Original article:

Comparison of three port laparoscopic cholecystectomy with four port laparoscopic cholecystectomy

Ram Kirti Garg[1], Rajesh Kumar[2] ,Bir Singh[3], Rikki Singal[4], Kiran Kumar Singal[5],Ram Gopal Sharma[6]

Abstract:

Objective: Laparoscopic cholecystectomy, gold standard treatment for cholelithiasis, has traditionally been done using 4 ports. We compared four port procedure with newer 3-port cholecystectomy.

Methods: Sixty patients were operated by equally dividing them into two groups and using two procedures mentioned in the objective.

Results and Discussion: Assessment was carried out using parameters like operative time, cosmetic appearance and complications. Results were similar except operative time which was much less with 4-port procedure.

Conclusion: It will require lot of training before three port laparoscopic cholecystectomy can become popular and beneficial compared to four-port procedure.

Keywords: cholelithiasis; three-port cholecystectomy; four-port cholecystectomy.

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Introduction

The incidence of cholelithiasis varies widely in different parts of the world. In US alone, 8,00,000 new cases are diagnosed annually.[1] The incidence of symptomatic gall stone disease is thought to be as high as 15-20% in North Indian population. Majority of people having gall stones are asymptomatic.[2] With the revolution brought about by ultrasound, more number of patients having gall stones, are being diagnosed early.

Cholecystectomy remains the gold standard treatment for cholelithiasis. Conventional (Open) cholecystectomy has significant morbidity[3] and disadvantages for the patients in terms of poor cosmetic result, significant post-operative pain and prolonged hospital stay. They require hospitalization for about one week and loss of work for upto one month .[4]

Mini-Cholecystectamy using a smaller incision has evolved as a better alternative method for quicker recovery and less post operative pain.[5]

The introduction of laparoscopy has further

1. Dr. Ram Kirti Garg,Ex. Assistant Professor, Department of Surgery, . M.M. Institute of Medical Sciences & Resarch, Mullana(Ambala), India.
2. Dr. RajeshKumar, Associate Professor, Department of Surgery, M.M. Medical College & Hospital, Kumarhatti, Solan(HP),India.
3. Dr. BirSingh, Ex. Professor, Department of Surgery, M.M.Institute of Medical Sciences & Resarch, Mullana (Ambala), India.
4. Dr. Rikki Singal, Ex.Professor, Department of Surgery, M.M.Institute of Medical Sciences & Resarch, Mullana (Ambala), India.
5. Dr Kiran Kumar Singal, Professor, Department of Medicine, M.M. Medical College & Hospital, Kumarhatti, Solan (HP), India.
6. Dr. Ram Gopal Sharma, Professor, Department of Surgery M.M.Institute of Medical Sciences &Resarch, Mullana (Ambala), India.

Correspondence: Dr. Rajesh Kumar, Associate Professor,Department of Surgery, M.M.Medical College & Hospital, Kumarhatti, Solan(HP), India E-mail: rajesh5403@rediffmail.com

revolutionised this concept of surgical minimalism. The abdominal incision has been reduced to four (or less) small stab incisions. This approach results in significantly less post-operative pain, short hospital stay and good cosmetic outcome.[6]

Since the advent of laparoscopic cholecystectomy, the four-port technique has been the standard procedure. With time, many refinements have been made in the procedure i.e. reducing number of ports and port – size. This has led to evolution of three-port, two-port and single-port laparoscopic cholecystectomy.

The present study was undertaken to compare the various merits and demerits of the Three versus four-port laparoscopic cholecystectomy, performed by the same surgical team in the same scenario, in terms of parameters mentioned subsequently.

Aims and objectives

To compare three port laparoscopic cholecystectomy with four port procedure regarding feasibility of the procedure, operative time, incidence of complications and cosmetic appearance.

Material and methods

Total 60 adult patients of cholelithiasis in the age group of 18-60, admitted, during the period December 2011 to December 2013, to M.M. Institute of Medical Sciences & Research, Mullana, Ambala, India;were taken up for the present study.

Inclusion criteria:

1. All the cases of symptomatic cholelithiasis

who were found fit for surgery

Exclusion criteria:

1. Acute cholecystitis

2. Empyema gall bladder

3. Perforation gall bladder

4. Badly scarred abdomen

In all the cases, investigational work up was done, to confirm the diagnosis and assess medical fitness of the patient.

Patients were blindly assigned to two groups of 30 patients each:

Group I: Three port laparoscopic cholecystectomy.

Group II: Four port laparoscopic cholecystectomy.

