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Three-Port Versus Four-Port Laparoscopic Cholecystectomy A Comparative Study

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ABSTRACT
Laparoscopic Cholecystectomy is now considered the Gold Standard for gall bladder stones. The standard procedure makes use of four ports. Surgeons nowadays have marched ahead with only three ports as it is considered to have a good outcome. We aim to compare both these procedures in terms of operative time, hospital stay, complications and cosmetic outcome. This study was conducted in a Tertiary Care Centre in Central India. Total 60 patients with stone in gall bladder seen on Ultrasound or CECT were included and randomly divided into two groups equally. Group A patients were operated by three-port technique and Group B patients were operated by four-port technique. Comparison was done between these two in terms of complications both intra operative and post-operative, hospital stay, operative time and cosmetic outcome. On comparison, the three-port technique was better in terms of hospital stay and cosmetic outcome. Intra operative and postoperative complications, demography, operative time were similar in both groups. Three-port laparoscopic cholecystectomy is a safe and feasible procedure with outcome similar to standard four-port technique and can be done routinely by experienced surgeon. It has better cometic satisfaction to patient and less hospital stay.

INTRODUCTION

Gallstones or Cholelithiasis mean stones inside the Gall Bladder. In India, the prevalence of cholelithiasis ranges from 10-20% in the adult population and affects nearly 4.3% of the population[1]. Hence it is a significant health problem in India. Gall stones or cholelithiasis is asymptomatic in majority of cases (>80%). Approximately 1-2 percent of these patients develop symptoms and complications requiring surgery, which constitute a large number making cholecystectomy one of the most common operations performed by general surgeons[2]. Open cholecystectomy was first performed in 1882 by Carl August Langenbuch[3]. It used to be the mainstay of treatment of gallstones. however, there has been a gradual shift in the treatment since the introduction of laparoscopic cholecystectomy, which was first performed by Philippe Mouret in Lyon, France[4]. Acute and Chronic Calculus Cholecystitis are known complications of cholelithiasis and standard treatment of choice is now Laparoscopic Cholecystectomy[5].

In routine practice, two techniques are usually followed which are French and American. The former uses the fourth trocar to retract liver for better exposure of Calot's triangle and the latter uses a fourth trocar to grasp the fundus of the gall bladder[6]. The standard four-port laparoscopic cholecystectomy is the American technique which consists of one camera port and three working ports. The fourth port is exclusively used to grasp the fundus of gall bladder and give traction sob as to expose the Calot's triangle[7].Many surgeons have now started to perform the Three port Laparoscopic Cholecystectomy with good results.

Many papers regarding the same have been published which showed that the three-port technique has better results than four port in terms of less postoperative pain and early recovery. Less postoperative pain seen due to reduction in number and size of ports[8]. Decreased hospital stay and operative time was documented which significantly increased the cost effectiveness of this procedure. In this study we compared the effectiveness of three-port vs four-port laparoscopic cholecystectomy and studied the various technical parameters, difficulties, intra operative and postoperative complications associated with the two techniques.

MATERIALS AND METHODS

Study description:

Study design: Comparative Study

Study conducted at: Department of General Surgery, N.K.P. Salve Institute of Medical Sciences and Research Centre and Lata Mangeshkar Hospital, Nagpur, India

Sample size: 60

Sampling technique and study population: Simple Random Selection-Into three port group and four port group Nature of subject population-All patients above 18 years of age.

Inclusion criteria: Acute Calculus cholecystitis, Chronic Calculus cholecystitis, Cholelithiasis.

Exclusion criteria: Carcinoma Gall bladder, Empyema of gall bladder, Mucocele of gall bladder. Patients with suspected common bile duct stones, Gallstone Pancreatitis, Acute Cholecystitis or Endoscopic Retrograde Cholangiopancreatography done in the last 1 week were excluded from the study.

Study setting and method of data collection: In all the cases history was taken, general physical examination and the routine blood and radiological investigations were done. Patients were randomly divided into two groups equally i.e. Group A including 30 patients and Group B including 30 patients. Pre-anesthetic checkup was done in all patients. Written well informed consent was taken and patients were posted for surgery which was performed by same operating team. Intra operative complication if any were noted. Operative time taken from first skin incision till closure and dressing was recorded.

