



Systematic Review

## Comparative Evaluation of Surgical Outcomes and Postoperative Complications in Laparoscopic Versus Open Appendectomy

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### ABSTRACT

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**Background:** Acute appendicitis is one of the most common surgical emergencies requiring prompt operative intervention. Appendectomy remains the gold standard treatment, traditionally performed using the open approach. With the advent of minimally invasive surgery, laparoscopic appendectomy has gained popularity due to its potential advantages. However, the comparative effectiveness of laparoscopic versus open appendectomy in terms of surgical outcomes and postoperative complications continues to be evaluated.

**Aim:** To evaluate and compare the surgical outcomes and postoperative complications of laparoscopic appendectomy and open appendectomy in patients with acute appendicitis.

**Materials and Methods:** This hospital-based comparative study was conducted over a period of one year in the Department of General Surgery. A total of 60 patients diagnosed with acute appendicitis were included and divided into two groups: Group A (laparoscopic appendectomy, n=30) and Group B (open appendectomy, n=30). Parameters assessed included operative time, postoperative pain (VAS score), duration of hospital stay, time to return to normal activity, bowel recovery, postoperative complications, and cosmetic outcomes. Statistical analysis was performed using Student's t-test and Chi-square test, with  $p < 0.05$  considered statistically significant.

**Results:** The demographic characteristics of both groups were comparable. The mean operative time showed no statistically significant difference between laparoscopic and open appendectomy ( $p=0.40$ ). Postoperative pain scores were significantly lower in the laparoscopic group on the day of surgery and subsequent postoperative days ( $p<0.05$ ). Patients undergoing laparoscopic appendectomy had shorter hospital stay ( $1.9 \pm 0.8$  vs  $3.1 \pm 0.5$  days), earlier return to normal activity ( $9.5 \pm 2.1$  vs  $16.1 \pm 4.2$  days), and faster bowel recovery ( $p<0.05$ ). The incidence of postoperative complications was significantly lower in the laparoscopic group (16.7%) compared to the open group (36.7%) ( $p=0.04$ ), with fewer wound infections. Cosmetic outcomes were significantly better in patients undergoing laparoscopic surgery ( $p=0.002$ ).

**Conclusion:** Laparoscopic appendectomy is a safe and effective alternative to open appendectomy, offering advantages such as reduced postoperative pain, shorter hospital stay, faster recovery, lower complication rates, and superior cosmetic outcomes. It may be considered the preferred surgical approach for the management of acute appendicitis whenever feasible.

**Keywords:** Acute appendicitis, laparoscopic appendectomy, open appendectomy, postoperative complications, surgical outcomes, minimally invasive surgery.

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### INTRODUCTION

Acute appendicitis is one of the most common causes of acute abdominal pain requiring emergency surgical intervention. It represents a significant proportion of emergency surgical admissions worldwide and frequently affects adolescents and

young adults (1). The standard treatment for acute appendicitis is surgical removal of the inflamed appendix, a procedure known as appendectomy. "Over the past century, appendectomy has remained the definitive management for this condition, with the primary goal of preventing complications such as perforation, peritonitis, and intra-abdominal abscess formation (2,3).

Traditionally, appendectomy has been performed using the open surgical approach, commonly through a gridiron or Rutherford Morrison incision. Open appendectomy has long been considered a reliable and effective technique with predictable outcomes (4). It allows direct visualization of the appendix and has been widely practiced in both elective and emergency surgical settings. Despite its effectiveness, the open technique is associated with certain disadvantages, including larger surgical incisions, increased postoperative pain, higher risk of wound infection, and longer recovery time (5).

With the advancement of minimally invasive surgical techniques, laparoscopic appendectomy has emerged as an alternative approach for the management of acute appendicitis. Since its introduction in the early 1980s, laparoscopic surgery has transformed many surgical procedures by offering improved visualization of the abdominal cavity through the use of a camera and specialized instruments (6,7). In laparoscopic appendectomy, small incisions are used to introduce trocars through which the camera and instruments are inserted, allowing surgeons to remove the appendix with minimal tissue trauma (8). This technique has gained increasing popularity due to potential advantages such as reduced postoperative pain, shorter hospital stay, faster return to normal activities, improved cosmetic outcomes, and lower wound complication rates (9).

