



POST-CHOLECYSTECTOMY RIGHT POSTERIOR SECTORAL BILE DUCT INJURY -- A SINGLE INSTITUTION SERIES.

Hepatobiliary Surgery

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ABSTRACT

Injuries to sectoral bile ducts are less common than their major bile duct counterparts and present diagnostic and therapeutic challenges because of their rarity. Records of 17 patients (5 men and 12 women) with right posterior sectoral bile duct injuries managed in a single institution from year 2000 to 2020 were analysed. Seven patients were managed non-operatively, and 9 patients underwent definitive surgery with a sectoral bile duct Roux – en – Y hepaticojejunostomy. Follow up ranged between 1 to 11 years. One patient had minor post-operative leak; 2 patients had anastomotic narrowing managed by percutaneous balloon dilatation. Persistence of bile leak despite a “normal” biliary anatomy on Endoscopic Retrograde Cholangiography ± Magnetic Resonance Cholangio Pancreatography should lead to a suspicion of a right sectoral bile duct injury. Awareness of the condition, Magnetic Resonance Cholangio Pancreatography ± Percutaneous Transhepatic Cholangiography, and expert interpretation of the findings of imaging, are the keys to diagnosis of a Right Posterior Sectoral Bile Duct Injury.

KEYWORDS

Right sectoral biliary injury, posterior sectoral bile duct injury, sectoral duct injuries, biliary leak.

INTRODUCTION:

Cholecystectomy, especially laparoscopic cholecystectomy (LC), is one of the most commonly performed abdominal operation worldwide [1]. The incidence of bile duct injury following open and laparoscopic cholecystectomy varies from 0.2% to 0.3% [1 - 3] and 0.4% to 1.5% [4 - 5], respectively.

Bile duct injuries associated with the anatomic variations of right segmental hepatic duct are less common than their major bile duct counterparts. They present unique diagnostic and therapeutic challenges. Being rare, their management protocol is not well defined in the available literature. Results of Endoscopic Retrograde Cholangiography (ERC) are often interpreted as “normal” with no leaks demonstrated [6].

PATIENTS AND METHODS:

A case series of 17 patients of post-cholecystectomy right posterior sectoral bile duct injuries managed in the Department of Gastrointestinal & Hepato Pancreato Biliary (HPB) Surgery of Jagjivanram Hospital, from year 2000 to 2020 (inclusive) is presented. Thirteen of these patients (76.5%) were referred from other hospitals. Patient's consent and Ethical Committee approval were obtained. Anonymity of patient's identity has been maintained in the manuscript.

RESULTS:

The study group included 12 women (70.6%), and 5 men (29.4%) with ages ranging between 17 to 56 years, (average 38.5 years). LC was performed in 9 patients (52.9%), upfront open cholecystectomy (OC) in 4 patients (23.5%) and LC converted to open cholecystectomy (LCOC) in 4 cases (23.5%).

Most common clinical presentations were abdominal pain and persistent bilious drainage. Jaundice was present in 6 patients, cholangitis in 4 patients and biliary peritonitis in 3 patients. Biloma was seen on ultrasonography (USG) in 3 patients,

All the 13 referred cases presented to our unit more than a week after the initial cholecystectomy (range 8 days to 64 days) with bilious drainage. Six patients had LC, 3 patients had OC, and 4 patients had LCOC.

Among the 13 referred cases, 5 patients with persistent bile leak had already undergone exploratory laparotomy with peritoneal lavage and abdominal drain placement outside – 4 cases of LC, and 1 case of LCOC, before referral to our unit. The LCOC case underwent an exploratory laparotomy outside with drain placement, then drain removal on 21st POD and finally drain reinsertion for persistent bile leak from drain site wound. He presented to us with biliary peritonitis and sepsis 6 weeks after the initial LCOC (subtotal cholecystectomy).

An emergency exploratory laparotomy with peritoneal lavage and multiple drains insertion was performed and patient improved without any further intervention.

