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**UNIVERSITAS MUHAMMADIYAH SIDOARJO**

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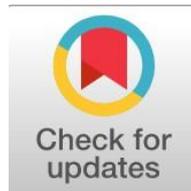
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**Comparative Outcomes of Laparoscopic Versus Open Appendectomy in Children Aged 9–13 Years: A Retrospective Study Hasil Perbandingan antara Laparoscopi dan Bedah Terbuka pada Pengangkatan Appendiks pada Anak Usia 9–13 Tahun: Studi Retrospektif**

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**Abstract**

**General Background:** Acute appendicitis is one of the most common causes of emergency abdominal surgery in children and appendectomy remains the standard treatment. **Specific Background:** While open appendectomy has long been the traditional surgical approach, laparoscopic appendectomy has gained attention in pediatric surgery because of its minimally invasive characteristics and potential benefits for postoperative recovery. **Knowledge Gap:** Despite numerous comparisons in adult populations, focused evidence evaluating surgical outcomes among school-aged children in specific clinical settings remains limited. **Aims:** This study compares the clinical and functional outcomes of laparoscopic and open appendectomy in children aged 9–13 years, particularly regarding operative time, postoperative recovery, hospital stay, complications, and return to daily activities. **Results:** A retrospective analysis of 100 pediatric patients treated between August 2023 and August 2025 showed that laparoscopic appendectomy was associated with reduced postoperative analgesic requirements, earlier oral intake, shorter hospital stay, and faster return to normal activities. Although operative time was slightly longer in the laparoscopic group, overall complication rates were lower and major complications were not significantly different between the groups. **Novelty:** This study provides focused clinical evidence on surgical outcomes specifically in children aged 9–13 years within a comparative framework. **Implications:** The findings support the consideration of laparoscopic appendectomy as a preferred surgical option in pediatric appendicitis when appropriate expertise and resources are available.

**Keywords:** Pediatric Appendicitis, Laparoscopic Appendectomy, Open Appendectomy, Postoperative Recovery, Pediatric Surgery

**Key Findings Highlights**

Laparoscopic surgery demonstrated reduced postoperative pain and shorter hospitalization.

Children undergoing minimally invasive procedures resumed normal activities sooner.

Surgical complications were lower overall despite slightly longer operative duration.

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## Introduction

Children still frequently require emergency abdominal surgery due to acute appendicitis. It is crucial to make initial diagnosis and surgical treatment rapidly in order to avoid complications such as perforation, peritonitis and intraabdominal abscess formation. Even though there have been improvements in diagnostic imaging and perioperative care, appendectomy remains the standard treatment for most patients. [1][2]

Open appendectomy has been traditionally done with good results and low mortality. Nevertheless, with the progress of minimally invasive surgery, laparoscopic appendectomy has become another method since it provides better exposure of abdominal cavity and less disruption to surgery. In childhood, reduction of postoperative pain, length of hospital stay and speed-up rehabilitation are particularly significant due to the emotional and physical effect. [3][4]

In terms of surgery, pain and recovery, children are physiologically distinct from adults. Thus, the appropriate selection of surgical methods should be based on these age-related factors [5]. Although many previous comparisons of laparoscopic and open appendectomy in adults are recorded, studies concentrating on school-aged children have not been performed in some countries. The aim of this study was to prospectively compare the results of laparoscopic versus open appendectomy in children aged 9–13 years over a two year period. [6][7].

## 2. Patients and Methods

### 1.2 Study Design and Population

The present study was a retrospective comparative study in which pediatric patients 9–13 years old had undergone appendectomy for clinically suspected acute appendicitis from August 2023 to August 2025. Patients with inadequate medical records, appendiceal mass requiring interval appendectomy or other intrabdominal pathology requiring prolonged operations were excluded.

### 2.2 Study Groups

One hundred patients met the requirements for inclusion and were split into two groups based on the type of surgery.:

- LA 55 patients
- OA (45 patients)

Age and sex were among the baseline demographic traits that did not significantly differ between the two groups.

### 3.2 Surgical Technique

The patient underwent laparoscopic appendectomy with the patient under general anesthesia by three ports technique. A pneumoperitoneum was created with the appendix identified, mobilized. Energy devices transected the mesoappendix, and endoloops were used to ligate the appendix's base before it was severed. Standard surgical technique was used to perform open appendectomy through a right-lower quadrant incision. Appendix was ligated at the base and amputated following division of the mesoappendix.

