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Need of Surgery after Failure of Conservative Treatment in Acute Appendicitis within 1 Year at Islamabad Medical Complex, Pakistan

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Article Details

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ABSTRACT

Background: Conservative, antibiotic-first management of imaging-confirmed uncomplicated acute appendicitis is now established as a viable alternative to surgery in selected patients, but regional outcome data from South Asia remain limited, and predictors of treatment failure are incompletely characterized. Methods: This prospective observational cohort study was conducted between April 2023 and April 2024. Adults (≥16 years) with a first episode of uncomplicated acute appendicitis confirmed by imaging were enrolled and managed with a standardized antibiotic protocol. The primary outcome was the requirement for appendectomy within one year. Baseline demographics, clinical parameters, and imaging features—including appendiceal diameter—were recorded. Statistical analyses included univariate and multivariate logistic regression to identify independent predictors of surgery, with surgery-free survival estimated using Kaplan-Meier analysis. Results: Thirty-three patients (mean age 30.2 ± 10.1 years; 54.5% male) were included. During the index admission, conservative management failed in 2 patients (6.1%). By six months, two additional patients (6.1%) required appendectomy for recurrence; between six and twelve months, three more patients (9.1%) underwent surgery. The cumulative appendectomy rate at one year was 21.2%, yielding a surgery-free survival rate of 78.8%. Comparative analysis found no significant differences in age, sex, comorbidities, symptom duration, WBC, or CRP between surgery-free and surgical groups. However, an appendiceal diameter >10 mm was significantly associated with the need for surgery (42.9% vs. 7.7%; p=0.045) and remained an independent predictor in multivariate analysis (OR 6.5, 95% CI 1.12–37.6; p=0.037). No deaths or major complications occurred. Conclusion:In this South Asian cohort, conservative management of uncomplicated acute appendicitis achieved a high surgery-free survival rate at one year, with a low incidence of complications. Appendiceal diameter >10 mm was the only independent predictor of treatment failure. These findings support the adoption of non-operative management as a safe and effective option for selected patients in similar resource settings, provided that thorough imaging assessment and close follow-up are ensured.

INTRODUCTION

Acute appendicitis remains one of the most prevalent surgical emergencies globally, with a lifetime risk of 8.6% for males and 6.7% for females[1]. Historically, immediate appendectomy has been the gold standard for management, based on the risk of perforation and sepsis if untreated[2,3]. However, recent decades have seen a paradigm shift, with robust evidence supporting conservative, antibiotic-first approaches in carefully selected patients with imaging-confirmed uncomplicated appendicitis[4–6].

Several large randomized controlled trials, including the APPAC and CODA studies, as well as European multicenter cohorts, have demonstrated that initial non-operative management results in surgical avoidance in approximately 60–70% of cases at one year, without an increased incidence of serious complications or disease progression[5–8]. Quality of life and patient-reported outcomes in these trials are equivalent, if not superior, to those observed after routine appendectomy[9–11]. As a result, international guidelines now recognize conservative management as an acceptable alternative in selected patients[12].

Despite these advances, adoption of antibiotic-first treatment in routine practice has been limited, especially in low- and middle-income countries. Data from South Asia are particularly sparse, and predictors of treatment failure—meaning subsequent need for appendectomy after an initial conservative approach—are incompletely characterized in this region[6,7]. Factors such as increased appendiceal diameter, elevated inflammatory markers, and specific imaging features have been associated with increased risk of failure in Western populations[8–12], but robust, location-specific data are lacking.

This prospective cohort study was conducted at Islamabad Medical Complex, Islamabad, Pakistan, to determine the frequency and timing of surgery following conservative management of uncomplicated appendicitis, and to identify clinical predictors of failure in a South Asian context. By closely aligning methods and outcome definitions with established European trials while incorporating local clinical practices, this study aims to provide valuable regional insight into the global debate on the non-operative management of acute appendicitis.

METHODS

STUDY DESIGN AND SETTING

This prospective, observational cohort study was conducted at the Department of General Surgery, Islamabad Medical Complex, Islamabad, Pakistan, between April 2023 and April 2024. The study protocol was approved by the Institutional Review Board (IRB No: RIHI/IRB/2023-04-APPEND), and all procedures adhered to the principles of the Declaration of Helsinki and the STROBE guidelines for reporting observational research.

