

## Comparison between the Retrieval of the Gallbladder by the Direct Extraction Method and the Bag Method in Laparoscopic Cholecystectomy

Amjad Gul, Zaki Hussain Salamat, Muhammad Rashid Husnain, Najam Shabbir, Syeda Sanila Aijaz, Shireen Sabir Ansari

### Abstract

**Objective:** This study aimed to compare the complications associated with direct versus endobag retrieval methods in laparoscopic cholecystectomy.

**Study design and setting:** A prospective cohort study was conducted at PNS Shifa Hospital, Karachi, from 1<sup>st</sup> June 2024 to 30<sup>th</sup> June 2025.

**Methodology:** A total of 270 patients with ultrasound-proven cholelithiasis undergoing laparoscopic cholecystectomy were included. Patients were divided into two groups: Group A (direct retrieval, n=114) and Group B (Endo bag retrieval, n=156). Postoperative complications, including port-site pain, infection, hernia, sinus formation, and intraperitoneal contamination, were assessed and statistically analyzed using SPSS v21.

**Results** Direct retrieval was associated with significantly higher intraperitoneal contamination (15% vs. 5.6%,  $p<0.05$ ). Endo bag retrieval showed a higher rate of port-site pain (14.5% vs. 22.3%). Rates of surgical site infection and port-site hernia were comparable between both groups.

**Conclusion** Endo bag use significantly reduced intraperitoneal contamination and stone spillage. However, it increased postoperative port-site pain due to larger fascial incisions. Direct retrieval remains cost-effective but carries higher contamination risk. Choice of retrieval technique should balance patient safety, surgical outcomes, and resource availability.

**Keywords:** bile spillage, gallbladder removal, laparoscopic cholecystectomy, port site infection, specimen bag

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### INTRODUCTION

The gallbladder is a small, pear-shaped, hollow viscus situated in the right upper quadrant of the abdomen. It forms an integral component of the biliary system—also referred to as the biliary tree or biliary tract—which comprises a network of ducts originating from the liver, gallbladder, and pancreas, collectively draining into the small intestine. Anatomically, the gallbladder is positioned on the inferior surface of the liver, within the gallbladder fossa, and is connected to the extrahepatic biliary apparatus through the cystic duct.<sup>1</sup>

Cholelithiasis is characterized by the formation of gallstones, which result from an imbalance in the chemical composition of bile. Gallstones are usually composed of bile, cholesterol and bilirubin. They are not always symptomatic, but with contraction of gall bladder upon stimulation may result in classic biliary pain. This happens as the stone slips into cystic duct and causes obstruction in bile flow. The obstruction of bile flow if sustained for few hours results in inflammation of gall bladder and commonly known as cholecystitis.<sup>2</sup> It is the most frequent reason for hospitalization in the setting of abdominal pain in affluent countries. In the UK alone, gallstones affect 5.5 million people, with 50,000 cholecystectomies being performed annually.<sup>3</sup>

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Obesity is one of the major modifiable risk factors for cholelithiasis, and South Asians are one of the communities showing an increasing prevalence of overweight.<sup>4</sup> This changing pattern of body composition can predispose to the pathogenesis of cholesterol gallstones. Recent data suggest a prevalence rate of 10-15 percent in Western countries, while 3-4% in South Asian communities. In Pakistan, it's found to be 8% and 20% in the population over 40 years and 60 years, respectively.<sup>5</sup> However, cholelithiasis in South Asians is mostly underexplored, with limited data available.<sup>6</sup>

For symptomatic patients, cholecystectomy has become the standard treatment. The first cholecystectomy was done in 1882 on an 83-year-old patient. Cholecystectomy has changed significantly since then, including the introduction of the laparoscopic technique, single-port laparoscopic cholecystectomy, and robotic-assisted cholecystectomy. Laparoscopic cholecystectomy was first performed in 1987, a century after the introduction of cholecystectomy. This method of surgery became mainstream just 20 years after it was initiated.<sup>7</sup> This minimally invasive procedure offers several benefits over open surgery, including reduced postoperative pain, lower analgesic requirements, shorter recovery times, and decreased hospital stays.<sup>8</sup> Although laparoscopic procedures are more expensive in terms of operating costs compared to the conventional open approach, the reduced hospital stay and the quicker return to normal work and activities provide both direct and indirect financial benefits, making laparoscopy a preferred option.<sup>9</sup>

