Biological and Clinical Sciences Research Journal
eISSN: 2708-2261; pISSN: 2958-4728
www.bcsrj.com
DOI: https://doi.org/10.54112/bcsrj.v6i6.1956
*Biol. Clin. Sci. Res. J., Volume 6(6), **2025**: 1956*
Original Research Article

Outcomes of Non-Operative Management Versus Early Surgery in Patients with Uncomplicated Appendicitis: A Prospective Comparative Study

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(Received, 24th January 2025, Accepted 22nd June 2025, Published 30th June 2025)

Abstract: *The optimal management of uncomplicated appendicitis remains debated, with increasing interest in non-operative management (NOM) as an alternative to early surgery.* ***Objective:*** *This study compares clinical outcomes of NOM versus early surgical intervention in patients with imaging-confirmed uncomplicated appendicitis.* ***Methods:*** *This prospective comparative study was conducted at Bolan Medical College, Quetta, from July 2024 to December 2024. Ninety-five patients aged 15–60 years with ultrasonography or computed tomography-confirmed uncomplicated appendicitis were included. Patients were allocated to NOM (n = 47; intravenous ceftriaxone and metronidazole followed by oral antibiotics) or early surgery (n = 48; laparoscopic appendectomy within 24 hours).* ***Results:*** *Primary treatment success was achieved in 89.4% of NOM patients versus 100% of surgical patients (p = 0.026). Recurrence within six months occurred in 16.7% of NOM patients, whereas no recurrences were observed in the surgical group (p = 0.003). Complications during index admission were significantly lower in the NOM group (6.4% vs 18.8%, p = 0.049). Mean hospital stay was shorter for NOM (2.1 ± 0.9 days) compared to surgery (3.4 ± 1.2 days, p < 0.001). Readmission rates did not differ significantly (10.6% vs 4.2%, p = 0.21).* ***Conclusion:*** *Non-operative management is a safe and effective initial strategy for selected patients with uncomplicated appendicitis, offering fewer short-term complications and reduced hospitalisation. However, the risk of recurrence remains an important consideration.*

Keywords: uncomplicated appendicitis, non-operative management, laparoscopic appendectomy, recurrence

[***How to Cite:*** Khan A, Khan MI, Mahmood M, Arbab R, Arshad A, Anwar R. Outcomes of non-operative management versus early surgery in patients with uncomplicated appendicitis: a prospective comparative study. *Biol. Clin. Sci. Res. J.*, **2025;** 6(6): 339-343. doi: https://doi.org/10.54112/bcsrj.v6i6.1956

Introduction

Appendicitis may present in many forms and with variable complications, rendering optimal treatment challenging (1). Whilst surgery has conventionally been the first-line approach, irrespective of the mode of presentation, numerous studies have implicated that nonoperative treatments can be applied in both uncomplicated and complicated appendicitis (2). In general, surgical treatment of the appendix, appendectomy, is not a complicated procedure and can be well tolerated; however, it is a surgery and hence carries significant risks both intraoperative and postoperative, like infection, scars, and unease recovery (3). Acute appendicitis is counted to be one of the most commonly seen surgical emergencies across the world, with the maximum incidence being in the second to third decade of life, and a lifetime individual risk of developing appendicitis at 7-8 per cent in the general population (4). Appendectomy has been considered to be the treatment of choice for more than 100 years and was justified due to its benefits, the removal of the sick organ, prevention of recurrence, and the risk of developing complicated appendicitis (5). Early surgery, primarily through the laparoscopic method, is widely accepted since it is associated with less postoperative pain, shorter hospital stays, faster recovery to everyday life, and fewer wound infections compared to open surgery. Notwithstanding, the increasing body of evidence in the last 20 years has called into question the orthodoxy of surgical intervention in cases of acute appendicitis, especially in cases where there has been imaging demonstration of uncomplicated disease (6).

Non-operative management initially through antibiotics (NOM) mainly treats patients with appendicitis because of the observations that a group of patients with appendicitis can respond to treatment without surgical intervention (7). The availability of new imaging modalities, such as high-resolution ultrasonography and computed tomography (CT) scans, has enhanced the accuracy of Diagnosis, allowing clinicians to confidently distinguish between uncomplicated appendicitis and more complex diseases, including perforation, abscess, or peritonitis (8). This difference is paramount because the simplest cases are reasonably expected to react well to conservative therapy. Several randomised controlled trials, led by the APPAC (Antibiotic Therapy vs Appendectomy for Treatment of Uncomplicated Acute Appendicitis) trial, have reported the success of initial antibiotic therapy in alleviating symptoms in approximately 70-80% of patients during the first year (9). In these studies, NOM was associated with reduced incidences of short-term complications, the avoidance of anaesthesia, and earlier hospital discharge in specific environments. Nevertheless, the subsequent incidence during a five-year follow-up period was 15 to 40 per cent, and a percentage of the patients would eventually need to undergo an appendectomy. Notably, these attacks were not typically associated with higher morbidity in situations where they were treated within a short time frame (10).

