

ORIGINAL RESEARCH

To compare two port laparoscopic cholecystectomy vs three port laparoscopic cholecystectomy

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Abstract

Introduction: Gallstone disease is a major public health issue. In most cases however, they do not cause symptoms and are detected incidentally on imaging. Patients with asymptomatic Gall stone disease can be observed but those with symptoms or with complications need cholecystectomy. Traditionally, Laparoscopic cholecystectomy is performed by 4 port technique. Recently several surgeons have been using more and more modified techniques to perform LC. The modifications may be either reduced port size, i.e. from 10 mm to 5 mm or from 5 mm to 3 or 2 mm or reduced port numbers.

Aim and objective: To evaluate two port laparoscopic cholecystectomy vs three-port laparoscopic cholecystectomy in various aspects.- Ease and feasibility of the procedure, Operative Time, Intra-operative complications, Comparison of morbidity and pain, Cosmetic appearance, Post-operative hospital stay, Post-operative complications and Overall outcome.

Material and methods: This prospective randomized study was conducted on 100 patients who were divided into group A and group B irrespective of their gender. Group A comprised 50 patients undergoing three-port laparoscopic cholecystectomy and Group B comprising 50 patients undergoing two port laparoscopic cholecystectomy.

Conclusion: It was concluded from the present study that two-port laparoscopic cholecystectomy is safe and technically feasible and may further improve surgical outcomes in terms of reduced postoperative pain and better cosmetic outcome. However, it is technically difficult even in expert hands as evident by the statistically significant increased operative time. Hence this technique can be used for simple and uncomplicated cases of cholelithiasis as it is associated with better patient satisfaction.

Introduction

Gallstone disease is a major public health issue.^[1] In most cases however, they do not cause symptoms and are detected incidentally on imaging.^[2] Only 10% and 20% will eventually become symptomatic within 5 years and 20 years of diagnosis.^[3,4] When symptoms occur, patients typically complain of either right upper quadrant or epigastric pain, which may radiate to the back or shoulder. Other symptoms include dyspepsia, flatulence, fat intolerance.^[5,6] The diagnosis of Gallstone disease is based on the history and physical examination with confirmatory radiological studies, such as transabdominal ultrasonography, magnetic resonance cholangiopancreatography (MRCP) and computed

tomography (CT). Transabdominal ultrasonography is the imaging modality of choice as it is highly sensitive.^[7] Patients with asymptomatic Gall stone disease can be observed but those with symptoms or with complications need cholecystectomy.^[8]; which may be open or laparoscopic. Traditionally, Laparoscopic cholecystectomy is performed by 4 port technique wherein the umbilical port is the camera port and one sub-xiphoid port and two lateral ports.^[9] Recently several surgeons have been using more and more modified techniques to perform LC. The modifications may be either reduced port size, i.e. from 10 mm to 5 mm or from 5 mm to 3 or 2 mm or reduced port numbers.^[10] The commonest modification used today is to reduce the size of epigastric trocar from 10 mm to 5 mm to reduce the pain and improve the cosmesis. This technique can be called “10-5-5-5” and can be performed for most LC today.^[10] Recently there are more advancements regarding laparoscopic cholecystectomy by reducing number of port sites. In 4-port LC, the critical view of safety is best ensured by three instruments, which enable both attainment of sufficient operative vision and bimanual manipulation. However, as the number of incisions for ports increases, the potential risks of port-related complications also can increase. Furthermore, as patients have growing awareness of the quality of life, there has been an increase in demand for cosmesis.^[11]

Three port Laparoscopic Cholecystectomy reduces the port numbers from 4 to 3 for performing standard LC. Studies suggest advantage of 3 ports LC over 4 ports LC in terms of less pain, shorter hospital stay and fewer surgical scars. Thus, in few selected patients; 3 port LC is possible without endangering patient's safety. This operation would be named as “10-10-5” or “3 port modified LC”. Recently two ports LC has become possible by using two traction sutures; one on the fundus of Gall bladder (SF) and another on the Hartmann's pouch (SH). With this technique in selected straightforward cases, two port LC is possible.^[10]

Aims and objective

Aim of present study was to compare two port laparoscopic cholecystectomy vs three-port laparoscopic cholecystectomy in the following areas.- Ease and feasibility of the procedure, Operative Time, Intra-operative complications, Comparison of morbidity and pain, Cosmetic appearance, Post-operative hospital stay, Post-operative complications, and Overall outcome.

