



COMPARISON OF THREE-PORT VS FOUR-PORT LAPAROSCOPIC CHOLECYSTECTOMY

General Surgery

Dr. Surya Prakash	Associate Professor and Head, Department of General Surgery, Maharani Laxmi Bai Medical College, Jhansi, Uttar Pradesh.
Dr. Pradeep Kumar Verma*	Junior Resident, Department of General Surgery, Maharani Laxmi Bai Medical College, Jhansi, Uttar Pradesh. *Corresponding Author
Dr. Rajkumar Rajpoot	Professor, Department of General Surgery, Maharani Laxmi Bai Medical College, Jhansi, Uttar Pradesh.
Dr. Chhaya Shevra	Assistant Professor, Department of Pathology, Maharani Laxmi Bai Medical College, Jhansi, Uttar Pradesh.

ABSTRACT

Introduction: The first laparoscopic cholecystectomy in India was performed in 1990 at the JJ Hospital, Mumbai, followed a few months later in Pune by Dr. Jyotsna Kulkarni. The first workshop in minimal access surgery (MAS) in a teaching hospital was held at the KEM Hospital by Dr. J. B. Agarwal and Dr. A. Dalvi, and in a private hospital at the P. D. Hinduja National Hospital, Mumbai. Viewed at first with apprehension and scepticism by surgeons and patients alike, the gratifying results of the early cases soon converted the surgical community to ardent believers, a conversion largely propelled by patient demand.

Aim: To compare three-port laparoscopic cholecystectomy (LC) with four-port LC in chronic calculous cholecystitis patients. We compared the following parameter Feasibility of the procedure, Total operative time, Incidence of complications and Cosmetic results

Material and Methods: The comparative study will be done on patients presenting to Department of Surgery, Maharani Laxmi Bai Medical College, Jhansi, either in emergency or OPD undergoing Three-port or Four-port Laparoscopic Cholecystectomy from August 2018 to September 2020. The study was done on 100 patients. Out of which 50 patients were included in group A (3 port laparoscopic cholecystectomy) and 50 patients were included in Group B (4 port laparoscopic cholecystectomy).

Result: There was no difference between the two groups in age, sex. In terms of outcome, there was significant result between the two groups in visual analogue scale, analgesia requirement in dose, cosmesis score and post operative hospital stay (in days).

Conclusion: 3 port laparoscopic cholecystectomy can be advocated to be better than the 4 port technique but especially in experienced hands and 4 port laparoscopic cholecystectomy is better for beginners.

KEYWORDS

Four port, laparoscopic cholecystectomy, outcome, three port

INTRODUCTION

The introduction of minimal access surgery for gallbladder surgery has revolutionized the treatment of gallstones. The advantages of laparoscopic procedure are lesser postoperative pain, lesser incidence of surgical site infection and shorter hospital stay^[1]. Abdominal incision has been reduced to four (or more) small stab incisions. This approach significantly causes less postoperative pain, less bleeding, short hospital stay, and a good cosmetic outcome. The benefits were assessed very soon afterward: Less postoperative pain, shortened hospital stay, rapid recovery, and better cosmetic results. As the technique became a routine procedure, modifications were made in order to make it less invasive and more cosmetic. Later, technical advances introduced the 5-mm laparoscope and the 5-mm clip applicators, thus decreasing the port size, and later, the newer 2- or 3-mm instruments allowed the surgeons to make smaller incisions. The use of a working channel laparoscope made it possible to use only two ports, along with transdermal sutures and needles, for an easier manipulation of the gallbladder. Natural orifice transluminal endoscopic surgery (NOTES) has been shown to offer further improvements in advantages of laparoscopic cholecystectomy (LC), i.e., decreased pain, early ambulation, and better cosmesis^[2]. Gallstone disease has been known since long as far as the 5th century when Greek physician Trallianus wrote about gallstones^[3]. Nowadays, LC is the gold standard for the treatment of symptomatic gallstones.

