

## Three-port versus Four-port Laparoscopic Cholecystectomy

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### ABSTRACT

**Background:** The preferred course of treatment for symptomatic gallstone disease includes cholecystectomy due to both therapeutic reasons and secondary prevention of recurring gallstone-related problems.

**Objectives:** This study examined the effectiveness, safety, and practicability of three- and four-port lap cholecystectomy: The intraoperative and postoperative complications of 3 port and 4 port lap cholecystectomies are compared: Days spent in the hospital, or operational time. Intraoperative and postoperative complications, as well as postoperative pain {by VAS visual analog scale}.

**Patients and methods:** At Assiut University Hospitals' Department of General Surgery, a randomized controlled study was done.

**Results:** Both groups had significant difference ( $p > 0.001$ ) as regard patient's satisfaction where good, average and poor satisfaction present in 47 (94%), 2 (4%) and 1 (2%) patients of 3-port Laparoscopic Cholecystectomy (LC) group and present in 27 (54%), 21 (42%) and 2 (4%) patients of 4-port LC group.

**Conclusion:** Three in terms of procedure and morbidity outcomes, the one-port laparoscopic cholecystectomy is comparable to the four-port approach. Additionally, it might lead to less postoperative discomfort, a shorter stay in the hospital, and a quicker return to normal activities.

**Keywords:** Cholecystectomy, laparoscopic, gall stones, conventional.

### INTRODUCTION

When treating acute calculus cholecystitis and biliary colic, as well as for secondary prevention of recurrent gallstone-related problems, the recommended course of treatment for symptomatic gallstone disease was cholecystectomy<sup>(1)</sup>. During a standard laparoscopic cholecystectomy, four ports are inserted: sub-umbilical, sub-xiphoid, right subcostal, and right lumbar<sup>(2)</sup>.

With more experienced surgeons, laparoscopic cholecystectomy has seen substantial advances, including a decrease in port size and number. In order to reveal the Calot's triangle, the fourth port is either utilised to retract the liver (French technique) or to grip the gallbladder fundus and drag it upward and outward (American technique)<sup>(3)</sup>. Many surgeons realized that the most lateral port in laparoscopic cholecystectomy had a minimal impact as their familiarity with using four ports increased. The result was, they decided to perform the treatment with just three ports, which was simple to execute, and remove the one that was the most lateral<sup>(4)</sup>. If a fourth port is required, this three-port approach is deemed to have failed<sup>(5)</sup>.

### PATIENTS AND METHODS

At Assiut University Hospitals' Department of General Surgery, a randomized controlled experiment was carried out.

**Inclusion criteria:** Any patient with clinical, laboratory and/or radiological evidence that candidate for cholecystectomy operation were enrolled in the study with age between 25 and 65 years' old

**Exclusion criteria:** Choledocholithiasis, severe acute calculus pancreatitis, severe co-morbid diseases (uncontrolled diabetes, hypertension, and severe direct hyperbilirubinemia), prior surgery or adhesion, radical

cholecystectomy, and the patient's refusal are all factors that should be taken into consideration.

### Ethical Approval:

**The Assiut University Ethics Board approved the study, and the patients received all the information they require on the trial. Each study participant provided their signed consent after receiving full information. The Declaration of Helsinki, the code of ethics of the World Medical Association, was followed when conducting this research on humans. Identifier: NCT04107909**

**Sample size and randomization:** Based on identifying the primary outcome variable, it is expected that a sample size of at least 100 patients is needed (50 in each group). Using G\*power software 3.1.9.2, the sample size was determined under the following presumptions:

Operating time is a key factor in the outcome. According to a prior study, the operating time for patients having a 3 port cholecystectomy was 47.3 29.8 minutes, whereas the time for patients having a 4 port procedure was 60.8 32.3 minutes. The primary statistical test used to identify operation time differences between the two groups was the t-test. Alpha error is 0.05, power is 0.80, effect size is 0.43, and allocation ratio is 1.

