



ORIGINAL ARTICLE

Association between abdominal pain and fecal impaction grade assessed through radiography in constipated patients at a pediatric emergency service[☆]



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KEYWORDS

Constipation;
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Abstract

Introduction and aim: Abdominal pain in children is a frequent cause of emergency room consultation. An important group of those patients presents with chronic constipation and fecal impaction. Plain abdominal x-ray is widely used for making a diagnosis and ruling out the need for surgical treatment. The present study examined the association between pain intensity and fecal impaction grade.

Materials and methods: An analytic cross-sectional study was conducted that compared two radiographic scales to determine the association between the grade of fecal impaction observed and abdominal pain intensity in patients that sought medical attention at an emergency service within a 7-month period. The analysis was carried out by two different observers, utilizing two different radiographic scales to confirm their reproducibility. The degree of interobserver agreement was measured using the Kappa coefficient and the association between abdominal pain and fecal impaction grade was measured through the Spearman correlation coefficient.

Results: There was a significant association between pain intensity and the radiographic grade of fecal impaction ($p < 0.05$) for the radiographic scale by segments and its interobserver agreement was high, compared with the scale by percentage.

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PALABRAS CLAVE

Estreñimiento;
Radiografía simple de
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Dolor abdominal;
Grado de coproestasis

Conclusions: Radiographic scales may be useful in the evaluation and treatment of patients with abdominal pain and constipation. The segmental scale showed less interobserver variability, suggesting its proposal as an alternative in the evaluation and follow-up of patients with chronic constipation.

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Asociación entre el dolor abdominal y el grado de coproestasis mediante la evaluación radiográfica en pacientes estreñidos que acuden a los servicios de urgencias pediátricas

Resumen

Introducción y objetivo: El dolor abdominal en niños es causa frecuente de consulta en el servicio de urgencias. Un grupo importante se compone de pacientes con estreñimiento crónico y coproestasis. La radiografía simple de abdomen (RSA) es muy utilizada para el diagnóstico y para descartar necesidad de tratamiento quirúrgico. El presente trabajo explora la asociación de la intensidad del dolor y el grado de coproestasis.

Material y métodos: Estudio transversal analítico en el que se realizó la comparación entre dos escalas radiográficas para asociar el grado de coproestasis observado con la intensidad del dolor abdominal en pacientes que acuden al servicio de urgencias en un periodo de siete meses. El análisis se realizó con dos escalas radiográficas distintas utilizadas por dos diferentes observadores con el fin de comprobar si ambas son reproducibles. Para determinar el grado de concordancia interobservador se utilizó el coeficiente Kappa y la prueba estadística utilizada para la asociación entre el dolor abdominal y el grado de coproestasis, el coeficiente de correlación de Spearman.

Resultados: Se obtuvo una asociación significativa entre la intensidad del dolor y el grado radiográfico de coproestasis ($p < 0.05$) para la escala radiográfica por segmentos. La concordancia interobservador fue alta comparada con la escala por porcentaje.

Conclusiones: El uso de escalas radiográficas puede ser de utilidad en la evaluación y tratamiento de pacientes con dolor abdominal y estreñimiento. La escala por segmentos mostró una menor variabilidad interobservador por lo que podría proponerse como alternativa para evaluación y seguimiento de pacientes con estreñimiento crónico.

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Introduction and aim

Functional constipation is one of the 10 most frequent causes of pediatric consultation and 25% of pediatric gastroenterology visits. Worldwide prevalence has increased and varies from 0.9% to 29.6% in the general population.¹ In Mexico, prevalence, according to Rome II and Rome III criteria, is estimated at 14.4%.² Functional constipation is the cause of more than 90% of cases of constipation, whereas only 5-10% of cases are due to an organic cause.¹

Abdominal pain is the most frequent clinical presentation of constipation in children,³ resulting in their going to the emergency room 3 times more than patients with other diagnoses.⁴ The differential diagnosis of abdominal pain is very broad and great professional experience is required for making the definitive diagnosis.⁵

The initial study of constipation in pediatrics should include the medical, surgical, and dietary histories of the

patients, as well as a complete physical examination. The guidelines of the North American Society for Pediatric Gastroenterology, Hepatology, and Nutrition (NASPGHAN)⁶ recommend utilizing plain abdominal radiography (PAR), when there is doubt as to the presence of fecal impaction and the patient does not allow a rectal examination to be carried out.

