



COMPARATIVE STUDY OF OPEN VERSUS LAPAROSCOPIC CHOLECYSTECTOMY AT AVBRH

Dr. Akshay Harish Baheti^{1*}, Dr. Kiran S. Kher² and Dr. Raju K. Shinde³

^{1*}Resident, Department of Surgery, AVBRH, Sawangi (Meghe), Wardha.

²Professor, Department of surgery, AVBRH, Sawangi (Meghe), Wardha.

³Professor and Head of Department of Surgery, AVBRH, Sawangi(Meghe), Wardha.

***Corresponding Author: Dr. Akshay Harish Baheti**

Resident, Department of Surgery, AVBRH, Sawangi (Meghe), Wardha.

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ABSTRACT

Laparoscopic cholecystectomy is the gold standard for cholecystectomy replacing decades old open cholecystectomy. This study compared open cholecystectomy and laparoscopic cholecystectomy in a medical college in rural setup consisting of 60 patients with a diagnosis of calculus cholecystitis, that underwent Cholecystectomy at Jawaharlal Nehru Medical College and Acharya Vinobha Bhave Rural Hospital from October 2015 To September 2017. Aim: To study the advantages of laparoscopic versus open cholecystectomy. Objectives: 1. To compare the operative time of surgery in open and laparoscopic Cholecystectomy. 2. To compare intraoperative and postoperative complications of both surgical procedures 3. To compare post operative pain in both surgical procedures 4. To compare duration of post operative hospital stay in both surgical procedures. Materials and Methods: All patients undergoing cholecystectomy either by open approach or by laparoscopic approach admitted in the AVBRH of JNMC were Included in the study. Patients of carcinoma gall bladder, patients in whom cholecystectomy is a part of another surgical procedure were excluded from the study. Type of Study: observational study. Sample size: -60 cases 30 patients in each group (Open Cholecystectomy and Laparoscopic Cholecystectomy). Result: Mean duration of Surgery: Open (81.50±16.72 min), Laparoscopy (101.66±35.99 min). Mean post operative pain (VAS): Open (5.9 ± 1.18), Laparoscopic (3.83 ± 0.78). Complications: Open cholecystectomy- 33.33% (10 patients), laparoscopic cholecystectomy-13.33% (4 patients). Mean post of hospital stay: Open (9.16 ± 3.54 days), Laparoscopy (3.56 ± 1.47 days). Conversion rate of Laparoscopic to Open cholecystectomy is 21.05%. Conclusion: laparoscopic cholecystectomy is associated with low complication rates, confers an advantage of less post operative pain and shorter hospital stay as compared to the open procedure. The only disadvantage of the Laparoscopic Cholecystectomy is longer duration of operating time. Conversion to open cholecystectomy should be done in proper time and conversion in such case reflects sound judgment and is not be considered as a complication.

KEYWORDS: Calculus cholecystitis, Complications, Conversion, Laparoscopic cholecystectomy, Open cholecystectomy.

I. INTRODUCTION

Gall stones disease is the commonest biliary pathology known, predominantly affects females all over the world^[1,2] with an overall prevalence ranging from 10 to 20% in India.^[3] It nearly affects 4.3% of the population.^[4] Almost 16% and 29% of women above the age of 40-49 years and 50-59 years, respectively have gall stones.^[5]

Cholecystectomy is considered to be the treatment of choice for symptomatic gallstones because it removes the organ that contributes to both gallstone formation and subsequent complications.^[6]

Carl Langenbuch in Berlin, Germany, in 1882 performed the first Open cholecystectomy^[7] and quoted that "The gallbladder should be removed, not because it contains stones, but because it forms them".^[8,9] The morbidity associated with cholecystectomy can be attributed to injury to the abdominal wall in the process of gaining access to the gallbladder or to inadvertent injury to surrounding structures during gallbladder dissection.^[10] Efforts to decrease the morbidity of open cholecystectomy led to the development of laparoscopic cholecystectomy which is made possible by modern optics and video technology.^[10]

In 1985, Erich Muhe of Boblingen, Germany, performed first endoscopic cholecystectomy.^[11] Shortly thereafter,

pioneers in France and the United States coupled a CCD video camera with a laparoscope and performed cholecystectomies thus facilitating the entire surgical team to view the operative field.^[12,15]

Laparoscopic cholecystectomy has been globally adopted and recognized as the gold standard for the treatment of gallstone disease.^[12,15]

In September 1992 a NIH consensus conference held in Bethesda stated that laparoscopic cholecystectomy is the treatment of choice for cholelithiasis.^[16]

Although majority of cholecystectomies are done laparoscopically,^[17] others are still completed by open cholecystectomy^[18] especially in elderly patients, cardiopulmonary compromised patients and patients with complicated gallstones where, laparoscopic procedure is not feasible.^[19] However it can safely be performed in cirrhotic patients^[20] and in cases of acute cholecystitis^[21] by experienced surgeon.

