

# Management of Spilled Stones during Laparoscopic Cholecystectomy

Toma Florin

Department of General Surgery, Bucharest Street, Budila Nr. 8, Romania

## Abstract

Laparoscopic cholecystectomy has become the preferred method to treatment for patients with cholelithiasis. Perforation of the gallbladder during laparoscopic cholecystectomy with spillage of stones into abdominal cavity is not uncommon. Although, overall complication rate is less than in open technique, injury of biliary tree and perforation of gallbladder with spillage of stones are more frequent in laparoscopic cholecystectomy.

The fate of spilled bile with gallstone is on a continuous debate. Recent reports have implicated dropped gallstones as a source of infrequent but severe complications of laparoscopic cholecystectomy. For this reason we have done this review regarding different possible outcomes, few suggestions to prevent these and their management.

**Keywords:** Spilled gallstones, lost gallstones, laparoscopic cholecystectomy, spilt gallstone, gallstone retrieval.

## INTRODUCTION

Nowadays, laparoscopic cholecystectomy is considered to be the golden standard for the treatment of symptomatic gallstone disease. Compared to open surgery, all studies show a lower rate of complications. Compared to open cholecystectomy, in LC, there are, however, two more frequent problems: (1) Injury to the common bile duct and (2) Complications from spilled gallstones. The rate of common bile duct injuries in LC has declined over the last 15 years, due to the fact that laparoscopic surgeons have gained more experience; but, unfortunately, the incidence of spilled gallstones has remained unchanged.

During the open cholecystectomy, spillage from the gallbladder cannot migrate from the right upper quadrant, as it is packed off routinely and Morrison's pouch occluded with a laparotomy pad. In LC, stones can become disseminated in abdominal cavity.

The common bile duct injury and bile leakage can be diagnosed soon after operation, but intraperitoneal gallstone spillage can manifest only months to years after the operation, and may have a confusing preservation, that leads to further examinations.

During laparoscopy, bile spillage is still relatively benign; however, the loss of gallstones causes considerable morbidity.

Even though lost gallstones were initially considered to be inoffensive, in the past years, with the shift from open cholecystectomy to LC, numerous reviews have reported a wide variety of complications.

This review aims to categorize these complications through a systematic literature search in order to show the variety of complications and to evaluate the frequency and management of spilled gallstones in LC.

## MATERIALS AND METHODS

The search was performed using the following search engines: Google, Springer link and Medline. The search strategy was performed with the below mentioned key words and combinations: "spilled gallstones", "lost gallstones", "laparoscopic cholecystectomy", "spilt gallstone" and "gallstone retrieval".

Out of 412 listed references, titles, abstracts, and full text articles were monitored to accumulate a selection of relevant studies. Afterwards, all reviews and case reports concerning lost gallstones in LC were screened for the reported complications.

The main search criterion was the "management of spilled gallstones", thus all studies that reported the incidence of lost peritoneal gallstones and/or perforated gallbladder were analyzed in this review for the intraoperative and postoperative actions.

## OPERATIVE TECHNIQUE

The laparoscopic procedure has been performed by either an attending surgeon or resident under direct staff supervision. The study included both elective and emergency cases. A four-trocar technique with a 30° angled laparoscopic video camera was used. Dissection of the gallbladder was performed using a combination of electrocautery and blunt dissection with fine graspers, and the cystic artery and cystic duct were ligated with titanium clips. The gallbladder was removed through either the umbilical or epigastric port. When perforation of the gallbladder occurred, attempts were made to retrieve all spilled stones, and the peritoneal cavity was irrigated with saline solution to evacuate the spilled bile. Patients typically received one preoperative and one postoperative dose of antibiotic, most commonly a cephalosporin. In patients with acute cholecystitis, especially when the bile culture was positive, broad-spectrum antibiotics were administered for a longer period depending on the clinical situation.

## RESULTS

The purpose of the study was to perform a systemic literature search in order to identify the different possible outcomes of the infrequent but severe laparoscopic cholecystectomy complications, the different possible outcomes, few suggestions to prevent these and their management. The most frequent complications that were found published are: intra-abdominal abscesses and abscesses of the abdominal wall, followed by subhepatic and subphrenic abscesses. (Fig. 1).



Fig. 1: CT scan which shows intra-abdominal mass representing the gallstones and the surrounding reaction

Other common encountered complication were fistula formation, which occurs across a broad spectrum, ranging from fistulas of the skin or umbilicus to colocutaneous or colovesical fistulas. Due to the fact that complications of lost gallstones in LC are infrequent, occurring in approximately 1,7 per 1000 LCs,<sup>1</sup> diagnosis becomes very difficult, if the complication occurs late. The incidence of lost gallstones in LC may be summarized at approximately 2%, out of 8 studies with more than 500 LCs. From this estimation, we can calculate that 8.5% of these lost gallstones will lead to a complication.

