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COMPARATIVE ANALYSIS OF CLINICAL OUTCOMES OF THREE-PORT VERSUS STANDARD FOUR-PORT LAPAROSCOPIC CHOLECYSTECTOMY AT A TERTIARY CARE CENTRE

Abhay Singhal[1], *Milind Gautam*[1], *Shaleen Jain*[1]

[1]*Associate Professor, Department of General Surgery, Saraswati Institute of Medical Sciences, Hapur, Uttar Pradesh, India.*

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Corresponding Author:
Dr. Milind Gautam,
Associate Professor, Department of General Surgery, Saraswati Institute of Medical Sciences, Hapur, Uttar Pradesh, India.
Email: meet2milind@gmail.com

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ABSTRACT

Background: Laparoscopic cholecystectomy (LC) is the gold standard treatment for symptomatic gallstone disease, with the conventional four-port technique widely practiced. However, increasing emphasis on minimally invasive approaches has encouraged the adoption of reduced-port techniques such as three-port LC, which may offer benefits in postoperative pain, cosmetic satisfaction, and recovery without compromising operative safety. Evaluating these two approaches in a controlled setting is essential to determine whether reducing the number of ports can enhance patient outcomes while maintaining procedural efficacy. The aim is to analyze comparatively clinical outcomes of three-port versus standard four-port laparoscopic cholecystectomy at a tertiary care centre.

Materials and Methods: This prospective comparative study included 88 patients allocated into two equal groups: Group A underwent three-port LC, while Group B underwent conventional four-port LC. Adult patients aged 18–70 years with symptomatic cholelithiasis were included, whereas those with acute cholecystitis, choledocholithiasis, gallbladder empyema, previous upper abdominal surgery, or significant comorbidities were excluded. Standardized operative protocols were used in all cases. Perioperative parameters including operative time, intraoperative blood loss, complications, conversion rates, and need for additional port placement were documented. Postoperative outcomes such as VAS pain scores at 6, 12, and 24 hours, analgesia requirement, nausea/vomiting, wound complications, length of hospital stay, time to resume routine activities, and cosmetic satisfaction were recorded. Data were analyzed using SPSS version 25.0, with $p \leq 0.05$ considered statistically significant.

Results: Demographic variables were comparable between both groups. Three-port LC demonstrated significantly shorter operative time (47.36 ± 8.42 vs. 54.91 ± 9.15 minutes; $p = 0.001$) and lower blood loss (41.82 ± 11.27 vs. 49.75 ± 12.14 mL; $p = 0.004$). Pain scores at all intervals were significantly lower in the three-port group ($p < 0.01$). Hospital stay was shorter (1.36 ± 0.48 vs. 1.77 ± 0.62 days; $p = 0.001$), and cosmetic satisfaction was higher (8.36 ± 0.92 vs. 7.23 ± 1.11; $p < 0.001$). Complication and conversion rates were similar.

Conclusion: Three-port laparoscopic cholecystectomy is a safe, efficient, and patient-friendly alternative to the standard four-port technique, offering advantages in postoperative pain, recovery, and cosmetic satisfaction without compromising surgical safety.

Keywords: Three-port cholecystectomy, Four-port cholecystectomy, Laparoscopic surgery, Gallstone disease, Minimally invasive surgery.

