COMPARATIVE STUDY OF LAPAROSCOPIC CHOLECYSTECTOMY WITH OPEN CHOLECYSTECTOMY

Mahesh Soni¹, Ritesh Bodade², J. C. Marhual³

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ABSTRACT: After the first laparoscopic cholecystectomy performed in 1988 by Dubois and Perissat, it soon became the gold standard for cholelithiasis and has evolved like a revolution in surgical field in recent times. This study was conducted to study and compare laparoscopic cholecystectomy with open cholecystectomy in terms of operative time, post-operative pain, post-operative analgesic requirement, post-operative oral intake resumption, time required for ambulation of patient, duration of hospital stay and complications and conversion rate. This was an observational comparative study and results were compared using Z Test of significance. All cases of symptomatic gall stones were included in this study. Of 159 cholecystectomy patients 124 patients had laparoscopic cholecystectomy of which 6 patients had to be converted to open cholecystectomy and 35 patients underwent open cholecystectomy. Main outcome measures were Operating time, Pain severity, Analgesic requirement, Time of resumption of oral feeds, Time of ambulation, Length of hospital stay, Rate of conversion from LC to OC, and Complications. After studying all these outcome measures we reached to a conclusion that Laparoscopic cholecystectomy is a safe, valid alternative to OC in patients with symptomatic cholelithiasis. The technique has a low rate of complications, implies a shorter hospital stay, and offers the patient a more comfortable postoperative period than 0C.

KEYWORDS: laparoscopic cholecystectomy, open cholecystectomy, symptomatic cholelithiasis.

INTRODUCTION: After the first laparoscopic cholecystectomy performed in 1988 by Dubois and Perissat, it soon became the gold standard for cholelithiasis and has evolved like a revolution in surgical field in recent times. Laparoscopic cholecystectomy (LC) has clearly displaced open cholecystectomy (OC) in the management of simple biliary lithiasis.¹⁻³ In our hospital cholecystectomy for symptomatic gall stones is being performed by both open as well as laparoscopic method. This study was conducted to study and compare laparoscopic cholecystectomy with open cholecystectomy in terms of operative time, post-operative pain, post-operative analgesic requirement, post-operative oral intake resumption, time required for ambulation of patient, duration of hospital stay and complications and conversion rate.

MATERIAL AND METHODS: This was an observational study carried out in the department of General Surgery at JLN Hospital and research Centre Bhilai, over a period of one year from January 2009 to December 2009. All cases of symptomatic gall stones were included in this study. Patients with choledocholithiasis, Gall bladder malignancy, Sepsis and peritonitis, COPD, Portal hypertension, Pregnancy, Major bleeding disorders, patients unable to tolerate general anaesthesia were excluded. Operation was done as per the standard method for conventional cholecystectomy via a right subcostal incision. Laparoscopic cholecystectomy was done using the standard four port technique described by Reddick.

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MAIN OUTCOME MEASURES: Operating time, pain severity, analgesic requirement, time of resumption of oral feeds, time of ambulation, length of hospital stay, rate of conversion from LC to OC, and complications.

- All this data was then recorded and studied. The variables were then compared between laparoscopic and open cholecystectomies.
- 'Z' test of significance was used when two variables had to be compared and a 'p' value <0.05 was considered significant.

OBSERVATIONS: Of 159 cholecystectomy patients 118 patients had laparoscopic cholecystectomy while 6 patients had to be converted to open cholecystectomy and 35 patients underwent open cholecystectomy.

Domographia	Oman	Laparoscopic (n=124)		
data	(n=35)	Successful lap (n=118)	Converted group (n=6)	
No. of patients	35	118	6	
Male	10	29	4	
Female	25	89	2	
Age Group				
0-20	0	2	0	
21-40	9	43	0	
41-60	19	55	5	
61-80	7	18	1	
Table 1: Showing Patients Demography				

Open (n=35)	Laparoscopic	'P' value		
	Successful lap	Converted		
	(n=118)	group(n=6)		
	Mean+/- SD	Mean		
45.28+/-7.75 min	60.72+/-9.16 min	135.83	1.40 x 10 ⁻¹⁴	
Table 2: Showing the time required for surgery (minutes)				

Post-operative pain scale Open (n=35) Davs Laparoscopic (n=124) 'P' value Mean+/-SD Successful lap Converted (n=118) Group Mean+/-SD (n=6)6.91+/-1.31 5.2+/-0.87 5.57x10-9 Day 1 8.5 7.71x10⁻¹⁵ Day 2 5.02+/-1.52 1.92+/-1.19 6.3 3.02+/-1.72 0.25+/-0.64 4.8 3.02x10⁻¹¹ Day 3 Table 3: Showing the post-operative pain scale (VNRS) on days 1,2,3.

