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Original Article

Outcomes of Laparoscopic Appendicectomy In Children with Complicated Appendicitis: A Retrospective Study

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ABSTRACT

Background: Complicated appendicitis in children is associated with increased morbidity and postoperative complications. Laparoscopic appendicectomy has increasingly become an accepted surgical approach due to its minimally invasive nature and favourable postoperative outcomes.
Aim: To evaluate the outcomes of laparoscopic appendicectomy in children with complicated appendicitis.
Materials and Methods: This retrospective observational study was conducted in the Department of General Surgery at SS Institute of Medical Sciences & Research Centre over a period of 2 years from 2024 to 2025. A total of 50 pediatric patients diagnosed with complicated appendicitis and treated with laparoscopic appendicectomy were included in the study. Data regarding demographic profile, clinical presentation, operative findings, postoperative complications, duration of surgery, hospital stay, and recovery were collected from hospital records and analysed statistically.
Results: The majority of patients belonged to the 11–15 years age group, with male predominance. Abdominal pain was the most common presenting symptom. Perforated appendicitis was the most common intraoperative finding. Most surgeries were completed within 60–90 minutes. Postoperative complications included fever, surgical site infection, postoperative ileus though the majority of patients had no significant complications. Most children resumed oral feeding within 24 to 48 hours and had a hospital stay of 6–8 days.
Conclusion: Laparoscopic appendicectomy is a safe and effective treatment modality for complicated appendicitis in children. It is associated with acceptable operative duration, low postoperative complication rates, shorter hospital stay, and faster postoperative recovery.

Keywords*: Complicated appendicitis; Laparoscopic appendicectomy; Pediatric appendicitis; Minimally invasive surgery; Perforated appendix; Postoperative complications; Children; Appendicectomy outcomes.*

INTRODUCTION

Acute appendicitis is one of the most common causes of emergency abdominal surgery in children and adolescents. It accounts for a significant proportion of pediatric surgical admissions worldwide.(1) Complicated appendicitis, which includes perforated appendicitis, gangrenous appendicitis, appendicular abscess, and diffuse peritonitis, is associated with increased morbidity, prolonged hospitalization, and higher postoperative complication rates compared to uncomplicated appendicitis.(2)

The diagnosis of appendicitis in children can often be difficult because younger patients may present with atypical symptoms and limited ability to communicate clinical complaints. Delayed diagnosis frequently results in perforation and

intra-abdominal sepsis, especially in younger age groups.(3) Early surgical intervention is therefore essential to prevent complications and reduce morbidity.

Traditionally, open appendicectomy was considered the standard treatment for complicated appendicitis. However, with advances in minimally invasive surgical techniques, laparoscopic appendicectomy has become increasingly popular in pediatric surgical practice.(4) Laparoscopy offers several advantages, including better visualization of the abdominal cavity, reduced postoperative pain, smaller incisions, decreased wound infection rates, wound dehiscence, shorter hospital stay, and earlier return to normal activities.(5)

Despite these advantages, the use of laparoscopy in complicated appendicitis remains controversial due to concerns regarding postoperative intra-abdominal abscess formation and technical challenges associated with severe inflammation and contamination.(6) Nevertheless, several recent studies have demonstrated that laparoscopic appendicectomy is safe and feasible in children with complicated appendicitis, with outcomes comparable or superior to open surgery.(7,8)

Improved laparoscopic expertise, better perioperative antibiotic protocols, and enhanced postoperative care have further contributed to the increasing acceptance of laparoscopic appendicectomy for complicated appendicitis in pediatric patients.(9) Early recovery, reduced postoperative discomfort, and improved cosmetic outcomes make laparoscopy particularly advantageous in children and adolescents.

The present retrospective study was conducted at SS Institute of Medical Sciences & Research Centre to evaluate the outcomes of laparoscopic appendicectomy in children with complicated appendicitis, focusing on operative findings, postoperative complications, duration of hospital stay, and recovery following surgery.

MATERIALS AND METHODS

Study Design and Setting

This retrospective observational study was conducted in the Department of General Surgery at SS Institute of Medical Sciences & Research Centre over a period of 2 years from January 2024 to December 2025. The study aimed to evaluate the outcomes of laparoscopic appendicectomy in children diagnosed with complicated appendicitis.

