Published in final edited form as:

J Pediatr Gastroenterol Nutr. 2007 January ; 44(1): 58–62. doi:10.1097/01.mpg.0000243423.93968.7c.

Multiple Somatic Symptoms Linked to Positive Screen for Depression in Pediatric Patients With Chronic Abdominal Pain

Cheryl A. Little^{*}, Sara E. Williams[†], Martina Puzanovova[†], Erin R. Rudzinski[‡], and Lynn S. Walker[†]

^{*}Department of Pediatrics, Division of Pediatric Gastroenterology, Hepatology, and Nutrition, Vanderbilt University Medical Center, Nashville, TN

[†]Department of Pediatrics, Division of Adolescent Medicine and Behavioral Science, Vanderbilt University Medical Center, Nashville, TN

[‡]Department of Pathology, Division of Investigative Pathology, Vanderbilt University Medical Center, Nashville, TN

Abstract

Objectives—Abdominal pain is a frequent childhood complaint, comprising 2% to 4% of all reasons for pediatric office visits. Patients referred for evaluation of chronic abdominal pain (CAP) frequently present with comorbid nonspecific somatic symptoms that may complicate the medical evaluation and lead to unnecessary diagnostic tests and procedures. We tested the hypothesis that multiple nongastrointestinal (GI) symptoms in children presenting with CAP is a marker for clinically significant levels of depressive symptoms.

Methods—Participants were 400 consecutive new patients (ages 8–17 years; 63% female) referred to the pediatric gastroenterology clinic for evaluation of abdominal pain of >3 months' duration. Patients reported how frequently they experienced 7 non-GI symptoms. Patients were screened for depression with the Children's Depression Inventory.

Results—On the basis of their Children's Depression Inventory scores, 58 (15%) patients had a positive screen for clinically significant depressive symptoms. Patients with a positive versus negative depression screen did not differ by sex, pain duration or laboratory evidence of organic disease. Patient report of ≥ 3 non-GI symptoms maximized sensitivity (71%) and specificity (75%) in prediction of depression screening results. With each addition of a non-GI symptom, the odds of a positive screen for depression doubled.

Conclusions—For patients with and without organic disease findings associated with CAP, the presence of ≥ 3 non-GI symptoms should signal the practitioner to evaluate for depression and may be used as an indicator of the likelihood of depression in the absence of specific inquiry into emotional symptoms.

Keywords

Chronic abdominal pain; Children; Depression; Somatic symptoms; Functional gastrointestinal disorders

INTRODUCTION

Chronic abdominal pain (CAP), defined by the American Academy of Pediatrics (1) as persistent or intermittent abdominal pain of at least 2 months' duration, accounts for 2% to 4% of all pediatric office visits (2) and comprises the majority of referrals to pediatric gastroenterologists (3). Although organic disease is rarely identified (4,5), CAP is associated with high levels of functional disability and health service use (6).

Many children with CAP also complain of somatic symptoms that do not involve the gastrointestinal (GI) tract, including headache, other pain and fatigue (7). The presence of such symptoms complicates the medical evaluation and may result in extensive diagnostic tests and procedures that carry risk and rarely yield useful diagnostic information. Studies of unselected community samples of both children (8–11) and adults (12,13) have demonstrated a link between multiple somatic symptoms and psychiatric disorders, particularly depression. However, no studies have investigated whether presentation of multiple somatic symptoms by pediatric patients referred for evaluation of CAP may signal a clinically significant comorbid psychiatric disorder.

This study tested the hypothesis that presentation of non-GI symptoms by pediatric patients referred for evaluation of CAP predicts positive results on a standardized depression screening instrument. We evaluated the utility of each of 7 common non-GI symptoms in predicting positive results on the screening instrument. In addition, we used logistic regression and receiver operating characteristic (ROC) curves to identify the optimal number of non-GI symptoms to predict depression screening results.

PATIENTS AND METHODS

Participants

Participants were consecutive new pediatric patients referred for evaluation of abdominal pain and interviewed before evaluation at a pediatric gastroenterology clinic. Eligibility requirements were abdominal pain of at least 3 months' duration, no positive diagnosis for pain by their referring provider, no chronic illness or disability, English speaking and living with a parent.

