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# **Iatrogenic Right Hepatic Duct, Right Posterior Hepatic Duct, Right Hepatic Artery and Duodenum Injury during Routine Laparoscopic Cholecystectomy Due to Symptomatic Gallstones: Rare but Serious Complication - Case Report and Literature Review**

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**Author's contribution**

*The sole author designed, analyzed, interpreted and prepared the manuscript.*

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**Case Study**

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## **ABSTRACT**

Laparoscopic cholecystectomy is a very frequent surgical procedure with a low complication rate. The reasons for such complications range from anatomical anomalies, obesity, poor exposure of anatomic structures, bleeding or lack of surgical experience. If complications arise, prompt recognition and correct management are essential. Early and correct treatment allows avoidance of serious complications, such as secondary biliary cirrhosis, hepatic failure, and ultimately death. In this paper is presented a case of a 40-years-old male patient, who sustained iatrogenic major bile duct, right hepatic artery and duodenum injury during routine laparoscopic cholecystectomy due to symptomatic gallstones.

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## 1. INTRODUCTION

Laparoscopic cholecystectomy is the standard surgical procedure for symptomatic cholelithiasis. Although it lowers the postoperative morbidity and mortality, injuries of bile ducts and other structures are more common (0–2.7%), compared to open surgery (0.2–0.5%) [1]. Most of the literature reports are on bile duct injuries, while descriptions of coexisting vascular and bowel injuries are rare, probably widely underestimated as the incidence is unknown [2]. Duodenal injuries are extremely rare complications and often go unrecognized at the time of the procedure and manifest later with significant morbidity and mortality [3].

We describe a case report showing rare but serious complications during routine laparoscopic cholecystectomy, which were overlooked during the procedure itself. This paper presented a case of a serious bile duct injury during routine laparoscopic cholecystectomy and further discussed about diagnosis and treatment of such injuries.

## 2. CASE PRESENTATION

A 40-years old male patient was admitted to a general hospital, with tenderness and pain below the right costal margin. The laboratory results were in a normal range, except for the minor elevation of leukocytes ( $12,6 \times 10^9/L$ ). The ultrasound showed a 12 mm gallstone in the infundibulum and some smaller gallstones in the lumen of the gallbladder without any signs of inflammation.

The patient underwent elective cholecystectomy the next day. The surgical report described a dense adhesions between the proximal duodenum and the lower half of the gallbladder which were resolved during the procedure. Due to hemorrhage, cystic artery and cystic duct were clipped. The source of the bleeding was most probably attributed to an accessory artery. Because of accidental perforation of the gallbladder during dissection from the liver bed, the abdominal cavity was washed with saline and the patient received empirical antibiotic treatment (Metronidazole and Amoxicillin / Clavulanic acid). Abdominal drains were inserted at the end of surgery.

On the first postoperative day, the patient was feeling well. There was around 600 ml of brown

fluid in the bulb of the drainage system, that ceased later in the day.

In the next few days the patient's condition gradually deteriorated with diffuse pain in the abdomen and increased collection of bile from the abdominal drains. The blood tests showed an elevation of inflammatory parameters and cholestasis markers (CRP 412 mg/L, direct bilirubin 19,3  $\mu\text{mol/L}$ , total bilirubin 26,0  $\mu\text{mol/L}$ ,  $\gamma$ -glutamyl transpeptidase 1,37  $\mu\text{kat/L}$ , procalcitonin 2,65  $\mu\text{g/L}$ , leukocytes  $11,4 \times 10^9/L$ ). ALT and AST were within normal range. Antibiotic treatment with Imipenem/Cilastatin was commenced.

Computed tomography (CT) scan showed a considerable collection of free fluid and gas in the perihepatic and Douglas space. Duodenal bulb showed signs of early abscess formation with a collection of fluid. The common bile duct was not visible on CT.

The patient was transferred to the tertiary hospital for further treatment. After admission, endoscopic retrograde cholangiopancreatography (ERCP) was performed as a preoperative diagnostic method which showed a defect in the duodenal bulb, roughly 1 cm in size. The common hepatic duct was not seen on the ERCP. After a short period of preoperative preparation, the patient underwent explorative laparotomy, where signs of biliary peritonitis were found. At further abdominal exploration, a complex injury of the right hepatic duct and previously undescribed perforation of the proximal duodenum was discovered. The duodenal perforation was closed with interrupted sutures. The distance between both ends of injured right hepatic duct was too long for primary reconstruction; therefore a Roux-en-Y hepaticojejunal anastomosis was fashioned.

Postoperatively there was still a considerable amount of bile fluid drained from the abdominal cavity and the patient's condition did not improve satisfactorily. Further surgical revision was indicated. At second revision additional injury of the posterior right hepatic duct for the right posterior section was discovered. The perfusion of the right hepatic lobe was questionable. The injury of the right hepatic artery was suspected. Two more hepaticojejunal anastomoses were made, one to the left bile ducts and anterior

section, the other to the segmental duct for the 6th hepatic segment. Bile duct for the 7th hepatic segment was injured and could not be reconstructed, therefore it was closed without anastomosis. Hepaticojejunal anastomoses were bridged with T- drains to lower the bile secretion through abdominal drains. Following surgery, there was still a minor quantity of bile drained from the abdomen that ceased with the restoration of normal peristaltic function.