Also, the advantages of laparoscopic over open cholecystectomy includes avoidance of large incision with improved cosmesis, less postoperative pain, earlier return of bowel function, shorter length of hospital stay, earlier return to full activity and decreased overall cost.^[22,26]

Certain difficulties encountered in laparoscopic cholecystectomy are difficulty in controlling significant hemorrhage in the surgical field^[27] and there is less discrimination of structures using laparoscopic instruments when compared with direct digital palpation during open cholecystectomy.^[28] A number of studies have reported that it takes longer time to complete the procedure by laparoscopic approach as compared to open surgery.^[29]

The most troublesome complication in laparoscopic cholecystectomy is bile leak and bile duct injuries.^[30] Expensive instruments, specialized training and longer learning curve also limit the widespread use of laparoscopy.^[31]

The success of laparoscopic procedure has a direct relation with the learning curve of the operating surgeon. Thus in a low resource settings and at grass route levels especially in developing countries like India, open cholecystectomy is still the preferred approach.^[32]

Our hospital being a tertiary care centre and teaching institute with patients admitted from far remote and rural areas and illiteracy, the acceptability of minimal access procedures is not that obvious as in urban population. This study has been undertaken to look into the response of our patients to laparoscopic cholecystectomy with the aim of comparing advantages of laparoscopic versus open cholecystectomy on the basis of following

parameters - operative time, complications, postoperative pain and post operative hospital stay.

II-AIMS AND OBJECTIVE

AIM: To study the advantages of laparoscopic versus open cholecystectomy.

OBJECTIVES

1. To compare the operative time of surgery in open and laparoscopic Cholecystectomy.
2. To compare intraoperative and postoperative complications of both surgical procedures
3. To compare post operative pain in both surgical procedures
4. To compare duration of post operative hospital stay in both surgical procedures

III-MATERIALS AND METHODS

TYPE OF STUDY: Observational Study.

PLACE OF STUDY: The study was conducted at Acharya Vinoba Bhave Rural Hospital, a Tertiary Health Care Centre attached to Jawaharlal Nehru Medical College which comes under Datta Meghe Institute of Medical Sciences, Deemed University.

DURATION OF STUDY: OCTOBER 2015 to SEPTEMBER 2017

SAMPLE SIZE: 60

30 patients in each group (Open Cholecystectomy and Laparoscopic Cholecystectomy).

INCLUSION CRITERIA

- All patients undergoing cholecystectomy either by open approach or by laparoscopic approach in Department of General Surgery at AVBRH
- Patients giving consent to participate in the study.

EXCLUSION CRITERIA

- Patients of carcinoma gall bladder.
- Patients in whom cholecystectomy is a part of another surgical procedure
- Patients not willing to give consent to be a part of the study.

STUDY DESGIN

All patients with suspected clinical signs and symptoms of cholecystitis were admitted in Department of General Surgery at AVBRH, for confirmation of diagnosis and cause on ultrasonography.

Open cholecystectomy was done by Kocher's right sub costal incision and laparoscopic cholecystectomy was done by 4 port technique with pneumoperitoneum created using Veress needle.

Duration of surgery in open cholecystectomy was calculated from start of incision to completion of last

suture and in laparoscopic cholecystectomy from insertion of Veress needle to last port closure.

During surgery when conversion was required from laparoscopic to open approach, all such cases were included under open approach group and duration of surgery in such cases was calculated from start of open approach incision till completion of last suture of open wound. The operative time required during laparoscopy in such cases was not included for study purpose.

Specimen obtained following surgery was sent for histopathology.

The following parameters were assessed in each group –

1. Duration of surgery

2. Post-operative pain at 24 hours after surgery by using Visual Analogue Scale score at the scale of 0-10.
3. Intraoperative and Postoperative complications
4. Duration of post-operative stay in hospital calculated from date of operation to date of discharge from hospital

Statistical analysis in this study was done by using descriptive and inferential statistics using chi-square test and student's unpaired t test and software used in the analysis were SPSS 22.0 version and GraphPad Prism 6.0 version and $p < 0.05$ is considered as level of significance.

IV. OBSERVATION AND RESULTS

Table 1: Age wise distribution of patients in two groups.

