

## COMPARATIVE STUDY BETWEEN LAPAROSCOPIC CHOLECYSTECTOMY AND OPEN CHOLECYSTECTOMY IN A TERTIARY CARE CENTRE OF SOUTHERN ODISHA

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### ABSTRACT

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#### BACKGROUND

Cholelithiasis popularly known as gall stone has become a matter of global concern particularly in the adult age group owing to our life styles. Although open cholecystectomy started earlier, laparoscopic cholecystectomy has replaced it with few exceptions. However, each procedure has its advantages and disadvantages pertaining to certain characteristics of the patient, infrastructure availability and financial feasibility.

The aim of this study was to compare the relative effectiveness of each procedure through different parameters before, during and after the surgery.

#### MATERIALS AND METHODS

In this cross-sectional study, 100 patients were included with equal proportion in each group. They underwent either of the surgeries and comparison was made utilizing different pre, intra and post-operative factors through different statistical tests applied accordingly.

#### RESULTS

Laparoscopic cholecystectomy was better than open cholecystectomy in terms of surgery duration, decreased pain post operatively, ambulation, hospital stay etc. with statistical significance between the 2 groups. The outcome was favourable leading to the impression of going for the former procedure in most of the settings of cholelithiasis.

#### CONCLUSION

Laparoscopic cholecystectomy was better alternative to open cholecystectomy in terms of less intra and postoperative complications.

#### KEYWORDS

Laparoscopic Cholecystectomy, Cholelithiasis, Gall Stones.

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#### BACKGROUND

Gall stones are one of the major causes of morbidity and mortality worldwide. Surgical removal is the definitive treatment of symptomatic gall stones.<sup>1</sup> Open cholecystectomy (OC) was the gold standard for treatment of stones in gall bladder till end of 1980's.

However laparoscopic approach replaced open surgery as the standard procedure in early 1990s causing less scarring, shorter hospital stay for the patients and faster their recovery as compared to the open procedure.<sup>2</sup> But

incidentally it was associated with a higher rate of bile duct injuries.<sup>3</sup>

As years passed, by various types of laparoscopic surgery evolved resulting in small incisive procedure, very few post-operative complications supplemented by early return of patient's mobility and resuming of normal daily activities. Operative morbidity & mortality in comparison to traditional cholecystectomy are low. Many studies have confirmed the safety of laparoscopic cholecystectomy (LC) in elderly making it an acceptable and preferred method for cholecystectomy particularly uncomplicated gallstone disease.<sup>4</sup>

However, uncertainty still persists about the application of laparoscopic techniques to the management of patients with complicated gallstone disease even after 20 years of its inception.<sup>5</sup> Longer duration of surgery is the only disadvantage of the laparoscopic cholecystectomy over the open procedure. Open cholecystectomy is better option in cases where it contraindicated such as cardiac patients, patients in whom general anaesthesia is contra indicated,

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CO<sub>2</sub> inflation provoking potential cardiac arrhythmia. In such cases open cholecystectomy can be carried out in regional anaesthesia. Post-operative pain, cosmesis and later complications like incisional hernia, intestinal obstruction decides the better technique to be used.<sup>6</sup>

Many factors are considered for treatment of gallstones. First and most important is procedure related mortality and morbidity. Others include overall efficacy of the technique, cost (both short and long term), patient convenience, disability and quality of life. When cholecystitis is associated with serious medical problems, operative mortality in most of the study groups is around 1%.<sup>7</sup> Thus each technique, though it be open or laparoscopic procedure has its own merits and demerits as per indications of the disease.

Taking into consideration of the above things, the study was carried out to compare conventional cholecystectomy and laparoscopic cholecystectomy with respect to duration of procedure, incision length, complications, postoperative pain, analgesic requirement, period of hospital stay and return to normal activity.

**MATERIALS AND METHODS**

It was a cross sectional study conducted on patients admitted to general surgery department in M.K.C.G. Medical College and Hospital from July 2016 to June 2018.

Those patients who satisfied the following criteria were selected-

- 1) Symptoms consistent with biliary colic.
- 2) Documented gallstones on ultrasonography.
- 3) No evidence of CBD disease.
- 4) Absence of acute cholecystitis (last attack more than 6 weeks back).
- 5) No major bleeding disorders.
- 6) No previous upper abdominal surgery.

