

THREE-PORT VERSUS FOUR-PORT LAPAROSCOPIC CHOLECYSTECTOMY: A RANDOMIZED CONTROLLED TRIAL

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ABSTRACT

Laparoscopic cholecystectomy (LC) is one of the most common surgery performed and is traditionally performed using four ports. With the aim of improving patient's comfort, port numbers have been reduced to single port. But feasibility and the extra expense that comes with single and double port LC has made them less attractive. Three port LC can be a safe alternative to four port LC, and various research has shown its safety. This study compares the three port LC with the traditional four port LC with the objective of assessing feasibility and benefit of the decreased port number. We evaluated 217 patients who were randomly allocated for three port and four port LC. Both the groups were compared for operative time, assessment of postoperative pain, days of hospital stay and postoperative recovery time after discharge. The parameters were compared using Statistical Package for the Social Sciences (SPSS) version 16. Among 217 patients, 123 underwent three port LC and 94 underwent four port LC. The larger number were females (79.7%), and with comparable age group of patients. Rate of conversion to open cholecystectomy, postoperative pain scale, analgesic requirement, average hospital stay and port site infection rates were comparable in both groups of patients. The average time taken for operation was less in three port LC than the four port LC but this was not statistically significant. There is no significant difference between 3 port and 4 port LC in terms of time required for the surgery, conversion rate, complication and duration of hospital stay.

KEYWORDS

Four-port laparoscopic cholecystectomy, laparoscopic cholecystectomy, three-port laparoscopic cholecystectomy

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INTRODUCTION

The first open cholecystectomy was performed on July 15, 1882, by the German surgeon Carl Johann August Langenbuch (1846–1901) at the Lazarus Krankenhaus, Berlin, on a 43-year-old man.¹ The history of laparoscopy began in 1901, when Russian gynaecologist Dimitri Ott examined the peritoneal cavity of a pregnant woman by using a head mirror and a speculum introduced into a culdoscopic opening.²

Philippe Mouret performed the first laparoscopic cholecystectomy, in Lyon, France, on March 17, 1987 which marked a revolution in the way surgery was done which was rightly quoted as “Before that, there was nothing, after that there was laparoscopic surgery.”³ Since then it has become a standard approach for the surgical treatment of symptomatic cholelithiasis and gallbladder polyps.⁴ Laparoscopic Cholecystectomy is traditionally performed through four ports,⁵ the fourth (lateral) trocar used to grasp the fundus of the gallbladder so as to expose Calot’s triangle, but recently to reduce analgesic need, to achieve better patient care and to obtain a better cosmetic result thus increasing cost-effectiveness, one-, two-, and three-port LC are being performed.^{6,7} It has been argued that the fourth trocar may not be necessary, and LC can be performed safely without using it.⁸ Several studies have demonstrated that less postoperative pain is associated with a reduction in either the size or number of ports.^{9,10} This study was done to compare three port versus four port LC to assess the feasibility and benefit of the reduced port number. Parameters like operative time, days of hospital stay, postoperative recovery time after discharge, days taken to return to work, and assessment of postoperative pain were compared between the two.

MATERIALS AND METHODS

We evaluated 217 consecutive patients who underwent elective three- or four-port LC. Group 1 was composed of 123 patients that underwent three-port LC for cholelithiasis. Group 2 contained 94 patients that underwent four-port LC. After the procedure was explained, written consent was taken and patient designated randomly to group one or two. Patients who did not give consent were excluded from the study but underwent fourport laparoscopic cholecystectomy. Patients who underwent early cholecystectomy for acute cholecystitis, gallbladder wall thickening more than 6mm detected during ultrasonographic examination, and those who underwent additional surgical intervention at the same time as LC were excluded from this study. Patients who underwent an elective LC for cholelithiasis but had signs of acute cholecystitis detected during the operation were included.

Operative procedure

Both four port and three port LC was performed with the patient in supine position, with the surgeon and assistant on the left side and the monitor on the right side. Head up and right up position was employed as was deemed required during surgery in both the groups. Pneumoperitoneum of 12mmHg was created using open Hassan’s method through the umbilical port. A second 10mm trocar was placed inferior to the sternum at the midline, while the third 5mm trocar was placed 4-5cm inferior to the right costal margin on the right midclavicular line. For the four port LC, additional 5mm port was placed in the subcostal region at the anterior axillary line. Posterior dissection and delineation of the Calot’s triangle was done. Then, the cystic artery and cystic duct were identified, isolated, doubly clipped and divided. The gallbladder was always removed through the umbilical port using a 10mm gallbladder extractor.

Postoperatively, the patient were kept nil by mouth for six hours then allowed liquids on the day of surgery. Day care surgery was not performed. Patient was discharged once they were taking adequately orally. In patients where drains were kept, they were discharged after the drains were removed. The drains were removed when the effluent was clear and less than 2ml/kg in amount.

Data were entered in Microsoft Excel version 10 and analyzed with the Statistical Package for the Social Sciences (SPSS). A *P*-value less than 0.05 was considered to indicate statistical significance in all tests.