But secondary to low frequency of LC in our setting, it was expected that a total of 100 cases would be operated during the study period. Hence, the total expected ample size is about 100 cases: 50 cases in each group. The patients are divided into treatment groups in a 1:1 ratio using a computer-generated table of random numbers. Patients were allocated to the appropriate therapy group in numerical order after providing their

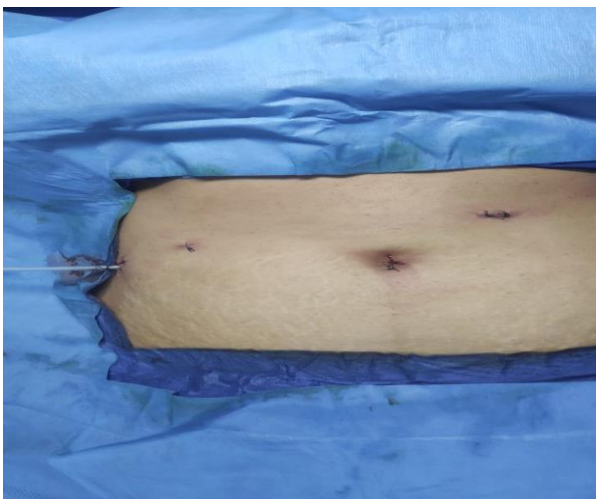
informed permission at the time of enrolment. To create the randomization list, permuted blocked randomization was used online. So, we had two groups in the study: Group I included patients who underwent 3 ports LC (n= 50 patients). Group II included patients who underwent 4 port LC (n= 50 patients).

### Methodology

For the current study, 100 cholelithiasis patients between the ages of 25 and 60 who were admitted to the Assiut University Hospitals' Department of General Surgery were included. These patients were randomised into two groups at random: group I had 50 patients undergo a three-port LC, while group II had 50 patients undergo a four-port LC. In the current investigation, there were negligible baseline data differences between the two groups. It was discovered that the majority of patients had several gall bladder stones and ongoing symptoms. Moreover, women made up the majority in both groups. According to a prior study of 90 patients, which is consistent with the present findings, the majority of the patients were women (77.8%) between the ages of 40 and 50. There were 7.2 more women than men altogether. The two groups' distributions of age and gender were quite comparable (7).

**Preoperative assessment:** All patients were subjected to thorough history taking (age, sex, symptoms and duration of symptoms) and full clinical evaluation. Abdominal ultrasound was done in all patients. Baseline laboratory (complete blood count and coagulation profile) was ordered in all patients.

**Operative procedure:** The patient is positioned supine for both types of laparoscopic surgery—four port and three port—with the surgeon and assistant on the patient's left side and the monitor on their right. In both groups, the head up and right up positions are used during surgery. Open Hassan's technique is used to produce pneumoperitoneum through the umbilical port at a pressure of 12 mmHg. (Figure 1).



**Figure (1) sites of ports in 4 port method post-operative**

**Three-port method:** One 5 mm trocar (right mid clavicular subcostal area) and two 10 mm trocars (one in the supraumbilical region for the camera port and one in the epigastrium for the functioning port) were placed. The third port was then used to enter a gripping forceps, which was then moved back and forth or side to side to reveal the Calot's triangle.

**Four port technique:** The ports on the anterior axillary line of the right flank received a fifth 5mm port. In order to assist in the dissection of the Calot's triangle and provide the gall bladder traction, this was employed to grab the fundus of the gall bladder. The final steps were conducted in a manner similar to that of the three-port approach. Figure (2)



**Figure (2) clipping of cystic artery**

**Postoperative:** Following surgery, the patients were instructed to fast for six hours before being given beverages on the operating table. There was no day-care surgery. Once the patient was taking oral medications effectively, they were released. Patients who had drains in place were released when the drains were taken out. When the effluent was clear and contained less than 2ml/kg, the drains were removed.

