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Original Research Article

# A Retrospective Cohort Study Comparing the Results of Open and Laparoscopic Appendectomy

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**Abstract:**

**Introduction:** Appendectomy is the most common emergency surgical procedure worldwide. In Western countries, the lifetime incidence of appendicitis is approximately 8%. Across all age groups, appendicitis is the most frequent reason for abdominal surgery. For over a century, open appendectomy has been the preferred method of treating patients with acute appendicitis.

**Aims and Objective:** To compare the results of open and laparoscopic appendectomy.

**Material and Method:** The study focuses on a retrospective analysis of appendectomies. This study examines the results of laparoscopic appendectomy and open appendectomy (OA and LA), taking into account a range of preoperative, intraoperative, and postoperative factors. With sample size of 250.

**Result:** There were 250 appendectomy cases in the study, with 39% female and 61% male. There was no discernible difference in the distribution of leukocyte counts between open and laparoscopic appendectomies. There was no peritonitis in either group. Alvarado Scores differed greatly, with fewer cases involving laparoscopic procedures. Variations in appendix conditions were found during surgical procedures. Significant differences were observed in postoperative characteristics, with laparoscopic appendectomies being preferred in terms of hospital stay duration, oral analgesic use, and parenteral analgesic use.

**Conclusion:** The overall positive results show that laparoscopy is a better option, providing an improved patient experience and possibly lowering healthcare costs, even though the longer operating time may initially raise concerns about its efficacy.

**Keywords:** Surgery, Appendicitis, Open Appendectomy, Laparoscopic Appendectomy.



## Introduction

The inflammation of the vermiform appendix is known as appendicitis. [1] Acute appendicitis (AA), which affects about 7% of the population, is the most common cause of surgical acute abdomen globally and it is the most common cause of abdominal surgeries in all the age groups. [2]

The lifetime risk of appendicitis is 6.7% for women and 8.6% for men. [3,4] The age range at which it peaks is 10–14 years for girls and 15–19 years for boys. Treatment of choice is appendectomy. In addition to providing a conclusive diagnosis, it also dramatically lowers the possibility of consequences like perforation, sepsis, and even death. [4]

When the appendix becomes inflamed, usually because of an obstruction within the appendix, bacterial overgrowth and infection ensue, resulting in appendicitis.

The appendix is a vestigial organ, [5] which means that evolution has stripped it of its original purpose. Although its precise function is still unknown, some theories speculate that it may have been involved in early humans' digestive systems. The appendix is no longer regarded as a necessary organ, and people can survive without it.

Appendicitis symptoms Include, fever, nausea, vomiting, and abdominal pain. [6] Appendectomy is the surgical procedure used to remove the inflamed appendix. [7] An appendectomy can be performed using either open surgery or laparoscopic surgery. To access the appendix directly during open surgery, the open approach to appendectomy was originally

described by McBurney, [8] a single, larger incision is made in the lower right abdomen. Smaller incisions are made during laparoscopic surgery, and specialized instruments and a camera are used for removal. [9]

An appendectomy is frequently regarded as a common and safe surgical procedure. [10] However, there are risks associated with any surgical procedure, including bleeding, anesthesia-related reactions, and infection. The degree of appendicitis and the patient's general health are two important considerations when deciding between open and laparoscopic surgery.

After an appendectomy, recovery is usually quick; many people can resume their regular activities in a few weeks. Long-term complications from the procedure are rare, and the removal of the appendix has little to no effect on digestive processes. [11]

**Aims and Objective:** To compare the Effectiveness of open and laparoscopic appendectomy.

**Material and Method**

The study focuses on a retrospective analysis of appendectomies. This study examines the results of laparoscopic appendectomy and open appendectomy (OA and LA), taking into account a range of preoperative, intraoperative, and postoperative factors. The study adheres to STROBE guidelines for reporting observational studies.

**Design and Setting:** Conducted as a retrospective cohort study. The study took place at 450-bed tertiary care center. Retrospective analysis covered patients undergoing open or laparoscopic appendectomy (OA or LA).

