

Evaluating the utility of Paediatric appendicitis score (PAS) score in case of children suspected with acute appendicitis over a period of time, correlation with ultrasonography and intra-operative findings, and a single institutional study

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Abstract

Introduction: Accurate and prompt diagnosis, appropriate surgical management and proper post-operative management are required in children to avoid complications. Despite intensive research and discussion, rapid, accurate diagnosis of pediatric appendicitis remains an elusive challenge. CT has better performance than US in diagnosing acute appendicitis, but the widespread use of CT is currently under scrutiny, given the increased awareness and concern about exposure to ionizing radiation in children. Paediatric appendicitis score (PAS) was developed by Samuel in 2002, has 100% sensitivity and 92% specificity. **Materials and method:** We undertook a study to address the usefulness of more validated PAS, first time in Indian population, to assess role of emergency ultrasonography and its correlation with PAS and to assess impact of the PAS on patient outcomes. **Results:** Out of 145 patients, 111 underwent surgery (100 open appendectomies, 10 laparoscopic appendectomies). Of 111 operated patients 75 (67.56%) were male and 36 (32.44%) were female. Mean (median, SD, range) duration of symptoms of appendicitis group was 2.56 (2, ± 1.09 , and 1-5) days. We used in PAS with cut off point 6 and showed sensitivity of 92.8% and specificity of 69.3%. **Conclusion:** Though this score was found to be useful in suspected cases of acute appendicitis and significant decrease was noticed in the negative and missed appendectomy rates.

Keywords: Pediatric Appendectomy Score (PAS), Ultrasonography.

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Introduction

Acute appendicitis is one of the most common non-traumatic abdominal emergencies in children[1]. Accurate and prompt diagnosis, appropriate surgical management and proper post-operative management are required in children to avoid complications. Despite intensive research and discussion, rapid, accurate diagnosis of pediatric appendicitis remains an elusive challenge[2-4]. A clinical decision to operate leads to the removal of a normal appendix in 10 to 20% of the cases [5, 6]. CT has better performance than US in diagnosing acute appendicitis [7] but the widespread use of CT is currently under scrutiny, given the increased awareness and concern about exposure to ionizing radiation in children [8, 9].

First clinical score 'ALVARDO' score was published in 1986 for adult and later used in pediatric appendicitis but does not provide sufficient PPV to be used in clinical practice as the sole method for determination of the need for surgery [10,11], while Hsiao KH showed significant discriminatory values of 'ALVARDO' score [12]. Paediatric appendicitis score (PAS) was developed by Samuel in 2002, has 100% sensitivity and 92% specificity [13]. We undertook a study to address the usefulness of more validated PAS, first time in Indian population, to assess role of emergency

ultrasonography and its correlation with PAS and to assess impact of the PAS on patient outcomes.

Materials and methods

Study Design

This prospective observational study was conducted in Pediatric Surgery ward of the VMMC and Safdarjung Hospital between October 2012 and May 2014. Informed written consent was obtained from all parents or legal guardians attending the children in Hospital. The study was approved by IEC vide letter no VMMC/SIH/ETHICS/THESIS/SEP-11/36 dated 27-06-2013.

Inclusion Criteria

- 1) All cases of suspected appendicitis after evaluation by Pediatric Surgery registrar.
- 2) Age of the children between 3 years to 12 years.
- 3) Duration of pain less than 5 days.

Exclusion Criteria

- 1) Patients with features of peritonitis.
- 2) Age less than 3 years.
- 3) Non verbal children.
- 4) Children with chronic abdominal conditions like abdominal koch's, major Complex abdominal surgery, significant congenital abdominal anomalies, documented mesenteric lymph node enlargement.
- 5) Previous history of appendectomy.
- 6) Palpable Abdominal Lump.
- 7) Discrepancy in evaluation done by two different registrars.

Study Protocol

1. Informed and written consent was taken.
2. Data was collected by Pediatric Surgery registrar at the time of admission.

