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ORIGINAL PAPER

Open cholecystectomy versus laparoscopic cholecystectomy: a comparative study

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ABSTRACT

***Introduction**: A gall bladder helps in fluid transport and its regulation. **Objectives**: The purpose of present study was to evaluate the safety and efficacy of laparoscopic cholecystectomy in comparison with open cholecystectomy. **Material and methods:** The present study comprised of 200 patients who underwent open and laparoscopic cholecystectomy. **Result**: The age and sex distribution of the whole series corresponds fairly well with the usual age and sex affection of gallbladder disease. Overall there was a female preponderance and the peak age group affected was 3rd and 4th decades. Most of the males affected were in the 4th and 5th decades of life. The most common indication for cholecystectomy was cholelithiasis followed by acutecalculous cholecystitis. Three cases were converted from laparoscopic to open cholecystectomy one due uncontrolled bleeding and two due to a large calculus in the cystic duct that could not be extracted. The mean operative time in laparoscopic group was 61.7 min compared to 108.1 minin open cholecystectomy groups. Laparoscopic group has intraoperative complications like minor bleedings, gall stone spillage and major bleeding in one case. There was no bile duct injury in laparoscopy group. Major complications like bile duct injury seen in only two cases of open cholecystectomy in our study, and liver bed bleeding and gall stone spillage. Open group had more complications like wound infections, chest infections. No mortality was seen in our study in both groups. **Conclusion**: The patients in the laparoscopic group had less pain, started oral intake earlier and were discharged earlier compared to open group. They were also able to resume their normal work sooner.*

***Keywords**: Intra operative complication, mortality, gallbladder disease*

INTRODUCTION

Benign diseases of the biliary tract are one of the most common surgical problems in the world. Gallstones especially, affect millions.[1] Surgery plays an important part in the treatment and over half a million cholecystectomies are performed worldwide.[2]Cholecystectomy has been the universal standard for the treatment of symptomatic cholelithiasis.[3]The first open cholecystectomy was performed in 1882. Since its introduction in France, laparoscopic cholecystectomy has become the treatment of choice for symptomatic cholelithiasis.[3] In developing countries like ours, where the medical cost and loss of working days is a major issue,whether laparoscopic cholecystectomy would be a cost-effective alternative to open cholecystectomy is an issue to be considered.

Pathophysiology: Studies have demonstrated that the gall bladder concentrates hepatic bile by selective re-absorption of bile constituents. Sodium and chloride ion are absorbed from the gall bladder ion by both active and transport mechanism; water absorption is thought to be passive and the secretion of the water and the electrolyte by the gall bladder mucosa is an active process which can take place against hydrostatic and osmotic gradients.[4] The net water transport across the gall bladder may be influenced by both humoral and autonomic nerves. The flow of bile into the gallbladder is modulated by hepatic secretary pressure, sphincter of Oddi and cystic duct resistance.

Acute cholecystitis: Acute cholecystitis is clinically defined as an episode of acute biliary pain accompanied fever and right hypochondrial tenderness and guarding, with persistence of the symptoms beyond 24 hours. It is usually due to

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persistent impaction of a stone in the neck of the gallbladder.[5]

Acute acalculous cholecystitis: Acute acalculous cholecystitis is found in approximately 5% of all patients undergoing cholecystectomy. It predominantly affects individuals with other conditions including trauma, non-biliary surgical procedures, sepsis, burns, TPN, mechanical ventilation, blood transfusions and use of narcotics or antibiotics.

Acute emphysematous cholecystitis: An uncommon variant characterized by the production of gas by the infecting bacterial organism. It occurs mostly in men between 50-60 years of age and in diabetics. [5]

Chronic cholecystitis: Chronic cholecystitis develops as a result of recurrent attacks of mild acute cholecystitis.The pathological changes, which often do not correlate well with symptoms, vary from those of an apparently normal gallbladder with minor chronic inflammation in the mucosa to a shrunken organ with gross transmural fibrosis and organized adhesions. The mucosa is initially hypertrophied but later become atrophied.[5]

METHODS

The subject of this study consists of 200 patients who have undergone gallbladder removal, in Guwahati Medical College and Hospital. 100 patients who have undergone laparoscopic cholecystectomy and 100 patients who have undergone open cholecystectomy from August 2014 to August 2015 have been taken into the study.

