

Comparison of three-port versus four-port laparoscopic cholecystectomy



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Submission: 15-06-2023

Revision: 15-11-2023

Publication: 01-01-2024

ABSTRACT

Background: In the era of laparoscopic surgery, early recovery and less post-operative pain are major goals to improve patient care and cut down cost. Several studies have demonstrated less post-operative pain and early recovery with the reduction in size and number of ports. **Aims and Objectives:** To compare three-port laparoscopic cholecystectomy (LC) with four-port LC in chronic calculous cholecystitis patients. We compared the feasibility of the procedure, total operative time, intraoperative difficulties, post-operative pain, incidence of complications, and cosmetic results. **Materials and Methods:** The study was done in Maharani Laxmi Bal Medical College, Jhansi, between April 2021 and November 2022, including 2 groups of patients (Group A-50 patients of three-port LC and Group B-50 patients of four-port LC). **Results:** Most of the participants were from 18 to 30 years (32%, 38%) and 31 to 40 years (30%, 12%) in both the groups. The mean duration of surgery in three-port and four-port group was 41.64 ± 6.972 and 42.22 ± 13.784 min, respectively ($p=0.79$). Hospital stay was three-port and four-port group was 3.33 ± 0.789 and 3.86 ± 0.707 days, respectively ($p=0.0001$). 100 patients were included, with 2085 patients. The mean age of the studied patients was 46.38 years with female preponderance. The mean operative time for three ports was 66.90 min and for four ports, it was 75.45 min. The mean duration of post-operative stay for three-port was 4.66, and for the conventional group, it was 5.30. **Conclusion:** Three-port lap cholecystectomy can be advocated to be better than the 4-port technique, but especially in experienced hands, and 4-port LC is better for beginners.

Key words: Abdominal wall; Incisional hernia; Repair

INTRODUCTION

Gallbladder is a pear-shaped helping digestive organ located in the right upper abdomen. The functions of the gall bladder include storage, concentration, and release of bile into the intestine by simultaneous contraction of the gall bladder.

Gallbladder disease is the most common digestive problem that may require hospitalization. Stones in the gall bladder (cholelithiasis) are quite common in adults, with the prevalence in India being 4.3%. In India, the prevalence of gallstones or cholelithiasis ranges from 10% to 20% in the adult population.¹

For both chronic and acute calculus cholecystitis, which are the complications of cholelithiasis, the standard treatment

of choice is laparoscopic cholecystectomy (LC) with reduced post-operative morbidity, complication rate, and quicker post-operative recovery, but carries a small increase in the rate of conversion. Hence, they are also included in the study. Hence, the standard treatment of choice for high-risk asymptomatic cholelithiasis, symptomatic cholelithiasis, chronic calculus cholelithiasis, and acute calculus cholelithiasis is LC. The standard LC is done using 4 ports. The fourth (lateral) port is used to grasp the fundus of the gallbladder so as to expose Calot's triangle. It is also seen that in experienced surgeon hand, many refinements in LC has been tried, which include a reduction in port size. It has that cholecystectomy can be done safely without using the 4 ports. By cooperative manipulation of the operative port instruments, Calot's triangle is exposed, dissected, and the gall bladder is dissected from the gall bladder bed.

Access this article online

Website:

<http://nepjol.info/index.php/AJMS>

DOI: 10.3126/ajms.v15i1.55752

E-ISSN: 2091-0576

P-ISSN: 2467-9100

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Table 1: Age distribution in study group

Age (in years)	Group A (3-port lap. chole.)		Group B (4-port lap. chole.)	
	Number	Percentage	Number	Percentage
18–30 years	16	32.00	19	38.00
31–40 years	15	30.00	06	12.00
41–50 years	08	16.00	08	16.00
51–60 years	06	12.00	11	22.00
>60 years	05	10.00	06	12.00
Total	50	100	50	100

Hence completing LC in 3 ports only. Several studies have reported that 3-port LC is technically possible.²

Aims and objectives

- To compare three-port LC with four-port LC in chronic calculous cholecystitis patients.
- We compared the feasibility of the procedure, total operative time, intraoperative difficulties, post-operative pain, incidence of complications, and cosmetic results.

MATERIALS AND METHODS

Source of data

The prospective study was done in Maharani Laxmi Bal Medical College, Jhansi between April 2021 and November 2022 including 2 group of patients. Each group of 100 patients, i.e.,

- Group A (50) patients of three-port LC
- Group B (50) patients of four-port LC

Inclusion criteria

- Age >18 years
- Acute calculus cholecystitis
- Chronic calculus cholecystitis
- Cholelithiasis
- Controlled DM, HT, obesity, hypothyroidism

Exclusion criteria

- Gallstone pancreatitis
- Empyema of gallbladder
- Mucocele of gallbladder
- Acute cholecystitis with mass formation
- Conversion from laparoscopic to open cholecystectomy
- CBD stone
- Coexistent other diseases for which surgery will done
- Pregnancy
- Malignancy

