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Incidence, Risk Factors and Consequences of Gallbladder Perforation and its Contents Spillage During Laparoscopic Cholecystectomy in Git Hospital

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ABSTRACT

Background: Laparoscopic cholecystectomy has become the standard treatment for cholecystitis and symptomatic gall stones. Accidental gallbladder perforation with spillage of its contents is common complications during laparoscopic cholecystectomy. **Objective:** The purpose of this study was to assess the incidence, risk factors and consequences of gallbladder perforation and its contents spillage during laparoscopic cholecystectomy in order to control the perforation rate, prevent and properly manage its complications. **Patients and methods:** A prospective comparative study on 331 patients who underwent laparoscopic cholecystectomy in the period between 1st of January and the 31 of December 2017 in Gastrointestinal and Hepatology Teaching Hospital. Data were collected, incidence of perforation was estimated and patients with and without gallbladder perforation were compared in terms of age, gender, clinical presentation at time of diagnosis, previous surgical history, body mass index, type of inflammation of gallbladder (acute or chronic cholecystitis), gallbladder wall thickness, effects of adhesions and gallbladder distension and experience of the surgeons. We also assessed the most common site and mechanism of perforation. Early postoperative complications like pain, ileus, nausea, vomiting, wound infection and abscess formations were evaluated. The length of operation time and hospital stay was also evaluated, and is compared between perforation and non-perforation groups. **Results:** 119 patients (36%) had perforation of gallbladder during laparoscopic cholecystectomy. Perforation occur more frequently with a significant P value ($P<0.05$) in male patients, first clinical presentation as an acute cholecystitis, obese persons, inflamed gallbladder (acute cholecystitis), distended, thin wall gallbladder, surrounded by adhesions and in laparoscopic cholecystectomy performed by surgeons with low experience. The common site of perforation was gallbladder body (64.7 %) and most common mechanism of perforation was during gallbladder dissection from its bed (61.3%). Concerning the postoperative fever, ileus, trocar site infection and pain there was no significant difference between the perforation and non-perforation groups and this is the same for the hospital stay (p value >0.05). There was a higher incidence of post-operative nausea and vomiting, intra-abdominal abscess formation and a longer operative time in the perforation group (p value <0.05). **Conclusion:** The incidence of gallbladder perforation in our target population was within the same range of that reported worldwide (36%). Male gender, first clinical presentation as an acute cholecystitis, obesity, inflamed, distended, thin walled gallbladder surrounded by adhesions and low experience of surgeons was to be significant risk factors associated with gallbladder perforation. Since the complications of gallbladder perforation and its contents spillage are rare following gallbladder perforation, so conversion to laparotomy is not routinely indicated.

Key words: Laparoscopic cholecystectomy, risk factors and gallbladder perforation.

Introduction:

Gallstones disease contributes substantially to health care costs, and its complications are sometimes life threatening. In the US, more than 700 000 cholecystectomies are performed each year. [1] Laparoscopic cholecystectomy (LC) has widely replaced open cholecystectomy (OC) as the standard treatment for symptomatic cholelithiasis and it is one of themost widelyperformed laparoscopic procedures worldwide nowadays. [2, 3] However, the spectrum of complications associated with LC differs from that of open surgery;these pertain to the Port sites, pneumoperitoneum, limited surgical access, and reduced tactile perception. One of these complications is the increased incidence of perforation of the gallbladder (GB) wall during the procedure, resulting in spillage of bile and gallstones. [4]Iatrogenic gallbladder perforation during LC is common and occurs in as many as 10 - 40% of cases, often leading to spillage of bile and gallstones into the peritoneal cavity. It has been reported that spilled stones can lead to intra-abdominal abscesses,wound infections,