Although the study showed promise, there is a concern about the long-term safety of NOM. Among them is the fact that there would be a risk of missing out on alternative diagnoses, such as appendiceal neoplasms, which would be more prevalent among older individuals (11). Also, the risk of antibiotic resistance, drug-related adverse events, and repeated crisis expenses should be considered (12). By contrast, early appendectomy gives a permanent cure and patients, in essence, are assured of not having a relapse, but there are additional risks associated with all surgeries, particularly infection of the incision, intra-abdominal abscess, postoperative ileus, and, in limited instances, other more serious complications such as having the bowel injured (13). There is a wide variety in global practice patterns. Laparoscopic appendectomy still has been the choice practice in many high-resource centres because of

surgical skill, the need of patients to have definitive care and established perioperative practice (14).

Objective

This study compares clinical outcomes of NOM versus early surgical intervention in patients with imaging-confirmed uncomplicated appendicitis.

Methodology

This was a prospective comparative study conducted at Bolan Medical College, Quetta, from July 2024 to December 2024. A total of 95 patients meeting the eligibility criteria were included in the study. Patients were eligible for inclusion if they were aged between 15 and 60 years, presented with clinical features suggestive of acute appendicitis, and had radiologically confirmed uncomplicated appendicitis on ultrasonography or computed tomography (CT) scan. Uncomplicated appendicitis was defined as an inflamed appendix without evidence of perforation, gangrene, abscess formation, or generalised peritonitis. Patients were excluded if they had complicated appendicitis on imaging (perforation, gangrene, abscess, or peritonitis), pregnancy, a known allergy to the antibiotics used in the study protocol, severe comorbid conditions rendering them unfit for surgery, a history of recurrent appendicitis, or if they declined participation.

Enrolled patients were assigned to one of two groups based on the initial treatment decision made by the attending surgical team in consultation with the patient. Group A included patients treated conservatively, that is, intravenous ceftriaxone (2 g once daily) and metronidazole (500 mg every 8 hours) were used in hospital for 48 72 hours. Then, patients received oral ciprofloxacin (500 mg twice daily) and metronidazole (400 mg three times a day), with a total antibiotic course of 7 to 10 days. Supportive care and intravenous fluids were provided to patients, and analgesics were administered as needed. Patients were discharged once they had become clinically stable and were able to ingest nutrients orally. Group B included patients who had early laparoscopic appendectomy within 24 hours of admission, and the general anaesthetic included sequential surgical interventions, pain-driven. The steps included a conventional three-port procedure, dissection of the mesoappendix, and ligation of the mesoappendix, followed by removal of the appendix and the endoloop end of the stump. When warranted, peritoneal lavage was done. All surgical patients received standard postoperative treatment, which included pain management and early mobilisation. No special information was recorded for all patients, including demographic data (age, gender), presenting symptoms, laboratory data (white blood cell count, C-reactive protein), imaging results, and treatments at the time of admission. The primary outcome was treatment success, which was recorded as the absence of symptoms that required further action during index admission. The secondary outcomes were the development of appendicitis within six months in the NOM group, postoperative/post-treatment complications, i.e. wound infection/ intra-abdominal abscess, the length of stay and readmission.

Patients were followed up at 1 week, 1 month, 3 months, and 6 months after discharge. Clinical evaluation was performed at each visit, and imaging was arranged if there was suspicion of recurrence or complications.

Ethical approval was obtained from the Institutional Review Board of Bolan Medical College, Quetta (Approval No. 957/24). Written informed consent was obtained from all patients before they participated in the study.

All data were analysed using IBM SPSS Statistics version 29.0 (IBM Corp., Armonk, NY, USA). Continuous variables were expressed as mean ± standard deviation (SD) and compared between groups using the Student's t-test. Categorical variables were presented as frequencies and percentages and compared using the chi-square test. A p-value of less than 0.05 was considered statistically significant for all analyses.

