

## Safe Surgical Approach to Laparoscopic Cholecystectomy: Posterior Wall Left Cholecystectomy

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### ABSTRACT

**Background:** Laparoscopic Cholecystectomy (LC) is one of the most common surgical procedures. This surgery can be difficult and risky for various reasons. Leaving the posterior wall of the gallbladder (GB) may be a safe option.

**Objectives:** This study aimed to discuss the results of patients who underwent LC with or without leaving the posterior wall of the gallbladder left in situ.

**Patients and methods:** Data of 105 patients who underwent consecutive laparoscopic cholecystectomy between 2017-2021 were analyzed retrospectively. The patients were divided into groups according to whether the posterior wall of the GB was left in situ and the severity of the sac. The results of 52 patients who underwent standard LC in group 1, 14 patients with normal cholelithiasis and posterior wall left in group 2, 13 patients with elective infection risk and posterior wall left in group 3, and 26 patients with acute cholecystitis and posterior wall left in group 4, were compared.

**Results:** White blood cell (WBC), C-reactive protein (CRP) values of group (3, 4) were statistically higher than the other two groups ( $p < 0.05$ ). There was no statistically significant difference between the groups in terms of postoperative fever, pulse, bile and gallbladder wall cultures, and trocar site infection rates.

**Conclusion:** Standard LC surgery can be performed in uncomplicated cholelithiasis cases. However, in difficult gallbladder cases, leaving the posterior wall of the GB can provide a safe operation. The postoperative results of this patient group were not different from the uncomplicated group.

**Keywords:** Critical view of safety, Difficult cholecystectomy, Gallbladder, Laparoscopy

### INTRODUCTION

Laparoscopic Cholecystectomy (LC) is one of the most common surgical procedures <sup>(1)</sup>. Although considered technically easy, it can have serious consequences when complications occur in patients with "difficult gallbladder" and biliary tract variation. For this reason, The Society of American Gastrointestinal and Endoscopic Surgeons (SAGES) has created a "Safe Cholecystectomy Task Force" to establish a universal culture of safety and reduce biliary injuries <sup>(2)</sup>. The classical anatomy of the biliary tract is present in only 30-50% of individuals, and the high rate of abnormal anatomical variation can make the surgical procedure even more dangerous <sup>(3)</sup>. Causes of difficult gallbladder include obesity, adhesions, acute or chronic inflammation, hydropic gallbladder (GB), and liver cirrhosis <sup>(4)</sup>. In patients with advanced cirrhosis and severe portal hypertension, the presence of portal cavernoma, adhesions, and neovascularization complicates the dissection of Calot's triangle and gallbladder hilum or control of liver bed bleeding <sup>(5)</sup>. In these cases, the risk of serious complications arises, and the rate of conversion to open surgery increases <sup>(6)</sup>. Therefore, in patients with anatomical variation, advanced cirrhosis, severe portal hypertension, and difficult gallbladder, LCs performed by leaving the posterior wall in situ may be safer than the standard technique.

This study aimed to evaluate the effectiveness of the classical LC and the modified LC technique in which the posterior wall is left in situ by comparing the

laboratory parameters, vital signs, bile fluid culture results, and complications, and to discuss them in light of the literature.

### PATIENTS and METHODS

Patients with indications for elective or emergency cholecystectomy who underwent LC between 2017 and 2021 in Atatürk University General Surgery Clinic, were analyzed retrospectively.

Patients were divided into 4 groups.

Group 1- 52 patients who underwent elective standard LC (without leaving the posterior wall of the GB)

Group 2- 14 elective, risk-free patients who underwent LC by leaving the posterior wall

Group 3- 13 Patients at risk of elective infection who underwent LC by leaving the posterior wall (patients with biliary colic attacks within 30 days before the procedure, Common bile duct stones, Jaundice, Non-functioning gall bladder)

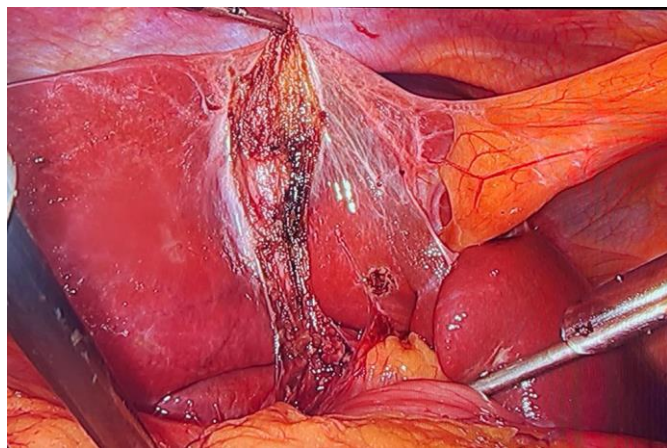
Group 4- 26 Patients with acute cholecystitis who underwent LC by leaving the posterior wall.

