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ORIGINAL ARTICLE

Retrospective Analysis of Pediatric Appendicitis Treated in a Tertiary Care Hospital in Puducherry

Arulselvan A,[1] Babu S,[2] Karthik Bhandary S[1] and Sneha Daffodil A[3,*]
[1]*Associate Professor, Department of General Surgery, Sri Manakula Vinayagar Medical College and Hospital, Puducherry, India*
[2]*Professor, Department of General Surgery, Sri Manakula Vinayagar Medical College and Hospital, Puducherry, India*
[3]*Senior Resident, Department of General Surgery, Sri Manakula Vinayagar Medical College and Hospital, Puducherry, India*

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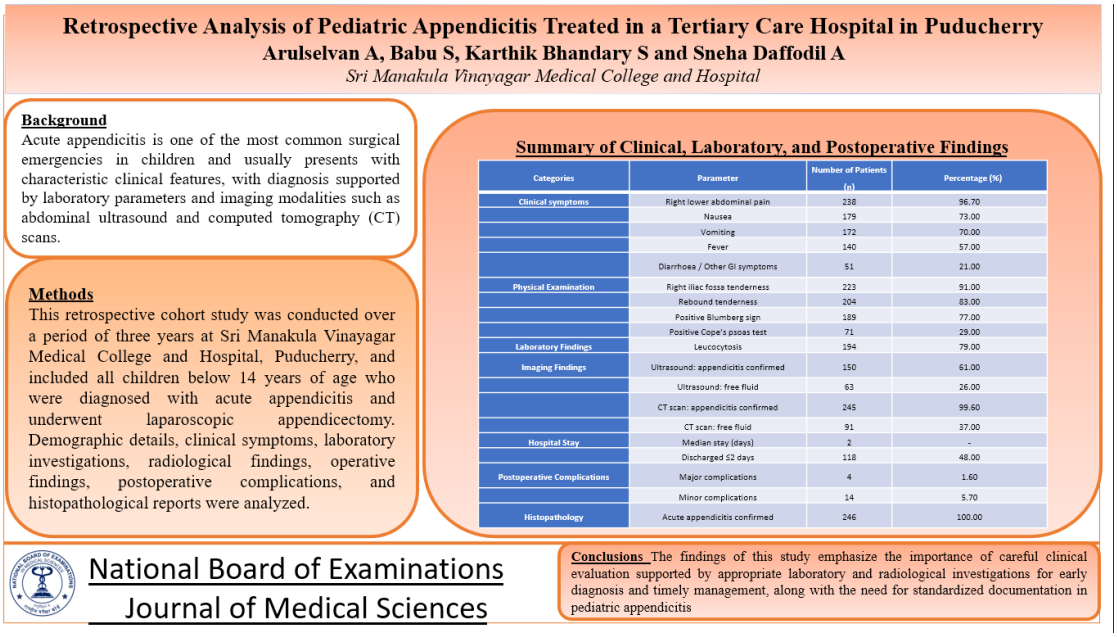
Abstract

Introduction: Acute appendicitis is one of the most common surgical emergencies in children and usually presents with characteristic clinical features, with diagnosis supported by laboratory parameters and imaging modalities such as abdominal ultrasound and computed tomography (CT) scans. **Materials and Methods:** This retrospective cohort study was conducted over a period of three years at Sri Manakula Vinayagar Medical College and Hospital, Puducherry, and included all children below 14 years of age who were diagnosed with acute appendicitis and underwent laparoscopic appendicectomy. Demographic details, clinical symptoms, laboratory investigations, radiological findings, operative findings, postoperative complications, and histopathological reports were analyzed. **Results:** A total of 246 children were included in the study. Right lower abdominal pain was the most common presenting symptom, observed in 96.7% (238/246) of children, followed by nausea in 73% (179/246), vomiting in 69.9% (172/246), and fever in 57% (140/246). On abdominal examination, right iliac fossa tenderness was present in 91% (223/246) of patients, rebound tenderness in 83% (204/246), Blumberg's sign in 77% (189/246), and Cope's psoas test was positive in 29% (71/246) of cases. Laboratory investigations revealed leukocytosis in 79% (194/246) of patients. **Conclusion:** Acute appendicitis should be considered in children presenting with acute abdominal pain. The findings of this study emphasize the importance of careful clinical evaluation supported by appropriate laboratory and radiological investigations for early diagnosis and timely management, along with the need for standardized documentation in pediatric appendicitis.

