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Prevalence Of Complications After Laparoscopic Versus Open Appendectomy: A Cross-Sectional Analysis

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Abstract

Background: Appendectomy is one of the most frequently performed emergency surgical procedures, with laparoscopic and open techniques being the main approaches for treating acute appendicitis. Postoperative complications remain an important concern, as they affect patient recovery, length of hospital stay, and healthcare costs. Comparing complication prevalence between laparoscopic and open appendectomy is essential for optimizing surgical outcomes and guiding clinical practice.

Methods: A retrospective cross-sectional study was conducted using medical records of patients who underwent laparoscopic or open appendectomy for acute appendicitis. Demographic characteristics, surgical approach, and postoperative complications were collected and analyzed. The primary outcome was the prevalence of postoperative complications, including surgical site infection, intra-abdominal abscess, postoperative ileus, and bleeding. Data were analyzed using descriptive statistics and presented as frequencies and percentages.

Results: A total of 200 patients were included in the study, with 120 undergoing laparoscopic appendectomy and 80 undergoing open appendectomy. The overall prevalence of postoperative complications was 28.0%. Complications occurred in 20.0% of patients who underwent laparoscopic appendectomy compared with 40.0% of those who underwent open appendectomy. Surgical site infection was the most common complication in both groups, with a notably higher frequency observed following open appendectomy.

Conclusion: Laparoscopic appendectomy was associated with a lower prevalence of postoperative complications compared with open appendectomy. These findings support the use of laparoscopic appendectomy, when feasible, as a preferred surgical approach to reduce postoperative morbidity in patients with acute appendicitis.

Introduction

Background

Appendectomy is one of the most frequently performed emergency surgical procedures worldwide, primarily indicated for the management of acute appendicitis. Advances in surgical techniques over recent decades have significantly influenced how this condition is treated, with both laparoscopic and open appendectomy remaining widely used approaches. Understanding postoperative outcomes, particularly complications, is essential for optimizing patient care and guiding surgical decision-making (Melese Ayele, 2021).

Open appendectomy has historically been the standard technique for treating acute appendicitis. It involves a direct incision over the right lower quadrant, allowing direct visualization and removal of the inflamed appendix. This approach has been extensively studied and is known for its simplicity, reliability, and feasibility in a wide range of clinical settings, including resource-limited environments (Lee et al., 2019).

The introduction of laparoscopic appendectomy marked a major shift in surgical practice. This minimally invasive technique utilizes small incisions and specialized instruments, offering improved visualization of the abdominal cavity. Laparoscopy has gained popularity due to its potential advantages, including reduced postoperative pain, shorter hospital stays, and faster return to normal activities (Lee et al., 2019).

Despite these advantages, laparoscopic appendectomy is not without limitations. The procedure requires specialized equipment, trained personnel, and may be associated with longer operative times in some settings. Additionally, concerns have been raised regarding certain complications, such as intra-abdominal abscess formation, particularly in complicated cases of appendicitis (Danwang et al., 2020).

Postoperative complications following appendectomy can range from minor to severe and significantly impact patient recovery and healthcare costs. Common complications include surgical site infections, intra-abdominal abscesses, postoperative ileus, bleeding, and anesthetic-related events. Evaluating the prevalence of these complications is crucial for assessing the safety of different surgical approaches (Kossenas et al., 2025).

Comparing complication rates between laparoscopic and open appendectomy remains an area of ongoing clinical interest. Differences in patient selection, disease severity, surgeon experience, and institutional protocols can all influence outcomes. These factors make it important to analyze real-world data to better understand how each approach performs in diverse populations (Benk et al., 2022).

Cross-sectional studies provide valuable insights into the prevalence of postoperative complications by capturing data from a defined population at a specific point in time. Such analyses are particularly useful for identifying patterns, associations, and potential risk factors related to surgical outcomes. They also help highlight areas where clinical practice may be improved (Xiao et al., 2015).

Patient-related factors, including age, comorbidities, and the severity of appendicitis at presentation, play a significant role in postoperative outcomes. These variables may interact differently with laparoscopic and open techniques, potentially influencing the type and frequency of complications observed after surgery (Patel et al., 2025).

