

Frequency of Iatrogenic Bile Duct Injuries during Laparoscopic Cholecystectomy

Dr Muhammad Naeem, Dr Erum Shehzadi, Dr Muhammad Adil
House Officer Nishtar Hospital, Multan
Corresponding Author: adil.120501@gmail.com

Abstract:

Objective: to assess the frequency of iatrogenic bile duct injuries during laparoscopic cholecystectomy Study Design: Prospective Study. Study Place and Duration: Department of General Surgery Nishtar Hospital Multan from 15th June 2017 to 31st July 2018. **Material and methods:** A total of 450 patients presented during this duration for laparoscopic cholecystectomy. A performa was designed to record all the measured data during the whole procedure. Data was collected by the consultant himself. All the patterns, mechanisms and management of the iatrogenic injuries occurring to the bile ducts were assessed. Statistical analysis was done for the data obtained at the end. Computer software SPSS version 23 was used for this purpose. Frequency and percentage was calculated for qualitative variables while mean and standard deviation was calculated for quantitative variables. **Results:** During laparoscopic cholecystectomy, 43 (9.5%) patients withstood multiple types of bile duct injuries. Out of the patients receiving injuries, CBD was clipped in 11 (25.6%) patients who were recognized while in another 5 (11.6%) patients CBD clipping was not recognized. Right hepatic duct was transected in 6 (13.9%) patients while 13 (30.2%) patients received other types of partial injuries to major bile ducts. Hole was formed due to diathermy in CBD in 5 (11.6%) patients and in RHD in 3 (6.9%) patients. **Conclusion:** Regardless of the advancements in the technique and experience of laparoscopic cholecystectomy the ratio of iatrogenic bile duct injuries is still high among the most parts of the world and these are life threatening in nature.

Keywords: Iatrogenic, Bile, Duct, Injury, Laparoscopic, Cholecystectomy, gallbladder, biliary tree

Introduction:

The standard choice of management of symptomatic gallbladder diseases and acute or chronic cholecystitis is laparoscopic cholecystectomy and since its advent in 1980s it is among the most common surgical procedures (1). Among the benefits of laparoscopic cholecystectomy, less pain, and less duration of post operative hospital stay are prominent while drawbacks of this procedure involve increased incidence of bile duct injuries and bile leakage as has been reported in previous literature (2). Although some studies has given this conclusion that laparoscopic cholecystectomy is associated with poor outcomes like bile duct injuries and bile leakage while some others did not show such results (3-7). These complications of laparoscopic cholecystectomy can result in severe consequences in case of some patients. Along with these short term complications some long term complications can also occur such as stricture of the bile duct and recurrent cholangitis. These complications not only result in heavy economic burden in the society but also result in higher rates of medicolegal cases (8).

The mechanisms of bile duct injuries can be undue dissection in a distorted Calot's triangle, local pathology like inflammation which can be either acute or chronic, damage to the bile ducts by diathermy, fibrosis of gallbladder, casual attitude of surgeon, or excessive traction on gall bladder. Use of intra operative cholangiography and magnetic resonance cholangiogram has been proposed to reduce as investigations to reduce the incidence of bile duct injuries. Despite overall improvement in experience as well as technique the number of iatrogenic bile duct injuries continues to happen. Studies are required in order to evaluate the outcome of laparoscopic cholecystectomy in terms of bile duct injuries so that efficient way of stopping such complications can be discovered. In this study we are going to assess the pattern, severity, treatment and probable factors which are responsible for iatrogenic bile duct injuries.

Material and Method:

This is a prospective study performed in Department of General Surgery Nishtar Hospital Multan from 15th June 2017 to 31st July 2018. A total of 450 patients presented during this duration for laparoscopic cholecystectomy. Ethical approval was obtained from Hospital Ethics committee. Sample was calculated from the reference study performed by Arshad M. et al (9). Non probability consecutive type of sampling technique was used in this

study. Patients with indications for laparoscopic cholecystectomy were included in this study such as patients with, biliary dyskinesia, chronic cholecystitis, gallstone pancreatitis, symptomatic cholelithiasis, acalculous cholecystitis and gall bladder masses or polyps. Whereas patients with acute cholecystitis, pregnancy, bowel obstruction, previous abdominal surgery, unable to tolerate general anesthesia, obesity, coagulopathy, cirrhosis and choledocholithiasis were excluded from the study. All details regarding history, clinical examination, ultrasound examination, liver function tests and complete blood picture were routinely done in each patient.

