Original Article
DOI: https://doi.org/10.70749/ijbr.v3i5.1513

INDUS JOURNAL OF BIOSCIENCE RESEARCH
https://induspublishers.com/IJBR
ISSN: 2960-2793/ 2960-2807

Comparison of Outcome in Patients with and without Abdominal Drainage in Complicated Appendicitis

Syeda Rawash Mehdi[1], Anum Liaquat[1]

[1]Department of Pediatric Surgery, Nishtar Hospital, Multan, Pakistan

ARTICLE INFO

Keywords: Pediatric appendicitis, surgical drainage, wound infection, intra-abdominal abscess, hospital stay, randomized trial.

Correspondence to: Syeda Rawash Mehdi, Department of Pediatric Surgery, Nishtar Hospital, Multan, Pakistan
Email: mehdirawash@gmail.com

Declaration

Authors' Contribution: All authors equally contributed to the study and approved the final manuscript.

Conflict of Interest: No conflict of interest.

Funding: No funding received by the authors.

Article History

Received: 07-02-2025 Revised: 09-05-2025
Accepted: 20-05-2025 Published: 31-05-2025

ABSTRACT

Background: Managing complicated appendicitis presents surgical challenges, particularly due to potential postoperative complications like wound infections and intra-abdominal abscesses. The necessity of routine abdominal drainage in such cases remains a subject of debate. **Objective:** This study aimed to assess postoperative outcomes specifically wound infection, intra-abdominal abscess, and length of hospital stay in pediatric patients with complicated appendicitis, comparing those managed with abdominal drainage to those without. **Material and Methods:** A randomized controlled trial was carried out in the Pediatric Surgery Department of Nishtar Hospital, Multan, from May 31, 2024, to November 30, 2024. Sixty children aged 2 to 12 years with intra-operative findings of complicated appendicitis were included and randomly allocated into two groups: Group A (drain placement) and Group B (no drain). The primary outcomes measured were wound infection, intra-abdominal abscess formation, and hospital stay duration. Further analysis was stratified by age, gender, and symptom duration. **Results:** Postoperative wound infections were observed in 36.7% of patients in the drain group versus 20.0% in the non-drain group ($p = 0.152$). Abscess formation occurred in 16.7% and 23.3% of the drain and no drain groups, respectively ($p = 0.519$). The mean hospital stay was significantly longer in the drain group (5.77 ± 1.39 days) compared to the no drain group (4.64 ± 1.07 days, $p = 0.001$). Subgroup analysis revealed that prolonged hospital stays were more pronounced in younger children, males, and those with longer symptom duration. **Conclusion:** Using abdominal drains in complicated appendicitis may lead to extended hospital stays without significantly lowering postoperative complications. A selective approach to drainage may be more beneficial than routine use.

INTRODUCTION

The appendix, a narrow, blind-ended tube extending from the cecum, holds considerable clinical relevance, especially in surgical practice. Once thought to be a vestigial organ, recent studies have shown that it contains abundant lymphoid tissue and may serve as a reservoir for beneficial gut flora [1]. This evolving understanding highlights the appendix's potential immunological and microbiological roles. Acute appendicitis, the inflammation of the appendix, remains one of the most frequent surgical emergencies worldwide and a common cause of acute abdominal pain [2].

Surgical removal of the appendix, known as an appendectomy, is the definitive treatment, performed either through an open approach or laparoscopically. In resource-limited settings like Pakistan, emergency open appendectomies are still widely practiced. For complicated cases—such as those involving perforation, gangrene, or peritonitis—surgeons may choose to insert an abdominal drain, often based on intraoperative findings and individual clinical judgment. Others argue that meticulous peritoneal lavage combined with appropriate antibiotic therapy can be equally effective, eliminating the need for drains [3].

Aneiros Castro et al. [4] compared drainage versus non-drainage in complicated appendicitis and found no significant difference in intraoperative complications. However, patients in the drainage group required longer operative times, extended antibiotic use, and prolonged hospital stays, without showing a reduction in postoperative complications. Diagnostic confirmation of complicated appendicitis is typically supported by imaging, such as ultrasound or CT scan. Delayed diagnosis—whether due to patient presentation or hospital processing can lead to advanced complications like perforation, abscess formation, or generalized peritonitis [5–6].