Gallstones are remarkably common, especially in female population, and are a major expensive health problem. Its prevalence has become more apparent since the introduction of ultrasonography. The incidence of cholelithiasis in the United States is reported to be 10%. In addition to these 20,000,000 people with documented cholelithiasis, another 800,000 new cases are diagnosed annually^[4] and 500,000 cholecystectomies are being performed annually^[5]. The advantages of laparoscopy over conventional or classic surgery include decreased pain, improved cosmetic results, and a decreased duration of hospital stay. For this reason, LC is nowadays performed through fewer and smaller ports. In recent years, multiple studies of single-incision laparoscopic surgery (SILS) have been published. The only reported advantage of SILS over standard LC is an improved cosmetic result^[6-7].

Four-port LC is most commonly used, as this method provides better anatomic views and is easier to learn^[8]. This study has been undertaken to assess the feasibility of three-port LC and compare its advantages and disadvantages over the standard four-port technique.

AIM

To compare three-port laparoscopic cholecystectomy (LC) with four-port LC in chronic calculous cholecystitis patients. We compared the following parameter

- Feasibility of the procedure
- Total operative time
- Postoperative pain
- Incidence of complications
- Cosmetic results

MATERIAL AND METHOD

The comparative study will be done on patients presenting to Department of Surgery, Maharani Laxmi Bai Medical College, Jhansi, either in emergency or OPD undergoing Three-port or Four-port Laparoscopic Cholecystectomy from August 2018 to September 2020. All patients admitted at Maharani Laxmi Bai Medical College, Jhansi who meet the inclusion and exclusion criteria are taken up for the study, on the basis of proposed sampling.

Sample size of 100 patients:

- Group A (50) Patients of Three-port Laparoscopic Cholecystectomy
- Group B (50) Patients of Four-port Laparoscopic Cholecystectomy

All the cases of chronic calculous cholecystitis were included in the study, and the cases diagnosed with acute cholecystitis, empyema gallbladder, perforation gallbladder, and contraindications for laparoscopic surgery were excluded from this study.

In all the cases, relevant history, general physical examination, and the routine blood and radiological investigations were done as per proforma attached, to confirm the diagnosis and assess medical fitness of the patients.

Laparoscopic cholecystectomy techniques:

The three-port technique involves inserting a 10 mm trocar (Bladeless trocar – Johnson and Johnson) just above the umbilicus using the open technique (Hasson's technique) through which the zero viewing videoscope (Olympus) was introduced. Another 10 mm trocar (Endopath Tristar trocar – Johnson and Johnson) was inserted 3 cm below the xiphisternum; and finally, a 5 mm trocar (Endopath Tristar trocar) at the right hypochondrium anterior axillary line 3 cm below the costal margin. The operating surgeon conducted the procedure from the left side of the patient together with the assistant holding the camera while the TV monitor was located on the upper left side of the patient and the nurse on the lower left side of the patient. The operating surgeon holds the dissecting instruments with his right hand through the 10 mm trocar while holding the gall bladder at the infundibulum with a grasper through the 5 mm trocar, moving the infundibulum right and left or back and forth to display Calot's triangle, blunt dissection was used for adequate display of the cystic duct and cystic artery. The cystic duct was then clipped and divided followed by the cystic artery. The gall bladder was then dissected from its bed and extracted from either the umbilical or the subxephesternal ports. IOC was performed through the 10 mm subxephesternal trocar. The four-port LC was performed using the North American 'flip over' technique.

Post-operative analgesia requirement

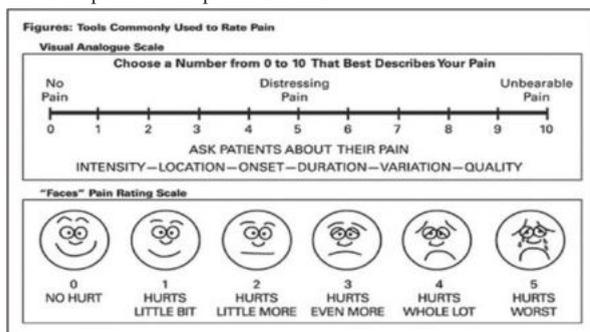
After surgery patients were taken to the post-anaesthesia care unit after which they were taken to the inpatient ward where they were given analgesics (pethidine and/ or diclofenac) unless allergies or specific contraindications were noted. Patients received their analgesics according to their pain ratings measured by nursing staff using the verbal rating scale. The total amount of analgesia required by each patient was calculated over 48 hours after surgery. Discharge from hospital was made as a joint decision between nursing staff, the surgical team and patients using an early discharge planning rating scale applied by the department of surgery in the hospital.

