



## Evaluating the Impact of Surgical Occurrence of Bile Duct Injuries in Laparoscopic Cholecystectomy- A Retrospective Observational study

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### Abstract

**Background:** Laparoscopic cholecystectomy (LC) is the gold standard for treating gallstone disease, offering numerous benefits over traditional open cholecystectomy. However, bile duct injuries (BDIs) are a significant complication, contributing to substantial morbidity and mortality. This study aims to evaluate the incidence, causes, risk factors, treatments, and outcomes of BDIs in laparoscopic cholecystectomy in Bangladesh.

**Material & Methods:** This retrospective observational study was conducted at the Department of Hepatobiliary, Pancreatic and Liver Transplant Surgery, Bangabandhu Sheikh Mujib Medical University, Al-Manar Hospital Limited, and Abeer General Hospital, Dhaka, Bangladesh. During this period, a total of 1255 complete hospital records of laparoscopic cholecystectomy conducted over the last 5 years at the study hospital were selected for the study following inclusion and exclusion criteria. **Results:** Out of laparoscopic cholecystectomy cases, 20 (1.64%) patients experienced BDIs. The most common cause of BDI was clipping or transection of the duct (33.33%), followed by mistaken anatomy (22.22%) and ischemic injury due to clip (18.52%). Acute cholecystitis was the most prevalent risk factor (37.04%). Standard laparoscopic cholecystectomy was performed in 83.33% of BDI cases, with the remaining 16.67% undergoing single-incision laparoscopic cholecystectomy. The majority of patients (74.07%) had no complications after BDI treatment, while 18.52% experienced minor complications, 5.56% had major complications, and 1.85% resulted in mortality. **Conclusion:** This study highlights the importance of meticulous surgical technique, early recognition, and appropriate management of bile duct injuries in laparoscopic cholecystectomy. By continually refining our understanding of the factors contributing to BDIs and implementing evidence-based strategies to prevent and manage this complication, we can optimize patient outcomes and ensure the highest standards of care in laparoscopic cholecystectomy.

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## INTRODUCTION

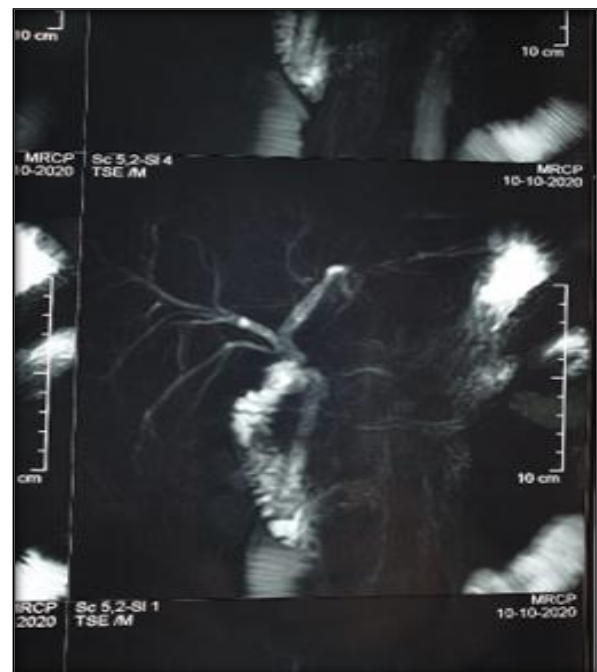
Laparoscopic cholecystectomy (LC) is a minimally invasive surgical procedure that has become the gold standard for treating

symptomatic gallstone disease, which is primarily caused by the formation of cholesterol or pigment stones in the gallbladder.<sup>[1]</sup> The advantages of LC over traditional open cholecystectomy include reduced postoperative

