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Comparative study of open cholecystectomy versus laparoscopic cholecystectomy

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Abstract

Background: After the introduction of laparoscopic cholecystectomy it has become the procedure of choice for the removal of gall bladder. The advantages of laparoscopic cholecystectomy cited were the avoidance of large incision, shortened hospital stay and earlier return to work. This study was conducted in an effort to determine if these proposed advantages could be achieved in practice.

Objectives: To assess safety and efficacy of laparoscopic cholecystectomy in comparison to open cholecystectomy and to compare laparoscopic cholecystectomy versus open cholecystectomy in terms of duration of operation, hospital stay, post-operative recovery, complications and patient satisfaction.

Methods: This was a Retrospective clinical study consisting of 50 patients undergoing cholecystectomy randomised in two groups-25 patients in group LAP (Laparoscopic cholecystectomy) and 25 patients in group OPEN (Open cholecystectomy).

Results: There was a preponderance of cases in the 3rd and 5th decades of life in both groups with a female preponderance. The most common indication for cholecystectomy was cholelithiasis. The duration of the procedure was less in the group LAP when compared to the group OPEN. Overall complications were more in group OPEN. Pain was less in group LAP. Resumption of oral intake was significantly earlier in group LAP. Also the duration of hospital stay was shorter with earlier return to normal work in group LAP.

Conclusion: Females were the main sufferers of gallbladder disease in our study. The duration of surgery was lesser in group LAP in our study. Over all complication were more in group OPEN. The postoperative pain was less and patients tolerated oral feeds earlier in laparoscopic cholecystectomy group when compared to open surgery. The patients undergoing laparoscopic cholecystectomy were discharged earlier and resumed their normal work earlier when compared to open cholecystectomy group. In conclusion, the study supports the view that laparoscopic cholecystectomy is safe and efficacious and offers definitive advantages over open cholecystectomy and should be the available option for all patients requiring elective cholecystectomy.

Keywords: open cholecystectomy, laparoscopic cholecystectomy, bile duct injuries, resumption of oral intake, duration of surgery, return to work, hospital stay

Introduction

The modern era of laparoscopic surgery has evoked remarkable changes in approaches to surgical diseases. The trend toward minimal access surgery (MAS) has prompted general surgeons to scrutinize nearly all operations for possible conversion to laparoscopic techniques.

Gallstones are the most common biliary pathology. It is estimated that gallstones affect 10-15 percent of the population in the western societies [1]. Surgery plays an important part in the treatment. In more than 90% of patients, cholecystectomy is curative, leaving them symptom free [2]. Patients with symptomatic gallstones should be advised to have elective laparoscopic cholecystectomy [3].

The first open cholecystectomy was performed by Langenbuch in 1882 in Berlin. The first laparoscopic cholecystectomy was performed by Muhe in 1985. However the first laparoscopic cholecystectomy recorded in medical literature was performed in March 1987 by Mouret in Lyon, France. The technique was perfected a year later in March 1988 by Dubois in Paris. Since its introduction in France, laparoscopic cholecystectomy has become the treatment of choice for symptomatic cholelithiasis.

The postulated advantages of laparoscopic cholecystectomy are the avoidance of large incision, shortened hospital stay and earlier return to work [4].

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Our purpose in this study is to compare results after cholecystectomy using a laparoscope to that using standard open technique, in an effort to determine if these proposed advantages could be achieved in practice.

Aims and Objectives

1. To assess safety and efficacy of laparoscopic cholecystectomy in comparison to open cholecystectomy.
2. To compare laparoscopic cholecystectomy versus open cholecystectomy in terms of:
 - Indication for surgery
 - Duration of surgery
 - Complications of each procedure
 - Resumption of oral intake
 - Hospital stay
 - Return to normal work
 - Patient satisfaction

Materials and Methods

This was a Retrospective study. This study consisted of 50 patients treated with cholecystectomy (25-open and 25-laparoscopic) in our hospital from October 2019 to May 2021.

Inclusion criteria

All patients with acute cholecystitis, chronic cholecystitis, cholelithiasis, empyema, mucocele and gangrenous gallbladder.

Exclusion criteria

Patients with choledocholithiasis, carcinoma of gallbladder, perforated gallbladder were excluded from the study. All the patients were admitted and a detailed history and clinical examination was carried out as per written proforma. The choice of operation in each case is decided by:

- Patient’s choice by explaining both procedures.
- The preference of the surgeon in each case.

Patients opting for laparoscopic cholecystectomy were explained the possibility of conversion to open cholecystectomy.

Preoperatively patient’s history was assessed with special reference to pain, fever, nausea, vomiting, dyspepsia, jaundice, mass per abdomen, weight loss and decreased appetite. A careful emphasis was made to record the physical findings particularly icterus tenderness in right hypochondrium and gallbladder mass. Laboratory testing and USG of gallbladder and CBD was done. CBD stone was ruled out by USG.