A standard laparoscopic cholecystectomy involves the following steps: the patient is prepared and given general anesthesia in the supine position. Pneumoperitoneum is created using a Veress needle or Hasson technique, and four ports are inserted. The peritoneal cavity is inspected. During laparoscopic cholecystectomy, the gallbladder itself is used as a retractor to elevate the right lobe of the liver and to gain visualization of the porta hepatis. This is done by securing gallbladder with grasping forceps and pushing it in a cephalad direction. Calot's triangle is dissected to identify the cystic duct and artery, achieving the critical view of safety (CVS). The CVS consists of three essential component or steps. Firstly, dissection of the hepatocystic triangle. Secondly, exposure of at least lower one third of the cystic plate and lastly demonstration of only two tubular structures (cystic duct and cystic artery) that remain attached to the gallbladder after the first two components have been achieved. All these three steps must be completed before claiming that CVS has been achieved. Next, cystic artery and cystic duct are clipped and cut respectively. The gallbladder is removed from its hepatic bed using thermal energy, either laser or electrocautery. specimen is retrieved outside the abdomen. Finally, the pneumoperitoneum is released, ports are removed, and the wounds are closed and dressed.<sup>10</sup>

While operating in the setting of an inflamed gall bladder, obese men, elderly, non-virgin abdomen, patients with

pigment stones, or in patients who have positive bile cultures, it is not uncommon to encounter gall bladder perforation during surgery. This is usually experienced while the gall bladder is being dissected from gall bladder fossa or during essential traction of gall bladder while dissecting Callot's triangle.<sup>11</sup> Soon afterwards, another crucial step includes the retrieval of the gallbladder after its dissection, which is usually done via the epigastric port. Perforation of gall bladder during surgery or while extraction has its dire consequences like biliary peritonitis, intra-abdominal abscess formation, adhesions leading to intestinal obstruction later on etc. Multiple ways to retrieve the gall bladder are in use to ensure ease of retrieval and to minimize complications, which include direct retrieval via grasper and the use of an endo bag for retrieval.<sup>12</sup> It is the choice of the primary surgeon to determine the method of retrieval.

Limited data is available comparing the complications associated with each method of retrieval. Use of the Endo bag for retrieval is apparently a safe surgical practice to prevent surgical site infection, but it adds to the cost and is an added burden in low-resource countries. Whereas the direct retrieval method is associated with its own set of complications, like intra-peritoneal contamination and port site inflammation.<sup>13</sup> This study aims to compare the frequency of complications associated with gallbladder retrieval using the endo glove technique versus conventional methods during laparoscopic cholecystectomy for cholelithiasis. The results will inform surgical practice and promote infection control strategies, ultimately reducing postoperative morbidity and healthcare burden.

## METHODOLOGY

This prospective cohort study was conducted in PNS Shifa Hospital, Karachi, from 1<sup>st</sup> June 2024 to 30<sup>th</sup> June 2025, spanning a period of 12 months (12 months for data collection and 2 months of data analysis). The ethical clearance was taken from the Institutional Ethics Committee, PNS Shifa, before the commencement of the study with form number ERC/2024/SURG/112. Written informed consent was obtained from each study subject before enrolment. The study included all patients who had a laparoscopic cholecystectomy, both with and without the use of a retrieval drain bag. Patients were divided into two groups according to the method of gall bladder retrieval. The choice of method was based completely on the surgeon's preference. Group A contains those patients in which direct retrieval method was used. In these patients after identifying the Callots triangle and achieving critical view of safety, cystic artery and cystic duct were secured. Gall bladder was dissected from liver bed and the specimen was handled by a non traumatic grasper and retrieved from the 10mm epigastric port directly without an endobag. Group B contains those patients in which endobag has been used. In these patients, after dissection of callots triangle an sterile endobag is introduced in abdominal cavity which was prepared

beforehand by following method: a sterile glove was securely tied at the wrist using vicryl suture and shaped like a bag by cutting the fingers. The bag was submerged in saline and then inserted into the abdomen with a non traumatic grasper through the epigastric port, positioning it on the superior surface of the liver. The gallbladder, along with any spilled stones, was placed inside the glove, and the ends of the glove was grasped with a toothed grasper through the axillary port before being removed via epigastric port. Our Study consisted of 12 months of data collection and 2 months of data analysis. All data was collected on a pre-formed questionnaire. Sample size was calculated using an online sample size calculator, considering a 800-bedded hospital with 5% margin of error and an 95% confidence level.<sup>14,15</sup> The total sample size was 270, which was randomly divided into two groups as mentioned. The inclusion criteria was designed including patients of any gender in the 20–60 age range. Every individual who underwent laparoscopic cholecystectomy having ultrasound-proven cholelithiasis was included and consented to take part in the research.<sup>7</sup>