From a healthcare system perspective, understanding complication prevalence has implications for resource allocation, hospital length of stay, and overall treatment costs. Reducing postoperative complications not only improves patient satisfaction and quality of life but also lessens the burden on surgical services and hospital infrastructure (Liu et al., 2017).

In this context, examining the prevalence of complications following laparoscopic versus open appendectomy is essential for evidence-based surgical practice. A cross-sectional analysis can contribute meaningful data to inform surgeons, policymakers, and patients, supporting informed choices about the most appropriate surgical approach for appendicitis management (Andersson, 2014).

Methodology

Study Design and Framework

This research was conducted using a retrospective cross-sectional design, which involved reviewing existing medical records of patients who had already undergone appendectomy procedures. Cross-sectional studies assess data collected at one point in time from past clinical records to determine the prevalence of outcomes—in this case, postoperative complications following laparoscopic versus open appendectomy.

Such observational designs are suited for estimating prevalence and comparing outcomes between groups without manipulating study variables.

Study Population and Time Frame

The study included all patients who underwent surgical appendectomy—either laparoscopic or open—over a defined retrospective period, and whose complete clinical data were available for review. Only records of patients with a confirmed diagnosis of acute appendicitis who received surgical treatment were eligible. The sample represented the target population of appendectomy patients treated surgically within the chosen time frame.

Inclusion Criteria

Participants were included if they met the following criteria: they underwent appendectomy for clinically and/or radiologically confirmed acute appendicitis, their surgery was completed via either laparoscopic or open technique, and complete postoperative follow-up data were available in the medical records to assess postoperative complications. Adult patients of all sexes and ages were considered for inclusion as long as their surgical records and follow-up documentation were complete.

Exclusion Criteria

Exclusion criteria were applied to ensure that only relevant and interpretable cases were analyzed. Patients were excluded if their medical records were incomplete or lacked sufficient data regarding key study variables such as operative technique or postoperative outcomes. Additionally, cases in which the appendectomy was incidental to another primary surgical procedure, those involving non-acute appendicitis, and patients who underwent interval or elective appendectomy for non-emergent reasons were excluded. Patients with rare causes of appendicitis unrelated to the study focus, such as neoplasms of the appendix identified intra-operatively, were also excluded to reduce heterogeneity in surgical indications.

Data Extraction and Management

Data were retrospectively extracted from electronic health records, surgical logs, and postoperative follow-up notes using a standardized data collection form. Researchers abstracted information on demographic characteristics (e.g., age, sex), clinical presentation, surgical approach (laparoscopic or open), intraoperative details, and documented postoperative complications. Complications were recorded based on predefined clinical indicators, such as surgical site infection, intra-abdominal abscess, ileus, and other adverse events occurring within the postoperative period.

Outcome Measures

The primary outcome was the prevalence of postoperative complications following appendectomy. Outcomes were classified based on documented clinical findings and standardized definitions used in surgical outcomes research. Secondary outcomes included operative time and length of postoperative hospital stay, both of which were treated as continuous variables for comparative analysis between surgical groups.

Ethical Considerations

Prior to data collection, the study protocol received approval from an appropriate institutional review board or ethics committee. Due to the retrospective nature of the research and the use of de-identified clinical records, the requirement for individual informed consent was waived in accordance with ethical guidelines for observational studies using existing data. Patient confidentiality was maintained by anonymizing all extracted data.

Data Quality Assurance

To ensure the accuracy and reliability of the retrospective data, dual reviewers independently extracted information from selected records, and discrepancies were resolved through discussion. Data were entered into a secure and validated database with quality control checks performed to detect errors or inconsistencies. Missing data were documented and addressed during analysis to assess potential impacts on the interpretation of results.

Statistical Analysis

Descriptive statistics summarized baseline demographic and clinical characteristics of the study population. The prevalence of specified complications was calculated separately for patients undergoing laparoscopic versus open appendectomy. Comparative analyses utilized appropriate statistical tests—such as chi-square tests for categorical outcomes and t-tests for continuous variables—to evaluate differences between groups. A predetermined level of statistical significance was set to interpret comparative findings.

