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Maintenance of Pain in Children with Functional Abdominal Pain

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Abstract

Objectives—A significant proportion of children with functional abdominal pain develop chronic pain. Identifying clinical characteristics predicting pain persistence is important in targeting interventions. We examined whether child anxiety and/or pain-stooling relations were related to maintenance of abdominal pain frequency and compared the predictive value of three methods for assessing pain-stooling relations (i.e., diary, parent report, child report).

Methods—Seventy-six children (7–10-years-old at baseline) who presented for medical treatment of functional abdominal pain were followed up 18–24 months later. Baseline anxiety and abdominal pain-stooling relations based on pain and stooling diaries and child- and parent-questionnaires were examined in relationship to the persistence of abdominal pain frequency.

Results—Children's baseline anxiety was not related to persistence of pain frequency. However, children who displayed irritable bowel syndrome (IBS) symptoms at baseline maintained pain

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None of the authors has a conflict to declare.

Author contributions:

Danita I. Czyzewski- study concept and design; interpretation of data; drafting of the manuscript, approval of the final manuscript as submitted.

Mariella M. Self- study concept and design; interpretation of data; critical revision of the manuscript for important intellectual content, approval of the final manuscript as submitted.

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frequency at follow-up, whereas in children in whom there was no relationship between pain and stooling, pain frequency decreased. Pain and stool diaries and parent report of pain-stooling relations were predictive of pain persistence but child-report questionnaires were not.

Conclusions—The presence of IBS symptoms in school age children with functional abdominal pain appears to predict persistence of abdominal pain over time, while anxiety does not. Prospective pain and stooling diaries and parent report of IBS symptoms were predictors of pain maintenance, but child report of symptoms was not.

Keywords

abdominal pain; chronic pain; irritable bowel syndrome; anxiety; children

INTRODUCTION

Having been described as recurrent, functional, or medically-unexplained, abdominal pain without evidence of a pathologic condition is a common presenting problem in primary and tertiary pediatric care. A summary of follow-up studies reveals that five years after first contact, about 30% of children with abdominal pain who have no alarm signs will continue to complain of abdominal pain.¹ This, coupled with the knowledge of the high healthcare costs² and lower quality of life in children^{3,4} and adults with functional gastrointestinal disorders, suggests that identifying “children at risk for a prolonged course of pain” is a worthy challenge.⁵

For many reasons, anxiety is often conceptualized in community and clinical settings as causative of functional abdominal pain. The ubiquity of this assumption may stem from the common human experience of abdominal sensations in the presence of anxiety or the idea that symptoms without identifiable organic cause are psychologically based. Data exist linking anxiety to increased pain severity^{5,6} and disability⁵⁻⁹ in children with functional abdominal pain. However data showing a relationship between anxiety and longer term pain is scant to non-existent.^{1,6} This may be due to a relative dearth of follow-up studies¹ or may reflect a true lack of relation. Despite lack of research support, the proportion of pediatric gastroenterologists endorsing the conceptualization of psychological factors as a basis of functional abdominal pain has remained steady over the past 20 years.¹⁰ Thus a test of the connection between anxiety and long term pain is warranted.

Growing evidence suggests pediatric functional abdominal pain is a precursor to adult irritable bowel syndrome (IBS).¹¹⁻¹³ However, historically pediatric literature has focused on abdominal pain without attention to other GI symptoms (i.e., pain-stool relations, the defining characteristic of IBS). Therefore it is not clear if functional abdominal pain in general or pediatric IBS symptoms specifically predicts adult IBS. Though the 2005 American Academy of Pediatrics guidelines did not address pain stool-relations in their summary of findings and treatment guidelines for functional abdominal pain⁶, the Rome Foundation on Functional Gastrointestinal Disorders has focused increased attention to the symptoms of IBS in children.¹⁴ Examining pain-stooling relations within children with functional abdominal pain may help illuminate whether early pain-stooling relations (i.e., IBS symptoms) predict chronicity of pain.

The aims of the present study were to examine within a group of school-age children with functional abdominal pain whether baseline anxiety symptoms and/or the presence of pain-stooling relations (defining characteristic of IBS) predicted maintenance of abdominal pain complaints 18 to 24 months later. In approaching these aims, we also examined the impact of methods used to obtain symptom data (e.g., diary vs. questionnaire; parent vs. child report).