A published study reported that despite the fact that PAR is not accepted as useful in the diagnosis of constipation, it is routinely employed by the majority of pediatric gastroenterologists.⁷ Children under 6 years of age cannot accurately express their symptomatology. The frequent use of PAR as part of the routine evaluation of constipation is justified, not only for ruling out a surgical pathology, but also for assessing other possibilities that include fecal impaction, especially in patients that state they have daily bowel movements.⁸

Studies have been published in the past that suggest different measuring scales that utilize PAR. In 1979, Barr et al.

designed a scale based on the presence of stool in the segments of the colon, identified through PAR.⁹ In 1995 and 1999, other scales were developed for the same purpose. Leech et al. utilized a scale from 0 (no stool) to 5 (important presence of stool plus dilation of the large bowel) in each of three different regions of the colon, with a maximum score of 15 points. Those authors found significant differences between the scores of constipated patients versus the control x-rays. Percentages of sensitivity ranging from 46-90% and specificity from 18-88% have been reported when using those scoring systems as a tool for diagnosing constipation.⁷ Only Leech et al.¹⁰ found a statistically significant difference with a likelihood ratio (LR) of 3.0. Blethyn et al.¹¹ employed PAR to distinguish clinically constipated patients from those with no constipation, with sensitivity percentages of 80% (65-90%). Significant interobserver variation was shown with that measuring scale.^{10,11}

At present, there are no conclusive studies that recommend the use of PAR in the diagnostic protocol for patients with constipation. There is no evidence of the association between clinical symptoms and the presence of stools revealed by PAR in pediatric patients. Cunha et al. conducted a comparative study on 3 different scales for fecal impaction that included the measurement of segments of the colon. They concluded that PAR and the scales employed could be of diagnostic use in those cases.¹²

The use of radiographic scales in cases of constipation has been controversial, observing low interobserver agreement that varies, depending on the scale employed.⁶

The aim of the present study was to evaluate the association between abdominal pain and fecal impaction grade evaluated through radiography in a group of constipated patients that sought medical attention at the emergency room of a private children's hospital in Mexico City.

Materials and methods

An analytic cross-sectional study was conducted on a consecutive sample of 45 patients at the emergency room of a private children's hospital, within the time frame of October 1, 2016 to May 30, 2017. The study patients sought medical attention for acute abdominal pain and were diagnosed with constipation at the emergency service. A questionnaire was designed for the parents that included pain semiology and the history related to constipation (family history, previous constipation diagnosis, bowel movement characteristics and pattern, etc.) based on the Rome IV criteria.¹³ For the purpose of the study, all patients underwent a plain abdominal x-ray.

The inclusion criteria were age between 1 and 18 years, seeking attention for abdominal pain, a diagnosis of constipation at the emergency service, and having a plain abdominal x-ray. The exclusion criteria were patients that had no plain abdominal x-ray, patients whose emergency room diagnosis was different from constipation, and patients with a plain abdominal x-ray that did not identify fecal impaction.

Two different methods were employed in the radiographic evaluation for classifying fecal impaction grade. All radiographic measurement was carried out by 2 observers: a pediatric radiologist (observer 1) and a general radiolo-

Table 1 Fecal impaction grade by segments.

Grade	Total score of the 3 segments
0	0 points
1	1-4 points
2	5-8 points
3	> 8 points

Table 2 Fecal impaction grade by length percentage.

Grade	Total percentage of colonic length filled with stools
0	0%
1	20-40%
2	40-60%
3	> 60%

gist (observer 2). We identified the first method as "fecal impaction grade by segments", which was the method validated in 1999 by Leech et al.¹⁰ The abdomen was divided into 3 segments, each with a score according to the dilation of the colon, regardless of the presence of air or stool. A score of 1 to 5 was assigned to each segment and the scores were then added together (Table 1).

The second scale consisted of a longitudinal measurement (centimeters) that excluded the segments of the colon that contained air. We identified the second method as "fecal impaction grade by length percentage". The complete measurement of the colon, corresponding to 100%, was obtained utilizing the curve measurement function of the 2008 Carestream Vue Motion© version 11.4.0.0 software, Carestream Health, Inc. The percentage of the length of colon filled with stool was calculated using a rule of 3 (Table 2).

Abdominal pain was evaluated in the applied questionnaire, according to the modified Wong-Baker facial scale of pain, and scored as follows: 0=no pain, 2=mild pain, 4-6=moderate pain, and 8-10=severe pain.³

The statistical analyses were evaluated using the SPSS version 17.0 (SPSS Inc. Chicago, USA) program. Statistical comparisons were made through the Spearman correlation coefficient to evaluate the association between abdominal pain intensity and the fecal impaction grade determined through the abovementioned techniques. Statistical significance was set at a $p < 0.05$.

The Kappa coefficient was employed to determine the degree of interobserver agreement.

Ethical considerations

The research was carried out according to the Declaration of Helsinki. All data were handled confidentially, and written statements of informed consent were obtained from the parents or guardians of the underage patients in the study. The authors emphasize that no intervention or studies were requested beyond those of emergency room protocol.

Table 3 Characteristics of the patients surveyed.

Characteristic	N	Data summary ^a
Sex	45	Male 26 (57.7%) Female 19 (42.2%)
Number of emergency room visits in the past year	45	1 (1st time) 29 (64.4%) 2 times 10 (22.2%) 3 times or more 6 (13.3%)
Previous constipation diagnosis	45	Yes 16 (35.5%) No 29 (64.4%)
Pain grade	45	Mild 1 (2.2%) Moderate 23 (51.1%) Severe 21 (46.6%)
Age	45	5.02 years ^b

^a Results expressed as frequency and percentage.

