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RESEARCH ARTICLE

The Comparison of Two-port Laparoscopic Cholecystectomy Technique and Standard Four-port Technique

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ABSTRACT

Objective: One of the purposes of laparoscopic surgery is being minimally invasive. In this context, we compared sling suture-assisted two-port techniques with the standard four-port technique in laparoscopic cholecystectomy.

Materials and Methods: A retrospective clinical study was planned and 96 patients over 18 years of age with gallstone disease were recruited from Zeynep Kamil Women and Children's Diseases Training and Research Hospital between November 2019 and June 2021. Two-port laparoscopic cholecystectomy was performed in 48 patients (Group 1) and standard four-port laparoscopic cholecystectomy (Group 2) in other 48 patients. The duration of surgery, postoperative pain, cosmetic appearance, analgesic use, complication rates, the duration of hospital stay, and return to work times were compared.

Results: The largest stone diameter, sac wall thickness, number of attacks, and pain radiating to back (p=0.007, p=0.001, p=0.013, and p=0.010, respectively) were significantly higher in the Group 2 than in the Group 1. The operation time was significantly lower (p=0.026) in the Group 2. The Numerical Rating Scale was used to assess postoperative pain. Although the 3rd day score was significantly higher (p=0.02) in the Group 2, no difference was found in the 3rd week evaluation (p=0.115). In the Group 2, postoperative symptoms, non-steroidal anti-inflammatory drug use, duration of hospital stay, and time to return to work were significantly higher (p<0.001, p<0.001, p=0.034, and p<0.001, respectively).

Conclusion: For standard four-port cholecystectomy, the two-port and two-suture assisted technique is a good alternative for selected cases. It can be applied successfully and is cosmetically effective.

Keywords: Benign gallbladder disease, equipment, methods, minimally invasive surgery, two port laparoscopic cholecystectomy

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INTRODUCTION

Cholecystectomy is one of the most commonly performed abdominal surgical procedures across the world. Laparoscopic cholecystectomy is currently the gold standard treatment of symptomatic gallstone disease. Laparoscopic surgery is preferred for less postoperative pain, better cosmetic appearance, shorter length of hospital stay, and earlier return to work.[1,2]

Several new surgical techniques have been investigated for laparoscopic cholecystectomy. Of these, mini laparoscopic cholecystectomy has advantages such as decreased postoperative pain and better cosmesis, but it has disadvantages such as higher cost and a 10% rate of conversion to standard laparoscopic cholecystectomy.[3,4] The single incision approach has no advantages and is linked to a fourfold increase in the risk of incisional hernia.[5–7] Robot-assisted technique for benign gallbladder diseases does not provide any contribution to efficacy and safety.[8,9] Natural orifice transluminal endoscopic surgery has potential advantages such as no scarring and less postoperative patient discomfort, but there are some technical and equipment challenges.[10] Finally, two-port and suture-assisted laparoscopic cholecystectomy has better cosmetic results, lower cost, and lower incidence of postoperative pain.[11]

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The present study aimed to compare the two-port laparoscopic cholecystectomy surgery, which was chosen as a minimally invasive surgical intervention, with the standard four-port laparoscopic cholecystectomy surgery in terms of operative efficacy and clinical results.

MATERIALS and METHODS

This study was carried out at Zeynep Kamil Women and Children's Diseases Training and Research Hospital. The study design was approved by the Research Ethics Committee (Approval no. 40/2021), and written informed consent was obtained from all participants, in accordance with the Declaration of Helsinki.

The study comprised f 96 cases; 48 were subjected to two-port laparoscopic cholecystectomy and 48 to four-port laparoscopic cholecystectomy. The results were evaluated retrospectively. The study population included all patients with gallstone disease. Patients with normal gallbladder wall thickness, normal bile duct on ultrasound, and virgin abdomen were included in the study. The patients with a history of jaundice or suspicion of gallbladder malignancy and those who were not suitable for the technique of two ports and two sutures (the cases in which the gallbladder fundus could not be seen or in which the gallbladder wall thickness was severely increased, the patients that had a hydropic gallbladder appearance, and who had gallbladder with adhesion to the surrounding tissues) were excluded from the study. Patients were allocated to two-port or four-port groups consecutively. One group was operated by the two port technique, and one group with four port techniques.