Material and methods

The present prospective randomised study was conducted from 2021 - 2022 on 100 patients of either sex who were admitted for laparoscopic cholecystectomy. All symptomatic Gallbladder stone patients with Body Mass Index (BMI) <30Kg/m², ASA Grade I/II and Age >12 years were included in the study. Patients with BMI >30 Kg/m² · previous major abdominal surgeries, patients who did not give consent for surgery, features of acute cholecystitis, choledocolithiasis, pancreatitis and malignancy on clinical examination and/or ultrasonography were excluded from the study.

Evaluation of all the patients was carried out. A detailed history, a thorough physical examination and local examination was carried out in each patient. Various investigations were done as follows: Complete haemogram (Hb, TLC, PLT), Blood urea, serum creatinine, serum bilirubin, ALT/AST, alkaline phosphatase, serum proteins-albumin, globulin, serum electrolyte, random blood sugar (RBS),PTI, HIV, HBsAG,HCV,ECG, Chest X-Ray.

An USG abdomen was done in each patient to confirm the Gallbladder calculi, to measure its wall thickness, common bile duct (CBD) diameter and stones and features of acute inflammation or malignancy.

Procedure

All patients were operated under general anesthesia in supine position. Pneumoperitoneum was created using CO₂ gas by placing a Veress needle followed by placement of a transumbilical/ subumbilical/supraumbilical 10-mm port with abdominal pressure to maintain at 12-14 mm Hg. 10-mm telescope was introduced and the operative difficulty was assessed based on the degree of inflammation, adhesions, condition of Gall bladder wall and/or presence of fistula formation with neighbouring organs/structures (duodenum, CBD, colon, stomach, etc). The patients were placed in reverse Trendelenburg position and tilted to the left.

Three-Port LC

Following the placement of 10mm umbilical port, a 10-mm trocar was placed in the epigastrium to the right of the falciform ligament and one 5-mm port in the right hypochondrium for retraction at gall bladder neck. The fundus of the gall bladder was retracted with a nylon straight needle suture passed from the anterior axillary line just below the tip of the ninth costal cartilage. Once the 'critical view' of safety was obtained, cystic duct and artery were clipped/ ligated and divided. The Gallbladder was dissected from its bed using electrocautery/ harmonic scalpel and retrieved through the epigastric port.

In case of bile spillage, irrigation was done and a drain (Romovac) No.14/16 was placed in the sub-hepatic pouch of Morrison's, inserted through the 5mm port by rail-roading technique and was positioned under vision.

Two-Port LC

In the two-port technique, one 10-mm port was passed in the umbilicus for camera and one 10-mm port passed in the epigastrium. One nylon straight needle suture was passed in the right hypochondrium in the anterior axillary line just below the tip of the ninth costal cartilage for retracting the gall bladder fundus. One more suture was passed in between the anterior axillary and mid-clavicular line about 5-7 cm below the previous suture and passed through the neck of the gall bladder for lateral traction during dissection of Calot's triangle. This suture was kept free to adjust the level of traction during different steps of the procedure(Fig 4). The cystic duct and artery were dissected and clipped; the gallbladder was then separated from the liver bed and extracted through the 10 mm epigastric port. When a drain was needed, it was introduced through the epigastric port.

To compare the two groups, following data was used:

- A. Time of operation: Counted from "skin to skin", i.e., from first incision to the end of closure of the final wound.
- B. Any difficulty faced during two port or three port laparoscopic cholecystectomy
- C. Feasibility of the procedure.
- D. Conversion from two-port LC or three-port LC to four-port LC/open cholecystectomy.
- E. Complications: CBD injury, hepatic injury/bleed, biliary/stone spillage, bowel injury, vascular injury
- F. Post-operative pain: Site; severity of pain as assessed by Visual Analog Scale (VAS) at 6, 12, 18 and 24 hours.
- G. Lengths of post-operative hospital stay (in days).
- H. Acceptability of the procedure.
- I. Any post-operative complication or adverse outcome.
- J. Cosmesis: Assessed at the end of 3 months by the patient and independent nurse in the ward/OPD.

These findings were recorded and the patients in two groups were compared and results were evaluated at the end of study.

Observations

Table 1: Distribution of patients according to age

Age Range (in Years)	Group A		Group B	
	No.	%age	No.	%age
≤20	2	4%	1	2%
21-30	6	12%	8	16%
31-40	15	30%	17	34%
41-50	12	24%	12	24%
51-60	12	24%	10	20%
≥61	3	6%	2	4%
Total	50	100%	50	100%
Mean±SD	42.98±12.96		41.88±10.60	
p-value	0.6433(>0.05)			
Significance	NS			

Maximum number of individuals were in the age group of 31-40 years in both group A and group B. Statistically, there was no significant difference in mean age of both the groups (p=0.6433). Hence, both the groups were comparable.

