Original Article

The early outcome of single-incision versus multi-port laparoscopic cholecystectomy

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Abstract

Background: Single-incision laparoscopic cholecystectomy (SILC) is a newly developed method of performing cholecystectomy and has been increasingly used. The aim of this study is to see if SILC has any advantages over conventional (three-port) laparoscopic cholecystectomy (CLC).

Materials and Methods: In this cross-sectional study, 52 patients who underwent SILC (group A) during the period from May 2011 to March 2013 were compared with 62 patients who underwent CLC (group B) at two centers affiliated to Shiraz University of Medical Sciences in Shiraz, Iran. Data were gathered on operation time, pre- and postoperative complications, patients' postoperative pain, pain reliever use, duration of hospital stay, and return to work, and these data were compared using SPSS software version 16.

Results: The mean age of patients was 38.01 ± 13.24 in group A and 44.82 ± 15.11 in group B. Mean body mass index (BMI) was 23.97 ± 4.78 and 26.22 ± 4.67 in groups A and B, respectively. The mean operation time was 76.4 ± 29.0 min in group A and 72.9 ± 24.1 min in group B ($P = 0.496$). Preoperative complications were 3.8% in group A and 0 in group B ($P = 0.206$). Postoperative complications were 17.3% in group A and 11.3% in group B ($P = 0.423$). The mean for early postoperative pain revealed no significant difference ($P = 0.814$), but the mean pain on discharge was significantly higher in group A patients ($P = 0.034$). Regarding the mean admission time and return to normal activity, we found no significant differences.

Conclusion: SILC does not have any special advantages over CLC with regard to surgical outcomes, but it can be a safe alternative to CLC, especially in patients concerned about cosmoses.

Key Words: Iran, laparoscopic cholecystectomy, minimal invasive surgery

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Received: 12.01.2014, **Accepted:** 13.01.2015

Access this article online	
Quick Response Code:	Website: www.advbiores.net
	DOI: 10.4103/2277-9175.162530

INTRODUCTION

The first laparoscopic cholecystectomy was performed in 1985, soon to be established firmly as the "gold standard" for the treatment of gallstone disease.[1-5] This treatment was shown to have distinct advantages over open surgery, such as faster recovery, shorter hospital stay, and quicker

How to cite this article: Hosseini SV, Solhjou Z, Pourahmad S, Rahimikazerooni S, Gabash KM, Bagherpourjahromi A, Rezaianzadeh A, Bahrami F. The early outcome of single-incision versus multi-port laparoscopic cholecystectomy. Adv Biomed Res 2015;4:161.

return to daily activity and it also provided better cosmoses.[6,7]

The current standard approach to laparoscopic cholecystectomy [conventional laparoscopic cholecystectomy (CLC)] involves a 10-mm incision on the umbilicus, a 5- or 10-mm incision in the epigastric or subxyphoid region, and one or two 5-mm incisions in the right upper quadrant.[8]

During recent years, surgeons have been trying to decrease surgical trauma; thus, attempts to reduce the number of traditionally used four ports have resulted in the development of safer and feasible three- and two-port methods.[8-11] The development of single-incision laparoscopic surgery (SILS) was another effort made toward the same direction.[12] Such advancements in surgical techniques focus on increasing the success rate, minimizing morbidity, decreasing pain, and improving the cosmetic results of the surgical procedures.[13]

Single-incision laparoscopic cholecystectomy (SILC) was first reported in 1995 and has gained greater interest and diffusion during recent years.[8] In this method, a single 15–25 mm incision is made around the umbilicus and a single port is passed through the fascia. The cosmetic outcome of SILC is, therefore, expected to be better because the surgical wound is hidden within the umbilicus, leaving no visible abdominal scars, hence it is called "scar less" surgery.[5]

Although long-term data on SILC is not yet available, a growing number of articles have been published about short-term morbidity parameters such as postoperative pain, hospital stay, cosmetic results, and pre- and postoperative complications like wound infection, bleeding, biloma, etc., in recent years.[12,14] Some of these studies have compared standard and SILC and have demonstrated either equivalency or statistical superiority of single-port techniques with regard to operative time, blood loss, and complications.[8,15-17] Others have shown no special advantage for SILC over CLC.[18] Since most of these studies were case series, more research needs to be carried out in order to come up with unified results.

