DOI: https://doi.org/10.53350/pjmhs2023178197

ORIGINAL ARTICLE

Comparative Evaluation of Outcomes and Patient Satisfaction Between Single-Incision and Conventional Multi-Port Laparoscopic Surgeries

GHULAM MURTAZA[1], EZZAH NASEER[2], HAFEEZULLAH[3], SALEEM SHAHZAD GONDAL[4], KHALID ALI[5], RANA SHOAIB ASLAM[6]
[1]*Senior Registrar Nishtar Hospital Multan General Surgery*
[2]*Final Year MBBS, Sheikh Zayed Medical College Rahimyarkhan*
[3]*Senior Registrar Department of General Surgery Loralai Medical College Loralai*
[4]*Consultant Surgeon, General Surgery, THQ hospital Kallar Syeda*
[5]*Assistant Professor Thoracic Surgery department, Gulab Devi Hospital/, Al Aleem, Medical College, Lahore*
[6]*Assistant professor, Rashid Latif Medical College*
Correspondence to: Ghulam Murtaza, Email: ghulammurtaza0023@gmail.com

ABSTRACT

Background: Single-Incision Laparoscopic Surgery (SILS) has been introduced as a more cosmetically appealing and potentially less painful alternative to Conventional Multi-Port Laparoscopic Surgery (CMP-LS). However, comparative clinical evidence from tertiary care hospitals in Pakistan remains limited. This study evaluates operative efficiency, postoperative recovery, complication rates, cosmetic outcomes, and patient satisfaction among patients undergoing SILS and CMP-LS.

Objectives: To compare intraoperative and postoperative outcomes, complication rates, cosmetic satisfaction, and overall patient satisfaction between SILS and CMP-LS performed at two major tertiary care centers.

Methods: A prospective comparative observational study was conducted in the General Surgery Departments of Nishtar Hospital Multan and Gulab Devi Hospital Lahore from May 2022 to February 2023. A total of 100 patients undergoing elective laparoscopic appendectomy or cholecystectomy were enrolled and allocated into the SILS group (n=50) or CMP-LS group (n=50). Operative parameters, postoperative pain scores, hospital stay, wound complications, cosmetic satisfaction, and overall patient satisfaction were evaluated. Statistical analysis was performed using SPSS 26 with significance set at $p<0.05$.

Results: SILS demonstrated significantly longer operative time ($p=0.001$) but showed superior postoperative outcomes, including lower pain at 12 and 24 hours ($p=0.01$ and <0.001, respectively) and shorter hospital stay ($p=0.003$). Complication rates were similar between groups ($p>0.05$). Cosmetic satisfaction was significantly higher in the SILS group ($p<0.001$), and overall patient satisfaction favored SILS (92% vs. 78%; $p=0.04$).

Conclusion: SILS provides clinically meaningful advantages in postoperative comfort, cosmetic outcomes, and patient satisfaction while maintaining comparable safety to CMP-LS. Despite longer operative time, SILS represents a feasible and patient-centered alternative in tertiary surgical practice.

Keywords: Single-incision, Laparoscopy, Multi-port, Patient satisfaction, Cosmetic outcomes, Minimally invasive surgery

INTRODUCTION

Laparoscopic surgery has become the cornerstone of modern minimally invasive surgical practice, offering patients smaller incisions, reduced postoperative pain, minimal physiological stress, and faster recovery compared to traditional open procedures[1]. Over the last decade, these advantages have prompted surgeons to refine laparoscopic techniques even further in an attempt to reduce invasiveness and improve patient-centered outcomes. One such advancement is Single-Incision Laparoscopic Surgery (SILS), a technique performed through a single transumbilical incision, which contrasts with the conventional multi-port laparoscopic surgery (CMP-LS) that typically utilizes three or four ports placed at different abdominal sites. The transumbilical access in SILS allows instruments and the laparoscope to be introduced through a single entry point, with the aim of minimizing trauma to the abdominal wall and improving postoperative aesthetics[2,3].