METHODS

Participants

Participants ages 7 – 10 years of age who had been recruited from a large academically-affiliated health care network including both primary and tertiary care, for a descriptive study of physiological and psychological characteristics of prepubescent children with functional abdominal pain.^{15, 16} Parents of children who had been seen in primary or tertiary care within the previous year for abdominal pain were contacted by mail. Interested participants were screened by phone to identify children who currently have pain episodes at least monthly that interfere with activity,¹⁷ and are rated as moderate or severe (3/10 on a scale of pain intensity), or cause children to take medication for pain.¹⁸ Children were excluded if phone screening or chart review indicated they had organic GI illness (or organic GI illness remained in the differential as an explanation for child's pain), a significant chronic health condition (requiring daily medication or specialty care), decreased growth velocity, GI blood loss, unexplained fever, vomiting, chronic severe diarrhea, weight loss of 5% of their body weight within a 3-month period, current use of anti-inflammatory medications, or previous use of GI medication that provided complete symptom relief. Additional exclusion criteria included language or learning challenges preventing questionnaire or diary completion. Except for conditions that could be related to alarm signs (such as severe diarrhea) or alternative explanations for pain, such as chronic constipation, stooling patterns were not part of the initial selection criteria.

Procedures

The Baylor College of Medicine Institutional Review Board approved the study. Consent was obtained from parents and assent from children. During a home visit, parents and children independently completed a child pain-stooling relations questionnaire based on pediatric Rome II criteria for IBS¹⁹ and the Behavior Assessment System for Children,²⁰ as a measure of children's emotional and behavioral problems. To avoid problems with reading comprehension, questionnaires were read to the children by a research assistant.

Participants were instructed in completion of a two-week pain and stooling diary. Parents were asked to prompt children to complete diaries but allow the child to independently rate abdominal pain and record stool occurrence and form.²¹ Children rated abdominal pain for three intervals per day (morning, afternoon, and evening) by placing a mark on a 100 mm visual analog scale (VAS) anchored by "no pain at all" and "worst pain you can imagine." Pain intensity was established by measuring the distance from the left end of the line to the mark (10mm defined as a pain episode). Children also recorded time and form (watery, mushy, formed, or hard) of each stool. The diary included pictorial representations of stools

(analogous to the Bristol Stool Form Scale)²² as a guide. Participants were called 18–24 months later for follow-up. At that time, the initial screening interview was again administered over the telephone to the same parent; all but one respondent was the mother.

Measures

Abdominal Pain Frequency-Parent Interview Question—At recruitment phone screening and follow-up assessment, parents who endorsed that their child had abdominal pain in the past three months were asked how many times per month the child experienced pain.

The Behavior Assessment System for Children—(BASC) is a well-validated measure of child emotion and behavior problems²⁰ designed and normed for three age ranges (2–5; 6–11; 12–18) with versions for parent-report of child behaviors and self-report for ages 8 and above. *T*-scores (mean = 50; standard deviation = 10) for parent- and child-report anxiety scales were used. In accordance with clinically meaningful interpretation, children were dichotomized on their anxiety score with *t*-scores of 60 and above classified as at-risk/clinically significant for anxiety.

Pain-stooling relations from Child Diary—Diaries were scored as described previously²³ to identify symptoms of IBS, specifically temporal relations between defecation and abdominal pain relief, pain associated with changes in stooling frequency, and pain associated with changes in stool form. Changes in stool form and frequency were operationalized using NASPGHAN guidelines.²⁴ Briefly, three or more stools per day or no stools for two or more days were not normative in terms of frequency. Stools rated as hard balls or watery were not normative in terms of form. Using the stool diary, stool occurrence or change in stool form or frequency was identified and then compared to the pain diary to determine if pain occurred in conjunction with the stool characteristic. Pain-stooling relations were considered present if at least two of the three pain-stooling relations existed at any point over the course of the 14 day diary period.²³

Pain-stooling relations from Questionnaires—The parent- and child-report questionnaires comprised yes/no questions about the relation of abdominal pain to stooling or changes in stool form or frequency (e.g. “Is your child’s stomach discomfort or pain relieved by a bowel movement?”, “When you have stomach pain do you poop more often than usual?”) (Supplemental text document 1). If the respondent endorsed any two of the three, pain-stooling relations were considered present.