Age Group (yrs)	Laparoscopy	Open	Total	χ^2 -value	p-value
Upto 20 yrs	2(6.67%)	1(3.33%)	3(5%)	2.16	0.82,NS
21-30 yrs	3(10%)	4(13.33%)	7(11.67%)		
31-40 yrs	9(30%)	7(23.33%)	16(26.67%)		
41-50 yrs	10(33.33%)	9(30%)	19(31.67%)		
51-60 yrs	4(13.33%)	4(13.33%)	8(13.33%)		
>60 yrs	2(6.67%)	5(16.67%)	7(11.67%)		
Total	30(100%)	30(100%)	60(100%)		
Mean \pm SD	42 \pm 13.55	45.26 \pm 16.06	43.63 \pm 14.82		
Range	18-80 yrs	20-83 yrs	18-83 yrs		

Mean age of patient in laparoscopy group was 42 \pm 13.55 years as compared to 45.26 \pm 16.06 in open cholecystectomy group. By using chi-square test statistically there was no significant difference was found between mean ages of patients of two groups. (χ^2 -value=2.16, p-value=0.82).

Maximum number of cases that is 19 (31.67%) were seen between the age group of 41-50 years. 9(30%) cases

were from open and 10(33.33%) from laparoscopic cholecystectomy group.

Youngest patient in present study in open and laparoscopic cholecystectomy group was of 20 years and 18 years respectively whereas eldest patient in open and laparoscopic cholecystectomy group was of 83 years and 80 years respectively.

Table 2: Gender wise distribution of patients in two groups.

Gender	Laparoscopy	Open	Total	χ^2 -value	p-value
Male	9(30%)	13(43.33%)	22(36.67%)	1.14	0.28,NS
Female	21(70%)	17(56.67%)	38(63.33%)		
Total	30(100%)	30(100%)	60(100%)		
M:F ratio	1:2.2	1:1.3	1:1.70		

Over all, there were 22 male patients and 38 female patients in our study with an overall male to female ratio of 1:1.7.

There were 13 and 9 males and 17 and 19 females in open and laparoscopic cholecystectomy group respectively.

Male to female ratio in laparoscopic cholecystectomy group was 1:2.2 whereas in open cholecystectomy group was 1:1.3.

Table 3: Duration of surgery (minutes) in two groups.

	No	Mean duration (minutes)	Std. Deviation	Std. Error Mean	t-value	p-value
Laparoscopy	30	101.66	35.99	6.57	2.78	0.007,S
Open	30	81.50	16.72	3.05		

Mean duration of surgery was longer in laparoscopy group (101.66±35.99min) than in open cholecystectomy (81.50±16.72min). By using Student's unpaired t test statistically significant difference was found in mean duration of surgery among two groups (t=2.78, p-value=0.007).

Minimum operative time for laparoscopic method: 50 minutes.

Maximum operative time for laparoscopic method: 180 minutes.

Minimum operative time for open method: 60 minutes.

Maximum operative time for open method: 120 minutes.

Table 4: Postoperative pain on Visual Analog Scale in two groups.

	No.	Mean	Std. Deviation	Std. Error Mean	t-value	p-value
Laparoscopy	30	3.83	0.78	0.14	7.94	0.0001,S
Open	30	5.90	1.18	0.31		

Mean post operative Visual Analog Scale Score for pain at 24 hours after surgery was more in open cholecystectomy 5.9 ± 1.18 than laparoscopy group 3.83 ± 0.78. By using Student's unpaired t test statistically

significant difference was found in mean post operative Visual Analog Scale Score among two groups (t=7.94, p-value=0.0001).

Table 5: Postoperative hospital stay (days) in two groups

	No.	Mean (days)	Std. Deviation	Std. Error Mean	t-value	p-value
Laparoscopy	30	3.56	1.47	0.26	7.98	0.0001,S
Open	30	9.16	3.54	0.64		

Mean postoperative hospital stay was more in open method 9.16 ± 3.54 days than in laparoscopic method 3.56 ± 1.47 days. By using Student's unpaired t test statistically significant difference was found in mean postoperative hospital stay among two groups (t=7.98, p-value=0.0001).

Minimum postoperative hospital stay for laparoscopic method: 1 day.

Maximum postoperative hospital stay for laparoscopic method: 7 days.

Minimum postoperative hospital stay for open method: 4 days.

Maximum postoperative hospital stay for open method: 18 days.

COMPLICATIONS

Table 6: Distribution of patients according to complications in two groups.

Complications	Laparoscopy	Open	χ^2 -value	p-value
Bleeding	1(3.33%)	1(3.33%)	26.02	0.0001,S
Bile leak through drain tube	2(6.67%)	0(0%)		
Bile Duct Injury	0(0%)	1(3.33%)		
Wound Infection/ port site infection	1(3.33%)	5(16.67%)		
Paralytic Ileus	0(0%)	2(6.67%)		
Pneumonia	0(0%)	1(3.33%)		
Total	4(13.33%)	10(33.33%)		

More complications were associated with open cholecystectomy 33.33% (10 patients), compared to 13.33% (4 patients) with laparoscopic cholecystectomy. By using chi-square test statistically significant difference was found in complications among two groups of (χ^2 -value=26.02, p-value=0.0001).