**Surgical Procedures:** Open appendectomy involves a single incision in the lower right abdomen (Gridiron Incision). Laparoscopic appendectomy is a minimally invasive surgery with small ports in the abdomen. Patients in both groups received prophylactic single-dose IV antibiotics (Inj. Ceftriaxone 1 gm IV) before the initial incision. No postoperative antibiotics were administered. All specimens were sent for histopathology in both approaches.

**Inclusion criteria:** Patients diagnosed with acute appendicitis clinically (Alvarado score) and radiologically, undergoing either OA or LA.

**Exclusion criteria:** Patients with specific conditions (history of lump, abdominal trauma, previous lower abdominal operation, pregnancy, severe medical diseases, and conversion from laparoscopic to open surgery).

**Limitations:** Single institution-based study. Results may have limitations when compared with other institutions. Sample size is only 250.

**Study Procedure:** Analyzed a total of 250 patients meeting inclusion criteria (150 OA, 100 LA). Collected preoperative baseline characteristics, intraoperative parameters, and postoperative outcomes. Baseline characteristics included age, sex, duration of symptoms, ALVARADO score, evidence of peritonitis, and leukocyte count. Intraoperative parameters included operative time, surgical findings, and complications. Postoperative outcomes included pain levels (VAS), analgesic usage, and bowel movements.

**Sample Size:** 250 patients (150 OA, 100 LA).

**Study Tool:** Utilized a research proforma and questionnaire during follow-up.

**Analytical Strategy:** Retrospective data collection followed by cleaning, classification, and coding. Coded data entered and tabulated using SPSS version 25. Categorical variables presented as frequency and percentage, compared using Chi-square tests and Likelihood Ratio. Parametric and non-parametric variables presented as mean ± standard deviation, compared using student's t-test and Mann–Whitney U tests, respectively. A p-value of $<0.05$ considered statistically significant.

**Results**

During the time that our data was being collected, 250 appendectomies were performed; 150 of those procedures were open (group OA), and the remaining 100 were laparoscopic (group LA).

**Table 1: Age of the respondents.**

| **Gender of the respondents** | | |
|---|---|---|
| | Frequency | Percentage |
| Male | 152 | 61% |
| Female | 98 | 39% |
| Total | 250 | 100% |

The above table discusses the frequency and percentage of Gender of the respondents.

**Table 2: Leukocyte count**

| Leukocyte count | | | | |
|---|---|---|---|---|
| | **Open appendectomy (*n* = 150)** | **Laparoscopic appendectomies (*n* = 100)** | **Pearson Values** | |
| <11,000 | 32 | 23 | | |
| 11,000–16,000 | 102 | 66 | $\chi2$= 0.330 | p= 0.833 |
| >16,000 | 16 | 11 | | |

The above table discusses the Leukocyte count. The two groups' leukocyte counts did not differ significantly ($\chi2 = 0.330$; $p = 0.833$).

**Table 3: Peritonitis in studied patients**

| **Peritonitis** | |
|---|---|
| Open appendectomy (n = 150) | Laparoscopic appendectomies (*n* = 100) |
| 0 | 0 |

The above table discusses the Peritonitis. There was no peritonitis in any of the cases.

**Table 4: Alvarado Score**

| **Alvarado Score** | | | | |
|---|---|---|---|---|
| | **Open appendectomy (n = 150)** | **Laparoscopic appendectomies (*n* = 100)** | **Pearson Value** | |
| 5 | 9 | 15 | | |
| 6 | 21 | 0 | | |
| 7 | 90 | 60 | | |
| 8 | 15 | 12 | | |
| 9 | 9 | 8 | | |
| 10 | 6 | 5 | $\chi2$= 30.10 | p= 0.004 |

The above table discusses the Alvarado's scores. Alvarado's scores in the two groups significantly different With Pearson $\chi2 = 30.10$ and $p = 0.004$.