The symptomatic cases of cholelithiasis was proven ultrasonographically and further gone elective cholecystectomy.

However, patients with conditions like history or investigations suggesting CBD disease, history of previous abdominal surgery, features of jaundice and were excluded from the study. After taking appropriate consent, a total 100 patients were finally selection by convenient sampling and

preoperative laboratory investigations were completed. Permission for the study was obtained from institutional ethics committee.

The patients were divided into Group A and Group B of 50 patients each. The former group had undergone laparoscopic cholecystectomy and the later undergone conventional open cholecystectomy.

The following observations of the 2 groups were made and compared for-

- a) Duration of surgery.
- b) Incision length.
- c) Post-operative events.
  - i. Drain removal
  - ii. Postoperative pain and analgesic requirement.
  - iii. Nausea and vomiting
  - iv. Ambulation and commencement of bowel movements.
  - v. Complications like wound infection, bile leakage, and sub-hepatic collection.
  - vi. Hospital stay and time taken to return to normal activity.
  - vii. Evaluation of the inflammatory mediators and stress response.
  - viii. Cosmetic aspect

Statistical analysis was done using Microsoft excel and SPSS version 20.0. For analysis of continuous data, mean and standard deviation was calculated. Percentage and proportion were used for analysing categorical variable. For comparing the mean of the 2 groups, independent T test was applied. Statistical significance was considered when p <0.05.

**RESULTS**

In the present study, 100 cases of symptomatic cholelithiasis were selected for the study. These were divided into Group A (who underwent laparoscopic cholecystectomy) and Group B (who underwent conventional or open cholecystectomy) of 50 patients each.

Age (Years)	Group-A				Group-B			
	Male		Female		Male		Female	
	No.	%	No.	%	No.	%	No.	%
10-19	0	0	2	5	0	0	2	4.7
20-29	0	0	6	15	0	0	10	23.9
30-39	0	0	20	50	0	0	20	47.6
40-49	7	70	12	30	6	75	8	19.2
50-59	2	20	0	0	1	12.5	1	2.3
60-69	1	10	0	0	1	12.5	1	2.3
Total	10	100	40	100	8	100	42	100

**Table 1. Age and Gender Distribution of The Study Population**

The age of the study participants varied from 10 years to 69 years. (Table 1) Out of 50 patients in group A, 20% were male and rest i.e. 80% were females. Among the males of this group, 70% were between 40 to 49 years of age, 20% between 50 to 59 years and 10% between 60-69 years of age. Similarly, in group B with 50 patients, 16% were male study population and 84% were female. Out of them, 75% from 40 to 49 years of age, 12.5% each from 50 to 59 years and 60 to 69 years constituted the male section. 4.7%, 23.9%, 47.6%, 19.2%, 2.3%. 2.3% were of 10-19 years, 20-29 years, 30-39 years, 40-49 years, 50-59 years and 60-69 years from the female proportion of group B respectively. The mean age of group A was  $38.84 \pm 9.27$  years and that of the other group was  $38.04 \pm 10.23$  years. However, no statistical significance was found between the mean age of both the groups. ( $p = 0.683$ )

The weight distribution of the patients demonstrated that in group A, 24% were between 40-50 kg, 50% between 51-60 kg, 18% between 61-70 kg and 8% between 71-80 kg. Majority (48%) from group B were between 51-60 kg followed by 20% each between 41-50 kg and 61-70 kg, and lastly 12% between 71-80 kg. Mean weight of group A was  $56.92 \pm 8.48$  kg and for group B it was  $58.56 \pm 8.63$  kg with no statistical significance between them. ( $p > 0.340$ ).

Time (in min.)	Group A		Group B	
	No.	%	No.	%
30-60	30	60	9	18
61-90	17	34	34	68
91-120	3	6	7	14
<b>Total</b>	<b>50</b>	<b>100</b>	<b>50</b>	<b>100</b>

**Table 2. Duration of Surgery**

Table 2 demonstrates the duration of surgery in the study participants. It was between 30-60 minutes in 60% of group A and only 18% in group B. In the former group, 34% had 61-90 minutes for the surgery but it was double the time in the latter group. The duration was 91-120 minutes in 6% of group A and 14% of group B. Mean duration in Group A was  $60.64 \pm 14.29$  minutes and  $75.00 \pm 13.89$  minutes in group B with statistical significance between the mean duration. ( $p < 0.0001$ ).

