

LAPAROSCOPIC CHOLECYSTECTOMY BY MINIMUM PORTS TECHNIQUE GIVES BETTER OUTCOME- AN OBSERVATION

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ABSTRACT

BACKGROUND

Less than four ports laparoscopic cholecystectomy (LC) has been accepted and has become the popular procedure for safe and cosmetically better outcome. But there are few studies comparing the number of ports used in laparoscopic cholecystectomy. This observational study was done to compare LC by two ports with four ports. We wanted to determine the advantages of minimum port laparoscopic cholecystectomy over conventional cholecystectomy.

METHODS

It is a descriptive study. This study was carried out over a period of 1 year at Gauhati Medical College from 1/1/17 till 4/1/18. All patients with cholelithiasis who attended the surgical OPD were evaluated. A total of 60 consecutive patients undergoing LC were analysed who had been executed a four-port conventional/two-ports LC. 10-mm umbilical and a 5-mm epigastric port were used in two ports technique. Time period of operation was noted. Along with cosmetic effect, the post-operative pain, requirement of analgesic to reduce pain, total hospital stay, and complications if any were meticulously studied.

RESULTS

Out of 60 patients, the M: F ratio was 1:4 with average age being 39 and 22 years respectively. The mean operative times were similar. Post-operative pain was minimal in the two-ports group at up to a maximum 24 hrs. The overall analgesia required, and return to day-to-day work were significantly lower in two-ports group of patients. Cosmetically two-ports group was much better than four-ports group. However, post-operative hospital stay and operative complications were similar between the two groups.

CONCLUSIONS

Two ports laparoscopic cholecystectomy (LC) resulted in reduced pain, minimum need for analgesics, better cosmesis without increasing the operative time period and reduced complication rates compared to that in four-ports LC. Thus, it can be recommended as an acceptable technique in selected patients. It is the procedures of choice so far as cosmesis and scar are concerned.

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BACKGROUND

Laparoscopic cholecystectomy (LC) is the standard and universally accepted procedure compared to open cholecystectomy. The main advantages of laparoscopic surgery over open technique include better cosmetic outcome, reduced post-operative pain and rapid functional recovery. Innovative techniques like Natural Orifice Endoscopic Surgery (NOTES), Single-Incision Laparoscopic surgery (SILS) along with two-ports and three-ports laparoscopic surgeries have also been adopted to remove gallbladder as a procedure of choice in comparison to conventional four-ports surgery. Many surgeons prefer two ports to remove gallbladder when cosmesis and post-operative recovery are placed primarily. These newer techniques represent popularity in terms of the results as scarless, more pain-free, better cosmesis, early return of functional work and better quality of life for the patient.

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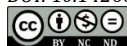
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Single port laparoscopic approach proposes to offer an acceptable cosmesis because it does not give scar due to port being hidden in the umbilicus. However, this type of technical procedure in minimal invasive surgery is more challenging because dissection is little cumbersome due to clashing of operative instruments, loss of normal ergonomic triangulation, restricted and limited vision and actual plane of dissection. Special wide port, angulated instruments and scopes are required for better and precious dissection. Hence SILS has been adopted with much caution though its popularity can't be ignored. All these factors might precipitate abrupt learning curve and enhances the risk of the development of hernia. Two-ports or four-ports laparoscopic cholecystectomy (LC) compared to SILS, surgery becomes easier to execute due to restoration of normal ergonomic triangulation, learning curve becomes shorter, causes minimal violation of anterior abdomen leading to minimum post-operative pain and acceptable cosmesis. With the recent techniques, the need for more high-tech instruments escalates the cost of surgery and causes limitation of the use of these minimally invasive techniques to few selected centres. Two-ports LC over the conventional techniques which requires minimal new instruments and can be performed at almost all laparoscopic centres without any extra cost and simultaneously achieve the goal of minimal invasive surgery in the modern era of laparoscopic surgery. The present study was carried out despite less number of

available literatures in this field of laparoscopic surgery in comparison to conventional LC.

