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Original Research Article

LAPAROSCOPIC CHOLECYSTECTOMY USING SINGLE PORT VERSUS CONVENTIONAL MULTI-PORT TECHNIQUE: A COMPARATIVE STUDY

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Corresponding Author:
Dr. Sanjeev Singhal,
Email: drsinghals@gmail.com

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Pankaj Kumar Arora[1], B N Tiwari[2], Neeti Gupta[3], Sanjeev Singhal[4], Prashant Kumar[5]

[1]Ex-ACHD-NF, Department of Surgery, Northern Railway Central Hospital & and Director, National Health Authority, New Delhi, India
[2]ACHD-NF, Department of Surgery, Northern Railway Central Hospital, New Delhi, India
[3]Sr. DMO-SG, Northern Railway Central Hospital and Associated Health Units, New Delhi, India
[4]Chief Specialist, Department of Surgery, Northern Railway Central Hospital, New Delhi, India
[5]DNB Department of Surgery, Northern Railway Central Hospital, New Delhi, India

Abstract

Background: This study evaluated the clinical outcomes of conventional laparoscopic cholecystectomy (CLC) and single incision laparoscopic cholecystectomy (SILC). Settings and Design: This prospective randomized comparative study included 31 cases of laparoscopic cholecystectomy in each group was done from July 2022 to December 2023. **Materials and Methods:** It compared operative time, intraoperative difficulties, post-operative pain by Visual Analogue Scale at 1, 6 & 24 hours. Post-operative stay, early and delayed post-operative complications were compared till 6-month post-surgery. Cosmesis was noted on Vancouver Scar Scale (VSS). **Result:** The mean operating time for CLC was 61.71 minutes & of SILC was 70.19 minutes. Bile spillage in 3.22% (n=1) case of CLC, none in SILC. On 6 months follow up none developed biliary stricture. Pain score P values were 0.6188 at 1 hr, 0.366 at 6 hr, and 0.0115 at 24 hr. No case developed wound infection and one CLC had developed umbilical port site hernia. The mean VSS score in CLC group was 7.322 and SILC was 5.838 (p=0.001). The mean post-operative stay was 1.09 days in CLC and 1.03 days in SILC group. **Conclusion:** SILC has significantly less post-operative pain and better cosmesis. The operative period, post-operative stay and complications are similar in SILC and CLC cases.

INTRODUCTION

For the treatment of benign gallbladder disease, conventional laparoscopic cholecystectomy (CLC) has established the gold standard since Mühe et al,[1] performed the first laparoscopic cholecystectomy (LC) in 1985. Smaller wounds and better cosmesis are now included in the notion of minimally invasive surgery.[2]

Navarra et al. in 1997 described the trans-umbilical single incision laparoscopic cholecystectomy (SILC) was first described for the first time and they suggested that SILC might be linked to less discomfort and fewer hospitalisations. According to later comparison research, SILC was a safe and practical treatment that produced better cosmetic outcomes and reduced postoperative pain.[3-5] However, other research has shown that SILC had higher postoperative discomfort, was linked to a longer operating time (OT), and did not appear to provide any advantage cosmetically over CLC.[6,7]

To compare the outcomes of SILC with CLC, nine meta-analyses,[8–16] have been conducted based on the randomised controlled trials (RCTs). These investigations validated SILC's viability and safety. There have been inconsistent results from other studies. Sajid et al,[12] did not find any difference between the two procedures cosmetically, but eight meta- analyses demonstrated that SILC provided a higher cosmetic score than CLC. SILC was discovered to have a greater procedure failure rate by Hao and Arezzo et al.[9,16] These results were not seen in the other seven meta-analyses.

Given these inconsistencies, a closer comparison of SILC and CLC is required, specifically to determine whether SILC is linked to better cosmetic outcomes and less postoperative pain, or whether it is linked to a higher procedure failure rate that results in conversion to multiport CLC, longer OTs, and port site hernia. The benefits and drawbacks of these two techniques were assessed in this randomised study.

