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RETROSPECTIVE STUDY

A Comparative Study of Single Incision *vs* Conventional Four Incision Laparoscopic Cholecystectomy: A Single Center Experience

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ABSTRACT

Laparoscopic cholecystectomy has traditionally been performed using multiple small incisions. Single incision laparoscopic cholecystectomy (SILC) has emerged as an alternative technique to improve cosmesis and minimize complications associated with multiple incisions. This study compared SILC with conventional four incision laparoscopic cholecystectomy.

Materials and methods: One hundred and twenty-one patients had laparoscopic cholecystectomy at the institute of minimal access, metabolic and bariatric surgery, Sir Ganga Ram Hospital, New Delhi, between January 2013 and October 2014. A total of 61 (50.4%) had conventional four port laparoscopic cholecystectomy (4PLC), while 60 (49.6%) had SILC. Indications for the operation were similar for the two groups. Excluded were patients who were operated for malignant gallbladder disease, patients with Mirizzi syndrome, patients with gallbladder perforation and patients who were in American Society of Anesthesiologists (ASA) 1V and V.

Primary end points: Analgesic requirements, Complications and hospital visits, Length of hospital stay.

Results: The average length of hospital stay including in-patient and out-patient surgeries was 23.93 ± 9.8, range 4 to 48 hours for those who had SILC and 30.07 ± 16, range 8 to 72 hours for patients who underwent 4PLC. Patients in both groups had either paracetamol or a nonsteroidal anti-inflammatory drug (NSAID) as postoperative analgesic. Only one (1.7%) patient who had SILC required an NSAID for postoperative analgesia, while 59 (98.3%) had postoperative pain relieve using only paracetamol. Four (6.6%) of patients who had 4PLC required an NSAID for postoperative analgesia, while 57 (93.4%) had only paracetamol for postoperative analgesia.

Conclusion: Single incision laparoscopic cholecystectomy appears to offer prospects for shorter hospital stay and early return to work compared to conventional 4PCL. Patients undergoing either SILC or 4PLC appear to have similar analgesic requirement. Extrapolating this to pain difference between the two surgical techniques, however, requires caution. Single incision laparoscopic cholecystectomy as a surgical technique is, however, feasible and promising for treatment of symptomatic cholelithiasis.

Keywords: Analgesic, Four incision laparoscopic cholecystectomy, Hospital stay, Single incision laparoscopic cholecystectomy.

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INTRODUCTION

Laparoscopic cholecystectomy (LC) has become one of the most effective procedures for the treatment of gallbladder pathology.[1] This technique has induced tremendous revolution in the surgery of biliary sytem, mainly due to improved results compared to the open technique and its cosmetic advantages has further endeared in the heart of surgeons.[1,2] Since, the first LC by Muhe et al in 1985, conventional laparoscopic cholecystectomy (CLC) has become the gold standard for treating gallbladder disease.[1,3,4,9,12,13] Conventional laparoscopic cholecystectomy is a safe established procedure and traditionally it is performed through three to four small incisions.[4,5,9,11] It is the commonest operation performed laparoscopically worldwide.[14]

A trend toward even more minimally invasive approaches has, however, led to techniques of single incision and natural orifices transluminal endoscopic surgery (NOTES).[1,2,4,4,9] The first published report of single incision laparoscopic cholecystectomy (SILC) was by Navarra in 1997 and since that time the idea of 'scarless' surgery has gained increasing popularity among patients as well as surgeons.[1,4,6] Single incision laparoscopic cholecystectomy is indeed a rapidly evolving technique that is complimenting CLC in selected fields and patients.[4] It is now considered by many as a bridge between traditional cholecystectomy and NOTES.[2,4,5] Single incision laparoscopic cholecystectomy utilizes three ports through a single skin incision at the umbilicus and is being considered as a 'no scar' surgery because the incision is placed within the umbilical scar.[4,7] It has gained increasing

attention due to the potential to maximize the benefits of laparoscopic surgery.[8,11] The reported advantages of SILC include less postoperative pain and minimum or no narcotic analgesic requirements, shorter hospital stay, quicker return to work and better cosmesis as well as low complication rate and cost.[1,4,9,11]

