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Validation of pediatric appendicitis inflammatory response score in the diagnosis of acute appendicitis in children between ages of 3 to 18 years: An observational study.

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Abstract

Introduction: Acute appendicitis is one of the most common pediatric surgical emergencies resulting in 1%–2% of pediatric surgical admissions. The diagnosis of acute appendicitis is rather difficult in pediatric age group as the signs and symptoms mimic other illnesses especially in the early stage. So, it is the most challenging aspect for a surgeon is to decide, whether to operate or not without increasing the rate of unnecessary surgical exploration. There are many scores to clinically diagnose appendicitis like Alvarado, Lintula, Fenyo-Lindberg, and RIPASA scoring systems. The most frequently used ones are the Alvarado and appendicitis inflammatory response score. Though there are many studies to validate alvarado score, only very few are available for pediatric appendicitis inflammatory response score in children.

Aim: The main aim of our study was to find out the usefulness of pediatric appendicitis inflammatory scoring system in the diagnosis of acute appendicitis. 88 children between the ages of 3 to 18 years, presenting with symptoms and signs of acute appendicitis to the Emergency room and in whom emergency appendicectomy was done were included in the study. They were evaluated using pediatric appendicitis inflammatory scoring system and the total score was given to each patient.

Results: In age group of 3 to 6 years, there were 4% of children diagnosed with acute appendicitis. In the age group of 7 to 12 years about 13.6% and in the age group of 12 to 18 years, 81% of children were diagnosed with acute appendicitis based on pediatric appendicitis inflammatory response score. Boys outnumbered girls with the ratio of 1.58:1. Nausea, vomiting (90%) followed by right lower quadrant pain (88.6%) were the commonest of all the symptoms followed by anorexia (87%) and percussion tenderness (85%). 69 children who had score of 7 to 10 underwent appendicectomy. Out of the 13 children, 3 children worsened with scores going above 6. Of the 72 children who were opened up for appendicectomy, 69 children had appendicitis which was proved histopathological. Finally the validity of pediatric appendicitis inflammatory scoring system was done by calculating the positive predictive value (the proportion of patients with a positive test result who actually have the disease) and the negative predictive value. The proportion of patients with a negative test result who actually did not have the disease. The positive predictive value was found out to be as high as 92.7%

Conclusion: In our study, 92.7% of the children had appendicitis and negative appendicectomy rates were 4.16% and the positive predictive value of the scoring system was 92.7%. So, the pediatric appendicitis inflammatory scoring system can be reliably used for clinically diagnosing acute appendicitis in children.

Keywords: Acute appendicitis, Appendicitis inflammatory score, Appendicectomy.

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Introduction

Acute appendicitis is one of the most common pediatric surgical emergencies resulting in 1%–2% in pediatric surgical admissions [1–3]. Acute appendicitis if not diagnosed early can progress to perforation, which could cause significant morbidity and mortality. The diagnosis of acute appendicitis is rather difficult in pediatric age group as the signs and symptoms mimic other illnesses especially in the early stage. This is in addition to the inability of children to express the symptoms and difficult abdomen examination especially in a fussy and irritable child [4].

So it is the most challenging aspect for a surgeon is to decide, whether to operate or not without increasing the rate of unnecessary surgical exploration. There is an accuracy of 70% to 90% in the diagnosis of acute appendicitis clinically and this greatly depends on the experience of the surgeon. There are many scores to clinically diagnose appendicitis like Alvarado, Lintula, Fenyo-Lindberg, and RIPASA scoring systems. These scoring systems utilise the clinical and laboratory findings to diagnose acute appendicitis. But in pediatric population, diagnosing acute appendicitis is very difficult due to overlapping symptoms and signs common to many diseases. The most frequently used scoring systems are the Alvarado and appendicitis inflammatory response score [5].

