

A Multidisciplinary Approach to Major Bile Duct Injury Following Laparoscopic Cholecystectomy

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ABSTRACT

Background and Objectives: Many series describing the management of major bile duct injuries after laparoscopic cholecystectomy have been reported with satisfactory short-term results. However, the information of their prognosis with sufficient time-period follow-up is sparse.

Methods: Sixteen consecutive patients with major bile duct injury following laparoscopic cholecystectomy were retrospectively reviewed, including six common bile duct transections, four bile duct perforations, and six hilar strictures but without perforation. With respect to the level of bile duct injuries, there were the following based on Bismuth's classification: type 1 in six patients, type 2 in five patients, type 3 in three patients, type 4 in one patient, and type 5 in one patient. All patients received surgical management, interventional radiology and endoscopic treatment. The time periods of follow-up ranged from 37 to 72 months (mean, 52 months). The final results were rated as being excellent, good, fair, or poor, based on the criteria of symptoms, biochemical data, and radiology.

Results: There was no procedure-related mortality. Ten of the 16 patients had either excellent or good results, two had fair results, and four had poor results. Of the latter four, the patients had been classified as Bismuth type 1, 3, 4, and 5, respectively, and all sustained a failed initial surgical repair.

Conclusions: Using a multidisciplinary approach, 12 (75%) of the 16 patients attained a promising result through a long-term follow-up, while those with the higher biliary stricture and with an unsuccessful initial surgical repair had a disappointing outcome.

Key Words: Laparoscopic cholecystectomy, Major bile duct injury.

INTRODUCTION

It is accepted worldwide that laparoscopic cholecystectomy (LC) is the treatment of choice for symptomatic gallstone disease. When compared to open cholecystectomy, the incidence of bile duct injuries appears to be increased, ranging from 0.5% to 0.9%.¹⁻³ In the early 1990s, most surgical series describing the management of major bile duct injuries (MBDI) after LC had been reported with good short-term result.¹⁻³ Recently, the Johns Hopkins series provided a gratifying result concerning endoscopic and surgical management of MBDI following LC, rated on presence of symptoms and the necessity of ongoing therapeutic procedures, with a mean follow-up period of 31.4 months.⁴ Based upon the previous experience of open cholecystectomy, there is a progressive restenotic rate and one third of recurrences are recognized beyond three years after repair.⁵ Therefore, we suggest that a three-year period be the minimal requirement to analyze the long-term prognosis of these cases.

In this article, although the size of the series is small, a longer follow-up and objective evaluation criteria is of benefit in elucidating the long-term prognosis of the MBDI following LC.

PATIENTS AND METHODS

Sixteen patients with MBDI following LC treated at the Surgical Department of Chang Gung Memorial Hospital from January 1992 to January 1995 were included in this study. MBDI was defined as a recognized laceration or disruption of any part of the major extrahepatic and intrahepatic biliary system. Patients who sustained a leak of the cystic duct stump were not included. Among the 16 patients, four had their initial LC performed at our hospital. During the same period, a total of 1450 LCs were performed at our hospital; thus, the incidence of major bile duct injury following LC was 0.27% (4 of 1450) in our hospital. The remaining 12 patients received their LCs elsewhere and were referred to our hospital. There were six men and ten women with a median age of 43 years (range, 28 to 75 years). All of these LCs were performed using electrocautery rather than laser dissection. The pattern of the injuries of these 16 patients was as follows: common bile duct (CBD) transection in six; bile duct perforation in four; and hilar stricture due to malposition of

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metallic clips and/or thermal injury but without bile duct perforation in six.

Manifestations of Biliary Injury:

In the six patients who sustained CBD transection, three injuries were identified during LC. Another three patients presented as gastrointestinal upset, deep jaundice, and fever approximately one week after LC. In the four patients who sustained bile duct perforation, the symptoms included abdominal pain and distension, ileus, anorexia, vomiting, fever and chills, and mild jaundice, which necessitated surgical intervention 4 to 45 days (mean, 18 days) after LC. Those six patients who had hilar stricture but without perforation had vague and insidious symptoms, including jaundice, abdominal fullness, failure to thrive, general malaise, and right hypochondralgia. For these six patients, the elapsed time from biliary injuries to surgical management ranged from 14 days to 10 months (mean, 150 days).

