

Managing iatrogenic bile duct injuries through a multidisciplinary team approach: A SIUT case series

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Abstract

Iatrogenic injury to the bile duct is one of the most serious and feared complication of cholecystectomy, with a high mortality ranging between 3-12%. The management of such injuries of the bile duct is far more complicated and prolonged than the procedure itself. A retrospective analysis of 36 patients with bile duct injuries (BDI) was conducted over a period of 7 years, from January 2007 to December 2014. Most of their injuries occurred during open cholecystectomy, 22 rather than laparoscopic 14 and were mostly elective surgeries 34. Most injuries were identified postoperatively in 33 (91.6%) patients, at a median of 3.0 days. Among the modalities used to diagnose and treat these patients, endoscopy was performed in 32 of the cases (88.8%), followed by surgery on 17 (47.2%) patients and radiology on 16 (44.4%) cases. Surgery remains the gold standard for treatment of complete transection of bile duct injuries and long term outcomes are usually good. Endoscopy and radiology has an increasing role in the diagnosis and treatment of a leaking (non-transected) bile duct injury.

Keywords: Bile duct, Gall stones, Iatrogenic disease, Cholecystectomy, Laparoscopic.

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Introduction

The advent of laparoscopy in the last century has greatly improved outcomes in abdominal surgeries that range from benign cholelithiasis to malignant diseases of the bowel. Laparoscopic cholecystectomy has now become the standard procedure for gallstone disease in modern surgical practice.¹ However, several adverse incidents have been reported with laparoscopic cholecystectomy including bleeding, gallbladder perforation, stone loss, common bile duct injury, injury of intra-abdominal organs, wound infection, sub-hepatic collection, bile leakage, incisional umbilical hernias, residual gallstones in common bile duct, urine retention and biliary peritonitis.² However, the procedure is safe in trained,

experienced hands with expected mortality of less than 0.1%.³

Iatrogenic injury to bile ducts is one of the most serious and feared complication of the procedure, with high mortality rate ranging between 3-12%.^{4,5} According to literature, independent risk factors for BDI are male gender, age >60 years, treatment in a teaching hospital, Asian ethnicity, severity of disease and long working hours for residents.⁶⁻⁸

The rate of bile duct injuries with laparoscopy has declined over time, but since the last decade, it has remained at a constant. Despite a learning curve, the rate of LC-BDI appears to be at a plateau. In literature, the rate of injury for open cholecystectomy is estimated to be 0.2% vs approximately 0.4% to 0.6% with LC.⁹⁻¹¹ In Islamabad, Pakistan, a 0.12% rate of injury with laparoscopic cholecystectomy has been reported.¹²

Although with appropriate training, laparoscopic cholecystectomy is easy to master, however the management of iatrogenic injuries of the bile duct is far more complicated and prolonged than the procedure itself. While surgery is the primary mode of treatment, radiology and endoscopy play a very important role in the management of complicated cases ranging from diagnostic to therapeutic interventions.¹³ A multidisciplinary approach is therefore the cornerstone of dealing with such adverse incidents.

We share our experience of managing patients who have suffered from iatrogenic bile duct injuries, either at our own setup or referred to us from other hospitals.

Patients and Methods

A retrospective analysis of patients diagnosed with bile duct injuries was conducted over a period of seven years, from January 2007 to January 2014 in the department of Hepatobiliary and Gastrointestinal surgery at the Sindh Institute of Urology and Transplantation (SIUT). The inclusion criterion was all patients diagnosed with bile duct injury after laparoscopic or open cholecystectomy. Patients who developed bile duct injury due to surgeries other than cholecystectomy were excluded. A total of 36 cases of iatrogenic bile duct injuries were identified

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through their case records and included for the study. Strasberg classification of bile duct injuries was used to categorise these patients¹⁴. Data regarding demographics, type of surgery, nature of surgery, nature of the center where the surgery was performed, modalities used for treatment of bile duct injuries, type of treatment for bile duct injuries and follow up complications was recorded on a pre-designed questionnaire. Frequencies of the above mentioned variables were calculated using SPSS version 20.