Single-port laparoscopic cholecystectomy is becoming increasingly popular in Iran. However, to the best of our knowledge, there have been no studies to show whether this method is clinically beneficial or not. The purpose of this study is, therefore, to detect the differences in post-op pain, pre- and post-op complications, and also hospital stay and return to work parameters between patients who underwent conventional technique versus those who had SILC, to see if SILC has any special advantages over the conventional three-port surgery with regard to surgical outcomes.

MATERIALS AND METHODS

Patient selection

In this cross-sectional study, the outcome of two groups of patients was compared. Group A consisted of 55 patients of age between 18 and 55 years and with body mass index (BMI) between 18 and 30, who underwent SILC during the period from May 2011 to March 2013. The comparison group (group B) included 62 patients with the same condition who underwent laparoscopic cholecystectomy at the same centers and were operated by the same surgeons at the same time. They were scheduled for operation with the diagnosis of symptomatic gall stone as confirmed by ultrasonography. They were all operated in two hospitals affiliated with Shiraz University of Medical Sciences in Shiraz, Iran. All operating data and outcomes were recorded, and the patients' charts were then reviewed by a trained General Practitioner for data gathering. Patients' pain severity was recorded on the basis of Visual Analog Scale (VAS) for pain 1 day after surgery and 7 days after surgery during the first clinical visit.

Our exclusion criteria were pregnancy, ASA classification of 3 or 4, history of previous abdominal surgery with midline incision, and acute attack of cholecystitis. Patients who underwent both single- and multi-port surgeries or patients who underwent operations required conversion were also excluded.

From the first 55 patients scheduled for single-port laparoscopic cholecystectomy, three were excluded; two of these underwent combined operations while the other was converted to conventional three-port laparoscopic cholecystectomy during the operation due to technical problems. The remaining 52 patients were included in the study as group A and the other 62 patients who underwent conventional three-port laparoscopic cholecystectomy were assigned to group B.

The patients' demographic data as well as weight, height, BMI, operation time, pre- and postoperative complications such as bleeding, bile leakage, incision hemorrhage, postoperative pain (both the pain of surgical diet (first diet after surgery) 1 day after surgery and the pain on discharge 2 days after surgery), 25 mg pethidine use, and surgical pathology were recorded. Time for the start of diet, the duration of hospital stay, and post-op days after which they could return to normal activity were also noted.

Surgical technique

All surgeries in both groups were performed by the same surgeon. In group A, after prep. and drep. under general anesthesia in supine position, a 2.5-cm incision was made at the right side on the umbilicus. After exposing the fascia, a SILS port (Covedien) [Figure 1] was inserted via this incision. A camera and two other trocars (out of articulating grasper, dissector, harmonic scalpel device, and clip applier) were introduced intermittently through the SILS port. Then the gall bladder was released, dissection was done, and after finding the cystic duct and cystic artery in the critical view, they were separately ligated by clips and cut with scissors. The gall bladder was dissected from the liver bed, bleeders were controlled, and irrigation was done. The gall bladder was then pulled out from the umbilical incision with the single-port device and sent for histopathology. Fascia was finally closed by Nylon 2/0 and skin sutured by Nylon 4/0. In the end, dressing was applied.

In group B, three ports were introduced: A 10-mm port in the infraumbilical region for the camera, a 10-mm port in the subxyphoid region for dissection, and a 5-mm port in right upper quadrant for retraction. The gall bladder was then released, dissection was done, and after finding the cystic duct and cystic artery in the critical view, they were separately ligated by clips and cut with scissors. The gall bladder was dissected from the liver bed, bleeders were controlled, and irrigation was done. The gall bladder was then pulled out from the epigastric incision and sent for histopathology. Fascia was closed by Nylon 2/0 and the skin sutured by Nylon 4/0. For suspected cases, we used Jackson Pratt (JP) drainage and removed it before discharge. Dressing was then applied.

Statistical analysis

The categorical data were compared using Chi-square and Fisher's exact tests. For continuous data, comparison was made using *t*-test and where the data was non-parametric, Mann–Whitney U test was used. Quantitative variables were presented as mean ± SD. *P*- values less than 0.05 were considered statistically significant. Statistical analysis was performed using SPSS version 16 software.

