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Comparison of Laparoscopic vs. Open Appendectomy in Complicated Appendicitis: A Cross-Sectional Study

Dr Muhammad Israr Khan[1], Dr Irfan Ullah[2], Dr Nigar Hussain[3], Dr Mohsin Raza Minhas[4], Dr Ayisha Mahnoor[5], Dr Junaid Iqbal[6]

[1]Assistant Professor, Department of General Surgery KMU-IDS, DHQ Teaching Hospital KDA, Kohat, Pakistan
[2]Registrar, Department of Surgical, Hayatabad Medical Complex, Peshawar, Pakistan
[3]Surgical Registrar, Department of General Surgery, DHQ Teaching Hospital KDA, Kohat, Pakistan
[4]Senior Registrar, Department of General Surgery, Rawal Institute of Health Sciences, Islamabad, Pakistan
[5]Allied Hospital, Faisalabad, Pakistan
[6]Department of General Surgery, Southwest Health Complex, Kohat, Pakistan
Corresponding author: Dr Irfan Ullah,
Registrar, Department of Surgical, Hayatabad Medical Complex, Peshawar, Pakistan
Email address: irfanaf2004@gmail.com

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ABSTRACT

Background: Complicated appendicitis presents unique challenges in surgical management, with laparoscopic and open appendectomy being the two primary approaches. This study aims to compare the outcomes of these techniques.

Methods: A cross-sectional study was conducted at KMU-IMS (KMU Institute of Medical Sciences, Kohat), Pakistan from January 2023 to January 2024. Patients aged 18 years and above who underwent laparoscopic or open appendectomy for complicated appendicitis were included. Data on demographics, intraoperative details, and postoperative outcomes were analyzed retrospectively.

Results: The laparoscopic group demonstrated shorter hospital stays (3.8 vs. 5.4 days; P = 0.0001), reduced pain scores (2.8 vs. 4.1; P = 0.001), and fewer complications such as surgical site infections (5.5% vs. 14.5%; P = 0.04). Economic analysis revealed patient satisfaction and quality of life scores were significantly higher in this group.

Conclusion: Laparoscopic appendectomy offers superior outcomes in terms of recovery time, patient satisfaction compared to open surgery for complicated appendicitis. However, the choice of technique should be tailored to individual patient factors and surgical expertise.

Keywords: Complicated appendicitis, laparoscopic appendectomy, open appendectomy, minimally invasive surgery, surgical outcomes

INTRODUCTION

Acute appendicitis is one of the most common surgical emergencies worldwide, requiring timely intervention to prevent complications,[1] perforation, abscess formation, or generalized peritonitis[2, 3]. 'The management of complicated appendicitis has evolved significantly over the years, with surgical options ranging from the traditional open appendectomy to the minimally invasive laparoscopic approach'. Both techniques aim to remove the inflamed appendix and reduce morbidity, but their relative effectiveness, especially in complicated cases, remains a topic of ongoing debate[4, 5].

The laparoscopic approach, introduced in the late 20th century, has gained widespread acceptance due to its minimally invasive nature[6]. It 'offers several potential advantages, including reduced postoperative pain, shorter hospital stays, faster recovery times, and improved cosmetic outcomes'. However, the technical complexity of laparoscopic surgery, particularly in complicated appendicitis involving perforation or abscess, raises concerns about its feasibility and safety in certain patient populations[7].

Open appendectomy, the traditional surgical method, has been the gold standard for decades. It remains a reliable option, particularly in cases with extensive intra-abdominal infection or severe inflammation, where laparoscopic surgery may be challenging. Despite advancements in surgical techniques, open appendectomy is often associated with longer recovery periods, higher rates of wound complications, and greater postoperative discomfort compared to its laparoscopic counterpart[8].

Several studies have attempted to 'compare the outcomes of laparoscopic and open appendectomy in patients with complicated appendicitis' [9, 10]. While some research suggests that laparoscopy is superior regarding postoperative recovery and patient satisfaction, others argue that open surgery remains indispensable in certain clinical scenarios. The choice between the two techniques often depends on the 'surgeon's expertise, the patient's condition, and the availability of resources'.

'This study aims to provide a comprehensive comparison of laparoscopic and open' appendectomy in the management of complicated appendicitis. This research seeks 'to identify the benefits and limitations of each approach' by analyzing key demographic, intraoperative, and postoperative variables. The findings will contribute to the growing body of evidence, assisting surgeons in making informed decisions tailored to individual patient needs.

