



## Cross-sectional Study

## Management of post-cholecystectomy bile duct injuries without operative mortality at Jakarta tertiary hospital in Indonesia – A cross-sectional study

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## ARTICLE INFO

## Keywords:

Cholecystectomy

Bile duct injury

Roux-en-Y-Hepaticojejunostomy

## ABSTRACT

**Background:** Bile duct injuries (BDI) can occur after a cholecystectomy procedure performed by any surgeons. These ensured a poor experience for patients and surgeons and marred the minimally invasive surgery approach, which should have promised rapid recovery. This study aimed to evaluate the management of BDI following cholecystectomy procedure in Cipto Mangunkusumo Hospital, Jakarta, as a tertiary hospital.

**Method:** Descriptive retrospective cross-sectional design was used on open and laparoscopic cholecystectomy performed between January 2008 and December 2018. This study is reported in line with STROCSS 2019 Criteria.

**Result:** A total of 24 patients with BDI were included, with female preponderance (62,5%) with a median age 45 (21–58) years. Sixteen post-laparoscopy cases were classified according to Strasberg classification; 6 cases were type E3, 2 cases each of type E1 and E2, and one case each of Strasberg C and D. The remaining 4 were Strasberg A. Eight post-open cases were classified based on Bismuth criteria: 4 cases of Bismuth I, 1 case of Bismuth II, and 3 cases of Bismuth III. Five cases were presented with massive biloma, 7 with jaundice, and 10 cases with biliary-pancreatic fluid production through the surgical drain. The average time of problem recognition to patient's admission was 19 (7–152) days and admission to surgery was 14 days. Roux-en-Y hepaticojejunostomy was performed in 18 cases, choledocho-duodenostomy in 2 cases, and primary ligation cystic duct in 4 cases. Post-operative follow-up showed 2 patients had recurrent cholangitis, 2 superficial surgical site infection, and 2 relaparotomy due to bile anastomosis leakage and burst abdomen. The median length of hospital stay was 38 (14–53) days with zero hospital mortality. No stricture detected in long term follow-up.

**Conclusion:** Common bile duct was the most frequent site of BDI, and Roux-en-Y hepaticojejunostomy reconstruction performed by HPB surgeons on high volume center results in a good outcome.

## 1. Introduction

Bile duct injuries (BDI) can occur after a cholecystectomy procedure performed by any surgeons. Laparoscopic cholecystectomy is the most frequently performed procedure on the digestive tract with a higher rate of BDI compared to open surgery. Many consider this kind of injury tarnishes minimally invasive approach for prolonging recovery which should have been shorter and better, not to mention deeply frustrating for patients and surgeons [1–6].

Early diagnosis, exact timing of operation, and appropriate

reconstruction can alleviate serious complications such as biliary cirrhosis, biliary sepsis, and hepatic failure and are essential for better recovery [3,5,7]. The aim of surgical intervention is ascertaining the flow of bile by an apt bilio-enteric reconstruction [4,5,7,8].

Initially, endoscopic treatment by sphincterotomy and/or stent placement is recommended in patients with simple and early detected BDI [8]. When endoscopic procedure cannot be performed, surgical management is required. Successful repair by an experienced hepatobiliary surgeon in a multidisciplinary center will reduce morbidity, length of stay and cost [9–11].

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Received 29 December 2020; Accepted 10 January 2021

Available online 19 January 2021

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The timing of surgical repair remains controversial and depends on the classification and severity of injury, patient's general condition, the presence of sepsis, the surgeons, and the hospital facilities [11–13].

The most common mistakes resulting in BDI are anatomy misinterpretation and technical error, which are often recognized late. This tardiness can delay patient's hospital admission then delay the diagnosis and management and eventually influence the outcome of the repair [14]. There are many risk factors which can be used as an intraoperative guide to avoid BDI. [13,15]

The purpose of this study is to evaluate the outcome of the management of BDI in Cipto Mangunkusumo Hospital, Jakarta, as a tertiary referral hospital.

## 2. Method

Retrospective cross-sectional study was conducted on subjects with extrahepatic bile duct injuries which were managed by senior consultants of Digestive Surgery from January 1, 2008 to December 31, 2018 at Cipto Mangunkusumo National Central General Hospital, Jakarta, Indonesia.

Ethical clearance was not required because all procedure was according to hospital's standard operational procedure. This study is reported in line with STROCSS 2019 Criteria [16]. In our academic center, we purposefully separate classification of BDI according to previous surgical approach. We refer laparoscopic BDI with Strasberg classification and open BDI with Bismuth to avoid redundant terminology. Demographic data, clinical presentation, diagnostic imaging, bilio-digestive reconstruction, and the outcome were the evaluated variables.