INTRODUCTION

Laparoscopic cholecystectomy (LC) is one of the most frequently performed abdominal operations worldwide, reflecting the high global burden of gallbladder and biliary tract disease. Gallstone disease is strongly associated with aging populations, obesity, metabolic syndrome, and changing dietary habits, and remains a major cause of hospital admissions for biliary colic, acute cholecystitis, and other gallstone-related complications. In many regions, gallbladder disease constitutes a substantial proportion of general surgical workload, with a marked predominance among women and working-age adults, translating into both direct healthcare costs and indirect socioeconomic impact through workdays lost and reduced productivity.[1] These epidemiological trends have driven continuous efforts to refine surgical techniques that can provide definitive treatment with minimal morbidity and rapid return to normal activities. Since its introduction in the late 1980s, LC has replaced open cholecystectomy as the gold standard treatment for symptomatic cholelithiasis and most forms of benign gallbladder disease. Compared with open surgery, LC offers smaller incisions, reduced postoperative pain, fewer wound-related complications, shorter hospital stay, and faster convalescence, while achieving comparable rates of symptom resolution and long-term outcomes.[2] Standard LC is traditionally performed using four ports, allowing triangulation of instruments, effective fundal retraction, and safe exposure of Calot's triangle to achieve the critical view of safety. Over time, accumulating experience and advances in equipment have encouraged surgeons to modify port number, size, and position to further enhance patient comfort and cosmetic results without compromising operative safety. One of the most widely adopted modifications is the reduction from four to three ports. The classical three-port technique typically omits the lateral right subcostal port used for fundal retraction, relying instead on strategic manipulation of the infundibulum to expose Calot's triangle. The rationale is that eliminating one incision may reduce tissue trauma, postoperative pain, and port-site–related complications, while improving cosmetic satisfaction. Several randomized trials and observational studies have suggested that three-port LC is technically feasible and safe in appropriately selected patients, with comparable conversion and complication rates to the standard four-port approach.[3] However, concerns persist that reducing the number of ports may limit retraction, narrow the operative field, and potentially increase operative difficulty, especially for less experienced surgeons or in complex gallbladders. High-level evidence comparing three-port and four-port techniques has grown in recent years. A systematic review and meta-analysis of randomized trials including more than 2000 patients reported that three-port LC was associated with significantly lower postoperative analgesia requirements and slightly shorter hospital stay, while showing no difference in operative time, overall success rates, or adverse events when compared with four-port LC.[3] These findings support the concept that, in experienced hands, a reduced-port approach can maintain operative safety while conferring measurable benefits in early postoperative recovery. More recently, a network of comparative and technical studies has examined port configuration in the broader context of minimally invasive cholecystectomy, reinforcing that fewer ports and smaller trocar diameters may contribute to improved pain scores and cosmetic outcomes, provided that fundamental principles of safe dissection are strictly observed.[4] Nonetheless, the evidence is not entirely uniform. Some studies of modified three-port techniques using specialized devices, such as internal vacuum-based liver retractors, have shown that while three-port LC is feasible, it may be associated with longer operative times, technical challenges in obtaining adequate exposure of Calot's triangle, and no clear advantage in postoperative pain or complications compared with conventional four-port LC.[5] These data highlight that the benefits of port reduction depend not only on the number of ports but also on the specific technique, learning curve, and institutional practice patterns. They also emphasize that any modification to standard LC must be evaluated against the overriding priority of preventing bile duct injury and other serious complications. In parallel, newer comparative studies have focused specifically on three-port LC performed with conventional instruments in routine practice. Recent prospective and retrospective series have reported that three-port LC can achieve similar operative times, conversion rates, and intraoperative complication profiles as the four-port technique, while significantly reducing early postoperative pain, analgesic requirements, and length of hospital stay.[6,7] Patient-reported cosmetic satisfaction has also been consistently higher with fewer incisions, reflecting an increasingly important patient expectation in elective benign surgery. However, many of these studies are single-center, involve relatively small sample sizes, and are influenced by surgeon experience and local protocols, which may limit the generalizability of their conclusions. Recent reviews have also placed three-port LC within the broader evolution of minimally invasive gallbladder surgery, which includes mini-laparoscopic, single-incision, and robotic approaches.4 While single-incision and ultra-minimal access techniques may offer superior cosmetic outcomes, they are often more technically demanding, require specialized equipment, and have not gained widespread adoption due to concerns about operative time, hernia risk, and cost.[2] In contrast, three-port LC uses standard laparoscopic instruments and familiar port sites, making it an attractive, low-cost, and easily adoptable modification in resource-limited settings and high-

volume public hospitals. This is particularly relevant for tertiary care centers, where case load is high and incremental improvements in pain control, hospital stay, and patient satisfaction can translate into meaningful system-level benefits. Present study was conducted to analyze comparatively clinical outcomes of three-port versus standard four-port laparoscopic cholecystectomy at a tertiary care centre.

MATERIALS AND METHODS

The investigation focused on adult patients with symptomatic gallstone disease who were planned for elective laparoscopic cholecystectomy at Department of General Surgery, Saraswati Institute of Medical Sciences, Hapur, Uttar Pradesh, India. All procedures were performed by consultants experienced in minimally invasive surgery using standardized operative protocols to ensure methodological uniformity. A total of 88 patients were included in the study. Patients were selected through non-probability consecutive sampling. Inclusion criteria comprised adult patients aged 18–70 years with symptomatic cholelithiasis confirmed by ultrasonography and deemed fit for general anesthesia. Patients with acute cholecystitis, choledocholithiasis, gallbladder empyema, previous major upper abdominal surgeries, severe cardiopulmonary comorbidities, or suspected gallbladder malignancy were excluded. After eligibility screening, patients were allocated into two groups: Group A underwent three-port laparoscopic cholecystectomy, and Group B underwent standard four-port laparoscopic cholecystectomy.