### Evaluation:

The duration of the procedure was compared between the two groups from the time of the initial skin incision to the time of skin closure. Arguments in favour of changing from a laparoscopic to an open cholecystectomy and from a three-port to a four-port surgery, respectively. Starting on the day of surgery and ending on the day of hospital release, early ambulation, and return to work cosmetics, the time period was covered. This was learned by probing questions of the patients, insightful questions regarding the scar's prognosis at the follow-up visit after a month. Biliary spilling, intraoperative haemorrhage, issues, and drain implantation were among the intraoperative variables. It was classified as either patient satisfied, moderately satisfied, or not satisfied, depending on the degree of the patient's contentment.

**Statistical analysis**

The recorded data were examined using statistical software for social sciences, version 20.0. (SPSS Inc., Chicago, Illinois, USA).

The Student t test was used to express and compare the mean and Standard Deviation (SD) of quantitative data. To compare qualitative data that was presented as frequency and percentage, Chi2 tests were conducted. As the level of confidence was maintained at 95%, a P value of 0.05 was considered significant.

**RESULTS**

Both groups of patients had insignificant differences as regard age ( $36.88 \pm 7.94$  vs.  $36.18 \pm 8.44$

(years);  $p= 0.67$ ) and body mass index ( $25.43 \pm 2.71$  vs.  $26.21 \pm 3.92$  ( $\text{kg}/\text{m}^2$ );  $p= 0.24$ ). Majority of patients in both groups were females and had ASA class I.

Three patients of 3-port LC and four patients of 4-port LC were present with acute symptoms while 45 (90%) patients in each group had chronic symptoms.

Ultrasound revealed that majority of both groups had multiple gall bladder stones while only 10 (20%) patients of 3-port LC and 6 (12%) patients of 4-port LC had single gall bladder stone. Both groups had insignificant differences regarding baseline data ( $p> 0.05$ ).

**Table 1: Baseline characteristics of studied patients**

	<b>3-port LC (n= 50)</b>	<b>4-port LC (n= 50)</b>	<b>P value</b>
Age (years)	$36.88 \pm 7.94$	$36.18 \pm 8.44$	0.67
Sex			0.21
Male	24 (48%)	19 (38%)	
Female	26 (52%)	31 (62%)	
Body mass index ( $\text{kg}/\text{m}^2$ )	$25.43 \pm 2.71$	$26.21 \pm 3.92$	0.24
ASA			0.39
Class I	41 (82%)	43 (86%)	
Class II	9 (18%)	7 (14%)	
Ultrasound findings			0.20
Single stone	10 (20%)	6 (12%)	
Multiple stones	40 (80%)	44 (88%)	
Acute symptoms	3 (6%)	4 (8%)	0.50
Chronic symptoms	45 (90%)	45 (90%)	0.63

Data expressed as frequency (percentage), mean (SD). P value was significant if  $< 0.05$ . LC: laparoscopic cholecystectomy; ASA: American society of anesthesiologist

It was found that 3-port LC had significantly lower VAS at 6 hours post-operative ( $5.76 \pm 0.92$  vs.  $6.20 \pm 0.99$ ;  $p= 0.01$ ) and VAS at 24-hour post-operative ( $2.76 \pm 0.91$  vs.  $3.66 \pm 0.76$ ;  $p= 0.02$ ). Also, diclofenac ampule need was significantly lower in 3-port LC group ( $3.35 \pm 0.90$  vs.  $3.80 \pm 0.76$  (amp);  $p< 0.001$ ).