A thorough preoperative anaesthetic evaluation was done and patient fitness for general anaesthesia assessed. A dose of antibiotics (usually a cephalosporin) was given 30 minutes before surgery. A nasogastric tube was inserted routinely. Injectable antibiotics and analgesics were given for 2-3 days postoperatively. Then they were given orally for another 3 days. Patients were started orally between 24-48 hours post-surgery in most cases. Sutures were removed usually by the 10th day. The patient was reviewed on the 7th day and 21st day after discharge. Follow up was done for a period of 6 months whenever possible.

Method of collection of data

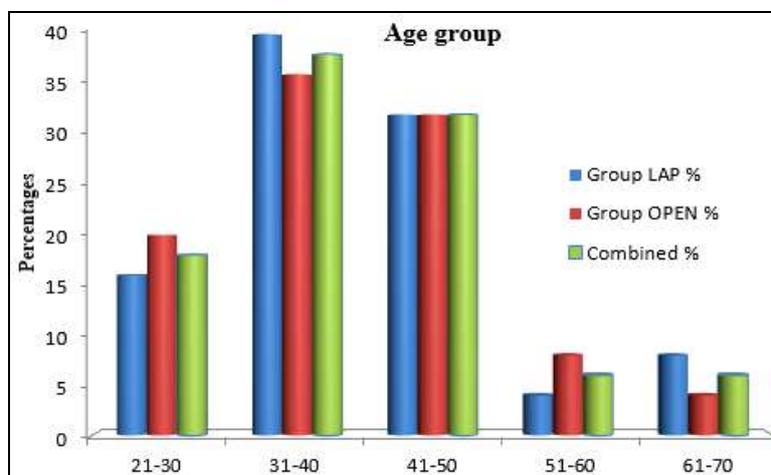
- Operative steps, duration, intra and postoperative complication were noted in detail and tabulated.
- Postoperative assessment with respect to postoperative hospital stay, complications including postoperative pain will be included as per protocol attached.

Results

Table 1: Age distribution of study groups

Age in years	Group LAP		Group OPEN		Combined	
	No	%	No	%	No	%
21-30	4	16.0	5	20.0	9	18.0
31-40	10	40.0	9	36.0	19	38.0
41-50	8	32.0	8	32.0	16	32.0
51-60	1	4.0	2	8.0	3	6.0
61-70	2	8.0	1	4.0	3	6.0
Total	25	100.0	25	100.0	50	100.0
Mean ± SD	39.68±10.74		39.72±9.96		39.7±10.25	

Inference: Samples are age matched with p=0.989.

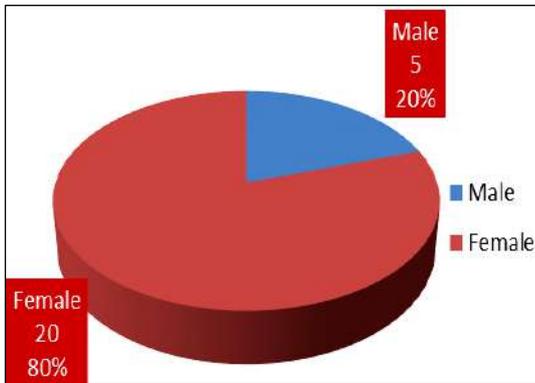


Graph 1: Age distribution of study groups

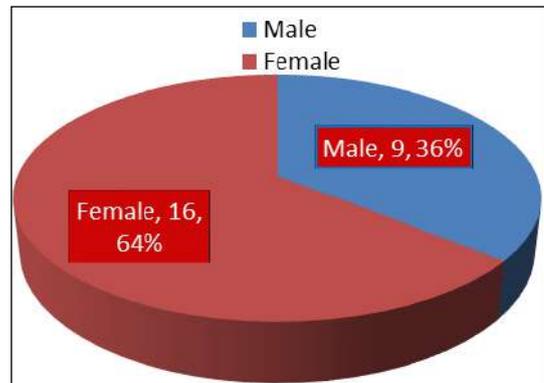
Table 2: Sex distribution

Gender	Group Lap		Group Open	
	No	%	No	%
Male	5	20.0	9	36.0
Female	20	80.0	16	64.0
Total	25	100.0	25	100.0

Samples are gender matched with P=0.208.