Despite these advantages, the superiority of laparoscopic appendectomy over the conventional open technique remains a subject of ongoing debate. Some studies suggest that laparoscopic surgery may require longer operative time and specialized equipment, which may increase the cost of treatment (10). Additionally, certain complications such as intra-abdominal abscess formation have been reported in some laparoscopic cases. Therefore, determining the most effective surgical approach requires careful evaluation of multiple perioperative parameters, including operative duration, postoperative pain, hospital stay, rate of complications, and recovery time (11).

Comparative studies evaluating laparoscopic and open appendectomy play an important role in guiding surgical decision-making and improving patient outcomes. By systematically assessing operative findings and postoperative recovery, these studies help surgeons identify the technique that provides optimal safety, efficiency, and patient satisfaction (12). In addition, laparoscopic surgery offers the advantage of exploring the entire abdominal cavity, which can be particularly useful when the diagnosis of appendicitis is uncertain or when other intra-abdominal pathologies are suspected (13).

Considering the increasing adoption of minimally invasive surgery and the continuing use of the conventional open method in many healthcare settings, it is essential to evaluate and compare the outcomes of both techniques (14). Therefore, the present study aims to assess and compare the surgical outcomes and postoperative complications associated with laparoscopic and open appendectomy in patients diagnosed with acute appendicitis". The findings of this study may contribute to better clinical decision-making and help determine the most appropriate surgical approach for the management of acute appendicitis.

## **AIMS AND OBJECTIVES**

**Aim:** To evaluate and compare the surgical outcomes and postoperative complications of laparoscopic appendectomy and open appendectomy in patients with acute appendicitis.

**Objective:** To assess and compare operative time, postoperative pain, duration of hospital stay, time to return to normal activity, and incidence of postoperative complications between laparoscopic and open appendectomy.

## **MATERIALS AND METHODS**

**Study Design:** This was a hospital-based comparative study conducted to evaluate surgical outcomes and postoperative complications in patients undergoing laparoscopic appendectomy and open appendectomy.

**Study Setting:** "The study was carried out in the Department of General Surgery.

**Study Duration:** The study was conducted over a period of 1 year.

**Study Population:** Patients presenting with clinical features suggestive of acute appendicitis and planned for appendectomy were included in the study.

### **Sample Size:**

A total of 60 patients were included in the study and were divided into two groups:

- **Group A:** 30 patients undergoing laparoscopic appendectomy
- **Group B:** 30 patients undergoing open appendectomy

A similar sample size and grouping were used in previous comparative studies evaluating laparoscopic and open appendectomy.

**Inclusion Criteria:**

Patients meeting the following criteria were included:

- Patients diagnosed with acute appendicitis
- Patients aged 18–60 years
- Patients willing to provide informed consent

**Exclusion Criteria:**

The following patients were excluded from the study:

- Patients with appendicular lump or abscess
- Patients with generalized peritonitis
- Patients with severe cardiorespiratory illness
- Patients unwilling to participate in the study

**Surgical Procedure:** In laparoscopic appendectomy, the procedure was performed using a standard three-port technique. The appendix was identified, the mesoappendix was divided, and the appendix was removed using laparoscopic instruments.

In open appendectomy, the procedure was performed through a right iliac fossa incision, commonly using a gridiron or Lanz incision. The appendix was identified, ligated, and removed according to standard surgical technique. Similar operative techniques have been described in comparative appendectomy studies.

**Study Parameters:**

The following parameters were evaluated:

- Operative time
- Postoperative pain
- Duration of hospital stay
- Time taken to return to normal activity
- Postoperative complications such as wound infection and intra-abdominal collection

**Data Collection:**

All relevant clinical details, operative findings, and postoperative outcomes were recorded in a pre-designed proforma.