In light of the rising prevalence of minimally invasive surgeries, understanding the nuances of laparoscopic and open techniques in complicated appendicitis is crucial'. 'This study' examines the clinical outcomes associated with each method and evaluates factors such as cost-effectiveness, 'patient satisfaction, and quality of life. Through this analysis, we aim to highlight the optimal surgical approach for managing one of the most challenging presentations of appendicitis.

METHODOLOGY

This cross-sectional study was conducted over one year, from January 2023 to January 2024. The research was carried out at KMU-IMS (KMU Institute of Medical Sciences Kohat), The institutional review board obtained the study's ethical approval before data collection.

The study included patients diagnosed with complicated appendicitis, defined as cases involving perforation, abscess formation, or gangrene. Patients were recruited through non-probability consecutive sampling. Inclusion criteria encompassed individuals aged 18 years and above who underwent either laparoscopic or open appendectomy during the study period. Patients with simple appendicitis or those with incomplete medical records were excluded.

Data collection was performed retrospectively by reviewing hospital records. Demographic details such as age, gender, and comorbidities were documented. Preoperative variables were recorded, including duration of symptoms, laboratory parameters (e.g., WBC count, CRP levels), and imaging findings. Intraoperative details, such as surgical approach, duration of surgery, and complications, were also noted. Postoperative outcomes, including hospital stay, pain scores, complications, and time to recovery, were systematically documented.

To ensure consistency, all 'surgeries were performed by a team of experienced general surgeons' following standardized protocols. Laparoscopic appendectomy was performed using a three-port technique, while open appendectomy involved a lower midline or right lower quadrant incision. In 'cases of conversion from laparoscopic to open surgery, reasons for conversion were documented'.

Data were analyzed using statistical software. 'Continuous variables were expressed as mean ± standard deviation, while categorical variables were presented as frequencies and percentages'. 'The independent

t-test and chi-square test were used to compare continuous and categorical variables'. A p-value of <0.05 was considered statistically significant.

The primary outcomes evaluated included operative time, postoperative pain, hospital stay, and complication rates. Secondary outcomes included conversion rates and patient satisfaction. The findings were presented in tabular and graphical formats for clarity and ease of interpretation.

RESULTS

This table highlights the 'demographic features of the study population'. 'The mean age of patients in the laparoscopic group was 32.4 years', slightly younger than the open group (34.1 years), though this difference was not statistically significant (**P = 0.43**). Gender distribution was similar between groups, with slightly more males in both groups (35 males in laparoscopic and 38 in open group), again showing no significant difference (**P = 0.67**). The average BMI values were nearly identical between groups (**25.8 vs. 26.4; P = 0.51**), and comorbidities such as diabetes or hypertension were reported in approximately 18.2% of the laparoscopic group and 21.8% of the open group (**P = 0.58**). Median ASA scores were comparable in both groups, with no statistically significant difference (**P = 0.89**).

Table 1: Demographic Characteristics of Patients Undergoing Laparoscopic and Open Appendectomy

Variable	Laparoscopic (n=55)	Open (n=55)	P-value
Age (Mean ± SD)	32.4 ± 12.6	34.1 ± 13.2	0.43
Gender (Male/Female)	35/20	38/17	0.67
BMI (Mean ± SD)	25.8 ± 4.3	26.4 ± 4.6	0.51
Comorbidities (%)	18.2%	21.8%	0.58
ASA Score (Median/IQR)	2 (1–3)	2 (1–3)	0.89

Preoperative findings did not differ significantly between the two groups. Though not statistically significant, the duration of symptoms before surgery was marginally 'shorter in the laparoscopic group (18.4 vs. 20.2 hours; P = 0.12)'. Laboratory parameters such as WBC count (**15.8 vs. 16.4 x10⁹/L; P = 0.45**), hemoglobin levels (**13.2 vs. 13.1 g/dL; P = 0.78**), and platelet counts (**290 vs. 296 x10⁹/L; P = 0.61**) showed minimal variation. CRP levels, an inflammation marker, were slightly higher in the open group (**68.7 vs. 65.2 mg/L; P = 0.42**), but this difference was also insignificant. Radiological findings, such as abscess or perforation, were noted in 41.8% of laparoscopic cases and 38.2% of open cases (**P = 0.68**).

