

# Comparative Study Between Standard Four-Port Versus Three-Port Laparoscopic Cholecystectomy

Smit Patel<sup>1</sup>, C.K. Jakhmola<sup>2</sup>, Shahnawaz Ahmad<sup>3</sup>

<sup>1</sup>PG 3rd Year Department of General Surgery, Teerthanker Mahaveer Medical College & Research Centre, Moradabad, India. <sup>2</sup>Professor, Department of General Surgery, Teerthanker Mahaveer Medical College & Research Centre, Moradabad, India. <sup>3</sup>Assistant Professor, Department of General Surgery, Teerthanker Mahaveer Medical College & Research Centre, Moradabad, India

## Abstract

**Background:** Laparoscopic cholecystectomy (LC) has become the gold standard for the management of symptomatic gallstone disease. Modifications such as reducing the number of ports has been explored to improve patient outcomes. The objective is to compare the clinical outcomes of standard four-port versus three-port laparoscopic cholecystectomy. **Material and Methods:** A prospective randomized study was conducted on 96 patients with symptomatic cholelithiasis, divided equally into two groups: Group A (four-port LC) and Group B (three-port LC). Parameters evaluated included operative time, conversion to open surgery, postoperative complications, pain, hospital stay, return to normal activity, and patient satisfaction. **Results:** Mean operative time was significantly higher in Group B ( $63.89 \pm 7.91$  minutes) than Group A ( $57.10 \pm 7.49$  minutes). Postoperative pain scores were lower in Group B (VAS 4.67) compared to Group A (VAS 6.10). No conversions to open surgery were recorded. Group B also had a quicker return to normal activity (11.31 vs. 14.97 days) and shorter hospital stay (4.52 vs. 4.75 days). **Conclusion:** Three-port LC is as safe and effective as four-port LC, with added benefits of reduced pain and quicker recovery. It is a viable alternative in experienced hands.

**Keywords:** Laparoscopic cholecystectomy, Three-port, Four-port, Cholelithiasis.

Received: 17 June 2025

Revised: 27 July 2025

Accepted: 19 August 2025

Published: 28 August 2025

## INTRODUCTION

The gallbladder is a pear-shaped organ located in the right upper abdomen, primarily involved in storing and releasing bile. Gallbladder disease, particularly cholelithiasis (gallstones), is a common condition, with an incidence of 4.3% in India and prevalence ranging from 10–20% among adults.<sup>[1]</sup>

Laparoscopic cholecystectomy (LC) has become the gold standard for managing symptomatic and complicated gallstone disease. Compared to open cholecystectomy, LC offers faster recovery, reduced postoperative morbidity, and shorter hospital stays, despite a slightly higher conversion rate.<sup>[2]</sup> First introduced by Phillip Mouret in 1987 and popularized by Dubois and Perissat in 1990,<sup>[3]</sup> LC typically uses four ports. The fourth (lateral) port assists in retracting the gallbladder fundus to expose Calot's triangle.

With increasing surgical expertise and technological advances, modifications such as reduced port size and number have emerged. Experienced surgeons have successfully performed LC using three ports without compromising safety or efficacy.<sup>[4,5]</sup> The three-port approach offers benefits like reduced bleeding, postoperative pain, hospital stay, and better cosmetic outcomes.

Although most surgeons still prefer the four-port technique, many now question the necessity of the fourth port, especially when effective exposure of Calot's triangle can be achieved using just the infundibulum through the mid-

clavicular port.<sup>[6]</sup> Innovations like 5-mm and 3-mm instruments have further minimized surgical invasiveness.<sup>[6,7]</sup>

Minimizing the number and size of ports has been associated with less postoperative discomfort and faster recovery, supporting the feasibility of three-port LC in selected patients.<sup>[7,8]</sup> However, success depends heavily on the surgeon's laparoscopic skill and teamwork during dissection and exposure.<sup>[9]</sup>

This study aims to compare three-port and four-port laparoscopic cholecystectomy in terms of outcomes, highlighting their respective advantages and limitations to support informed surgical decisions for optimal patient care.<sup>[10,11]</sup>

**Address for correspondence:** Dr. Shahnawaz Ahmad, Assistant Professor, Department of General Surgery, Teerthanker Mahaveer Medical College & Research Centre, Moradabad, India  
E-mail: shaikhshahnawazahmad@gmail.com

### DOI:

10.21276/amit.2025.v12.i2.8

**How to cite this article:** Patel S, Jakhmola CK, Ahmad S. Comparative Study Between Standard Four-Port Versus Three-Port Laparoscopic Cholecystectomy. Acta Med Int. 2025;12:36-39.

