ORIGINAL ARTICLE

Surgical management of bile duct injuries following open or laparoscopic cholecystectomy

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Abstract

Objective: To evaluate the management of bile duct injuries following open and laparoscopic cholecystectomy in a tertiary care hospital.

Methods: The descriptive case series was conducted from July 2002 to June 2008 at Hayatabad Medical Complex Peshawar, Pakistan. A total of 32 patients who sustained extra hepatic bile duct injuries during open and laparoscopic cholecystectomy were included. Patients having hepatobiliary malignancy or those managed through endoscopic retrograde cholangiopancreatography and stenting were excluded. Patients were thoroughly investigated including to reach a final diagnosis, and were followed up for 02 years.

Results: The mean age of patients was 45.4±2.7 years with a female preponderance (M:F=1:9.7). The time of presentation was up to 03 months after initial surgery. Seven (21.87%) patients sustained bile duct injury during laparoscopic cholecystectomy, while 25 (78.13%) sustained injury during open procedure. Abdominal ultrasound scan was performed in 29 (90.63%) cases, endoscopic retrograde cholangiopancreatography in 14 (43.75%) and magnetic resonance cholangiopancreatography in 26 (81.25%) cases. Eleven (34.37%) patients had common bile duct leak, 9 (28.13%) had common hepatic duct injury, 9 (28.13%) had CBD strictures and 3 (09.37%) had injury to the biliary tree at porta hepatis level. Operative procedures performed included Roux-en-Y hepaticojejunostomy in 19 (59.38%) cases, choledochoduodenostomy in 7 (21.88%) cases, Roux-en-Y portoentrostomy and primary repair in 3 (09.37%) cases each. Postoperative morbidity included recurrent cholangitis 9 (28.12%), wound infection 4 (12.50%) and bile leakage 2 (06.25%). Hospital stay ranged 08-16 days. Hospital mortality rate was 03.13%, (n=1).

Conclusion: The most frequent site of bile duct injury during open and laparoscopic cholecystectomy was the common bile duct, and Roux-en-Y hepaticojejunostomy was the procedure of choice by experienced surgeons for the management of such injuries.

Keywords: Cholecystectomy, Bile duct injury, Roux-en-Y hepaticojejunostomy. (JPMA 63: 1008; 2013)

Introduction

Before the advent of laparoscopic procedures in the late 1980s, open cholecystectomy was the prevalent mode of treatment for gall-stones.[1] As the surgeons were getting used to the basics of minimal intervention, their inexperience and lack of familiarity with telescopic interpretation of biliary anatomy resulted in a significant number of bile duct injuries.[2] While the incidence of the later complication was around 0.1-0.3%, with the open approach,[3-7] a higher risk of injury - almost 2% was related to laparoscopic cholecystectomies. With the growing experience of laparoscopic surgeons and availability of better operating instruments, the rate of iatrogenic bile duct injuries has now dropped to < 0.5%.[4-7] and the procedure is now accepted as the treatment of choice for symptomatic gallstones. Surgeons now readily adopt on laparoscopic approach even for acute cholecystitis which was previously viewed as a relative risk owing to excessive dissection in the Calot's Triangle and inadvertent use of diathermy for associated bleeding, resulting in bile duct damage.[8] The presence of chronic adhesions secondary to recurrent attacks of cholecystitis, morbid obesity and presence of anomalous duct or vessels can render the procedure somewhat challenging and difficult.[9]

Biliary injuries associated with either the laparoscopic or open approach include leaks, strictures, transaction or ligation of major biliary ducts.[8] Magnetic resonance cholangiopancreatography (MRCP) is the most sensitive and accurate test frequently used for the diagnosis of complications of cholecystectomy even though percutaneous transhepatic cholangiography (PTC) can better delineate certain complications, e.g. common bile duct (CBD) strictures.[10] Other investigations in use are endoscopic retrograde cholangiopancreatography (ERCP) and ultrasonography. Intra-operative cholangiography

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(IOC) is helpful in elucidating biliary anatomy and detecting causes of biliary obstruction such as strictures and stones within the duct lumen.[8] However, IOC may itself cause bile duct injury if the anatomy in CA lot's Triangle is not clear.[10] This is why many surgeons are against its routine use.

