

# Early Detection of Common Bile Duct Injury Post Cholecystectomy, What are the Options?

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## Abstract

In the present scenario, laparoscopic cholecystectomy remains the most common surgery performed by the general surgeons but there is constant fear of the common bile duct injury associated with it. We have moved from the era of open to laparoscopic cholecystectomy with a long initial learning curve for the surgeons.<sup>2,3</sup> During this period, the most vulnerable structure to injury is common bile duct<sup>1,4</sup> which can lead to serious complications like biliary peritonitis, hepatic failure and death.<sup>22</sup> Majority of the patients are identified later with progression of jaundice and a few are recognized on table requiring immediate repair. Our study is focused on the role of ultrasound in the postoperative period as a tool for detecting common bile duct injury within 72 hours of cholecystectomy.

**Keywords:** Ultrasound; Common bile duct; Laparoscopy; Jaundice.

**Key message:** The incidence of CBD injury may be rising with Increasing trend of laparoscopic cholecystectomy. Early recognition is the key of management of CBD injury. MRCP is the gold standard investigation for bile duct injuries. Ultrasound is of immense significance in resource poor settings where the MRCP, CT are not available.

## Introduction

Laparoscopic cholecystectomy remains the most common surgery performed by the general surgeons but there is constant fear of the common bile duct injury associated with it. There has been tremendous advancements in laparoscopic surgery since the days of Von Ott who performed the inspection of the abdominal cavity in 1901 using laparoscopy to Georg Kelling who called it koelioscopie<sup>5</sup>, the most intricate procedures done today are performed using laparoscopy.

Following development of laparoscope, many authors in Europe and United states started doing diagnostic procedures using it. It was only with the introduction of the rod-lens optical system and of the cold light fiberglass illumination that laparoscopy became more popular especially in the gynecology departments.<sup>5</sup> In 1882, Carl Langenbuch performed the first open cholecystectomy and in 1905 Mayo reported bile duct stricture following cholecystectomy. Prof Dr. Erich Muhe of Germany was the first person to perform laparoscopic cholecystectomy in 1957. Now a days laparoscopic cholecystectomy has become the gold standard procedure of treating uncomplicated cholelithiasis.<sup>6</sup> The procedure is associated with less discomfort, shorter hospital stay and better cosmetic results.<sup>4,21</sup>

**Aim:** To study the incidence of common bile duct injury immediately in the post-operative

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period.

### Methods and Material

The following study was conducted in the department of surgery and radiology on 189 patients admitted between June 2017 and June 2020. All the patients undergoing laparoscopic cholecystectomy were subjected to ultrasound of abdomen within 24 hours post-operatively. The next ultrasound was done after 7 days of the procedure (post discharge) of the patient. The end point of study was decided on the basis of prevalence of iatrogenic bile duct injuries (3%).<sup>23</sup>

$$N = Z^2P(1-P)/E^2$$

$$N = \frac{3.84 \times 0.30 \times 0.97}{0.000625} = 179$$

Assuming 5% attrition error, N=187

(N = Sample size; P = Estimated Prevalence (Here 3%); Z = Confidence level at 95% = 1.96 ; E = Error of estimation)

Complications of cholecystectomy were divided into major [extra hepatic common bile duct (CBD) injury necessitating hepatojejunostomy] and minor (wound infection, minor biliary leak, transient jaundice, pain and ileus). These patients were subjected to blood investigation (LFTs) to look for any rising serum bilirubin levels. No specific sign other than pain in right hypochondrium is exhibited to detect CBD injury early.

#### *Inclusion criteria*

- All patients between 18 to 90 yrs undergoing laparoscopic cholecystectomy were taken up in the study.

#### *Exclusion Criteria*

- Patients undergoing open cholecystectomy.
- Patients with previously diagnosed common bile duct injury.
- Extremes of age i.e. <18 years and >90 years of age.
- Patients in the ICU or with multiple co-morbid conditions.

CBD injuries are classified by different classifications as follow:

#### *Classification of Bile Duct Injuries*

##### • **Corlette-Bismuth Classification**

- Type 1** Low CHD (Common Hepatic Duct) stricture, with a length of the CHD stump of >2 cm.
- Type 2** Middle stricture: length of CHD <2 cm.
- Type 3** Hilar stricture, sans remainder of CHD, but the confluence is preserved.
- Type 4** Hilar stricture, with involvement of confluence and loss of communication between right and left hepatic duct.
- Type 5** Combined CHD and aberrant right hepatic duct injury, separating from the distal CBD.

##### • **Strasberg Classification**

- Type A** Bile leak from cystic duct or liver bed without any CBD injury.
- Type B** Partial occlusion of the biliary tree, most commonly an aberrant RHD.
- Type C** Bile leak from duct (aberrant RHD) sans communication with the common bile duct.
- Type D** Lateral injury of biliary system, without loss of continuity.
- Type E** Circumferential injury of biliary tree with loss of continuity.