Among the 4 patients operated at our centre, bile leak was detected intra operatively (LC) in 2 patients. In both these patients USG guided percutaneous drainage of the collection in GB fossa was performed post operatively. Bile leak was seen in the drain starting on POD 4 -- 1 patient of LCOC, and in 1 patient who underwent an open extended cholecystectomy for incidental cancer of gall bladder (detected following LC outside).

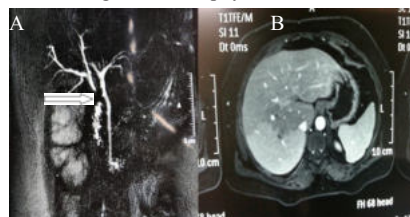
Diagnostic investigations in this series:

Abdominal USG, the first investigation performed, could not detect bile duct injury in any of the 17 patients. Small biliary collections were present in 11 patients (64.7%). USG guided percutaneous catheter drain (PCD) was performed to drain large collections in 2 patients (11.76%) and the drainage stopped subsequently. In 1 patient a CT guided drain insertion was performed 1 month after cholecystectomy, for recurrent collections in GB fossa, despite an initial USG guided aspiration. But patient had recurrent collection and improved only after definitive surgery.

Magnetic Resonance Cholangio Pancreatography (MRCP) was the main investigation in all the 17 patients for identifying the site of the bile duct injury. It was diagnostic in 8 patients (47.06%), showing Right Posterior Sectoral Bile Duct cut off. (Fig 1A).

Endoscopic Retrograde Cholangiopancreatography (ERCP) was performed selectively in 09 patients (52.94%) with persistent biliary drainage but non-diagnostic MRCP. In 7 patients ERCP showed normal Right & Left Hepatic ducts, with no contrast leak. In 1 patient, biliary stenting done as suspected cystic duct stump leak, but it did not decrease the bile leak. In 1 patient after endoscopic biliary stenting drainage stopped 2 weeks later, but subsequent MRCP revealed atrophy of posterior liver segments confirming Right Posterior Sectoral Duct (RPSD) injury (Fig 1B).

Fig 1a. Pre Operative MRCP (block Arrow At Site Of RPSD Cut Off)
Fig 1b. Posterior Segmental Atrophy On MRI Post RPSD Injury



Percutaneous transhepatic external biliary drainage (PTBD) was performed in 11 patients (64.70%) with persistent high biliary drainage for >3 weeks even in MRCP confirmed cases of RPSD injury. Drainage stopped with only external catheter insertion in 3 patients, internalization of catheter was required in 1 case. (Fig 3)

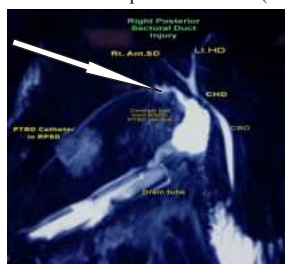


Fig 2. PTBD gram through RPSD -- showing RPSD injury site with leaked contrast coming into the drainage tube.

Management of Posterior Sectoral Bile Duct Injury in this series:

a) Definitive Surgery:

Nine out of the 17 patients (52.9%) in this series underwent surgery for either persistent biliary drainage for more than 6 weeks despite PTBD or recurrent cholangitis &/or recurrent sub hepatic collection (in various combinations). Definitive surgery was performed electively at least 6 – 8 weeks after the last operative procedure (i.e., the index cholecystectomy or subsequent surgery to deal with the complications of the biliary leak). The PTBD catheter was useful for localization of the site of the RPSD injury and also as a trans- anastomotic stent (Fig 3A). The definitive surgical procedure performed in all patients was Roux-en-Y-Sectoral Bile duct- Jejunal Anastomosis. Fig 3B shows the RPSD being anastomosed to jejunum. One patient developed a low output biliary fistula in early postoperative period which improved with conservative management.

