

Management in bile duct injuries and differences of early and delayed repair

Erdem Baris Carti

Adnan Menderes University, Faculty of Medicine, Department of General Surgery, Aydin, Turkey

Copyright © 2019 by authors and Annals of Medical Research Publishing Inc.

Abstract

Aim: Bile duct repair surgery in injured patients is delayed in general until the inflammation is resolved. In this study we aimed to investigate whether early repair yields good results in bile duct injuries.

Material and Methods: A total of 62 patients with the diagnosis of bile duct injury and treated in our hospital between March 2016 and November 2018 were included in the study. In all patients, ERCP was performed for identification of the type and severity of the injury. The type and severity of the injury were classified using the Strasberg classification. 32 (51.6%) of 62 patients were treated by ERCP + Stenting while the remaining 30 (48.4%) patients underwent surgery at the early period.

Results: Amongst 30 patients who had undergone surgery, only one patient needed additional intervention due to leakage at the early period. The rate of anastomotic stricture and recurrent cholangitis, which are among long-term complications, was 3.3%.

Conclusion: The collaboration of hepatobiliary surgeons, gastroenterologists, and interventional radiologists having skills and experience on this are very important. Early repair can yield good result in experienced centers.

Keywords: Bile duct injury; early repair; delayed repair; management

INTRODUCTION

Cholecystectomy is the most commonly performed surgical procedure throughout the world. In our country, an average of 200,000 patients undergoes cholecystectomy operation every year. Since the population of our country is 78,000,000, 0.26% of the populations undergo cholecystectomy operation every year (1). The laparoscopic approach has currently become the gold standard in treatment of symptomatic cholelithiasis and acute or chronic cholecystitis. While the rate of iatrogenic bile duct injury secondary to conventional open cholecystectomy is 0.1-0.5%, this rate is increased to 0.3-1.4% in laparoscopic cholecystectomy. Even though laparoscopic skills and experience of surgeons have increased, the incidence of iatrogenic bile duct injury is still higher when compared to open cholecystectomy (2). In addition, when compared to open cholecystectomy, iatrogenic bile duct injuries secondary to laparoscopic cholecystectomy lead to more complex injuries (3).

The most commonly used method in postoperative bile duct injury is endoscopy. Endoscopic methods such as biliary stenting procedures, biliary sphincterotomy, and nasobiliary drainage may be preferred (4). With these endoscopic procedures, transpapillary pressure is reduced, transpapillary flow is provided, extravasation from the biliary tract is reduced, and with reduction of extravasation, healing of the injured site is accomplished without necessitating any surgical intervention. The surgical intervention required in significant bile duct injuries is generally extensive, experience and skills of hepatobiliary surgeons, gastroenterologists and interventional radiologists working in tertiary stage hospitals are necessary (5,2,3,6).

When not properly managed, bile duct injury can lead to life-threatening complications such as cholangitis, secondary biliary cirrhosis, and portal hypertension. Even if the correct treatment methods have been chosen in the patient, the risk of mortality and morbidity is increased (7).

Received: 01.10.2019 **Accepted:** 10.12.2019 **Available online:** 10.01.2020

Corresponding Author: Erdem Barış Carti, Adnan Menderes University, Faculty of Medicine, Department of General Surgery, Aydin, Turkey **E-mail:** erdemcarti@yahoo.com

In patients with bile duct injuries diagnosed postoperatively and necessitating surgical repair, most surgeons wait for the resolution of the inflammation with percutaneous drainage and ERCP (Endoscopic retrograde cholangiopancreatography) before construction surgery. Early surgical repair is not preferred due to its significant long-term complication (30% stricture) and mortality risks (8). The delayed repair is described as scheduling reconstruction surgery 6-12 weeks following injury (9). However, there are studies reporting good results after early surgical repair (most of the authors have described early repair group as surgical intervention for reconstruction within two weeks following injury) in nonseptic patients (10,11). The time for surgical intervention in cases with postoperatively diagnosed biliary leakage is still a controversial issue (12).