The pain scores to be used in our study would be —

1. Visual analogue scale (VAS)
2. Faces pain scale (FPS)

Visual analogue scale (VAS)

A visual analogue scale (VAS) is a measurement instrument that tries to measure a characteristics or attitude that is beveled to range across a continuum of values and cannot easily be directly measured. For example, the amount of pain that a patients feels ranges across a continuum from none to an extreme amount of pain. From the patients perspective this spectrum appears continuous their pain does not take discrete jumps, as a categorization of none, mild, moderate and severe would suggest. It was to capture this idea of an underlying continuum that the VAS was devised. Operationally a VAS is usually a horizontal line, 100 mm in length, anchored by word descriptors at each end, as illustrated in Figure. The patients marks of the line the point that they feel represents their perception of their current state. The VAS score is determined by measuring in millimeters from the left hand end of the line to the point that the patients marks.



Method of recording:

The pain VAS is self completed by the respondents. The respondents are asked to place a line perpendicular to the VAS line at the point that represents their pain intensity.

STATISTICAL ANALYSIS:

Descriptive statistical analysis has been carried out to present the data in the present study. Results on continuous measurements are presented with Mean and standard deviation and results on categorical measurements are presented in number and percentages. Significance is assessed at 5% level of significance. Student t test (two tailed, independent) has been used to find the significance of study parameters

on continuous scale between two groups. Chi-square/ fisher exact test has been used to find the significance of study parameters on categorical scale between the two groups.

The statistical software SPSS version 17.0 was used for the analysis of the data and Microsoft word and Excel have been used to generate graphs and tables.

RESULT

Table 1: Age wise distribution in study group

Age (in years)	Group A (3 Port)		Group B (4 Port)	
	No of Patients	Percentage	No of Patients	Percentage
11-30 years	16	32%	13	26%
31-50 years	18	36%	27	54%
>51 years	16	32%	10	20%
Mean±SD	41.80±15.038		39.74±13.689	
p value	0.47 (NS)			

Table 2: Sex wise distribution in study group

Sex	Group A (3 Port)		Group B (4 Port)	
	No of Patients	Percentage	No of Patients	Percentage
Male	7	14%	7	14%
Female	43	86%	43	86%
Total	50	100%	50	100%

Table 3: Presenting complaints distribution in study group

Presenting complaints	Group A (3 Port)		Group B (4 Port)	
	No of Patients	Percentage	No of Patients	Percentage
Pain	26	52%	34	68%
Vomiting	17	34%	28	56%
Burning sensation in chest and upper abdomen	2	4%	2	4%
Fever with jaundice (yellowish discoloration of skin/nail)	3	6%	7	14%
Other	0	0%	0	0%

Table 4: Comparison of incidence of single/multiple stone in study group

Gall bladder stone	Group A (3 Port)		Group B (4 Port)	
	No of Patients	Percentage	No of Patients	Percentage
Single	21	42%	19	38%
Multiple	29	58%	31	62%
Total	50	100%	50	100%

Table 5: Mean size of stone (in mm) stone in study group

Mean size of stone (in mm)	Group A (3 Port)	Group B (4 Port)	p value
Mean±SD	11.84±3.190	11.31±3.088	0.40 (NS)

Table 6: Mean CBD diameter (in mm) in study group

Mean CBD diameter (in mm)	Group A (3 Port)	Group B (4 Port)	p value
Mean±SD	4.15±0.898	4.21±0.950	0.74 (NS)

Table 7: VAS pain score before surgery and after surgery in study group

VAS pain score before surgery and after surgery	Group A (3 Port) (Mean±SD)	Group B (4 Port) (Mean±SD)	p value
Day 1 after surgery	3.22±0.418	3.5±0.580	0.03 (S)
Day 2 after surgery	1.22±0.418	1.48±0.544	0.008 (S)

Table 8: Analgesia requirement in dose (1 dose=75mg diclofenac sodium given i.m.) in study group

Analgesia requirement (in dose)	Group A (3 Port)		Group B (4 Port)	
	No of Patients	Percentage	No of Patients	Percentage
1 dose	31	62%	24	48%
2 dose	17	34%	9	18%
3 dose	1	2%	13	26%
4 dose	1	2%	4	8%

