Original Article

Clinical Predictors of Organic Aetiology in Children Presenting with Recurrent Abdominal Pain: A Retrospective Study

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Abstract

Background: Differentiating functional from organic aetiologies in paediatric recurrent abdominal pain (RAP) remains a significant clinical challenge. This study aimed to identify independent clinical features associated with organic RAP and to develop and validate a practical risk-stratification model. **Material and Methods:** A retrospective observational study evaluated 50 children (aged 4–18 years) presenting with RAP at a tertiary care center. Clinical characteristics and alarm symptoms were systematically analyzed. Variables approaching significance in univariate analysis were entered into a multivariable logistic regression model. A 7-item Paediatric Organic Abdominal Pain Prediction Score (POAPS) was developed based on alarm features, and its diagnostic performance was evaluated using receiver operating characteristic (ROC) curve analysis. **Results:** Among the 50 children (mean age 6.8 years; 56% female), organic etiologies were identified in 84% (n=42), whereas 16% (n=8) had functional disorders. An abnormal abdominal examination was the strongest independent predictor, demonstrating 100% predictive accuracy for organic disease. Other features included in the multivariable model were school absenteeism, localized pain site, fever, and urinary symptoms. The POAPS model showed excellent diagnostic discrimination with an area under the curve (AUC) of 0.857. At an optimal cut-off score of, the POAPS yielded 71.4% sensitivity, 100% specificity, and a 100% positive predictive value. **Conclusion:** Organic pathology is highly prevalent in this tertiary pediatric cohort. The POAPS serves as a highly specific, non-invasive bedside tool that accurately identifies high-risk patients, facilitating targeted investigations while safely minimizing unnecessary testing for children with functional RAP.

Keywords: Recurrent abdominal pain; Paediatric gastroenterology; POAPS (Paediatric Organic Abdominal Pain Prediction Score); Organic aetiology.

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Introduction

Recurrent abdominal pain is a prevalent and challenging clinical entity in paediatric clinical practice.[1] It is classically defined by the Apley criteria as at least three episodes of abdominal pain occurring over a period of at least three months, which are severe enough to interfere with a child's normal daily activities.[2,3] While evaluating RAP, a clinician consistently faces complex diagnostic dichotomy of differentiating functional gastrointestinal disorders that constitute most of the cases with underlying organic pathology. Organic causes range from urinary tract infection and mesenteric lymphadenopathy to more severe conditions like chronic appendicitis, chronic pancreatitis, and inflammatory bowel disease.[4]

Diagnostic evaluation of RAP heavily relies on complete medical history and physical examination. Clinical features such as unexplained fever, failure to gain weight or involuntary weight loss, significant vomiting, gastrointestinal bleeding, urinary symptoms, significant school absenteeism, and abnormal abdominal examination findings are traditionally associated with a higher pretest probability of organic disease. Occurrence of these symptoms can drive deeper evaluation including further laboratory, radiological, or endoscopic diagnostic testing. However, relying only on clinical symptoms often resulting in either a delayed diagnosis of organic conditions or, conversely, excessive, invasive, and costly investigations for children who ultimately have functional disorders.[5]

Therefore, there is a critical need to systematically evaluate the predictive value of individual clinical features in distinguishing organic from functional abdominal pain.[5,6] While international guidelines report frequently caution against routine testing in absence of alarm signs practitioners often struggle to balance reassurance with risk of missing an underlying organic disease.[7,8] An evidence-based clinical prediction model such as Paediatric Organic Abdominal Pain Prediction Score (POAPS) that can effectively stratify patient risk during initial evaluation, guide appropriate and cost-effective diagnostic workups, and

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minimize unnecessary testing in pediatric patients presenting with RAP.

Addressing the above mentioned clinical imperative, the present study was undertaken with objectives to identify clinical features independently associated with organic recurrent abdominal pain, to describe the demographic and clinical characteristics of children presenting with recurrent abdominal pain, to determine the proportion of organic and functional causes, to compare clinical characteristics between children with organic and functional abdominal pain and to develop a simple clinical prediction model for identifying children at high risk of organic abdominal pain.