Measures

Depressive Symptoms—The Children's Depression Inventory (CDI) (14) is a self-report measure of depressive symptoms designed for children from 7 to 17 years of age. The CDI is a validated, reliable measure that has been standardized on normal and clinical pediatric populations. Children rate, on a 3-point scale, the extent to which they have experienced each depressive symptom during the previous 2 weeks. (Two CDI items, fatigue and worry about aches and pains, were omitted from data analysis because of their overlap with somatic symptoms. The item regarding suicidal intent was not administered because of sensitivity.) Items are summed to create a total score, with higher scores representing higher levels of depressive symptoms. A cutpoint of 16 served as the criterion for a positive screen for depressive symptoms (15). Alpha reliability of the CDI for this sample was good at .85.

Non-GI Symptoms—Children's non-GI symptoms were assessed with the Children's Somatization Inventory (CSI) (16), a validated self-report measure of children's nonspecific somatic symptoms. The 7 most frequently endorsed non-GI symptoms from the CSI were assessed: dizziness, chest pain, weakness, headaches, back pain, fatigue and racing heart. Children rated the extent to which they experienced each non-GI symptom on a 5-point

scale ranging from “not at all” (0) to “a whole lot” (4) during the previous 2 weeks. In addition, children rated how much they experienced each symptom during a typical abdominal pain episode, for example, “How much do you feel this when you have a stomachache?” Symptom ratings were dichotomized by coding the symptom as “present” if patients rated it “some,” “a lot” or “a whole lot” and coding the symptom as “absent” if patients rated it “not at all” or “a little.”

Procedure

In following the research protocol approved by the institutional review board, parents of children scheduled for evaluation of abdominal pain at a pediatric gastroenterology clinic were identified by clinic staff and contacted several days before their initial clinic visit. Those who expressed interest in the study were screened for eligibility and were asked to arrive early for their child’s appointment if they wished to participate. Informed consent for the study was obtained by research staff at the clinic. The research protocol was administered before the children’s medical evaluation. A trained interviewer read the questionnaire items to children in a private room and children selected answers from a printed response sheet. Items were read to children to ensure understanding and to standardize the procedure across participants. The attending physician did not have access to participants’ responses to the research protocol. Several months after completion of data collection, patients’ medical records were reviewed for laboratory evidence of organic disease (eg, esophagogastroduodenoscopy biopsy).

Data Analysis

For data analysis, participants were divided into those with a positive-versus-negative screen for clinically significant depressive symptoms based on their CDI scores. *t* tests compared patients with positive versus negative CDI screening results with respect to age and duration of abdominal pain. χ^2 analysis tested differences in CDI screening results by sex, presence/absence of organic findings on medical evaluation and presence/absence of each non-GI symptom. Logistic regression and ROC curves (17) identified the optimal number of non-GI symptoms to predict CDI screening results. Separate analyses were conducted for non-GI symptoms reported in the previous 2 weeks and for non-GI symptoms reported to occur concurrently with abdominal pain episodes.

RESULTS

Patient Characteristics

Of the 790 children scheduled for clinic evaluation whose parents were contacted by telephone for study recruitment, 56 cancelled their clinic evaluation and 242 did not meet eligibility requirements (primarily because their abdominal pain was <3 months in duration), leaving a potential sample of 492 participants. Of these, 439 (89%) children participated; however, 39 participants were excluded because of incomplete data, leaving a final sample of 400 patients for data analysis.

Participants ranged in age from 8 to 17 (mean 11.92; SD 2.49) years, and 63% were female. The duration of abdominal pain ranged from 3 months to a reported “lifetime” of pain (mean 54.58 mo; SD 163.27). The group was 92% white, 4% African American, 1% Hispanic, 1% Asian and 2% from other ethnic backgrounds. The majority of participants lived in counties adjacent to the metropolitan center in which the medical center is located. Of the 400 participants, 390 (98%) parents gave permission for the investigators to review results of their children’s medical records for laboratory evidence of organic disease. Of these 390 participants, evidence of organic disease was documented for 54 (14%) participants;

diagnoses included peptic ulcer disease (n = 49), ulcerative colitis (n = 3), Crohn disease (n = 1) and celiac disease (n = 1).

