



## General Surgery

## COMPARATIVE EVALUATION OF OPEN VS. LAPAROSCOPIC CHOLECYSTECTOMY IN GALL STONE MANAGEMENT: A HOSPITAL BASED STUDY

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**ABSTRACT**

**Background:** Gallstones are common in Indian population and its treatment has shown a decisive shift from open to laparoscopic route. There is no doubt that laparoscopy require longer and steeper learning curve and incur higher cost. However, preferences of patients are changing rapidly due to better level of awareness and availability of healthcare facility.

**Aim and objective:** To compare open cholecystectomy and Laparoscopic cholecystectomy in view of duration of surgery, post-operative hospital stays and post operative complication.

**Material and Method:** Present study was conducted on adults of 25 years to 65 years operated at a teaching hospital. They were divided into open and laparoscopic cholecystectomy group by draw by lottery method. Patient's written valid informed consent for the particular procedure was taken and the pros and cons of both the procedure were explained in detail to the patient. This study was done after due clearance of Ethical committee.

**Results:** The median (range) operation time for laparoscopic cholecystectomy was 30-180 min (mean=82.64 min) and 20-60 min (mean=32.64 min) for open cholecystectomy ( $p < 0.001$ ). During the study period operation time for laparoscopic cholecystectomy showed a tendency to become longer. The use of injectable analgesics in case of laparoscopic cholecystectomy is considerably less than open cholecystectomy.

**Conclusion:** laparoscopic cholecystectomy is better than open cholecystectomy in terms of post-operative pain, analgesic requirement and early return to work. However, open cholecystectomy is preferred method for Surgeons in the beginning of their career and in case of difficult cholecystectomy.

**KEYWORDS :** Cholelithiasis; Cholecystitis; Laparoscopic cholecystectomy; Open cholecystectomy; Bile duct injury.

**INTRODUCTION:**

Cholecystectomy is the standard treatment for cholelithiasis ever since it was 1st performed by Carl Langenbuch1 in 1882. Prior to that, cholecystostomy with cholecystolithotomy was performed and advocated by John Stough Bobbs, but it carried a high recurrence rate, high morbidity and the potential for malignant change in the Gallbladder. Karl langenbuch in 1882 quoted. "The gallbladder should be removed, not because it contains stones, but because it forms them"

The pain associated with open cholecystectomy is due to a long incision and its effect on postoperative chest complications and also the various wound complications of traditional open cholecystectomy, added to the morbidity of this open cholecystectomy procedure. In order to minimize the post operative pain and to reduce the wound morbidity, minilap cholecystectomy was devised in which, through a 5-7 cm incision and with aid of extra-long instrument the gall bladder is removed.<sup>2</sup>

The advent of laproscopic cholecystectomy has revolutioned the surgical management of gall stone disease. 1st performed by Phillipe Mouret of Lyon, France, this minimally invasive surgery has received an unprecedented acceptance both by the patient as well as the surgeons.

Also labeled as "Band-Aid" surgery, it is performed through 4 incisions with the longest one 1.1 cm long. The peritoneal cavity is insufflated with CO<sub>2</sub> gas and a laparoscope is passed through one of the incisions. The operator performs the surgery by looking at a two dimensional magnified image on a video monitor. The distinct advantages of Laparoscopic cholecystectomy over open cholecystectomy are reduced hospital stay, morbidity, convalescence with a better cosmetic scar.<sup>3</sup>

**Aim and Objective:**

To compare open cholecystectomy and Laparoscopic cholecystectomy in view of duration of surgery, post-operative hospital stays and post operative complication.

**Material and Methods:**

The study was conducted on fifty patients of cholelithiasis, requiring elective cholecystectomy, attending the surgical OPD of TMMC & RC, Moradabad. The selected patients were randomly allocated to two groups : Group A: (25 patients) those undergoing Open Cholecystectomy and Group B: (25 patients) those undergoing

Laparoscopic Cholecystectomy depending on the inclusion and exclusion criteria. Information was collected from the patients after a written valid informed consent from them. The study was approved by IEC. This study involved preoperative Evaluation, intra-operative assessment and post-operative assessment and follow up till 3 months. All the patients were studied with reference to duration of surgery, post-operative analgesic, post-operative stay, intra operative and post-operative complications.