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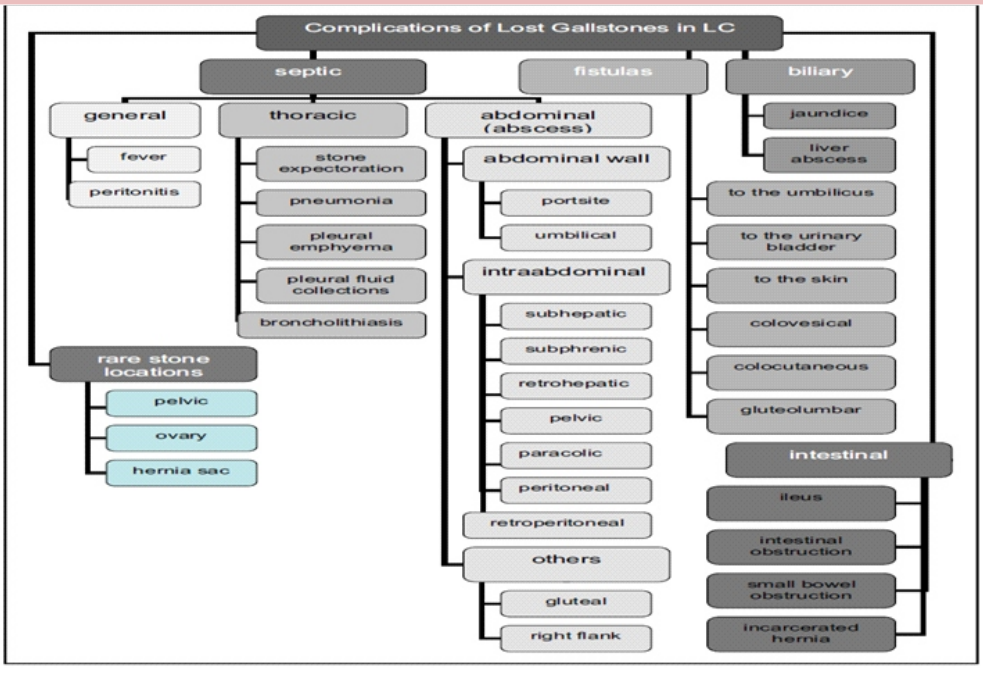
small bowel obstruction, and even colo-cutaneous fistula.[5]

Iatrogenic perforation is an event which occurs mainly in those where dissection is difficult, or during extraction when the gallbladder is withdrawn directly through the laparoscope port. It has been commonly assumed that contamination with bile in the abdominal cavity could be a cause of infection and can lead to the formation of a residual abscess or even to surgical wound infection. [6] The primary factor related to the risk of gallbladder perforation is the surgeon's experience. 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.[7]There are other conditions that have been related to an increased risk of gallbladder perforation during LC such as a male patient, advanced age, obesity, acute cholecystitis with gallbladder distention and adhesions of the omentum, and a long preoperative inflammatory process. An appropriate surgical procedure is fundamental in reducing the risk of perforations and gallstone spillage.[8]

Two main factors are predictive for the mishap of a gallstone spillage: the surgeon's experience in laparoscopic cholecystectomy and the degree of inflammation.

In a retrospective analysis from Switzerland, only 1.4% of patients with spillage of gallstones during LC developed serious postoperative complications. Horton and Florence reported that 5% of their patients showed symptoms. Stones might be lost in the abdominal cavity, due to gallbladder perforation during the dissection, or in the abdominal wall during extraction of the gallbladder. Secondary complications due to spilled gallstones are various. The most frequent one is intra-abdominal abscess formation followed by abdominal wall infection or a permanent sinus formation.Some other serious complications reported in the literature are small bowel obstruction, incarceration in a hernia sac and trans-diaphragmal migration that results in pleural empyema or expectoration of bile and pus. Stevens et al. reported one case of spillage that caused dysmenorrhea, resulting in a hysterectomy.[9] While Bobby Dasari et al reported a case with family history of ovarian cancer presented with recurrent lower abdominal pain associated with abdominal distension 2 years after LC and her CT scan revealed multiple, round hyperdense soft tissue nodules within the abdominal cavity suggestive of mesenteric lymphadenopathy and peritoneal metastases, diagnostic laparoscopy was performed and It revealed multiple spilled gallstones.Figure (1) shows a diagram of the possible complications of lost gallstones.[10]

Figure (1):Diagram of possible complications of lost gall stones (10)



Aim of the study:

The objective of this study is to evaluate the incidence, risk factors, early outcome and complications that associate iatrogenic gallbladder perforation in patients undergoing laparoscopic cholecystectomy, so that to reduce the perforation rate, prevent and properly manage its complications.