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3. Data sheet contained age, sex of the patient, time of examination, date and time of onset of symptoms, address with telephone no., admission no. (MRD no), all the 8 components of Pediatric appendicitis score (PAS).
4. Second assessment was done by another senior registrar within 1 hr of first assessment. If the patient had two score by two physician, the score from the first physician was always used in the primary analysis to calculate the PAS.
5. There was no indication of score values on data collection form.
6. Complete blood count (CBC) and serum electrolytes of all the patients were sent after admission.
7. Patients who were discharged directly home from the Emergency Department were contacted by telephone at 1 and 2 Week to verify final outcome.
8. The components of the PAS were used exactly as described by Samuel. However, as Samuel did not provide definitions for polymorphonuclear neutrophilia or pyrexia, we defined polymorphonuclear neutrophilia >75% neutrophils on CBC and pyrexia as >38°C (oral).

Pas score

Diagnostic Items	Score
Tenderness RLQ	2
Migration of pain	1
Nausea/vomiting	1
Anorexia	1
Fever >38°C (oral)	1
Cough/percussion tenderness	2
Leucocytosis > 10x10 ⁹ /L	1
PMNcytosis > 7.5x10 ¹⁰ /L	1

Appendectomy was done when PAS score was ≥ 6 .

If PAS was less than 6, patients were given 2 dose of antibiotic (Ceftriaxone, amikacin, and metrogyl).

Antibiotics were given to all patients of suspected appendicitis after Proforma completion and laboratory investigation. Patients having clinically palpable lump were managed conservatively. Ultrasonography was done in all patients but had not affected the decision of surgery. Ultrasonographic findings suggestive of acute appendicitis are non compressible appendix, appendiceal diameter ≥ 7 mm and periappendiceal fluid. Appendicitis was defined as appendectomy with positive histology. A negative appendectomy was defined as an appendectomy with negative histology.

Missed appendicitis was defined as a child who was discharged home from the ED but within 1 week had an appendectomy with positive histology.

Inflamed appendix was defined as red and oedematous appendix. Ruptured appendicitis (perforated appendicitis) was defined as intra-operative or pathologic identification of either a hole in the appendix or the presence of a fecolith in the abdomen. Gangrenous appendix was defined as black or greenish appendix on gross appearance.

Outcome was measured by

1. Negative appendectomy rate.
2. Missed appendectomy.
3. Readmission of initially discharged patients with pain abdomen, initially not falling in to operative group.

Statistics

One hundred forty five consecutive cases of suspected appendicitis were enrolled in this study. Of 145 patients, 98 (67.59%) were male and 47 (32.41%) were female. Mean age of presentation was

9.3 \pm 2.23 years (median age 10 years and range was 3 years to 12 years). Mean duration of symptoms were 2.65 \pm 2.23 days (median duration 3 days and range was 1-5 days). (Table 1)

Table 1: Patient characteristics with suspected appendicitis

No of patients	Male	Female	Age of presentation, Mean \pm SD days, Median and range (years)	Duration of symptoms, Mean \pm SD days, Median and range (days)
145	98(67.59%)	47(32.41%)	9.3 \pm 2.23 10 3-12	2.65 \pm 2.23 3 1-5

Out of 145 patients, 111 underwent surgery (100 open appendectomies, 10 laparoscopic appendectomies). Of 111 operated patients 75 (67.56%) were male and 36 (32.44%) were female. Mean (median, SD, range) duration of symptoms of appendicitis group was 2.56 (2, \pm 1.09, and 1-5) days. Of 34 non-operated patients 23 (67.65%) were male and 11 (32.35%) were female. Mean (median, SD, range) duration of symptoms of without appendicitis group was 2.97 (3, \pm 1.08, and 1-5) days. (Table 2)

Table 2: Patient characteristics grouped by with and without appendicitis

Patient characteristic	Children with appendicitis(n==111)	Children without appendicitis(n==34)
Mean Age, yrs (SD)	9.17 \pm 2.26	9.70 \pm 2.11
Male	75 (67.56%)	23 (67.65%)
Female	36 (32.44%)	11(32.35%)
Mean duration of symptoms(Days) \pm SD	2.56 \pm 1.09	2.97 \pm 1.08
Median duration of symptoms(Days)	2	3
Range duration of symptoms(Days)	1-5	1-5

Mean (median, SD, range) PAS of children with appendicitis was 8.44 (8, \pm 1.2, 6-10). Mean (median, SD, range) PAS of children without appendicitis was 4.56 (5, \pm 0.66, 3-5).

