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Original Research Article

Three port versus four port laparoscopic cholecystectomy: a prospective comparative clinical study

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ABSTRACT

Background: Although, traditional laparoscopic cholecystectomy is performed using four-port technique, various modifications were made to further enhance the advantages of laparoscopic cholecystectomy. Aim of the study is to compare the results of three-port and four-port laparoscopic cholecystectomy at single centre in terms of technical feasibility, safety of the procedure, operative time, intra-operative complications, postoperative pain and post-operative analgesia requirement.
Methods: It was a prospective comparative study conducted in the department of surgery Smimer medical college Surat, India from July 2018 to July 2019. The study was performed on all adult patients with ultrasound documented cholelithiasis. The total number of patients studied was 50 which were divided into two groups of 25 each.
Results: Demographic data were comparable for both study groups. Patients in the 3-port group had shorter mean operative time (47.3±29.8 min versus 60.8±32.3 min) for the 4-port group (p=0.04). Post-operative requirement of analgesia was less in 3 port group as compared to 4 port group. Pain visual analog scale (VAS) score, intra operative complications, post- operative complications and return to normal activity were significant in our study. Hospital stay and patient satisfaction were non- significant.
Conclusions: The three-port technique is as safe as the standard four-port technique and can be a viable alternative to four port cholecystectomy with an advantage of less analgesic requirement, early post-operative ambulance, early oral feed, and better cosmetic results.

Keywords: Bile, Cholelithiasis, Laparoscopic cholecystectomy, Cystic artery, Cystic duct, Pneumoperitoneum

INTRODUCTION

Phillip Mouret performed the first laparoscopic cholecystectomy (LC) in 1987, and later, Dubois and Perissat established it in 1990.[1] Among digestive tract disorders, diseases of the gallbladder constitute the most, of which gallstone disease is the most common.[2] The mainstay of treatment for symptomatic gallstone disease is cholecystectomy. LC is the gold standard method of treatment of cholelithiasis.[3,4] Attempts at improvement since the first LC are continuous aiming at improving cosmesis and reduction of postoperative pain, hospital stay, and cost.[5] Reduction of pain and duration of hospital stay postoperatively has been attempted through reduction in the size and number of ports.[6-8] Reducing the number of the ports from four to three is the most practical option.[9] In American technique, the gallbladder fundus is grasped and retracted laterally through the lateral fourth port to expose the Calot's triangle. In the three-port technique, the use of this fourth port was omitted with encouraging results from recent studies.[6,10] Performing LC without much difficulty by using the three-port technique defines technical feasibility. This three-port technique is considered to be failed if a fourth port is needed.[11] This prospective comparative study aims at evaluating the feasibility of the three-port technique without affecting the safety and at comparing the outcome of the three port and four-port techniques regarding operative time, requirement of

analgesia, complications, postoperative pain, hospital stay, cosmetic outcome, and return to work.

METHODS

This study included 50 patients with symptomatic gallstone disease and gall bladder polyp confirmed by ultrasound in the Surgical Department, SMIMER medical college from July 2018 to the July 2019. The study was approved by institutional Ethical Committee. Patients who were unwilling to be a part of the study, jaundiced patients with radiologically evidence of common bile duct stones, patients unfit for general anaesthesia, patients with liver cirrhosis, patients with portal hypertension, patients with coagulopathy, patients with acute cholecystitis, patients with empyema of gall bladder, pregnant female or patients with malignancy were excluded. All patients were operated by the same operating team. Informed consent for randomization had been taken from all patients. Patients were randomized for the three-port LC group or the four-port LC group. The patients' demographics and ultrasound findings were recorded. Preoperative workup was done, and patients were admitted the day before surgery.

Three-port technique

The pneumoperitoneum was achieved by either open Hasson's technique or Veress needle technique. Ten millimetres infraumbilical (camera port), 10-mm subxyphoid (working port), and single 5-mm port 3 cm right to right midclavicular line and 3 cm downward from subcostal margin were inserted. This allows better retraction of gall bladder. We used a 10-mm 30° operating telescope (Karl Storz, Germany) in the infraumbilical port. The gallbladder was retracted using grasping forceps through the 5-mm port holding the infundibulum by it jaws and retracting the liver by its shaft providing exposure similar to that done by fundal grasper. Dissection was done through the 10-mm subxyphoid port. The infundibulum was retracted with the left hand, and anterior and posterior dissection is done in Calot's triangle with the right hand creating wide window. Critical view of safety was obtained as it is the most important step to avoid bile duct injury. Clipping of the cystic duct and cystic artery was achieved using 10-mm reloaded single clip applicator through the 10-mm subxyphoid port. Retrieval of the gallbladder was done through the umbilical port .The fascia of port site is closed with one or two absorbable suture. Skin incisions were closed by subcuticular absorbable suture and infiltrated with sensoricane in all patients. Surgical adhesive tape was applied to the port sites at the end of the operation. All dressings were kept in place until the first follow-up visit after 1 week.

