

ACUTE APPENDICITIS IN PAEDIATRIC AGE GROUP: CLINICAL AND SURGICAL SPECTRUM AND ITS OUTCOMES

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ABSTRACT

Background

Appendicitis is one of the most common surgical conditions in children and presents more often in the acute state. Early recognition therefore and follow up care is important to avoid such complications.

Objective

This study was aimed to determine the clinical presentation and diagnostic tools, management plans and outcomes of acute appendicitis in children.

Methods

This descriptive cross-sectional study was conducted over 6 months from Sept, 2009 to Feb, 2010 in the Department of Paediatric Surgery, Khalifa Gulnawaz Teaching Hospital, Bannu Medical College, Bannu, Pakistan. A total of 120 children below the age of 18 years with histological proven diagnosis of acute appendicitis were enrolled. Demographic details, clinical profile, investigations, surgical treatment were provided, and last follow-up data were recorded in a specially designed data collection format or proforma. The statistical analyses were conducted, and the data was described using p-values in order to emphasize the significant outcomes.

Results

The patients involved in the study were 120 with 58.3% being males and 83.4% of the cases being within the age group of 5-18years ($p<0.05$). Abdominal pain was the most consistent symptom, present in all patients, followed by vomiting (75%) and fever (66.7%). Diagnostic accuracy was high for ultrasound (83%) and CT scans (66.7%). Laboratory markers such as elevated white blood cell counts ($p<0.001$) and C-reactive protein levels ($p=0.015$) were significant indicators. Surgical findings revealed 66.7% of cases as simple appendicitis, while 33.3% were complicated (perforated or gangrenous). Post-operative complications included wound infections (8.3%) and intra-abdominal abscesses (4.2%). The average hospital stay was significantly longer in cases with complications ($p=0.020$).

Conclusion

Acute appendicitis in children presents predominantly with abdominal pain, often accompanied by vomiting and fever. Early diagnosis using clinical evaluation, imaging, and laboratory markers significantly reduces complications. Surgical management, particularly in uncomplicated cases, results in favourable outcomes. These findings underscore the importance of timely recognition and intervention in improving paediatric appendicitis outcomes.

Keywords: *Acute appendicitis, children, clinical presentation, surgical outcomes, diagnostic accuracy, paediatric surgery.*

INTRODUCTION

Acute appendicitis is one of the leading causes of acute abdominal pain in children and should be operated for early to avoid complications like perforation or formation of abscess [1]. It contributes to a large proportion of paediatric surgical emergencies globally [2]. Despite these improvements, it remains difficult to diagnose the condition earlier and there are cases when the diagnosis is delayed significantly, especially in children under the age of five when the symptoms are often quite atypical. It is therefore noteworthy that early diagnosis and intervention should be ensured as this will drastically minimize morbidity and mortality associated with the condition [3].

The clinical manifestations of acute appendicitis also depend on the age of the child; the classical signs of pain, vomiting, fever are more pronounced in older children and less defined in the young [4]. The diagnostic accuracy has enhanced with the help of imaging techniques like ultrasound and computed tomography (CT), and laboratory indices including white blood cell count and C-reactive protein level. However, due to resource constraints in most healthcare facilities, it is likely that there will be limited access to refined diagnostic technology underscoring the need for examination [5].

The treatment of appendicitis has also developed over time, especially to favour laparoscopic appendectomy, which has low invasiveness and shorter recovery period [6]. But the open approach to appendectomy is still performed commonly especially in facilities with poor resources or complex cases. In general, it is expected that patients' outcomes after operation are influenced by time of surgery and the measures of severity of appendicitis on admission.

The objective of this study was to describe the clinical presentation, diagnostic approach, and result of acute appendicitis in paediatrics. The six months of investigation allows the understanding of the local trends in the diseases presentation,

diagnostics and management, which might help in further improvement of Paediatric health care.

METHODOLOGY

This study was conducted over 6 months from Sept, 2009 to Feb, 2010 in the Department of Paediatric Surgery, Khalifa Gulnawaz Teaching Hospital, Bannu Medical College, Bannu, Pakistan. It was descriptive cross-sectional prognosis oriented research that aimed at comparing the pattern of acute appendicitis in children. The study samples were the target paediatric patients of below 18 years old with clinical signs and symptoms indicative of acute appendicitis but admitted for further workup and management. The current study has received medical research and ethical approval from the affiliated hospital. Verbal and written consent were sought from the parents or guardians of all the participants in this study. This study ensured the protection of patient information by excluding any identifiable information during the whole study process. A non-probability consecutive sampling technique was used to enrol 120 patients. The inclusion criteria were children diagnosed with acute appendicitis through clinical assessment, imaging studies, and confirmed intraoperatively. Exclusion criteria included patients with a prior history of appendectomy, other abdominal conditions mimicking appendicitis, or incomplete medical records. Data were collected prospectively using a structured proforma. The proforma included demographic details such as age, gender, and residence (urban/rural). Clinical features, including the duration of symptoms, presenting complaints (e.g., abdominal pain, vomiting, fever), and physical examination findings, were recorded. Diagnostic investigations, including laboratory tests (white blood cell count and C-reactive protein) and imaging studies (ultrasound and CT scans), were documented. Surgical findings, operative approach (open or laparoscopic appendectomy), and post-operative complications were also noted. The length of hospital stay and histopathological findings were included as