Incision length	Group-A		Group B	
	No.	%	No.	%
0-5	40	80	0	0
5.1-10	10	20	2	4
10.1-15	0	0	42	84
15.1-20	0	0	6	12
<b>Total</b>	<b>50</b>	<b>100</b>	<b>50</b>	<b>100</b>

**Table 3. Incision Length**

Table 3 demonstrates the incision length in both the groups. It varied from 0-10 cm in group A and 5-20 cm in group B. The length was minimal i.e. 0-5 cm in 80% and from 5-10 cm in 20% of the cases undergoing laparoscopic cholecystectomy. Majority (84%) had the length ranging

between 10-15 cm in those who had passed through open cholecystectomy. But it was between 10-15 cm and 15-20 cm in only 12% and 4% cases. The mean length in group A was  $4.79 \pm 0.383$  cm and  $13.45 \pm 1.621$  cm in group-B. The mean difference between them was found to be statistically significant ( $p < 0.0001$ ).

With regard to the peritoneal drainage of both the groups, drain was present in 80% of group A patients and in every patient of group B.

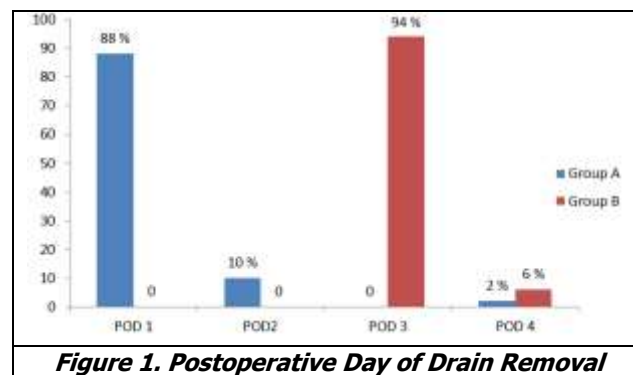


Figure 1 shows the post-operative day of drain removal. It was day 1 in 88% and day 2 in 10% of group A population. However, for 94% patients of group B, it was day 3 for removal. POD 4 was the day of drain removal in 2% of group A patients and 6% of group B patients.

Parameters	Group-A				Group-B			
	Day of Surgery		POD-1		Day of Surgery		POD-1	
	No.	%	No.	%	No.	%	No.	%
None (0)	0	0	33	66	0	0	0	0
Mild (1-3)	35	70	8	16	0	0	4	8
Moderate (4-6)	10	20	9	18	12	24	12	24
Severe (7-10)	5	10	0	0	38	76	34	68
Narcotic Requirement	No.		%		No.		%	
Mild (No Narcotic Required)	42		84		13		26	
Moderate (Narcotic on Day 1)	8		16		30		60	
Severe (Narcotic Beyond Day 1)	0		0		7		14	

**Table 4. Assessment of Post-Operative Pain**

Most of the patients in group A had mild VAS score (70%) on the day of surgery but no pain on first post-operative day. No narcotic medication was required in group A population in majority of them. Interestingly 76% of group B had severe pain both on day of surgery and on the next day.

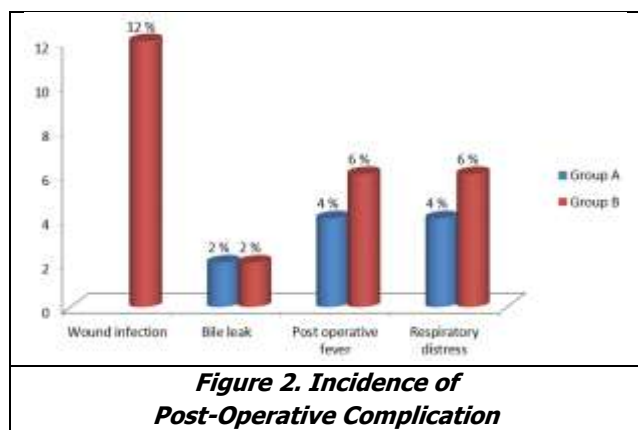
Mean VAS score for laparoscopic cholecystectomy patients was 3.5 on day of surgery and 1.16 on just postoperative day, whereas for open cholecystectomy these were 6.90 and 6.00 respectively ( $p < 0.05$ ).

