Complications Due to Spilled Gallstones and Surgical Clips During Laparoscopic Cholecystectomy

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Abstract

The presence of biliary gallstones and surgical clips in the abdominal cavity after a laparoscopic cholecystectomy can cause complications, which even though they are uncommon, can be serious. We carried out a review of the various complications, their incidence, related risk factors, ways to deal with them and recommendations to reduce morbidity associated with the presence of ectopic material (gallstones and surgical clips) in the peritoneum.


Introduction

Laparoscopic cholecystectomy is the treatment of choice for symptomatic cholelithiasis. The rate of general complications related to laparoscopic cholecystectomy is lower than in conventional or open cholecystectomy, although injury to the bile duct and intra-abdominal infection caused by gallstones left in the peritoneal cavity are more frequent in laparoscopic cholecystectomy.1-3 Accidental opening of the gallbladder is a relatively frequent intraoperative incident (15%-40%).1,4 Accidental perforation of the gallbladder facilitates bile leakage, the spilling of gallstones into the peritoneal cavity only occurs in 16%-66% of perforation cases.1,4,5 Perforation of the gallbladder with gallstone spillage extends operating time4 and may lead to some of them being left in the peritoneal cavity. Nevertheless, despite the increased rate of perforations with gallstone spillage, complications caused by intraperitoneal gallstones are infrequent, though sometimes they may be serious.4,5 On the other hand, the metallic clips used in laparoscopic cholecystectomy may also be left in the abdominal cavity and cause complications.9,10 The purpose of this study is to review the different complications related to ectopic material (gallstones or clips) in the peritoneum, their incidence, risk factors, and management. For this purpose, a review of the existing literature has been performed based on a search of the MEDLINE database using different combinations of the following key words: “Laparoscopic cholecystectomy, gallbladder perforation, spilled gallstones, lost gallstones, surgical clips, complications, abdominal abscess, adhesions.” No language restriction has been applied to the search. We found 207 articles on gallbladder perforation and/or complications related to intra-abdominal gallstones. Another 18 studies were experimental and dealt with the influence of gallstones in the peritoneum. No experimental studies...
were found which analyzed the possible relation between intra-abdominal clips and the development of complications. However, 53 articles presented clinical cases of complications caused by metallic clips.

Factors Related to Gallbladder Perforation

The primary factor related to the risk of gallbladder perforation is the surgeon’s experience.11 The increased experience gained in laparoscopic surgery has led to a decrease in the rate of gallbladder perforation in recent years, though at a lower rate than one would expect, probably due to the influence of the learning curve for surgeons in training.5,11-13 In addition to the surgeon’s experience, there are other conditions that have been related to an increased risk of gallbladder perforation during laparoscopic cholecystectomy such as a male patient, advanced age, obesity, acute cholecystitis with gallbladder distention and adhesions of the omentum, and a long preoperative inflammatory process.1,5,7,8,13,14 The spillage of bile and gallstones generally occurs because of gallbladder perforation during dissection (42%-75%), traction (15%-51%), or extraction of the gallbladder through a trocar opening that is too narrow (5%-10%), or due to slippage of the cystic duct clip during handling of the gallbladder (14%-21%).1,11,15,16 An appropriate surgical procedure is fundamental in reducing the risk of perforations and gallstone spillage.

Complications Due to Intra-abdominal Gallstones

**Incidence of Gallstone Spillage and Lost Gallstones**

The real rate of gallstones lost in the peritoneal cavity during laparoscopic cholecystectomy is difficult to ascertain; there is a very wide range of incidences in scientific literature (0.2%-32%).1,7,10,15,16 Woodfield et al10 have reported an incidence of dropped gallstones of 7.3% and have estimated that 2.4% of laparoscopic cholecystectomies definitely leave lost gallstones in the peritoneal cavity. The most frequent definite locations of lost gallstones are the right hypochondrium (41%) and the pelvis (33%).15 Twenty per cent of gallstones remain inadvertently lost in the peritoneum during surgical intervention, while in those laparoscopic cholecystectomies in which gallstone spillage is identified, their complete extraction is only possible in 50%-67% of cases.1,11,15,16 The difficulty in recovering all gallstones laparoscopically makes the rate of complications due to lost gallstones higher in laparoscopic cholecystectomy than in open cholecystectomy.16