Table 2: Distribution of patients according to gender

Gender	Group A		Group B	
	Frequency	%	Frequency	%
Male	8	16%	5	10%
Female	42	84%	45	90%
Total	50	100%	50	100%
X ²	0.796			
p value	0.3724			
Significance	NS			

Statistical analysis showed that the difference between the two groups was not significant (p value=0.3724). Hence, both the groups were comparable.

Table 3: Distribution of patients according to past medical history

Medical history	Group A		Group B	
	Frequency	%	Frequency	%
Rheumatoid arthritis	0	0%	1	2%
Hypertension	7	14%	5	10%
Diabetes	3	6%	4	8%
Tobacco use	1	2%	1	2%
Alcohol use	2	4%	1	2%
Arthritis	1	2%	0	0%
Hypothyroidism	1	2%	2	4%
Generalized anxiety disorder	0	0%	0	0%
Depression	0	0%	1	2%
Drug allergy	0	0%	0	0%
Migraine	0	0%	1	2%
Yates' chi-square	0.583			
Yates' p-value	0.999			
Significance	NS			

Statistical analysis showed that the difference between the two groups with respect to past medical history was not significant (p value=0.3724). Hence, both the groups were comparable in this regard.

Table 4: Intra-operative findings/complications in Group A and Group B

Intra-operative findings	Group A		Group B	
	Frequency	%	Frequency	%
Adhesions (including omental)	6	12%	4	8%
Bleeding	1	2%	2	4%
Wide cystic duct	1	2%	1	2%
Mucocoele	1	2%	2	4%
Converted to open	0	0%	0	0%
Converted to 4-port	1	2%	2	4%
Pus aspirated from Gall	1	2%	0	0%

bladder				
Stone Spillage	0	0%	0	0%
CBD Injury	0	0%	0	0%
Injury to GIT	0	0%	0	0%
Yates' chi-square	0.613			
Yates' p-value	0.996			
Significance	NS			

The variation in incidence of various intra-operative findings/complications was found to be statistically non-significant (p value=0.996) and both the groups were comparable in this regard.

Table 5: Time taken for Cholecystectomy in Group A and Group B

Group A		Group B	
Mean time (mins)	SD	Mean time (mins)	SD
55.12	9.69	60.34	8.49
p value		0.00511	
Significance		S	

Time taken was observed to be more in Group B as compared to Group A and this difference was found to be statistically significant (p value=0.00511).

Table 6: Post-operative pain score in Group A and Group B

Time lapse (Hrs)	Group A		Group B		p-Value	Significance
	Mean	SD	Mean	SD		
6	5.14	1.20	4.04	1.14	< 0.0001	S
12	4.16	1.09	3.02	1.15	< 0.0001	S
18	3.18	1.00	2.10	1.04	< 0.0001	S
24	2.36	0.72	1.50	0.68	< 0.0001	S

So it was observed that mean post operative pain was more in group A as compared to group B which was found to be statistically significant.

Table 7: Cosmesis score in Group A and Group B

Group A		Group B	
Mean score	SD	Mean score	SD
5.74	1.74	7.04	1.44
p value		<0.0001	
Significance		S	

It was observed that the cosmesis score was higher in Group B (7.04 ± 1.44) as compared to Group A (5.74 ± 1.74) and this difference was found to be statistically significant (p value= <0.0001)

Table 8: Duration of post-operative stay in Group A and Group B

Group A		Group B	
Mean time (days)	SD	Mean time (days)	SD
2.24	0.68	2.14	0.71
p value		0.4737 (>0.05)	
Significance		NS	

It was observed that the duration of post-operative stay was lesser in Group B (2.14 ± 0.71 days) as compared to Group A (2.24 ± 0.68 days), but this difference was found to be statistically non significant (p value= 0.4737).

Discussion

The classical four port method of LC uses the fourth right flank port to retract the gall bladder fundus (American technique) or liver (French technique) for better exposure of Calot's triangle.^[12,13] Reduction in post-operative pain with better cosmesis and early return to work have been the goals to improve cost effectiveness and patient satisfaction. Reduction in the number and size of ports has been advocated as a means to achieve the same. Recent published data has shown positive results in this regard.^[14-18]

In the new era of minimal access surgery, the preferred outcomes under consideration are not only safety, but also quality, which is often defined by pain and cosmetic results. Scarless surgery is the ultimate goal for both surgeons and patients.^[19] Minimally invasive surgical techniques continue to evolve and advancement in instrumentation has allowed more complex surgeries to be performed laparoscopically.^[20]

Demographic distribution

Age distribution: Mean age of presentation of patients in Group A was 42.98 ± 12.96 years whereas in Group B was 41.88 ± 10.60 years. Maximum number of patients were in the age group of 31-40 years in both group A and group B (Table-1).