## MATERIALS AND METHODS

The study was conducted on patients attending the surgical outpatient department at TMMC&RC, Moradabad for 18 months  
**Study Design:** Randomized controlled trial.

**Period:** 18 months.

**Sample Size:** 48 patients in each group.

**Inclusion Criteria:**

- Age group between 18 to 75 years
- Symptomatic cholelithiasis
- Acute calculus cholecystitis (within 48 hours)
- Chronic calculus cholecystitis

**Exclusion Criteria:**

- Empyema of gallbladder
- Mucocele of gallbladder
- Acute cholecystitis with mass formation
- Patients with malignancy
- Jaundiced patients with radiological evidence of CBD stones
- Patients with liver cirrhosis/portal hypertension

**Methodology:** After approval from CRC and IEC (given by TMMC&RC), all patients coming to the surgical OPD were included based on inclusion and exclusion criteria. Informed consent was taken. History taking, physical and local examination were done. Basic laboratory investigations including CBC, blood group, blood glucose, HbA1c, liver and renal function tests, coagulation profile, viral markers, and USG were performed. Eligible patients were randomized into two groups: Group A (four-port laparoscopic cholecystectomy) and Group B (three-port laparoscopic cholecystectomy). Patients were compared in terms of operative time, conversion to four-port/open cholecystectomy, intraoperative and postoperative complications, postoperative pain (on VAS), length of hospital stay, and return to normal activities. All surgeries were performed by an experienced surgeon (>100 laparoscopic cholecystectomies).

**RESULTS**

Statistical analysis was carried out using Statistical Package of Social Sciences (SPSS) software version 20.0 (SPSS Inc., Chicago, IL, USA). Statistical analysis was carried out using descriptive statistics, by calculating frequencies and percentage for qualitative data; mean with standard deviation and median for quantitative data of each parameter in the study. Independent t-test was used to compare mean values. Chi square statistical analysis was used to assess the level of significance. The level of significance was adjusted at p-

value being less than 0.05.

Out of 96 cases, 33.33% patients were aged 20-30yrs, followed by 30.2% aged 31-40yrs, with mean age being 37.723±11.35 yrs. 86.5% cases were females. All cases were diagnosed with Symptomatic Cholelithiasis; out of which 50% each were treated with four and three port laparoscopic cholecystectomy [Table 1 & Figure 1]

More (4.2%) cases suffered from wound hematoma in group A (four port laparoscopic cholecystectomy) than 2.1% cases in Group B. 2.1% cases in both the groups showed GB perforation, and wound infection. Chi square statistical analysis revealed an insignificant (p-value>0.05) difference statistically between both the groups in relation to intra-operative complications [Table 2]. No case in Group B reported with Conversion to fort port LC, in both the groups, no case showed Conversion to open surgery. Mean operative time was significantly (p-value<0.05) more in Group B (Three port LC) (63.89) than Group A (Four port LC) (57.10). [Table 3] Mean post-operative pain score or VAS score was significantly (p-value<0.05) less in Group B (Three port LC) (4.67) than Group A (Four port LC) (6.10). [Table 4] Mean time of hospital stay was comparable (p-value>0.05), but less in Group B (Three port LC) (4.52) than Group A (Four port LC) (4.75) [Table 5]. Mean days taken to return to normal activity was significantly (p-value<0.05) less in Group B (Three port LC) (11.31) than Group A (Four port LC) (14.97) [Table 6]. In both the groups, patients were satisfied with treatment.