Patients and Methods:

This is a prospective study, a total of 347 patients were admitted to the Gastroenterology and Hepatology Teaching Hospital, in the period between the 1st of January 2017 and the 31 of December 2017, all were operated as laparoscopic cholecystectomy. Patients with symptomatic gallstones who underwent LC were included in this study, patients with conversion from laparoscopic to open cholecystectomy for any cause where excluded from this study, so 16 patients were excluded from this study because of conversion and the included patients number in this study was 331, only 119 patients documented to have iatrogenic laparoscopic gallbladder perforation, with a total number of 267 females and 64 males. Age of the patients was ranging between 17 71 years.

Data were collected using history, physical examination and investigations like blood investigations and ultrasound examination and all data were recorded.

Patients were divided into two groups: those with gallbladder perforation during laparoscopic cholecystectomy and those without perforation.

Four ports procedure were used in LC, most gallbladders were removed from epigastric port. In cases of perforation, spilled stones were removed, bile was aspirated and irrigation with normal saline was done, however complete removal of spilled stones was not successful in some patients and in some cases of perforation tube drain was inserted.All cases received 3rd generation cephalosporin immediately preoperatively as prophylaxis, in cases were infective complications occurred the type and duration of antibiotics therapy was changed according to the individual cases.

Patient's data including age, gender, weight, clinical presentation of the patient (biliary colic, acute cholecystitis, obstructive jaundice and biliary pancreatitis) and operation variables such as operation time, cause of perforation, site of perforation (fundus, body or infundibulum), mechanism of injury (grasping, dissection from bed, release of adhesions, extraction and lost clips), gallbladder condition such as wall thickness using the ultrasound were the cut point was 3mm (if the wall thickness was < 3mm it was considered as thin wall and if more than this it was considered as thick wall) ,omental and other organs adhesions to the gallbladder , acutely or chronically inflamed and

The state of distension of gallbladder (by measuring the length and anterior-posterior diameter of gallbladder using ultrasound and if the length was more than 10 cm and the anterior-posterior diameter more than 5 cm so it was regarded as distended gallbladder). (11)When studying the obesity as a risk factor for perforation the patients were divided into three groups according to the body mass index (normal group with BMI between 18-24, overweight group with BMI between 25-29 and obese group with BMI more than 30). All data were recorded and studied separately. The follow up of our patients was made regularly in our hospital post-operatively. The desired informations were recorded in a questionnaire specially designed for this study. The surgeons` experience was also evaluated; the learning curve was arranged by dividing the patients into two groups:

Group one: those operated upon during the first six months of our study.

Group two: those operated upon during the second six months of our study.

All LC were done in this study by same surgical team (resident doctors) in our hospital and supervised by the seniors. Early postoperative complications like pain, ileus, nausea and vomiting, wound infection and abscess formation were evaluated. The patients were asked to quantify the pain subjectively 6 and 24 hours postoperatively on visual analog scale (VAS) of 0 to 10, with 0 being no pain and 10 severe pain. The left-most face shows no pain. The faces show more and more pain from left to right up and right most face show extreme pain. The operative time and hospital stay were also evaluated, and are compared between perforation and non-perforation groups. The statistical analysis for assessing clinical significance was done by using P-value and was analyzed by Chi-square and Mann Whitney tests. The statistical results are converted to tables to simplify their study.

Results:

Out of 331 patients included in our study, 267 were females (80.7%) and 64 were males (19.3%). Age ranging from 17 to 71 years with mean age of 35.9 years (P value >0.05).Intact gallbladder removal without bile leakage was carried out in 212 patients (64%). Gallbladder perforation occurred in 119 patients (36%). Table (1) shows the gender distribution, Presentation of patients at time of diagnosis, the relationship of BMI in perforation and non- perforation groups and the type of inflammation (acute or chronic) in relation to gallbladder perforation.