Table 3: Comparison of PAS in cohort of patients with and without appendicitis

Variables	Children with appendicitis(n==111)	Children without appendicitis(n==34)
Mean PAS (SD)	8.44 \pm 1.2	4.56 \pm 0.66
Median PAS	8	5
Range of PAS	6-10	3-5
Tenderness RLQ	111(100%)	34 (100%)
Migration of pain	98 (88.28%)	23 (67.65%)
Nausea/vomiting	89 (80.18%)	22 (64.71%)

Anorexia	78 (70.2%)	09(26.47%)
Fever>>38°C (oral)	84 (75.67%)	05 (14.70%)
Cough/percussion tenderness	97 (87.38%)	02 (5.88%)
Leucocytosis> 10x10 ⁹ /L	87 (78.37%)	14 (41.17%)
PMNcytosis >7.5x10 ⁹ /L	94 (84.68%)	10 (29.41%)

CI, Confidence interval; OR, odds ratio; PMN-polymorphonuclear; RLQ-Right lower quadrant

Table 3: Correlation of USG and PAS in patients with and without appendicitis

USG finding	PAS	Appendicitis (n=111)	Without appendicitis (n=34)
Positive	8.5(8,±1.24,6-10)	96 (86.49%) 64-male 32-female 2.61,±1.07,3	29 (85.29%) 20-male 9-female 3.07, 1.1,3
Negative	8.06(8,0.88,7-10)	15 (13.51%) 11-male, 4-female 2.2,±1.21,2	05 (14.71%) 3-male, 2-female 2.4,±0.89,3

Table 4: Patient characteristics grouped by on operative findings and PAS Correlation Ethics

Operative finding	No of patients (n=111)	Age yrs mean(Median, SD, range)	Duration days mean(Median, SD, range)	PAS mean(Median, SD, range)
Inflamed	38	9.42(10,±2.43,3-12)	2.13(2,±1.02,1-5)	7.86(8,±1.19,6-10)
Perforated	66*	8.9(9,±2.26,3-12)	2.74(3,±1.07,1-5)	8.81(9,±1.07,6-10)
Gangrenous	7	9.43(10,±1.4,7-10)	2.86(3,±0.69,2-4)	8.29(8,±1.25,7-10)

Discussion

The diagnosis of appendicitis in children is a challenge. Ultrasonography is operator dependent and computed tomography has disadvantage of radiation. Paediatric appendicitis score (PAS) was developed by Samuel in 2002, 100% sensitivity and 92% specificity [13]. Kulik in his study showed that PAS outperformed the Alvarado score [14]. We used in PAS with cut off point 6 and showed sensitivity of 92.8% and specificity of 69.3%. Our results are consistent with findings of Saucier et al [15] who used Paediatric appendicitis score (PAS) and selective ultrasonography and noticed a 92.3% sensitivity and 94.7% specificity. Bhatt et al [16] showed best cut-off of point 6 with 92.8% sensitivity and 94.12% specificity. In our study both the negative and missed appendectomy rate was 1.8%, which was significantly much lesser than the negative appendectomy and missed appendectomy rate of 37.6% and 7.2% respectively, in the study by Bhatt et al [16] but consistent with negative appendectomy rate of 4% and missed appendectomy rate of 2.4% by Goldman et al [17]. The cut-off value of pediatric appendicitis score of 6 for definitive diagnosis of appendicitis was used originally by Samuel and equivalent result was reproducible in our study. Though Alvarado score is an equally validated score as PAS as recently described by Merhi et al [18], Sencan et al [19] and Kulik et al [14] but we used PAS as it was not used in Indian population. Sensitivity and specificity of USG was 89.49% and 14.71% in our study. This is consistent with Bullapur [20] and Scrmgeour [21]. Though this score was found to be useful in suspected cases of acute appendicitis and significant decrease was noticed in the negative appendectomy rates.

Conclusion

Paediatric appendicitis score (PAS) score has a high performance in the diagnosis of acute appendicitis in children and is because it is both sensitive and specific. Agreement between USG and PAS is weak because of low kappa values so USG alone may not be useful. PAS has a strong impact on outcome because of low missed and negative appendectomy rates.

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