Patients having any gall bladder complications like gangrenous gall bladder, perforated gall bladder, gallbladder cancer, patient undergoing hybrid procedure i.e. laparoscopic converted to open cholecystectomy, or patient having any terminal illnesses were excluded from the study, to ensure unbiased results. Patients who were unable to keep follow-ups were also excluded. Regarding postoperative assessment, severity of port site pain on different post-operative days was noted using the pain score (VAS score). Patients were also examined for surgical site infection. Regular followups were ensured after discharge for port site hernia and sinus formation etc. The data was transferred to an Excel sheet. All statistical analyses were done on advanced Excel and relevant tools. Statistical analysis using SPSS-21 data analysis software & Chi square test.

## RESULTS

The study consisted of 270 patients who underwent laparoscopic cholecystectomy, 96 patients were in the age bracket of 20-40 years, 107 patients belonged to the 40-60 years age bracket, and 57 patients were aged greater than 60. 64.4 percent of total patients were female, and 35.6 percent were male. Out of all patients, direct retrieval of the gall bladder was done in 114 patients and an Endo bag was used in 156 patients, contributing to the percentages of

42.22% and 57.77% respectively. In the case of direct retrieval, 69 patients were female and 45 were male, whereas via Endo bag retrieval, 93 patients were female and 63 were male. Only intra-peritoneal contamination show statistically significant results. The rest doesn't show any significance

## DISCUSSION

Laparoscopic cholecystectomy has emerged as a successful alternative to the open technique and gained popularity due to its merits of shorter hospital stay, significantly smaller incision size, and lower number of complications than the open technique.<sup>16</sup> It comes with its own set of demerits that include bile leakage, iatrogenic injury, bile peritonitis, postoperative bleeding, etc.<sup>17</sup> A few absolute contraindication

Table 1: Presenting complaint

	Frequency (n=)	Percentage
asymptomatic cholelithiasis	32	11.8%
Epigastric pain	22	8%
Fever	14	5.2%
RUQ pain	193	71.5%
Vomiting	9	3.5%
Total	270	100

Table 2: Complications encountered after the retrieval of the gall bladder via direct retrieval

	Frequency	Percentage
epigastric port site hernia	1	1.2%
epigastric port site infection (pod 7th)	5	4.4%
epigastric port site pain	17	14.5%
epigastric port site sinus	0	0%
intra-peritoneal contamination	17	15%
No complications	73	64.9%
Total	114	100

Table 3: Complications encountered after retrieval of the gall bladder via endobag

	Frequency	Percentage
epigastric port site hernia	00	0%
epigastric port site infection (pod 7th)	3	2%
epigastric port site pain	34	22.3%
epigastric port site sinus	0	0%
intra-peritoneal contamination	9	5.6%
No complications	109	70.1%
Total	156	100

Table 4: Comparison of complications encountered in both techniques

Complications	While direct retrieval via grasper (n=114)	While using a sterile endobag (n=156)	P value
epigastric port site hernia	1.2% (n=1)	00%	0.42
epigastric port site infection (pod 7th)	4.4% (n=5)	2% (n=3)	0.29
epigastric port site pain	14.5% (n=17)	22.3% (n=17)	0.36
epigastric port site sinus	00%	00%	1.00
intra-peritoneal contamination	15% (n=17)	5.6% (n=9)	0.02 (p<0.05)

to laparoscopic cholecystectomy includes, uncontrolled coagulopathy, severe chronic obstructive pulmonary disease, congestive cardiac failure (ejection fraction <20%) and inability to tolerate anesthesia.<sup>18</sup>