Study Population

The study included pediatric patients aged below 18 years who underwent laparoscopic appendicectomy for complicated appendicitis during the study period. A total of 50 patients who fulfilled the inclusion criteria were included in the study.

Inclusion Criteria

- Children below 18 years of age.
- Diagnosed intraoperatively with complicated appendicitis, including perforated appendicitis, gangrenous appendicitis, appendicular abscess, or appendicular peritonitis.
- Patients who underwent laparoscopic appendicectomy.

Exclusion Criteria

- Children with uncomplicated appendicitis.
- Patients converted to open appendicectomy.
- Patients with incomplete medical records.
- Patients with significant associated gastrointestinal anomalies or severe systemic illness.

Data Collection

Data were collected retrospectively from hospital medical records, operative notes, anesthesia records, and postoperative follow-up charts. Variables recorded included:

1. Demographic details (age, sex)
2. Clinical presentation and duration of symptoms
3. Laboratory and radiological findings
4. Operative findings
5. Duration of surgery
6. Intraoperative complications
7. Postoperative complications such as surgical site infection, intra-abdominal abscess, ileus, and fever
8. Duration of hospital stay
9. Time to oral feeding and recovery

Preoperative Evaluation

All children admitted with suspected complicated appendicitis underwent detailed clinical evaluation, laboratory investigations, and radiological assessment prior to surgery. Initial stabilization included intravenous fluid resuscitation, correction of dehydration, electrolyte imbalance management, and administration of broad-spectrum intravenous antibiotics covering gram-negative and anaerobic organisms.

Routine hematological investigations included complete blood count (CBC), serum electrolytes, renal function tests, coagulation profile, and C-reactive protein (CRP). Leukocytosis with neutrophilic predominance and elevated CRP levels were commonly observed, indicating significant intra-abdominal inflammation and sepsis. Electrolyte abnormalities such as mild hyponatremia and hypokalemia were corrected before anesthesia induction.

Radiological evaluation was performed in all patients using abdominal ultrasonography, which demonstrated inflamed appendix, periappendiceal collection, free fluid, appendicular abscess, or perforation. In selected doubtful or advanced cases, contrast-enhanced computed tomography (CECT) abdomen was utilized for confirmation of diagnosis and operative planning.

All patients received preoperative anesthetic assessment. Nasogastric decompression was performed in children presenting with abdominal distension, persistent vomiting, or paralytic ileus. Urinary catheterization was selectively done in patients with diffuse peritonitis or prolonged operative duration.

Special attention was given to children with associated coagulopathy or systemic illness. One patient with congenital afibrinogenemia had markedly prolonged coagulation parameters and received preoperative cryoprecipitate and fresh frozen plasma transfusion to normalize coagulation profile prior to surgery.

Written informed consent was obtained from parents or guardians after detailed explanation regarding the surgical procedure, possible intraoperative findings, postoperative complications, and the possibility of conversion to open surgery if required

Surgical Procedure

Laparoscopic appendicectomy was performed under general anesthesia using a standard three-port technique. Pneumoperitoneum was established using the open Hasson technique Intraoperatively, perforated appendicitis was the most common finding, observed in 44% of patients. The appendix was frequently edematous, gangrenous, friable, and densely adherent to surrounding bowel loops, omentum, and cecum. Purulent contamination of the peritoneal cavity with localized or diffuse peritonitis was commonly encountered.

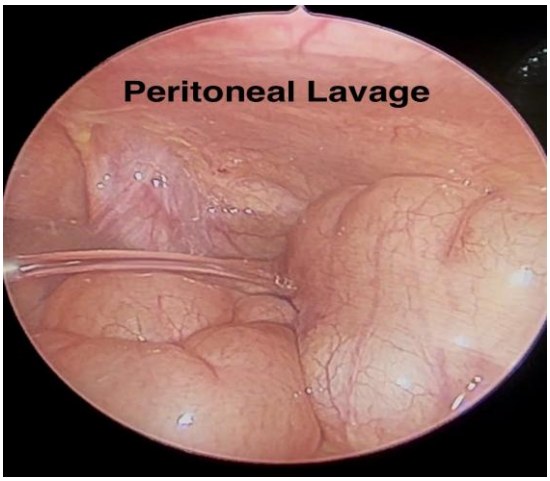
Gangrenous appendicitis was identified in 24% of patients, characterized by blackish discoloration, necrotic wall changes, and impending perforation. Appendicular abscess was noted in 18% of children, while diffuse appendicular peritonitis was present in 14% of cases.