Surgical Techniques

Four-port technique: In standard four-port technique one 10 mm Umbilical port is used for the camera. One 10 mm Epigastric port 5 cm below the xiphisternum, one 5 mm port in the right midclavicular line 5 cm below the right costal margin were used as working ports. One 5 mm port i.e., the fourth port in the right anterior axillary line at the level of umbilicus to the right was used to hold the fundus of gall bladder and give traction to expose the Calot's triangle. Instruments were inserted from working ports and dissection started. Posterior dissection was done first followed by anterior dissection to define the anatomy. Critical View of Safety was achieved and cystic duct and cystic artery were clipped and cut. Gallbladder specimen was retrieved from 10mm epigastric port and closure was done.

Three-port technique: Ports similar to standard four-port technique were inserted except for the fourth port i.e. anterior axillary line port. With 5mm midclavicular port a Grasper was inserted to hold the infundibulum or fundus of the Gall Bladder and traction was applied accordingly to expose the Calot's triangle. Rest of the procedure was done similar to that of four-port technique.

Outcome factors: The outcomes factors were operating time, conversion rate, intra-operative

complications, post-operative complications, hospital stay. Conversion rate included conversion to standard four-port technique or open cholecystectomy in three-port group and conversion to open Cholecystectomy in standard laparoscopic (four-port) technique. Intra-operative complications include bile leak due to gall bladder injury, bleeding from liver bed, bleeding from cystic artery, bleeding from liver bed and bile duct injury.

Statistical analysis: For descriptive statistics, continuous variables were presented as mean, standard deviation and range. Comparison of parameters between three-port and four-port laparoscopic cholecystectomy was done using "Chi Square test" or "Fisher Exact test" for categorical variables and "Student T-test" for continuous variables. Software used for statistical analysis was EPI Info version 7 and p<0.05 was considered as significant.

RESULTS AND DISCUSSIONS

Demography: A total of 60 patients were included in this study. Out of these 30 patients were operated by three-port technique i.e. 50% and 30 patients were operated by four-port technique. Age range in group A was 32-65 years with mean age of 49.46±7.614y, while in group B age range was 38 - 66 years with mean age of 49.26±7.59y. Among the total population female patients were more in number than males patients with a Female to Male ratio of 2.3:1. Average weight among Group A was 61.46 with range of 50-76kgs while that in Group B was 63.43 with range of 49-79 kgs.

Conversion to open/four-port laparoscopic cholecystectomy: Out of 30 patients in Group A three patients were converted to Open Cholecystectomy and two patients were converted to four-port technique by inserting an extra port. In Group B, four patients were converted to Open Cholecystectomy. Thus, by applying Fischer Exact Test the p-value is 0.999

Intra operative complications: Various complications seen intra operatively are shown in Table 3. Among the total study population, bleeding was most common complication and Common Bile Duct injury was least common. Bile leak was seen in two patients in group A while in group B three patients had bile leak. Intra operative complications details are shown in figure below.

Operative time and hospital stay: The mean operative time for Group A was 52.23±9.97 9 (in mins) whereas for group B it was 53.87±9.09 which on comparison was Not Significant. Postoperative hospital stay in Group A was 45.97±10.84 (in hours) whereas in Group B was 55.27±9.09, on comparison it was statistically significant.

Post-operative complications: Post operative complications are shown in Table 5. Out of total study population Hematoma was least common followed by wound infection and jaundice. Wound hematoma was not seen in any patient in group A [3-port technique]. Patients with no complications were nearly same in both groups. So, by applying Fischer exact test P value was 0.999.

Cosmetic outcome: In Group A, 24 patients had a good post operative scar and only 1 patient had poor response. In Group B, 16 patients had poor response to scar and 4 patients had a good scar. So, by applying Chi Square test the P value came out to be 0.07.

Laparoscopic Cholecystectomy is the treatment of choice for gall stone disease. Reduction in post-operative pain with better cosmesis and early return to work have been the goals to improve cost effectiveness and patient satisfaction[8,9]. Nowadays due to increasing experience in advanced techniques, Laparoscopic Cholecystectomy is performed by following methods -Four port technique (standard procedure), Three-port technique, Two-port technique, Single port technique or NOTES[10]. Also experience of operating surgeon is vital for a successful and safe procedure[11]. In this study total 60 patients were taken according to inclusion criteria and randomly divided into two groups namely Group A and

