Long-Term Consequences of Intraoperative Spillage of Bile and Gallstones During Laparoscopic Cholecystectomy

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Compared to open cholecystectomy, laparoscopic cholecystectomy is linked to a greater rate of iatrogenic gallbladder perforation. The long-term effects of gallstones and spilled bile are unknown. Over a three-year period, data were gathered prospectively from 1059 patients who had laparoscopic cholecystectomy. The operating techniques and postoperative outcomes of individuals who had gallbladder perforation were examined in detail. Long-term follow-up (varying from 24 to 59 months) was available for 92 % of patients. The gallbladder was perforated in 306 patients (29%); it was more prevalent in men and was linked to increasing age, body weight, and the presence of omental adhesions (all P less than 0.001). Patients with acute cholecystitis had no higher risk (P = 0.13). Pyrexia was more likely postoperatively in individuals who had gallbladder contents spilled (18% vs. 9%; P less than 0.001). Intra-abdominal abscesses formed in 1 (0.6%) of 177 patients with just bile leakage and 3 (2.9 %) of 102 patients with both gallstones and bile spilling, but no intra-abdominal abscesses formed in the 696 patients in whom the gallbladder was removed intact (P less than 0.001). During laparoscopic cholecystectomy, intraperitoneal leakage of gallbladder contents is linked to an increased risk of intra-abdominal abscess. Attempts should be undertaken to irrigate the operating field in order to drain spilt bile and retrieve all gallstones that may have been spilled during the process.

Keywords *: Gallbladder, laparoscopic, gallstones, abscesses, cholecystectomy.*

Introduction

Laparoscopic cholecystectomy has supplanted open cholecystectomy as the "gold standard" for the surgical treatment of symptomatic cholelithiasis. Although laparoscopic cholecystectomy has a slightly greater incidence of iatrogenic biliary tract damage than open approaches, overall complication rates appear to be comparable. Iatrogenic gallbladder perforation occurs more commonly after laparoscopic cholecystectomy, resulting in intraperitoneal leakage of bile and gallstones, as we and others have shown [1,2]. Although some writers suggested that gallbladder perforation during surgery should precipitate conversion to an open procedure [3], most institutions now remove as many stones as feasible while irrigating the peritoneal cavity to clear the spilled bile.

Although gallbladder contents spilling is regarded to be generally harmless, the long-term repercussions of intraperitoneal bile and gallstone spilling remain unknown. Experiments on animals have shown inconsistent results. Several investigations have shown that intraperitoneal stones cause a minor fibrotic response [2, 4, 5], whereas others have shown that abscess development occurs.[6] There have also been several accounts of difficulties resulting from spilling bile and gallstones[7 – 15]. The goal of this study was to establish the variables that predispose to gallbladder perforation during surgery, as well as the incidence and range of unfavorable consequences associated to bile leakage and gallstones.

Material and Methods

For symptomatic cholelithiasis, 1139 consecutive patients underwent attempted laparoscopic cholecystectomy between July 2017 and August 2020. Prospectively gathered clinical, diagnostic, treatment, and follow-up data. 80 patients (7.0 %) who were converted to open cholecystectomy due to dense adhesions (n = 26), severe inflammatory alterations (n = 22), substantial spilling of bile or gallstones (n = 10) or other causes (n = 22) were excluded from the study. In 753 patients (71%) the gallbladder was removed intact, but in 306 patients (29%) the gallbladder was perforated during the procedure. The particular specifics of the operating technique were evaluated in these individuals.

Depending on a clinic visit two to four weeks postoperatively, the follow up of Short term is done. While the follow up of long term was achieved by telephone conversation or questionnaire in 977 patients (92%) at a mean of 3.3 years (range

2.1 to 5 years). 26 of the 82 patients who had not received satisfactory follow-up had died, nine had been incarcerated, eight had moved out of Iraq, and 39 had refused to complete questionnaires. To rule out selection bias, the hospital records of these patient subgroups were thoroughly examined. Gallbladder perforation was equally common in patients with and without good follow-up data (29% vs. 32

%). Patients with intact gallbladders experienced no notable early problems, whereas two patients with intraoperative gallbladder rupture developed perihepatic abscesses and two had superficial wound infections. The incidences of postoperative complications in the following results are based exclusively on patients who have completed long-term follow-up.

