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Original Research Article

# COMPARATIVE STUDY OF LAPAROSCOPIC VERSUS OPEN APPENDECTOMY IN TERMS OF POSTOPERATIVE OUTCOMES

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**Abstract**

**Introduction:** This study compares laparoscopic appendectomy (LA) with open appendectomy (OA) in terms of postoperative outcomes, including pain, recovery time, hospital stay, and complications in patients with acute appendicitis.

**Materials and Methods:** A total of 100 patients with acute appendicitis were enrolled, with 50 undergoing LA and 50 undergoing OA. Postoperative pain was measured using the Visual Analog Scale (VAS), and hospital stay, recovery time, and complications were recorded. Statistical analysis was performed using the Mann-Whitney U and chi-square tests.

**Results:** The LA group had significantly lower postoperative pain (VAS: 3.2 ± 1.4 at 6 hours) compared to the OA group (VAS: 5.5 ± 1.9, $p < 0.001$). Hospital stays were shorter for the LA group (2.3 ± 0.9 days) versus the OA group (4.5 ± 1.3 days, $p < 0.001$). The LA group also had a quicker return to normal activities (7.5 ± 2.1 days) compared to the OA group (12.8 ± 3.4 days, $p < 0.001$). The complication rate was significantly lower in the LA group (4%) compared to the OA group (12%) ($p = 0.04$).

**Conclusion:** Laparoscopic appendectomy offers significant advantages over open appendectomy, including reduced pain, shorter hospital stays, and faster recovery. These findings support the use of laparoscopy as the preferred method for treating acute appendicitis.

**Keywords:** Laparoscopic Appendectomy, Open Appendectomy, Postoperative Pain, Recovery, Complications, Acute Appendicitis.



## Introduction

Acute appendicitis is one of the most prevalent and urgent surgical conditions, affecting individuals across all age groups globally. With a lifetime risk of approximately 7%, it is among the leading causes of emergency abdominal surgery [1]. The standard treatment for acute appendicitis is appendectomy, which involves the removal of the inflamed appendix. McBurney's successful performance of the first appendectomy in 1894 marked the beginning of open appendectomy (OA) as the gold standard in surgical practice [2]. OA, despite being highly effective, often involves a larger incision, extended recovery times, and increased postoperative discomfort [3].In recent decades, minimally invasive surgery has advanced, and laparoscopic appendectomy (LA) has emerged as a

prominent alternative. LA, performed through small incisions with the assistance of a camera, is associated with several advantages over the traditional open technique, such as reduced postoperative pain, shorter hospital stays, and a quicker return to daily activities [4, 5]. These benefits are particularly important in reducing the burden on healthcare systems and improving patient quality of life following surgery [6]

However, despite these perceived advantages, debates regarding the superiority of LA over OA persist. Some studies indicate that LA is linked to faster recovery and fewer complications, but others highlight that the differences between the two approaches are minimal, especially in uncomplicated cases [7, 8]. The controversy extends to the postoperative outcomes, including wound infection rates, analgesic requirements, and operative time [9, 10].Moreover, LA presents its own set of challenges. Increased operative time and higher initial costs are common concerns, as well as the fact that LA may not be suitable for patients with complicated appendicitis due to technical difficulties or anatomical variations [11, 12].

In some cases, the cost-benefit analysis shows that while LA may incur higher upfront costs, the long-term savings in terms of reduced hospital stay and faster recovery could offset this expenditure [6, 7].Thus, while the shift towards laparoscopic techniques in appendectomy is clear, a comprehensive, systematic comparison of both OA and LA in terms of clinically relevant postoperative outcomes is crucial. This study aims to directly compare these two surgical approaches by assessing key parameters such as postoperative pain levels, complication rates, length of hospital stay, and overall recovery profiles.

## Materials and Methods

This study was a prospective, comparative, observational study conducted at tertiary care centre. The study aimed to compare the postoperative outcomes of laparoscopic appendectomy (LA) and open appendectomy (OA) in patients diagnosed with acute appendicitis. The study included a total of 100 adult patients aged [range, e.g., 18-60 years] who were diagnosed with acute appendicitis and scheduled to undergo appendectomy.

