
PROFILE OF PATIENTS WITH BILE DUCT INJURY IN RSUD DR. SOETOMO PERIOD JANUARY 224-DECEMBER

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ABSTRACT

Surgical procedures involving the biliary system are among the most common in digestive surgery. Advances in laparoscopic techniques have increased the frequency of bile duct injuries (BDI), a major contributor to morbidity and mortality, remarkably when unrecognized during surgery, which occurs in 25% to 32.4% of cases. This study describes the characteristics of BDI patients treated at RSUD Dr. Soetomo Surabaya from January to December 2024. Employing an observational analytical design with a cross-sectional approach, data were collected from the medical records of 26 patients meeting inclusion and exclusion criteria. Patients who underwent laparoscopic surgery had a shorter average Length of Stay (LOS) of 12.91 days compared to 23.57 days for those with open surgery. Mortality was observed exclusively among patients with a history of open surgery, notably in BDI type E4 cases. These findings highlight the importance of timely recognition and effective management of BDIs to mitigate their significant impact on patient outcomes.

Keywords: bile duct injury; length of stay; mortality rate; outcome

INTRODUCTION

Biliary tract surgery is one of the most commonly performed procedures in digestive surgery (Gonçalves, Cordeiro, et al., 2024; Gonçalves, Sodero et al., 2024; Shen et al., 2024; Surapaneni, 2023). Among the various types of biliary surgeries, cholecystectomy is the most common. This procedure can be performed openly or with minimally invasive laparoscopy techniques (Laudari et al., 2024; Maspero et al., 2024; Tanming et al., 2019; Tidjane et al., 2024). Each year, an estimated 1.2 million cholecystectomy procedures are performed, with 0.5% - 1.3% of the population having undergone this surgery. Thanks to technological advances, approximately 90% of these procedures are now performed laparoscopically (Janczewski et al., 2024; Luciano et al., 2019; Søreide et al., 2024). However, laparoscopic cholecystectomy carries the risk of complications such as bile duct injury (BDI), with an incidence rate of 0.3% - 0.7%, which is 2-3 times higher than open cholecystectomy (Yang et al., 2022).

BDI is an injury to the biliary tract that can result from surgical procedures or trauma to the hepatobiliary area. The increasing incidence of BDI aligns with the increasingly frequent use of laparoscopic cholecystectomy techniques in treating inflammation or gallstones (Cheng et al., 2023; Kagoura et al., 2024; Sakata et al., 2021). BDI is a significant cause of increased morbidity and mortality, especially if undetected during surgery, which is only recognized in 25% to 32.4% of cases (Moghul & Kashyap, 2023). Proper management

of BDI is essential to prevent further complications. This is tailored to the type of injury that has occurred, where the Strasberg Classification can help determine the most appropriate intervention. The main goal of BDI management is to restore bile flow to the gastrointestinal tract, preventing cholangitis, stone formation, re-strictures, and progressive liver damage (Manguso & Zuckerman, 2024).

Serious complications such as strictures, ascending cholangitis, cirrhosis, and portal hypertension can occur if BDI is not adequately managed (Çavuşoğlu et al., 2020; Chapuis-Roux et al., 2017; Christou et al., 2021). These conditions can significantly decrease patients' long-term survival and quality of life. Therefore, hepatobiliary surgeons should have high skills in intra-abdominal infection control, intraoperative cholangiography, and proper surgical reconstruction techniques. However, the appropriate timing of BDI repair surgery is still debatable, especially in intra-abdominal sepsis, as some studies suggest that infection may worsen the patient's condition (Moghul & Kashyap, 2023). Most patients with mild bile duct injuries can recover well through endoscopic procedures without the need for prolonged hospitalization. However, patients with more complex BDI usually require more extended treatment and may require postoperative rehabilitation (Moghul & Kashyap, 2023).

Previous studies have focused on the complications and management of BDI. Moghul and Kashyap (2024) highlighted the prevalence of significant complications such as cholangitis, cirrhosis, and portal hypertension when BDI is not adequately managed. Similarly, Mercado and Domínguez (2011) emphasized the importance of early detection and tailored interventions to minimize morbidity. Kalayci and Ilikerden (2024) identified Strasberg-type E2 injuries as the most common in laparoscopic procedures, necessitating comprehensive surgical expertise. Despite these findings, challenges in BDI management persist due to variations in patient anatomy, surgical skill, and timing of intervention.