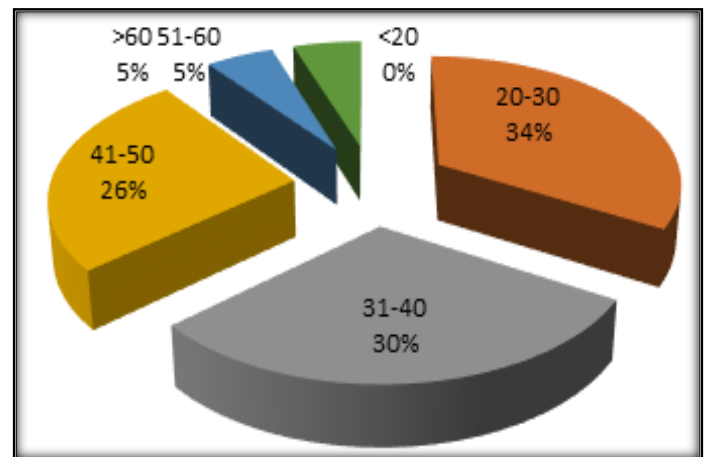


Figure 1: Age Group

Table 1: Demographic profile of study participants

| Parameters                 | Frequency (n)  | Percentage (%) |
|----------------------------|----------------|----------------|
| Age groups (yrs)           |                |                |
| <20                        | 0              | 0.0            |
| 20-30                      | 32             | 33.333         |
| 31-40                      | 29             | 30.208         |
| 41-50                      | 25             | 26.042         |
| 51-60                      | 5              | 5.208          |
| >60                        | 5              | 5.208          |
| Mean age ± SD              | 37.723 ± 11.35 | -              |
| Gender                     |                |                |
| Female                     | 83             | 86.5           |
| Male                       | 13             | 13.5           |
| Diagnosis                  |                |                |
| Symptomatic Cholelithiasis | 96             | 100.0          |
| Procedure                  |                |                |

|   |    |       |
|---|----|-------|
| Four port laparoscopic cholecystectomy  | 48 | 50.0  |
| Three port laparoscopic cholecystectomy | 48 | 50.0  |
| Total                                   | 96 | 100.0 |

**Table 2: Intraoperative complication**

| Intraoperative Complications | Group A Frequency (n) | Group A Percentage (%) | Group B Frequency (n) | Group B Percentage (%) |
|------------------------------|-----------------------|------------------------|-----------------------|------------------------|
| GB perforation               | 1                     | 2.1                    | 1                     | 2.1                    |
| CBD injury                   | 0                     | 0.0                    | 0                     | 0.0                    |
| Liver injury                 | 0                     | 0.0                    | 0                     | 0.0                    |
| Vascular injury              | 0                     | 0.0                    | 0                     | 0.0                    |
| Haemorrhage                  | 0                     | 0.0                    | 0                     | 0.0                    |
| Wound hematoma               | 2                     | 4.2                    | 1                     | 2.1                    |
| Wound infection              | 1                     | 2.1                    | 1                     | 2.1                    |
| Chi square                   | 2.551                 |                        |                       |                        |
| p-value                      | 0.115*                |                        |                       |                        |

**Table 3: Operative time comparison**

| Operative Time           | Group A (Four port LC) Mean | Group A SD | Group B (Three port LC) Mean | Group B SD |
|--------------------------|-----------------------------|------------|------------------------------|------------|
| Operative time (minutes) | 57.1042                     | 7.49252    | 63.8958                      | 7.91239    |
| t-test                   | 2.223                       |            |                              |            |
| p-value                  | 0.029*                      |            |                              |            |

**Table 4: Postoperative pain scores (VAS)**

| Post op. pain on VAS | Group A (Four port LC) Mean | Group A SD | Group B (Three port LC) Mean | Group B SD |
|----------------------|-----------------------------|------------|------------------------------|------------|
| Post op. pain on VAS | 6.1042                      | 1.41781    | 4.6667                       | 1.13613    |
| t-test               | 2.007                       |            |                              |            |
| p-value              | 0.011*                      |            |                              |            |