1 patient (3.33%) of laparoscopic cholecystectomy group and 1 patient (3.33%) of open cholecystectomy group had bleeding, 2 patients (6.67%) of laparoscopic cholecystectomy group had bile leak through drain tube and 1 patient (3.33%) of open cholecystectomy group had bile duct injury.

2 patients (6.67%) of open cholecystectomy group developed paralytic ileus postoperatively. 1 patient (3.33%) of laparoscopic cholecystectomy group and 5 patients (16.67%) of open cholecystectomy group developed wound/port site infection (3.33%). 1 patient (3.33%) of open cholecystectomy group developed pneumonia.

Table 7: Conversion rate in our study.

	No of patients
Total no of patients who underwent Laparoscopic Cholecystectomy	38
No of patients in whom laparoscopy was converted to open procedure	8
Conversion Rate	21.05%

Rate of conversion in our study is 21.05%.

Table 8: Reason for Conversion in our study.

Reason	No of patients	Percentage(%)
Adhesions at Calot's triangle	6	75.00
Adhesions between gall bladder, small bowel and omentum	2	25.00
Total	8	100.

V-DISCUSSION

This study was undertaken to look into the response of our patients to laparoscopic cholecystectomy with the aim of studying advantages of laparoscopic versus open

cholecystectomy on the basis of following parameters - operative time, complications, postoperative pain and post-operative hospital stay.

SEX DISTRIBUTION

Table 9: Gender wise distribution of patients in our study and different other studies in two groups.

Authors	Place of study	Open cholecystectomy (No. of patients)		Laparoscopic cholecystectomy (No. of patients)	
		Male	female	male	Female
Singh et al. ^[33]	India	7	32	5	37
Sinha et al. ^[34]	India	5	15	10	10
Saeed et al. ^[35]	Pakistan	12	88	10	90
Anmol et al. ^[36]	India	11	14	7	18
Present study	India	13	17	9	21

There were 22 male and 38 female patients in our study. Overall male to female ratio of our study population was 1:1.7 which suggest female predominance for cholecystitis.

In studies done by other authors mentioned in the table above, in both open as well as laparoscopic cholecystectomy group there were more female patients as compared to male patients.

AGE DISTRIBUTION

Table 10: Mean age of patients in our study and different other studies in both groups.

Authors	Place of study	Mean age (years)	
		Open cholecystectomy	Laparoscopic cholecystectomy
Singh et al. ^[33]	India	43.2	37.3
Agrawal. ^[37]	India	47.5 ± 9.8	45.62 ± 10.2
Anmol et al. ^[36]	India	39.12 ± 13.79	42.76 ± 12.09
Zacks et al. ^[38]	United States	55.5 ± 18.8	51.3 ± 18.6
Present study	India	45.26 ± 16.06	42 ± 13.55

Mean age in open cholecystectomy group was 45.26 ± 16.06 years and in laparoscopic cholecystectomy group was 42 ± 13.55 years. However the difference in mean age in two groups in our study is not significant.

Maximum mean age of patients in open cholecystectomy group was 55.5 ± 18.8 years in a study done by Zacks et al.^[38] whereas minimum mean age of patients in open cholecystectomy group was 39.12 ± 13.79 years in a study done by Anmol et al.^[36]

Maximum mean age of patients in laparoscopic cholecystectomy group was 51.3 ± 18.6 years in a study done by Zacks *et al.*^[38] whereas minimum mean age of patients in laparoscopic cholecystectomy group was 37.3 years in a study done by Singh *et al.*^[33]

DURATION OF SURGERY / OPERATIVE TIME

Table 11: Mean duration of surgery in both groups in our study and different other studies.

Authors	Place of study	Mean duration of surgery (minutes)	
		Open cholecystectomy	Laparoscopic cholecystectomy
Rao <i>et al.</i> ^[39]	India	90	120
Agrawal ^[37]	India	45±11	90±12
Karim <i>et al.</i> ^[31]	India	70	103.98
Rubert <i>et al.</i> ^[40]	Brazil	76±27	88±31
Cawich <i>et al.</i> ^[41]	West indies	81	83
Gupta <i>et al.</i> ^[42]	India	41.89 ± 5.75	66.26 ± 9.08
Anmol <i>et al.</i> ^[36]	India	90±13.84	120±10.80
Talpur <i>et al.</i> ^[11]	Pakistan	54.16 ± 11.94	46.89 ± 14.83
Meena <i>et al.</i> ^[43]	India	67.2	89.2
Present study	India	81.50±16.72	101.66±35.99

In our study, mean duration of surgery was longer in laparoscopy group (101.66±35.99min) than in open cholecystectomy (81.50±16.72min). This difference was statistically significant. (p-value = 0.007).