Postoperatively, each patient was given paracetamol (500 mg tab, twice a day) and a non-steroidal anti-inflammatory drug (NSAID) with the same active ingredient (lornoxicam 8 mg tab, twice a day). Preferably, they were asked to take paracetamol. Those who needed to use NSAIDs were recorded. Duration of return to work and hospital stay were determined as the days. Postoperative complaints in both groups were analyzed and grouped. As a standard procedure, a 10 mm Jackson-Pratt (JP) drain was placed in all patients who were operated on; and a day after the operation, if there was no bile drainage, it was removed. Except for prophylaxis (1 g iv cefazolin), antibiotics were not given unless necessary. Preoperative ultrasonography was performed on all patients. Gallbladder wall thickness was measured, and those >3 mm were considered cholecystitis. The number of stones was specified as single or multiple, and the largest stone diameter was measured in millimeter. In addition, for differential diagnosis, esophagogastroduodenoscopy was recommended for each patient. Endoscopic gastric biopsy was performed on those who gave consent. Blood samples were tested for leukocytes, C-reactive protein, gamma-glutamyl transferase, lactate dehydrogenase, alkaline phosphatase, amylase, and total and direct bilirubin. The number of attacks was determined according to the patients who previously applied to the emergency department, were diagnosed with gallstone disease, and were given a prescription. The diagnosis was confirmed by examining the number of stones, the largest stone diameter, and cholecystitis status with post-operative pathologic examination. The operation time was starting to be recorded at the beginning of the dissection after the placement of the umbilical port in both groups. It was terminated by removing the gallbladder from the abdomen and calculated as minutes. The drain flow was measured in milliliter by draining the fluid in the measuring cup 24 h after the operation. The Numerical Rating Scale (NRS) was applied to the entire patient group 3 days and 3 weeks after the surgery. Bile duct injury, bile leakage, subcutaneous infection, and bleeding were evaluated as complications. The body mass index limit was determined as 33 for the patients with excess subcutaneous adipose tissue.

Statistical Analysis

In the descriptive statistics of the data, mean, standard deviation, median, minimum and maximum, frequency, and ratio values were used. The distribution of variables was measured with by the Kolmogorov–Smirnov test. Independent sample t-test and Mann–Whitney U test were used in the analysis of quantitative independent data. Chi-square test was used in the analysis of qualitative independent data, and conditions for Fisher's test application were not met. Analyses were performed with the SPSS 27.0 software (IBM SPSS, Inc., Armonk, NY, USA).

RESULTS

Two-port laparoscopic cholecystectomy (Group 1) was performed in 48 patients and standard four-port laparoscopic cholecystectomy (Group 2) in 48 patients. Demographic, biochemical, ultrasonographic, endoscopic, clinical, and pathological data of the study patients are shown in Table 1. Twenty-seven patients (28.1%) were operated on with a preliminary diagnosis of cholecystitis and 69 patients (71.9%) with a preliminary diagnosis of cholelithiasis. While 80 (83.3%) patients had multiple stones in the gallbladder, 16 (16.7%) patients had a single stone. The mean gallbladder wall thickness was 4.8±1.8 mm (range: 2–10 mm), and the mean stone diameter was 16±9.4 mm (range 2–40 mm). There were 63 (65.6%) patients whose prominent complaint was abdominal pain. This was followed by

Table 1. Demographic, biochemical, ultrasonoghraphic, endoscopic, clinic and pathological parameters of the two groups