**Table 5: Operative characteristics.**

| **Operative characteristics.** | | | |
|---|---|---|---|
| | Open appendectomy (n = 150) | Laparoscopic appendectomies (*n* = 100) | p value |
| Operative time (Mins) | 45.14 ± 14.04 | 59.8 ± 10.76 | 0.003 |

The above table discusses the Operative characteristics.

Open Appendectomy: With a standard deviation of 14.04 minutes, the mean operating time is 45.14 minutes. Laparoscopic Appendectomy: The mean operating time for this type of procedure is 59.8 minutes, with a standard deviation of 10.76 minutes. p value: 0.003, the difference in operative time was statistically significant.

**Table 6: Surgical procedure**

| **Surgical procedure** | | |
|---|---|---|
| | Open appendectomy (n = 150) | Laparoscopic appendectomies (*n* = 100) |
| SP findings | | |
| Normal appendix | 26 | 17 |
| Acutely inflamed tip | 111 | 78 |
| Gangrenous appendix | 8 | 5 |
| Perforated appendix | 5 | 0 |

The above table discusses the surgical procedure. Normal Appendix: Open Appendectomy: 26 cases, Laparoscopic Appendectomy: 17 cases Acutely Inflamed Tip: Open Appendectomy: 111 cases, Laparoscopic Appendectomy: 78 cases Gangrenous Appendix: Open Appendectomy: 8 cases, Laparoscopic Appendectomy: 5 cases Perforated Appendix: Open Appendectomy: 5 cases, Laparoscopic Appendectomy: 0 cases

**Table 7: Postoperative characteristics**

| **Postoperative characteristics.** | | | |
|---|---|---|---|
| | **Open appendectomy (n = 150)** | **Laparoscopic appendecto-mies (*n* = 100)** | **p value** |
| Length of hospital stay (days) | 1.15 ± 0.93 | 1.10 ± 0.22 | 0.001 |
| Time to first bowel movement (days) | 1.05 ± 0.39 | 1.04 ± 0.28 | 0.089 |
| Oral analgesics (days) | 3.45 ± 0.78 | 4.00 | 0.002 |
| Parenteral analgesics (days) | 1.00 ± 0.59 | 1.03 ± 0.29 | 0.006 |

The above table discusses the Postoperative characteristics.

Length of Hospital Stay: Open Appendectomy: 1.15 days (± 0.93), Laparoscopic Appendectomy: 1.10 days (± 0.22), p-value: 0.001 Time to First Bowel Movement: Open Appendectomy: 1.05 days (± 0.39), Laparoscopic Appendectomy: 1.04 days (± 0.28), p-value: 0.089 Oral Analgesics Duration: Open Appendectomy: 3.45 days (± 0.78), Laparoscopic Appendectomy: 4.00 days, p-value: 0.002 Parenteral Analgesics Duration: Open Appendectomy: 1.00 day (± 0.59), Laparoscopic Appendectomy: 1.03 days (± 0.29)

p-value: 0.006. There was no significant difference in the incidence of intraoperative complications in the two groups.

**Table 8: Intraoperative complications**

| | Open appendectomy (n = 150) | Laparoscopic appendectomies (*n* = 100) | p value |
|---|---|---|---|
| None | 148 | 98 | 0.49 |
| Ileal injury | 1 | 2 | |
| Limited colectomy | 1 | 0 | |

The above table discusses the Intraoperative complications.

**None:** Open Appendectomy: 148 cases**,** Laparoscopic Appendectomy: 98 cases

**Ileal Injury:** Open Appendectomy: 1 case**,** Laparoscopic Appendectomy: 2 case

**Limited Colectomy:** Open Appendectomy: 1 case**,** Laparoscopic Appendectomy: 0 cases**,** p-value: 0.49, There was no significant difference in the incidence of intraoperative complications in the two groups.