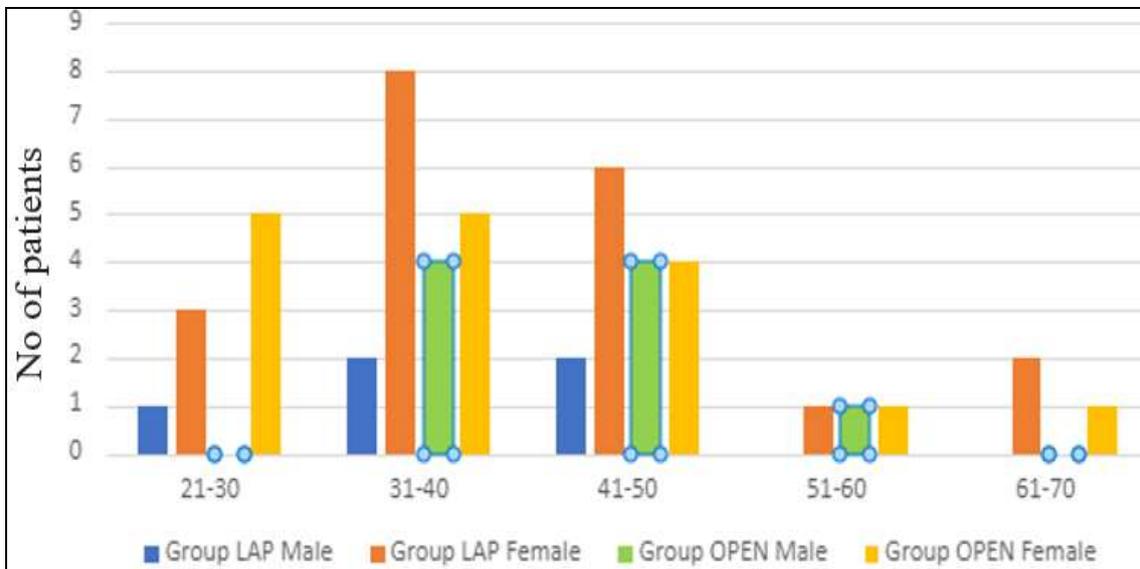
Graph 3: Sex distribution in LAP group



Graph 4: Sex distribution in OPEN group

Table 3: Age distribution

Age in years	Group LAP			Group OPEN		
	Male	Female	Total	Male	Female	Total
21-30	1	3	4	0	5	5
31-40	2	8	10	4	5	9
41-50	2	6	8	4	4	8
51-60	0	1	1	1	1	2
61-70	0	2	2	0	1	1
Total	5	20	25	9	16	25
Mean ± SD	39.68±10.74			39.72±9.96		



Graph 5: Age distribution

There was a preponderance of cases in the 3rd, 4th and 5th decades of life in both groups accounting for nearly 88% of the cases. The mean age of patients in both groups was around 40 years.

There was a female preponderance in both groups with 80% of patients being female in Group LAP and 64% patients being female in group OPEN. Both males and females were more in 4th and 5th decades.

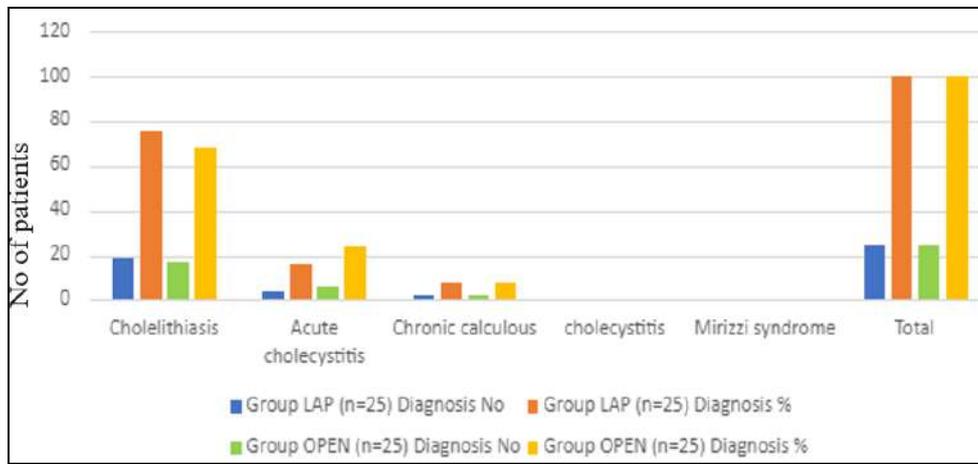
Table 4: Indication for Cholecystectomy

Diagnosis	Group LAP (n=25)		Group OPEN (n=25)	
	No	%	No	%
Cholelithiasis	19	76.0	17	68.0
Acute cholecystitis	4	16.0	6	24.0
Chronic calculous cholecystitis	2	8.0	2	8.0
Mirizzi syndrome	0	0.0	0	0.0
Total	25	100	25	100

Inference: indication for cholecystectomy is similarly distributed among both open and lap groups

The most common indication for open cholecystectomy was symptomatic cholelithiasis (68%). In the laparoscopic group also

cholelithiasis (76%) was the most common cause.

