The Pharma Innovation Journal 2017; 6(3): 185-189

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277- 7695
ISSN (P): 2349-8242
NAAS Rating 2017: 5.03
TPI 2017; 6(3): 185-189

www.thepharmajournal.com
Received: 20-01-2017
Accepted: 25-02-2017

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# A research on the management of biliary tract injuries arising from cholecystectomy complications

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**Abstract**
**Objectives:** To assess the frequency of injuries to the bile duct and other parts of the biliary system following cholecystectomy in our hospital, as well as the causes of these injuries and their management.
**Methods:** This Study Carried out between January 2016 to December 2016 at Department of Paediatrics, Mahavir Institute of Medical Sciences, Vikarabad, Telangana, India, who had an iatrogenic biliary tract injury underwent a prospective analysis.
**Results:** There was 2.52% of cases of bile duct injury. Most of the bile duct damage was often seen in patients undergoing cholecystectomy for cholecystitis that persisted for more than 72 hours. Cholangitis, acute cholecystitis, and choledocholithiasis were among the conditions that increased the risk of bile duct damage. After surgery, the majority of the injuries were found. Typically, the common hepatic duct was the location of injury. ERCP and stenting were two radiological procedures that helped with the final repair used in most BDI instances.
**Conclusion:** Bile duct injuries during cholecystectomy have been shown to occur more frequently in our institution due to the steep learning curve associated with laparoscopic surgery. A multidisciplinary approach, early discovery, and repair offer the best chance of recovery.

**Keywords:** Cholecystectomy, bile duct injury, incidence, management

## Introduction
Disorders of the biliary tract can be deadly, debilitating, and extremely painful [1, 2]. The complex development of the liver and biliary system during pregnancy may result in multiple anatomical variations. Rigorous dissection and structural identification, along with a comprehensive grasp of these anatomical variances, are essential for the safe execution of any hepatobiliary procedure. The biliary system is a cruel organ, thus errors in technique or decision-making can have serious consequences for the patient, potentially resulting in death or lifelong disability. That's why it's highly valued to follow the correct procedures the first time around, without any technological errors. Identification of iatrogenic injury is equally important in order to provide timely repair or referral to a hepatobiliary surgery specialist. For a solution to be successful, a careful blend of technical expertise, sound judgment, and attention to detail is required [2, 3]. More importantly, today's surgeons need to be able to integrate the growing array of radiologic and endoscopic therapy choices with surgical alternatives in order to effectively manage patients with these disorders. Due in part to its high frequency of use, cholecystectomy continues to produce the greatest amount of post-operative biliary damage.
Strasberg and associates found a 0.3% incidence of injuries in a literature review of over 25,000 open cholecystectomies performed since 1980 [3, 4]. But with the significant increase in injuries, the popularity of laparoscopic cholecystectomy has drawn attention to this problem once again. Numerous investigations carried out worldwide have revealed an increase in bile duct damage caused by the laparoscopic procedure ranging from 0.4% to 1.3%. Furthermore, a survey of about 125,000 laparoscopic cholecystectomies reported in the literature between 1991 and 1993 by Strasberg and colleagues revealed an overall prevalence of biliary injuries of 0.85% [4, 5].

## Material and Methods
A prospective analysis was conducted on all patients at the Department of Paediatrics, Mahavir Institute of Medical Sciences, Vikarabad, Telangana, India, who underwent an iatrogenic BDI between January 2016 to December 2016. The case files, surgical, and postoperative records were reviewed and data was collected. The following factors are taken into consideration: gender, age, vascular anatomy of the extra-hepatic bile duct, gall stone pancreatitis, acute

cholecystitis, or cholangitis; the timing of the cholecystectomy in relation to the onset of symptoms (72 hours or more); the presence of BDI; the interval between the cholecystectomy and the recognition of BDI; the type of injury; the duration from injury to definitive management; endoscopic retrograde cholangiography and stenting and definitive repair are taken into consideration [5, 6].

The sample size was established using the laparoscopic cholecystectomy incidence of complications, which was computed using the n-master program to be 0.5% with a relative precision of 10% and an alpha error of 5% (95% confidence interval). proportionate descriptive statistics to explain how often BDI occurs. To assess the statistical variation among various parameters, such as age, gender, and so on, the Chi Square test will be employed.

