International Journal of Contemporary Pediatrics
Parveen KZ et al. Int J Contemp Pediatr. 2017 Nov;4(6):2196-2199
http://www.ijpediatrics.com
pISSN 2349-3283 | eISSN 2349-3291

DOI: http://dx.doi.org/10.18203/2349-3291.ijcp20174756

Original Research Article

Pediatric appendicitis score in the diagnosis of childhood appendicitis: a validation study

Kambalabettu Zohara Parveen[1]*, K. Shreedhara Avabratha[1], Kishan Shetty[2]

[1]Department of Pediatrics, Father Muller Medical College Hospital, Mangalore, Karnataka, India
[2]Department of Pediatric Surgery, Father Muller Medical College Hospital, Mangalore, Karnataka, India

Received: 15 September 2017
Accepted: 06 October 2017

***Correspondence:**
Dr. Kambalabettu Zohara Parveen,
E-mail: dr.kzp.paeds@gmail.com

ABSTRACT

Background: Pediatric appendicitis score (PAS) is a scoring system which includes symptoms, physical examination and laboratory tests in children suspected to have appendicitis. The objectives of this study were to analyze the diagnostic value of Paediatric Appendicitis Score and to aid early diagnosis of appendicitis.
Methods: A prospective study was done in a Medical College hospital, in Mangalore in children aged between 4-16 years, admitted during study period June to December 2016, with right Iliac fossa pain, suspected to have appendicitis. Data from the children including demographic details, clinical features, laboratory investigations and ultrasound done were recorded in proformas after consent from parents. The PAS score was applied to them. If PAS was between 4-6, PAS scoring was repeated after 6 hours. Investigations done were noted. If child was taken up for surgery, histopathology report of the biopsy specimen was collected. The decision to operate or manage conservatively was taken up by the treating pediatric surgeon. PAS score was compared with ultrasound and biopsy report.
Results: Sixty children were included in the study. Anorexia, emesis, migration pain, cough tenderness and leukocytosis were the features most consistently seen in appendicitis. Initial PAS were comparable to the repeat scores. Ultrasound showed presence of appendicitis in 88.3% of the children. Ultrasound showed appendicitis in all children with PAS ≥7. Twenty-six children out of 60 underwent surgery. Out of 20 children with PAS ≥7.15 (75%) were taken up for surgery and biopsy showed appendicitis. Biopsy was done in 26 children, of whom 58.1% had PAS ≥ 7. These findings were statistically significant.
Conclusions: Paediatric appendicitis score is a valuable tool in diagnosing childhood appendicitis.

Keywords: Appendicitis, PAS

INTRODUCTION

The diagnosis of appendicitis in children is problematic because many present with symptoms and signs that resemble other common but self-limiting causes. They often lack classic clinical features seen in adults. This poses a challenge for the treating physician in making a timely diagnosis.[1]

There are different clinical and computer assisted scoring systems which have been used to diagnose appendicitis, with variable benefits. Improvement in clinical performance with their use has increased diagnostic accuracy.[2]

Children come to Pediatricians with complaints of pain abdomen. It's a pediatrician's dilemma to confirm if the

child is having appendicitis or not. In such cases, PAS score would be helpful.

Acute appendicitis is relatively rare in infants and becomes increasingly common in childhood and early adult life.[3] Negative appendicectomy rate, despite in - hospital observation is high.[2] The purpose of this study is to analyze the diagnostic value of PAS, use of PAS to aid early diagnosis of appendicitis in children. There have been very few studies in India on this topic, hence this study is being done.

METHODS

Children in whom appendicitis was suspected, who were admitted under Department of Paediatric or Paediatric Surgery in a Medical College Hospital in Mangalore were taken as the study group. It was done over a period of 6 months starting from June 2016 as a prospective validation study. The sample size was calculated to be 60.

Inclusion criteria

All children between 4-16 years of age, presenting with Right Iliac fossa pain of less than 3 days duration, diagnosed clinically to have appendicitis, admitted in a Hospital in Mangalore.