Single incision laparoscopic cholecystectomy is feasible and promising method of cholecystectomy and it is possible to do this procedure without the use of special equipment.[1,4,9] It is a safe and effective alternative to four incision laparoscopic cholecystectomy that provides surgeons with an alternative minimal access surgical option and the ability to hide the surgical incision within the umbilicus.[4,9,10] It is predicted by some reports that it may become a standard approach to LC.[1] This procedure is, however, not without drawbacks. Among the suggested disadvantages are prolonged operative time, high cost of special instruments, increased risk of operative complications and ergonomically disadvantageous to the surgeon.[1]

The main aim of this study is to compare SILC with conventional four incision laparoscopic cholecystectomy in patients who had cholecystectomy for gallbladder disease. The specific objectives include finding out the advantages of SILC over CLC, to evaluate any operative challenges inherent in SILC as well as unveil a single center experience with both operative approaches.

MATERIALS AND METHODS

After institutional clearance, clinical data of all patients who had LC at the institute of minimal access, metabolic and bariatric surgery Sir Ganga Ram Hospital between January 2013 and October 2014 was retrieved from the hospital database. Patients were evaluated with respect to demographic characteristics, surgical complications, analgesic requirements, length of hospital stay, conversion from single incision to four incision laparoscopic cholecystectomy or to open cholecystectomy.

The analysis included profiling of patients on different demographic and clinical parameters. Quantitative data is presented in terms of means and standard deviation. Student t-test was used for comparison of individual quantitative parameters. Cross tables were generated and Chi-square test was used for testing of associations. p-value < 0.05 is considered statistically significant. Software Package for the Social Sciences (SPSS) software was used for analysis.

OPERATIVE TECHNIQUES

All operations were performed under general anesthesia and orotracheal intubation. Patients were placed in reverse Trendelenburg position (30°) with table tilted right up to displace the intra-abdominal organs away from the gallbladder. A nasogastric tube was placed for decompression. For SILC, after pneumoperitoneum using the standard Veress needle technique, a 2 cm trans-umbilical incision was made. A 10 mm camera port was inserted and diagnostic laparoscopy performed. Two other 5 mm ports were placed through the umbilical incision (Figs 1 and 2). A striker mini alligator was passed through the right hypochondrium to provide cephalad retraction of the gallbladder fundus. A hunter's grasper was used to grasp the infundibulum, providing lateral traction. The gallbladder was dissected laterally with a combination of harmonic scalpel and blunt suction tip to creat a large lateral window. The hilum was dissected and the cystic duct and cystic artery are identified. The posterior branch of the cystic artery which is present almost all the time is coagulated with harmonic. The cystic artery and cystic duct are clipped and divided (Figs 3 to 5). The gallbladder is dissected from the liver bed along the cystic plate. The gallbladder bed was inspected