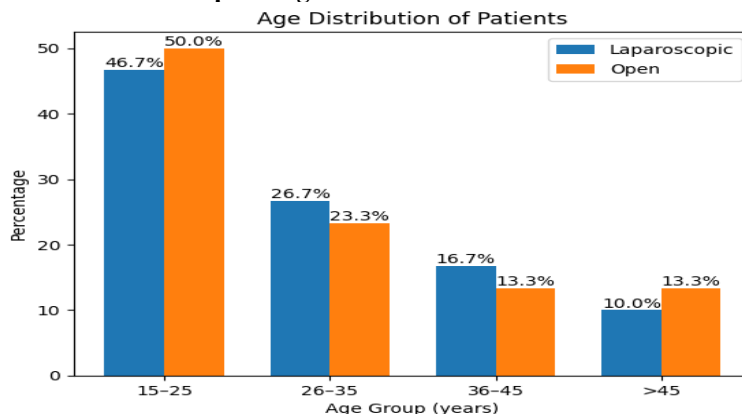
**Statistical Analysis:** The collected data were entered into Microsoft Excel and analyzed using SPSS software. Continuous variables were expressed as mean ± standard deviation, while categorical variables were expressed as frequency and percentage. The student’s t-test and Chi-square test were used for comparison between the two groups”. A p-value <0.05 was considered statistically significant.

**RESULTS**

**Table 1: Age Distribution of Patients**

Age Group (years)	Laparoscopic (n=30)	Open (n=30)	Total	p-value
15–25	14 (46.7%)	15 (50%)	29 (48.3%)	0.89
26–35	8 (26.7%)	7 (23.3%)	15 (25%)	
36–45	5 (16.7%)	4 (13.3%)	9 (15%)	
>45	3 (10%)	4 (13.3%)	7 (11.7%)	

**Graph 1: Age Distribution of Patients**

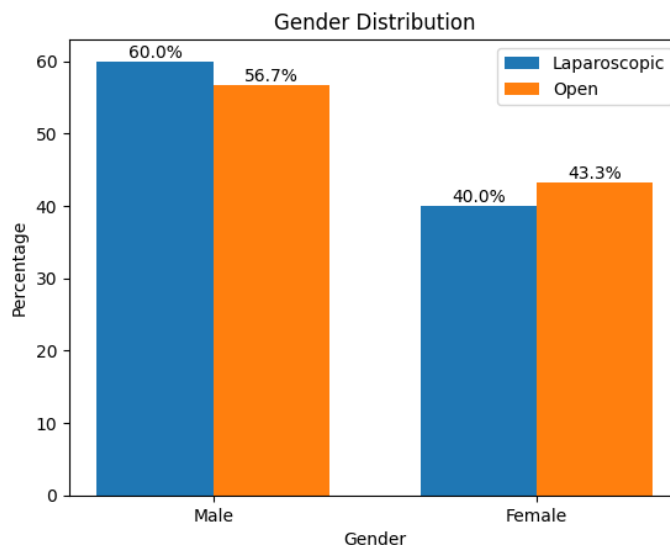


The majority of patients belonged to the 15–25 year age group. “There was no statistically significant difference between the two groups in terms of age distribution ( $p > 0.05$ ).

**Table 2: Gender Distribution**

Gender	Laparoscopic	Open	Total	p-value
Male	18 (60%)	17 (56.7%)	35 (58.3%)	0.79
Female	12 (40%)	13 (43.3%)	25 (41.7%)	