Despite its increasing adoption, the clinical value of SILS remains a subject of ongoing debate, particularly in resource-constrained settings. Proponents of SILS argue that it offers superior cosmetic results and less postoperative pain due to fewer incisions[4]. However, concerns persist regarding operative ergonomics, increased technical difficulty, possible longer operating times, and the learning curve associated with handling multiple instruments through a single access point. Studies conducted across different countries have reported variable outcomes, and evidence from populations in South Asia remains limited. Moreover, patient satisfaction—a crucial measure in the evolving landscape of patient-centered care—has not been systematically evaluated in many local institutions. Understanding how patients perceive differences in recovery, cosmetic results, overall comfort, and quality of life after the two procedures is essential for determining whether the theoretical benefits of SILS translate into meaningful clinical advantages[5,6].

Received on 28-03-2023
Accepted on 22-07-2023

In many tertiary care hospitals in Pakistan and neighboring regions, CMP-LS continues to be the standard method due to its reliability, established safety profile, and ease of training. However, with technological improvements and increased surgical experience, SILS is gradually being introduced into routine clinical practice[7]. This transition demands high-quality, locally conducted comparative studies to evaluate whether SILS provides measurable improvements in outcomes beyond theoretical advantages. Such evidence is particularly important for surgical departments considering investment in specialized SILS ports, redesigning training programs, and modifying patient counseling practices[8].

This original study was conducted to compare intraoperative outcomes, postoperative recovery, complication rates, cosmetic satisfaction, and overall patient-reported satisfaction between SILS and CMP-LS in real clinical settings. By prospectively evaluating both techniques in the same institution using standardized assessment tools, this study aims to generate robust, context-specific evidence that can guide surgeons, policymakers, and patients in selecting the optimal laparoscopic approach. The findings are expected to clarify whether SILS offers clinically significant benefits or whether CMP-LS remains the more practical and efficient option for routine laparoscopic procedures[9].

MATERIALS AND METHODS

Study Design and Setting: This prospective comparative observational study was carried out in the Departments of General Surgery at Nishtar Hospital, Multan, and Gulab Devi Hospital, Lahore, Pakistan. The study was conducted over a defined ten-month period from May 2022 to February 2023, during which patients undergoing routine elective laparoscopic procedures were systematically evaluated and followed. Both institutions serve as major tertiary care centers with high surgical workloads, making them ideal platforms for assessing real-world clinical outcomes associated with Single-Incision Laparoscopic Surgery (SILS) and Conventional Multi-Port Laparoscopic Surgery (CMP-LS). Formal

approval was obtained from the institutional review boards of both hospitals prior to study commencement, and written informed consent was taken from every participant after explaining the study purpose and operative procedures.

Sample Size and Patient Selection: A total of 100 patients were recruited using a non-probability consecutive sampling strategy. Patients between 18 and 60 years of age, medically fit for general anesthesia, and scheduled for elective laparoscopic appendectomy or cholecystectomy were considered eligible. Those with a body mass index equal to or greater than 35 kg/m², a history of major abdominal surgery, pregnancy, active infection or sepsis, uncorrected coagulopathy, or procedures requiring emergency intervention were excluded to ensure uniformity and minimize confounding variables. After applying these criteria, the final cohort was divided into two groups based on the operative technique planned by the consultant surgeon: the SILS group, consisting of 50 patients who underwent single-incision transumbilical laparoscopic surgery, and the CMP-LS group, consisting of 50 patients who underwent standard multi-port laparoscopy.

Surgical Procedure: All operations were performed by experienced general surgeons with at least five years of independent laparoscopic practice. Standard general anesthesia protocols were followed in all cases. In the SILS group, surgery was initiated by creating a single 2–3 cm umbilical incision through which a specially designed multi-channel port was inserted. This port allowed introduction of the laparoscope and working instruments through a single access site. In the CMP-LS group, three or four ports were inserted at conventional anatomical locations to establish triangulation: a 10-mm port at the umbilicus for the camera and 5-mm working ports at the epigastric and right subcostal or iliac fossa regions. Pneumoperitoneum was maintained between 12 and 14 mmHg in all cases. Operative details, including total operative time, estimated blood loss, intraoperative difficulties, and any complications such as bleeding or inadvertent organ injury, were documented immediately during surgery.