We retrospectively investigated our patients who were referred from peripheral hospitals to our department due to cholecystectomy-related bile duct injury. We documented their demographic characteristics, the type and severity of the injury, diagnostic methods for preoperative diagnosis, timing and type of surgery, morbidity, mortality, and long-term complications, and then, we compared our results with the literature.

MATERIAL and METHODS

A total of 62 patients, involving 54 patients who had postoperative diagnosis, and 8 patients in whom bile duct injury was realized but not identified during cholecystectomy were referred from peripheral hospitals to the Hepatobiliary Surgery and Liver Transplantation Unit in Adnan Menderes University, Department of General

Surgery between March 2016 and November 2018.

In all patients, I.V. contrasted abdominal angio-CT scans were obtained and evaluated regarding the presence of additional vascular injury, intra-abdominal collection, and abscess. Percutaneous drainage procedure was performed when necessary. In all patients, ERCP was performed for identification of the type and severity of the injury. The type and severity of the injury were classified using the Strasberg classification (Table 1). During this process, we excluded the 4 patients either we diagnosed the bile duct injury intraoperatively and repaired immediately in our clinic or we were invited to the center that injury had occurred and performed the repair immediately. We also excluded benign biliary strictures that had developed at the post-cholecystectomy period and treated either by interventional procedures such as ERCP and stenting, or surgically. We retrospectively investigated these 62 patients in terms of demographic characteristics, the type and severity of the injury, the methods used for preoperative diagnosis, the timing and type of surgery, morbidity, mortality, and long-term complications.

The Statistical Package for the Social Sciences (SPSS 21.0 software, IL-Chicago- USA) was used for data analyses. Descriptive analysis was done for demographic and clinical features. The results were presented as percentages for continuous variables, and number/percentage for categorical variables.

RESULTS

Of the 62 cases included in the study, 40 (64.5%) were female, and 32 (35.5%) were male. The mean age was

Table 1. The Distribution of the Types and Severity of Bile Duct Injury in Our Cases according to the Strasberg Classification

Type of injury		n=62 (100%)
Strasberg A	Cystic duct leaks or leaks from small ducts in the liver bed	24(38.8%)
Strasberg B	Occlusion of part of the biliary tree, almost invariably the aberrant right hepatic ducts	
Strasberg C	Transection without ligation of the aberrant right hepatic duct	
Strasberg D	Lateral injuries to major bile duct	14(22.6%)
Strasberg E1	Low common hepatic duct (CHD) stricture, with the length of the CHD stump of > 2 cm	6(9.7%)
Strasberg E2	Proximal CHD stricture - hepatic duct stump < 2 cm	8(12.8%)
Strasberg E3	Hilar stricture, no residual CHD, but the hepatic ductal confluence is preserved	6(9.7%)
Strasberg E4	Hilar stricture, with the involvement of confluence and loss of communication between the right and left hepatic ducts	4(6.4%)
Strasberg E5	Involvement of aberrant right sectorial hepatic duct alone or with concomitant stricture of the CHD	

54.2 (34-76) years. The diagnosis was made during the postoperative period in 54 patients whereas it was made intraoperatively in 8 patients. Of the 62 patients, 59 patients had undergone laparoscopic cholecystectomy, and in 3 patients, the operation had started as a laparoscopic procedure but was converted to an open cholecystectomy. The referral process of 62 patients involved in the study occurred on the postoperative 6.2 (0-21) day on average. In the Strasberg type A and D injuries, for prevention of biliary leakage, sphincterotomy and temporary stenting with a 10-French plastic-coated stent were performed. In cases that the biliary tract could not be visualized by ERCP, percutaneous transhepatic cholangiography (PTC) was performed. The cases classified as Strasberg B, C, and E1 to E5 were operated for emergency repair (biliodigestive anastomosis). The average time between admission to our clinic and the date of emergency surgery was found as 2.1 (1-4) days in these cases classified as B, C, E1 to E5, requiring emergency surgical intervention. Surgical procedure for biliodigestive anastomosis was performed due to ongoing bile leakage in 6 out of 14 patients who had a Strasberg type D injury, and who were attempted to treat by a coated stent using ERCP. The modality of our treatment was summarized in Figure 1. We managed to treat 32 (51.6%) of 62 patients by ERCP + Stenting and treated the remaining 30 (48.4%) patients surgically at the early period. We treated 29 patients with hepaticojejunostomy procedure (both the posterior and anterior walls of the hepaticojejunostomy anastomosis were performed in classical fashion by using 6/0 PDS suture continuously). In one patient in whom a Strasberg type E4 injury was present together with the injury of the right hepatic artery, we performed right hepatectomy + resection of the