**Conversion to Laparotomy**

The indication for converting to laparotomy in the event of gallbladder perforation and gallstone spillage has been a controversial subject. Currently, most surgeons consider that intraperitoneal gallstones may cause severe consequences, although the incidence of major complications due to lost gallstones is very low and does not justify conversion to laparotomy except for selected cases of patients with a significant spillage of gallstones in which recovery of most of them has not been possible, especially when bile contamination is suspected.1,5,6,10,13,15,16,18 Despite the efforts to extract the gallstones, approximately 6% of patients with gallstone spillage ultimately require conversion to laparotomy.8,19 Perforation of the gallbladder with gallstones dropped into the peritoneum represents 2.1%-2.5% of all causes for conversion to laparotomy in laparoscopic cholecystectomy.7,20,21 Schafer et al9 have reported an increased incidence of systemic complications in patients with conversion due to spilled gallstones, mainly because of increased patient age and extended surgical time.

**Natural History of Lost Gallstones**

The natural history of gallstones lost in the peritoneal cavity is controversial. Initially, it was thought that intraperitoneal gallstones were gradually absorbed due to the reabsorbing capacity of the peritoneum.7 However, there are currently several publications relating intra-abdominal gallstones to the development of different complications.

In a review of the literature, Brockmann et al15 have reported significantly increased average hospital stay in patients with spilled gallstones primarily because of abdominal pain and fever. Z’graggen et al,19 in a review of 10 174 laparoscopic cholecystectomies did not find differences in local and systemic complications between patients with and without dropped gallstones except for one significantly major incidence of intra-abdominal abscesses in patients with lost gallstones (P<.001). One study carried out at the Mayo Clinic by Rice et al,13 in which 1059 laparoscopic cholecystectomies were prospectively analyzed, showed that spillage of gallstones and bile is associated with a significantly higher rate (P<.001) of fever and intra-abdominal abscesses compared to the laparoscopic cholecystectomy group without gallbladder perforation. Nevertheless, other clinical studies show that intra-abdominal gallstones do not cause a significant increase in complications of laparoscopic cholecystectomy.4,5 Ruiz et al22 have analyzed postoperative morbidity attributable solely to lost gallstones in a retrospective study of 22 patients with an extended average follow-up (42 months); they excluded patients with acute cholecystitis, hydrocholecystis, or gallbladder fibrosis from their study. The authors found that, in the absence of gallbladder inflammation and eliminating the bias of the learning curve, the spilling of gallstones into the peritoneal cavity extends surgical time and hospital stay, but does not increase postoperative morbidity. Manukyán et al17 also did not see complications in 24 patients with intraperitoneal gallstones after a 121-months follow-up.

There are also experimental studies in animals on the effects and consequences of intraperitoneal gallstones with conflicting results. In this respect, Welch et al23 and Cline et al24 note that leaving sterile gallstones in the peritoneum does not increase the formation of adhesions or abscesses. Zisman et al25 also have not find systemic
effects attributable to intra-abdominal gallstones, although they did cause a moderate local inflammatory reaction. Different studies have evaluated the effect of bile, sterile and infected, alone or in combination with single or multiple gallstones, on the development of adhesions and abscesses; some authors have found an increased risk of adhesions and abscesses in cases of gallstones with infected bile.26,27 On the contrary, other authors26,29 have also reported an increased risk of adhesion and abscesses due to gallstones even with sterile bile, probably due to the increased rate of gallstone contamination by microorganisms (20%-66%).30 In this respect, the composition of gallstones is of high etiopathogenic importance given that several studies have demonstrated that pigment and mixed gallstones have a greater incidence of inflammatory and infectious complications than cholesterol ones.15,30 Faced with a rate of less than 20% of inflammatory and infectious complications than that pigment and mixed gallstones have a greater incidence of complications in patients with intraperitoneal gallstones.15 In the Yerdel et al31 study, cholesterol gallstones did not cause serious effects except for the cases where they were broken or came for a gallbladder with an intense inflammatory reaction. Similarly, Hornof et al32 only obtained a higher incident of abscesses when cholesterol gallstones had associated gram-negative organisms.