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MATERIALS AND METHODS

The study included 62 patients operated for gall stone disease, randomized into two groups of consisting of 31 patients undergoing SILC and another 31 patients undergoing CLC from July 2022 to December 2023

Inclusion criteria:

- The inclusion criteria were elective surgery in patients with symptomatic cholelithiasis.

Exclusion criteria:

- Patients with obstructive jaundice, CBD stones, recurrent cholecystitis, Gall bladder wall thickness of more than 4mm on ultrasound abdomen, and the largest gall stone size of more than 3 cm.
- Patients with contraindication to laparoscopy.
- Patients with complicated gallstone disease, e.g., empyema gall-bladder, suspected Mirizzi syndrome, previous upper abdominal surgery, and previous mesh repair of an umbilical hernia.
- Pregnancy.
- Major comorbidities (ASA score III to V).

Operative time included time from making the skin incision to closure of the skin incision. The initial peritoneal access was by closed method using a Veres's needle puncture, by a supraumbilical incision, and CO2 gas insufflation. Pneumoperitoneum was created using the closed method in both groups.

In the CLC group (n=31) cholecystectomy was performed using two 10-mm ports- umbilical and epigastric, and two 5-mm right subcostal ports, and a 30° 10mm telescope of was used.

In SILC group (n=31), 2.5 cm incision was made along the superior umbilical fold. Once abdomen was adequately distended the skin incision was deepened to the rectus sheath & then the peritoneum was lifted and cut. The silicon multiport cannula assembly was inserted and tightly fitted by screwing movement. Trocar was withdrawn and the silicon port having 3 entry points with one gas port was left in position.

Pneumoperitoneum was recreated, 5.7 mm 30-degree telescope was inserted, and double curved long instruments were used, Gall Bladder neck was grasped and retracted, the convexity on shaft of instrument helped to retract the liver. Adhesionolysis was done. Using long double curved Maryland, the dissection at neck was done, followed by posterior and anterior dissection. Once the critical view of safety was achieved, the Cystic Artery was cut with a Harmonic scalpel. 5 mm pre-loaded clip applicator inserted & cystic duct clipped, followed by cutting it with the long scissors. The Gall-Bladder separated from the Cystic plate with electrocautery and harmonic scalpel. Once adequate hemostasis & clip position were reconfirmed, the Gall Bladder was grasped with long forceps, and the lid of the Keyport cannula was snapped open to remove the stone-filled Gall Bladder.

The Keyport cannula system was removed by anticlockwise motion & port site was closed under vision using Polypropylene no.1 suture.

Skin incision was closed with nylon 3-0 interrupted sutures. Patients of both groups were followed up in a similar manner.

Paracetamol 1000 mg 8-hourly for 1 day was given to all patients in both groups. A VAS (Visual Analogue Scale) was used to monitor the pain postoperatively at 1 hour, 6 hours, and on day 1. The patients with a VAS score of > 6 received intravenous tramadol in the postoperative phase to alleviate discomfort and pain as an additional analgesic. The patients were followed up on the 7th postoperative day to assess early complications, dressing, and stitch removal. They were subsequently followed at 1 month, three months & 6 months postoperatively. During follow-up visits, a clinical examination was performed to assess late complications, port site hernia, and cosmesis.

The cosmesis was assessed based on the Vancouver scar scale (VSS), 0 (best) to 13(worst). The post-operative stay was calculated till the time patients were discharged based on oral intake, adequate pain control with oral analgesia, ability to mobilize and self-care.

RESULTS

Age Distribution: The mean age of CLC group was 39.53 years (range 20 years to 60 years) and mean age of SILC was 40.26 years (range 19 years to 60 years). There were 7 male patients in CLC group & 6 male patients in SILS group, while rest of them were female patients.

For age sex distribution there was no statistically significant difference observed (p-value = 0.748).

Operative Time

The mean operative time of CLC was 61.70 ±8.14 minutes and that of SILC was 70.19 ± 18.72 minutes. In CLC 9.67% (n=3) underwent 3 port CLC and rest of them underwent 4 port CLC. 3.22% (n=1) cases in SILC required additional epigastric port placement. Minimum time in CLC was 40 minutes & in SILS was 45 minutes. On comparison the difference in operative time was statistically insignificant (P = 0.0756).