During this systemic search of the literature, several factors that lead to the development of severe septic complications were found. As shown in several studies,<sup>2-7</sup> whether the bile is infected or not, bile and gallstones are at an increased risk for abscess formation and formation of adhesions. The type of stones is one of the factors involved in complication occurrence; more experimental studies and reported cases show that the bacterial contamination is less in cholesterol calculi than in pigment stones (black, brown or mixed). The size and number of spilled gallstones is another involved factor. In Brockmann et al<sup>8</sup> systemic review, a total of 91 patients had 555 stones in locations ranging from the abdominal wall to all possible intra-abdominal sites. At the time of reoperation, 40% of these patients were found to have 15 or more stones. Based on these systemic observations, they concluded that the risk factors for complications because of lost gallstones are, as summarized by Woodfield et al,<sup>1</sup> stone size (>1.5 cm), spillage of pigment stones, acute cholecystitis with infected bile, multiple stones (>15 stones), and age. From the published case reports and studies as well as the experimental studies, we can conclude that spilled stones are no indication for laparotomy if the following therapeutic guidelines are followed.

## DISCUSSION

A great number of animal experiments have been conducted in order to study the fate of the retained intraperitoneal gallstones.

Using the rat model, Zisman et al<sup>4</sup>, performed a study during a follow-up period of one year and he found no systemic deleterious outcome except for minor local effects due to the presence of the implanted gallstones.

They have concluded that there is no systemic illness associated with the presence of gallstones in the peritoneal cavity and the local effects consisted mainly of fibrosis, adhesions, and mild local inflammatory reaction in 83% of

the rats. Seventeen percent of them have not reacted to the presence of the stone at all. These results are in concordance with and also complement Welch et al observation, which showed very little, mild inflammatory reaction, no evidence of infection, and satisfactory clinical outcome in both rabbits retaining gallstones for up to 3 months, and in humans with intraperitoneal gallstones.<sup>9</sup>

Based on the rat model the authors have concluded that a conversion of the laparoscopic procedure to an open laparotomy has no justification only for the purpose of retrieving a lost stone, however, reasonable effort should be made in order to retrieve an escaped gallstone.

Other authors, like Bonar et al<sup>10</sup> reported increased adhesions and inflammatory response due to retained intra-abdominal gallstones, especially when these are associated with infected bile. Chin et al<sup>11</sup> also found numerous adhesions in the rat and inflammatory reactions in dogs with no spontaneous resolution tendency, due to lost gallstones. Johnston et al<sup>2</sup> studied the effects of retained human bile and gallstones in rats. They found that the combination of gallstones and bile (infected or sterile) in the intraperitoneal cavity was associated with significant adhesion formation.

A few studies have specifically examined the potential early and long-term consequences of bile spillage and unretrieved gallstones in the abdomen, however, in humans, the natural history of retained gallstones is not documented. Some reports, like Brueggemeyer et al,<sup>12</sup> demonstrated that spillage of gallstones can cause intraperitoneal abscess. Zamir et al<sup>13</sup> reported similar findings. Antibiotic prophylaxis may decrease the rate of early complications, especially infections, although the late sequelae of retained stones are unaffected. The time between laparoscopy and clinical manifestation has been reported to be as long as 9 years.<sup>15</sup> A recent case report by Walch et al<sup>14</sup> has showed that the spillage of stones during LC occurs in 10% of operations. Late complications associated with this type of surgical procedure include abscesses and fistulas in the abdominal cavity and on the abdominal wall.

Implanting human gallstones in the peritoneal cavity of rats, Hornof et al<sup>3</sup> sustain that only cholesterol stones in association with gram-negative bowel germs cause abscess formations. Other studies sustain that intraperitoneally retained cholesterol gallstones remained inert and are well tolerated in the abdominal cavity except when they are caused by acutely inflamed gallbladder or were crushed (Yerdel et al<sup>5</sup>). Agalar et al<sup>6</sup>, using a mouse model, showed that free gallstones within the peritoneal cavity with or

without *Escherichia coli*, sterile bile, or both increased the rate of formation of both abscesses and adhesions. In the same way, Aytekin et al<sup>7</sup> sustains that spilled gallstones and bile cause postoperative adhesions, no matter if the bile is infected or not.

Soper and Dunnegan<sup>16</sup> and Schafer et al<sup>17</sup> have analyzed 10,174 laparoscopic cholecystectomies performed at 82 surgical institutions over a 3-year period. They have discovered that the mortality rate and the incidence of serious complications of retained gallstones are extremely low, thus have advised surgeons against converting laparoscopic cholecystectomy to an open procedure.