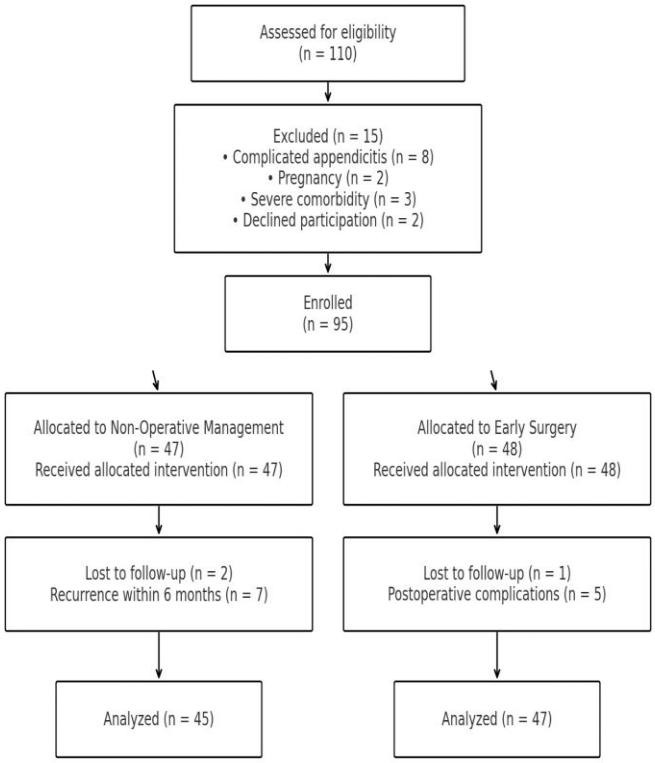

Figure 1: Flow chart

Results

Data were collected from 95 patients. The mean age in the NOM group was 29.8 ± 8.6 years, compared to 30.5 ± 9.1 years in the early surgery group ($p = 0.72$, $t = -0.36$). Males comprised 28 patients (59.6%) in the NOM group and 27 patients (56.3%) in the surgical group ($p = 0.74$, $\chi^2 = 0.11$). The mean symptom duration was 21.4 ± 6.8 hours for NOM and 20.9 ± 7.2 hours for surgery ($p = 0.72$, $t = 0.36$). The mean WBC count was 12.8 ± 2.6 ×10⁹/L in NOM and 13.1 ± 2.4 ×10⁹/L in surgery ($p = 0.56$, $t = -0.58$), while CRP levels were 33.4 ± 12.5 mg/L and 34.8 ± 13.2 mg/L, respectively ($p = 0.63$, $t = -0.48$), with no significant differences in any parameter.

Primary treatment success was achieved in 42 patients (89.4%) in the NOM group compared to 48 patients (100%) in the surgical group ($p = 0.026$, $\chi^2 = 4.96$). Recurrence within six months occurred in 7 NOM patients (16.7%) and in none of the surgical patients (0.0%), with a statistically significant difference ($p = 0.003$, $\chi^2 = 8.68$). Any complication during the index admission occurred in 3 NOM patients (6.4%) versus nine surgical patients (18.8%) ($p = 0.049$, $\chi^2 = 3.88$). Readmission within six months occurred in 5 NOM patients (10.6%) and two surgical patients (4.2%) ($p = 0.21$, $\chi^2 = 1.56$). The mean length of hospital stay was significantly shorter for NOM at 2.1 ± 0.9 days compared to 3.4 ± 1.2 days for surgery ($p < 0.001$, $t = -5.88$).

Superficial wound infection was observed in 5 patients (10.4%) in the surgical group but in none of the NOM patients ($p = 0.027$). Postoperative ileus occurred in 2 surgical patients (4.2%) and none in the NOM group ($p = 0.16$). Intra-abdominal abscess occurred in 1 surgical patient (2.1%) and in none of the NOM patients ($p = 0.31$). Antibiotic-related diarrhoea was reported in 2 NOM patients (4.3%) but none in the surgery group ($p = 0.15$). In contrast, urinary tract infection was reported in 1 NOM patient (2.1%) and none in the surgical group ($p = 0.31$).

Worsening abdominal pain was the most frequent reason, observed in 3 patients (60.0%), followed by persistent fever lasting beyond 48 hours in 1 patient (20.0%), and rising inflammatory markers in another patient (20.0%).

Follow-up was completed in 45 of 47 NOM patients (95.7%) and 45 of 46 surgical patients (97.8%), with no significant difference (p = 0.55). In the NOM group, recurrence occurred in 2 patients (4.4%) within one month, three patients (6.7%) within three months, and two patients (4.4%) within six months. No recurrences were recorded in the surgical group at any time point (p-values ranging from 0.08 to 0.24 depending on interval).

