

## Frequency of Appendectomy in Children after Conservative Treatment of Uncomplicated Acute Appendicitis

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### Abstract

### Original Research Article

**Background:** Acute appendicitis, frequently seen in children, involves an inflamed appendix. Conventionally, surgical removal (appendectomy) has been the go-to treatment. Recently, interest in a conservative approach, utilizing antibiotics and close monitoring, has grown, particularly for uncomplicated cases. This shift aims to reduce surgical intervention, reflecting a changing understanding of the condition. **Aim of the study:** The aim of the study was to assess the frequency of appendectomy in children after conservative treatment of uncomplicated acute appendicitis. **Methods:** This prospective observational study spanned from July 2017 to March 2019, conducted at the Department of Paediatric Surgery, Dhaka Medical College Hospital, Bangladesh. It involved 62 children admitted for uncomplicated acute appendicitis. Data collection employed purposive sampling, and MS Office tools were used for data analysis. **Results:** In this study, the mean age of the total participants was  $8.95 \pm 2.10$  years within a range from 4 years to 12 years. The male-female ratio was 1.6:1. The frequency of appendectomy among the total participants was 4.9% (n=3). After taking conservative treatment, 95.1% (n=59) of patients were successfully discharged. Within six months, 13.0% (n=8) experienced recurrence, and the average hospital stay was  $5.26 \pm 0.63$  days. **Conclusion:** The frequency of appendectomy in children after conservative treatment of uncomplicated acute appendicitis. So, by using conservative treatment physicians can save a huge number of paediatric patients from the hassles and sufferings of surgery for uncomplicated acute appendicitis.

**Keywords:** Frequency, Appendectomy, Children, Conservative treatment, Uncomplicated acute appendicitis.

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## 1. INTRODUCTION

Appendicitis is a prevalent surgical abdominal condition in children aged 2 years and older, affecting 1% to 8% of children with abdominal pain [1]. The lifetime risk is 6.7% for females and 8.6% for males, with incidence rates rising from 1-2 cases per 10,000 children annually between birth and age 4 to 25 cases per 10,000 children per year between ages 10 and 17 [2]. For over a century, the standard practice for managing acute appendicitis has been surgical removal of the appendix, known as appendectomy, which comes with a spectrum of complications, including vascular injuries, urinary tract problems, hematomas, colonic fistulas, surgical site infections, adhesions, bowel obstructions, and prolonged

hospital stays [5]. Post-operative complication rates vary widely, ranging from 2% to as high as 23%, with more than 3% of patients requiring readmission due to complications [6]. However, in recent years, this traditional surgical approach has faced challenges from a growing body of literature suggesting that antibiotics alone may effectively treat acute appendicitis in both adults and children, sparking controversy due to the lack of large-scale randomized controlled trials (RCTs) [7]. Surgical complications and anesthesia-related issues occur in over 10% of children within 30 days of undergoing an appendectomy [8]. To establish the non-operative approach as a viable alternative to surgery, it must prove its efficacy in curing acute appendicitis. Even

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with advanced imaging techniques, approximately 6.3% of children in Canada and 4.3% in the USA who undergo appendectomy are subsequently found to have a normal appendix, raising questions about the necessity of the operation. Surgery can cause physical trauma, physiological stress, and emotional distress for both the child and their parents, making a non-operative approach potentially less burdensome. Additionally, there may be social and economic benefits, such as reduced disruptions to daily life, including schooling and parental time off work, which could benefit both the healthcare system and society as a whole. In a 2012 meta-analysis, Mason *et al.* concluded that non-operative treatment had advantages, such as fewer complications, improved pain management, and shorter recovery times, but faced challenges due to higher failure and recurrence rates [10]. However, Varadhan *et al.*, (2012) deduced from their meta-analysis that antibiotics could safely serve as the primary treatment for acute uncomplicated appendicitis since 63% of patients responded favorably to non-operative treatment [11]. The ongoing debate underscores the need for further research in this critical area of pediatric medicine.

