

## ORIGINAL RESEARCH

### A Comparative Study Between Open and Laparoscopic Cholecystectomy

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#### ABSTRACT

**Background:** The aim of this study is to compare conventional cholecystectomy and laparoscopic cholecystectomy.

**Materials and Methods:** The study subjects consisted of 40 patients with a diagnosis of calculous cholecystitis that underwent cholecystectomy at Bhaskar Medical College and General Hospital, yepakally from January 2018 to June 2019. The patients will be evaluated for detailed clinical history according to a definite proforma. All the patients will be examined and routine blood investigations with LFT wherever necessary will be done. Abdominal USG will be performed in all the cases.

**Results:** The commonest presenting complaint in both the groups was pain in the right upper quadrant followed by vomiting, fever and dyspepsia. Majority of the patients in both the groups had multiple stones. (15 patients in LC group and 14 patients in OC group) The duration of LC was significantly more than for OC (median 105 min v/s 75min respectively). The intra operative blood loss and the complications were more for the open procedure. Two patients of laparoscopic group required conversion to open procedure. The drains were required in less number of patients of LC group and for less number of days. Wound infection was seen in 1 of LC patient and 5 of OC patients. One patient of OC group developed incisional hernia. The antibiotic requirement was less in LC group (median 5days) compared to OC group (median 7days). The Visual Analogue Scale for pain in the post op period was significantly less for LC patients compared to OC patients (median Grade1 v/s Grade3 respectively). The duration of pain in the LC group was significantly less (median of 2 days) compared to OC group (median of 4 days). The analgesic requirement was significantly less in LC patients (median for 3 days) compared to OC patients (median for 5 days). The LC patients tolerated oral feeds earlier compared to OC patients (6- 8 hours compared to 12-36 hours respectively). The duration of hospital stay was significantly longer for OC group than for LC group (median 7 days versus 4 days respectively). The time to return to normal work was delayed for OC group (median 8 days) compared to LC group (median 5 days). The cosmetic end result was unacceptable in majority of OC patients (14 of 20). While majority of LC patients were satisfied with the operative scar (16 of 20).

**Conclusion:** The laparoscopic procedure was costly compared to open procedure. But this difference was overcome by the other costs incurred in post-operative period of open procedure.

**Keywords:** Laparoscopy, cholecystectomy, Wound infection, incisional hernia

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## INTRODUCTION

Gastro-intestinal surgery has undergone a revolution in the recent years by the introduction of laparoscopic techniques. The concept of “keyhole surgery” created an immediate disparity between the potential of the new technique and training of surgeons to perform it. Now modern surgical methods are aimed at giving cure along with minimal invasive techniques with patient in mind, safety never being compromised.

Cholelithiasis, which continues to be one of the most common digestive disorders encountered, was traditionally being dealt by conventional or open cholecystectomy. With the introduction of laparoscopic cholecystectomy, the surgical community witnessed a revolution in basic ideology and the importance of minimal access surgery has suddenly impacted.

Laparoscopic cholecystectomy (LC) has become so safe and easy that it can be performed with much ease and safety because of better magnification. Although LC has shown clear benefits in terms of shortened hospital stay, less morbidity, mortality, a quicker return to work and with cosmetic advantage, many questions regarding this procedure remain unanswered, particularly relative to the gold standard procedure of open cholecystectomy.

Some surgeons have suggested that the rates of serious complications, particularly bile duct injury might be significantly higher in laparoscopic procedures resulting in major morbidity and even mortality. Apart from the high costs of the equipment and the specialized training that is mandatory for mastery of the technique, the procedure inherently carries hazards and risks.

In a developing country like ours, where the medical costs and loss of working days constitute major issues, could laparoscopic cholecystectomy establish itself as a safe and cost effective alternative to the open method?

In our study, we have made an attempt to compare the advantages and drawbacks of both the procedures in an Indian set up.