Work-Up Before Definite Management:

Ultrasonography was initially employed in all patients to evaluate the biliary system. Either endoscopic retrograde cholangiopancreatography (**Figure 1**) or percutaneous transhepatic cholangiography (**Figure 2**), or both, were performed to delineate the detailed pathology. Computed tomography was used to search for fluid collections within the peritoneal cavity. Selective angiography with embolization was done in patients manifesting as hemobilia. Not all patients received all the above tests, which were adopted individually. With respect to the level of bile duct injuries based on Bismuth's classification, there were type 1 in six patients, type 2 in five patients, type 3 in three patients, type 4 in one patient, and type 5 in one patient.⁶

Interventional Radiology, Surgical Treatment, and Endoscopic Therapy:

Those who presented with emergent signs, such as peritonitis due to infected biloma, cholangitis, hemobilia, esophageal variceal bleeding, and sepsis, were managed by nonoperative methods as follows: computed tomography-guided aspiration of biloma in two patients; endoscopic biliary drainage or percutaneous transhepatic biliary drainage in eight; angiographic embolization for bleeding hepatic artery pseudoaneurysms in two; endoscopic sclerotherapy for esophageal variceal bleeding in one. Among the six patients who sustained CBD transection repaired by hepaticojejunostomy, two received their surgery elsewhere and were referred to our hospital for anastomotic leak (**Figure 3**), and one underwent revision of hepaticojejunostomy nine months later. Among four

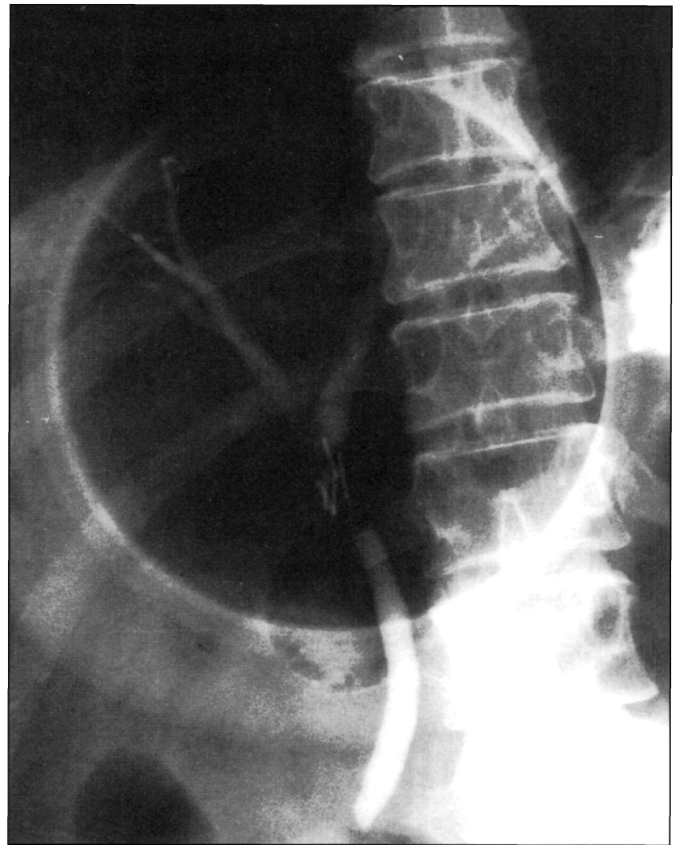


Figure 1. Endoscopic retrograde cholangiopancreatography shows malposition of metal clips on the common bile duct resulting in hilar stricture, rated as Bismuth type 2 injury.