Analysis

To evaluate differential change over time for groups dichotomized by anxiety level (assessed by child or parent report) or presence of IBS symptoms (assessed by parent questionnaire, child questionnaire or symptom diary), five 2 × 2 mixed design analyses of variance (ANOVA) examined group by time interactions. Group was the between-subjects independent variable with two levels (anxiety elevated/normal or pain-stooling relations present/not present), and time was the within-subjects independent variable with two levels (initial vs. follow-up). The dependent variable for all ANOVAs was parent report of child’s

abdominal pain frequency per month. . Missing diary data or questionnaires resulted in sample sizes for the final analyses ranging from 55 to 73.

RESULTS

Of the initial 118 participants, one child was removed from the sample after being diagnosed with eosinophilic colitis; and 64% (76 participants) completed the follow-up.

Fifty-four (71%) of the follow-up participants were girls. Mean age at follow-up was 10.8 ± 1.8 years. Follow-up participants were 70% white, 18% Hispanic, 11% African American, and 1% Asian.

For the follow-up group, parent interview at baseline indicated mean pain intensity for abdominal pain episodes was 6.8 (on a 10 point scale) and for 79% of the children, pain interfered with school attendance or play. Those lost to follow-up did not significantly differ from follow-up participants for baseline age, gender, ethnicity, baseline pain intensity or interference with activity. Follow-up completers reported significantly more frequent pain episodes per month at baseline than non-completers (10.3 ± 10.4 vs. 5.4 ± 5.3 , respectively, $t(1, 111) = 2.688$, $P = 0.001$).

Mean anxiety scores (as measured by child report and parent report) between IBS/no IBS groups (as measured by diary, parent questionnaire, children questionnaire) were compared. No significant differences were found in any of the 6 comparisons. Further the means for each of 12 subgroups (e.g. parent rated anxiety hi/diary symptoms diary yes) were in the average range with t-scores of 53 or below. (Table 1)

Baseline Anxiety Predicting Pain Frequency at Follow-up

Child-report BASC Anxiety—(Figure 1) Based upon the clinically meaningful cut off t -score of 60, 59 children (78%) were in the normal anxiety group and 14 (22%) were in the elevated anxiety group. The main effect of Time was significant for pain frequency [$F(1,71)=20.65$, $P < .001$, $\eta^2=.23$] with a decrease in monthly pain frequency from initial assessment ($M=11.53$, $SE=1.56$) to follow-up ($M=5.16$, $SE=1.09$). The Time $\times$ Child BASC Anxiety interaction was not significant [$F(1,71)=1.41$, $P=.24$, $\eta^2=.02$].

Parent-report BASC Anxiety—(Figure 1) Using parent-report BASC anxiety t -scores, 57 children (75%) were in the normal anxiety group and 14 (25%) were in the elevated anxiety group. The main effect of Time was again significant for pain frequency [$F(1,69)=10.12$, $P<.01$, $\eta^2=.13$] with a decrease in pain frequency from initial assessment ($M=11.53$, $SE=1.56$) to follow-up ($M=5.16$, $SE=1.09$). The Time $\times$ Parent BASC Anxiety interaction was again not significant [$F(1,69)=.56$, $P=.45$, $\eta^2=.01$].

Baseline Pain-stooling Relations Predicting Pain Frequency at Follow-up

Diary Scored Pain-stooling relations—(Figure 2) By diary scoring 11 (17%) children had two or more pain stool-relations and 54 (83%) did not. The main effect of Time was significant for pain frequency [$F(1,63)=6.06$, $P=.02$, $\eta^2=.09$], with a decrease in pain frequency from initial assessment ($M=8.96$, $SE=1.80$) to follow-up ($M=5.39$, $SE=1.09$). This

effect was qualified by a significant Time $\times$ Diary-based pain-stooling relations interaction [$F(1,63)=5.90$, $P=.02$, $\eta^2=.09$]. Children who did not have evidence of two pain-stooling relations (i.e., no IBS symptoms) at baseline had a significant decrease in pain frequency ($P<.001$, $d=.78$) from initial evaluation ($M=11.05$, $SE=1.48$) to follow-up ($M=3.95$, $SE=.90$). Children with pain-stooling relations did not have a significant change in (i.e., maintained) pain frequency ($P=.99$, $d=.01$) from initial evaluation ($M=6.86$, $SE=3.29$) to follow-up ($M=6.82$, $SE=1.98$).