**Inclusion Criteria**

Patients of all ages and both sexes were included in the study. The major criterion for accepting patients for the study was the reasonable certainty that no other surgically correctable intra-abdominal disease is present as suggested by clinical examination and/or upper GI Endoscopy and/or abdominal Ultrasonography.

**Exclusion Criteria**

Patients with a past history of jaundice, abnormal LFT or USG findings suggestive of open cholecystectomy were excluded. Also excluded were all those patients who were converted to traditional long incision cholecystectomy because of any technical difficulty and/or complications encountered during Laparoscopic cholecystectomy.

**PREOPERATIVE EVALUATION**

A Detailed History of the patients was taken with special reference to Duration of pain in right hypochondrium, its periodicity, relief by oral or parenteral analgesics, any attack of acute cholecystitis and any other complaint for associated other intra abdominal disease requiring surgery along with any past history of previous abdominal surgery and/or any other major illness was recorded.

Detailed examination of patient was conducted counting General physical examination especially for icterus, Systemic examination especially chest to rule out COPD etc. as they are likely to affect the outcome and Abdominal examination to rule out GB lump/GB mass, any other lump or organomegaly. Grading of Biliary Tract Disease was done according to the McSherry Scheme.

General investigations like Hemogram, Blood sugar, Blood Urea, Urine routine and microscopic examination, Liver Function Tests, Chest X-Rays (to see for any evidence of atelectasis etc.) and Ultrasonography of abdomen was done in all cases.

Diagnosis of cholelithiasis was carried out in expressions of Number of Laparoscopic cholecystectomy calculi, Thickness of GB wall, Adhesions with the surrounding structures, open cholecystectomy and marking of the fundus of GB, CBD laparoscopic cholecystectomy, if any, Diameter of CBD or Any other intra-abdominal pathology.

#### INTRA-OPERATIVE ASSESSMENT

A detailed intra-operative record was kept for each patient with special emphasis on:

1. Type of anesthesia: As the technique of anesthesia greatly influences the early post-operative period, the technique of anesthesia used in each case was recorded.
2. Length of Incision: was noted in each case of O.C. using a standard scale.
3. The anatomy of calot's triangle was noted to see for any abnormalities.
4. Adhesions to the surrounding structure were noted and graded as Mild, Moderate and Severe.
5. Intraoperative complications were also noted.

#### POST-OPERATIVE ASSESSMENT -

The post operative period of each patient was closely monitored-and following parameters were recorded in terms of Amount of additional Analgesia Requested by Patients, Pain Scores, Chest Roentgenogram, Duration of Mandatory Intra-Venous Fluids, Duration of Hospital Stay, Cost analysis, Time for Return to Work, Evaluation of Operation Scar. Operation scars were examined carefully at six weeks interval.

#### Statistical Analysis

Collected data was tabulated and subjected to statistical analysis using the student's T test for mean and standard deviation. Chi square test was applied to Intra and Post Operative complications and co-efficient of correlation was calculated for the VAS at 24 hour scales.

#### Results:

The present study was conducted on 50 adults with age ranging 25-66 years with mean age of 40.40 in Laparoscopic Cholecystectomy Group and 39.20 in Open Cholecystectomy Group whereas mean weight in Laparoscopic Cholecystectomy and Open Cholecystectomy group was 58.60 and 52.40 respectively. One patient in the Open Cholecystectomy group has an avulsion of the cystic artery which was managed through the same incision, and one had GB perforation "with consequent bile and stone spill. Three patients in the Laparoscopic Cholecystectomy group had GB perforation with bile and stone spill. The overall incidence of major complications in the Open Cholecystectomy group was 4% and zero in the Laparoscopic Cholecystectomy group. ( $p>0.05$ )

Duration of surgery was calculated from the time giving the skin incision to the last skin suture. The median (range) operation time for Laparoscopic cholecystectomy was 30-180 min (mean=82.64 min) and 20-60 min (mean=32.64 min) for open cholecystectomy ( $p<0.0001$ ).

Laparoscopic Cholecystectomy required a longer time to complete than Open Cholecystectomy and this Difference was statistically significant.