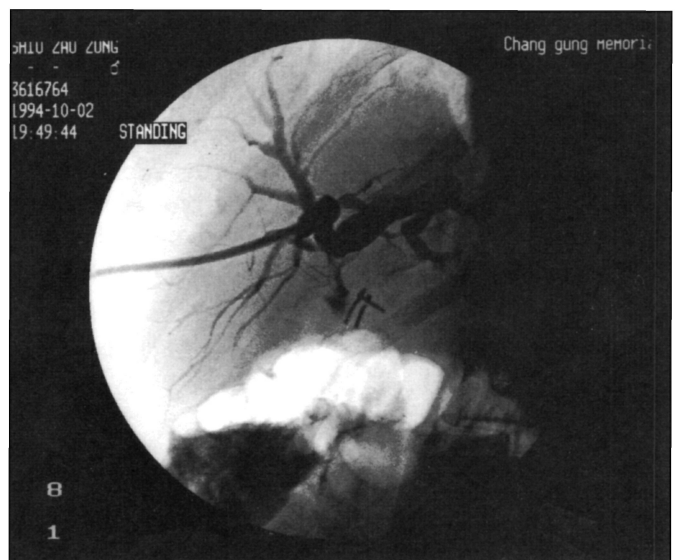


Figure 2. Percutaneous transhepatic cholangiography shows transection of the common bile duct, rated as Bismuth type 1 injury.

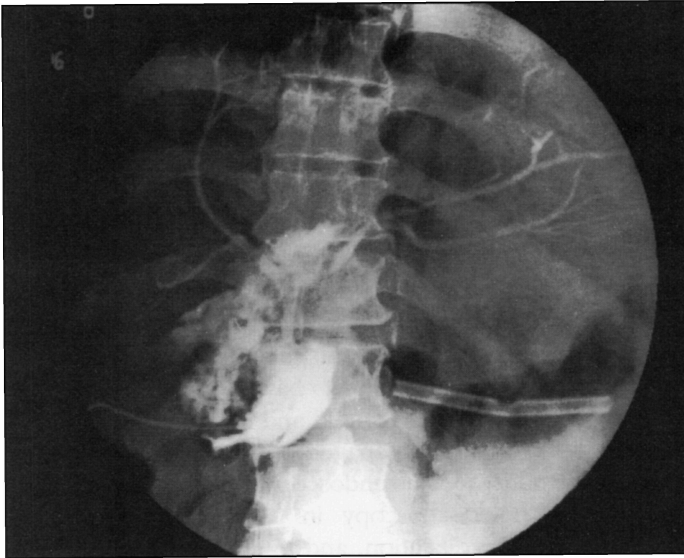


Figure 3. T-tube cholangiography shows extravasation of the dye indicating hepaticojejunostomy leak.

patients who sustained bile duct perforation, laparotomy was done to evacuate biloma, to repair bile duct laceration, and to set a biliary stent with T-tube. One patient sustained bile leak via choledochotomy. Two patients required frequent percutaneous balloon dilatation; it was impossible to remove the biliary stent. Another patient underwent endoscopic sphincterotomy to retrieve dislodged metal clips and retained stones within the CBD. Among the six patients who sustained hilar stricture without perforation, hepaticojejunostomy was performed as the initial surgical interven-

tion in two individuals. One was performed at a referring hospital, and the patient was transferred to our hospital for management of an anastomotic leak. Choledochotomy with T-tube or Y-tube stent was performed in four patients, followed by repeated sessions of percutaneous balloon dilatation. Two of them needed re-exploration following hepaticojejunostomy for poor response to percutaneous balloon dilatation.

Follow-Up:

All patients were available for close follow-up at the time of this report, ranging from 37 to 72 months (mean, 52 months). A triad of criteria proposed by Schweizer, including symptoms, biochemistry data, and radiology, was employed to evaluate the effectiveness of the management and the results rated as excellent, good, fair, or poor.⁷ The symptoms evaluated were mainly those of cholangitis and gastrointestinal upset. Biochemistry data included serum bilirubin, aspartate aminotransferase, alanine aminotransferase and alkaline phosphatase. Radiology studies consisted of ultrasonography, and cholangiography whenever ultrasonography revealed significant abnormality of the biliary system.

RESULTS

There were no procedure-related mortalities. Long-term outcomes of the 16 patients were tabulated (**Table 1**). Excellent or good results were rated in ten patients; fair in two; and poor in four. Among the four patients classified with poor results included Bismuth type 1, 3, 4 and 5, respectively; all had a failed initial surgical repair.

Table 1.
Long-term results of 16 patients with major bile duct injuries after laparoscopic cholecystectomy.