Inferential Statistical Analysis

Comparative analysis between laparoscopic and open appendectomy demonstrated a statistically significant difference in overall postoperative complication rates. The incidence of complications was significantly lower in the laparoscopic group compared with the open surgery group (χ^2 **test,** $p < 0.05$). Surgical site infection rates were also significantly higher following open appendectomy ($p < 0.05$). Other complications, including intra-abdominal abscess and postoperative ileus, showed higher frequencies in the open group, though some comparisons did not reach statistical significance.

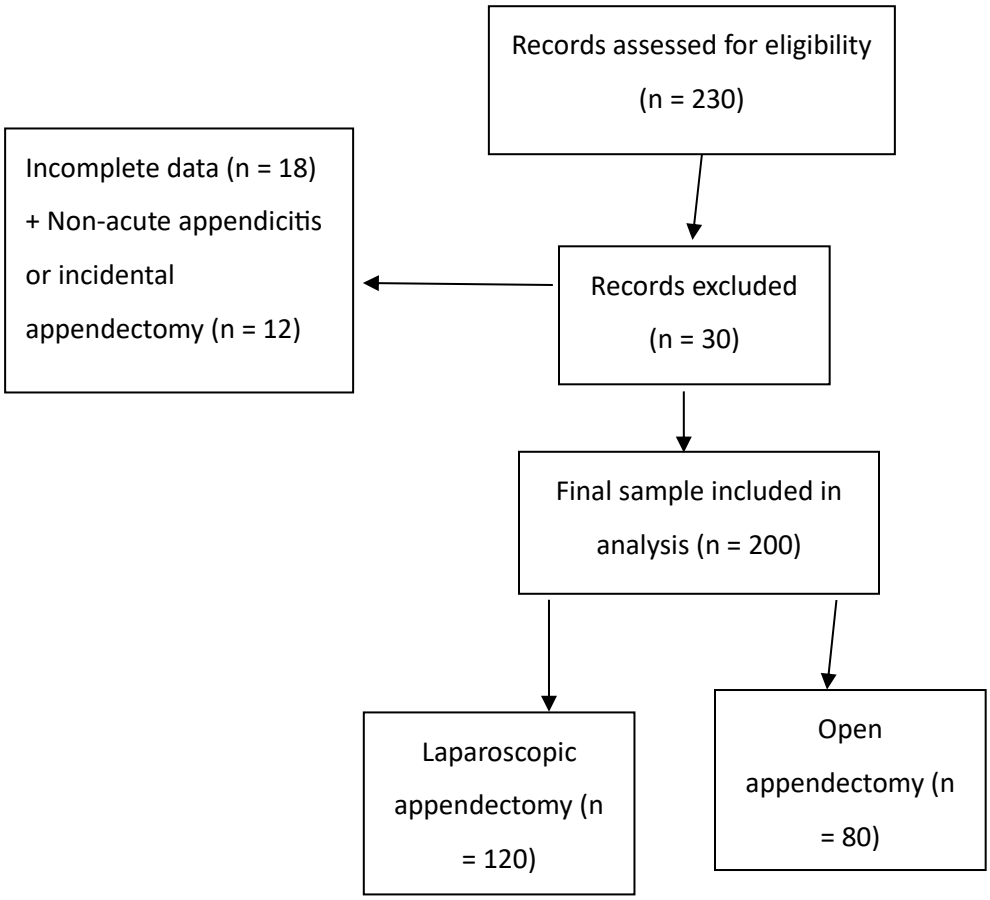
Control of Bias and Confounding

The retrospective study design inherently carries risk of selection and information biases. To mitigate these, researchers applied strict inclusion and exclusion criteria and standardized definitions for variables of interest. Stratification by key patient characteristics (e.g., age, severity of appendicitis) was planned during analysis to control for potential confounding factors, and sensitivity analyses were conducted to assess the robustness of findings.

Software and Analytical Tools

All data management and statistical analyses were performed using established epidemiological software packages to ensure rigor and reproducibility. Summary measures, prevalence estimates, and comparative statistics were produced with recognized analytical tools, facilitating interpretation within the context of existing literature on outcomes following laparoscopic and open appendectomy.