Methodology

All patients underwent a uniform preoperative evaluation including clinical history, physical examination, routine laboratory investigations (complete blood count, liver function tests, serum electrolytes), and abdominal ultrasonography to assess gallbladder morphology and rule out complications. Anesthesia fitness was obtained from the pre-anesthesia clinic, and all patients provided informed written consent after being counseled about the risks and benefits of both surgical techniques.

Both surgical procedures were carried out under general anesthesia with the patient in the supine position. For the three-port technique, access was obtained via an umbilical camera port, a subxiphoid working port, and a single right subcostal port. The four-port technique utilized an additional lateral right subcostal port for retraction. Pneumoperitoneum was established using a standard closed technique. Dissection was performed to obtain the critical view of safety in all cases prior to clipping and dividing the cystic duct and cystic artery. Gallbladder extraction was performed via the umbilical port. Hemostasis, irrigation, and inspection of the operative field were carried out routinely before closure. Conversion to open surgery, if required, was documented along with the underlying reason.

The study assessed multiple perioperative and postoperative parameters to allow comprehensive comparison between the two techniques. Operative parameters included operative time, number of ports used, intraoperative blood loss, ease of gallbladder dissection, intraoperative complications, and need for additional port placement or conversion to open cholecystectomy. Postoperative outcomes included pain scores assessed using the Visual Analog Scale (VAS) at 6, 12, and 24 hours, requirement for rescue analgesia, incidence of postoperative nausea or vomiting, wound complications, port-site infection, length of hospital stay, and time to return to routine activities. Cosmetic satisfaction was evaluated on postoperative follow-up using a standardized patient-reported satisfaction scale.

All patient data were recorded on a structured proforma designed for uniform documentation. Intraoperative findings and events were noted immediately by the operating team, while postoperative observations were recorded by trained ward staff under supervision of the surgical team. Follow-up assessments were carried out in the outpatient clinic, ensuring completeness of data collection for all included patients.

Statistical Analysis: Data were compiled and analyzed using IBM Statistical Package for the Social Sciences (SPSS) version 25.0. Quantitative variables such as operative time, blood loss, pain scores, and hospital stay were expressed as mean ± standard deviation, and comparison between groups was performed using the independent samples t-test for normally distributed data or Mann–Whitney U test for non-normal distributions. Qualitative variables such as intraoperative complications, conversion rates, and wound infection rates were presented as frequencies and percentages, and compared using the chi-square test or Fisher's exact test where appropriate. A p-value of ≤ 0.05 was considered statistically significant.

RESULTS

The baseline demographic characteristics of both groups are shown in [Table 1]. The mean age of patients undergoing three-port laparoscopic cholecystectomy (LC) was 41.82 ± 11.46 years, while the mean age in the four-port LC group was 42.95 ± 10.88 years. The difference was not statistically significant ($p = 0.62$), indicating comparable age distribution between groups. Gender distribution was also similar, with males representing 31.82% in the three-port group and 36.36% in the four-port group ($p = 0.64$). Females constituted the majority in both groups. Mean BMI values were comparable between the groups (27.18 ± 3.55 vs. 27.63 ± 3.42; $p = 0.53$), showing no significant variation in body habitus. All patients in both groups belonged to ASA class I–II, further confirming similar baseline clinical status.

Overall, both groups were demographically and clinically comparable, allowing for a reliable assessment of surgical and postoperative outcomes.

Intraoperative parameters are detailed in [Table 2]. The mean operative time was significantly shorter in the three-port LC group, recorded as 47.36 ± 8.42 minutes, compared with 54.91 ± 9.15 minutes in the four-port LC group (p = 0.001). This clinically meaningful difference indicates that the three-port technique may facilitate a faster surgical procedure. Intraoperative blood loss was also significantly lower in the three-port group (41.82 ± 11.27 mL) compared to the four-port technique (49.75 ± 12.14 mL), with a statistically significant p-value of 0.004. Additional port placement was needed in 3 patients (6.82%) in the three-port group, indicating that some cases required modification of the technique; however, no patient in the four-port group required extra ports. Intraoperative complications occurred in 2 patients (4.55%) in the three-port group and in 3 patients (6.82%) in the four-port group, with no significant difference (p = 0.64). Conversion to open surgery was also comparable, occurring in 1 patient (2.27%) in the three-port group and 2 patients (4.55%) in the four-port group (p = 0.56). These findings demonstrate that both techniques are safe, with similar rates of complications and conversion.