Observations

Table 1. Operative time

Duration of surgery (in mins)	Group I		Group II	
	No.of cases	**%age**	**No. of cases**	**%age**
Upto 40	0	0	10	33
41 – 80	10	33	20	67
> 80	17	57	0	0
Conversion to 4 port surgery	3	10	0	0
Total	**30**	**100**	**30**	**100**
Range	65 – 150		30 – 60	
Mean ±SD	93.16 ± 21.23		50.66 ± 10.40	
't' and p value	-9.84<0.05			
Significance	Significant			

Three patients (10%) of Group I were converted to four port procedure and none of the patient of Group II was converted to open cholecystectomy. Mean operative time in Group I was 93.16 minutes and 50.66 minutes in Group II. This difference in time is significant as p value

Table 2. Peroperative complications

Complications	**Group I**		**Group II**	
	No. of cases	**%age**	**No. of cases**	**%age**
Bile duct injury	-	-	-	-
Spillage of stones	10	33	3	10
Bile leak from gall bladder	10	33	3	10
Cystic artery bleed	1	3	-	-

Statistical Analysis

	X2	**DF**	**p**	**Significance**
Spillage of stones	2.769	1	>0.05	NS
Bile leak from gall bladder	2.769	1	>0.05	NS

Spillage of stones occurred in 10 patients (33%) in Group I and in 3 patients (10%) in Group II. Bile leak from gall bladder occurred in 10 patients (33%) in Group I and in 3 patients (10%) in Group II. Only one patient had cystic artery bleed in Group I. There was no such case of in Group II.

Table 3. Analgesic requirement

No. of Injections (Diclofenac)	Group I		Group II	
	No. of cases	%age	No. of cases	%age
1	25	83	29	97
2	2	7	1	3
=/> 3	-	-	-	-
Conversion	3	10	-	-
Total	**30**	**100**	**30**	**100**
Range	1 – 2		1 – 2	
Mean ±SD	1.1 ±0.30		1.03 ± 0.18	
't' and p value	-1.09	>0.05		
Significance	NS			

Mean number of injections of analgesic (diclofenac) required in Group I were 1.1 and in Group II were 1.03. 25 patients (83%) in Group I required 1 injection of analgesic postoperatively, 29 patients (97%) in Group II required 1 injection of analgesic postoperatively.

Table 4. Number of days in hospital

Hospital Stay (in days)	Group I		Group II	
	No. of cases	%age	No. of cases	%age
1 – 3	4	13	9	30
4 – 6	14	47	11	37
7 – 9	4	13	6	20
> 10	5	17	4	13
Conversion	3	10	-	-
Total	**30**	**100**	**30**	**100**
Range	3 –21		2–8	
Mean ±SD	7.0 ±4.16		6.0 ± 4.12	
't' and p value	-0.93>0.05			
Significance	NS			

Mean hospital stay for Group I patients was 7.0 ± 4.16 days and for Group II was 6.0 ± 4.12 days.

Minimum hospital stay in Group I was 3 days and maximum of 21 days. Minimum hospital stay in Group II was 2 days and maximum of 18 days.

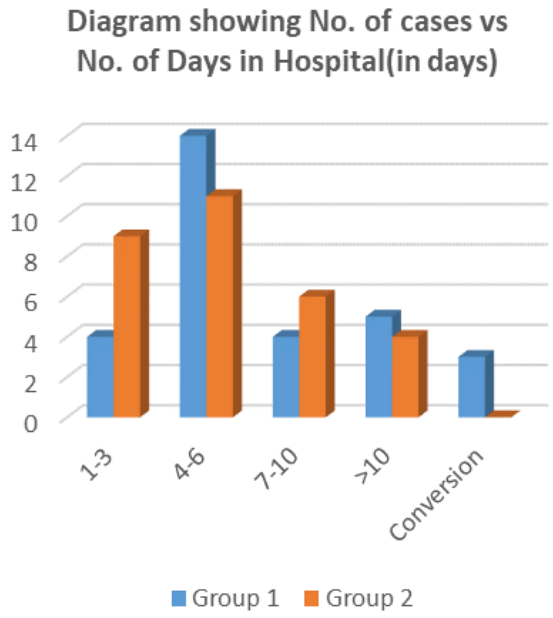

Figure **1.** Hospital Stay

Table 5. Cosmetic appearance

Cosmetic Appearance	Group I		Group II	
	No. of cases	%age	No. of cases	%age
Good	20	67	26	87
Very Good	7	23	4	13
Conversion	3	10	-	-
Total	**30**	**100**	**30**	**100**

Statistical Analysis

X^2	DF	p	Significance
4.601	2	>0.05	NS

27 patients (90%) of Group I reported cosmetic appearance of scar either good or very good and it was same response in all patients (100%) of Group II.