Results of Depression Screening with the Children's Depression Inventory

On the basis of their CDI scores, 58 (15%) patients had a positive screen for clinically significant depressive symptoms. Patients with a positive screen were older (mean 12.88 y, SD 2.80) than those with a negative screen (mean 11.76 y, SD 2.40), $t(398) = 3.21$, $P < 0.01$ (Table 1). The proportion of females in the positive screen group (67%) did not differ significantly from that in the negative screen group (62%). Duration of abdominal pain in the positive screen group (mean 63.36 mo, SD 175.47) did not differ from that in the negative screen group (mean 53.08, SD 161.33). In addition, duration of abdominal pain was not significantly correlated with the CDI ($r = .05$, NS) or total number of non-GI symptoms ($r = .03$, NS). Finally, the positive screen group did not differ significantly from the negative screen group with respect to the proportion of patients with laboratory evidence of organic disease (12% in the positive depression screen group, 14% in the negative depression screen group).

χ^2 analyses tested for differences between positive versus negative depression screen groups on the presence of each non-GI symptom. The frequency of the 7 non-GI symptoms in the previous 2 weeks was significantly greater for patients with positive CDI screening results than for those with negative screening results, with Pearson χ^2 values ranging from 5.98 to 45.15, $P < 0.01$ (Fig. 1). Similarly, the frequency of non-GI symptoms experienced concurrently with abdominal pain episodes was significantly greater for patients with positive CDI screening results compared with those with negative screening results, with Pearson χ^2 values ranging from 11.06 to 35.51, $P < 0.01$.

Predicting CDI Depression Screening Results

Each non-GI symptom was a significant independent predictor of CDI screening results, with β values ranging from .37 to .94 (all $P < 0.01$). Odds ratios for the individual symptoms are presented in Table 2. No single symptom was a better predictor than other symptoms; therefore, subsequent analyses focused on the total number of symptoms reported.

Results of logistic regression analysis revealed that the total number of non-GI symptoms experienced in the previous 2 weeks was a significant predictor of CDI screening results, $\beta = .72$, $SE = .10$, $P < 0.001$. With each addition of a non-GI symptom experienced in the previous 2 weeks, the odds of a positive CDI screen increased by 2.05. Neither age nor sex was a significant covariate.

Information from these logistic regression analyses was examined graphically with an ROC curve to determine the optimal number of non-GI symptoms to predict CDI screening results. The ROC curve illustrates changes in the sensitivity and specificity of non-GI symptoms in predicting CDI screening results as the total number of non-GI symptoms endorsed increases. Sensitivity reflects the percentage of patients with a positive CDI screen who were correctly classified on the basis of the number of non-GI symptoms endorsed. Specificity reflects the percentage of patients with a negative CDI screen who were correctly classified on the basis of the number of non-GI symptoms endorsed. The area underneath the ROC curve can range from .5, which represents prediction of CDI results at the level of chance, to 1.0, which represents perfect prediction of CDI results.

Results of the ROC analysis are presented in Table 3 and Figure 2. Examination of the values for the area under the curve revealed that the criterion of ≥ 3 non-GI symptoms experienced in the previous 2 weeks represented the best statistical combination of sensitivity and specificity for predicting CDI screening results (area = .73). Specifically, the

criterion of ≥ 3 non-GI symptoms correctly classified 71% of patients with a positive screen for depressive symptoms and 75% of patients with a negative screen for depressive symptoms. This prediction was significantly better than chance ($SE = .037$, $P < 0.001$).

We repeated the logistic regression analysis to evaluate whether non-GI symptoms reported to occur concurrently with episodes of abdominal pain also predicted CDI screening results. Similar to findings for non-GI symptoms reported in the previous 2 weeks, the ROC curve indicated that the criterion of ≥ 3 non-GI symptoms reported concurrently with abdominal pain was the best statistical combination of sensitivity and specificity for predicting CDI screening results (area = .70).

DISCUSSION

In pediatric patients referred for evaluation of CAP, presentation of multiple non-GI symptoms was associated with a positive screen for clinically significant depressive symptoms on the CDI, a validated instrument that is widely used to screen for depression in children. The reliability and validity of our findings are supported by the large sample size of 400 patients and consistent results for measures of non-GI symptoms reported both in the previous 2 weeks and concurrently with abdominal pain episodes.

The best predictor of a positive screen for depressive symptoms, maximizing both sensitivity and specificity, was the presence of ≥ 3 non-GI symptoms. This criterion correctly classified 71% of patients with a positive depression screen and 75% of patients with a negative depression screen. With each addition of a non-GI symptom, the odds of scoring in the clinical range for depressive symptoms doubled. Thus, assessment of non-GI symptoms is a powerful tool for the identification of pediatric abdominal pain patients at risk for depression.