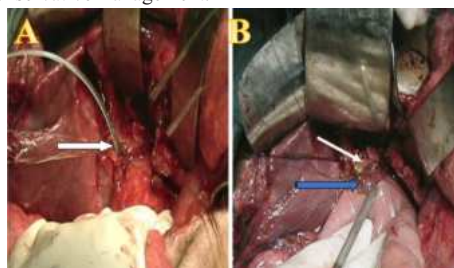


Fig 3A. RPSD opening with catheter inside (Block arrow)

Fig 3B. Sectoral Bile duct Jejunal anastomosis (White arrow pointing at the RPSD opening and blue arrow on Jejunal mucosa)

b) Non definitive exploratory laparotomy:

One patient (5.9%) who had undergone LCOC (subtotal cholecystectomy) outside followed by exploratory laparotomy + drain placement & subsequent drain removal 20 days later, presented with biliary peritonitis and sepsis in our department 6 weeks after the index LCOC. An emergency exploratory laparotomy with peritoneal lavage and multiple drains insertion was performed. He improved without need for definitive surgery and remains asymptomatic at 12 months of subsequent follow up.

c) Conservative (Non – operative) treatment:

In 7 patients (41.1%) managed conservatively (non - surgically), the biliary drainage stopped gradually. The procedures were -- USG guided PCD in 2 patients, PTBD with internalization of stent in 1 patient, PTBD and external biliary drainage in 3 patients, and ERCP with biliary stenting in 1 patient.

Follow Up:

Follow up ranged between 1 to 11 years with a mean follow up of 7.2 years. Two patients were lost to follow up. Two out of the 9 patients managed by definitive biliary enteric anastomosis, developed anastomotic stricture which was managed with percutaneous biliary balloon dilatation. Rest of the patients were well in the follow – up period.

Among the conservatively managed cases, stricture developed in 2 patients at the cut off site of RPSD along with right posterior segment liver atrophy. One patient developed recurrent episodes of cholangitis,

but managed conservatively. No patient required resection of the atrophic segments. Patients with partial duct disruption and segmental bile duct injury with GB fossa collection managed by PCD are doing well on follow up.

DISCUSSION:

Dangerous anatomy, pathology and surgery are three main risk factors which may be responsible for bile duct injury (BDI) during open and laparoscopic cholecystectomy [7]. Incorrect interpretation of anatomy, especially the aberrant anatomy of sectoral biliary ducts, appears to be the most common cause of injury in isolated right sectoral BDI [6, 8 - 9].

Right posterior sectoral bile duct injury is a very difficult problem to diagnose and manage. The biliary imaging is often reported as “normal” with no leaks demonstrated. Some of them are likely to be underreported as they may be asymptomatic and unrecognized due to segmental atrophy over time. A high index of suspicion is required to avoid missing these rare injuries [6].

Among the biliary tree anomalies present in up to 25 % of patients, variations of the right sectoral duct draining segment 6 &7, are the most common. As per Theodoros Mariolis – Sapsakos et al [10], the main variations of the right hepatic duct in 73 Greek cadavers were as follows: (a) Typical anatomy of the right hepatic duct (n = 48, 65.75%). (b) Ectopic drainage of the right anterior duct into the common hepatic duct, the most common variation (n = 11, 15.07%). (c) Triple confluence - the common hepatic duct receives independently the right anterior duct, the right posterior duct, and the left hepatic duct (n = 7, 9.59%). (d) Ectopic drainage of the right posterior duct into the left hepatic ductal system (n = 3, 4.11%). (e) Ectopic drainage of the right posterior duct into the common hepatic duct (n = 2, 2.74%). (f) Ectopic drainage of the right anterior duct into the left hepatic ductal system (n = 1, 1.37%). (g) Ectopic drainage of the right posterior duct into the cystic duct (n = 1, 1.37%). Wojcicki M et al [9] describe another dangerous anatomical variant of the RPSD draining into the gall bladder neck close to its junction with the cystic duct, where it is liable to injury during dissection of neck of the gall bladder. The most dangerous posterior sectoral duct variants are types 'd' and 'g', both of which are very rare, and are present in 4.8–8.4% of the population [11].