Our study included 162 female patients, (93 and 69 in direct retrieval group and endo bag group respectively), whereas 108 male candidates participated in the study (45 and 63 in direct retrieval group and endo group, respectively). This is in accordance to the well-established fact that cholelithiasis is more prevalent in females as also discussed in study by Lazarchuk I. et al. Reasons include, hormonal changes in reproductive years, hormone replacement therapy, usage of oral contraceptive, rapid weight loss, and predisposition to high carbohydrate and low protein diet etc. Hormones particularly estrogen impair the contraction of gall bladder that augment stone formation.<sup>19</sup>

71.5 percent of our total inclusion criteria presented to hospital with complain of right upper quadrant pain either in out patient department or in emergency room. As stated by Martin Wt, in his study any right upper quadrant pain that is lasting for greater than four hours is an indication of pathological cholecystitis and warrants urgent cholecystectomy. Clinical examination by a skilled physician is a more reliable parameter to detect cholecystitis than ultrasound in this setting.<sup>20</sup> An additional consideration is that our study includes 11.8% patients that present with asymptomatic cholelithiasis, as incidental finding on abdominal ultrasound. Routine cholecystectomy for subjects with silent gallstones is an aggressive management option, not indicated for most subjects with asymptomatic cholelithiasis.<sup>21</sup> However, we consider cholecystectomy for asymptomatic gallstone patients include gallstones > 3 cm, concurrent gallbladder polyps, concomitant cholecystectomy during bariatric surgery, existing comorbidities such as diabetes as backed by studies. Prophylactic cholecystectomy is also indicated in patients of sickle cell anemia and hereditary spherocytosis.<sup>22</sup>

Retrieval of the gall bladder is one of the most crucial steps during the surgery. Direct retrieval of the gall bladder was attempted in 114 patients in our study. The merits of direct retrieval are its significance in being cost-effective, decreased intraoperative time, and lower rates of postoperative port site pain.<sup>12</sup> In our study, the prevalence of intra-peritoneal contamination in the direct retrieval group is significant, i.e.15%. This result is similar to the studies by Kuldeep Singh et al., which also showed increased bile spillage in the case of direct retrieval.<sup>12</sup> Spillage of bile into the peritoneal cavity during gallbladder extraction can precipitate biliary peritonitis, a potentially severe inflammatory response triggered by the caustic nature of bile on the peritoneum.<sup>23</sup> Complications reported from gallstone spillage include peritoneal-cutaneous sinus formation, intra-abdominal and hepatic abscesses, subhepatic inflammatory masses, persistent trocar site discharge, micro-abscesses, retroperitoneal

collections, granulomas, cholelithoptysis, small bowel obstruction, enteric and colonic fistulae, as well as bowel perforation and ileus caused by adherence of the intestine to abscess walls. Retained gallstones may remain asymptomatic within the peritoneal cavity for extended periods, but can later become infected following septicemic episodes, leading to abscess formation.<sup>24</sup>

Direct extraction of the gallbladder markedly increases the risk of port-site spillage as well. This occurs because the resistance of the abdominal wall compresses the edematous and fragile gallbladder, causing it to tear during withdrawal or allowing bile and stones to escape through the narrow incision. This can lead to the formation of port site sinus later on, in accordance with the study by Faridi SH et al.<sup>25</sup> However, no case of port site sinus was reported in our study. These results are also in accordance with the study by Kuldip Singh et al, which had no reported port sinus cases.<sup>12</sup> One possible reason could be the shorter duration of follow-up in our study.

In our study, we used sterile glove of size 7.5-8.0 as an endobag which was uneventful for any mishap. We found it to be cost-effective, easily available, and easier to replicate for young residents in training and assistants. Worldwide, commercially available endobags are used for this purpose, examples including EndoCatch bag and Endopouch (Ethicon); Pleatman Sac (Abbot Medicals); and Ponsky Endosac (US Endoscopy). These endobags are easy to use, but the main demerit is the huge cost, which limits their use in the developing countries like Pakistan where patients usually pay for their surgeries. The other commonly used inexpensive alternatives include sterile male condoms, recloseable zipper bags, Nadiad bags. Out of all these sterile glove is the most common entity as backed by studies.<sup>26</sup> A few studies also implied using sterile empty polythene drain bags as endobag.<sup>7,12</sup>

Endo bags have been introduced in the setting of gall bladder retrieval with the benefit of a decrease in prevalence of surgical site infections, a decreased rate of intra-peritoneal contamination during retrieval, avoiding spillage of stones, and a decrease post-operative pain in Visual analog scales. An endo bag is also very helpful when used in suspected cases of GB cancer to reduce the risk of tumor cell seedlings and in situations of acute cholecystitis and GB empyema to prevent the wound from becoming contaminated with infected bile or stones when the GB is being removed.<sup>27,28,29</sup> Our study proves a very significant role of Endo bag in preventing intraperitoneal contamination in laparoscopic cholecystectomy, with statistically significant results.