Endoscopic Interventions: All endoscopic retrograde cholangiography procedures were done under general anaesthesia for which a side-viewing enteroscope was used. After identification and cannulation of ampulla, guide wire was inserted and an initial cholangiogram was taken. Double pigtail plastic stents were placed in case the guide wire crossed the area of narrowing or biliary leak. No metallic stents were used in these cases. More than one plastic stents — up to 4 — were placed to achieve endoscopic dilation of stricture. The endoscopic dilation procedure was repeated every three months for a period of two years. For biliary leaks only, the stents were removed 6 weeks after insertion. Stent removal was done under sedation. A formal Endoscopic Retrograde Cholangio Pancreatography (ERCP) was repeated at the time of stent removal only if cholangiogram images were required.

Technique of Surgery: A side-to-side Roux-en-y hepaticojejunostomy was the standard procedure for all of bilioenteric anastomosis.¹⁵ A right subcostal incision with extension to the left subcostal area (extended Kocher's incision) was made. The exposure attained using self-retaining Thompson retractors. Dissection of the hilum was done to identify the biliary ducts (left, common hepatic) confirmed by using fine needle aspiration (25G) of bile. A 1.5-2 cm longitudinal incision over the bile duct was performed the most. A roux-loop of jejunum constructed and anastomosed with hepatic ducts using PDS 4/0 or 5/0 suture. An interrupted layer of sutures with needles at both ends was taken through the anterior lip of bile duct opening approximately 2-3 mm apart and placed in clamps. A standard 60-80 cm Roux-en-Y limb of jejunum was created. The Roux limb of jejunum was opened at anti-mesenteric border using diathermy current in length approximately equal to the length of bile duct opening. Similar sutures were then placed through the posterior lip of bile duct and jejunal openings ensuring good mucosa to mucosa approximation. Sutures of posterior layer were tied in such a way that knots appeared within the lumen of anastomosis. The already placed sutures on the anterior

lip of bile duct opening were now placed through anterior lip of jejunal opening and tied so that the knots were placed outside the lumen of anastomosis. Anastomotic stents were not used.

Radiological Interventions: The indications of doing percutaneous trans-hepatic cholangiography (PTC) were two folds. Firstly PTC provided excellent images of the proximal biliary tree which were superior to MRCP. Secondly proximal drainage relieved obstructive jaundice and improved patients' feelings of nausea and low appetite so that nutritional optimisation could be achieved. The procedure was done under local anaesthesia and analgesia at angiography suite in over both, dilated and non-dilated bile duct systems. With the guidance of ultrasound, 22 G spinal needle was used to tap secondary radicles of right hepatic duct in mid axillary line. After entering the biliary radicle successfully, guide wire was inserted up to the confluence and cholangiogram images were taken. An attempt to cross the stricture was made in every procedure. An external or interno-external drain was placed depending whether the guide wire crossed the stricture or not. For interno-external drains additional eyes were made in such a way that it could drain the bile pooled proximal to the stricture. The drains were fixed to the skin using silk sutures.

Magnetic resonance cholangiopancreatography was used in several cases as indicated. The imaging was done with 2 Tesla machine. The average time of investigation was 30 minutes. Ultrasound was used routinely in all cases to check for ductal dilation and abdominal collections postoperatively as indicated. Computerised tomography was not used routinely for the management of these cases.

Results

A total of 36 patients were included in the study based on inclusion criteria. Among the patients included, 12 (33.3%) were males and 24 (66.6%) were females. The mean age of patients was 42.8 ± 12.3 years and majority (61.1%) had no known co-morbid. In most of the cases 22 (61.1%), injuries occurred while performing open cholecystectomy rather than during laparoscopic in 14 (38.8%) cases. Majority of these cases 34 (94%) were elective surgeries. The distribution of injuries in private vs. public and teaching vs. non-teaching centers was approximately equal.

In only three (8.3%) cases, injuries were identified intraoperatively, while in 33 (91.6%) patients, they were identified postoperatively, at a mean of 5.7 days (SD 7.3).

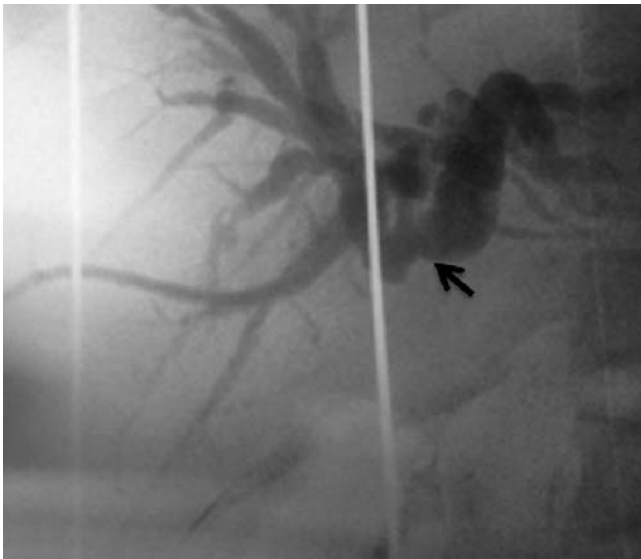


Figure-1: Percutaneous Cholangiogram, Strasberg's E4 Injury.

