

ORIGINAL ARTICLE

Prevalence of Iatrogenic Bile Duct Injury Following Open and Laparoscopic Cholecystectomy Treatment Outcomes

AREEB AFZAAL¹, MUHAMMAD FAIZAN², ARFA MAHMOOD³, MARIA SHAIKH⁴, POOJAKUMARI⁵¹Senior House Officer, Forensics Medicine, ShaikhZayed Medical and Dental College, Lahore²Medical Officer General Surgery Pak Red Crescent Hospital, Kasur³House Officer, ShaikhZayed Medical and Dental College, Lahore⁴PGT General Surgery, JPMC Hospital, Karachi⁵PGT General Surgery, CMC Hospital, LarkanaCorresponding author: Muhammad Faizan, Email: phaizie@gmail.com, Cell: +92 348 2930341

ABSTRACT

Background and Aim: Iatrogenic bile duct injuries (IBDI) continue to be a difficult diagnostic and therapeutic problem. The prevalence of iatrogenic IBDI increased with the laparoscopic technique introduction for the cholecystolithiasis treatment. The study's objective was to determine the frequency of iatrogenic bile duct injuries (IBDI) following open and laparoscopic cholecystectomy treatment outcomes.

Materials and Methods: This retrospective observational study was carried out on 131 bile duct injuries sustainable patients who underwent laparoscopic cholecystectomy at General Hospital, Lahore for the duration of six months from May 2021 to October 2021. All the patients who satisfied the inclusion criteria were enrolled in this study. Ethical approval and informed consent were taken from the institutional ethical committee and individual respectively. The data outcomes such as time details of laparoscopic cholecystectomy and injuries recognition, injury types, injuries definitive repair time, IBDI management, intraoperative cholangiography use, post-operative complications, laparoscopic cholecystectomy to open cholecystectomy conversion, bile duct injury, morbidity, postoperative outcomes, and mortality rate were recorded. SPSS version 20 was used for data analysis.

Results: A total of 131 referred patients were treated for iatrogenic bile duct injury caused by open cholecystectomy (n = 60), and Laparoscopic cholecystectomy (n = 71). During laparoscopic cholecystectomy, bile duct injuries were identified in only 28 (39.4%) patients. Following the LC conversion to open operation, 50% successive procedures were deemed ineffective. In case of no recognized injury during LC, bile leak/peritonitis was developed in 70% of patients, with nearly half being referred and the remainder underwent various procedures recommended by their surgeon. The rest of the patient's developed and abnormal liver function, jaundice, cholangitis. About 43% of patients underwent IOC, but two-thirds of patients did not have an injury. Laparoscopic cholecystectomy developed bile duct injury was more severe compared to the IBDI in open cholecystectomy. One patient died during definitive repair and 92% of patients were recovered without any complications.

Conclusion: The iatrogenic bile duct injury increasing rate is a major surgical intervention challenge. Multidisciplinary treatment should be followed for iatrogenic bile duct injury prevention and management. Bile duct injury could be effectively treated when suspected and confirmed patients are referred to tertiary care hospitals.

Keywords: Iatrogenic bile duct injuries; Laparoscopic Cholecystectomy; Complications

INTRODUCTION

Iatrogenic bile duct injury (IBDI) is the postoperative complication of various surgical procedures especially open and laparoscopic cholecystectomy significantly affecting the long-term survival, life quality, and increasing the morbidity and mortality rate [1]. The prevalence of iatrogenic bile duct injury increases in laparoscopic cholecystectomy despite the surgeon's expertise and skills enhancement regarding laparoscopy [2]. The incidence of bile leaks and injuries ranges 0.1-0.5% and 3% for open and laparoscopic cholecystectomy respectively [3-5]. Currently, laparoscopic cholecystectomy is a common surgical procedure for cholecystolithiasis. Laparoscopic cholecystectomy was performed in 70% of the cholecystolithiasis patients with 70 million reported cases in the United State [6]. The bile duct injury incidence rate becomes double after open and laparoscopic cholecystectomy which was reported 0.8% to 2.2% [7]. IBDI during cholecystectomy is influenced by a number of factors. According to the previous studies [8].

Intraoperative cholangiography (IOC) utilization could reduce the IBDI incidence and severity. Age, disease severity, gender, and hospital and surgeon characteristics are also thought to influence the risk of IBDI [9]. Injuries can range from minor to severe. Besides the bile duct minor leakage comes from cystic stumps, aberrant duct or main bile duct, main duct or branch complete occlusion is possible. Furthermore, leakages from biliary and bile stricture can cause serious complications following laparoscopic cholecystectomy. Prolong hospitalization, mortality, and a higher rate of morbidity are associated with bile duct injury [10]. Nowadays iatrogenic bile duct injury is commonly treated with endoscopic techniques such as drainage of nasobiliary, biliary stent placement, and sphincterotomy [11]. The biliary tract extravasation can be reduced with transpapillary flow improvement and reducing pressure gradient of transpapillary utilizing endoscopic therapy. Direct surgical repair or reconstruction could be avoided for duct lesion healing by reducing leakage from bile. On contrary, surgical intervention is advised for severe iatrogenic bile duct injury such as common bile duct

complete dissection[12]. Hepatoduodenal ligament complications and bile duct injuries could be reduced and controlled by the collaboration of experienced and skilled gastroenterologists, radiologists, and hepatobiliary surgeons.