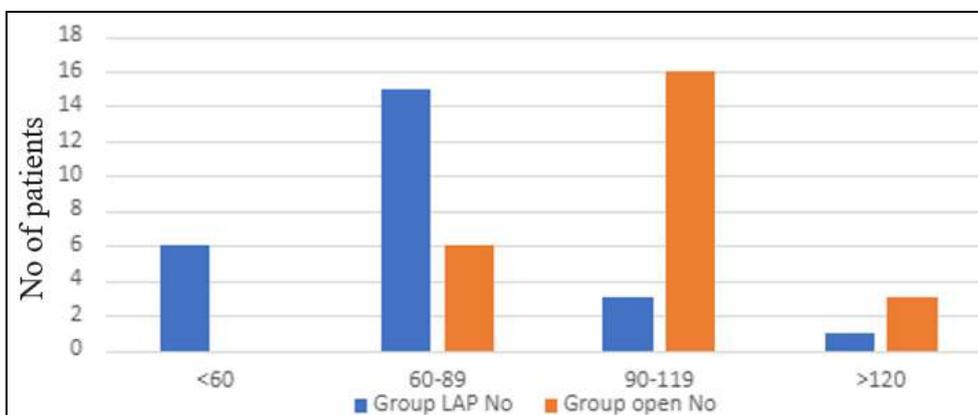


Graph 6: Indication for Cholecystectomy

Table 5: Duration of surgery Comparison of duration of surgery in two groups of patients studied.

Duration of surgery (mins)	Group LAP		Group open	
	No	%	No	%
<60	6	24.0	0	0.0
60-89	15	60.0	6	24.0
90-119	3	12.0	16	64.0
>120	1	4.0	3	12.0
Total	25	100.0	25	100.0
Mean ± SD	65.8±19.24		91±21.02	

Mean duration of surgery is significantly less in Group LAP when compared to Group OPEN with P = <0.001**



Graph 7: Comparison of duration of surgery in two groups of patients studied

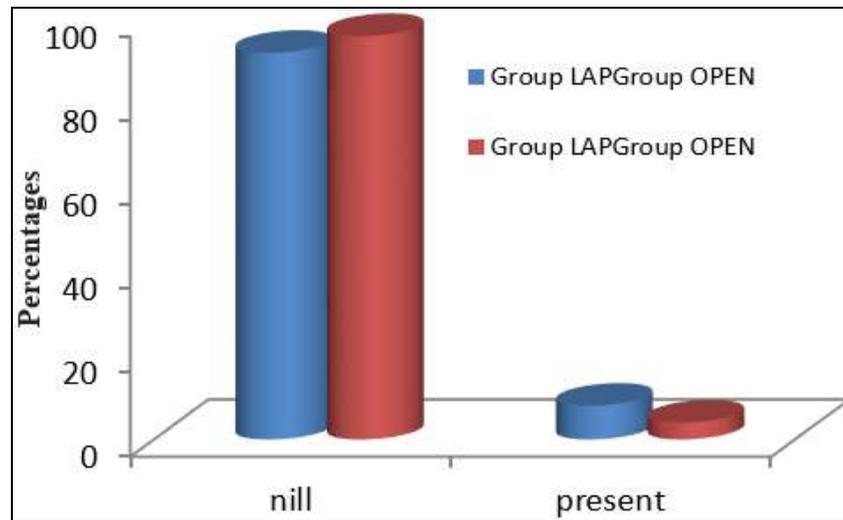
The duration of procedure in laparoscopic group is counted from insertion of Veress needle to the port site suturing and in open cholecystectomy group from skin incision to skin suturing. The

duration of procedure ranged from 60-89 min in lap group and 90-119 min in open group with statistical significance.

Table 6: Complications Comparison of intra-operative complications in two groups of patients studied.

Intra-operative complications	Group LAP (n=25)		Group OPEN (n=25)	
	No	%	No	%
Nil	23	92.0	24	96.0
Present	2	8.0	1	4.0
1. Major bleeding requiring conversion to open cholecystectomy	0	0.0	0	0.0
2. Minor bleeding not requiring conversion to open cholecystectomy	1	4.0	0	0.0
3. Bile duct injury	0	0.0	0	0.0
4. Gall stone spillage	1	4.0	1	4.0
5. Visceral injuries	0	0.0	0	0.0

Rate of intra-operative complications is similar in both groups with p >0.999.