The difference in the pain scores at 0 hr. and 12 hr. postoperative was significant and was actually lower for the Laparoscopic Cholecystectomy group. The Laparoscopic Cholecystectomy group had lower pain scores at 6, 24, 48 and 72 hours postoperatively. These differences were highly significant, especially at the end of the 24 hours (Table 1).

The additional amount of Diclofenac sodium requested by the patients in the Laparoscopic Cholecystectomy group was much less than the Open Cholecystectomy group with a mean value of  $26.36\pm 19.71$  and  $122\pm 102.14$  respectively and this difference was statistically significant at  $p<0.0001$ . Two patients in the Open Cholecystectomy group had basal atelectasis on CXR whereas the CXR was normal in all the patient in the Laparoscopic Cholecystectomy group. This difference was statistically insignificant.

The mean duration for which the patients had to be kept on i/v fluids was  $36.4\pm 5.97$  in Open Cholecystectomy Group and  $22.72\pm 2.09$  in Laparoscopic Cholecystectomy Group, which was reported to be much longer in the Open Cholecystectomy group and this difference was statistically significant at  $p<0.0001$ .

The postoperative complications in the Laparoscopic Cholecystectomy group were more but these were mostly Grade I. The incidence of Grade II complications in both groups was reported to be almost similar. There were no Grade III or IV complications in either group. This difference is not significant at  $p<0.05$ .

The total expenditure (Intra operative + Post operative) compared for the two groups and was ranged between 2500-4000 and 1500-3000 in Laparoscopic Cholecystectomy and Open Cholecystectomy Group respectively. This expenditure was statistically significant even at  $p<0.0001$ , showing that Open Cholecystectomy is much cheaper than Laparoscopic Cholecystectomy for patients undergoing cholecystectomy.

#### DISCUSSION:

The present study included 50 patients who underwent either Laparoscopic Cholecystectomy or Open Cholecystectomy. Intra operative parameters such as the duration of surgery, length of incision, and intra operative complications were recorded. The demographic characteristics of the patients as regards to age, sex, weight, grade of biliary tract disease and adhesions were similar in the two groups.

The mean duration of Laparoscopic cholecystectomy was 82.68 min. Open cholecystectomy on the other hand required less operating time i.e. 32.64 min showing a difference which is statistically significant. These results are in accordance with the results of studies conducted by CH Chau et al., Lujan et al., Gupta et al. The greater operating time required for Laparoscopic Cholecystectomy was attributable to the fact the sometime is required for creating pneumo peritonium. And also, Laparoscopic Cholecystectomy requires a greater amount of coordination between various members of the surgical team and hence is likely to take more time during the initial phase of the learning curve. 4,5,6

Three patients in the Laparoscopic Cholecystectomy group had perforation of the GB with consequent stone and bile spillage. These were managed by retrieval of the stones one by one, and thorough irrigation and suction of the spilled bile. This complication is a minor one but more difficult to handle than in open cholecystectomy. This is due to, as yet the unavailability, of efficient suction - irrigation devices. Spilled stones can also be retrieved by introducing a cut finger of surgical glove in the peritoneal cavity and placing the spilled stones in the "bag" and then removing the stone containing bag in one go. One patient in the Open Cholecystectomy group had a perforation of the GB which was easily managed through the same incision. There was no open cholecystectomy case of CBD injury in either group. According to the literature CBD injury has been variously reported as ranging from 0.1 to 2.5% 7,8

The pain scores were recorded at 0,6,12,24,48,72 hours post operatively using the Visual Analogue 1 Score (VAS). The difference in the VAS at 0 hours was highly significant at the rest of the time intervals. The Laparoscopic Cholecystectomy group experienced less pain when compared with the Open Cholecystectomy group. The present study is in concordance with the other studies done so far but such detailed analysis as in the present study has not been recorded. Reasons for less post operative pain after Laparoscopic Cholecystectomy could be due to shorter length of incision, being, 1 cm each in Laparoscopic Cholecystectomy and from 10 to 15cm (average 12 cm) in Open Cholecystectomy, Less operating trauma as Open Cholecystectomy requires forceful retraction of the wound edges for exposure of the operating field.