Exclusion criteria

- Children with traumatic cause of Right Iliac fossa pain
- Non-verbal children
- Appendicectomy done previously
- Chronic abdominal pathology like inflammatory bowel disease, complex abdominal surgery, or significant congenital abdominal anomalies that may interfere with abdominal assessment.

Table 1: Pediatric appendicitis score includes the following criteria.

Parameter	Score
Anorexia	1
Nausea/ emesis	1
Fever	1
Migration of pain	1
Tenderness in right lower quadrant	2
Cough/ percussion/ hop tenderness	2
Leucocytosis	1
Neutrophilia	1
Total	10

- Migration of pain: It refers to the migration of pain from the umbilicus to the right lower quadrant.[2]
- Cough tenderness: Coughing causes increased pain (Dunphy's sign).[4]
- Neutrophilia and Leukocytosis was defined, depending on the age of the child.[5]

Interpretation

- PAS 0-3: No appendicitis, can be discharged
- PAS 4-6: Require further imaging/repeat evaluation
- PAS ≥ 7: Require surgery.

Method of data collection

Children who met the inclusion criteria were included after consent from their parents. The history and clinical examination was done. The investigations were done as per the protocols prevailing in our hospital. Investigations done were collected. PAS score was applied to all of the children. The Paediatric surgeon was blinded to the PAS score of the children. The decision to operate or not was taken by the surgeon based on his clinical impression, and the results of the investigations. The gold standard for the study was histologically proven appendicitis. Decision for investigations, ultrasound and treatment was left to the discretion of one treating paediatric surgeon. Those taken up for surgery (Appendicectomy); the histopathology report of the appendix was collected in order to confirm the diagnosis of appendicitis. The children managed conservatively with IV fluid and antibiotics were noted.

The children were divided into two groups: Those with appendicitis and those without appendicitis. Ultrasound abdomen showing inflamed appendix or histopathology confirming appendicitis was considered for desicion making / confirmation. The parents were contacted by phone 1 month after discharge to see whether those who were not operated in the hospital were subjected to appendicectomy later on. The PAS score, the histopathology and ultrasound of the child were compared to assess effectiveness of PAS score in diagnosing appendicitis.

RESULTS

The study group included 60 children with features of appendicitis. Most of the children included in the study (50%) were between 11-16 years of age. Majority of them were males (61%). Majority of the children (25%) with PAS score 4-6 were between 11-16 years of age. 16.6 % of children with PAS ≥7, were between 11-16 years of age. 25% of the males had PAS score between 4-6 and 25% had PAS score ≥ 7 (Table 2).

Table 2: Demographic characteristics.

	PAS ≤3 n = 10	PAS 4-6 n = 30	PAS ≥ 7 n = 20	Total
Age				
4-5	1 (1.6%)	1 (1.6%)	3 (5%)	5 (8.3%)
6-10	4 (6.6%)	14 (23%)	7 (11.6%)	25 (41.6%
11-16	5 (8.3%)	15 (25%)	10 (16.6%)	30 (50%)
Sex				
Male	7 (11.6%)	15 (25%)	15 (25%)	37(61%)
Female	3 (5%)	15 (25%)	5 (8.3%)	23(38%)

Anorexia, emesis, migration pain, cough tenderness and leukocytosis were the features most consistently seen in appendicitis (Table 3).

Table 3: Comparison of various factors with PAS.

	PAS ≤ 3	PAS 4-6	PAS ≥ 7	P value
Anorexia absent	10 (16.6%)	22 (36.6%)	2 (3.3%)	
Anorexia present	0	8 (13.3%)	18 (30%)	0.001
Emesis absent	6 (10%)	15 (25%)	1 (1.6%)	
Emesis present	4 (6.6%)	15 (25%)	19 (31.6%)	0.059
Fever absent	9 (15%)	19 (31.6%)	6 (10%)	
Fever present	1 (1.6%)	11 (18.3%)	14 (23.3%)	0.004
Migration pain absent	10 (16.6%)	24 (40%)	12 (20%)	
Migration pain present	0	6 (10%)	8 (13.3%)	0.023
Tender RLQ absent	0	0	0	
Tender RLQ present	10 (16.6%)	30 (50%)	20 (33.3%)	0.772
Cough tenderness absent	10 (16.6%)	8 (13.3%)	2 (3.3%)	
Cough tenderness present	0	22 (36.6%)	18 (30%)	0.000
Leukocytosis absent	10 (16.6%)	18 (30%)	1 (1.6%)	
Leukocytosis present	0	12 (20%)	19 (31.6%)	0.000
Neutrophilia absent	10 (16.6%)	24 (40%)	9 (15%)	
Neutrophilia present	0	6 (10%)	11 (18.3%)	0.007

