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DIAGNOSTIC ACCURACY OF PAS (PEDIATRIC APPENDICITIS SCORES) IN DIAGNOSING ACUTE APPENDICITIS IN PEDIATRIC SUBJECTS VISITING THE EMERGENCY DEPARTMENT WITH ACUTE ABDOMINAL PAIN

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ABSTRACT

Background: The most frequent cause of severe abdominal discomfort in paediatric patients is acute appendicitis, which requires prompt surgical intervention. In order to reduce radiation exposure in paediatric patients, it is often evaluated using PAS (paediatric appendicitis scores). Regarding the accuracy of PAS in diagnosing acute appendicitis in paediatric patients, the literature evidence is contradictory.

The objective of this study was to evaluate the diagnostic performance of paediatric appendicitis scores, or PAS, in the identification of acute appendicitis in paediatric patients presenting to the emergency room with severe abdominal pain. Methods: Children between the ages of 4 and 18 who presented to the paediatric emergency room with a clinical suspicion of acute appendicitis were retrospectively evaluated based on institutional data.

The diagnostic accuracy of paediatric appendicitis scores was evaluated using specificity, sensitivity, negative predictive value, and positive predictive value.

Findings: the mean age of 52 kid participants was 10.7±3.3 years. Of the individuals, 25% were female and 75% were male (n = 39). 90.38% of the participants (n=47) had moderate to high PAS scores of ≥4, and 98.07% of the subjects (n=51) had biopsy-proven appendicitis. The probability ratios were 2.51, 2.15, and 0.12 for high, equivocal, and low-risk paediatric appendicitis scores, respectively. For equivocal PAS, the corresponding positive predictive value, specificity, and sensitivity were 98.7%, 80%, and 96.6%.

The current study suggests that when child subjects with acute abdominal pain enter the emergency room, paediatric appendicitis scores have a high diagnostic accuracy in predicting acute appendicitis.

Keywords: Acute appendicitis, abdominal pain, pediatric appendicitis scores, perforation.

INTRODUCTION

When a kid presents to the paediatric emergency department with severe abdominal discomfort, one of the most frequent diagnosis is acute appendicitis. Acute appendicitis is a medical emergency that has to be treated with surgery

right away. Paediatricians must promptly and properly identify patients who come with acute appendicitis since there is strong evidence that between 12% and 30% of instances of acute appendicitis result in an increased risk of perforation.

Additionally, there is a significant likelihood that the diagnosis of acute appendicitis may be misinterpreted; in around 25% to 56% of paediatric cases, this has been shown.1, 2

Computed tomography (CT) scans and ultrasonography are typically used to identify acute appendicitis. Nevertheless, these imaging methods exposed young patients, whose organs are still growing and maturing, to a high level of ionising radiation exposure. Therefore, different scoring methods are employed in child subjects to diagnose acute appendicitis in order to rule out the subjective character of ultrasonography and its limits in child subjects with high body mass and to reduce the exposure of ionising radiations used in CT scans.3. In kid subjects, the PAS (paediatric appendicitis scores) and Alvarado scoring systems are most frequently utilised. Both of these scoring methods provide cut-off values to identify the existence of appendicitis based on point values for data gathering from laboratory tests, physical examinations, and subject histories.4,5Computed tomography (CT) scans and ultrasonography are typically used to identify acute appendicitis.

Regarding the effectiveness of paediatric appendicitis scores and Alvarado scores in the diagnosis of acute appendicitis in kid subjects, the available research evidence is contradictory. Utilising these scores is beneficial in underdeveloped countries where access to various diagnostic tests in most medical facilities is restricted.Six Thus, the purpose of the current study was to evaluate the diagnostic accuracy of paediatric appendicitis scores, or PAS, in the diagnosis of acute appendicitis in paediatric patients presenting to the emergency room with severe abdominal pain. The study also sought to determine if gold-standard histology and paediatric appendicitis scores on ultrasound imaging were related.

MATERIALS AND METHODS

In this retrospective assessment research, paediatric patients presenting to the emergency room with severe abdominal pain were to be evaluated for acute appendicitis, with the goal of evaluating the diagnostic accuracy of PAS (paediatric appendicitis scores).

The study also sought to determine if gold-standard histology and ultrasound imaging scores for paediatric appendicitis are related. The SMBT Institute of Medical Science and Research Centre in Nasik, Maharashtra is home to the Department of Paediatrics, where the study was conducted.

Subjects having full data to assess appendicitis and those presenting with acute abdominal pain with a clinical suspicion of acute appendicitis met the study's inclusion criteria. Subjects with previously confirmed diagnoses of appendicitis, abdominal trauma, lymphoproliferative illness, ectopic pregnancy, and insufficient data for evaluation were excluded from the research.