**Table 2: Hospital stay and post-operative complications and pain in studied groups**

	<b>3-port LC (n= 50)</b>	<b>4-port LC (n= 50)</b>	<b>P value</b>
VAS at 6 hour post-operative	$5.76 \pm 0.92$	$6.20 \pm 0.99$	<b>0.01</b>
VAS at 24 hour post-operative	$2.76 \pm 0.91$	$3.66 \pm 0.76$	<b>0.02</b>
Diclofenac ampule (amp)	$3.35 \pm 0.90$	$3.80 \pm 0.76$	<b>&lt; 0.001</b>
Wound infection	2 (4%)	2 (4%)	0.69
Abdomen pain	2 (4%)	3 (6%)	0.50
Port site bleeding	0	2 (4%)	0.24
Paralytic ileus	2 (4%)	1 (2%)	0.50
Hospital stay (h)	$33.32 \pm 9.31$	$35.40 \pm 7.27$	0.25

Data expressed as frequency (percentage), mean (SD). P value was significant if  $< 0.05$ . LC: laparoscopic cholecystectomy; VAS: visual analogue score

Both groups had significant difference ( $p> 0.001$ ) as regard patient's satisfaction where good, average and poor satisfaction present in 47 (94%), 2 (4%) and 1 (2%) patients of 3-port LC group and present in 27 (54%), 21 (42%) and 2 (4%) patients of 4-port LC group. Return to daily activity was insignificantly earlier among 3-port LC group ( $6.35 \pm 0.90$  vs.  $6.70 \pm 0.56$  (day);  $p= 0.86$ ).

**Table 3: Patient's satisfaction and time to return to daily activity among groups**

	3-port LC (n= 50)	4-port LC (n= 50)	P value
Return to daily activity (day)	6.35 ± 0.90	6.70 ± 0.56	0.86
Patient's satisfaction			< 0.001
Good	47 (94%)	27 (54%)	
Average	2 (4%)	21 (42%)	
Poor	1 (2%)	2 (4%)	

Data expressed as frequency (percentage), mean (SD). P value was significant if < 0.05. LC: laparoscopic cholecystectomy.

## DISCUSSION

A three-port laparoscopic cholecystectomy has been implemented in place of the customary four-port method. The three-port method does not use the fourth or lateral port, which is frequently used to withdraw the fundus of the gallbladder (6).

The bulk of gall stone disease-afflicted women are in their middle years. Oestrogen hormone has only recently been linked to the pathophysiology in a few studies. In all groups, the majority of patients had many calculi and lingering symptoms (8). The current study found that the mean operative time for the 4-port LC was only marginally longer (46.78 5.93 vs. 47.56 5.70 (minute); p=0.85). Additionally, there were no statistically significant differences between the two groups for intraoperative complications including bile leakage (12% vs. 16%; p=0.38), cystic artery haemorrhage (6% vs. 4%; p=0.50), or bile duct damage (4% vs. 4%; p=0.69). The results of the current study are supported by a recent meta-analysis that included 2111 patients from 13 trials and found no difference in the length of the procedure between the two groups (6). Additionally, **Kumar et al.** discovered that the four-port group's mean operative time was somewhat shorter than the three-port group's (6). It may be easier to dissect the Calot's triangle using the fourth port because the gall bladder has been laterally retracted and is now more visible (7).

Contrarily, Garge et al. asserted that the time needed to conduct a 3-port and 4-port laparoscopic cholecystectomy would be a maximum of 65 minutes and 30 minutes, respectively (9). In Group 4-port LC, all patients had procedures finished in less than 80 minutes. In Group 3-port LC, 17 patients (57%) needed more than 80 minutes of surgery. Between the two groups, there is a statistically significant difference in the mean operative time (10). While in our study it was measured as the time from the skin incision to closure, the variation in operating time between the two studies is attributable to various criteria utilised by surgeons for operative time. Additionally, as the surgeons' proficiency with both approaches increases, the duration of the procedure is getting shorter. (11).

As per the ongoing review's discoveries, there was no way to see a distinction in the quantity of issues between the two gatherings, which is in accordance with prior examinations. However, the three-port gathering had somewhat less drains than the four-port gathering.

The more noteworthy number of patients with grips in the Calot's triangle in the four-port gathering could be the explanation (7). There were no massive contrasts between the two gatherings when it came to the absolute number of exploration members who required change to open cholecystectomy (5%) (two patients from 3-port LC and three patients from 4-port LC). Looking at 2150 patients from 12 examinations uncovered no distinctions between the two gatherings in the probability of changing over completely to open a medical procedure, as per the ongoing review (6).

