

Original Research

Comparative Evaluation of Three Port and Four Port Laparoscopic Cholecystectomy Procedure: An Institutional Based Study

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Abstract

Background: Standard laparoscopic cholecystectomy typically involves the use of four trocars. The fourth trocar, positioned laterally, facilitates the grasping of the gallbladder's fundus, thereby allowing for the exposure of Calot's triangle. As surgeons gain experience, the technique of laparoscopic cholecystectomy has seen. Hence, the present study was conducted for comparative evaluation of three port and four port laparoscopic cholecystectomy procedure.

Materials & Methods: The present study included 100 patients who underwent elective laparoscopic cholecystectomy. The patients were divided into two groups: Three-port group and Four-port group. Both the groups included 50 patients each. Ethical clearance was obtained from the ethical committee of the institution and written consent was obtained from all the patients after explaining in detail the entire research protocol. Patients were randomized to receive either 3-port laparoscopic cholecystectomy (3-port group) or conventional laparoscopic cholecystectomy (4-port group) in a synchronized manner. Outcome was assessed.

Results: Mean age of the subjects of the three-port group and four port group was 46.3 years and 44.1 years respectively which was comparable in both the groups. It was observed that 80 percent and 82 percent of the patients of the three-port group and four port group were females. Mean operative time among subjects of the three port group and four port group was 63.8 minutes and 51.7 minutes respectively. Among three-port group, conversion to four port and to open cholecystectomy was seen in 6 percent and 4 percent of the patients respectively while in four-port group, conversion to open cholecystectomy was seen in 2 percent of the patients. On the day of surgery, at 6 hours, the mean VAS for the subjects of the three-port group and for the subjects of the four port group was 5.8 and 7.5 respectively. Significant results were obtained while comparing the mean postoperative VAS score in between two study groups on of surgery at 6 hours. Moreover mean VAS was again significantly higher for the subjects of the four port group on the day of discharge and after one week of follow-up.

Conclusion: The three-port technique for laparoscopic cholecystectomy demonstrates a safety profile comparable to that of the conventional four-port approach. Notably, the three-port method offers several benefits, including reduced postoperative pain, enhanced safety, and minimal scarring. However, it is advisable for surgeons to remain open to the option of adding a fourth port if necessary to guarantee the safe execution of the procedure.

Key words: Laparoscopic Cholecystectomy, Three-Port, Four-Port.

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INTRODUCTION

Biliary calculosis represents one of the most prevalent conditions necessitating surgical intervention on the bile ducts. Patients typically

undergo either open cholecystectomy (OC) or a laparoscopic approach utilizing gasless or low-pressure techniques. However, individuals with cirrhosis and portal hypertension face heightened

risks due to two primary factors: diminished peripheral resistance and the potential for uncontrollable bleeding during surgery. Consequently, laparoscopic cholecystectomy is not advisable for these patients. Recent literature has extensively examined the detrimental physiological impacts of intra-abdominal hypertension. Additionally, a study investigated the relationship between intra-abdominal pressure in patients undergoing laparoscopic cholecystectomy (LC) and hepatic blood flow, employing a laser-Doppler technique alongside tonometric assessment of gastric perforation. The findings revealed a significant decline in both hepatic and gastric microcirculation during LC conducted with a pneumoperitoneum pressure of 12 mmHg, suggesting the occurrence of splanchnic ischemia.¹⁻³ Standard laparoscopic cholecystectomy typically involves the use of four trocars. The fourth trocar, positioned laterally, facilitates the grasping of the gallbladder's fundus, thereby allowing for the exposure of Calot's triangle. As surgeons gain experience, the technique of laparoscopic cholecystectomy has seen numerous enhancements, including a decrease in the size of the ports. There is a growing discourse suggesting that the fourth trocar may be superfluous, indicating that laparoscopic cholecystectomy can be conducted safely without its use. Effective coordination in the manipulation of surgical instruments is crucial during this procedure, particularly for the exposure of Calot's triangle and the dissection of the gallbladder from its bed when employing a three-port approach. Various studies have indicated that performing a three-port laparoscopic cholecystectomy is technically feasible.⁴⁻⁶ Hence; the present study was conducted for comparative evaluation of three port and four port laparoscopic cholecystectomy procedure.