## 3. Result

A total of 24 subjects were enrolled in this study, including 15 females and 9 males with a median age of 45 (21–58) years old. Twenty-two patients were referral cases from all over Indonesia. Sixteen cases occurred in laparoscopy and 8 in open surgery. Five laparoscopic patients presented with biloma, and 4 of them were drained preoperatively (2 huge sub-hepatic bile collection/biloma and 2 abscess formation). The average of time of recognition to patient's admission to our hospital was 19 (7–152) days. More than one-third of patients presented with malnutrition and were in poor health status (see Table 1).

Abdominal ultrasound was done in all patients as the first-line

**Table 1**  
Demographic data.

<b>Demographic Data</b>	
Male/Female (n)	9/15
Age (average)	45 y.o.
Subjective Global Assessment A/B/C	5/8/10
Time of recognition – admission (median)	19 days
Time of admission – surgery (median)	14 days
Laparoscopy/open (previous surgical approach)	16/8
<b>Presentation on admission</b>	
Biloma	5
Jaundice	7
Biliary-pancreatic juice (surgical drain production)	10
<b>Diagnostic tools</b>	
Abdominal ultrasonography	24
ERCP	2
MRCP	8
PTCD	2
Length of stay (average)	38 days
<b>Morbidity on Outpatient Follow-up</b>	
Recurrent cholangitis	2
SSI (superficial type)	2
Relaparotomy	2

ERCP: Endoscopic Retrograde Cholangiopancreatography; MRCP: Magnetic Resonance Cholangiopancreatography; PTCD: Percutaneous transhepatic cholangiography; SSI: Surgical Site Infection.

diagnostic tool to identify the biloma. Endoscopic Retrograde Cholangiopancreatography (ERCP) were done in patients with suspected cystic duct leaks which turned out to be completely occluded in cholangiography. MRCP was performed in 8 cases. Percutaneous transhepatic cholangiography was done in 2 patients.

Sixteen post-laparoscopy cases were classified according to Strasberg classification; 6 cases were type E3, 2 cases each of type E1 and E2, and one case each of Strasberg C and D. The remaining 4 were Strasberg A. Eight post-open cases were classified based on Bismuth criteria: 4 cases of Bismuth I, 1 case of Bismuth II, and 3 cases of Bismuth III. Five cases presented with massive biloma, 7 jaundice, and 10 cases of bile-producing abdominal drainage (see Table 2).

Roux-en-Y hepaticojejunostomy were performed in 18 cases (see Fig. 1), choledocho-duodenostomy in 2 cases, and 4 cases of primary cystic duct ligation.

On follow up, 2 patients had recurrent cholangitis, 2 had superficial surgical site infection, and 2 underwent relaparotomy due to anastomosis leakage and burst abdomen. No hospital mortality occurred and the average length of stay was 38 (14–53) days. No stricture found on outpatient follow-up.

## 4. Discussion

This study reports no operative mortality on 24 cases of BDI in 10 years. Average age was 45 years old, predominantly female (64%), similar to other study. The rate of BDI cases in our hospital does not represent our iatrogenic injury rate because 91% of them were referred from other hospitals [5,11,12,17]. Two iatrogenic laparoscopy injuries occurred in our hospital were lower compared to recent literature, with incidence 2/1000 cases for 10 years [4–6,17].

Interestingly, one third of BDI cases referred to our center occurred after open approach. This data can be used as an information for evaluation of General Surgery Training Program in order to improve learning curve thus reduce rate of iatrogenic injury in open cholecystectomy [7,14,18].

Strasberg E and Bismuth I/III were the most frequent type found and were nearly similar to other reports [6,19]. All BDI cases (22) referred from other hospital were detected postoperatively and the remaining 2 were recognized intraoperatively [6,17,19]. Out of 22, only 2 cases underwent fail repair at previous hospital. Longer referral time were due to patients' financial concern and transportation problem to experienced centers in Indonesia, one of which is our hospital. These caused delay of treatment and reconstruction mostly in intermediate phase (2–12 weeks after event). Radiologic diagnosis was performed at the first/initial hospital, then placement of abdominal drainage was done by previous surgeons before referring to our center.