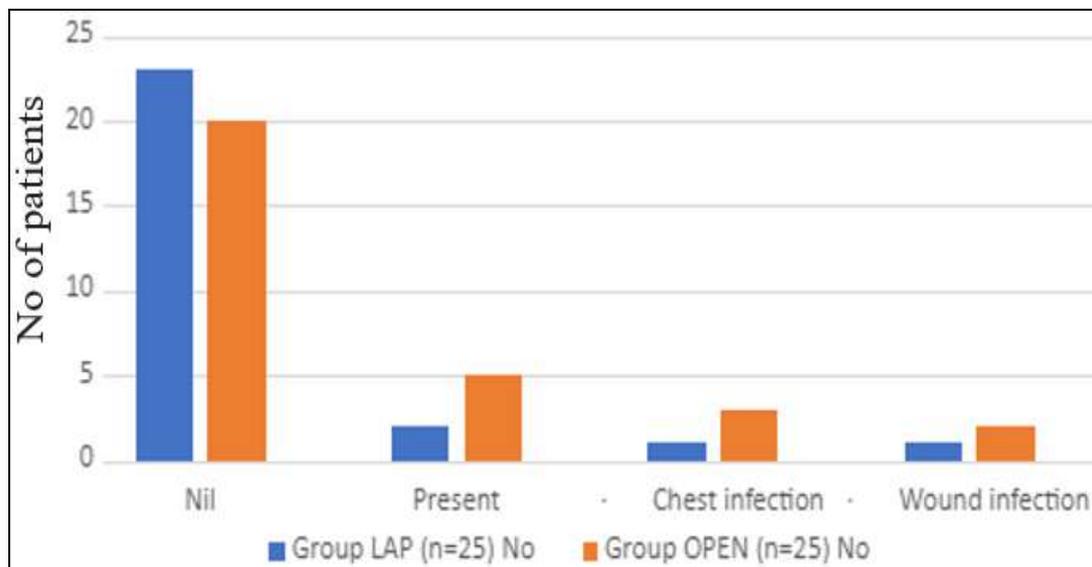


Graph 8: Comparison of intra-operative complications in two groups of patients studied

Table 7: Comparison of post-operative complications in two groups of patients studied

Post-operative Complications	Group LAP (n=25)		Group OPEN (n=25)	
	No	%	No	%
Nil	23	92.0	20	80.0
Present	2	8.0	5	20.0
• Chest infection	1	4.0	3	12.0
• Wound infection	1	4.0	2	8.0
Total	25	100	25	100

Post-operative complications are statistically more associated with Group open with P=0.417.

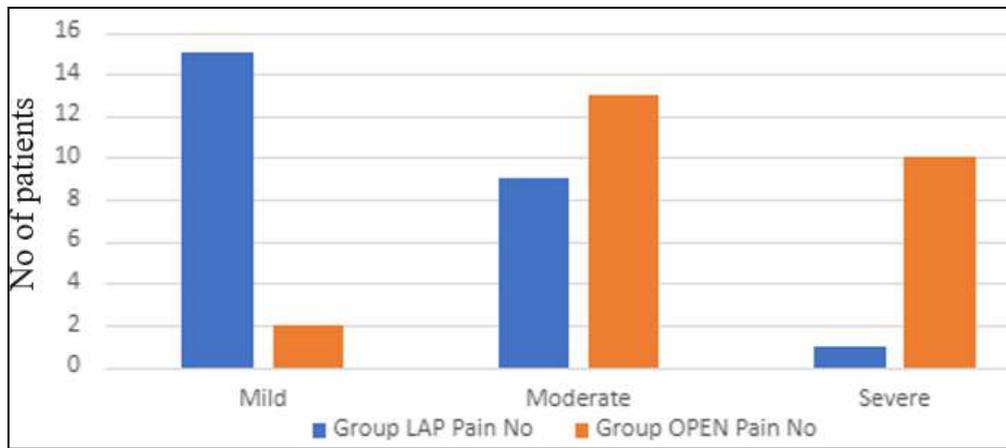


Graph 9: Comparison of post-operative complications in two groups of patients studied

Table 8: Post-operative pain Comparison of post-operative pain in two groups of patients studied.

Pain	Group LAP		Group OPEN	
	No	%	No	%
Mild	15	60.0	2	4.0
Moderate	9	36.0	13	52.0
Severe	1	4.0	10	44.0
Total	25	100.0	25	100.0

Mean pain is significantly less in Group LAP with P <0.001**.



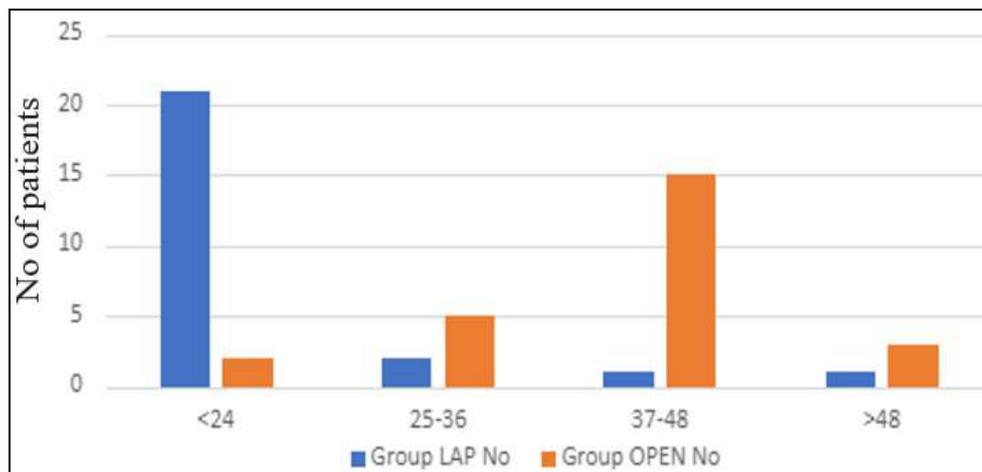
Graph 10: Comparison of post-operative pain in two groups of patients studied

More than 90% of the patients in open cholecystectomy group had moderate to severe pain, whereas most of the patients in the laparoscopic cholecystectomy had mild to moderate pain.

