

# Report of two cases of aberrant hepatic duct entering cystic duct: Identifying and preventing bile duct injury

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**Received date: 29/7/2024**

**Accepted date: 23/9/2024**

**Published date: 30/9/2024**

## Abstract

*Introduction:* Although laparoscopic cholecystectomy has been considered to have more advantages than open cholecystectomy, the incidence of bile duct injury still remains high. One of the reasons reported is biliary ductal anomalies, especially extrahepatic bile duct. We reported two cases in which the patients had the right posterior sectional duct entering the cystic duct. Bail-out procedure (fundus-first technique) was performed for both cases and the patient were discharged safely without bile duct injury.

*Keyword:* biliary ductal anomalies, variant biliary anatomy, bile duct injury.

## Introduction

Laparoscopic cholecystectomy is currently considered the gold standard for the treatment of gallbladder stone-related diseases. Despite its numerous advantages such as less post-operative pain, shorter recovery and hospitalization time, and more aesthetic incision, bile duct injury is a severe complication with an incidence of approximately 0.15-0.36%, higher than the rate during the era of open cholecystectomy, which was about 0.1-0.2% [1]. The most common cause of biliary tract injury is misidentification of anatomy: the most common mistake is mistaking the common hepatic duct for the cystic duct, and less commonly, mistaking an accessory hepatic duct for the cystic duct [2]. We describe herein two cases of laparoscopic cholecystectomy in patients with a rare variation of the extrahepatic biliary system, in which the right posterior sectional duct entering the cystic duct.

## Case report

### Case 1

A 45 years old female patient was admitted with a 6-month history of colicky pain in the right upper quadrant, often occurred after meals with mild to moderate intensity, sometimes accompanied by nausea and vomiting. Each episode lasted approximately 1 hour and resolved spontaneously or after taking a painkiller. Physical examination and imaging studies revealed only abnormalities on abdominal ultrasound, showing a non-distended gallbladder with thin walls and a few stones, the largest measuring approximately 8mm.

### Case 2

A 53 years old male patient was admitted with a continuous right upper quadrant abdominal pain for 2 days. His past history was incidentally discovered gallstones on abdominal ultrasound one year ago. On examination, the patient

had a mild fever and tenderness in the right upper quadrant. Laboratory findings revealed leukocytosis, and abdominal ultrasound suggested acute calculous cholecystitis with a wall thickness of approximately 5 mm, a size of approximately 92x52 mm, an impacted stone in the gallbladder neck measuring approximately 11 mm, and pericholecystic fat stranding.

Both patients were indicated for laparoscopic

cholecystectomy. The surgery were performed under general anesthesia using three ports and attempting to clearly define “critical view of safety” (CVS). During the surgery, monopolar energy devices (laporoscopic hook and Maryland dissector) with low setting ( $\leq 30W$ ) were used to remove all the fibro-fatty and soft areolar tissue along with separating the lowest part of the gall bladder from its cystic plate.

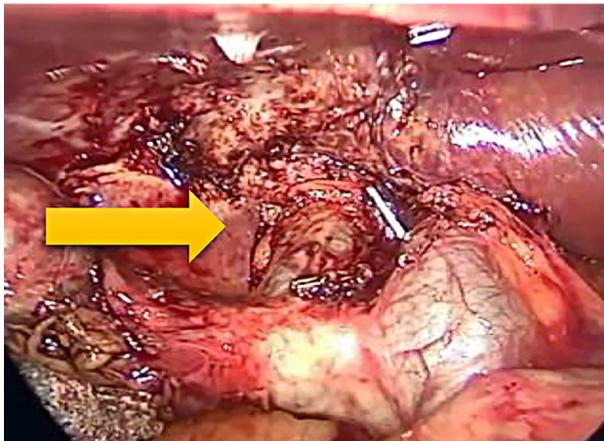


Figure 1. Abberant right hepatic duct in case 1 (Huynh Thi Kim L.)

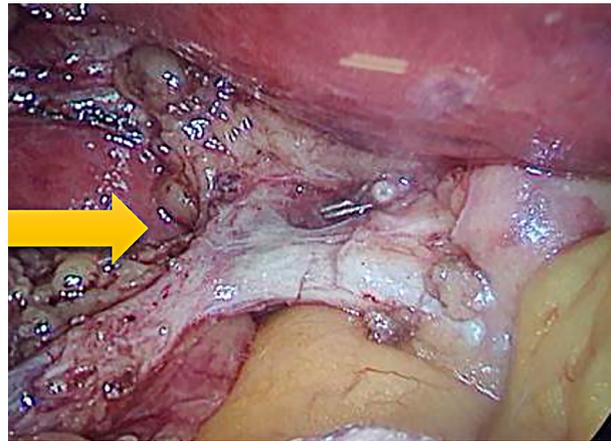


Figure 2. Abberant right hepatic duct in case 2 (Bui Huu D.)

Afterwards, we observed an abnormal duct originating from the right lobe of the liver draining into the cystic duct before joining the common bile duct. Suspecting that this might be an anatomical variation, the surgeon decided not to ligate it, but only applied the critical view of safety and then performed a fundus – first cholecystectomy. Subsequent steps were performed sequentially, and no drainage tube was placed. There were no intraoperative complications. Both patients had a favorable postoperative course and were discharged after 2-3 days.