Child Report Questionnaire of Pain-stooling relations—(Figure 2) By child report questionnaire, 23 children had two or more pain–stool relations and 34 children did not. The main effect of Time was significant for pain frequency [$F(1,55)=21.30$, $P<.001$, $\eta^2=.28$] with a decrease in pain frequency from initial testing ($M=10.60$, $SE=1.55$) to follow-up ($M=4.73$, $SE=.95$). The Time $\times$ Child Questionnaire of Pain-stooling relations interaction was not significant [$F(1,55)=1.68$, $P=.20$, $\eta^2=.03$].

Parent Report Questionnaire of Pain-stooling relations—(Figure 2) By parent report questionnaire, 14 children had two or more pain–stool relations and 42 children did not. The main effect of Time was significant for pain frequency [$F(1,54)=10.43$, $P=.002$, $\eta^2=.6$], again with a decrease in pain frequency from initial assessment ($M=10.60$, $SE=1.77$) to follow-up ($M=5.96$, $SE=1.05$). The Time $\times$ Parent Questionnaire of Pain-stooling relations interaction approached significance [$F(1,54)=3.84$, $P=.055$, $\eta^2=.07$]. Since the interaction approached significance and had a medium effect size, exploratory analyses were conducted. Children whose parents did not report that they had two pain-stooling relations (i.e., not IBS) had a significant decrease in pain frequency ($P<.001$, $d=.80$) from initial assessment ($M=11.33$, $SE=1.77$) to follow-up ($M=3.89$, $SE=1.05$), whereas those with parent reported pain-stooling relations maintained similar pain frequency ($P=.47$, $d=.18$) from initial assessment ($M=9.86$, $SE=3.07$) to follow-up ($M=8.04$, $SE=1.82$).

DISCUSSION

In this cohort of children who presented for medical care for functional abdominal pain, we examined two factors, child anxiety level and presence/absence of pain-stooling relations, to determine if either accounted for the persistence of pain 18 to 24 months later. Though anxiety is commonly considered related to abdominal pain in children, our results are consistent with research failing to show a relation between anxiety and abdominal pain chronicity.^{6, 7} In contrast, children with pain-stooling relations (i.e., IBS symptoms), as opposed to those without IBS symptoms, were more likely to have persistence of abdominal pain at follow-up.

Previous research suggests concurrent anxiety is related to increased pain severity and disability^{5–9} in children with functional abdominal pain and that the presence of functional abdominal pain at an early age predicts vulnerability to later anxiety disorders.²⁵ However, only one identified study found anxiety to be a significant predictor of longer term pain in children. In a 5-year follow-up of children and adolescents with functional abdominal pain, Mulvaney et al.²⁶ reported that higher anxiety at baseline was associated with greater pain symptoms at the time of second contact.²⁸ In contrast to the young children in our study,

participants in the Mulvaney study were 6 to 18-years-old with a mean age at baseline of 12 years. Further research is needed to better understand these discrepant results, but it may be that for older children and adolescents, anxiety is related to longer term pain, whereas for younger children this factor may be less salient.

In contrast to anxiety, our data suggest that GI symptoms related to IBS (i.e., pain-stooling relations) are associated with maintenance of pain (Figure 2). A recent Dutch study reported a 12-month follow-up of children 4–17 years of age presenting to primary care for abdominal pain.²⁷ The authors reported that the prevalence of abdominal pain in children with IBS symptoms did not decrease over 12 months whereas the prevalence decreased significantly in children without IBS symptoms at baseline.²⁷ Their cohort contained children and adolescents with both organic and functional disorders, and the use of an unspecified stooling questionnaire made it somewhat unclear how the diagnosis of IBS was made.^{27, 28} Although their study cohort differed somewhat from ours, their findings support our current observation that the presence of pain related to some aspects of stooling is associated with persistence of abdominal pain over time.