Table (1): demonstrates the gender distribution, Presentation at diagnosis, the relationship of BMI inboth groups and the type of inflammation in relation to gallbladder perforation.

Risk factors	Perforation	Non Perforation	Total	P value
Gender				
Male	36	28	64(19.3%)	<0.05(S)*
female	83	184	267(80.7%)	>0.05 (NS)**
Presentation at diagnosis time				
Biliary colic	90	178	268 (81%)	>0.05 (NS)*
Acute cholecystitis	25	9	34 (10%)	<0.05 (S)**
Obstructive jaundice	3	19	22 (7%)	>0.05 (NS)*
Gallstone pancreatitis	1	6	7 (2%)	>0.05 (NS)*
BMI of patients				
Normal	29	97	126 (38%)	>0.05 (NS)*
Overweight	31	87	118(35.7%)	<0.05 (S)**
Obese	59	28	87 (26.3%)	<0.05 (S)**
Inflammation				
Acute	14	11	25(7.6%)	<0.05 (S)*
Chronic	105	201	306(92.4%)	>0.05(NS)**

*S means P value significant (< 0.05)
**NS means P value not significant (> 0.05)

Regarding the previous surgical history of patients in our study, 96 patients (29%) had previous surgical history 45 of them developed gallbladder perforation and51 didn't. while 235(71%) had no previous surgical history, 74 of them develop gallbladder perforation and 161 didn't, for both groups P value was not significant (p>0.05). In regard to the wall thickness, incidence of adhesions, gallbladder distension and experience of surgeons in relation to both groups all shown in table (2).

Table (2) demonstrate the relation of gallbladder wall thickness, incidence of adhesions, gallbladder distension and experience of surgeons in relation to the perforation and non-perforation groups

Risk factor	Perforation	Non Perforation	Total	P value
Wall thickness				
Thin	102	153	255(77%)	<0.05 (S)*
Thick	17	59	76(23%)	>0.05(NS)**
Adhesions				
Present	88	32	120(36.3%)	<0.01 (HS)*
Absent	31	180	211(63.7%)	>0.05(NS)**
Distension				
Present	73	31	104 (31.4%)	<0.01 (HS)*
Absent	46	181	227 (68.6%)	>0.05(NS)**
Experience of surgeons				
1st 6 months	73	82	155(46.8%)	<0.05 (S)*
2nd 6 months	46	130	176(53.2%)	>0.05(NS)**

*S means P value significant (< 0.05)
**NS means P value not significant (> 0.05)

In concern to the site of perforation, 15 cases occur with fundus injury (12.6%), 77 cases with body injury (64.7 %) and 27 cases with infundibulum injury (22.7 %), P value was significant (p<0.05) only for body injury site. Regarding the mechanism of injury, 14 patients out of 119perforations (11.8%) occur during grasping (retraction) of gallbladder , while in 73 patients (61.3%) perforation occur during dissection from gallbladder bed, in 18 patients (15.1%) perforation occur during release of adhesions, in 10 patients (8.4%) perforation occur during gallbladder extraction through port site and the remaining 4 patients (3.4%) had perforation by lost clips during extraction. P value was significant (< 0.05) only for perforation caused by dissection from bed.With regard to the postoperative complications in our study, it is shown in table (3).

Table (3): Shows the Postoperative complications in relation to gallbladder perforation

stoperative Complications	Perforation group	Non perforation group	P value
in (VAS)	5 (3-8)	4 (3-7)	>0.05 (NS)*
ver	5 (4.2%)	11 (5.1%)	>0.05 (NS)*
stoperative ileus	15 (12.6%)	22 (10.3%)	>0.05 (NS)*
usea & Vomiting	62 (52.1%)	67 (31.6%)	<0.05 (S)**
rocar site infection	1 (0.8%)	3 (1.4%)	>0.05 (NS)*
tra-abdominal abscess	6 (5%)	1 (0.4%)	<0.05 (S)**
perative time (min)	80 min. (65-90 min.)	47 min. (35-60 min.)	<0.05 (S)**
spital stay time (hours)	30 hr. (24-48 hr.)	28 hr. (24-48 hr.)	>0.05 (NS)*