On the other hand, other factors can still affect the condition of patients with BDI. Therefore, further research is needed to reduce mortality and the duration of hospitalization in these patients. Based on this description, the author intends to examine the profile and factors that influence the clinical outcomes of BDI patients at RSUD Dr. Soetomo Surabaya.

This research problem is formulated to describe patients with BDI at RSUD Dr. Soetomo Surabaya. The general objective of this study is to determine the description. In contrast, the specific objectives include knowing the number of patients, age and gender characteristics, length of hospitalization, type of injury, type of treatment given, and the relationship between length of hospitalization and patient outcomes. The benefits of this study consist of clinical benefits, which aim to provide an overview of BDI to improve its management and prevention, and theoretical benefits, which provide essential information for the development of better management and prevention algorithms for BDI in the future.

METHOD

The method employed in this study is an observational analytic design with a cross-sectional approach chosen to analyze the relationships between bile duct injury (BDI) types, treatment methods, and patient outcomes using retrospective data. The study was conducted over one year, from January 2024 to December 2024, utilizing medical records from RSUD Dr. Soetomo Surabaya. The population included all patients diagnosed with BDI and treated at the hospital during the specified period. A total sampling technique was used to ensure comprehensive data collection, whereby all patients meeting the inclusion criteria were included. The inclusion criteria included patients with complete medical records detailing age, gender, type of BDI, treatment methods, length of hospitalization, and outcomes. In contrast, patients with incomplete medical records or insufficient data were excluded.

Data was collected through the hospital's medical record system, capturing demographic, clinical, and treatment-related variables. Subsequently, the data were analyzed using descriptive statistics to summarize patient characteristics and bivariate analysis to examine relationships between variables such as BDI types, treatment methods, and outcomes. Statistical significance was assessed using tests such as Chi-square and t-tests, with all analyses performed using SPSS software. This study aims to provide a thorough understanding of BDI management and outcomes by integrating these methods, thereby contributing valuable insights for improving patient care strategies.

RESULTS AND DISCUSSION

Research Demographic Data

During January (2024). – In December 2024 (1 year), this study obtained BDI cases in 48 patients hospitalized at RSUD Dr. Soetomo Surabaya. Data that met the research criteria were subjects consisting of 19 men (39.6%) and 29 women (60.4%). This study grouped age into five groups, namely < 30 years, 30 - 39 years, 40 - 49 years, 50 - 59 years, and ≥ 60 years. From the data, it was found that the most subjects in the age range of 50 - 59 years were 16 subjects (33.3%) and the lowest at the age of > 60 years (10.4%).

Table 1. Demographic Data of Research Subjects

Variables	n	%
Gender		
Male	19	39.6
Female	29	60.4
Age		
<30	6	12.5
30-39	11	22.9
40-49	10	20.8
50-59	16	33.3

>=60	5	10.4
Surgery History		
Laparoscopy	33	68.8
Open	15	31.3

Of the 33 research subjects who fit the research criteria, 17 had a history of previous surgery recorded, but the remaining 16 patients did not have a history of surgery recorded.

This study analyzed three variables: type of BDI, type of treatment, and the length of time from injury to treatment associated with patient outcomes. The BDI variable was divided into Strasberg Types A, B, C, D, and E. Type E is subdivided into E1 to E5. For type A, three subjects (6.3%) were identified. There were no subjects categorized under types B and C. In type D, eight subjects (16.7%) were found. Within type E, E1 included two subjects (4.2%); E2 had 24 subjects (50.0%); E3 consisted of 7 subjects (14.6%); E4 had four subjects (8.3%), and no subjects were found in type E5.