### Aims and Objectives

The aim of this study is to compare conventional cholecystectomy and laparoscopic cholecystectomy with respect to:

1. Duration of the procedure.
2. Blood loss during surgery.
3. Post-operative discomfort or pain.
4. Antibiotic and analgesic requirement.
5. Complications encountered.
6. Period of hospitalization.
7. Cost factor involved.
8. Patient satisfaction.

To enumerate the merits and demerits of conventional cholecystectomy and laparoscopic cholecystectomy

To derive a criterion for patient selection for conventional cholecystectomy and laparoscopic cholecystectomy

## MATERIALS & METHODS

The study subjects consisted of 40 patients with a diagnosis of calculous cholecystitis that underwent cholecystectomy at Bhaskar Medical College and General Hospital, Yenkapally from January 2018 to June 2019. The patients will be evaluated for detailed clinical history according to a definite proforma. All the patients will be examined and routine blood

investigations with LFT wherever necessary will be done. Abdominal USG will be performed in all the cases.

**Inclusion criteria:**

Patients with cholelithiasis proven by USG and considered fit for elective cholecystectomy are included in the study.

**Exclusion criteria:**

- The patients with following conditions are excluded from the study:
- Patients with CBD stones.
- History of prior upper abdominal surgery.
- Patient's age above 70 years with comorbid conditions like cerebral vascular diseases and neurological disorders etc.

Written informed consent was obtained from all the patients before their enrolment in the study. The study protocol was approved by the local ethical committee of this hospital.

Patients were randomly distributed into two groups of (laparoscopic cholecystectomy and open cholecystectomy) 20 each by sealed envelope method. One group was subjected to laparoscopic cholecystectomy and the other to open cholecystectomy.

All patients were kept nil by mouth overnight prior to surgery and received antibiotic prophylaxis. Nasogastric tube was inserted depending on individual basis and all patients were asked to empty the bladder prior to entering the operating room.

**Surgical Procedure:**

All operations were performed by the consultant surgeon. All operations were done under General Anaesthesia.

**Open Cholecystectomy:** A sub costal muscle transection incision was used for open cholecystectomy; the length of the incision was tailored to the individual patient and kept to the minimum necessary to allow safe and adequate access to the gall bladder. Dissection was started at Calot's triangle and proceeded antegradely towards the fundus. "Fundus first method" was used in case of dense adhesions where anatomy of Calot's triangle was not clear.

**Laparoscopic Cholecystectomy:** Laparoscopic cholecystectomy was performed with the operating surgeon on the left side of the table. Pneumoperitoneum was created using Veress needle and by Hassan's technique in some cases. It involved two 10mm and two 5 mm trocars. Peritoneal cavity was visualized and any adhesions if present were released. Calot's triangle was visualized and dissection was carried out by means of electrocautery and the cystic duct and artery were secured with titanium clips.

At the completion of the operation, a sub hepatic drain was inserted as required in both the groups. All wounds were infiltrated with local anaesthetic. Once the patients were reversed from anaesthesia, they were shifted to recovery room for observation for an hour and then shifted to the post op ward.

All patients were administered NSAID's and anti-emetics as required. Patients were allowed liquids once bowel sounds returned. Patients were discharged from the hospital once they were fully mobilized and able to tolerate a normal diet and pain relief was adequate. Pain in the post op period was rated by each patient using a Visual Analogue Scale (from 0 to 5). Patients were encouraged to resume work and normal daily activity as soon as possible. Evaluation of return to normal work and post op complications was made during an OPD appointment 4 weeks after surgery.

Data was collected prospectively and included patient's demographics, laboratory results, operative findings, requirement for conversion to open cholecystectomy, operating time

(from incision to closure), peri-operative bleeding, operative complications, duration of post-operative pain, analgesic administration and length of hospital stay along with post-operative complications if any.

The total cost incurred during hospitalization was recorded. The cost included the investigations costs, operation costs, medications and the post-operative period costs. The patients were also asked to grade their perception to the cosmetic results on a scale of 1 to 5.

The histopathology of the specimen was also noted.

## RESULTS

Twenty patients were randomized to each group. The results were:

### Patients demographics

**Table 1: Sex Distribution**

Sex	LC	OC
Male	5	10
Female	15	10

10 patients of OC and 5 patients of LC were males. Among OC group 10 were females and among LC group 15 were females.

