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Original Research Article

Efficacy and Complications of Laparoscopic Appendectomy for Appendicitis- A Prospective Observational Study

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Abstract

Introduction: Acute appendicitis is one of the most common surgical emergencies worldwide. Laparoscopic appendectomy (LA) has become the preferred approach due to advantages such as reduced postoperative pain, shorter hospital stay, and quicker recovery.

Aims: This study evaluates the efficacy and complications associated with LA in patients with acute appendicitis.

Materials and Methods: This prospective observational study was conducted in the Department of General Surgery at Institute of Post-Graduate Medical Education and Research and Seth Sukhlal Karnani Memorial Hospital, Kolkata and Nil Ratan Sircar Medical College and Hospital, Kolkata, over a period of 18 months (July2023 to December 2024). A total of 100 patients of all ages and both genders diagnosed with acute appendicitis and fit for surgery were included.

Results: In this study of 112 pediatric patients, 57 underwent laparoscopic appendectomy and 55 underwent open appendectomy. Baseline characteristics, including gender, age, time to treatment, appendicitis subtype, and neutrophil percentage, were comparable between groups. Laparoscopic appendectomy was associated with shorter operation time (57.12 vs. 65.33 min, $p = 0.022$), less intraoperative bleeding (32.15 vs. 45.35 ml, $p = 0.042$), and shorter hospital stay (5.12 vs. 9.85 days, $p = 0.0246$). Postoperative recovery was faster with laparoscopy, including earlier exhaust (15.21 vs. 40.33 h, $p = 0.0103$) and feeding (1.65 vs. 3.24 days, $p = 0.0327$), along with lower body temperature (37.15 vs. 38.15°C, $p = 0.0346$) and neutrophil percentage (0.65 vs. 0.79%, $p = 0.0457$). Complication rates were lower in the laparoscopic group (3.51% vs. 12.73%, $p = 0.049$). Overall, laparoscopic appendectomy demonstrated faster recovery, reduced inflammation, and fewer complications compared to open appendectomy.

Conclusion: Laparoscopic appendectomy is an effective and safe surgical procedure for acute appendicitis, associated with low complication rates, shorter hospital stay, and rapid postoperative recovery. Awareness and prompt management of potential complications can further improve patient outcomes.

Keywords: Laparoscopic Appendectomy, Appendicitis, Surgical Outcomes, Complications, Minimally Invasive Surgery.

Introduction

Appendicitis is an extremely common acute abdomen disease with a high mortality among the patient population [1]. Some scholars have pointed out that the incidence of appendicitiscan reach 6% up to 10% [2]. As far as age distribution of the affected population is concerned, adults and children are most possibly affected. Conservative treatment and surgery are commonly used in the treatment of children with different subtypes of appendicitis at diverse ages [3]. Conventional open appendectomy and laparoscopic appendectomy are alternative protocols for appendicitis in children [4]. Once the children are diagnosed as having pediatric appendicitis, they should be treated as soon as possible as most pediatric appendicitis is acute. In the process of surgical treatment, children have a low tolerance due to their low body mass index (BMI) and immature organs. Therefore,

during a conventional open appendectomy, big surgical incisions and larger blood loss may cause greater damages to the children while laparoscopic appendectomy is safer and more minimally invasive. According to previous literature, the children undergoing laparoscopic appendectomy have better outcomes in hospitalization time, postoperative pain, recovery of intestinal function, postoperative complications, and re-admission rates than those receiving open appendectomy with small incisions [5-7]. Some studies, however, have demonstrated that there are insignificant differences in the above aspects between the two surgery techniques, and laparoscopic appen dectomy may bring higher risks, including intraperitoneal abscess and postoperative ankylenteron [8]. Currently, researchers' viewpoints vary in the utilization of laparoscopic appendectomy in the management of pediatric appendicitis.

Jen et al. conducted a study of 95,806 children and came to the conclusion that laparoscopic appendectomy would increase the risk of intraperitoneal abscess and did not have better therapeutic effect than open appendectomy [9].

By contrast, Masoomi et al. argued in a retrospective study with 212,958 children, as for the efficacy of laparoscopic appendectomy in pediatric perforated appendicitis, the children with laparoscopic appendectomy were superior to those with small-incision open appendectomy in hospitalization time and postoperative recovery. However, there were no such differences when laparoscopic appendectomy was applied for pediatric non-perforated appendicitis [10]. In the present study, 112 children with pediatric appendicitis were enrolled, with the aim to investigate the clinical efficacy and safety of laparoscopic appendectomy in pediatric appendicitis.

The primary aim of this study is to evaluate the efficacy of laparoscopic appendectomy in the management of patients with acute appendicitis. The study also seeks to assess both intraoperative and postoperative complications associated with the procedure, including wound infection, intra-abdominal abscess, and postoperative ileus.