STUDY POPULATION

Adults aged 16 years or older presenting with a first episode of acute appendicitis confirmed by imaging—either ultrasonography or computed tomography (CT)—were eligible for inclusion, provided there was no evidence of perforation, abscess, or generalized peritonitis. All patients were initially managed with a conservative, antibiotic-first protocol. Exclusion criteria were: complicated appendicitis (perforation, abscess, or phlegmon), prior appendectomy, pregnancy, immunosuppression or malignancy, significant comorbidities contraindicating non-operative management, and loss to follow-up within one year. Consecutive sampling was used to enroll all eligible patients during the study period. Written informed consent was obtained from all participants prior to study inclusion.

CONSERVATIVE MANAGEMENT PROTOCOL

All patients received standardized conservative management, comprising intravenous ceftriaxone (1 g every 12 hours) and metronidazole (500 mg every 8 hours) for 48–72 hours, followed by transition to oral antibiotics—either amoxicillin-clavulanate or a combination of ciprofloxacin and metronidazole—to complete a 7–10-day course. Supportive care included intravenous fluids, analgesia (paracetamol and non-steroidal anti-inflammatory drugs), and antiemetics as needed. Clinical and laboratory reassessment was performed daily during the initial admission.

OUTCOME MEASURES

The primary outcome was the requirement for surgical intervention (appendectomy) within one year following initiation of conservative management. Patients were categorized according to timing and need for surgery: (1) failure of conservative therapy during the index admission (requiring surgery prior to discharge), (2) readmission and appendectomy within six months, (3) readmission and appendectomy between six and twelve months, and (4) no recurrence or appendectomy during one-year follow-up. Secondary outcomes included hospital length of stay (initial and cumulative), recurrence rates and timing, and identification of predictors for surgical intervention.

DATA COLLECTION AND FOLLOW-UP

At baseline, data collected included demographic variables (age, sex, body mass index [BMI]), comorbidities (diabetes, hypertension), symptom duration prior to admission, laboratory values (white blood cell [WBC] count, C-reactive protein [CRP]), and imaging findings, notably appendiceal diameter. Follow-up was conducted at 6, and 12 months via clinic visits or structured telephone interviews. All readmissions and surgical procedures were confirmed through review of hospital records.

STATISTICAL ANALYSIS

Statistical analyses were performed using SPSS version 26 (IBM Corp., Armonk, NY, USA) and R version 4.2.3 (R Foundation for Statistical Computing, Vienna, Austria). Continuous variables were summarized as mean ± standard deviation (SD) or median (interquartile range [IQR]), as appropriate. Categorical variables were presented as frequencies and percentages. Between-group comparisons were conducted using the independent-samples t-test or Mann-Whitney U test for continuous variables, and the chi-square or Fisher's exact test for categorical variables. Multivariate logistic regression was performed to identify independent predictors of surgical intervention within one year, with particular attention to appendiceal diameter >10 mm as the main imaging risk factor. A two-sided p-value <0.05 was considered statistically significant. Missing data exceeding 5% were handled by multiple imputation; otherwise, case-wise deletion was used. Kaplan-Meier survival analysis estimated surgery-free survival over one year, and group differences were assessed with the log-rank test. Sensitivity analyses excluded patients lost to follow-up and included subgroup analyses by age (<30 vs. ≥30 years).

ETHICAL CONSIDERATIONS

The study was approved by the Institutional Review Board of Islamabad Medical Complex (RIHI/IRB/2023-04-APPEND). Written informed consent was obtained from all participants. The study was registered with ClinicalTrials.gov (NCT05831479). Data collection tools were pre-validated, and the STROBE checklist was completed and submitted as supplementary material.

RESULTS

A total of 33 patients with imaging-confirmed, uncomplicated acute appendicitis were enrolled. The mean age was 30.2 ± 10.1 years, and 54.5% were male. Most participants were previously healthy, with hypertension present in 9.1% and diabetes in 6.1%. The mean duration of symptoms prior to presentation was 30 ± 17 hours. Ultrasonography was the primary diagnostic modality in 81.8% of cases, with computed tomography performed in 18.2%. The mean admission white blood cell (WBC) count was 12.2 ± 3.7 × 10^9/L, and mean C-reactive protein (CRP) was 31.1 ± 21.9 mg/L. An appendiceal diameter >10 mm was observed in 15.2% of the cohort. Baseline characteristics, stratified by surgery-free status at one year, are shown in Table 1.