RLQ: Right Lower Quadrant

All of those with initial PAS of 3 had same repeat score.

70% of the children with initial PAS of 4-6 had repeat scores of ≤3 and remaining were operated. 70% of 20 children with initial PAS of ≥7 were taken up for surgery. So, initial scores were comparable to the repeat scores. Ultrasound showed presence of appendicitis in 88.3% of the children. Ultrasound showed appendicitis in all children with PAS ≥ 7 (Table 4).

Out of 26 children who underwent surgery, in whom biopsy was done, 58.1% had PAS ≥ 7. All the biopsies done showed presence of appendicitis. PAS was compared with ultrasound and biopsy which showed good correlation between PAS and biopsy (Table 5).

Out of 20 children with PAS > 7, 15 who underwent surgery had appendicitis. Out of 40 who had PAS<7, 11 who underwent surgery had appendicitis.

Table 4: Surgery and PAS.

Surgery	PAS ≤3	PAS 4-6	PAS ≥7	Total
Surgery not done	9 (15%)	20 (33%)	5 (8.3%)	34 (56.3%)
Surgery done	1 (1.6%)	10 (16%)	15 (25%)	26 (43.3%)

P value is 0.001, significant

Table 5: Comparison of PAS score, ultrasound and biopsy.

	PAS ≤ 3	PAS 4-6	PAS ≥ 7
USG: Appendicitis	8 (13.3%)	25 (41.6%)	20 (33%)
USG: No Appendicitis	2 (3.3%)	5 (8.3%)	0
Biopsy not done	9 (15%)	20 (33%)	5 (8.3%)
Biopsy done	1 (1.6%)	10 (16%)	15 (25%)

The sensitivity of PAS was 57.6%, while specificity was 85.2%. So, PAS is very specific for appendicitis. The positive predicitve value was 75% and negative predictive value 72.5%.The positive likelihood ratio was 3.92, while negative likelihood ratio was 0.5.

DISCUSSION

PAS is a scoring system which includes symptoms, physical examination and laboratory investigations in children in whom acute appendicitis is suspected.[6] This scoring system was first proposed by Madan Samuel, after conducting a study on 1,170 children in 2 hospitals in London for a period of 5 years. According to his study, a score of ≤5 indicated no appendicitis, PAS of 6 meant appendicitis and PAS ≥7 meant there were higher chances of appendicitis.[2]

Majority of the children included in the present study were males (61%) and 56.7% of children did not have appendicitis which is similar to findings in other studies[6-8] Anorexia, emesis, migration pain, cough tenderness and leukocytosis were the features most consistently seen in appendicitis which is comparable to other studies.[1,6,8]

Children with PAS of 3, had same PAS even after 6 hours. Only 1 out of the 10 children with PAS ≤3 underwent surgery and biopsy done showed appendicitis. There were 30 children (49%) with PAS 4-6, 70% of whom had repeat score of ≤3 and the remaining 10 children were taken up for surgery, as their repeat PAS ≥7. Biopsy done in all of them showed appendicitis. 70% of 20 children with initial PAS of ≥7 were taken up for surgery and their histopathology showed appendicitis. So, PAS of ≥7 is strongly indicative of appendicitis, which

requires surgery. Rate of negative appendicectomy in the present study was 0%, which is similar to another study.[8]