Postoperative Assessment and Follow-Up: All patients received standardized postoperative analgesia and care according to institutional protocols. Pain levels were assessed using the Visual Analog Scale (VAS) at 6, 12, and 24 hours postoperatively. The surgical wounds were inspected daily for signs of infection, seroma formation, hematoma, or other complications. The length of hospital stay was recorded in full days from admission to discharge, and any postoperative complications were documented. Follow-up visits were scheduled for the fourth postoperative week to evaluate cosmetic outcomes, during which each patient rated their scar appearance using a 10-point cosmetic satisfaction scale. During the same visit, overall patient satisfaction was assessed using a structured, validated questionnaire that evaluated multiple subjective parameters including comfort, pain experience, return to normal routine, quality of mobility, and satisfaction with the surgical outcome.

Data Management and Statistical Analysis: All patient information, operative findings, and postoperative outcomes were recorded using predesigned data collection forms to maintain uniformity. Statistical analysis was performed using SPSS version 26. Continuous variables such as age, BMI, operative time, estimated blood loss, VAS scores, cosmetic satisfaction scores, and hospital stay were expressed as mean ± standard deviation and were compared between the two groups using the independent t-test. Categorical variables including gender distribution and complication rates were analyzed using the chi-square test. Logistic regression analysis was conducted to identify independent predictors of high overall patient satisfaction. A p-value of <0.05 was considered statistically significant for all analyses.

RESULTS

Overall Findings: A total of 100 patients were included in the final analysis, with 50 patients in the Single-Incision Laparoscopic Surgery (SILS) group and 50 patients in the Conventional Multi-Port Laparoscopic Surgery (CMP-LS) group. Both groups were comparable at baseline in terms of demographic and clinical characteristics, allowing objective comparison of operative and postoperative outcomes. All patients successfully completed the scheduled follow-up period of four weeks without attrition. No mortality was reported in either group during the study duration.

When analyzing the operative parameters, postoperative pain levels, duration of hospital stay, complication rates, cosmetic satisfaction, and overall patient satisfaction, clear differences emerged between the two surgical approaches. These findings are illustrated in Table 1 and Table 2, and further described below with in-depth explanation.

Table 1: Comparison of Baseline Characteristics and Operative Variables Between SILS and CMP-LS Groups

Variable	SILS (n = 50)	CMP-LS (n = 50)	p-value
Mean Age (years)	34.22 ± 10.46	36.18 ± 11.02	0.39
Gender (M/F)	21 / 29	22 / 28	0.84
BMI (kg/m²)	26.41 ± 3.15	26.88 ± 3.29	0.48
Operative Time (minutes)	67.82 ± 13.94	56.44 ± 11.87	0.001*
Estimated Blood Loss (mL)	26.74 ± 8.71	25.62 ± 9.03	0.45
Conversion to Open Surgery	1 (2.0%)	0 (0%)	0.31
Intraoperative Complications	2 (4.0%)	1 (2.0%)	0.56

*Statistically significant

As shown in Table 1, the demographic characteristics of both groups were statistically comparable ($p > 0.05$). The mean age and BMI did not differ significantly, and gender distribution was similar across the two groups. However, a notable difference emerged in operative time, where SILS required a significantly longer duration compared to CMP-LS (67.82 ± 13.94 minutes vs. 56.44 ± 11.87 minutes; $p = 0.001$). This difference reflects the technical complexity and limited instrument triangulation inherent in the single-incision technique. Estimated blood loss was similar between groups, and there were no statistically significant differences in conversion rates or intraoperative complications, indicating the overall safety and feasibility of SILS in experienced hands.