MATERIALS & METHODS

The present study included 100 patients who underwent elective laparoscopic cholecystectomy. The patients were divided into two groups:

- A. Three-port group
- B. Four-port group

Both the groups included 50 patients each. Ethical clearance was obtained from the ethical committee of the institution and written consent was obtained from all the patients after explaining in detail the entire research protocol. Patients were randomized

to receive either 3-port laparoscopic cholecystectomy (3-port group) or conventional laparoscopic cholecystectomy (4-port group) in a synchronized manner. All procedures were conducted by expert laparoscopic surgeons utilizing general anaesthesia. In the case of the 4-port laparoscopic cholecystectomy, a 10-mm port was placed supraumbilically, a 10-mm port was positioned subxiphoid, and two 5-mm ports were inserted subcostally. For the 3-port laparoscopic cholecystectomy, a 10-mm supraumbilical port, a 10-mm subxiphoid port, and a single 5-mm subcostal port were employed. An operating telescope was introduced through the supraumbilical port. The gallbladder was retracted using long grasping forceps inserted through the 5-mm subcostal port, while dissection was performed via the 10-mm subxiphoid port. The gallbladder was extracted through the subxiphoid port. At the conclusion of the procedure, surgical adhesive tapes were applied to the standard 4-port sites in both surgical groups. Outcome was assessed. SPSS software was used for evaluation of level of significance.

RESULTS

The mean age of the subjects of the three-port group and four port group was 46.3 years and 44.1 years respectively which was comparable in both the groups. It was observed that 80 percent and 82 percent of the patients of the three-port group and four port group were females. Mean operative time among subjects of the three-port group and four port group was 63.8 minutes and 51.7 minutes respectively. Among three-port group, conversion to four port and to open cholecystectomy was seen in 6 percent and 4 percent of the patients respectively while in four-port group, conversion to open cholecystectomy was seen in 2 percent of the patients. On the day of surgery, at 6 hours, the mean VAS for the subjects of the three-port group and for the subjects of the four-port group was 5.8 and 7.5 respectively. Significant results were obtained while comparing the mean postoperative VAS score in between two study groups on of surgery at 6 hours. Moreover, mean VAS was again significantly higher for the subjects of the four port group on the day of discharge and after one week of follow-up.

Table 1: Operative time

Variable	Three port group	Four port group
Mean	63.8	51.7
SD	8.6	7.1
p-value	0.001 (Significant)	

Table 2: Number of cases of converted into four port/open cholecystectomy

Number of conversions	Three port		Four port	
	Number of patients	Percentage	Number of patients	Percentage
To four port	3	6	NA	NA
To open cholecystectomy	2	4	1	2
No conversion	45	90	49	98
Total	50	100	50	100

Table 3: Mean Post-op pain score on VAS

Postoperative pain score on VAS	Three port	Four port	P- value
One day of surgery at 6 hours	5.8	7.5	0.010 (Significant)
At discharge	3.7	5.3	0.000 (Significant)
At one week follow-up	2.1	3.9	0.000 (Significant)

DISCUSSION

Gallbladder-related diseases have emerged as one of the most prevalent reasons for both elective and emergency surgical interventions. The management of cholecystitis and its associated complications has undergone significant advancements over the years. Since the advent of laparoscopic cholecystectomy in the mid-1990s, there have been notable shifts in treatment paradigms for affected patients. Recent studies have underscored the significance of performing laparoscopic cholecystectomy during the initial hospital admission. Extensive patient demographics and imaging data have been meticulously documented in numerous large-scale studies and meta-analyses. Various international guidelines have been established to recommend specific care pathways. Efforts have also been made to standardize definitions, particularly concerning cholecystitis. A comprehensive understanding of patient outcomes is crucial for the progression of healthcare practices. While the possibility of converting to open cholecystectomy remains a vital component of safe surgical procedures, it is equally important to gain insights into the factors that contribute to such conversions and the potential complications that may arise post-operatively.⁶⁻⁹

