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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 center 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 Skims Medical college Srinagar, India from July 2015 to March 2017. The study was performed on all adult patients with ultrasound documented cholelithiasis and gall bladder Polyposis. The total number of patients studied was 100 which were divided into two groups of 50 each.
Results: The average operative time in three port group was 29.2 minutes (range, 15-37) compared to 30.66 minutes (range, 15-42) in four port group, which was statistically insignificant. The final visual analog scores for pain in the postoperative period was 2.30 vs 2.86 in three port and four port group respectively, with a P value=0.008, which was statistically 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 pain and less analgesic requirement and better cosmetic results.

Keywords: Bile, Cholelithiasis, Cholecystectomy, Cystic artery, Cystic duct, Pneumoperitoneum

INTRODUCTION

Surgery has been the mainstay of treatment for cholelithiasis and in the past several decades research has been conducted to develop less invasive and less painful treatment for gallstone.[1-3] In 1882, Carl Langenbuch, a noted German surgeon, performed the first successful cholecystectomy which remained a gold standard for symptomatic cholelithiasis for over a century.[4,5] However, the introduction of laparoscopic technique to perform cholecystectomy has revolutionized this procedure.[6] The first laparoscopic cholecystectomy was performed by Phillip Mouret in 1987 in France and later established by Dubois and Perissat in 1990.[7] Laparoscopic cholecystectomy is a patient friendly surgery due to reduced incision related morbidity, reduced pain and length of hospital stay, early feeding, better cosmesis and early return to routine work.

Laparoscopic cholecystectomy has been traditionally performed by the standard four port technique. With increasing experience, various modifications were made

to further enhance advantages of laparoscopic cholecystectomy. Laparoscopic cholecystectomy can be safely performed by using three ports and more recently two ports and even single port only.[7,8] These newer techniques take similar time to perform operation and caused less postoperative pain reducing analgesic requirement and have better cosmetic benefits .[7-11]

This study was designed to evaluate the safety and feasibility of three port laparoscopic cholecystectomy as compared to four port laparoscopic cholecystectomy.

The aim of the study was to compare Three-port and four-port laparoscopic cholecystectomy at single centre in with respect to various parameters particularly safety of the procedure ,operative time, intra-operative complications, need for fourth port, conversion rate, Postoperative Pain score, post-operative analgesic requirement and cosmesis.

METHODS

The study Three port vs four port laparoscopic cholecystectomy: a prospective comparative clinical study was conducted prospectively in the department of surgery SKIMS Medical college Bemina Srinagar from July 2015 to March 2017. The study was performed on all adult patients with ultrasound documented cholelithiasis, gall bladder Polyposis or gall bladder adenomyomatosis admitted in the Department for elective surgeries. The study comprised of 100 patients which were randomly taken for a three port (Group 1,50 patients) or four port laparoscopic cholecystectomy (Group 2, 50 patients). Patients which were excluded from the study included patients with acute cholecystitis**,** patients with surgical jaundice associated cholidocholithiasis, carcinoma of gall bladder and patients who had undergone endoscopic retrograde cholangio pancreatography graphy (ERCP) less than three weeks before.

Preoperative assessment

Before the procedure, fully informed consent was taken. Additionally, patient's consent for conversion to an open procedure was obtained. The patients were assured that conversion from one procedure to another procedure does not mean failure, and the two techniques differ only in terms of access to the gallbladder.

Operative technique

Patients were randomly taken either for three port or four port laparoscopic cholecystectomy under general anesthesia using same anesthetic drugs. Pneumo-peritoneum was created by inserting veress needle through a supra-umbilical incision. After creating pneumo-peritoneum,10 mm cannula (camera port) was inserted through the same incision used for veress needle.30^0 operating telescope from Karl storz was placed through this port and peritoneoscopy performed. In four port technique, a 10 mm epigastric port was placed in the midline to the right of falciparum ligament, 5 cm below the xiphisternum (working port). A 5 mm subcostal port, 5 cm below the right costal margin in the mid clavicular line and another 5mm port in the anterior axillary line at the level of umbilicus were placed under direct vision.