A variety of interventional procedures ranging from simple drainage to stricturoplasty and others like Roux-en-Y hepaticojejunostomy[8] have been proposed for the management of bile duct injuries.

The aim of this study was to report our experience with bile duct injuries and their management following open or laparoscopic cholecystectomy.

Patients and Methods

The prospective study was carried out at the surgical unit, Hayatabad Medical Complex Peshawar, from July 2002 to June 2008. Initially, 36 patients regardless of their age and gender who sustained iatrogenic extra-hepatic bile duct injuries following open or laparoscopic cholecystectomy at the surgical unit and those referred from other hospitals in the periphery, were included, but 04 patients who were lost to follow-up, were then excluded from the study. Similarly, patients having bile duct injuries but managed through ERCP and stenting or those having hepatobiliary malignancy were also excluded. Investigations performed included full blood count, liver function tests (LFTs), Prothombin Time (PT), Activated partial Thromboplastin Time (APTT), urea, creatinine, blood sugar and serum electrolytes. Specific investigations to reach a final diagnosis included abdominal ultrasonography (US), ERCP and MRCP. Patients were followed in the outpatient department (OPD) at 3rd week, 3rd month, 6th month, one year and final visit after 2 years. On the first visit, abdominal US and LFTs were performed in all patients to assess liver function and to look for intraabdominal collection. At 6th month (3rd visit), MRCP was performed in to look for the patency of bilioenteric anastomosis in patients where abdominal US showed biliary dilatation or there were more than one attack of ascending cholangitis.

Data regarding number of cases, age, gender, time between cholecystectomy and recognition of an injury, type of injury, surgical procedure performed and post-operative outcome was collected on a proforma and processed on Microsoft Excel.

Results

After the exclusion of 4(11.11%) patients who were lost to follow-up the study population comprised 32(88.88%) patients with bile duct injuries following open or laparoscopic cholecystectomy. Out of the 32 patients, 03 (09.37%) were males and 29 (90.63%) were females, with a male-to-female ratio of 1:9.7. The mean age of the patients was 45.5±2.7 years. Three (09.37%) patients had sustained bile duct injury at our unit, while 29 (90.63%) had been referred from other hospitals in the periphery and from Afghanistan. All the 03 injuries which occurred in our unit were recognised at the time of primary surgery and were managed accordingly.

The time of presentation of biliary injuries from other hospitals was up to 3 months after the initial surgery. The clinical presentation included abdominal pain, jaundice, fever and vomiting in 28 (87.50%) cases. Twenty (62.50%) patients had biloma and 12 (37.50%) had biliary leak revealed either through drains placed during the initial

Table-1: Site of injury.

Operative procedure	Site of injury	No. of cases	Percentage
Laproscopic	CHD injury	2	6.25%
Cholecystectomy (07)	CBD leak	2	6.25%
	CBD strictures	3	9.37%
Open	Injury at the level of Porta hepatis	3	9.37%
Cholecystectomy (25)	CHD injury		
	CBD leak		
	CBD strictures	7	21.87%
		9	28.14%
		6	18.75%
Total		32	100%

CHD: Common hepatic duct. CBD: Common bile duct.

Table-2: Operative Procedures.

Procedure	No of cases	Percentage
Roux-en-Y hepaticojejunostomy	19	59.38%
Choledochodudenostomy	07	21.88%
Roux-en-Y portoentrostomy	03	09.37%
Primary repair over T tube	03	09.37%
Total	32	100%

Table-3: Post-operative Morbidity.

Complication	No of cases	Percentage
Recurrent cholangitis	09	28.13%
Wound infection	04	12.50%
Bile leakage	02	06.25%
Stenosis (Bilioenteric)	02	06.25%
Deep vein thrombosis	01	03.13%

surgery or biliary peritonitis. Nine (28.13%) patients presented with biliary strictures which were confirmed through ERCP and MRCP. Out of 32 patients, 7 (21.87%) patients had sustained injury during laparoscopic cholecystecyomy, while 25 (78.13%) had biliary injury during open procedure.