### 4.2 Intraoperative Findings

Intraoperative findings in laparoscopic cases often involved congested inflamed appendices with greater vascularity. In some cases, omental capping of the appendix was noted with localized inflammation. In all laparoscopic procedures, There were no intraoperative complications after the appendiceal base was successfully cut.

### 5.2 Postoperative Management

Postoperative monitoring was the same for both groups. Analgesia was administered per institutional protocols. Enteral nutrition was begun with the return of bowel sounds and escalated as tolerated. Criteria for discharge were stabilization of the clinical state, afebrile condition, possibility to take oral feeding and ambulation independently.

### 6.2 Outcome Measures

The following outcomes were assessed:

- Operative time
- Postoperative analgesic requirements
- Time to oral intake
- Length of hospital stay
- Time to resumption of activities of daily living
- Postoperative complications

### 7.2 Ethical Considerations

This study was performed in compliance with the local ethic guidelines. Confidentiality was safeguarded, and no information was shared. All intraoperative pictures served exclusively the purpose of academic and scientific documentation.

## 3. Results

The investigation involved 100 kids between the ages of 9 and 13. The two groups did not differ significantly in terms of age or sex distribution.

### 1.3 Operative Time

Compared to the open group, the laparoscopic group had a longer average operating time. The additional procedures required for minimally invasive surgery and to cause pneumoperitoneum were used to explain this disparity.

### 2.3 Postoperative Recovery

Laparoscopic appendectomy reduced postoperative analgesic dosage and pain in children. Oral tolerance emerged sooner with laparoscopic versus open approach.

### 3.3 Length of Hospital Stay

Shorter length of stay in hospital was observed among patients treated with laparoscopy. The majority of children in this group were also discharged sooner postoperatively than their open appendectomy counterparts.

### 4.3 Return to Normal Activity

The recovery to normal daily life, including attending school could be earlier in children who were treated with laparoscopic appendectomy than that in open surgery.

### 5.3 Complications

Total postoperative complications were less in the L group. Postoperative nausea and temporary ileus were significantly higher occurrence among patients in the open appendectomy group. Regarding major complications, whether in both groups or between the two methods, there was no statistically significant difference.

## 4. Discussion

A simple but effective study from [8], showed the superiority of LA over OA for children aged 9–13. Decreased postoperative pain, hospital stay, and time to returning to normal activities are especially favorable in children, where postoperative recovery can have a significant impact on both functional and psychological status [9]. However, the longer operative time in laparoscopy group did not lead to higher complication or morbidity [10]. Thus, better visualization and lower tissue trauma compared to laparoscopy might explain the positive aspects of postoperative course. [11] [12]

The results of the present study add to the accumulating evidence for performing laparoscopic appendectomy in those children where surgical expertise and facilities exist [13] [14]. Nevertheless, the retrospective nature of our study is a limitation and prospective studies are needed to validate these results[15].

## 5. Conclusion

When treating acute appendicitis in young children (9–13 years old), laparoscopic appendectomy is both safe and effective. It has the advantage over open appendectomy of better postoperative recovery, decreased hospital stay, and earlier return to activities. Whenever possible laparoscopy should be approached as the preferred technique in pediatric appendectomy

### Figures

Figure 1. Laparoscopic view showing a congested and inflamed appendix with marked vascular engorgement.

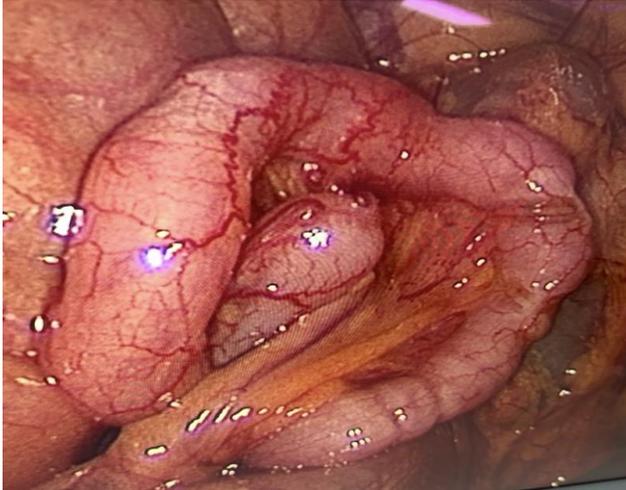


Figure 2. Omental wrapping around the inflamed appendix representing a localized inflammatory response.



Figure 3. Secure ligation of the appendiceal base following laparoscopic appendectomy.



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