Materials and Methods

Study Design and Setting: A retrospective observational study was conducted in the Department of Paediatrics of a tertiary care teaching hospital. Medical records of children evaluated for recurrent abdominal pain during the study period were reviewed and analysed.

Study Population: The study population consisted of children presenting with recurrent abdominal pain who underwent clinical evaluation and diagnostic workup at the tertiary care center.

Recurrent abdominal pain was defined as at least three episodes of abdominal pain occurring over a period of at least three months and severe enough to interfere with normal daily activities, consistent with the classical Apley criteria.

Sample Size and Sampling Technique

A total of 50 eligible children satisfying the diagnostic criteria for recurrent abdominal pain and having complete clinical records were included in the study. Consecutive sampling of all eligible medical records available during the study period was employed.

Eligibility Criteria: Children aged 4–18 years presenting with recurrent abdominal pain and having complete clinical documentation, investigation records, and final diagnosis were included in the study.

Children with incomplete medical records, undocumented final diagnosis, or insufficient clinical information for classification into organic or functional abdominal pain categories were excluded from the study.

Data Collection: Data were extracted from outpatient records, inpatient case files, investigation reports, and discharge summaries using a structured data extraction form.

Demographic variables recorded included age, sex, and socioeconomic status.

Clinical variables included duration of abdominal pain, site of pain, frequency of episodes, severity of pain, character of pain, relationship of pain to meals, school absenteeism, vomiting, constipation, diarrhea, fever, weight loss or failure to gain weight, gastrointestinal bleeding, urinary symptoms, and findings on abdominal examination.

The final diagnosis established by the treating paediatrician after clinical evaluation and relevant investigations was recorded for each patient.

Classification of Aetiology: Patients were classified into two groups based on the final diagnosis. Functional abdominal pain and functional constipation were categorized as functional causes. Diagnoses including urinary tract infection, mesenteric lymphadenopathy, chronic gastritis, dysentery, worm infestation, gastroesophageal reflux disease, chronic appendicitis, chronic pancreatitis, inflammatory gastrointestinal disorders, and other identifiable pathological conditions were categorized as organic causes.

The primary outcome variable for the study was the presence of an organic aetiology.

Paediatric Organic Abdominal Pain Prediction Score (POAPS): To facilitate early identification of children at increased risk of organic recurrent abdominal pain, a Paediatric Organic Abdominal Pain Prediction Score (POAPS) was developed using clinically relevant alarm features documented during initial evaluation.

The score was constructed using seven variables traditionally associated with organic gastrointestinal pathology and routinely assessed during evaluation of recurrent abdominal pain. One point was assigned for the presence of each of the following clinical features – fever, weight loss or failure to gain weight, vomiting, gastrointestinal bleeding, urinary symptoms, abnormal abdominal examination findings and significant school absenteeism attributable to abdominal pain. The cumulative score ranged from 0 to 7, with higher scores indicating a greater likelihood of an underlying organic cause.

For interpretation, patients were categorized into three risk groups: Low risk: POAPS score 0–1, Intermediate risk: POAPS score 2–3 and High risk: POAPS score ≥4.

The diagnostic performance of POAPS for predicting organic abdominal pain was evaluated using receiver operating characteristic (ROC) curve analysis. Area under the curve (AUC), sensitivity, specificity, positive predictive value, negative predictive value, and optimal cut-off values were calculated.

In addition, the association between increasing POAPS score and probability of organic disease was evaluated using logistic regression analysis. Predicted probabilities of organic pathology across the range of POAPS scores were estimated and graphically represented using conditional effects plots.

Outcome Measures: The primary outcome was the identification of clinical predictors associated with organic recurrent abdominal pain and to evaluate the diagnostic accuracy of the Paediatric Organic Abdominal Pain Prediction Score (POAPS) for identifying children with organic recurrent abdominal pain. Secondary outcomes included the proportion of organic and functional causes, comparison of demographic and clinical characteristics between the two groups, evaluation of individual alarm symptoms, and assessment of the diagnostic performance of the Red Flag Score in predicting organic disease.

Statistical Analysis: Data were entered into Microsoft Excel and analysed using JASP statistical software (Version 0.19.3, University of Amsterdam, Netherlands). Continuous variables were assessed for normality using the Shapiro-Wilk test. Normally distributed variables were expressed as mean ± standard deviation, whereas non-normally distributed variables were presented as median and interquartile range. Categorical variables were summarized as frequencies and percentages.