Mean±SD	1.44±0.644	1.94±1.038
P value	0.004 (S)	

Table 9: Mean operative time (in min) in study group

Operative time (in min)	Group A (3 Port)	Group B (4 Port)	p value
Mean±SD	41.38±7.071	41.78±14.424	0.86 (NS)

Table 10: Intra operative complications in study group

Intra operative complications	Group A (3 Port)		Group B (4 Port)	
	No of Patients	Percentage	No of Patients	Percentage
Vascular injury	2	4%	2	4%
Ductal injury	2	4%	2	4%
Biliary leakage	4	8%	2	4%

Table 11: Post operative complications in study group

Intra operative complications	Group A (3 Port)		Group B (4 Port)	
	No of Patients	Percentage	No of Patients	Percentage
Wound complication (Seroma)	0	0%	2	4%
Biliary peritonitis	0	0%	0	0%
Bleeding	4	8%	0	0%

Table 12: Mean cosmesis scoring in study group

Mean cosmesis scoring	Group A (3 Port)	Group B (4 Port)	p value
Mean±SD	7.24±0.771	6.32±1.133	0.0001 (S)

Table 13: Drain removal (in days) after surgery in study group

Drain removal after surgery	Group A (3 Port)		Group B (4 Port)	
	No of Patients	Percentage	No of Patients	Percentage
2 days	15	30%	46	92%
3 days	1	2%	3	6%
4 days	0	0%	1	2%

Table 14: Mean post operative hospital stay (in days) in study group

Mean post operative hospital stay (in days)	Group A (3 Port)	Group B (4 Port)	p value
Mean±SD	3.22±0.648	3.9±0.707	0.0001 (S)

DISCUSSION

Good results in Laparoscopic Cholecystectomy depends on many factors and most important one is experience of the surgeon in laparoscopy. Laparoscopic Cholecystectomy using three ports mandate good experience in Laparoscopy for not to threaten the benefits of this procedure. The standard four port approach is followed by the majority of surgeons. The use of the fourth trocar which is generally used for fundus retraction in the American technique seemed unnecessary by some surgeon.

In our study the most common age group was 31-50 years in three port group and 31-50 years in four port group (p value=0.47), which is almost similar to Manoj Kumar et al^[9] who found the mean age to be 38.7±13.7 in 3 port and 39.13±14.1 in 4 port group. Similar results were reported by Dhafir Al-Azawi et al^[10] and HS Harsha et al^[11] who all found the most common age group to be 31- 50 yrs in both the groups.

Female to male ratio in our study was 6.14:1 in both 3 and 4 port groups, which is almost similar to Dhafir Al-Azawi et al^[10] who reported the female male sex ratio to be 4:1 in both the groups whereas Manoj Kumar et al^[9] found the sex ratio to be 5:1 in 3 port group and 4:1 in 4 port group.

In our study **pain RHC (on/off)** was present in 26 (52%) patients in 3 port groups and 34 (68%) patients in 4 port group. This was more after fatty meals. **Epigastric discomfort** was present in 2 (4%) patients in 3 port group and 2 (4%) patients in 4 port group. **Vomiting** was present in 17 (34%) patients 3 port and 28 (56%) patients in 4 port group. **Fever with jaundice** was present in 3 (6%) patients in 3 port and 7 (14%) patients in 4 port group. Our results were comparable with the study of Manoj Kumar et al^[9].

Routine laboratory investigations were done in all the cases.

However no statistically significant difference was found between the two groups.

In our study 21 (42%) patients in 3 port group had a **single stone** in gall bladder while as 29 (58%) patients had **multiple stones**. In 4 ports group 19 (38%) patients were having a **single stone** in contrast to 31 (62%) patients who had **multiple stones**.

Mean size of stone was 11.84±3.190 in 3 port and 11.31±3.088 in 4 port group (p value=0.40).

Mean CBD diameter was 4.15±0.898 in 3 port group and 4.21±0.950 in 4 port group (p value=0.74).

Subhepatic drain was placed in 16 (32%) patients in 3 port group because of difficult dissection in view of adhesions and gallbladder perforation during surgery leading to spillage of bile and stones. After saline washes and retrieval of stones a drain was left in sub hepatic region in all these patients. Sub hepatic drain was placed in all 50 (100%) patients in 4 port group conventionally.