**Graph 2: Gender Distribution**

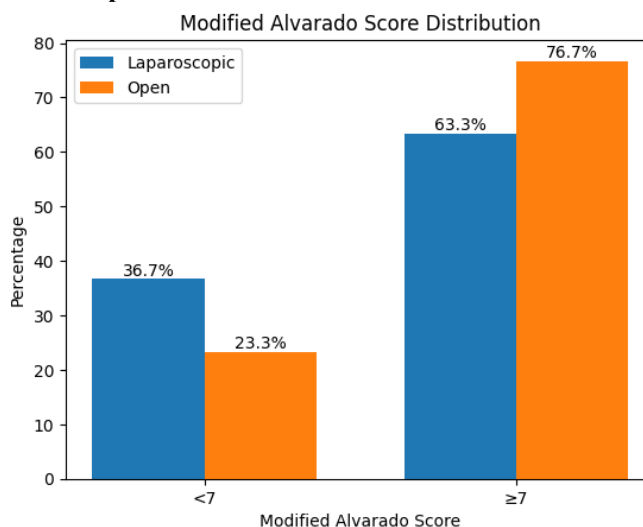


Male patients were slightly more common than females. The gender distribution between the two groups was comparable with no significant difference.

**Table 3: Modified Alvarado Score Distribution**

Score	Laparoscopic	Open	p-value
<7	11 (36.7%)	7 (23.3%)	0.28
≥7	19 (63.3%)	23 (76.7%)	

**Graph 3: Modified Alvarado Score Distribution**

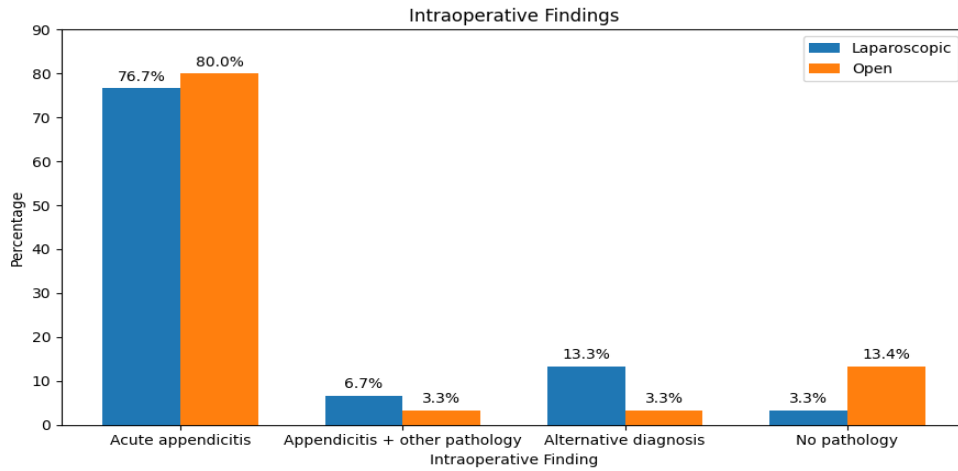


Most patients in both groups had a Modified Alvarado Score  $\geq 7$ , indicating a high probability of acute appendicitis. No significant difference was observed between the groups.

**Table 4: Intraoperative Findings**

Finding	Laparoscopic	Open	p-value
Acute appendicitis	23 (76.7%)	24 (80%)	0.24
Appendicitis + other pathology	2 (6.7%)	1 (3.3%)	
Alternative diagnosis	4 (13.3%)	1 (3.3%)	
No pathology	1 (3.3%)	4 (13.4%)	

**Graph 4: Intraoperative Findings**

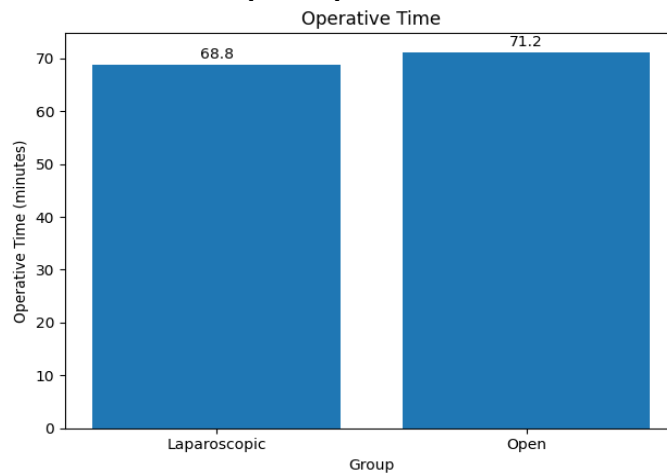


Most cases were confirmed to have acute appendicitis intraoperatively. Laparoscopy detected more alternative diagnoses, although the difference was not statistically significant.

