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## Postoperative incidence of iatrogenic gallbladder perforation during laparoscopic cholecystectomy in Sulaimaniyah Teaching Hospital

### ABSTRACT

**Background and objective:** Iatrogenic perforation of the gallbladder has been reported in 28% of those patients who undergo laparoscopic cholecystectomy. It has been pointed out that gallbladder perforation can result in formation of gallstones and spillage of bile. The present study was carried out in order to investigate the postoperative incidence of iatrogenic gallbladder perforation during laparoscopic cholecystectomy in Sulaimani Teaching Hospital.

**Patients and methods:** The present investigation was a single center, retrospective observational study that was carried out in Sulaimani Teaching Hospital in 2018-2019. The study sample included 99 patients who had undergone elective cholecystectomy. Required data on the possible risk factors and early outcomes and the patients' demographics including age, BMI, and gender were collected. The collected data were analyzed through the Statistical Package for the Social Sciences (version 22.0.)

**Results:** The results revealed that 80% of the patients were females. Also, 42.4% had no chronic diseases, while diabetes mellitus (DM), DM along with hypertension (HT), and HT were found to be the most prevalent chronic diseases among them with 18.2%, 16.2%, and 10.1% of prevalence, respectively. Only 17.2% of the patients had abdominal operation before, and acute cholecystitis and chronic cholecystitis were seen respectively in 13% and 17% of them. The most common causes of gallbladder perforation (GP) were found to be electrocautery (16.2%) and grasper (7.1%). Moreover, 33.3% of the patients were overweight (BMI between 25 and 29.9), 45.5% were obese (BMI between 30 and 34.9), and 20.2% had BMI of over 35. Most of the patients aged 30 to 49 (62.6%). A majority of the patients (94.9%) were found to have gallstones.

**Conclusion:** Iatrogenic gallbladder perforation is prevalent among patients who undergo laparoscopic cholecystectomy. However, laparoscopic cholecystectomy is still a better choice and associated with fewer complications compared to open cholecystectomy. Required measures need to be adopted for patients with perforated gallbladder in order to minimize spillage and remove as much spilled gallbladder content as possible.

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## Introduction:

As a small hollow pear-shaped organ, the gallbladder receives, collects, and stores bile produced by the liver through the common hepatic duct. Later, it releases the bile into the duodenum in which the bile helps with the digestion of fats [1]. The gallbladder has a length of about 7 to 10 cm, can hold about 30 to 80 milliliters of fluid, and is located at the upper right quarter of the abdomen and in an indentation under the liver [2].

Benign gallbladder disease is mainly treated through laparoscopic cholecystectomy as the first treatment choice instead of open surgery [3]. However, surgeons have pointed out that this procedure is associated with a higher risk of injury than open cholecystectomy [4]. That is why cholecystectomy is the second most widely conducted abdominal operation in general surgery practice [5]. Iatrogenic perforation of the gallbladder (PGB) has been reported to be 28% prevalent during laparoscopic cholecystectomy (LC). PGB can result

in formation of gallstones and spillage of bile [6]. According to Neimeir's classification, acute cholecystitis is a spontaneous preoperative gallbladder perforation, which is a rare life-threatening condition. .

The surgeon's judgment, skill, experience, and training and the quality of the instruments used for the operation can remarkably affect the outcome of laparoscopic cholecystectomy. Stopping bile leak during laparoscopic cholecystectomy and examining its source can have a great effect on the outcomes, which should be done by the surgeon [7]. In this surgical procedure, a few small incisions are made on the right side of the abdomen. Then, one of the incisions is used to insert a laparoscope which shows the gallbladder on a screen. Afterwards, the gallbladder is removed through another small incision. Compared with open cholecystectomy, laparoscopic cholecystectomy is less invasive [8].

In comparison with conventional

techniques, laparoscopic cholecystectomy has some advantages, including early return to daily activities, shorter hospital stay, lesser postoperative pain, and better cosmetic results. Moreover, laparoscopic cholecystectomy might be associated with some severe complications, such as pancreatitis, abscess, bleeding, and bile duct injury [9]. The patients' health status, the surgeon's experience, and post-operative care can remarkably affect the complications of this treatment. However, this procedure is believed to result in fewer postoperative complications [10]. Elevated risk of GP has been reported to be correlated with a difficult operation, an inflamed or non-visualized gallbladder, the use of a laser, a history of acute cholecystitis or previous laparotomies, and male sex [11].

The present study was aimed at investigating the postoperative incidence of iatrogenic gallbladder perforation during laparoscopic cholecystectomy in Sulaimani Teaching Hospital.