Our institute being a tertiary health care centre, many patients that come to hospital are referred cases usually come after multiple attacks of pain. Also being and a teaching institute, laparoscopic surgeries are assisted by residents who were being trained with endo trainers. Operative time required for laparoscopic cholecystectomy is longer as there is “learning curve” which represents adapting to depth perception and becoming familiar with the instrumentation, ergonomics and technique.

Because of difficult Calot’s triangle, intra-operative difficulties were encountered and hence more time was required for dissection in laparoscopic cholecystectomy.

In our study, one patient of laparoscopic group required longer duration (180 minutes) for completion of procedure because of adhesions to surrounding structures which were cleared successfully without any complication.

Duration of surgery was longer in one patient each of laparoscopic group (120 minutes) and open group (90 minutes) as there was persistent bleeding from gall bladder bed because of which more time was required to achieve adequate hemostasis.

One patient of open group had inadvertent bile duct injury which was identified intra-operatively and primary repair was done thus required longer time due complication for completion of procedure (120 minutes).

In a study done by Karim *et al.*^[31] at a teaching hospital had similar result requiring longer time in laparoscopic procedure.

In the study by Anmol *et al.* more time was required in Laparoscopic Cholecystectomy, reasons being intra-operative gas leak, difficult adhesions, delivery of gall bladder through port site and slipping of clips.^[36]

Meena *et al.* found that more time was required in laparoscopy compared to open cholecystectomy because of the learning curve.^[43]

Mean operative time in open cholecystectomy of our study was comparable with studies of other authors like Cawich *et al.*^[41], Anmol *et al.*^[36] and Rubert *et al.*^[40]

In contrast to our study, Talpur *et al.*^[11] reported that less operative time was required in laparoscopic cholecystectomy as compared to open cholecystectomy.

The surgeon gets trained in dealing with challenging cases in the course of his/ her learning curve. Meena *et al.* in his study stated that - with experience and as the learning curve progresses, operating time decreases.^[43]

CONVERSION

Table 12: Rate of conversion in our study and different other studies.

Author	Place of study	Conversion Rate
Van der Steeg et al. ^[44]	Netherlands	12%
Sinha et al. ^[34]	India	10%
Cawich et al. ^[41]	West indies	7.7%
Rao et al. ^[39]	India	8%
Anmol et al. ^[36]	India	8%
Ghnam. ^[45]	Saudi Arabia	5%
Porte et al. ^[46]	Netherlands	12%
Karim et al. ^[31]	India	6%
Gupta et al. ^[42]	India	7.5%
Present study	India	21.05%

Conversion rate in our study was 21.05%, higher when compared with studies of various authors mentioned in table.

There were total 8 conversions in our study. In 6 patients (75%) there was difficult Calot's triangle thus difficulty in delineating proper anatomy and in 2 patients (25%) because of adhesions between gall bladder, colon and omentum.

Ghnam et al reported a conversion in 17 patients with a conversion rate of 5%, reasons being contracted very small fibrotic adherent gall bladder in 3 patients, gallbladder empyema in 3 patients, unclear anatomy (acute cholecystitis) in 6 patients, difficult dissection in 3 patients, gallbladder mass (cancer) 1 patient and common bile duct injury in 1 patient.^[45]

Sinha et al reported conversion in 2 patients (10%) out of 20. Reasons were difficult dissection due to acute

cholecystitis in one case and slipping of clip applied to cystic artery in other case.^[34]

Saeed et al in his study had conversions in 3 patients, reasons being hemorrhage from cystic artery due to slipping of clip, injury to common hepatic duct and biliary leakage from cystic duct stump.^[35]

Gupta et al reported conversion in 30 patients with a conversion rate of 7.5% reasons being unclear anatomy in 15 cases, dense adhesions in 13 patients and uncontrolled bleeding in 2 patients.^[42]

High conversion rate of our study conveys a message among residents that conversion to open cholecystectomy should be done in proper time without any hesitation in cases where complication is suspected by continuing laparoscopic surgery. Conversion is a wiser option and should not be considered as a complication or operative incompetency in the better interest of patient.

POST OPERATIVE PAIN

Table 13: Post operative pain at 24 hours after surgery in both groups in our study and different other studies.

Authors	Place of study	Mean postoperative pain (VAS score)	
		Open cholecystectomy	Laparoscopic cholecystectomy
Kum et al ⁽⁴⁷⁾	-	6.2	2.8
Singh et al ⁽³³⁾	India	8.3	4.7
Agrawal ⁽³⁷⁾	India	7.5 ± 2.2	5.4±1.2
Present study	India	5.9 ± 1.18	3.83 ± 0.78

Mean post operative pain on Visual Analog Scale Score at 24 hours after surgery was more in open cholecystectomy (5.9 ± 1.18) than laparoscopy group (3.83 ± 0.78). This difference was statistically significant (p-value=0.0001).

