

Anxiety and Depressive Symptoms and Anxiety Sensitivity in Youngsters With Noncardiac Chest Pain and Benign Heart Murmurs

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Objective Chest pain in children and adolescents is rarely associated with cardiac disease. We sought to examine psychological symptoms in youngsters with medically unexplained chest pain. We hypothesized that children and adolescents with medically unexplained chest pain would have high rates of anxiety and depressive symptoms. **Methods** We assessed 65 youngsters with noncardiac chest pain (NCCP) and 45 comparison youngsters with benign heart murmurs using self-report measures of anxiety and depressive symptoms and anxiety sensitivity. **Results** Compared with the asymptomatic benign-murmur group, youngsters with NCCP had higher levels of some anxiety symptoms and anxiety sensitivity. Differences on depressive symptoms were not significant. **Conclusions** Though preliminary, results suggest that youngsters with chest pain may experience increased levels of some psychological symptoms. Future studies of noncardiac chest pain in youngsters should include larger samples and comprehensive diagnostic assessments as well as long-term follow-up evaluations.

Key words chest pain; anxiety; depressive; murmurs; children.

Chest pain occurs with some frequency in about 1 in 10 school-aged children (Garber, Walker, & Zeman, 1991). It is a frequent presentation in pediatric emergency rooms (Selbst, Ruddy, Clark, Henretig, & Santilli, 1988) and the second most common reason for referral to pediatric cardiologists (Brenner, Ringel, & Berman, 1984). However, medical testing rarely reveals evidence of cardiac disease (Selbst et al., 1988); the majority of pediatric chest pain cases have no clear medical etiology.

In children and adolescents, unexplained somatic symptoms are often associated with psychological symptoms and distress. Numerous studies of youngsters with complaints such as recurrent abdominal pain and headaches have found high rates of depressive and anxiety symptoms (Campo & Fritsch, 1994). Diagnostic studies (e.g., Egger, Costello, Erkanli, & Angold, 1999) indicate that youngsters with somatic complaints also have higher

rates of psychiatric disorders. In fact, somatic complaints may be the most frequent presentation of psychological problems in pediatric settings (Campo & Fritsch, 1994).

Two clinical studies suggest that youngsters with noncardiac chest pain (NCCP) may have high levels of anxiety and depressive symptoms. Kashani, Lababidi, and Jones (1982) interviewed 4 youngsters with NCCP and diagnosed all 4 with depressive disorder. Tunaoglu et al. (1995) conducted unstructured interviews with 74 youngsters with NCCP and found that nearly three quarters of the sample had psychiatric symptoms; "anxiety" was the most common problem. This finding is consistent with diagnostic studies of adults in which roughly a third with NCCP had panic disorder (Beitman et al., 1989).

Using self-report measures, we sought to assess anxiety and depressive symptoms in a sample of youngsters

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with NCCP referred to a pediatric cardiologist for evaluation. We also assessed anxiety sensitivity (AS), defined as the tendency to focus on internal sensations and think catastrophically about them. AS is thought to reflect a cognitive vulnerability to development of anxiety symptoms and specifically panic disorder (e.g., Kearney, Albano, Eisen, Allan, & Barlow, 1997). Because many youngsters with NCCP misinterpret benign pain symptoms as indications of heart problems, AS may be a salient dimension for this group.

To control for anxiety that may be associated with referral to a cardiologist (Geggel et al., 2002), we compared NCCP youngsters with a group of asymptomatic youngsters who had been referred for cardiology evaluations of benign (i.e., innocent) heart murmurs (BHM). In an effort to examine enduring rather than transient symptoms, we conducted assessments 1 to 3.5 years following cardiology evaluations.

Method

Participants

Participants were youngsters, ages 7–18 years, referred to a large university-affiliated pediatric cardiology practice because of complaints of chest pain or heart murmurs. Youngsters whose medical findings were conclusively negative were considered eligible for this study. One hundred thirty-five parents of youngsters with NCCP were contacted by telephone, of whom 114 (84%) consented to participate and 65 (48%) returned completed self-report forms. Parents of 111 youngsters with BHM were contacted, of whom 96 (86%) consented to participate and 45 (40%) returned completed self-report forms.

