

Routine cholangiography reduces sequelae of common bile duct injuries

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Abstract

Background: An effort was made to determine whether a policy of routine cholangiography affects the incidence, morbidity, and cost of bile duct injuries.

Methods: A retrospective review of consecutive 3,242 laparoscopic cholecystectomies was performed. Most patients had routine intraoperative cholangiography.

Results: There were 12 bile duct injuries (0.37%). All injuries were Bismuth levels 1 and 2. Eleven of 12 injuries were recognized intraoperatively. Ten were repaired primarily and one required hepaticojejunostomy. All repairs were successful. Average hospital charges were \$26,669. One of 12 patients had delayed recognition of a bile duct injury and underwent primary repair over a T-tube on post-operative day 7. Hospital charges were \$43,957.

Conclusion: Routine cholangiography did not appear to decrease the absolute incidence of bile duct injuries compared to previously published reports. Injury severity, morbidity, late sequelae, and costs were reduced by a policy of routine cholangiography.

Key words: Laparoscopic cholecystectomy — Bile duct injuries — Cholangiography — Complications

Injury to the common bile duct is the most devastating complication of laparoscopic cholecystectomy. Common sequelae are bile leaks, peritonitis, jaundice, cholangitis, septicemia, and cirrhosis. Delayed recognition of injuries occurs frequently, and attempts at surgical repair are adversely affected by inflammation, infection, and malnutrition. Reoperations, chronic morbidity, and premature death are not uncommon. Injuries result from misidentification of normal anatomy more frequently than from anomalies [9]. Prior to the laparoscopic era, bile duct injuries were the

third-most-common cause for malpractice litigations of all general surgical procedures [9]. It is likely that the trend toward litigation of injuries that occur during laparoscopic cholecystectomy will increase because of the patient's expectation of minimal scarring and quick recovery.

Prevention, early recognition, and proper techniques of repair can reduce the impact of bile duct injuries on the patient and society. This study evaluates the effect of a policy of routine intraoperative cholangiography on the incidence, morbidity, sequelae, and cost for treatment of bile duct injuries.

Materials and methods

We reviewed all laparoscopic cholecystectomies performed at the Cedars-Sinai Medical Center between August 1989 and November 1995. This paper updates previously published data on bile duct injuries through mid 1994 reported by Morgenstern et al. [13]. Two cases included in the previous report were deleted because it was discovered that they were not true injuries of the extrahepatic bile ducts; one additional case was added from the 1995 data. There were 3,242 consecutive operations performed by 30 surgeons. The data were recorded concurrently. Medical records of patients who sustained iatrogenic injuries to the bile ducts were then reviewed. The ten primary attending surgeons were queried. Data on surgeon experience level, type of injury, management, morbidity, delayed sequelae, hospital charges, and legal actions were recorded. Follow-up data ranging from 3 months to 75 months were obtained from the primary surgeons in all cases. There were five males and seven females, with an average age of 54 years.

Results

Twelve common bile duct injuries occurred in 3,242 laparoscopic cholecystectomies (0.37%). The experience of the surgeon at the time an injury occurred was as follows: Six injuries occurred in the surgeon's first 25 cases; two occurred between the 25th and 100th case; and four occurred after the surgeon's 100th case. Four patients had acute cholecystitis at the time of injury (urgent cases), and eight had symptomatic cholelithiasis/chronic cholecystitis (elective cases). Eleven of 12 injuries were recognized during the initial surgery. One injury was detected after 7 days. Seven injuries were at a level greater than 2 cm distal to the common hepatic duct (Bismuth 1; Table 1). Five were less than 2 cm distal to the common hepatic duct (Bismuth 2). All patients with injuries had cholangiography. Six had cholangiography prior to the injury. Two of these were misinter-

Table 1. Bismuth's and Strasberg's injury classifications

Bismuth [3]	Strasberg [16]		Level of injury
	Partial	Complete	
0	D	E1	Common bile duct below cystic insertion
1	D	E1	Low stricture (>2 cm below confluence)
2	D	E2	Middle stricture (<2 cm below confluence)
3	D	E3	High stricture (confluence preserved)
4	D	E4	High stricture (confluence destroyed)
5	D	E5	Right anomalous duct