In three-port technique a 10 mm epigastric port and one 5 mm subcostal port were placed in the right hypochondrium in the mid clavicular line in the same fashion as in standard four port cholecystectomy. The fourth port in the anterior axillary line was omitted. Dissection was started high in the neck of gallbladder and kept close to the gallbladder until the anatomy was well-defined. The cystic artery and cystic duct were defined, separated and clipped. The gallbladder was dissected off the liver bed using monopolar cautery and finally extracted. The drain was placed in all the patients. The skin incisions were closed by silk sutures. Operative time was recorded from the beginning of first incision till the closure of last incision.

Postoperative care

All the patients were put on intravenous fluid during first 12 hours. Two doses of intravenous antibiotics were given, one in the evening and one in morning. Intramuscular injection of diclofenac 75 mg were given 12 hourly for first 24 hours for postoperative pain control and any patient requiring any additional analgesic injection was documented. Patients were put on orals on the first operative day and advised to take oral analgesic tablets (aceclofenac 100 mg) on need basis only. Patients were monitored for pulse rate, temperature, respiratoryrate, colour and quantity of discharge from drain and any jaundice.

Our primary outcome measure was pain score and analgesia requirement after surgery. An independent doctor assessed the pain score by using 10-cm unscaled visual analog scale (VAS) for each dressing site for next 48 hours after operation (Figure 1).

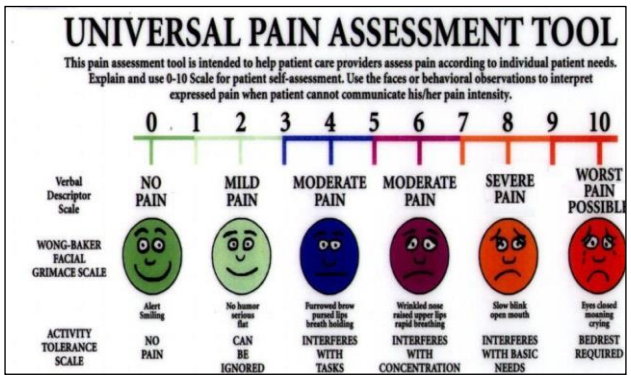

Figure 1: visual analog scale (vas) for assessment of pain.

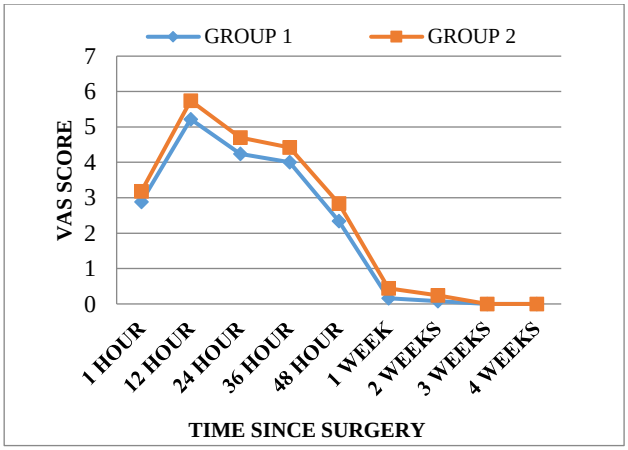

Figure 2: Comparison of postoperative pain score based on visual analog scale.

Follow up

Patients were discharged on second postoperative day, and were advised to take analgesics in tablet form on need basis and to keep a record of it. Patients were followed for at least four weeks on weekly basis. During these visits patients were followed as per the proforma and they were particularly asked about the severity of pain at port sites and the number of analgesics tablets needed, if any.

Statistical analysis

SPSS version 20.0 was used for statistical analysis. Student-ttest was used to evaluate the significance of each parameter. P value <0.05 was considered statistically significant.