LC techniques

The three-port technique involves inserting a 10 mm trocar (bladeless trocar - Johnson and Johnson) just above the umbilicus using the open technique (Hasson's technique) through which the zero viewing videoscope (olympus)

Table 2: Mean age distribution in study group

Mean age (in years)	Group A (3-port lap. chole.)	Group B (4-port lap. chole.)	P-value
Mean±SD	39.38±13.406	41.06±16.360	0.58

Table 3: Sex-wise distribution in study group

Sex	Group A (3-port lap. chole.)		Group B (4-port lap. chole.)	
	Number	Percentage	Number	Percentage
Male	34	68.00	27	54.00
Female	16	32.00	23	46.00
Total	50	100	50	100

was introduced. Another 10 mm trocar (Endopath Tristar trocar - Johnson and Johnson) was inserted 3 cm below the xiphisternum; and finally, a 5 mm trocar (Endopath Tristar trocar) at the right hypochondrium anterior axillary line 3 cm below the costal margin. The operating surgeon conducted the procedure from the left side of the patient, together with the assistant holding the camera while the TV monitor was located on the upper left side of the patient and the nurse on the lower left side of the patient. The operating surgeon holds the dissecting instruments with his right hand through the 10 mm trocar while holding the gall bladder at the infundibulum with a grasper through the 5 mm trocar, moving the infundibulum right and left or back and forth to display Calot's triangle, blunt dissection was used for adequate display of the cystic duct and cystic artery. The cystic duct was then clipped and divided followed by the cystic artery. The gall bladder was then dissected from its bed and extracted from either the umbilical or the sub xiphisternal ports. IOC was performed through the 10 mm sub-xiphisternal trocar.

The four-port LC was performed using the North American "flip over" technique.

Post-operative analgesia requirement

After surgery, patients were taken to the post-anesthesia care unit after which they were taken to the inpatient ward, where they were given analgesics (pethidine and/or diclofenac) unless allergies or specific contraindications were noted. Patients received their analgesics according to

Table 4: VAS pain score after surgery in study group

VAS pain score before surgery and after surgery	Group A (3-port) (mean±SD)	Group B (4-port) (mean±SD)	P-value
Day 1 after surgery	3.30±0.463	3.59±0.610	0.008
Day 2 after surgery	1.36±0.485	1.66±0.519	0.004

VAS: Visual Analog Scale, SD: Standard deviation

Table 5: Analgesia requirement in dose (1 dose=75 mg diclofenac sodium given i.m.) in study group

Analgesia requirement (in dose)	Group A (3-port lap. chole.)		Group B (4-port lap. chole.)	
	No. of patients	Percentage	No. of patients	Percentage
1 dose	32	64.00	16	32.00
2 dose	16	32.00	17	34.00
3 dose	02	04.00	12	24.00
4 dose	00	00.00	05	10.00
Mean±standard deviation	1.40±0.571		2.12±0.982	
P-value	0.0001 (S)			

their pain ratings measured by nursing staff using the verbal rating scale. The total amount of analgesia required by each patient was calculated over 48 h after surgery. Discharge from the hospital was made as a joint decision between nursing staff, the surgical team, and patients using an early discharge planning rating scale applied by the department of surgery in the hospital.

Statistical analysis

The statistical software SPSS version 26.0 was used for the analysis of the data, and Microsoft Word and Excel have been used to generate graphs and tables. Student *t*-test (two-tailed, independent) has been used to find the significance of study parameters on a continuous scale between two groups. Chi-square/Fisher's exact test has been used to find the significance of study parameters on a categorical scale between the two groups. $P < 0.05$ will be considered statistically significant.

RESULTS

The mean duration of surgery in three-port and four-port group was 41.64 ± 6.972 and 42.22 ± 13.784 min, respectively ($P = 0.79$). Hospital stay was three-port and four-port group was 3.33 ± 0.789 and 3.86 ± 0.707 days, respectively ($P = 0.0001$). 100 patients were included, with 2085 patients. The mean age of the studied patients was 46.38 years with female preponderance. The mean operative time for three ports was 66.90 min and for four ports, it was 75.45 min. The mean duration of post-operative stay for three-port was 4.66, and for the conventional group, it was 5.30.

DISCUSSION

Good results in LC depend on many factors, and most important one is experience of the surgeon in laparoscopy. LC using three ports mandates good experience in

Table 6: Mean operative time (in min) in study group

Operative time (in min)	Group A (3 port)	Group B (4 Port)	P-value
Mean±standard deviation	41.64 ± 6.972	42.22 ± 13.784	0.79 (NS)

laparoscopy for not to threaten the benefits of this procedure. The standard four-port approach is followed by the majority of surgeons. The use of the fourth trocar, which is generally used for fundus retraction in the American technique, seemed unnecessary by some surgeons.