Diagnostic imaging has been used with increasing frequency but has limitations, including exposure to ionizing radiation (e.g., computed tomography), limited availability of skilled technicians at all hours (e.g. ultrasound) and cost.[9] These tools may delay treatment (appendicectomy) in children with appendicitis. Evaluation of abdominal pain in children should be able to identify which children with abdominal pain and likely appendicitis, who should undergo immediate surgical evaluation for potential appendectomy and which children with equivocal presentations of possible appendicitis may benefit from further diagnostic evaluation, including the use of diagnostic imaging, observation and / or surgical consultation.[10]

Non visualization of the appendix is the most common situation in which interpretive uncertainty exists, occurring in approximately half of ultrasound examinations performed to evaluate for appendicitis.[11-13] The PAS score's performance improved when deciding if a child could be discharged home or required appendicectomy.[12] A study done by Elahifar MA and others shows that a positive ultrasound is indicative of appendicitis, but a negative ultrasound does not rule out appendicitis.[14] In the present study, ultrasound showed presence of appendicitis in 88.3% of the children. Ultrasound showed appendicitis in all children with PAS ≥7, but its correlation with PAS was not statistically significant. In conclusion, pediatric appendicitis score is a valuable aid in diagnosing childhood appendicitis especially in resource limited settings.

CONCLUSION

Paediatric appendicitis score is a valuable tool in diagnosing childhood appendicitis.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

REFERENCES

1. Mason J. The evaluation of acute abdominal pain in children. Emergency Medicine Clinics of North Am. 1996;14(3):629-43.
2. Samuel M. Pediatric appendicitis score. J Pediatr Surg. 2002;37(6):877-81.
3. Williams N, Bulstrode C, O' Connell P. The Vermiform appendix. In: O' Connell P.R, editor Bailey and Love: Short practise of Surgery. 26th ed. New York: CRC Press; 2013:1199-1200.
4. Maa J, Kirkwood KS. The Appendix. In Sabiston textbook of surgery, 19th Ed, Townsend C, Beauchamp R, Evers B, Mattox K, Canada, Elsevier; 2012;14:1279-80.
5. Engorn B, Flerlage J. Haematology. In The John Hopkins Hospital, The Harriet lane Handbook. Philadelphia, Elsevier Saunders; 2015;14:314.
6. Kim D, Shim D, Cho K. Use of the Paediatric appendicitis score in a community hospital. Ind Pediatr. 2016;53(3):217-20.
7. Rao P, Shetty K. Retrospective analysis of pediatric Appendicitis score. Int J Sci Res. 2015;4(3):232-3.
8. Dhruv K, Singh K, Patley D, Painkara U. Paediatric appendicitis scoring: a useful guide to diagnose acute appendicitis in children. Int Surg J. 2016;3(1):84-9.
9. Frush D, Donnelly L, Rosen N. Computed Tomography and Radiation Risks: What pediatric health care providers should know. Pediatr. 2003;112(4):951-7.
10. Bundy D, Byerley J, Liles E, Perrin E, Katznelson J, Rice H. Does this child have Appendicitis? JAMA. 2007;298(4):438-51.
11. Ang A, Chong A, Daneman A. Pediatric appendicitis in real-time. The value of sonography in diagnosis and treatment. Pediatr Emergency Care. 2001;17(5):334-40.
12. Jaremko J, Crockett A, Rucker D, Magnus K. Incidence and significance of inconclusive results in ultrasound for Appendicitis in Children and teenagers. Canadian Assoc Radiol J. 2011;62(3):197-202.
13. Koo H, Kim H, Yang D, Kim S, Park S, Ryu J. Does computed tomography have any additional value after sonography in patients with suspected acute appendicitis?. J Ultrasound Med. 2013;32(8):1397-403.
14. Elahifar M, Taheri H, Bighamian A. Diagnostic Value of Ultrasonography in patients suspected acute appendicitis. Nepalese J Radiol. 2013;2(2):13-9.

Cite this article as: Parveen KZ, Avabratha KS, Shetty K. Pediatric appendicitis score in the diagnosis of childhood appendicitis: a validation study. Int J Contemp Pediatr 2017;4:2196-9.