RESULTS

A total of 100 patients were included in this prospective study and were randomly distributed into two groups, Group 1 and Group 2, each comprising of 50 patients.

Patients in Group 1 were subjected to three port laparoscopic cholecystectomy, whereas patients in Group 2 were subjected to four port laparoscopic cholecystectomy. It was our routine to take the first patient in the list for three port laparoscopic cholecystectomy and the second patient in the list for four port laparoscopic cholecystectomy. Following observations were noted during the course of the study**.**

The average age of the patient in three port group was 38±12 years with a range, 21 to 53, while as in in four port group average age of the patient was 41±10 Years with a range of 24 to 60 (P=0.1776). In three port group, 12 (24 %) were male and 38 (76%) were females (1:3). On the other hand, in four port group, 11 (22 %) patients were male and 39(78%) were females (1:3), (P=0.648) (Table 1).

Table 1: Demographic data of study group.

Parameter	Three-port (Mean±SD)	Four-port (Mean±SD)	P-value
Age in years	38±12 (21-53)	41±10 (24-60)	0.1776
Weight (kg)	54.13±8.15	53.56±9.56	0.695
Sex ratio (male:female)	12:38	11:39	0.648

The average operative time in Group 1 was 29.26±4.60 minutes (range, 15-37) compared to 30.66±4.02 minutes (range, 15-42) in Group 2. Operative times were similar between the two groups (P=0.1084 (Table 2). The amount of analgesia in early postoperative period was measured by mean number of diclofenac injections consumed by each patient during the first 24 hours and it was significantly higher in Group 2.There was also statistically significant difference in the number of oral analgesic tablets consumed by the patients after they were discharged from hospital (Table 2). Postoperative pain was assessed by visual analogue scale (Figure 1 and Figure 2). The pain scores were calculated at 4, 8, 12, 24, 36 and 48 hours postoperatively, and, at first, second, third and fourth week of follow up. The pain scores were significantly lower in the three port group as compared to the four port group in both the early postoperative period as well as late postoperative period at first and second weeks. The mean visual analogue scale (VAS) score for pain was 2.88 at 1 hour, 5.22 at 12 hours, 4.24 at 24 hours, 4.00 at 36 hours and 2.34 at 48 hours in the three port group and 3.18 at 1 hour, 5.74 at 12 hours, 4.70 at 24 hours, 4.42 at 36 hours and 2.84 at 48 hours in four port group. This difference was statistically significant (P <0.05). Mean VAS score was 0.162 at 1 week and 0.08 at 2 weeks in Group 1. In Group 2 mean VAS score at was 0.44 at 1 week and 0.24 at 2 weeks. This difference in VAS scores at late postoperative period was also statistically significant. The final visual analog scores in the postoperative period was 2.30+/-1.022 vs 2.86+/-1.184 in three port and four port group respectively, with a P value=0.008, which is statistically significant. This suggests that there was a significant difference in pain between the two groups.

Mean postoperative stay in the hospital was 2 days in both the groups and it was not statistically significant. Days to return to normal activity in group 1 and group 2 were 8.02+/0.553 v/s 8.16+/0.681 (p=0.2619), which was not statistically significant (Table 2).

Patient satisfaction score on scars were reviewed 1 week after surgery by an independent doctor who assessed the satisfaction score for the scar by using a 10-cm unscaled VAS (0, unsatisfied, 10 very satisfied). There was no significant difference between the two groups regarding the mean patient satisfaction score for the scar on day 7, which was 8.16+/-0.370 for the Group 1 vs 8.10+/-0.461 for Group 2 (Table 2).

Complication rate was similar in the two groups with no statistical difference (Table 3). In each group 1, there were two cases of gall bladder perforation, one case of bleeding from liver bed and one case of biliary leak.

Table 2: Comparison of study variables.