Table 9: Post-operative mobilization Comparison of post-operative mobilization in two groups of patients studied.

Post-operative mobilization (hrs)	Group LAP		Group OPEN	
	No	%	No	%
<24	21	84.0	2	8.0
25-36	2	8.0	5	20.0
37-48	1	4.0	15	60.0
>48	1	4.0	3	12.0
Total	25	100.0	25	100.0
Mean ± SD	26.72±6.78		42±8.12	

Post-operative mobilization is significantly earlier in Group LAP with $P < 0.001^*$.

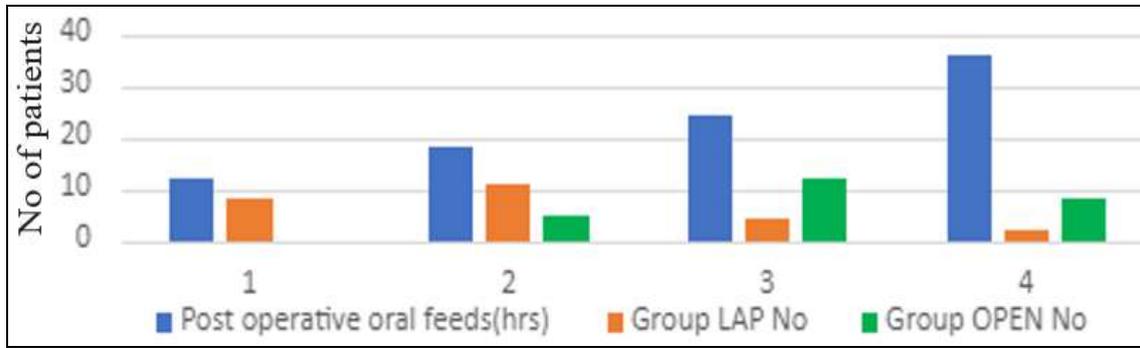


Graph 11: Comparison of post-operative mobilization in two groups of patients studied

Table 10: Resumption of oral intake Comparison of post-operative oral feeds in two groups of patients studied

Post-operative oral feeds (hrs)	Group LAP		Group OPEN	
	No	%	No	%
12.00	8	32.0	0	0.0
18.00	11	44.0	5	20.0
24.00	4	16.0	12	48.0
36.00	2	8.0	8	32.0
Total	25	100.0	25	100.0
Mean ± SD	18.48±6.69		26.64±6.95	

Duration to mean post-operative oral feeds is significantly less in Group LAP when compared to group Open with $P < 0.001^{**}$



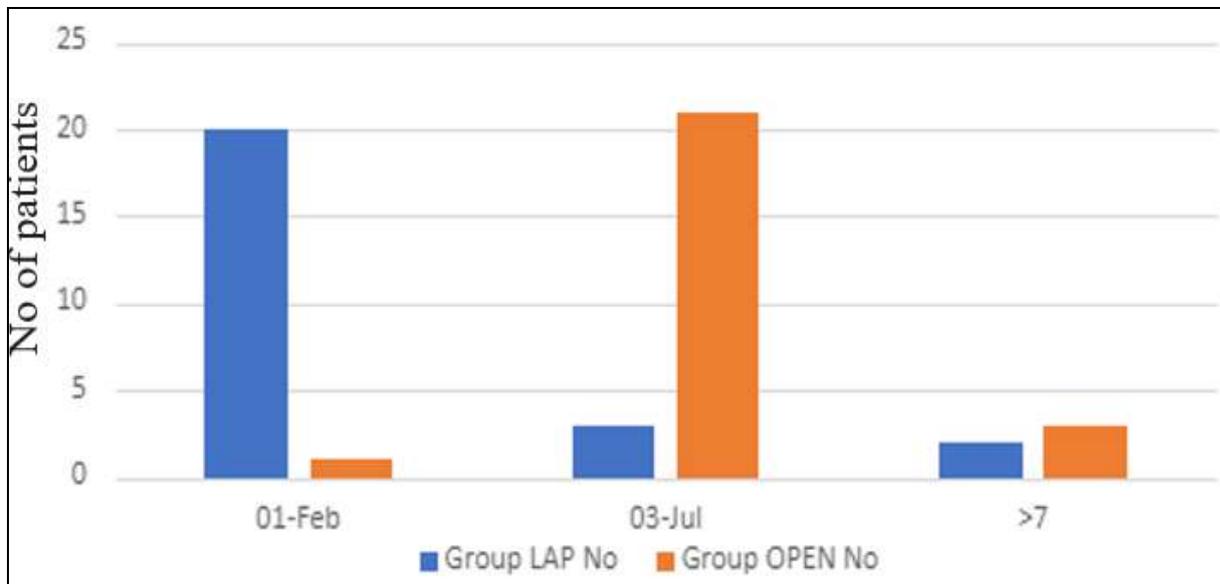
Resumption of oral intake was significantly earlier in group Lap (18.48hrs) when compared to group Open (26.64hrs).