Table 2. Characteristics of Research Subjects

Variables	n	Percentage
Strasberg Type		
A	3	6,3
B	0	0,0
C	0	0,0
D	8	16,7
E1	2	4,2
E2	24	50,0
E3	7	14,6
E4	4	7,7
E5	0	0

The type of treatment variable is divided into several types, namely most Bypass as many as 20 subjects (41.7%), Repair over the drain as many as six subjects (12.5%), repair only as many as four subjects (8.3%) and conservative with drain only as many as 18 subjects (37.5%). The last variable assessed was the duration of treatment from the first injury, which was divided into 2 weeks, more than 2 weeks for as many as 18 subjects (37.5%), and less than 2 weeks for as many as 30 (62.5%).

Table 3. Patient management characteristics

Variables	n	Percentage
Handling Type		
Repair over the drain	6	12,5
Bypass	20	41,7
Drain	18	37,5

Repair Only	4	8,3
Handling Time (weeks)		
>2	18	37,5
≤2	30	62,5

Patients admitted with BDI in this study all had a history of biliary surgery, either laparoscopic or open laparotomy. It was found that 33 patients had a history of laparoscopic surgery, while 15 had undergone open laparotomy. Of the 33 subjects who underwent laparoscopy, 16 patients (48.48%) were classified as E2 and nine subjects (27.27%) were classified as D. The majority of those who underwent laparoscopy were classified as E2. Among the 15 subjects with a history of open laparotomy, most were classified as type E2, with five subjects (50%) fitting this classification. In contrast to laparoscopic surgery, the history of open laparotomy did not include any patients classified as Strasberg type D.

Table 4. Relationship between surgical history and BDI type

Surgery History/Type	Total	
Laparoscopy	n	%
A	2	6.06
E2	16	48.48
E3	4	12.12
E4	2	6.06
D	9	27.28
Total	33	100.00
Open		
E1	3	20.00
E2	7	46.67
E3	2	13.33
E4	2	13.33
D	1	6.67
Total	15	100.00

Comparison of Research Variables

This study examined three variables: the BDI type group, treatment type, and duration. It compared these three variables with the outcomes of patients with BDI treated at RSUD Dr. Soetomo.

Table 5. Comparison between Study Variables and Mortality of Study Subjects

Variable	Outputs	
	Live	Die
Handling Type		

Repair over the drain	6	0
Bypass	20	3
Drain	18	0
Repair Only	4	0
Strasberg Type		
A	3	0
B	0	0
C	0	0
D	8	0
E1	2	0
E2	22	2
E3	7	0
E4	3	1
E5	0	0
Handling Time (weeks)		
>2	15	0
≤2	30	3

This study evaluated mortality in patients with our collected BDI cases. Three mortalities were found out of 48 cases. Mortality cases were found in the bypass treatment group: Three out of 20 (15%) patients experienced mortality in the bypass treatment type group.

Patients who experienced mortality were found in the E4 Strasberg group 1 out of 3 (33.3%) of all E4 Strasberg cases and E2 2 out of 20 (9.09%) of all E2 Strasberg cases. Mortality patients belonged to the treatment duration ≤2 weeks. 3 out of 30 patients (10%) experienced mortality in the treatment duration ≤2 weeks group. This, when further evaluated, was influenced by the patient's previous condition of sepsis with a 10x increase in liver function.

Discussion

Technological and scientific developments in the field of biliary surgery have contributed to an increase in the incidence of bile duct injury (BDI). One of the main factors for the increased incidence of BDI is the increasing frequency of laparoscopic cholecystectomy procedures. Although this procedure is minimally invasive, the risk of BDI is higher than open cholecystectomy due to the limited visualization and difficulty of the operation. Previous studies have revealed that BDI in laparoscopic procedures tends to be more complex than open methods. Other risk factors include anatomical variations, patient condition, gallbladder pathology, and doctor's surgical experience.

Anatomically, errors in identifying the cystic duct as short or parallel to the common bile duct often lead to injury. Anatomical variations, such as the junction of the common hepatic duct, an accessory cystic duct, or Luschka's duct, also heighten the risk of injury. Other patient factors, including obesity, a history of hepatobiliary surgery, or liver disease, may complicate visualization and increase the risk of biliary duct injury (BDI). However, most injuries (80%) occur without apparent risk factors. Inflammation resulting from acute

cholecystitis, the presence of adhesions, and excessive bleeding are also significant contributors. Additionally, less experienced surgeons tend to experience a higher incidence of BDI.