Parameter	Three-port	Four-port	P value
Operating time in min	29.26±4.60 (15-37)	30.66±4.02 (15-42)	0.1084
Intra-operative complications	4	4	1.00
Post-operative pain score on VAS (1-10)	2.30±1.022	2.86±1.184	0.260*
Analgesic injection Requirement	1.96±0.450	2.22±0.418	0.170*
Need for fourth port	Nil	NA	Nil
Conversion rate	Nil	Nil	Nil
Hospital stay	2 days	2 days	1.00
Analgesic tablet Requirement	5.52 +/- 0.735	5.86 +/- 0.700	0.198*
Number of days to return to normal activity (Mean)	8.02+/0.553	8.16+/0.681	0.2619
Cosmesis satisfaction score	8.16+/-0.37	8.10+/-0.461	0.4746

P-value <0.05 (significant).

Table 3: Intra-operative complications in two groups.

Parameter	Group A	Group B	P value
Gall bladder wall perforation	2	2	1.00
Bilious drain- not clinically significant	1	1	1.00
Bleeding from liver bed	1	1	1.00
Iatrogenic liver injury	0	0	-
Bile duct injury	0	0	-

P-value <0.05 (significant).

DISCUSSION

Surgical removal of gall bladder has been the gold standard for the treatment of symptomatic gall stones because it alone ensures the permanent cure.[2] Although laparoscopic cholecystectomy has been traditionally performed by the standard four port technique but it can be safely performed by using three ports.[9-11] Three port technique is technically feasible and safe, and has cosmetic and cost advantages over the four-port technique. The operator who performs three-port LC should not hesitate to add another port, or to convert to open laparotomy, whenever any difficulties occur during this procedure, to prevent critical complication. Reducing the number and size of ports in laparoscopic cholecystectomy sustains or enhances the advantages of laparoscopic cholecystectomy.

Although some studies suggest that overall pain score, analgesia requirements, hospital stay, and patient satisfaction score on surgery and scars are similar between the two groups, but large number of studies conclude that the two-port laparoscopic cholecystectomy results in less individual port-site pain and fewer surgical scars compared to four-port laparoscopic cholecystectomy.[12,13] Thus, it can be recommended as a routine procedure.

In this study, the age of the patients in the three port group ranged from 21 to 53 years with a mean of 38 years and that in the four port group ranged from 24 to 60 years with a mean of 41 years. This difference in the age of the patients was not statistically significant (P >0.05). Manoj Kumar et al[12] reported a similar age distribution in their study with a mean age of 38.22 years in three port group and a mean age of 39.13 years in four port group. Our results were also comparable to those obtained by A I Nafeh et al.[13]

In the three port, group 38 (76%) were females and 12 (24%) were males (male: female ratio of 1:3). In four port group a 39 (78%) females and 11(22%) males (male:female ratio 1:3), with no statistically significant difference between the two groups. This preponderance of females in our study is also reflected by the results of Dhafir Al-Azawi et al in which the female to male ratio was 4.15:1.[14] Present study results were also comparable to those obtained by Cerci C et al, Tuveri et al, and Burhan Mayir et al.[15-17]

Complication rate was similar in the two groups. There was no incidence of bile duct injury or iatrogenic liver injury in both groups. Mayir B et al, and Harsha et al, published similar results in their studies in terms of complication rates, with no evidence of bile duct injury in any patient.[17,18] However, contrary to our study, there were 12 % cases of gall bladder perforation, 12% cases of biliary leak and 3 12% cases of bleeding from liver bed.

