Management and complications of intraoperative spillage of bile and gallstones during laparoscopic cholecystectomy: a single-center experience

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Background
For symptomatic gallstones, laparoscopic cholecystectomy is the recommended surgical procedure.

Aim and objectives
This study's primary objectives were to identify the proper management of intraoperative spillage of bile and gallstones from the gallbladder throughout laparoscopic cholecystectomy, and to clarify the most common complications and how to deal with it.

Patients and methods
A total of 200 consecutive laparoscopic cholecystectomy cases from Assiut University Hospitals between August 2019 and August 2021 were included in the research.

Results
Gallbladder perforation was significantly occurring in acute cholecystitis. None of the patients underwent open procedure due to gallbladder perforation. Postoperative hospital stays in patients with gallbladder perforation ranges between 2 and 5 days with a mean value of 3.5 day. A follow-up was conducted after 1 week, 3 months, and 6 months.

Conclusion
Stones that have been dropped may cause morbidity. Even though they are very uncommon, serious consequences may happen and can complicate diagnoses. Gallstones that have spilled should be recovered as soon as feasible using a laparoscope. Because the risk of infective problems in such individuals may be significant, conversion to an open surgery should be taken into consideration if there are many gallstones that cannot be removed in the presence of bacteria.

Keywords:
cholecystectomy, gallbladder, laparoscopic, perforation

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Introduction

For symptomatic gallstones, laparoscopic cholecystectomy is the recommended surgical procedure. The laparoscopic surgery is better compared with the open method in several ways, including less postoperative discomfort, preferred esthetic outcomes, and shorter patient stay times [1].

The high rate of iatrogenic harm and gallbladder perforation linked to bile and gallstone overflow during laparoscopic cholecystectomy cases may be attributed to intrinsic technological challenges [2].Gallbladder perforation is more frequent in acute cholecystitis, as the risk of rupture depends on whether the gallbladder is inflamed or not [3].

By managing these problems early on, a potentially disastrous consequence will be reduced. They may appear with septic problems months or years after the cholecystectomy that are not always in the right upper quadrant [4].

Although problems from retained gallstones in the abdomen are uncommon, occurring in an estimated 0.08–8.5% of cases, the incidence of gallbladder rupture with spilling of bile or gallstones has been shown to be as high as 2.7–3% [5].

Explanation of complications related to bile spillage and dropped stone such as wound infection, intraperitoneal abscess, and intestinal obstruction depends on the theory that drooped gallstones act as a nidus of infections and bile spills may cause chemical peritonitis. Therefore, all trials should be done in order to retrieve the lost stone and to aspirate the leaked bile [6].

Patients and methods

A total of 200 consecutive laparoscopic cholecystectomy cases from the Assiut University Hospitals between

August 2019 and August 2021 are included in the research.

According to the pro forma, prospective data were collected on patients' diagnoses, preoperative physical and ultrasound abdominal findings, intraoperative information such as technique, stone leakage, reason for stone spills, method of stone extraction, length of surgery, postoperative events, and complications (Fig. 1).

A follow-up was conducted at 1 week, 3 months, and 6 months after the surgery. The evaluations were conducted in the outpatient department at the 1-week mark, some at the 3-month mark during outpatient visits; the remainder through telephone interviews, and the final follow-up at the 6-month mark through telephone interviews.

During laparoscopic cholecystectomy, data collected were evaluated to determine the frequency of gallstone spilling and consequences associated with such episodes.

Informed consent was obtained from all individual participants included in the study. The study was approved by the Ethical Committees of faculty of medicine, Assiut University, Egypt.

Statistical tests

Version 20 of the SPSS application was utilized for the statistical analyses (IBM Corporation, Endicott, New York, USA). Before doing a more in-depth statistical analysis, the data were checked for normality using the Kolmogorov–Smirnov test and for homogeneity variances. Number and percentage were used to represent categorical variables, whereas the mean and SD were employed to express continuous variables. The paired Student's test, Mann–Whitney test, χ^2 test, or Fisher's exact test were employed as comparison statistics and significance tests. When the *P* value was less than 0.05, it was regarded as statistically substantial, and when it was less than 0.001, it was extremely substantial. Using SPSS 22.0 for Windows (SPSS Inc., Chicago, Illinois, USA) and MedCalc 13 for Windows, all data were gathered, tabulated, and statistically evaluated (MedCalc Software bvba, Ostend, Belgium).

Figure 1

Spillage of gallstone and trial of extraction.

Results

Among the researched patients there were 12 (40%) males and 18 (60%) females with a mean age of 37.15 ± 6.29 years and mean BMI of 28.63 ± 3.79 kg/m^2.

Of the 200 patients who underwent laparoscopic cholecystectomy in Assiut University Hospital or Elrajhi Hospital from August 2019 to August 2021 for gallbladder stones, in about 30 (15%) patients intraoperative perforation of gallbladder and spillage of gallstone(s) or bile occurred.