pain, shorter hospital stays, faster recovery, and better cosmetic results.<sup>[2]</sup> Despite the numerous benefits of laparoscopic cholecystectomy, it is not without drawbacks. One of the most significant complications associated with this procedure is the occurrence of bile duct injuries (BDIs).<sup>[3,4]</sup> Bile duct injuries are serious and potentially life-threatening complications, which can lead to significant morbidity, mortality, and increased healthcare costs.<sup>[5,6]</sup> Globally, the incidence rate of bile duct injuries during laparoscopic cholecystectomy is reported to range from 0.3% to 1.5%.<sup>[7]</sup> The Asian prevalence rate is considerably higher compared to the global incidence rate, as Asian race/ethnicity is considered a significant risk factor for bile duct injury.<sup>[8]</sup> However, specific data for Bangladesh is limited. The severity of bile duct injuries can vary significantly, ranging from minor leaks to complete transection of the bile duct.<sup>[5]</sup> The morbidity rate associated with bile duct injuries is considerable, as these injuries often necessitate complex surgical repair and prolonged hospitalization.<sup>[9]</sup> Mortality rates for bile duct injuries have been reported to be as high as 10% in certain cases, depending on the severity of the injury and the patient's overall health.<sup>[10]</sup> Various risk factors have been identified that may predispose patients to bile duct injuries during laparoscopic cholecystectomy. Some of these risk factors include acute cholecystitis, severe inflammation, obesity, and aberrant anatomy.<sup>7</sup> Additionally, surgeon-related factors such as experience and technical skill can also play a role in the occurrence of bile duct injuries.<sup>[11]</sup> This retrospective observational study aims to evaluate the impact of surgical occurrence of bile duct injuries in laparoscopic cholecystectomy in Bangladesh, where the

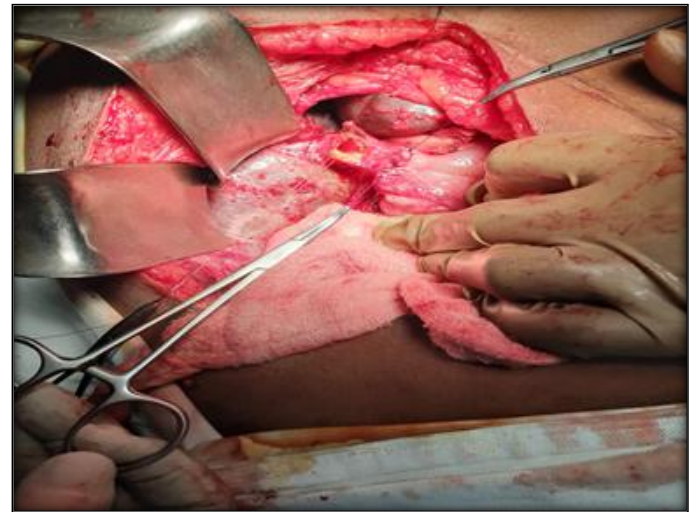
prevalence of gallstone disease is high, and the procedure is widely performed. By understanding the incidence rate, risk factors, and outcomes of bile duct injuries in the local population, this study can provide valuable insights to guide clinical practice and improve patient safety in Bangladesh. In conclusion, laparoscopic cholecystectomy is a widely accepted surgical procedure for treating gallstone disease, with numerous advantages over traditional open cholecystectomy. However, bile duct injuries remain a significant complication associated with the procedure, contributing to substantial morbidity and mortality. This retrospective observational study will assess the impact of bile duct injuries in laparoscopic cholecystectomy in Bangladesh, with the aim of improving surgical outcomes and patient safety in this population.

## MATERIAL AND METHODS



**Image 1:** MRCP image of bile duct injury

This retrospective observational study was conducted at the Department of Hepatobiliary, Pancreatic and Liver Transplant Surgery of the Bangabandhu Sheikh Mujib Medical University, Al-Manar Hospital, and Al-Razi Islamia Hospital, Dhaka, Bangladesh. The study duration was 16 months, from July 2019 to December 2020. During this period, a total of 1255 complete hospital records of laparoscopic cholecystectomy conducted over the last 5 years at the study hospital were selected for the study following inclusion and exclusion criteria. Only completed hospital records of patients and only patients undergoing laparoscopic cholecystectomy were included, regardless of age or gender were included for sample size selection. Incomplete hospital records were excluded from the study. Available variables were recorded from hospital charts and entered into an SPSS database.



**Image 2:** Repairing process of a bile duct injury

## RESULTS

Among the total 3300 cases of laparoscopic cholecystectomy, only 1.64% of the participants had bile duct injury.