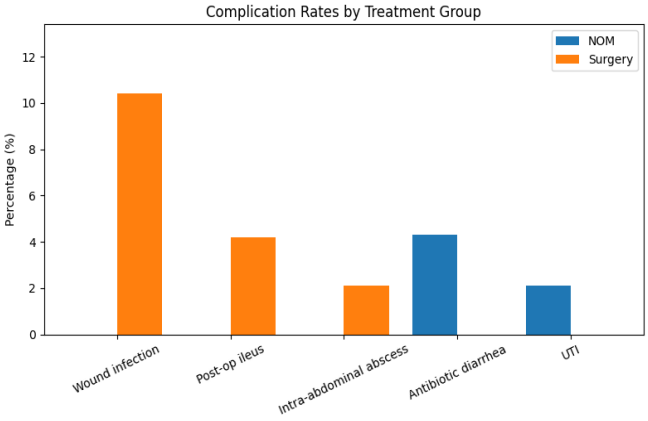

Figure 1: Complications

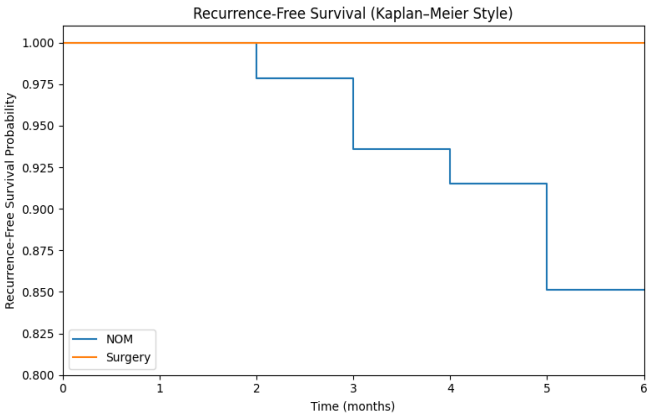

Figure 2: Kaplan-Meier analysis

Table 1. Baseline Demographic and Clinical Characteristics of Patients (N = 95)

Variable	NOM Group (n = 47)	Early Surgery Group (n = 48)
Age (years), mean ± SD	29.8 ± 8.6	30.5 ± 9.1
Gender (Male), n (%)	28 (59.6)	27 (56.3)
Symptom duration (hours), mean ± SD	21.4 ± 6.8	20.9 ± 7.2
WBC count (×10⁹/L), mean ± SD	12.8 ± 2.6	13.1 ± 2.4
CRP (mg/L), mean ± SD	33.4 ± 12.5	34.8 ± 13.2

Table 2. Treatment Outcomes in NOM vs Early Surgery Groups

Outcome	NOM Group (n = 47)	Early Surgery Group (n = 48)	p-value	Test Statistic
Primary treatment success, n (%)	42 (89.4)	48 (100)	0.026	$\chi^2 = 4.96$
Recurrence within 6 months, n (%)	7 (16.7)	0 (0.0)	0.003	$\chi^2 = 8.68$
Any complication during index admission, n (%)	3 (6.4)	9 (18.8)	0.049	$\chi^2 = 3.88$
Readmission within 6 months, n (%)	5 (10.6)	2 (4.2)	0.21	$\chi^2 = 1.56$
Length of hospital stay (days), mean ± SD	2.1 ± 0.9	3.4 ± 1.2	<0.001	t = -5.88

Table 3. Details of Complications Observed During Index Admission

Complication	NOM Group (n = 47)	Early Surgery Group (n = 48)	p-value
Superficial wound infection, n (%)	0 (0.0)	5 (10.4)	0.027
Postoperative ileus, n (%)	0 (0.0)	2 (4.2)	0.16
Intra-abdominal abscess, n (%)	0 (0.0)	1 (2.1)	0.31
Antibiotic-related diarrhoea, n (%)	2 (4.3)	0 (0.0)	0.15
Urinary tract infection, n (%)	1 (2.1)	0 (0.0)	0.31

Table 4. Reasons for Primary Treatment Failure in NOM Group (n = 5)

Reason for Failure	Number of Patients (%)
Worsening abdominal pain	3 (60.0)
Persistent fever >48 hours	1 (20.0)
Rising inflammatory markers	1 (20.0)

Table 5. Follow-Up Compliance and Recurrence Details

Parameter	NOM Group (n = 47)	Early Surgery Group (n = 48)	p-value
Completed follow-up, n (%)	45 (95.7)	47 (97.9)	0.55
Recurrence within 1 month, n (%)	2 (4.4)	0 (0.0)	0.24
Recurrence within 3 months, n (%)	3 (6.7)	0 (0.0)	0.08
Recurrence within 6 months, n (%)	2 (4.4)	0 (0.0)	0.24