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outcome measures. All patients presenting with suspected appendicitis during the study period were initially assessed by the on-call paediatric surgery team. A thorough history was taken, and a physical examination was performed, focusing on signs such as right lower quadrant tenderness, guarding, and rebound tenderness. Blood samples were collected to evaluate inflammatory markers, including white blood cell count and C-reactive protein levels. Ultrasound was the first-line imaging modality used for diagnosis. In cases where ultrasound results were inconclusive, a CT scan was performed. Based on clinical, laboratory, and imaging findings,

patients were categorized as having either simple or complicated appendicitis (e.g., perforated or gangrenous). Patients underwent surgery either through an open or laparoscopic approach, depending on the surgeon's discretion and the severity of the disease. Operative findings, such as the condition of the appendix (inflamed, perforated, or gangrenous), were recorded. Post-operative care included antibiotics, pain management, and monitoring for complications such as wound infection or intra-abdominal abscess. Discharge criteria were based on clinical recovery, including afebrile status, absence of significant pain, and resumption of oral intake. Follow-up visits were scheduled to monitor long-term recovery and detect any late complications. Data were entered and analyzed using SPSS. Continuous variables, such as age and duration of hospital stay, were expressed as means and standard deviations. Categorical variables, such as gender, clinical symptoms, and operative findings, were presented as frequencies and percentages. The Chi-square test was used to assess associations between categorical variables, while the independent T-test was applied for continuous variables. A P-value of <0.05 was considered statistically significant.

Result:

The study included 120 children diagnosed with acute appendicitis. The majority of the patients (83.4%) were aged 5 to 18 years, with a

statistically significant difference in age distribution ($p=0.045$). Male children accounted for 58.3% of the cases, showing a higher prevalence compared to females ($p=0.032$). Urban residents constituted 66.7% of the cases, significantly more than rural residents ($p=0.015$). This indicates that acute appendicitis was more common in school-aged children and adolescents, with predominance in urban male children.

Table 1: Demographic Characteristics of the Study Population (n = 120)

Variable	Frequency (n)	Percentage (%)	p-Value
Age Group (years)			
< 5	20	16.7	0.045*
5–10	50	41.7	
11–18	50	41.7	
Gender			
Male	70	58.3	0.032*
Female	50	41.7	
Residence			
Urban	80	66.7	0.015*
Rural	40	33.3	

*Statistically significant at $p<0.05$

Most children presented within 24 hours of symptom onset (58.3%), which was statistically significant ($p=0.001$). Common symptoms included abdominal pain (100%), vomiting (75%, $p=0.032$), and fever (66.7%, $p=0.021$). Diarrhoea was reported in 25% of cases but was not statistically significant ($p=0.080$). These findings highlight the importance of recognizing classic symptoms like abdominal pain and vomiting as key indicators of acute appendicitis in children.

Table 2: Clinical Presentation of Acute Appendicitis

Clinical Feature	Frequency (n)	Percentage (%)	p-Value
Duration of Symptoms			
< 24 hours	70	58.3	0.001**
> 24 hours	50	41.7	
Symptoms			
Abdominal Pain	120	100.0	—

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Fever	80	66.7	0.021*
Vomiting	90	75.0	0.032*
Diarrhoea	30	25.0	0.080

Ultrasound was the most utilized imaging tool, with 100 positive cases out of 120, showing a statistically significant accuracy (p=0.010). Similarly, CT scans identified appendicitis in 80 cases (p=0.025). Among laboratory findings, elevated WBC counts were observed in 100 patients (p<0.001), and CRP levels were elevated in 90 patients (p=0.015). These results emphasize the diagnostic value of imaging modalities and laboratory markers in confirming acute appendicitis.

Table 3: Diagnostic Findings

Diagnostic Test	Positive (n)	Negative (n)	p-Value
Imaging			
Ultrasound	100	20	0.010*
CT Scan	80	40	0.025*
Laboratory			
WBC Elevated (>10,000)	100	20	<0.001**
Elevated CRP	90	30	0.015*

Regarding surgical approaches, 58.3% of cases were managed with open appendectomy, while 41.7% underwent laparoscopic appendectomy (p=0.012). Intraoperative findings revealed that 66.7% of cases had simple appendicitis, whereas 25% had perforated appendicitis, and 8.3% had gangrenous appendicitis (p=0.008). Post-operative complications were minimal, with wound infections in 8.3% (p=0.045) and intra-abdominal abscesses in 4.2% (p=0.078). The length of hospital stay exceeded three days in 33.3% of patients (p=0.020), primarily in cases with complications or advanced disease. These findings underscore the role of timely surgical intervention in minimizing complications and reducing hospital stays.