## **Patients and methods**

**Study design and setting:** The present single center, retrospective observational study was carried out in Sulaimani Teaching Hospital located in Sulaimani, Kurdistan-Iraq in 2018-2019.

### **Study sample and sampling**

**method:** The study sample consisted of 99 patients who underwent an elective cholecystectomy in Sulaimani Teaching Hospital and were analyzed retrospectively. The inclusion criteria were all age groups with gallstone and all cases who underwent laparoscopic cholecystectomy not open cholecystectomy. The exclusion criteria were patients who underwent open cholecystectomy, cases who did not respond to our phone call, and gallbladder perforation that was not recorded in the operation note. The selected patients were assigned into two groups based on the presence of GP.

**Data collection:** Required data on the possible risk factors and early outcomes were collected from the patients'

profiles. Moreover, the patients' demographics including age, gender, and BMI was also gathered.

**Statistical analysis:**The collected data were analyzed through the Statistical Package for the Social Sciences (version 22.0). For this purpose, descriptive statistics was employed, and the results were presented as frequencies and percentages in appropriate tables.

**Ethical considerations:**The protocol of the study was approved by the Research Protocol Ethics Committee of Kurdistan Board of Medical Specialties. Moreover, informed consent was obtained from the patients during our phone calls with them. In addition to

these, required permission was obtained from the authorities of Sulaimani Teaching Hospital.

## Results

The results of the present study indicated that most of the patients (80.8%) were females, and 19.2% were males. The results also revealed that 42% of them did not have any chronic diseases, and the most frequent chronic diseases were respectively diabetes mellitus (DM) in 18.2% cases, DM and hypertension (HT) in 16.2%, and HT in 10.1%. It was observed that 17 patients (17.2%) had abdominal operations. Moreover, chronic and acute cholecystitis was seen in 17 and 13 patients, respectively (See **Table 1**).

**Table 1.** The patients' gender and other variables

	Frequency (N)	Percentage (%)
<b>Gender</b>		
Male	19	19.2
Female	80	80.8
Total	99	100.0
<b>Chronic diseases</b>		
Normal	42	42.4
DM	18	18.2
HT	10	10.1
Respirator	1	1.0
DM and HT	16	16.2
DM, HT and Valvular	3	3.0

DM and Respirator	1	1.0
HT and Valvular	2	2.0
HT and Respirator	6	6.1
Total	99	100.0
<b>Abdominal operation</b>		
No	82	82.8
Yes	17	17.2
Total	99	100.0
<b>Acute and chronic cholecystitis</b>		
Normal	69	69.7
Acute	13	13.1
Chronic	17	17.2
Total	99	100.0

According to the results, any perforation gallbladder that change to open cholecystectomy we had not included in our study ,endoscopic retrograde cholangiopancreatography (ERCP) was used for 5 patients (5.1%). A large number of the patients (72.7%) did not havegallbladder perforation (GP), while the causes of GP were electrocautery in 16% of the cases, grasper in 7.1%, clip in 2%, and removal in 2%. In terms of BMI, 65.7% of the patients were obese with a BMI ranging from 30 to 39.9, and 33.3% were overweight with a BMI of 25 to 29.9. The patients' age ranged from 20 to 69 years, with 33.3% and 29.3% being 40-49 and 30-39 years, respectively (See **Table 2**).

**Table 2.** The patients' age, BMI, and other variables

	Frequency (N)	Percentage (%)
<b>ERCP</b>		
No	94	94.9
Yes	5	5.1
Total	99	100.0
<b>Causes of GP</b>		
No GP	72	72.7
Electrocautery	16	16.2
Grasper	7	7.1
Clip	2	2.0
Removal	2	2.0
Total	99	100.0

<b>BMI</b>		
18.5 - 24.9 Normal weight	1	1.0
25 - 29.9 Overweight	33	33.3
30 - 34.9 Obesity class 1	45	45.5
35 - 39.9 Obesity class 2	20	20.2
Total	99	100.0
<b>Age group</b>		
20 - 29	13	13.1
30 - 39	29	29.3
40 - 49	33	33.3
50 - 59	13	13.1
60 - 69	11	11.1
Total	99	100.0

The ultrasound findings demonstrated that 94.9% of the patients had stone, 3% had polyp, and 2% had sludge (See **Figure 1**).