Common symptoms of these bile duct injuries were abdominal distention (54%), fever (43.2%), abdominal pain (35%) and jaundice (32%). Patients presenting with bile in intraoperatively placed subhepatic drains were 11 (29.2%). The mean serum bilirubin was higher for transection injuries (5.7%) compared to leak injuries

(3.1%).

The diagnosis of bile duct injuries rests on clinical and radiological scenarios, as well as on endoscopic investigations. An ultrasound was done in all these cases to check for collection and dilation of bile ducts. Magnetic resonance cholangiopancreatography was performed in 14 (37.8%) of the cases to delineate the bile duct, anatomy in 12 (85%) patients and for diagnosis in 2 (14.2%) cases. Computerised tomography of abdomen was performed in only one case for the purpose of identifying multiple intra-abdominal collections and subsequent percutaneous drainage. The invasive endoscopic retrograde cholangiopancreatography (ERCP) was done in 32 (88.8%) cases.

ERCP was diagnostic only in 18 (56.2%) and therapeutic in 14 cases (43.7%). Findings of ERCP included, complete cut off in 16 cases, bile duct stricture in 5 and distal CBD stone in 4 cases. The cases found to have distal CBD stone, presented with biliary leak from cystic duct stump (Strasberg A). An associated choledocho-dudenal fistula was seen in 5 complete transection cases. Successful stenting was done in 14 out of 32 patients (therapeutic).

Surgery in form of bilioenteric anastomosis was the next modality of treatment used in 17 (47.2%) of the cases. Radiology contributed in form of percutaneous trans-