After preoperative assessment and ensuring the fitness for the procedure, all 450 patients underwent laparoscopic cholecystectomy with classical 4 port technique with few exceptions where amendments were made to facilitate the procedure. A performa was designed to record all the measured data during the whole procedure. Data was collected by the consultant himself. All the patterns, mechanisms and management of the iatrogenic injuries occurring to the bile ducts were assessed. Statistical analysis was done for the data obtained at the end. Computer software SPSS version 23 was used for this purpose. Frequency and percentage was calculated for qualitative variables while mean and standard deviation was calculated for quantitative variables.

Results:

Laparoscopic cholecystectomy was attempted on 450 candidates. Mean age, weight and BMI of all the patients were 34.56 ± 5.43 years, 52.47 ± 7.23 kg and 22.31 ± 3.12 kg/m². Out of 450, 167 were males and 283 were females. Table-I. Multiple calculi in gall bladder were seen in 214 (47.6%) of the patients while 159 (35.3%) patients had distended gall bladder. Gall bladder was more than 3mm thick in 77 (17.1%) patients. During laparoscopic cholecystectomy, 43 (9.5%) patients withstood multiple types of bile duct injuries. Out of the patients receiving injuries, CBD was clipped in 11 (25.6%) patients who were recognized while in another 5 (11.6%) patients CBD clipping was not recognized. Right hepatic duct was transected in 6 (13.9%) patients while 13 (30.2%) patients received other types of partial injuries to major bile ducts. Hole was formed due to diathermy in CBD in 5 (11.6%) patients and in RHD in 3 (6.9%) patients. Underlying mechanisms of injury included anatomical variation, traction on gall bladder, failure to identify anatomy, excessive diathermy use and excessive adhesions in 10 (23.3%), 9 (20.9%), 5 (11.6%), 7 (16.3%) and 12 (27.9%) patients who received bile duct injuries, respectively. Out of 450, 25 (5.5%) patients converted to open cholecystectomy. The reasons for conversion included gall bladder perforation, excessive adhesions, CBD injury and cystic duct injury in 5 (20.0%), 8 (32.0%), 10 (40.0%) and 2 (8.0%) patients. Out of 11 patients in which CBD was clipped and then recognized, 5 (45.4%) patients developed CBD stricture with 12 months of the surgery. Table-II. CBD clip was removed in all the 11 patients in whom CBD was mistakenly clipped in place of cystic duct but later on recognized. Out of 5 patients in whom CBD was mistakenly clipped in place of cystic duct and not recognized, choledochoduodenostomy was performed in 1 patient and Roux-en-Y hepaticojejunostomy was performed in 4 patients. Aberrant RHD was transected in 6 patients; suture ligation was done in 4 while primary repair was performed in 2 patients. Primary repair was performed in 9, Roux-en-Y hepaticojejunostomy in 1 patient and choledochoduodenostomy in 3 patients out of 13 patients who received partial injuries to major bile ducts. Out of 5 patients in whom CBD was punctured with diathermy, T tube was placed in 4 patients and primary repair was done in 1 patient. Out of 3 patients in whom RHD was punctured with diathermy, primary repair was performed in 1 and suture ligation was done in 2 patients. Table-III

Table-I

Demographic Data

Variable	Total patients (n=450)
Age, years	34.56±5.43
Weight, Kg	52.47±7.23
BMI, kg/m ²	22.31±3.12
Gender (male/female)	167 / 283

Data is mean (standard deviation).

Table-II

Cholecystectomy data

Variable	Total patients (n=450)
Gall Bladder features	
Multiple calculi	214(47.6%)
Distended gall bladder	159(35.3%)
Thickened gall bladder wall >3mm	77(17.1%)
Bile ducts injuries	43 (9.5%)
Type of Bile ducts injury, (n=43)	
CBD clipped in place of cystic duct but recognized	11 (25.6%)
CBD clipped in place of cystic duct and not recognized	5(11.6%)
Transection of aberrant RHD	6 (13.9%)
Partial injury to major bile ducts	13(30.2%)
Hole in CBD due to diathermy	5(11.6%)
Hole in RHD due to diathermy	3(6.9%)
Underlying mechanism of injury (n=43)	
Anatomical variation	10(23.3%)
Traction on gall bladder	9(20.9%)
Failure to identify anatomy	5(11.6%)
Excessive diathermy use	7(16.3%)
Excessive adhesions	12(27.9%)
Conversion to open cholecystectomy	25(5.5%)
Cause of conversion, (n=25)	
Gall bladder perforation	5(20.0%)
Excessive adhesions	8(32.0%)
CBD injury	10(40.0%)
Cystic duct injury	2(8.0%)
Stricture development within 12 months of LC in 11 patients with recognized CBD clipping.	5 (45.4%)

Data is number (percentage).