Aim of The Study

To determine the advantages of minimum port laparoscopic cholecystectomy over conventional cholecystectomy.

METHODS

This observational study was carried out over a period of 1 years at Gauhati Medical College from 1/1/17 till 4/1/18. All patients with cholelithiasis attended in the surgical OPD were evaluated. All symptomatic patients with BMI < 30 kg/m², ASA Grade I/II, Age > 20 yrs were included in the study. Patients with BMI > 30 kg/m², previous major abdominal surgeries, ASA Grade III/IV, refused to give consent, associated choledocholithiasis, evidence of pancreatitis and malignancy on clinical and USG examination were excluded from the study. The patients were selected by conveniences allocation technique. The sample size estimation was also done at conveniences.

The patients were evaluated by detailed history taking, a thorough clinical examination and investigations which includes a routine blood, Blood urea, serum creatinine, Liver function test (LFT), serum electrolytes, Na⁺/K⁺ and blood sugar. A USG was done in each patient to study status of gallbladder like calculi, wall thickness, common bile duct (CBD) status and features of acute inflammation or malignancy. An informed written and verbal consent explaining that he/she has understood the procedure and was obtained at least one day prior to surgery.

Patients were divided into two groups-

Group A- patients undergoing standard four-port LC

Group B- patients undergoing two-port LC.

Operative Procedure

After proper position and general anaesthesia (GA) pneumoperitoneum was created using CO₂ gas by placing a Veress needle followed by placement of a transumbilical/sub umbilical/supraumbilical 10-mm port with abdominal pressure maintained at 12 mm Hg. A 30 degree 10-mm laparoscope was passed, and the operative difficulty was assessed based on the degree of inflammation, adhesions, condition of gall bladder wall, presence of fistula formation with neighbouring organs/structures (Duodenum, CBD, colon, stomach, etc.)

Conventional Four-Port LC

The patient was placed in reverse Trendelenburg position and tilted to the left as convenient and surgery proceeded as standard and conventional procedure. A 10-mm trocar was placed in the epigastrium to the right of the falciform ligament with two additional 5-mm ports in the right upper abdomen two finger breadths below the costal margin in mid clavicular line and anterior/midaxillary line at the level or just below the umbilicus. Dissection of the gall bladder was performed by the standard technique by first grasping and lifting the fundus, followed by dissection of the cystic duct and artery. Once the 'critical view' of these structures was obtained, these were clipped and divided. The gall bladder

was removed from its bed using electrocautery and retrieved through the epigastric port.

Two-Port LC

Following the placement of umbilical port, instead of a 10-mm, a 5-mm epigastric port was place. Two special 2.3 mm alligator graspers [Fig. 1] were used trans abdominally for grasping the fundus [Fig. 2] and Hartmann's pouch of the gallbladder for its retraction and manipulation [Fig. 3], respectively. A 1-0 silk suture was also used to retract fundus in different time. In some cases, fundus can be retracted by a No 1 or No 1- Silk suture instead of alligator. Sometime more than 1 suture may be required to hold different places of GB to make safety triangle. Using the standard Maryland laparoscopic instrument, the cystic duct and artery were dissected as in the four-port technique [Fig. 4]. For clipping the cystic duct and artery, a 5-mm clip applicator was used with 300-mm clips. In case of wider cystic duct, single-hand suturing of the duct was done with 2/0 silk or 400 sized LIGACLIP applied. Alternatively, the position and size of the scope was changed to a 5-mm 30° scope through the epigastric port and clips (300/400 mm) were applied through the 10-mm umbilical port. The structures were divided, and dissection proceeded by reversing the laparoscope and dissecting instruments to their original sites. Gallbladder specimen was retrieved through the umbilical port by rail-road technique or using 5-mm 30° scope through the epigastric port and 10-mm jaw forceps from the umbilical port. The ports were closed in layers. Sheath with 2/0 vicryl and skin with 3/0 nylon in both procedures. In some occasion 5 mm port skin by simple skin stapler without closing sheath. Skin stapler eventually used to close the wounds in many instances.