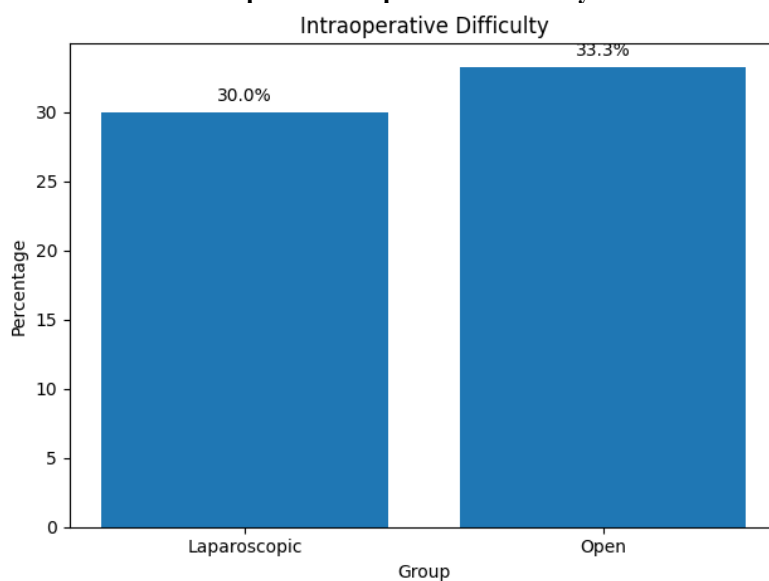
**Table 5: Operative Parameters**

Parameter	Laparoscopic	Open	p-value
Operative time (minutes)	68.8 ± 7.8	71.2 ± 8.6	0.40
Intraoperative difficulty	9 (30%)	10 (33.3%)	0.79

**Graph 5: Operative Time**



**Graph 6: Intraoperative Difficulty**

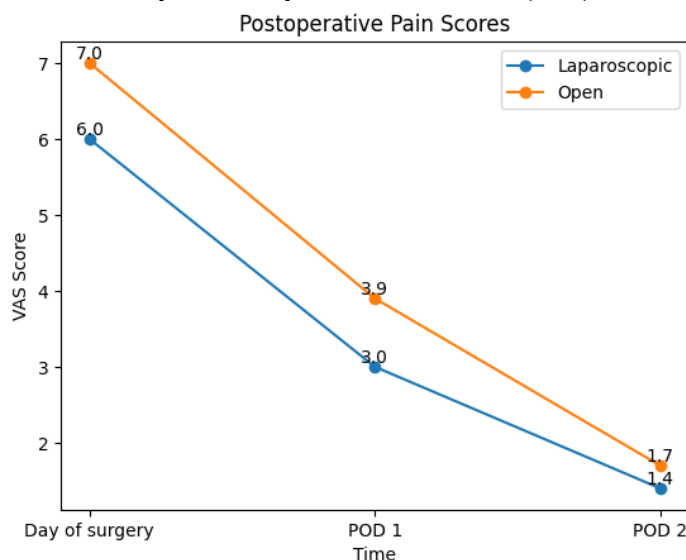


The mean operative time was slightly shorter in the laparoscopic group, but the difference was not statistically significant.