Keywords: Acute appendicitis, Pediatric appendicitis, Laparoscopic appendicectomy, Abdominal pain in children

*Corresponding Author: Sneha Daffodil A
Email: asdaffodil@gamil.com

Graphical Abstract



Introduction

Acute appendicitis is one of the most common causes of acute abdominal pain requiring emergency medical attention in children and adolescents. It represents a major proportion of surgical emergencies in the Pediatric population. The estimated lifetime risk of developing appendicitis is approximately 8.6% in males and 6.7% in females. The disease most frequently occurs during the second decade of life and shows an increased risk among the male patients [1-3].

In the United States, appendicitis has been reported as one of the leading causes of children getting hospitalized and ranks among the most common pediatric surgical conditions, with an estimated hospitalization rate of about 97.4 cases per 100,000 children [4]. Globally, the occurrence of acute appendicitis in the pediatric age group has been estimated to range between 100 and 151 cases per 100,000 person-years, although the incidence may vary across worldwide [5].

The diagnosis of appendicitis is mainly based on clinical assessment, including history and physical examination. However, due to the variability of symptoms in children, several clinical scoring systems have been developed to assist clinicians in improving diagnostic accuracy. These scoring methods help in identifying patients who may require further evaluation or surgical management [6-9]. Laboratory investigations are commonly used as supportive tools during the diagnostic process. Tests such as complete blood count, absolute neutrophil count, and measurement of C-reactive protein (CRP) levels are frequently performed to evaluate the presence of inflammation. In addition, imaging techniques including ultrasonography, computed tomography (CT), and magnetic resonance imaging (MRI) are often utilized to help confirm the diagnosis and reduce diagnostic uncertainty. Traditionally, appendicectomy has been considered the standard treatment

for pediatric appendicitis. However, in recent years, non-operative management using antibiotics has gained attention as a potential alternative treatment option in selected patients with uncomplicated appendicitis. Ongoing research continues to evaluate the safety, effectiveness, and long-term outcomes of this conservative treatment [2,3,10].

Our aim is to analyse the symptoms, diagnostic approaches, intraoperative observations, and recovery outcomes of children with acute appendicitis, which is managed by laparoscopic appendicectomy at a tertiary care hospital in Puducherry.

Methodology

This study was a three-year hospital-based retrospective cohort conducted at Sri Manakula Vinayagar Medical College and Hospital, Puducherry. It included all children under 14 years of age who were diagnosed with acute appendicitis and underwent laparoscopic appendicectomy. The minimum sample size was estimated using the single population proportion formula $n=Z^2pq/d^2n = Z^2pq/d^2n=Z^2pq/d^2$. Previous literature (Awuah et al.) [26] reports that acute appendicitis accounts for approximately 8% of abdominal pain cases in children. Considering this expected proportion ($p = 0.08$), a 95% confidence level ($Z = 1.96$), and an absolute precision of 5%, the minimum required sample size was calculated as 113. Since this was a retrospective hospital-based study, all eligible pediatric appendicitis cases managed during the study period were included, yielding a final sample size of 246 patients.

Materials

The following resources were used for data collection and analysis:

1. **Hospital Records:** Medical case files and records.
2. **Demographic Data:** Age, sex, weight, and relevant personal information.
3. **Clinical Assessment Tools:** Standardized forms to record symptoms, duration, and examination findings.
4. **Laboratory Investigations:** Blood tests including complete blood count (CBC), C-reactive protein (CRP), and other routine biochemical parameters.
5. **Radiological Imaging:** Ultrasound and/or CT scan reports confirming acute appendicitis.
6. **Surgical Records:** Operative notes documenting intraoperative findings.
7. **Postoperative Follow-up Data:** Records of complications, duration of hospital stay, and recovery outcomes.
8. **Histopathological Reports:** Analysis of resected appendix confirming diagnosis and pathological grading.
9. **Data Collection Tools:** Pre-designed data sheets and digital spreadsheets for systematic recording and the data collected were entered in Microsoft Excel 2019 and the results were analyzed using SPSS software version 23.0. Quantitative data was expressed in Mean, Range, Frequency and Distribution.

Results

In this retrospective cohort study, a total of 246 Pediatric patients diagnosed with acute appendicitis and managed with laparoscopic appendicectomy were analyzed. The study population predominantly presented with classical

features of appendicitis. Right lower abdominal pain was the most frequently reported symptom, observed in 96.7% (238/246) of children, underscoring the typical clinical presentation of the disease. Gastrointestinal symptoms were also common, with nausea reported in 73% (179/246) and vomiting in 70% (172/246) of cases. Fever was documented in 57% (140/246) of patients, while less frequent symptoms such as diarrhoea or generalized malaise were reported in 21% (51/246) of the cohort.