##### • **Stewart-Way Classification**

Mechanism of laparoscopic bile duct injury and associated RHA injury %:

- Class I** CBD mistaken for cystic duct, but recognized; cholangiogram incision in cystic duct extended into CBD.5%.
- Class II** Lateral damage to the Common hepatic duct from cautery or clips placed on duct; associated bleeding, poor visibility 20%.
- Class III** CBD mistaken for cystic duct, not recognized; CBD, CHD, RHD, LHD transected and/or resected 35%.
- Class IV** RHD (or right sectoral duct) mistaken for cystic duct, RHA mistaken for cystic artery; RHD (or right sectoral duct) and RHA transected; lateral damage to the RHD (or right sectoral duct) from cautery or clips placed on duct 60%.

#### *Statistical Analysis Used*

The Data collected was evaluated by routine

statistical techniques.

## **Results**

It is a retrospective study done between June 2017 and June 2020 at our tertiary care institution. Out of 189 patients who underwent cholecystectomy, 38 (20%) were males and 151(80%) were females. 174 patients (92%) underwent laparoscopic cholecystectomy and 15 patients (8%) converted to open cholecystectomy owing to adhesions. 20 patients (10.5%) out of these 189 patients who were suspected to have bile duct injury were found to be negative on ultrasonography. Seven patients (3.7%) were found to have bile duct injury on ultrasonography except one patient where MRCP exhibited the leak from CBD injury whereas USG missed the same. Signs suggestive of bile duct injury were post op slightly raised serum bilirubin levels, collection in gallbladder fossa which resolved spontaneously within 7 days. Biliary leak continued till 7th post-op day in one patient who underwent MRCP and further subjected to ERCP suggestive of minor cystic duct leak for which no further intervention was done and resolved by itself.

The above results suggest that ultrasound can be used as primary modality along with the liver function tests evaluation to look for early bile duct injuries in the centres where better and invasive investigations are not available.

## **Discussion**

One of the most dreaded and devastating complications of laparoscopic cholecystectomy is common bile duct injury. It has been well established that as laparoscopic cholecystectomy was gaining popularity, the number of cases of bile duct injuries also increased.<sup>8-11</sup> The rate of clinically relevant bile leaks after conventional open cholecystectomy ranges between 0.1 and 0.5%. In contrast, biliary leakages have increased in the era of laparoscopic cholecystectomy (LC) by up to 3%. Both the patient and the surgeon have to undergo a lot of mental agony and financial burden in cases of iatrogenic CBD injury. They may result from: cutting, severing, burning or locking with a clip the common bile duct or accessory hepatic bile duct, usually the right one.<sup>12</sup> While improvement in optics, instruments, training of surgeons on laparoscopic simulators and understanding of the anatomy has greatly

reduced the burden of common bile duct injury but still there is no definitive way to diagnose iatrogenic injury to the CBD immediately.

Contrary to wide spread opinion, the determination of serum alkaline phosphatase and total bilirubin in particular is not sensitive in the initial post-operative course. The majority of patients with CBD injury present within first few weeks following the index operation. The symptoms are non-specific and may include fever, pain, and mild hyperbilirubinemia (<2.5 mg/dl) from biloma or bile peritonitis.<sup>15</sup> In severe early post-operative cases, patients present with sepsis from cholangitis or intra-abdominal fluid collections. In the case of a suspected bile leak, ultrasound and/or an abdominal computed tomography (CT) scan will identify peritoneal fluid, biloma, or an abscess.

Presence of up to 60ml of fluid in the gallbladder bed should be considered insignificant post cholecystectomy which gradually absorbs within 2-4 days.<sup>6</sup> Carbon dioxide is absorbed from the peritoneal cavity within two days whereas air takes considerably longer time to absorb.<sup>6</sup> Hemostatic material left during the surgery may mimic an abscess which can be detected by magnetic resonance imaging.<sup>14</sup> Rapidly accumulating fluid around the liver is an alarming symptom, particularly when there is inadequate blood supply or when peritoneal irritation symptoms develop. Depending on the suspected cause of the patient's deteriorating condition, it is essential to perform urgent computed tomography angiography, celiac angiography or endoscopic retrograde cholangiopan creatography or magnetic resonance cholangiopancreatography. The character of the fluid collection may be determined by its ultrasound guided puncture.<sup>6</sup> This procedure allows for aspiration of fluid and placement of a drain.<sup>13</sup> Moreover, transabdominal ultrasound examination after laparoscopic cholecystectomy may contribute to the identification of: dropped stones in the right hypochondriac region,<sup>17,18</sup> residual fragment of the gallbladder with possible concretions,<sup>19</sup> undiagnosed choledocholithiasis, existing cholestasis, pseudoaneurysm of the hepatic artery, portal vein thrombosis and hematoma<sup>16</sup> as well as hernias of the abdominal wall.<sup>20</sup>

Post-operative diagnosis of CBD injury can be made if the patient has continuous pain, increased drain output, or develops jaundice.

MRCP is the recommended diagnostic modality for the diagnosis of CBD injury. In our study, ultrasound was found to be a useful and cost effective modality for the diagnosis of gallstones and common bile duct injuries although it has its own drawbacks of limited view due to bowel or peritoneal gas and being more operator dependent.

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