Youngsters completed assessments an average of 24.4 months (range, 12–42; $SD = 7.6$) following their initial medical evaluations. Because of sequence of recruitment, the interval between medical visit and self-report assessment was somewhat larger for the BHM group than for the NCCP group (27.2 months vs. 22.4 months), $t(108) = 3.3, p < .001$.

Forty-seven participants (43%) were female and 63 (57%) were male. Gender distribution was roughly equivalent in the NCCP (42% female) and BHM (43% female) groups. Mean age for the entire sample was 12.8 years ($SD = 3.3$). The BHM group was older than the NCCP group (14.1 years vs. 11.9), $t(108) = 3.5, p < .001$. Participants did not differ from nonparticipants in age (12.8 years vs. 12.6), $t(354) = .59, p > .55$, or gender distribution, both 57% female, $\chi^2(1, N = 356) = 0.00, p > .99$.

Measures

Three widely used self-report measures assessed current anxiety symptoms, depressive symptoms, and anxiety sensitivity.

Multidimensional Anxiety Scale for Children (MASC)

The MASC (March, 1997) is a 39-item self-report scale designed to assess anxiety symptoms relevant to diagnoses in the *Diagnostic and Statistical Manual of Mental Disorders*, fourth edition, in youngsters ages 8–19 years. Each item is rated on a 4-point scale ranging from 0 = *never true about me* to 3 = *often true about me*. In addition to the total score, it includes four factors: (1) physical symptoms (including tense/restless and somatic/autonomic subfactors), (2) social anxiety (including humiliation/rejection and public performance subfactors), (3) harm avoidance (including anxious coping and perfectionism subfactors), and (4) separation/panic anxiety. Test-retest reliability of the MASC is excellent. *T* scores of 65 or above are thought to reflect clinically significant symptoms (March, 1997).

Current Chest Pain. Item 18 of the MASC asks specifically about current chest pain. The respondent circles one of four answer choices to the statement *I have pains in my chest*: never true, rarely true, sometimes true, and often true. Although this is by no means a clinical assessment of chest pain, it provides some indication of the presence and frequency of chest pain at the time the self-report forms are completed.

Children's Depression Inventory (CDI)

The CDI (Kovacs, 1992) is the most widely used self-report measure of depressive symptomatology for children and adolescents. It consists of 27 items, rated from 0 to 2, assessing depressive symptoms and associated impairment over the preceding 2 weeks. Reliability and concurrent validity have been found to be high, and extensive norms are available (Kovacs, 1992). The CDI is used as a screening tool for detecting depression in nonclinical populations. A cutoff score of 17 yields high sensitivity and specificity for detecting clinical symptoms (Craighead, Curry, & Ilardi, 1995).

Child Anxiety Sensitivity Index (CASI)

The CASI (Silverman, Fleisig, Rabian, & Peterson, 1991) is an 18-item scale for rating AS in youngsters age 7 years and above. Each item is rated on a 3-point scale (none, some, a lot). The CASI has shown good internal consistency and test-retest reliability (Silverman et al., 1991). CASI scores have distinguished between youngsters with anxiety disorders and those with other

psychiatric disorders (Rabian, Peterson, Richters, & Jensen, 1993) and between youngsters with panic disorder and those with other anxiety disorders (Kearney et al., 1997). To consider AS independently of chest pain, we also derived an adjusted CASI total, which excluded two CASI items that asked specifically about heart symptoms. This adjusted total was prorated to allow for comparison with the standard total.

In addition, we examined three independent CASI factors derived from analyses by Muris, Schmidt, Merckelbach, and Schouten (2001): physical concerns, social and control concerns, and mental incapacitation.

Procedures

The institutional review boards of the New York State Psychiatric Institute and Columbia Presbyterian Medical Center approved all procedures for this study. After identifying potential participants, the cardiology practice sent a letter to the parents inviting them to contact the practice if they preferred not to be contacted by study personnel. Parents were contacted by telephone and invited to participate. We mailed assessment forms along with an information sheet explaining the study and a stamped, self-addressed envelope. A \$15 gift certificate was provided upon return of completed forms. Individuals who did not return their forms were contacted again by phone, and a final reminder was sent by mail.

Data Analysis

MASC, CDI, and CASI scores were compared using analysis of covariance with age and interval since medical visit as covariates. For the CDI and MASC scales, we compared proportions in each group that exceeded cut-offs, which may have indicated clinical problems. Non-parametric comparisons were made using chi-square tests. Significance level was set at $p < .05$.