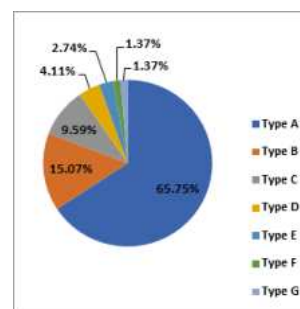


Fig 4 Graphic Representation of incidence of Anatomic variations of Right Hepatic duct Theodoros Mariolis – Sapsakos et al. Doi: 10.1155/2012/838179

As per Strasberg [12], right posterior sectoral bile duct injuries are classified as below:

Type	Description of the injury
B	Injury of the right posterior sectoral bile duct with occlusion of the injured duct.
C	Injury of the sectoral bile duct with leakage of bile from the divided right posterior sectoral bile duct.
E5	Stricture of the main bile duct and the right posterior sectoral duct.

The true incidence of Strasberg type B injury may be underestimated as they may be asymptomatic and pass unnoticed (no bile leak from occluded injured duct), with later atrophy or segmental cirrhosis of part of the liver [12 - 13]. In some cases, there may be cholestasis, recurrent cholangitis or liver abscess formation in the posterior segments, requiring treatment.

Transection (Strasberg type C injuries) on the other hand presents mainly with external biliary leak through the abdominal drains or signs of biliary peritonitis as seen in the studies by Lillemoe [6], Wojcicki [9], Jun Li [14], Laura [15] and Perera [16]. Most common

presentation in the present study were external biliary leak and biloma (12/17, 70.5%).

In the present study over a 21-year period at a specialty HPB surgery centre, the diagnosis of sectoral and segmental bile duct injury was delayed in all of the 17 cases, ranging from 8 to 54 days. Similar delay in diagnosis is also stated by Lillemoe [6], Wojcicki [9], Jun Li [14] and Colovic RB [17]. Wojcicki [9] reported 1 patient referred 56 days after laparoscopic cholecystectomy outside where he had multiple admissions and ultrasound guided aspirations and drainage of intra-abdominal biliary collections. In Jun Li's series [14], patients were referred on median day 12 after the cholecystectomy (range 8 to 55 days) with persistent bile leak, unexplained abdominal pain or jaundice. In Colovic RB's study [17], diagnosis was delayed in 6 cases of isolated segmental, sectoral and right hepatic bile duct injuries ranging from 2 to 8 weeks.

Most important diagnostic imaging in this study were MRCP and PTC. Jun Li [14], Laura [15], Perera [16] also used MRCP, PTC and helical CT for diagnosis. Drain tube cholangiogram was not performed in any of the patients in this study or other studies except by Perera [16]. In this study, ERCP was "Normal" in 7 out of 9 patients, bile leak was seen in 2 patients, reported as a cystic duct leak, followed by biliary stenting. However, subsequent course of the patients showed leak from RPSD on PTC in one case and posterior segmental atrophy on CT scan in the other case. Similarly, in the studies of Lillemoe [6], Jun Li [14], and Perera [16], ERCP was "normal" with absence of contrast leak in all the patients.

In this study 52.9% patients (9 out of 17) were managed by definitive surgery (Sectoral bile duct to Roux – en – y jejunal anastomosis) and 41.1% patients (7 out of 17) were managed conservatively. Among the surgically managed cases, definitive surgery was delayed in all cases (by at least 6 weeks). Lillemoe [6] and Jun Li [14] delayed definitive surgical treatment in all patients. In Laura's study all cases were managed conservatively [15]. In Perera's study 50% cases were managed surgically and 50% cases were treated conservatively [16]. Among their patients, the definitive surgery was delayed in two third cases. Similarly, in Colovic's study, around two third cases were managed surgically, of which in two third cases had delayed surgical intervention [17].

In this series, 2 out of 10 (20%) patients managed by definitive surgery developed anastomotic site stricture, and were managed by percutaneous transhepatic balloon dilatation. This is similar to Lillemoe's study [6]. In Jun Li's study, 20% developed anastomotic site stricture [14]. In Colovic's study one patient developed anastomotic stricture which required a re-do surgery [17].