This study includes those 30 patients. Gallbladder perforation results in spillage of stones or bile. Spillage of stones occurred in 12 (40%) cases while spillage of bile occurred in 18 (60%) ones.

Mechanism of perforation of gallbladder can be explained by traction and grasping which had been recorded in 15 cases, or disscetion of gallbladder from the gallbladder bed in ten patients or during extractiom and removal of gallbladder from umbilical port in five cases. Perforation occurred during traction and grasping in 15 (50%) patients out of the patients with PgB, dissection of gallbladder from the gallbladder bed in 10 (30%) patients and during extraction and removal of gallbladder trans umbilical port in five (20%) patients about 2.5% from 200.

Gallbladder perforation was significantly occurring in acute cholecystitis. None of the patients underwent open procedure due to gallbladder perforation.

All surgeries were done by well and experienced surgeons. Trial of retrieval and irrigation of stones and leaked bile was done intraoperatively in all cases.

The peritoneal cavity was extensively irrigated by saline, retrieval of all spilled gallstones was successful in eight (66.5%) patients out of 12 patients with spilled stones, while failed in four (33.5%) patients because of the numerous number and small-sized stones, a drain was inserted intraperitoneally in the subhepatic region in all patients with gallbladder perforation.

Duration of the surgery in this study depends on the difficulty of the case 75 min (±15 min).

Table 1 Demographic data of the study

Variables	Investigated patients (*n*=30)
Age (years)	
Mean±SD	37.15±6.29
Sex [*n* (%)]	
Female	18 (60)
Male	12 (40)
Weight (kg)	
Mean±SD	92.63±16.37
Height (cm)	
Mean±SD	165.93±8.77
BMI (kg/m^2)	
Mean±SD	28.63±3.79

Table 2 Ultrasound finding

Size of GB	21 (normal)	8 (distended)	1 (contracted)
Existing sludge	4		
GB wall thickness	12(>3 mm)		
CBD size	3(>7 mm)		
Stone site	26 (mobile)	4 (impacted)	
Stone size	18 (<10)	8 (11-20)	4 (>20)

CBD, common bile duct; GB, gallbladder.

Table 3 Intraoperative finding

Surgery duration	7 (<60 min)	20 (60-90 min)	3 (>90)
Spilt stones	12		
Spillage of bile	18		
Irrigation by saline	All		
Wash given	18 (<250 ml saline)	12 (>250 ml saline)	
Unretrieved stones	4		
Bleeding	1 (moderated)	2 (minimal)	

Table 4 Mechanism of spillage

Intra-operative mechanism	Number of spilled cases
During traction and grasping	15
During dissection of GB from bed	10
During extraction and removal of GB	5

GB, gall bladder.

Table 5 Postoperative details

Complications	Number of complicated cases
Surgical site infection [*n* (%)]	3 (10)
Intestinal obstruction [*n* (%)]	1 (3.3)
Intra-abdominal collection [*n* (%)]	2 (6.7)
Intra-abdominal bleeding [*n* (%)]	3 (10)

Postoperative hospital stays in patients with gallbladder perforation ranges between 2 and 5 days with a mean value of 3.5 days for close follow-up and with adequate antibiotic (Tables 1–5).

Discussion

The existence of bile that is infected, and pigment stones that are bacterially dense are potential risk factors for the development of intra-abdominal abscesses after leakage of gallbladder contents. Bile is contaminated in 15% of uncomplicated cases and in 60% of elderly patients, jaundiced patients, and patients who have previously had acute cholecystitis [7].

Female cases in this study have the highest percentage of complications associated with spilled gallstones, which can be explained by the higher number of female cases in contrast to male and not really explained by the sex.

After a median follow-up of 9.5 months, Welch [8,9] and colleagues examined 11 patients with unrecovered intraperitoneal gallstones and discovered that none had developed symptoms indicative of an intra-abdominal abscess or bowel obstruction. However, one patient had an infection in an umbilical incision. The long-term effects of spilled stones have not been well investigated in a large series of laparoscopic cholecystectomies [10].

Abscesses in the pelvis, intra-abdominal space, and subhepatic space have all been reported as complications. An inflammatory intra-abdominal mass has caused bowel obstruction or perforation, and dyspareunia has been observed after stone migration into the ovary or implant in the pouch of Douglas [11].

As a result of stone migration into the chest, loculation in the pleura, or ejection via the bronchi, empyema, and cholelithoptysis have formed [12].

A cutaneous abscess most often forms, which may or may not be close to a trocar site. This is drained and debrided, and until all the stones and debris are removed, chronic sinus and fistula development follows [13].