A highly significant difference was reported in additional analgesics as the Laparoscopic Cholecystectomy group of patients required only 25 mg (mean) of parenteral analgesic whereas, the Open Cholecystectomy group required a mean of 122 mg leading us to conclusion that compared to open cholecystectomy the lower pain was experienced by the Laparoscopic Cholecystectomy group of patients. Mac Mohan et al also documents that compared to open cholecystectomy the lower amount of analgesics was required by

Laparoscopic Cholecystectomy patients (22 mg of morphine vs 40 mg) as compared to that by patients undergoing MC.9

Latimer, Laszelo and Wightman et al open cholecystectomy unmented higher incidence of basal atelectasis with larger abdominal incisions.10 This is due to the splinting of the accessory muscles of respiration as well as the decreased excursions of the diaphragm due to pain. This results in the lower respiratory passages becoming blocked by secretions and thereby resulting in atelectasis. However, in the present study, the difference was not significant when analyzed by the X2 test. This could be due to the small sample size in this study.

Patients undergoing Laparoscopic Cholecystectomy had to be maintained on I.V. fluids for 16-28 hrs. (mean 22 hours) as compared to 18-48 hours (mean 36 hours) for those undergoing Open Cholecystectomy and this difference is statistically highly significant. Barkun et al reported a shorter time for the Laparoscopic Cholecystectomy group i.e. 1.1 days vs 1.7 days for Open Cholecystectomy group. The present study shows the difference in the two groups to be significant.11

Laparoscopic Cholecystectomy patients could be safely discharged from the hospital after a mean 32.4 hours whereas Open Cholecystectomy patients have to be kept for 7.2 days postoperatively. This difference is once again highly significant and is a reflection on the lower morbidity associated open cholecystectomy. Mc Mohan et al and Cuschieri et al also document the lower morbidity in the Laparoscopic Cholecystectomy group.9,12 Their patients were discharged from the hospital 2 days after the operation. Data regarding Open Cholecystectomy is varied and ranges from 7-8 days. Stephenson et al on the other hand performs Laparoscopic Cholecystectomy on a day care basis and discharges them on the same day.13

The mean time for return to household work for Laparoscopic Cholecystectomy was 2 weeks and for Open Cholecystectomy was 5 weeks, which was in accordance to study conducted by Barkun et al and McMohan et al who reported the time taken for return to work and found the duration to be shorter in the Laparoscopic Cholecystectomy group a compared to MC (2 wks vs 3 week)11,14. Golco et al also open cholecystectomy unmented the mean time for return to work in the MC as 18.6 days.15 This is an ample testimony to the fact that Laparoscopic Cholecystectomy courses less postoperative morbidity than Open Cholecystectomy.

The operation scar when evaluated in all patients in both the groups, six weeks postoperatively, were formed to be either Grade I or Grade II except for 4 patient of Open Cholecystectomy group for whom the scan was graded as grade III. This patient did have post-operative wound infection with the resultant mildly hyper trophied scar in which the patient complained of pain and itching. However, on close scrutiny, it was found that the majority, of patients undergoing Laparoscopic Cholecystectomy (21 out of 25) had grade II scars whereas, in the Open Cholecystectomy group grade I and grade II scars were rather evenly distributed (6- and d 5 respectively).

From this it appears that laparoscopic cholecystectomy gives a better scar, however, this difference is because all the patients of Laparoscopic Cholecystectomy group had smaller skin incision. Thus, it is anticipated that if intradermal sutures are applied, the cosmetic result is certainly going to be better as compare to those who undergo simple suture.

This is accordance with the literature where cosmetic results of the highest order have been found in patients undergoing Laparoscopic Cholecystectomy. This understandably is one of the most important reasons of the high patient acceptance and universal appeal in favour of Laparoscopic Cholecystectomy.

**Conclusion:**

Worldwide many case series have been published regarding comparison between Laparoscopic cholecystectomy and open cholecystectomy and results are in favor of laparoscopic cholecystectomy. Laparoscopic cholecystectomy is certainly better than open cholecystectomy in terms of post-operative pain, analgesic requirement, duration of hospital stay and early return to work. However, open cholecystectomy is preferred method for Surgeons in the beginning of their career and in case of difficult cholecystectomy.