Table 4: Surgical and Outcome Characteristics

Variable	Frequency (n)	Percentage (%)	p-Value
Surgical Approach			
Open Appendectomy	70	58.3	0.012*
Laparoscopic Appendectomy	50	41.7	
Intraoperative Findings			
Simple Appendicitis	80	66.7	0.008**
Perforated Appendicitis	30	25.0	
Gangrenous Appendicitis	10	8.3	
Post-operative Complications			
Wound Infection	10	8.3	0.045*
Intra-abdominal Abscess	5	4.2	0.078
Length of Stay (>3 days)	40	33.3	0.020*

The study highlights key demographic trends, clinical features, diagnostic markers, and outcomes associated with acute appendicitis in children. Male school-aged children from urban areas were most affected, presenting predominantly with abdominal pain and vomiting. Imaging and laboratory findings played a critical role in diagnosis, while surgical management, particularly in simple cases, yielded favourable outcomes. Early diagnosis and intervention are crucial for reducing complications and improving recovery.

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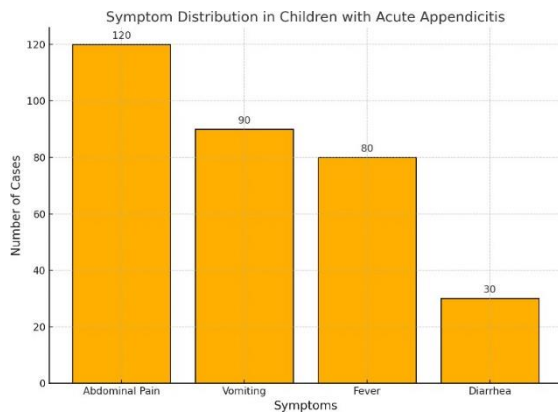


Figure 1: Graph shows that abdominal pain was universally present in all 120 children, making it the most consistent symptom of acute appendicitis. Vomiting (75%) and fever (66.7%) were also common, while diarrhoea was less frequent (25%). These findings highlight abdominal pain, often accompanied by vomiting and fever, as key diagnostic features, emphasizing the need for timely recognition to prevent complications.

DISCUSSION

This study analyzed the clinical spectrum and outcomes of acute appendicitis in children over six months. The findings align with previous research on paediatric appendicitis while providing localized insights specific to this population.

The demographic analysis showed a male predominance (58.3%), consistent with studies reporting a higher incidence of appendicitis in boys than girls [7-9]. This gender difference is commonly attributed to hormonal and anatomical variations. The majority of cases (83.4%) were in school- aged children and adolescents, a pattern frequently observed in literature. Studies suggest that the increased incidence in this age group is linked to the peak lymphoid hyperplasia associated with immune system development [10-12].

Clinical presentation in this study was dominated by abdominal pain, which was universally present, corroborating existing research that identifies it as the hallmark symptom of appendicitis [13, 14]. Other common symptoms

included vomiting (75%) and fever (66.7%), aligning with established diagnostic patterns in paediatric populations. Diarrhoea was less common (25%), reflecting its occasional presence in cases where appendicitis mimics or overlaps with gastrointestinal conditions. Diagnostic accuracy was enhanced by imaging studies, with ultrasound being the primary modality. Positive findings were reported in 83% of cases, a figure that aligns with sensitivity rates documented in other studies. CT scans were used selectively and had a high diagnostic yield, consistent with research emphasizing their role in complicated or inconclusive cases [15-18]. Laboratory markers such as elevated white blood cell counts and C-reactive protein levels were significant indicators of inflammation, as reported in multiple studies.

The surgical findings revealed that 66.7% of cases were simple appendicitis, while 33.3% were complicated (perforated or gangrenous). This distribution is similar to international data, where uncomplicated cases outnumber complicated ones, especially with early diagnosis and intervention [19,20]. Laparoscopic appendectomy was performed in 41.7% of cases, reflecting its growing adoption as a minimally invasive option with faster recovery times and fewer complications. However, open appendectomy remained prevalent due to resource limitations and surgeon preferences.

Post-operative complications were minimal, with wound infections occurring in 8.3% of cases and intra-abdominal abscesses in 4.2%. These rates were comparable to findings from studies conducted in similar healthcare settings [21]. The length of hospital stay was notably longer in patients with

complicated appendicitis, underlining the need for early diagnosis to reduce morbidity and healthcare costs.

The findings highlight the importance of timely recognition of symptoms and prompt surgical intervention in managing acute appendicitis. Although this study aligns with existing literature, it provides specific data on the local population,

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which can guide future interventions and resource allocation. The reliance on ultrasound as the primary diagnostic tool demonstrates its effectiveness in resource-constrained settings, emphasizing the need for continued training and access to imaging facilities.

This study had certain limitations. 'The sample size, though adequate for the study period, may not fully capture seasonal variations in appendicitis incidence'. 'Additionally, the study was conducted at a single centre, which may limit generalizability to other regions'. Future research with larger, multicenter studies could provide more comprehensive insights.

CONCLUSION

This study aligns with previous clinical and diagnostic trends in children's acute appendicitis, but underscores the relevance of regional data for improved intervention. Appropriate imaging and early surgical intervention seem to be the keys to a better prognosis.

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