Graph 12: Comparison of post-operative oral feeds in two groups of patients studied

Table 11: Hospital stay Comparison of duration of stay in two groups of patients studied.

Duration of stay (days)	Group LAP		Group OPEN	
	No	%	No	%
1-2	20	80.0	1	4.0
3-7	3	12.0	21	84.0
>7	2	8.0	3	12.0
Total	25	100.0	25	100.0
Mean ± SD	2.56±1.89		5.2±1.89	

Duration of hospital stay is significantly less in Group LAP compared to Group open with P<0.001**



Graph 13: Comparison of duration of stay in two groups of patients studied

The total duration of hospital stay was shorter in group LAP (mean 2.56± 1.89 days) compared to patients in group OPEN (mean 5.2 ± 1.89).

Table 12: Return to work Comparison of Return to work in days in two groups of patients studied.

Return to work (days)	Group LAP		Group OPEN	
	No	%	No	%
1-7	19	76.0	1	4.0
8-14	4	16.0	13	52.0
>14	2	8.0	11	44.0
Total	25	100.0	25	100.0
Mean ± SD	7.68±2.59		12.76±3.77	

Mean return to work is significantly earlier in Group LAP with P = <0.001**

Patients in the Lap group returned to work earlier (7.68 days) when compared to Open group (12.76 days).

Table 13: Patient satisfaction Comparison of patient satisfaction in two groups of patients studied.

Patient satisfaction	Group LAP		Group OPEN	
	No	%	No	%
Excellent	8	32.0	1	4.0
Good	12	48.0	10	40.0
Average	4	16.0	11	44.0
Poor	1	4.0	3	12.0
Total	25	100.0	25	100.0

Mean patient satisfaction score is significantly less in Group OPEN with P =0.009.

Significant number of patients responded with good to excellent grading (80%) in LAP group when compared to those patients in group OPEN (44%)

For statistical analysis purpose we combined excellent + good as above average and average + poor as below average satisfaction. Significant numbers of patients are satisfied with laproscopic

surgery when compared with open surgery.

Discussion

Cholelithiasis is a common disease entity. Frequent occurrence and serious complications of cholelithiasis have made this one of the most important surgically correctable diseases.

Laparoscopic cholecystectomy has significantly changed the treatment of gallstone disease. Although this new technique has been adopted by many practicing surgeons, concern about the incidence of major complications still exists. The morbidity and mortality associated with laparoscopic cholecystectomy should be comparable to open cholecystectomy before it is accepted as the treatment of choice for gallstone disease. Several large published series have reported their experience with laparoscopic cholecystectomy.

This was a comparative clinical study consisting of 50 patients undergoing cholecystectomy conducted in our institute, KIMS, Narketpally from October 2019 to May 2021.

The patients were randomized into two groups; 25 patients in Group LAP (laparoscopic cholecystectomy) and 25 patients in group OPEN (open cholecystectomy).

The study was undertaken to compare the efficacy, safety and patients' satisfaction between the two procedures.

A comparative study was made on

- Duration of surgery
- Complications
- Postoperative pain
- Resumption of oral intake
- Period of hospital stay
- Return to normal work
- Patient satisfaction

Age and sex

The main sufferers of gallbladder disease in our study were females as compared to males. Out of total 50 cases, 14 cases were males, which are very much similar to those observed by Fraze and others^[5] and U. Berggren and others^[6]. The reason for the high incidence among females could be that pregnancy and child birth have a definitive influence on biliary tract disease, acting by causal stasis as well as weight gain and consequent hypercholesteremia.

Age

No age is said to be immune to gallbladder disease, however they were more common in the third, fourth and fifth decades of life as 88% of the cases belonged to these decades. Workers like Thomas B Hugh *et al.*^[7], R Schmitz *et al.*^[41] have reported a similar peak incidence in the 4th and 5th decade.

Duration of surgery

The duration of surgery was lesser in the lap group at 60-89 mins in laparoscopic group compared with 90-119 minutes in open group. Other studies quoted Sooper *et al.*^[8] 95 minutes for laparoscopic and 122 min for open.

	Group Lap	Group Open
AJ Karayiannakis <i>et al.</i> ^[9]	105 minutes	98 minutes
Ravimohan SM <i>et al.</i> ^[10]	46.8 minutes	44.7 minutes
Bart M Redemaker ^[11]	78 minutes	90.5 minutes
Sooper <i>et al.</i> ^[8]	95 minutes	122 minutes
Axel ROS <i>et al.</i> ^[12]	93 minutes	118 minutes

The duration of surgery is lesser in the LAP group when compared to the OPEN group for the following reasons:

- 1) Ease of access-laparoscopic cholecystectomy requires the creation of few small port sites in the abdomen for insertion of the instruments hence, the time taken to open the abdomen by dissecting the muscles and fascia is minimized when compared to the open procedure and conversely closure of the port sites is faster when compared to closing a large abdominal incision.
- 2) Better visualization of the anatomy using the laparoscope which magnifies the view thereby facilitating easy dissection
- 3) Laparoscopic cholecystectomy is performed under general anaesthesia, hence the anaesthetic time is also minimized, thereby minimizing total procedure time.

