



The Management of Gallbladder and Extrahepatic Biliary Duct Injuries

 Mikail Çakır,  Okan Murat Aktürk

Department of General Surgery, University of Health Sciences Turkey, Haseki Health Application and Research Center, Istanbul, Turkey

Abstract

Introduction: Injury of the biliary system is rare. They can be divided into traumatic biliary injuries and iatrogenic biliary injuries. In this study, extrahepatic bile duct and gall bladder injuries and treatment methods and complications were reviewed in the general surgery clinic.

Methods: The files of the patients who were operated in the general surgery service of our hospital for extra-hepatic bile ducts and gallbladder trauma were examined in a retrospective cohort study. In addition to iatrogenic and traumatic injuries of the gallbladder, traumatic and iatrogenic injuries due to ERCP, laparoscopic interventions, Bismuth Strasberg classifications, repairs and complications of these injuries were examined.

Results: A total of 13 non-hepatic biliary injuries were detected, four of which were in the gallbladder. 75% (3/4) of gallbladder injuries arose from abdominal trauma. The leading cause of common hepatic canal and choledochal injuries was iatrogenic. These injuries may occur during ERCP or cholecystectomy. In iatrogenic biliary tract injuries, 80% primary repair and drain placement were performed without a major complication.

Discussion and Conclusion: The vast majority of gallbladder injuries are due to abdominal trauma. They are most commonly seen in piercing and firearm injuries. The most common cause of non-liver biliary tract injuries is iatrogenic injuries. Traumatic injuries of the common hepatic canal and the choledochus are rare and rarely represent in isolation.

Keywords: Biliary ductus injury; choledochal trauma; gallbladder injury.

Bile duct injuries (BDI) occur in a wide range of clinical settings and necessitate a multidisciplinary treatment comprising of surgery, endoscopy and interventional radiology to properly manage this complex disease^[1]. Injuries of the biliary system are uncommon and may be categorized as traumatic and iatrogenic injuries. Traumatic injuries are associated with blunt or penetrating abdominal trauma, while the iatrogenic injuries arise from surgical, endoscopic or radiological invasive diagnostic and therapeutic procedures, happening more often than traumatic

injuries^[2]. BDI during laparoscopic cholecystectomy is reported to be two-folds more frequent than the open procedure (0.3% open vs 0.6% laparoscopic)^[3]. Accidental traumas are responsible only for 1–5% of the total number of biliary injuries^[4]. BDI may have severe consequences, such as early complications, which can be life-threatening and the probability of a delayed stricture formation^[5].

The primary aim of this study is to evaluate patients with extrahepatic biliary duct traumas considering etiology and treatment.

Correspondence (İletişim): Okan Murat Aktürk, M.D. Istanbul Sağlık Uygulama ve Araştırma Merkezi, Sağlık Bilimleri Üniversitesi, Genel Cerrahi Kliniği, İstanbul, Turkey

Phone (Telefon): +90 532 320 69 83 **E-mail (E-posta):** omakturk@gmail.com

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Materials and Methods

This study was conducted between January 2017 to February 2020 as a retrospective cohort study. All patients who underwent surgery because of the gallbladder and extrahepatic bile duct injury were included in this study. Patient charts were reviewed regarding peri-operative complications as morbidity and mortality within 30 days. In addition to standard demographics, the type of cholecystectomy, the rate of intra-operative BDI recognition, the reconstruction, the severity of BDI and concomitant vascular and organ injuries were also recorded. The complications were described concerning 30-day mortality and morbidity according to the Clavien-Dindo grading system of surgical complications. The Bismuth-Strasberg (BS) classification was utilized as a tool to decide the best intervention when it was applicable (Fig. 1).

The permission was granted by the local ethics committee with the number of 9/01/2020/20.