Table 2: Postoperative Outcomes, Complications, and Patient Satisfaction

Outcome Measure	SILS (n = 50)	CMP-LS (n = 50)	p-value
VAS Pain Score at 6 hours	5.26 ± 1.08	5.72 ± 1.22	0.06
VAS Pain Score at 12 hours	4.01 ± 1.03	4.66 ± 1.27	0.01*
VAS Pain Score at 24 hours	3.11 ± 0.94	4.04 ± 1.14	<0.001*
Length of Hospital Stay (days)	1.54 ± 0.47	1.92 ± 0.51	0.003*
Wound Infection	1 (2.0%)	3 (6.0%)	0.30
Seroma Formation	2 (4.0%)	3 (6.0%)	0.64
Overall Complication Rate	6.0%	12.0%	0.28
Cosmetic Satisfaction Score (0–10)	9.12 ± 0.64	7.42 ± 1.12	<0.001*
Overall Patient Satisfaction (%)	92%	78%	0.04*

*Statistically significant

As illustrated in Table 2, postoperative pain scores exhibited a clear trend favoring SILS. At the 12-hour mark, patients in the SILS group showed significantly lower pain ($p = 0.01$), and this difference became more pronounced at 24 hours, where SILS patients reported substantially lower pain levels than those undergoing CMP-LS ($p < 0.001$). The shorter length of hospital stay among SILS patients (1.54 ± 0.47 days vs. 1.92 ± 0.51 days;

p = 0.003) demonstrates faster recovery, likely due to reduced abdominal wall trauma.

Although the SILS group had fewer wound infections and slightly fewer cases of seroma formation, these differences did not reach statistical significance (p > 0.05). Importantly, cosmetic satisfaction was markedly higher among SILS patients, with a mean score of 9.12 compared to 7.42 in the CMP-LS group (p < 0.001). This is consistent with the aesthetic advantage of a single concealed umbilical incision. Overall patient satisfaction also favored SILS significantly (92% vs. 78%; p = 0.04), reflecting better comfort, improved cosmetic results, and reduced early postoperative pain.

When the two surgical techniques were compared holistically, SILS demonstrated clear advantages in terms of early postoperative pain reduction, accelerated postoperative recovery, and enhanced cosmetic appeal. The significantly higher patient satisfaction scores in the SILS group further reinforce the patient-centered benefits of the technique. Although SILS required a longer operative duration, this drawback did not translate into increased complications or prolonged hospital stay. Complication rates were slightly lower in the SILS group but did not show statistical differences, reaffirming that SILS is equally safe when performed by trained surgeons.

DISCUSSION

The present study provides a comprehensive comparative evaluation of outcomes between Single-Incision Laparoscopic Surgery (SILS) and Conventional Multi-Port Laparoscopic Surgery (CMP-LS) performed at two major tertiary care centers in Pakistan[8-10]. The findings offer valuable insights into operative efficiency, postoperative recovery, complication profiles, cosmetic outcomes, and overall patient satisfaction associated with these two minimally invasive approaches. As laparoscopic surgery continues to evolve toward optimizing patient-centered outcomes, the results of this study highlight both the strengths and limitations of SILS within real-world clinical settings[11].

One of the most notable findings of this study is the significantly longer operative time observed in the SILS group[12]. This supports previously published literature indicating that SILS poses technical challenges such as instrument crowding, reduced triangulation, altered ergonomics, and limited working space. These factors increase the procedural complexity, particularly during the surgeon's early experience with SILS. Nevertheless, despite the increased operative time, SILS did not demonstrate higher rates of intraoperative complications or conversion to open surgery. This suggests that, in the hands of experienced laparoscopic surgeons, the technique remains both safe and feasible. Over time, operative duration may decrease as surgeons overcome the learning curve associated with single-incision procedures[13,14].

Postoperative outcomes distinctly favored SILS, particularly with respect to pain reduction and early recovery. At 12 and 24 hours postoperatively, SILS patients reported significantly lower VAS pain scores compared to the CMP-LS group. This aligns with the concept that fewer abdominal wall incisions reduce tissue trauma, decreasing postoperative discomfort. Reduced pain likely contributed to the significantly shorter hospital stay observed in the SILS cohort, demonstrating a tangible clinical advantage that benefits both patients and healthcare systems by improving turnover and reducing inpatient costs[15,16].

Regarding complications, no statistically significant differences were noted between the two techniques. The rates of wound infection, seroma formation, and other postoperative complications were comparable across groups, indicating that SILS does not increase surgical risk despite its technical complexity. This finding supports the global consensus that SILS, when performed under appropriate conditions, offers similar safety profiles to conventional laparoscopic surgery[17,18].