**Table 6: Postoperative Pain Scores (VAS)**

Time	Laparoscopic	Open	p-value
Day of surgery	6.0 ± 1.1	7.0 ± 1.1	0.001
POD 1	3.0 ± 1.3	3.9 ± 1.0	0.003
POD 2	1.4 ± 0.9	1.7 ± 0.9	0.02

**Graph 7: Postoperative Pain Scores (VAS)**

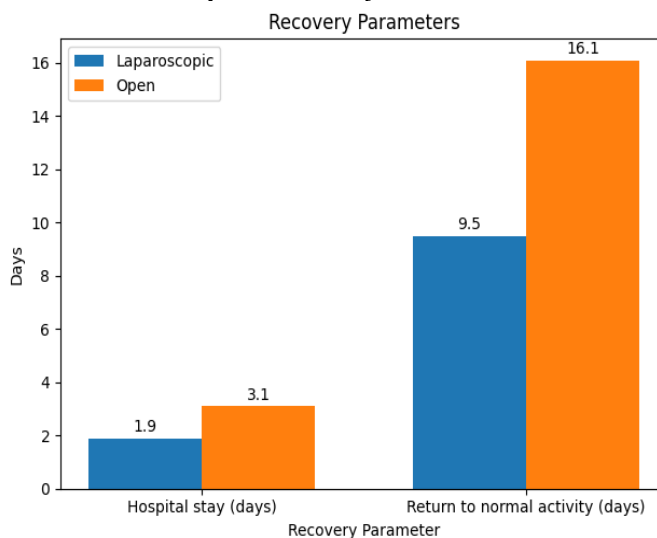


Patients undergoing laparoscopic appendectomy experienced significantly less postoperative pain compared to open appendectomy.

**Table 7: Recovery Parameters**

Parameter	Laparoscopic	Open	p-value
Hospital stay (days)	1.9 ± 0.8	3.1 ± 0.5	0.05
Return to normal activity (days)	9.5 ± 2.1	16.1 ± 4.2	0.01

**Graph 8: Recovery Parameters**

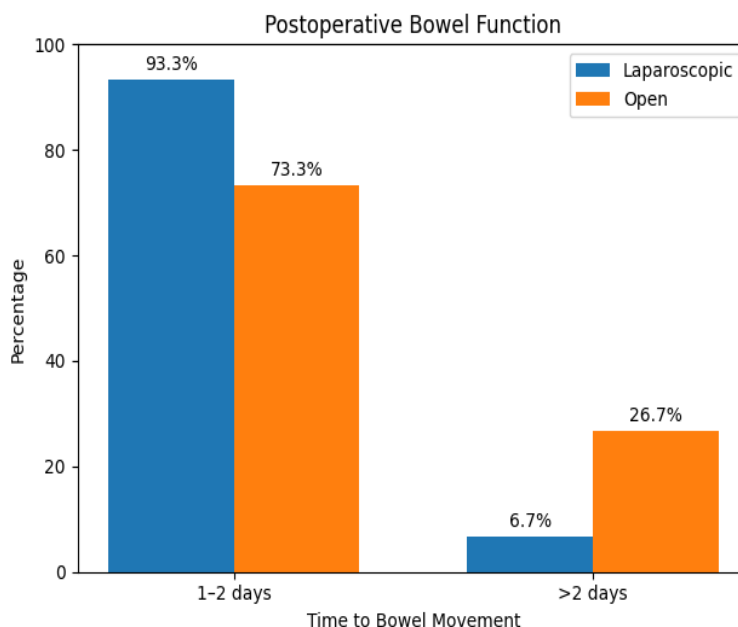


Patients in the laparoscopic group had shorter hospital stay and earlier return to normal activities, and the differences were statistically significant.

**Table 8: Postoperative Bowel Function**

Time to bowel movement	Laparoscopic	Open	p-value
1–2 days	28 (93.3%)	22 (73.3%)	0.03
>2 days	2 (6.7%)	8 (26.7%)	