external biliary tract + Roux-en-Y hepaticojejunostomy to the left canal. All operations were performed by the same hepatopancreaticobiliary and hepatic transplantation surgeon. Regarding the technique of operation for Roux-en-Y hepaticojejunostomy, continuous end-to-side suturing with 6/0 PDS suture material was used.

Among our 62 patients, a vascular injury was present concomitant to biliary tract injury in only one (0.16%) patient. No mortality occurred. Among 30 patients that we performed surgery, biliary leakage at the early postoperative period was detected in only one (3.3%) patient with Strasberg type E4 injury in whom we performed Roux-en-Y hepaticojejunostomy. The biliary leakage of the patient regressed following external and internal drainage with PTC, and the patient was discharged after full recovery. During the mean follow-up period of 19 (2-32) months of 30 patients who had undergone surgery, only one patient with leakage at the early period who had undergone placement of a catheter for internal + external drainage by PTC presented twice due to a cholangitis episode. The patient needed no additional intervention, and the clinical features of cholangitis, the enzyme levels indicating cholestasis, and moderately elevated bilirubin levels regressed with the intravenous administration of antibiotics. The rate of anastomotic stricture and recurrent cholangitis, which are among long-term complications, was 3.3%.

DISCUSSION

When it is considered that approximately 200,000 cholecystectomies are performed yearly in our country, about 600-2,400 patients are exposed to the injury of the biliary tract every year. Various factors such as misinterpretation

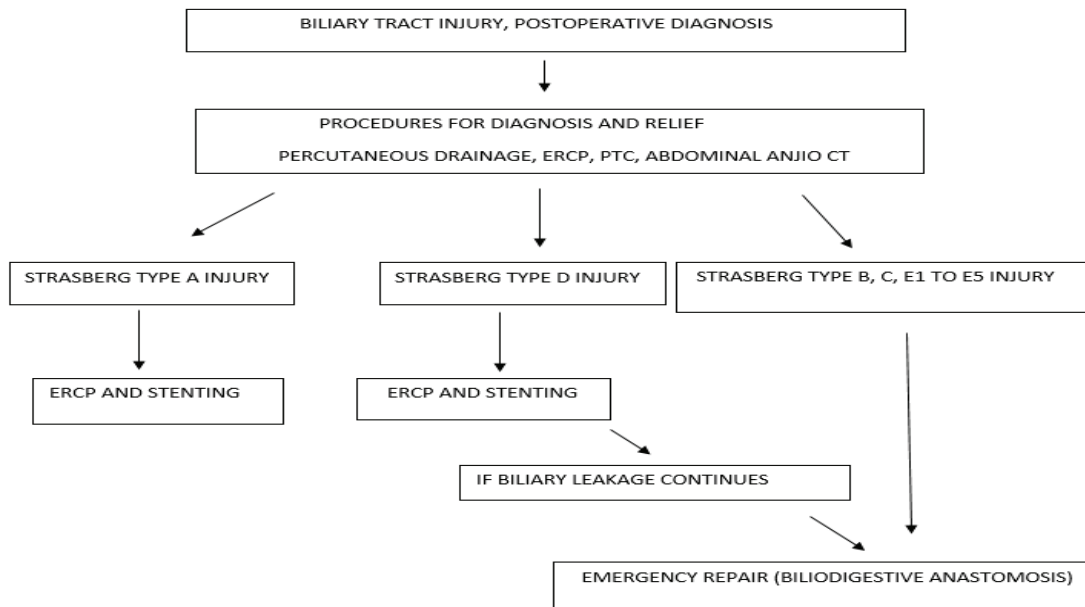


Figure 1. The Modalities of Our Treatment

of the anatomy, thermal injury, diffuse inflammation, short cystic duct, hemorrhage, and morbid obesity have been found to be related to this complication (13).