During the index hospital admission, conservative management failed in 2 patients (6.1%), both requiring appendectomy prior to discharge. By six months, an additional 2 patients (6.1%) underwent appendectomy for recurrent symptoms. Between six months and one year, three further patients (9.1%) required surgical intervention. The cumulative appendectomy rate at one year was 21.2% (7 of 33), resulting in a surgery-free survival rate of 78.8% (26 of 33) at one year (Table 2).

The time course of surgical intervention is illustrated in Figure 1. The majority of failures occurred during the index admission and within the first six months, with the Kaplan-Meier curve demonstrating a plateau between 6 and 12 months.

Comparative analysis demonstrated no significant differences in age, sex, BMI, comorbidities, symptom duration, WBC, or CRP between surgery-free and surgical groups. However, an appendiceal diameter >10 mm was significantly associated with subsequent need for surgery (42.9% in the surgical group vs. 7.7% in the surgery-free group, p=0.045). This relationship is depicted in Figure 2, which shows a markedly higher risk of surgery among patients with a baseline appendiceal diameter >10 mm.

In multivariate logistic regression analysis, appendiceal diameter >10 mm remained an independent predictor of surgery within one year (odds ratio [OR] 6.5, 95% confidence interval [CI] 1.12–37.6, p=0.037). Neither elevated CRP (>30 mg/L), age, male sex, nor WBC >12 × 10^9/L were statistically significant predictors in the adjusted model (Table 3).

No deaths or major complications occurred during the study period. The median length of stay during the index admission was three days (IQR, 2–4) for patients managed successfully without surgery and five days (IQR, 3–6) for those who underwent appendectomy

TABLE 1. BASELINE DEMOGRAPHIC AND CLINICAL CHARACTERISTICS BY SURGICAL OUTCOME

Variable	All Patients (n=33)	Surgery-Free (n=26)	Underwent Surgery (n=7)	p-value
Age (years), mean ± SD	30.2 ± 10.1	29.5 ± 10.5	33.0 ± 8.7	0.36
Male sex, n (%)	18 (54.5)	14 (53.8)	4 (57.1)	0.88
BMI, mean ± SD	24.8 ± 3.5	24.6 ± 3.6	25.6 ± 3.2	0.48
Hypertension, n (%)	3 (9.1)	2 (7.7)	1 (14.3)	0.59
Diabetes, n (%)	2 (6.1)	1 (3.8)	1 (14.3)	0.32
Symptom duration (h), mean ± SD	30 ± 17	29 ± 16	33 ± 19	0.48
WBC (×10^9/L), mean ± SD	12.2 ± 3.7	12.1 ± 3.5	12.6 ± 4.5	0.76
CRP (mg/L), mean ± SD	31.1 ± 21.9	29.2 ± 20.8	38.2 ± 25.0	0.33
Appendiceal diameter >10mm, n (%)	5 (15.2)	2 (7.7)	3 (42.9)	0.045

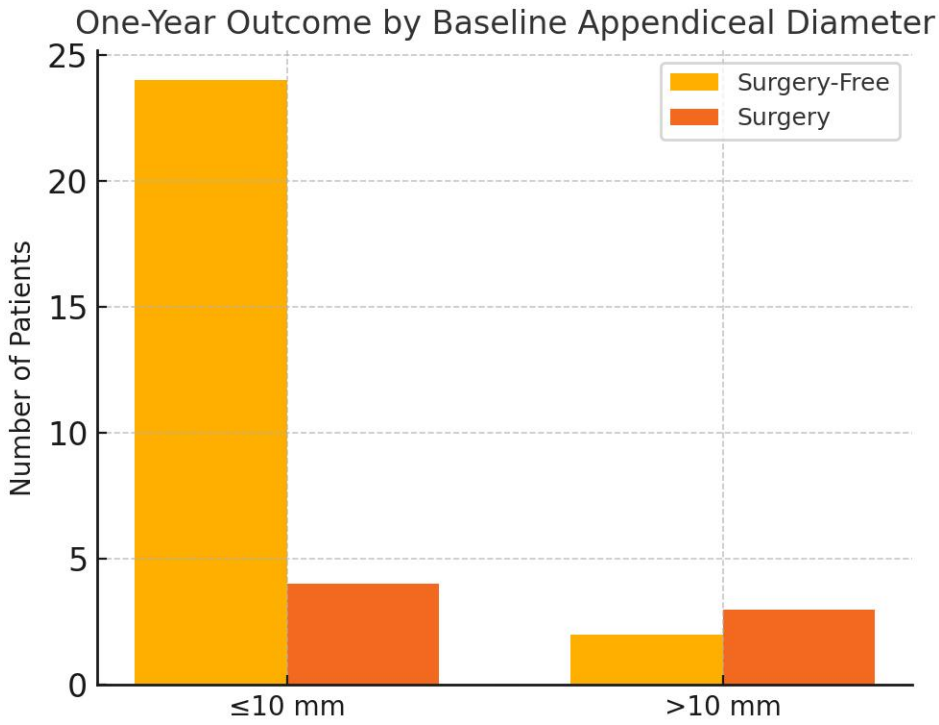
Imaging: Ultrasound, n (%)	27 (81.8)	21 (80.8)	6 (85.7)	0.77
Imaging: CT, n (%)	6 (18.2)	5 (19.2)	1 (14.3)	0.76

