

A study of factors associated with bile duct injury in cholecystectomy operations

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Abstract

Introduction: The biliary tract is a complex organ system that performs the simple though vital task of collecting, storing, and delivering bile to the gastrointestinal tract. Diseases of the biliary tract can be painful, debilitating, and occasionally life threatening. The development of the liver and biliary system in utero can result in multiple anatomic variations. An absolute knowledge of these anatomic variations with careful dissection and identification of structures at the time of surgery is a minimal requirement for the safe performance of any biliary surgery. Because of the great frequency with which the operation is performed, cholecystectomy remains the greatest source of post-operative biliary injuries. **Aims and Objective:** To study the clinical profile and Factors Associated With Bile Duct Injury in Cholecystectomy Operations. **Methodology:** A prospective analysis was done on all patients with an iatrogenic Bile Duct Injury (BDI) from June 2008 to July 2010. Retrospective study for BDI during the period January 2006 to May 2008 done using the available hospital records was also done. BDI as a complication of cholecystectomy done at M.S. Ramaiah hospitals and also those referred from elsewhere with BDI as a complication of cholecystectomy were included in the study. The case papers, referral letters, operative and postoperative records were scrutinized and data collected. BDI occurring as a complication of other surgeries apart from cholecystectomy, post ERCP, due to penetrating and blunt injuries to the abdomen, during Cholecystectomies done along with other surgeries-such as for pancreatic malignancy were excluded from the study. **Result:** A total of 731 cholecystectomies were carried out in the study period. The incidence of Bile duct injury was 3.42%. Most of the patients were from the age group of 50-59 (7) followed by 60-69 (6); 40-49 (5); 30-39 (3) and 20-29 (3). Majority of the patients were Female i.e.14 (56%). Majority of the bile duct injuries were seen in patients undergoing cholecystectomy for cholecystitis of > 72 hours duration. Among the 25 cases of BDI 80% were done laparoscopically and 20% were open cholecystectomies. Bile duct injuries mostly associated with; one (4%) had cholangitis, another (4%) had pancreatitis and two patients(8%) had choledocholithiasis. Three of the patients (12%) with BDI had cholecystitis of <72 hours duration. 28% of bile duct injuries were noted in patients with the above risk factors. **Conclusion:** Bile duct injury remains a dreaded complication in all cases of cholecystectomy, factors such as acute cholecystitis, cholangitis, pancreatitis, choledocholithiasis are contributory to occurrence of BDI and help of senior colleagues should be sought in cases with such co-morbidities. Detailed investigations to determine the site of injury is a must prior to any definitive repair.

Keywords: Bile Duct Injury (BDI), ERCP, Cholecystectomy.

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Received Date: 02/10/2015 Revised Date: 30/10/2015 Accepted Date: 24/11/2015

Access this article online

Quick Response Code:	Website: www.statperson.com
	DOI: 08 December 2015

INTRODUCTION

The biliary tract is a complex organ system that performs the task of collecting, storing, and delivering bile to the gastrointestinal tract. The complex development of the liver and biliary system in utero can result in multiple anatomic variations. An absolute knowledge of these anatomic variations with careful dissection and identification of structures at the time of surgery is a minimal requirement for the safe performance of any biliary operation. Because of the unforgiving nature of the biliary system, errors in technique or judgment can be

disastrous to the patient, resulting in lifelong disability or death. For this reason, a high premium exists on performing the correct procedure, without technical misadventure, the first time. Equally important is the ability to recognize iatrogenic injury so that prompt repair or referral to a surgeon who has expertise in hepatobiliary surgery can be instituted. Positive outcome requires a balance between sound judgment, technical acumen, and attention to detail. Additionally, the surgeon of today must be able to integrate surgical options with the broadening array of radiologic and endoscopic treatment options available in the management of patients who have these disorders. Because of the great frequency with which the operation is performed, cholecystectomy remains the greatest source of post-operative biliary injuries. In a review of more than 42,000 open cholecystectomies performed in the United States in 1989, the incidence of biliary injuries was documented to be 0.2%¹. Strasberg and associates reported a 0.3% incidence of injuries in a literature review of more than 25,000 open cholecystectomies since 1980². The advent and preference for laparoscopic cholecystectomy has refocused attention on this issue, however because of the significant increase in the number of injuries. Several studies worldwide have documented a marked increase in the frequency of bile duct injuries associated with the laparoscopic approach, ranging from 0.4% to 1.3%^{3,4,5,6,7}. Also in a review of nearly 125,000 laparoscopic cholecystectomies reported in the literature in the years 1991-1993, Strasberg and colleagues reported an overall incidence of biliary injuries of 0.85%². There are several reasons that the bile duct is at increased risk of injury during laparoscopic cholecystectomy compared with open cholecystectomy. It has long been argued that surgeon inexperience is a major culprit, and that with increased familiarity with the procedure, the number of injuries will decrease: the so-called 'learning curve effect'⁸. There is considerable evidence to support this view. Several authors have shown an inverse relationship between the incidence of bile duct injuries and number of cases performed^{4,8,11}. Also, large population-based reviews have documented a decline in injuries over time^{6,10}, and some authors have noted a decline in the number of injuries referred for repair⁹.