Results

Current Chest Pain

Sixty-two percent of the NCCP group indicated that the statement *I have pains in my chest* was often true (16%) or sometimes true (46%). Twenty-four percent of this group indicated that this statement was rarely true, and 14% indicated that it was never true. In contrast, 7% of the BHM sample indicated that the statement was sometimes true (often true = 0%). Thirty-one percent of BHM youngsters indicated that the statement was rarely true, and 62% indicated that it was never true. Overall chi-square test indicates significant differences across groups on responses to this item, $\chi^2(3, N = 110) = 39.0, p < .001$.

Anxiety Symptoms

Anxiety-symptom ratings are presented in Table I. As shown, the total MASC score was significantly higher in the NCCP group after covarying for effects of age and

Table I. Analysis of Covariance (ANCOVA) Comparing Youngsters with Chest Pain and Youngsters with Benign Heart Murmurs

	Chest Pain ($N = 65$), ^a	Murmur ($N = 45$), ^a	F^b	p
	$M (SD)$	$M (SD)$		
Multidimensional Anxiety Scale for Children (MASC) total score	46.5 (15.6)	36.9 (15.3)	5.5	.02
Physical symptoms	12.6 (5.4)	8.0 (6.4)	18.3	.001
Tense	5.1 (3.2)	3.7 (3.7)	6.2	.01
Somatic	7.4 (3.0)	4.3 (3.1)	27.7	.001
Harm avoidance	15.1 (4.3)	13.1 (4.4)	2.9	.09
Perfectionism	7.6 (2.4)	6.7 (2.1)	0.90	.34
Anxious coping	7.6 (2.7)	6.4 (2.8)	3.6	.06
Social	10.1 (6.8)	9.5 (5.4)	0.70	.40
Humiliation	6.1 (4.4)	5.4 (3.8)	0.84	.36
Performance	4.0 (3.1)	4.0 (2.7)	0.23	.63
Separation/panic	8.3 (4.6)	6.8 (4.2)	0.00	.96
Children's Depression Inventory total	8.0 (6.7)	6.6 (6.5)	3.0	.09
Child Anxiety Sensitivity Index (CASI) total	29.5 (5.8)	25.7 (5.8)	12.2	.001
CASI adjusted total ^c	29.4 (5.8)	25.8 (5.7)	12.0	.001
Physiological arousal	12.5 (3.0)	10.0 (2.9)	12.6	.001
Control/social	6.9 (1.6)	6.5 (1.6)	1.9	.18
Mental incapacitation	6.9 (1.8)	6.0 (1.5)	6.9	.01

^aData were missing on some items for 1–2 participants.

^bANCOVA of diagnostic group difference, $F(1, 108)$, after covarying for age and interval since medical visit.

^cCASI adjusted total based on all items excluding items related to chest pain (prorated).

interval since medical visit. Overall, 8% of youngsters had a total MASC score of 65 or higher (11% NCCP and 7% BHM, *ns*).

Twenty-eight percent of youngsters had at least one MASC subscale *t* score of 65 or higher (31% NCCP, 24% BHM, *ns*). NCCP youngsters scored significantly higher on the MASC physical symptoms subscale. The difference was significant for both the somatic symptoms subfactor of this subscale (e.g., chest pain, dyspnea, abdominal pain) and the tension symptoms subfactor (feeling tense, uptight, or ill at ease). Differences for other MASC subscale scores were not significant. Because the MASC is not validated for youngsters below age 8 years, MASC comparisons were repeated excluding youngsters who were age 7. Differences remained significant.

Depressive Symptoms

Mean scores on CDI depressive symptoms did not differ significantly (Table I). Overall, 10 youngsters (9%) scored above 17 on the CDI. This included 11% of NCCP and 7% of BHM youngsters. Rates did not differ across groups.

Anxiety Sensitivity

As shown in Table I, mean scores of AS were significantly higher for the NCCP group after covarying for age effects. This difference was also found using adjusted CASI totals, which excluded CASI items related to cardiac concerns. When the three component factors of the CASI were considered, differences were found for physiological arousal and mental incapacitation factors, but not for the control/social evaluation factor.