Results

A total of 13 patients were found to have gallbladder and extrahepatic biliary duct injuries. Gallbladder injuries comprised four (31%) of the patients, while choledochal and common hepatic duct injuries made up the rest (nine patients, 69%). Of the gallbladder injuries three (75%) injuries arose from penetrating trauma, while one (25%) injury was iatrogenic (Table 1). There were two cases of external bil-

iary ductus trauma that took place during the ERCP procedure (Table 2). The mean age of iatrogenic choledochal injury patients was 51±6.48. The majority (80%, 4 in 5) were small choledochal injuries of a few millimeters in the extrahepatic bile duct and repaired by simple closure and drain replacement. A larger defect that occurred during the open cholecystectomy was repaired by T-tube drainage. The characteristics of two non-iatrogenic trauma injuries to the extrahepatic bile duct are given in Table 3.

Discussion

Gallbladder injury is uncommon and occurs in approximately 2% of cases of blunt abdominal trauma^[6]. Gallbladder injuries are rarely found in isolation and are mostly accompanied by liver injuries, as well as other abdominal organ injuries^[7]. The majority of the four gallbladder injuries were traumatic (75%). The main reason for trauma was stab wounds in two cases (50%) and a gunshot wound in one case (25%). Among our patients, none occurred as a result of blunt trauma, penetrating trauma being the main etiologic factor. This is in line with a study by Ball et al.,^[8] in their study, they found out that the major reason for gallbladder injury was penetrating trauma in 89% of the cases and associated injuries were almost always present (98%), and sometimes, the patients are hemodynamically unstable at presentation.

One gunshot patient had multiple organ injuries, including liver and major arterial systems. He was hemodynamically

Type	Description
A	Bile leak from the cystic duct or liver bed.
B	Occlusion of the right segmental duct.
C	Bile leak from the divided right segmental duct.
D	Lateral injury to the common hepatic duct.
E1	Common hepatic duct injury, >2 cm from the primary confluence.
E2	Common hepatic duct injury, <2 cm from the primary confluence.
E3	Injury at the hilum, the confluence is intact.
E4	Injury at the hilum, confluence separated.
E5	Combined injury to the main bile duct and right segmental bile duct.

Figure 1. Strasberg-Bismuth classification of bile duct injury.

Age (years)	Sex	Etiology	Complication
26	Male	Stab wound	Wound infection, grade 1*
37	Male	Gunshot	Grade 5*
29	Male	Stab wound	None
53	Male	Iatrogenic	None

*Clavien-Dindo Grading System of Surgical Complications.

Age	Sex	Injury Type	Intervention	Complication
53	Female	BS type D	Repair on T-tube	None
82	Male	BS type D	Conservative	Grade 4b*

BS: Bismuth-Strasberg Classification; *Clavien-Dindo Grading System of Surgical Complications.

Age	Sex	Etiology	Type	Intervention	Complication
29	Male	Blunt trauma	BS type E1	Repair on T-tube	Prolonged hospital stay associated with duodenal and liver trauma Grade 4b*
24	Male	Stab wound	BS type D	Repair on T-tube	None

BS: Bismuth-Strasberg Classification; *Clavien-Dindo Grading System of Surgical Complications.

instable at admission and lost his life due to associated vascular damage in the first hours following admission. Likewise, mortality is almost always associated with the accompanying organ injuries and wounds^[8,9]. As in the case of a male patient with peritoneal carcinomatosis, ileostomy procedure was accompanied by gallbladder resection due to iatrogenic injuries to the bladder caused by extensive adhesions.

Endoscopic retrograde cholangiopancreatography (ERCP) is a common procedure which has a wide range of usages, such as diagnostic procedures cholangiopancreatography, biopsy, or brush cytology, and is an important intervention in the treatment of choledocholithiasis, bile duct leak, and the palliation of malignant obstructive jaundice, choledochal strictures, stones, and pancreatic duct leaks^[10]. This procedure is also of grave importance in the management of bile duct injuries^[11]. ERCP and sphincterotomy have proven to be effective and safe methods for common use for the bile duct stone extraction, and by the increase in experience, the procedure goes with a high success rate with low complications. Although duodenal and biliary perforations occur at a lower rate of 0.6%, mostly related to sphincterotomy, they carry the highest mortality rates among ERCP complications^[12]. However, ERCP may have relative contraindications and limitations, such as the presence of multiple intrahepatic stones, stones >1.5 cm, the presence of a nondilated CBD, or concomitant duct stenosis. In these circumstances, a surgical approach will be required^[13].