**Table 1:** Distribution of BDI cases by cause/mechanism of injury [n=20]

| Cause of Injury                         | n | %      |
|---|---|--------|
| Congenital anomalies                    | 6 | 33.33% |
| Lateral wall injury/laceration          | 3 | 22.22% |
| Thermal injury                          | 4 | 18.52% |
| Transected CBD                          | 3 | 14.81% |
| Clipping of CHD due to mistaken anatomy | 4 | 11.11% |

The most common cause of BDI was clipping or transection of the duct, which accounted for 33.33% of cases, followed by mistaken anatomy (22.22%), ischemic injury due to clip (18.52%), stricture from thermal injury (14.81%), and inadvertent laceration (11.11%).

**Table 2:** Distribution of BDI cases by observed risk factors [n=54].

| Risk Factor                      | n  | %      |
|----------------------------------|----|--------|
| Acute Cholecystitis              | 20 | 37.04% |
| Aberrant anatomy                 | 15 | 27.78% |
| Severe inflammation and adhesion | 12 | 22.22% |
| Obesity                          | 9  | 16.67% |
| Previous Abdominal Surgery       | 6  | 11.11% |
| Cirrhosis                        | 2  | 3.70%  |

The most commonly observed risk factor was acute cholecystitis, accounting for 37.04% of cases, followed by aberrant anatomy (27.78%), severe inflammation (22.22%), obesity (16.67%), previous abdominal surgery (11.11%), and cirrhosis (3.70%).

**Table 3:** Distribution of BDI cases by postoperative treatment method [n=54]

| Treatment Method                           | n  | %      |
|--|----|--------|
| Endoscopic retrograde cholangiography      | 11 | 55.56% |
| Percutaneous trans-hepatic cholangiography | 5  | 22.22% |
| Surgical repair                            | 4  | 18.52% |
| Conservative management                    | 1  | 3.70%  |

Among the 20 cases of BDI, 55.56% of patients received endoscopic retrograde cholangiography, while 22.22% received percutaneous trans-hepatic cholangiography, and 18.52% underwent surgical repair. Only 3.70% of cases were managed conservatively.

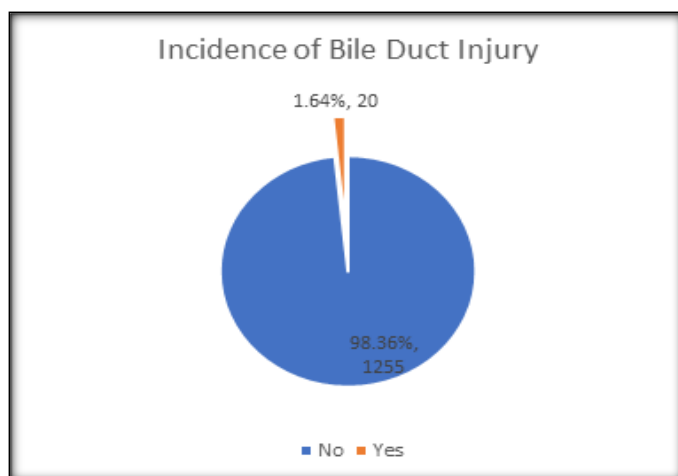
**Table 4:** Distribution of BDI cases by outcome of treatment [n=54]

| Outcome             | n  | %      |
|---------------------|----|--------|
| No Complications    | 14 | 74.07% |
| Minor Complications | 4  | 18.52% |
| Major Complications | 1  | 5.56%  |
| Mortality           | 1  | 1.85%  |

Among the total BDI cases, 74.07% had no complications after treatment, while 18.52% had minor complications, and 5.56% had major complications. Mortality occurred in 1.85% of cases.