On physical examination, localized tenderness in the right iliac fossa was present in 91% (223/246) of children, while rebound tenderness was observed in 83% (204/246). A positive Blumberg sign was noted in 77% (189/246), indicating peritoneal irritation, and Cope's psoas test was positive in 29% (71/246), suggestive of retrocecal appendiceal involvement. These findings collectively reinforce the predominance of classic clinical signs in Pediatric acute appendicitis, though atypical presentations were noted in a minority of cases.

Laboratory investigations revealed leucocytosis in 79% (194/246) of patients, serving as a supportive marker for inflammation and aiding in the diagnostic workup. Radiological assessment played a crucial role in confirming the diagnosis: ultrasonography identified appendicitis in 61% (150/246) of patients, with free fluid noted in 26% (63/246), whereas CT imaging demonstrated near-universal diagnostic accuracy, confirming appendicitis in 245 out of 246 patients and detecting free peritoneal fluid in 37% (91/246). These findings highlight the complementary roles of ultrasonography and CT in pediatric appendicitis evaluation.

The postoperative course was generally favourable. The duration of hospital stay ranged from 1 to 6 days, with a median of 2 days, reflecting the minimally invasive nature of laparoscopic management. Nearly half of the patients (48%, 118/246) were discharged within the first two postoperative days. Complications were relatively uncommon, with major complications occurring in only 4 patients and minor complications in 14, demonstrating the safety and efficacy of laparoscopic appendicectomy in the Pediatric population.

Histopathological examination of all resected appendices confirmed to be features consistent with acute appendicitis, including suppurative changes in some specimens. No cases of neoplasia or other unexpected pathology were identified among the specimens included in the study.

Overall, the findings of this study emphasize the classical clinical presentation of acute appendicitis in children, the high diagnostic yield of laboratory and imaging investigations, the effectiveness of laparoscopic appendicectomy, and the favourable postoperative outcomes with minimal complications. These results underscore the importance of early recognition and timely surgical intervention in optimizing Pediatric patient care (Table 1).

Table 1. Summary of Clinical, Laboratory, and Postoperative Findings in 246 Pediatric Patients with Acute Appendicitis

Categories	Parameter	Number of Patients (n)	Percentage (%)
Clinical symptoms	Right lower abdominal pain	238	96.70
	Nausea	179	73.00
	Vomiting	172	70.00
	Fever	140	57.00
	Diarrhoea / Other GI symptoms	51	21.00
Physical Examination	Right iliac fossa tenderness	223	91.00
	Rebound tenderness	204	83.00
	Positive Blumberg sign	189	77.00
	Positive Cope's psoas test	71	29.00
Laboratory Findings	Leucocytosis	194	79.00
Imaging Findings	Ultrasound: appendicitis confirmed	150	61.00
	Ultrasound: free fluid	63	26.00
	CT scan: appendicitis confirmed	245	99.60
	CT scan: free fluid	91	37.00
Hospital Stay	Median stay (days)	2	-
	Discharged ≤2 days	118	48.00
Postoperative Complications	Major complications	4	1.60
	Minor complications	14	5.70
Histopathology	Acute appendicitis confirmed	246	100.00

Discussion

In our study, the most common symptom and sign of appendicitis were abdominal pain and rebound tenderness, similar to the findings reported by Benabbas et al. [11]. Doctors described abdominal pain in different ways, including “diffuse abdominal pain,” “right lower quadrant pain,” and “pain radiating to the right lower quadrant,” depending on the physical examination and the child’s ability to communicate. All these descriptions were considered indicative of possible appendicitis. Fever was noted either based on the parents’ history or by measuring the child’s temperature at the hospital.

Although tools like the Alvarado Score and can help exclude appendicitis in children [12], our study relied primarily on a high clinical suspicion for children presenting with abdominal pain. According to various clinical scores and guidelines, routine laboratory tests and measurement of inflammatory markers are recommended to evaluate the intensity of inflammation and to determine whether imaging is necessary. In this study, all children suspected of acute appendicitis underwent a complete blood count and CRP measurement. Based on these results, radiological tests were performed to confirm the diagnosis.

Three imaging methods are commonly reported for diagnosing appendicitis: ultrasound, CT scan, and MRI. A systematic review by Doria et al in 2006 found that CT scans were more sensitive than ultrasound in detecting appendicitis in children [13]. Conversely, a recent study by Lee and Yun showed that emergency physician–performed point-of-care ultrasound reached 95% sensitivity and specificity in Pediatric appendicitis [14]. Additionally, Kharbanda et al highlighted that ultrasound is cost-effective, while higher CT use is associated with increased expenses, supporting the use of ultrasound as the initial imaging choice for children [15].