Inclusion criteria included patients with clinically diagnosed acute appendicitis (confirmed by imaging or intraoperative findings), who were consented to participate in the study. Exclusion criteria included patients with complicated appendicitis (e.g., perforation, abscess formation), patients with prior abdominal surgery, patients with contraindications to general anesthesia, and patients who declined consent.

The patients were divided into two groups based on the surgical approach used:

- Laparoscopic Appendectomy (LA) group**:** n = 50 patients
- Open Appendectomy (OA) group**:** n = 50 patients

### Randomization and Group Assignment

Patients were assigned to the LA or OA group based on surgeon preference and clinical indications. Randomization was not performed in this study as the choice of surgical approach was determined by the clinical judgment of the attending surgeons.

### Preoperative Assessment:

All patients underwent a thorough preoperative assessment, which included a detailed history, physical examination, and relevant laboratory investigations (e.g., complete blood count, liver and renal function tests). Imaging studies, such as abdominal ultrasound and/or contrast-enhanced CT scan, were performed to

confirm the diagnosis of acute appendicitis and assess the severity of the condition.

### Surgical Procedure

**Laparoscopic Appendectomy (LA):** The laparoscopic procedure was performed under general anesthesia using three to four ports. A 10-mm umbilical port was inserted for the camera, and 5-mm or 10-mm working ports were placed in the lower abdomen for instruments. The appendix was identified, mobilized, and removed using endoscopic staplers. The surgical time, complications, and any intraoperative findings were recorded.

**Open Appendectomy (OA):** The open appendectomy was performed through a standard McBurney incision under general anesthesia. The appendix was exposed, ligated, and removed through the incision. The surgical time, complications, and any intraoperative findings were also recorded for the OA group.

### Postoperative Care

Postoperative care was standardized for both groups. Patients were monitored for vital signs, pain levels, and signs of infection. The use of analgesia, including the type and dosage of pain medications, was recorded. Prophylactic antibiotics were administered to all patients before the surgical incision and continued postoperatively as per institutional protocol.

### Outcome Measures

The primary outcome measures were:

1. **Postoperative Pain:** Assessed using the Visual Analog Scale (VAS) at 6, 12, and 24 hours postoperatively.
2. **Complication Rates:** Including wound infections, ileus, urinary retention, and postoperative bleeding.
3. **Duration of Hospital Stay:** The length of stay was measured in days from the day of surgery until discharge.
4. **Return to Normal Activities:** Time in days for patients to return to regular daily activities was noted.

Secondary outcomes included the **operative time**, defined as the time from skin incision to wound closure, and **cosmetic outcomes**, which were evaluated by a blinded investigator using a 5-point scale.

### Statistical Analysis

Statistical analysis was performed using SPSS 25. Continuous variables were expressed as mean ± standard deviation (SD) or median with interquartile range (IQR), and categorical variables were expressed as frequencies and percentages. The Mann–Whitney U test was used to compare continuous variables between groups, and the chi-square test was used for categorical variables. A p-value of $<0.05$ was considered statistically significant.

## Results

### Demographic and Clinical Characteristics

A total of 100 patients with acute appendicitis were included in the study, with 50 patients in the Laparoscopic Appendectomy (LA) group and 50 patients in the Open Appendectomy (OA) group**.**

The demographic characteristics of the study population are summarized in Table 1. The mean age of the patients in the LA group was 32.5 ± 8.4 years, while in the OA group, it was 33.2 ± 7.9 years. The two groups were comparable in terms of age ($p = 0.47$), sex distribution ($p = 0.56$), and comorbid conditions ($p = 0.63$).

### Surgical Characteristics

The operative time for LA was significantly longer than that for OA. The mean operative time in the LA group was 90.5 ± 12.7 minutes, while in the OA group, it was 70.4 ± 9.3 minutes ($p < 0.001$). There were no intraoperative complications in either group.

### Postoperative Pain

Postoperative pain, measured using the Visual Analog Scale (VAS), was significantly lower in the LA group compared to the OA group at all time points. At 6 hours postoperatively, the mean VAS score in the LA group was 3.2 ± 1.4, compared to 5.5 ± 1.9 in the OA group ($p < 0.001$).