## 2. METHODOLOGY

This prospective observational study was conducted at the Department of Paediatric Surgery, Dhaka Medical College Hospital, Dhaka, Bangladesh, spanning from July 2017 to March 2019. The study enrolled 62 children who were admitted for uncomplicated acute appendicitis. Ethical approval for the study was obtained from the hospital's ethical committee, and all participants provided written consent before any data collection procedures. Throughout the entire study, all interventions adhered to the principles of human research outlined in the Helsinki Declaration [12]. The study was also carried out following the relevant regulations and in compliance with the provisions of the General Data Protection Regulation (GDPR) [13]. The study included patients with uncomplicated acute appendicitis, aged up to 12 years, regardless of gender, and those with appendicitis associated with fecolith but excluded patients over the age of 12, patients with an obstructed appendix, and those with an appendicular lump or abscess. All cases were purposively selected from the specified study location for inclusion in the research. The researcher created a questionnaire covering various factors, and data collection was carried out personally. Informed consent was obtained from the patients or their guardians, emphasizing confidentiality. Conservative treatment involving antibiotics was administered to uncomplicated

acute appendicitis patients for five days, with regular follow-up and assessments. Demographic and clinical data were recorded throughout the study. All data were processed, analyzed and disseminated by using MS Office tools.

## 3. RESULT

The mean age of our total participants was  $8.95 \pm 2.10$  years within a range from 4 years to 12 years. Males were more predominant than females and the male-to-female ratio was 1.58:1. Among the participants, pain reduced gradually from 1<sup>st</sup> day to 5<sup>th</sup> day, from a mean VAS score of  $9.42 \pm 0.92$  to  $0.77 \pm 0.98$ . The mean body temperature ( $^{\circ}$ ) also reduced from  $101.02 \pm 0.84$  to  $98.90 \pm 0.41$  with 5 days of conservative treatment. Neutrophil count (Mean) was reduced from  $79.98 \pm 3.99$  to  $62.26 \pm 7.83$ . The periodic findings related to the diameter of the appendix, measured by ultrasound (USG), in the study involving 62 subjects are as follows: At the time of admission, the mean appendix diameter was  $6.97 \text{ mm} \pm 0.36$ , with a range between 6.10 mm and 7.50 mm. After 15 days, the mean diameter decreased to  $5.71 \text{ mm} \pm 0.82$ , ranging from 0.20 mm to 7.10 mm. At the 30-day mark, the mean diameter further reduced to  $5.55 \text{ mm} \pm 0.67$ , ranging between 4.20 mm and 7.40 mm. Finally, at the 3-month follow-up, the mean diameter was  $5.05 \text{ mm} \pm 0.76$ , with a range from 3.60 mm to 7.00 mm. Among the 62 participants in the study, symptom recurrence was observed in a total of 8 cases (13%). At day 15, 4 participants (6.5%) experienced a recurrence of symptoms, which decreased to 2 participants (3.2%) by day 30 and remained the same after 3 months. Encouragingly, no symptom recurrence was reported after the 6-month mark, suggesting a favorable trend in the study's findings. In the study involving 62 participants, ultrasound (USG) results revealed that at day 15, 4 participants (6.5%) exhibited probe tenderness, which increased to 5 participants (8.1%) by day 30 and subsequently decreased to 2 participants (3.2%) after 3 months. No cases of probe tenderness were reported after 6 months. Regarding peri appendicular fluid, 1 participant (1.6%) displayed it at day 15, increasing to 6 participants (9.7%) by day 30 and then reducing to 3 participants (4.8%) after 3 months. No instances of peri appendicular fluid were observed after 6 months. For lumen distension, 2 participants (3.2%) exhibited it at day 15, increasing to 5 participants (8.1%) by day 30 and further increasing to 8 participants (12.9%) after 3 months. However, no cases of lumen distension were recorded after 6 months. In this study, after completing conservative treatment, the frequency of appendectomy was found only 5% (4.9%).