Operative Technique

An attending surgeon or a resident performed the laparoscopy under the supervision of the medical personnel. The study took into account both elective and emergency situations. The procedure was performed using a four-trocar method and a 30-degree angled laparoscopic video camera [16]. The cystic artery and cystic duct were ligated with titanium clips, and gallbladder dissection was done with a mixture of electrocautery and blunt dissection with fine graspers. Either the umbilical or epigastric port was used to reposition the gallbladder. When the gallbladder perforated, efforts were undertaken to recover all lost stones, and the peritoneal cavity was irrigated with saline solution to remove the spilt bile. Antibiotics, most often a cephalosporin, were given to patients once before surgery and once thereafter. Broad-spectrum antibiotics were prescribed for a longer duration in patients with acute cholecystitis, especially when the bile culture was positive, depending on the clinical circumstances.

Statistical Analysis

The chi-square test or Fisher's exact test were used to do statistical comparisons of proportions, as applicable. The Wilcoxon rank-sum test was used to compare continuous variables. P values of less than 0.05 were deemed statistically significant. The mean and/or standard deviation are used to convey summary parameters in the text.

Results

Between July 2017 and August 2020, 1059 patients received successful laparoscopic cholecystectomy. Iatrogenic gallbladder perforation was found in 306 individuals (29 %, with a 95 % confidence interval ranging from 26 % to 32 %), with 191 (62 %) having just bile spilling and 115 (38 %) having both bile and gallstone spilling (Table I). The group of gallbladder perforation had a larger proportion of male patients than the intact group (43 % vs. 28 %; P less than 0.001). Also, they had a higher mean age than the intact group (56 ± 15 years vs. 52 ± 16 years; P less than 0.001), and the perforated gallbladder group had a higher mean weight (80 ± 18 kg vs. 76 ± 17 kg; P less than 0.001). Regarding the history of abdominal surgery, an increased risk of intraoperative gallbladder

perforation was not linked to it. Gallbladder perforation was more likely when there were adhesions between the gallbladder and the omentum (42 % vs. 30 % ; P less than 0.001). Although the perforated group had a slightly greater incidence of acute cholecystitis than the intact group (11% vs. 8.5%), the difference was not statistically significant.

Table I. Patient and operative characteristics

	Gallbladder status		P value
	Intact	Perforated	
Patients	753 (71%)	306 (29%)	
Bile only		191 (62%)	
Gallstones and bile		115 (38%)	
Sex			
Male	214 (28%)	132 (43%)	<0.001
Female	539 (72%)	174 (57%)	
Mean age (yr)	52 -± 16	56 -± 15	<0.001
Mean weight (kg)	77 ± 17	81 ± 18	<0.001
Acute cholecystitis	64 (8.5%)	35 (11%)	NS
() mental adhesions	226 (30%)	127 (42%)	<0.001
Mean surgical time (min)	100 ± 38	106 ± 38	0.008
Operation performed by surgical trainee	182 (24%)	79 (26%)	NS

The rate of iatrogenic gallbladder perforation was greater in the first year of our experience with laparoscopic cholecystectomy (40%) in 2017, but it gradually decreased each year following, reaching 24 % in 2020. Perforation of the gallbladder occurred in 47 % of patients during dissection of the gallbladder from the liver, 21% during extraction through the abdominal wall, and 14% as a result of intraoperative retraction. Patients in the perforated group had a little longer operation time (100 ± 38 minutes vs. 106 ±38 minutes; P less than 0.01), although this was not clinically significant. Surgical residents conducted the same number of laparoscopic cholecystectomies in both patient groups (26% vs.24%; P = 0.573).