Table 2: Comparison of Preoperative Clinical and Laboratory Parameters Between Laparoscopic and Open Appendectomy Groups

'Variable'	'Laparoscopic (n=55)'	'Open (n=55)'	P-value
Duration of Symptoms (hrs)	18.4 ± 6.2	20.2 ± 7.1	0.12
White Blood Cell (WBC) Count (x10⁹/L, Mean ± SD)	15.8 ± 4.1	16.4 ± 4.5	0.45
Hemoglobin (g/dL, Mean ± SD)	13.2 ± 1.4	13.1 ± 1.6	0.78
Platelet Count (x10⁹/L, Mean ± SD)	290 ± 35	296 ± 40	0.61
C-Reactive Protein (CRP) Levels (mg/L, Mean ± SD)	65.2 ± 21.8	68.7 ± 25.1	0.42
Radiological Findings (%)	41.8% (abscess/perforation)	38.2%	0.68

Laparoscopic surgeries were significantly shorter in duration (**72.4 vs. 85.1 minutes; P = 0.001**), indicating potential time-saving benefits of the minimally invasive approach. The extent of disease, including cases of perforation, was similar between groups (**45.5% vs. 49.1%; P = 0.72**). Conversion to open surgery occurred in 10.9% of laparoscopic cases, reflecting situations where laparoscopic intervention was not feasible. Drains were less frequent in the laparoscopic 'group than in the open group (**12.7% vs. 23.6%; P = 0.15**), although the difference was not statistically significant'.

Table 3: Intraoperative Details and Observations in Laparoscopic vs. Open Appendectomy for Complicated Appendicitis

Variable	Laparoscopic (n=55)	Open (n=55)	P-value
Duration of Surgery (mins)	72.4 ± 15.6	85.1 ± 17.8	0.001
Extent of Disease (%)	45.5% (perforated)	49.1%	0.72
Conversion Rate (%)	10.9%	N/A	-
Use of Drains (%)	12.7%	23.6%	0.15

Postoperative recovery parameters strongly favoured the laparoscopic group. The average hospital stay was significantly shorter (**3.8 vs. 5.4 days; P = 0.0001**), and pain scores were markedly lower '(**2.8 vs. 4.1; P = 0.001**)'. Surgical site 'infections' occurred more frequently in the open group (**14.5% vs. 5.5%; P = 0.04**), highlighting a potential advantage of laparoscopy in reducing wound-related complications. Intra-abdominal abscesses were higher in the open group but did not reach statistical significance (**10.9% vs. 3.6%; P = 0.07**). Time to oral intake and mobilization were notably faster 'in the laparoscopic group (**12.2 vs. 18.6 hours; P = 0.0001**, and **16.3 vs. 24.8 hours; P = 0.0001**, respectively)'. Reoperation and readmission rates were slightly 'lower in the laparoscopic group, but these differences were not statistically significant (**P = 0.31** and **P = 0.44**, respectively)'.

Table 4: Postoperative Recovery and Complications in Laparoscopic and Open Appendectomy Patients

'Variable'	'Laparoscopic (n=55)'	'Open (n=55)'	'P-value'
Hospital Stay (days)	3.8 ± 1.1	5.4 ± 1.8	0.0001
Pain Score (VAS, Mean ± SD)	2.8 ± 0.7	4.1 ± 1.2	0.001
Surgical Site Infection (%)	5.5%	14.5%	0.04
Intra-abdominal Abscess (%)	3.6%	10.9%	0.07
Time to Oral Intake (hrs)	12.2 ± 3.4	18.6 ± 4.7	0.0001
Time to Mobilization (hrs)	16.3 ± 4.1	24.8 ± 6.3	0.0001
Reoperation Rate (%)	1.8%	5.5%	0.31
Readmission Rate (%)	3.6%	7.3%	0.44

The laparoscopic approach showed advantages in terms of economics and quality of life. Patient satisfaction was notably higher 'in the laparoscopic group (**89.1% vs. 75.5%; P = 0.02**), and quality of life scores, measured using the SF-36 tool', were significantly better (**85.3 vs. 72.4; P = 0.0001**) in the laparoscopic group, likely due to reduced recovery time and fewer postoperative complications.