**Table 2: Age distribution**

Age in years	LC	OC
<30	4	2
31 –40	8	4
41 –50	5	6
51 –60	3	6
61 –70	0	2

p value > 0.025 (Chi Square test)

The median age (range) of the patients were 38 (18 - 60) and 42 (20 - 68) years in LC and OC group respectively. The difference was not found to be statistically significant.

**Table 3: Presenting complaints**

Complaints	LC	OC
PainRUQ	20	20
Vomiting	7	6
Fever	5	4
Dyspepsia	4	4
Similarhistory	10	8

p value > 0.05 (Chi Square test)

All patients in both the groups [20 (100%)] presented with pain in the right upper quadrant. The other complaints seen were fever (4 in OC and 5 in LC), vomiting (6 in OC and 7 in LC) and dyspepsia (4 each in OC and LC). None of the patients had jaundice or previous history of jaundice. 8 patients in OC and 10 patients in LC group had similar history of pain abdomen in the past.

**Table 4: Sonographic findings**

USG Findings	LC	OC
Solitarystone	5	6
Multiplestones	15	14

Pericholecysticfluid	3	5
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p value > 0.05 (Chi Square test)

All patients in both the groups underwent abdominal sonography. Solitary stone was found in 6 patients of OC group and 5 patients of LC group. Multiple stones were seen in 14 and 15 patients of OC and LC group respectively. 5 patients in OC group and 3 patients in LC group had peri-cholecystic fluid collection suggestive of acute cholecystitis. The difference was not found to be significant.

**Table 5: Operative Findings**

Operative findings	LC	OC	P Value
Operatingtime			
(InMin)	105	70	P=0.001
(Range)	(60 –160)	(40 –135)	(S)
Bloodloss			
<100ml	18	15	p>0.05+
>100ml	2	5	(NS)
Complications			
Bileleak	8	4	p>0.05+
Stonespillage	3	1	(NS)
CBDInjury	0	0	
Adj.Organinjury	1	1	
Drainsused	17	19	p>0.05+
Conversion	2	-	

\*Wilcoxon rank sum test; +Chi square test

All patients were operated under general anaesthesia. The intra operative blood loss was <100 ml in 15 patients and >100ml in 5 patients who underwent OC and was <100 ml in 18 patients and >100ml in 2 patients who underwent LC.

The main reason for blood loss in LC group was the slippage of the clip applied to the cystic artery and from the gall bladder bed.

The median duration of operative procedure was 70min (40-135min) for OC and 105min (60-160 min) for LC. The difference was found to be significant (p=0.001).The more time required in LC was due to intra- operative gas leak, Calot's triangle dissection, slippage of clip and delivery of gall bladder through the port site.

The main complications noted were bile leak (8 patients in LC and 4 patients in OC group) and stone spillage (3 in LC and 1 in OC). There was no instance of CBD injury in either group. Injury to liver during retraction was seen in 1 patient who underwent OC. The sub-hepatic drains were required in 19 patients in OC group and 17 patients in LC group. In other cases, drains were not kept as the haemostasis was found to be adequate.

**Two patients were converted from laparoscopy to open surgery due to:**

1. Dense adhesions in the Calot's triangle in a case of acute cholecystitis.
2. Chronic cholecystitis with fibrosis, dense adhesions in the Calot's triangle.

**Table 6: Pain score and medication**

	LC	OC	p Value*
VAS (Grades0–5) (Rang)	Grade2 (0 –3)	Grade3 (1 –5)	P=0.024 (S)
Durationof pain(days)	2	4	P=0.001

(Range)	(1 –6)	(2 – 10)	(S)
Analgesic used for (days)	3	5	P=0.016
(Range)	(2 –6)	(2 – 10)	(S)

\*Wilcoxon rank sum test

The VAS was median Grade 3 in OC group as compared to median Grade 2 in LC group,  $p=0.024$ . The pain was more in the initial 2 days in both groups and it lasted for median duration of 4 days in OC group compared to 2 days in LC group,  $p=0.001$ .