Inclusion Criteria: All patients with acute cholecystitis, chronic cholecystitis, cholelithiasis, empyema, and mucocoele of gallbladder.

Exclusion Criteria: Patients with choledocholithiasis, carcinoma of gallbladder, perforated gallbladder,gangrenous gallbladder has been 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 and also preference of the surgeon in each case. 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.

Method of Collection of Data: Operative steps, duration, intra and postoperative complication were noted in detail and tabulated.

Post-operative assessment with respect to post operation hospital stay,complication including post-operative pain.

Conversion rate:cases that had encountered difficulty during laparoscopic cholecystectomy were converted to open but were included into laparoscopic group.

Chi-square Test

$$\chi^2 = \sum \frac{(Oi - Ei)^2}{Ei}$$, where Oi is observed frequency and Ei is expected frequency

Fisher Exact Test

	Class 1	Class 2	Total
Sample 1	a	b	a + b
Sample 2	c	d	c + d
Total	a + c	b + d	n

$$\text{Fisher Exact Test statistic} = \sum p = \frac{(a+b)!(c+d)!(a+c)!(b+d)!}{n!} \cdot \frac{1}{\sum a!b!c!d!}$$

Student t test

$$t = \frac{(\bar{x}_1 - \bar{x}_2) - (\mu_1 - \mu_2)}{\sqrt{s^2 (1/n1 + 1/n2)}}$$

Statistical software: The statistical software namely SPSS 11.0 and Systat 8.0 were used for the analysis of the data and Microsoft word and Excel have been used to generate graphs, tables etc.

RESULTS

Age wise distribution is shown in **Table 1**.

Table 1 Age distribution of patients studied

Age_group	Lap		Open		Total	
< = 20	10	10.00%	8	8.00%	18	9.00%
21-30	30	30.00%	28	28.00%	58	29.00%
31-40	29	29.00%	26	26.00%	55	27.50%
41-50	18	18.00%	22	22.00%	40	20.00%
51-60	9	9.00%	14	14.00%	23	11.50%
61-70	4	4.00%	2	2.00%	6	3.00%
Total	100	100.00%	100	100.00%	200	100.00%
Mean	35.85 ±12.73		37.58 ± 13.01		36.715 ± 12.87	

P = 0.76

Sex distribution among the cases are shown in **Figure 1.**

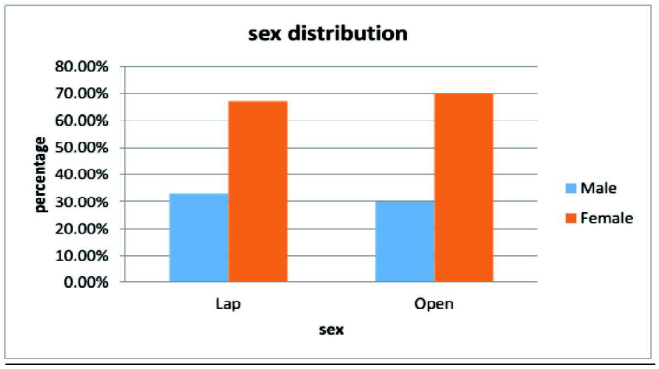

Figure 1 Sex distribution among the cases

Incidence of Cholelithiasis is more in female population so the operative ratio is more in females.

Statistical Methods: Chi-square and Fisher Exact test has been used to find the significance of proportion of age, sex, indications, complications, post-op pain, and patients' satisfaction between the two groups. Student t-test has been used to find the significance of resumption of oral intake,duration of surgery, number of days of stay in hospital, return to normal work in days between the two groups.

Table 2 Gender Distribution in different age groups

Age_group	Lap						Open					
	Male		Female		Total		Male		Female		Total	
< = 20	3	9.10%	7	10.40%	10	10.00%	2	6.70%	6	8.60%	8	8.00%
21-30	7	21.20%	23	34.30%	30	30.005	5	16.70%	23	32.90%	28	28.00%
31-40	8	24.20%	21	31.30%	29	29.00%	4	13.30%	22	31.40%	26	26.00%
41-50	8	24.20%	10	14.90%	18	18.00%	10	33.30%	12	17.10%	22	22.00%
51-60	6	18.20%	3	4.50%	9	9.00%	8	26.70%	6	8.60%	14	14.00%
61-70	1	3.00%	3	4.50%	4	4.00%	1	3.30%	1	1.40%	2	2.00%
Total	33	100.00%	67	100.00%	100	100.00%	30	100.00%	70	100.00%	100	100.00%
Mean	39.33 ± 12.63		34.13 ± 12.52		35.85 ± 12.73		43.63 ± 14.2		34.99 ± 11.63		37.58 ± 13.01	
P =	0.187						0.029					

There was a preponderance of cases in the2nd, 3rdand 4th decades of life in both groups accounting for nearly 72.5% of the cases. The mean age of patients in both groups was around 35 years.There was a female preponderance in both groups with 67% of patients being femalein Group LAP and 70% patients being female in group OPEN (**Table 2**).