Fig. 1: Port position for SILC



Fig. 2: Port position for 4PLC

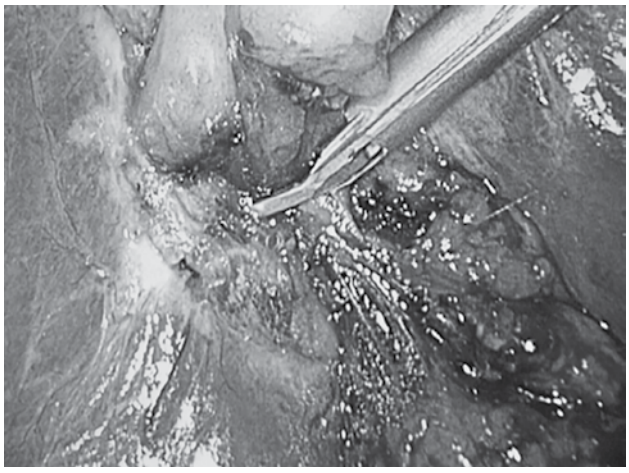


Fig. 3: Applying a clip

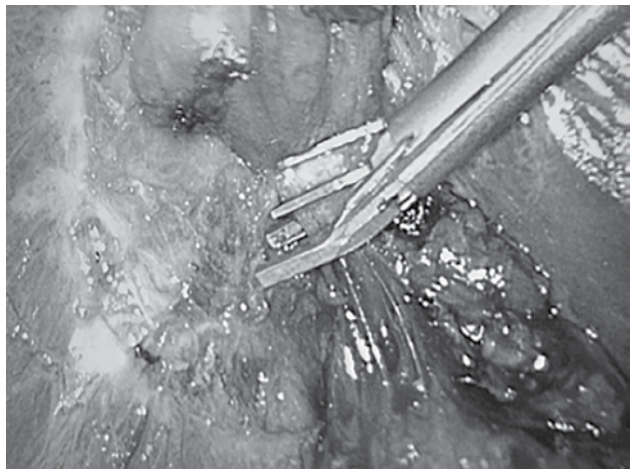


Fig. 4: Clip application

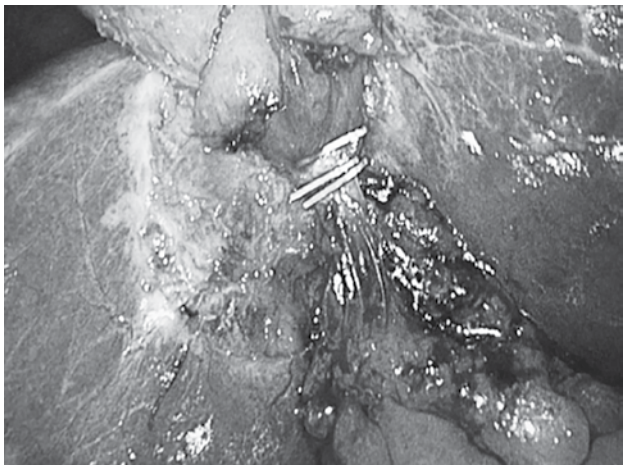


Fig. 5: Clips on cystic duct

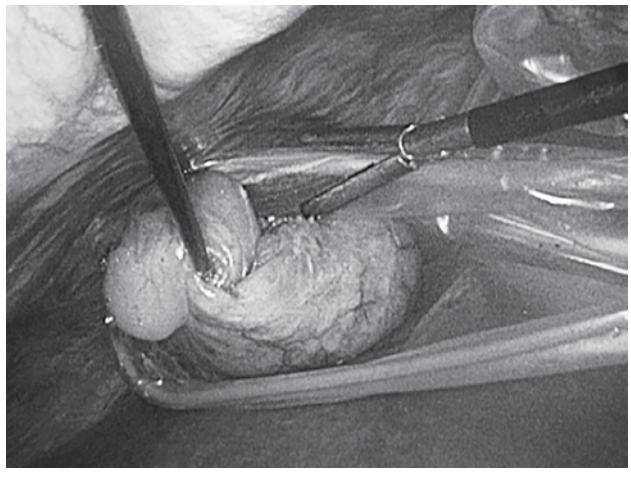


Fig. 6: Specimen in endo bag

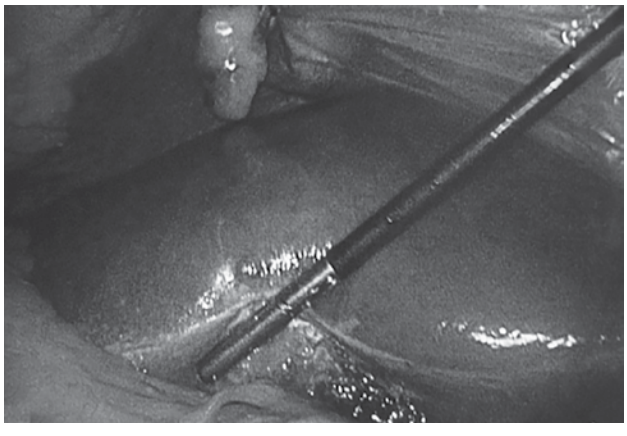


Fig. 7: Inspecting the gallbladder bed

before final separation of the gallbladder from its bed to ensure no bleeding or leaks were left unattended (Fig. 6). The specimen was delivered by a retrieval bag through the 10 mm port after changing the camera to a 5 mm 30° camera for retrieval under vision (Fig. 7). The umbilical incision was closed with vicryl 2/0 suture.

For the four incision laparoscopic cholecystectomy, after pneumoperitoneum using the standard Veress needle technique. A 10 mm 30° umbilical port was placed and 360° diagnostic scan of the entire abdomen was performed to exclude injury or bleeding incurred during pneumoperitoneum, first port placement and to identify any unsuspecting gross pathology. Following this, 10 or 5 mm epigastric, 5 mm right hypochondriac working ports as well as 5 mm assisting port just below right hypochondriac port were subsequently placed (Fig. 2). A hunter's grasper passed through the assisting port was used for cephalad retraction of the gallbladder fundus. Another grasper through the right hypochondriac port is used to provide lateral retraction of the infundibulum of the gallbladder. The gallbladder was dissected laterally with a combination of harmonic scalpel and bunt suction tip as describe earlier. The hilum was dissected and the cystic duct and cystic artery were identified. The posterior branch of the cystic artery which is always present was coagulated with harmonic. The cystic duct and artery are clipped and divided. The gallbladder is