## Discussion

During laparoscopic cholecystectomy, surgeons may encounter anatomical variations of the extrahepatic biliary ducts. Typically, the right

hepatic duct joins the left hepatic duct to form the common hepatic duct, observed in 72% of cases [3]. The right hepatic duct drains segments V, VI, VII, and VIII and arises from the junction of two main sectional duct tributaries, which are right anterior and right posterior sectional ducts. Several variations of drainage of the intrahepatic ducts into the neck of the gallbladder or cystic duct have been reported (Figure 3) such as drainage of cystic duct into the left hepatic duct, associated with no biliary confluence; drainage of segment VI duct into the cystic duct; drainage of the right posterior (RP) sectional duct into the cystic duct; drainage of the distal part of the right posterior sectional duct into the neck of the gallbladder; and drainage of the proximal part of the right posterior sectional duct into the body of the gallbladder.

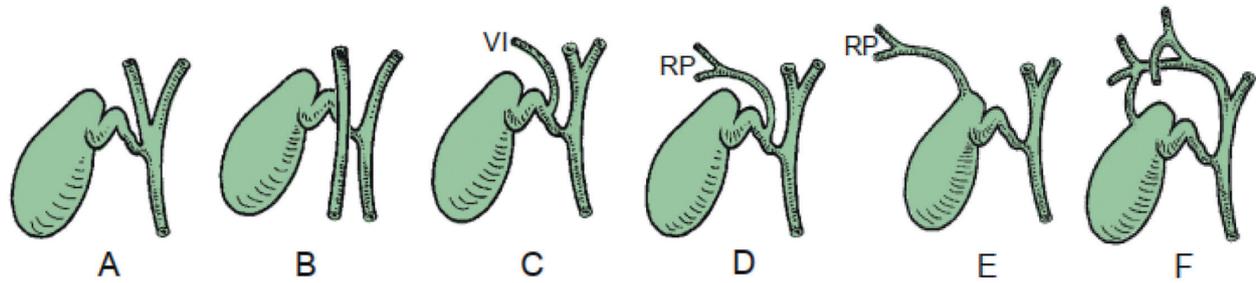


Figure 3. The main variations of ectopic drainage of the intrahepatic ducts into the gallbladder and cystic duct.

In the two cases reported above, during surgery, we observed an abnormal duct leading to the position of the cystic duct before the conjunction with the common bile duct. Therefore, this might be an aberrant right biliary duct, either the right posterior sectional hepatic duct or the duct of segment VI, draining into the cystic duct. Although imaging studies such as intraoperative cholangiography or postoperative magnetic resonance cholangiopancreatography could have been used to precisely identify aberrant bile duct, they were not performed to minimize health care costs and due to the obvious structures in the hepato-biliary triangle. Instead, the "bail-out" strategy ensured that patients had the lowest risk of biliary tract injury.

To reduce the rate of bile duct injury by increasing the accuracy in identifying anatomical structures, the concept of CVS has emerged and is frequently mentioned and applied. To achieve CVS, surgeon must achieve three essential components: (1) Fibrofatty tissue has been cleared from the hepatocystic triangle; (2) Lower part of the cystic plate has been clearly exposed; and (3) Only two tubular structures are seen entering the gallbladder. The study by Yegiyants which was conducted on 3042 laparoscopic cholecystectomy cases with the application of critical view of safety, reported no cases of biliary tract injury [4]. Nevertheless, a definitive study directly assessing the efficacy of critical view of safety is still lacking, and there remains no level I evidence to conclusively support its role in reducing

biliary tract injuries [5]. In challenging cases where a critical view of safety cannot be achieved, there are more than two structures entering the gallbladder, an abnormally large cystic duct, or uncontrollable bleeding requiring blood transfusion, the issue of complete cholecystectomy may become less important than ensuring patient safety from biliary injury. Experts have proposed an alternative strategy, known as the "bail-out" strategy, involving five techniques: abort the procedure; open conversion; tube cholecystostomy; subtotal cholecystectomy; and fundus-first cholecystectomy. According to the Tokyo Guidelines 2018, the recommended strategies include open conversion, subtotal cholecystectomy and fundus-first cholecystectomy (with two types: fenestrating and reconstituting). Depending on the specific situation, surgeon may perform one or a combination of these techniques [6]. While subtotal cholecystectomy has a higher postoperative bile leak rate compared to open conversion, it has a lower rate of severe postoperative complications, reoperation, and mortality. Additionally, approximately 5% of cases of subtotal cholecystectomy have been reported to have recurrent gallstones with or without remnant inflammation, requiring reoperation.

Despite utilizing a three-port approach, we adhered to the principles of the CVS concept and employed a flexible combination of sharp and blunt dissection in the hepatobiliary triangle to minimize bile duct injuries. Bail-out procedures were strategically incorporated to ensure safe completion

of the operations. However, we recognize that certain complex scenarios, such as Mirizzi syndrome or severe fibrosis in the hepatobiliary triangle, may necessitate a four-port technique or even open conversion for optimal outcomes. In challenging cases requiring imaging assistance, we recommend performing intraoperative cholangiography with contrast agent injection through the gallbladder fundus to enhance visualization of the biliary anatomy. It is crucial to prevent contrast agent spillage into the operative field by avoiding leakage from the fundus or multiple perforations in the gallbladder. Additionally, indocyanine green (ICG) has demonstrated its effectiveness in delineating bile ducts.

### Conclusions

Anatomical variations of the biliary tract are a significant risk factor for biliary injury during laparoscopic cholecystectomy. Surgeons must know normal and variant biliary anatomy to prevent inadvertent injury. In order to distinguish exactly whether it is the right posterior sectoral duct or Segment VI bile branch pouring into the cystic duct, MRCP or CT cholangiography with contrast enhancement should be advised. In addition, techniques and strategies such as critical view of safety, intraoperative cholangiography, and bail-out

procedures, etc. should be considered depending on the situation to minimize biliary injury. Although there have been many studies, no technique has been proven to be completely beneficial, so the management of difficult gallbladder cases still depends on the skill and expertise of the surgeon.

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