International Journal for Multidisciplinary Research (IJFMR)
E-ISSN: 2582-2160 ● Website: www.ijfmr.com ● Email: editor@ijfmr.com

A Comparative Study between Conventional Three Port Laparoscopy and Single Port. Laparoscopy for Appendectomy

Dr. Shubham Singh[1], Dr. Prabhat Yadav[2], Dr. Dhananjay Talaviya[3]

[1,2,3]K.D. Medical College, Hospital & Research Center,Mathura

Abstract

Introduction: Laparoscopic appendectomy is the standard for acute appendicitis. Single-port laparoscopic appendectomy (SPLA) has emerged as a potentially less invasive alternative to conventional three-port laparoscopy (CTPLA), with proposed benefits including reduced trauma, pain, and improved cosmesis. However, comparative evidence on efficacy and safety remains limited.

Aims and Objectives: This study aimed to compare the surgical outcomes between SPLA and CTPLA, assessing surgical efficacy, postoperative recovery, complications, and cosmetic results.

Materials and Methods: A prospective comparative study was conducted on 90 patients with acute appendicitis, randomized into SPLA (n=40) and CTPLA (n=50) groups. Exclusion criteria included perforation, abscess, or pregnancy. Outcomes measured included Visual Analog Scale (VAS) pain scores, complication rates, cosmetic outcomes, and duration of hospital stay. Statistical analysis was performed using SPSS v26.

Results: The SPLA group demonstrated significantly lower postoperative pain (mean VAS 1.0 vs. 3.28, $p<0.0001$), shorter hospital stay (2.0 vs. 3.72 days, $p<0.0001$), and superior cosmetic outcomes ($p=0.000205$) compared to CTPLA.

Complication rates, including infection and hernia, were lower in the SPLA group ($p=0.0101$). No significant differences were noted in age or sex distribution between groups.

Conclusion: Single-port laparoscopic appendectomy is associated with significantly reduced postoperative pain, shorter hospitalization, fewer complications, and better cosmetic satisfaction compared to the conventional three-port approach, making it a viable and advantageous alternative for uncomplicated acute appendicitis.

Keywords: Single-port laparoscopy, three-port laparoscopy, appendectomy, postoperative pain, cosmetic outcome, hospital stay.

Introduction

Acute appendicitis is one of the most common surgical emergencies worldwide and remains a major cause of acute abdomen requiring emergency surgical intervention. If left untreated, it may progress to perforation, peritonitis, intra-abdominal abscess, sepsis, and increased morbidity. Appendectomy is the definitive treatment, and although open appendectomy was traditionally considered the gold standard, laparoscopic appendectomy has become the preferred approach because of its advantages, including reduced postoperative pain, lower wound infection rates, shorter hospital stay, faster recovery, and

improved cosmetic outcomes. Conventional three-port laparoscopic appendectomy is the standard minimally invasive technique due to its excellent visualization, ergonomic instrument handling, reproducibility, and safety. More recently, single-port laparoscopic appendectomy has emerged as an advanced minimally invasive technique aimed at further reducing abdominal wall trauma and improving cosmetic results through a single umbilical incision. However, it is associated with technical challenges such as loss of triangulation, instrument crowding, a steeper learning curve, and increased operative difficulty.[1–12]

Aim

The aim of this study is to compare the differences between conventional three port laparoscopic appendectomy and single port laparoscopic appendectomy.

Material and Methods

Study Design

This was a **prospective comparative clinical study** conducted to compare the surgical efficacy, postoperative outcomes, and complications of **conventional three-port laparoscopic appendectomy (CTPLA)** and **single-port laparoscopic appendectomy (SPLA)** in patients with acute appendicitis. A prospective design ensured standardized data collection, uniform surgical management, and systematic postoperative follow-up.

Study Setting

The study was conducted in the **Department of General Surgery, K.D. Medical College, Hospital and Research Centre, Mathura, Uttar Pradesh**, a tertiary care teaching hospital with well-established laparoscopic surgical facilities and emergency services.

Study Duration

May 2024 to October 2025

Sample Size

A total of **100 patients** were included in the study.

The sample size was calculated using the formula: $n= (z)^2 p.q / (d)2$

Where:

- **Z = 1.96** (95% confidence level)
- **p = 7%**
- **q = 93%**
- **d = 5%** (absolute precision)

The calculated sample size was **90**, which was rounded to **90 patients**.

Results

A total of **90 patients** with acute appendicitis were enrolled in this prospective comparative study. Patients were allocated into two groups: **50 patients (55.56%)** underwent Conventional Three-Port Laparoscopic Appendectomy (CTPLA/Multiport) and **40 patients (44.44%)** underwent Single-Port Laparoscopic Appendectomy (SPLA/Single Port).