Clinical and demographic variables were compared between children with organic and functional abdominal pain using the Chi-square test or Fisher's exact test for categorical variables and the independent Student's t-test or Mann-Whitney U test for continuous variables, as appropriate.

Variables demonstrating a p-value less than 0.20 on univariate analysis were entered into a multivariable logistic regression model to identify independent predictors of organic abdominal pain. Adjusted odds ratios (aOR) with 95% confidence intervals (CI) were reported.

Calibration of the POAPS model was assessed by comparing observed and predicted probabilities of organic disease. ROC curve analysis was used to evaluate discrimination, and the optimal cut-off value was determined using the Youden Index. The area under the ROC curve (AUC), optimal cut-off value, sensitivity, specificity, positive predictive value, and negative predictive value were calculated.

All statistical tests were two-tailed, and a p-value less than 0.05 was considered statistically significant.

Ethical Considerations: Institutional Ethics Committee approval was obtained prior to commencement of the study. As the study involved retrospective review of existing medical records without direct patient interaction or intervention, a waiver of informed consent was obtained from the Ethics Committee. Patient confidentiality was maintained throughout the study by anonymizing all records before data extraction and analysis. No personal identifiers were included in the study database, presentations, or publications.

Results

Demographic and Clinical Characteristics: A total of 50 children presenting with recurrent abdominal pain were included in the study. The mean age of the study population was 6.8 ± 2.91 years. Females constituted a slight majority, accounting for 28 cases (56%), while 22 children (44%) were males.

The majority of children belonged to the upper-lower socioeconomic class (58%, n=29), followed by the lower-middle class (36%, n=18). Only a small proportion belonged to the upper-middle (4%, n=2) and lower socioeconomic classes (2%, n=1).

The clinical presentation was heterogeneous with varying duration, frequency, severity, and site of abdominal pain. Associated symptoms included vomiting, constipation, diarrhea, fever, urinary symptoms, and school absenteeism.

Etiological Spectrum of Recurrent Abdominal Pain

Organic causes were identified in 42 children (84%), whereas functional causes accounted for 8 children (16%) [Figure 1].

Among the organic causes, urinary tract infection was the most common diagnosis, followed by mesenteric lymphadenopathy, chronic gastritis, dysentery, worm infestation, gastroesophageal reflux disease, chronic appendicitis, and chronic pancreatitis [Table 1]. Functional abdominal pain and functional constipation comprised the functional group.

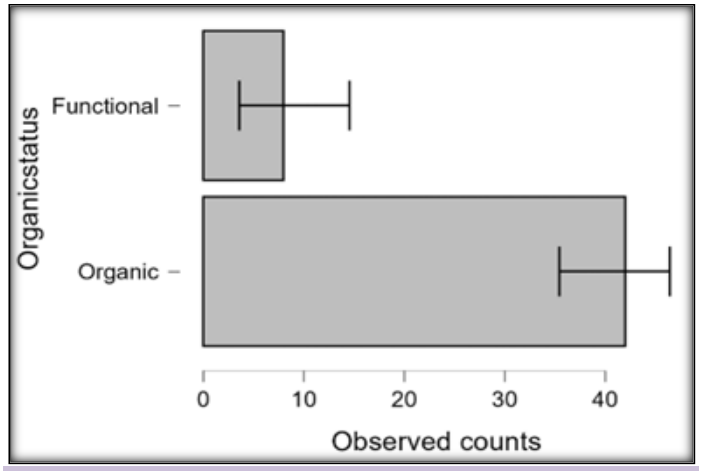

Figure 1: Organic vs Functional aetiology of recurrent abdominal pain (n=50).

Table 1: Etiological distribution of recurrent abdominal pain

Final diagnosis	Observed
Acute gastroenteritis	2
Chronic appendicitis	2
Chronic constipation	3
Chronic gastritis	3
Chronic GI bleeding	1
Chronic pancreatitis	2
Dysentery	3
Functional abdominal pain	6
Functional constipation	2
GERD	2
Mesenteric lymphadenopathy	9
Mesenteric lymphadenopathy with UTI	1
Uti	11
Worm infestation	3

Comparison Between Organic and Functional Recurrent Abdominal Pain

Comparison of demographic and clinical characteristics between children with organic and functional abdominal pain revealed several significant differences.