Our data do not address potential causal influences in the relationship between abdominal pain, non-GI symptoms and symptoms of depression. It is possible that depression contributes to abdominal pain and non-GI symptoms or that abdominal pain and non-GI symptoms contribute to depression. Alternatively, all of these symptoms may reflect the interaction between biological and psychological processes (18). The severity of depressive symptoms was not associated with the duration of abdominal pain, and, furthermore, the proportion of patients with a positive depression screen did not differ for patients with and without subsequent laboratory evidence of organic disease. These findings underscore the relevance of a biopsychosocial approach in the evaluation of CAP.

Previous research has shown that psychiatric symptoms and disorders are common in children with chronic or recurrent abdominal pain (19–21), but no studies have addressed how to identify these patients efficiently in a clinical setting. Limited time and resources prohibit the primary care physician or GI specialist from using mental health professionals to conduct psychological assessments of all patients with CAP. Brief assessment of non-GI symptoms by the physician is an alternative approach that provides empirical data regarding the likelihood of depression and the need to refer selected patients for formal psychological evaluation. Of course, the possibility of organic disease associated with GI and non-GI symptoms always should be evaluated. Evidence of organic disease, however, does not obviate the need to address comorbid depressive symptoms.

It should be noted that the CDI is a screening tool that does not yield a psychiatric diagnosis but rather a score indicating the severity of depressive symptoms. The clinical cutpoint identifies patients who are at high risk for meeting diagnostic criteria for a depressive disorder. Although the CDI has excellent validity and reliability, our study would have been strengthened by inclusion of a psychiatric evaluation that yielded psychiatric diagnoses for

comparison with CDI results. By including a psychiatric diagnostic evaluation, future studies also could address whether multiple non-GI symptoms may signal emotional disorders other than depression (eg, anxiety) that are common in pediatric patients with abdominal pain.

Additional research is needed to evaluate the extent to which our findings generalize beyond the tertiary care medical center that was the source of patients for this study. Results of this study suggest that brief assessment of non-GI symptoms in patients referred for evaluation of persistent abdominal pain has the potential to detect patients with clinically significant levels of depressive symptoms. Clinical trials are needed to evaluate whether early treatment of depressive symptoms will improve GI and mental health outcomes in these patients.

Acknowledgments

This research was supported by a grant to Dr Walker from the National Institute on Child Health and Development (HD23264), by a core grant to the John F. Kennedy Center at Vanderbilt University (HD15052), by the Vanderbilt Digestive Disease Research Center (DK058404) and by grant M01 RR-00095 to Vanderbilt University Medical Center from the National Center for Research Resources, National Institutes of Health.

References

1. Subcommittee on Chronic Abdominal Pain, American Academy of Pediatrics. Technical report: chronic abdominal pain in children. *Pediatrics*. 2005; 115:370–81.
2. Starfield B, Hoekelman R, McCormick M, et al. Who provides health care to children and adolescents in the United States? *Pediatrics*. 1984; 74:991–7. [PubMed: 6504643]
3. Fleisher, DR.; Feldman, EJ. The biopsychosocial model of clinical practice in functional gastrointestinal disorder. In: Hyman, PE., editor. *Pediatric Functional Gastrointestinal Disorders*. New York: Academy Professional Information Services; 1999. p. 1-20.
4. Stickler GB, Murphy DB. Recurrent abdominal pain. *Am J Dis Child*. 1979; 133:486–9. [PubMed: 433872]
5. Walker LS, Garber J, Van Slyke DA, et al. Long-term health outcomes in patients with recurrent abdominal pain. *J Pediatr Psychol*. 1995; 20:233–45. [PubMed: 7760222]
6. Campo JV, Comer DM, Jansen-McWilliams L, et al. Recurrent pain, emotional distress, and health service use in childhood. *J Pediatr*. 2002; 14:76–83. [PubMed: 12091855]
7. Walker LS, Garber J, Greene JW. Somatization symptoms in pediatric abdominal pain patients: relation to chronicity of abdominal pain and parent somatization. *J Abnorm Child Psychol*. 1991; 19:379–94. [PubMed: 1757708]
8. Beiter M, Ingersoll G, Ganer J, et al. Relationships of somatic symptoms to behavioral and emotional risk in young adolescents. *J Pediatr*. 1991; 118:473–8. [PubMed: 1999794]
9. Egger HL, Costello EJ, Erkanli A, et al. Somatic complaints and psychopathology in children and adolescents: stomach aches, musculoskeletal pain, and headaches. *J Am Acad Child Adolesc Psych*. 1990; 38:852–60.
10. Larsson BS. Somatic complaints and their relationship to depressive symptoms in Swedish adolescents. *J Child Psychol Psychiatry*. 1991; 32:821–32. [PubMed: 1918231]
11. Zwaigenbaum L, Szatmari P, Boyle MH, et al. Highly somatizing young adolescents and the risk of depression. *Pediatrics*. 1999; 103:1203–9. [PubMed: 10353930]
12. Hoptopf M, Carr S, Mayou R, et al. Why do children have chronic abdominal pain, and what happens to them when they grow up? Population based cohort study. *BMJ*. 1998; 316:1196–200. [PubMed: 9552994]
13. Dworkin SF, Von Korff M, LeResche L. Multiple pains and psychiatric disturbance: an epidemiologic investigation. *Arch Gen Psychiatry*. 1990; 47:239–44. [PubMed: 2306165]
14. Kovacs M. The Children's Depression Inventory. *Psychopharmacol Bull*. 1985; 21:995–8. [PubMed: 4089116]
15. Kovacs, M. *Children's Depression Inventory Manual*. Toronto: Multi-Health Systems; 1992.