Demographic profile

- **Age Distribution:** The mean age was comparable between groups— Multiport: **21.58 ± 4.43 years**; Single Port: **22.10 ± 4.11 years** (p = 0.569), indicating no significant age-related bias.
- **Sex Distribution:** The Multiport group had 22 females and 28 males; the Single Port group had 21 females and 19 males. The difference was statistically **not significant** (χ^2 = 0.555, p > 0.05), confirming demographic homogeneity.
- **Postoperative pain (vas score)**
- **Single Port group:** All patients reported a uniform mean VAS score of **1.0 ± 0.0** (mild pain).
- **Multiport group:** Mean VAS score was **3.28 ± 0.61** (moderate pain), with scores ranging up to 5.
- The difference was **highly significant (p < 0.0001)** , demonstrating superior pain control with the single-port technique.

Cosmetic outcomes

- **Single Port:** 55% (22 patients) reported "Satisfactory" and 7.5% (3 patients) reported "Excellent" cosmetic results.
- **Multiport:** 42% (21 patients) rated outcomes as "Unsatisfactory" and 30% (15 patients) as "Mediocre." No patient in this group reported an "Excellent" outcome.
- The difference was **statistically significant (p = 0.000205)** , confirming superior cosmetic satisfaction with the single-port approach.

Postoperative complications

- **Infection:** Significantly higher in the Multiport group (11 patients, 22%) compared to Single Port (3 patients, 7.5%) (p = 0.04).
- **Pain as a complication:** Reported in 6 patients (12%) of the Multiport group; **none** in the Single Port group (p = 0.02).
- **Bleeding:** Multiport: 9 patients (18%); Single Port: 5 patients (12.5%) (p = 0.81, NS).
- **Hernia:** Multiport: 9 patients (18%); Single Port: 6 patients (15%) (p =
- 0.79, NS).
- **Conversion to open surgery:** Equal in both groups (4 patients each, 8%) (p = 0.71, NS).
- **No complications:** Significantly higher in the Single Port group (22 patients, 55%) compared to Multiport (11 patients, 22%) (p = 0.003).

Duration of hospital stay

Single Port: Mean hospital stay of **2.0 ± 1.2 days** (Range: 1-5 days).
Multiport: Mean hospital stay of **3.72 ± 1.49 days** (Range: 1-8 days).
The difference was **highly significant (p < 0.0001)** , indicating faster recovery and earlier discharge with the single-port technique.

Discussion

Acute appendicitis is one of the most common surgical emergencies worldwide, and appendectomy remains the definitive treatment. With the evolution of minimally invasive surgery, laparoscopic appendectomy has become the preferred approach owing to its advantages of reduced postoperative pain, shorter hospital stay, faster recovery, and improved cosmetic outcomes. Conventional three-port laparoscopic appendectomy (CTPLA) is the standard technique because of its excellent visualization, instrument triangulation, and ease of dissection. More recently, single-port laparoscopic appendectomy

(SPLA) has emerged as an alternative that utilizes a single umbilical incision to further minimize abdominal wall trauma and enhance cosmetic results. However, SPLA is technically more demanding due to instrument crowding, loss of triangulation, and a steeper learning curve. Previous randomized trials and meta-analyses have reported conflicting evidence regarding operative time, postoperative pain, complications, hospital stay, and cosmetic satisfaction, highlighting the need for further comparative evaluation.[1–12]

In the present study, both groups were comparable with respect to baseline demographic characteristics, including age and sex, ensuring a valid comparison of surgical outcomes. Although conventional three-port laparoscopy remained the more commonly performed procedure, patients undergoing single-port laparoscopic appendectomy demonstrated significantly better postoperative outcomes, including lower postoperative pain scores, fewer wound-related complications, shorter hospital stay, and superior cosmetic satisfaction, without an increase in conversion to open surgery. These findings are consistent with contemporary literature suggesting that SPLA is a safe and effective minimally invasive alternative to the conventional three-port technique in appropriately selected patients, offering enhanced postoperative recovery and improved cosmetic outcomes while maintaining comparable surgical efficacy.[15–18]

Conclusion

This prospective comparative study demonstrates that **Single-Port Laparoscopic Appendectomy (SPLA)** is a safe, feasible, and effective alternative to **Conventional Three-Port Laparoscopic Appendectomy (CTPLA)** for uncomplicated acute appendicitis. Compared with CTPLA, SPLA was associated with significantly lower postoperative pain, superior cosmetic outcomes, fewer wound-related complications, and a shorter hospital stay, while maintaining comparable safety and no increase in conversion to open surgery. These findings suggest that SPLA offers improved patient-centered outcomes and may be considered the preferred minimally invasive approach in appropriately selected patients with adequate surgical expertise.