The different diagnostic modalities employed to reach a final diagnosis included abdominal US in all the 29 (90.63%) referred cases which showed sub-hepatic collection in 20 (62.50%). ERCP was performed in 14 (43.75%) cases. Majority of these patients had been referred from the gastroenterology unit where ERCP had already been performed, but it had been either unsuccessful or there had been complete disruption of the extra-hepatic biliary tract. MRCP was carried out in 26 (81.25%) patients to define the anatomy of biliary tract and plan subsequent surgery.

During laparoscopic surgery, 2 (06.25%) had injury to the common hepatic duct (CHD), 2 (06.25%) had CBD leak and 3 (09.38%) patients had stricture of CBD. Similarly, 3 (09.38%) patients had injury to biliary tree at the level of porta hepatis, 7 (21.86%) had CHD injury, 9 (28.14%) had CBD leak and 6 (18.74%) had CBD strictures (Table-1).

The different operative procedures performed included Roux-en-Y hepaticojejunostomy in 19 (59.38%) cases (10 cases of CBD and 9 cases of CHD injuries), choledochoduodenostomy and primary repair over T-tube in 7 (21.88%) and 3 (09.37%) cases of CBD injury respectively. Roux-en-Y portoentrostomy was performed for 3 (09.37%) cases of biliary injury at the level of the porta hepatis (Table-2).

Post-operative complications both early and late included wound infection 4 and bile leakage 2 which were treated conservatively. Recurrent cholangitis occurred in 9 (28.13%) cases. Five (15.63%) patients were re-admitted for conservative management. Two (06.25%) patients were picked with CBD strictures; one having primary repair of CBD and the other after bilioenteric anastomosis (hepaticojejunostomy). One (03.13%) patient had developed deep vein thrombosis (Table-3). Besides, one patient died of uncontrolled sepsis and multiple organ failure. Mortality rate was 03.13%. Hospital stay ranged between 08-16 days. Patients were followed up in the OPD for 02 years.

Discussion

Bile duct injury is the most feared complication of cholecystectomy. Usually manifesting itself in the early post-operative period as biliary leak leading to localised collection, persistent drain discharge or biliary peritonitis.[11] However, an injury may pass unnoticed with the patient remaining asymptomatic and presenting months after the surgery with progressively deepening jaundice due to the development of a stricture.[12] Factors responsible for operative biliary injuries include inaccurate placement of clips, misidentification of anatomy in the Calot's Triangle, transaction of CBD, crushing injury by haemostat or diathermy injury.[13] Studies in Pakistan, have shown that the incidence of biliary injuries after open and laparoscopic cholecystectomy is 0.13% and 0.55% respectively.[8,14] This difference in incidence following the two different approaches to cholecystectomy is a result of the learning curve which many young surgeons are still trying to surmount, and also due to the inferior quality of equipment and instruments available in Third World countries because of the financial constraints.[15-17] In the modern world, laparoscopic cholecystectomy is recognised as the gold standard for the treatment of symptomatic gallstones and other benign diseases of the gall bladder.[18,19]

Iatrogenic bile duct injuries should be suspected intraoperative if there is appearance of bile in the operative field, and promptly dealt with during the course of the same procedure depending on the expertise available. Post-operatively, patients who have undergone a difficult procedure may be suspected of having a biliary complication if they have intractable pain, fever and altered liver biochemistry, or if bile is observed in the sub-hepatic drains.[12] Abdominal ultrasound followed by ERCP and MRCP are the investigations of choice for diagnosing this condition.[12,20]

In our study, abdominal ultrasound scan was the first line of investigation in all 29 (90.63%) referred cases for detecting the extent of any collection and the state of intra and extra-hepatic biliary tree, while those 03 (09.37%) patients in whom biliary injury was detected at the time of initial surgery, ultrasound scan was not performed. This figure of 90.63% is less than 100% reported by one study,[12] but higher than 75% reported by another.[8] In our study, ERCP and MRCP were performed in 43.75% and 81.25% of patients respectively who presented late or had persistent symptoms despite initial management. These figures are higher than reported in literature.[8-12]