AIMS AND OBJECTIVE

To study the clinical profile and Factors Associated With Bile Duct Injury in Cholecystectomy Operations.

MATERIAL AND METHODS

The study was conducted on the patients admitted to M.S.Ramaiah hospitals, who underwent cholecystectomy and also on those patients who were referred with

documented bile duct injuries (done elsewhere) for further management. A prospective analysis was done on all patients with an iatrogenic BDI from June 2008 to July 2010. Retrospective study for BDI during the period January 2006 to May 2008 done using the available hospital records. The case papers, referral letters, operative and postoperative records were scrutinized and data collected. For the injuries sustained during cholecystectomy, timing of cholecystectomy after the onset of symptoms (<72 hours or >72 hours), gender, age, presence of aberrant anatomy (extra-hepatic bile duct and vascular anatomy), presence of gall stone pancreatitis, acute cholecystitis or cholangitis, time between cholecystectomy and recognition of BDI, time from injury to definite management, type of injury, endoscopic retrograde cholangiography and stenting and definitive repair were noted. Bile duct injury was noted as bile leak intraoperatively (bile ducts, gall bladder bed) or in the postoperative period as evidenced by bilious drainage, failure to recover along expected lines, abdominal pain, sepsis, etc. All patients who have undergone cholecystectomy at M.S. Ramaiah Hospitals during the period January 2006 to July 2010. All patients referred with bile duct injuries occurring as complication of cholecystectomy (done elsewhere) to M.S. Ramaiah Hospitals included into study and the Bile duct injuries occurring as a complication of other surgeries apart from cholecystectomy, post ERCP, or due to penetrating and blunt injuries to the abdomen or Cholecystectomies done along with other surgeries-such as for pancreatic malignancy were excluded from the study.

RESULT

A total of 731 cholecystectomies were carried out in the study period. The incidence of Bile duct injury was 3.42%. The mean age was 48.72 yrs. with a standard deviation of 14.04 and a range of 20-78 yrs.

Table 1: Distribution of the patients as per Age and sex wise

Age	Male	Female	Total
20-29	1	2	3
30-39	1	2	3
40-49	3	2	5
50-59	3	4	7
60-69	2	4	6
70-79	1	0	1
Total	11	14	25

Majority of the patients were from the age group of 50-59 i.e. 7 followed by 60-69 i.e. 6; 40-49 i.e. 5; 30-39 i.e. 3 and 20-29 i.e. 3. Majority of the patients were Female i.e.14 (56%) and Male 11(44%)

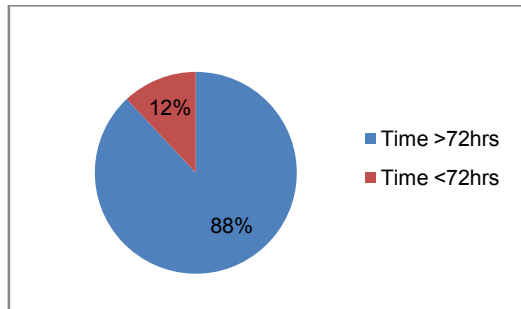


Figure 1: Bile Duct Injuries

Majority of the bile duct injuries were seen in patients undergoing cholecystectomy for cholecystitis of > 72 hours duration. Among the 25 cases of BDI 80% were done laparoscopically and 20% were open cholecystectomies. Of the 20 cases done laparoscopically 8 were converted to open. Among the 25 cases of BDI, 5 were cases of documented BDI referred to our hospital for further management. BDI was recognized intraoperatively in 52%, in the early postoperative period (<1 wk.) in 44% and only 1 case was identified in the latepostoperative period. Intraoperative cholangiogram was done to define bile leakage in 2 cases only.