The mean operative time required in three port group was 29.26 minutes and in four port group it was 30.66 minutes. This difference was statistically insignificant (p >0.05). Mayir B et al, reported similar results, with a mean operative time in three port group as 31+/-9.1 versus 31.6+/-7.6 mins in four port group.[17] The difference in the operative time was statistically insignificant. Mean Operative time in a study, by A I Nafeh MD et al , was higher than our study (62 mins in three port group and 65 mins in four port group) with no statistically significant difference.[13] Other studies by Harsha et al and Dhafir Al-Azawi et al, and Harsha et al, also demonstrated statistically insignificant difference in the operative times of two groups.[14,17]

Postoperative pain was assessed by visual analogue scale. The pain scores were significantly lower in the three port group as compared to the four port group in early postoperative period as well as late postoperative period at first and second weeks. The mean visual analogue scale (VAS) score for pain was 2.88 at 1 hour, 4.24 at 24 hours and 2.34 at 48 hours in the three port group and 3.18 at 1 hour 4.70 at 24 hours and 2.84 at 48 hours in four port group. This difference was statistically significant (P <0.05). Mean VAS score was 0.162 at 1 week and 0.08 at 2 weeks in Group 1. In Group 2, mean VAS score was 0.44 at 1 week and 0.24 at 2 weeks. This difference in VAS scores at late postoperative period was also statistically significant. Manoj Kumar, et al reported similar findings in their study.[12] In their study the VAS pain score was significantly low in three port. Mean pain score using 10-cm unscaled VAS was 2.19±1.06 in three port group compared to four port group where it was 2.91±1.20 at 12 hours (p value=0.02). Similarly, at 24 hours mean pain score was 2.22 vs 2.44 (p=0.44). A I Nafeh, et al[13] reported similar findings in their study; the VAS pain score was significantly low in three port group (P value<0.05). Harsha HS et al, also reported similar findings in their study.[18] Patients in three port group had mean pain score of 2.20 compared to 2.96 in four port group and this difference was statistically significant.

In this study, postoperative analgesia requirement was assessed and calculated as the mean number of intramuscular injections needed, in the form of non-steroidal anti-inflammatory drugs by each patient during the first 24 hours and number of days of analgesic tablet requirement after 24 hours. Mean number of analgesic injection requirement was 1.96 in Group 1 versus 2.2 in Group 2. This difference in analgesia requirement was significantly higher in Group 2. There was also statistically significant difference in the number of oral analgesic tablets consumed by the patients after they were discharged from hospital. Nafeh AI et al, reported similar results in their study.[13] The mean number of intramuscular analgesic injections requirement was significantly higher in four port group (1.3+/-0.7) than in three port group (0.9+/-0.6). HS Harsha et al also found statistically significant difference in postoperative analgesia requirement in the two groups.[18] Mean number of analgesic injection requirement was 2.72 in three port and 3.48 in four port group. In another study conducted by Manoj Kumar et al analgesic tablet requirement was significantly higher in four port group as compared to three port group (3.6 vs 4.3).[12]

Mean hospital stay in both the groups was 2days which was statistically insignificant. Nafeh Al et al, reported similar results with a mean hospital stay of 2.2 days in three port group in comparison to mean hospital stay of 2.3 days in four port group which was statistically insignificant.[13] In the study conducted by Manoj Kumar, et al, the hospital stay was 1.19±0.06 days and 1.44± 0.17 days in three port and four port group respectively.[12]

In our study, mean number of days required to return to normal activity was 8.02 in three port group and 8.16 in four port group. This difference was statistically insignificant. However, in a study conducted by Manoj Kumar et al, mean number of days needed to return to normal activity was 4.9 in three port group and 5.8 in four port group and the difference was statistically insignificant.[12] Another study by Nafeh AI et al, also reported no significant difference in return to normal activities in both the groups, however, mean number of days to return to normal activity was significantly higher than this study.[13,19]

Mean satisfaction score in three port group was 8.16 versus 8.10 in four port group, but it did not show any statistical significance. Our results were similar to Manoj Kumar et al, with a mean satisfaction score of 8.2 in three port group and 7.8 in four port group and the difference was statistically insignificant.[12]

CONCLUSION

The three-port technique is as safe as the standard four-port technique and can be a viable alternative to four port cholecystectomy. The main advantages of the three-port technique are it causes less pain, there is less analgesic need and leaves fewer scars. To ensure good results we need experience careful case selection, meticulous technique, well trained team and high standard equipment.

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