Discussion

Overall, youngsters with NCCP had higher rates of some anxiety symptoms and higher levels of anxiety sensitivity than youngsters with BHM. Differences for anxiety symptoms were due mostly to somatic symptoms of anxiety, but were not limited to these. Diagnostic studies are needed to determine whether youngsters with NCCP, like adults with this presentation, may also have high rates of anxiety disorders such as panic disorder. In a preliminary interview study of 27 children and adolescents with NCCP, 15 (55%) had a current anxiety disorder diagnosis. Panic disorder occurred in 9 youngsters (33%), 3 of whom were age 12 or under (Lipsitz et al., 2003).

The mean total CASI score for the NCCP group is comparable to levels reported for youngsters being treated for anxiety disorders (Rabian et al., 1993). Higher scores on the adjusted CASI total as well as the

mental incapacity factor, which focuses on concerns about going crazy and losing control, suggest that increased anxiety sensitivity is not limited to specific focus and catastrophic worry about chest pain symptoms. Although most frequently studied as it relates to anxiety symptoms and disorders, AS may also play a role in other psychological symptoms such as hypochondriacal concerns (Otto, Demopulos, McLean, Pollack, & Fava, 1998), chronic pain (Asmundson, 1999), and functional gastrointestinal symptoms (Norton, Norton, Asmundson, Thompson, & Larsen, 1999). Thus, the relationship of NCCP and anxiety sensitivity may be independent of anxiety symptoms.

Depressive symptoms did not differ significantly across groups. Because peak onset of major depressive disorder is at age 15 years, NCCP youngsters in this sample (mean age 12) may have been at lower risk for severe depressive symptoms from a developmental perspective (Lewinsohn, Clarke, Seeley, & Rohde, 1994). However, studies of youngsters with other somatic complaints have found associations with depressive symptoms and diagnoses in similarly aged samples (e.g., Egger et al., 1999).

Because the respondents in this study reflect only a partial sample of those identified, it is possible that those who responded may be biased (e.g., toward the presence or absence of psychopathology). Nevertheless, response rates were roughly comparable in both groups, and one might expect such a bias to affect both groups in the same direction. Comparison of gender and age of participants versus nonparticipants showed no differences. Another limitation is that participants were recruited from a single suburban medical practice with a predominantly white patient population of upper socioeconomic status. Finally, group differences in this preliminary study were considered without correcting for multiple comparisons and are therefore vulnerable to type 1 error. Future studies should examine larger, more diverse samples of youngsters recruited from a variety of clinical settings.

Current findings provide evidence that for many youngsters who are evaluated for NCCP, chest pain occurs years later. However, we have no information about the level of symptoms at the time that NCCP initially prompted the medical evaluation. It is possible that patterns across groups would differ across measures if we had assessed youngsters closer to the time that chest pain symptoms prompted the cardiology evaluation. Because the follow-up interval was somewhat longer for murmur youngsters, we repeated comparisons adding length of follow-up as a covariate. Findings were the same. In future studies, youngsters with NCCP should be evaluated soon after their cardiology evaluation and

followed up at specific intervals to assess the persistence of symptoms and determine patterns of change in the symptoms over time.

Psychosocial studies of youngsters with other types of functional syndromes such as recurrent abdominal pain and headaches have helped raise physician awareness of psychological distress. These studies have also provided a groundwork for developing and testing psychosocial interventions to alleviate symptoms. Systematic study of psychological symptoms and distress in youngsters with NCCP may similarly increase recognition of psychological symptoms in this population; this may pave the way for specific interventions to alleviate symptoms and distress in youngsters with NCCP.

