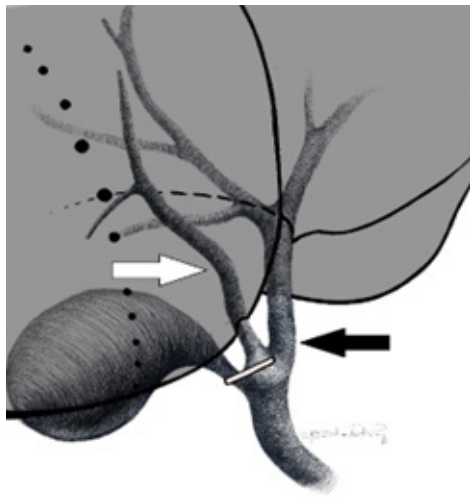


Figure 1: Laparoscopic clip closing partially the common hepatic duct (black arrow) and the right posterior segmental duct (white arrow). Variant of Strasberg type E5.

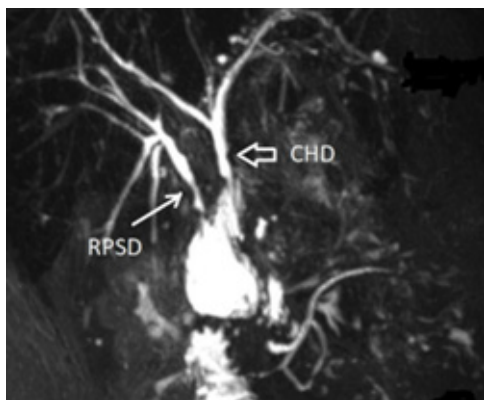


Figure 2: MRCP image of double barrel hepaticojejunostomy. RPSD – right posterior segmental duct, CHD – common hepatic duct.

5.2. Case 2: An iatrogenic RPSD injury (Strasberg type C) was recognized in a 15-year-old female patient (Figure 3) who underwent laparoscopic CHL converted to open procedure (2010). Bile drainage was continued for a period of several weeks giving time for the expiration of local inflammation and a possible spontaneous closure of the leak. Due to the bile leak duration of >12 weeks, a Roux-Y HJ to the damaged posterior sectoral duct was initially planned. However, due to contraction of the damaged bile duct toward the liver parenchyma, an attempt of its identification during the surgery was unsuccessful. Therefore, resection of the hepatic segments 6 and 7 was performed in order to remove the affected section of the liver.

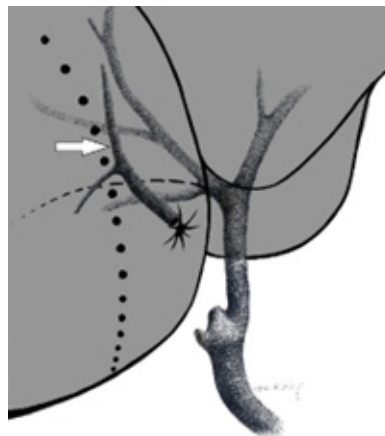
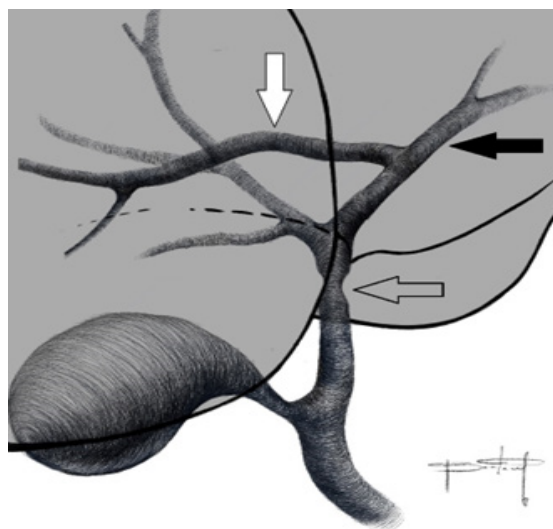


Figure 3: An iatrogenic right posterior segmental duct (white arrow) injury with contraction of the damaged bile duct toward the liver parenchyma. Variant of Strasberg type C.

5.3. Case 3: An increasing jaundice and a bile leak via an abdominal drain was detected in a 31-year-old female who underwent left hepatectomy (2015) for an enlarging focal nodular hyperplasia (FNH) a few days earlier. Postoperative ERCP revealed a short stenosis of CHD with a slight leak high up at the liver hilum that was continuing despite the effective dilatation and stenting of the bile duct stricture. MRCP showed a leak from the RPSD that had no communication with the remaining biliary tree (Strasberg type E5). During re-laparotomy, an open stump of the RPSD measuring around 3 mm in diameter was identified at the transection plane close to the liver hilum (variant of RPSD entering left hepatic duct) (Figure 4). A Roux -Y HJ over a transanastomotic external biliary drain was performed.