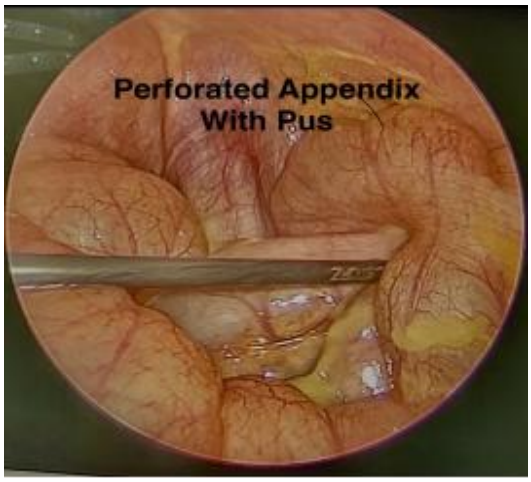
Dense inflammatory adhesions and phlegmon formation in the right iliac fossa posed technical difficulty during dissection in several patients. Careful blunt and sharp adhesiolysis was performed to avoid bowel injury and minimize bleeding. Thorough suction and peritoneal lavage with warm normal saline were carried out in all contaminated cases until clear effluent was obtained.

The mesoappendix was dissected using bipolar cautery or harmonic energy device, and the appendiceal base was secured using endoloops or intracorporeal knotting techniques. Peritoneal drains were placed in all patients following appendicectomy and peritoneal lavage to facilitate postoperative drainage, monitor contamination, and reduce the risk of residual intra-abdominal collection.

In one patient with congenital afibrinogenemia, extensive adhesions with diffuse capillary ooze made safe appendicectomy technically hazardous. Therefore, the procedure was limited to peritoneal lavage, hemostasis, and drain placement, with interval appendicectomy planned after stabilization.

No major intraoperative bowel injury, vascular injury, or anesthetic complications were encountered in the study population.





Postoperative Outcome

All patients were monitored postoperatively for hemodynamic stability, pain control, return of bowel activity, drain output, and signs of postoperative complications. Intravenous broad-spectrum antibiotics were continued for 5–7 days depending on the severity of contamination and clinical response.

Postoperative analgesia was administered using weight-adjusted intravenous paracetamol and nonsteroidal anti-inflammatory drugs. Early mobilization and incentive spirometry were encouraged to reduce pulmonary complications and facilitate recovery.

Oral liquids were initiated after the return of bowel sounds, and progression to soft diet was done as tolerated. Most patients resumed oral feeding within 24 hours after surgery, while delayed feeding was required in patients with postoperative ileus or diffuse peritonitis.

Surgical drains were monitored daily and removed once the output became minimal and nonpurulent, usually between postoperative day 3 and 5. Drain output was assessed for quantity and nature of fluid collection, and regular wound inspection was performed to identify surgical site infection or seroma formation.

Patients were followed postoperatively for fever, wound infection, prolonged ileus, adhesive bowel obstruction, and other procedure-related complications. No patient developed postoperative intra-abdominal abscess during hospital stay or follow-up period. Surgical site infections were managed conservatively with dressing changes and antibiotics, while postoperative ileus improved with bowel rest and supportive management.

Follow-up evaluation was conducted in the outpatient department at 1 week, 2 weeks, and 1 month after discharge. Clinical recovery, wound healing, bowel function, and return to normal activities were assessed during follow-up visits. Most children demonstrated satisfactory recovery with no long-term morbidity or readmission.

The patient with congenital afibrinogenemia remained stable postoperatively following additional cryoprecipitate transfusion and was planned for interval appendicectomy after hematological optimization.

Outcome Measures

Primary outcome measures included postoperative complications and duration of hospital stay. Secondary outcomes included operative time, time to oral intake, and recovery following surgery.