If in any patient, for any reason, there was difficulty in proceeding with two ports, additional port(s) was used, or the procedure was converted to open cholecystectomy. The patients were followed up for 30 days after discharge.

Comparing the Two Type of Operative Techniques on-

- Time period of operation: Counted from "skin to skin."
- Conversion from two-port LC to four-port LC/open cholecystectomy.
- Complications: CBD injury, hepatic injury/bleed, biliary/stone spillage, bowel injury, vascular injury or any other complication up to 30 days post-operatively.
- Post-operative pain: Site and severity of pain at 2, 4, 6, 8, 12 and 24 hours; and total 24 hours.
- Analgesia required.
- Post-operative hospital stay.
- Cosmesis: Assessed at the end of 30 days by the patient and independent nurse in the ward/OPD. Every patient was asked to rate cosmesis on a scale of 1 (Worst) to 10 (Best). The mean of both the patients score and nurse's score was taken as the final score [Fig. 5]

Statistical Analysis

Parametric summary statistics were presented as means with standard deviation. Non-parametric statistics were presented as medians with interquartile ranges. Categorical data were analysed with Chi-square test. Independent t-test was used to

test the means using the SPSS software package version 19.0 (SPSS Inc., Chicago, IL, USA).

RESULTS

In this descriptive study a total 76 patients were operated during the study period. 10 patients were excluded as they underwent additional procedure. Six patients out of 10 had an American Society of Anaesthesiologists (ASA) grade more than II and were not included in the study as per the study protocols. A total of 60 patients were included in the study. 30 patients were randomised each into the four-port and two-port. Out of three patients, two in the four-port group and one in the two-port group were lost to follow-up. A total of 57 patients were left in the study group for the final analysis and follow up [Chart 1- CONSORT Flow Chart].The mean age, sex ratio, ASA grades and BMI between the two groups were comparable [Table 1].

The operative time between the two groups were not statistically significant (Four Port LC-67 min; Two port mini LC-71 min) [Table 2]. The operative difficulty score showed that both groups were comparable in terms of difficulty of operation levels [Table 2]. The Average incidence of per-operative complications such as bleeding from liver bed (Four port LC-1 [3.33%], Two port mini LC-2 [6.66%] and bile spillage (Four port LC-3 [10.0%], Two port LC - 2 [6.66%]) were not significantly different between both groups; however, there was a single incidence of minor CBD injury in the two-port group, which was detected per-operatively and repaired [Table 3].One patient from two port LC group required open cholecystectomy (0.18%), and one patient needed.

Enrolment- (Chart 1. Consort Flow Chart)

- a. Assessed for eligibility (n=70)
- b. Randomized (n=60) ► Excluded (n=10).Not meeting inclusion criteria. Other procedure coupled s (n=6).ASA grade more than II.
- c. Allocated to 4 port (n=30).Allocated to 2 port LC (n=30).
- d. Lost to follow up (n=2) in 4 port.
- e. Lost to follow up (n= 1) in 2 port.
- f. Analysed (n=28) in 4 port.
- g. Analysed (n=29) in 2 port.
- h. Total analysed = 57 [Consort Flow Chart type].

Conversion to four port LC (3.33%). The conversion to open cholecystectomy was required for an abnormal vessel injury, while the conversions to four port LC were due to difficult anatomy and adhesions around the GB fossa. That patient was converted to open cholecystectomy for dense adhesions around the gallbladder and obliterated narrow Calot triangle. There was oedema and fixed infundibulum at Rouviere’s level.

The average post-operative pain scores (As assessed by VAS) of both groups as shown in table-4. The average pain scores as assessed during post-operative period at 2, 4, 6,8,12 and 24 hours was significantly less in two port LC than in four port LC. But after 24 hours no difference of pain in both groups. The parenteral analgesic requirement (i.m Diclofenac 75 mg) in the two-port mini LC was significantly lower than four port LC for the first 24 hrs. The mean duration of

hospital stay was similar in both groups; four port LC-25 hrs, two port LC-24 hrs.