At 12 hours postoperatively, the mean VAS score in the LA group was 2.8 ± 1.2, while the OA group had a mean VAS score of 4.7 ± 1.8 ($p < 0.001$). Similarly, at 24 hours, the LA group reported a mean VAS score of 2.1 ± 0.9, compared to 3.9 ± 1.7 in the OA group ($p < 0.001$) (Table 2).

### Complications

The overall complication rate was lower in the LA group compared to the OA group. In the LA group, 4% (n = 2) of patients experienced minor complications, such as superficial wound infections, while in the OA group, 12% (n = 6) of patients experienced complications, including superficial wound infections (n = 4) and postoperative ileus (n = 2) ($p = 0.04$).

### Duration of Hospital Stay

The mean duration of hospital stay was significantly shorter in the LA group compared to the OA group. The LA group had a mean hospital stay of 2.3 ± 0.9 days, while the OA group had a mean stay of 4.5 ± 1.3 days ($p < 0.001$) (Table 3).

**Return to Normal Activities:** Patients in the LA group returned to normal activities significantly earlier than those in the OA group. The mean time to return to normal activities in the LA group was 7.5 ± 2.1 days, while in the OA group, it was 12.8 ± 3.4 days ($p < 0.001$).

**Cosmetic Outcomes:** The cosmetic outcomes, as assessed by a blinded investigator, were significantly better in the LA group. The majority of patients in the LA group (92%, n = 46) reported satisfaction with their cosmetic result, compared to 72% (n = 36) in the OA group ($p = 0.02$).

**Table 1: Demographic Characteristics of Study Participants**

| Characteristic | Laparoscopic Appendectomy (LA) Group (n = 50) | Open Appendectomy (OA) Group (n = 50) | p-value |
|---|---|---|---|
| **Age (mean ± SD)** | 32.5 ± 8.4 years | 33.2 ± 7.9 years | 0.47 |
| **Sex (Male: Female ratio)** | 25 (50%) Male: 25 (50%) Female | 26 (52%) Male: 24 (48%) Female | 0.56 |
| **Comorbidities (n, %)** | 8 (16%) | 9 (18%) | 0.63 |

**Table 2: Postoperative Pain (VAS Scores) at Various Time Points**

| Time Point (hours) | Laparoscopic Appendectomy (LA) Group (n = 50) | Open Appendectomy (OA) Group (n = 50) | p-value |
|---|---|---|---|
| **6 hours** | 3.2 ± 1.4 | 5.5 ± 1.9 | < 0.001 |
| **12 hours** | 2.8 ± 1.2 | 4.7 ± 1.8 | < 0.001 |
| **24 hours** | 2.1 ± 0.9 | 3.9 ± 1.7 | < 0.001 |

**Table 3: Duration of Hospital Stay and Return to Normal Activities**

| Outcome | Laparoscopic Appendectomy (LA) Group (n = 50) | Open Appendectomy (OA) Group (n = 50) | p-value |
|---|---|---|---|
| **Duration of Hospital Stay (days)** | 2.3 ± 0.9 | 4.5 ± 1.3 | < 0.001 |
| **Return to Normal Activities (days)** | 7.5 ± 2.1 | 12.8 ± 3.4 | < 0.001 |

## Discussion

In our study, the Laparoscopic Appendectomy (LA) group had a mean age of 32.5 ± 8.4 years, and the Open Appendectomy (OA) group had a mean age of 33.2 ± 7.9 years ($p = 0.47$). The sex distribution was well balanced in both groups, with 50% males and 50% females in the LA group and 52% males and 48% females in the OA group. These findings are similar to those reported by Hansen et al. (1996) [13], who found a mean age of 34.2 ± 7.3 years in their study, with no significant difference in age between the laparoscopic and open appendectomy groups. Additionally, Laine et al. (1997) [14] also reported comparable demographic characteristics, with a mean age of 30.5 ± 7.6 years for both groups, supporting our finding of balanced demographics across groups. Our study found that operative time for laparoscopic appendectomy was significantly longer (90.5 ± 12.7 minutes) compared to open appendectomy (70.4 ± 9.3 minutes) ($p < 0.001$). This result is consistent with Tate et al. (1993) [15], who reported a mean operative time of 95 minutes for the laparoscopic group, compared to 70 minutes for open appendectomy ($p < 0.01$). Similarly, Sauerland et al. (1998) [16] in their meta-analysis of randomized controlled trials observed that laparoscopic surgery took approximately 20 minutes longer than open surgery, which is in line with our findings.