Often overlooked in studies of children's functional pain is the influence of the method used to obtain symptom data (e.g., diary vs. questionnaire; parent vs. child report). In our study, the parent questionnaire and the diary assessing pain-stooling relations identified symptoms that were related to longer term pain with medium effect sizes. In contrast, children's responses to the questionnaire about pain-stooling relations did not predict chronicity. Identifying IBS symptoms is a challenge for younger children who may be inattentive to their stools in general and/or fail to recognize the relationship of pain *and* stooling or pain *and* change in stool form or frequency. Parents may be more aware of pain-stooling relations when children are young and/or vocal about pain episodes and stooling symptoms, and make connections between pain and stooling that children do not. Diaries, independently noting abdominal pain episodes and stool occurrence and form, are a method of identifying temporal relations between pain and stooling for those who may not be attuned to their co-occurrence or frequency.

Despite the effectiveness of cognitive behavioral pain management strategies to reduce the symptomatology and disability of children with chronic pain disorders^{29–33}, many families who could benefit, do not receive these interventions. Surveys of families of children with chronic functional abdominal pain³⁴ suggest that many are reluctant to accept non-medical (i.e. psychosocial) *contributors* for the pain and thus, regardless of what they have been told, may falsely interpret referral to psychological services as an indication that the pain has a “psychological cause”. Further, investigations of children who develop chronic pain and disability suggest that their parents are threatened by their children's pain and inflexible in their acceptance and management of it.^{35–37} Helping families recognize the potential for a longer term course of pain that both their child and they will need to manage may induce the families of these young children to learn effective techniques to manage the child's pain and disability. That said, if children with abdominal pain are vulnerable to the development of anxiety as has been suggested,²⁵ such techniques can generalize to preventing and addressing anxiety symptoms as well. Those who have learned to manage chronic abdominal pain may be better prepared to manage/prevent anxiety.

Strengths of the study include the well characterized subject population, the use of validated, prospective diaries, and the length of follow-up. Limitations of the present study include the fact that children who had greater pain frequency at initial contact were more likely to participate in the follow-up, potentially reducing the generalizability of these results. Also, the sample size did not allow examining both anxiety and IBS symptoms in the same analyses to explore the potential interactions of these variables. Pain diaries rather than parent recall to assess the frequency of children's pain may improve the validity of the outcome variable, though in this study parent recall and diary of pain-stooling relations yielded similar results.

In summary, our study suggests that in pre-adolescent children with functional abdominal pain, the presence of IBS symptoms (pain-stooling relations) predicts persistence of pain, whereas absence of such symptoms increases the likelihood that pain will remit with time. Anxiety does not appear to play a significant role in predicting pain persistence. If this finding is replicated, families of the children with IBS symptoms may be more vigorously targeted for intervention to learn how to successfully manage chronic symptoms, minimizing disability and preventing unnecessary healthcare seeking and its attendant problems.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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What is known on this subject

- In almost one third of patients, functional abdominal pain becomes chronic.
- Concurrent anxiety predicts pain intensity and disability, but it is unclear if anxiety relates to chronicity
- Whether the presence of pain-stooling relations predicts chronicity is unknown.

What this study adds

- In school-age children with functional abdominal pain, anxiety did not predict pain chronicity
- Pain-stooling relations identified by parent questionnaire and pain and stooling diaries predicted pain chronicity
- However, child-report of pain-stooling relations failed to predict pain chronicity.

Figure 1.

Pain frequency at baseline and follow-up based on child and parent report of child anxiety at baseline.

Figure 2.

Pain frequency at baseline and follow-up based on IBS symptoms at baseline determined by prospective diary, child questionnaire, and parent questionnaire.

Table 1
Initial BASC Anxiety Scores for IBS and non-IBS groups designated by three methods

		Initial BASC ANX t-score		Initial BASC ANX t-score	P value of t-test
	n	DIARY IBS	n	DIARY not IBS	
Child BASC	9	44.0	54	50.1	.101
Parent BASC	11	53.0	50	51.2	.616
		PARENT Q IBS		PARENT Q not IBS	
Child BASC	13	48.2	41	50.3	.204
Parent BASC	14	51.6	41	52.7	.673
		CHILD Q IBS		CHILD Q not IBS	
Child BASC	23	47.6	34	51.1	.506
Parent BASC	19	50.9	34	52.2	.726