Analgesic requirement (days)				
Open(n=35) Mean+/-SD	Laparoscop (n=12	'P' value		
	Successful lap	Converted		
	(n=118)	Group (n=6)		
	Mean +/- SD	Mean		
4.31+/-3.06days	1.39+/-0.55days	4.83	2.68x10-6	
Table 4: Showing analgesic requirement (days)				

Analgesic requirement was calculated in terms of number of days of injectable analgesics required for pain relief in post-operative period. The analgesic used was injection diclofenac. Thus the open group required analgesics for a mean of 4.31+/-3.06 days and the successful laparoscopic group required it for 1.39+/-0.55 days. The difference between the open and laparoscopic group was found to be statistically significant ('p'= 2.68×10^{-6}). Mean analgesic requirement in converted group was 4.83 days.

Post-operative oral resumption (hours)				
Open (n=35) Mean+/-SD	Laparoscopic Group (n=124) 'P' value			
	Successful lap	Converted		
	(n=118)	Group (n=6)		
	Mean+/-SD	Mean		
11.42+/-4.16 hrs	7.7+/-1.81 hrs	72Hrs	1.59x10-4	
Table 5: Showing post-operative oral resumption (hours)				

The time of starting oral feeds was after return of intestinal motility which was assessed by auscultating the bowel sounds. The mean time of starting oral feeds in open group was 11.42+/-4.16 hours while that in successful laparoscopic group was 7.7+/-1.18 hours. The difference was statistically significant ('p'= 1.59×10^{-4}). The mean time of starting oral feeds in converted group was 72 hours.

Time of Ambulation				
Open(n=35) Mean+/-SD	Laparoscopic G	'P' value		
	Successful lap	Converted		
	(n=118)	Group (n=6)		
	Mean+/-SD	Mean		
22.63+/-4.06 hrs	6.98+/-1.14 hrs	22	1.23x10 ⁻²²	
Table 6: Showing time of ambulation (hours)				

The time of ambulation was assessed as the time taken by the patients to get from their bed on their own. The mean time of ambulation in open group was 22.63+/-4.06 hours and for laparoscopic group was 6.98+/-1.14 hours. This difference was found to be statistically significant. ('p'= 1.23×10^{-22}) The mean time of ambulation in converted group was 22 hours.

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Post-operative hospital stay				
Open (n=35) Mean+/-SD	Laparoscopic gr	'P' value		
	Successful lap	Converted		
	(n=118)	Group (n=6)		
	Mean+/-SD			
4.88+/-4.67 days	2.22+/-0.47days	7 days	1.92x10 ⁻³	
Table 7: Showing post-operative hospital stay (days)				

Post-operative hospital stay was defined as time in days from the day of surgery to the day of discharge of patients. The mean length of hospital stay was 4.88+/-4.67 days in open group and 2.22+/-0.47 days in laparoscopic group. This difference was statistically significant ('p'=1.92x10⁻³). The mean length of hospital stay in converted group was 7 days.

Reasons	No. of patients		
Adhesions	2 (33.2%)		
Bleeding	1(16.6%)		
CBD Injury	1(16.6%)		
Adhesions+ Bleeding	1(16.6%)		
Viscus injury	1(16.6%)		
Rate of conversion 4.8%			
Table 8: Showing the rate of conversion and reasons of conversion			

The conversion rate of laparoscopic to open cholecystectomy was 4.8% i.e. out of 124 cases which were started as laparoscopic method 6 (4.8%) had to be converted to open method. The reasons for conversion were Adhesions in 2 cases (33.2%), Bleeding in 1 case (16.1%), CBD transaction in 1 case (16.6%), both bleeding and adhesion in 1 case (16.6%) and viscus injury was seen in 1 case (16.6%).

Complications	Open (n=35)	Laparoscopic (n=124)	
Intraoperative Bleeding	3	5	
Viscus Injury	0	1	
Gall Bladder rupture	2	2	
Stone Spillage	0	4	
CBD Injury	0	1	
Pancreatitis	0	0	
Wound Infection	2	0	
Wound Gape	0	0	
Hernia	0	0	
Scar Pain	2	0	
Scar Hypertrophy	0	0	
Mortality	0	0	
Table 9: Table showing the complications of cholecystectomy			

Amongst the complications as stated, we encountered intraoperative bleeding in 3 cases of open cholecystectomy all were from gall bladder fossa while separating it from dense adhesions. Similarly there were 5 cases of intraoperative bleeding in laparoscopic group of which 2 had to be converted into open cholecystectomy because of uncontrolled bleeding. One patient had bleeding from posterior cystic artery branch that was unnoticed and had to be converted to open cholecystectomy. Other cases had bleeding from Gall Bladder fossa due to adhesions.