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Figure 4: The right posterior segmental duct (white arrow) entering left hepatic duct (black arrow) and stenosis of common hepatic duct (empty arrow). Version of Strasberg type E5

5.4. Case 4: Transected RPSD (Strasberg type C) was only revealed during the second re-laparotomy carried out by a HPB surgeon because of a persistent bile leak in a 53-year-old female who underwent laparoscopic CHL at a university hospital a few days earlier (2017). The re-laparotomy also showed an extensive necrosis within the anterior wall of the common hepatic duct and the hepatic duct confluence (Strasberg type E3) caused by the T-tube placed there for unknown reasons during the first re-laparotomy (Figure 5). Both hepatic ducts as well as the proximal part of the anomalous RPSD were drained using three separate extra-corporal silicon drains. The needle catheter jejunostomy was used to return the bile to the alimentary tract. The bilio-enteric anastomosis of all three hepatic ducts (right anterior, right posterior and the left hepatic duct) was done on Roux-Y limb of the jejunum (portoenterostomy) four months after CHL.

The three patients described in cases 1 - 3 remain in good health condition 8 to 10 years since the final surgery. The fourth patient moved abroad a few months post bilio-enteric reconstruction and was lost for further follow-up.

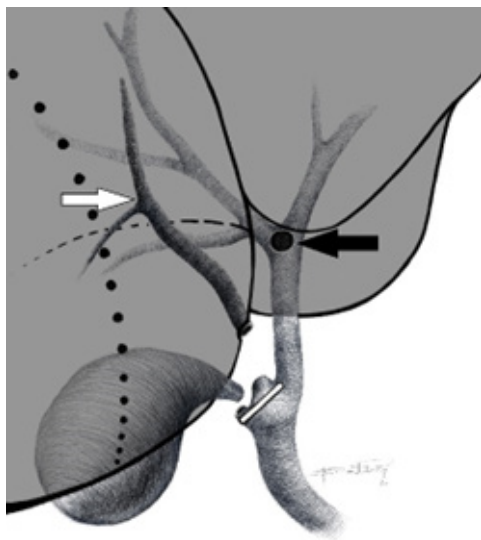


Figure 5: Lesion of anterior wall of the hepatic duct confluence (version of Strasberg type E3 – black arrow) and the proximal part of right posterior segmental duct (version of Strasberg type C – white arrow).

6. Discussion

In most cases of aberrant hepatic bile ducts, accidental injuries during surgical procedures are particularly likely to occur to the RPSD. Such injuries are reported in 6 up to 9% of all laparoscopic BDIs [1, 6]. The incidence of BDIs in patients with anatomical anomalies within the biliary

tree is around 3 to 8 times higher relatively to those with typical anatomy. However, there is still a limited number of cases of Strasberg B, C or E5 BDI described in the literature [1, 5, 7, 8]. Consequently, no clear-cut guidelines regarding the diagnostics and treatment of this type of BDIs are available.

Strasberg BDI type E5 still tends to be treated by frequent replacement of one or two plastic stents to dilate biliary strictures (the Amsterdam approach). However, according to current recommendations, a sequential placement of multiple plastic biliary stents (the Rome approach) represents the preferred option offering a ~90% success rate, with patients free of symptoms and dilatation of the stricture to >75% of the bile duct diameter at the end of therapy [7, 9]. Unfortunately, the bile duct stenosis in patients with Strasberg type E5 BDI sustained during CHL often occurs due to a laparoscopic clip partially closing the external bile ducts, which can cause their devascularization. This type of blunt BDI usually precludes healing without leaving a rigid scar [7]. Therefore, HJ should be considered the first-choice therapy in such patients following 12 up to 18 months of unsuccessful endoscopic stenting [7, 9]. Otherwise, a long-standing bile duct stenosis resulting in recurrent cholangitis may lead to irreversible intrahepatic biliary tree stenosis, liver fibrosis and finally secondary liver cirrhosis. Then, liver transplantation may be the only effective ultimate treatment in such cases of BDI [10, 11].

The diagnosis of Strasberg type C BDI tends to be quite challenging. Intraoperative cholangiogram done via the cystic duct as well as ERCP can be interpreted as normal despite the presence of a persistent bile leak and/or abdominal bile collection and sepsis [1, 12, 13]. However, bile leak in the presence of an intact common or hepatic bile duct shown on cholangiogram or MRCP should raise the suspicion of a Luschka or sectoral (type C) BDI [2, 3, 12].

Perera et al. proposed the drain tube cholangiogram (“tubogram”) as another method of help to diagnose Strasberg type C BDI [1]. Contrast pressure injection into the subhepatically placed surgical drain with the patient positioned under X-ray imaging may allow contrast material to enter the cut end of the RPSD. The majority of tubograms are usually performed 7–14 days after the index CHL.