*NS means P value not significant (> 0.05)
**S means P value significant (< 0.05)

Discussion:

Laparoscopic cholecystectomy is the gold standard treatment for symptomatic gallstones. One of the common complications of the procedure is iatrogenic gallbladder perforation with spillage of bile and gallstones within the peritoneal cavity, an event that occurs more frequently than with open cholecystectomy.[12]

In our study, gallbladder perforation occurred in 119 patients (36%), and this goes with the incidence found by Sathesh-Kumar et al [9], Kamran Mohiuddin et al[13] and Andreas Shamiyeh, et al[14] " Incidence of gallbladder perforation during laparoscopy is 10% to 40%, with a mean of 18.3% out of those studies with more than 500 LCs. The reason for gallbladder perforation is often correlated with the surgeon's skill and experience; however, the incidence is higher in acute cholecystitis". [14]Regarding the age distribution, the P value was > 0.05, so in our study there is no significance difference regarding age distribution. This goes with Harju J. et al.[15], Woodfield et al[16] who found no difference in age distribution regarding gallbladder perforation.

Our study shows more perforation incidence in male patients; This can be explained by that the male patients usually presented late and so they have multiple risk factors like dense adhesions and may be complicated by acute episode of infection; This agrees with studies of Kamran Mohiuddin et al [13],Sarli L. et al.[17] and Rice DC.et al[18] and Woodfield et al[16] who found the increased incidence of complication in male patients (64.7%) and it is probably due to an increased inflammatory reaction associated with acute cholecystitis.

In regard to the clinical presentation at time of diagnosis of patients in our study, P value was significant only for the acute cholecystitis group while it wasnot significant for the other 3 presentation groups. This can be explained by the fact that patients with history of acute cholecystitis will suffer from dense adhesions and fibrosis because most of patients with acute cholecystitis will be treated conservatively and will be postponed till They get free of symptoms and this will make the dissection very difficult and anatomy unclear, This agrees with studies of Kamran Mohiuddin et al [13]

And R.J. Loffeld [19] which showed the same results.

In regard to the previous surgical history. Our study shows that previous abdominal surgeries had no effect on the rate of perforation of gallbladder, and that agree with other studies of Kamran Mohiuddin et al [13] ,Bas et al. [20] and De-Simone et al[21] that showed the same results.

In concern to the body mass index (BMI) of patients, our study shows that overweight and obesity are significant risk factor for gallbladder perforation during LC ($p<0.05$) and this can be explained by the fact that obese people may have thick intra-abdominal fat layers with adhesions causing difficult anatomical viewing making their gallbladder liable for perforation during LC. This in agreement with study of Oktay Irkorucu[22] et al and Kamran Mohiuddin et al[13] that showed the same results.

Regarding the inflammation of gallbladder whether acute or chronic cholecystitis during LC, our study shows that acutely inflamed gallbladder is a risk factor for perforation, this is because the friability of its wall makes it prone to rupture under the stress of traction with various instruments in addition to the gallbladder adhesions to nearby organs or omentum because of acute inflammatory process all these factors put the gallbladder at risk of perforation during LC, and that agree with other studies of Calik A. et al[23], Bruggemeyer MT et al[24] and Barrat C. et al[25]with same results.

In regard to the wall thickness of gallbladder, the p value was<0.05 in our study. This mean that thin wall gallbladder is a risk factor for perforation and this goes with the finding of Massarrat S.[26],and Woodfield et al[16] who said " The thickened gallbladder wall may protect against inadvertent perforation during the different aspects of the operative procedure ".

In our study the adhesions around the gallbladder by omentum or other organs is a significant risk factor for gallbladder perforation, this is because adhesions make the dissection very difficult and anatomy unclear, causing a high level of difficulty and liability for perforation. Such finding was similar to studies done by Bas et al [20],B. Aytaç, S. Çakar [27] and T. Sathesh-Kumar et al[9].