Conversion

None of the laproscopic surgery cases were converted to open surgery in our study.

Complications

The overall rates of complications were more in the open group. The most common complications found were wound and chest infection (seen almost exclusively in open group). These findings can be explained on the basis of a large subcostal incision used in the open group.

The presence of such a large incision and the associated pain inhibits respiratory movement's, thereby leading to atelectasis and pulmonary infection.

The large wound hematoma associated with a large incision can act as a nidus for infection thereby leading to wound infection and its associated complications like delayed wound healing, wound dehiscence, incisional hernia etc., There was no mortality in this study.

Postoperative pain

Patients undergoing laparoscopic cholecystectomy had less pain (mild to moderate) when compared to those undergoing open cholecystectomy (moderate to severe). In a similar study conducted by Hieronymus PJD *et al.*^[13] similar findings were seen.

This can be attributed to the fact that laparoscopic cholecystectomy uses smaller skin incisions and less dissection of muscles and fascia that is associated with a lesser degree of local inflammatory response and consequently less pain and less requirement of analgesics.

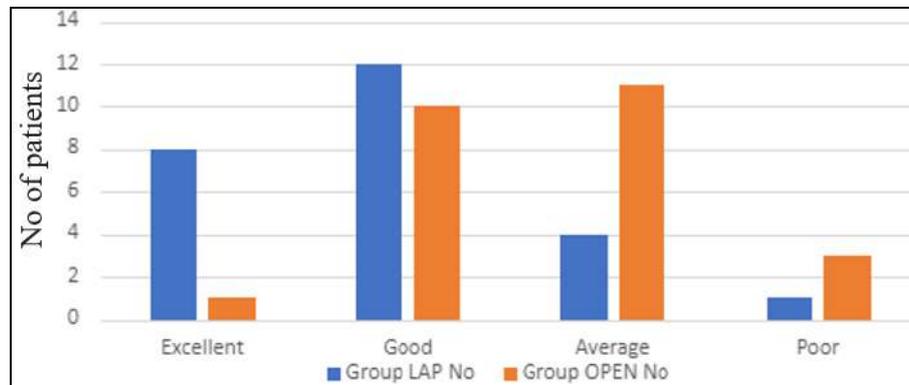
Resumption of oral intake

Most of the patients in the laparoscopic group were able to take orally within the first 12-24 hours where as the oral intake of most patients in the open group was possible only after 24-36 hours.

This difference is due to the fact that in laparoscopic cholecystectomy bowel handling is minimum, hence the associated post op paralytic ileus lasts for a shorter period leading to early return of bowel motility. This early resumption of enteral feeding also prevents gut colonization by pathogenic bacteria and also gives a sense of well-being to the patient.

Period of hospital stay

The period of hospital stay was taken from day of surgery to discharge the total period of hospital stay in our study was around 2-3 days for the lap group and around 5-6 days in the open group.



Graph 14: Comparison of patient satisfaction in two groups of patients studied

Early discharge from the hospital has a positive influence on the patient as it decreases the convalescence period and also promotes early return to work and also prevents nosocomial infections. Early discharge also decreases hospital costs.

Studies by Jeffrey S Barkun ^[14], Ahmed Assalea ^[15], AW Majeed *et al.* ^[16] and Tuula Kivilvoto *et al.* ^[17] also showed a much shorter stay in both groups a postoperative hospital stay of 1.8 days (which is similar to that seen in our study) & 3-5 days in the open group which is slightly lesser than our study.

Return to work

The mean time for return to normal work after surgery was 8 days in the laparoscopic group and 13 days in the open group. Since most of our patients were from the low socioeconomic group, this early return to work decreases the financial burden associated with a major surgery on the patients' and their families.

Patient satisfaction

Patients in the LAP group were much more pleased with the outcome of their surgery in terms of early oral feeds, early mobilization, early return to work, less pain and better cosmesis. Most of the patients gave excellent to good rating when compared to open group who gave good to average rating.

Conclusion

The results support the view that laparoscopic cholecystectomy is a safe and justified replacement for open cholecystectomy. There is a definite learning curve for surgeons who are newly exposed. The complication rates reduced as the surgeons become more experienced in this procedure to a level comparable with that of open cholecystectomy.

Laparoscopic cholecystectomy was safe with less postoperative morbidity associated with faster patient recovery and satisfaction as documented by less postoperative pain, earlier resumption of oral feeds, earlier full mobilization and discharge home, as well as early return to work. In conclusion, the study supports the view that laparoscopic cholecystectomy is safer and efficacious and offers definitive advantages over open cholecystectomy and should be an available option for all patients requiring elective cholecystectomy.

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