The same opinion is shared by Rice and Associates, at the Mayo Clinic, who have studied the long-term consequences of intraoperative bile and gallstones spillage during laparoscopic cholecystectomy. They advised conversion to an open procedure only in patients for whom it is not possible to retrieve the majority of the gallstones laparoscopically, especially when bacteriobilia is suspected or confirmed by Gram stain of the bile. Also they emphasized the need for removal of as many calculi as possible during the laparoscopic procedure. Moreover, they showed that if the inciting gallstones were not removed, the percutaneous drainage of intra-abdominal abscesses was ineffective in most of their patients.<sup>18</sup>

Hussain<sup>19</sup> reported that of seven patients who harbored dropped surgical clips or spilled gallstones, five had no complications; in the other two patients, subphrenic abscesses, empyemas, and a lung abscess can develop. He suggests that stones may remain silent a long-time in the peritoneal cavity but dropped gallstones and clips represent a risk factor for abdominal sepsis. Consequently, during the laparoscopy, every procedure must be made to avoid leaving any surgical clips or dropped gallstones in the peritoneal cavity. Laufer et al recommends that if the gallbladder is accidentally perforated, all efforts must be taken in order to prevent the spread of the bile and calculi and remove the spilled gallstones whenever possible.<sup>20</sup>

Despite the unaffected long-term sequel, any patient with gallbladder perforations and spillage of bile and gallstones should be considered for extension of antibiotic prophylaxis to avoid early complications. Patient records should be properly kept and checked when necessary.

### Management of Gallbladder Perforation

The incidence of the gallbladder perforation complications was analyzed and the management discussed in the recent published reviews.<sup>1,8</sup> During laparoscopy, the incidence of

gallbladder perforation is 13 to 40%,<sup>21</sup> with a mean of 18.3% out of those 8 studies with more than 500 LCs. The incidence is higher in acute cholecystitis, the most accurate predictor of rupture being the hydropic gallbladder.<sup>23</sup> On the other side, the reason for gallbladder perforation is mostly correlated with the surgeon's skill and experience.<sup>22</sup> To minimize this complication, proper dissection is required. If a perforation occurs, the use of suction devices to minimize the spilled bile and spilled gallstones as well as the use of an endo-bag is mandatory. If possible, the hole in the gallbladder should be closed by the grasp forceps or by an endoclip or endoloop. The abdominal cavity should be intensively irrigated immediately to reduce the spillage of bile and gallstones.

### Management of Spilled Gallstones

Careful removal of as many stones as possible should be performed immediately if gallstones are spilled in the abdominal cavity, either through gallbladder perforation during dissection or extirpation of the gallbladder.<sup>24</sup> After collecting the visible stones, in order to minimize the number of lost gallstones, intense irrigation and suction should be performed carefully, without spreading the gallstones into difficult accessible sites. The use of an intra-abdominal bag and a laparoscopic grasper, a 10 mm suction device, may facilitate the gallstones retrieval.<sup>25</sup>

Most authors do not advise conversion to open surgery. They recommend that in cases of patients with a high probability for lost gallstones or acute cholecystitis with visibly infected bile therapeutic antibiotics should be used in cases of spilled gallstones.

Other studies<sup>1,8</sup> emphasize the importance of documentation and patient information. They advise that in the medical report the surgeon should alert the clinician in the future to the possibility of stones causing any subsequent problems that might lead to earlier diagnosis. Moreover, the medicolegal risk for further prolonged diagnosis may be reduced by informing the patient, in case of late complications occurrence. However, this might also provoke unnecessary repeated examinations.

### CONCLUSION

In our opinion, each and every surgical procedure has a potential of unwanted or unexpected outcome. The main purpose for all surgeons is to minimize the physical and psychological discomfort for the patient, and sometimes this implies managing their own complications with minimal harm to the patient. Thus, a complication can be accepted

as an unwanted consequence of a surgical procedure. In many institutions, the consequences of spilled stones are virtually never mentioned as a part of the preoperative consent process. In case patients are not informed preoperatively about the possibility of bile and gallstone spillage, they will be surprised and confused if related complications appear.

Even though spilled gallstones have a low Incidence of causing complications, they have a large variety of different postoperative problems. In order to remove the lost gallstones for prevention of further complications, every effort should be made, but conversion is not mandatory. When abscesses due to spilled gallstones occur, open or laparoscopic removal should be preferred to interventional drainage.