**Graph 9: Postoperative Bowel Function**

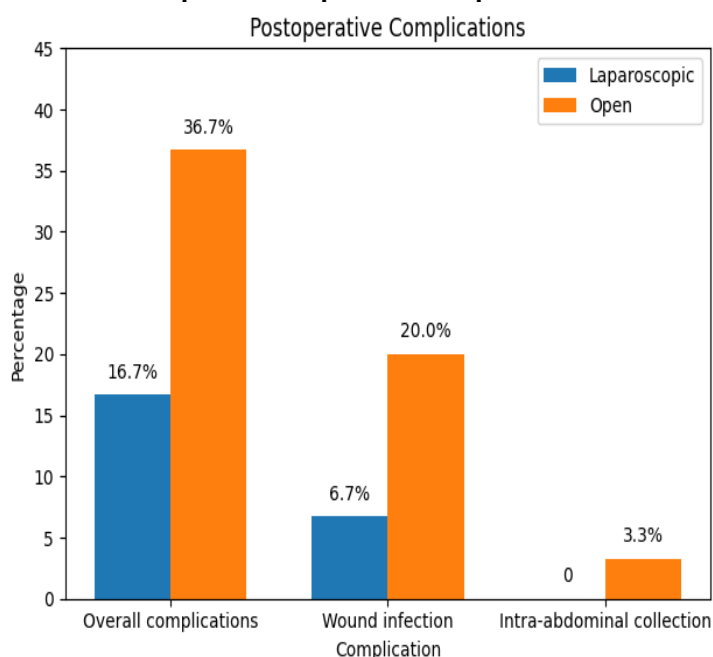


The return of bowel activity occurred earlier in the laparoscopic group, showing faster postoperative recovery.

**Table 9: Postoperative Complications**

Complication	Laparoscopic	Open	p-value
Overall complications	5 (16.7%)	11 (36.7%)	0.04
Wound infection	2 (6.7%)	6 (20%)	
Intra-abdominal collection	0	1 (3.3%)	

**Graph 10: Postoperative Complications**

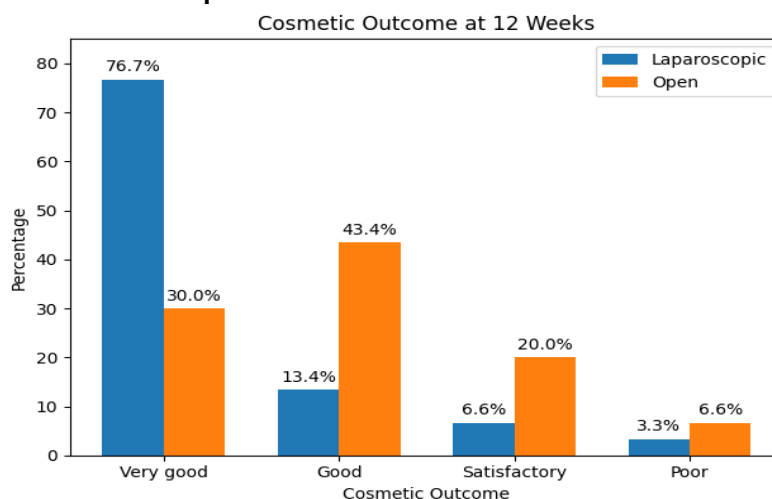


Postoperative complications were more common in the open appendectomy group, particularly wound infections, and the difference was statistically significant.

**Table 10: Cosmetic Outcome at 12 Weeks**

Outcome	Laparoscopic	Open	p-value
Very good	23 (76.7%)	9 (30%)	0.002
Good	4 (13.4%)	13 (43.4%)	
Satisfactory	2 (6.6%)	6 (20%)	
Poor	1 (3.3%)	2 (6.6%)	

**Graph 11: Cosmetic Outcome at 12 Weeks**



Patients undergoing laparoscopic appendectomy reported significantly better cosmetic outcomes compared to open appendectomy.

## DISCUSSION

Acute appendicitis remains one of the most common causes of acute abdominal pain requiring emergency surgical intervention. “Appendectomy has been the standard treatment for acute appendicitis for many decades, and surgical techniques have evolved considerably with the development of minimally invasive procedures. The present study compared laparoscopic appendectomy and open appendectomy with respect to surgical outcomes and postoperative complications. The findings of this study demonstrate that laparoscopic appendectomy offers several advantages over the conventional open technique in terms of postoperative recovery and complication profile.