**Risk Factors for Complications**

In addition to infected bile and pigment gallstones,16 Brockmann et al15 have identified the following risk factors for complications in patients with intraperitoneal gallstones: male gender, advanced age peripheral location of gallstones, more than 15 gallstones, and average size greater than 1.5 cm. The increased incidence of complication in male patients is probably due to an increased inflammatory reaction associated with acute cholecystitis.3,15 Regarding advanced age as a risk factor, changes in the immune response related to aging and an increased incidence of emergency surgery due to the more conservative attitude towards surgery adopted because of increased morbidity in this patient group are probably influences.15 However, there currently are no large studies analyzing the possible importance of the patient’s concomitant diseases in the development of complications, mainly of infectious nature, due to intraperitoneal gallstones.

**Complications Due to Lost Gallstones**

The real incidence of complications due to intra-abdominal gallstones following laparoscopic cholecystectomy is difficult to determine due to the low reporting rate of gallbladder perforation in the operative report and because most published studies are retrospective and/or with short follow-up periods or isolated clinical cases.6 Considering the high number of laparoscopic cholecystectomies currently being performed, the potential risk of complications related to intraperitoneal gallstones is very low, although the number of published cases with serious consequences is ever increasing.6,8 According to several studies, 0.08%-0.8% of all patients undergoing laparoscopic cholecystectomy develop some type of complication due to lost gallstones.6,12,16,33 When the study is limited to the group of cholecystectomies with gallbladder perforation and dropped gallstones, the rate of complications is 2.4% (1.4%-12%).6,13,16,34 which increases to 7% in cases in which gallstones left in the peritoneal cavity are well documented.16

Intraperitoneal gallstones usually progress painlessly, although sometimes they may be accompanied by poorly defined and intermittent symptoms.39 There is a wide variety of clinical manifestations due to complications related to gallstones left in the peritoneum, and the average time from laparoscopic cholecystectomy until the appearance of the first symptoms is 5.5 months.6,15,35 The most frequent complication is the formation of abscesses in different locations.6,15,33,35 In one review of the literature, Papasavas et al33 have obtained an intra-abdominal abscess rate of 55.7%, 20% of which are located in the abdominal wall, 13% were thoracic, and 11.3% were retroperitoneal. The most frequent microorganisms in the abscess cultures are *Escherichia coli, Klebsiella pneumoniae*, and *Enterococcus faecalis*.15,16

Intra-abdominal gallstones is the most frequent complication,15 which occurs in 0.1%-2.9% of laparoscopic cholecystectomies with lost gallstones.12-13 Intra-abdominal abscesses are more frequent in males (64.7%) and are usually located in the subhepatic zone (31%-34%), with an average clinical presentation time of 12-14 months (10 days to 72 months).6,15,37 Late complications are less frequent, though the development of an intra-abdominal abscess has been reported 20 years after leaving a gallstone in the peritoneal cavity during an open cholecystectomy.33 Recurrent and complicated intra-abdominal abscesses have been described with extension to the retroperitoneum, including gluteal abscesses.5,38 Subphrenic abscesses may also cause pleural effusions and ipsilateral thoracic abscesses, and there are also exceptional cases of thoracoabdominal actinomycosis,40 hemoptysis, and expectoration of bile due to the passage of gallstones to the respiratory tract via the diaphragm.6,12,41

The diagnosis of intra-abdominal abscesses due to gallstones requires a high level of clinical suspicion in patients with a history of previous laparoscopic cholecystectomy. Computed tomography (CT) and ultrasound are the most useful diagnostic tests. On CT, a hypodense mass with or without central calcification and a peripheral ring of contrast medium may be seen.44 In cases where the gallstones are not radiopaque, the diagnosis may be confused with simple abscesses, actinomycosis,3 appendicitis,43 endometriosis,44 and neoplastic processes.3,13,36,42 Ultrasound is more specific in the diagnosis of intra-abdominal gallstones, revealing a hyperechoic lesion with an acoustic shadow, regardless of whether there is calcification or not.3,42

In some cases, intra-abdominal abscesses have been treated with antibiotic therapy, and drainage of the abscess and percutaneous extraction of the gallstone have been sometimes attempted,45 although the rate of failure and recurrence is high.5,6,15,37 Nevertheless, the definitive treatment, especially when there are diagnostic doubts,
is surgery (86%-90.5%) via drainage of the abscess and extraction of gallstones to avoid future recurrence.\textsuperscript{6,15,37} There are cases in which resolution of the abscess has been achieved via a new laparoscopic approach, using thoracoscopy or even via retroperitoneoscopy.\textsuperscript{19,16,46} However, most patients require laparotomy and up to 32% undergo reintervention due to intra-abdominal abscess recurrence.\textsuperscript{15}