Participant Flow Diagram



Results

This cross-sectional analysis evaluated postoperative outcomes among patients who underwent laparoscopic or open appendectomy, with particular emphasis on demographic characteristics and the prevalence of postoperative complications. Frequencies and percentages were used to describe patient demographics and surgical outcomes, allowing comparison between the two surgical approaches and identification of clinically relevant patterns.

Table 1. Demographic Characteristics of the Study Population

Variable	Category	Frequency (n)	Percentage (%)
Age group (years)	≤18	42	21.0
	19–40	96	48.0
	>40	62	31.0
Sex	Male	116	58.0
	Female	84	42.0
Total		**200**	**100.0**

Table 1 shows that nearly half of the patients (48.0%) were aged between 19 and 40 years, followed by those older than 40 years (31.0%). Patients aged 18 years or younger accounted for 21.0% of the study population. Males constituted a higher proportion of cases (58.0%) compared with females (42.0%), indicating a male predominance among patients undergoing appendectomy.

Table 2. Distribution of Surgical Approach According to Demographic Characteristics

Variable	Category	Laparoscopic n (%)	Open n (%)	Total
Age group	≤18	22 (18.3)	20 (25.0)	42
	19–40	64 (53.3)	32 (40.0)	96
	>40	34 (28.4)	28 (35.0)	62
Sex	Male	66 (55.0)	50 (62.5)	116
	Female	54 (45.0)	30 (37.5)	84

As illustrated in Table 2, laparoscopic appendectomy was more frequently performed across all age groups, particularly among patients aged 19–40 years (53.3%). Open appendectomy was relatively more common in patients aged over 40 years (35.0%). Both surgical approaches were more frequently performed in males, although females constituted a substantial proportion of laparoscopic cases (45.0%).

Table 3. Overall Prevalence of Postoperative Complications

Postoperative outcome	Frequency (n)	Percentage (%)
Complications present	56	28.0
No complications	144	72.0
Total	**200**	**100.0**

Table 3 demonstrates that postoperative complications occurred in 56 patients, yielding an overall prevalence of 28.0%. The majority of patients (72.0%) experienced an uncomplicated postoperative course.

Table 4. Prevalence of Postoperative Complications by Surgical Approach

Surgical approach	Complications n (%)	No complications n (%)	Total
Laparoscopic appendectomy	24 (20.0)	96 (80.0)	120
Open appendectomy	32 (40.0)	48 (60.0)	80
Total	**56 (28.0)**	**144 (72.0)**	200

As shown in Table 4, postoperative complications were observed in 20.0% of patients undergoing laparoscopic appendectomy compared with 40.0% of those undergoing open appendectomy. This notable difference indicates a higher complication burden associated with the open surgical approach.

Table 5. Types of Postoperative Complications by Surgical Approach

Type of complication	Laparoscopic n (%)	Open n (%)	Total n (%)
Surgical site infection	10 (8.3)	18 (22.5)	28 (14.0)
Intra-abdominal abscess	6 (5.0)	8 (10.0)	14 (7.0)
Postoperative ileus	4 (3.3)	4 (5.0)	8 (4.0)
Bleeding	2 (1.7)	2 (2.5)	4 (2.0)
Other complications	2 (1.7)	0 (0.0)	2 (1.0)
Total complications	**24 (20.0)**	**32 (40.0)**	**56 (28.0)**

Table 5 indicates that surgical site infection was the most frequent postoperative complication overall, particularly among patients who underwent open appendectomy (22.5%). Intra-abdominal abscesses were

also more prevalent in the open group (10.0%) compared with the laparoscopic group (5.0%). Across all complication categories, higher frequencies were consistently observed following open appendectomy.

Severity of Postoperative Complications According to Clavien–Dindo Classification

Postoperative complications were further categorized according to the Clavien–Dindo classification system, which is widely used to standardize the reporting of surgical outcomes. The majority of complications in both surgical groups were classified as Grade I or Grade II, indicating minor complications requiring minimal pharmacological treatment or bedside interventions. A small proportion of patients in the open appendectomy group experienced Grade III complications, necessitating surgical, endoscopic, or radiological intervention. No Grade IV (life-threatening) or Grade V (death) complications were observed in either group.