Postoperative Complications

There were no bile duct damage or perioperative fatalities. Ten patients (1%), including two in the

intact group (0.3%) for persistent cystic duct stump leaks closure and eight in the group of gallbladder perforation (3%) for intra-abdominal abscesses drainage, two for empyema decortication, and two for an iatrogenic cautery injury repairing that happened to the duodenum. Wound infection, pulmonary problems, bile leakage, or ileus across groups have no differences in the incidence postoperatively (Table II). Pyrexia developed after surgery in 53 patients (18%) in the group of gallbladder perforation and 66 (9%) in the intact group (P less than 0.001). Although the group of gallbladder perforation had a higher postoperative white blood cell count, (9800 ± 3200 vs. 9800 ± 3400; P equal to 0.02, a difference of minimal clinical significance), there were no clinically significant changes in the preoperative white blood cell count. Regarding the use of oral analgesics or the use of parenteral analgesics or the need for an antiemetic following surgery, there were no difference between the two patient groups. The perforated gallbladder group had a longer hospital stay (2.1 ± 3.2 days vs. 1.6 ± 1.3 days; P less than 0.01); however, there was no significant difference in the meantime to return to work (13.6 ±10.7 days vs. 17.0 ± 31.8 days; P = 0.3). In both groups, the majority of patients were happy with their surgical operations (92 % vs. 96 %; P = 0.29).

Table II. Complications: Intact vs. perforated gallbladder (long-term follow-up)

Complication	Intact (%)	Perforated (%)	P value
Intra-abdominal infection	0 (0)	4 (1.4)	0.001
Ileus	9 (1.3)	4 (1.4)	NS
Pulmonary infection	1 (0.1)	2 (0.7)	NS
Bile leakage	2 (0.3)	1 (0.4)	NS
Hemorrhage	2 (0.3)	2 (0.7)	NS
Wound infection	17 (2.4)	3 (1.1)	NS
Residual gallstone symptoms	72 (10.9)	30 (11.1)	NS

Four (0.4 %) of the 977 individuals for whom long-term follow-up data was available had intra-abdominal infections. All of them had a perforated gallbladder (P = 0.001). Two more patients in the perforated gallbladder group were found to have developed intra-abdominal abscesses after no long-term follow-up. One of the patients died of prostate cancer before the follow-up survey, while the other refused to answer the questions. Four of the six patients experienced bile and gallstone spilling, whereas the other two just had bile leakage. Three of the six patients developed a perihepatic abscess, two of whom also had right-sided empyema. In the other three individuals, a subhepatic abscess developed.

Only one patient with an intra-abdominal abscess was reported to have gallstones left after the treatment. These were not removed laparoscopically due to their inaccessibility. Four individuals had signs

of intra-abdominal infection within 10 days following laparoscopic cholecystectomy; however, one patient developed infection 28 days after the procedure and another patient after 34 months.

Four patients had their intra-abdominal abscesses percutaneously drained under CT guidance, although three of them needed surgery afterwards (Table III). Symptoms in one patient improved following CT drainage, but the patient suffered recurrent right upper quadrant discomfort six months later, necessitating laparotomy. The symptoms disappeared after a tiny chronic subhepatic abscess was discovered, which included three big, mixed stones (**Fig. 1**).