	4 Port Group (N-30)	2 Port Group (N-30)	p Value
Mean age (yrs.)	40.8	37.0	.12
M:F ratio	1:3.4-6(M) and 22(F)	1:3.1-7(M)and 22(F)	.23
ASA grade (I-II)	40.8	51.4	.14
BMI (Mean)	22.1	21.9	.15

Table 1. Patient Demography

	Four Port Group	Two Port Group	P value
Duration of surgery (Minutes)	67	71	.727
Operative difficulty score	6	5	.303
Analgesic needed	2.9	2.3	.003
Length of stay (hrs)	25	24	.76
Return to daily activities (days)	5	4	.001
Cosmesis	5	7	.001
Post-operative complications	1	1.5	.24

Table 2. A Comparison

Complications	Four Port Group	Two Port Group
Bleeding from cystic artery	0	0
Bleeding from hepatic artery	0	0
Bleeding from liver bed	1	2
Bleeding from portal vein	0	0
Bleeding from other sources	0	0
CBD injury	0	1 (minor)
Injury to gastrointestinal tract	0	0
Stone spillage	3	2
Any other complications	0	0
Converted	Nil	1 to open due to injury to abnormal vessel. 1 converted to 4 port technique.

Table 3. Intra-Operative Complications

The patients’ return to daily activities at home was faster by almost one day and was statistically significant (Four port LC-4 days, two port LC-5 days).

The standard cosmesis scoring system on a scale of 1-10 (means of both patients and the independent nurse’ score) was significantly better in the two port LC compared to four port LC at the end of 30 days.