The second most frequent complication due to lost gallstones (14%) is infection of the abdominal wall.\textsuperscript{16} In addition to cutaneous fistulization of an intra-abdominal abscess, migration, and expulsion of gallstones via a communication between one of the trocar incisions and an underlying abscess or fistula has been reported.\textsuperscript{5,15} More common is the formation of subcutaneous abscesses and persistent wall sinuses at the level of the surgical wound secondary to gallstones or fragments of these left in the path of the trocar opening during extraction of the gallbladder.\textsuperscript{8,15,16,18} Though spontaneous expulsion of gallstones and subsequent resolution of infection has been described,\textsuperscript{42} most cases require drainage and surgical debridement. Umbilical infections are the most frequent.\textsuperscript{16,46} The number of studies that have analyzed the influence of dropped gallstones on surgical wound infection is very low and the conclusions are controversial. Some authors have obtained a significantly higher incidence (P<.05) of surgical wound infection in patients with gallbladder perforation during laparoscopic cholecystectomy (0.4%-1.3% vs 5%),\textsuperscript{8,42} while other studies have not found significant differences.\textsuperscript{11,13,14,19,18} In the review performed by Diez et al,\textsuperscript{18} in addition to the increased incidence of wound infections, it was found that all of the infected wounds in this laparoscopic cholecystectomy group without injury to the gallbladder were cured with medical treatment, while the 20% of wound infections in the group with gallbladder perforation required surgical treatment due to persistent suppuration secondary to gallstones in the abdominal wall. Ruiz et al\textsuperscript{15} have also obtained a higher incidence of surgical wound infection in the patient group with lost gallstones, although without achieving statistical significance. Rice et al\textsuperscript{14} also did not find a higher risk of infection in patients with gallstone spillage in the same trocar path, probably due to the use of wide-spectrum antibiotics in these cases.

Other digestive complications frequently described due to lost gallstones are fistulas,\textsuperscript{15} non-infectious intra-abdominal collections,\textsuperscript{14} adhesions,\textsuperscript{46} intestinal perforation,\textsuperscript{50} and intestinal obstruction.\textsuperscript{51} Intrahepatic abscesses,\textsuperscript{52} spontaneous liver bleeding,\textsuperscript{53} and an episode of obstructive jaundice due to a subhepatic abscess around lost gallstones\textsuperscript{44} have also been reported.

Gynecological and urological complications are the most infrequent. Gallstones located at the bottom of the Pouch of Douglas may also lead to a local inflammatory reaction and fibrosis, causing pelvic pain, dyspareunia, infertility, and dysmenorrhea.\textsuperscript{5,36,43} Cases of bladder fistulization and expulsion of gallstones via the urethra have also been described.\textsuperscript{56}

Systemic complications are infrequent. Septicemia secondary to gallstones left in the peritoneal cavity is rare; there is 1 case of death due to septic shock described in the literature.\textsuperscript{54}

### Complications Due to Intra-abdominal Clips

There are no studies which allow estimating the incidence of dropped clips in the peritoneal cavity during laparoscopic cholecystectomy. Nonetheless, it is not an infrequent event, which occurs generally during handling of the endostapler and during extraction of the gallbladder without a collection bag. The clips applied to the cystic duct may also slip due to incorrect application, a short or wide cystic duct, or even during dissection, retraction, or aspiration.\textsuperscript{54} When it is known during surgery that there are loose clips in the peritoneum, these are usually recovered laparoscopically without great difficulty, but there are occasions when, inadvertently, clips may remain in the peritoneal cavity. Later migration of the clips may also occur as a reaction to local infection and/or ischemia of the cystic duct.\textsuperscript{50} This slippage usually occurs within the first month following surgery\textsuperscript{48} and may lead to a biliary fistula and later lodging of the clip in the peritoneum, which generally is found in sloped areas such as the pelvis, Morrison's pouch, and the right iliac fossa.\textsuperscript{52} Additionally, there are various articles that describe the secondary formation of choledochal calculi around metallic clips which have migrated through the wall of the biliary tract.\textsuperscript{58}