Viscus injury as a complication was restricted to laparoscopic group. There was a single case of viscus injury while separating adhesions of gall bladder to duodenum by electrocautery. The case was converted to open cholecystectomy; only serosal damage was identified and repaired with Vicryl (2-0). Patient recovered fully and discharged on 6th post-operative day. Gall Bladder rupture was encountered in 2 cases of open cholecystectomy due to dense adhesions. In one of the 2 cases partial cholecystectomy was done due to dense adhesion.

In laparoscopic cases 2 patients had Gall Bladder rupture but the procedure was laparoscopically satisfactorily without any spillage of stone with slight spillage of bile. There was no case of stone spillage in open group while there were 4 cases of stone spillage in laparoscopic group. All of them had occurred while extracting gall bladder out. In all cases the spilled stones were recovered. However the duration of surgery was prolonged on that account. There was no case of CBD injury in open group and 1 case of CBD transection in laparoscopic group.

The case had to be converted to open cholecystectomy and hepatico-jejunostomy with Rouxn-y jejunojejunal anastomosis was done. The patient recovered fully and was discharged on 10th postoperative day. There was no case of pancreatitis in either group. Wound infection was seen in 2 cases of open cholecystectomy and no case of laparoscopic cholecystectomy. Scar pain was a complaint of 2 patients of open group in follow-up period which was not seen in laparoscopic group. There were no complications of wound gape, hernia, scar hypertrophy in either group. No mortality was seen in either group.

DISCUSSION: Present study depicted that laparoscopic cholecystectomy takes a longer time than open method. It is consistent with the findings of Glinatsis MT et al⁴ Jan YY⁵ Porte RJ et al in⁶ Smith JF et al⁷ Bosch et al⁸ Hardy KJ et al⁹ Trondsen et al.¹⁰ The difference is statistically significant in all the studies including the present study. Neugebauer E et al and Gadacz TR et al in their study found that though the operative time for laparoscopic cholecystectomy is longer as compared to open method, it decreases significantly with the learning curve and laparoscopic cholecystectomy can be done in even lesser time than open cholecystectomy.

We observed that patients operated laparoscopically experience less pain as compared to open method, right from the day of operation because of small key hole incisions. On all the three days, the difference between the two groups was found to be statistically significant. Similar findings were also noted by Barkun JS et al¹¹ Gursoy Set al¹² and Kum et al.

In our study we observed that laparoscopic group requires analgesics for shorter duration as compared to open because of smaller key whole incisions thereby causing less pain in contrast to longer muscle cutting incision in open method. Similar findings were observed by Smith JF et al (1992)⁷ Schietroma et al (2001)¹³ Buanes et al (1996)¹⁴ Rooh Ul Muquim et al (2008)¹⁵ Al Haidi (1998)¹⁶ Chan HS et al (1995)¹⁷ and Trondsen et al (1993).¹⁰

The finding of Smith JF et al in 1992⁷ Jan YY et al in 1993⁵ Geng W et al in (1999)¹⁸ and this study suggest that the patients of laparoscopic groups can be started on oral feeds earlier than the open group as there is no handling of bowel loops which disturbs the peristaltic activity of the gut, provoking adynamic ileus.

Our study indicate that the patients of laparoscopic group can be mobilized earlier than in open group because of less post-operative pain due to keyhole size incisions as compared to muscle cutting incision in open method which increases the morbidity. Similarly Chung Mau Lo et al (1996)¹⁹ and Chan HS et al (1995)¹⁷ found that the patients who underwent LC were observed to have mobilized earlier than the laparoscopic group.

In our study we established that the post-operative hospital stay was less in laparoscopic cases because of key-hole size incision, less post-operative pain score, early ambulation with early start of oral feeds and shorter convalescence which allow early discharge from hospital. Similar observations were made by Vikas Gupta et al (2009)²⁰ Rooh Muquim et al (2008)¹⁵ Syrakas T et al (2004)²¹ Capizzi et al (2003)²² Chau CH et al (2002)²³ Schietroma M et al (2001)¹³ Port RJ et al (1996)⁶ Buanes T et al (1996)¹⁴ Glinatsis MT et al (1992)⁴ Sanabria JR et al in 1993²⁴ Hardy KJ et al (1994)⁹