The most effective factor in conversion from laparoscopic to open surgery is not identifying the anatomy clearly. Conversion to open surgery should not be considered as a complication or failure; on the contrary, it should be considered as an attempt to accomplish surgery as safely as possible. The operation was concluded laparoscopically in 59 out of 62 patients diagnosed with biliary tract injury following cholecystectomy. Only in 3 patients, surgery was converted to open cholecystectomy. Such a low rate of conversion to open surgery suggests that surgeons had insisted on finishing the operations laparoscopically even in cases in whom anatomic exposure had not been provided satisfactorily.

It is observed that approximately 75% of surgeons perform the repair operation themselves in cases in which bile duct injury has occurred. Only 17% of such interventions end with success, and in secondary attempts by the same surgeon, success can never be accomplished (14). When it is considered that the number of interventions performed with the purpose of treatment of bile duct injury has utmost importance in the outcome of the patient, the importance of performing the repair by an experienced hepatobiliary surgeon for obtaining an optimum result will be much better understood (15,16). It was reported that the long-term success rate was over 90% in cases managed by hepatobiliary surgeons experienced in biliary reconstruction. If an experienced hepatobiliary surgeon is not present in the medical center that cholecystectomy is performed, we suggest that surgery should not be converted to an open procedure when injury was realized during laparoscopy, hepatoduodenal dissection for identification of the injury should be avoided when recognized during open surgery, and the patient should be transferred in the early period to a medical center having an experienced hepatobiliary surgeon after insertion of a drainage catheter for preventing the injury from becoming more complicated. Even though there are studies suggesting that minor injuries can be repaired by the index surgeon, for the injury not to become more complicated, we have the opinion that this suggestion is not valid (17). Eight of the 62 patients who were included in our study were diagnosed intraoperatively and transferred immediately following the operation to our medical center.

Early diagnosis and early intervention reduce morbidity and mortality in biliary tract injuries (13). The duration for referral ranged between 0 and 21 days (6.2 days in average). Numerous studies have reported that the timing of the reconstruction surgery is effective on the outcome. Although there are some reports claiming that poor results are obtained following surgery at the first week or at the first six weeks (18), there are also reports stating that timing creates no difference (19). The general opinion is that a waiting period of 5-12 weeks should be preferred

for resolution of inflammation. However, there are studies reporting that the success rate was around 20% when the repair surgery was performed by the index surgeon, and around 90% when performed by a hepatobiliary surgeon, independent from timing. There are also studies reporting that the most crucial factor affecting success is not the timing of surgery, but the experience of the surgeon on biliary reconstruction.

It was also reported that repair surgery performed early in the appropriate patients had similar results with the late surgical approach in terms of surgical outcome, complication rate, and quality of life, and was more advantageous regarding early return to daily activity, and cost (13).

In their study, Reuver et al. reported that perioperative complication rate was higher, and stricture development risk, which is among the late complications, was more significant in their cases in whom early repair was performed when compared to those who underwent late repair (20). Since the mean follow-up period was 19 months in our study, and this duration was relatively small, it would not be appropriate to make a final judgment on this subject. The shortness of the follow-up period may be among the limitations of the study.

The severity of bile duct injury has been shown to be effective on the outcome in many conducted studies (18). However, although it has been considered that high-level injuries make the repair more difficult, there are also studies stating that it is not an independent factor affecting the surgical outcome in the repairs performed by experienced hepatobiliary surgeons (21).

CONCLUSION

According to our study results, we suggest that the experience of hepatobiliary clinics in terms of interventions related to hepatoduodenal region and biliary tract has been increasing more with the inclusion of the experience in liver transplantation. The success of reconstruction surgery of the biliary tract is related to the experience of the surgeon and the success rate is higher if the operation is performed by an experienced hepatobiliary surgeon independent from timing of surgery and the level of biliary tract injury.

Financial Disclosure: This study was not funded by any institution.

Ethical approval: None (Retrospective Study).