Table 2: Factors Associated With Bile Duct Injuries

Factors	No.	Percentage
Cholangitis	1	4%
Pancreatitis	1	4%
Choledocholithiasis	2	8%
cholecystitis of <72 hrs. duration	3	12%
Total	7	28%

In the patients with BDI, one (4%) had cholangitis, another (4%) had pancreatitis and two patients (8%) had choledocholithiasis. Three of the patients (12%) with BDI had cholecystitis of <72 hours duration. 28% of bile duct injuries were noted in patients with the above risk factors. Majority of the patients who did not undergo any definitive surgery for the bile duct injury immediately in the same setting were evaluated postoperatively with an ultrasound abdomen and pelvis (72%), further evaluation to detect the site of injury was done with a CT abdomen (36%), ERCP (36%) and PTBD (12%). The site of BDI was determined to be CHD in 36%, CBD in 28%, cystic duct in 28% and from the gall bladder bed in 8% of the cases.

DISCUSSION

In September 1985, Erich Muhe performed the first LC. The widespread acceptance and application of LC brought not only the obvious benefits of decreased postoperative pain and length of hospital stay but was associated with a troublesome increase in certain complications, specifically BDI. Over the last decade,

BDI following LC has become recognized as a major health problem, as evidenced by studies evaluating the postoperative management and long-term quality-of-life outcomes of patients. Despite expectations that the rate of BDI would decrease over time as the “learning curve” of LC flattened, the rates appear to have reached a plateau, as evidenced by a recent review of nearly 1.6 million cholecystectomies performed among Medicare beneficiaries. These studies revealed a steady 0.5% incidence of BDI from 1992 to 1999. Unfortunately, BDI appears to be a complication that may continue to exist at rates greater than in the pre-LC era. Despite improvements in technology, BDI continues to pose a significant clinical challenge. Proper diagnosis and appropriate treatment of BDI are paramount in preventing life-threatening complications of cholangitis, biliary cirrhosis, portal hypertension, end-stage liver disease, and death. Although the mechanisms of bile duct injury during laparoscopic cholecystectomy are varied, the common denominator is failure to recognize the anatomy of the triangle of Calot. This failure can be attributed to anatomic risk factors, factors inherent in the laparoscopic technique, or inadequate training. Anatomic risk factors may include acute or severe chronic inflammation, morbid obesity, bleeding, and the presence of anatomic anomalies. Factors inherent in the laparoscopic technique include the lack of depth perception, differences in the lines of traction of the gallbladder, the difficulty of performing ante grade cholecystectomy, and the use of the electro cautery or laser in a limited field that can be easily obscured by blood or bile. The current study illustrates the magnitude of the problem resulting from BDI. Most of the injuries were noted in the sixth and seventh decades of life with a slight female preponderance. The rate of BDI in our study is higher being 3.42% when compared to other studies (0.4-0.6%)^{11,3,12,13}. This could be attributable to the learning curve for laparoscopic surgery in our institution. 12% of the BDI were noted in patients undergoing cholecystectomy for cholecystitis of <72 hours duration. This underlies the difficulties in performing a safe surgery in situations where the anatomy of the Calot’s triangle is unclear. No aberrant vascular or ductal anatomy was encountered in this study. Eighty percent of the injuries occurred during laparoscopic cholecystectomy. Forty percent of these were converted to open procedure. While less than a third of the bile duct injuries are recognized intraoperatively^{14,15}, in our study this rate was 52%. Majority of these were managed at the same time immediately after recognition during cholecystectomy. Multidisciplinary approach involving surgeons, hepatobiliary surgeon and interventional radiologists in management of complications is essential.

The most frequent investigation used to determine BDI postoperatively was ultrasound of the abdomen and pelvis. ERCP, PTC, PTBD were used to further delineate the bile duct anatomy and site of injury. In our study the most common site of BDI was found to be the common hepatic duct. Strasberg type A was the most common BDI encountered in our study. This is in agreement with the findings in another study by Strasberg *et al*, 1995². Most of the cases of BDI were managed by a definitive repair, these were assisted with radiological/endoscopic interventions in the form of ERCP and stenting, PTBD. A minority were managed by stenting only and did not require any surgical intervention. Among BDI recognized intraoperatively, 54% of these were managed with primary suturing or additional clipping of the cystic duct leak. For the injuries discovered postoperatively the most common surgery done was the Roux-en-Y hepaticojejunostomy. Of the twenty five BDI profiled, five were referred from other hospitals/surgeons for further management. Most of these cases were managed with a Roux-en-Y hepaticojejunostomy while one was amenable to closure of the CHD over a PTBD drain.

CONCLUSION

Bile duct injury remains a dreaded complication in all cases of cholecystectomy, factors such as acute cholecystitis, cholangitis, pancreatitis, choledocholithiasis are contributory to occurrence of BDI and help of senior colleagues should be sought in cases with such comorbidities. Detailed investigations to determine the site of injury is a must prior to any definitive repair.

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Source of Support: None Declared
Conflict of Interest: None Declared