MATERIALS AND METHODS

This retrospective observational study was carried out on 131 bile duct injury sustainable patients who underwent laparoscopic cholecystectomy at General Hospital, Lahore for the duration of six months from May 2021 to October 2021. All the patients who satisfied the inclusion criteria were enrolled in this study. Ethical approval and informed consent were taken from the institutional ethical committee and individual respectively. The data outcomes such as time details of laparoscopic cholecystectomy and injuries recognition, injury types, injuries definitive repair time, IBDI management, intraoperative cholangiography use, post-operative complications, laparoscopic cholecystectomy to open cholecystectomy conversion, bile duct injury, morbidity, postoperative outcomes, and mortality rate were recorded. The postoperative outcomes of a group of postoperative LC patients with sustainable injury were all examined. Long-term outcomes were assessed using liver functionality tests, clinical symptoms and patients were contacted directly for any symptoms since their previous assessment.

The bile duct injuries were categorized into different groups based on Strasberg classification. Cystic duct sump bile leak known as type A is not involved in bile duct injury. The abnormal hepatic duct of the right side is the most common biliary tree branch known as occlusion or type B, whereas type C injury is irrelevant bile duct leakage. Type D injury is extra-hepatic bile duct lateral injury. Type E injury is characterized by the duodenum and lower duct separation from liver parenchyma as well as a convoluted injury to the extra hepatic ducts. Type E various injuries resulted in fistula instead of occlusion were considered as diagrammatic representation. Additional hepatic artery injury/occlusion was recorded but not classified separately. In order to compare the severity of sustained injuries during LC and open cholecystectomy were classified. Difference in both groups injury severity was evaluated with Fisher's exact test.

RESULTS

A total of 131 referred patients were treated for iatrogenic bile duct injury caused by open cholecystectomy (n = 60), and Laparoscopic cholecystectomy (n = 71). During laparoscopic cholecystectomy, bile duct injuries were identified in only 28 (39.4%) patients. Following the LC conversion to open operation, 50% successive procedures were deemed ineffective. In case of no recognized injury during LC, bile leak/peritonitis developed in 70% of patients, with nearly half being referred and the remainder underwent various procedures recommended by their surgeon. The rest of the patient's developed and abnormal liver function, jaundice, cholangitis. About 43% of patients underwent IOC, but two-thirds of patients did not have an injury. Laparoscopic cholecystectomy developed bile duct injury was more severe compared to the IBDI in open cholecystectomy. One patient died during definitive repair

and 92% of patients were recovered without any complications.

The prevalence of recognized bile duct injury during laparoscopic and open cholecystectomy was 28 (39.4%) and 23 (38.3%) respectively as shown in Figure 1. Of the remaining laparoscopic cholecystectomy 43 (60.6%) patients, The frequency of LC patients where Laparoscopic suture done in two patients, 26 patients were LC to open operation converted while 15 patients underwent various procedures as follows; I. A tube was placed in one patient with the divided proximal duct. II. A T-tube was inserted in two patients with persistent bile leak referred at intervals of 4, 7, and 28 days. III. Anastomosis (duct to duct) was carried out in 9 patients where 5 patients have referred at 8-48 days intervals for continuing leakage of the bile duct and 4 patients recovered. IV. Three patients were repaired utilizing Roux-en-Y biliary. Table 1 shows the intraoperative cholangiography (IOC) utilization in laparoscopic cholecystectomy. During laparoscopic cholecystectomy, the prevalence of bile duct injury with IOC was 26.8% compared to the IBDI without IOC 33.8% as shown in Figure 2. Patient operated with seven IOC procedures had no injury based on diagnosis and procedures, on the other hand, unrecognized injuries revealed and imply that 60.6% of injury sustained cases should have been diagnosed utilizing IOC.

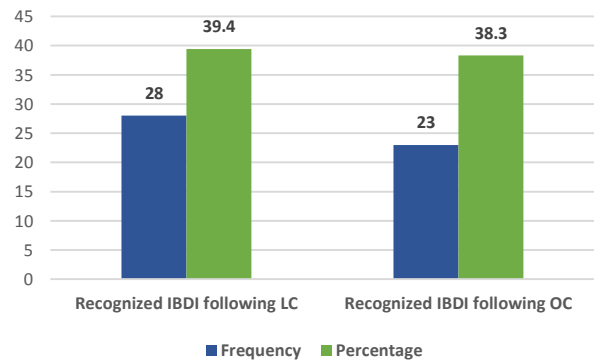


Figure 1: Prevalence of recognized bile duct injury in LC (n=71) and Open cholecystectomy (OC) (n=60).