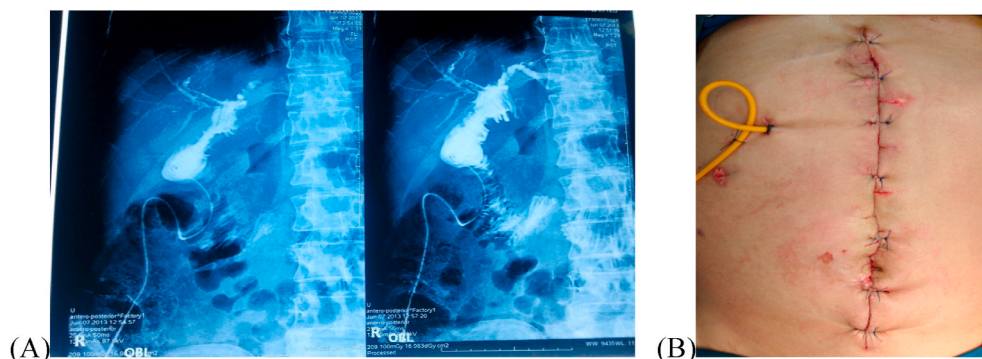
The goal of surgical treatment is to reconstruct the bile duct to allow proper bile flow to the alimentary tract without leakages of bile through many techniques.

Before 2010, repair for 4 cases of BDI Strasberg A were directly performed through open approach without ERCP due to lack of experienced endoscopists which cause long waiting list for treatments. Experienced endoscopist can even manage BDI occurring in graft hepatectomy in liver transplant simply with insertion of biliary stent. Two BDI cases recognized during laparoscopy were also directly managed with conversion to open surgery by doing Roux-en Y hepaticojejunostomy by experienced HPB surgeons in our hospital. Most experienced surgeon especially in HPB field are not available at non-tertiary hospital in Indonesia. Non-tertiary surgeons usually perform abdominal drainage (sub-hepatic region) before referring patients with BDI [14, 20].

In this study, choledocho-choledochostomy anastomosis cannot be performed due to late recognition of injury. Transection of common hepatic duct or common bile duct can be repaired immediately through a tension-free end-to-end anastomosis with or without an internal stent, using a non-absorbable suture. End-to-end anastomosis with internal

**Table 2**  
Surgical management in BDI.

Strasberg Classification	Number	Reconstruction	Bismuth Classification	Number	Reconstruction
Type A	4	Primary cystic duct ligation	–	–	–
Type C	1	Roux-en-Y hepaticojejunostomy	–	–	–
Type D	1	Roux-en-Y hepaticojejunostomy	–	–	–
Type E1	2	Choledocho-duodenostomy	Type I	4	Roux-en-Y hepaticojejunostomy
Type E2	2	Roux-en-Y hepaticojejunostomy	Type II	1	Roux-en-Y hepaticojejunostomy
Type E3	6	Roux-en-Y hepaticojejunostomy	Type III	3	Roux-en-Y hepaticojejunostomy



**Fig. 1.** Cholangiogram (A) and clinical picture (B) of male, 55 y. o. underwent Roux-en-Y hepatico-jejunostomy reconstruction with stent across the RYHJ anastomosis and passing through the anterior abdominal wall.

stent was associated with a significantly higher stricture rate than choledocho-choledochostomy [21].

Roux-en-Y hepaticojejunostomy (RYHJ) is recommended when there is a long tissue loss [21,22]. In BDI, especially in cases treated in early phase (within 45 days), inflammation and adhesion not only can cause slight inaccuracy of injury classification but also hinder the recognition of remnant healthy biliary tract which will be used in biliary-enteric anastomosis. RYHJ is currently considered as the definitive therapy due to its versatility in anastomosis of varying size of remnant biliary tract, therefore in this study, RYHJ was chosen as a reconstruction in various type of BDI.

Choledocho-duodenostomy was recommended in injury of distal common bile duct or distal stricture. This procedure guarantees physiological bile flow into the duodenum and maintains natural anatomy for endoscopic follow-up. It should be performed on a large common bile duct (>15 mm in diameter). Choledocho-duodenostomy should be created as distal as possible between the duodenum and the distal common bile duct in order to decrease the risk of Sump syndrome (noted in literature 0.14%–3.3%) and recurrent ascending cholangitis of bile reflux (noted in 4%) [22].

BDI cases of Strasberg A were repaired in early phase (<2 weeks) but the remain cases were done in intermediate phase (2 weeks and after 5 weeks). This difference is caused by long process of patients' referral time which took between 7 and 52 days, excluding additional preoperative hospitalization approximately 1 week to confirm diagnosis and perform perioperative support. Six biloma cases underwent preoperative drainage then definitive reconstruction after 2 weeks.

