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ORIGINAL ARTICLE

BILE DUCT INJURIES ASSOCIATED WITH LAPAROSCOPIC AND OPEN CHOLECYSTECTOMY: SINGLE CENTER EXPERIENCE

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Abstract

Aim: To summarize the experience in diagnosis, and management of iatrogenic bile duct injuries (IBDI).

Methods: Forty patients with IBDI were included in this study, were managed from January 2008 to January 2011 at Al-Zahraa University Hospital. Demographic data, clinical presentation, immediate and long-term results of surgical repair are analyzed from a prospective database.

Results: Only 12.5% of injuries are recognized during operation, while the remaining 87.5% of patients were diagnosed postoperatively. According to Strasberg, (1995) classification 20% of patients type A, while 77.5% of patients were type E1, E2, and 2.5% of patients were type E3. All type A injuries were treated endoscopically with 100% success rate. Type E1, type E2 and type E3 underwent repair by a Roux-en γ hepatico jejunostomy (HJ). Long-term follow-up revealed one case (3.1%) with anastomotic stricture, which was managed by refashioning of the site of anastomosis HJ from end-to-side HJ to side-to-side anastomosis left duct approach.

Conclusion: (i) Minor bile duct injuries can be well treated by endoscopic techniques, (ii) Major injuries of bile ducts require operative intervention after good and adequate preparation, (iii) Raux-en-Y HJ is the gold standard operation for these major bile duct injuries. So, it imperative for this operation to be in the surgical armamentarium of any biliary surgeon, (iv) Junior surgeons should be acquainted with OC as well LC to avoid many injuries in difficult OC.

Keywords: Bile duct stricture, bile leak; hepaticojejunostomy.

INTRODUCTION

Gallstone disease is common all over the world. Cholecystectomy is the treatment of choice for symptomatic gall stones.[1] Langenbuch[2] performed the first open cholecystectomy (OC) in 1882, and it remained the gold standard for the treatment of cholelithiasis. Laparoscopic cholecystectomy (LC) in the late 1980 has replaced OC as the gold standard for surgical treatment of benign gallbladder disease. Despite the advantages of LC over OC, the incidence of IBDI, which is the most common and serious complication during LC, has increased from 0.2% to 0.7% compared with 0.1% to 0.4% during OC.[3] Bile duct injury (BDI) following cholecystectomy is an iatrogenic catastrophe associated with significant morbidity and mortality, reducing long-term survival and quality of life, and high rates of subsequent litigation.[4]

Recognition and proper diagnosis of bile duct injuries is advantageous in preventing serious complications and obtaining high repair success rates. Unfortunately, most

bile duct injuries are not recognized intraoperatively, and most patients are sent home immediately after or within the first few days. However, it is stressed that progressive vague abdominal symptoms should be evaluated for a bile duct injury. There are 2 general types of injuries-namely biliary obstructions and bile leaks and sometimes both can occur simultaneously. In addition, to bile duct injury, concomitant vascular injuries are often present, and resultant ischemia can more complicate matters, especially if immediate repair is performed and the vascular injury goes unrecognized.[5]

Several classification systems have been proposed[6] for iatrogenic bile duct lesions, reflecting the diversity of injury patterns and their sequelae. Such as Bismuth (1982),[7] and Strasberg et al. (1995)[8] classification.

PATIENTS AND METHODS

Forty patients with IBDI were included in this study. In 16 patients (40%) the biliary lesion occurred in Al-Zahraa University Hospital whereas 24 patients (60%) were referred from other hospitals without previous repair. This study continued from January 2008 to January 2011 and was conducted at Al-Zahraa University Hospital. There were 14 males (35%) and 26 females (65%) at the age of 21-62 years (average 46 years). Cholelithiasis and gallbladder polyps were the surgical indications. Iatrogenic injury committed in 26 patients at LC and in 14 patients at OC. Twelfth of the operations (30%) were reported as uncomplicated, whereas in 28 cases (70%) some kind of technical problem was encountered Table 1. Six operations (15%) were converted from LC to OC because of technical problems.

Table 1. Technical problems during holecystectomy.

Technical problem	LC	OC	Total number
Adhesions	7	4	11
Bleeding	3	2	5
Acute cholecystitis	4	1	5
Obesity	3	1	4
Short cystic duct	2	1	3

The presenting symptoms and signs in all 40 cases in this study in both LC and OC. Table 2.