Table 1: Demography

Variables	3-Port [Group A]	4-Port [Group B]
Mean Age [in years]	49.46±7.614	49.26±7.59
Age range [in years]	32-65	38-66
Gender: Males	10	8
Females	20	22
Average Weight [in kgs]	61.46	63.43

Table 2: Conversion Rates

Variables	3-port	4-port	p-value
Conversion to open	3	4	0.999
Conversion to 4-port	2	-	
No conversion	25	26	

Table 3: Intraoperative Complications

Variables	3-port	4-port	p-value
Bile leak from Gall Bladder	2	3	0.57
Bleeding	4	5	
CBD injury	2	2	
No complications	22	20	

Table 4: Operative Time and Hospital Stay

Variables	3-port	4-port	p-value
Operative time [in minutes]	52.23±9.97	53.87±10.59	0.54
Hospital Stay [in hours]	45.97±10.84	55.27±9.09	0.00065

Table 5: Comparison of Post-operative Complications

Complications	3-port	4-port	p-value
Wound infection	2	1	0.999
Wound hematoma	0	1	
Jaundice	1	2	
No complication	27	26	

Table 6: Cosmetic Outcome

Cosmetic Outcome	3-port	4-port	p-value
Good	24	16	0.07
Average	5	10	
Poor	1	4	

Group B. Group A patients were operated by three-port technique and Group B by four-port technique. Among total study population age range was 32-66 years with majority patients being in their fourth and fifth decade of life. Similarly, females were more than males i.e. 42 females and 18 males in the study population. Average weight comparison of the two groups was also nearly similar with weight range of 50-79 kgs among total population.

Laparoscopic cholecystectomy is considered as a standard procedure for Gallstones with less complications as compared to open procedure. Laparoscopic cholecystectomy is currently considered the gold standard treatment for gallstones[12]. In our study we came across some complications such as Bile leakage due to injury to Gall Bladder, bleeding and Common Bile Duct Injury out of which bleeding was most common among both the groups. On comparing the complications of both the groups they were found to be similar and most procedure performed had no complications. These complications were taken care of intra operatively but there were some instances which led us to convert to an Open procedure. One example was due to accidental injury to cystic artery due to faulty energy source for which an additional fourth port was inserted thus converting the procedure to four-port technique.

Majority of cases did not require conversion to open surgery in both groups. Similarly post-operative complications were also very less in both groups and no significance was seen. For an experienced surgeon, the average operative time for a laparoscopic cholecystectomy is less than 1 hour[13]. In our study the average operative time for both groups was around 55-60 minutes and fastest surgery done took 35 mins as it was an easy case and procedure went uneventful. As stated earlier, hospital stay also plays in important role to determine the efficiency of a surgical procedure. Hospital stay was time from completion of surgery up to discharge of patient from hospital which was significantly less in group A patients as compared to group B. This difference might be due to number of factors such as patient selection, minimal intra-operative and post-operative complications and less pain due to one less port in the three-port technique. Cosmetic outcome was more satisfactory in group A patients as compared to group B due one less scar of the fourth port.

CONCLUSIONS

We conclude that the three-port laparoscopic cholecystectomy is an easy and safe procedure when performed by an experienced surgeon. Three-port Laparoscopic Cholecystectomy can be more efficacious than standard technique (four-port technique) as hospital stay and cosmetic satisfaction was found to be better in three-port than the four-port technique. Still in case of complicated event during the procedures either three-port one should not wait to insert an extra port or four-port to open surgery conversion should be considered as the patient's life is the first priority.

Additional information

Disclosures

Human subjects: Consent was obtained or waived by all participants in this study. Institutional Ethics Committee, Reg. No.- ECR/88/Inst/MH/2013/RR-19 issued approval 9/2023. The Institutional Ethics Committee approved the proposal of the Project titles "Three Port Versus Four Port Laparoscopic Cholecystectomy - A Comparative Study" for the period of one year and six months in the meeting held on 31/08/2023. It is necessary to inform all the serious adverse events occurring during the course of the study for the committee to decide the future plan of action. Animal subjects: All authors have confirmed that this study did not involve animal subjects or tissue. Conflicts of interest: In compliance with the ICMJE uniform disclosure form, all authors declare the following: Payment/services info: All authors have declared that no financial support was received from any organization for the submitted work. Financial relationships: All authors have declared that they have no financial relationships at present or within the previous three years with any organizations that might have an interest in the submitted work. Other relationships: All authors have declared that there are no other relationships or activities that could appear to have influenced the submitted work.

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