

Cholecystectomy related bile duct and vasculobiliary injuries

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Abstract:

B a c k g r o u n d : To determine whether surgical residency training has influenced the occurrence of common bile duct injuries during laparoscopic cholecystectomy, and to assess the anatomic and technical details of bile duct injuries from the practices of surgeons trained in laparoscopic cholecystectomy after residency versus surgeons trained in laparoscopic cholecystectomy during residency.

M e t h o d s : This was a retrospective study of BDI following cholecystectomy managed in the department of surgery, Al-Hussein Teaching Hospital, from March 2018 to November 2022. The clinical data, severity of BDI, preoperative management, operative management and postoperative outcomes were analyzed. All the cases of BDI following cholecystectomy either open or laparoscopic for cholelithiasis were included in this study.

R e s u l t s : VBIs represent serious and challenging surgical complications and this study finds that acute cholecystitis, hospital type, experience and education level of surgeon are the most significant risk factors in selective set of logistic regression models.

Conclusion: Bile duct injury with intact continuity of the duct can be successfully managed with endoscopic stenting of the biliary tree. Intraoperative diagnosis of bile injury and immediate surgical management has good outcome. Similarly, bile duct injury diagnosed after 7 days of surgery can be managed with roux en-y hepatojejunostomy with Hepp- Cauinaud approach after 6 weeks of index surgery following resolution of inflammation with good long term outcome.

Key words: Bile duct, BDI, VBIs, cholecystectomy.

Introduction:

Laparoscopic cholecystectomy (LC) is the procedure of choice for symptomatic cholelithiasis, but is associated with a higher incidence of iatrogenic bile duct injuries than the open procedure [1,2]. Vasculobiliary injury (VBI), defined as bile duct, hepatic artery and/or portal vein injury, has been recognized as one of the most severe complications after cholecystectomy that may result in various degrees of hepatic ischemia with subsequent liver necrosis, abscess formation, acute liver failure or secondary biliary cirrhosis. [3-5]. Biliary tree anomalies present in up to 25% of patients [6], and may lead to anatomical misidentification and technical problems that

contribute to the development of these injuries. The management of VBI depends considerably on development of biliary ischemia and hepatic infarction, necessitating in some cases hepatectomy or even urgent liver transplantation [7]. However, the best treatment strategy and timing of surgical repair when there is a VBI is still controversial. Here we present a management of VBI after LC. The presented case emphasizes the need for prompt and adequate management of patients with VBI in order to avoid life-threatening complications.

Bile duct injury (BDI) is a serious complication of cholecystectomy, arising in 0.2–0.3 per cent of patients undergoing an open procedure (8) and 0.5 per cent of those undergoing laparoscopic surgery (9). Concomitant vasculobiliary injuries (VBIs) are present in 12–61 per cent of these patients^{5 – 17}. Isolated vascular injuries (mostly to the right hepatic artery) are usually uncomplicated in otherwise healthy patients^{18,19}, and discovered only as incidental findings at autopsy¹⁰. However, hepatic artery flow disruption presents a significant problem with BDI repair or reconstruction owing to relative duct ischaemia¹⁰. This study examined medium- to long-term outcomes following referral of VBI to a tertiary centre.

Biliary injury is the most common severe complication of cholecystectomy. Iatrogenic bile duct injury had been well recognized by 1920⁽¹¹⁾ and the introduction of laparoscopic cholecystectomy led to a sharp rise in its incidence.⁽¹²⁾ Biliary injuries are commonly associated with vascular injuries, especially arterial injuries.⁽¹³⁾ In 1948, Shapiro and Robillard theorized that arterial injury might induce biliary ischaemia and thereby worsen a biliary injury.⁽¹⁴⁾ The first actual description of an arterial injury leading to the failure of a biliary repair was provided by ⁽¹⁵⁾ In 1994, Madariaga et al. described a patient in whom the biliary injury seemed to potentiate hepatic ischaemia induced by an arterial injury.⁶ Thus, a second concept began to emerge: namely, that a biliary injury, which disrupted collateral arteries running along the biliary tree, could exacerbate hepatic ischaemia caused by an arterial injury. Although biliary and vascular injuries frequently occur together, there has been no overview of this subject in the literature and important issues remain unresolved. These include the effect of vascular injuries on the outcome of biliary repairs, and the advisability and timing of vascular and biliary repairs when there is a vasculobiliary injury (VBI).