**Inclusion Criteria**

1. Every patient who had a cholecystectomy at hospital in 2016, whether it was a laproscopic or open procedure.
2. All patients were included, regardless of their socioeconomic standing, gender, or place of residence.
3. Included were all patients over the age of 12 years.
4. Everyone who is qualified for general anaesthesia has been included.

**Exclusion Criteria**

Bile duct injuries that develop as a side effect of procedures other than cholecystectomy

1. As a side effect of ERCP
2. Abdominal piercing and blunt injuries.
3. Cholecystectomies performed in conjunction with other procedures, such as those for pancreatic cancer.
4. Children younger than 12 years old were not included in the study.
5. Study participants who were unfit for general anaesthesia were not included.

**Results**

**Table. 1:** Distribution of age and sex among the study population with injuries (BDI)

| Age group | Males | Females | Total |
|---|---|---|---|
| 30-39 yr | 0 | 1 | 1 |
| 40-49 yr | 3 | 1 | 3 |
| 50-59 yr | 0 | 1 | 2 |
| Total | 3 | 3 | 6 |

A total of 238 cholecystectomies were performed during the study period. The percentage of bile duct injuries was 2.52%. The age range was 38 to 53 years old, with an average age of 43.16.

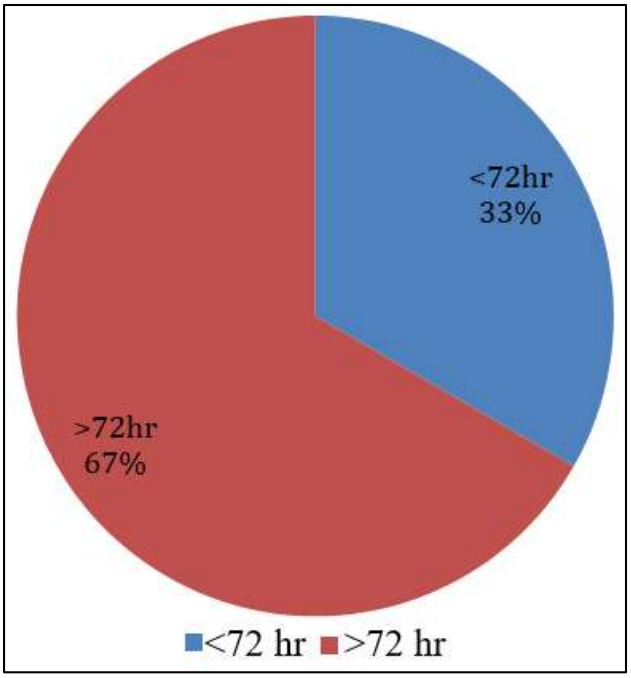


**Chart 1:** Route of cholecystectomy

Two of the six BDI cases had documentation and were forwarded to a higher center for additional treatment. 33.33% of patients had BDI recognized during surgery, and 66.67% did so in the first week following surgery.

Cholangitis, pancreatitis, or choledocholithiasis were not present in any of the BDI individuals. Cholecystitis that lasted shorter than 72 hours was present in two (33.33%) of the BDI patients. Those with bile duct injuries made up 33.33% of those with the aforementioned risk factors.

The majority of patients who were reviewed after surgery but did not receive prompt definitive treatment for their bile duct injuries were assessed. An ultrasonography of the pelvis and abdomen was performed on 4 individuals (66.67%). Next, to determine the location of the injury, an MRCP (66.67%) or ERCP (16.67%) was performed.

