



Research Article

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Iatrogenic Bile Duct Injury and Its Management with Intensive Care Unit Process: A Single-Center Experience

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Abstract

Background: The delayed recognition of bile duct injury (BDI) and the challenges in its diagnosis lead to clinical variability. The management of BDI is complicated and ranges from ERCP to liver transplantation. But infections related to BDI and sepsis control, prior to the bile flow reestablishment, are the mainstay of the treatment. In this study, we aimed to report the clinical outcomes of iatrogenic BDI and intensive care unit (ICU) process in a tertiary state hospital.

Materials and methods: In this single-center, retrospective, cohort study, 17 patients admitted to our hospital with BDI after LC or ERCP were enrolled from January 2016 to July 2018. The outcomes of BDI were assessed only in short term period-as long as the length of hospital stay-and the statistical analysis was performed using SPSS version 20.0 for Windows (SPSS Inc., Chicago, IL, USA). Statistical significance was determined by a p value less than 0.05.

Results: Throughout the study period, the patients with BDI were referred mostly after LC (n = 14, 82.4%). The mean age was 52.5 years and 14 of these patients were referred us from another hospital. 94.1% of the patients admitted to ICU in the first week after injury and the main symptom in the admission was right quadrant pain. Surgery was required only in seven cases (41.2%) and the in-hospital mortality rate was 17.6% (n = 3). It was clearly shown that mortality and sepsis relation was significant statistically (p < 0.001) whereas delayed admission was not related to morbidity or mortality statistically.

Discussion: The rate of BDI after LC or ERCP varies and the challenge in the diagnosis of BDI is that they are not recognized at the time of LC or ERCP in the majority of cases. The identification of sepsis in the early phase leads to proper management of BDI while the morbidity and mortality rates are increasing in cases of major BDI, delayed referral and sepsis involvement. In our study, the in-hospital mortality rate was higher than the mortality rate related to BDI (17.2% vs. 7.2%) in the literature. There are many studies comparing surgical techniques and the timing of the definitive treatment while endoscopic methods have become more preferable than surgery in the early phase of BDI.

Conclusion: In conclusion, early recognition of BDI after LC or ERCP is essential and the management of this feared complication requires a multidisciplinary approach with the contribution of a surgeon, gastroenterologist, and intensivist.

Keywords

Bile duct Injury, Iatrogenic, Mortality, Sepsis, Intensive care

Background

Laparoscopic cholecystectomy (LC), which becomes the standard of care for symptomatic cholelithiasis, and endoscopic retrograde cholangiopancreatography (ERCP), the gold standard diagnostic pathway for biliary disease, may lead to serious complications like bile duct injury (BDI). Iatrogenic bile duct injury after LC was reported at 0.3% to 2.6% interval and approximately 80% of patients with BDI underwent definitive surgery [1]. In fact, approximately

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70% of the transection of the common bile duct (CBD) and true partial injury may be recognized and repaired during the surgery or ERCP [2]. Delayed recognition and the challenges in the diagnosis of BDI lead to clinical variability from mild tenderness and asymptomatic abdominal pain to the life-threatening complications like septic shock at presentation [3].

The management of BDI is also complicated and ranges from nonsurgical interventions like ERCP to liver transplantation. But infections related to BDI and sepsis control, prior to the bile flow reestablishment, is the mainstay of the treatment [1]. More recently ERCP becomes one of the definitive treatment modality among with surgery and percutaneous transhepatic cholangiography (PTC). Especially in cases of bile leak without transection ERCP was found adequate for definitive treatment [4]. The ERCP intervention includes ERCP, sphincterotomy, and stenting while the surgical options for BDI are simple repair, End-to-end bile duct anastomosis, Roux-en-Y biliary enteric anastomosis and partial hepatectomy [3]. Although the advancements in surgery, gastroenterology and intensive care ameliorate the outcomes of BDI, the mortality and morbidity rates are still high [5]. In this study, we aimed to report the clinical outcomes of iatrogenic BDI and intensive care unit (ICU) process in a tertiary state hospital.