A total of 5 patients (12.5%) were diagnosed during cholecystectomy by the presence of bile leaking in the operative field and a double biliary stump. The remaining 35 injury (87.5%) were diagnosed postoperatively. Thirty three patients (82.5%) were recognized in the early stage (within 3 weeks). The other 2 patients (5%) were recognized in the late postoperative stage (over 3 months after BDI).

All patients in this study underwent a complete biochemical workup, mainly bilirubin and alkaline phosphatase were markedly elevated in patients presented by jaundice. The mean preoperative total bilirubin was 9.2mg/dL, alkaline phosphatase was 640unit/dL, and serum albumen 3.3g/dL. Imaging examination include: Ultrasonography (US) was done in all cases. US revealed proximal biliary tree dilatation and disruption of continuity of the bile duct in 23 patients (57.5%) and abdominal collection due to bile leak in 12 cases (30%). Endoscopic retrograde cholangiopancreatography (ERCP) was done in 34 patients (85%), ERCP revealed biliary dilatation, or disruption of CBD and lack of visualization of the proximal biliary tree (Fig. 1).Percutaneous transhepatic cholangiography (PTC) was done in 12 cases (30%), showed intraheptic bile duct dilatation, disruption or stenosis of the bile duct (Fig. 2). Magnetic resonance cholangio-pancreatography (MRCP) was done in 12 cases (30%), MRCP was highly accurate showing the type and level of injury and any intra-abdominal collection (Fig. 3). Computerized tomography (CT) scan was done in 8 cases (20%), CT revealed intra-abdominal collection and intrahepatic biliary dilatation (Fig. 4). Fistulogram which was done in one case (2.5%) with external biliary fistula.

The anatomic extent of BDIs in this study were classified using the Strasberg-Bismuth system Table 3.

Management of type A injuries (non-surgical management): Lesions were treated endoscopically, e.g., aspiration of biloma under CT or US guidance was done in 4 cases prior to endoscopic treatment (Fig. 4). Eight patients (20%) underwent endoscopic sphinecterotomy and biliary stenting (10fr).

Surgical management of BDIs: All patients after a complete evaluation and preoperative preparation underwent surgical correction. In eleven patients with evidence of preoperative bile leak and intra-abdominal sepsis, preoperative antibiotics were administrated and operative drainage and primary repairs were delayed for 6 weeks.

Elective repair: tension-free mucosa to mucosa hepatico-jejunostomy (HJ) performed in a single layer, using interrupted 3/0 Vicryl sutures between un-scarred proximal bile ducts (CHD and LHD) and to 45-60cm long Roux-en-Y loop of jejunum. The hilar plate needs to be lowered and the extra-hepatic part of the left hepatic duct (LHD) exposed. Transanastomotic tubal stent have been used and left in site for 10 days for biliary decompression and obtaining a postoperative cholangiogram (Fig. 5).

Follow-up: All patients were followed up: (i) every 3 months in the first year, (ii) every 6 months in the second year, (iii) then once annually. Follow-up includes clinical evaluation (jaundice, cholangitis pruritus), liver function tests especially alkaline phosphatas, abdominal US for biliary dilatation and HIDA (Hydroxy imino diacetic acid) scan if needed (Fig 6).

Table 2. The presenting symptoms and signs in all 40 cases in this study in both LC and OC.

No	Symptoms and signs	In all cases		LC cases		OC cases	
		No (40)	%	No (26)	%	No (14)	%
1	Abdominal pain	34	85	22	55	12	30
2	Jaundice	31	77.5	20	50	11	27.5
3	Fever and chills	25	62.5	18	45	7	17.5
4	Nausea and vomiting	21	52.5	13	32.5	8	20
5	Prutitus	18	45	11	27.5	7	17.5
6	Discharge from external fistula	1	2.5	-	-	1	2.5

Table 3. Shows the anatomic extent of BDIs.

Biliary complications after cholecystectomy	LC category		OC category		Strasberg grading
	No (26)	%	No (14)	%	
Cystic duct or CBD leak	6	15	2	5	Type A
Ligation of CBD	12	30	6	15	Type E, αE_2
Ligation of CBD with bile leak	8	20	3	7.5	Type E1, αE_2
Biliary stricture	-	-	2	5	Type E_2
Biliary fistula	-	-	1	2.5	Type E_3

Table 4. Early and late postoperative complications.