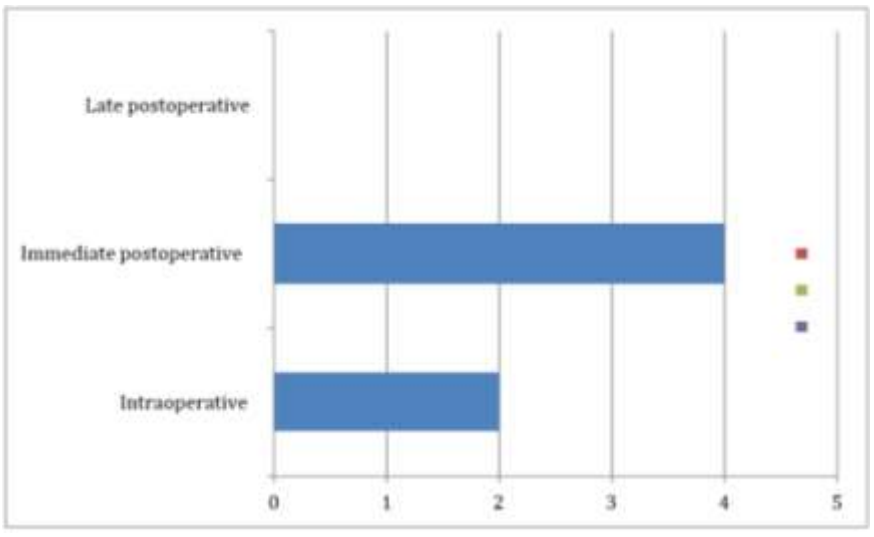


**Chart 2:** Time to diagnosis of BDI

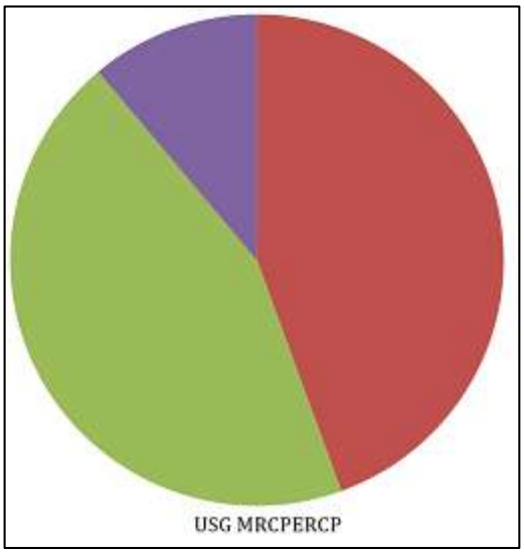


**Chart 3:** Investigations for evaluating BDI

The site of BDI was determined to be CHD in 50%, CBD in 33.33%, cystic duct in 16.67% cases.

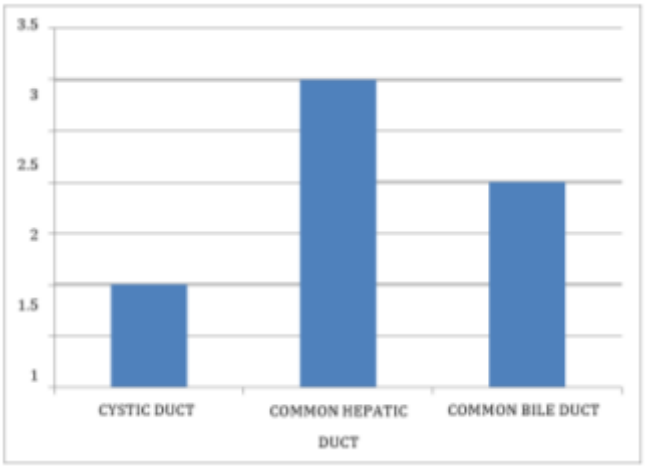


**Chart 4:** Site of BDI

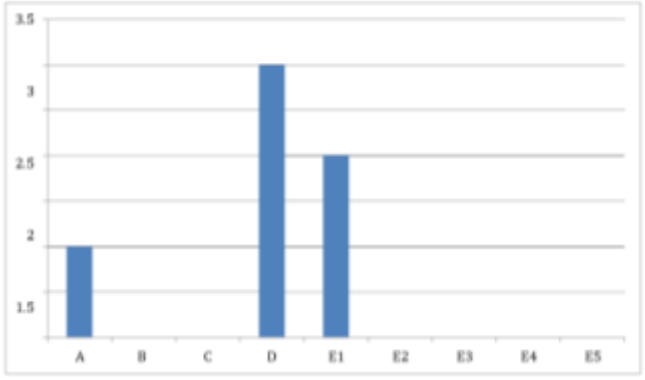


**Chart 5:** Strasberg's classification of BDI noted in the study

A total of 16.67% of BDI respondents were type A. The proportion was 33.33% Strasberg E1 type. They were D for half of them. The procedure turned up two of the six BDI patients. Materials that would dissolve with time were used to sew three together. Following the procedure, four cases were discovered in the first week, and two cases were discovered during the procedure. The cystic duct stump had to be sewn back together in one instance due to damage. Whereas a T tube and primary suturing were required in one CBD damage instance, an ERCP stent was required in another. A higher center was consulted for a hepatojejunostomy after two CHD injuries that required percutaneous drainage were sent. First-line suturing and a T tube were used to treat a CHD damage.