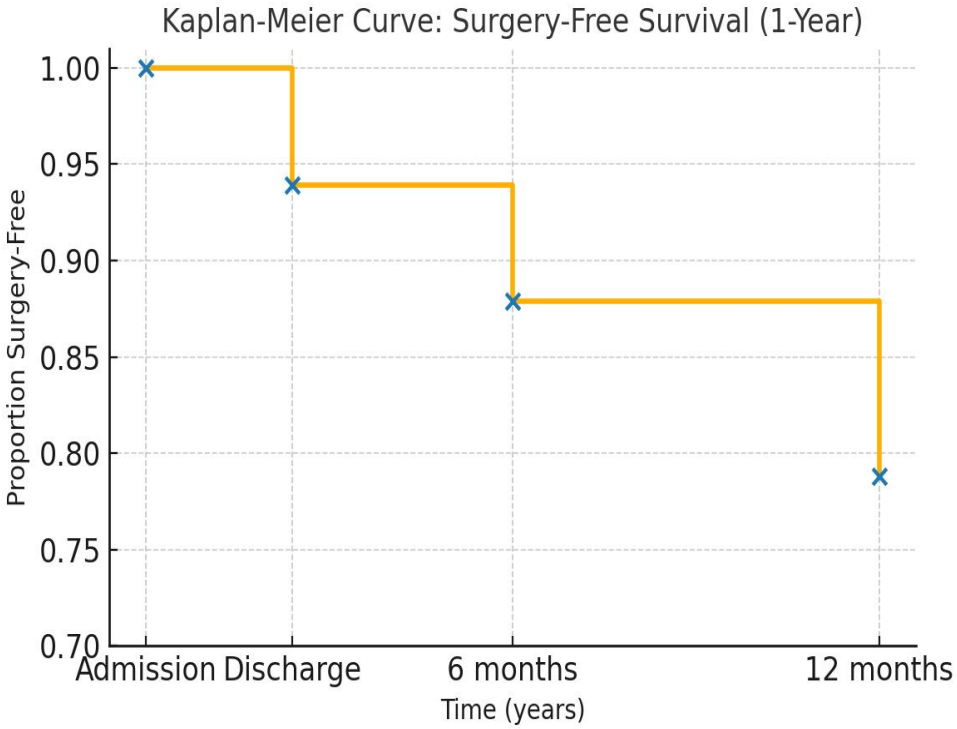
TABLE 2. OUTCOMES OF CONSERVATIVE MANAGEMENT AT 6 MONTHS AND ONE YEAR

Outcome	By 6 Months n (%)	By 1 Year n (%)
Index admission failure (surgery)	2 (6.1)	2 (6.1)
Readmission + appendectomy (≤6 months)	2 (6.1)	2 (6.1)
Readmission + appendectomy (6–12 months)	3 (9.1)	3 (9.1)
Cumulative appendectomy	**4 (12.2)**	**7 (21.2)**
Surgery-free at 1 year	**29 (87.8)**	**26 (78.8)**

TABLE 3. MULTIVARIATE LOGISTIC REGRESSION ANALYSIS OF PREDICTORS FOR SURGERY WITHIN ONE YEAR

Predictor	Odds Ratio (OR)	95% CI	p-value
Appendiceal diameter >10 mm	6.5	1.12–37.6	0.037
CRP > 30 mg/L	2.4	0.45–13.0	0.31
Age (per year increase)	1.04	0.95–1.15	0.41
Male sex	1.16	0.23–5.78	0.86
WBC > 12×10^9/L	1.28	0.31–5.29	0.74




Kaplan-Meier Curve: Surgery-Free Survival (1-Year)
Proportion Surgery-Free
1.00
0.95
0.90
0.85
0.80
0.75
0.70
Admission Discharge
6 months
12 months
Time (years)

DISCUSSION

The findings of this prospective cohort study reinforce the safety and efficacy of conservative, antibiotic-first management for uncomplicated acute appendicitis in a South Asian tertiary care context. At one year, nearly four out of five patients remained surgery-free, a rate that aligns with or surpasses international experiences reported in recent guidelines and multicenter trials[12–15]. This high success rate is notable, given the limited adoption and published data on non-operative management from low- and middle-income countries.