Beek et al. [7] reported equal rates of wound infection (3%) in both groups, though intra-abdominal abscesses were more frequent in patients without drains (15%) compared to those with drains (6%). In contrast, Afzal et al. [8] found significantly higher wound infection rates

(52.9%) and longer hospital stays (5.97 ± 1.33 days) in the drainage group compared to the no-drainage group (14.7% infection rate, 3.38 ± 0.95 days stay; $p < 0.001$), highlighting the potential drawbacks of routine drainage.

The debate on the advantages and disadvantages of intra-abdominal drainage has been ongoing. The various aspects being considered for argument include operative time, incidence of intra-abdominal abscess formation, hospital stay, analgesic requirement and duration of nil per oral depending upon the post-operative gut ileus. No local study has been conducted to determine the efficacy of abdominal drainage. Research on the said topic at our institute would help in clarification of the uncertainty surrounding the use of abdominal drainage and planning improved management of complicated appendicitis. The results of my study will help to generate local data regarding the use of drains after appendectomy in patients with perforated appendicitis.

MATERIALS AND METHODS

This randomized controlled trial was conducted in the Departments of Pediatric Surgery at Nishtar Hospital, Multan, over a period of six months from May 31, 2024 to November 30, 2024. A total of 60 patients diagnosed with complicated appendicitis were enrolled, with 30 patients allocated to each group. The sample size was calculated using the WHO software for sample size determination in health studies, assuming a 95% confidence interval, 80% power of test, 14.7% infection rate in the non-drainage group, and 52.9% infection rate in the drainage group [8]. A consecutive non-probability sampling technique was used to recruit participants.

Inclusion criteria were patients aged 2 to 12 years, of either gender, who were diagnosed intra-operatively with complicated appendicitis and had disease duration of less than 72 hours. Exclusion criteria included patients with a history of abdominal malignancy or previous abdominal surgery, confirmed through medical records, and those who did not consent to participate.

Approval was obtained from the hospital's ethical committee prior to the start of the study. Informed written consent was taken from the patients' guardians. Data were collected by the principal investigator. After taking a detailed history and conducting a thorough physical examination, baseline data such as age, gender, duration of symptoms, and obesity status were recorded. Once complicated appendicitis was confirmed intra-operatively, patients were randomized into two groups using the lottery method. Group A included 30 patients in whom an abdominal drain was inserted at the end of the appendectomy, while Group B comprised 30 patients who underwent appendectomy without drain insertion.

All surgical procedures were performed by a senior consultant surgeon with more than three years of experience. Patients were followed up on a weekly basis postoperatively. Wound infections were assessed clinically by a resident who was blinded to group allocation, and intra-abdominal abscesses were evaluated using ultrasonography performed by a consultant radiologist. Patient details including name, age, sex, and address were recorded on a predesigned proforma.

Data were analyzed using SPSS version 23.0. Quantitative variables such as age, duration of symptoms, and postoperative hospital stay were presented as mean ± standard deviation. Categorical variables including gender, intra-abdominal abscess, and wound infection were presented as frequencies and percentages. The Chi-square test was used to compare the incidence of intra-abdominal abscess and wound infection between the two groups. The independent sample t-test was applied to compare postoperative hospital stay. Outcome variables were stratified by age, duration of illness, BMI, and gender. A p-value ≤ 0.05 was considered statistically significant.

RESULTS

A total of 60 pediatric patients diagnosed with complicated appendicitis were included in the study, with 30 assigned to the drain group and 30 to the no-drain group. The average age in the drainage group was 7.40 ± 3.06 years, while the non-drainage group had a mean age of 6.77 ± 3.01 years. The overall mean age for all participants was 7.08 ± 3.03 years.

When comparing postoperative complications, there was no statistically significant difference between the groups. Wound infections were reported in 11 patients (36.7%) from the drain group and in 6 patients (20.0%) from the no-drain group ($p = 0.152$). Although a higher frequency was noted in the drainage group, the difference was not statistically meaningful. Similarly, intra-abdominal abscesses were observed in 5 cases (16.7%) with drains and 7 cases (23.3%) without drains ($p = 0.519$). These findings indicate that using drains did not significantly lower the rate of postoperative infections or abscess formation.

Stratification of wound infection by age showed no significant differences: in children aged 2–7 years, infection rates were 33.3% with drainage versus 18.8% without ($p = 0.354$); for ages 8–12 years, rates were 40.0% and 21.4%, respectively ($p = 0.280$). A higher infection rate was seen in boys with drains (42.9%) than without (21.1%), and in girls (34.8% vs. 18.2%), but neither comparison reached statistical significance. Symptom duration under two days yielded low and similar infection rates between groups (10.0% vs. 12.5%, $p = 0.867$). Among those presenting after two days, infection was more common in the drain group (50.0% vs. 22.7%, $p = 0.065$), approaching significance.