Four-port technique

Another 5-mm port was inserted in right flank in the anterior axillary line in addition to the three ports used to grasp and provide traction to the gallbladder fundus. Rest of the procedure was the same as the three-port technique.

Injection ceftriaxone 1 gm intravenous (iv) every 12 hourly, injection metronidazole 100 mg (iv) 8 hourly, injection pantoprazole 40 mg (iv) 12 hourly and iv fluids given to all patient. Injection tramadol 50 mg (iv) single dose given to all patient during the first postoperative 24 hours for pain control. Doses of injection tramadol increased as per requirement of patient. Pain score was the primary outcome measured by VAS (visual analogue score) at 12 hours and 24 hours and was assessed. Other outcome measures included operative time and operative difficulty. The operative time was calculated from the first incision until finishing wound closure. Patients were discharged the day of surgery or the next postoperative day if pain is controlled, oral intake can be tolerated, and no other problems arose; otherwise, the discharge was delayed. The duration required to stop oral analgesic tablets and duration required to return to normal activity were recorded.

Statistical analysis

The student's t test, chi square test, z test with standard deviation was used to evaluate the difference in each parameter. A p value <0.05 was considered statistically significant.

Openepi version 2.3.1 software was used for statistical analysis.

RESULTS

The study included 50 patients: three-port group included 25 patients and four-port group included 25 patients. The demographic data were comparable in both groups (Table 1). In the three-port group no additional port was added. In the four-port group, one (4%) patient was converted to open cholecystectomy (Table 2). The mean operating time in three-port group was 47.3±29.8 min and four-port group was 60.8±32.3 min. Operative time was shorter in three port group than four port group (p=0.04).

Table 1: Demographic data.

Parameters	Three port	Four port	P value
Age (years, mean±SD)	41.24±15.05	38.64±11.74	0.4
Sex, N (%)			
Male	13 (52)	7 (28)	0.08
Female	12 (48)	18 (72)	

Table 2: Conversion.

Conversion	3-port, N (%)	4-port, N (%)
Conversion to open	0	1 (4)
Conversion to 4 port	0	-

Regarding intraoperative complications (haemorrhage, gallbladder perforation, spillage, biliary injury, iatrogenic

liver injury and vascular injury), the difference was statistically significant between the two groups (p=0.001) (Table 3). In three port group there was no post-operative complications where as in four port group 3 (12%) patients showed post-operative complication which is statistically significant (p=0.03). Most common complication was port site infection (Table 4). Satisfaction about cosmetic results between the two groups was statistically insignificant (p=0.16). Post-operative hospital stay was non-significant. Mean hospital stat for three port group was 2.8±0.95 and for four port group was 3.36±1.6 days (p=0.13). Mean days for return to work in three port group (3.8±0.86) and four port group (4.92±1.8) was statistically significant (p=0.007). Post-operative analgesia required in three port groups was 70.83±25.33 and in four port groups was 142±40.3 with p value 0.0001 which is statistically significant. Regarding post-operative pain it was measured using VAS score every 12 and 24 hours. A VAS score 1-3 was called as low pain score (mild) and 4-10 as high pain score (severe). Mean VAS score for three port group was 2.20±1.08 and in four port group was 2.9±0.84, which was statistically significant (p=0.008).

Table 3: Intra operative complications.

Complications	3-port, N (%)	4-port, N (%)	P value
Wound infect	0	3 (12)	0.03
Wound hematoma	0	0	
Haemorrhage	2 (8)	1 (4)	0.001
Gall bladder perforation/bile duct injury	0	0	
Intra operative liver injury	0	0	
Vascular injury	0	0	

Table 4: Post-operative complications.