Figure 1: Single-incision laparoscopic surgery (SILS) three-port device (Covidien)

RESULTS

Female predominance was observed in both groups of this study, as they formed 90.4% (47 out of 52) of group A patients and 90.3% (56 out of 62) of group B patients. The mean age of group A patients was 38.01 ± 13.24 years and of group B patients was 44.82 ± 15.11 years. Also, the mean BMI was 23.97 ± 4.78 and 26.22 ± 4.67 in groups A and B, respectively. Patient characteristics of both groups are presented in Table 1.

Operative and postoperative results

From the primarily selected 50 patients to undergo SILC, just one operation was converted to the conventional three-port surgery, and therefore, the conversion rate was found to be 0.018. The mean operation time was 76.4 ± 29.0 min in group A and 72.9 ± 24.1 min in group B ($P = 0.496$), which was not significantly different between the two groups. This time was equal in the first cases compared to the last cases.

Preoperative complications were 0% in group B (multi-port laparoscopic cholecystectomy) and 3.8% (2 out of 52) in group A (single-port laparoscopic cholecystectomy), one being due to iatrogenic liver injury and the other being due to blood oozing from the gall bladder bed (small venous injury at the liver surface). Yet, there was no significant difference between the two groups regarding preoperative complications ($P = 0.206$). Postoperative complications were 17.3% (9 out of 52) and 11.3% (7 out of 62) in groups A and B, respectively ($P = 0.423$).

In Table 2 is presented the pre- and postoperative complications of the groups. Postoperative pain was also recorded [both in early hours (during 10 h) after surgery and at the time of discharge] for both groups

Table 1: Patient characteristics and outcome variables of each group

	SILC (*n*=52)	CLC (*n*=62)
Age (years)	38.01±13.24	44.82±15.11
Sex-female	47 (90.4%)	56 (90.3%)
Sex-male	5 (9.6%)	6 (9.7%)
BMI	23.97±4.78	26.22±4.67
Operation time (min)	76.4±29.0	72.9±24.1
Hospital stay (h)	1.56±0.95	1.61±1.23
Return to work (days)	16.77±16.6	16.55±17.44

using a comparative pain scale. The mean for early postoperative pain was 5.84 ± 2.35 for group A and 6.01 ± 4.79 for group B; it seems to be a little lower in group A, but this difference was not statistically significant (P = 0.814). Nevertheless, the patients' mean pain on discharge was 3.56 ± 2.55 in group A, which was significantly higher than in group B which had a mean of 2.57 ± 2.24 (P = 0.034).

To subside pain during admission, half of the group A patients (26 out of 52) and 46.8% of group B patients (29 out of 62) received opioid pain relievers (25 mg pethidine, PRN) (P = 0.851) while 40.4% of group A and 22.6% of group B patients received non-opioid pain relievers (100 mg diclofenac supp. or 1 g paracetamol, PRN) (P = 0.044). Non-opioid pain killer use in group B was significantly lower than in group A.

The mean time for starting the postoperative diet was 20.78 ± 7.63 h in group A and 19.37 ± 8.20 h in group B (P = 0.346), which was not significantly different in the groups. Mean admission time was 1.56 ± 0.95 days in group A and 1.61 ± 1.23 days in group B (P = 0.803), and return to normal activity took 16.77 ± 16.6 days after discharge in group A and 16.55 ± 17.44 days in group B (P = 0.948).

Pathology reports gathered from all 114 surgeries have been presented in Table 3.

Table 2: Peri- and postoperative complications

	SILC (n=52)	CLC (n=62)
Peri-operative complication	2	0
Postoperative complication	9	7
Hemorrhage	1	0
Wound infection	2	1
Jaundice and abnormal LFT	1	0
Leakage	2	3
Umbilical hernia	1	0
Wound dehiscence	1	0
Biloma	0	1
Hematoma	0	1
Severe dysfunctioning pain	0	1

Table 3: Pathology reports

	CLC (n=62)	SILC (n=52)
Chronic cholecystitis with cholelithiasis	29	46
	59.8%	74.2%
Acute on chronic cholecystitis with cholelithiasis	0	4
	0%	6.5%
Chronic cholecystitis	14	5
	26.9%	8.1%
Chronic cholecystitis with cholelithiasis and cholesterolosis	6	2
	11.5%	3.2%
Ulceration with acute on chronic cholecystitis with cholelithiasis	1	0
	1.9%	0%
Acute cholecystitis with cholelithiasis	2	1
	3.8%	1.6%
Acute on chronic cholecystitis with cholelithiasis and focal wall necrosis	0	1
	0%	1.6%
Chronic cholecystitis with cholesterolosis	0	2
	0%	3.2%
Follicular cholecystitis	0	1
	0%	1.6%