The study included 105 patients. All patients had gallstones. The disease was diagnosed with the imaging methods of ultrasonography (US) and/or magnetic resonance cholangiopancreatography (MRCP). Patients who underwent LC were included in the study consecutively. All operations were performed by experienced surgeons under general anesthesia. No patients' gallbladder was opened and no posterior wall was left to increase the number of patients in the study.

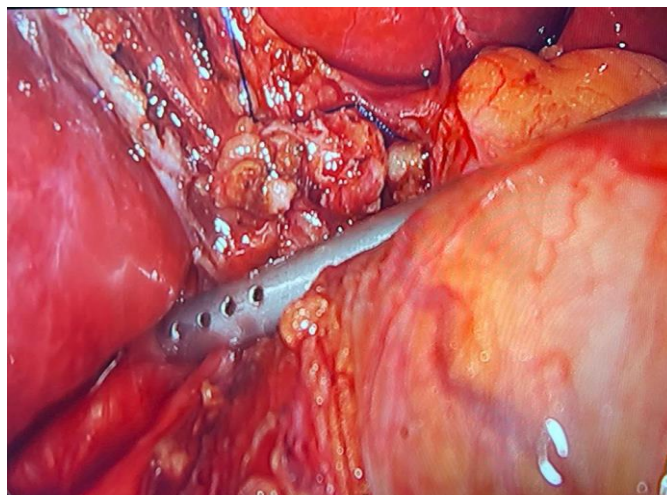
A 30-degree telescope and high-resolution camera monitor were used as standard in all groups, and operations were performed with four ports.

In group 1, after hanging the gallbladder fundus with a holder, the Calot's triangle was dissected and opened in accordance with the "critical view of safety" method (7).

The cystic artery and cystic duct were clipped and cut. In groups 2, 3, and 4, LC was performed by leaving the posterior wall in situ. In 85% (n=45) of the cases in these groups, the anterior wall of the sac was cut over the cystic duct with cautery and removed, leaving the posterior wall in situ, and the inner orifice of the cystic duct was sutured with a 3.0 monofilament suture (Figure 1). Approximately 40% of the gallbladder wall was left in bed (Figure 2). In the remaining 8 cases (15%), Calot's triangle was dissected, and the cystic duct and cystic artery were exposed and clipped in accordance with safe LC, but the posterior wall was left.



**Figure (1):** The gallbladder was removed by cutting the front face



**Figure (2):** Cystic duct suture

Antibiotic prophylaxis was not applied to groups 1 and 2. During the induction of anesthesia, a single dose of antibiotic (cephalosporin) was administered prophylactically to Group 3 in the presence of signs of GB infection (GB wall thickness, pericholecystic fluid, anterior/posterior sac diameter greater than 4 cm) and to all group 4 patients.

After achieving hemostasis, the entire gallbladder in group 1 and the anterior wall of the gallbladder and stones in groups 2, 3, and 4 were removed from the abdomen through a 10 mm port with the help of a bag. Bile fluid and a 2x2 mm piece of the bladder wall were taken as culture samples from all patients. As standard procedure, the GB was sent for pathological examination.

Postoperatively, fever was monitored every 6 hours, CRP and WBC were monitored every 12 hours.

Cases in groups 1 and 2 were discharged after 24 hours. In groups 2 and 3, patients who had a drain were discharged after drain removal.

#### **Ethical considerations:**

**An approval from Erzurum Atatürk University Faculty of Medicine Ethics Committee (No: 2020/12-10-74) was obtained. This work has been carried out in accordance with The Code of Ethics of the World Medical Association (Declaration of Helsinki) for studies involving humans.**

#### **Statistical analysis**

While the statistics of the study were performed, numerical data were given as mean and standard deviation in the descriptive statistics and categorical data were given as number and percentage. Chi-square test was used to compare categorical data. P significance value was accepted as <0.05. SPSS 23.0 package program was used for analyses.

#### **RESULTS**

A total of 105 patients, 53 female (50.5%) and 52 male (49.5%), were included in the study over a 5-year period. The mean age of the patients was  $55.2 \pm 13$  (26-84). The patients' distribution according to the groups, mean age, gender, length of hospital stay and operation times are shown in table 1.