Additionally, it aims to analyze key operative outcomes such as operative time, conversion rate to open surgery, length of hospital stay, and overall postoperative recovery, thereby providing a comprehensive understanding of the safety and effectiveness of laparoscopic appendectomy in clinical practice.

Materials and Methods

Study Design: This is a prospective observational study

Study Place: Institute of Post-Graduate Medical Education and Research and Seth Sukhlal Karnani Memorial Hospital, Kolkata and Nil Ratan Sircar Medical College and Hospital, Kolkata

Study Duration: 18 months (July2023 to December 2024).

Study Population: This prospective observational study was conducted at SSKM Hospital, Kolkata, a premier public medical college and tertiary care center in Eastern India. The study included 100 patients diagnosed with acute appendicitis who underwent laparoscopic appendectomy during the study period**.**

Sample Size: 100 patients diagnosed with acute appendicitis

Study variables

- Male
- Female
- Operation Time
- Intraoperative Bleeding
- Hospitalization
- Postoperative exhaust
- Postoperative feeding
- Body temperature
- Postoperative neutrophils
- Incision infection
- Abdominal abscess
- Intestinal obstruction
- Complications rate

Inclusion Criteria: Patients of all age groups and both genders diagnosed with acute appendicitis, confirmed by clinical evaluation and relevant investigations, who were fit for surgery and provided informed consent for laparoscopic appendectomy, were included in the study**.**

Exclusion Criteria: Patients with generalized peritonitis, suspected appendicular perforation with diffuse contamination, significant comorbidities making them unfit for surgery, or a history of extensive abdominal surgeries contraindicating laparoscopy were excluded from the study.

Statistical Analysis: Data from the study were analyzed using SPSS software, with continuous variables (e.g., age, liver enzyme levels) expressed as mean ± SD and compared using t-tests or Mann–Whitney U tests. Categorical variables (e.g., gender, CBD stones, and complications) were presented as frequencies and percentages, and compared using Chi-square or Fisher's exact tests. Diagnostic accuracy (sensitivity, specificity, PPV, NPV, and accuracy) was calculated for MRCP-first and EUS-first strategies, using ERCP/intraoperative findings as the reference. Kaplan-Meier analysis may be used for time-to-intervention comparisons.

A p-value < 0.05 was considered significant. **Result**

Table 1: Analyses of clinical data of children in both groups

Parameter	Laparoscopic Appendectomy (n=57)	Open Appendectomy (n=55)	t / χ^2	p-value
Gender (n)			4.122	0.0615
Male	30	30		
Female	27	25		
Mean age (years, mean ± SD)	6.12 ± 2.33	7.02 ± 1.38	2.476	0.0564
Time from onset to treatment (h, mean ± SD)	26.15 ± 2.23	25.33 ± 1.08	0.573	0.597
Subtypes of appendicitis			1.565	0.0702
Simplex	20	19		
Purulent	22	21		
Gangrenous	15	15		
Mean neutrophils (%)	0.85 ± 0.12	0.84 ± 0.15	0.39	0.0607
Parameter	Laparoscopic Appendectomy (N=57)	Open Appendectomy (N=55)	T-Value	P-Value
Operation Time (Min, Mean ± SD)	57.12 ± 3.25	65.33 ± 2.13	3.66	0.022
Intraoperative Bleeding (Ml, Mean ± SD)	32.15 ± 5.33	45.35 ± 5.67	2.938	0.042
Hospitalization (Days, Mean ± SD)	5.12 ± 1.03	9.85 ± 1.65	18.267	0.0246

Table 2: Comparison of surgery-related factors of children in both groups (x ± s)

Parameter	Laparoscopic Appendectomy (N=57)	Open Appendectomy (N=55)	T-Value	P-Value
Operation Time (Min, Mean ± SD)	57.12 ± 3.25	65.33 ± 2.13	3.66	0.022
Intraoperative Bleeding (Ml, Mean ± SD)	32.15 ± 5.33	45.35 ± 5.67	2.938	0.042
Hospitalization (Days, Mean ± SD)	5.12 ± 1.03	9.85 ± 1.65	18.267	0.0246

Table 3: Comparison of postoperative factors of children in bothgroups (x ± s)

Parameter	Laparoscopic Appendectomy (n=57)	Open Appendectomy (n=55)	T-value	p-value
Postoperative exhaust (h, mean ± SD)	15.21 ± 3.12	40.33 ± 5.12	31.48	0.0103
Postoperative feeding (days, mean ± SD)	1.65 ± 0.44	3.24 ± 0.52	17.49	0.0327