Complications	No. of patients	%	Management
(A) Early			
1. Cholangitis	1	3.1	Antibiotics
2. Biliary leak	1	3.1	Spontaneous closure with conservative treatment
3. Wound infection	1	3.1	Antibiotic, dressing and 2ry suture.
(B) Late			
Biliary stricture	1	3.1	Refashioning

Fig 1. ERCP showing clip ligation of CBD.

Fig 4. CT showing postoperative bile collection (note aspiration guided by CT).

Fig 2. PTC showing complete occlusion of CHD.

Fig 5. Tubogram showing free passage of dye after HJ.

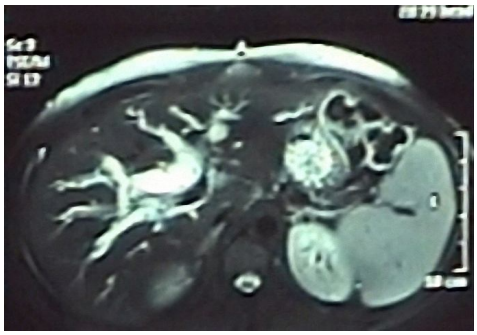

Fig 3. MRCP showing intra-hepatic bile duct dilatation.

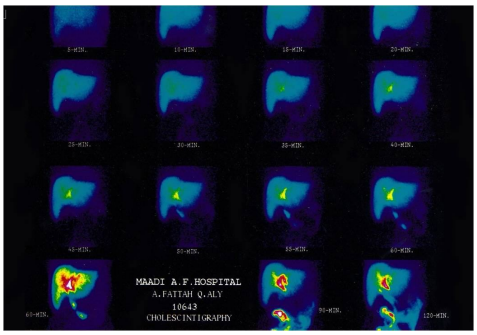

Fig 6. HIDA scan showing biliary stricture at the site of previous HJ.

RESULTS

Eight patients with type A injury, who were managed by aspiration of biloma (Fig. 4) and endoscopic stenting were accomplished successfully. All these cases were followed from 3 to 6 months and there were no complaints.

The 32 patients with type E1, E2 and E3, the operation was accomplished successfully (Fig. 5) in all cases with no operative mortality. The median hospital stay was 10 days (range 9-14 days). Early and late postoperative complications were described in Table 4.

Late postoperative complications revealed biliary stricture (Fig. 6) in one case. This case was re-explored with refashioning of the site of anastomosis from end-to-side HJ to side-to-side anastomosis left duct approach.

Long-term follow-up (8-40 months) average 22 months revealed improvement of serum enzyme, alkaline phosphatase and patient's symptoms.

DISCUSSION

BDI is still a serious complication of cholecystectomy with a long-term morbidity, reduced survival and impaired quality of life. Some injuries remain unrecognized for many years, occasionally coming to light only when the patient develops secondary biliary cirrhosis. Cholecystectomy is a kind of operation full of danger.[9]

Tantia et al.[10] reported that, 63.5 of the patients with injury had cholecystitis, and 38.5% of the patients were male. Considering that more than 70% of the patients are female. The median age of the patients with injury was 50 years. In this study there were 35% male patients and 65% female patients treated for gallstone disease with the median age 46 years. Recognition of BDI at the time of cholecystectomy allows an opportunity for the surgeon to assess its severity and the presence of any vascular injury. If bile or a double biliary stump presents in the operative field during cholecystectomy, BDI should be considered. Wu et al.[9] reported that a total of 29% patients were diagnosed during cholecystectomy while 71.5% were diagnosed postoperatively. Fifty half of patients were recognized in the early stage (within 3 months after BDI), and other 20.5% of patients were recognized in the late postoperative stage (over 3 months after BDI). In this study: a total of 12.5% patients were diagnosed during cholecystectomy, while 82.5% were recognized in the early stage, and the other 5% were recognized in the late postoperative stage. Many different conditions have been associated with increased risk of BDI, including acute inflammation around Calot's triangle makes the tissue friable and difficult to grasp. Dissection in such conditions leads to excessive blood being present. This, together with the distorted anatomy, increase the risk of BDIs. On the other hand, extensive fibrosis around Calot's triangle in cases of chronically inflamed and fibrosed gallbladder may make them extremely difficult to dissect. Overuse, of electrocautery near Calot's triangle and extensive dissection around the CBD may damage its axial blood flow, leading to ischemic damage to the duct and late stricture-formation. Excessive traction leading to tenting of the CBD is another factor predisposing to clipping and ligation of the bile duct. Obesity and excessive fat in the porta hepatis area also poses technical difficulties and can predispose to bile duct injuries.[11] In this study only 12.5% of BDIs occurred in acute cases. The most common problem encountered was scarring of Calot's triangle due to chronic cholecystitis in 27.5% of cases, intraoperative bleeding in 12.5% of the cases, short cystic duct in 7.5% of the cases and obesity in 10% of the cases. Most problems can be avoided by meticulous dissection close to gallbladder-cystic duct junction, and stay out of Calot's triangle and common bile duct area. Three-step principle of "identifying-cutting-identifying" should be recommended during cholecystectomy, namely, identifying CBD and CHD before cutting the cystic duct and identifying the integrity of CBD and CHD again after removal of the gallbladder.[9]