**Table 1: EVALUATION OF PAIN**

	0 hrs.	6 hrs.	12 hrs.	24 hrs.	48 hrs.	72 hrs.
LAPAROSCOPIC CHOLECYSTECTOMY	4.7	1.27	2.00	1.63	1.30	1.03
OPEN CHOLECYSTECTOMY	6.4	5.6	4.2	3.0	2.2	1.6
T value	1.9241					

**Table 2: DURATION OF HOSPITAL STAY AND CONVALESCENCE**

	Hospital stay			Convalescence(wks)		
	mean	S.D.	Range	mean	S.D.	Range
LAPAROSCOPIC CHOLECYSTECTOMY	31.68hrs	22.68	24-216hrs	2	0.309	
OPEN CHOLECYSTECTOMY	7.2 day	0	7-8 days	5	0.52	4-6wks

**REFERENCES:**

- Langenbuch C.: Ein Fall Von exterpation der Gallenblase wegen chronischer cholelithiasis. Heilung Klin Wochinschr 1882; 19: 725-7.
- Thistle TH, Clearly PA, Lachin JM, Tyor MP, Hersh T: The natural history of cholelithiasis. The National Cooperative gallstone study. Ann Intern Med 1984; 101. 1. Langenbuch C.: Ein Fall Von exterpation der Gallenblase wegen chronischer cholelithiasis. Heilung Klin Wochinschr 1882; 19: 725-7.
- Strasberg SM, Clavien PA: Overview of Therapeutic modalities for the treatment of Gallstone Disease. Am. Jr. Surgery. 1993; 165: 420-425.
- Lujan JA, Parrilla P, Robles R, Marin P, Torralba JA, et al. (1998). Laparoscopic cholecystectomy vs open cholecystectomy in the treatment of acute cholecystitis: a prospective study. [Internet]. Archives of surgery 173-175.
- Karim T, Kadyal A (2015) A Comparative Study of Laparoscopic vs. Open Cholecystectomy in a Suburban Teaching Hospital. J Gastrointest Dig Syst 5: 371.
- Chau CH, Tang CN, Siu WT, Ha JP, Li MK: Laparoscopic cholecystectomy versus open cholecystectomy in elderly patients with acute cholecystitis: retrospective study Hong Kong Med J. 2002 Dec;8(6):394-9
- Szabo G, Miko I, Nagy P, Brath E, Peto K, Furka I, Gamal EM: Adhesion formation with open versus laparoscopic cholecystectomy: an immunologic and histologic study Surg Endosc. 2007 Feb;21(2):253-7.
- Oyogoa SO, Komenaka IK, Lkhani R, Wise L: Minilaparotomy cholecystectomy in the era of laparoscopic cholecystectomy: A community - based hospital prospective. Am. Surg. 2003 Jul; 69(7): 604-7.
- Mc Mohan AJ, Baxter JN, Russell IT et al : Laparoscopic and Minicholecystectomy : a randomized trial comparing post operative pain and PFT. Surgery 1993.
- Wightman Jak: A prospective survey of the incidence of post operative pulmonary complications. Br. J. Surg. 1968; 55: 85-91.
- Barkun JS, Barkun AN, Sampalis JS, Fried G, Taylor B, Wexler MJ et al : Randomized controlled trial of laparoscopic versus mini laparotomy cholecystectomy. The McGill gall stone treatment group. Lancet 1992 Nov. 7; 340(8828): 1116-9.
- Cuschieri Syrakos T, Antonitsis P, Zacharakis E, Takis A, Manousari A, Bakogiannis K et al : Small incision ( mini laparotomy) versus laparoscopic cholecystectomy : a retrospective study in a university hospital. Langanbecks Arch Surg 2004 Jun; 389(3): 172-7
- Stephenson et al: Day care Laparoscopic cholecystectomy Arcse 1993;75(6):437.
- McMahon AJ, Russell IT, Baxter JN, Ross S, Anderson JR, Morran CG, Sunderland G, Galloway D, Ramsay G, O'Dwyer PJ: Laparoscopic versus minilaparotomy cholecystectomy: a randomised trial Lancet. 1994 Jan 15;343(8890): 135-8.
- Goco IR, Chambers LG: Dollors and Cents : Minicholecystectomy and early discharge. South Med J. 1988; 81: 161-3.