Traditional laparoscopic cholecystectomy (LC) is typically conducted using a four-port approach. Modifications that involve reducing the size or

number of ports have not compromised the safety of the procedure; rather, they have further highlighted the benefits of laparoscopic techniques compared to open cholecystectomy. These adaptations have been associated with decreased postoperative pain and a lower requirement for analgesics. The use of three or even two trocars has been documented in the execution of LC, alongside the application of mini-instruments. Proponents of these innovative methods assert that they require a comparable duration to perform and result in less postoperative discomfort than conventional laparoscopic cholecystectomy. Some researchers have even recommended the routine implementation of techniques such as needlescope cholecystectomy. Additionally, the necessity of the lateral (fourth) trocar, which is employed in the American technique to stabilize the fundus of the gallbladder, has been called into question.⁸⁻¹² Hence; the present study was conducted for comparative evaluation of three port and four port laparoscopic cholecystectomy procedure.

The mean age of the subjects of the three-port group and four port group was 46.3 years and 44.1 years respectively which was comparable in both the groups. It was observed that 80 percent and 82 percent of the patients of the three-port group and four port group were females. Mean operative time among subjects of the three-port group and four port group was 63.8 minutes and 51.7 minutes respectively. Among three-port group, conversion to four port and to open cholecystectomy was seen in 6 percent and 4 percent of the patients respectively while in four-port group, conversion to

open cholecystectomy was seen in 2 percent of the patients. On the day of surgery, at 6 hours, the mean VAS for the subjects of the three-port group and for the subjects of the four port group was 5.8 and 7.5 respectively. Significant results were obtained while comparing the mean postoperative VAS score in between two study groups on of surgery at 6 hours. Moreover, mean VAS was again significantly higher for the subjects of the four port group on the day of discharge and after one week of follow-up. Arora B assessed total of fifty patient's suffering from gall stone disease. In twenty five patients three ports laparoscopic cholecystectomy and in rest of twenty five patients four ports laparoscopic cholecystectomy was done. Observations were made in both groups regarding the condition of gall bladder, bleeding, perforation of gall bladder, bile spillage, stone spillage and bile duct injuries. Both groups A and B were similar in age and sex. There was no difference in mean operative time between the two groups. Statistically there was no significant difference in two groups in regards to bile and stone spillage, gall bladder rupture and haemorrhage. No bile duct injury was recorded in this study. Two patients in each group A and B were converted to open cholecystectomy because of difficulty in dissection. The overall results were told as satisfactory in both the groups. From this study it was concluded that three ports laparoscopic cholecystectomy is a safe technique and is feasible technique for routine use.¹³ Hajong R compared three-port against two-port LC techniques and to see whether there is any advantage in using one technique over the other. A prospective comparative type of study was designed. An odd number of patients were operated on by using the three-port technique (Group A), whereas an even number of patients were operated on by the two-port technique (Group B). Sixty patients with symptomatic gallstone disease were included in the study after obtaining informed consent from each of the patients. All patients were operated on under general anaesthesia. There were 51 female patients and 9 male patients. The mean patient age was 38.67 years. There was less operative time in group A but less postoperative pain in group B. Cosmetic appearance and patient satisfaction for the scar were better in group B. The two-port method appeared to have better acceptability among patients due to lower pain score and better cosmesis.¹⁴

CONCLUSION

The three-port technique for laparoscopic cholecystectomy demonstrates a safety profile comparable to that of the conventional four-port approach. Notably, the three-port method offers several benefits, including reduced postoperative pain, enhanced safety, and minimal scarring. However, it is advisable for surgeons to remain open to the option of adding a fourth port if necessary to guarantee the safe execution of the procedure.

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