dissected from the liver bed along the cystic plate. Inspection of the bed was done before the last bit of the gallbladder was completely separated, to ensure adequate hemostasis. The specimen was delivered in a retrieval bag through the 10 mm port under vision. The 10 mm incision was closed using vicryl 2/0 suture.

RESULTS

Of the 150 patients who had LC at the institute of minimal access, metabolic and bariatric surgery, Sir Ganga Ram Hospital, New Delhi, 61 (50.4%) had conventional four port laparoscopic cholecystectomy (4PLC), while 60 (49.6%) had SILC (Table 1). The average age of the patients was 45.9 ± 9 to 85 years for both groups (Table 2). The average age for those who had SILC was 46.7 ± 15 while that for those who had 4PLC was 45.2 ± 14. The number of males who had SILC was 26 (43.3%), while 34 (56.7%) were females. Those who had conventional 4PLC had 31 (50.8%) males and 34 (56.7%) females. Indications for the operation were similar for the two groups (Table 3). There was one conversion from SILC to 4PLC. This was a patient who had prior percutaneous drainage of gallbladder empyema in another hospital. None of the patients in the two groups were, however, converted to open cholecystectomy. There was also no intraoperative

Table 1: Demographics, symptomatology and diagnosis

Study parameters	*Number (n = 121)*	*%*
Gender		
Male	57	47.1
Female	64	52.9
Complications		
Pain	120	99.2
No pain	1	0.8
Examination		
JAU	1	0.8
TEN	40	33.1
No complication	80	66.1
USS		
CHOLECY	1	0.8
CHOLELI	3	2.5
MSTONE	1	0.8
STONE	36	29.8
STONES	74	61.2
NONE	6	5.0
Diagnosis		
CHOLECYS	6	5.0
CHOLELIT	113	93.4
CHOLIELI	1	0.8
NONE	1	0.8
Anesthesia		
GA	118	97.5
NO GA	3	2.5
Findings		
MSTONES	1	0.8
PUS/STN	1	0.8
STONE	33	27.3
STONES	78	64.5
NONE	8	6.6
Convert		
YES	1	0.8
NO/NILL	120	99.2
Complic		
YES	0	0.0
NO/NILL	121	100.0
LC/LICS		
LC	61	50.4
LICS	60	49.6
Analges		
NSA	5	4.1
PCM	116	95.9