Discussion

Cholecystectomy has come a long way since it was first performed by Langenbuch in year 1882. The increasing acceptance of surgical treatment for gall stone disease over past 130 years is the result of increasing safety and ease with which the operation is accomplished and the satisfactory long-term relief of symptoms and interruption of the pathological processes involved.[7]

Today laparoscopic cholecystectomy has become the gold standard for treating cholelithiasis, and since its advent four ports have been used for performing the procedure. But with time, many refinements have

been made. These include decreasing the number of ports and port-size leading to evolution of the three-port procedure, two-port procedure and even single incision laparoscopic cholecystectomy.

In the present study, we have compared the two methods of laparoscopic cholecystectomy i.e. three-port laparoscopic cholecystectomy and the standard four-port cholecystectomy. Cases were randomly divided into two groups of 30 each and were designated as Group I and II. In Group I three-port laparoscopic cholecystectomy was performed and in Group II surgery was carried out using 4 ports.

The operative technique which we followed in Group I was like the usual four-port technique but without the lateral most fourth port usually needed for retraction of fundus of gall bladder. The same technique had been used by Tagaya et al, 1998[8]; Leggett et al, 2000[9] and Trichak, 2003[10]. However, Slim et al, 1995[11] used different port placements. In his technique, the primary 10 mm trocar was placed at the umbilicus for the video laparoscope, the second 10 mm trocar was placed midway between the umbilicus and the xiphoid process, 2-3 cm on the left of the midline and the third 5 mm trocar was placed in the iliac fossa.

Peroperative Difficulties:

Anatomy of Calot's triangle was obscured by dense adhesions with surrounding structures in 8 cases (27%) of Group I and in 15 cases (50%) of Group II. Due to dense adhesions in Calot's triangle 3-port laparoscopic cholecystectomy had to be abandoned in three cases and procedure was converted to 4-port laparoscopic cholecystectomy. Despite more number of cases having dense adhesions in Calot's triangle in Group II, operation could be performed with ease and none of the cases required conversion to open procedure.

Slim et al, 1995[11] reported conversion rate of 3-port laparoscopic cholecystectomy to 4-port procedure to be 10% and no conversion to open cholecystectomy. Tagaya et al, 1998[8] reported the use of additional fourth port in 4.6% of patients due to poor operative field and conversion to open cholecystectomy in 3.8% patients.

The following table shows conversion rate of 3 -port laparoscopic cholecystectomy to 4-port procedure or open cholecystectomy.

Table 6. Procedure Conversion

Study	Conversion rate to open cholecystectomy (in %age)	Conversion rate to 4-port Cholecystectomy (in %age)
Slim et al, 1995[11]	3.6	8
Tagaya et al, 1998[8]	3.8	4.6
Leggett et al, 2000[9]	0	0
Present Study, 2011-2013	0	10

The conversion rate of 10% in the present study may appear to be high compared to the above-mentioned studies. But, the threshold for conversion was kept low in the interest of the patients and it was not regarded as a complication or failure of 3-port procedure but a prudent approach under the circumstances. Also, the clinical material may be different from western experience since many of our patients presented late and had evidence of severe chronic inflammation. Moreover, the surgical team was not experienced in performing 3-port laparoscopic cholecystectomy.

Much difficulty was encountered while clipping the cystic artery and cystic duct in 3-port laparoscopic cholecystectomy as surgeon was unable to see both the ends of the clip. This was due to poor retraction of gall bladder due to lack of fourth fundal port and it repeatedly fell back into the operative field. However, Slim et al, 1995[11]; Tagaya et al, 1998[8]; Leggett et al, 2000[9] and Trichak, 2003[10] in their studies had not commented on this difficulty. Study shows that despite difficulties faced during 3 port surgery, in 90% of the cases procedure could be accomplished; therefore, it is definitely a feasible proposition.

Peroperative complications:

Most of the complications occur early in the surgeon's experience. Moore and Bennett, 1995[12], in their multivariate regression analysis concluded that the only significant factor associated with an adverse outcome was the surgeon's experience with procedure. The regression model predicted that a surgeon had a 1.7% chance of a bile duct injury occurring in the first case and 0.17% chance of a bile duct injury in the 50th case.

Most common source of bleeding during laparoscopic cholecystectomy is injury to the cystic artery or its branches (Cuschieri et al, 1991).[13]

Table 7. Per operative Bleeding

Bleeding	
Study	**Incidence (%age)**
Cuschieri et al, 1991[13]	0.9
Southern Surgeons Club, 1991[14]	0.3
Present study, 2011-2013	0

In the present study the incidence of hemorrhage during surgery is low and comparable with the series mentioned in the table above; however, no conclusion can be drawn from this because the number of cases was less.