As per the consequences of the ongoing research, 41 cases in the three-port gathering were sufficiently settled without the requirement for change. Three patients went through a four-port activity and one went through an open cholecystectomy. Three patients in the four-port gathering should have been done as open cholecystectomy. This result needed factual importance (7). Comparative discoveries were tracked down by numerous journalists in different examinations (10-12). Regarding postoperative torment and difficulties, it was found that 3-port LC had altogether lower VAS at 6 hours post-usable (5.76 ± 0.92 versus 6.20 ± 0.99; p= 0.01) and VAS at 24-hour postoperative (2.76 ± 0.91 vs. 3.66 ± 0.76; p= 0.02). Likewise, diclofenac ampule need was altogether lower in 3-port LC bunch (3.35 ± 0.90 versus 3.80 ± 0.76 (amp); p< 0.001). Also, the on-going investigation discovered that two patients in each gathering had twisted contamination while port site draining announced in just two patients of 4-port LC. Disabled ileus happened in two patients of 3-port LC gathering and one patient of 4-port LC bunch. The two gatherings had immaterial distinction in regards to clinic stay (33.32 ± 9.31 versus 35.40 ± 7.27 (hours); p= 0.25). Our work revealed that the two gatherings had tremendous contrast (p> 0.001) as respect patient's fulfilment where great, normal and unfortunate fulfilment present in 47 (94%), 2 (4%) and 1 (2%) patients of 3-port LC gathering and present in 27 (54%), 21 (42%) and 2 (4%) patients of 4-port LC bunch. Get back to day to day action was inconsequential before among 3-port LC bunch (6.35 ± 0.90 versus 6.70 ± 0.56 (day); p= 0.86). The length of getting back to work and ordinary exercises was measurably more limited in the three-port gathering as well as postoperative agony at 6 and 24 hours and pain relieving use. The three-port gathering's mean medical

clinic stay length was in like manner somewhat more limited <sup>(7)</sup>.

Moreover, **Hajibandeh et al.** discoveries showing the 3-port gathering had a lower VAS torment score 24 hours after medical procedure were steady with the ongoing discoveries<sup>(10)</sup>. The examiners likewise found no distinction in emergency clinic stay term between the two gatherings. In the 3-port gathering, how much time expected to continue typical exercises was diminished <sup>(6)</sup>. Patients were examined concerning their viewpoints on their various techniques during the postoperative period, while they were in the emergency clinic, and at follow-up visits at multi week, multi month, 2 months, and 90 days. Improvement in side effects, a re-visitation of ordinary activity, and corrective results were among the elements thought of. Over 77% of patients in the two gatherings felt that their singular activities worked out in a good way. Just 18% of the patients gave their activities excellent grades; however nobody communicated disillusionment with the outcomes. There is no measurably massive distinction between the two gatherings' patient encounters in such manner <sup>(10)</sup>.

This implies that the three-port gathering had extensively higher generally quiet fulfilment with connection to scar result. The patients in the four-port gathering knew that there was plausible of decreasing how much scars, which the essential element was adding to their fractional fulfilment <sup>(7)</sup>.

## CONCLUSION

In terms of procedural and morbidity outcomes, the three-port laparoscopic cholecystectomy is comparable to the four-port procedure in an elective setting with uncomplicated cholelithiasis as the justification for cholecystectomy. It may also resulted in less postoperative pain, a shorter hospital stay, and a quicker return to normal activities. It's still unclear how the data stacks up in emergency scenarios versus those with life-threatening conditions.

## DECLARATIONS

- **Consent for publication:** I attest that all authors have agreed to submit the work.

- **Availability of data and material:** Available
- **Competing interests:** None
- **Funding:** No fund
- **Conflicts of interest:** no conflicts of interest.

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