Erdem Baris Carti ORCID: 0000-0002-7139-0339

REFERENCES

1. Abbasoğlu O, Tekant Y, Alper A, et al. Prevention and acute management of biliary injuries during laparoscopic cholecystectomy: Expert consensus statement. *Ulus Cerrahi Derg* 2016;32:300-30.
2. Renz BW, Bosch F, Angele MK. Bile Duct Injury after Cholecystectomy: Surgical Therapy. *Visc Med* 2017;33:184-90.

3. Chun K. Recent classifications of the common bile duct injury. *Korean J Hepatobiliary Pancreat Surg* 2014;18:69-72.
4. Chow S, Bosco JJ, Heiss FW, et al. Successful treatment of post-cholecystectomy bile leaks using nasobiliary tube drainage and sphincterotomy. *Am J Gastroenterol* 1997;92:1839-43.
5. Melton GB, Lillemoe KD, Cameron JL, et al. Major bile duct injuries associated with laparoscopic cholecystectomy: effect of surgical repair on quality of life. *Ann Surg* 2002;235:888-95.
6. Karanikas M, Bozali F, Vamvakerou V, et al. Biliary tract injuries after lap cholecystectomy-types, surgical intervention and timing. *Ann Transl Med* 2016;4:163.
7. Hariharan D, Psaltis E, Scholefield JH, et al. Quality of Life and Medico-Legal Implications Following Iatrogenic Bile Duct Injuries. *World J Surg* 2017;41:90-9.
8. Stilling NM, Fristrup C, Wettergren A, et al. Long-term outcome after early repair of iatrogenic bile duct injury. A national Danish multicentre study. *HPB (Oxford)* 2015;17:394-400.
9. Ghumman AQ, Ahmad M, Khan A, et al. Bile duct injuries and outcomes: a retrospective medical record review. *Pak Armed Forces Med J* 2016;66:185-9.
10. Ismael HN, Cox S, Cooper A, et al. The morbidity and mortality of hepaticojejunostomies for complex bile duct injuries: a multi-institutional analysis of risk factors and outcomes using NSQIP. *HPB (Oxford)* 2017;19:352-8.
11. Perera MT, Silva MA, Hegab B, et al. Specialist early and immediate repair of post-laparoscopic cholecystectomy bile duct injuries is associated with an improved long-term outcome. *Ann Surg* 2011;253:553-60.
12. Martin D, Uldry E, Demartines N, et al. Bile duct injuries after laparoscopic cholecystectomy: 11-year experience in a tertiary center. *Biosci Trends* 2016;10:197-201.
13. Felekouras E, Petrou A, Neofytou K, et al. Early or Delayed Intervention for Bile Duct Injuries following Laparoscopic Cholecystectomy? A Dilemma Looking for an Answer. *Gastroenterol Res Pract* 2015;2015:104235.
14. Stewart L, Way LW. Bile duct injuries during laparoscopic cholecystectomy. Factors that influence the results of treatment. *Arch Surg* 1995;130:1123-8.
15. Heise M, Schmidt SC, Adler A, et al. [Management of bile duct injuries following laparoscopic cholecystectomy]. *Zentralbl Chir* 2003;128:944-51.
16. Melton GB, Lillemoe KD. The current management of postoperative bile duct strictures. *Adv Surg* 2002;36:193-21.
17. Gouma DJ, Callery MP. Bile duct injury: examining results of early repair by the index surgeon. *HPB (Oxford)* 2017;19:1-2.
18. Lillemoe KD, Melton GB, Cameron JL, et al. Postoperative bile duct strictures: management and outcome in the 1990s. *Ann Surg* 2000;232:430-41.
19. Thomson BN, Parks RW, Madhavan KK, et al. Early specialist repair of biliary injury. *Br J Surg* 2006;93:216-20.
20. de Reuver PR, Grossmann I, Busch OR, et al. Referral pattern and timing of repair are risk factors for complications after reconstructive surgery for bile duct injury. *Ann Surg* 2007;245:763-70.
21. Stewart L, Way LW. Laparoscopic bile duct injuries: timing of surgical repair does not influence success rate. A multivariate analysis of factors influencing surgical outcomes. *HPB (Oxford)* 2009;11:516-22.