Tantia et al.[10] reported that the most common injury was Strasberg type A. However, when these minor type A injuries were excluded, most of the injuries were in the middle CHD and would be identified as Bismuth type 2 and 3, and the most common type of iatrogenic bile duct injury was complete transection, accounting for 42% of the cases. In this study Strasberg type A was 20% of cases, while CHD injuries were identified as Bismuth type 1 and 2 in 77.5%. However, Bismuth type 3 was 2.5%. The most common type of iatrogenic bile duct injuries, in this study there were ligation of CHD in 40%, while ligation of CHD and leakage in 32.5%.

The common clinical symptoms of BDIs are jaundice, fever, chills and epigastric pain. In patients with bile leak, subhepatic bile collection (biloma) or abscess develops if the area is not well drained.[12] In this study the main clinical symptoms are abdominal pain, jaundice, fever and chills, nausea and vomiting, pruritus and discharge from external fistula.

Preoperative cholangiographic delineation of the biliary anatomy proximal to the stricture is mandatory for an accurate preoperative classification of BDIs and to plan the operative strategy. Imaging diagnostics in this study involve abdominal US, ERCP, PTC, MRCP, CT and fistulogram. The fundamental principles underlying the management of bile leaks include decompression of the biliary tree and drainage of any associated bile collections (bilomas) to minimize the risk of bile peritonitis. Endoscopic therapy by sphincterotomy, stenting or the combination is effective in 80%-100% of patients with bile leaks. For patients with intra-abdominal fluid collections, percutaneous ultrasound or CT guided drainage should be performed to avoid abdominal abscess formation. A drain catheter can be left until the amount of drainage is minimal.[13] In this

study patients with bile leaks were managed by endoscpic stenting and aspiration of biloma with success rate 100%.

Management of peritoneal and biliary sepsis is the first priority in a patient with BDI. The acute BDI should be converted to an external biliary fistulae (EBF) which then evolves into a benign biliary stricture (BBS). The benign biliary stricture should be repaired electively by performing a Roux-en-γ HJ.[14] In this study 11 patients (27.5%) with biliary peritonitis, the primary definitive repair was delayed for 6 weeks. The delayed approach allows the inflammation in the right upper quadrant to subside prior to definitive reconstruction. This facilitates a technically optimal repair and appears to be associated with decreased postoperative complications. Surgery should only be contemplated when the infection is controlled and the patient is stable, because reconstruction during peritonitis is associated with worse outcomes.[15]

The procedure of choice for repair of a duct injury or stricture is a Roux-en-γ HJ with a tension-free mucosa-to-mucosa anastomosis of the proximal healthy bile duct (confluence extending on to the left hepatic duct) to a 45 to 60cm Roux-en-γ loop of jejunum. The anastomosis should be a single layer with interrupted sutures using long-acting absorbable material, e.g., Vicryl, PDS.[1,5,9] In this study HJ performed in 32 patients (80%). Early intervention in 21 patients, and the operation was delayed 6 weeks in 11 cases due to biliary peritonitis. Transanastomotic tubal stent have been used in all cases.

Sikora et al.[16] reported that, the use of trans-anastomotic stent in patients undergoing BBS repair is still a matter of debate, with recommendations ranging from routine use in all patients to those considering stenting superfluous.