It is extremely important that the anatomy in the Calot's Triangle should always be defined beyond doubt and no

tubular structure should be cut unless its identity is ascertained. To avoid the chances of thermal injury, excessive diathermy should be avoided. It is advisable that a laparoscopic surgeon should not make it a matter of ego, when deciding about conversion to open procedure in difficult cases where persistence with the minimal access approach may result in inadvertent biliary damage. If in spite of all precaution, an injury still occurs, the surgeon should be prepared to seek a second opinion from a senior colleague, remembering that the best chance of repair is at the time of the initial surgery.[12,14,21] If expert opinion is not available, then simple placement of a drain with immediate referral to a specialised unit is the best course of action. Injuries recognised post-operatively are best dealt with after full control of sepsis.[12]

In the current study, only 3 (09.38%) patients were diagnosed during the initial surgery and underwent intra-operative primary repair. This is significantly less than 29.4% reported by one study,[22] but almost comparable to 10% reported by another.[8] The sites of injury recorded in our study are almost similar to those reported by a study.[8] Roux-en-Y hepaticojejunostomy is still the gold standard definitive procedure for iatrogenic bile duct injuries.[8,12,14,17,23,24] In the current study, 19 (59.38%) cases had undergone Roux-en-Y hepaticojejunostomy for CBD and CHD injuries. All these patients had a fairly good outcome on their follow-up visits. This figure is slightly higher than 45% reported earlier,[8] but comparable to other local studies[12,14] and a 21-year reported review of iatrogenic bile duct injuries in Mexico.[25] Other procedures performed in this study were almost comparable to those reported earlier with minor differences.[8]

Post-operative morbidity in our study comprised recurrent cholangitis in 28.13% patients. These patients suffered recurrent attacks of pain. Five patients were re-admitted and they responded well to conservative management. No patient among those five needed revision surgery. In our set-up the incidence of ascending cholangitis is higher compared to 10% reported by a local study.[14] Two (06.25%) patients developed strictures of CBD; one after primary repair of CBD and the other having Roux-en-Y portoentrostomy. The patient having CBD stricture was managed through redo surgery in the form of Roux-en-Y hepaticojejunostomy, while the second patient with Roux-en-Y portoentrostomy was referred to a hospital in Karachi for percutaneous trans-hepatic dilatation and stenting. This figure of 06.25% is closer to 04.54% reported earlier.[14] The other post-operative complications in our study were acceptable by comparing them with different local studies.[8,12,14] In our study, the mortality rate was 03.13% which is fairly acceptable compared with 04.54% and 14.28% by reported in earlier studies.[12,14]

Conclusion

Common bile duct is the most frequently injured site of biliary tree during both open and laparoscopic cholecystectomy, and Roux-en-Y hepaticojejunostomy is the procedure of choice preferred by hepatobiliary surgeons for the management of such injuries.

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References

1. Ou ZB, Li SW, Liu CA, Tu B, Wu CX, Ding X, et al. Prevention of common bile duct injury during laparoscopic cholecystectomy. Hepatobiliary Pancreat Dis Int 2009; 8: 414-7.
2. Huang ZQ, Huang XQ. Changing patterns of traumatic bile duct injuries: a review of forty years experience. World J Gastroentrol 2002; 8: 5-12.
3. Hussain MI, Zahid M, Fazal A. Outcome of surgery for bile duct injuries following laparoscopic cholecystectomy: Lahore General Hospital experience. J Coll Physicians Surg Pak 2005; 15: 720-22.
4. Karvonen J, Gullichsen R, Laine S, Salminen P, Grönroos JM. Bile duct injuries during laparoscopic cholecystectomy: primary and long term results from a single institution. Surg Endosc 2007; 21: 1069-73.
5. Söderlund C, Frozanpor F, Linder S. Bile duct injuries at laparoscopic cholecystectomy: a single-institution prospective study. Acute cholecystitis indicates an increased risk. World J Surg 2005; 29: 987-93.
6. Nuzzo G, Giuliante F, Giovannini I, Ardito F, D'Acapito F, Vellone M, et al. Bile duct injury during laparoscopic cholecystectomy: results of an Italian national survey on 56591 cholecystectomies. Arch Surg 2005; 140: 986-92.
7. Ali U, Ma ZH, Pan CE, Ma QY. Iatrogenic bile duct injuries from biliary tract surgery. Hepatobiliary Pancreat Dis Int 2007; 6: 326-9.
8. Bakhsh R, Zahid MA, Dar FS, Malik ZI, Akhtar N, Akhtar S. Iatrogenic bile duct injuries: experience at PIMS. J Ayub Med Coll Abbottabad 2002; 14:16-18.
9. Ahrendt SA, Pitt HA. Surgical therapy of iatrogenic lesions of biliary tract. World J Surg 2001; 25: 1360-5.
10. Chaudhary A, Negi SS, Puri SK, Narang P. Comparison of magnetic resonance cholangiography and percutaneous transhepatic cholangiography in the evaluation of bile duct strictures after cholecystectomy. Br J Surg 2002; 89: 433-6.
11. Al-Kubati WR. Bile duct injuries following laparoscopic cholecystectomy: a clinical study. Saudi J Gastroentrol 2010; 16: 100-4.
12. Qureshi MS, Urooj R, Dawani A, Soomro I, Maher M. Post cholecystectomy injuries: diagnosis and management. Pak J Surg 2007; 23: 166-8.
13. Russel RCG. The gall bladder and bile ducts. In: Russell RCG, Williams NS, Bulstrode CJK, (eds.). Bailey and Love's Short Practice of Surgery. 24th ed. London: Arnold Publishers; 2004; pp 1094-113.