Material and Method

In this single-center, retrospective, cohort study, 17 patients admitted to our hospital with BDI after LC or ERCP were enrolled from January 1, 2016, to July 31, 2018. Patient characteristics, details of BDI, and hospital courses were derived from the hospital database and patients' medical records. The patients with BDI presented to our intensive care unit either as acute bile duct injury (before 48 h) or as delayed (after 48 h) injury, and BDI were classified according to Bismuth-Strasberg Classification [6]. The patients with BDI after PTC, trauma or surgical operations other than LC were excluded. The outcomes of BDI were assessed only in short term period-as long as the length of hospital stay-because the data about long-term outcomes could not be derived from the hospital database.

Statistical analysis was performed using SPSS version 20.0 for Windows (SPSS Inc., Chicago, IL, USA). Since the number of patients included in this study was small and the variables did not show a normal distribution in Kolmogorov-Smirnov test, the variables were evaluated by non-parametric tests. The correlation between variables was assessed with Spearman Rho Correlation Coefficient test, and the Mann-Whitney U test was used for categorical variables. Statistical significance was determined by a p value less than 0.05.

An extra formal consent other than the patients had given prior to the admission to as a routine procedure, was not required for the current study because it was a case-control medical record review. This study adhered to the principles in accordance with the Helsinki Declaration of 1975, as revised in 2008.

Results

Throughout the study period, 17 patients with BDI were managed in our institution and they were referred mostly after LC (n = 14, 82.4%). Nine of the patients were males and eight of them were females. The mean age was 52.5 years (minimum 23 and maximum 87 years). 14 of these

Table 1: The demographic variables and data related to hospital admission.

Variable		Frequency/ mean	Percent/ SD
Male gender		9	52.9%
Female gender		8	47.1%
Reason for admission	Right quadrant pain	13	76.5%
	Fever	2	11.8%
	Acute abdomen	2	11.8%
Out hospital admission		14	82.4%
In-hospital admission		3	17.6%
Cause of BDI	LC	14	82.4%
	ERCP	3	17.6%
Delayed admission/referral		5	29.4%
Acute admission/referral		12	70.6%
Age		52.5	± 19.6
Bismuth-Strasberg classification	A	5	29.4%
	B	0	0
	C	1	5.9%
	D	2	11.8%
	E1	3	17.6%
	E2	3	17.6%
	E3	3	17.6%
Management	ERCP and stenting	10	58.8%
	Surgical intervention	7	41.2%
Surgical method	Choledocotomy and primary repair on T tube	4	23.5%
	Roux-en-Y hepatico-jejunostomy	2	11.8%
	Hepp-Couinaud approach	1	5.9%
	No surgery	10	58.8%
Mortality		3	17.6%
Complication		4	23.50%
Septic shock		2	11.8%
No complication		12	70.6%

Abbreviations: SD: Standard Deviation; BDI: Bile Duct Injury; LC: Laparoscopic Cholecystectomy; ERCP: Endoscopic Retrograde Cholangiopancreatography; BDI were classified according to Bismuth-Strasberg Classification (6) from A to E.

Table 2: The variables and outcomes of BDI, and their relations with sepsis and delayed admission factor.

Variable	Septic shock (+) (n = 2)	Septic shock (-) (n = 15)	Delayed admission (n = 5)	Total (n = 17)	p*	p†
Male gender	1 (50%)	8 (53.3%)	3 (60%)	9 (52.9%)	0.935	0.728
Acute abdomen	0	2 (13.3%)	0	2 (11.8%)	0.16	0.498
Out hospital admission	2 (100%)	12 (80%)	5 (100%)	14 (82.4%)	0.517	0.244
After LC	1 (50%)	13 (86.7%)	4 (80%)	14 (82.4%)	0.226	0.879
Surgery	2 (100%)	5 (33.3%)	3 (60%)	7 (41.2%)	0.080	0.20
Mortality	2 (100%)	1 (6.7%)	2 (40%)	3 (17.6%)	< 0.001	0.134
Complication	2 (100%)	2 (13.3%)	3 (60%)	4 (23.5%)	0.04	0.082
Noticed in the first week	2 (100%)	14 (93.3%)	NA	16 (94.1%)	0.03	NA
Age (years)	71.5 ± 13.4	50 ± 19.2	48.6 ± 23.2	52.5 ± 19.6	0.017	0.598
LOS hospital (days)	25 ± 29.6	17.2 ± 18.7	27.4 ± 24	18.1 ± 19.2	0.613	0.291
LOS ICU(days)	25 ± 29.6	10.8 ± 13.3	18.2 ± 16.7	12.4 ± 15.2	0.160	0.134

The variables were presented either as mean ± SD or frequency and percentage.