Table 2. CBD injuries

Reason for injury of the bile duct	#	Injury type
Common duct misidentified as cystic	4	Otomy
Puncture/tear during dissection (inflamed)	1	Puncture
Mirrizzi's syndrome (inflamed)	1	Otomy
Puncture during CBDE ^a	3	Puncture
Misinterpretation of cholangiogram	2	Transection
Unknown reason (inflamed)	1	Occlusion (clip)

^aCBDE = common bile duct exploration

preted and therefore failed to prevent duct transection. Three had CBD stones and the injury occurred during CBD exploration. One duct was clipped for unknown reasons after normal cholangiography. Six patients had cholangiography after bile duct injury. Four injuries were small lacerations of the common duct that resulted from misidentification of the common duct as the cystic duct with deliberate incision for cholangiography. All of these injuries were evident on cholangiography. In another the cystic duct was partially avulsed from the common duct by a needle-nosed dissector in an inflamed case. One case had a Mirrizzi's syndrome (Table 2).

Eleven of 12 patients underwent immediate repair of the bile duct injury. Three were repaired by placement of a T-tube directly through the injury. Two had simple suture closure without use of a T-tube but one of these required postoperative percutaneous aspiration of a bile collection. Three required suturing with placement of a T-tube through a separate incision. There were two primary anastomoses with T-tubes and one hepaticojejunostomy. The one patient who underwent delayed repair had an uncomplicated primary repair of a side hole over a T-tube. None of the patients had delayed strictures or further biliary interventions. There have been no medical-legal actions for any case in this series.

The postoperative hospitalization for all patients with immediately recognized bile duct injuries averaged 7.3 days (range 5–9 days). Hospital charges averaged \$26,669 (range \$9,731–\$63,472). For the subset of four patients who had a deliberate incision in the common duct for cholangiography (immediately recognized), hospitalization averaged 5.5 days with an average charge of \$16,876. The patient with a delayed diagnosis of a bile duct injury was hospitalized for 10 days following repair with total charges of \$43,957. The charges for the one patient who underwent an hepaticojejunostomy were \$38,445 vs \$25,491 average for 10 patients who had immediate primary repairs.

Discussion

In spite of a policy of routine intraoperative cholangiography, iatrogenic bile duct injuries occurred in 0.37% of patients in this series. We expected that routine cholangiography would decrease injuries by allowing for early identification of anomalies (i.e., cystic duct joining right hepatic, short cystic duct, etc.). In spite of this obvious advantage, cholangiography *did not* appear to reduce the absolute incidence of biliary injuries compared to previous reports. The incidence of bile duct injuries during laparoscopic cholecystectomy is reported at 0.3–0.6% [1, 16] but this is probably an underestimation of the scope of the problem. The reason for the underestimation is that bias existed in reporting initial laparoscopic cholecystectomy results. Poor results were less frequently published than good results. Also, studies that relied on computerized diagnosis codes or discharge summaries underestimated injury rates. In our series, 67% of patients with injuries had no mention of a bile duct injury in their discharge summaries and would have been overlooked if not for our prospective study. Voluntary audits are similarly inadequate. Delayed presentation of strictures also causes underreporting. The true incidence of bile duct injuries during laparoscopic cholecystectomy may be as high as one in 1.0% [11].

In this series, routine cholangiography decreased complications of bile duct injuries and long-term sequelae compared to prior reports [4, 17] (Table 3). Eleven of 12 injuries (92%) were detected and successfully repaired during the initial operation. There were two end-to-end choledochostomies and eight primary repairs (with or without T-tubes). Routine intraoperative cholangiography led to early identification of partial injuries and prevented complete transection (or excision) of the bile duct in most cases. Routine cholangiography prevented extension of injuries above Bismuth's level 2. Prompt recognition of injuries occurred prior to extensive dissection in the hilum, thereby minimizing damage to the vascularity of the extrahepatic ducts. There were no cases where portions of the bile duct were excised. Early recognition allowed for optimal repairs at the initial operation, preventing delayed complications such as peritonitis, strictures, cholangitis, and cirrhosis. It is well known that higher injury levels and delayed recognition result in poorer outcomes [1, 7]. Clearly, routine cholangiography led to lower injury levels and earlier recognition than would have occurred without cholangiography. In the present series, 67% of bile duct injuries occurred during elective cases that had no preoperative indication for cholangiography, and the surgeons perceived no anatomical ab-