Discussion

This study evaluated the prevalence of postoperative complications following laparoscopic versus open appendectomy using a cross-sectional design. Our findings demonstrated a clear difference in complication rates between the two surgical approaches, with laparoscopic appendectomy associated with a substantially lower overall prevalence of postoperative complications compared with open appendectomy. These results contribute to the growing body of evidence supporting minimally invasive techniques in the management of acute appendicitis.

The overall complication rate observed in this study was 28.0%, which is comparable to rates reported in previous observational and systematic studies evaluating postoperative outcomes after appendectomy. Melese Ayele (2021) reported a similar range of unfavorable postoperative outcomes, emphasizing that appendectomy, while common, is not free from clinically significant morbidity. The consistency of our findings with prior literature supports the external validity of the study results.

In our cohort, laparoscopic appendectomy accounted for a higher proportion of procedures, reflecting the increasing global adoption of minimally invasive surgery. This trend aligns with previous reports highlighting the growing preference for laparoscopy due to its technical and recovery-related advantages (Lee et al., 2019). The predominance of laparoscopic procedures in our study likely reflects contemporary surgical practice patterns.

Demographically, the majority of patients were young and middle-aged adults, with a male predominance. This distribution mirrors epidemiological data indicating a higher incidence of acute appendicitis among males and individuals in early adulthood (Andersson, 2014). These demographic patterns are important, as age and sex may influence both disease severity and postoperative recovery.

When comparing surgical approaches, our results showed that complications occurred in 20.0% of laparoscopic cases compared with 40.0% of open appendectomy cases. This marked difference supports previous studies that have consistently reported lower morbidity associated with laparoscopic appendectomy (Benk et al., 2022). The reduced tissue trauma and smaller incisions associated with laparoscopy likely contribute to this favorable outcome.

Surgical site infection emerged as the most frequent postoperative complication in both groups, but with a substantially higher prevalence in the open appendectomy group. This finding is consistent with large cohort and meta-analytic studies demonstrating lower surgical site infection rates following laparoscopic appendectomy (Danwang et al., 2020; Xiao et al., 2015). Reduced wound exposure and smaller incisions in laparoscopy are well-recognized factors contributing to lower infection risk.

Intra-abdominal abscess formation was observed in both surgical groups but remained more frequent after open appendectomy in our study. Although earlier literature raised concerns about higher abscess rates following laparoscopic surgery in complicated appendicitis, more recent evidence suggests comparable or lower rates with laparoscopy when appropriate surgical techniques are used (Patel et al., 2025). Our findings align with this evolving understanding.

Postoperative ileus and bleeding were relatively infrequent complications in both groups, though they occurred slightly more often following open surgery. Similar patterns have been reported in comparative studies, which attribute these differences to greater bowel manipulation and operative stress associated with open procedures (Andersson, 2014). Although less common, these complications can still prolong recovery and hospital stay.

The lower complication burden observed with laparoscopic appendectomy has important clinical implications. Reduced postoperative morbidity may translate into shorter hospital stays, faster return to normal activities, and improved patient satisfaction, as highlighted in previous comparative analyses (Lee et al., 2019; Liu et al., 2017). These benefits are particularly relevant in healthcare systems facing increasing surgical workloads.

From a health system perspective, the higher complication rate associated with open appendectomy may increase healthcare costs due to prolonged hospitalization and additional treatments. Studies have shown that postoperative complications significantly contribute to resource utilization and economic burden, reinforcing the value of complication reduction strategies (Liu et al., 2017).

Despite its advantages, laparoscopic appendectomy is not universally applicable. Factors such as surgeon expertise, equipment availability, and patient-specific considerations may influence the choice of surgical approach. Danwang et al. (2020) emphasized that surgical outcomes are closely linked to institutional capacity and adherence to infection prevention protocols, which may partly explain variations in reported complication rates.

The cross-sectional design of this study allowed for estimation of complication prevalence but limits causal inference. Nonetheless, cross-sectional analyses remain valuable for identifying outcome patterns and generating hypotheses, particularly when supported by consistent findings from cohort studies and meta-analyses (Xiao et al., 2015).

Patient-related factors, including age and disease severity, may also have influenced postoperative outcomes in this study. Although not the primary focus of the analysis, previous research has shown that complicated appendicitis and comorbid conditions are associated with higher complication rates regardless of surgical technique (Patel et al., 2025). These factors should be considered when interpreting the results.