In concern to the gallbladder distension during LC, our study shows that a distended gallbladder is a risk factor for perforation. This explained by the law of laplace, which states the proportional relation of wall tension to the pressure (*Laplace's law: Wall tension= Radius x Pressure*); This goes with Sathesh-Kumar et al [9] and Barrat C. et al[25] ; who stated "attempting to grasp or remove distended or loaded gallbladder is associated with perforation rate about (53.7%)".

With regards to the experience of surgeons, our study found that LC done in the first 6 months had higher Rate of perforation as compared to LC done in the Second 6 months. So our study found that experience of surgeons is a risk factor of gallbladder perforation. This can be explained that surgeons with performing more LC, with time they will gain more experience and skills and will establish the correct plane in dissecting and removing the gallbladder. Such findings agreed with the works done by B.Aytaç, S. Çakar[27] and Tarragona E.M. et al[28]with same results.

In concern to the site of perforation, our study found that the body of gallbladder is the commonest site for perforation ($p<0.05$). This comes with agreement with Woodfield et al [16] and Shaffer EA. [29] who mentioned high prevalence of body injury (59.1%) among patients of gallstones treated by LC.

Regarding the mechanism of injury, our study found that dissecting the gallbladder from its bed is the most common mechanism of perforation with an incidence of 61.3% and ($p<0.05$). This comes with agreement with studies done by R.J. Loffeld [19], Woodfield et al [16] and Brockmann JG et al [30] with an incidence of perforation during gallbladder dissection from its bed of 75% in their studies.

With regard to the postoperative complications in our study, concerning the postoperative fever, ileus, trocar site infection and pain there was no significant difference between the perforation and non-perforation groups and this is the same for the hospital stay (p value >0.05), This agrees with Brockmann JG et al [30], Tschmelitsch J. et al. [31]; that found no significance influence of gallbladder perforation on these post-operative complications.

While regarding the post-operative nausea and vomiting and the operative time, there was significant difference between both groups ($p< 0.05$). So our study found a higher incidence of post-operative nausea and vomiting and a longer operative time, this can be explained by that more time elapsed for manipulation with perforated gallbladder, leaked bile aspiration and stone retrieval resulted in prolonged operative time and makes the patient prone for more exposure to pneumo-peritonium and so more Co2 absorption and more effects of general anesthesia leading to increase incidence of postoperative nausea and vomiting. This comes in agreement with Hui T.et al [32], Barrat C. et al [25] and Catarci M. et al [33] which came with same results.

In concern to the intra-abdominal abscess formation, there was a significant difference between both groups (p value < 0.05). This mean that the risk for intra-abdominal abscess formation is more if perforation of gallbladder occurs, And these results are similar to that found in studies of Zehetner et al [10], Sathesh-Kumar et al [9], Zülfikaroglu et al [34], Papasava et al [35] and Oktay Irkorucu et al [22] that said The most common complication of gallbladder

Perforation is abscess formation accounting for 60% of complications. To minimize this complication, proper dissection is required. And if a perforation occurs, the use of suction devices to retrieve 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.[10,16,19]
Therapeutic use of antibiotics in gallbladder perforation is not obligatory.[10,22] However in cases of lost stones most authors do not advise conversion to open surgery.
Three of our cases with abdominal abscesses were treated conservatively with antibiotics (third Generation Cephalosporin and metronidazole) and follow up only, while two of the remaining cases treated with repeated aspiration and the last two cases need tube drain insertion under ultrasound guide to drain the abscess, all of our cases improved and get well later on. These results are the same in Studies of Apostolos V. Pappas et al [36] and G. Chatzimavroudis et al [37] who showed the same line of management.
Other possible complications mentioned in the literatures and other studies did not occur in our study, this is perhaps due to: First, because of its low incidence (0.08-0.3%)[9,22,38], Woodfield et al.[16]estimated the risk of complications due to split gallstones to b[19]e 1,7 cases per 1000 LCs. Similarly, in a more recent article representing a single center experience, Tummer et al.[39]reported that only seven out of 1528 (0.45%) patients with LC presented with complications due to the spilled gallstones. Second, most of these complications occur after a prolonged period, in other words a long delay can be present between the initial operation and the complications time. While the period of our study is only one year, so follow up for many years may be needed to search for the occurrence of late complications.
So the limitation in our study was the short follow up time of our patients. Table (4) demonstrates the reported cases of complications and there time in other studies.