RESULTS

A total of 217 patients were enrolled in this study among whom 123 underwent three port LC and 94 patients underwent four port LC. There were, 44 (20.3%) male patients and 173 (79.7%) females. The average patient age in 3 port group (Group1) was 43.62 years and 39.84 years in 4 port (Group 2) (*p*=0.057) (Table-1).

Table-1: Demographic data			
Characteristic	Group 1 (n=123)	Group 2 (n=94)	p value
Sex			
Male	27	17	0.057
Female	96	77	
Age	43.62 years	39.84 years	

In Group 1 (three ports) patients, 7 (5.69%) cases were converted to open cholecystectomy, because of adhesions and bleeding. Drain was kept in 5(4%) of the patients, and all drains were removed by the second postoperative day. All patients were ambulated and orally allowed four to six hours after surgery. The average hospital stay was 2 days. Length of hospital

stay was similar in both the groups ($p=0.213$). There were no significant postoperative complications in Group 1 patients except port site infections in 7 (5.69%) which were managed with simple dressing and none required secondary suturing or additional oral/iv antibiotics.

In Group 2 (four port) patients, 5 (5.39%) cases were converted to open cholecystectomy, which was not statistically significant ($p=1.00$) when compared to Group 1. Drain was kept in 3 (3.19%) patients, and all were removed by second postoperative day. Ambulation, oral intake and average hospital stay was similar to Group 1 patients. Port site infection was seen in 8 (8.51%) patients in Group 2 and was comparable to Group 1 patients ($p=0.43$).

The average operative time in Group 1 (three port) was 31.21 minutes compared to 31.28 minutes in Group 2 (four port). Operative times were comparable between two groups ($p=0.85$). Thus all parameters were comparable between the two groups (Table-2).

longer operating time for three port laparoscopic cholecystectomy. A study by Mayir *et al.*¹⁵ shows similar operating time for both the groups which is more in line with our own findings.

In this study, drains were kept in 4% of three port LC and 3% in four port LC which was not statistically significant. The drains were placed where lots of adhesiolysis was involved and thus chances of seroma formation or inadvertent injury were high. We considered the umbilical port site infection as the wound infection as there was no infection in other port sites and there was no significant difference between the two groups of patients.

Incidence of common bile duct injury is an important safety parameter to decide success of three port or four port laparoscopic cholecystectomy. Studies done by Dubois *et al.*¹⁶ and Endo *et al.*¹⁴ have argued about the probability of higher incidence of bile duct injuries in three port LCs, because the fourth port is used to grasp the gallbladder fundus away from the dissection site; long gallbladders with long peritoneal

Table-2: Patient Outcomes

Outcome	Group 1	Group 2	P value
Operative time	31.21 minutes	31.28 minutes	0.85
Laparoscopic to open conversion	7 (5.7%)	5 (5.4%)	1.00
Drain requirement	5 (4.0%)	3 (3.2%)	0.56
Hospital stay	2 days	1.3 days	0.213
Port site infection	7 (5.7%)	8 (8.5%)	0.43
Days of parenteral analgesic requirement	1.2 days	1.5 days	0.07

DISCUSSION

Four port LC is now the standard of care in gallstone disease. However, many variations like single port, double port and three port LC have been described. Single and double port LC require specialized equipment and tend to be more expensive than standard four port LC while three port LC can be done without additional expenses or equipment. Spaner *et al.*¹¹ Sarli *et al.*¹² and Tagaya *et al.*¹³ have shown significant decrease in postoperative pain and thus early return to work after reducing the number of ports. Our study also showed a reduced requirement for postoperative intravenous analgesics in three port group patients although the difference was not statistically significant.

The rates of conversion to open cholecystectomy in both the groups were similar and statistically insignificant. Bleeding from cystic artery or dense adhesions and unclear anatomy were the major causes of conversion. None of the three port laparoscopic cholecystectomies required conversion to four ports which is similar to experiences reported by Trichak *et al.*⁸ Tagaya *et al.*¹³ and Endo *et al.*¹⁴ Operating time taken was slightly longer for four port LC however, it was not statistically significant. It can probably be attributed to time spent on making and closing the fourth port. Trichak *et al.*⁸ report

fold and distended gallbladders would disturb the field of dissection. Slim K *et al.*⁹ have argued that it can be avoided if the gallbladder is gripped at the infundibulum and pulled laterally thus dissecting at the infundibulum-cystic duct junction. Our study had no incidence of common bile duct injury in both the groups but it has shown that almost all variables are comparable in both the group of patients which is in line with other past studies.^{8,14} Research has shown the safety of three port LC.^{8,9,17-19} A study done by Al Awazi *et al.*²⁰ has even shown that three port LC is safer in case of acute cholecystitis.

The meta-analysis published in 2010 by Sun S *et al.*²¹ has concluded that three-port and four-port cholecystectomies resulted in similar operating times, success rates, analgesia requirements, and postoperative hospital stays but the trials that were studied were of poor quality in terms of randomization method, blinding methods, follow-up of patients and small sample sizes (as small as less than 100 patients in some trials).

Three port and four port laparoscopic cholecystectomy are comparable. Reduced amount of parenteral analgesic requirement and decreased operative time were the only advantages but they were not statistically significant. Therefore three port LC can be a safe alternative to four port LC.

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