Analysis of intra-abdominal abscesses by subgroup also showed no statistically significant differences. Among younger children (2–7 years), abscesses occurred in 20.0% of the drain group and 43.8% of the no-drain group ($p = 0.157$). For the older age group (8–12 years), abscess rates were 13.3% with drains and 0% without ($p = 0.157$). In males, no abscesses occurred with drains compared to 21.1% without ($p = 0.187$). Among females, the rates were 21.7% and 27.3% in the drain and no-drain groups, respectively ($p = 0.722$). Patients treated within two days showed similar abscess rates (20.0% with drains vs. 25.0% without, $p = 0.800$), while those presenting after two days had slightly higher abscess rates in the no-drain group (22.7% vs. 15.0%, $p = 0.524$).

The mean postoperative hospital stay was significantly longer in the drainage group (5.77 ± 1.39 days) compared

to the no-drain group (4.64 ± 1.07 days), with a statistically significant difference of 1.13 days (p = 0.001). Stratified analysis supported this finding: children aged 2–7 years in the drain group stayed an average of 5.63 ± 1.29 days versus 4.49 ± 1.10 days in the no-drain group (p = 0.012); for ages 8–12 years, the durations were 5.91 ± 1.52 and 4.81 ± 1.04 days, respectively (p = 0.033). Among male patients, those with drains had a significantly longer stay (6.24 ± 1.09 days) than those without (4.58 ± 0.88 days, p = 0.001). In females, the difference was not significant (5.63 ± 1.46 vs. 4.74 ± 1.37 days, p = 0.101). Regarding symptom duration, no significant difference was found for patients presenting within two days (p = 0.161), while those with 2–3 days of symptoms had significantly longer stays in the drain group (5.73 ± 1.42 vs. 4.54 ± 0.99 days, p = 0.003).

These results suggest that while drainage does not significantly lower infection or abscess rates, it is consistently linked with extended hospitalization, especially in younger children, males, and those with delayed presentation.

Table 1

Comparison of Postoperative Complications between Drain and No Drain Groups (n = 60)

Outcome Variable	Category	Drain Group (n = 30)	No Drain Group (n = 30)	p-value
Wound Infection	Yes	11 (36.7%)	6 (20.0%)	0.152
	No	19 (63.3%)	24 (80.0%)	
Intra-Abdominal Abscess	Yes	5 (16.7%)	7 (23.3%)	0.519
	No	25 (83.3%)	23 (76.7%)	

Table 2

Stratified Analysis of Wound Infection between Drain and No Drain Groups

Stratification Variable	Drain Group n (%)	No Drain Group n (%)	p-value
Age (2–7 years)	5 (33.3%)	3 (18.8%)	0.354
Age (8–12 years)	6 (40.0%)	3 (21.4%)	0.280
Gender (Male)	3 (42.9%)	4 (21.1%)	0.266
Gender (Female)	8 (34.8%)	2 (18.2%)	0.320
Duration (<2 days)	1 (10.0%)	1 (12.5%)	0.867
Duration (2–3 days)	10 (50.0%)	5 (22.7%)	0.065

Table 3

Stratified Analysis of Intra-Abdominal Abscess between Drain and No Drain Groups

Stratification Variable	Drain Group n (%)	No Drain Group n (%)	p-value
Age (2–7 years)	3 (20.0%)	7 (43.8%)	0.157
Age (8–12 years)	2 (13.3%)	0 (0.0%)	0.157
Gender (Male)	0 (0.0%)	4 (21.1%)	0.187
Gender (Female)	5 (21.7%)	3 (27.3%)	0.722
Duration (<2 days)	2 (20.0%)	2 (25.0%)	0.800
Duration (2–3 days)	3 (15.0%)	5 (22.7%)	0.524

Table 4

Comparison of Postoperative Hospital Stay between Groups

Group	n	Mean Stay (days)	Standard Deviation	p-value
Drain	30	5.77	1.393	0.001
No Drain	30	4.64	1.067	

Table 5

Stratified Comparison of Postoperative Hospital Stay Between Drain and No Drain Groups