The study's data were gathered from the institute's historical records. The information was taken from the Institute's Paediatric Department's files. Histopathology results, laboratory results, clinical symptoms, signs, and the demographics of the participants were among the data gathered. An examiner who was blind to the evaluation procedure entered the preliminary data gathered from the records into a file. The senior paediatrician, a specialist in his profession, conducted a thorough evaluation of the documents. All of the enrolled patients who had been clinically diagnosed with acute appendicitis were evaluated using the Paediatric Appendicitis Score (PAS)7, which was collected at the time of the subject's initial presentation to the institution. For the purposes of this study, appendicitis was defined as an appendectomy with positive gold-standard findings and a positive histology. Next, the relationship between the histopathological findings and the PAS scores was evaluated.

After that, the collected data were statistically evaluated using IBM Corp.'s SPSS programme, version 25.0 (Armonk, NY, USA). For acute appendicitis, PAS was evaluated as a continuous variable with values ranging from 0 to 10. The information was presented as frequencies, percentages, mean, and standard deviation. There is a proven correlation between PAS and other clinical outcomes such as CT, ultrasound, and histology reports.

RESULTS

This retrospective assessment research evaluated the diagnostic performance of paediatric appendicitis scores, or PAS, in identifying acute appendicitis in patients under the age of five who were presenting to the emergency room with

severe abdominal pain. 52 participants with a mean age of 10.7±3.3 years were evaluated for the research. There were thirteen girls and seventy-five men (n = 39).

75% of the individuals (n = 39) reported having lower right abdomen discomfort, while 65.38% of the subjects (n = 34) reported experiencing pain migration. Fever and leukocytosis were recorded in 46.15% (n=24) and 82.69% (n=43) of the research participants, respectively. Table 1 displays the following findings for the study subjects: 23.07% (n=12) reported cough/hoping and pain on percussion; 92.30% (n=48) reported lower right quadrant tenderness; 84.61% (n=44) reported vomiting and nausea; 38.46% (n=20) reported anorexia; and 86.53% (n=45) reported WBC differential left shift. In this current investigation, 88.46% (n=46) of the study individuals had abdominal imaging performed on them. An abdominal ultrasound was the most popular imaging modality, chosen by 65.38% (n=34) of the research participants.

In contrast, 3.84% (n=2) of the participants with clinical suspicion of acute appendicitis but no ultrasound evidence of the illness underwent a CT scan. Prior to any surgical intervention, computed tomography was performed on these participants.

Surgery was done at the paediatric surgery department on all 52 individuals. Of these 52 participants, a biopsy revealed appendicitis in 94.23% (n=49) of the research individuals. A biopsy revealed appendicitis in 48.07% (n=25), 40.38% (n=21), and 5.76% (n=3) of the high-risk, equivocal, and low-risk paediatric appendicitis score participants, respectively.

High-risk, equivocal, and low-risk research participants were compared for PAS, and specificity, sensitivity, positive predictive value, and negative predictive value were evaluated for each group. Additionally, PAS was compared to the groups for histology and ultrasonography. For PAS <4, PAS 4-6, and PAS >6, the accuracy of the point estimates (95% CI) was 92.1 (85.2-96.64), 95.94 (89.96-98.87), and 75.2 (66.53-82.95), in that order. For PAS <4, PAS 4-6, and PAS >6, the corresponding negative predictive values are 33.1 (14.84-58.94), 57.12 (28.74-81.54), and 13.77 (8.44-21.76). Positive predictive values are 97.87 (94.05-99.25), 98.93 (94.01-99.83), and 98.65 (92.72-99.75) for PAS <4, PAS 4-6, and PAS >6. The specificity values were 60.2 (14.64-94.71), 80.2 (28.34-99.47), and 80.2 (28.34-99.47) for PAS <4, PAS 4-6, and PAS >6. Sensitivity was 93.92 (87.25-97.72), 96.83 (90.94-99.32), and 74.73 (65.04-82.92) for PAS <4, PAS 4-6, and PAS >6 respectively (Table 2).

