

# Common Bile Duct Injuries During Laparoscopic Cholecystectomy

BV Sridhar Varma

General Surgeon and Endoscopist, Neela Nursing Home, Bhadrachalam, Khammam, Andhra Pradesh, India

## Abstract

Iatrogenic common bile duct injuries are the worst complication of laparoscopic cholecystectomy. The goal of this study is to increase awareness of the problem and educate surgeons about the consequences and proper management of these injuries. Cholecystectomy is the most common gastrointestinal operation performed. Laparoscopic cholecystectomy was first performed by Erich Muhe in 1985 in Germany. In 1987 laparoscopically complete removal of GB was performed by Mourat in Lyon, France. The widespread acceptance of laparoscopic cholecystectomy was based on anticipated reduction in postoperative pain, minimal tissue injury intraoperatively and early return to work. It has now become a gold standard for the treatment for GB stone in experience and safe hand.

Many articles source that soon after introduction, how it became clear that laparoscopic cholecystectomy was associated with unique complication of higher rate of CBD injures compared with open cholecystectomy. Highest rates of CBD injuries were reported in early 1990s when laparoscopic cholecystectomy was introduced, suggesting a learning curve effect. In a review by Strasburg et al and Roslyl et al, the incidence of biliary injuries during open cholecystectomy was found 0.2-0.3%. The review by Strasburg et al in 1995 of more than 124000 laparoscopic cholecystectomies reported in literature found the incidence of major bile duct injuries to be 0.5%. Even as the surgeon passed through learning curve and has reached "steady-state" and there has been no significant improvement in the incidence of biliary duct injuries. The impact of major CBD injuries is staggering to both the patient and health care system.

**Keywords:** CBD injury, laparoscopic cholecystectomy, complication of laparoscopy.

## INTRODUCTION

Article study shows that about 95% bile injuries are minor and were irrelevant to patients out come and only 5% were major and almost always required a technologically demanding and expensive operative reconstruction of billiary tree. In spite of proper diagnosis and treatment of major bile duct injuries mortality rate was found to be 10-12%.

As noted by WHO in 1947 health is not limited to absence of disease, fulfillment of physical, mental, and social well-being, therefore the extent to which a procedure and disease process impact the physical, psychologies and social aspect of patient life and filling of well-being. Therefore to truly assess a patient out come after CBD injury one must not measure the usual objective clinical outcome, but also evaluate the patients subjective health related quality of life.

In most of study it was found health related quality of life and time to returned to work among the patients who had CBD injuries during laparoscopic cholecystectomy and under went treatment at secondary and tertiary center, out comes were compared with those under went uncomplicated laparoscopic cholecystectomy.

## MATERIAL AND METHOD

A literature search was performed using Google, Yahoo, Springer link, Highwire press and the following search terms were used. Iatrogenic bile duct injuries, common bile duct injuries during laparoscopic cholecystectomy, postcholecystectomy

complication, long-term detrimental effect of bile duct injuries. The 15 no of quality citations reviewed were selected for these reviews.

The criteria for selection was the following:

1. At least 40 cases should be included the study especially for complicated cases.
2. Method of analysis: Retrospective analysis.
3. Type of procedure: Laparoscopic cholecystectomy using four port.
4. The institution where the procedure was practice (preference for those specialist for laparoscopic surgery).
5. Laparoscopic cholecystectomy practice: In all studies laparoscopy.
6. Cholecystectomy was performed with a standard technique using four ports.
7. Creation of pneumoperitoneum with CO<sub>2</sub>.
8. Insertion of port followed by diagnostic laparoscopic.
9. Holding the fundus by assistant through four ports.
10. Dissections of visceral peritoneum.
11. Dissections of Calot's triangle and homeostasis maintain by using various type of energized instrument.
12. Clipping and division of cystic duct and artery.
13. Dissection of GB from liver bed.
14. Extraction of GB and any spilled stone.
15. Irrigation of suction of operating field.
16. Final diagnosis laparoscopy.
17. Removal of instrument with complete exit of CO<sub>2</sub>.
18. Closure of wound.