Table-III

Type of injury versus treatment plan

Injury	Treatment plan						Total
	T tube placement	Clip removal and reapplication	Choledochoduodenostomy	Roux-en-Y hepaticojejunostomy	Suture ligation	Primary Repair	
CBD clipped in place of cystic duct but recognized		11					11
CBD clipped in place of cystic duct and not recognized			1	4			5
Transection of aberrant RHD					4	2	6
Partial injury to major bile ducts			3	1		9	13
Hole in CBD due to diathermy	4					1	5
Hole in RHD due to diathermy					2	1	3
Total	4	11	4	5	6	13	43

Discussion:

As we have already mentioned over the past decade laparoscopic cholecystectomy has replaced the conventional open cholecystectomy as a standard procedure for the treatment of gall stone diseases. In previous studies there is strong evidence regarding the efficacy of this procedure in terms of shorter postoperative hospital stay duration and better recovery of the patients after surgery associated with minimal morbidities (10, 11). Increased rate in the bile duct injuries during laparoscopic cholecystectomy as compared to open procedure has also been reported by some studies (12, 13, 14 & 15). Many other studies have reported that overall rate for bile duct injuries has been declining with gaining of experience with the passage of time (16, 17). Undue use of diathermy, obscured anatomy in the region of Calot's triangle and congenital malformations etc are the common risk factors during laparoscopic cholecystectomy for bile duct injuries. Based on the findings of this study misidentification of the anatomy of biliary tree seems to be the most common reason for the occurrence of bile duct injuries. Similar results have been found in previous studies (18).

Diathermy use close to the main biliary tree has been attributed to be associated with a large proportion of bile duct injuries. In a previous study by Agarwal (19) they have deduced the similar conclusion that use of diathermy close to the vital structures is associated with certain hazards. Minimal use of diathermy should be implemented and also its use should remain near the gallbladder and only used after the identification and clipping of cystic duct. Identification of bile duct injuries during the same operation is associated with better outcomes. Similar results have also been proposed by some past studies as well (20, 21). Most of the reasons for the bile duct injuries in this survey were avoidable as these were not associated with the inexperience of surgeon instead it was associated with undue use of diathermy in a distorted anatomical area and blind dissection in a frozen Calot's triangle. It has been suggested by the previous literature that such injuries can be prevented by simply asking the opinion of the expert or lowering the criteria for conversion to open cholecystectomy in cases anatomy is difficult to identify. In order to ensure the safety to laparoscopic cholecystectomy one should have

thorough knowledge of the anatomy and its anomalies as has been previously described by some studies (22). Intraoperative use of cholangiography is still controversial for prevention of iatrogenic bile duct injuries. Identification of tears to the extra hepatic ducts during the procedure and reconstruction of these injuries in the form of hepaticojejunostomy were the methods used to treat these injuries. Use of these mechanisms has also been reported in certain previous studies.

Conclusion:

Regardless of the advancements in the technique and experience of laparoscopic cholecystectomy the ratio of iatrogenic bile duct injuries is still high among the most parts of the world and these are life threatening in nature. Casual attitude of staff in the operating room, unnecessary over confidence and personal ego should be evaluated and studies further to avoid these fatal bile duct injuries.

Conflict of interest:

There was no conflict of interest.