Surgical clips have traditionally been considered inert and their loss in the peritoneal cavity is not accompanied by clinical consequences. However, complications related to intra-abdominal clips have already been described. In a review of the literature, we have found 4 patients with prolonged abdominal pain related to clips in the peritoneum,\textsuperscript{9,36} 1 patient with chronic pelvic pain due to a clip lodged in the right ovary,\textsuperscript{53} and another 4 patients with intra-abdominal abscesses (2 with associated empyema) due to clips.\textsuperscript{9,10,58} We have not found differences in the average time of development of an abscess between patients with lost gallstones or clips (14.1 vs 14.7 months, respectively). Episodes of upper digestive bleeding due to a duodenal ulcer caused by a migrated clip following laparoscopic cholecystectomy have also been described.\textsuperscript{59}

With the exception of the articles on the migration of clips to the common bile duct and the formation of calculi, all of the clinical cases describing lost clips have been published within the last 7 years. Though only dealing with a very low number of complications, currently there are no studies that have studied the possible long-term consequences of lost or slipped clips, so the natural history of clips in the peritoneum should still be considered uncertain and not as innocuous and banal as initially believed.\textsuperscript{56}

### Recommendations

Gallbladder perforation and the subsequent spilling of gallstones and bile is a source of infrequent, but potentially serious complications which is why it is important to prevent them. To this end, it is fundamental to perform a correct procedure using dissection without excessive traction, careful use of the electronic scalpel around the gallbladder wall, and finally a careful extraction of the gallbladder, placing it in a collection bag or widening the extraction
incision, especially if there is a large gallstone. In the event that perforation of the gallbladder occurs, it is recommended that immediate repair of the defect by stapling the orifice be performed or even using sutures if the tear is wide and there are multiple small gallstones. It is necessary to try to remove slipped clips and all spilled gallstones or, otherwise, the most gallstones possible using pliers or with the help of the bag used to extract the gallbladder if the number of spilled gallstones is high. Afterwards, a thorough peritoneal lavage should be performed with a large quantity of saline solution with will permit the most complete extraction of the residual floating material via aspiration. Placement of a suction drain is a controversial subject, given that there are no studies that demonstrate its usefulness in preventing complications in laparoscopic cholecystectomies with gallstone spillage. If you are unsure of having removed all of the gallstones, it should be documented on the operative report to help guide diagnosis of a possible future complication. Except in very exceptional cases, conversion to laparotomy is not necessary.

Great attention has been drawn in the literature to the administration of antibiotics in laparoscopic cholecystectomy, and its use is especially controversial when there is gallbladder perforation. Some authors do not recommend the use of prophylactic antibiotics after gallstone spillage except for high-risk patients because they do not see a correlation with an increased risk of septic complications. On the other hand, other authors consider it justified to administer early postoperative antibiotics due to the high number of cases described of abscesses due to intraabdominal gallstones, since many patients with gallbladder perforation have positive peritoneal cultures, and because there currently are not randomized studies contraindicating the use of antibiotics in patients with gallstones left in the peritoneum. A third group of authors recommend antibiotic therapy solely when there is a significant spillage of gallstones and their complete extraction is uncertain, or within the context of acute cholecystitis with clearly infected bile. In these cases, before administering the first antibiotic dose, it would be advisable to obtain a sample of the bile and gallstones for microbiological study.

It is important to perform close follow-up of patients with gallstones left in the peritoneal cavity, mainly pigment gallstones, due to the increased risk of complications, and to consider the possibility of a perforation when confronted with the first suspicious symptoms, in order to reduce more serious complications caused by a delay in diagnosis and treatment of possible complications.

Conclusions

– The incidence of complications due to intra-abdominal gallstones is very low, though they may occasionally be serious
– A careful surgical procedure is fundamental in preventing gallbladder perforation and spillage of gallstones and clips into the peritoneum
– It is important to remove all dropped clips and gallstones or, otherwise, the most possible

Perforation of the gallbladder with gallstone spillage does not justify conversion to laparotomy except for special cases
– It is advisable to write down if there are spilled or lost gallstones, or clips during laparoscopic cholecystectomy in the operative report in order to guide diagnosis of a possible future complication

References