The mean VAS score of 8.3 in study done by Singh et al^[33], 7.5 ± 2.2 in study of Agrawal^[37] and 6.2 in study of Kum et al^[47] was more as compared to our study's mean VAS score of 5.9 ± 1.18 after open cholecystectomy.

In laparoscopic cholecystectomy group, mean VAS score in our study was 3.83 ± 0.78 which is higher as

compared to mean VAS score of 2.8 found in study by Kum et al^[47] and less than mean VAS score of 4.7 found in study of Singh et al^[33] and 5.4±1.2 found in the study by Agrawal^[37] after laparoscopic cholecystectomy.

In studies done by different authors like Cawich et al^[41], Karim et al^[31], Anmol et al^[36], Solanki et al^[48], Talpur et al^[1] found that patients experience less pain post operatively after laparoscopic cholecystectomy.

Laparoscopic surgery is a minimally invasive procedure affecting only a limited tissue area^[3] and hence resultant pain is less.

POST OPERATIVE HOSPITAL STAY**Table 14: Post operative hospital stay in both groups in our study and different other studies.**

Authors	Place of study	Mean post-operative hospital stay (days)	
		Open cholecystectomy	Laparoscopic cholecystectomy
Karim et al. ^[31]	India	5.46	3.7
Meena et al. ^[43]	India	5.18	2.5
Agrawal. ^[37]	India	4±2	2±1
Rao et al. ^[39]	India	10	5
Talpur et al. ^[11]	Pakistan	5.96 ± 9.8	3.02 ± 1.75
Solanki et al ^[48]	India	5.36	3.42
Gupta et al. ^[42]	India	3.98	3.12
Anmol et al. ^[36]	India	7.76±1.23	3.04±1.34
Ahmed et al. ^[49]	Pakistan	5.66±1.72	2.49±1.49
Zacks et al. ^[38]	United states	7.4±8.9	4.1±5.6
Present study	India	9.16 ± 3.54	3.56 ± 1.47

In our study, mean postoperative hospital stay was longer in open method 9.16 ± 3.54 days than in laparoscopic method 3.56 ± 1.47 days. The difference was statistically significant (p -value=0.0001). Similar observation was found in studies by various other authors mentioned in table.

Patients in laparoscopic cholecystectomy group of our study were discharged earlier compared to those in open cholecystectomy group because of early mobilization, less post operative pain and fewer wound complications.

In our study, mean post operative hospital stay (9.16 ± 3.54 days) was longer compared to mean post operative hospital stay after open cholecystectomy in studies done by other authors mentioned in the table above.

The patients in our hospital usually come from remote areas where health care facilities are few and far. Hence majority of patients wish to remain admit till suture removal is done. Hence, duration of stay was longer in open cholecystectomy group.

Mean post operative hospital stay in our study after laparoscopic cholecystectomy (3.56 ± 1.47 days) was comparable with mean post operative hospital stay after laparoscopic cholecystectomy in studies of other author like Solanki et al^[48] (3.42 days), Anmol et al^[36] (3.04 ± 1.34 days), Zacks et al^[38] (4.1 ± 5.6 days), Gupta et al^[42] (3.12 days).

One patient of open group had prolonged hospital stay of 14 days as patient developed pneumonia.

Total 5 patients of open group had prolonged hospital stay because of wound infections requiring daily dressing and broad spectrum injectable antibiotics. One patient stayed for 18 days because of wound infection and constant serous discharge from wound.

In laparoscopic group one patient has longer stay of 7 days due to persistent pain at port site and one patient stayed for 6 days for umbilical port site infection.

In study done by Ahmed et al mean hospital stay was significantly less in laparoscopic group (2.49 ± 1.49 days) compared to (5.66 ± 1.72) in open group. The reason behind longer stay in open group was most of patients were from rural background and came from far of places. Patients insisted to stay in hospital to avoid distant travel in early part of post operative period otherwise many patients could have been discharged earlier.^[49]

Anmol et al^[36] and Solanki et al^[48] also had similar result. Post operative hospital stay was longer after open cholecystectomy due to increased pain, wound infection, less mobilization due to pain and injectable antibiotics.

Authors like Rubert et al^[40], Saeed et al^[35] also concluded that postoperative hospital stay was longer after open cholecystectomy.

COMPLICATIONS**Table 15: Overall complications in both groups in our study and different other studies.**

Authors	Place of study	Complications	
		Open cholecystectomy	Laparoscopic cholecystectomy
Rao et al. ^[39]	India	16%	6%
Anmol et al. ^[36]	India	3(6%)	7(14%)
Present study	India	10(33.33%)	4(13.33%).

Significantly more complications were seen with open cholecystectomy group that is in 10 patients (33.33%) when compared with laparoscopic cholecystectomy group, 4 patients (13.33%).

INTRAOPERATIVE COMPLICATIONS

BILE DUCT INJURY

Table 16: Bile duct injury in both groups in our study and different other studies.