In our study, in group A (3 ports), 32% were in 18–30 years, 30% in 31–40 years, 16% in 41–50 years, 12% in 51–60 years, and 10% in >60 years. In group B (4 ports) 38% were in 18–30 years, 12% in 31–40 years, 16% in 41–50 years, 22% in 51–60 years, and 12% in >60 years (Table 1).

The mean age of patient in group A was 39.38 ± 13.406 and in Group B was 41.06 ± 16.360 (Table 2).

There was no significant difference between the two groups on the basis of age distribution ($P \geq 0.05$) and maximum patients were in 18–40 years of age in both the groups, which is almost similar to Mohamed et al.,³ who found the mean age to be 38.26 ± 13.6 in 3 ports and 37.65 ± 11.69 in 4-port group.

In our study, in group A (3 port), males were 68% and females were 32%, and in group B (4 ports), males were 54% and females were 46% (Table 3).

Visual analog scale (VAS) pain score

The VAS scores were significantly lower in the three-port group as compared to the four-port group on day one and two. The mean Visual Analog Score for pain on post-operative

Table 7: Intraoperative complications in study group

Intraoperative complications	Group A (3-port lap. chole.)		Group B (4-port lap. chole.)	
	No of Patients	Percentage	No of Patients	Percentage
Vascular injury	2	4.00	2	4.00
Ductal injury	2	4.00	2	4.00
Biliary leakage	3	6.00	2	4.00

Table 8: Mean post-operative hospital stay (in days) in study group

Mean post-operative hospital stay (in days)	Group A (3-port lap. chole.)	Group B (4-port lap. chole.)	P-value
Mean±standard deviation	3.33±0.789	3.86±0.707	0.0001 (S)

days was 3.30 ± 0.463 on day one, 3.59 ± 0.610 on day two in the 3-port group and 1.36 ± 0.485 on day 1, 1.66 ± 0.519 on day 2 in 4-port group ($P=0.004$) (Table 4). Kumar et al.,⁴ Shivakumar et al.,⁵ Chauhan et al.,⁶ and reported that the VAS score was significantly low in three-port group.

Analgesia requirement

The average analgesia required was 1.40 ± 0.571 doses in 3-port group and 2.12 ± 0.982 doses in 4-port group (one dose=75 mg of diclofenac sodium given i/m), the difference was statistically significant ($P=0.001$) (Table 5). These results were comparable with the results reported by Nip et al.,⁷ and Dion and Morin.⁸

Operative time

The mean operative time in 3 ports was 41.64 ± 6.972 min and in 4-port group was 42.22 ± 13.784 min ($P=0.79$) (Table 6). Similar results were reported by Chauhan et al.,⁶ Akay et al.,⁹ Mujahid et al.,¹⁰ and Nafeh et al.,¹¹ The operative field was quite clear and better in standard 4-port cases. In some cases of 3-port group, the liver and gall bladder hindered the operative field and consumed slightly more time (average 5–10 min).

Intraoperative complications

In 3-port group, vascular injury in 2 (4%) patients from each group, ductal injury in 2 (4%) patient, biliary leakage 3 (6%) patients and in 4-port group vascular injury in 2 (4%) patient from each group, ductal injury in 2 (4%) patient, biliary leakage 2 (4%) patients (Table 7). Post-operative period was uneventful in both groups. AI Nafeh et al.,¹¹ and Slim et al.,¹² also reported similar results in their studies.

Hospital stay (in days)

In our study, there is difference in hospital stay in 3 ports as compared to 4 ports (3 ports 3.33 ± 0.789 vs. 4 ports 3.86 ± 0.707 , $P=0.0001$) (Table 8). LC is a day care surgery, and the patient can be discharged in a day. However, in our study, the time was beyond 72 h as the patient population catered was from a rural background, so the discharge was postponed for their satisfaction. In a study by Kumar et al.,⁴ Akay et al.,⁹ Kalwaniya et al.,¹³ mean post-operative stay in the hospital was statistically significant groups

Limitations of the study

This was a single-centered study.

CONCLUSION

We concluded that the use of 3 ports in LC did not significantly affect the

- Procedure's safety,
- Conversion rate,
- Operating time when used in chronic cholecystitis.

The introduction of the three-port technique, which is still in routine practice in our institute, has the following advantages:

- Less workforce requirement.
- Need of fewer painkillers.
- Shorter hospital stays.
- Better cosmetic outcome.

Where is 4-port technique has the following advantages

- Better view of the operative field.
- Easy dissection of Calot's triangle.
- Easy suture applicability.
- Dissection of difficult gall bladder from GB fossa.

Hence, 3-port lap cholecystectomy can be advocated to be better than the 4-port technique, but especially in experienced hands and 4-port LC is better for beginners.

ACKNOWLEDGMENT

The authors would like to thank the Department of General Surgery, Maharani Laxmi Bai Medical College, Jhansi, Uttar Pradesh.

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Source of Support: Nil, **Conflicts of Interest:** None declared.