Type of injury	Bismuth classification ⁶	No.	Result ⁷			
			Excellent	Good	Fair	Poor
Hilar stricture	Type 2	3	1	1	1	
	Type 3	2		2		
	Type 4	1				1
CHD perforation	Type 2	2		2		
	Type 3	1				1
	Type 5	1				1
CBD transection	Type 1	6	2	2	1	1
Total		16	3	7	2	4

CHD, common hepatic duct. CBD, common bile duct.

DISCUSSION

Long-term prognoses of patients who sustain MBDI following LC are supposed to be worse than those caused by open cholecystectomy, mainly because of the increased thermal effects of electrocautery dissection, more instrument manipulation, more complex nature of injury, significant inflammation and scarring secondary to the bile leakage with associated infection, and delayed recognition of the complications. It usually takes considerable time to observe the progression of biliary stricture, to apply different modalities of management in stages, and even to revise prior work. Thus, an insufficient time-period of follow-up might lead to underestimation of the severity of injury. Bergman et al. reported that at a median follow-up of 25 months (range 6 - 38 months) 5 (33%) of 15 patients, who had received hepaticojejunostomy for MBDI following LC, required subsequent transhepatic balloon dilatation or reconstruction with a secondary hepaticojejunostomy.⁸ In the present study, all patients have been closely followed for three to six years. Different modalities of management including surgical and nonsurgical methods were complementarily employed. We hope that this report will reflect the natural course of ongoing biliary stricture, that occurs despite modern medical technology.

In the present study, the symptomatic, biochemical and radiological assessments provide a critical and objective evaluation. Persistent worsening of symptoms such as cholangitis, jaundice, and failure to thrive indicate unsuccessful treatment. In our experiences, alkaline phosphatase was the most sensitive parameter for biliary stricture. Abnormally elevated alkaline phosphatase can herald stricture several months before specific symptoms appear. Aggressive imaging study is warranted in symptomatic patients, as well as in patients with abnormal laboratory data. However, it should be emphasized that a picture of stenosis on cholangiography alone is not necessarily an indication for surgery. In elderly or high-risk patients, we would rather accept a degree of biliary stenosis, if the symptoms are tolerable and readily handled by nonoperative methods.

Bismuth proposed that the following factors effect the outcome of biliary stricture repair: proximal biliary stricture, intrahepatic or multiple stricture, concurrent cholangitis or hepatic abscess, intra-abdominal abscess, portal hypertension, and cirrhosis.⁶ Thus, it is important to identify and optimize these disabling situations before any surgical attempt. Furthermore, medical emergency such as bilious peritonitis, acute cholangitis, hepatic failure, hemobilia, or esophageal variceal hemorrhage, should be stabilized with nonoperative methods first. Nonetheless, in patients

with profound peritonitis, multiple or multiloculated abscesses, or in those who do not respond as anticipated, surgical intervention should proceed without hesitation. In critically ill patients, the priority of management is to salvage the patients as simple as possible. Therefore, our patients who had bile duct perforation underwent laparotomy to repair laceration of the bile duct and insertion of a T-tube stent instead of a time-consuming biliary-enteric anastomosis. For these patients, definite reconstruction is seldom possible, the bile ducts having collapsed and the tissue being deeply bile stained and friable. The ongoing biliary stenosis can be managed by staged use of nonoperative methods, such as endoscopic biliary drainage, percutaneous choledochoscopy in association with stone retrieval, balloon dilatation, and biliary stenting. In contrast, patients with hilar stricture but without bile duct perforation were generally in a more stable condition. For such cases, under appropriate preparation, definite surgical intervention such as hepaticojejunostomy can be considered as initial treatment.

The fact that three of the four patients with poor results in the present study had been categorized as Bismuth types 3, 4, and 5, respectively, confirms the previous study that the more proximal the anastomosis, the greater the likelihood of subsequent stricture.³ Three of the four patients with poor results had their initial surgical repair performed at referring hospitals. Indeed, it is not easy for surgeons with a low case load to deal with a small bile duct anastomosis when unexpectedly confronting a major biliary complication. These difficulties emphasize the importance of correct performance of the first repair by a well-trained and experienced hepatobiliary team.

In conclusion, after long-term follow-up, 12 (75%) of 16 patients with MBDI following LC were found to have gratifying results, while the remaining four patients had poor results due to higher stricture and an unsuccessful initial surgical repair.

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