SILS Learning curve- All the surgeries were performed by the same surgical team. The operative time of the first SILC performed to the last case performed in this study was noted. It was observed that there was progressive decline in the operative time from initial 116 minutes to 45 minutes. This decline in time indicates the learning curve for the SILC. The operative time for CLC didn't show much variation in the study period. The operative time of SILC performed in later cases are comparable to the CLC.

Intraoperative difficulties: While performing the SILC several difficulties were encountered

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considering the ergonomics of single incision surgery:

- Adequate hemostasis had to be achieved before inserting the Keynote trocar cannula assembly because of the larger size of incision causes more bleed from the port site which hampers intraoperative vision.
- The vision with the 5.7 mm telescope had a narrow operative field to display, so frequent adjustments had to be made, leading to increased operative time.
- The convexity of the shaft of the left-hand instrument was used for fundal traction, no additional suture grip over the fundus needed for this. The removal of gall bladder with calculi was convenient because of wide incision and wide mouth port.

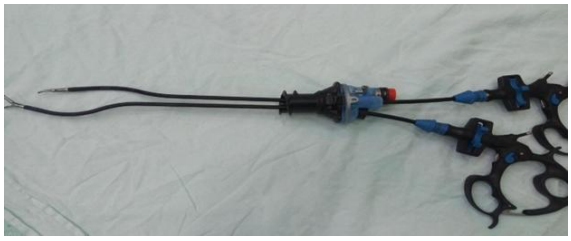

Figure 1. SILC port and instruments.

Post-operative abdominal pain: The post-operative pain was assessed at one hour, six hours, and 24 hours post-surgery using the Visual Analogue Scale (VAS) from 0 to 10, as depicted in [Table 1]. In all patients, anytime the VAS score was above 6, they were administered with opioid (tramadol) intravenous analgesic. The site of pain in the CLC group was the right hypochondrium and epigastrium owing to the traction in removing the gall bladder from the epigastric port. In the SILC group, the pain was reported predominantly at the right hypochondrium. On statistical analysis, the P values were 0.6188 at 1 hour, 0.366 at 6 hours, and 0.0115 at 24 hours. It shows significantly less pain in the SILS group.

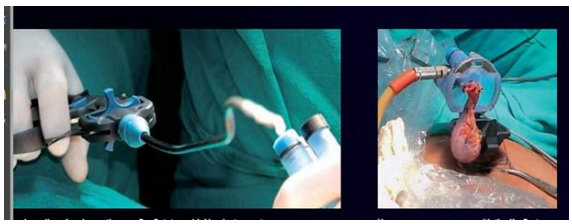

Figure 2: Gall bladder extraction in SILS

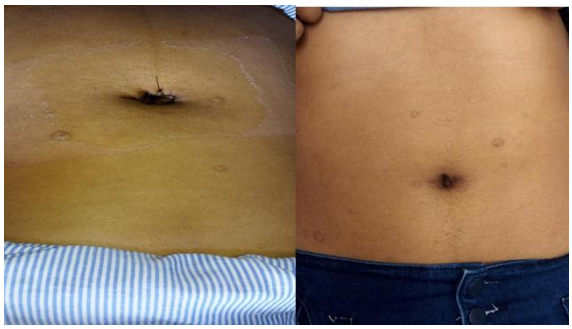

Figure 3: Post-operative image at 1 week and 1 month

Table 1: Post-operative pain score.

POST SURGERY	CLC		SILS		P value
	Mean	Variance	Mean	Variance	
at 1 hour	4	2.4	4.19	2.228	0.6188
at 6 hours	3.87	3.98	4.25	3.66	0.366
at 24 hours	4.58	3.25	3.41	2.25	0.0115

Additional analgesic requirement: The additional requirement of tramadol was noted in both the groups. In CLC group 16% (n=5) & in SILC group 9.6% (n=3) had additional analgesia. This difference was insignificant p=0.4486.

Wound infection: None of the cases in both the groups developed surgical site infection.