Statistical Analysis

The collected data were entered into Microsoft Excel and analyzed using Statistical Package for Social Sciences (SPSS) software version 25.0. Continuous variables were expressed as mean ± standard deviation, while categorical variables were expressed as frequencies and percentages. Appropriate statistical tests such as Chi-square test and Student's t-test were applied wherever necessary. A p-value of less than 0.05 was considered statistically significant.

Ethical Consideration

Institutional Ethics Committee approval was obtained prior to commencement of the study. Confidentiality of patient information was maintained throughout the study.

RESULTS AND OBSERVATIONS

A total of 50 children with complicated appendicitis who underwent laparoscopic appendicectomy were included in the study. The demographic profile, clinical characteristics, operative findings, and postoperative outcomes were analyzed.

Table 1: Age Distribution of Study Population (n = 50)

Age Group (Years)	Number of Patients	Percentage (%)
0–5	6	12%
6–10	18	36%
11–15	20	40%
16–18	6	12%
Total	**50**	**100%**

Observation: Majority of the children belonged to the 11–15 years age group.

Table 2: Gender Distribution (n = 50)

Gender	Number of Patients	Percentage (%)
Male	32	64%
Female	18	36%
Total	**50**	**100%**

Observation: Male children were more commonly affected than females.

Table 3: Clinical Presentation of Patients (n = 50)

Clinical Feature	Number of Patients	Percentage (%)
Abdominal pain	50	100%
Fever	38	76%
Vomiting	34	68%
Abdominal distension	15	30%
Diarrhea	8	16%

Observation: Abdominal pain was present in all patients, while fever and vomiting were common associated symptoms.

Table 4: Types of Complicated Appendicitis Observed (n = 50)

Intraoperative Finding	Number of Patients	Percentage (%)
Perforated appendicitis	22	44%
Gangrenous appendicitis	12	24%
Appendicular abscess	9	18%
Appendicular peritonitis	7	14%
Total	**50**	**100%**

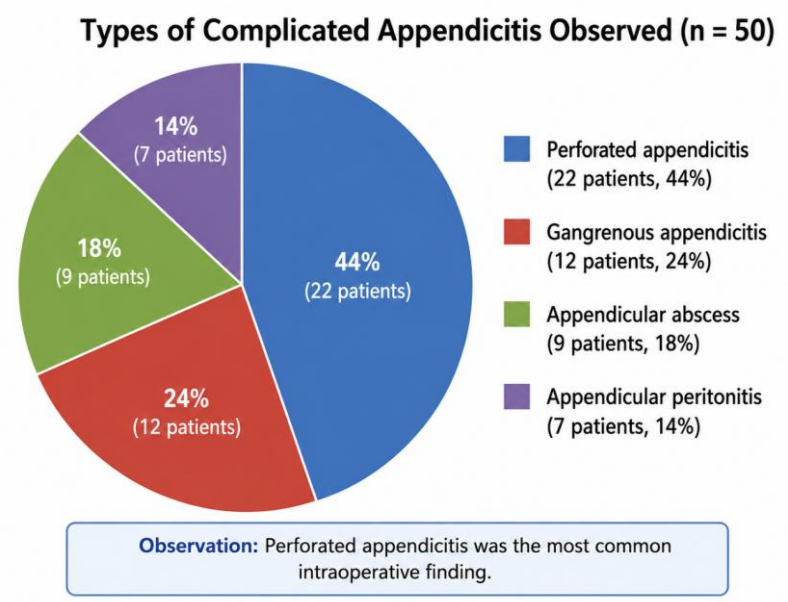


Table 5: Duration of Surgery (n = 50)

Duration (Minutes)	Number of Patients	Percentage (%)
< 60 minutes	12	24%
60–90 minutes	28	56%
> 90 minutes	10	20%
Total	**50**	**100%**

Observation: Most surgeries were completed within 60–90 minutes.

Table 6: Postoperative Complications (n = 50)

Complication	Number of Patients	Percentage (%)
Surgical site infection	5	10%
Intra-abdominal abscess	0	0%
Postoperative ileus	4	8%
Fever	6	12%
No complications	35	70%

Observation: Majority of patients had no postoperative complications. Fever was the most common postoperative complication observed.

Table 7: Duration of Hospital Stay (n = 50)

Hospital Stay	Number of Patients	Percentage (%)
≤ 5 days	20	40%
6–8 days	22	44%
> 8 days	8	16%
Total	**50**	**100%**

Observation: Most children stayed in the hospital for 6–8 days following surgery.