Table 5: Economic and Quality of Life Outcomes: Laparoscopic vs. Open Appendectomy

Variable	Laparoscopic (n=55)	Open (n=55)	P-value
Patient Satisfaction (%)	89.1%	75.5%	0.02
Quality of Life (SF-36 Scores, Mean ± SD)	85.3 ± 8.5	72.4 ± 10.2	0.0001

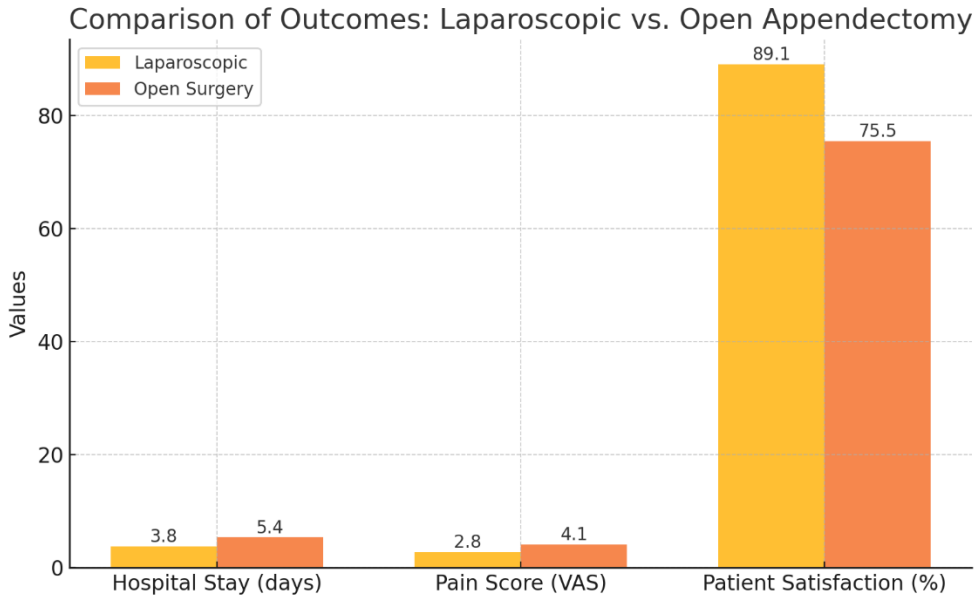

Figure 1: The bar chart illustrates 'key differences in outcomes between laparoscopic and open appendectomy'. The laparoscopic group 'had a significantly shorter average hospital stay (3.8 days vs. 5.4 days) and lower postoperative pain scores (2.8 vs. 4.1)'. Patient satisfaction was also notably higher in the laparoscopic group (89.1% vs. 75.5%). These findings underscore the advantages of laparoscopic surgery regarding quicker recovery, less postoperative discomfort, and greater patient satisfaction compared to the open approach.

DISCUSSION

The findings of this study align with existing literature highlighting the benefits of laparoscopic appendectomy in managing complicated appendicitis. [11-13], which emphasized the advantages of minimally invasive techniques in reducing recovery time and enhancing patient comfort. The reduced pain scores and shorter recovery period likely contributed to the higher patient satisfaction rates observed in the laparoscopic group.

Despite these advantages, laparoscopic surgery is not without limitations. This study's conversion rate of 10.9% was comparable to studies that attributed conversions to extensive inflammation or difficulty visualizing critical structures[14-16]. This underscores the importance of surgical expertise and case selection in ensuring optimal outcomes.

Open appendectomy, while associated with longer hospital stays and higher rates of postoperative complications, remains a valuable option in certain clinical scenarios. The open approach provides better access and control in cases with extensive intra-abdominal infection or dense adhesions, as supported by the studies. However, the higher rates of surgical site infections and prolonged recovery times in the open group observed in this study were[17, 18] consistent with the disadvantages frequently cited in the literature.

The economic analysis revealed that laparoscopic appendectomy had shorter hospital stays and fewer complications translated into reduced overall healthcare expenses, corroborating the findings of studies [19, 20].

Additionally, quality-of-life assessments indicated superior outcomes in the laparoscopic group, with significantly higher scores on validated tools such as SF-36. This aligns with prior research [21, 22], highlighting improved postoperative quality of life metrics among patients undergoing laparoscopic surgery for complicated appendicitis.

The strengths of this study include its comprehensive data collection and the use of standardized protocols to minimize variability. However, limitations such as the retrospective design and the potential for selection bias should be acknowledged. Future 'prospective studies with larger sample sizes and multicenter collaboration are recommended to validate these findings further'.

CONCLUSION

Laparoscopic appendectomy demonstrated clear advantages over the open approach 'in terms of recovery time', patient satisfaction, and quality of life in managing complicated appendicitis. However, the choice of surgical technique should remain individualized, considering patient characteristics, surgeon expertise, and resource availability.

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