**Table 5: Hospital Stay Duration**

| Hospital Stay (days) | Group A (Four port LC) Mean | Group A SD | Group B (Three port LC) Mean | Group B SD |
|----------------------|-----------------------------|------------|------------------------------|------------|
| Hospital stay (days) | 4.7500                      | 1.53678    | 4.5208                       | 1.05164    |
| t-test               | 2.280                       |            |                              |            |
| p-value              | 0.088*                      |            |                              |            |

**Table 6: Days Return to Normal Activity**

| Days Return to Normal Activity    | Group A (Four port LC) Mean | Group A SD | Group B (Three port LC) Mean | Group B SD |
|-----------------------------------|-----------------------------|------------|------------------------------|------------|
| Days to return to normal activity | 14.9792                     | 3.29080    | 11.3125                      | 2.08496    |
| t-test                            | 2.006                       |            |                              |            |
| p-value                           | 0.038*                      |            |                              |            |

## DISCUSSION

Gallstones are a common global health issue, affecting 10–20% of adults. Laparoscopic cholecystectomy (LC) has become the gold standard treatment for gallbladder disease, offering advantages such as faster recovery, shorter hospital stays, and reduced postoperative pain.<sup>[12]</sup> Recent developments suggest that minimizing the number or size of ports may further improve outcomes.<sup>[13–15]</sup>

This study compared three-port and four-port LC in 96 patients, equally divided into two groups. Demographically, most patients were female (86.5%), with a mean age of 37.72±11.35 years. These findings align with previous studies by Kumar M et al,<sup>[4]</sup> and Singhal P et al,<sup>[16]</sup> which also reported female predominance and similar age distributions. Regarding intra-operative complications, both groups showed comparable rates of gallbladder perforation (2.1%) and wound infections. However, wound hematoma was slightly more in the four-port group (4.2%) than the three-port group (2.1%), though statistically insignificant (p>0.05). Similar findings were reported by Kumar M et al,<sup>[4]</sup> and Mujahid DM et al.<sup>[17]</sup>

No conversions to four-port or open surgery were required in our study. These results are consistent with the findings of Trichak S,<sup>[18]</sup> Poon CM et al,<sup>[19]</sup> and Mori T et al.<sup>[20]</sup>

Operative time was significantly longer in the three-port group (63.89 minutes) compared to the four-port group (57.10 minutes). Singhal P et al,<sup>[16]</sup> reported similar trends, while Kumar M et al.<sup>[4]</sup> and Mujahid DM et al,<sup>[17]</sup> observed conflicting results. Postoperative pain, measured by VAS score, was significantly lower in the three-port group (4.67) than the four-port group (6.10), supporting the hypothesis that fewer incisions may lead to less discomfort.<sup>[4]</sup>

Return to normal activities was faster in the three-port group (11.31 days vs. 14.97 days), and hospital stay was slightly shorter (4.52 vs. 4.75 days), although not statistically significant. Similar outcomes were observed in studies by Kumar M et al,<sup>[4]</sup> and Singhal P et al.<sup>[16]</sup>

Both groups reported high satisfaction levels, with some studies suggesting slightly higher satisfaction in the three-port group.<sup>[4]</sup> Overall, three-port LC is safe, effective, and associated with minimal complications, reduced pain, and quicker recovery when performed by skilled surgeons. Limitations of the study include its single-centre design and the

relatively small sample size. Further multicentre randomized controlled trials are recommended to validate these findings. Nonetheless, the results support the use of the three-port laparoscopic cholecystectomy as a safe and effective alternative to the standard four-port approach, particularly in patients seeking improved cosmetic outcomes and reduced postoperative pain.

## CONCLUSION

The three-port laparoscopic cholecystectomy is a feasible and safe alternative to the standard four-port technique. It offers comparable operative outcomes, with potential benefits in terms of reduced postoperative pain and improved cosmetic satisfaction. The results of this study support the adoption of the three-port approach in routine clinical practice, provided that the surgeon has adequate laparoscopic experience. Further multicenter studies are warranted to confirm these findings.

## Financial support and sponsorship

Nil.