A minimally invasive approach to BDI Strasberg type B and C should be carefully considered in every case, as the risk of late stricture at the bilio-enteric anastomosis is as high as 33% [1, 3, 12]. A “wait and see” policy has been proposed in patients with Strasberg type C injury to avoid extended surgery. This may lead to a spontaneous closure of the biliary leak in up to 50% of patients [1, 5]. Such a “conservative” treatment may be supported by a prolonged percutaneous transhepatic biliary drainage (PTBD) combined with effective abdominal drainage [3]. Nevertheless, if the bile leak persists beyond more than 8 weeks, a more invasive treatment approach is usually indicated [1, 3]. With a BDI Strasberg type C of a small bile duct caliber, surgical ligation or radiological closure of the injured bile duct may be justified (conversion to Strasberg type B).

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This should serve to induce affected liver segment atrophy [1, 3]. Gradual atrophy of hepatic sectors should not have serious clinical implications in most cases, as the remaining liver undergoes compensatory hypertrophy. It may only occasionally cause temporary cholangitis or very rarely be responsible for development of liver abscess.

Liver resection can be an alternative when the detection of an anomalous duct is impossible or its diameter is too small to perform a patent anastomosis. It may also be indicated in a case of biliary abscess or recurrent cholangitis in isolated liver segments [5, 13].

In conclusion, early identification of the type and extent of BDI prior to a first attempt of bile duct reconstruction as well as an effective planning of all steps of the subsequent treatment should be performed expeditiously in experienced HPB centers. The management of RPSD injuries in HPB centers allows to minimize the risk of serious complications as well as increase the likelihood of a good long – term outcome.

References

1. Perera M, Monaco A, Silva M, Bramhall S, Mayer A, Buckels J, et al. Laparoscopic posterior sectoral bile duct injury: the emerging role of nonoperative management with improved long-term results after delayed diagnosis. *Surg Endosc.* 2011; 25: 2684-2691.
2. Donnellan E, Coulter J, Mathew C, Choynowski M, Flagalan L, Bucholtz M, et al. A meta – analysis of the use of intraoperative cholangiography; time to revisit our approach to cholecystectomy. *Surg Open Sci.* 2021; 3:8-15.
3. Mazer L, Tapper E, Sarmiento J. Non-operative management of right posterior sectoral duct injury following laparoscopic cholecystectomy. *J Gastrointest Surg.* 2011; 15:1237-1242.
4. Cavusoglu S, Doganay M, Birben B, Akkurt G, Keskek M. Management of bile duct injuries: a 6-year experience in high volume referral center. *Euroasian J Hepatogastroenterol.* 2020; 10:22-26.
5. Wojcicki M, Patkowski W, Chmurowicz T, Bialek A, Wiechowska-Kozłowska A, Stankiewicz R, et al. Isolated right posterior bile duct injury following cholecystectomy: Report of two cases. *World J Gastroenterol.* 2013; 19: 6118-6121.
6. Babel N, Sakpal S, Paragi P, Wellen J, Feldman S, Chamberlain R. Iatrogenic bile duct injury associated with anomalies of the right hepatic sectoral ducts: a misunderstood and underappreciated problem. *HPB Surg.* 2009; 2009: 153269.
7. Parlak E, Disibeyaz S, Odemis B, Koksak A, Kucukay F, Sosmaz N, et al. Endoscopic treatment of patients with bile duct stricture after cholecystectomy: factors predicting recurrence in the long term. *Dig Dis Sci.* 2015; 60: 1778-86.
8. Colovic R. Isolated segmental, sectoral, and right hepatic bile duct injuries. *World J Gastroenterol.* 2009; 15: 1415-9.
9. Rustagi T, Jamidar P. Endoscopic management of benign biliary strictures. *Curr Gastroenterol Rep.* 2015; 17: 422.
10. Thomson B, Parks R, Madhavan K, Garden O. Liver resection and transplantation in the management of iatrogenic biliary injury. *World J Surg.* 2007; 31: 2363-2369.
11. Lubikowski J, Chmurowicz T, Post M, Jarosz K, Bialek A, Milkiewicz P, et al. Liver transplantation as an ultimate step in the management of iatrogenic bile duct injury complicated by secondary biliary cirrhosis. *Ann Transplant.* 2012; 17: 38-44.
12. Lillemo K, Petrofski J, Choti M, Venbrux A, Cameron J. Isolated right segmental hepatic duct injury: a diagnostic and therapeutic challenge. *J Gastrointest Surg.* 2000; 4:168-177.
13. Li J, Frilling A, Nadalin S, Broelsch CE, Malago M. Timing and risk factors of hepatectomy in the management of complications following laparoscopic cholecystectomy. *J Gastrointest Surg.* 2012; 16: 815-820.