Parameters	Group-A		Group-B	
	No.	%	No.	%
<b>Nausea/Vomiting</b>				
None	40	80	12	24
Mild (No Medication Required)	7	14	14	28
Moderate (Medication Once)	3	6	22	44
Severe (Persistent Despite Medication)	0	0	2	4
<b>Ambulation (Post-Op Day)</b>				
First	44	88	8	16
Second	6	12	12	24
Third	0	0	26	52
Fourth	0	0	4	8
<b>Passage of Flatus (Post-Op Day)</b>				
First	38	76	14	28
Second	10	20	30	60
Third	2	4	6	12

**Table 5. Other Post-Operative Events**

Assessing the postoperative condition like nausea and vomiting, majority of the group A had no incidence of the same while in the other group 44% had moderate incidence of the above symptoms requiring medication once.

88% of patients undergoing laparoscopic surgery had ambulation and flatus passage in the first post-operative day while in the latter group majority had ambulation on 3<sup>rd</sup> post-operative day and passage of flatus on 2<sup>nd</sup> POD.



**Figure 2. Incidence of Post-Operative Complication**

The incidence of post-operative complication is shown in figure 8. 10% of group A study population had developed post-operative complications while the incidence of such occurrence was 26% of Group B. Wound infection was present in only the later group and it was 12%. In both the groups the incidence of bile leak was equal (2%). Similarly, 4% of group A had each of post-operative fever and respiratory distress. Likewise, the above 2 complications were present in equal proportions in group B.

Hospital Stay (Days)	Group-A		Group-B	
	No.	%	No.	%
1-3	35	70	2	4
4-6	8	16	13	26
7-9	7	14	28	56

>10	0	0	7	14
Total	50	100	50	100

**Table 6. Hospital Stay Post Operatively**

Duration of hospital stay in days is shown in table 10. Most of the group A (70%) stayed for 1-3 days after surgery. However, the duration was 7-9 days in 56% of group B patients. The mean hospital stay in group A was 3.72 ± 1.773 days and 6.98 ± 2.190 days in group B with statistical difference between them (p < 0.0001).

Time (Days)	Group-A		Group-B	
	No.	%	No.	%
<7	38	76	0	0
8-14	6	12	10	20
15-21	6	12	33	66
22-28	0	0	4	8
>28	0	0	3	6
Total	50	100	50	100

**Table 7. Time to Return to Normal Activity**

Table 6 demonstrates the time of the study participants to return to normal activity after the surgery. 76% from group A took less than 7 days. The time taken was 15 to 21 days in 66% by group B patients. Mean time for laparoscopic cholecystectomy (group A) was 8.30 days ± 4.79 and that for open cholecystectomy (group B) it was 18.40 days ± 6.72. The difference between the mean time of both the groups was found to be statistically significant (p < 0.0001).

The level of all the inflammatory mediators was determined by C-reactive-protein and polymorphonuclear leucocyte, which were elevated on the first postoperative day, significantly less following LC as compared to conventional cholecystectomy. The laparoscopic cholecystectomy group showed a significantly lower stress response with respect to glucose.

Cosmetic results were much better in laparoscopic cholecystectomy group and hence were acceptable in 18% cases and good in 82% of the cases of LC group. But it was unacceptable in 38% cases, acceptable in 36% case, and good in 26% cases of OC group.

**DISCUSSION**

The following study was done with intention of knowing the advantages and disadvantages of both laparoscopic and open cholecystectomy in a comparative manner. Parameters like duration of surgery, incision length for surgery, post-operative day of drain removal etc. were taken into consideration to reach to any inference.