Pathogenesis of the ‘classical’ injury :

1. The common bile duct is mistaken as the cystic duct and is clipped and divided.
2. The dissection is carried up along the left side of the common hepatic duct in the belief that This is the underside of the gallbladder.
3. The common hepatic duct is transected as the surgeon tries to dissect what he believes is

The gallbladder from the liver bed. If the structure is recognized as a bile duct at this point, it is often thought to be a second cystic duct or an accessory duct. As the common hepatic duct is divided, the right hepatic artery is often injured.⁽¹⁶⁾

Patients and methods:

This was a retrospective study of BDI following cholecystectomy managed in the department of surgery, Al-Hussein Teaching Hospital, from March 2018 to November 2022. The clinical data, severity of BDI, preoperative management, operative management and postoperative outcomes were analyzed. All the cases of BDI following cholecystectomy either open or laparoscopic for cholelithiasis were included in this study. The necessary ethical approval has been obtained prior to initiate this study.

The BDI was classified as per the Strasberg classification (3) and operative repair of Roux-en-Y hepato-jejunostomy as per the Heppcouinaud (17) approach. We analyzed the follow up data from five months to 37 months for clinical outcomes, liver function test (LFT) and abdominal sonography.

Results:

Thirty five patients had been referred to department of surgery, Al-Hussein Teaching Hospital, During the same period 96 patients had undergone cholecystectomy in Gastroenterology, in this group five out 96 (0.58%) patient had a biliary injury type (A) according to Strasberg et al classification 6 which showed in figure 1. All of them after laparoscopic cholecystectomy, three of them were males and two were females, two of them were managed conservatively, and the other two with Endoscopic Retrograde Cholangiopancreatography (ERCP). The last one was managed with percutaneous drainage under sonography guidance and all stabilized on follow up.

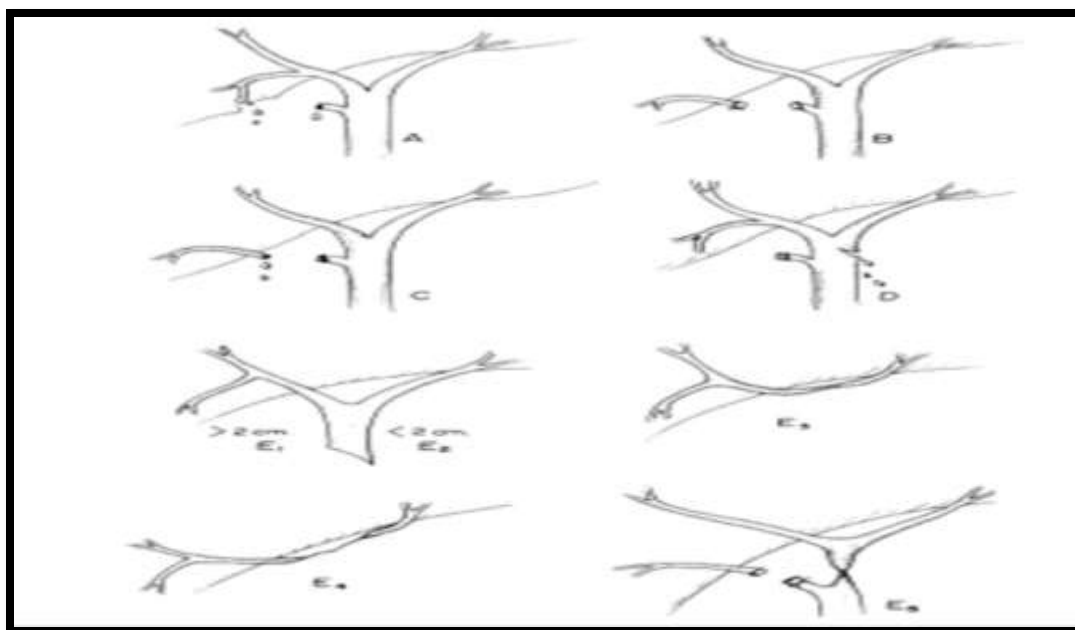


Fig. 1. Classification of open & laparoscopic injuries to the biliary tract. by permission from Strasberg et al.,