Abnormal abdominal examination findings demonstrated a strong association with organic pathology (p=0.005). All children exhibiting abnormal abdominal examination findings were ultimately diagnosed with an organic cause of recurrent abdominal pain.

School absenteeism also differed significantly between the two groups (p=0.001). Interestingly, absenteeism was proportionally more common among children with functional abdominal pain than among those with organic causes.

Pain location approached statistical significance (p=0.096), with suprapubic and epigastric pain occurring exclusively among children with organic disease [Table 2].

Table 2: summary of the sites of pain for the organic and functional recurrent abdominal pain

Site of pain	Organic (n=42)	Functional (n=8)	Total (n=50)
Periumbilical	22	8	30
Suprapubic	11	0	11
Epigastric	7	0	7
Right iliac fossa	2	0	2
Total	42	8	50

Fever (p=0.174) and urinary symptoms (p=0.173) also demonstrated associations with organic pathology and therefore met the predefined threshold for inclusion in multivariable analysis.

No statistically significant differences were observed with respect to age, sex, socioeconomic status, pain severity, vomiting, constipation, diarrhea, weight loss, or gastrointestinal bleeding (all p >0.20).

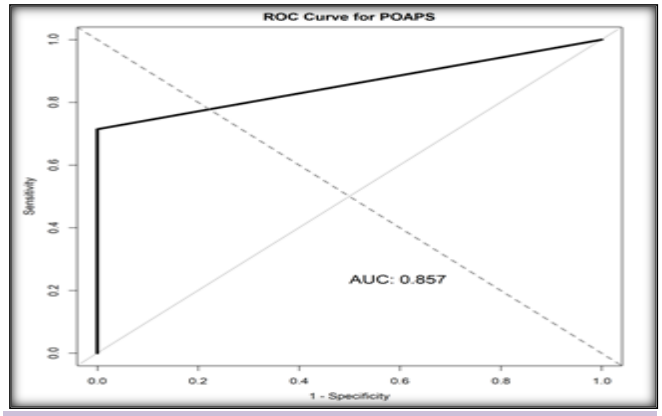

Figure 2: Receiver operating characteristic (ROC) curve demonstrating the diagnostic performance of the Pediatric Organic Abdominal Pain Prediction Score (POAPS) in predicting organic recurrent abdominal pain. The score demonstrated good discriminatory ability with an area under the curve (AUC) of 0.857 (95% CI: 0.788–0.926). The optimal cut-off value was ≥1, yielding a sensitivity of 71.4% and specificity of 100%.

Independent Predictors of Organic Recurrent Abdominal Pain

Variables demonstrating p-values <0.20 during univariate analysis were entered into a multivariable logistic regression model.

Abnormal abdominal examination emerged as the most important predictor of organic recurrent abdominal pain. Because all children with abnormal abdominal findings were diagnosed with organic disease and no child with functional abdominal pain demonstrated abnormal abdominal examination findings, complete statistical separation was observed. This finding indicates an extremely strong predictive relationship between abnormal abdominal examination and underlying organic pathology.

Although fever, urinary symptoms, pain site, and school absenteeism demonstrated associations during univariate analysis, none demonstrated predictive strength comparable to abdominal examination findings.

Performance of the Paediatric Organic Abdominal Pain Prediction Score (POAPS)

The POAPS, developed using seven predefined alarm features, was evaluated for its ability to distinguish organic from functional recurrent abdominal pain.

Receiver operating characteristic (ROC) curve analysis demonstrated excellent discriminatory performance, with an area under the curve (AUC) of 0.857. This finding indicates good overall diagnostic accuracy of the score for identifying children with organic abdominal pathology [Figure 2]. The optimal cut-off value identified using the Youden Index was a POAPS score of ≥1. At this threshold, the score demonstrated a sensitivity of 71.4%, specificity of 100%, positive predictive value of 100%, and negative predictive value of 40.0%.