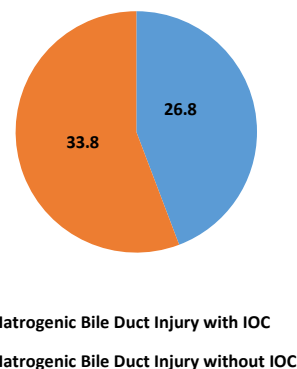


Figure 2: Prevalence of bile duct injury with and without intraoperative cholangiography (IOC)

Table 1: The intraoperative cholangiography (IOC) utilization in laparoscopic cholecystectomy

Status of intraoperative cholangiography (IOC)	Recognized IBDI in LC (28)	Unrecognized IBDI in LC (43)
Yes	9	17
No	12	23
Unknown	7	3

DISCUSSION

Laparoscopic cholecystectomy was widely introduced and accepted before the evaluation of its efficacy and safety. The advantages of LC over open cholecystectomy are now well established, and it has become calculous gallbladder disease standard treatment. In the early 1990s, studies found that open cholecystectomy resulted in bile duct injury higher rate than laparoscopic cholecystectomy [13, 14]. Beyond the learning curve, the rate of iatrogenic bile duct injury following laparoscopic cholecystectomy was expected to be reduced but still, it gives a 0.3-0.7% higher rate than 0.125% in open cholecystectomy [15]. A previous study found that the laparoscopic cholecystectomy sustained injuries had more severity compared to open cholecystectomy as demonstrated in the current study as well [16]. The bile duct injuries patient's outcomes have been significantly influenced by the occlusion of concomitant hepatic surgery [17]. Parrilla et al. [18] reported that both hepatic artery and bile duct injuries combined accounts for 57% liver necrosis and 50% bile duct failed in anastomoses whereas occlusion in hepatic artery both groups had null complications. Of iatrogenic bile duct injuries' major causes, biliary tract incorrect identification is the prominent cause that accounts for 70% to 80% of cases of biliary complications [19]. Despite some evolution in perspectives on the "Calot's triangle," the assumptions remain constant. Proper orientation and safe treatment of insight structure can be seen with the help of suitable segmentation of cystic duct, liver edge, and hepatic duct space.

Despite the fact that they are not highly suggestive, the surgeon should be attentive for clinical signs like nausea, increased body temperature, and abdominal pain during the postoperative period. The clinical picture is completed by bile leak through the drain (severing the bile outflow tract) and/or jaundice (occlusion of the main biliary tract) confirmed in imaging examinations and blood chemistry. According to reports, the laparoscopic bile duct injury incidence ranges between 0% and 1% [20]. More recently a single-center cohorts have frequently demonstrated local expertise and thus report a lower rate but UK based study has reported higher rate of laparoscopic bile duct injury 1.2% [21].

The postoperative laparoscopic cholecystectomy bile duct injury pattern seems more severe than that observed following open cholecystectomy, where predominated injuries were minor injuries [22]. Major injuries account for 39% of the total (28 of 71), according to the proposed classification system. However, the minor ductal trauma incidence rate was 38.3% as higher than in previous studies, implying a more thorough screening. Although no proper classification of IBDI exists, numerous attempts have been made to define the underlying mechanisms by categorizing bile duct injuries.

The increased occurrence of minor injuries changed the whole pattern of observed injuries. Most injuries were previously thought to be 'classical' or 'variant classical,' as first described by Mungai et al [23].

Defensive cholecystectomy was the term used for reducing the bile duct injuries major risks during open cholecystectomy. In the present study, the operative surgeon somehow lost the bile duct injury location which signifies the importance of injuries types and sites. Bansal et al [24] reported that Rouviere's sulcus ventral dissection was a prerequisite landmark for hepatobiliary triangle dissection. The quadrate lobe and segment IV are other useful landmarks. The extra-hepatic course of the left hepatic duct travels through the segment IV base to juncture the right hepatic duct nearest to the gallbladder fossa inferior body. During dissection, the operative telescope is mandatory for dissection close view. In the era of open to laparoscopic cholecystectomy, Proponents of the IOC [25], and against the IOC [26] make compelling arguments to sustainance their cases. Prior to IOC, careful dissection anatomical delineation could be used without considering IOC as a substitute.

Despite all the efforts, avoiding bile duct injury is critical and should be identified then treated as soon as possible. Early injury recognition and optimum reparation can ease the consequences and severity of such injury, and the outcome is improved upon the sighting of injury during procedure rather than later [26]. Post identification of laparoscopic cholecystectomy injuries, surgeon critical advice regarding drain insertion or immediate patch-up is important. In most of the cases, surgeon take impetuous decision exacerbating an already precarious condition and increase complexity in repairing surgery. Long-term obstruction and infection can lead to liver abscesses. On rare occasions, cholangitis without a stricture can be linked to Roux-en-Y biliary anastomosis [27]. Long-term biliary-enteric anastomosis may be carcinogenic, and patients who underwent biliary-enteric anastomosis might have late bile duct cancer for an iatrogenic bile duct injury many years ago [28].

CONCLUSION

The iatrogenic bile duct injury increasing rate is a major surgical intervention challenge. Multidisciplinary treatment should be followed for iatrogenic bile duct injury prevention and management. Bile duct injury could be effectively treated when suspected and confirmed patients are referred to tertiary care hospitals.

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