Though there are many studies to validate Alvarado score, only very few are available for pediatric appendicitis inflammatory

response score in children. In 2002, Samuel first time published a scoring system (pediatric appendicitis score) that was more reliable and specific to diagnose acute appendicitis in children between 3 to 18 years (Table 1) [6-8].

Symptoms	Points
Nausea and vomiting	1
Anorexia	1
Fever	1
Migration of pain	1
Leucocytosis	1
Neutrophilia	1
Right lower quadrant tenderness	2
Hopping/percussion pain	2

Table 1. Pediatric appendicitis inflammatory response score.

Low risk PAS (<4 points): These children have a low risk of acute appendicitis. Imaging is usually not usually required in these patients. Other reasons of acute abdominal pain should be considered in patients with low-risk scores.

Equivocal PAS (4-6 points): Ultrasound or MRI is preferred for pediatric patients. Pediatric surgery consultation is needed in these patients.

High risk PAS (≥ 7 points): Emergency surgical consultation is required in this group of children. The Alvarado score gives more points for leukocytosis as compared to rebound tenderness while in the appendicitis inflammatory response score rebound tenderness carries more points [7,8].

Methodology

Aim

The main aim of our study was to find out the usefulness of pediatric appendicitis inflammatory response scoring system in the diagnosis of acute appendicitis. 88 children between the ages of 3 to 18 years, presenting with symptoms and signs of acute appendicitis to the Emergency room and in whom emergency appendicectomy was done were included in the study.

The study was conducted over a period of 3 years from July 2018 to June 2021 at Sree balaji medical college and hospital, Chennai. The study was approved by the Institute's Ethical Committee.

Children presenting with features of acute appendicitis such as acute pain in abdomen, rebound tenderness, nausea, vomiting or fever were admitted. Informed consent was obtained. Then they were evaluated using pediatric appendicitis inflammatory scoring system and the total score obtained was entered in excel sheet along with other demographic information. Children with comorbidities and those who didn't give consent were excluded from the study. Those children who had symptoms and signs of perforation were also not included in the study. Based on the scoring system, children were divided into three categories

Group 1: Those children whose score was between 7 to 10 were most likely to be suffering from acute appendicitis. These children were shifted for emergency appendicectomy after all the necessary investigations.

Group 2: Those children with score between 4 to 6 were possibly suffering from acute appendicitis. These children were admitted and were conservatively managed with fluids and antibiotics. These children were reassessed every 6th hourly. Children whose score decreased and those who symptomatically improved,were discharged. They were advised to return back immediately if there is recurrence of symptoms. In those children whose score increased, surgical consultation was done.

Group 3: Children with scores between 1 to 3 were unlikely to be suffering from acute appendicitis: These children were symptomatically treated and sent home. They were advised to return immediately with recurrence of symptoms.

All children whose pediatric assessment score was from 7 to 10 underwent a detailed assessment and decision for appendicectomy was made. All eligible children underwent open appendicectomy. The gold standard for the diagnosis of acute appendicitis was made by the histopathological examination of the operated specimen.

The reliability of the pediatric assessment score was done by calculating the positive and the negative predictive value.

Results

In age group of 3 to 6 there were 4% of children diagnosed with acute appendicitis. In the age group of 7 to 12 years about 13.6% and in the age group of 12 to 18 years, 81% of children were diagnosed with acute appendicitis based on pediatric appendicitis inflammatory response score (Table 2).

Age group	No. of children (%)
3 to 6 years	4(4%)
7 to 12 years	12(13.6%)
12 to 18 years	72(81%)

Table 2. Age distribution.

Boys outnumbered girls with the ratio of 1.58:1 (Table 3).