^b Mean age of the patients surveyed.

Results

A total of 45 patients were included, with a predominance of males (57.7%). Mean patient age was 5.02 years (1-18 years) (Table 3). It was the first time seeking medical attention at an emergency room for abdominal pain secondary to constipation for 64.4% of the patients and only 16 of the patients (35.5%) stated that they had a previous diagnosis of constipation. Moderate abdominal pain was the most frequent (51.1%), corresponding to grades 4, 5, and 6 on the Wong-Baker scale.

In the comparison of the two radiographic evaluations, the assessment according to fecal impaction grade by colonic segment had high interobserver agreement ($\kappa = 1.00$) and the fecal impaction grade by colonic length percentage had low interobserver agreement ($\kappa = 0.133$).

The evaluation of the association of the abdominal pain grade with the fecal impaction grade in the 2 scales was different between the 2 observers (Fig. 1). Their evaluations produced a significantly greater correlation between the fecal impaction grade by segment and the pain grade ($p < 0.05$). The association between abdominal pain intensity and fecal impaction grade observed in the x-rays of the majority of the patients with moderate and severe pain occurred in the cases with fecal impaction grades 2 and 3.

Discussion and conclusions

There is no conclusive evidence in the literature on the use of PAR for the diagnosis of constipation and for making decisions with respect to patients with constipation. However, its use is very frequent in emergency services, as part of the study of constipated patients, especially those that present with abdominal pain.

In previous studies that have compared the different scales published in the literature, their focus is on the usefulness of said scales for showing the changes after fecal disimpaction in constipated patients. The justification for the use of PAR is based on the reduced scores in each scale, after treating the fecal impaction.¹²

We utilized 2 radiographic scales in our study to determine whether there really was an association between abdominal pain grade and the x-ray results. One of the scales we proposed is a new radiographic technique we called "fecal impaction grade by length percentage". It utilizes curve measurements, which have not been previously described in the literature.

Interobserver and intraobserver differences have been reported with the use of radiographic evaluations.¹⁰ One of the limitations observed with the length percentage measuring scale in the present study was each observer's perception of the shape of the colon. Said differences interfered with the final percentage of the colonic length filled with stool, and therefore we suggest conducting a larger study to obtain more accurate measurements.

Reports have stated that large quantities of stool can go undetected as palpable abdominal masses in the physical examination, even in cases of severe abdominal pain. Physicians and healthcare personnel consider PAR a useful tool for patients diagnosed with constipation.⁹

Pain evaluation in children tends to be very subjective, especially in those under 3 years of age. We utilized the same questionnaire for all our study patients and the majority were filled out by the parents.

According to our results, we conclude that PAR can be a useful diagnostic method in the evaluation of emergency room patients with abdominal pain and fecal impaction. However, there are limitations. The length percentage scale proposed in our study did not correlate better than the scale by segments because of the significant differences in the perception of colonic length percentages. We obtained high interobserver agreement with the scored segmental scale,

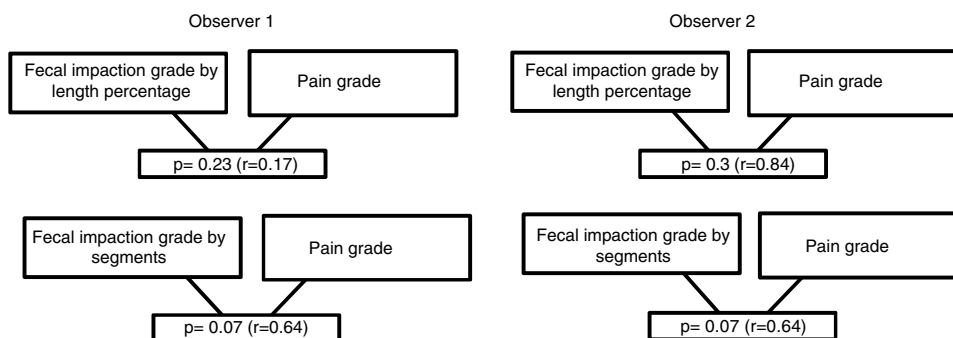


Figure 1 Relation of the grades of fecal impaction to abdominal pain according to the two observers. Spearman coefficient.

supporting the use of said scales in the follow-up of patients with chronic constipation. We believe a study with a larger sample and a larger number of observers could produce better results.

In conclusion, our study suggests that PAR can be routinely used as a diagnostic aid, as well as for making therapeutic decisions in children that arrive at the emergency room with abdominal pain and constipation, based on established diagnostic criteria, such as the Rome IV criteria. Future studies are recommended for perfecting the use of radiographic evaluation scales.

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Conflict of interest

The authors declare that there is no conflict of interest.

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