DISCUSSION

Multi-port cholecystectomies which were traditionally performed through four ports are now being carried out successfully with fewer ports, and several techniques have been described to reduce the port numbers.[19,20] Although the first transumbilical cholecystectomy was described more than 10 years ago, there have been some comparisons between single-incision and conventional multi-port laparoscopic cholecystectomy, and SILC has not consistently demonstrated superiority to the CLC which is now the standard technique with respect to outcomes relevant to the operation.[21-23]

This study was designed to compare the surgical outcomes of these two methods in our center and also to see whether SILC is a safe method of performing cholecystectomy. It must be noted, though, that certain limitations existed due to the lack of standardization and its retrospective nature.

We found no significant differences in terms of operating time between the groups (mean 76.44 ± 29 for group A and 72.98 ± 24 for group B, P = 0.496), which was similar to the report of Lai[24] but different from the reports of Hao,[25] Gangl,[26] and Pan.[21] These mentioned articles reported longer operating times in the SILC group in comparison to the CLC group. Some associated this difference to the surgeon's experience. We did not find any learning curve, however, similar to that reported by Britney *et al.*,[27] can be related to our surgeon's experience or the fact that the operations were performed at a teaching institute.

Early postoperative pain was similar in both groups (mean 5.84 ± 2.53 in group A and 6.01 ± 4.79 in group B, P = 0.814), but pain on discharge was significantly lower in the CLC group, a finding which was almost similar to that of Lai.[24] A systematic review revealed that 10 out of 13 articles reviewed by the author have reported postoperative pain in the SILC to be similar to or worse than that in CLC group.[28] This difference can be due to single port causing more tissue trauma and limited mobility of instruments causing more damage to the abdominal wall.[3] Yet, the issue is still controversial, as some

studies have reported less postoperative pain in the SILC than in the CLC group.[29]

No preoperative complications were observed in group B; however, two complications were noted during single-incision surgery – one due to liver injury during operation and the other due to blood oozing from the cholecystectomy site. Postoperative complications were 9 out of 52 in group A (17.%) and 7 out of 62 in group B (11.3%), but there was no statistical significance in regard to both pre- and postoperative complications between the two groups. The complications are shown in Table 2. Most of the studies comparing the complications of SILC and CLC also found no significant differences.[18,25,30]

Mean length of hospital stay was 1.56 ± 0.95 days and 1.61 ± 1.23 days in groups A and B, respectively, which was similar in both groups (P = 0.803). This finding corresponded to some studies,[18,24,25] but was in contrast with some others[3] which reported longer hospital stay for patients who underwent conventional multi-port surgery.

The mean time to return to work was 16.77 ± 16.6 days in group A and 16.55 ± 17.44 days in group B. Although there were no differences between the groups, it seems that returning to work is highly related to the patients' characteristics and their subjective perception of pain, as there were wide ranges of days reported by patients to return to normal activity. Lai *et al.*,[24] Sajid *et al.*,[18] and Matthew Sappington[31] reported similar results regarding their patients' return to work, but there are still some studies which revealed earlier return to normal activity in patients who underwent SILC.[27]

CONCLUSION

SILC is a safe and feasible method of performing cholecystectomy. Although SILC is technically difficult, it can be a safe alternative to conventional multi-port laparoscopic cholecystectomy, especially in patients concerned about cosmoses. According to our study, SILC did not have any special advantages over the conventional three-port surgery, with regard to surgical outcomes. But controversies still remain, and the need for high-powered randomized trials with larger sample sizes to determine whether SILC truly offers any advantages over CLC other than cosmoses is felt.

ACKNOWLEDGMENT

This article was extracted from the research proposal No. 90-01-01-3810 approved by the research vice-chancellor of Shiraz University of Medical Sciences. Hereby, the authors would like to thank the vice-chancellery for financially supporting the study.

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Source of Support: Nil, **Conflict of Interest:** None declared.