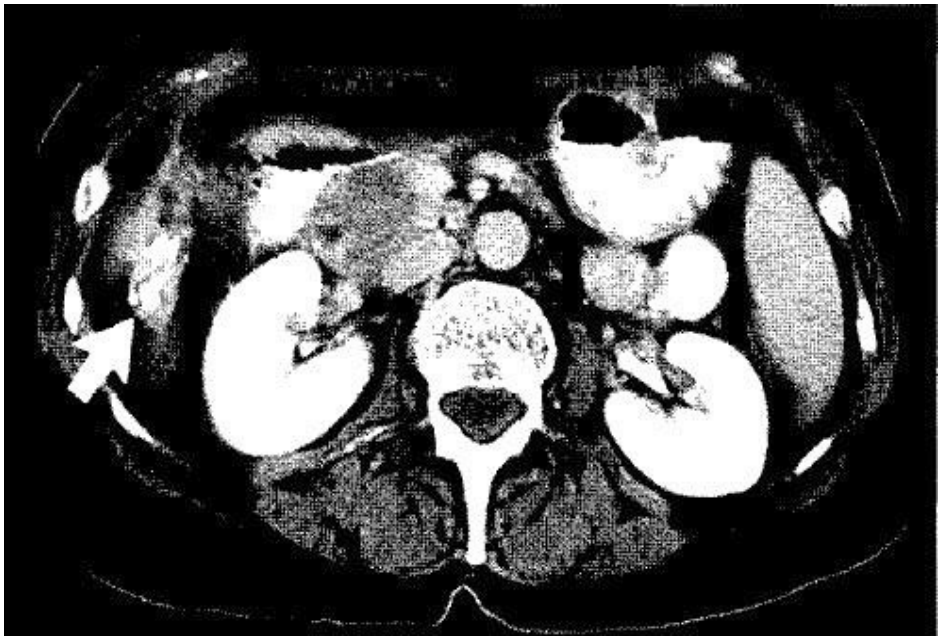

Fig 1. CT scan demonstrating intraperitoneal gallstones (arrow) with surrounding inflammatory reaction and fluid collection.

Table III. Major infective complications secondary to spilled bile and 'gallstones

Patient	Spillage	Site of infection	Percutaneous CT drainage	Operative intervention
1	Bile	Perihepatic	Successful	None
2	Bile	Perihepatic, right chest	Unsuccessful	Right thoracotomy and decortication of empyema, drainage of perihepatic abscess
3	Bile + gallstones	Subhepatic	Not attempted	Laparotomy, removal of intraperitoneal gallstones; postoperative pulmonary embolus
4	Bile + gallstones	Subhepatic	Unsuccessful	Laparotomy, drainage of abscess
S	Bile + gallstones	Subhepatic	Unsuccessful	Laparotomy, drainage of abscess
6	Bile + gallstones	Perihepatic, right chest	Not attempted	Right thoracotomy and decortication of empyema, removal of gallstones and drainage of perihepatic abscess

In two other patients, a laparotomy was performed to drain an intra- abdominal abscess. Empyema caused by perihepatic abscess necessitated transthoracic decortication in two patients (**Fig. 2**).

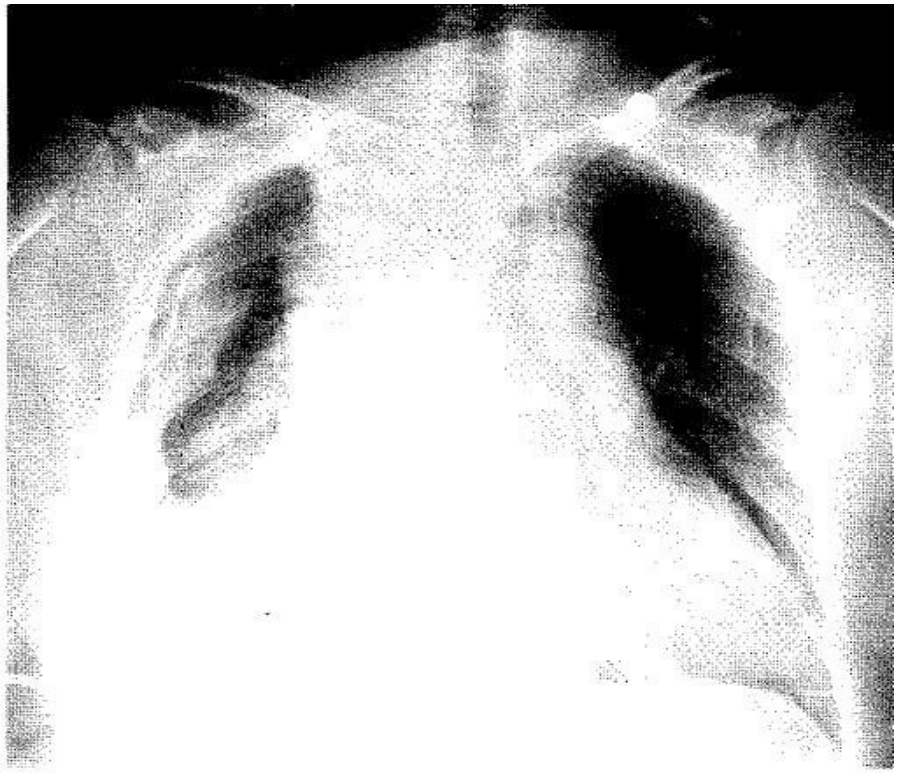

Fig. 2. A, Right-sided empyema due to a perihepatic abscess caused by gallstones that have not been removed. Thoracocentesis, right thoracotomy, and decortication were all done.