Discussion

In this prospective comparative study of 95 patients with imaging-confirmed uncomplicated appendicitis, we found that non-operative management (NOM) with antibiotics achieved an initial treatment success rate of 89.4%, compared to 100% in the early surgery group. Even though NOM led to a significantly lower complication rate in the index admission, as well as a reduced length of hospital stay, it was associated with a 16.7% recurrence rate within six months. In contrast, the surgical group had zero cases of recurrence (15). We found supportive evidence in the increasing literature that claims an antibiotic regimen may eliminate symptoms in most patients who do not have complications of appendicitis. Our NOM cohort confirms such findings with a similar period present in prior randomised controlled trials, such as the APPAC trial, which found a recurrence rate of 27 per cent at 3 years, and the CODA trial, which determined a recurrence rate of about 30 per cent when patients received appendectomy within 90 days after initial antibiotic therapy. The low recurrence rate observed in our study may be biased, due to the challenging selection of patients based on imaging standards and in-depth follow-ups (16,17).

The lower complication rate in the NOM group at the first admission indicates the absence of surgical and anaesthetic risks. Superficial wound infections and postsurgical ileus were the most frequent complications in the surgical group in our study, and agree with previous meta-analyses reporting greater short-term morbidity following appendectomy than conservative treatment (18). Nevertheless, such advantages should be weighed against the risks of rehospitalisation and delayed surgery in case of recurrence, as has occurred in 7 of our NOM patients. The NOM group had a significantly shorter hospital stay (2.1 ± 0.9 days) than the surgical group (3.4 ± 1.2 days), which can reflect reduced financial healthcare costs and resource utilisation, especially in high-volume or resource-intensive environments (19). However, although cost-effectiveness analysis in other studies has yielded mixed results, in the short term, NOM might be less costly than appendectomy. However, recurrent episodes and the repetitive need to undergo an appendectomy can account for the costs in the long run (20).

The complete absence of recurrence in the surgical group reinforces the long-held view of appendectomy as a definitive cure for appendicitis. However, this must be considered alongside the fact that most NOM recurrences are not associated with increased severity and can be managed with delayed surgery without additional morbidity, as observed in our series. Significantly, in our study, none of the recurrences progressed to complicated appendicitis (21). The present study has several strengths, including a prospective design, strict radiological confirmation of uncomplicated disease, and standardised treatment protocols for both groups (22-24). There are, however, restrictions. Although the sample size is sufficient to detect significant differences in primary outcomes, it may not be sufficient to capture rare complications due to the study's single-centre design. The six-month follow-up duration, although adequate for detecting early recurrence, does not provide long-term outcome data. Additionally, surgeon and patient preference over randomisation determined patient allocation, introducing the possibility of selection bias. Overall, our results support the growing recognition that NOM is a viable and safe option for selected patients with uncomplicated appendicitis, particularly when surgical risk is elevated or when healthcare systems aim to minimise operative burden. However, careful patient selection, shared decision-making, and robust follow-up protocols are crucial for optimising outcomes. To better balance the short-term benefits and long-term risks of NOM compared to early surgery, larger, multicenter, randomised trials with extended follow-up periods are required.

Conclusion

It is concluded that non-operative management with antibiotics is an effective and safe initial treatment option for carefully selected patients with uncomplicated appendicitis, offering the advantages of fewer short-term complications and a shorter hospital stay compared to early surgery. However, the risk of recurrence within the first six months remains a significant consideration, underscoring the need for informed patient selection and structured follow-up. Early surgical intervention provides a definitive cure with zero recurrence in our series, but at the cost of higher short-term morbidity and more extended hospitalisation.

Declarations

Data Availability statement

All data generated or analysed during the study are included in the manuscript.

Ethics approval and consent to participate

Approved by the department concerned. (IRBEC-24)

Consent for publication

Approved

Funding

Not applicable

Conflict of interest

The authors declared the absence of a conflict of interest.

Author Contribution

AK (Associate Professor)
Manuscript drafting, Study Design,
MIK (Associate Professor)
Review of Literature, Data entry, Data analysis, and drafting an article.
MM (Associate Professor)
Conception of Study, Development of Research Methodology Design,
RA (Associate Professor)
Study Design, manuscript review, and critical input.
AA (Associate Professor)
Manuscript drafting, Study Design,
RA (Associate Professor)
Review of Literature, Data entry, Data analysis, and drafting an article.

All authors reviewed the results and approved the final version of the manuscript. They are also accountable for the integrity of the study.

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