### REFERENCES

1. Woodfield JC, Rodgers M, Windsor JA. Peritoneal gallstones following laparoscopic cholecystectomy: Incidence, complications, and management. *Surg Endosc* 2004;18:1200-07.
2. Johnston S, O'Malley K, McEntee G, et al. The need to retrieve the dropped stone during laparoscopic cholecystectomy. *Am J Surg* 1994;167:608 -10.
3. Hornof R, Pernegger C, Wenzl S, et al. Intraoperative cholelithiasis after laparoscopic cholecystectomy—behavior of 'lost' concretions and their role in abscess formation. *Eur Surg Res* 1996;28:179-89.
4. Zisman A, Loshkov G, Negri M, et al. The fate of long-standing intraperitoneal gallstone in the rat. *Surg Endosc* 1995;9:509 -11.
5. Yerdel MA, Alacayir I, Malkoc U, et al. The fate of intraperitoneally retained gallstones with different morphologic and microbiologic characteristics: An experimental study. *J Laparoendosc. Adv Surg Tech A* 1997;7:87-94.
6. Agalar F, Sayek I, Agalar C, et al. Factors that may increase morbidity in a model of intra-abdominal contamination caused by gallstones lost in the peritoneal cavity. *Eur J Surg* 1997;163:909-14.
7. Aytakin FO, Tekin K, Kabay B, et al. Role of a hyaluronic-acid derivative in preventing surgical adhesions and abscesses related to dropped bile and gallstones in an experimental model. *Am J Surg* 2004;188:288-93.
8. Brockmann JG, Kocher T, Senninger NJ, Schurmann GM. Complications due to gallstones lost during laparoscopic cholecystectomy. *Surg Endosc* 2002;16:1226-32.
9. Welch NT, Hinder RA, Fitzgibbons RJ, Rouse JW. Gallstones in the peritoneal cavity. *Surg Laparosc Endosc* 1991;1(4): 246-47.
10. Bonar JP, Bowyer MW, Welling DR, Hirsch K. The fate of retained gallstones following laparoscopic cholecystectomy in a prairie dog model. *J Soc Laparoendosc Surg* 1998;2:263-68.
11. Chin PT, Boland S, Percy JP. Gallstone hip and other sequelae of retained stones. *HPB Surg* 1997;10:165-68.
12. Zamir G, Lyass S, Pertsemidid D, Katz B. The fate of the dropped gallstones during laparoscopic cholecystectomy. *Surg Endosc* 1999;13:68-70.

13. Brueggemeyer MT, Saba AK, Thibodeaux LC. Abscess formation following spilled gallstones during laparoscopic cholecystectomy. *J Soc Laparoendosc Surg* 1997;1:145-52.
14. Walch C, Bodner G, Hufner K. On the fate of lost gallstones. *Ultraschall Med* 2000;21:189-91.
15. Battaglia DM, Fornasier VL, Mamazza J. Gallstone in abdominal wall: A complication of laparoscopic cholecystectomy. *Surg Laparosc Endosc Percutan Tech* 2001;11:50-52.
16. Soper NJ, Dunnegan DL. Does intraoperative gallbladder perforation influence the early outcome of laparoscopic cholecystectomy? *Surg Laparosc Endosc* 1991;1:156-61.
17. Schafer M, Suter C, Klaiber CH, et al. Spilled gallstones after laparoscopic cholecystectomy: A relevant problem? A retrospective analysis of 10,174 laparoscopic cholecystectomies. *Surg Endosc* 1998;9:344-47.
18. Rice DC, Memon MA, Jamison RL, et al. Long-term consequences of intraoperative spillage of bile and gallstones during laparoscopic cholecystectomy. *J Gastrointest Surg* 1997;1:85-91.
19. Hussain S. Sepsis from dropped clips at laparoscopic cholecystectomy. *Eur J Rad* 2001;40:244-47.
20. Laufer JM, Krahenbu" HL L, Baer HU, et al. Clinical manifestations of lost gallstones after laparoscopic cholecystectomy: A case report with review of the literature. *Surg Laparosc* 1997;7:103-12.
21. Gerlinzani S, Tos M, Gornati R, et al. Is the loss of gallstones during laparoscopic cholecystectomy an underestimated complication? *Surg Endosc* 2000;14:373-74.
22. Barrat C, Champault A, Matthyssens L, Champault G. Iatrogenic perforation of the gallbladder during laparoscopic cholecystectomy does not influence the prognosis. Prospective study. *Ann Chir* 2004;129:25-29.
23. De Simone P, Donadio R, Urbano D. The risk of gallbladder perforation at laparoscopic cholecystectomy. *Surg Endosc* 1999;13:1099-102.
24. Hashimoto M, Matsuda M, Watanabe G. Reduction of the risk of unretrieved stones during laparoscopic cholecystectomy. *Hepatogastroenterology* 2003;50:326-28.
25. Klaiber C, Metzger A, Saager C. The "shuttle" stone collector: A new device for collecting lost gallstones in laparoscopic cholecystectomy. *Surg Endosc* 1992;6:84.