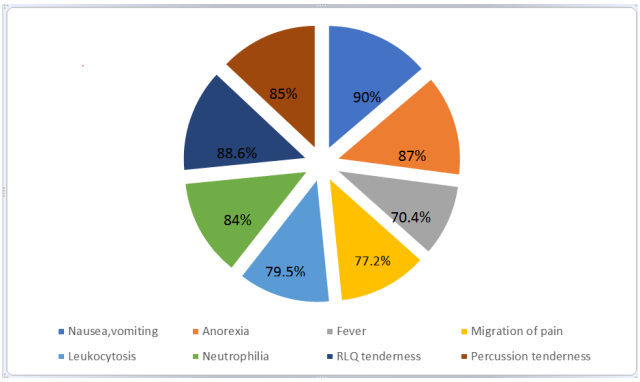
Gender	Number (%)
Male	54(61.3%)
Female	34(38.6%)

Table 3. Gender distribution.

Nausea, vomiting (90%) followed by right lower quadrant pain (88.6%) were the commonest of all the symptoms followed by anorexia (87%) and percussion tenderness (85%) (Table 4; Figure 1).

Symptoms and signs	Number (%)
Nausea and vomiting	80(90%)
Anorexia	77(87%)
Fever	62(70.4%)
Migration of pain	68(77.2%)
Leukocytosis	70(79.5%)
Neutrophilia	74(84%)
Right lower quadrant tenderness	78(88.6%)
Hopping/percussion tenderness	75(85%)

Table 4. Variables of pediatric appendicitis inflammatory response scoring system.



69 children who had score of 7 to 10 underwent appendicectomy. 13 children who had score of 4 to 6 were admitted and were treated conservatively.

They were reassessed and scoring was done every 6th hourly.

Out of the 13 children, 3 children worsened with scores going above 6.

They were also taken up for appendicectomy (Table 5).

Figure 1. Variables of pediatric appendicitis inflammatory response scoring system.

Pediatric assessment score	No. of patients
7 to 10	69
4 to 6	13
1 to 3	6

Table 5. Distribution of patients based on pediatric assessment score.

The other ten children who improved were discharged home with the advice to review immediately if symptoms recur. children who had scores below 3 were symptomatically treated

and sent home with the advice to return back immediately if condition worsened.

Intra operative findings

Of the 72 children who were opened up for appendicectomy, 69 children had appendicitis which was proved histopathologically. In the remaining 3 children one had meckel's diverticulitis, the second has torsion ovarian cyst and the last child had ileal perforation [9,10].

Finally the validity of pediatric appendicitis inflammatory scoring system was done by calculating the positive predictive value (the proportion of patients with a positive test result who actually have the disease) and the negative predictive value. The proportion of patients with a negative test result who actually did not have the disease. The positive predictive value was found out to be as high as 92.7%

Discussion

In our study the most common affected age group is between 12 to 18 years. This is in accordance with the study done by Korner et al. [1]. The boys are more prone for appendicitis when compared to girls. This is similar to the study findings done by Sulu et al. [2]. Nausea, vomiting (90%) followed by right lower quadrant pain (88.6%) were the commonest of all the symptoms followed by anorexia (87%) and percussion tenderness (85%). This is similar to the study findings by Martin solo et al. [8].

Among the 72 children who had high pediatric appendicitis inflammatory score, 69 children had histopathologically proved appendicitis. This shows that the pediatric appendicitis inflammatory score has a positive appendicectomy rates as 92.7% and negative appendicectomy rates as 4.16% with high positive predictive value of 92.7% and this is in accordance with the study done by Samuel et al. [6].

Conclusion

At 12 to 18 year age group which constituted 81% of population were more frequently affected by acute appendicitis. Out of 88 children, 69 children had appendicitis inflammatory response score of 7-10, were taken up for surgery. Boys were affected more than the girls (1.56:1). Acute appendicitis is the most common histopathologic examination finding in our study group (95%).

In our study, 92.7% of children had appendicitis which was proved histopathologically and negative appendicectomy rates were 4.16%. Pediatric appendicitis inflammatory scoring system has high positive predictive value of 92.7%. So, the pediatric appendicitis inflammatory scoring system can be reliably used for clinically diagnosing acute appendicitis in children.

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