Postoperative complications and long-term outcomes of hepaticojejunostomy reconstruction such as stricture rate is debatable [1,5, 23]. Early repair may avoid readmissions, improve quality of life, and reduce hospital costs, but the presence of (local) inflammation, biliary peritonitis, and sepsis were the relative contraindications for early repair. In late repair, reconstruction is performed once sepsis has been controlled in order to wait for local inflammation to subside and bile duct vascularization to be restored, which will result in better anastomotic patency [8,10]

Thomson et al. published a similar outcome between early repair (<2 weeks) and delayed repair (>6 weeks) when treated in an experienced

center [23]. Perera et al. stated that immediate and early repairs (<21 days) done by non-experienced surgeons were the independent risk factors for recurrent cholangitis, recurrent bile duct stricture, redo reconstructions, and overall morbidity [10]. Immediate and early repair results in incomparable clinical outcomes, but a late repair might show different outcomes when performed by a hepato-pancreato-biliary surgeons. In contrast, Stilling et al. found early hepaticojejunostomy (<2 weeks) to be a considerable risk factor for long-term complications and mortality compared to late hepaticojejunostomy (>2 weeks) [4].

In the largest cohort of 614 patients who underwent hepaticojejunostomy for BDI, analyzing primary versus secondary repair, the authors found that sepsis control is a significant protective factor to anastomotic failure after primary repair. We also believe that the patient's general condition and, in particular, the presence of sepsis, biliary leakage or bile collections, perihepatic abscesses, and concomitant vascular injury are more important than timing alone [6,12].

This study showed that most of our biliary reconstructions were performed in less than 45 days (early phase) in accordance with Ianelly's study but on the contrary showed a good physiology of bile flow with low complication (average 33 day) [11]. We recommend to avoid further delay of definitive treatment and start reconstruction on 33rd day, to accelerate recovery time and improve quality of life.

Many publications debate the timing of repair, but what more important is choosing a case which can be repaired in an immediate or late phase. It is essential to evaluate the surgical difficulty appropriately and standardize treatment strategies to reduce serious complications. Many of previous studies have used factors such as the open conversion rate, operating time, and the incidence of complications as indicators of surgical difficulty [14,24].

An investigation of preoperative data and diagnostic imaging using operative duration or the conversion rate as indicators of surgical difficulty in symptomatic cholelithiasis (including acute cholecystitis) proved that body mass index, non-visualized gallbladder on preoperative cholangiography, cystic duct length, body's temperature, and abnormal findings on CT Scan as key factors that significantly affected the time required for cholecystectomy.

We have no information of frequency of acute cholecystitis as indication of cholecystectomy. A recent study has found that the rate of

conversion and complication were significantly higher in acute cholecystitis Grade II and III. Thus, the level of surgical difficulty can be predictable based on factors including preoperative blood tests, imaging, and grade of acute cholecystitis [13,14,25].

The development of a biliary stricture was associated with level of BDI, referral delay, pre-transfer procedures, vascular injury, presence of infection, availability of cholangiogram, surgeon's experience, and technique of anastomosis [22,26].

Currently, it is widely accepted that the best result in biliary reconstruction can be achieved in hepatobiliary centers, performed by experienced HPB surgeons. Many surgeons, without proper understanding and clear recognition of the anatomy of biliary injury, attempt to repair the injury they cause. This is associated with inferior short term and long-term outcomes, substantial morbidity, and higher rates of complications. Every failed attempt at a repair leads to a decreased bile duct length which will complicate next definitive reconstruction [26]. This report shows that the repair of BDI require experienced surgeon who is familiar with biliary cases. Centralization of hospital is the superior strategy for complex BDI management.

## 5. Conclusion

Common bile duct was the most common location of bile duct injury. Reconstruction of Roux-en-Y hepaticojejunostomy results in a good outcome and is recommended to be performed in high-volume tertiary center. Good preoperative support to assure no ongoing sepsis and good nutrition promise best result for complex cases.

## Ethical Approval

Our institution exempt this study from ethical approval because all actions, examination, and procedure were done according to hospital's standard of procedure and policy.

## Sources of funding

None.

## Author contribution

Toar JM Lalisang: study concept, data collection, data analysis & interpretation, writing the papers. Indah Situmorang: study concept, data collection, data analysis & interpretation, writing the papers. Febiansyah Ibrahim: study concept, data collection, data analysis & interpretation, writing the papers Perwira Widiyanto: study concept, data collection, data analysis & interpretation, writing the papers. Vania Myralda Giamour Marbun: study concept, data collection, data analysis & interpretation, writing the papers.

## Research Registration Unique Identifying Number (UIN)

1. Name of the registry: ClinicalTrials.gov
2. Unique Identifying number or registration ID: NCT04582240
3. Hyperlink to your specific registration (must be publicly accessible and will be checked): <https://clinicaltrials.gov/ct2/show/NCT04582240>

## Guarantor

Toar JM Lalisang

## Provenance and peer review

Not commissioned, externally peer-reviewed.

## Declaration of competing interest

Authors declare no conflict of interest

## Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.amsu.2021.01.012>.

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