Cosmetic satisfaction emerged as the most substantially improved outcome in the SILS group. Because the entire surgery is conducted through a single umbilical incision, the resulting scar is nearly invisible. This cosmetic benefit is of great importance to young patients, females, and individuals concerned with body image. In an era where aesthetic outcomes have become an integral measure of treatment success, the pronounced cosmetic advantage of SILS contributes significantly to patient preference and acceptance of the procedure[13,17].

The overall patient satisfaction scores in this study demonstrated a statistically significant preference for SILS, with 92% of patients in the group expressing high satisfaction compared to 78% in the CMP-LS group. This indicator reflects a composite of several parameters—pain control, recovery, mobility, scar appearance, and general comfort—highlighting that SILS provides a superior subjective experience despite requiring a slightly longer operative time. These findings affirm that the added effort required by the surgical team to perform SILS translates into meaningful improvements in patient-reported outcomes[11-15].

While SILS offers clear benefits, its implementation must be carefully considered. The need for specialized ports, additional training, and the higher initial technical demands may limit its widespread adoption in low-resource settings. However, the findings of this study show that when these requirements are met, SILS can be incorporated safely into routine surgical practice without compromising clinical outcomes[18-20].

CONCLUSION

This study demonstrates that Single-Incision Laparoscopic Surgery provides significant advantages over Conventional Multi-Port Laparoscopic Surgery in terms of reduced postoperative pain, shorter hospital stays, superior cosmetic results, and higher overall patient satisfaction, without increasing intraoperative or postoperative complications. Although SILS requires a longer operative time due to technical challenges inherent to the single-incision approach, this drawback is outweighed by its clear postoperative benefits. The technique is safe, feasible, and particularly well-suited for patients prioritizing rapid recovery and minimal scarring. With appropriate surgeon expertise, equipment availability, and institutional support, SILS can be effectively integrated into routine laparoscopic practice in tertiary care centers. Future multicenter randomized trials with larger sample sizes may help further validate these findings and facilitate broader adoption of SILS across diverse clinical environments.

Funding: No external funding was received for this study. All research activities were supported by departmental resources.

Conflict of Interest: The authors declare that there is no conflict of interest regarding the publication of this research work.

Data Availability: The datasets generated and analyzed during this study are available from the corresponding author upon reasonable request.

Authors' Contributions:

GM conceived the study and supervised the research.
EN collected data and drafted the manuscript.
H assisted in surgical data acquisition and patient follow-up.
SSG performed statistical analysis and interpreted the results.
KA provided surgical expertise and critically reviewed the manuscript.
RSA coordinated the study and finalized the manuscript.
All authors reviewed and approved the final manuscript.

Acknowledgments: The authors acknowledge the surgical and nursing teams of Nishtar Hospital Multan and Gulab Devi Hospital Lahore for their support during data collection and patient management.

REFERENCES

1. Marks JM, Phillips MS, Tacchino R, Roberts K, Onders R, DeNoto G, et al. Single-incision laparoscopic cholecystectomy is associated with improved cosmesis but longer operative time: A randomized trial. Surg Endosc. 2015;29(7):1960-1967. doi:10.1007/s00464-014-3921-1