	Port-II				Port-IV				p
	Mean±SD	n	%	Median	Mean±SD	n	%	Median	
Age	49.0±13.5			46.0	49.2±13.4			51.0	0.797 [m]
Gender									
Female		33	68.8			35	72.9		0.653 X^2
Male		15	31.3			13	27.1		
Comorbidity									
No		16	33.3			11	22.9		0.256 X^2
Yes		32	66.7			37	77.1		
Diabetes Mellitus		5	15.6			7	18.9		
Cancer		1	3.1			1	2.7		
Essential hypertension		5	15.6			11	29.7		
Hypertriglyceridemia		1	3.1			3	8.1		
Coronary artery disease		2	6.3			6	16.2		
Others		18	56.3			9	24.3		
Diagnosis									
Cholelithiasis		37	77.1			32	66.7		0.256 X^2
Cholecystitis		11	22.9			16	33.3		
Largest stone diameter (mm)	14.0±10.2				17.9±8.1			16.0	**0.007** [m]
Gallbladder wall thickness (mm)	4.3±1.7				5.3±1.7			5.0	**0.001** [m]
Number of stones									
Single		9	18.8			7	14.6		0.584 X^2
Multiple		39	81.3			41	85.4		
Number of attacks									
I		24	50.0			18	37.5		**0.013** X^2
II		16	33.3			9	18.8		
≥III		8	16.7			21	43.8		
Symptom									
Stomachache		36	75.0			27	56.3		0.013 X^2
Nausea		11	22.9			11	22.9		
Back pain		1	2.1			10	20.8		
Pre-operative gastroscopy									
Yes		34	70.8			41	85.4		0.084 X^2
No		14	29.2			7	14.6		
Gastroscopic diagnosis									
Acute gastritis		4	11.8			2	4.9		0.401 X^2
Chronic gastritis		14	41.2			24	58.5		0.205 X^2
Peptic ulcer		1	2.9			3	7.3		0.529 X^2
Gastropathy		15	44.1			12	29.3		0.274 X^2
Pathology result									
Acute cholecystitis		5	10.4			7	14.6		0.129 X^2
Chronic cholecystitis		29	60.4			35	72.9		
Cholelithiasis		14	29.2			6	12.5		

Table 1. Cont.

	Port-II				Port-IV				p	
	Mean±SD	n	%	Median	Mean±SD	n	%	Median		
Leukocyte (x10^3)	9.3±3.0				9.9±2.4				0.299	t
C-Reactive protein	2.8±2.3				2.9±1.2				0.076	m
Gamma-glutamyl transferase	56.5±59.4				55.8±27.0				0.051	m
Lactate dehydrogenase	189.6±65.9				192.6±115.5				0.980	m
Alkaline phosphatase	95.8±72.4				94.4±56.1				0.344	m
Total bilirubin	0.82±0.28				0.90±0.29				0.184	t
Direct bilirubin	0.59±0.26				0.66±0.28				0.197	t
Amylase	51.6±23.1				59.6±20.1				0.075	t

m: Mann–Whitney U test; X^2: Ki-kare test(Fischer test); t: Independent sample t test. SD: Standard deviation

nausea and bloating in 22 (22.9%) patients and back pain in 11 (11.5%) patients. The largest stone diameter, sac wall thickness, number of attacks, and the rate of radiating back pain (p=0.007, p=0.001, p=0.013, and p=0.010, respectively) were significantly higher in the Group 2 than in Group 1 (Table 1). The mean operation time in the whole group was 60.7±10.4 (range 38–86) min. The operation time was significantly lower in the Group 2 (p=0.026). Although the NRS score on the third day was significantly higher in the Group 2 (p=0.02), there was no difference in the 3rd week NRS scores (p=0.115). Fifty-seven (59.4%) patients had complaints after surgery, whereas 39 (40.6%) patients did not have any complaints. The most common complaint was indigestion and bloating observed in 33 (57.9%) patients. Twenty (35.1%) patients had pain at the port sites and four (7%) patients had back pain. The postoperative complaint rate was significantly higher in the Group 2 (p<0.001). The mean time to return to work was 7.2±2.7 (range: 4–21) days. The number of patients who stayed in the hospital for 1 day was 72 (75%). Twenty-three (24%) patients stayed for 2 days, and one (1%) patient with bile leakage stayed longer than 3 days. The rate of postoperative non-steroidal anti-inflammatory drug use, the duration of hospital stay, and postoperative return to work time were significantly higher in the Group 2 (p<0.001, p=0.034, and p<0.001, respectively) (Table 2). The postoperative antibiotic was prescribed for one patient. Complications developed in seven (7.3%) patients, including six subcutaneous infections and one bile leakage.