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References

- Asmundson, J. G. (1999). Anxiety sensitivity and chronic pain: Empirical findings, clinical implications, and future directions. In S. Taylor & I. B. Weiner (Eds.), *Anxiety sensitivity* (pp. 269–287). Hillsdale, NJ: Lawrence Erlbaum Associates.
- Beitman, B. D., Mukeji, V., Lamberti, J. W., Schmid, L., DeRosear, L., & Kushner, M. (1989). Panic disorder in patients with chest pain and angiographically normal coronary arteries. *American Journal of Cardiology*, *63*, 1399–1403.
- Brenner, J. I., Ringel, R. E., & Berman, M. A. (1984). Cardiologic perspectives of chest pain in childhood: A referral problem? To whom? *Pediatric Clinics of North America*, *316*, 1241–1258.
- Campo, J. V., & Fritsch, S. L. (1994). Somatization in children and adolescents. *Journal of the American Academy of Child and Adolescent Psychiatry*, *33*, 1223–1235.
- Craighead, W. E., Curry, J. F., & Ilardi, S. S. (1995). Relationship of Children's Depression Inventory factors to major depression among adolescents. *Psychological Assessment*, *7*, 171–176.
- Egger, H. L., Costello, E. J., Erkanli, A., & Angold, A. (1999). Somatic complaints and psychopathology in children and adolescents: Stomach aches, musculoskeletal pains, and headaches. *Journal of the American Academy of Child and Adolescent Psychiatry*, *38*, 852–860.
- Garber, J., Walker, L. S., & Zeman, J. (1991). Somatization symptoms in a community sample of children and adolescents: Further validation of the children's somatization inventory. *Psychological Assessment*, *3*, 588–595.
- Geggel, R. L., Horowitz, L. M., Brown, E. A., Parsons, M., Wang, P. S., & Fulton, D. R. (2002). Parental anxiety associated with referral of a child to a pediatric cardiologist for evaluation of a Still's murmur. *Journal of Pediatrics*, *140*, 747–752.
- Kashani, J. H., Lababidi, Z., & Jones, R. S. (1982). Depression in children and adolescents with cardiovascular symptomatology: The significance of chest pain. *Journal of the American Academy of Child and Adolescent Psychiatry*, *21*, 187–189.
- Kearney, C. A., Albano, A. M., Eisen, A. R., Allan, W. D., & Barlow, D. H. (1997). The phenomenology of panic disorder in youngsters: An empirical study of a clinical sample. *Journal of Anxiety Disorders*, *11*, 49–62.
- Kovacs, M. (1992). *The Children's Depression Inventory (CDI) manual*. Toronto, ON: Multi-Health Systems.
- Lewinsohn, P., Clarke, G., Seeley, J., & Rohde, P. (1994). Major depression in community adolescents: Age at onset, episode duration, and time to recurrence. *Journal of the American Academy of Child and Adolescent Psychiatry*, *33*, 809–818.
- Lipsitz, J. D., Masia, C. L., Apfel, H. D., Marans, Z., Dent, H., & Fyer, A. J. (2003). *Anxiety disorders in children and adolescents with non-cardiac chest pain (NCCP)*. Columbia University. Manuscript submitted for publication.
- March, J. S. (1997). *Multidimensional Anxiety Scale for Children technical manual*. Toronto, ON: Multi-Health Systems Inc.
- Muris, P., Schmidt, H., Merckelbach, H., & Schouten, E. (2001). Anxiety sensitivity in adolescents: Factor structure and relationships to trait anxiety and symptoms of anxiety disorders and depression. *Behaviour Research and Therapy*, *39*, 89–100.
- Norton, G. R., Norton, P. J., Asmundson, G. J. G., Thompson, L. A., & Larson, D. K. (1999). Neurotic butterflies in my stomach: The role of anxiety, anxiety sensitivity, and depression in functional gastrointestinal disorders. *Journal of Psychosomatic Research*, *47*, 233–240.

- Otto, M. W., Demopulos, C. M., McLean, N. E., Pollack, M. H., & Fava, M. (1998). Additional findings on the association between anxiety sensitivity and hypochondriacal concerns: Examination of patients with major depression. *Journal of Anxiety Disorders, 12*, 225–232.
- Rabian, B., Peterson, R. A., Richters, J. A., & Jensen, P. S. (1993). Anxiety sensitivity among anxious children. *Journal of Clinical Child Psychology, 22*, 441–446.
- Selbst, S. M., Ruddy, R. M., Clark, B. J., Henretig, F. M., & Santilli, T., Jr. (1988). Pediatric chest pain: Prospective study. *Pediatrics, 82*, 319–323.
- Silverman, W. K., Fleisig, W., Rabian, B., & Peterson, R. A. (1991). Childhood Anxiety Sensitivity Index. *Journal of Clinical Child Psychology, 20*, 162–168.
- Tunaoglu, F. S., Olgunturk, R., Ackabay, S., Oguz, D., Gucuyener, K., & Demirsoy, S. (1995). Chest pain in children referred to a cardiology clinic. *Pediatric Cardiology, 16*, 69–72.