Stratification Variable	Drain Group Mean ± SD	No Drain Group Mean ± SD	Mean Difference	p-value	95% CI of Difference
Age (2–7 years)	5.63 ± 1.29	4.49 ± 1.10	1.15	0.012	0.27 – 2.03
Age (8–12 years)	5.91 ± 1.52	4.81 ± 1.04	1.09	0.033	0.09 – 2.09
Gender (Male)	6.24 ± 1.09	4.58 ± 0.88	1.66	0.001	0.80 – 2.52
Gender (Female)	5.63 ± 1.46	4.74 ± 1.37	0.89	0.101	-0.18 – 1.96
Duration (<2 days)	5.86 ± 1.41	4.91 ± 1.30	0.95	0.161	-0.42 – 2.31
Duration (2–3 days)	5.73 ± 1.42	4.54 ± 0.99	1.18	0.003	0.43 – 1.94

DISCUSSION

The routine use of abdominal drainage in pediatric complicated appendicitis remains a debated topic. In our study, the insertion of drains did not result in a statistically significant reduction in postoperative wound infections or intra-abdominal abscesses. However, it was associated with a significantly longer hospital stay, suggesting that routine drainage may offer limited clinical benefit and may instead contribute to prolonged recovery.

Beek et al. [7] reported equal wound infection rates (3%) in both drainage and non-drainage groups, though the frequency of intra-abdominal abscesses was notably higher in the non-drain group (15% vs. 6%). This supports the theory that drainage may reduce abscess formation but does not necessarily prevent wound infections. In contrast, Afzal et al. [8] demonstrated significantly higher wound infection rates (52.9%) and longer hospital stays (5.97 ± 1.33 days) in the drainage group compared to the non-drain group (14.7% infection rate; 3.38 ± 0.95 days), highlighting the potential harms of routine drain use, particularly in terms of infection risk and hospitalization.

A meta-analysis by Wu et al. [9] further emphasized that peritoneal drainage following laparoscopic appendectomy is associated with increased wound infection, postoperative pain, and longer hospital stays, with no significant reduction in abscess risk. This aligns with our findings, where drains did not offer protective benefits but were linked to longer recovery times.

Ghansham et al. [10] similarly reported that patients who received drains had significantly higher rates of wound infection (p = 0.008) and prolonged hospital stay (p = 0.005), supporting the growing evidence against routine drainage. Moreover, Abu et al. [11], in a meta-analysis of over 4,000 patients, found that drains did not reduce abdominal collections (OR = 1.41, p = 0.13), and instead increased risks of surgical site infections (OR = 1.93, p = 0.0001), bowel obstruction, paralytic ileus, and fecal fistula.

Fadl et al. [12], in a prospective comparative study, observed no significant difference in complication rates between groups but reported significantly longer hospital stays in patients with drains. This echoes the findings of our study, particularly in younger patients and those with delayed presentation.

A randomized pediatric trial by Tran et al. [13] concluded

that drainage did not reduce postoperative complications such as abscess or infection but significantly extended hospitalization and raised treatment costs. Liao et al. [14], through retrospective analysis, showed that drainage increased complication risk, failed to prevent abscess formation (OR = 1.655, p = 0.4193), and delayed recovery. Sridhar et al. [15] found that intraoperative drain placement significantly increased the risk of postoperative abscesses (OR = 13.33) and sepsis (OR = 11.37), with longer hospital stays in the drainage group. In a second study by Liao et al. [16], drainage was again associated with more complications and delayed resumption of oral intake, reinforcing the risks of routine drain placement.

In conclusion, while drainage may have selective indications in severe or contaminated cases, our findings along with recent literature, support the avoidance of routine abdominal drainage in pediatric complicated appendicitis. Doing so may reduce postoperative infection risk and shorten hospital stays, contributing to safer and more efficient patient care.

CONCLUSION

In conclusion, this study demonstrates that the use of abdominal drainage in patients with complicated appendicitis is associated with a significantly longer postoperative hospital stay, particularly among younger children, male patients, and those presenting after two days of symptom onset. While the use of drains did not significantly reduce the rates of wound infection or intra-abdominal abscess, it was linked to increased hospitalization time without clear clinical benefit. These findings suggest that routine use of abdominal drainage may not be necessary in all cases of complicated appendicitis and should be carefully considered based on individual patient factors.