Figure 1. All Ports Displayed with Alligators



Figure 2. Alligators with Operating Team at GMC



Figure 3. Alligators Displayed. 1-0 Silk used to Retract Fundus



Figure 4. Alligator



Figure 5. Fundus Retracted

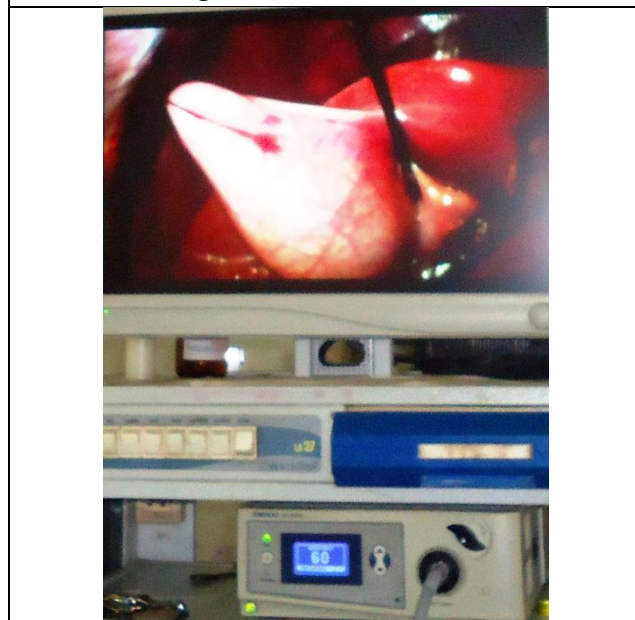


Figure 6. At Neck



Figure 7. Grasper at The Neck

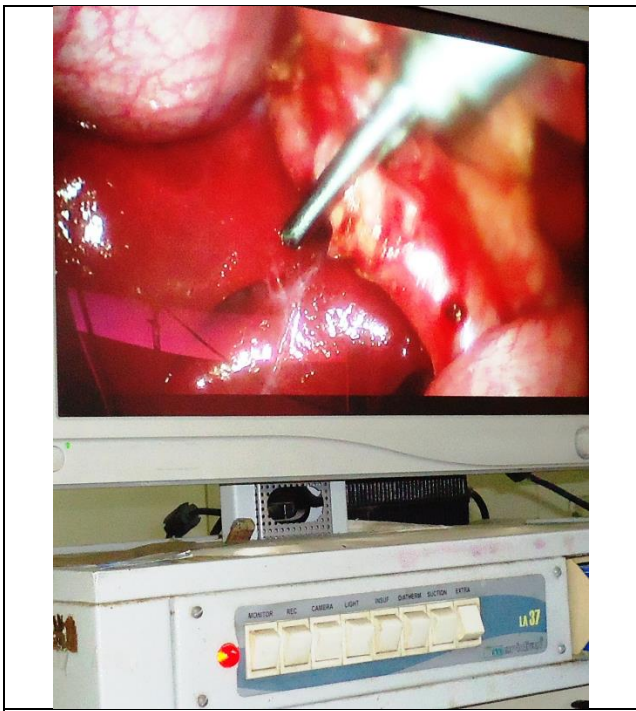


Figure 8. CD Dissected

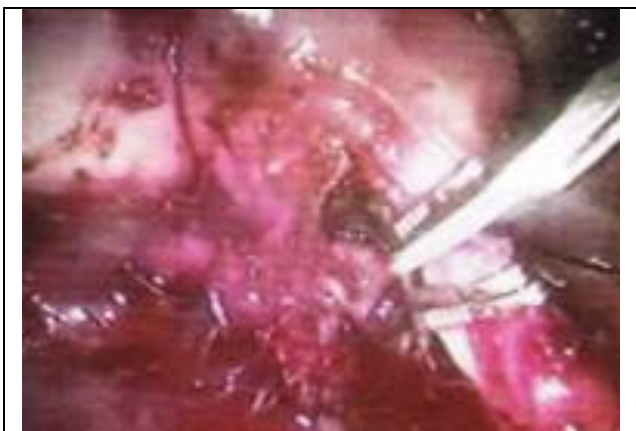


Figure 9. CD Dissected and Divided



Figure 10. Cosmetic Scar After 2 Ports. Black Arrow= 10 mm; White Arrow=5 mm.

DISCUSSION

Considering the history of cholecystectomy from Langenbeck's first open cholecystectomy with a hospital stay of a week into a day-care specialty following the introduction of LC is indeed magnificent in the era of surgical evolution.^[1] The main focus has been on the-

VAS at hrs.	Group	Average	p Value	Confidence Limit (95%)	
				Lower	Upper
2	A	7.3	.006	.213	1.213
	B	6.6			
4	A	6.4	0	.392	1.319
	B	5.5			
6	A	5.7	0	.432	1.380
	B	4.8			
8	A	5	0	.679	1.611
	B	4			
12	A	3.9	0	.393	1.337
	B	3			
24	A	2	.039	.023	.871
	B	1.6			
48	A	1	.749	.370	.267
	B	1.2			
72	A	1	.743	.200	.143
	B	1.1			

Table 4. Pain Score

Reduction of pain and improvement cosmesis throughout the history of cholecystectomy. In fact, post-operative pain is the key factor for the delay in discharge in day-care cholecystectomies. The concept of scarless or less scar has led to increased acceptance of the procedures among patients. Surgeries by less port may seem more costly procedures but by achieving higher bed-patient ratio, reduced requirement of analgesia and with one less assistant they may indeed be cost-effective on a long-term basis. Particularly in private sector. Two-port LC using conventional instruments can afford the benefits of reduced port surgeries without cost escalation.

Most significant advantage of two-port LC as described in the present study is the ease of performing the technique, and main principles of surgery remain similar to the conventional four-port LC. Compared to this, other LC like NOTES^[2] and SILS^[3,4] are technically more demanding as because the dissection becomes more difficult due to clashing of instruments, loss of normal triangulation, restricted vision and depth of dissection. Special large port, angulated instruments and scopes are needed for better dissection. All these.

Factors lead to a steeper learning curve, and hence, operating time.^[4] The port sizes in our study were 10 + 5 + 2.3. Various port sizes have been used by other researchers, which might require more sophisticated instruments [Table 5]. There is not standard size of the ports, and we choose the above size simply to use the normal four port LC instruments.