Jukka et al.[17] reported that at tertiary referred centers specialized in bile duct surgery, successful outcome after surgical therapy is between 84% and 98%. Winslow et al.[18] reported that postoperative strictures occurred in only 4% of patients after HJ and each was treated successfully non-operatively. In this study postoperative strictures occurred in only 3.1% of patients which was salvaged by conversion the site of anastomosis from end-to-side to side-side HJ. The advantage of the side-to-side approach over the end-to-side approach is likely that it is superior in terms of providing a well vascularized bile duct opening. It does so by minimizing, dissection behind the bile ducts, thereby decreasing the risk of devascularizing the duct and by creating an opening away from end of the duct where adequacy of blood flow is most likely to be inadequate.[19]

REFERENCES

1. Vinay K, Kapoor. Managemnt of bile duct injuries: A practical approach. The American Surgeon. 2009;75:1157-60.
2. Langenbuch CIA. Ein fall von extirpation gallenblase wegen chroiscer cholelithiasis; heilung. Beri Klin Wochenschr. 1882;19:725-27.
3. Zhi-Bing OV, Sheng-Weili, Chang-Anliu, Bing TU, Chuan-Xin WU, et al. Prevention of common bile duct injury during laparoscopic cholecystectomy. Hepatobiliary Pancreatic Dic Int. 2009;8:414-17.
4. Wan-Yee Lau and Eric CH Lai. Classification of iatrogenic bile duct injury. Hepatobiliary pancreatic Dis Int. 2007;6:459-63.
5. Yuhsin V, Wu, Linehan David. Bile duct injuries in the era of laparoscopic cholecystectomies. Surg Clin N Am. 2010;90:787-802.
6. Bektas H, Schrem H, Winny M, Klempnaver J. Surgical treatment and outcome of iatrogenic bile duct lesions after cholecystectmy and impact of different clinical classification systems. British Journal of Surgery, 2007;94:1119-27.
7. Bismuth H. Postoperative strictures of the bile ducts. In: Blumgart LH (ed). The biliary tract v. New York; NY: Churchill-Livingstone. 1982;209-18.
8. Strasberg SM, Herti M, Soper NJ. An analysis of the problem of biliary injury during laparoscopic cholecystectomy. J Am Coll surg. 1995;180:101-25.
9. Wu JS, Chuang Peng, Xian-Hai Mao, Pin LV. Bile duct injuries associated with laparoscopic and open cholecystectomy: Sixteen-year experience. World Gastroenterol. 2007;28:2374-8.
10. Tantia O, Jain M, Khanna S, Ben B. Iatrogenic biliary injury: 13, 305 cholecystectomies experienced by a single surgical team over more than 13 years. Surg Endosc. 2008;22:1077-86.
11. Wheeb R, Al-Kubati. Bile duct injuries following laparoscopic cholecystectomy: A clinical study. The Saudi Journal of Gastroenterology. 2010;16:100-4.
12. Beata Jablonska and Pawel Lampe. Iatrogenic bile duct injuries: Etiology, diagnosis and management. World J Gastroenterol. 2009;15:4097-104.
13. Wan Yee Lau, Eric CH, Lai, Stephanie H. Management of bile duct injury after laparoscopic cholecystectomy: A review. ANZ J Surg. 2010;80:75-81.
14. Vinay K, Kapoor. Bile duct injury: When? What? Who? J Hepatobiliary Pancreatic Surg. 2007;14;476-9.
15. Schmidt SC, Settmachez U, Langrehr JM. Management and outcome of patients with combined bile duct and hepatic arterial injuries after laparoscopic cholecystectomy. Surgery. 2004;135:613-8.

16. Sikora SS, Pottakkat B, Srikanth G, Kumar A. Postcholecystecomy benign biliary strictures long-term results. Dig Surg. 2006;23:304-12.

17. Jukka Karvonen, Risto Gullichsen, Simo Laine, Paulina Salminen. Bile duct injuries during laparoscopic cholecystectomy: Primary and long-term results from a single institution. Surg Endscop. 2007;21:1069-73.

18. Winslow Emily, Elizabeth A, David C, William G. Sideways results of repair of biliary injuries using a policy of side-to-side hepatico-jejunostomy. Annals of Surgery. 2009;249:426-34.

19. Alves A, Farges O, Nicolet J. Incidence and consequence of an hepatic artery injury in patients with postcholecystectomy bile duct strictures. Ann Surg. 2003;238:93-6.