Validation of POAPS Risk Categories: Risk stratification based on POAPS categories showed clear discrimination between functional and organic abdominal pain. All eight children diagnosed with functional abdominal pain had a POAPS score of 0 and were categorized as low risk (Figure 3). Conversely, every child with a POAPS score of 1 or greater was found to have an organic cause of recurrent abdominal pain. These findings support the utility of POAPS as a simple clinical screening tool for identifying children who may benefit from further diagnostic evaluation.

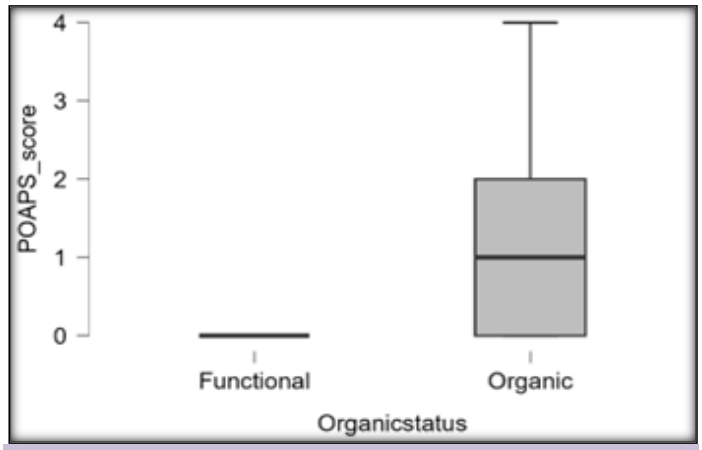

Figure 3: Distribution of Paediatric Organic Abdominal Pain Prediction Scores (POAPS) among children with organic and functional recurrent abdominal pain. Higher scores were predominantly observed among children with organic pathology, demonstrating the discriminatory ability of the score.

Discussion

Historically, many paediatric societal guidelines and literature have supported the argument that chronic or recurrent abdominal pain in children is overwhelmingly functional.[9,10] However, this notion lacks objective evidence of underlying organic or biochemical disorders. The cohort considered in this study demonstrated a strikingly high proportion of organic diagnoses (84%). While this contrasts with classical Western epidemiological data, it aligns closely with emerging literature from developing and non-Western regions.[11–14] For instance, a recent Indonesian study similarly challenged the functional paradigm by reporting a 77.8% diagnostic yield for organic pathology via endoscopy in pediatric RAP patients.[15] The high burden of organic disease observed in our study is likely reflective of similar regional epidemiological variations, specific infectious burdens (such as dysentery and worm infestations), as well as inherent referral bias, given that the study was conducted in a tertiary care teaching hospital where more severe or complex cases are typically managed.

Our univariate and multivariable analyses reinforce the critical value alarm features. The study identified an abnormal abdominal examination as the single strongest independent predictor of organic pathology. Further, features like school absenteeism, localized pain sites, fever and urinary symptoms approached or met statistical significance for distinguishing organic from functional causes. Balancing parental anxiety with the risks and costs of over-investigation is a major challenge for paediatricians. This is being addressed in this study with development of POAPS. This model demonstrated 100% specificity and positive predictive value for organic disease. It can allow clinicians to confidently reassure the families of low-risk children (POAPS = 0) and manage them for functional pain without resorting to expensive, invasive, or low-yield diagnostic procedures. Conversely, it swiftly identifies intermediate and high-risk patients who require targeted laboratory, radiological, or endoscopic evaluation.

Limitations: Retrospective observational design restricts ability to establish definitive causality assessment. In addition small sample size of 50 patients limits the statistical power. As it was single centered study, patient population may not be accurately representing the prevalence of functional versus organic pain in the community.

Conclusion

Organic causes accounted for the majority (84%) of recurrent abdominal pain cases in the present cohort. Abnormal abdominal examination was the strongest clinical predictor of organic disease. The newly developed POAPS score demonstrated excellent diagnostic discrimination (AUC = 0.857), with a score of ≥1 showing perfect specificity and positive predictive value for identifying organic pathology. These findings suggest that systematic assessment of alarm symptoms and physical examination findings can facilitate early recognition of children at increased risk of underlying organic disease.

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Conflicts of interest

There are no conflicts of interest.

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