[Table 3] shows a comparison of postoperative pain scores. At all measured intervals—6, 12, and 24 hours after surgery—the three-port LC group demonstrated significantly lower pain scores than the four-port LC group. At 6 hours, the mean VAS score was 4.27 ± 1.02 in the three-port group compared to 5.14 ± 1.21 in the four-port group (p = 0.001). At 12 hours, the difference persisted, with scores of 3.55 ± 0.94 versus 4.32 ± 1.05 respectively (p = 0.002). At 24 hours, pain further decreased in both groups, but remained significantly lower in the three-port group (2.68 ± 0.81 vs. 3.23 ± 0.97; p = 0.006). These results suggest that using one fewer port leads to less postoperative discomfort and potentially faster recovery.

Postoperative outcomes are summarized in [Table 4]. Rescue analgesia was required in 25.00% of patients in the three-port group and 38.64% in the four-port group, although this difference did not reach statistical significance (p = 0.17). Postoperative nausea and vomiting were slightly more common in the four-port group (20.45%) compared to the three-port group (13.64%), but the difference was non-significant (p = 0.40). Port-site infection occurred in 1 patient (2.27%) in the three-port group and 2 patients (4.55%) in the four-port group (p = 0.56). Wound complications followed a similar pattern, occurring in 2.27% vs. 6.82% respectively (p = 0.31). Notably, the mean hospital stay was significantly shorter in the three-port LC group (1.36 ± 0.48 days) compared to the four-port group (1.77 ± 0.62 days), with a significant p-value of 0.001. These findings indicate that while overall complication rates were similar, the three-port technique offers advantages in terms of reduced postoperative pain, lower analgesia requirements, and shorter hospitalization.

Recovery and cosmetic satisfaction outcomes are shown in [Table 5]. Patients undergoing the three-port LC returned to routine activities more quickly, with a mean recovery time of 5.14 ± 1.08 days compared to 6.09 ± 1.22 days in the four-port LC group (p = 0.001). This significant difference may reflect less postoperative pain, reduced tissue trauma, and fewer port-site wounds. Cosmetic satisfaction was significantly higher in the three-port group, with a mean score of 8.36 ± 0.92 on a 10-point scale, compared with 7.23 ± 1.11 in the four-port group (p < 0.001). These findings underscore the cosmetic benefits of reducing the number of incisions and their impact on patient satisfaction.

Table 1: Baseline Demographic Characteristics of Patients (n = 88)

Variable	Three-Port LC (n=44)	Four-Port LC (n=44)	p-value
Mean Age (years)	41.82 ± 11.46	42.95 ± 10.88	0.62
Gender (Male)	14 (31.82%)	16 (36.36%)	0.64
Gender (Female)	30 (68.18%)	28 (63.64%)	—
BMI (kg/m²)	27.18 ± 3.55	27.63 ± 3.42	0.53
ASA I–II	44 (100.00%)	44 (100.00%)	—

Table 2: Intraoperative Parameters

Parameter	Three-Port LC (n=44)	Four-Port LC (n=44)	p-value
Mean Operative Time (minutes)	47.36 ± 8.42	54.91 ± 9.15	0.001
Intraoperative Blood Loss (mL)	41.82 ± 11.27	49.75 ± 12.14	0.004
Additional Port Required	3 (6.82%)	—	—
Intraoperative Complications	2 (4.55%)	3 (6.82%)	0.64
Conversion to Open Surgery	1 (2.27%)	2 (4.55%)	0.56

Table 3: Postoperative Pain Scores (VAS)

Time Interval	Three-Port LC (Mean ± SD)	Four-Port LC (Mean ± SD)	p-value
6 hours	4.27 ± 1.02	5.14 ± 1.21	0.001
12 hours	3.55 ± 0.94	4.32 ± 1.05	0.002
24 hours	2.68 ± 0.81	3.23 ± 0.97	0.006

Table 4: Postoperative Outcomes

Parameter	Three-Port LC (n=44)	Four-Port LC (n=44)	p-value
Rescue Analgesia Required	11 (25.00%)	17 (38.64%)	0.17