Table 2: Age distribution and hospital stay

Study parameters	*Mean*	*Median*	*SD*	*Min.*	*Max.*
Age (years)	45.94	46.00	14.84	9.0	85.0
Hospital stay (hrs)	27.0	24.0	13.8	4	120

Table 3: Analgesic requirement, symptomatology, and demographics

Study parameters	*NSA (n = 5)*	*PCM (116)*	*Chi-square*	*p-value*
Gender				
Male	3 (60.0)	54 (46.6)	0.348	0.555
Female	2 (40.0)	62 (53.4)		
Complications				
Pain	5 (100.0)	115 (99.1)	0.043	0.835
No pain	0 (0.0)	1 (0.9)		
Examination				
JAU	0 (0.0)	1 (0.9)	0.464	0.793
TEN	1 (20.0)	39 (33.6)		
No complication	4 (80.0)	76 (65.5)		
USS				
CHOLECY	0 (0.0)	1 (0.9)	9.851	0.080
CHOLELI	1 (20.0)	2 (1.7)		
MSTONE	0 (0.0)	1 (0.9)		
STONE	3 (60.0)	33 (28.4)		
STONES	1 (20.0)	73 (62.9)		
NONE	0 (0.0)	6 (5.2)		
Diagnosis				
CHOLECYS	0 (0.0)	6 (5.2)	23.602	0.000*
CHOLELIT	4 (80.0)	109 (94.0)		
CHOLIELI	1 (20.0)	0 (0.0)		
NONE	0 (0.0)	1 (0.9)		
Anesthesia				
GA	5 (100.0)	113 (97.4)	0.133	0.716
NO GA	0 (0.0)	3 (2.6)		
Findings				
MSTONES	0 (0.0)	1 (0.9)	2.963	0.564
PUS/STN	0 (0.0)	1 (0.9)		
STONE	3 (60.0)	30 (25.9)		
STONES	2 (40.0)	76 (65.5)		
NONE	0 (0.0)	8 (6.9)		
Convert				
YES	0 (0.0)	1 (0.9)	0.043	0.835
NO/NILL	5 (100.0)	115 (99.1)		
Complic				
YES	0 (0.0)	0 (0.0)	—	—
NO/NILL	5 (100.0)	116 (100.0)		
LC/LICS				
LC	4 (80.0)	57 (49.1)	1.826	0.177
LICS	1 (20.0)	59 (50.9)		

p-value < 0.05, statistically significant

complication or perioperative mortality recorded in both groups of patients.

The average length of hospital stay including in-patient and out-patient surgeries was 23.93 ± 9.8, 4 to 48 hours for those who had SILC and 30.07 ± 16, 8 to 72 hours for patients who underwent 4PLC (p = 0.014). After undergoing SILC, 90% (54 of 60) of patients went home within 24 hours, while 75% (46 of 61) of those who had 4PLC went home within 24 hours (p = 0.05). Patients in both groups had either paracetamol or a nonsteroidal anti-inflammatory drug (NSAID) as postoperative analgesic. Only one (1.7%) patient who had SILC required an NSAID for postoperative analgesia, while 59 (98.3%) had postoperative pain relieve using only paracetamol. Four (6.6%) of patients who had 4PLC required an NSAID for postoperative analgesia, while 57 (93.4%) had only paracetamol for postoperative analgesia (p = 0.177), which was not statistically significant. The difference in analgesic requirement of males and females was not statistically significant, although, more males tended to take stronger analgesics (Table 4). Younger patients appeared to need stronger analgesics for pain relieve compared to older patients, (p = 0.015) (Table 5).