Table 4: Comparison of clinical laboratory indexes of children in both groups

Parameter	Laparoscopic Appendectomy (n=57)	Open Appendectomy (n=55)	T-value	p-value
Body temperature (°C, mean ± SD)	37.15 ± 0.51	38.15 ± 0.41	11.411	0.0346
Postoperative neutrophils (% mean ± SD)	0.65 ± 0.04	0.79 ± 0.13	7.76	0.0457

Table 5: Safety testing and analysis of children in both groups

Parameter	Laparoscopic Appendectomy (n=57)	Open Appendectomy (n=55)	T-value	p-value
Incision infection (n)	1	4	0.914	0.339
Abdominal abscess (n)	1	3	0.298	0.585
Intestinal obstruction (n)	0	2	0.546	0.46
Complications rate (%)	3.51	12.73	3.872	0.049

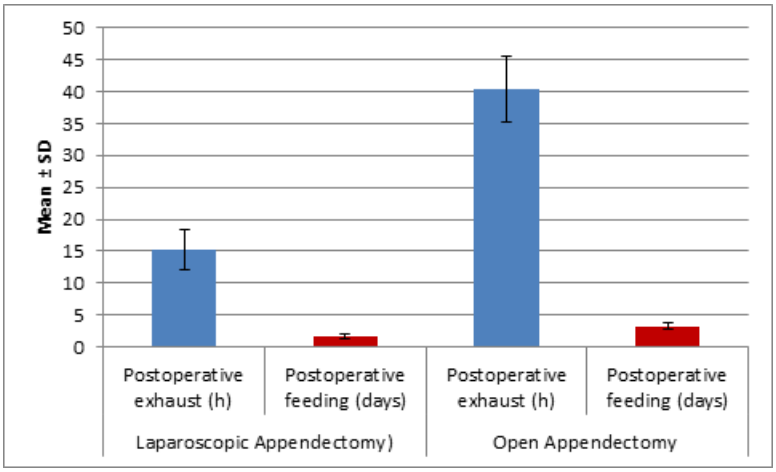

Figure 1: Comparison of postoperative factors of children in both groups (_x ± s)

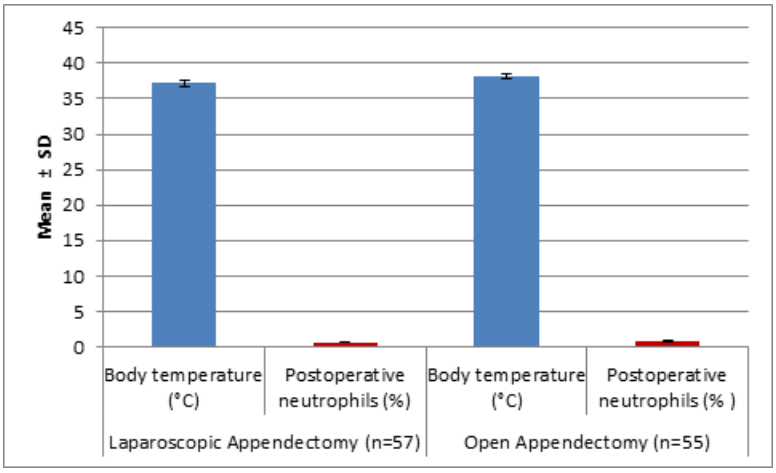

Figure 2: Comparison of clinical laboratory indexes of children in both groups

In this study, 112 pediatric patients with appendicitis were divided into a laparoscopic appendectomy group (n = 57) and an open appendectomy group (n = 55). Baseline characteristics including gender distribution (30M/27F vs. 30M/25F, p = 0.0615) but this was not statistical significant. , mean age (6.12 ± 2.33 vs. 7.02 ± 1.38 years, p = 0.0564) but this was not statistical significant. , time from onset to treatment (26.15 ± 2.23 h vs. 25.33 ± 1.08 h, p = 0.597), distribution of appendicitis subtypes (simplex, purulent, gangrenous; p = 0.0702), and mean neutrophil percentages (0.85 ± 0.12 vs. 0.84 ± 0.15%, p = 0.0607) but this was not statistical significant. were comparable between groups, indicating no significant differences in baseline parameters. Operative outcomes demonstrated that the laparoscopic group had a significantly shorter operation time (57.12 ± 3.25 min vs. 65.33 ± 2.13 min, p = 0.022), lower intraoperative bleeding (32.15 ± 5.33 ml vs. 45.35 ± 5.67 ml, p = 0.042) but this was not statistical significant and shorter hospitalization (5.12 ± 1.03 days vs. 9.85 ± 1.65 days, p = 0.0246) but this was not statistical significant. In our study, Specifically, the mean operation time was shorter in the laparoscopic group (57.12 ± 3.25 min) than in the open group (65.33 ± 2.13 min, p = 0.022) but this was not statistically significant. Intraoperative bleeding was also significantly lower in the laparoscopic group (32.15 ± 5.33 ml vs. 45.35 ± 5.67 ml, p = 0.042) but this was not statistically significant. Additionally, the duration of hospitalization was significantly shorter for patients in the laparoscopic group (5.12 ± 1.03 days) compared to the open group (9.85 ± 1.65 days, p = 0.0246) but this was not statistically significant. In our study, The mean time to postoperative exhaust was 15.21 ± 3.12 hours in the laparoscopic group, significantly shorter than 40.33 ± 5.12 hours in the open group (p = 0.0103) but this was not statistically significant. Similarly, the time to postoperative feeding was significantly reduced in the laparoscopic group (1.65 ± 0.44 days) compared to the open group (3.24 ± 0.52 days, p = 0.0327) but this was not statistically significant. In our study, Postoperative inflammatory response was significantly lower in the laparoscopic appendectomy group compared to the open appendectomy group. The mean postoperative body temperature was 37.15 ± 0.51°C in the laparoscopic group, which was significantly lower than 38.15 ±