This study reported 48 cases of BDI at Dr. Soetomo Hospital from January to December 2024. The subjects comprised 19 males (39.6%) and 29 females (60.4%). Most patients were aged 50 to 59 years (33.3%), while those under 30 and 30 to 39 years recorded the lowest proportions (12.5%).

Gallbladder diseases such as gallstones are more common in women due to the influence of estrogen and progesterone hormones that increase cholesterol saturation in bile, facilitating gallstone formation (Ceci et al., 2023). As a result, women are more likely to undergo cholecystectomy and are, therefore, more at risk of developing BDI. The commonly performed laparoscopic cholecystectomy procedure has a higher risk of BDI than the open method. Female anatomical factors, such as thicker abdominal fat tissue and bile duct variations, make visualization during surgery difficult. In addition, the hormone estrogen affects bile metabolism, increasing the risk of gallbladder disorders (Ceci et al., 2023). Middle-aged to older women are more likely to undergo cholecystectomy as decreased estrogen levels increase the risk of gallbladder disease and surgical complications (McCarty et al., 2021).

This study analyzed three main variables: type of BDI, treatment method, and duration of time from injury to treatment. Based on the Strasberg classification, type E (E1 to E5) was the most common, with type E2 dominating 50% of cases. Type A was found only in 6.3% of patients, while B and C were not. The most common treatment was the bypass method (41.7%), followed by conservative drainage (37.5%), repair over the drain (12.5%), and repair only (8.3%). Most patients (62.5%) received treatment within the first two weeks.

This finding aligns with Martínez-Mier et al. (2020), which also found a predominance of Strasberg type E BDI, particularly type E2. Factors such as the patient's condition, type of surgery, intraoperative findings, and surgeon's skill influence the outcome. Type E BDI is categorized as a significant injury that requires more intensive care and has a higher risk of mortality. Kement et al. (2022) reported that out of 83 patients, one death occurred in Strasberg type D cases. Generally, BDI mortality rates range from 0-3% and are often caused by abdominal sepsis.

Type E2 involves transection or stricture of the common hepatic duct less than 2 cm from the hilum hepaticus. This condition often results from misidentification of the common hepatic duct as the cystic duct, especially in laparoscopic cholecystectomy, due to visualization limitations (Moghul & Kashyap, 2023). Anatomical variations such as the cystic duct being short or parallel to the common hepatic duct increase the risk of injury. The area near the hilum hepaticus has a complex bile duct configuration, making it more prone to injury (Moghul & Kashyap, 2023). Chronic inflammation or adhesions in Calot's triangle worsen anatomical visualization, increasing the risk of transection of the common hepatic duct (Mascarenhas et al., 2024).

The type and timing of treatment affect patient outcomes. Patients with severe injuries requiring bypass tend to have more extended hospitalizations. While there is debate regarding the optimal timing of surgical repair, most studies show that early repair speeds up recovery and reduces costs. However, delayed repair may allow time to optimize the patient's condition before definitive surgery.

Delays in referral to tertiary care facilities also impact treatment outcomes. Treatment at a center with hepatobiliary expertise through a multidisciplinary approach can improve clinical outcomes. These findings emphasize the importance of better planning in preventing and managing BDI to reduce patient morbidity and mortality.

CONCLUSION

From January 2024 to December 2024, 26 patients with BDI cases underwent inpatient treatment at RSUD Dr. Soetomo Surabaya, with BDI type E2 being the most common, reaching 46%. Most treatments were performed in less than two weeks using the bypass method. Of the total number of patients, 16 had a history of laparoscopic surgery, while the other 10 underwent open surgery. The most extended length of hospitalization was in patients with BDI type E2 who were treated with the bypass method, which was more than two weeks, and had a history of open surgery. Cases of death were recorded in patients who had a history of open surgery and type E4 BDI. Based on these results, it is recommended that awareness of bile duct injury be increased in every hepatobiliary surgery so that treatment can be carried out promptly. In addition, research that takes a more extended period is needed to increase the number of patients who can be analyzed, resulting in more comprehensive data.

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