**Table 1: Clinical findings over time, (N=62)**

Characteristics	Mean $\pm$ SD	Min-max
Pain (VAS score)		
1 <sup>st</sup> day	9.42 $\pm$ 0.92	8.00 - 10.00
2 <sup>nd</sup> day	7.13 $\pm$ 1.00	6.00 - 8.00
3 <sup>rd</sup> day	4.77 $\pm$ 0.98	4.00 - 6.00
5 <sup>th</sup> day	0.77 $\pm$ 0.98	0.00 - 2.00
Temperature (°)		
1 <sup>st</sup> day	101.02 $\pm$ 0.84	100.00 - 103.10
2 <sup>nd</sup> day	100.04 $\pm$ 0.76	99.00 - 101.40
3 <sup>rd</sup> day	99.45 $\pm$ 0.64	98.00 - 101.20
5 <sup>th</sup> day	98.90 $\pm$ 0.41	98.00 - 99.60
Total count (TC)		
1 <sup>st</sup> day	14708.23 $\pm$ 2575.15	16000 - 21000
3 <sup>rd</sup> day	11820.97 $\pm$ 1957.09	12000 - 16400
5 <sup>th</sup> day	9852.26 $\pm$ 1018.44	7800 - 11800
Neutrophil count		
1 <sup>st</sup> day	79.98 $\pm$ 3.99	68.80 - 89.00
3 <sup>rd</sup> day	73.42 $\pm$ 5.20	52.00 - 82.20
5 <sup>th</sup> day	62.26 $\pm$ 7.83	11.30 - 72.20

**Table 2: Diameter (mm) of the appendix by USG, (N=62)**

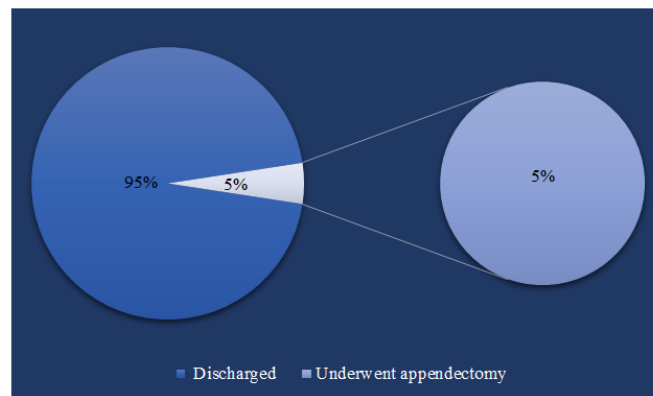
Period	Mean $\pm$ SD	Min-max
At admission	6.97 $\pm$ 0.36	6.10 - 7.50
At day 15	5.71 $\pm$ 0.82	0.20 - 7.10
At day 30	5.55 $\pm$ 0.67	4.20 - 7.40
At 3 months	5.05 $\pm$ 0.76	3.60-7.00

**Table 3: Symptom recurrence in the study subjects, (N=62)**

Time	n	%
At day 15	4	6.5
At day 30	2	3.2
After 3 months	2	3.2
After 6 months	0	0.0
Total	8	13.0

**Table 4: USG finding of the study subjects, (N=62)**

Time	%	%
Probe tenderness		
At day 15	4	6.5
At day 30	5	8.1
After 3 months	2	3.2
After 6 months	0	0.0
Peri appendicular fluid		
At day 15	1	1.6
At day 30	6	9.7
After 3 months	3	4.8
After 6 months	0	0.0
Lumen distended		
At day 15	2	3.2
At day 30	5	8.1
After 3 months	8	12.9
After 6 months	0	0.0