DISCUSSION

Gallstone disease affects about 9% of women and 6% of men.[12] It is mostly asymptomatic and is discovered incidentally. Treatment is determined according to the patient's symptoms, the results of imaging tests, and the development of complications.[13] The present study aimed to compare the standard laparoscopic four-port cholecystectomy technique with the two-port cholecystectomy technique.

In this comparative study, a better cosmetic appearance was achieved with a two-port and suture-assisted laparoscopic collet system with reduced hospital cost and no special tools. In addition, the researchers found lower postoperative pain, higher patient satisfaction, less need for NSAID use, shorter return-to-work time, and shorter hospital stay. The largest stone diameter, gallbladder wall thickness, and the number of attacks were significantly higher in the in the standard technique group. It is considered that, as the frequency and practice of the technique improve, it can be safely applied to more difficult cases.

Various techniques for two-port laparoscopic cholecystectomy have been described in the literature. The technique performed by Ramachandran et al.,[11] with two ports and three multifilament suture materials, is quite similar to the technique we used in our study. Similar to our study, it was reported that the two-port group required fewer analgesics and shortened hospital stay. It was concluded that the oral food intake was earlier in the post-operative two-port group, and there was no difference in terms of operating time. Hajong and Khariong.[14] compared the technique performed with three-port, single-multifilament suture material and the technique with two-port, two-multifilament suture material. They observed less pain, better cosmetic appearance, and shorter hospital stay in the two-port group. On the other hand, there was no difference between the two groups regarding operative time. The study indicated that better results could be obtained by reducing the number of ports.

Table 2. Results of the compared parameters of two groups

	Port- II				Port- IV				p
	Mean±SD	n	%	Median	Mean±SD	n	%	Median	
Operation time (min)	63.0±10.3			62.0	58.3±10.0			60.0	**0.026** [t]
The numerical rating scale day 3	2.17±1.15			2.00	3.02±1.49			3.00	**0.002** [m]
The numerical rating scale week 3	0.52±0.62			0.00	0.73±0.68			1.00	0.115 [m]
Drain flow (ml)	33.8±10.8			30.0	34.7±7.0			35.0	0.276 [m]
Postoperative antibiotics?									
No		48	100.0			47	97.9		1.000 X^2
Yes		0				1	2.1		
Postoperative symptoms?									
No		29	60.4			10	20.8		**0.001** X^2
Yes		19	39.6			38	79.2		
Pain at port sides		6	31.6			14	36.8		
Back pain		0				4	10.5		
Indigestion		13	68.4			20	52.6		
Analgesic preference									
NSAID		11	22.9			33	68.8		**0.001** X^2
Paracetamol		37	77.1			15	31.3		
Complication									
(-)		45	93.8			44	91.7		0.695 X^2
(+)		3	6.3			4	8.3		
Bile leakage		0				1	25.0		
Wound infection		3	100.0			3	75.0		
Hospitalization period									
I		41	85.4			31	64.6		**0.034** X^2
II		7	14.6			16	33.3		
≥III		0	0.0			1	2.1		
Return to work time (days)	6.2±2.3			5.0	8.3± 2.8			8.0	**0.001** [m]

[t]: Independent sample t test; [m]: Mann-whitney u test; X^2: Ki-kare test(Fischer test). SD: Standard deviation; NSAID: Non-steroidal anti-inflammatory drugs