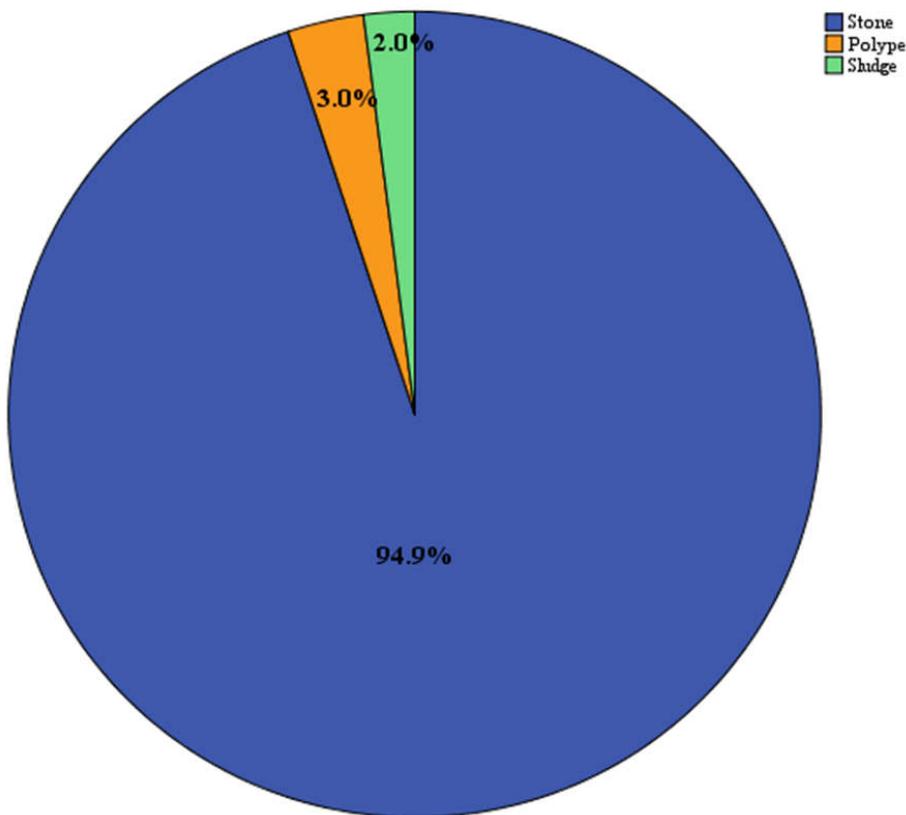


Figure 1. Ultrasound findings

According to the results, the patients' mean age was  $42.10 \pm 11.46$  years with a minimum of 20 and a maximum of 69 years. Their mean weight was  $87.28 \pm 9.83$  kg with a minimum and a maximum weight of respectively 68 and 110 kg. Their mean height was  $166.36 \pm 4.97$  cm with a minimum and maximum height of respectively 158 and 178 cm. Their mean BMI was  $31.56 \pm 3.50$  with a minimum and a maximum BMI of respectively 22.98 and 38.46 (See **Table 3**).

**Table 3.** Mean and standard deviation of the patients' age, weight, height, and BMI

	Age (years)	Weight (kg)	Height (cm)	BMI
<b>Mean ± SD</b>	42.10± 11.46	87.28 ± 9.83	166.36 ± 4.97	31.56 ± 3.50
<b>Min - Max</b>	20- 69	68 - 110	158 - 178	22.98 - 38.46

## Discussion

Laparoscopic cholecystectomy was introduced in 1985, and since then, it has widely been employed as a technique to treat gallbladder perforation (GP). Through this technique, complications associated with open surgery and the high cost of hospital stay can be tackled. In spite of being the first chosen treatment technique for GP, laparoscopic cholecystectomy can cause GP [12]. It is highly essential to classify and manage perforated cholecystitis appropriately. In addition, it has been shown that morbidity in gallbladder perforations can safely and feasibly be

reduced through laparoscopic cholecystectomy [13].

As shown by the results of the present study more than four-fifths of the participants were females, and less than half of them did not have any chronic diseases. While, less than one-fifth of participants were detected with DM. In this regard, Whiting et al (2011) demonstrated that diabetic patients are typically diagnosed with clinically silent gallbladder disorders which can lead to sudden catastrophic complications which need emergency surgery. In their study, they noticed a positive correlation between the duration of diabetes mellitus and the

prevalence of gallbladder dysfunction and subsequent gallbladder diseases [14].

In their retrospective study, Gunasekaran et al (2015) found that 18 patients with gallbladder perforation had comorbid diseases, among whom 12 patients had diabetes mellitus (DM), 4 had ischaemic heart disease, and 2 had both DM and hypertension (HT) [15]. In this regard the findings of the present study showed that about 17% of the patients had abdominal operations, and chronic and acute cholecystitis were seen in 17 and 13 patients, respectively.