## Conflicts of interest

There are no conflicts of interest.

## REFERENCES

1. Kumar A et al. Comparison of three-port versus four-port laparoscopic cholecystectomy. *Asian Journal of Medical Sciences.*2024;15:1
2. Gupta R, Singal R, Sharda VK, Ahluwalia JS, Bhatia G and Arora G. Two port laparoscopic assisted appendicectomy versus three port laparoscopic appendicectomy: A prospective study of 50 cases. *Trop J Med Res.* 2015;18(1):14-19.
3. Dubois F, Icard P, Berthelot G, Levard H. Coelioscopic cholecystectomy: preliminary report of 36 cases. *Ann Surg.* 1990; 211: 60–62
4. Kumar M, Agrawal CS, Gupta RK. Three-port versus standard four-port laparoscopic cholecystectomy: a randomized controlled clinical trial in a community-based teaching hospital in eastern Nepal. *JSLs.* 2007;11(3):358-62.
5. Arroyo JP, Martin-Del-Campo LA and Torres-Villalobos G. Single-incision laparoscopic cholecystectomy: Is it a plausible alternative to the traditional four-port laparoscopic approach? *Minim Invasive Surg.* 2012;2012:347607.
6. Slim K, Pezet D, Stencl J, Jr., et al. Laparoscopic cholecystectomy: an original three-trocar technique. *World J Surg.* 1995;19 (3): 394–7
7. Bisgaard T, Klarskov B, Trap R, Kehlet H, Rosenberg J. Pain after microlaparoscopic cholecystectomy. A randomized double-blind controlled study. *Surg Endosc.* 2000;14(4):340–4.
8. Leggett PL, Bissell CD, Churchman-Winn R, Ahn C. Three-port microlaparoscopic cholecystectomy in 159 patients. *Surg Endosc.* 2001;15(3):293–6.
9. Chauhan H, Kothiya J, Savsaviya J. Three port versus four port laparoscopic cholecystectomy: a prospective comparative clinical study. *Int Surg J*2020;7:3666-9.
10. Nip L, Tong KS, Borg CM. Three-port versus four-port technique for laparoscopic cholecystectomy: systematic review and meta-analysis. *BJS Open.* 2022;6(2):zrac013.
11. Mohamed AAE; Zaazou, Mohamed M.T.b. Three-port versus conventional four-port laparoscopic cholecystectomy: a comparative study. *The Egyptian Journal of Surgery.*2020; 39(1):119-23.
12. Saccomani G, Arezzo A, Percivale A, Baldo S, Pellicci R. Laparoscopic cholecystectomy can be performed safely with only three ports in the majority of cases. *Chir Ital* 2009;61(5-6): 613-6.
13. Udwadia TE. Laparoscopy in India a personal perspective *J Minim Access Surg.* 2005;1:51–2
14. Haribhakti SP, Mistry JH. Techniques of laparoscopic cholecystectomy: nomenclature and selection *J Minim Access Surg.* 2015;11:113–8
15. Mayir B, Dogan U, Koc U. Safety and effectiveness of three-port laparoscopic cholecystectomy *Int J Clin Exp Med.* 2014;7:2339-42.
16. Singhal P, Aggarwal A, Altamash S, Verma AK. A comparative evaluation of three port versus standard four port laparoscopic cholecystectomy in SGRRIMHS and SMIH Dehradun. *Int Surg J* 2019;6:2900-4.
17. Mujahid DM et al. Three Port Versus Four Port Laparoscopic Cholecystectomy. *A.P.M.C* 2011;5(2):80-4.
18. Trichak S. Three-port vs standard four-port laparoscopic cholecystectomy. *Surg Endosc.* 2003;17(9):1434–6
19. Poon CM, Chan KW, Lee DW, et al. Two-port versus four-port laparoscopic cholecystectomy. *Surg Endosc.* 2003;17(10):1624–7.
20. Mori T, Ikeda Y, Okamoto K, et al. A new technique for two-trocar laparoscopic cholecystectomy. *Surg Endosc.* 2002;16(4):589–91.