Lee et al.[15] reported that there was no difference in terms of operating time in the two-port techniques, the length of hospital stay, and complication rates were similar, and more JP drains were used in the four-port group. Umbilical hernia rates are not usually specified during the long follow-up period. Drains are used selectively. Considering that the drain may have an effect on pain, a routine JP drain was placed in each patient in our study. It was useful to understand whether the dissection would be effective on the rate of drainage flow between the two groups, and no difference was found between the groups. Justo Janeiro et al.[16] compared single, two, and three port laparoscopic cholecystectomy and concluded that a single-port does not provide any advantages in terms of pain. In their two mini-incision technique, Tavassoli et al.[17] showed that the average operating time was 2 min longer, the pain rate was significantly lower, the patient satisfaction was higher, and the time to return to work was shorter. Similarly, in our study, there is an average of 2 min of significant difference between the two port techniques in terms of operating time. It is considered that the difference is acceptable and can easily be made up with experience. Poon et al.[18] used an optical system that can pass through an 11 mm port, which the working port is advanced. This technique system is difficult to reach in every operating room. Similar to the studies in our technique, no transition to open surgery and no perioperative gallbladder perforation were observed. The bile leak from the duct of Luschka developed in one patient in the four-port group due to the dislocation of the endo-clip. None of the

patients in the two-port technique group underwent standard four-port cholecystectomy. Two-port technique could be applied easily after a small number of surgical interventions during the learning curve. And also, if necessary, it would not be difficult to convert to the standard four-port technique or open surgery during the application of this technique.

Unlike other studies, the endoscopic examination could be performed in 78.1% of the patients. Chronic gastritis was found simultaneously in 41.17% of the patients in the two-port group and 58.5% of the four-port group (Table 1). Preoperative upper endoscopy should be recommended for all patients to reduce postoperative complaints.

The fact that the NSR score in the 3rd week, except for the 3rd day, provided information about the pain status in the long term. While there was a significant difference in favor of the two-port groups on the 3rd day, this was not observed in the 3rd week (Table 2). In addition, our study found that the need for NSAIDs is significantly lower in the two-port technique. It can be concluded that, as the number of ports decreases, the rate of pain decreases. However, our study did not examine post-operative oral food intake.

The study has some limitations. All surgeries were performed by one experienced surgeon, and the evaluation was made retrospectively. Future prospective, multicenter studies might increase the reliability of the technique. Surgeons who have reached a certain level of experience by applying the technique have gained valuable experience. The more the technique was applied, the shorter the operation time. Furthermore, more complicated cases can be operated in a highly selected patient population. In this regard, there is a significant difference in favor of the four-port group in our study. Initial concerns were the involuntary inclusion of people with larger stone diameters, a greater wall thickness, and a high number of attacks in the standard technique. To prevent this bias, the patient must be selected by another surgeon and the performer must be blind. The fact that some patients stayed in the hospital for more than 1 day was due to the hospital conditions at the time of the study and the experience of the surgeon. It is considered that, when a similar study is conducted in appropriate centers, there will be no difference between the lengths of hospital stay. It would be useful to employ an objective assessment scale for cosmesis outcome. In our study, this inference could be made subjectively according to the patient's opinion.

With less postoperative pain, the length of hospital stay and return to work can be shortened, and the damage caused by loss of workforce can be reduced.

CONCLUSION

It is valuable for both the surgeon and the patient to facilitate the application of frequently performed surgical interventions without increasing the complication rates. In conclusion, the two-port laparoscopic cholecystectomy technique may be an alternative to the standard four-port technique in highly selected cases in terms of operative efficacy and clinical outcomes.

Disclosures

Ethics Committee Approval: The study was approved by the Zeynep Kamil Gynecology and Pediatrics Training and Research Hospital Clinical Research Ethics Committee (No: 40, Date: 17/02/2021).

Informed Consent: Written informed consent was obtained from all patients.

Peer-review: Externally peer reviewed.

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