The NSAID's were used for more days in OC group (median-5 days) compared to LC group (median-3 days),  $p=0.016$ .

**Table 7: Post-operative outcome and antibiotics used**

Post-operative outcome	LC	OC	p Value*
Wound infection			
Nil	19	15	$p>0.05$ (NS)
Moderate	1	3	
Severe	0	2	
Duration of Antibiotics used in days	5	7	P=0.1
(Range)	(3 –7)	(5 – 14)	(NS)
Incisional hernia	0	1	

\*Wilcoxon rank sum test

There was difference in wound infection rate, 5 patients in OC group compared to only 1 patient in LC group,  $p>0.05$ . One patient in OC group had wound dehiscence which was sutured later under anaesthesia.

Due to this, the antibiotics were used for 7 days in OC group compared to 5 days in LC group. One patient who underwent OC developed incisional hernia at 6 months follow up which was repaired by onlay mesh repair.

The drains were kept for an average of 3 days in OC group compared to 2 days in LC group. They were removed once the drainage was  $<10$  ml in 24 hours.

**Table 8: Post-operative recovery**

Post-operative recovery	LC	OC	p Value*
Time taken to return of	9	21	$p=0.2$
bowel sounds (in hours)+	(6-12)	(12-30)	1(NS)
Time to resumption of oral	9	21	$p=0.34$
feeds (in hours)+	(6-18)	(12-36)	5(NS)
Duration of hospital stay (in days)+	4(2-7)	7(4-10)	$p=0.001$ (S)
Time taken to return to normal work (in days)+	5(3-10)	8(5-14)	$p=0.018$ (S)

The LC group patients were started on oral feeds at an average of 9 hours (6 - 8 hours) while in OC group patients it took an average of 21 hours (12 - 36 hours).

The duration of hospital stay was for a median period of 4 days (2 – 7 days) in LC group and 7 days (4 - 10 days) in OC group. The difference was statistically significant,  $p=0.001$ . It was more in OC group due to increased pain, wound infection, injectable antibiotics used and less mobilization due to pain.

All patients who underwent LC were able to return to normal work on an average of 5 days compared to 8 days in OC group. The difference was statistically significant,  $p=0.018$ .

**Table 9: Cosmesis.**

Cosmetic result	LC	OC
Unacceptable	0	14
Acceptable	4	6
Good	16	0

16 patients who underwent LC felt that they had a good cosmetic end result while only 6 patients of open group acceptable,  $p > 0.05$ .

The length of the incisional scar in open group ranged from 5 - 10 cm and was visible as a thick scar.

**Table 10: Cost analysis.**

Cost in Rs.	LC	OC
<3000	2	8
3000–6000	14	8
>6000	4	4

p value > 0.05(NS) (Chi Square test)

LC was costlier compared to the cost of the open procedure. (Average of Rs. 4,070 in OC group compared to Rs. 4,642.50 in LC group;  $p > 0.05$ ). The cost in the LC group was more due to its increased operative costs. The difference was not found to be statistically significant.

## DISCUSSION

Traditional cholecystectomy is an integral part of every surgical training programme and is performed by most general surgeons. The advent of laparoscopic cholecystectomy has created an excitement and a flurry of activity in the medical community.

This study showed that morbidity rate is more with open cholecystectomy than laparoscopic cholecystectomy. The open procedure was associated with a shorter operating time (LC 60 - 160min and OC 40 - 135min). This is comparable with that of Trondsen<sup>7</sup> and Porte<sup>19</sup>. As experience is gained, an operating time of about 50 min can be achieved, but this increases as other surgeons are trained or more challenging cases are performed. This “learning curve” represents adapting to operating in the 2-D screen, becoming familiar with the instrumentation and becoming accustomed to the technique.