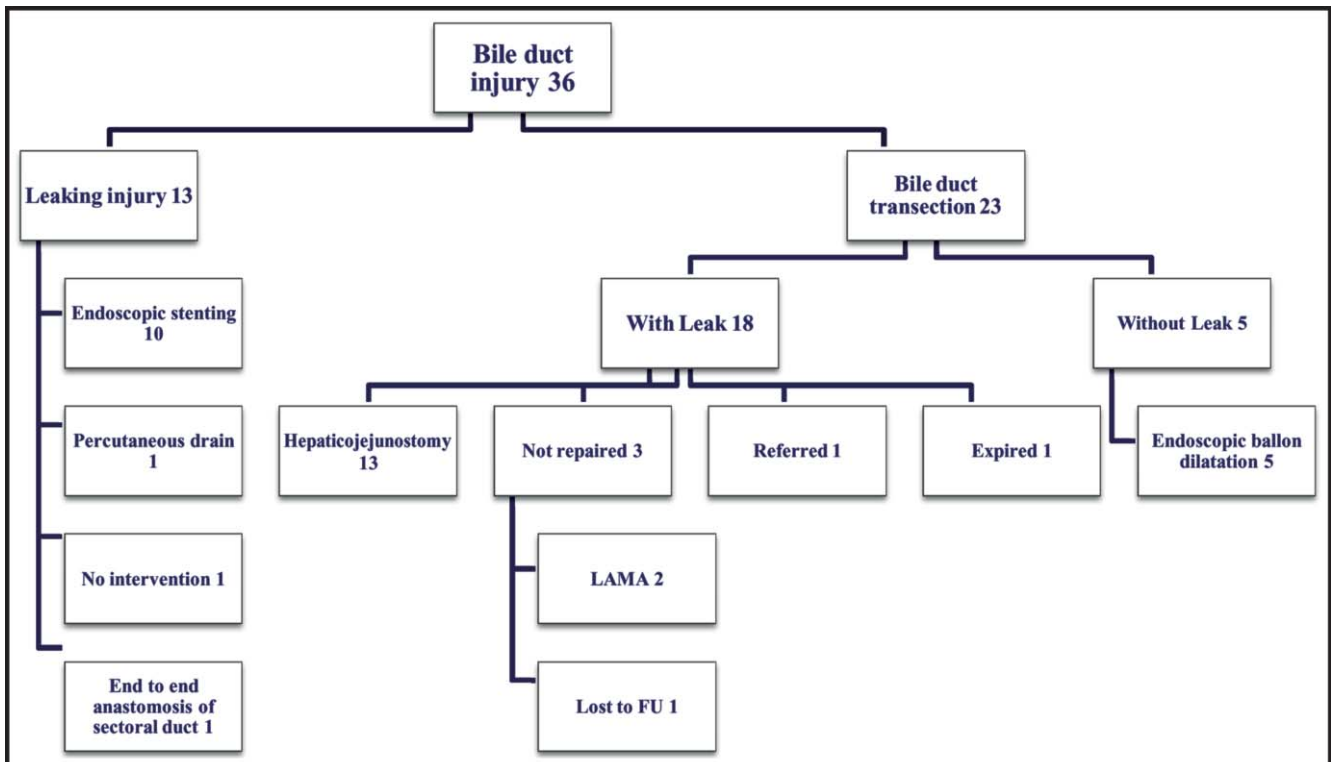


Figure-2:

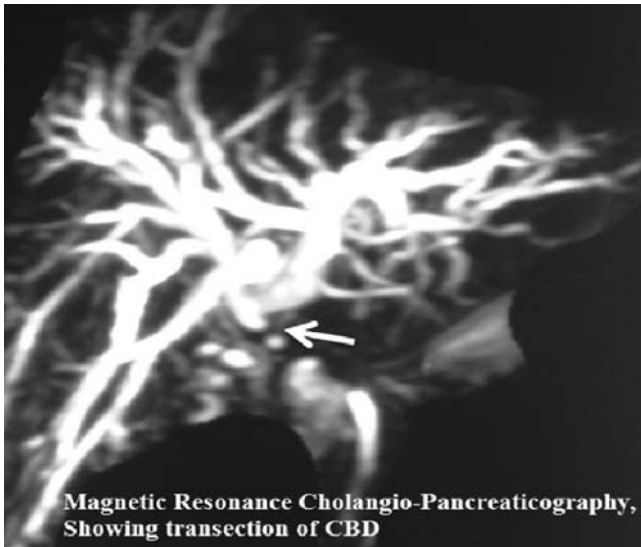


Figure-3: Magnetic Resonance Cholangio-Pancreaticography, showing transection of CBD.

hepatic drains, percutaneous intra-abdominal drains and magnetic resonance cholangiopancreaticography. Interventional radiology was used in 16 (44.4%) cases. It was curative only in one case (2.2%) making it only an adjuvant modality of treatment.

Based on mode of presentation, patients were divided into biliary leak alone, biliary obstruction alone or biliary leak with obstruction combined.

Among the 13 biliary leaks, endoscopic stenting of common bile duct was performed on 10, percutaneous drainage of bilioma in one and end-to-end repair of right posterior sectoral duct in one (identified intraoperative in our center); while the remaining one patient required no intervention as her bile leak was controlled with intraoperative drain and stopped spontaneously after two weeks of parent surgery.

Among the 21 patients who presented with biliary obstruction, 16 patients had complete transection of bile ducts (E1=2, E2=6, E3=6, E5=1), 12 of these underwent Roux-en-Y hepaticojejunostomy. The procedure was done after biliary sepsis was under control and nutritional optimisation. The patients had good outcomes at mean follow up of 2.02 years in this group. Three patients had advance secondary biliary cirrhosis and therefore were not offered major surgery. One patient was referred to another center because of early cirrhosis (4 years post injury, managed by left hepatic duct PTD for 2 years) and underwent segment 3 duct-jejunostomy Roux En Y. On follow-up for 2 years, he is doing well.

Biliary stricture was the cause of biliary obstruction in 5 (13.5) patients, all of whom underwent successful endoscopic biliary stenting, followed by a plan to do endoscopic balloon dilation on a quarterly basis for a period of 18 months to two years. After mean of 3.6 ± 2.0 session of endoscopic dilation, none of these patients had complete resolution of stricture.

Two patients presented with features of both complete cut off and proximal bile leak. One of these patients expired due to septic shock following biliary peritonitis in spite of percutaneous drains x 2. The other underwent Roux-en-Y hepaticojejunostomy after initial percutaneous drainage to control sepsis was done.