Table 3. Summary of literature

Author	No. injuries	Cholangiogram (%)	Injury level Bismuth >3, 4	Delayed recognition	Hepaticojejunostomy
Moosa et al. [12]	6	0 (0%)	4 (67%)	6 (100%)	6 (100%)
Larson et al. [10]	5	0 (0%)	1 (20%)	5 (100%)	1 (20%)
Rossi et al. [14]	11	1 (9%)	6 (55%)	8 (72%)	11 (100%)
Barkun et al. [2]	5	1 (20%)	1 (20%)	4 (80%)	1 (20%)
Davidoff et al. [8]	12	3 (25%)	6 (50%)	12 (100%)	12 (100%)
Woods et al. [17]	81	25 (40%) ^a	29 (36%)	50 (62%)	46 (57%)
S.S.C. [15]	7	4 (57%)	3 (43%)	3 (43%)	3 (43%)
Present series	12	12 (100%)	0 (0%)	1 (8%)	1 (8%)

^a Cholangiography data available on only 63 cases

normality prior to the injury. Therefore a policy of selective cholangiography would have resulted in injuries of greater severity that would have been detected later.

One criticism of the use of routine cholangiography is that a ductal structure must be incised to perform the procedure. If the bile duct is inadvertently cannulated with the cholangiogram catheter, then clearly an injury has not been prevented. This series demonstrates, however, that injuries created in this manner are relatively minor ones that are easily treated by simple suturing with T-tube decompression. In four patients who had a recognized cannulation of the bile duct for cholangiography, there were no complete transections or excisions of the duct. The average hospitalization was only 5.5 days. There were no late sequelae in this group.

It is important to note that two patients had cholangiograms that were abnormal and were misinterpreted intraoperatively. Complete transection of the ducts ensued, requiring complicated repairs. It is emphasized that if cholangiography can affect the rate of bile duct injuries, it must be performed and interpreted properly by the surgeon (Figs. 1 and 2). This problem has been previously addressed [5, 6, 13].

There is an axiom of gallbladder surgery that dictates “no structure should be divided until it is clearly identified.” Because of this, there is frequently a presumption of culpability on the part of the surgeon whenever a bile duct is injured. This is clearly not true but, in general, injuries should not occur in routine cases in the absence of mitigating circumstances. In cases where recognized anatomical distortion exists (i.e., dense scarring, severe inflammation, or suspected anomalies), cholangiography should be used to clarify the anatomy. If a surgeon incises the bile duct for the purpose of cholangiography under these circumstances there will be little or no significant damage. The cost of treatment of such an “injury” will average less than \$17,000, and should have little long-term impact on the patient. Such an injury may have no medical-legal implications. However, if a cholangiogram is not performed under these circumstances and injury occurs, consequences are likely to be more severe. If percutaneous procedures (such as balloon dilations, or stenting) are required for treatment, costs will average \$7,000–10,000 per procedure. If reoperation is necessary, the cost will usually exceed \$43,000 even if no complications occur. Liver transplantation for multiple failed revisions will cost at least \$300,000 and will have profound effects on the patient and his family. The medical-legal implications are also more significant.