**Figure I: Frequency of appendectomy**

#### 4. DISCUSSION

This study aimed to assess the frequency of appendectomy in children after conservative treatment of uncomplicated acute appendicitis. Despite advancements in surgical techniques, appendectomy continues to be associated with significant morbidity and mortality. A study by Blomqvist and colleagues (2001) [14] analyzed a large cohort of 117,424 patients who underwent appendectomy in Sweden between 1987 and 1996. They found a 3.5-fold increase in mortality within 30 days after surgery for non-perforated appendicitis and a 6.5-fold increase after perforated appendicitis. Moreover, the standardized mortality rate was 9.1-fold higher after negative appendectomy with a discharge diagnosis of non-specific abdominal pain, suggesting that the increased mortality is not solely due to underlying conditions concealed by the surgery. This finding aligns with a study by Flum and Koepsell (2002) [15], which reported a threefold increase in mortality after negative appendectomy compared to appendectomy for appendicitis. Another research revealed that 1.3% of appendectomy patients experienced small bowel obstructions (SBO) during a 30-year follow-up, compared to 0.2% of controls [16]. Recent reviews, such as one by Leung *et al.*, (2009) [17], reported an incidence of SBO after appendectomy at 2.8%, with 1.1% requiring reoperation for SBO during a 5-year follow-up. Furthermore, a study by Wu *et al.*, (2015) [18] supported the hypothesis that patients who underwent appendectomy had an elevated risk of colonic cancer in the post-appendectomy period. In our study, 95.1% of patients responded positively to antibiotic therapy and were discharged from the hospital, with varying discharge times. Three patients (4.9%) eventually required surgery during the conservative treatment period. The success rate of conservative treatment with antibiotics in our study aligns with previous research, such as 86.0% in Styrud *et al.*, (2006) [19], 91.0% in Park *et al.*, (2011) [20], 95.0% in Malik and Bari (2009) [21], 95.0% in Liu *et al.*, (2007) [22], and 92.0% in Winn *et al.*, (2004) [23]. Hansson *et al.*, (2009) [24] reported a treatment efficacy rate of 90.8% for antibiotic therapy. We observed a 13.0% recurrence rate of appendicitis in children treated conservatively within six months. This is consistent with the recurrence rates reported in Styrud

*et al.*, 's study (2006) [19], which was 15.0% within one year, and Park *et al.*'s study (2011) [20], which reported 5.0% within 18 months. In our study, 10.0% of patients were readmitted within one year due to recurrent appendicitis and subsequently underwent surgery, as noted in Malik and Bari's study (2009) [21]. Hansson *et al.*, (2009) [24] observed a recurrence rate of 13.9%, with one-third of recurrences occurring within 10 days and two-thirds between 3 and 16 months after hospital discharge. However, Liu *et al.*, (2007) [22] and Winn *et al.*, (2004) [23] reported a lower recurrence rate of 5.0%. In this study, upon completion of the conservative treatment, only 5% (4.9%) of participants required an appendectomy. In a similar study conducted at Sahlgrenska University Hospital (May 2009 to February 2010), involving 442 patients, 77.4% (342 patients) successfully responded to conservative treatment, while 22.6% (100 patients) did not [25]. Another study at the surgical department of GMERS Medical College, Gandhinagar (2011-2013) with 30 patients undergoing conservative management found a success rate of 70% (21 patients) and a failure rate of 30% (9 patients) [26]. A more recent study in India in 2016 by Gedam PS *et al.*, involving 71 patients, reported a success rate of 74.65%, a treatment failure rate of 14.08%, and a recurrence rate of 13.11% [27].

#### Limitation of the study

This study has several limitations. Firstly, its short duration prevented long-term follow-up, potentially limiting the assessment of treatment outcomes over time. Secondly, the sample size of 62 cases, although informative, may not provide precise figures or cover the full range of outcomes. Thirdly, logistical challenges like transportation issues and participants residing in remote areas from the study center led to variations in follow-up schedules, potentially affecting data consistency and completeness. These limitations should be kept in mind when interpreting the study's findings and highlight the importance of future research with larger samples and extended follow-up periods.



## 5. CONCLUSION & RECOMMENDATION

In conclusion, the results of this study indicate that conservative treatment can significantly reduce the frequency of appendectomy in children with uncomplicated acute appendicitis. This approach offers a valuable alternative that can spare a substantial number of pediatric patients from the challenges and discomfort associated with surgery for this condition. The findings underscore the importance of considering conservative management as a viable option, particularly in cases of uncomplicated appendicitis, and highlight the potential benefits it can bring to young patients. Further research and exploration of this approach may lead to improved outcomes and reduced reliance on surgical interventions in the management of pediatric appendicitis. Ultimately, the pursuit of conservative treatment offers a promising avenue for enhancing the care and well-being of children facing this common abdominal ailment.

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