**Table 9: Late complications**

| | Open appendectomy (n = 150) | Laparoscopic appendectomies (*n* = 100) | p value |
|---|---|---|---|
| None | 141 | 96 | 0.12 |
| Intrabdominal abscess | 2 | 1 | |
| ECF | 1 | 0 | |
| SSI | 6 | 1 | |
| STUMP appendix | 0 | 2 | |

Above table shows; None: Open Appendectomy: 141 cases, Laparoscopic Appendectomy: 96 cases Intrabdominal Abscess: Open Appendectomy: 2 cases, Laparoscopic Appendectomy: 1 case Enterocutaneous Fistula (ECF): Open Appendectomy: 1 case, Laparoscopic Appendectomy: 0 cases Surgical Site Infection (SSI): Open Appendectomy: 6 cases, Laparoscopic Appendectomy: 1 case STUMP Appendix: Open Appendectomy: 0 cases, Laparoscopic Appendectomy: 2 cases

**Discussion**

The average age of the OA group and the LA group was determined to be comparable to certain research. [12] Several comparable studies have claimed that the average age in both groups is approximately in the 30s, which contradicts our findings. [13, 14, 15, 16]

The overall duration of the operation, consistent with the existing literature, was notably longer for laparoscopic appendectomy (LA) compared to open appendectomy (OA). [ 12, 10 17] The extended duration of local anesthesia (LA) can be attributed to the heightened use of instruments, the inclusion of extra setup procedures, and the learning curve experienced by surgeons. Our study found that the laparoscopic group had a much shorter hospital stay, consistent with several studies. [10, 12, 18, 19]

While the LA group saw an earlier average number of days for the first bowel movement, there was no significant statistical difference observed. Nevertheless, multiple studies have documented that the laparoscopic method leads to earlier bowel movement and decreased delay to oral intake after surgery. [10, 12, 13, 16, 18, 19, 20, 21]

Patients who had laparoscopic appendicitis in our study reported less pain than those who had open appendectomy. One major cause of postoperative pain is the reduced damage to the abdominal wall. Our result is consistent with other research that found that a laparoscopic procedure resulted in less pain following surgery. Additionally, the literature reports that the open group required significantly more parenteral analgesics, just as our study did. [12, 22, 23, 24]

Ileal damage and limited colectomy were noted intraoperative complications. Appendicular tumors, pelvic abscesses, and appendicular abscesses were not reported. The incidence of intraoperative complications did not, however, differ significantly between the two groups. The literature reports

similar findings. (19) Purulent peritonitis was found to be prevalent in OA groups by a study. [25]

With a laparoscopic procedure, there is less chance of early postoperative complications and less need for analgesics due to improved abdominal muscle mobility and early ambulation. [22] Late complications were noted, including stump appendix, enterocutaneous fistula, and intra-abdominal abscess. We did not observe any other complications in our study, including respiratory issues, venous thromboembolism, sepsis, or portal pyemia. Multiple studies have reported a higher incidence of late complications following an open appendectomy. [23,24,25] In previous research, an intra-abdominal abscess was the most frequent side effect of LA as opposed to OA; however, this was not the case in our investigation. [24, 26] However, extensive nationwide data from the United States has demonstrated that LA has lower overall morbidity, mortality, and shorter hospital stays than OA. [27]

Subsequent large-scale studies, spanning ten years in Sweden and Denmark, also reported a significant reduction in general complications, which included intra-abdominal abscesses. [28,29]

## Conclusion

When laparoscopic and open appendectomy techniques were compared, the laparoscopic procedure demonstrated a statistically longer operative time. On the other hand, patients who underwent laparoscopy recovered more quickly and had less pain following surgery thanks to shorter parenteral anesthesia times. An open appendectomy led to a significantly longer hospital stay, which increased medical expenses and put more pressure on patients' recovery. On the other hand, laparoscopic appendectomy showed promising results with shorter hospital stays, indicating a possibly quicker and seamless recovery after surgery. The results show that laparoscopy is a better choice for treating uncomplicated appendicitis because of its advantages, which include shorter hospital stays, less pain after surgery, and a possible decreased risk of complications. This is true even though the procedure takes longer.

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