Table 1 Shows general patient risk factors in both groups

General Patient Factors		Case (35)
Age		21.76
Gender	Male	19 (17%)
	Female	16 (14 %)
Comorbidity	None	21 (83%)
	Hypertension	4 (9%)
	DM	0 (0%)
	IHD	1 (1%)
	others	3 (5.0%)
smoking	Non	26(87%)
	Smoker	9 (6 %)
Alcohol	Non	3 (95%)
	Present	0

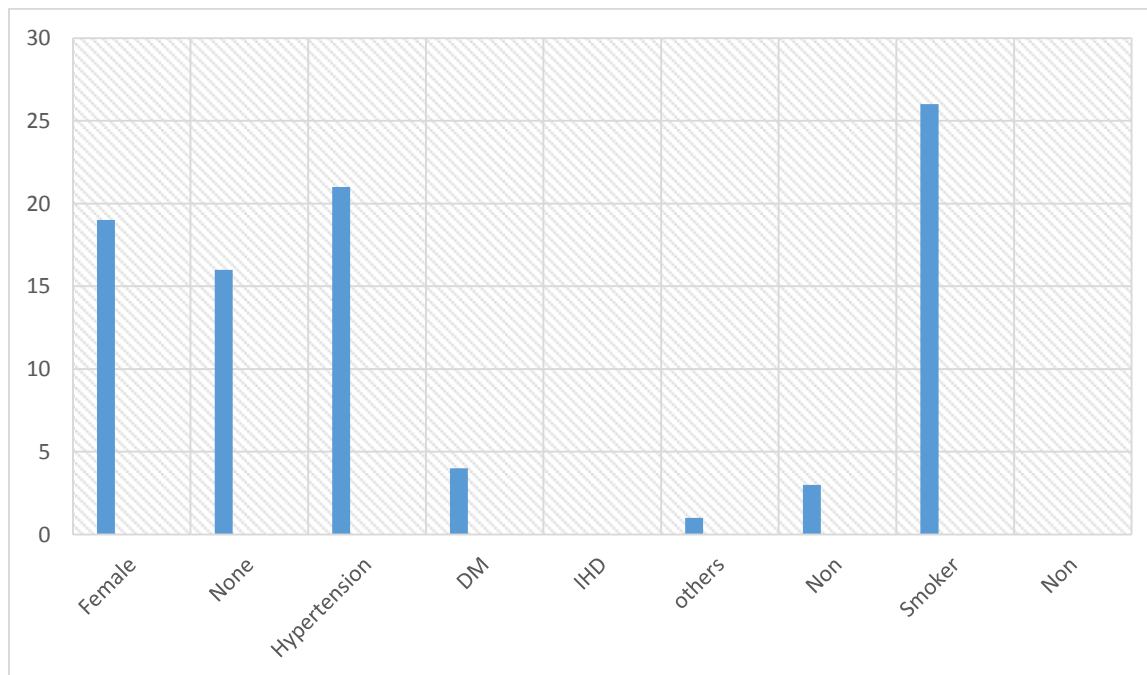
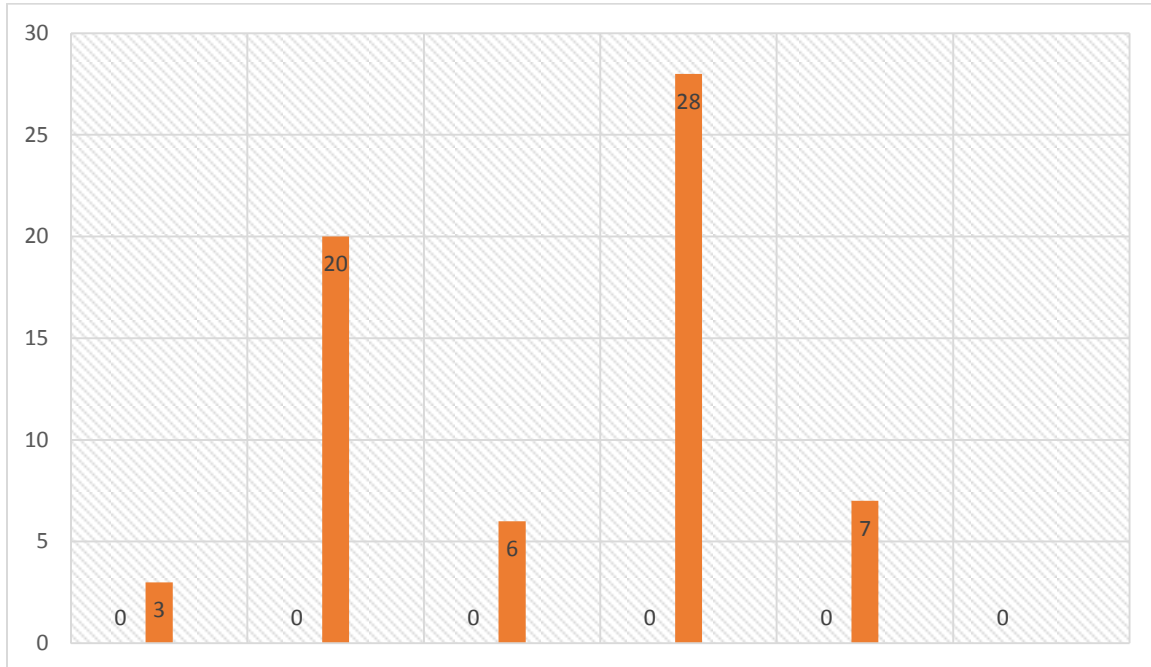
**Fig.2.** show the general patient risk factors