Post-operative stay: The duration of post-operative stay as defined in methodology was noted in days depicted in [Table 2]. The mean stay was 1.09 days in CLC group & 1.03 days in SILC group. The maximum duration of the stay was 2 days in both the group. The p value for this difference in stay was 0.30 which was insignificant.

Table 2: Post-operative stay in days.

	CLC		SILS		P- value
	Mean	Variance	Mean	Variance	
Cases	1.096	0.090	1.032	0.032	0.3051

Delayed Complications: Patients were evaluated for delayed complications which included biliary injuries leading to bile duct stricture and port site hernias.

None of the patients in any group developed biliary stricture. However, one patient in CLC group developed Umbilical port site hernia, detected clinically at three months of his follow up visit. None of the SILC group patient developed port site hernia.

Cosmesis: The cosmetic satisfaction was analyzed using Vancouver Analogue Scale (VSS) depicted in table 3, the mean of the patient's score at one month & 6 month was taken into consideration. The mean score in CLC group was 7.322, the SILs group had a better mean score of 5.838 with a p value of 0.001. Thus, SILC has better cosmesis than CLC.

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Table 3: Cosmesis VSS score

	CLC		SILS		P- value
	Mean	Variance	Mean	Variance	
Cases	7.322	1.559	5.838	1.339	0.001

DISCUSSION

Laparoscopic Cholecystectomy is among the most performed surgery & is considered the gold standard. With the advancement in instruments and telescopes, it is feasible to reduce the number of entry ports in laparoscopic surgeries. Conventional Laparoscopic cholecystectomy is performed using 4 ports which has been reduced to three ports because of increasing expertise of the surgeons in laparoscopic surgeries. With the modified large size single access ports which has multiple adaptable plastic sleeves and seal caps for instrument diameters of 5 –15 mm, cholecystectomy can be performed through single incision with the similar outcomes as compared to CLC. This study involves comparison of clinical outcomes CLC and SILC.

The cases were randomized in both the groups thus avoiding any statistically significant difference in age sex distribution of the studied population.

The operating time in the SILC group was higher, but it has decreased over the 31 cases, with the last SILC requiring 45 minutes, which is comparable to the mean time of CLC. This describes the learning curve with the new technique. The surgical team was the same, and it was comfortable with the 3-port CLC; this reduced the requirement of a fourth port for fundal traction. So, a team which is good at 3-port CLC can acquire skills for SLC in a shorter span of cases.

Intraoperative dissection in SILS required different maneuvers by passing the telescope to the right of the Maryland forceps while doing anterior dissection and to the left of the Maryland forceps while performing posterior dissection along the gall bladder. The use of long double curved instruments also reduced the overriding and clashing of instruments. Retrieval of the dissected gall bladder was easier in SILC; no case required dilation of the port site. However, in CLC to deliver the gall bladder, the epigastric port was dilated frequently, contributing to more post-operative pain. There was no difference in bile leak and CBD injury during surgery, which can be attributed to better surgical techniques and vision provided by the longer telescope.

At 24-hour post-surgery, the pain was significantly less in SILC cases, thus reducing the post-operative additional analgesia requirement and hospital stay. However, the post-operative hospital stay was not significantly shorter in the SILC group.

None of the cases developed wound infection, biliary stricture. However, one case in CLC group developed an umbilical port site hernia after three months of surgery

None of the SILC group cases developed any complication, but one case of the SILS group developed port site hernia at the umbilical port. This hernia was detected on clinical examination at the third month of follow-up. In SILC, the incision is wide enough for easy visualization of the fascial defect edges. Use of a curved hooked instrument with an eye further ensures a good closure of the fascial defect, thus preventing the formation of a hernia.

SILC cases have better cosmesis and patient satisfaction. It is being considered a no-scar surgery because the incision is placed within the umbilicus and is not visible.[17,18]

CONCLUSION

This study concludes that the SILC is a safe, feasible, and adaptable surgical technique, when performed in appropriately selected patients with a specialized set of instruments, access port & closure device. It results in significantly less pain and better cosmesis. It does not compromise the procedural safety, both early and delayed complication rates are minimal and comparable to the CLC. With a greater number of cases undergoing CLC, the operative time is gradually declining along with improved intraoperative ergonomics.

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