REFERENCES

1. Ghidini F, Virgone C, Donà D, Frigo AC, Leon FF, Gamba P. Complicated acute appendicitis in children: the importance of stewarding antibiotic prescriptions. Turk J Pediatr. 2022;64(5):839-847. PMID: 36305433. https://doi.org/10.24953/turkjped.2022.247.
2. Téoule P, Laffolie J, Rolle U, Reissfelder C. Acute appendicitis in childhood and adulthood. Dtsch Arztebl Int. 2020 Nov 6;117(45):764-774. PMID: 33533331; PMCID: PMC7898047. https://doi.org/10.3238/arztebl.2020.0764.
3. Di Saverio S, Podda M, De Simone B, Ceresoli M, Augustin G, Gori A, et al. Diagnosis and treatment of acute appendicitis: 2020 update of the WSES Jerusalem guidelines. World J Emerg Surg. 2020 Apr 15;15(1):27. PMID: 32295644; PMCID: PMC7386163. https://doi.org/10.1186/s13017-020-00306-3.
4. Aneiros Castro B, Cano I, García A, Yuste P, Ferrero E, Gómez A. Abdominal drainage after laparoscopic appendectomy in children: an endless controversy? Scand J Surg. 2018 Sep;107(3):197-200. Epub 2018 Apr 9. PMID: 29628008. https://doi.org/10.1177/1457496918766696.
5. Liao YT, Huang J, Wu CT, Chen PC, Hsieh TT, et al. The necessity of abdominal drainage for patients with complicated appendicitis undergoing laparoscopic appendectomy: a retrospective cohort study. World J Emerg Surg. 2022 Mar 17;17(1):16. PMID: 35300711; PMCID: PMC8928608. https://doi.org/10.1186/s13017-022-00421-3.
6. Bekiaridou K, Kambouri K, Giatromanolaki A, Foutzitzi S, Kouroupi M, Aggelidou M, et al. Predicting complicated appendicitis in children: pros and cons of a new score combining clinical signs, laboratory values, and ultrasound images (CLU Score). Diagnostics (Basel). 2023 Jul 5;13(13):2275. PMID: 37443669; PMCID: PMC10340468. https://doi.org/10.3390/diagnostics13132275.
7. Beek MA, Jansen TS, Raat JW, Twiss EL, Gorbardhan PD. The utility of peritoneal drains in patients with perforated appendicitis. Springer Plus. 2015;4(1):371. https://doi.org/10.1186/s40064-015-1154-9
8. Afzal S, Hussain I, Khan AZ, Ashraf MK. Comparison of early outcome between patients of open appendectomy with and without drain for perforated appendicitis. J Fatima Jinnah Med Uni. 2017;11(1):20-3.
9. Wu H, Liao B, Cao T, et al. Advantages comparison of peritoneal drainage versus no drainage after laparoscopic appendectomy for complicated appendicitis: a meta-analysis. *BMC Gastroenterol*. 2024;24(1):411. https://doi.org/10.1186/s12876-024-03500-8
10. Ghansham, Ejaz S, Hyder Z, et al. Wound infection and length of hospital stay with and without placement of drain in patients with complicated appendicitis. *J Surg Pak*. 2017;22(1):12–15. https://doi.org/10.21699/jsp.22.1.4
11. Abu A, Mohamedahmed AY, Alamin A, et al. Evaluation of drain insertion after appendicectomy for complicated appendicitis: a systematic review and meta-analysis. *Cureus*. 2022;14(11):e32111. https://doi.org/10.7759/cureus.32018
12. Fadl EM, Amer AF, Abdelrahim HS. Is Abdominal Drain Necessary after Laparoscopic Appendectomy for Complicated Appendicitis? *Surg Gastroenterol Oncol*. 2022;27(2):130. https://doi.org/10.21614/sgo-427
13. Tran HV, Quang HV, Long DT, et al. Laparoscopic treatment of appendiceal peritonitis without drainage in children: A prospective randomized clinical trial. *J Pediatr Surg Open*. 2023;3:100046. https://doi.org/10.1016/j.yjpso.2023.100046
14. Liao YT, Huang J, Wu CT, et al. The necessity of abdominal drainage for patients with complicated appendicitis undergoing laparoscopic appendectomy: a retrospective cohort study. *World J Emerg Surg*. 2022;17(1):16. https://doi.org/10.1186/s13017-022-00421-3
15. Sridhar M, Guerrero M, Miller J, et al. Analysis of Outcomes Using Intraoperative Irrigation and Drainage for Complicated Appendicitis. *J Curr Surg*. 2019;9(2–3):17–21. https://doi.org/10.14740/jcs385
16. Liao YT, Huang J, Wu CT, et al. The necessity of abdominal drainage for patients with complicated appendicitis undergoing laparoscopic appendectomy: a retrospective cohort study. *World J Emerg Surg*. 2022;17(1):16. https://doi.org/10.1186/s13017-022-00421-3