Table (4) shows the reported cases of complications and there time.

Author	Number of cases	Time after laparoscopic cholecystectomy	Complication
Botterill	1	2-5 years	Abscesses
Van Hoecke	1	5 years	Fistula
Weiler	1	Immediately	Fistula
Daoud	1	7 months	Fistula
Castro	1	2-11 months	Fistula
Lutken	1	9 months	Fistula
Patterson	1	14 months	Abscess and fistula
Memon	1	8 months	Fistula
Willekes	1	17 months	Empyema
Catarci	1	3 months	Fistula
Whiting	1	12 months	Abscess
Vadlamidi	1	20 months	Abscess
Lauffer	1	3 months	Abscess
McDonald	6	Immediately-18 months	Abscess and fistula
Groebli	2	15 months/24 months	Abscess/abscess
Van derLugt	2	15 months/38 months	Abscess/abscess
Zaans Medical Centre	3	7weeks-7months/24months/10 years	Fistula/abscess/fistula
Our study	7	2 weeks (3cases)/1month (2 cases)/2 months (2 cases)	Abscesses

Brockmann et al [30] and Woodfield et al[16]said that the clear documentation of the intraoperative gallstone spillage in the medical report is recommended for alerting the clinician in the future to the possibility of stones causing any subsequent problems that might Lead to earlier diagnosis. In addition, informing the patient may reduce the medicolegal risk for further prolonged diagnosis if late complications occur but might also provoke unnecessary repeated examinations.

Conclusions:

1. Gallbladder perforation in LC is common worldwide (10-40%), and in our hospital it was 36%.
2. Risk factors for perforation are male gender, first clinical presentation as an acute cholecystitis, obesity, inflamed, distended, thin walled gallbladder surrounded by adhesions and low experience of surgeons.
3. The age of patients and previous surgical history are not risk factors for gallbladder perforation.
4. The body of gallbladder was the most common site of perforation during LC, while dissecting the gallbladder from its bed was the most common mechanism. So surgeons should pay attention to these points during LC in order to prevent perforation occurrence.
5. Gallbladder perforation results in a prolonged operative time and higher incidence of postoperative nausea and vomiting and intra-abdominal abscess formation but it doesn't affect the hospitalization time.
6. Because the complications of gallbladder perforation and its contents spillage are rare following gallbladder perforation, conversion to laparotomy is not routinely indicated.

Recommendations:

1. Every attempt should be made to avoid perforation during LC. Careful dissection and identification of correct planes between the wall of the gall bladder and surrounding structures should be strictly adhered to.
2. Use of retrieval bags to retrieve the gall bladder decreases the chances of spillage during extraction and avoids inadvertent spillage or contamination during surgery.
3. In cases of spillage, efforts should be made to retrieve the spilled stones and the peritoneal cavity should be irrigated with normal saline solution. Attempts at repairing gallbladder perforations are often unsatisfactory. Use of retrieval bags or even a surgical glove with a purse string attached to its opening is recommended to collect any spilled stones and the gallbladder.
4. In cases of distended gallbladder, it is recommended to do controlled aspiration during LC to reduce the tension and this will decrease the possibility of perforation.
5. Documentation of gallbladder perforation and spillage of its contents in the operative note is necessary and patients should be informed to minimize any legal implications and to aid in the early diagnosis of later complications.
6. Gallbladder perforations with abscess formation should be referred to proper management which may include interventional drainage procedures.
7. We recommend that during the learning curve of LC, surgical trainees should be closely supervised when undertaking this procedure in patients with high risk of perforation. This may reduce the rate of perforation and hence the sequels associated with it.
8. Finally we recommend a long term follow up for patients with gallbladder perforation and spillage to determine any late complications that may occurs in the future.

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