## DISCUSSION

In the recent past laparoscopic cholecystectomy is the gold standard of gall stone diseases, though the impact of CBD injuries staggering to both patients and health care system. After reviewing the many articles through internet. I found the so many cases of injuries and the proper management in time can decrease the serious complication and mortality. There are many factor in laparoscopic cholecystectomy regarding increase risk of CBD injury:

1. Misinterpretation of anatomy 70%.
2. Anatomical variation of Calot's triangle.
3. Risk factor.
4. Technical errors.
5. Surgeon operates on image rather than reality.
6. Anatomical variation and misinterpretation of anatomy.
7. GB is the organ having one of the most variable anatomy like.
8. Low union with common hepatic duct.
9. High union with common hepatic duct.
10. Adherent to common hepatic duct.
11. Cystic duct absent are very short.
12. Anterior spiral joining common hepatic duct left side.
13. Posterior spiral joining common hepatic duct left side.
14. Intrahepatic GB.
15. Aberrant cystic duct.

Surgeons operate on image rather than reality. Visual psychological studies show that laparoscopic surgeon works on snap interpretation by brain, and success or disasters depend on whether snaps are right or wrong. Snap interpretation will be wrong if there is eye balldegradation. Lack of initial identification and memory of the structure to the points of absolute certainty, i.e. relative anatomy. Though recall the anatomical variation of Calot's triangle but it is more important to remember the relative anatomy to minimize the risk of CBD injury. Though so many articles published regarding preoperative cholangiography regarding the CBD injury like: David R Flum, Thomas Koepsell, Patrik Hegarty, et al. Arch Surg 2001;136:1287-92 claiming some decrease risk of CBD injury but in my opinion it is not much helpful because surgeon works on relative anatomy rather than absolute anatomy. A little bit advantage of chalcographic is compensated by the injury to cystic duct during processor and increase operative time of processor and little risk of injury during procedure itself. Though preoperative cholangiography is helpful in diagnosis of stones in biliary duct and to treat them in same time. Therefore now, days it is matter of choice from center to center to do the intraoperative cholangiography. In the same way the high resolution ultrasound preoperatively is not much helpful because it is not of much help in interpreting the biliary channel. It can only interpretate bile duct dilatation and any stone or debris in spite of cost and specialty involving.

After the introduction of laparoscopic cholecystectomy in the late decade of 1980, the field of general surgery was revolutionized. After the study of the many articles about laparoscopic cholecystectomy and bile duct injuries, it was found that laparoscopic cholecystectomy had many benefits

to patient's like less pain, less blood loss during operation, decreased hospital stay and earlier return to normal activities. In spite of these benefits unfortunately the data of many studies show a higher incidence of CBD injuries when compared with open cholecystectomy (atleast 0.4 to 0.5% vs 0.1 to 0.2% respectively). After review of many articles about CBD injuries regarding risk factor of injuries their proper management and long-term detrimental effect of bile duct injury on health and quality of life, it is still a gold standard for treatment of symptomatic gallstone disease uncomplicated gallbladder diseases like mucocoele, empyema, cholesterosis, porcelain GB, adenomatous polyp of GB.

## RISK FACTOR

Many studies show that the risk factor increases the chance of CBD injury. Many studies like a/population base study of 152776 cholestomy in sweet disk by Anne Waugh, MD, PhD, Magnus Nilsson, MD, PhD, show that old age, male sex, increase the risk of CBD injuries. In the same group the injuries were three times more, when performed in acute cholecystitis compared to elective and even more risk in acute to chronic cholecystitic when GB is inflamed and fibrosed.