*The relations between variables and outcomes were calculated for “septic shock” factor.

†The relations between variables and outcomes were calculated for “delayed admission” factor.

Abbreviations: SD: Standard deviation; BDI: Bile Duct Injury; LC: Laparoscopic Cholecystectomy; LOS: Length of Stay; ICU: Intensive Care Unit; NA: Not Applicable.

patients were referred us from another hospital and only 17.6% of cases sustained BDI in our institution. The demographic variables and data related to hospital admission were summarized in Table 1 and 94.1% of the patients admitted to ICU in the first week after injury. 70.6% of patients were classified as acute (n = 12) and 29.4% of them were classified as delayed admission. The main symptom in the admission was right quadrant pain.

Surgery was required only in seven cases (41.2%) and the in-hospital mortality rate was 17.6% (n = 3). The length of stay (LOS) in hospital and in ICU was 18.12 and 12.47 days respectively as mentioned in results Table 2. Table 2 summarizes the outcomes and their relations with sepsis and delayed admission. It is clearly shown that mortality and sepsis relation was significant statistically (p < 0.001) whereas delayed admission was not related to morbidity or mortality statistically.

Discussion

The rate of BDI after LC or ERCP varies between 0.3% and 2.6% in the literature [1] while major BDI was reported as low as 0.08% [7,8]. In a recent review, it was reported that the majority of the BDI cases after LC were Strasberg type A injury (about 83%) and managed with ERCP successfully [1]. In this review, the definitive treatment of Strasberg type D injuries was reported as ERCP and stenting in 75% of cases. Even in extreme cases of CBD complete transection without tissue defect ERCP and PTC combination was used due to high operative risks and the outcomes were defined as good [9].

The challenge in the diagnosis of BDI is that they are not recognized at the time of LC or ERCP in a majority of cases (as high as 80%) and the presentation after interventions can be covert by nonspecific symptoms [10]. This mandates the clinicians and the intensivists to be suspicious about the risk

of BDI. The identification of the biliary peritonitis and sepsis in the early phase lead to proper management of BDI while the morbidity and mortality rates are increasing in cases of major BDI, delayed referral and sepsis involvement [11,12].

Schreuder, et al. [7] claimed that delayed referral after BDI was related to increased morbidity and in our study delayed admission group had longer LOS in ICU and in-hospital (27.4 days vs. 14.2 and 18.2 days vs. 10.1 days respectively). Although this difference in our study was not significant statistically (p > 0.05) it was in line with Martinez-Lopez, et al. study [13] in which the relation between longer LOS in hospital and delayed referral was shown.

In our study, the in-hospital mortality rate was higher than the mortality rate related to BDI (17.2% vs. 7.2%) in the literature [1]. This is probably due to the deteriorating effect of sepsis and septic shock which was detected in 66% of mortal cases in our study. Also, the majority of cases (n = 9, 52.8%) in our study was presented with Strasberg type E injuries unlike the literature and this factor might affect the mortality rate.

There are many studies comparing surgical techniques for BDI as a definitive management modality [1,11,12]. The timing of the definitive treatment (either in the early phase or after controlling the sepsis and bile leak) is another disputable issue although endoscopic methods have become more preferable than surgery in the early phase of BDI [4,10]. Sendino, et al. [14] claimed that endoscopic methods like ERCP and stenting could be utilized for BDI even after liver transplantation.

Conclusion

In conclusion, early recognition of BDI after LC or ERCP is essential and the management of this feared complication re-

quires a multidisciplinary approach with the contribution of a surgeon, gastroenterologist, and intensivist.

Limitations

The limitations related to this study were the retrospective nature of this analysis, the small number of patients and the limited data derived from the database of our institution.

Declarations

Ethics approval and consent to participate

Since our study was in the category of non-interventional clinical research with its retrospective structure, the need for ethical approval was waived. This is in line with the National Code of Clinical Research which is recently published on 13th April 2013.

This study adhered to the principles in accordance with the Helsinki Declaration of 1975, as revised in 2008. An extra formal consent other than the one which was taken prior to hospitalization was not required for the current study because of the non-interventional, retrospective design. It was a case-control medical record review.

Consent to publish

Not applicable.

Availability of data and materials

The datasets during the current study available from the corresponding author on reasonable request.

Competing interests

The authors declare that they have no competing interests.

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Disclosures

None.

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