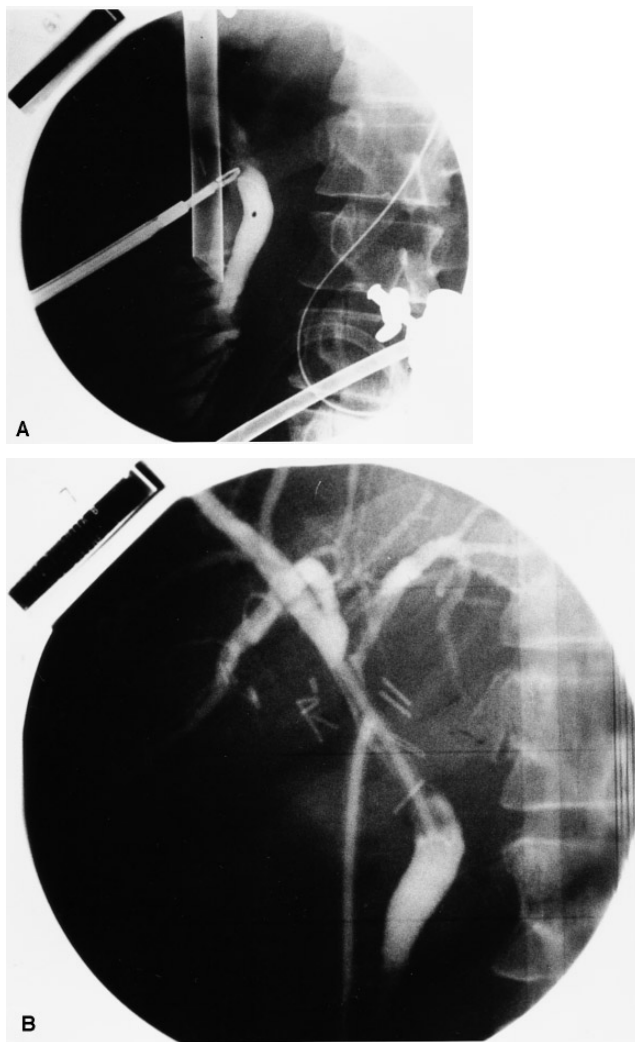


Fig. 1. **A** Nonvisualization of hepatic ducts during cholangiography is a harbinger of bile duct injury. **B** Misinterpretation of this cholangiogram resulted in transection of the common bile duct requiring repair over T-tube.

If a complete transection of the bile duct is detected, treatment by Roux-en-Y choledochojejunostomy usually results in the best outcome [17]. Primary end-to-end repairs occasionally produce satisfactory results, but when primary repairs fail, damages are increased. The best opportunity for a satisfactory outcome is lost. Attempts to “minimize the damage” by performing a primary anastomosis (rather than

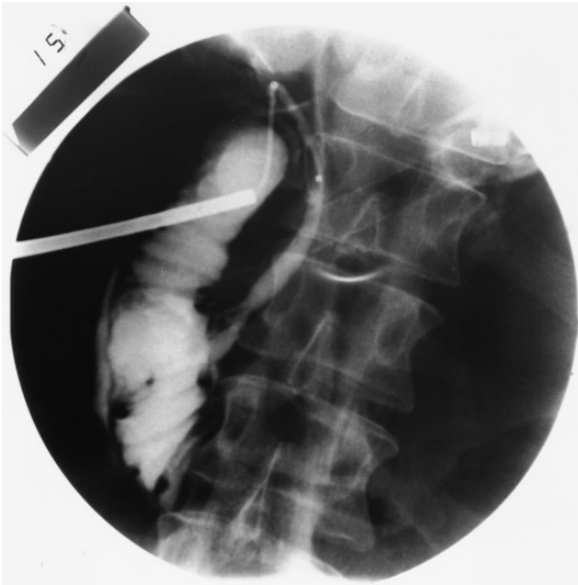


Fig. 2. Unsuspected perforation of the intraduodenal bile duct discovered on routine completion cholangiogram after common duct exploration. Note extravasation of contrast in the duodenal wall allowed early recognition and repair of the injury.

a biliary-enteric anastomosis) under suboptimal conditions will almost always result in failure. It is well documented that failed attempts at repair are associated with a higher incidence of long-term disability from biliary cirrhosis and portal hypertension. Consideration should always be given to consultation with a surgeon experienced in biliary repairs.

When a bile duct injury is suspected after laparoscopic cholecystectomy, reoperation should be preceded by radiographic studies (endoscopic-retrograde or transhepatic cholangiography) to identify the injury whenever possible. Many partial injuries are amenable to treatment by stenting and percutaneous drainage without the need for laparotomy. Others may be difficult to localize at laparotomy in the face of bile peritonitis without adequate preoperative studies.

The goal of the surgeon should be to avoid bile duct injuries by a combination of meticulous dissection at the cystic duct–gallbladder junction and cholangiography. If injury occurs, prompt recognition and repair produce the best chance for successful outcome. Routine cholangiography

increases the early identification of bile duct injuries. Early recognition reduces the severity, cost, and consequences of bile duct injuries.

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