In the present study both the comparative groups had equal proportion of study subjects which coincides with finding by Soper et al.<sup>8</sup> Vander Velpen et al.<sup>9</sup> but unequal in the studies by Williams et al.<sup>10</sup> and Rubert et al.<sup>11</sup>

Mean age of patients undergoing laparoscopic surgery was 38.84 ± 9.27 years and that of the other group was 38.04 ± 10.23 years. It was 62 years in the former group and 61.5 years in the latter in the study by Vander Velpen et al.<sup>9</sup>

Females had higher prevalence (82%) than males (18%) which was also seen in the study by Barase AK.<sup>12</sup>

The mean duration of surgery in group A was 60.64 ± 14.29 minutes and 75.00 ± 13.89 minutes in group B. In the study by Soper et al. the duration was higher than the present study in patients who had undergone laparoscopic cholecystectomy.<sup>8</sup>

Laparoscopic cholecystectomy took twice as long as open cholecystectomy (100 min vs 50 min,) as shown by Tronsden et al. with significant difference between them<sup>13</sup> and also in the study by Rubert et al.<sup>11</sup> There was no significant difference in operation time between laparoscopic cholecystectomy and open cholecystectomy in the study by Keus F et al.<sup>14</sup> In the study by Bosch ME et al. the operating time for open cholecystectomy was shorter as compared to laparoscopic cholecystectomy.<sup>15</sup>

Our finding on the duration was also contradicted by Barase AK where it longer in laparoscopic surgery as compared to open.<sup>12</sup> However Hardy et al had shown much higher operating time for both the groups.<sup>16</sup>

5 patients had postoperative complications of laparoscopic surgery group and 7 patients from the open surgery group. Postoperative complications were present in 3 and 7 patients respectively from both the groups in the study by Barase AK.<sup>12</sup>

In the present study there was increased wound related complications in patients with open cholecystectomy which was also found in the study by Williams et al.<sup>10</sup> and Tronsden et al.<sup>13</sup> and Stoker et al. with statistical significance.<sup>17</sup> However no significant difference was observed in the complications between laparoscopic cholecystectomy and open cholecystectomy in the study by Keus F et al.<sup>14</sup>

Bile leak was observed in 6.67% patients of group A patients and 10% patients of group B with no statistically significance by Barase AK.<sup>12</sup>

The hospital stay in patients undergoing laparoscopic cholecystectomy was less (3.72 days) as compared to in open cholecystectomy (6.98 days). The above finding was supported by Tronsden et al.<sup>13</sup> Rubert et al<sup>11</sup> and Keus F et al.<sup>14</sup> Grace et al.<sup>18</sup> Hardy et al.<sup>16</sup> Chan et al.<sup>19</sup> Buanes et al.<sup>20</sup> Porte and DeVries.<sup>21</sup> Lujan et al.<sup>22</sup> and Schietroma et al.<sup>23</sup>

The time to return to normal activity was less in group A which is evident from studies by Vander Velpen et al.<sup>9</sup> Peters JH et al.<sup>24</sup> Vitale GC et al.<sup>25</sup> and Cuschieri A et al.<sup>26</sup>

There was significant rise of inflammatory mediators in open cholecystectomy and low stress response in laparoscopic cholecystectomy. The notion was also seen in the studies by Ehtesham S et al. (IL-1 $\beta$  and TNF alpha)<sup>27</sup> and Schietroma et al. (IL-1 and IL-6).<sup>28,29</sup> But contradicted by studies of Lausten et al. and Helmy et al.<sup>30,31</sup>

Cosmetic results were much better in cases of LC as compared to OC. Similar results was also reached at by Barase AK.<sup>12</sup>

## CONCLUSION

Laparoscopic cholecystectomy holds several significant advantages over conventional open cholecystectomy which includes safety, post-operative pain, recovery and time loss

from work and daily activities apart from some patient's objection to the unaesthetic aspect of a large abdominal scar of open cholecystectomy. Laparoscopic cholecystectomy offers the potential to decrease significantly post-operative length of stay along with more rapid return to work for most patients. However, the incidence of bile duct injury, overall morbidity, and mortality compare favourably with those of open cholecystectomy. Thus, laparoscopic cholecystectomy is a safe and efficacious procedure that offers a viable alternative to conventional open cholecystectomy. As such laparoscopic cholecystectomy has replaced open cholecystectomy as the gold standard in its management. However, larger studies with longer follow up are required to confirm this.

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