Table 2 Shows local patient risk factors in both groups

Local Patient Factors		Case (35)
Biliary&vascular Anomaly	Non	32 (96%)
	Present	3 (4 %)
Previous Laparotomy	No	20(83%)
	yes	6(17%)
Surgery done on	Acute cholecystitis	28 (73%)
	Chronic cholecystitis	7 (27%)

**Fig.3.** show the local patient risk factors

Indications for referral are listed in Table 1,2. The most common type of biliary injury was Strasberg 35 patients (29 per cent), 16 patients had disruption of the right hepatic artery, three had disruption of the common hepatic artery, and one patient had a pseudoaneurysm of the right hepatic artery; in one patient there was combined right hepatic artery resection with a portal venous injury. The latter was repaired primarily on site before referral, with a surgical drain to the divided hepatic duct followed by a delayed hepaticojejunostomy because of concern that hepatic duct ischaemia would compromise immediate biliary repair.

Discussion:

A VBI as an injury of a bile duct and adjacent vascular structures is mainly caused by operative trauma during cholecystectomy. Injuries to the bile duct and liver vessels may occur due to mistakes in dissection, so their identification and careful dissection around the neck of the gallbladder is the best way to avoid them. Common bile duct or aberrant right hepatic ducts are most often misidentified as the cystic duct. The most dangerous biliary anomaly is the cystic duct that runs along the side of a low-lying aberrant right segmental duct. (18).

It had been found that surgeon experience, education level, cholecystectomy being done in acute phase and hospital type where cholecystectomy performed are the most significant factors of less than 0.05 in our thesis and in comparison to other thesis like (19-21) we found that the high rate of VBI injury was due to inexperience in the procedure. Also the incidence of injury when laparoscopic cholecystectomy is performed for acute cholecystitis was reported to be three times higher than that for elective laparoscopic cholecystectomy and twice as high as for open cholecystectomy for acute cholecystitis, and in reserch the relative risk for acute cholecystitis in laparoscopic and open cholecystectomy (22)

Also in (23) he found that the risk of VBIs is 3.5 times higher in those with acute inflammation, but it was considered as independent risk factor.

Early reports of laparoscopic VBIs cited that bleeding and subsequent attempts to achieve hemostasis are major contributing factors to bile duct injury.(23)

Relatively low rate of re-stricture and good outcome following hepaticojejunostomy in our series may be due to our policy of delayed repair, mucosa to mucosa anastomosis and hepp-couinaud approach. Studies show, aminimum period of 4-6 weeks between injury and repair isdesirable for resolution of tissue edema and inflammationand for dilatation of the proximal ductal system.(24-26) Also, end-to-side hepaticojejunostomy, mucosa-to-mucosa, tension-free anastomosis between the well vascularized proximal bile ducts and the jejunum using Hepp-Couinaud technique produces a wide anastomosis and decreases the risk of devascularization of the ducts.(27,29)

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