In this series, there were no vascular injury or mortality. In Jun Li's series there was one death after surgery of a case associated with right hepatic artery injury for which a right hepatectomy was performed [14]. In Colovic's study, one patient who underwent surgery, developed liver abscess with abdominal wound disruption and pneumonia and ultimately died [17].

In this series, 2 out of 7 patients managed conservatively, developed right posterior segmental atrophy, of which one developed recurrent episodes of cholangitis requiring long term antibiotics. None of these patients required liver resection. In Laura's study MRI in all patients managed conservatively was either normal or showed some degree of atrophy of the right posterior liver with compensatory hypertrophy of the left segments [15]. In Perera's study on follow up of conservatively managed cases only one patient developed dilated biliary ductal system with deranged liver function test. [16]. In Colovic's study among patients in whom the injured bile duct was intraoperatively ligated, one patient developed liver abscess with abdominal wound disruption and pneumonia and ultimately died [17].

Unlike the series of Lillemoe et al [6] where all patients underwent percutaneous transhepatic stenting for initial control of the biliary leak, PTBD was used selectively in this study. Out of the 17 patients only 9 underwent definitive surgery. Seven patients were treated non – operatively and 1 patient improved after an exploratory laparotomy with multiple intra- abdominal drainage tubes insertion for biliary peritonitis & sepsis. This is in line with some authors who advocate conservative treatment as an essential modality [15 - 18].

Post cholecystectomy RPSBD injury is a rare entity. In the literature,

small case series [6, 14 - 17] and a case report [9] have been noted. Due to the rarity of the condition, no definite protocols are described in the literature for follow - up of such patients managed operatively or non-operatively. Our follow - up protocol for the first year included complete liver function tests every month, ultrasonography at 3 monthly intervals, MRCP after 6 months of definitive operative repair or non-operative treatment cases. Subsequent follow up included ultrasonography and liver function test at 3 monthly intervals and MRCP at 1 yearly interval for subsequent years (or earlier if any abnormality is found on clinical examination or investigations).

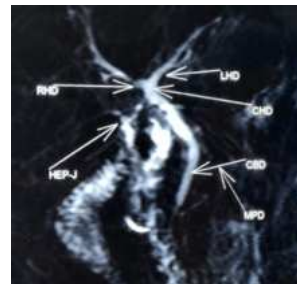


Fig 5 Post RPSD injury repair by Roux en Y jejunostomy (MRCP reconstruction)

CONCLUSIONS:

Right posterior sectoral bile duct injury is an "enigma" -- difficult to understand and diagnose. Similar to other series, failure to diagnose and delayed referral to a Hepato Pancreato Biliary Surgery centre was also seen in this series. The "Alert" signs for a possible right posterior sectoral bile duct injury were a "Normal" cholangiogram on Endoscopic Retrograde Cholangiography ± Magnetic Resonance Cholangio Pancreatography, despite continued bile leak and "neglected" biliary leak/biliary peritonitis ± ineffective/negative exploration(s).

In the absence of an algorithm for management of right posterior sectoral bile duct injury in the literature, in this study apart from Magnetic Resonance Cholangio Pancreatography, a Percutaneous Transhepatic Cholangiography ± biliary drainage was used as a diagnostic and therapeutic tool in the initial management and also for subsequent definitive surgical treatment. Conservative treatment was the initial mode of treatment in all the cases in this series, similar to other studies. Prolonged high output biliary leak ± sepsis/collections in the sub hepatic region, despite adequate conservative treatment, constituted the main indication for definitive surgical treatment -- Sectoral bile duct Roux – en – Y jejunal anastomosis. The results of this surgery with minimal complications, at a dedicated Hepato Pancreato Biliary Surgery centre in this study, compares well with other studies.

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Declarations:

The authors have no relevant financial or non-financial interests to disclose.

The authors declare that there are no competing interests directly or indirectly related to the work submitted for publication.

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