Follow-up was limited to one to two postoperative office visits. No complications were noted in this period in the two groups.

DISCUSSION

Single incision laparoscopic cholecystectomy is not totally a new concept, it was introduced into practice as far back as 1992 by Pelosi et al[4] who performed a single puncture laparoscopic appendicectomy. First experiences with SILC were reported by Navarra et al in 1997 and with a different approach by Piskun and Rajpal in 1999.[4] There have been many studies establishing the advantages of SILC as a complimentary or substitude surgical technique to conventional 4PLC. This topic, however, remains contentious and incompletely settled.

This study showed that 90% of patients who had SILC went home within 24 hours. This is similar to a study reported by Brittney et al.[14] This showed a statistically significant shorter length of hospital stay for patients who had SILC. Patients who had SILC stayed an average of 7 hours less than those who had 4PLC. This result is similar to the result of other studies[14] who reported the mean postoperative hospital stay after SILC to be 12 hours shorter than that of patients who had 4PLC. Prasad also reported a mean postoperative hospital stay of 0.34 days after SILC as against 0.98 days after 4PLC.[4] Older patients stayed longer in hospital (Table 1) which is understandable because most of them have other comorbidities.

The analgesic requirement of patients who had SILC was not quite different from that of patients who went through 4PLC. Although only one patient in the SILC group required a stronger analgesic NSAID as against four patients for the 4PLC group, this was not statistically significant. Other factors which other studies have addressed either in favor or against either of the operative procedures include cost, operative time, blood loss, ergonomics and return to normal activity. Single incision laparoscopic cholecystectomy has been reported to have a slightly higher operative cost than 4PLC due to the peculiarity of the roticulating instruments required to ensure ergonomically smooth procedure.[4,14] It has also been reported that SILC take more operative time to complete compared to 4PLC[14] this has been attributed to the steep learning curve associated with SILC. This has also been associated with a high conversion rate and as well as complications.

There was one conversion from SILC to 4PLC in this study. This was a patient who had prior percutaneous drainage of gallbladder empyema in another hospital. There was no perioperative complications in the two groups.

LIMITATIONS OF THE STUDY

This study was a retrospective nonrandomized, single center study with few patients which constituted a limitation to the strength of its findings. The inability of the study to also address factors, such as cost, operative

Table 4: Demographics and hospital stay

Study parameters	NSA (5)	PCM (116)	Mean difference	Standard error of mean	95% CI		t-value	p-value
					Lower	Upper		
Age (years)	30.20 ± 9.96	46.62 ± 14.66	–16.42	6.637	– 29.562	– 3.279	– 2.474	0.015*
Hospital stay (hrs)	24.80 ± 15.59	27.10 ± 13.74	– 2.296	6.310	– 14.791	10.199	– 0.364	0.717

*p-value < 0.05, statistically significant

Table 5: Hospital stay SILC *vs* 4PLC

Study parameters	LC (61)	SILS (60)	Mean difference	Standard error of mean	95% CI		t-value	p-value
					Lower	Upper		
Age (years)	45.18 ± 14.66	46.71 ± 15.10	– 1.536	2.705	– 6.893	3.820	– 0.568	0.571
Hospital stay (hrs)	30.07 ± 16.33	23.93 ± 9.81	6.133	2.459	1.264	11.00	2.494	0.014*

*p-value < 0.05, statistically significant

time, blood loss and long-term outcomes also constitute a weakness. It is hoped that future studies would address this inherent challenge.

CONCLUSION

Single incision laparoscopic cholecystectomy appears to offer prospects for shorter hospital and early return to work compared to conventional 4PLC. Patients undergoing either SILC or 4PLC appear to have similar analgesic requirement. Extrapolating this to pain difference between the two surgical technique, however, require caution. Single incision laparoscopic cholecystectomy as a surgical technique is, however, feasible and promising for treatment of symptomatic cholelithiasis.

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