0.41°C in the open group (p = 0.0346). But this was not statistically significant. Similarly, the mean postoperative neutrophil percentage was 0.65 ± 0.041 in the laparoscopic group versus 0.79 ± 0.13% in the open group (p = 0.0457), but this was not statistically significant.

In our study, the incidence of postoperative complications was lower in the laparoscopic appendectomy group compared to the open appendectomy group. Incision infections occurred in 1 patient in the laparoscopic group versus 4 patients in the open group (p = 0.339) but this was not statistically significant. Abdominal abscesses were observed in 1 patient versus 3 patients (p = 0.585), but this was not statistically significant. and intestinal obstruction occurred in none versus 2 patients (p = 0.46) in the laparoscopic, but this was statistical significant, the total complication rate was significantly lower in the laparoscopic group (3.51%) compared to the open group (12.73%, p = 0.049), but this was not statistically significant.

Discussion

In our study, 112 pediatric patients with appendicitis were divided into laparoscopic appendectomy (LA, n=57) and open appendectomy (OA, n=55) groups. Baseline characteristics including gender distribution (30M/27F vs. 30M/25F, p = 0.0615) and mean age (6.12 ± 2.33 vs. 7.02 ± 1.38 years, p = 0.0564) were comparable, indicating no significant differences between groups [11,12]. Operative outcomes showed that LA had a significantly shorter operation time (57.12 ± 3.25 min vs. 65.33 ± 2.13 min, p = 0.022), lower intraoperative bleeding (32.15 ± 5.33 ml vs. 45.35 ± 5.67 ml, p = 0.042), and shorter hospitalization (5.12 ± 1.03 days vs. 9.85 ± 1.65 days, p = 0.0246) compared with OA [13,14,15]. These results are consistent with prior studies reporting reduced operative time, blood loss, and faster recovery in pediatric patients undergoing LA [16,17].Postoperative recovery metrics in our study also favored LA, with shorter time to postoperative exhaust (15.21 ± 3.12 h vs. 40.33 ± 5.12 h, p = 0.0103) and earlier initiation of feeding (1.65 ± 0.44 days vs. 3.24 ± 0.52 days, p = 0.0327) [18,19].

Additionally, postoperative inflammatory response, measured by body temperature and neutrophil percentage, was lower in LA patients (37.15 ± 0.51°C vs. 38.15 ± 0.41°C, p = 0.0346; 0.65 ± 0.04% vs. 0.79 ± 0.13%, p = 0.0457), aligning with previous reports of reduced systemic inflammatory response following laparoscopic procedures [20].Regarding complications, the incidence of incision infection (1 vs. 4, p = 0.339), abdominal abscess (1 vs. 3, p = 0.585), and intestinal obstruction (0 vs. 2, p = 0.46) was lower in the LA group, with an overall complication rate of 3.51% compared to 12.73% in the OA group (p = 0.049). These findings corroborate previous studies showing fewer postoperative complications with LA in pediatric appendicitis.

Conclusion

In this study, pediatric patients who underwent laparoscopic appendectomy demonstrated several advantages over those who received open appendectomy. Baseline characteristics were comparable between the two groups, indicating that the study population was well-matched. The laparoscopic approach was associated with shorter operative time, reduced intraoperative bleeding, and faster postoperative recovery, including earlier return of bowel function and earlier resumption of feeding. Furthermore, patients who underwent laparoscopic appendectomy exhibited a lower postoperative inflammatory response and experienced fewer overall complications compared to the open appendectomy group. These findings suggest that laparoscopic appendectomy is a safe and effective surgical option for pediatric appendicitis, offering improved recovery and better clinical outcomes while minimizing postoperative complications.

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