14. Shaikh R, Pohani MR, Ayub M, Asghar A, Malik KA, Rehman SU. Bile duct injuries during open and laparoscopic cholecystectomy: management and outcome. Pak J Med Sci 2009; 25: 496-9.
15. Buchmann P, Dincler S. Learning curve: calculation and value in laparoscopic surgery. Ther Umsch 2005; 62: 69-75.
16. Teoh AY, Chong CN, Wong J, Lee KF, Chiu PW, Ng SS, et al. Routine early laparoscopic cholecystectomy for acute cholecystitis after conclusion of a randomized controlled trial. Br J Surg 2007; 94: 1128-32.
17. Schmidt SC, Lanrehr JM, Hintze RE, Neuhaus P. Long-term results and risk factors influencing the outcome of major bile duct injuries following cholecystectomy. Br J Surg 2005; 92: 76-82.
18. Mir IS, Mohsin M, Kirmani O, Majid T, Wani K, Hassan MU, et al. Is intra-operative cholangiography necessary during laparoscopic cholecystectomy? A multicentre rural experience from a developing world country. World J Gastroentrol 2007; 13: 4493-7.
19. Lalwani S, Misra MC, Bhardwaj DN, Rajeshwari S, Rautji R, Dogra TD. Common bile duct injury in laparoscopic cholecystectomy - inherent risk of procedure or medical negligence - a case report. World J Laproscopic Surg 2008; 1: 49-51.
20. Regalado S, Funaki B. Radiological reasoning: postoperative hemorrhage after open cholecystectomy and bile duct exploration. AJR Am J Roentgenol 2008; 190 (Suppl 6): S69-74.
21. Lau WY, Lai EC, Lau SH. Management of bile duct injury after laparoscopic cholecystectomy: a review. ANZ J Surg 2010; 80: 75-81.
22. Sawaya DE Jr, Johnson LW, Sittig K, McDonald JC, Zibari GB. Iatrogenic and non iatrogenic extra hepatic biliary tract injuries: a multi-institutional review. Am Surg 2001; 67: 473-7.
23. Manouras A, Paras N, Antonakis P, Lagoudiannakis EE, Papageorgiou G, Dalianoudis IG, et al. Management of bile duct injury after laparoscopic cholecystectomy: a case report. J Med Case Reports 2009; 3: 44. doi: 10.1186/1752-1947-3-44.
24. Wu JS, Peng C, Mao XH, Lv P. Bile duct injuries associated with laparoscopic and open cholecystectomy: sixteen-year experience. World J Gastroentrol 2007; 13: 2374-8.
25. Palacio-Vélez F, Castro-Mendoza A, Oliver-Guerra AR. Results of 21 years of surgery in iatrogenic lesions of the bile ducts. Rev Gastroentrol Mex 2002; 67: 76-81.