Reasons for conversion	Strasberg SM et al ²⁵ (No. of cases: 3114)	Peters JH et al ²⁶ (No. of cases: 746)	Kumar A et al ²⁷ (No. of cases: 433)	Present Study (No. of cases: 159)
Bleeding	8.5%	8%	8%	16.6%
Aberrant anatomy	8.5%	6%	40%	0%
Viscus Injury	3.5%	1%	5%	16.6%
CBD injury	8.5%	-	15%	16.6%
Adhesions	35.46%	31%	13%	33.2%
Equipment failure	4.25%	3%	6%	0%
Adhesion + Bleeding	-	-	-	16.6%
Rate of conversion	4.5%	14%	14.3%	4.8%
Table 10: Rate of conversion and its reasons				

Rate of conversion and reasons for conversion are compared with various studies in the following table.

The findings in the present study are similar to the study by Strasberg SM et al (1993)^{25.} The higher rate of conversion can be attributed to small number of patients in the study and the learning curve of the surgeon. Thus we can infer that the common reasons for conversion are adhesions, bleeding, viscus injury, CBD injury. Majority of conversions occurred with the patients operated by newly trained surgeon (14.28%) as compared to experienced surgeon (2.08%). In such cases surgeon should not hesitate to convert the procedure to open. Conversion in these circumstances reflects sound surgical judgement and should not be considered a complication of laparoscopic cholecystectomy.

Complication	Series	Open	Laparoscopic
Bleeding	Strasberg SM et al	-	12(0.38%)
	Kumar A et al	-	5(1.15%)
	Present Study	8.5%	4%
Viccus injury	Strasberg SM et al	-	5(0.16%)
viscus injui y	Present Study	0%	0.8%
	Strasberg SM et al	-	3(0.09%)
GB Rupture	Ros et al	-	31%
	Present Study	5.7%	1.8%
	Strasberg SM et al	-	1(0.03%)
Stone spillage	Kumar A et al	-	2(0.46%)
	Present study	0%	3.2%
	Strasberg SM et al	-	12(0.38%)
	Kumar A et al	-	9(2%0
CBD Injury	Fletcher DR et al	0.06%	0.27%
	Puliz Z et al	0.16%	0.45%
	Present Study	0%	0.8%
	Strasberg SM et al	-	1(0.03%)
Pancreatitic	Kumar A et al	-	2(0.46%)
1 and Catters	Ros A et al	-	2(0.54%)
	Present study	0%	0%
	Strasberg SM et al	-	34(1.09%)
Wound Infection	Kumar A et al	-	8(1.84%)
would infection	Richard C et al	1.82%	0.62%
	Present Study	5.7%	0%
Hornia	Fitzgibbons RJI	-	0.1-0.3%
nerma	Present Study	0%	0%
Scar Dain	Vander Velpen et al	9.4%	4.6%
Scal I alli	Present Study	5.71%	0%
	Gadacz TR et al	0.4%	0-1%
Mortality	Smith JF et al	0%	0.2%
	Present study	0%	0%
Table 11: Complications of cholecystectomy observed by			
various surgeons are listed in the following table			

The relatively higher percentage of complications in the study may be attributed to smaller number of patients included in the study and the learning curve as the surgeon gain experience the number of complications are expected to decrease. Thus the commonest complications are bleeding, CBD injury, trocar injuries, spillage of stones and wound infection. These can be avoided by being extra cautious during dissection, avoiding hesitancy to convert to open when in dilemma, using open method of port placement in difficult cases, usage of endobags to avoid spillage and proper wound care to avoid infection.

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CONCLUSIONS: Laparoscopic cholecystectomy is a safe, valid alternative to OC in patients with symptomatic cholelithiasis. The technique has a low rate of complications, implies a shorter hospital stay, and offers the patient a more comfortable postoperative period than OC. Conversion to OC is attributed to learning curve of the surgeon and should not be considered as complication. Rather it is mature surgical judgment.

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AUTHORS:

- 1. Mahesh Soni
- 2. Ritesh Bodade
- 3. J. C. Marhual

PARTICULARS OF CONTRIBUTORS:

- 1. Senior Resident, Department of Surgery, IGGMC, Nagpur.
- 2. Assistant Professor, Department of Surgery, IGGMC, Nagpur.
- 3. Jt. Director & Senior Consultant, Department of Surgery, JLNH & RC, Bhilai.

NAME ADDRESS EMAIL ID OF THE CORRESPONDING AUTHOR:

Dr. Mahesh Soni, M-15, Nadhanvan Colony, Hasanbagh Road, Nagpur-440009. Email: drmaheshkumarsoni@gmail.com

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