Authors	BILE DUCT INJURY	
	Open cholecystectomy - No. of patients (%)	Laparoscopic cholecystectomy – No. of patients (%)
Cawich et al. ^[41]	1(3.6%)	0
Agrawal. ^[37]	1(4.76%)	7(33.33%)
Present study	1(3.33%)	0

In our study, one patient (3.33%) of open group had inadvertent bile duct injury which was identified intraoperatively and primary repair was done immediately with no further complications. Post operative period was uneventful.

Cawich et al in his study concluded that bile duct injury was seen in 1 case (3.6%) of open and in no case of laparoscopic cholecystectomy. There was one bile duct injury after open cholecystectomy in a patient who initially presented with gallstone pancreatitis. Patient developed symptoms of bile leak one week after open cholecystectomy. ERCP revealed spillage of bile in the region of the cystic duct and common bile duct junction. At exploratory laparotomy, 50% lateral wall transection of the distal common hepatic duct was present and Roux-en-Y hepatico-jejunostomy was done.^[41]

In a study done by Anmol et al, there was no bile duct injury in any group.^[36]

Agrawal in his study found bile duct injury in 1 case (4.76%) of open and in 7 cases (33.33%) of laparoscopic cholecystectomy.^[37]

Bile duct injury can be identified intra operatively or post operatively with appropriate investigation and the treatment is warranted at specialized hepatobiliary centre equipped with a multidisciplinary service so as to avoid further morbidity or mortality.^[50]

BLEEDING

Table 17: Bleeding in both groups in our study and different other studies.

Authors	BLEEDING	
	Open cholecystectomy - No. of patients (%)	Laparoscopic cholecystectomy – No. of patients (%)
Anmol et al. ^[36]	1(4%)	2(8%)
Cawich et al. ^[41]	2(7.1%)	1(4.2%)
Agrawal. ^[37]	5(23.80%)	3(14.28%)
Talpur et al. ^[11]	17(8.5%)	0
Rao et al. ^[39]	4	1
Present study	1(3.33%)	1(3.33%)

In our study, one patient (3.33%) from open and laparoscopic group had persistent bleeding from gall bladder bed for which hemostasis was achieved intra operatively using cautery coagulation and local application of gel foam. Drain was placed in patient of open cholecystectomy group and was removed after 2 days once the output decreased.

Anmol et al in his study reported that intra operative bleeding was found in 1 case (4%) of open and 2 cases (8%) of laparoscopic cholecystectomy reasons being slipping of clip applied to cystic artery and bleeding from gall bladder bed.^[36]

Cawich et al in his study reported bleeding in 2 cases (7.1%) of open and in 1 case (4.2%) of laparoscopic cholecystectomy.^[41]

Agrawal^[37] reported bleeding in 5 cases (23.80%) of open and in 3 cases (14.28%) of laparoscopic cholecystectomy where as Rao et al^[39] in his study found bleeding in 4 cases of open and in 1 case of laparoscopic cholecystectomy.

In a study done by Talpur et al^[11], they reported bleeding in 17 cases (8.5%) of open and in no case of laparoscopic cholecystectomy.

With the advances in energy sources like harmonics and vessel sealing devices, intra operative bleeding during dissection has minimized or is controlled effectively as compared to initial days.

POSTOPERATIVE COMPLICATIONS

PARALYTIC ILEUS

Table 18: Paralytic ileus in both groups in our study and different other studies.

Authors	PARALYTIC ILEUS	
	Open cholecystectomy - No. of patients (%)	Laparoscopic cholecystectomy – No. of patients (%)
Gupta et al ⁽⁴²⁾	1	1
Present study	2(6.67%)	0

In our study, 2 patients (6.67%) from open group developed abdominal distension with paralytic ileus and were managed with continuation of nasogastric decompression and correction of electrolytes.

Gupta et al in his study found prolonged paralytic ileus in 1 case of open as well as laparoscopic cholecystectomy.^[42]

BILIARY LEAK THROUGH DRAIN TUBE

Table 19: Biliary leak through drain tube in both groups in our study and different other studies.

Authors	BILIARY LEAK	
	Open cholecystectomy - No. of patients (%)	Laparoscopic cholecystectomy – No. of patients (%)
Anmol et al ⁽³⁶⁾	0	3(12%)
Rao et al ⁽³⁹⁾	4	1
Present study	0	2(6.67%)

In our study, two patients (6.67%) of laparoscopic group had bile leak through drain tube most probably from gall bladder bed. Patients were managed conservatively, drain was kept and leak subsided within 3 days and drain was removed. None of the patient developed sub diaphragmatic collection or abscess, biliary peritonitis and post operative course was uneventful.