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References:

- 1- Wolfe BM, Gardiner B, Frey CF. Laparoscopic cholecystectomy: a remarkable development. *Jama*. 2015 Oct 6;314(13):1406-.
- 2- McKinley, SK, Brunt, LM, Schwaitzberg, SD: Prevention of bile duct injury: The case for incorporating educational theories of expertise. *Surg Endosc* 2014;28:3385–3391
- 3- Agrusa A, Romano G, Frazzetta G, Chianetta D, Sorce V, Di Buono G, Gulotta G. Role and outcomes of laparoscopic cholecystectomy in the elderly. *International Journal of Surgery*. 2014 Oct 1;12:S37-9.
- 4- Pekolj J, Alvarez FA, Palavecino M, Clariá RS, Mazza O, de Santibañes E. Intraoperative management and repair of bile duct injuries sustained during 10,123 laparoscopic cholecystectomies in a high-volume referral center. *Journal of the American College of Surgeons*. 2013 May 1;216(5):894-901.
- 5- Berci G, Hunter J, Morgenstern L, Arregui M, Brunt M, Carroll B, Edye M, Fermelia D, Ferzli G, Greene F, Petelin J. Laparoscopic cholecystectomy: first, do no harm; second, take care of bile duct stones.
- 6- Fullum TM, Downing SR, Ortega G, Chang DC, Oyetunji TA, Van Kirk K, Tran DD, Woods I, Cornwell EE, Turner PL. Is laparoscopy a risk factor for bile duct injury during cholecystectomy?. *JSL: Journal of the Society of Laparoendoscopic Surgeons*. 2013 Jul;17(3):365.
- 7- Sheffield KM, Riall TS, Han Y, Kuo YF, Townsend CM, Goodwin JS. Association between cholecystectomy with vs without intraoperative cholangiography and risk of common duct injury. *Jama*. 2013 Aug 28;310(8):812-20.
- 8- Morris S, Gurusamy KS, Patel N, Davidson BR. Cost-effectiveness of early laparoscopic cholecystectomy for mild acute gallstone pancreatitis. *British Journal of Surgery*. 2014 Jun;101(7):828-35.
- 9- Malik AM, Laghari AA, Talpur AH, Khan A. Iatrogenic biliary injuries during laparoscopic cholecystectomy. A continuing threat. *International journal of surgery*. 2008 Oct 1;6(5):392-5.
- 10- Victorsdottir O, Bloendal S, Magnusson J. Frequency of serious complications following laparoscopic cholecystectomy. *Laeknabladid* 2004;90(6):487–90.

- 11- Fleming WR, Michell I, Douglas M. Audit of outpatient laparoscopic cholecystectomy. *ANZ J Surg* 2000;70:423–7.
- 12- Johnson SR, Koehlar A, Pennigton LK, Hanto DW. Long term results of surgical repair of bile duct injuries following laparoscopic cholecystectomy. *Surgery* 2000;128:668–77.
- 13- Hasl DM, Ruiz OR, Baumert J, Gerace C, Matyas JA, Taylor PH, et al. A prospective study of bile leaks after laparoscopic cholecystectomy. *Surg Endosc* 2001;15:1299–300.
- 14- Flum DR, Cheadle A, Prela C, Dellinger EP, Chan L. Bile duct injury during cholecystectomy and survival in medicare beneficiaries. *J Am Med Assoc* 2003;290:2168–73.
- 15- Lai EC, Lau WY. Mirizzi syndrome: history, present and future development. *ANZ J Surg* 2006;76:251–7.
- 16- Voitk AJ, Tsao SG, Ignatius S. The tail of the learning curve for laparoscopic cholecystectomy. *Am J Surg* 2001;182:250–3.
- 17- Hobbs MS, Mai Q, Knuiman MW, Fletcher DR, Ridout SC. Surgeon experience and trends in intra-operative complications in laparoscopic cholecystectomy. *Br J Surg* 2006;93:844–53.
- 18- Hugh TB. New strategies to prevent laparoscopic bile duct injuries – surgeons can learn from pilots. *Surgery* 2002;132:826–35.
- 19- Agarwal B, Gupta M, Agarwal S, Mahajan K. Anatomical footprint for safe laparoscopic cholecystectomy without using any energy source: a modified technique. *Surg Endosc* 2007;21(12):2154–8.
- 20- Lau WY, Lai ECH. Classification of iatrogenic bile duct injury. *Hepatobiliary Pancreat Dis Int* 2007;6(5):459–60.
- 21- Boerma D, Rauws EA, Keulemans YC, Begman JJ, Obertop H, Huibregtse K, et al. Impaired quality of life 5 years after bile duct injury during laparoscopic cholecystectomy: a prospective analysis. *Ann Surg* 2001;234:750–7.
- 22- Conor S, Garden OJ. Bile duct injury in the era of laparoscopic cholecystectomy. *Br J Surg* 2006;93:158–68.