DISCUSSION

The mean age of the 52 individuals evaluated in this retrospective research was 10.7±3.3 years. There were thirteen girls and seventy-five men (n = 39). 75% of the individuals (n = 39) reported having lower right abdomen discomfort, while 65.38% of the subjects (n = 34) reported experiencing pain migration. Fever and leukocytosis were recorded in 46.15% (n=24) and 82.69% (n=43) of the research participants, respectively. 23.07% (n=12) of the study participants reported coughing/hoping and pain upon percussion; 92.30% (n=48) reported lower right quadrant tenderness; 84.61 (n=44) reported vomiting and nausea; 38.46 (n=20) reported anorexia; and 86.53% (n=45) reported WBC differential left shift. These results were comparable to research conducted in 2006 by Doria AS et al. and in 2013 by Kulik DM et al. where authors assessed subjects with similar clinical presentation following appendicitis.

It was observed that 88.46% (n=46) of the research participants had abdominal imaging completed. An abdominal ultrasound was the most popular imaging modality, chosen by 65.38% (n=34) of the research participants. In contrast, 3.84% (n=2) of the participants with clinical suspicion of acute appendicitis but no ultrasound evidence of the illness underwent a CT scan. Prior to any surgical intervention, computed tomography was performed on these participants.

The findings aligned with the research conducted by Ebell MH et al. (2014) and Sayed A et al. (2017), which established the validity of ultrasonography and CT scans in the diagnosis of acute appendicitis. Of these 52 participants, a biopsy revealed appendicitis in 94.23% (n=49) of the research individuals.

A biopsy revealed appendicitis in 48.07% (n=25), 40.38% (n=21), and 5.76% (n=3) of the high-risk, equivocal, and low-risk paediatric appendicitis score participants, respectively. The present study's results were consistent with those of Kim DY et al. (2009) and Bhatt M et al. (2009), who reported good reliability in biopsies and PAS scores. In the current investigation, the PAS was compared in high-risk, equivocal, and low-risk study participants. Specificity, sensitivity, negative predictive value, and positive predictive value were evaluated for each group. Additionally, PAS

was compared to the groups for histology and ultrasonography. For PAS<4, PAS 4-6, and PAS >6, the accuracy in point estimates (95% CI) was 92.1 (85.2-96.64), 95.94 (89.96-98.87), and 75.2 (66.53-82.95), in that order.

For PAS <4, PAS 4-6, and PAS >6, the corresponding negative predictive values are 33.1 (14.84-58.94), 57.12 (28.74-81.54), and 13.77 (8.44-21.76). Positive predictive values are 97.87 (94.05-99.25), 98.93 (94.01-99.83), and 98.65 (92.72-99.75) for PAS <4, PAS 4-6, and PAS >6. The specificity values were 60.2 (14.64-94.71), 80.2 (28.34-99.47), and 80.2 (28.34-99.47) for PAS <4, PAS 4-6, and PAS >6. For PAS <4, PAS 4-6, and PAS >6, the corresponding sensitivity values were 93.92 (87.25-97.72), 96.83 (90.94-99.32), and 74.73 (65.04-82.92). These findings were consistent with the high sensitivity and specificity of PAS scores reported by the authors in their separate investigations by Rehman S et al. in 2014 and Goldman RD et al. in 2008.

CONCLUSION

The current study, taking into account its limitations, finds that paediatric appendicitis scores are very accurate in predicting acute appendicitis in child subjects presenting to the emergency room with severe abdominal pain. The study evaluated participants from a specific geographic area using a low sample size and a brief observation time. Therefore, larger sample numbers and longer monitoring periods are required for future prospective longitudinal research.

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TABLES

Characteristics	Number (n=52)	Percentage (%)
Mean age (years)	10.7±3.3	
Gender		
Males	39	75
Females	13	25
Right lower abdomen pain	39	75
Pain migration	34	65.38
Leukocytosis	43	82.69
Fever	24	46.15
Percussion pain/hopping/cough	12	23.07
Tenderness of lower right quadrant	48	92.30
Vomiting/nausea	44	84.61
Anorexia	20	38.46
WBC differential left shift	45	86.53

Table 1: Clinical and demographic characteristics of child subjects with clinical suspicion of acute appendicitis

Variable	PAS <4	PAS 4-6	PAS >6
Accuracy	92.1 (85.2-96.64)	95.94 (89.96-98.87)	75.2 (66.53-82.95)
Negative predictive value	33.1 (14.84-58.94)	57.12 (28.74-81.54)	13.77 (8.44-21.76)
Positive predictive value	97.87 (94.05-99.25)	98.93 (94.01-99.83)	98.65 (92.72-99.75)
Specificity	60.2 (14.64-94.71)	80.2 (28.34-99.47)	80.2 (28.34-99.47)
Sensitivity	93.92 (87.25-97.72)	96.83 (90.94-99.32)	74.73 (65.04-82.92)

Table 2: Efficacy of pediatric appendicitis scores at different cut-off values