In the present study, the use of two ports and graspers we used did not increase the operative difficulty as the mean duration of the procedures was similar in both groups though operative time varies with different studies as some require less and some more than the conventional technique.^[5-9]

	N-CLC	N-RPG	Port	Operating Time	Pain Difference	Cosmesis Difference	Conversion to CLC (%)	Additional Comment
Schwenk et al	25	25	5-3	Equal	Not difference	Superior	1	No difference in pulmonary function
Cheah et al	25	37	10-3	Equal	Decreased	NA	5	Similar oral analgesic requirement
Look et al	38	28	10-3	NA	Decreased	NA	7	Similar functional recovery
Alponat et al	36	22	10-3	Equal	Not difference	Superior	5	Randomization after lap examination
Bisgaard et al	27	25	5-3	NA	Decreased	Superior	4	M-LC is feasible
Sarli et al	68	67	12-3	Equal	Decreased	Superior	7	Enhances advantage of LC
Ainsli et al	68	21	10-3	Equal	Not difference	NA	3	Reduces analgesic
Huang et al	19	25	5-3	increased	Decreased	No difference	5	M-LC not accepted universally
Novitsky et al	33	34	10-5	Equal	Decreased	Superior	8	Instrument durability need to be increased
Table 5. Comparison of Various Variables in Two Port Technique								
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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 was similar in both groups in our study. The incidence of intra-operative and post-operative complications was similar in comparison to other studies; however, it is not reported by any other study. The present study had a single incident of minor CBD injury in the two-port mini LC. It would be difficult to attribute the same to the use of two ports, as it was the only case which happened in the entire study group. Besides this, no other major intra-operative complication was noted in the entire study group. The conversion rates from two port mini LC to four port LC and open cholecystectomy in many studies are in the range of 23% to 38%.^[8,10,11] The conversion rates from two port mini LC in our study were much less than the other studies. The main reasons in our study for conversions were difficult anatomy due to dense inflammation from cholecystitis and one abnormal vascular injury. Instrument failure was seen in few early studies, and we had no episode of instrument failure. A planned two-port surgery must be given up in the event of such difficult anatomy on initial diagnostic exploration or hindrance to proceed further during the course of the dissection. ^[12,13] A conversion can be with additional ports or with open cholecystectomy.

Researchers such as Cheah et al, and Bisgaard et al attributed less pain following two port LC.^[6,14] By omitting two 5-mm ports resulted in decreased post-operative pain in the first 24 hours. This has been observed by many other studies, which have also shown reduced pain in reduced port surgery compared to conventional four-port LC. The post-operative pain was assessed by VAS, which is the same method used in other studies. The pain was recorded during the patient's stay at hospital. The post-operative pain in our series was significantly lower in the first 24 hrs only, and not later. 24 hrs (Group A 89.5%, Group B 92.7%). This was further support by less requirement of analgesia and the early return to their activities in the two port mini LC in contrast to the four port LC.

The mean length of hospital stay was same in both groups. This was in consistent with other studies.^[6,7,10,11,14-17] [Table 5]. Even though we did not perform these procedures as outpatient procedures but in our view, these can be performed as day-care procedures.

Cosmesis has been one of the reasons for easy acceptance of laparoscopic surgery among the patient population. Smaller and lesser incisions have led to minimal scarring and improved cosmesis.^[12,18] With 0 being worst and 10 being the best. In our study, we had a nurse blinded to procedures and the patient's own score which minimised bias, the final score was arrived at by calculating the mean of the two scores. In our study, the cosmetic score was significantly better in two port LC, which is consistent to other studies where cosmetic benefit was studied.

CONCLUSIONS

In our conclusion, LC can be performed with two-port technique using 10-mm umbilical, 5-mm epigastric and two 2.3-mm alligator graspers in properly selected cases and optimise the benefits of minimal access surgeries. A No. 1-0 or No. 1 silk suture can be used instead of grasper as per surgeon's convenience. Single incision LC (SILS) can be done with much better cosmesis but is a cumbersome operation. Less the port, much the cosmesis is the dictum in the genesis of laparoscopic surgery.

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