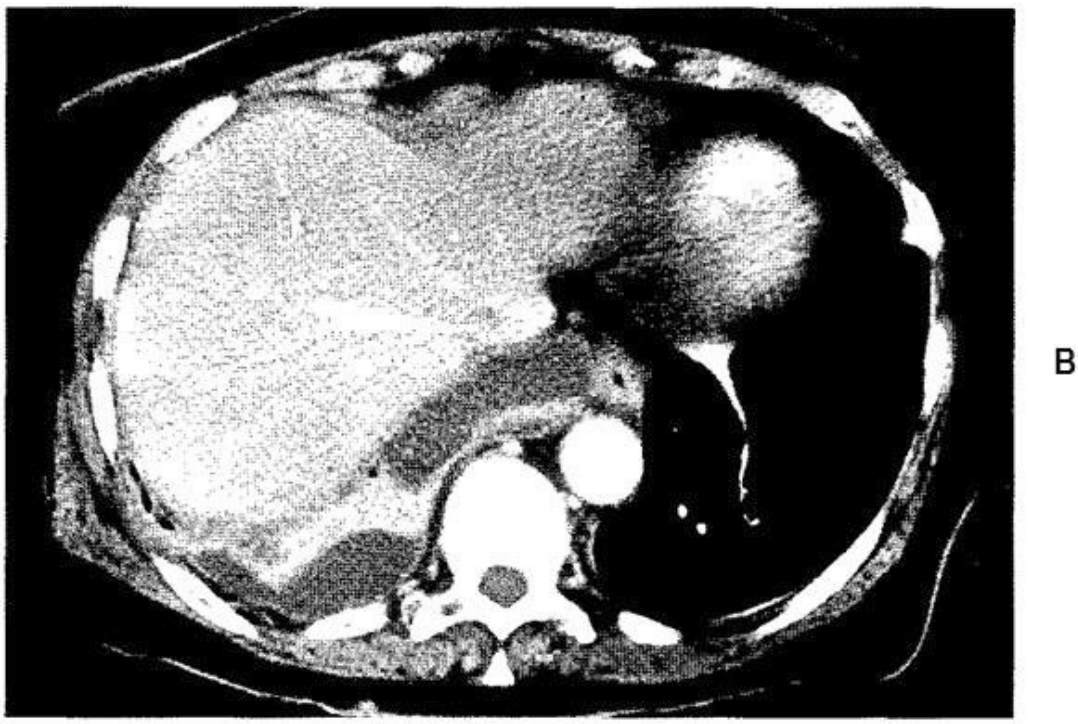

Fig. 2. B, Patient A's CT scan revealed a subhepatic abscess that required surgical drainage.

Discussion

Laparoscopic cholecystectomy has quickly become the standard treatment for symptomatic cholelithiasis since it was first reported in 1989 [17]. The procedure, however, is not without risks, the most serious of which is a higher risk of biliary tract injuries than open cholecystectomy [18–21]. Despite this, 5 years of clinical experience and numerous prospective [22-25] and retrospective [26-28] trials have shown that laparoscopic cholecystectomy is a safe procedure with a low risk of major complications. Despite the fact that many studies have looked at the clinical outcomes of laparoscopic cholecystectomy, few have specifically addressed the consequences of bile and gallstone spillage into the peritoneal cavity, which occurs more frequently with laparoscopic than with open cholecystectomy [1,2]. Gallstones that were lost during surgery have been reported to cause intra-abdominal abscesses, empyema,[9] abdominal wall abscesses, [1,11,12] cutaneous sinus tracts, [13-14] and bladder fistulas.[15] Although these complications appear to be uncommon, there is no way of knowing how common they are.