Complications	3-port	4-port	P value
Operative time (min)	47.3±29.8	60.8±32.3	0.04
Post-operative pain score on vas (1-10)	2.20±1.08	2.9±0.84	0.008
Requirement of analgesia (milligram)	70.83±25.33	142±40	0.001
Days return to normal activity	3.8±0.86	4.92±1.8	0.007
Hospital stay	2.8±0.95	3.36±1.6	0.13
Patient satisfaction score	7.4±0.7	7.08±0.9	0.16

DISCUSSION

The treatment of choice for gallstone disease is LC.[3,4] American technique uses the fourth right flank port to retract the gallbladder fundus, whereas French technique uses the fourth right flank port to retract the liver to expose Calot's triangle.[10,12] Improving outcome of LC depends on reduction in postoperative pain, better cosmetic results, and early return to work. It has been claimed that reduction in the number and size of ports can achieve this outcome. This was proved by previous studies.[13,14]

In the present study, port reduction to three had shown positive results without affecting safety. The present study included 50 patients, with most of the patients being in age group of 20-30 years. Male to female ratio was 12:13 in three port group and in four port group the ratio was 18:7. Gallstone disease is predominant in middle aged females, which might be linked to oestrogen and progesterone hormone especially progesterone acting on gallbladder and reducing motility, causing stasis and thereby promoting gallstone formation.[15] It was also interesting that the mean operative time was shorter for the 3-port LC group, which does not correlate with previous studies.[6,8] One explanation for the shorter operative time in the 3-port group is that less time was spent on the establishment and subsequent closure of the additional port. On the contrary, some authors reported shorter operative time with the four-port group, which agreed with the previous studies.[6,8,16] This might be owing to that the fourth port addition provides good exposure facilitating dissection at the Calot's triangle owing to lateral retraction of the gallbladder. Operative time also depends upon the skill of operating surgeon for the different technique.

Intraoperatively, haemorrhage was the most common complication in both techniques. Three port group showed 8% and four port group showed 4% incidence with p value=0.001 hence it was significant. No other complications (gall bladder perforation, bowel injury, vascular injury, and iatrogenic liver injury) were seen in our study. Haemorrhage in our study was due to dense adhesion of gall bladder with surrounding structures and also due to buried gall bladder. This result of our study was similar with the Sharma study.[17]

In the three-port group, there were no conversions to four-port technique and no conversion to open cholecystectomy because we tried to accomplish procedure without requiring extra port and open conversion, irrespective to time. This result was similar with Kumar et al and Harsha et al study.[11,18] In our study one patient of four port group was required open cholecystectomy because of dense adhesion of acute on chronic inflamed gallbladder with duodenum, stomach and transverse colon. This conversion rate was similar with the studies of Al Aziwa et al Sharma.[17,19] In our study three port group required less analgesia than four port group due to less number of skin incision in three port group. This result is similar with Kumar et al, Harsha et al and Trichak study.[6,11,18] In our study it was seen that three port group showed no post-operative complication and four port showed significant post-operative complication in 3 (12%) patient with most common complication was port site infection. This result

is dissimilar with Al Aziwa and Kumar study.[17,19] It is difficult to explain in terms of number of ports. Postoperative pain was significantly less in three port group. This is similar with previous study.[18]

Post-operative hospital stay was non-significant in our study which correlates with Trichak and Kumar et al study.[6,11] The period of hospital stay was taken from day of surgery till the day of discharge. In our study difference in hospital stay in both group were not significant because of effective management of intra operative and post-operative complications. Early return to work in three port group as compared to four port group was seen whereas patient satisfaction score (score using 10 cm unscaled VAS) were similar in two groups. It was similar with Kumar study.[11]

Although the hospital stay and patient satisfaction were non-significant but time was shorter in the three-port LC, postoperative pain, return to normal activity, intra operative complications and post-operative complications were in favour of the three-port LC. The three-port LC was associated with reduced cost of an additional port, less use of analgesics, and less work days lost, so it seems cost-effective than four-port LC. The three-port LC might be difficult in some situations such as thick wall of the gallbladder, gallbladder packed with calculi, impacted calculus at Hartman's pouch, gallbladder empyema, severe adhesions especially at Calot's triangle, and acute cholecystitis.[11] So, LC can be started with three ports and in case of facing such difficulties a forth port can be inserted.

CONCLUSION

It appeared that three port LC resulted in less post-operative requirement of analgesia, less postoperative pain, early return to work, no post-operative complications with less operative time with comparable hospital stay, intra operative complications when compared to four port LC. Thus three port cholecystectomy can be recommended as a safe alternative procedure in elective surgery.

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