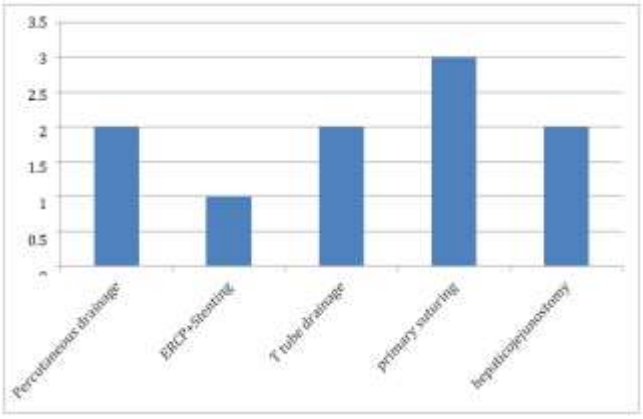


**Chart 6:** Treatment modalities for BDI in the study

**Discussion**

September 1985 saw the first LC performed by Erich Muhe20. Surgeons were dubious of his novel procedure at first, but by the early 1990s, "minimally invasive surgery," which incorporates LC, had become commonplace. Surgeons began performing the procedure, reporting case series, and developing protocols for it all around the world. Some clear advantages of the widespread adoption and use of LC included a reduction in postoperative pain and a shorter hospital stay. It was, nevertheless, also connected to a concerning increase in comorbidities, particularly BDI [6, 7].

Research conducted over the past ten years examining post-operative care and the evolution of patients' quality of life has demonstrated the seriousness of BDI following LC. People believed that once the "learning curve" of LC flattened, the rate of BDI would eventually decrease. Nonetheless, a new analysis of almost 1.6 million cholecystectomies performed on Medicare recipients reveals that the rates have stabilized. According to these research, 0.5% of the population developed BDI between 1992 and 1999 [7, 8].

Regretfully, it appears that BDI is still an issue and may even be more prevalent now than it was before to the LC. Despite advancements in technology, BDI remains a significant clinical issue. It is crucial to diagnose and treat BDI accurately in order to prevent potentially fatal consequences such as cholangitis, biliary cirrhosis, portal hypertension, end-stage liver disease, and death. There are a variety of laparoscopic cholecystectomy complications that can harm the bile duct, but they are all related by an incomplete understanding of the anatomy of the triangle of Calot [9, 10]. This failure may have resulted from anatomical factors, complications related to the laparoscopic procedure, or inadequate training. Acute or severe chronic inflammation, morbid obesity, hemorrhage, and the existence of anatomic malformations are examples of anatomic risk factors.

The inability to see depth, variations in the gallbladder's lines of traction, the challenge of executing an antegrade cholecystectomy, and the use of electrocautery in a tiny area that is easily covered in blood or bile are all inherent aspects of the laparoscopic technique [10, 11].

95% of the 711,454 cholecystectomies that were recorded in the California Office of Statewide Health Planning and Development (COSHPD) database between 2005 and 2014

were LCs. This data was examined by the California Cholecystectomy Group. The necessity for endoscopic retrograde cholangiopancreatography (ERCP) or percutaneous transhepatic cholangiography (PTC) within 4 weeks of cholecystectomy allowed them to determine that the bile leak rate was 0.5% [12]. The current investigation reported six occurrences of biliary tract injury from medical professionals looking at 238 cholecystectomies.

Case 1: Immediately following a laproscopic cholecystectomy, CHD damage was discovered with the use of USG and MRCP. Following percutaneous drainage, the patient was moved to a higher center for hepaticojejunostomy.

Case 2: Using USG and MRCP, CBD injury was discovered immediately following a laproscopic cholecystectomy. Since only around 30% of the CBD was impacted, ERCP and stenting were used as treatments.