**Table (1):** Demographic and clinical features of patients

	Group 1	Group 2	Group 3	Group 4
Patient number (%)	52 (49.5%)	14 (13.3%)	13 (12.4%)	26 (24.8%)
Age ± SD (years)	53.5±13.8	54.6±13.7	55.4±14.6	59±10.1
Gender (female/male)	39/13	2/12	4/9	8/18
Hospital stay/days± SD	1.9±1.3	1.8±0.9	2.4± 1	2.4±1.3
Operation time (min.)± SD	60±5.8	62.5±5.2	64±5.2	65±4.8

During the operation, iatrogenic gallbladder perforation occurred in 9 (17.3%) of 52 patients in group 1. In 6 (42.9%) of 14 patients in group 2, the gallbladder was perforated for technical or iatrogenic reasons. In 32 (82.1%) of 39 patients in groups 3 and 4, the gallbladder was opened by the surgeon with the help of cautery due to fibrosis, adhesions, and the failure to identify the Calot's triangle, and the bladder was perforated spontaneously in 7 (17.9%) of them.

Table 2 presents the distribution of the findings on heart rate, C-reactive (CRP), white blood cell (WBC), bile culture, gallbladder wall culture, trocar site infection, and fever observed in cases of cholecystectomy performed by leaving the posterior wall of the gallbladder in situ along with the statistical analysis results.

CRP (5 mg/dl ≤ high) and WBC (3.9-10.8 (×10<sup>3</sup>/mm<sup>3</sup>) normal, 10.8 ≤ high) values were regarded normal or high relative to the reference ranges of the laboratory kits.

Statistical analyses revealed a statistically significant difference only in the distribution of normal and high CRP and WBC values according to the study groups.

**Table (2):** Clinical characteristics and laboratory parameters of the studied groups

	Heart rate		C-reactivate protein		White blood cells		Bile culture		Gallbladder wall culture		Trocar incision infection		Body temperature	
	Normal	High	Normal	High	Normal	High	Absent	Present	Absent	Present	Absent	Present	Normal	High (1)
Group I	51	1	25	27	45	7	46	6	48	4	52	0	50	2
Group II	13	1	4	10	14	0	14	0	13	1	14	0	11	3
Group III	13	0	2	11	5	8	11	2	12	1	13	0	12	1
Group IV	24	2	3	23	10	16	24	2	22	4	25	1	25	1
Statistic method	$\chi^2=2.514$		$\chi^2=12.817$		$\chi^2=31.527$		$\chi^2=2.338$		$\chi^2=1,382$		$\chi^2=3.068$		$\chi^2=5.922$	
P value	P=0.473		P=0.005 **		P<0.001 ***		P=0.505		P=0.710		P=0.381		P=0.115	

\*\* : Highly significant, \*\*\*: Very highly significant, 1: Analyzed sub-febrile fever combined with high fever due to fewer cases

Table 3 presents the results of the pairwise comparison of group 1 and other groups to determine the differences of standard LC patients (group 1) from other groups with a posterior wall left in situ in terms of CRP and WBC characteristics.

As shown in table 3, group 1 cases were statistically significantly different from both group 3 and group 4 cases. Examination of the bile and gallbladder culture results revealed growth in 10 of the patients and determined the responsible agents as Escherichia coli in 4 patients, Enterococcus sp in 4 patients, and candida in 2 patients. Appropriate antibiotics and antifungal drugs were started after evaluation with infectious diseases specialists. Infection in the trocar incision was observed in only one patient with acute cholecystitis. Pathological examinations detected no polyps or cancer in any of the patients.

**Table (3):** Statistical analysis results of CRP and WBC pairwise comparisons of group I and other groups

Comparisons of groups	C-reactivate protein		White blood cells	
	Statistical analysis	P value	Statistical analysis	P value
Group I-II	$\chi^2 = 1.704$	p=0.192	$\chi^2 = 2.108$	p=0.147
Group I-III	$\chi^2 = 4.577$	p=0.032	$\chi^2 = 13.542$	P<0.001
Group I-IV	$\chi^2 = 10.056$	p=0.002	$\chi^2 = 19.269$	P<0.001

## DISCUSSION

Although laparoscopic cholecystectomies are considered easy operations by surgeons, they are procedures that should be given great importance due to the seriousness of their complications (8).

A six-step safe cholecystectomy program has been published by The Society of American Gastrointestinal and Endoscopic Surgeons (SAGES) (9). This program indicates that the key to safe cholecystectomy is understanding the anatomy. The Tokyo guideline 2018 for surgical management of acute cholecystitis (10) also emphasizes similar matters. The classical anatomy of the biliary tract is present in only 30-50% of individuals, so it can be said that abnormalities are the rule, not the exception (3). Therefore, performing LC by leaving the posterior wall in situ can reduce the occurrence of complications after the surgery of an organ with such high anatomical variation. Despite its low mortality and morbidity, LC should be deemed important as its complications are very serious and frustrating (11).