## TECHNICAL ERRORS

All the articles like Strasbarg et al in 1995 of more than 124000 Laparoscopic cholecystotomies reported that high rate of biliary injury was due in part of learning curve effect, as surgeon passed through learning curve have reached, steady-state, there has been no significant in the improvement of incident of biliary duct injuries. Major associations have established specific guide lines to avoid this dreaded complication in 1991 Hunter noted that bill duct injury in laparoscopic cholecystectomy appear to more common in US (0.5 to 2.7%) than in Europe 0.33%. He observed that American teaching stressed cephalic (towards the right shoulder) traction of the infundibulum in GB tenting the CBD in risking its miss identification. European teaching stressed the lateral retraction places the cystic duct at right angle to CBD reducing the likely hood of miss identification.

After studying many articles regarding CBD injury in recommendation of guide line for clinical application in laparoscopy cholecystectomy by many associations like society of American gastrointestinal endoscopic surgeons, it is found that:

1. Try to memorize the initial anatomy of Calot's triangle surgeon should concern more about relative anatomy than initial anatomy.
2. Surgeon must clearly identify the cystic duct at its junction with GB.
3. A large distended GB should be aspirated and lifted rather than grasped.
4. The surgeon should retract the GB infundibulum laterally rather than in cephalic direction and avoid force fully pulling up of GB can cause tenting of CBD.
5. The surgeon should meticulously dissect the cyst duct and cyst artery.

6. The surgeon should limit the use of all energy sources and prefer pledged dissection near the CBD and recognized that they can cause occult injury.
7. Use suction and irrigation frequently.
8. The surgeon should not hesitate to convert to an open operation for technical difficulties, anatomy uncertainties or anatomical anomalies.
9. The surgeon need to see all structure clearly before dividing any ductal structure.
10. Peroperative cholangiography may be a little helpful to avoid bill duct injury, but it is quite helpful to diagnose bill duct injury at the same time allowing first appropriate treatment at the same time.
11. Surgeon should prefer extracorporeal knotting as mass legation just below the GB.
12. Neck in cases of difficult dissection of cyst duct and artery.

## BILE DUCT

Biliary tree is the whole network of various size ducts branching through liver path is as follows:

Bilicalculi – Canals of hering – Interlobular bile duct – Intra-hepatic bile duct – Right and left hepatic bile duct merge to form – Common hepatic duct and join cystic duct form – Common bile duct (join pancreatic duct) form ampulla of vater and enters the second part of duodenum.

The Bismuth classification for bile duct injury is:

Type I – CHD stump > 2 cm.

Type II – CHD stump < 2 cm.

Type III – Hilar right and left duct injury with confluence intact.

Type IV – Hilar separation of right and left duct.

Type V – Injury to aberrant right duct ± CBD injury.

In 1995 Strasberg and Soper modified the Bismuth classification of bile duct injury.

1. Type A – Bile leak from a minor duct still in continuity with the common bile duct.  
These leaks occur at the cystic duct or from the liver bed.
2. Type B – Occlusion of part of the biliary tree. Usually the result of an injury to an aberrant right hepatic duct. In 2% of patients, the cystic duct enters a right hepatic duct rather than the common bile duct–Common hepatic duct junction. The aberrant duct may be a segmental duct, a sectoral duct (the right anterior or posterior duct), or even
3. Type C – Bile leak from duct not in communication with common bile duct.  
Usually diagnosed in early postoperative period as an intraperitoneal bile collection.
4. Type D – Lateral injury to extrahepatic bile ducts. May involve the common bile duct, common hepatic duct, or the right or left bile duct.
5. Type E – Circumferential injury of major bile ducts. This type of injury causes separation of hepatic parenchyma from the lower ducts and duodenum. May be treated by

percutaneous or endoscopic techniques depending on length of stenosis or if.

## Classification of Biliary Duct Injuries

If complication recognized intraoperatively:

1. For high complete transaction Roux-en-y hepatojejunostomy.
2. For lower complete injuries – Primary suture repair over T tube.
3. Long end of T-Tube most not be exteriorized from same side for partial injuries insertion of T-tube and Roux-en-y serosal patch.

Strategy to handle complication recognized postoperatively  
Ultrasound + ERCP + MRCP + PTC.