## DISCUSSION

The present study analyzed the occurrence of bile duct injury (BDI) in laparoscopic cholecystectomy (LC) among a total of 1255 cases, finding a 1.64% incidence rate. This rate is in line with other global studies, which have reported BDI incidence rates ranging from 0.3% to 1.5%.<sup>[2]</sup> However, this incidence rate is somewhat higher compared to an Italian study, which had an overall incidence of 0.42%.<sup>[10]</sup> In terms of causes of BDI, the present study found that clipping or transection of the duct was the most common cause, accounting for 33.33% of cases. This finding is consistent with the literature, as Davidoff et al., 1992 reported similar rates of clipped or transected ducts as a leading cause of BDI.<sup>[12]</sup> The remaining causes of BDI in this study were also in agreement with the findings reported by Nuzzo et al., 2015, with



**Figure 1:** Incidence rate of Bile Duct Injury (BDI) cases among total participants [N=1255]



mistaken anatomy (22.22%), ischemic injury due to clip (18.52%), stricture from thermal injury (14.81%), and inadvertent laceration (11.11%) being the other major causes.<sup>[10]</sup> The most common risk factor for BDI in the present study was acute cholecystitis (37.04%), followed by aberrant anatomy (27.78%), severe inflammation (22.22%), obesity (16.67%), previous abdominal surgery (11.11%), and cirrhosis (3.70%). These findings align with the risk factors identified by Törnqvist et al. (2016), who also reported acute cholecystitis, aberrant anatomy, and severe inflammation as significant risk factors for BDI.<sup>[2]</sup> However, the present study showed a higher proportion of obesity as a risk factor compared to Törnqvist et al. (2016), possibly indicating a difference in patient demographics.<sup>[2]</sup> Regarding surgical techniques, 83.33% of the BDI cases in this study underwent standard laparoscopic cholecystectomy, while the remaining 16.67% underwent single-incision laparoscopic cholecystectomy. The literature on the specific relationship between surgical technique and BDI is limited, but this finding highlights the need for further investigation to determine whether the type of laparoscopic technique used influences the likelihood of BDI. For the treatment of BDI, the present study found that 55.56% of patients received endoscopic retrograde cholangiography, while 22.22% received percutaneous transhepatic cholangiography, and 18.52% underwent surgical repair. Only 3.70% of cases were managed conservatively. In terms of postoperative outcomes, 74.07% of BDI cases in this study had no complications following treatment, while 18.52% had minor complications, and 5.56% had major complications. Mortality occurred in 1.85% of

cases. These outcomes are generally consistent with the findings of Nuzzo et al. (2005), who reported mortality rates of up to 10% in some cases, depending on the severity of the injury and the patient's overall health.<sup>[10]</sup>

### Limitations of The Study

The study was conducted in comparative a small sample size. So, the results may not represent the whole community.

### CONCLUSIONS

In conclusion, this study contributes valuable insights into the causes, risk factors, treatments, and outcomes of bile duct injuries in laparoscopic cholecystectomy in a Bangladeshi population. Despite the numerous benefits of this procedure, bile duct injuries remain a significant complication. The findings emphasize the importance of meticulous surgical technique, early recognition, and appropriate management of bile duct injuries. By continually refining our understanding of the factors that contribute to bile duct injuries and implementing evidence-based strategies to prevent and manage this complication, we can optimize patient outcomes and ensure the highest standards of care in laparoscopic cholecystectomy.

### Recommendation

Based on the findings of this study, we recommend the following measures to reduce the incidence of bile duct injuries in laparoscopic cholecystectomy and optimize patient outcomes:

1. Enhance surgical training and skill development, with a focus on the prevention, early recognition, and

management of bile duct injuries during laparoscopic cholecystectomy.

2. Promote the use of intraoperative imaging techniques such as intraoperative cholangiography or fluorescence cholangiography to help identify bile duct anatomy and reduce the risk of bile duct injuries.
3. Encourage a multidisciplinary approach to the management of bile duct injuries, involving gastroenterologists, radiologists, and hepatobiliary surgeons to facilitate the delivery of comprehensive and coordinated care.
4. Prioritize patient education and shared decision-making in the management of gallstone disease, ensuring that patients are informed about the potential risks and benefits of laparoscopic cholecystectomy,

including the possibility of bile duct injuries.

5. Implement quality improvement initiatives and establish dedicated bile duct injury registries to monitor patterns and trends in bile duct injury incidence and outcomes, enabling healthcare providers and policymakers to develop targeted interventions to address specific areas of concern.

By adopting these recommendations, healthcare professionals and institutions can work towards minimizing the occurrence of bile duct injuries in laparoscopic cholecystectomy, ultimately enhancing patient safety and improving surgical outcomes in the treatment of gallstone disease.

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