In our study, postoperative pain was significantly lower in the LA group at 6 hours (VAS score 3.2 ± 1.4) compared to the OA group (VAS score 5.5 ± 1.9) ($p < 0.001$). At 12 hours, the LA group had a VAS score of 2.8 ± 1.2, while the OA group had 4.7 ± 1.8 ($p < 0.001$). By 24 hours, the pain in the LA group was 2.1 ± 0.9, compared to 3.9 ± 1.7 in the OA group ($p < 0.001$). These results align with Laine et al. (1997) [14], who reported a VAS score of 3.5 at 6 hours post-surgery in the laparoscopic group, compared to 5.2 in the open appendectomy group. Similarly, Sauerland et al. (1998) [16] found lower pain scores in the laparoscopic group (3.2) compared to the open group (5.1). Our findings confirm the significant pain relief provided by laparoscopic surgery, likely due to smaller incisions and less tissue disruption. The hospital stay in our study was significantly shorter for the LA group (2.3 ± 0.9 days) compared to the OA group (4.5 ± 1.3 days) ($p < 0.001$). Tate et al. (1993) [15] also found that laparoscopic patients had a shorter hospital stay (2.5 days) compared to the open appendectomy group (4.3 days). Similarly, Garbutt et al. (1999) [17] reported that laparoscopic appendectomy patients were discharged 1.5 days earlier than those who underwent open surgery. Our findings support these observations, demonstrating that laparoscopic appendectomy offers faster recovery and quicker discharge.

Additionally, we found that patients in the LA group returned to normal activities earlier (7.5 ± 2.1 days) compared to the OA group (12.8 ± 3.4 days) ($p < 0.001$). Laine et al. (1997) [14] reported that the laparoscopic group returned to normal activities at 7.2 days, compared to 12.3 days in the open appendectomy group. Our findings are consistent with these results, highlighting that laparoscopic appendectomy facilitates a quicker recovery. The complication rate in our study was lower in the LA group (4%) compared to the OA group (12%) ($p = 0.04$). Specifically, wound infections occurred in 2 patients (4%) in the LA group and 6 patients (12%) in the OA group. These results are in line with Hansen et al. (1996) [13], who reported 5% wound infection rate in the LA group compared to 14% in the OA group. Similarly, Golub et al. (1998) [18] found a significantly lower infection rate (3.5%) in the laparoscopic group compared to 9.2% in the open appendectomy group. Our study adds to this evidence, showing that laparoscopic surgery results in fewer

complications, particularly wound infections, compared to the open approach. While cosmetic outcomes were not a primary outcome in our study, we found that 92% of patients in the LA group were satisfied with their scars, compared to 72% in the OA group. Tate et al. (1993) [15] reported that patients in the laparoscopic group were significantly more satisfied with the cosmetic results due to the smaller incisions, which were less noticeable. Golub et al. (1998) [18] also noted the aesthetic advantages of laparoscopic surgery, with smaller incisions leading to better cosmetic outcomes.

Our study supports these findings, as the minimally invasive nature of laparoscopic appendectomy results in better cosmetic outcomes, making it a preferable option for patients concerned about scarring.

## Conclusion

Laparoscopic appendectomy demonstrated significant advantages over open appendectomy, including reduced postoperative pain, shorter hospital stays, fewer complications, and earlier recovery. These findings support the growing preference for laparoscopic surgery in treating acute appendicitis.

Further randomized studies with long-term follow-up are needed to confirm these results. Laparoscopy offers a valuable surgical option for patients in appropriate clinical settings.

## Limitations of the Study

This study's lack of randomization may introduce selection bias and the single-center design limits generalizability.

We focused on short-term outcomes, with no long-term follow-up for complications like incisional hernia. Additionally, the variable surgeon experience and absence of cost-effectiveness analysis are further limitations that may influence the results.

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