The most common indication for open cholecystectomy was symptomatic cholelithiasis (91.5%). In the laparoscopic group also symptomatic cholelithiasis (90%)was the most common cause (**Table 3**).

Table 3 Indication for Cholecystectomy

Diagnosis	Lap		Open		Total	
Symptomatic Cholelithiasis	90	90.00%	93	93.00%	183	91.50%
Acute Cholelithiasis	10	10.00%	7	7.00%	17	8.50%
Total	100	100.00%	100	100.00%	200	100.00%
P =	0.447					

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 60-90 min in lap group and 90-120 min in open group with statistical significance ($p<0.05$). The total duration of the surgery includes both anaesthetic time and operative time.

Table 4 Intra operativecomplications

Intraop-Complications	Lap		Open		Total	
None	92	92.00%	85	85.00%	177	88.50%
Cbd injury	0	0.00%	2	2.00%	2	1.00%
Gall stone spillage	4	4.00%	3	3.00%	7	3.50%
Liver bed bleeding	0	0.00%	5	5.00%	5	2.50%
Major bleeding	1	1.00%	1	1.00%	2	1.00%
Minor bleeding	3	3.00%	4	4.00%	7	3.50%
Total	100	100.00%	100	100.00%	200	100.00%
P =	0.182					

Intra-operative complication is low in laparoscopic group but not statistically significant as

p=0.182 (**Table 4**).Post-operative complications are statistically more associated with Group open with p =0.004(**Table 5**).

Table 5 Post-Operative Complications

Post-op-Complications	Lap		Open		Total	
None	94	94.00%	78	78.00%	172	86.50%
Chest Infection	2	2.00%	10	10.00%	12	6.00%
Wound Infection	4	4.00%	12	12.00%	16	8.00%
Total	100	100.00%	100	100.00%	200	100.00%
P =	0.004					

Drain output is significantly low in laparoscopic cholecystectomy as shown in **Table 6**.

Table 6 Comparison of Drain Output

Drain (ml)	Lap		Open		Total	
0	80	80.00%	47	47.00%	127	63.50%
< 25	7	7.00%	20	20.00%	27	13.50%
< 50	7	7.00%	18	18.00%	25	12.50%
< 100	5	5.00%	14	14.00%	19	9.50%
< 200	1	1.00%	1	1.00%	2	1.00%
Total	100	100.00%	100	100.00%	200	100.00%
P =	0.00001					

Mean pain is significantly less in Group LAP with p = <0.001. More than 50% of the patient in open cholecystectomy group had moderate to severe pain whereas most of patient in laparoscopycholecystectomy has mild pain.

Post-operative mobilization is significantly earlier in Group LAP with p <0.001. Post-operative mobilization is significantly earlier in lap group(26 hrs) compared to open group (46hrs).

Duration to mean post-operative oral feeds is significantly less in Group LAP when compared to group Open with p <0.0001. Resumption of oral intake was significantly earlier in group LAP (17.64hrs) when compared togroup Open(24.18 hr).

Duration of hospital stay is significantly less in Group LAP compared to Group open with p<0.0001. The total duration of hospital stay was shorter in group A (mean 2.43 days) compared to patients in group B (mean 6.32 days).

Mean return to work is significantly less in Group LAP with p = <0.0001. Return to work is calculated from the day of surgery.Patients in the lap group returned to work earlier (6.95 days) when compared to open group (14.7 days).