Postoperative Nausea/Vomiting	6 (13.64%)	9 (20.45%)	0.40
Port-Site Infection	1 (2.27%)	2 (4.55%)	0.56
Wound Complications	1 (2.27%)	3 (6.82%)	0.31
Mean Hospital Stay (days)	1.36 ± 0.48	1.77 ± 0.62	0.001

Table 5: Recovery and Cosmetic Satisfaction

Parameter	Three-Port LC (n=44)	Four-Port LC (n=44)	p-value
Return to Routine Activities (days)	5.14 ± 1.08	6.09 ± 1.22	0.001
Cosmetic Satisfaction (Score 1–10)	8.36 ± 0.92	7.23 ± 1.11	<0.001

DISCUSSION

In the present study, baseline demographic and clinical characteristics were comparable between the three-port and four-port groups, with mean ages of 41.82 ± 11.46 and 42.95 ± 10.88 years respectively, and a clear female predominance in both groups (68.18% vs. 63.64%). This pattern mirrors the established epidemiology of gallstone disease, where women have a two- to three-fold higher risk of gallstones than men, particularly during the child-bearing years, as described by Novacek et al. (2006).[8] The similarity in BMI (27.18 ± 3.55 vs. 27.63 ± 3.42 kg/m²) and uniformly low ASA status (I–II) between our groups ensured that subsequent differences in perioperative outcomes could reasonably be attributed to port configuration rather than baseline risk profile, reinforcing the internal validity of the comparison.

Our findings demonstrated a significantly shorter mean operative time in the three-port group (47.36 ± 8.42 minutes) compared with the four-port technique (54.91 ± 9.15 minutes; p = 0.001), along with reduced intraoperative blood loss (41.82 ± 11.27 mL vs. 49.75 ± 12.14 mL; p = 0.004). This suggests that eliminating the fourth port did not compromise exposure or technical control and may even streamline operative steps. Kumar et al. (2007) reported similar observations in a randomized trial from Nepal, where three-port laparoscopic cholecystectomy achieved operative times in the same general range as standard four-port surgery while maintaining comparable conversion and complication rates, and offering the additional benefit of fewer scars.[9] Taken together, the consistency between our data and those of Kumar et al. (2007) supports the view that three-port laparoscopic cholecystectomy is at least as efficient as the four-port technique and may modestly improve operative efficiency in experienced hands.

Intraoperative safety outcomes in our series were comparable between techniques: intraoperative complications occurred in 4.55% of three-port cases and 6.82% of four-port cases, while conversion to open surgery was required in only 2.27% and 4.55% of patients, respectively, with no statistically significant difference. A small proportion (6.82%) of patients in the three-port group required insertion of an additional port, highlighting that conversion to a four-port configuration remains an important safety option rather than a failure of the technique. Trichak et al. (2003) similarly randomized 200 patients to three- versus four-port laparoscopic cholecystectomy and found no significant differences in success rate, operating time, or conversion to open surgery between groups; however, the three-port group required fewer injectable analgesic doses (0.4 vs. 0.77 injections; p = 0.024), further underscoring that reducing the number of ports does not compromise safety when performed by experienced surgeons.[10] The comparable complication and conversion rates in both studies reinforce the conclusion that three-port laparoscopic cholecystectomy is a safe modification of the standard approach.

Postoperative pain and analgesia requirements in our cohort consistently favored the three-port technique. Mean VAS scores were significantly lower in the three-port group at 6 hours (4.27 ± 1.02 vs. 5.14 ± 1.21; p = 0.001), 12 hours (3.55 ± 0.94 vs. 4.32 ± 1.05; p = 0.002), and 24 hours (2.68 ± 0.81 vs. 3.23 ± 0.97; p = 0.006). Although the proportion of patients requiring rescue analgesia was numerically lower with three ports (25.00% vs. 38.64%; p = 0.17), the difference did not reach statistical significance, likely due to sample size. Al-Azawi et al. (2007) reported concordant findings in a large comparative series of 495 patients, where three-port cholecystectomy resulted in significantly reduced opiate consumption (mean pethidine 167.23 mg vs. 210.73 mg over 48 hours; p = 0.0001), and the reduction in opiate requirement was directly related to shorter hospital stay.[11] Our study similarly demonstrates that a smaller number of ports is associated with lower pain scores and a trend toward reduced analgesia use, supporting the analgesic benefit of port minimization.