In the present study, the majority of patients belonged to the younger age group, particularly between 15–25 years. This observation is consistent with the established epidemiology of acute appendicitis, which is known to occur more frequently in adolescents and young adults. Rosenthal and Sarosi (2024) also described appendicitis as a common surgical emergency predominantly affecting younger individuals and emphasized the importance of early surgical management to prevent complications (1). The comparable age and gender distribution between the two groups in this study ensured that the outcomes were not influenced by demographic bias.

The operative time in the present study showed no statistically significant difference between laparoscopic and open appendectomy. Although laparoscopic procedures are sometimes considered technically demanding, improvements in surgical training and equipment have reduced the difference in operative duration. Similar findings were reported by Azaro et al. (1999), who observed that operative times between laparoscopic and open appendectomy were comparable once surgeons gained adequate laparoscopic experience (12). Kehagias et al. (2008) also reported that the operative time may initially be longer for laparoscopic appendectomy but tends to decrease with increasing surgical expertise (5).

Postoperative pain was significantly lower in patients undergoing laparoscopic appendectomy compared to open appendectomy in the present study. This reduction in pain can be attributed to smaller surgical incisions and less tissue trauma associated with laparoscopic procedures. De (2005) reported similar findings and suggested that minimally invasive approaches reduce postoperative discomfort and improve patient satisfaction (10). Switzer et al. (2012) also described that the evolution of appendectomy toward minimally invasive techniques has contributed to improved postoperative outcomes and patient recovery (6).

Another important finding of the present study was the shorter duration of hospital stay and earlier return to normal activities among patients who underwent laparoscopic appendectomy. These findings support the concept that minimally invasive surgery facilitates faster recovery and earlier mobilization. Kirshtein et al. (2003) emphasized that laparoscopy in abdominal emergencies not only improves visualization of the operative field but also contributes to quicker postoperative recovery (13). Similarly, Seo et al. (2020) noted that patients undergoing laparoscopic appendectomy often achieve earlier discharge due to reduced postoperative pain and faster functional recovery (9).

The incidence of postoperative complications, particularly wound infection, was higher in the open appendectomy group in the present study. The larger incision and direct exposure of inflamed tissues in open surgery may contribute to higher rates of wound infection. Kehagias et al. (2008) reported that laparoscopic appendectomy is associated with lower wound infection rates compared to the open technique (5). Furthermore, Taha et al. (2025) highlighted that postoperative intra-abdominal infections remain an important concern in abdominal surgery and emphasized the need for proper surgical technique and infection prevention strategies (11).

An additional advantage of laparoscopic appendectomy observed in this study was improved visualization of the abdominal cavity, allowing detection of alternative diagnoses in certain cases. This benefit has also been noted in previous literature. Vanover and Saadai (2025) discussed that laparoscopic procedures provide a wider field of view and allow surgeons to examine other abdominal structures when the diagnosis is uncertain (3).

Overall, the findings of the present study are consistent with previously published literature suggesting that laparoscopic appendectomy provides better postoperative recovery, lower wound complication rates, and improved patient satisfaction compared to open appendectomy. These advantages make laparoscopic appendectomy a preferred surgical approach in the management of acute appendicitis whenever facilities and surgical expertise are available.

## CONCLUSION

The present study compared the surgical outcomes and postoperative complications of laparoscopic appendectomy and open appendectomy in patients with acute appendicitis. "The findings of the study indicate that laparoscopic appendectomy offers several advantages over the conventional open technique. Patients who underwent laparoscopic appendectomy experienced significantly less postoperative pain, shorter hospital stay, earlier return to normal daily activities, and better cosmetic outcomes. In addition, the incidence of postoperative complications, particularly wound infection, was lower in the laparoscopic group compared to the open appendectomy group. Although the operative time between the two procedures was comparable, the overall postoperative recovery was faster in patients treated with the laparoscopic approach. Furthermore, laparoscopy allowed better visualization of the abdominal cavity and helped in identifying alternative intra-abdominal pathologies when present". Therefore, laparoscopic appendectomy can be considered a safe and effective surgical technique and may be preferred over open appendectomy for the management of acute appendicitis whenever feasible.

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