In our hospital, abdominal ultrasound is routinely used as the first-line imaging tool to diagnose appendicitis in children. This was applied to all patients except two, who were referred from another facility with a CT scan already confirming the diagnosis. Ultrasound does have limitations: it requires skilled operators, is dependent on the examiner, can be affected by the child’s body habitus and may yield different results in Pediatric patients compared to adults [15].

CT scans in children with appendicitis have reported sensitivities ranging from 94% to 97% and specificities from 94% to 99%. The main benefits of CT imaging are rapid image acquisition and independence from the operator’s experience. Limitations include limited availability in certain regions, higher costs, and exposure to ionizing radiation [3,16,17]. At our hospital, we coordinate with the radiology team to minimize radiation and reserve CT scans for patients whose ultrasound results are unclear.

MRI has shown sensitivities of 96–97% and specificities of 96–98%, with the major advantage of avoiding radiation exposure [3,18,19]. However, its routine use is limited by longer scan times, higher cost, need for sedation, and restricted availability, making it impractical for standard Pediatric appendicitis diagnosis in our facility.

There is ongoing discussion about treating early or suspected appendicitis non-surgically with antibiotics, reserving surgery for more advanced cases. Possible

advantages of this approach include fewer CT scans, reduced radiation exposure, lower rates of perforation and negative appendicectomy, and decreased risks related to anesthesia and surgery. Potential disadvantages include over-treatment, disease recurrence, and progression [20]. Svensson et al found that nonoperative management can be safe; however, failure rates increase in the presence of an appendicolith, in which case surgical intervention is recommended [2]. In our hospital, Pediatric patients are usually treated surgically, with nonoperative management applied only in selected scenarios and these cases were excluded from this study.

Research indicates that complication rates do not differ significantly between emergent and urgent appendectomies. Therefore, children presenting overnight were admitted and operated on the following day to reduce stress for both patients and staff [3]. Children have a higher risk of appendicitis perforation than adults, with a rate of 7.7% within the first 24 hours, increasing over time. Perforation is more strongly linked to pre-hospital delays than delays within the hospital [21]. Other factors influencing perforation include age, race, socioeconomic status, insurance coverage, and the presence of appendicolith [22,23]. Tan et al. also reported that higher body temperature at admission increases the likelihood of perforation [24]. Kim et al. demonstrated that are operated by Pediatric specialists are associated with shorter operative times, reduced hospital stays, higher rates of laparoscopic procedures, and less peritoneal drainage compared to those performed by general surgeons. However, access to Pediatric surgeons may be limited in certain regions [25].

Conclusion

Acute appendicitis in children remains a largely clinical diagnosis, grounded in careful history-taking and thorough physical examination, with laboratory tests and imaging serving as valuable supportive tools. This study underscores the importance of structured documentation and the selective, judicious use of investigations, which together enhance diagnostic accuracy, guide timely management, and reduce unnecessary interventions. By integrating clinical expertise with targeted testing, healthcare providers can streamline care, minimize complications, and improve outcomes for pediatric patients. Ultimately, adopting a standardized, evidence-based approach ensures safe, efficient, and effective management of appendicitis in children, setting a benchmark for both clinical practice and future research.

Limitations

The study involved a small number of patients. Not all patients underwent the same diagnostic tests, leading to variable data. Only children diagnosed clinically and supported by imaging were included, which may introduce selection bias. Variability in ultrasound results could occur due to different operators performing the scans. Some patients were managed non-surgically and were excluded from the study.

Recommendations

Early clinical suspicion of acute appendicitis in children presenting with abdominal pain is essential for timely diagnosis and management. Clinical

evaluation should be supported by appropriate laboratory investigations and imaging, particularly ultrasound as the first-line modality. Standardized documentation and prompt laparoscopic intervention can help reduce complications and hospital stay. Further multicentric prospective studies are recommended to strengthen the evidence for optimal management of pediatric appendicitis. Future research should focus on large, multicenter prospective studies incorporating clinical scoring systems, advanced imaging, and emerging diagnostic tools such as biomarkers or AI-assisted decision support to further improve the early and accurate diagnosis of acute appendicitis in children.

Statements and Declarations

Conflicts of interest

The authors declare that they do not have conflict of interest.

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This study provides regional clinical data on the presentation, diagnostic approaches, and outcomes of pediatric acute appendicitis in a tertiary care setting. The findings emphasize the importance of early clinical suspicion supported by appropriate laboratory and radiological investigations for timely diagnosis and management. The study also contributes to improving standardized documentation and management strategies for pediatric appendicitis in similar healthcare settings.

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