The mean operating time of 12 Roux-en-Y hepaticojejunostomies at our center was 332.6 ± 107.0 minutes. Mean blood transfusion was 0.85 ± 1.5 units and mean blood loss was 357.6 ± 229.0 ml. The average postoperative stay was 10 ± 4.8 days. Postoperative complications were wound infection in 3 and CVA with left hemiparesis in one. The CVA resolved slowly over the course of six months and the patient is now able to lead a normal life.

The mean follow up of these patients was 1.6 years (SD 1.2). Complications recorded were recurrent cholangitis in one which was managed with appropriate antibiotics, and anastomotic stricture in one which was managed with percutaneous dilatation.

Discussion

Management of iatrogenic bile duct injuries is complex and demanding. With the advent of laparoscopy, the risk and complexity of these injuries has increased significantly. Overall, the rate of injury with laparoscopy is approximately double that of open cholecystectomy. However, in the current series, 61.1% of injuries were recorded with open surgery, rather than laparoscopy. Similar results have been reported in other case series from the same region,^{12,16} Reasons for the difference from the international data is difficult to establish from the current series. One reason could be the endemic nature of the disease in our part of the world, and a relative lack of health care facilities in the government sector. Several of these patients suffered multiple attacks and had thick fibrosis by the time they came to a private hospital. These were difficult cases and usually ended up being either open or converted to open.

Intraoperative identification of injuries was small at 8.3% in the current series. Other studies have reported variable numbers in this regard ranging from 14 to

46%.^{17,18} Among the injuries identified during postoperative period, 88.8% presented in the first four weeks while only 11.2% presented later. There was no difference in injuries at teaching and non-teaching hospitals, although surgery at teaching hospitals has been reported as a risk factor of BDI⁴ because these were done by less trained surgeons in small private hospitals.

Endoscopy has been identified as most useful modality in the management of injuries for 88.8% of these patients. It has both diagnostic and therapeutic options. Endoscopy alone was curative in 12 (33.3%) of the patients in the group, all of which were Strasberg A injuries. Endoscopy revealed a choledocho-duodenal fistula in 5 cases, all of which were complete transection injuries. These were diagnosed based on finding bile in duodenum that was not coming through ampulla of Vater. These fistulas can be the reason for occasionally late presentation of complete transection injuries (Strasberg E). However, does presence of such a fistula obviate the need for definitive bilioenteric anastomosis? In our opinion, the fistulas are small and drain only a fraction of the bile produced, hence the need for a wide anastomosis.

Surgical repair was the next commonly used modality contributing to 47.2% of cases, majority of them being complete transection injuries (Strasberg E), while surgery alone was curative in 15 (41.6%) of the patients. The standard procedure was Rou-en-y hepaticojejunostomy which is reported to be most suitable bilioenteric anastomosis for such cases.¹⁹ We ensured a wide >2cm anastomosis and always used the left duct and sometimes also the right duct for a wide anastomosis. A well-constructed high level Rou-en-y hepaticojejunostomy performed by an experienced hepatobiliary surgeon using appropriate technique and suture material, has a low stricture rate. This was demonstrated in 12 of such surgeries performed at our center, among which only one (7.69%) developed stricture. The rate of anastomotic stricture in bilioenteric anastomosis is reported in literature ranging from 5 to 17.2%.²⁰

Radiological interventions have a small but important contribution. In the current series, radiologic interventions were done in 44.4% of cases. However such intervention was curative alone in only one case (2.7%). This makes radiology an important diagnostic option but not a therapeutic one for such cases. In cases where the serum bilirubin level progressed beyond 6mg, and caused anorexia, a PTD played a vital role for nutritional rehabilitation. However, there is always a risk

of cholangitis, and drain dislodgement and hence this modality was used judiciously. In a couple of cases, radiology helped to guide the surgeons to the left hepatic duct. The role of radiology in management of recurrent stricture after bilio-enteric anastomosis is substantial and growing.²¹

Conclusion

Bile duct injuries (BDI) are complex, clinical problems occurring during commonly performed gall bladder surgeries. Such cases should be managed in centers where there are multidisciplinary teams are available that include a surgeon, an endoscopist and a radiologist.

Surgery remains the gold standard for treatment of complete transection bile duct injuries and the long term outcomes are good. Endoscopy has an increasing role in the diagnosis and treatment of leaking (non-transected) bile duct injuries. Radiological interventions benefit some patients in the short term, by allowing the diversion of bile and optimising a patient's overall condition until definitive surgical intervention can be done.

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Conflict of Interest: None to declare.

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