Overall postoperative morbidity in our data—specifically port-site infection and wound complications—was low and comparable between groups, with port-site infection observed in 2.27% vs. 4.55% and wound complications in 2.27% vs. 6.82% of three- and four-port patients, respectively. These small absolute differences did not reach statistical significance but numerically favored the three-port technique. Dilawaiz et al. (2011), in a comparative study from a Pakistani tertiary centre, similarly reported that three-port cholecystectomy yielded complication and conversion rates comparable to the four-port approach, while preserving the advantages of reduced port number and better cosmetic outcome.[12] The alignment of our low infection and wound complication rates with those reported by Dilawaiz et al. (2011) suggests that reducing one port does not increase wound-related morbidity and may,

if anything, slightly decrease the risk of port-site issues.

The marked reduction in early postoperative pain in our three-port group is consistent with other contemporary series that have specifically quantified pain using VAS scores. In our study, the difference in pain between groups remained significant up to 24 hours, with approximately 0.5–0.9 points lower VAS scores at each time interval in the three-port cohort. Bari et al. (2019), in a prospective comparative study of 100 patients (50 in each group), also found significantly lower final postoperative VAS scores in the three-port group (2.30 vs. 2.86; $p = 0.008$), despite similar operative times (29.2 vs. 30.66 minutes) and comparable intraoperative findings.[13] When viewed alongside our data, these results reinforce the concept that, even when surgery duration and technical difficulty are similar, reducing the number of ports provides a consistent, modest but clinically relevant reduction in postoperative pain.

Length of hospital stay and early postoperative recovery further highlight the clinical advantages of the three-port approach in our series. Patients in the three-port group had a significantly shorter mean hospital stay (1.36 ± 0.48 vs. 1.77 ± 0.62 days; $p = 0.001$), without an associated increase in readmissions or postoperative complications. This finding parallels earlier work by Liu et al. (2016), who reported that three-port cholecystectomy resulted in a shorter hospital stay (2.2 ± 1.5 vs. 3.6 ± 1.7 days; $p < 0.05$), lower pain scores at 24 hours (VAS 2.3 ± 2.1 vs. 4.3 ± 2.6; $p < 0.01$), and reduced hospitalization costs compared with the conventional four-port technique.[14] Together, these observations suggest that reducing one port may accelerate immediate postoperative recovery and facilitate earlier discharge while maintaining safety.

Functional recovery and return to routine activities in our study also favored the three-port technique. Patients resumed routine activities significantly earlier after three-port cholecystectomy (5.14 ± 1.08 vs. 6.09 ± 1.22 days; $p = 0.001$), which likely reflects the combined effects of less pain, fewer incisions, and slightly shorter hospital stay. Liu et al. (2016) similarly documented earlier return to normal activity (12 ± 3.8 vs. 20 ± 4.3 hours; $p < 0.01$) and earlier return to work (5.3 ± 2.7 vs. 7.8 ± 2.5 days; $p < 0.05$) in their three-port cohort, along with better scores on the Patient Scar Questionnaire and improved mental health and health perception domains in quality-of-life assessments.[14] When integrated with our findings, this suggests that the benefits of three-port cholecystectomy extend beyond purely clinical endpoints to tangible improvements in early functional recovery and patient-reported outcomes.

Cosmetic satisfaction in our study was significantly higher in the three-port group (mean 8.36 ± 0.92 vs. 7.23 ± 1.11 on a 10-point scale; $p < 0.001$), underscoring the importance of incision number and placement for patient perception of outcome in otherwise similar operations. Yuvaraj et al. (2022) likewise reported that three-port laparoscopic cholecystectomy achieved less postoperative pain, reduced analgesic requirement, and shorter operating time compared with the four-port technique, while maintaining similar complication and conversion rates; the authors concluded that beginning with three ports and adding a fourth only when required is a safe and cosmetically superior strategy.[15] The concordance of our cosmetic satisfaction scores with these findings supports the practice of adopting three-port laparoscopic cholecystectomy as the default approach in elective cases at tertiary care centres, reserving the fourth port for selected difficult situations.

CONCLUSION

The present study demonstrates that three-port laparoscopic cholecystectomy is a safe and effective alternative to the standard four-port technique, with comparable intraoperative complication and conversion rates. The three-port approach significantly reduced operative time, intraoperative blood loss, postoperative pain, and hospital stay, while also improving cosmetic satisfaction and accelerating return to routine activities. These findings suggest that three-port LC can be routinely adopted in elective cases at tertiary care hospitals without compromising surgical safety. Overall, reducing one port provides meaningful clinical and patient-centered advantages while maintaining the operative reliability of the conventional technique.

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