According to Anmol et al 3 cases (12%) of laparoscopic cholecystectomy had bile leak through drain tube due to

injury to gall bladder bed during dissection and patients were treated conservatively, drains were kept and the leak subsided.^[36]

In study done by Rao et al, 1 case of laparoscopic cholecystectomy and 4 cases of open cholecystectomy had bile leak through drain tube. According to author, bile leak was probably from gall bladder bed in liver. All patients were treated conservatively.^[39]

PNEUMONIA

Table 20: Pneumonia in both groups in our study and different other studies.

Authors	PNEUMONIA	
	Open cholecystectomy - No. of patients (%)	Laparoscopic cholecystectomy – No. of patients (%)
Cawich et al ⁽⁴¹⁾	1(3.6%)	1(4.2%)
Present study	1(3.33%)	0

In our study, one patient (3.33%) from open group developed pneumonia post operatively and was treated with antibiotics and bronchodilators.

In a study done by Cawich et al, 1 case (3.6%) of open and 1 case (4.2%) of laparoscopic cholecystectomy developed pneumonia.^[41]

WOUND INFECTION/PORT SITE INFECTION**Table 21: Wound infection/port site infection in both groups in our study and different other studies.**

Authors	WOUND INFECTION/PORT SITE INFECTION	
	Open cholecystectomy - No. of patients (%)	Laparoscopic cholecystectomy – No. of patients (%)
Anmol et al. ^[36]	2(8%)	0
Cawich et al. ^[41]	1(3.6%)	0
Meena et al. ^[43]	4(12.12%)	1(3.03%)
Rooh-ul-Muqim et al. ^[51]	11(57.8%)	0
Gupta et al. ^[42]	9(2.3%)	2(0.5%)
Agrawal. ^[37]	4(19.04%)	1(4.76%)
Sinha et al. ^[34]	5(25%)	1(5%)
Ahmed et al. ^[49]	11(22%)	3(6%)
Rao et al. ^[39]	6	2
Present study	5(16.67%)	1(3.33%)

Wound infections were more commonly encountered in the open group in 5 patients (16.67%) compared to one patient (3.33%) in laparoscopic group who had umbilical port wound infection. 5 patients of Open Cholecystectomy group who developed wound infection requiring regular dressing of the wounds and broad spectrum injectable antibiotics according to culture sensitivity report. Wounds healed over a period of 5-10 days.

Similar result that is wound infection is more common with open cholecystectomy as compared to laparoscopic cholecystectomy was also found by other authors like Meena et al^[43], Rooh-ul-Muqim et al^[51], Gupta et al^[42], Agrawal^[37], Rao et al^[39] in their studies.

In a comparative study between open cholecystectomy versus laparoscopic cholecystectomy done by Ahmed et al, post operative wound infection was seen in 3 cases (6%) of laparoscopic group and in 11 cases (22%) of open group. The reason for higher rate of wound infection in open group mentioned in their study was large wound hematoma in association with large incision, which can act as nidus for infection and associated with complications like delay in wound healing, wound dehiscence and incisional hernia.^[49]

Sinha et al (2011-2013) in his comparative study between open cholecystectomy and laparoscopic cholecystectomy in rural medical college set up observed that wound infection was more common that is 5 patients (25%) of open group compared to 1 patient (5%) in laparoscopic cholecystectomy group. One patient of open group has wound dehiscence which later required suturing under anesthesia.^[34]

Anmol et al^[36] and Cawich et al^[41] found wound infection in 2 cases (8%) and 1 case (3.6%) respectively after open cholecystectomy. There was no wound infection in any patient after laparoscopic cholecystectomy in both the studies. Anmol et al stated that regular dressing of wound was required and wound healed over a period of 10 days.

Rooh-ul-Muqim et al in his study stated wound infection in 11 cases (57.8%) of open and in no case of laparoscopic cholecystectomy.^[51]

Gupta et al in his study reported wound infection in 9 cases (2.3%) of open and in 2 cases(0.5%) of laparoscopic cholecystectomy developed umbilical port site infection.^[42]

Agrawal^[37] and Rao et al^[39] in their study found wound infection in 4 cases (19.04%) and 6 cases(n=50) after open cholecystectomy respectively and in 1 case (4.76%) and 2 cases(n=96) after laparoscopic cholecystectomy respectively.

Other complications, such as those related to pneumoperitoneum or cautery coagulation (energy sources), visceral injury were not seen in our study.

VI-CONCLUSION

Laparoscopic cholecystectomy is associated with lower complication rates as compared to open cholecystectomy. It confers an advantage of less post-operative pain and shorter hospital stay as compared to the open procedure.

Disadvantage of the Laparoscopic Cholecystectomy over open procedure is longer operating time.

As laparoscopic Cholecystectomy has more advantages, patients should be made aware of its advantages and laparoscopic cholecystectomy should be offered as the procedure of choice in treatment of cholecystitis.

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