After the detecting the injury or other complication due to bile duct injury, after resuscitation the patient, is treated with fluid + electrolytes + systemic antibiotic.

Patient should be referred to appropriate center like: secondary or tertiary center for further management accordingly  
The principal of treatment is to re-establish a pressure gradient that will favour the follow of bile into the duodenum not outside the leak side like:

1. Conservative treatment and biliary drainage for 6 weeks by ERCP stent- insertion.  
Or PTBD if endoscopic stent application is not possible.
2. Some times internal stenting with or without sphincterotomy is effective in treatment of small leaks.
3. A retrospective study by De Palana, et al in 2002 showed that sphincterotomy alone was highly effective in producing closure of bile fistulas by reducing endobiliary pressure.
4. After several weeks, reconstative surgery like Roux-en-y cholecystectomy or hepato jejunostomy should be performed if necessary.

## CONCLUSION

The principal difference form surgeon's perspective between laparoscopy and open cholecystectomy is the lack of three dimensional views of structures to be manipulated. During laparoscopy procedure a surgeon is guided by a two dimensional image seen on a television and screen depth perception is affected. That required higher level of coordination and patience. After diagnosing the CBD injury during operation it should be repaired with appropriate method either open or laparoscopically. If diagnosed in postoperative period then it should be always managed in secondary or tertiarycenter with the operate methods with fully skilled surgeon. In spite of a little more risk of bile duct injury. Laparoscopic cholecystectomy is still the gold standard of method for GB stone diseases due to other benefits over open cholecystectomy. After taking care of possibilities of CBD injury, early diagnosis and proper management, laparoscopic cholecystectomy is still the gold standard for GB stone diseases.