Mean patient satisfaction score is significantly less in Group open with p<0.0001. Significant number of patients responded with good to excellent grading (>75%) when compared to those patients in group B (14%) as shown in **Table 7.**

Table 7 Patient Satisfaction

Patient Satisfaction	Lap		Open		Total	
Poor	5	5.00%	26	26.00%	31	15.50%
Average	10	10.00%	60	60.00%	70	35.00%
Good	55	55.00%	13	13.00%	68	34.00%
Excellent	30	30.00%	1	1.00%	31	15.50%
Total	100	100.00%	100	100.00%	200	100.00%
P =	0.0001					

DISCUSSION

Cholelithiasisis 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.

This was a comparative clinical study consisting of 200 patients undergoing cholecystectomy conducted in our institute, Guwahati Medical College and Hospital from August 2014 to August 2015.

The patients were randomized into two groups:100 patients in Group LAP (laparoscopic cholecystectomy) and 100 patients in Group OPEN (open cholecystectomy). The study was undertaken to compare the efficacy, safety and patient's satisfaction between the two procedures.

The main sufferers of gallbladder disease in our study were females as compared to males. Out of total 200 cases, 63 cases were males,and 137 females, which are very much similar to those observed by Fraze and others[6]and U. Berggren and others[7].

No age is said to be immune to gallbladder disease, however they were more common in the 3rd, 4thand 5thdecades of life as 72% of the cases belonged to these decades.Workers like Thomas B Hugh et al[8]R Schmitz et al[9]have reported a similar peak incidence in the 4th and 5thdecade. In this study also, average age group affected were 3rdand 4thdecade and themean age group of this study was 36years. The duration of surgery was lesser in the LAP group at 60 – 90 mins compared with 90 – 120 minutes in OPEN group in this study. Other studies quoted Soper et al[10]with 95 minutes for laparoscopic and 122 min for open. The duration of surgery is lesser in the LAP group when compared to the OPENgroup for the following reasons:1.) Ease of access. 2.)Better visualization3.) Minimal anaesthetic time.

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).Other complications like bile duct injury, major bleeding requiring conversion to open cholecystectomy, visceral injury was not encountered probably due to improved visualization afforded by the laparoscope thereby facilitating better delineation of normal anatomy and also early detection of aberrant anatomy. There was no mortality in this study.

Patients undergoing laparoscopic cholecystectomy had less pain (mild to moderate) when compared to those undergoing open cholecystectomy (moderate to severe).In this study open cholecystectomy group having severe pain(46%),moderate pain (39%), mildpain(15%). Laparoscopic Cholecystectomy group having severe pain (3%), moderatepain (15%),mild pain. In a similar study conducted by Hieronymus PJD et al[11] similar findings were seen. Most of the patients in the laparoscopic group were able to take orally within the first 18- 24 hours whereas the oral intake of most patients in the open group was possible only after 24 - 36 hours.In the present study average interval of oral intake was in open group(24.8hr),LAP group(17.6).The total period of hospital stay in our study was around 2 days for theLAP group and around 7 days in the open group. The mean time forreturn to normal work after surgery in the present studywas 7 days in the laparoscopic groupand 14 days in the open group**.**Studies by Jeffrey S Barkun[12], Ahmed Assalea[13],and AW Majeed et al[14] also showed a much shorter stay in both groups a postoperativehospital stay of 1.8 days (which is similar to that seen in our study) & 3-5 days in theopen group which is slightly lesser than our study.

Only three cases were converted into open surgery making it comparable with the conversion rate in other studies. Two were converted due to large cystic duct stone, one was converted due to the uncontrolled bleeding.Patients in the lap group in comparison to the open group were allowed early oral feeds, were mobilized early, returned to work earlier, experienced less pain and better comesis. Consequently, most of the patients gave excellent to good rating when compared to open group who gave good to average rating, as most of them experienced more pain, were in the hospital for longer duration. Most of the patients in the open group were more dissatisfied with the large scar associated with the surgery.

CONCLUSION

The results support the view that laparoscopic cholecystectomy is a safe and justified replacement for open cholecystectomy with less postoperative morbidity associated with faster patient recovery and satisfaction as documented

by less postoperative pain, less duration of analgesic requirement, earlier resumption of oral feeds, earlier full mobilization and discharge, as well as early returnto 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. Laparoscopic cholecystectomy can be considered the gold standard against which other procedures have to be compared.

Conflict of interest: No conflict of interest associated with this work.

Ethical issues: Ethical clearance was sought from the institutional ethics committee.

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Author's contribution: We declare that this work was done by the authors named in this article and all liabilities pertaining to claims relating to the content of this article will be borne by the authors.

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