Düzenli et al (2021) showed that endoscopic retrograde cholangiopancreatography (ERCP) is a very useful technique in the detection of most biliary tract diseases. They also demonstrated that gallbladder and intrahepatic duct system diseases can be diagnosed through endoscopic selective biliary cannulation despite its preponderance in extrahepatic biliary tract conditions [16]. The results of the current study indicated that ERCP was

used as a diagnostic method for about 5% of participants, revealing that over two-thirds of them did not suffer from GP. Also, electrocautery was the main cause of GP in 16% of the cases. In a similar study, Ahmad et al (2013) showed that the harmonic scalpel can be used to safely and effectively dissect gall bladder and hemostasis in laparoscopic cholecystectomy. They also referred to electrocautery as an appropriate alternative for this purpose [17].

The results of this study demonstrated that patients with a higher BMI were at a higher risk of gallbladder perforation. A similar study by Enami et al (2021) reported a higher risk of gallstones in adults with a higher BMI [18]. Female gender and elevated BMI have been referred to as definitive risk factors for gallstone growth [19]. Elevated BMI has also been reported to cause symptomatic gallstone disease [20]. Obesity can have a remarkable effect on most pathogenic mechanisms of gallstone formation, including defective gallbladder emptying, stone

aggregation, and supersaturation of bile with cholesterol increased propensity to cholesterol crystallization [21]. A remarkable increase in the risk of gallstones has been reported during rapid weight loss ( $>1.5$  kg/week) [22, 23]. Similar to these studies, nearly two-thirds of the patients in the present study were obese and the other one-third were overweight. According to the results of some similar studies, high prevalence of obesity can lead to an elevated incidence of benign gallbladder conditions [24]. The early outcomes of open surgical procedures can be unfavorably affected by obesity and obesity-related comorbidities; however, this influence changes in case of utilizing laparoscopy [25, 26].

The results of the present study demonstrated that nearly 95% of patients were detected with stone through conducting ultrasound examinations. Similarly, in a study by Salih (2020) in Iraq, it was shown that iatrogenic gallbladder perforation and spillage of gall stones are correlated, and this association might result in

abdominal infections which in turn can cause a number of abdominal problems. Therefore, the probability of more abdominal infections and problems can rise as a result of the presence of any kind of stones [10]. The results of another study conducted by Hanashe et al (2021) in Iraq revealed that the risk of gallbladder perforation can drop by precisely detecting the presence of any kind of stones. They also stated that gallbladder perforation can result in gallstone spillage and, in many cases, an unsuccessful retrieval of the stones. Most of the spilled stones are clinically asymptomatic, but 0.04% to 19% of the cases experience adverse events. Intra-abdominal abscess formation has been reported as the most widespread complication when there is any kind of stones [27].

In this study, it was observed that the mean age of patients was 42 years with a maximum of 69 years. Similarly, Hanashe et al (2021) showed that significant risk factors that cause gallbladder perforation include the patient's factor such as male gender,

older age, and obesity and the surgeon's experience and the difficulty of the surgery (including palpable gallbladder preoperatively, pain >96 hours before surgery, adhesions in the right upper abdomen, and acute cholecystitis). Among these factors, the patient's age has been referred to as one of the most decisive factors that could affect gallbladder perforation [27]. Similar findings were reported by Akmoosh et al (2019) who carried out a study in Iraq and concluded that both old age and female gender are significant risk factors for development of gallbladder perforation [2]. This finding is in agreement with those of the present study.

### **Conclusion**

One-third of the patients undergoing laparoscopic cholecystectomy experience iatrogenic gallbladder perforation. Laparoscopic cholecystectomy is not always the only good procedure to follow; however, it is associated with less pain and possible complications. It has been reported to

be accompanied by various complications due to variety of factors including the patient's health status. Iatrogenic gallbladder perforation can be caused by factors like inflamed gallbladders, old ages, and overweight male with acute inflammation. Moreover, patients with a higher BMI were at a higher risk of gallbladder perforation. The incidence of benign gallbladder conditions increases as the prevalence of obesity soars. In spite of low incidence of iatrogenic gallbladder perforation during laparoscopic cholecystectomy, the morbidity associated with this complication can be serious. As a result, it is necessary to make sufficient attempt to prevent iatrogenic PGB intra-operatively. In case of perforated gallbladder, measures need to be taken to minimize spillage and to remove as much spilled gallbladder content as possible.

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