Our results closely mirror those of the ACTUAA multicenter trial, which found a surgical avoidance rate of over 60% with conservative therapy, as well as similar outcomes reported in systematic reviews and cost-effectiveness studies from Western populations[13–15]. The consistently low incidence of major complications observed in these studies, and reaffirmed in our own cohort, supports the ongoing paradigm shift away from routine emergency appendectomy for all cases of uncomplicated appendicitis[16–18].

Importantly, this study identified appendiceal diameter >10 mm on baseline imaging as an independent predictor of conservative treatment failure, in line with recent evidence suggesting the value of detailed imaging in prognostication[19,20]. While previous literature has highlighted several risk factors—such as elevated inflammatory markers and the presence of appendicolith—our data found that only increased diameter significantly predicted the need for delayed surgery. This supports the emerging view that comprehensive imaging assessment should guide individualized management decisions, particularly in borderline or higher-risk cases[19–21].

Our study's complication rate was minimal, and all patients returned to baseline function, consistent with the established safety profile of non-operative management[15,17,22]. Avoidance of unnecessary surgery is especially relevant in LMICs, where health system resources are limited and minimizing surgical morbidity is of paramount importance. Additionally, studies suggest that patient satisfaction and quality of life after conservative management are equivalent, if not superior, to routine appendectomy in carefully selected cases[15,23].

Nonetheless, our results also highlight the need for judicious patient selection and robust follow-up. Although conservative management is highly effective in the majority, prompt recognition of recurrence or failure—particularly in those with increased appendiceal diameter—remains crucial to optimize outcomes[20,22]. The generalizability of our findings is subject to some limitations, including the single-center design and modest sample size, yet the prospective methodology and standardized protocols increase confidence in the results.

Overall, these data reinforce recent guideline recommendations from the World Society of Emergency Surgery and other expert panels, which now advocate conservative management as an appropriate first-line option for selected patients[12,24]. Our results provide region-specific validation of these recommendations and underscore the value of ongoing research and multicenter collaboration to further refine risk stratification and long-term follow-up strategies[18,25]

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TABLE LEGENDS

TABLE 1. BASELINE DEMOGRAPHIC AND CLINICAL CHARACTERISTICS BY SURGICAL OUTCOME

Demographic, clinical, and laboratory characteristics of all patients, stratified by one-year surgical outcome. Data are presented as mean ± standard deviation (SD) or number (percentage). p-values reflect comparisons between surgery-free and surgical groups.

TABLE 2. OUTCOMES OF CONSERVATIVE MANAGEMENT AT 6 MONTHS AND ONE YEAR

Primary and secondary outcomes following conservative (antibiotic-first) management of uncomplicated acute appendicitis, including rates of surgical intervention at specified time points and cumulative surgery-free survival.

TABLE 3. MULTIVARIATE LOGISTIC REGRESSION ANALYSIS OF PREDICTORS FOR SURGERY WITHIN ONE YEAR

Adjusted odds ratios (OR) and 95% confidence intervals (CI) for predictors of surgical intervention within one year following conservative management. Statistically significant predictors ($p < 0.05$) are highlighted in bold.

FIGURE LEGENDS

FIGURE 1. KAPLAN-MEIER CURVE OF SURGERY-FREE SURVIVAL AT ONE YEAR

Kaplan-Meier plot showing the proportion of patients remaining surgery-free at key time points up to one year after initial conservative management for uncomplicated acute appendicitis. The greatest decline occurs during the index admission and first six months, with a plateau thereafter.

FIGURE 2. ONE-YEAR SURGICAL OUTCOMES STRATIFIED BY BASELINE APPENDICEAL DIAMETER

Bar chart illustrating the number of patients undergoing surgery versus remaining surgery-free at one year, grouped by baseline appendiceal diameter (≤10 mm vs. >10 mm). Patients with an initial diameter >10 mm demonstrated a significantly higher risk of surgical intervention (p=0.045).