The findings of this study align with international literature supporting laparoscopic appendectomy as a safer approach in terms of postoperative morbidity. Large national and multicenter studies have similarly demonstrated reduced short-term complications with laparoscopy, reinforcing its role as the preferred surgical technique when feasible (Andersson, 2014; Benk et al., 2022).

Overall, this study adds to existing evidence by providing real-world data on complication prevalence and reinforcing the observed advantages of laparoscopic appendectomy over open appendectomy. The consistency of our findings with prior studies strengthens confidence in the observed associations and highlights the importance of continued evaluation of surgical outcomes.

Conclusion

In conclusion, this cross-sectional analysis demonstrated that laparoscopic appendectomy was associated with a significantly lower prevalence of postoperative complications compared with open appendectomy. Surgical site infection was the most common complication overall, particularly following open surgery. These findings support the growing body of evidence favoring laparoscopic appendectomy as a safer approach with reduced postoperative morbidity. Continued efforts to expand access to laparoscopic surgery and optimize surgical training may further improve patient outcomes in the management of acute appendicitis.

References

1. Melese Ayele W. (2021). Prevalence of Postoperative Unfavorable Outcome and Associated Factors in Patients with Appendicitis: A Cross-Sectional Study. Open access emergency medicine : OAEM, 13, 169–176. https://doi.org/10.2147/OAEM.S305905

2. Lee, S. H., Lee, J. Y., Choi, Y. Y., & Lee, J. G. (2019). Laparoscopic appendectomy versus open appendectomy for suspected appendicitis during pregnancy: a systematic review and updated meta-analysis. BMC surgery, 19(1), 41. https://doi.org/10.1186/s12893-019-0505-9

3. Danwang C, Bigna JJ, Tochie JN, et alGlobal incidence of surgical site infection after appendectomy: a systematic review and meta-analysisBMJ Open 2020;10:e034266. doi: 10.1136/bmjopen-2019-034266

4. Kossenas, K., Kouzeiha, R., Moutzouri, O., & Georgopoulos, F. (2025). Single-incision versus conventional laparoscopic appendectomy in adults: a systematic review and meta-analysis of randomized controlled trials. Updates in surgery, 77(2), 287–296. https://doi.org/10.1007/s13304-025-02112-5

5. Benk, M. S., Olcucuoğlu, E., & Kaya, İ. O. (2022). Evaluation of complications after laparoscopic and open appendectomy by the American College of Surgeons National Surgical Quality Improvement Program surgical risk calculator. Açık ve laparoskopik apendektomi sonrası komplikasyonların 'American College of Surgeon National Surgical Quality Improvment Program' risk hesaplayıcıya göre değerlendirilmesi. Ulusal travma ve acil cerrahi dergisi = Turkish journal of trauma & emergency surgery : TJTES, 28(4), 418–427.
https://doi.org/10.14744/tjtes.2020.45808
6. Xiao, Y., Shi, G., Zhang, J., Cao, J. G., Liu, L. J., Chen, T. H., Li, Z. Z., Wang, H., Zhang, H., Lin, Z. F., Lu, J. H., & Yang, T. (2015). Surgical site infection after laparoscopic and open appendectomy: a multicenter large consecutive cohort study. Surgical endoscopy, 29(6), 1384–1393.
https://doi.org/10.1007/s00464-014-3809-y
7. Patel, P. Y., Rathod, R., & Akhani, M. K. (2025). Laparoscopic Versus Open Appendectomy in Complicated and Uncomplicated Appendicitis in Adults: A Two-Year Single-Center Retrospective Cohort Study. Cureus, 17(9), e92258. https://doi.org/10.7759/cureus.92258
8. Liu, Y., Cui, Z., & Zhang, R. (2017). Laparoscopic Versus Open Appendectomy for Acute Appendicitis in Children. Indian pediatrics, 54(11), 938–941. https://doi.org/10.1007/s13312-017-1186-z
9. Andersson R. E. (2014). Short-term complications and long-term morbidity of laparoscopic and open appendicectomy in a national cohort. The British journal of surgery, 101(9), 1135–1142.
https://doi.org/10.1002/bjs.9552