1 (2%) patients was **converted to open** in 3 port group and 4 (8%) patient in 4 port group. Total 14 (28%) patients, 8 (16%) from 3 port and 6 (12%) from 4 port group had difficulty in dissection of gall bladder bed, resulting in **vascular injury** in 2 (4%) patient from each group, **ductal injury** in 2 (4%) patient from each group and **biliary leakage** in 4 (8%) patient in 3 port group and 2 (4%) patient in 4 port group. Post-operative period was uneventful in both group. Nafeh A I et al^[12] and Slim K et al^[13] also reported similar results in their studies.

There was no **death** in either group, and there were a total of 6 (12%) **minor complications** in the study group 4 (8%) in 3 port and 2 (4%) in 4- port groups and was statistically insignificant. 4 (8%) patients two from each group develops **fever >100F** probably due to thrombophlebitis in both groups.

2 (4%) patients in 4 port group developed **port site seroma** in epigastric port only, because the enlargement of the epigastric port was needed in view of large stone size and 4 (8%) patient in 3 port group had **Minor port site bleeding**:

None of the patient in our study group has jaundice, port site hematoma and port site hernia.

The **mean operative time** in 3 port was 41.38±7.071 minutes and in 4 port group was 41.78±14.424 minutes (p value=0.86). Similar results were reported by Nafeh A I et al^[12]. The **operative field** was quite clear and better in standard 4 port cases. In some cases of 3 port group, the liver and gall bladder hindered the operative field and consumed slightly more time (average 5-10 minutes).

In our study there is difference in **hospital stay** in 3 port as compared to 4 port (3 port 3.22±0.648 vs 4 port 3.9±0.707, p=0.0001). Laparoscopic cholecystectomy is a day care surgery and the patient can be discharged in a day. But in our study the time was beyond 72 hours as the patient population catered was from a rural background so the discharge was postponed for their satisfaction. In study by Manoj Kumar et al^[9], mean postoperative stay in the hospital was 1.19 vs 1.44 (P=0.39) in the 3- and 4-port groups.

The **VAS scores** were significantly lower in the three port group as compared to the four port group on day one and two. The mean visual analogue score for pain on postoperative days was 3.22±0.418 on day one, 1.22±0.418 on day two in the 3 port group and 3.5±0.580 on day 1, 1.48±0.544 on day 2 in 4 port group (P value=0.008). Manoj Kumar et al^[9] reported that the VAS score was significantly low in three port group.

The **average analgesia** required was 1.44±0.644 doses in 3 port group and 1.94±0.038 doses in 4 port group (one dose= 75mg of diclofenac sodium given i/m), the difference was statistically significant (P value= 0.004). These results were comparable with the results reported by Dion Y M et al^[14].

Cosmesis was assessed by the subjective satisfaction score based on size of the surgical scars and the number of scars. Patients in both the groups were operated laparoscopically, however in three port group there was one less scar than four port group. Average(range) scar size

was 4 mm scar (3.5–5.5 mm) at 5 mm port and 11 mm scar (9–11 mm) at the epigastric port area, the umbilical scar was not seen. It was noted that port site scars were hardly visible after healing. Mean cosmesis scoring was 7.24 ± 0.771 in 3 port group and 6.32 ± 1.133 in 4 port group (p value= 0.0001). Overall patients in both the groups were highly satisfied over the cosmetic outcomes of their surgery. The three-port technique is as safe as the standard four-port laparoscopic cholecystectomy in experienced hands.

CONCLUSION

We concluded that the use of 3 ports in laparoscopic cholecystectomy did not significantly affect the

- Procedure's safety,
- Conversion rate,
- Operating time when used in chronic cholecystitis.

The introduction of the three-port technique, which is still in routine practice in our institute, has the following advantages

- Less man power requirement.
- Need of fewer painkillers.
- Shorter hospital stays.
- Better cosmetic outcome.

Where is 4 port technique has following advantages

- Better view of operative field.
- Easy dissection of calot's triangle.
- Easy suture applicability.
- Dissection of difficult gall bladder from GB Fossa.

So 3 port lap cholecystectomy can be advocated to be better than the 4 port technique but especially in experienced hands and 4 port laparoscopic cholecystectomy is better for beginners.

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