306 (29%) of 1059 patients who underwent laparoscopic cholecystectomy had bile spillage alone or bile and gallstones spillage into the peritoneal cavity. This rate is similar to Jones et al. [29]. 32 % incidence of gallbladder perforation, but it is significantly higher than the perforation rate described in multicenter study in Canada (9%). Male sex, increasing age, and weight were all associated with a higher risk of intraoperative gallbladder perforation. Jones et al. discovered similar connections. Larger abdominal wall adipose tissue, increased liver mass and friability (frequently fatty infiltration), which puts higher force on the gallbladder during cephalad retraction, and a bigger quantity of fat around the cystic duct are all likely to make the surgery more technically hard in larger male patients. The most common time of iatrogenic gallbladder perforation in our study was during gallbladder dissection from the liver. Electrocautery was used in 11 of our 1059 cholecystectomies. We can't draw any conclusions regarding the relative risk of perforation using alternative methods of dissection because just a few patients had the procedure done using laser dissection. The removal of the gallbladder through the abdominal wall was the second most common cause of iatrogenic gallbladder perforation. When a large gallstone burden prevents the gallbladder from being extracted through one of the ports, the gallbladder can be placed in a specimen bag before crushing or extracting stones with a stone forceps, or the fascia! The impact at the port site can be increased. Gallbladder perforation and its subsequent infective complications should be reduced as a result of these steps.

The frequency of acute cholecystitis was comparable in the intact and nonintact patient groups, a result that was also reported by others [2]. Although a severely inflamed gallbladder may appear to be more friable on the surface, the edematous and thicker gallbladder wall may guard against unintended perforation during several phases of the operating procedure. In our early experience, when the gallbladder was extremely inflamed, there was a low threshold for converting to open cholecystectomy, which likely contributed to the low frequency of gallbladder perforation in these patients. The incidence of gallbladder perforation was higher during the first year of laparoscopic cholecystectomy at our institution, as one might expect; however, after that, the iatrogenic perforation rate stabilized at around 25%.

Despite the high rate of gallbladder perforation during surgery, spillage of bile or gallstones did not cause serious complications in the majority of patients. Surprisingly, both patients with an intact gallbladder and those with a perforated gallbladder had the same rate of wound infection. Even when spillage into the port site was looked at separately, there was no evidence of a link to subsequent wound problems. In the group of patients of the gallbladder perforation, only six had intra- abdominal abscesses; in two of them, decortication required due to

empyema developed. Empyema is thought to have developed as a result of spilled gallstones causing a perihepatic abscess and subsequent diaphragm erosion into the right pleural cavity. This complication has been previously reported [9]. Despite the fact that percutaneous CT guided drainage was attempted in four patients, three of them required surgical intervention due to insufficient drainage, most likely due to the inability to remove the inciting gallstones.

In animal studies, gallstones plus bile have been shown to increase the risk of abscess formation,[6] whereas sterile gallstones only cause a mild inflammatory response [5]. In our study, 4 of 6 patients who developed intra-abdominal abscesses had known bile and gallstone spillage. Because of their frequent association with bacterobilia, brown pigmented stones may be more problematic when left in the abdomen [31]. Because bile culture or stone analysis were not routinely performed, no conclusions about the effects of infected bile spillage or the types of gallstones spilled can be drawn.

Conclusion

After intraoperative leakage of gallbladder contents after laparoscopic cholecystectomy, the risk of significant sequelae is minimal. Only patients who had bile and/or gall stones spilled after laparoscopic cholecystectomy developed an intra-abdominal abscess (1.4 %). There were no intra-abdominal abscesses in the 753 patients who had their gallbladders removed intact. It is appropriate to irrigate the peritoneal cavity with a large (>1 liter) quantity of saline solution If an iatrogenic gallbladder perforation with bile leakage or gallstones occurs. It's unclear whether topical antibiotics are necessary. If gallstones are intentionally spilled within the abdominal cavity, all gallstones should be removed. Conversion to laparotomy is not always recommended after gallbladder perforation because infective complications are uncommon. However, if the majority of gallstones cannot be removed laparoscopically, conversion to an open procedure should be considered, especially if bacterobilia is suspected or confirmed by a Gram stain of the bile. Furthermore, unless the inciting gallstones can be removed, percutaneous drainage is unlikely to be effective if a trans-abdominal abscess develops.

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Ethical Clearance: This study is ethically approved by the Institutional ethical Committee

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