## BIBLIOGRAPHY

1. Adamsen S, Hansen Oh, Funch- Jensen P, Schulze S, stage JG, Ware P. Bile duct injury during laparoscopic Cholecystectomy: A prospective nationwide series. *J Am Coll Surg* 1997;184:571-78.
2. Archer Sb, Brown DW, Smith CD, Branum GD, Hunter JG. Bile duct injury during laparoscopic Cholecystectomy: Results a national survey. *Ann Surg* 2001;234:549-58.
3. Boerma D, Rauws EA, Keulemans YC, et al. Impaired quality of life 5 years after bile duct injury during laparoscopic Cholecystectomy: A prospective analysis. *Ann Surg* 2001;234:750-57.
4. Calvete J, Sabater L, Camps B, et al. Bile duct injury during laparoscopic Cholecystectomy: Myth or reality the learning curve? *Surg Endosc* 2000;14: 608-11.
5. Caroll BJ, Birth M, Phillips EH. Common bile duct injuries during laparoscopic. Cholecystectomy that result in litigation. *Surg Endosc* 1998;12:310-14.
6. Chen XR, Lou D, Li Sh, et al. Avoiding serious complication in laparoscopic. Cholecystectomy –lessons learned from an experience of 2428 cases. *Ann Acad Med Singapore* 1996;25:635-39.
7. Cox Mr, Wilson TG, Jeans PL, et al. Minimizing the risk of bile duct injury at laparoscopic Cholecystectomy. *World J Surg* 1994;18:422-27.
8. Fletcher Dr Hobbs MS, Tan P, et al. Complication of Cholecystectomy: Risks of the laparoscopic approach and protective effects of operative cholangiography: A population-based study. *Am Surg* 1999;229:449-57.
9. Flowers JL, Zucker KA, Graham SM, et al. Laparoscopic cholangiography: Result and indicatina. *Ann Surg* 1992;215:209-16.
10. Gouma DJ, Go PM Bile duct injury during laparoscopic and congenital Cholecystectomy. *J Am Coll Surg* 1994;178:229-33.
11. Hawasli A. Does routine cystic duct cholangiogram during laparoscopic. Cholecystectomy prevent common bile duct injury? *Surg Laparosc Endosc* 1993;3:290-95.
12. Huang CS, Lein HH, Tai FC, Wu Ch. Long-term results of major bile duct injury associated with laparoscopic Cholecystectomy. *Surg Endosc* 2003;17:1362-67.
13. Hunter JG, Avoidance of bile duct injury during laparoscopic Cholecystectomy. *Am J Surg* 1991;162:71-76.
14. Kullman E, Borch K, Lindstrom E, et al. Value of routine intraopeartive cholangiography in detecting aberrant bile ducts and bile duct injuries during laparoscopic Cholecystectomy. *Br J Surg* 1996; 83:171-75.
15. Lorimer JW, Fairfull-Smith RJ. Intraopeartive cholangiography during laparoscopic Cholecystectomy.
16. MacFadyen BV Jr. Vecchio R, Ricardo AE, Mathis CR. Bile duct injury after laparoscopic Cholecystectomy: The United States experience. *Surg Endosc* 1998;12:315-21.
17. Melton Gb, Lilemoe KD, Cameron JL, Saute PA, Coleman J, et al. Major bile duct injuries associated with laparoscopic Cholecystectomy: Effect of surgical repair on quality of lie. *Ann Surg* 2002;235:888-95.
18. Perissat J. Laparoscopic Cholecystectomy: The European experience. *Am J Surg* 1993;165:444-49.
19. Prof Dr RK Mishra. Essentials of laparoscopy New Delhi, M/s all Medical Publisher 2005.
20. Prof Dr RK Mishra. Textbook of practical laparoscopic surgery New Delhi, Jaypee Brothers Medical Publisher 2008. Jordan AB; Hospital charges for laparoscopic and open Cholecystectomy (letter), *JAMA* 226(24).
21. Raute M, Podlech P, Jäschke W, et al. Mangement of bile duct injuries and strictures following Cholecystectomy. *World Surg* 1993;17:914-18.
22. Richardson MC, Bell G, Fullarton GM, West of Scotland Laparoscopic Cholecystectomy Audit Group. Incidence and nature of bile duct injuries following laparoscopic Cholecystectomy: An audit of 5913 cases. *Br J Surg* 1996;83:1356-60.
23. Roslyn JJ, Binns GS, Hughes EF, Sauders-Kirkwood K, Zinner MJ, Cates JA. Open Cholecystectomy: A contemporary analysis of 42,474 patients. *Ann Surg* 1993;218:129-37.
24. Sabharwal AJ, Minford EJ, et al. Laparoscopic cholangiography: A prospective study. *Br J Surg* 1998;85:624-26.
25. Schol FP, Go PM, Gouma DJ. Outcome of 49 repairs of bile duct injuries after laparoscopic. *World J Surg* 19:753-57.
26. Strasberg SM, Herti M, Soper NJ. An analysis of the Problem of biliary injury during laparoscopic Cholecystectomy. *J Am Coll Srug* 1995;180:101-1255.
27. Targarona EM, Marco C, Balague C, et al. How, when, and why bile duct injury occurs: A comparison between open and laparoscopic Cholecystectomy. *Surg Endosc* 1998;12:322-26.
28. Taylor B. Common bile duct injury during laparoscopic Cholecystectomy in Onatrio: Does ICD-9 Coding indicate true incidence? *CMAJ* 1998;158:481-85.
29. Windsor JA, Pong J. Laparoscopic biliary injury: More than a learning curve problem. *Aust N Z J A Surg* 1998;68:186-89.
30. Woods MS, Traverso WL, Kozarek RA, et al. Characteristics of biliary tract complication during laparoscopic Cholecystectomy: A multi-institutional study. *A J Surg* 1994;167:237-34.
31. Wright KD, Wellwood JM. Bile duct injury during laparoscopic Cholecystectomy without operative cholangiography. *Br J Surg* 1998;85:191-94.
32. Wudel LJ Jr, Wright JK, Pinson CW, et al. Bile duct injury following laparoscopic Cholecystectomy: A cause for continued concern. *Am Surg* 2001;67:557-63.

Roscopic Cholecystectomy. *Br J Surg* 1996;83:171-75.