In this study, there were no major complications and several minor ones. There was no peri-operative mortality and no CBD injury. The complications observed were bile leak, stone spillage and blood loss which were found to be comparable in both the groups. Fewer drains were used in the laparoscopic group but the difference was not found to be significant. Harris<sup>9</sup> in his study found similar results. [Bile leak (LC - 2%, OC-1%) and bleeding requiring transfusion (LC-1%, OC-2%)]. Other studies also reported similar results.<sup>[1,2]</sup>

The conversion was necessary in 2 patients out of 20. One patient (10%) required conversion due to difficult dissection in view of acute cholecystitis and the other due to chronic cholecystitis with fibrosis and dense adhesions in Calot's triangle. Conversion rate was also found to be higher in acute cases in other studies (0 - 45%).<sup>[3-5]</sup>

The wound infection rate in this study was found to be less in laparoscopic group being (5% in laparoscopic group versus 25% in open group). This was due to the reduced size of the incision and lesser wound. This also reduced the need for post-operative antibiotics in the laparoscopy group. Due to the severe wound infection and wound dehiscence 1 patient in the OC group developed incisional hernia in the follow up period. Harris also noted 1 wound infection in 100 OC patients and 0 in LC group.<sup>[6]</sup>

Use of minimally invasive techniques in elective surgeries is associated with a reduced inflammatory stress response with improved pulmonary function and less hypoxia. The VAS was significantly less for LC group [Grade 2 (median) for LC and Grade 3 (median) for OC;  $p=0.024$ ]. Kum also found a mean VAS score of 3.8 v/s 7.7 between LC and OC. The pain duration (median 2 days for LC and median 4 days for OC patients;  $p=0.001$ ) and the duration of analgesics used (median 3 days for LC and median 5 days for OC patients;  $p=0.016$ ) also were significantly less in laparoscopic group patients. This was due to the lesser incision size in LC. Other studies have also shown similar results.<sup>[1,7,8-11]</sup>

In this study, patients who underwent LC were started with oral feeds at duration of 6 - 8 hours post op compared to 12 - 36 hours in OC group. The difference was not found to be statistically significant.

The two most beneficial aspects of LC are the short hospital stay and the rapid recovery.<sup>[12]</sup> In this study, the median duration of hospital stay was 4 days for LC group and 7 days for OC group. The difference was found to be statistically significant ( $p=0.001$ ). Porte, Trondsen and Lujan also found similar results.<sup>[4,13,14]</sup> This was also confirmed in various other series.<sup>[15]</sup>

The time taken to return to normal work was found to be more in OC (median 8 days) compared to LC (median 5 days). It was comparable to Schietroma11 who found the time taken were 4.4 days for LC and 7.6 days for OC patients. Other studies found that the duration of sick leave was less in LC compared to OC.<sup>[8,10]</sup>

The cosmetic outcome was found to be acceptable in 4 of LC patients and 6 of OC patients. While 16 of LC patients were satisfied with the scar of the operation, 14 of OC patients did not accept the surgical scar and deemed it ugly.

The cost was found to be more in LC patients compared to OC patients, but the difference was not found to be statistically significant in this study. The cost of laparoscopy operation was overcome by other costs of open procedure namely increased expenditure on the analgesics, antibiotics, number of dressing changes and the loss of working hours. This is in concordance with other studies.<sup>[17]</sup>

## CONCLUSION

Laparoscopic cholecystectomy is a considerable advancement in the treatment of gall bladder disease. The advantages of laparoscopic cholecystectomy are several:

- Technically, the dissection of the cystic artery and cystic duct is very precise and bleeding is easily controlled with less peri-operative blood loss.
- LC is associated with less chances of wound infection and there is no risk of wound dehiscence.
- The antibiotic usage in LC is comparatively lesser than that of OC.
- The degree of post-operative pain and its duration is less.
- The amount of analgesic requirement is less in LC.
- LC patients tolerate oral feeds earlier and are mobilized faster.
- The duration of hospital stay is less and patients can be discharged quickly from the hospital.
- Patients of LC group can resume their work earlier.
- The cosmetic advantage in LC is obvious.
- LC is associated with significant financial saving to the patient.

The only disadvantage of the laparoscopic cholecystectomy over the open procedure is the duration of operating time which is significantly longer.

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