Case 3: An open cholecystectomy was necessary due to cholecystitis, and a CBD injury was discovered on the operating table that required primary sutures and a T tube for treatment.

Case 4: A CHD damage was discovered immediately during an open cholecystectomy using USG and MRCP. The patient underwent a hepaticojejunostomy at a higher center after a percutaneous drain was placed.

Case 5: A CHD injury was discovered during a laproscopic cholecystecomy procedure for cholecystitis. Dissection proved to be difficult, thus an open technique was adopted instead. The patient is taken care of by placing a T-tube and performing primary suturing or repair [13, 14].

Case 6: Following a laproscopic cholecystectomy, USG and MRCP were utilized to determine that the cystic duct stump had blown out. During the initial day following the procedure, a relaproscopy revealed that the clip had shifted. Clamping and suturing the cystic duct stump blowout was the initial step in fixing it [15, 16].

Upon discovering bile duct damage following surgery, patients experienced fever, bile leakage from the drain, and in certain instances, infection. Stabilize the patient and stop the sepsis before determining how to treat the patient going forward.

The size of the issue produced by BDI is demonstrated by the current investigation. According to this study, the majority of injuries were observed in the fourth decade of life and were primarily brought on by non-sexual causes. 2.52% of patients in our study experienced BDI following laparoscopic cholecystectomy. In other research, 0.4% to 0.6% of patients experienced BDI following laparoscopic cholecystectomy. This can be the result of our hospital's ongoing education in laparoscopic procedures.

Those undergoing a cholecystectomy for cholecystitis that had persisted for less than 72 hours had 33.33% of the BDI. This is one of the reasons that unclear anatomy surrounding the Calot's triangle makes safe surgery difficult to perform. No anomalies in the blood vessel or duct structure were found in this investigation. Of the injuries, 83.33 percent were related to laparoscopic cholecystectomy. Of them, 40% had their status changed from closed to open. In our study, the rate of bile duct damage was 33.33%, or one third, despite the fact that less than one third are discovered after surgery. The majority of them were treated concurrently with the cholecystectomy, as soon as they were discovered [16, 17].

It is crucial to employ a multidisciplinary team of interventional radiologists, hepatobiliary surgeons, and surgeons when handling problems. Once surgery was performed, the most common test to determine BDI was abdominal and pelvic ultrasound. We employed MRCP, ERCP, and PTC to learn more about the location of the injury and the bile duct. According to our research, the most typical location of BDI is the common hepatic duct. Strasberg type D was the most common BDI that we observed in our investigation. This is consistent with findings from another study conducted by Strasberg *et al*. in 1995. Stenting and ERCP were used to treat the majority of BDI cases. A small number did not require surgery and could be managed with stenting alone. Treatment options for Strasberg type A BDIs, which accounted for 25% of all BDIs discovered following surgery, included repairing the cystic duct stump leak or re-clipping it [17].

Two patients were moved to a higher center for additional care due to injuries discovered after surgery, and they had a procedure known as hepaticojejunostomy. A hepaticojejunostomy was used to treat the majority of these CHD injuries, however one was discovered during surgery and was able to be closed and drained with a T tube. While primary sutures and a T tube were used to treat one CBD injury, ERCP and a stent were used for the other.

## Conclusion

The most feared side effect of a cholecystectomy is still damage to the bile duct. In educational institutions, the rate is probably higher because new faculty members and graduate students are still learning. In contrast to previous research, our school has a higher number of BDI cases. Acute cholecystitis, cholangitis, pancreatitis, and choledocholithiasis are a few conditions that can lead to BDI. It is best to ask more seasoned coworkers for assistance in these situations. If the dissection is difficult or if a biliary tract injury is discovered during the procedure, the laparoscopic cholecystectomy must be converted to an open procedure. A critical assessment of safety needs to be done before to cutting the artery and duct. Determining the extent of the damage requires extensive analysis prior to implementing a long-term fix. The fundus first approach is one of the "bailout" procedures that must be utilized when anatomy is unclear. An intraoperative cholangiogram should be performed when there is a possibility of biliary tract damage.

**Funding Source**: None

**Conflict Of Interest**: None

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