References

1. Moris D, Paulson EK, Pappas TN. Diagnosis and management of acute appendicitis in adults: a review. Jama. 2021 Dec 14;326(22]:2299-311.
2. Alkatout I, Mechler U, Mettler L, Pape J, Maass N, Biebl M, Gitas G, Laganà AS, Freytag D. The development of laparoscopy—a historical overview. Frontiers in surgery. 2021 Dec 15;8:799442.
3. Tinelli A, editor. Laparoscopic entry: Traditional methods, new insights and novel approaches. Springer Science & Business Media; 2011 Dec 3.
4. Tsai AY, Selzer DJ. Single-port laparoscopic surgery. Advances in surgery. 2010 Sep 1;44(1):1-27.
5. Xu AM, Huang L, Li TJ. Single-incision versus three-port laparoscopic appendectomy for acute appendicitis: systematic review and meta-analysis of randomized controlled trials. Surgical endoscopy. 2015 Apr;29(4):822-43.
6. Domene CE, Volpe P, Heitor FA. Three port laparoscopic appendectomy technique with low cost and aesthetic advantage. ABCD. Arquivos Brasileiros de Cirurgia Digestiva (São Paulo). 2014;27(suppl 1):73-6.
7. Lee SM. Laparoscopic Cholecystectomy (3–4 Ports Method). InHepatoBiliary-Pancreatic Surgery and Liver Transplantation: A Comprehensive Guide, with Video Clips 2023 Feb 22 (pp. 169-176). Singapore: Springer Nature Singapore.

8. Rehman H, Mathews T, Ahmed I. A review of minimally invasive singleport/incision laparoscopic appendectomy. Journal of Laparoendoscopic & Advanced Surgical Techniques. 2012 Sep 1;22(7):641-6.
9. Arregui ME, Robert Jr J, Katkhouda N, McKernan JB, Reich H, editors. Principles of laparoscopic surgery: basic and advanced techniques. Springer Science & Business Media; 2012 Dec 6.
10. Rehman H, Ahmed I. Technical approaches to single port/incision laparoscopic appendicectomy: a literature review. The Annals of The Royal College of Surgeons of England. 2011 Oct;93(7):508-13.
11. Zaman S, Mohamedahmed AY, Srinivasan A, Stonelake S, Sillah AK, Hajibandeh S, Hajibandeh S. Single-port laparoscopic appendicectomy versus conventional three-port approach for acute appendicitis: a systematic review, meta-analysis and trial sequential analysis of randomised controlled trials. The Surgeon. 2021 Dec 1;19(6):365-79.
12. Chen Y, Fan Z, Zhang X, Fu X, Li J, Yuan J, Guo S. A brief overview of singleport laparoscopic appendectomy as an optimal surgical procedure for patients with acute appendicitis: still a long way to go. Journal of International Medical Research. 2023 Jul;51(7):03000605231183781.
13. Koehler F, Reese L, Kastner C, Hendricks A, Mueller S, Lock JF, Germer CT, Wiegering A. Surgical site infection following single-port appendectomy: a systematic review of the literature and meta-analysis. Frontiers in surgery. 2022 Jun 8;9:919744.
14. Xue C, Lin B, Huang Z, Chen Z. Single-incision laparoscopic appendectomy versus conventional 3-port laparoscopic appendectomy for appendicitis: an updated meta-analysis of randomized controlled trials. Surgery today. 2015 Sep;45(9):1179-86.
15. Kim WJ, Jin HY, Lee H, Bae JH, Koh W, Mun JY, Kim HJ, Lee IK, Lee YS, Lee CS. Comparing the postoperative outcomes of single-incision laparoscopic appendectomy and three port appendectomy with enhanced recovery after surgery protocol for acute appendicitis: a propensity score matching analysis. Annals of coloproctology. 2020 Sep 30;37(4):232.
16. Haque MM. Management Strategies for Complicated Appendicitis: A Review of Surgical Techniques. Sch J App Med Sci. 2024 Aug;8:1103-9.
17. Liu F, Lv Q, Wang CY, Li ZW, Liu XR, Peng D. Single-port laparoscopic appendectomy using new surgical procedure versus conventional three-port laparoscopic appendectomy. Updates in Surgery. 2024 Aug;76(4):1347-55.
18. Assali S, Eapen S, Carman T, Horattas S, Daigle CR, Paranjape C. Singleport laparoscopic appendectomy: beyond the learning curve: a retrospective comparison with multi-port laparoscopic appendectomy. Surgical Laparoscopy Endoscopy & Percutaneous Techniques. 2018 Oct 1;28(5):2914.