Identifying difficult LC patients is key to being prepared to deal with intraoperative challenges. However, it is often difficult to predict this situation (12), or even if it can be predicted, it still needs to be done. Dissection of the Calot's triangle in classical LC teachings may cause serious biliary tract or vascular injuries, especially in cases with fibrosis or edema (13). In difficult LC, sometimes the safest and best approach is to view the anatomy from inside the gallbladder, which the surgeon knows is safe (14). Alternative procedures should be considered in patients scheduled for LC and when dissection of the hepatocystic triangle is considered too difficult or dangerous to progress and/or safety critical vision cannot be obtained. These salvage procedures are performing LC by leaving the posterior wall, transitioning to open operation, and intraoperative imaging when necessary (15). In our study, biliary tract injuries were not encountered thanks to the suturing of the cystic duct orifice through the pouch.

In difficult LCs, where the hepatocystic triangle can be reached but dissection cannot be performed safely, subtotal cholecystectomy (SC) with a fundus-first approach may be considered. Although SC cannot replace LC, it is considered an important tool for use in difficult gallbladder (5,16). The remaining piece of bladder can act as a symptomatic gallbladder and lead to various problems such as the need for reoperation. Rather than performing SC and increasing morbidity, laparoscopic cholecystectomy by leaving the posterior wall, as we performed in our study, may reduce the risk of complications and reoperation (5,16).

In patients with cirrhosis with an indication for cholecystectomy, exploration may be difficult due to portal hypertension and the potential for bleeding from increased collaterals and fibrosis in the liver (17-19). No such case was encountered in our series, but we think that it may be a very good indication for LC performed by leaving the posterior wall.

In almost one third of patients, bile or stone spillage occurs during surgery (20). LC is considered as a clean-contaminated wound (13). It becomes a contaminated wound when the gallbladder is emptied during the operation, the anterior wall of the GB is removed, and the stones are spilled into the GB bed and its surroundings (21).

In other words, it is necessary to evaluate the consequences of voluntarily converting a surgically clean-contaminated wound into a contaminated wound. In our study, no statistically significant difference was found between the groups in terms of fever, pulse, bile and gallbladder wall cultures, and trocar site infection rates. Only CRP and WBC values were significantly different between the groups. These groups were patients with acute cholecystitis at risk of infection and had high WBC and CRP values during their hospitalization. These results show that LC performed by leaving the posterior wall is a feasible method.

Stones remaining in the peritoneal cavity during LC can potentially lead to complications (22-23). To avoid this, we gave great importance to stone and bile cleaning. The only difference between patients with and without gallbladder perforation is the longer operative time due to the time spent cleaning the operative field.

Also, in our study, except for the prolongation of the operation time, which can be considered insignificant, there were no complications in patients with perforation compared to patients without perforation (Table 1).

Acute cholecystitis is the most common cause of a difficult gallbladder dissection and accounts for 10% of all cholecystectomies. The technical difficulties of acute cholecystitis are primarily the inflammatory process and hydrops (10,12). **Hubert et al.** (14) stated that entering the fundus of the gallbladder from a safe point will provide decompression of the gallbladder and allow the surgeon to see the infundibulum and cystic duct from inside the gallbladder. Other complications of acute cholecystitis include gangrenous gallbladder, emphysematous cholecystitis, abscess, and perforation (24). There is no information that complications increase even in cases of possibly infected bile, and we know from our clinical experience that there is no concern. Besides, in cases of acute cholecystitis, while the edematous gallbladder is

tried to be separated from the edematous gallbladder bed, it is not uncommon for the gallbladder bed to be completely separated from the liver. In this case, tedious and time-consuming bleeding and bile leaks may be encountered <sup>(5)</sup>. **Matsumura et al.** <sup>(25)</sup> defined their study, which is technically the same as our study, as SC by leaving the posterior wall. However, LC leaving the posterior wall in situ, which we also performed, is not SC. Because the sac has completely lost its function, the cystic duct is disabled, and the remaining sac part turns into a completely dysfunctional piece of tissue that remains without harming the body. Our study shows that the results of the LC procedure performed by leaving the posterior wall are not different from the standard LC, and it is a feasible method without switching to open operation.

## CONCLUSION

Performing laparoscopic cholecystectomy by leaving the posterior wall may be beneficial especially in cases with difficult bladder conditions and biliary tract variation, but also in patients with severe cirrhosis and severe portal hypertension, who are considered easy/normal LC but have abnormal vascularization of the sac bed. In such cases, although switching to open surgery is not considered a failure, LC can be performed by leaving the posterior wall in order not to disrupt the cosmetic appearance of the patients and to reduce the postoperative complications. The postoperative results of patients whose posterior wall was left in situ are not different from the results of LC surgery with the posterior wall removed.

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**Conflict of interest:** Nil

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