In the present study there was spillage of stones in 10 patients (33%) in Group I and in 3 patients (10%) in Group II. Our study is comparable with other studies in this regard as depicted in the following table:

Table 8. Stone Spillage

Gall bladder perforation with spillage of stones	
Study	**Incidence (%age)**
Cuschieri et al, 1991[13]	16
Jones et al, 1995[15]	33
Schafer et al, 1998[16]	5.7
Diez et al, 1998[17]	8
Present study, 2011-2013	21

Spillage could be easily managed in both the groups without conversion to open surgery

Operative time:

Mean operative time in Group I was 93.16 mins and 50.66 minutes in Group II. Minimum time taken to perform 3-port laparoscopic cholecystectomy was 65 mins and to perform 4-port laparoscopic cholecystectomy was 30 minutes. In 100% patients in Group II the operation was completed in less than 80 mins. 17 patients (57%) in Group I took more than 80 mins for operation. The difference in mean operative time between both the groups is statistically significant ($p<0.05$).

Operative timings of different studies and the present study are compared in the table as follows:

Table 9. Operative Time

Study	3-port LC	4-port LC
Cuschieri et al, 1991[13]	-	50
Barkun et al, 1992[18]	-	86
McGinn et al, 1995[19]	-	74
Slim et al, 1995[11]	45	-
Majeed et al, 1996[20]	-	65
Tagaya et al, 1998[8]	105	-
Leggett et al, 2000[9]	15	-
Trichak, 2003[10]	59.22	57.05
Syrakos et al, 2004[21]	-	61
Present study, 2011-2013	93.16	50.66

The difference in operative time in these studies is due to different criterion used by surgeons for operative time. In the study by McGinn et al, 1995[19], operative time was taken as time between patient entering and leaving the operation theatre; whereas in our study it was taken as time from skin incision to closure. Also, as the experience of the surgeons is growing in both the procedures the operative time is decreasing.

Analgesic Requirement:

Assessment of pain was done by the number of doses of the analgesic required by the patients in the first 48 hours. Analgesic used in the study was injection Diclofenac. It was seen that the mean analgesic required in Group I was 1.10 doses as compared to 1.03 doses in Group II. Only 10% patients of both the groups required 2 injections of diclofenac.

McGinn et al, 1995[19] reported mean analgesic requirement after 4-port laparoscopic cholecystectomy to be 3 injection of Diclofenac. The results are thus comparable. The mean analgesic requirement in 4 -port laparoscopic cholecystectomy is less than 3-port laparoscopic cholecystectomy, but thedifference is statistically not significant.

Some surgeons try pre operative(preemptive) analgesia for better patient comfort, but in our study this was not practiced because its need was not felt[22].

Hospital stay:

In the present study patients were discharged from the hospital when they were fit and willing to go home. The mean hospital stay in 3-port laparoscopic cholecystectomy group was 7 days as compared to 6 days in 4-port group. Nearly 42% of the patients in both the groups were discharged within 6 days of surgery. None of the patients in both the groups was discharged within 24 hours of surgery. Some patients wanted to go home after the removal of sutures, as the cost of travel to their villages was more than that of stay in the hospital. This factor was kept in mind while discharging them and this led to their longer hospital stay. This factor was common in both the

groups. The difference in mean hospital stay between the two groups is statistically not significant.

Cosmetic Appearance:

In postoperative period, during hospital stay and during follow-up visits at 1 week, 1 month, 2 months and 3 months patients were asked for evaluation of their respective operations. Factors included were improvement in symptoms, return to normal activity and cosmetic results. More than 77% patients in both the groups had assessed their respective procedures good. Only 18% of the patients assessed their procedures as very good but none complained of poor outcome after their operation.

The difference in patients' experience in this regard for the two groups is not statistically significant so it can be inferred that the outcome of both the procedures is similar.

Conclusion

Hence, we conclude that both 3-port laparoscopic cholecystectomy and 4-port cholecystectomy are equally good procedures in the hands of experienced surgeons with comparable operative time, per and post-operative complications, analgesic requirement, hospital stay and cosmesis. The "three-port operation should be adopted only by surgeons experienced in laparoscopic surgery and familiar with the technique as it is more difficult to perform particularly in patients with adhesions. The operator who performs three-port laparoscopic cholecystectomy should be prepared for placement of an additional port or conversion to open cholecystectomy whenever need arises.

Ethical clearance: Ethical clearance was obtained.

Conflict of Interest:

All authors declare there is no conflict of interests regarding the publication of this article

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Author's contributions:

Author's contribution

Ram Kirti Garg developed the concept and

contributed to design, analysis, interpretation of data, and manuscript writing of the study. Ram Kirti Garg organized and collected data. All authors helped in the editing and refining of the manuscript. All authors read and approved the final manuscript.

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