16. Walker LS, Greene JW. Children with recurrent abdominal pain and their parents: more somatic complaints, anxiety, and depression than other patient families? *J Pediatr Psychol.* 1989; 14:231–43. [PubMed: 2754574]
17. Kraemer, HC. *Evaluating Medical Tests: Objective and Quantitative Guidelines.* Newbury Park, CA: Sage Publications; 1992.
18. Aaron LA, Buchwald D. A review of the evidence for overlap among unexplained clinical conditions. *Ann Intern Med.* 2001; 134:868–81. [PubMed: 11346323]
19. Campo JV, Bridge J, Ehmann M, et al. Recurrent abdominal pain, anxiety, and depression in primary care. *Pediatrics.* 2004; 113:817–24. [PubMed: 15060233]
20. Garber J, Zeman J, Walker LS. Recurrent abdominal pain in children: psychiatric diagnoses and parental psychopathology. *J Am Acad Child Adolesc Psych.* 1990; 29:648–56.
21. Liakopoulou-Kairis M, Alifieraki T, Protagora D, et al. Recurrent abdominal pain and headache. *Eur Child Adolesc Psychiatry.* 2002; 11:115–22. [PubMed: 12369770]

FIG. 1.
Percent of patients reporting nongastrointestinal symptom presence in the previous 2 weeks by positive vs negative depression screening group.

FIG. 2.
ROC curve for sensitivity and specificity of prediction of positive depression screening based on number of nongastrointestinal symptoms endorsed.

TABLE 1

Characteristics of patients with positive and negative Children's Depression Inventory screening results

	Negative n = 342	Positive n = 58	<i>P</i>
Age, y, mean (SD)	11.76 (2.80)	12.88 (2.40)	.01
Females, %	62	67	NS
Months' pain duration, mean (SD)	53.08 (161.33)	63.36 (175.47)	NS
Laboratory evidence of organic disease, %	14	12	NS

TABLE 2

β Weights, SEs and ORs of individual non-GI symptoms reported in the prediction of positive and negative screening for depression

Non-GI symptom	β^*	SE	OR
Dizziness	.51	.13	1.67
Chest pain	.94	.14	2.56
Weakness	.85	.14	2.33
Headaches	.37	.13	1.44
Back pain	.43	.11	1.54
Tired	.73	.13	2.08
Heart racing	.85	.13	2.35

* All β weights are significant at $P < 0.01$.

TABLE 3

Sensitivity, specificity, and ROC curve area associated with number of non-GI symptoms used as the criterion for predicting Children's Depression Inventory screening results

Non-GI symptoms	Sensitivity, %	Specificity, %	Area
1	96.6	26.9	.62
2	84.5	55.0	.70
3	70.7	74.6	.73
4	56.9	87.7	.72
5	46.6	94.7	.71
6	17.2	99.4	.58
7	3.4	100	.52