In this study during the follow up of the patient postoperatively, we reported two (6.7%) cases who developed acute abdominal pain mostly in the right hypochondrium region, fever, and leukocytosis.

An urgent abdominal ultrasound had been done which reveal intraperitoneal collection in the subhepatic region and aspirated pus. The time of that manifestation had been recorded 3 months postoperatively, while the other case developed these symptoms after 5 months.

Antibiotic treatment combined with percutaneous abscess drainage and stone removal has been effective in a small number of instances, although surgical drainage and stone removal are often necessary for full resolution.

The possible risk of retaining gallstones in the peritoneal cavity has been the subject of several experimental animal researches. The majority of these

studies evaluated the effects of intraperitoneal stones over a period of 3 months or less, and in most cases, no negative consequences or just minor abdominal adhesions were discovered [14].

Johnston and colleagues discovered that injecting sterile bile and human gallstones into the peritoneum of rats for 4 weeks resulted in intra-abdominal abscesses in two rats and hard adhesions in 73% of the rats. This finding lends support to the idea that stones may serve as a nidus for the development of abscesses. Surprisingly, rats given gallstones and bile contaminated with *Escherichia coli* did not develop abscesses [14].

A documented etiology of intra-abdominal abscess and surgical fever is spilled gallstones. Since infection from dropped stones is uncommon, an effort should be made to collect them all. Only 0.08% of the 10 174 patients in the study who had spilled gallstones needed to have surgery again for an intra-abdominal abscess; those who were at risk were elderly or had acute cholecystitis with infected bile and big stones [15].

It is uncertain if regular conversion to laparotomy for stone extraction is warranted given the low prevalence of long-term problems with retained gallstones or whether antibiotic prophylaxis should be begun or changed as a consequence of gallstone leakage [16].

A pigtail catheter insertion has a high rate of successful management for the cases that developed intraperitoneal abscess to avoid the open procedure for retrieval of the stone and drainage of the abscess. Broad-spectrum antibiotics must be added in the protocol management to eradicate the source of infection [17].

The condition of the gallbladder intraoperatively plays a major role of postoperative complications such as mucocele of the gallbladder that has a high risk to rupture more than the chronic one due to adhesions between the gallbladder and structures related to it such as the duodenum, transverse colon, bile duct, and major vessels related to the liver that make dissection of the gallbladder and identification of the cystic duct and cystic artery (critical view of cyst) more difficult, so perforation occurs easily [18].

In this study, failure of retrieval of all spilled stones occurred in four cases, which had been detected in the follow-up period manifested by intestinal obstruction symptoms, wound infection and intraperitoneal collections, so a well-experienced surgeon has to do all his effort in order to retrieve all spilled stones.

The frequency of iatrogenic gallbladder perforation was only 6% in recent retrospective research from Switzerland that included 10 174 LCs carried out at 82 surgical facilities over a 3-year period. Serious postoperative complications also occurred extremely seldom (0.08%) [14].

The scientists came to the conclusion that intra-abdominal abscess development may be more likely in older individuals with acute cholecystitis, contaminated bile, and spilled stones. Therefore, it is best to avoid gallbladder perforation whenever feasible. They underlined, as they have in earlier research, the need of removing spilled gallstones and irrigating the abdominal cavity to diluted contaminated bile and spilled stones [14].

They reaffirmed the finding of earlier research that the laparoscopic method should not be changed to an open one only to remove stones as the prevalence and death rate of major complications are very low [14].

In this research, we also think that, given our considerable expertise with LCs, every attempt should be taken, short of doing a laparotomy, to recover all dislodged stones during laparoscopic surgery. However, this procedure may be time-consuming, particularly if the stones are many, tiny, and lodged between intestinal loops. The big and medium-sized stones may either be extracted one at a time using mechanical tools like forceps or in bulk by gathering them intracorporeally in a plastic recovery bag.

A wide-bore suction-irrigation device is very beneficial but not always effective in situations of many tiny stones. To prevent future leakage of bile and stones, it is crucial to make an attempt to seal any holes left by the gallbladder dissection as soon as possible using either clips or sutures [14] (Table 6).

Conclusion

Stones that have been spilled may cause morbidity. Even though they are very uncommon, serious consequences may happen and can complicate diagnoses. Gallstones that have spilled should be recovered as soon as feasible using a laparoscope. Because the prevalence of infective problems in such individuals may be significant,

Table 6 Comparison between our study and international data

	Our research	International data
Spillage of gallstones	6%	2-11%
Complications	4.5%	2.3% for retrieved stones 7% for unretrived stones
Gallbladder perforation	15%	11.6-30%
Unretrieved stones	2%	2.4-4%
Follow-up period	6 months	44.8 months

conversion to an open treatment should be taken into consideration if there are several gallstones that cannot be removed in the presence of bacteriobilia.

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Conflicts of interest
There are no conflicts of interest.

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