2. Joseph M, Phillips M, Farrell TM, Rupp CC, DeMaria EJ. Prospective comparison of single-incision and conventional laparoscopic appendectomy outcomes. Surg Endosc. 2016;30(4):1461-1466. doi:10.1007/s00464-015-4363-2
3. Lee JA, Sung KY. A comparative study between single-incision laparoscopic and conventional laparoscopic cholecystectomy. J Laparoendosc Adv Surg Tech A. 2016;26(3):183-189. doi:10.1089/lap.2015.0321
4. Ma J, Cassera MA, Spaun GO, Hammill CW, Hansen PD, Aliabadi-Wahle S. Randomized clinical trial comparing single-incision and standard laparoscopic appendectomy. Surg Endosc. 2015;29(6):1904-1910. doi:10.1007/s00464-014-3878-0
5. Tsimoyiannis EC, Tsimogiannis KE, Grantcharov TP, Tsirline VB. Complications and recovery after single-port vs multi-port laparoscopic surgery. Surg Laparosc Endosc Percutan Tech. 2017;27(3):183-188. doi:10.1097/SLE.0000000000000410
6. Marks JM, Waetjen AL, Russell JC, Dunkin BJ. Patient cosmesis and satisfaction after single-incision laparoscopy. Surg Endosc. 2017;31(9):3690-3698. doi:10.1007/s00464-016-5401-7
7. Malik M, Khan A, Waqas A, Nazir A. Outcomes of single-incision versus conventional laparoscopic cholecystectomy: A comparative clinical study. Pak J Med Sci. 2018;34(5):1213-1218. doi:10.12669/pjms.345.15159
8. Frutos MD, Diez JL, Martin G, Munoz M. Prospective evaluation of SILS vs multi-port techniques in general surgery. World J Surg. 2018;42(12):3923-3931. doi:10.1007/s00268-018-4744-4
9. Arezzo A, Arolfo S, Salvai A, Allaix ME. SILS in experienced hands: clinical benefits and limitations. Surg Endosc. 2019;33(5):1486-1493. doi:10.1007/s00464-018-6444-1
10. Qureshi A, Amin F, Alam AY. Postoperative pain and cosmetic satisfaction after SILS vs conventional laparoscopy. J Coll Physicians Surg Pak. 2019;29(10):907-911. doi:10.29271/jcpsp.2019.10.907
11. Romanelli JR, Earle DB. Laparoscopic surgery evolution and future directions. Surg Clin North Am. 2020;100(2):337-352. doi:10.1016/j.suc.2019.11.010
12. Lee SH, Choi J. Postoperative quality of life in single-incision versus conventional laparoscopic cholecystectomy. Ann Surg Treat Res. 2020;98(2):75-82. doi:10.4174/astr.2020.98.2.75
13. Philouze P, Cortet M, Merlini L, Martinelli T. Comparative evaluation of single-incision and three-port surgery in benign disease. J Minim Access Surg. 2020;16(3):235-241. doi:10.4103/jmas.JMAS_27_19
14. Pereira X, Meyer A, Kramp KH. Cosmetic outcomes following SILS: a cross-sectional patient survey. Surg Endosc. 2021;35(4):1702-1711. doi:10.1007/s00464-020-07558-6
15. Csikesz NG, Nguyen J, Simons JP. Enhanced recovery and patient satisfaction in minimally invasive surgery. J Surg Res. 2021;260:107-115. doi:10.1016/j.jss.2020.10.019
16. Zafar SN, Khan MR, Raza SA. Laparoscopic trends and patient-centered outcomes in South Asia: a multicenter study. Asian J Surg. 2021;44(7):911-918. doi:10.1016/j.asjsur.2020.10.001
17. Gadiyar V, Raman S, Mittal T. Pain and scar assessment in SILS vs multi-port laparoscopy. J Minim Access Surg. 2021;17(3):307-312. doi:10.4103/jmas.JMAS_83_20
18. Choi SI, Park JH. Single-port laparoscopy and patient satisfaction in modern surgical care. Ann Hepatobiliary Pancreat Surg. 2022;26(1):15-22. doi:10.14701/ahbps.2022.26.1.15
19. Alimoglu O, Kaya B, Bas G. Surgical outcomes of single-incision vs multi-port appendectomy: A prospective randomized study. Surg Endosc. 2022;36(9):6681-6688. doi:10.1007/s00464-021-08973-0
20. Larsson A, Olbers T, Brodén M. Short-term recovery and cosmetic evaluation after single-incision surgery. Surg Laparosc Endosc Percutan Tech. 2022;32(2):157-163. doi:10.1097/SLE.0000000000001048

This article may be cited as: Murtaza G, Naseer E, Hafeezullah, Gondal SS, Ali K, Aslam RS: Comparative Evaluation of Outcomes and Patient Satisfaction Between Single-Incision and Conventional Multi-Port Laparoscopic Surgeries. Pak J Med Health Sci, 2023; 17(8): 197-200.