In two patients, biliary duct complications related to ERCP were observed. One of them corresponded to Bismuth-Strasberg D injuries as diagnosed in open surgery and suspicion of bile leak at the time of procedure led to surgical exploration. There was a difficulty in cannulation, and the patient had multiple impacted large stones. Later, it was handled by T-tube repair with no complications. The other patient was an octogenarian with malignant obstruction of the common bile duct. Biliary duct complications are as common as duodenal complications, but unlike the duodenal complications, biliary complications may be managed conservatively in most of the cases^[14].

Extrahepatic biliary tract injuries occur in 3% to 5% of all abdominal trauma patients, with 85% resulting from penetrating wounds. Of the remaining 15%, resulting from blunt trauma, the vast majority, 85%, involve only the gallbladder; thus, biliary tract injuries arising from blunt trauma are rare^[15]. Most lesions of extrahepatic bile ducts arise from penetrating trauma. Ductal injury often localizes at one of

three anatomic sites: the origin of the left hepatic duct, the bifurcation of the hepatic ducts, or the pancreaticoduodenal junction^[16].

A young male patient experienced blunt abdominal trauma because of a motorcycle accident. The patient underwent operation because of intraabdominal hemorrhage. Multiple grade 3 lacerations on the liver, right gonadal vein, (the kidney intact) multiple lacerations in the small intestine, full laceration on the second part of the duodenum and more than 50% laceration of the bile duct were present.

The other patient was a young male victim of a stab wound in which he suffered from a minor liver laceration, and bile duct leakage was observed in laparoscopic evaluation. T-tube drainage has been employed successfully for the repair of biliary duct regardless of the trauma etiology.

Laparoscopic cholecystectomy is one of the most frequently performed procedures worldwide in general surgery and bile duct injury is the most serious complication of LC. Misidentification of the biliary system is the major cause of biliary injuries^[18]. The rate of bile duct injury secondary to laparoscopic cholecystectomy is reported to be between 0.2 to 0.9%^[19]. The first successful choledocholithotomy was performed by Robert Abbe of New York in 1889 in a patient who had significant jaundice^[20]. The choledochotomy was popularized as a routine procedure by Hans Kehr, who introduced T tube for intraductal drainage, which is still in use today^[21].

For the last century, T tube drainage of the bile duct has remained standard practice following choledocholithotomy^[22]. Placement of a T-tube for biliary decompression is a well-established surgical method done for controlling bile flow and pressure in the CBD and minimizing the post-operative bile leakage through the suture line until the swelling and edema at the ampulla of Vater to subside after CBD exploration^[23].

The biliary tract injuries during cholecystectomy were all injuries that occurred because of excessive traction and dissection. One was on the located right below the common hepatic ductus (BS E2 type), and the rest were in the common bile duct in the lower part than the cystic duct. Four (80%) of them were corrected by simply primary suturing, while the one that occurred in open cholecystectomy was repaired by T-tube placement. Intraoperative diagnosis, which brings, immediate repair has the best outcomes^[24]. Primary closure has gained popularity, especially through laparoscopic interventions^[25].

Conclusion

The majority of gallbladder traumas are penetrating traumas. The mortality arises from associated traumas with the gallbladder. Extrahepatic biliary duct trauma is mainly because of iatrogenic causes. When recognized during the operation or intervention, the majority of these defects can be repaired by simple closure or primary closure with T-tube application. The disease may be mortal, especially because of associated morbidities.

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