Table 8: Time to Oral Feeding After Surgery (n = 50)

Time to Oral Feeding	Number of Patients	Percentage (%)
Within 48 hours	30	60%
48–72 hours	15	30%
> 72 hours	5	10%
Total	**50**	**100%**

Observation: Majority of patients resumed oral feeding within 48 hours after surgery.

DISCUSSION

Complicated appendicitis continues to be a significant cause of morbidity among children presenting with acute abdominal emergencies. In the present retrospective study, laparoscopic appendicectomy was evaluated in 50 pediatric patients with complicated appendicitis, and the findings demonstrated favorable surgical outcomes with low postoperative morbidity.

In the current study, the majority of patients belonged to the 11–15 years age group, with a predominance of male patients. Similar observations were reported in previous studies by Esposito et al.(7) and Kulaylat et al.(9), which demonstrated a higher incidence of appendicitis among male children and adolescents. Delayed healthcare seeking behavior and hormonal as well as dietary factors may contribute to this distribution.

Abdominal pain was the most common presenting complaint, followed by fever and vomiting. These findings are consistent with previous literature describing abdominal pain as the hallmark symptom of pediatric appendicitis.(3) However, the nonspecific clinical presentation in younger children frequently delays diagnosis, thereby increasing the risk of perforation and abscess formation.

Perforated appendicitis was the most common intraoperative finding in the present study. Similar results were reported by Menezes et al.(8), who observed that perforation constituted a major proportion of complicated appendicitis cases in children. Delayed presentation and rapid disease progression in pediatric patients are important factors contributing to perforation.

The majority of procedures in the present study were completed within 60–90 minutes. Although laparoscopic appendicectomy may initially require longer operative time compared to open surgery, increasing surgical expertise and technological advancements have significantly improved operative efficiency.(5) Furthermore, laparoscopy provides excellent visualization of the peritoneal cavity, enabling adequate lavage and better management of contamination.

Postoperative complications observed in this study included fever, surgical site infection, and postoperative ileus. However, most patients recovered without major morbidity. No postoperative intra-abdominal abscess formation was observed in the present study. Adequate peritoneal lavage, thorough suction clearance, proper antibiotic coverage, drain placement, and careful intraoperative handling may have contributed to this favorable outcome. The incidence of wound infection was low, supporting the findings of previous studies demonstrating reduced surgical site infections with laparoscopic surgery due to smaller incisions and minimal tissue trauma.

Intra-abdominal abscess formation remains a concern following laparoscopic management of complicated appendicitis; however, in the present study, no intra-abdominal abscess developed postoperatively. Similar findings were reported by Esposito et al.(7) and Menezes et al.(8), who concluded that with proper peritoneal lavage, suction, and antibiotic coverage, laparoscopic appendicectomy can be safely performed in complicated appendicitis.

Most patients in this study resumed oral feeding within 48 hours and had a hospital stay of 6–8 days, indicating faster postoperative recovery. Minimally invasive surgery reduces postoperative pain, promotes early mobilization, and facilitates quicker return of bowel function.(5) These benefits are particularly important in pediatric patients, as they reduce psychological stress and improve overall patient satisfaction.

Overall, the present study supports the growing evidence that laparoscopic appendicectomy is a safe and effective treatment modality for complicated appendicitis in children. The procedure is associated with acceptable operative time, low complication rates, early recovery, and shorter hospitalization. However, the study is limited by its retrospective design, small sample size, and single-center setting. Further prospective multicentric studies with larger populations are needed to validate these findings.

CONCLUSION

Laparoscopic appendicectomy is a safe and effective surgical approach for the management of complicated appendicitis in children. The procedure is associated with favorable outcomes, including low postoperative complication rates, shorter hospital stay, early initiation of oral feeding, and faster recovery. Improved visualization of the abdominal cavity and reduced surgical trauma make laparoscopy particularly beneficial in pediatric patients. Although postoperative complications such as fever, surgical site infection, and intra-abdominal abscess may occur, most children recover without significant morbidity. Therefore, laparoscopic appendicectomy must be considered a reliable and preferred treatment modality for complicated appendicitis in the pediatric population.

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