During follow-up, several ultrasound examinations were performed and there was no sign of fluid collection. With antibiotic therapy, the inflammatory parameters started to restore.

The patient was discharged for a few days and came back for a control ultrasound, showing minor fluid collections. Inflammatory parameters were falling, but hepatic enzymes were rising (alkaline phosphatase: 12, 07  $\mu$ kat/L, AST: 3,61  $\mu$ kat/L, ALT: 6,63  $\mu$ kat/L,  $\gamma$ -glutamyl transpeptidase 21,11  $\mu$ kat/L, lipase: 2,20  $\mu$ kat/L, CRP: 37 mg/L, direct bilirubin: 11  $\mu$ mol/L). The patient was discharged with diet instructions and scheduled outpatient visits to the hospital. The T-drains were removed at further outpatient clinic follow-ups.

### 3. DISCUSSION

Laparoscopic cholecystectomy is a gold standard for treating symptomatic cholelithiasis as it allows a safe, quick and minimally invasive approach. Complications are rare but have to be carefully and critically analyzed to learn from these mistakes [4]. In the literature, the percentage of LC complications is directly related to surgeon's experience, which is expressed in numbers per year [5,6]. The main reason for complications is the degree of inflammation, the adhesions and the anatomic variations which inflict as many as 50% of cases. The first surgeon, who performed LC in other hospital, was a junior specialist, however overall he performed more than 100 LC. Every surgeon, who is performing LC, must have a critical view of safety during surgery. If there is unclear anatomical situation, in which the surgeon is not sure, whether he is ligating and dividing the proper structure, a low threshold for conversion to open surgery must exist.

To compare the extent of injury, many different classification systems have been introduced. Bismuth classification was the base for all the following versions and it evaluates the location of

the injury in the biliary tract, dividing them into five types according to the distance from the hilar structure. Strasberg classification is a more recent version, adopted for the laparoscopic procedures, where the injuries occur in a different pattern compared to those seen in open cholecystectomy. Stewart-Way classification is a simple and effective classification of laparoscopic bile duct injuries which also incorporates vascular injuries [7].

The surgical repair of injured structures depends on the time and extent of the injury. If immediate repair is possible, even a completely transected bile duct can be primarily reconstructed as an end-to-end ducto-ductal anastomosis. For this procedure the edges should be healthy, without any inflammation, ischemia or fibrosis, with proper vascularization of the anastomosis. In case of late identification of injury, when a revision surgery has to be done, the goal of surgical repair should be the establishment of a bilio-enteric anastomosis, Roux-en-Y hepaticojejunostomy [8].

The patient that underwent LC needs to be followed up thoroughly to notice various clinical signs, laboratory changes with prompt radiological investigations in order to diagnose the injury of bile ducts and other structures in proper time. In laboratory results, special attention must be given to serum bilirubin, alkaline phosphatase,  $\gamma$ -glutamyl transpeptidase, alanine and aspartate aminotransferases as well as the inflammatory markers [7]. In the early stage, when the liver is not damaged, the indicators of cholestasis can be elevated, which was also observed in our case, but AST and ALT can still be in the normal range. Later these parameters can elevate as a result of secondary biliary hepatic damage. If the synthetic function of the liver is compromised as well, changes in coagulation and hypoalbuminemia can occur. [9].

It is important to keep in mind that normal laboratory results do not exclude bile duct injury, as they sometimes need few weeks to rise above normal values, therefore clinical signs and drained fluids must be observed closely [8]. One of the studies showed that the median time of the patient's presentation was 7 days after laparoscopic cholecystectomy and 14 days following open cholecystectomy [10].

Radiological investigations for detecting bile duct injuries are ultrasound, cholangiography, ERCP, CT and magnetic resonance

cholangiopancreatography (MRCP) [11]. Cholangiography can be done intraoperatively, to clarify biliary anatomic variations and reveal occult common bile duct calculi [12]. ERCP can be, apart from diagnostic values, used also as a treatment. It enables the localization of the injured region and therapeutic maneuvers, such as stent placement and extraction of calculi [11]. In our case, ultrasound and CT were performed in the first hospital, ERCP being done later in a tertiary hospital. Postoperatively more ultrasounds were done as a follow-up [13,14].

The literature describes many cases of bile duct injuries after LC but rarely as extensive as in this case. Keeping in mind, that cholecystectomy is considered a minor surgery, complications like these can lead to a poor outcome as the patients are often committed to a long period of follow-ups [15,16,17]. Biliary injury in our case was type E biliary injury, which is the heaviest [18].

#### 4. CONCLUSION

Our case report shows an extensive injury made during LC, inadequate first revision surgery, but critical observation of the patient, which led to successful second revision surgery. Although we can minimize the risk of injuries during LC, they cannot be completely avoided. In case of insecurities, a low threshold for conversion to the open procedure is advised. If revisions are needed, reconstruction should be made by an experienced hepatobiliary surgeon in a tertiary hospital [13].

#### CONSENT

As per international standard or university standard, patient's written consent has been collected and preserved by the authors.

#### ETHICAL APPROVAL

As per international standard, ethical approval has been collected and preserved by the author(s).

#### COMPETING INTERESTS

Author has declared that no competing interests exist.

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