The results of present study were found to be similar to the study conducted by Hajong et al in 2016 which reported that the mean age in three-port group was 37.68 ± 9.81 years and in two-port group was 38.18 ± 10.81 years.^[21] Another study conducted by Rajkhowa et al in 2016 also found that the mean age was 47.63 ± 8.35 years in three-port LC and 46.25 ± 6.75 years in two-port LC.^[22]

Table I: Comparison of age (in years) in 2 groups

S. No	Author	3 port	2port
1	Present study	42.98±12.96	41.88±10.60
2	Hajong et al	37.68±9.81	38.18±10.81
3	Rajkhowa et al	47.63±8.35	46.25±6.75

Gender distribution: In the present study, the male: female ratio was 1:6.6. It shows a female preponderance. Horn et al postulated that under the influence of female sex hormones, the muscles may relax, biliary passages dilate, and duodenal contents or pancreatic secretions regurgitates into the gallbladder and there promote conditions which favour the formation of Gallstones.^[23]

The results of the present study can be compared to the study conducted by Hajong et al in 2016 in which the baseline characteristics of patients revealed that out of 60 patients, the male: female ratio was 1:5.6.^[21]

Another randomised control study conducted by Prasad et al in 2019 found that percentage of females in 2 port LC was 97.97% and 90.91% in 4 port LC.^[24]

It was concluded that there was no statistically significant difference in both groups as far as age and gender distribution was concerned.

Time taken for Cholecystectomy: In the present study, the mean time taken for the completion of cholecystectomy was 55.12±9.69 minutes in Group A and 60.34±8.49 minutes in Group B (Table-5).

It was concluded that time taken was more in two port LC as compared to three port laparoscopic cholecystectomy.

The results of the present study are comparable to the study conducted by Kim et al (2009) who reported mean time of surgery of 3 port LC 23.25±5.0 min and of 2 port LC 38.95±10.0 min.^[25]

Hajong et al in 2016 reported that the mean operative time required in the three-port group was 38.34±8.91 minutes and in two-port group was 41.24±10.27 minutes.^[21] Rajkhowa et al (2016) reported the mean operative time to be 64.78±9.34 min for three-port group and 65.82±9.5 min for two-port group.^[22]

Operative time of the procedure varies with different studies depending on the operative difficulty based on the status of Gallbladder, adhesions around the Gallbladder fossa and elsewhere in the abdomen, calot's triangle and cystic duct anatomy.^[26]

Table II: Comparison of operative time (in minutes) in 2 groups

S. No	Author	3port	2 port
1	Present study	55.12±9.69	60.34±8.49
2	Hajong et al	38.34±8.91	41.24±10.27
3	Rajkhowa et al	64.78±9.34	65.82±9.5
4	Kim et al	23.25±5.0	38.95±10.0

Post-operative pain score: In present study at 6 hours, the pain score was 5.14±1.20 and 4.04 ± 1.14 in Group A and Group B respectively. At 12 hours, the pain score was 4.16±1.09 and 3.02 ± 1.15 in Group A and Group B respectively. At 18 hours, the pain score was 3.18 ± 1.00

and 2.10 ± 1.04 in Group A and Group B respectively. And, at 24 hours, the pain score was 2.36 ± 0.72 and 1.50 ± 0.68 in Group A and Group B respectively (Table-6).

It was concluded that pain score at 6, 12, 18 and 24 hours was more in three port LC as compared to two port laparoscopic cholecystectomy.