A further point of interest is the fact that 22.3% experienced port site pain with Endo bag use compared to 14.5% incase of direct retrieval method. One possible explanation for this is the need to increase the fascial incision during the retrieval of the gall bladder,<sup>30</sup> which later on becomes a reason for

increased epigastric port site pain. This is further augmented by a study conducted in 2001 by Lomanto D et al, which proved that there is a significant reduction in post operative pain in VAS when 5mm trocar was replaced by 2mm trocar ultimately resulting in smaller fascial incision.<sup>31</sup> Increased fascial incision later on may lead to epigastric port site hernia, which may become a life-threatening complication if ignored and would require another surgery, adding to cost and liability. There have been cases of Richter's hernia that occurred at a port site after laparoscopic surgery, reported, and its incidence is found to be 0.2% to 3%.<sup>12</sup> Our study didn't report any port site hernia in the Endo bag group, and one patient was reported to have a port site hernia in the direct retrieval group. Not performing fascial closure at the time of surgery could be one of the reasons for port site hernia later on, and this was taken care of in all of our patients indigenously.<sup>12</sup>

Several studies have also reported iatrogenic injury to the gut during manipulation and increased operative time while using the Endo bag.<sup>23</sup> However, it is subjective to the surgical skills of the operating surgeon.<sup>32</sup> For determining port site infection, we assessed the patients between their 7<sup>th</sup> to 10<sup>th</sup> post operative day, i.e. on their first follow up visit. Our results indicate 4.4% of the patients exhibiting port site infection in direct retrieval group while percentage reduced to 2% incase of endobag. As discussed above endobag has been successful in preventing port site spillage and thereby reducing contamination. It has been explained in study by Divya et al., the source of microorganisms in surgical site infections can be internal or external. Hollow viscera flora, patients' skin, subcutaneous fat, positive bile cultures are considered endogenous sources whereas any contaminated object or instrument, inadequate sterile techniques by surgeons and assistants are the exogenous pools.<sup>7</sup> In our study there was no morbidity reported in either of the groups. The cosmesis and total cost of surgery was similar for all the patients. Limitations: Although this study provides valuable insights regarding retrieval methods of the gall bladder during laparoscopic cholecystectomy, there are few limitations that need to be addressed. Firstly, variability of surgical skills might affect the results of the study as patients were operated by multiple surgeons. Moreover, our study being a single-centre study with a shorter duration of follow-up might prove to be a bias. To address this, further multicenter prospective trials, with longer duration of follow-up and decreased variability in surgical skills, will add to the benefit of masses.

## CONCLUSION

Laparoscopic cholecystectomy is a safe and effective alternative to open surgery, but gallbladder retrieval remains a critical step associated with risks of bile spillage and contamination. Our study demonstrated that the use of an endobag significantly reduced intraperitoneal contamination and gallstone spillage compared to direct retrieval. Overall,

while both techniques yielded comparable SSI outcomes, the use of endobags remains valuable in minimizing intraperitoneal contamination and preventing stone-related complications. In addition to this our study, proves the efficacy of sterile surgical glove as an innovative, cheap and safe alternative to the traditional specimen retrieval endobag for gall bladder extraction during laparoscopic cholecystectomies.

### Authors Contribution:

**Amjad Gul:** Conception, Design and collection of data

**Zaki Hussain Salamat:** Data analysis, interpretation and writing

**Muhammad Rashid Husnain:** Conception, Design and collection of data

**Najam Shabbir:** Conception, data analysis, Approval of final draft

**Syeda Sanila Aijaz:** Interpretation of data and analysis

**Shireen Sabir Ansari:** Revision and finalization of manuscript

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