The results of the present study can be compared with study conducted by Hajong et al (2016). They recorded post-operative pain score between three-port (Group A) and two-port LC (Group B) using a different parameter and classified it into mild, moderate or severe pain. The severity of postoperative pain in group A was mild in 8 patients (26.67%), moderate in 18 patients (60.00%) and severe in 4 patients (13.33%). As regards Group B, the severity of postoperative pain was mild in 20 patients (66.67%), moderate in 9 patients (30.00%) and severe in 1 patient (3.33%). The results were statistically significant with P values = 0.017, <0.0001.^[21]

Table III: Comparison of post operative pain in 2 groups

S. No	Author	3 port	2 port
1	Present study	4.16 ± 1.09 (VAS at 12 hrs) 2.36 ± 0.72 (VAS at 24 hrs)	3.02 ± 1.15 (VAS at 12 hrs) 1.50 ± 0.68 (VAS at 24 hrs)
2	Hajong et al (2016)	8 (26.6%) mild 18 (60%) moderate 4 (13.3%) severe	20 (66.6%) mild 9 (30%) moderate 1 (3.3%) severe

Cosmesis score: In the present study, the mean cosmesis score was 5.74 ± 1.74 and 7.04 ± 1.44 in Group A and Group B respectively (Table-7).

It was concluded that cosmesis score was more in two port as compared to three port laparoscopic cholecystectomy which was found to be statistically significant.

The results of the present study can be compared with the study conducted by Hajong et al (2016) who reported cosmesis using a different parameter. Cosmetic appearance was assessed using the Hollander Wound Evaluation Scale which addresses the following six clinical items: Step-off borders, Contour irregularities, Scar width, Edge inversion, Excess inflammation and Over all cosmetic appearance. Each of these items was graded between 0 and 1; the optimal score was 6, and any score lower than this was considered suboptimal. Cosmetic appearance and patient satisfaction for the scar were excellent in 20 patients (66.67%) and good in 10 patients (33.33%) in Group A, whereas in Group B, it was excellent in 27 patients (90.00%) and good in 3 patients (10.00%).^[21]

Table IV: Comparison of mean cosmesis score in 2 groups

S. No	Author	3 port	2 port
1	Present study	5.74 ± 1.74	7.04 ± 1.44
2	Hajong et al (2016)	20 (66.6%) Excellent 10 (33.3%) Good	27 (90%) Excellent 3 (10%) Good

Duration of post-operative stay: In the present study, the mean duration of post-operative stay was 2.24 ± 0.68 days and 2.14 ± 0.71 days in Group A and Group B respectively (Table-8).

It was concluded that post operative hospital stay was more in three port as compared to two port laparoscopic cholecystectomy but it was found to be statistically non significant ($p=0.47$).

Hajong et al (2016) reported that the hospital stay was shorter in the two-port group (1.86 ± 0.55 days) as compared to three-port group (2.0 ± 0.65 days), and the results were statistically significant (P value = 0.041).^[21]

Table V: Comparison of post operative stay (in days) in 2 groups

S. No	Author	3 port	2 port
1	Present study	2.24±0.68	2.14±0.71
2	Hajong et al	2.0±0.65	1.86±0.55

There were no complications at the needle puncture sites in the abdominal wall or the trocar sites in any of the patients undergoing two-port or three-port laparoscopic cholecystectomy at the end of the follow up period. This was similar to the finding of the study conducted by Hajong et al in 2016 on two-port vs three-port laparoscopic cholecystectomy.^[21]

Summery and Conclusion

The present study was conducted with the objective to compare two port laparoscopic cholecystectomy versus three port laparoscopic cholecystectomy.

Following conclusions were drawn

- Both groups were comparable with regard to demographics, baseline characteristics, past medical history and intra-operative findings/complications.
- The time taken for the completion of cholecystectomy was more for two port LC (60.34 ± 8.34 minutes) as compared to three port LC (55.12 ± 9.69 minutes) and this difference was found to be statistically significant ($p=0.00511$).
- The post-operative pain scores at 6, 12, 18 and 24 hours, were all lower for two port LC as compared to three port LC and this difference was found to be statistically significant ($p < 0.0001$).
- The cosmesis score was more for two port LC (7.04 ± 1.44) as compared to three port LC (5.74 ± 1.74) and this difference was found to be statistically significant ($p < 0.0001$).
- The duration of post-operative stay was slightly lower for two port LC (2.14 ± 0.71 days) as compared to three port LC (2.24 ± 0.68 days). However, this difference was found to be statistically non significant ($p=0.4737$).

It was concluded that two-port laparoscopic cholecystectomy is safe and technically feasible and may further improve surgical outcomes in terms of reduced postoperative pain and better cosmetic outcome. However, it is technically difficult even in expert hands as evident from the statistically significant increased operative time. Hence this technique can be used for simple and uncomplicated cases of cholelithiasis as it is associated with better patient satisfaction.

This study was fraught with a few limitations. First of all, the duration of the study was limited with limited patient enrolment. Another limitation was the region specific nature of the research data. So, the results cannot be generalised to other population groups.

Further studies with a larger sample size and longer duration are, therefore warranted.

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