

Brief Report: Psychosocial Factors and Pediatric Noncardiac Chest Pain

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Objective To investigate the associations between children's perceived chest pain severity, somatization symptoms, depressive symptoms, anxiety sensitivity, and maternal somatization symptoms in children and adolescents with noncardiac chest pain (NCCP). **Methods** Measures of chest pain and psychosocial functioning were collected from 35 participants (*M* age = 12.5 years, 54% female) with NCCP and their parents during evaluation at cardiology clinics. **Results** Among children presenting for cardiac evaluations, wide variation in ranges of pain severity, episode frequency, and history were observed. Children's somatic symptoms and fear of physiological arousal predicted significant variance in children's chest pain severity. Additionally, children's depressive symptoms and maternal somatization were both significant predictors of children's somatic symptoms. **Conclusions** These results suggest NCCP may be part of a broader pattern of somatic responding and sensitivity to physiological arousal. This pattern is associated with both child and maternal functioning. Suggestions for future research are provided.

Key words anxiety sensitivity; chest pain; child somatization; pediatric pain.

Episodes of chest pain are reported by about 10% of school-age children and are a common reason for referral to pediatric cardiologists (Garber, Walker, & Zeman, 1991; Selbst, Ruddy, Clark, Henretig, & Santilli, 1988). Multiple investigations have found that symptoms of chest pain persist for a number of patients 1–3 years after initial medical evaluation (Lipsitz et al., 2004; Selbst, Ruddy, & Clark, 1990). Noncardiac chest pain (NCCP) is the most common type of pediatric chest pain, accounting for over 80% of chest pain cases seen in pediatric settings (Tunaoglu et al., 1995; Yildirim et al., 2004). These data indicate that pediatric NCCP rarely involves cardiac dysfunction and is oftentimes unexplained.

Although NCCP is a common and persistent problem, research investigating the psychosocial factors associated with NCCP is scarce. Among the small group of studies addressing this topic, Brenner, Ringel, and Berman (1984) described NCCP as “psychogenic” and proposed that this type of pain may be evidence of a somatoform disorder. If NCCP is indeed psychosomatic in nature, then perhaps

children with NCCP are more sensitive and attentive to pain signals and more likely to experience or interpret normal physiological signals as signs of a potentially threatening physical condition. Lipsitz et al. (2004) found that children who had been diagnosed several years earlier with NCCP reported more current symptoms of anxiety, anxiety sensitivity, and physiological arousal than children with benign murmurs. Later, Lipsitz et al. (2005) found that 56% of their NCCP sample met diagnostic criteria for an anxiety disorder. Psychiatric symptoms were found in about 75% of another sample of children with NCCP, with anxiety being the most common symptom (Tunaoglu et al., 1995). In addition to child factors, research in the area of recurrent pain suggests that parents may influence somatic development by serving as models and agents for prompting and reinforcing the children's pain and illness behaviors (Craig, Cox, & Klein, 2002; Walker, Garber, & Greene, 1994; Walker & Greene, 1989).

This study examines the associations between psychosocial factors, pain severity, and somatization in children

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with NCCP. The severity of the participant's chest pain was hypothesized to be associated with higher levels of child somatic symptoms and heightened anxiety sensitivity. Children's somatization symptoms were hypothesized to be associated with higher anxiety sensitivity, depressive symptoms, and maternal somatization symptoms.

Method

Settings and Participants

Participants consisted of 35 pediatric cardiology patients aged 8–18 years who presented at three outpatient cardiology clinics within a single cardiology practice and received a discharge diagnosis of NCCP. Participants were excluded if either the parent or child was non-English speaking ($N = 1$) or if the child had a medical condition which could account for his or her reported physical symptoms (cerebral palsy, $N = 1$). Six potential participants (14%) who were approached declined to participate due to time demands or did not provide a reason. Mean child age was 12.5 years ($SD = 2.59$ years) and 54% were female. The ethnic makeup of the sample was 71.4% Caucasian, 20.0% African-American, and 8.6% Hispanic. Thirty-three mothers (94.3%) and two fathers participated in the study. Children in the sample had experienced NCCP between 1 and 52 times over the previous month ($M = 10.3$, $SD = 10.68$). The time since onset of reported NCCP symptoms ranged from 2 weeks to 6 years ($M = 14.8$ months, $SD = 16.99$ months).

Procedures and Instruments

Participants were recruited during their initial cardiology visit to be evaluated for complaints of chest pain. Prior to participation in the study, assent and informed consent were obtained from the participants and their parents. Before receiving diagnostic feedback from their cardiologist, participants and their parents completed separate self-report measures assessing demographics, pain, somatic functioning, and psychosocial functioning. This study was approved by the Institutional Review Boards of the investigating university and medical school. Children completed measures assessing pain, anxiety sensitivity, and depression. Parents completed measures of their child's and their own somatic symptoms, and demographics.

Chest Pain Questionnaire

A questionnaire was developed for use in this study to assess NCCP variables including severity, frequency, and time since onset. Subjects responded to the question, "Usually, how severe is the pain when you experience chest pain?" Thus, this rating reflected typical chest pain

severity, regardless of duration of symptoms or number of episodes. NCCP severity was rated on a 10-point scale with verbal anchors of "1- no pain" and "10- extreme, worst pain imaginable." Numeric rating scales have been classified as Well-established measures for gauging children's pain severity (Cohen et al., 2008). Frequency was assessed as the reported number of episodes in the previous month. Parents and children conferred and reached consensus on their reports of the time of onset and the number of episodes of NCCP.

Child Somatization Inventory

The Child Somatization Inventory (CSI; Garber et al., 1991) assesses the extent to which children are bothered by 35 somatic complaints. Each item is scored on a five-point rating scale. The CSI has established adequate psychometric properties (Garber et al.; Walker & Garber, 2003). For our analyses assessing chest pain, the CSI item assessing chest pain was removed to avoid criterion/predictor overlap. For this sample, the total and modified CSI had good internal consistency (CSI- total $\alpha = .80$, CSI- modified $\alpha = .79$).

Anxiety Sensitivity Inventory for Children

The Anxiety Sensitivity Inventory for Children (ASIC; Laurent, Schmidt, Catanzaro, Joiner, & Kelley, 1998) assesses children's trait-like tendencies to react to autonomic arousal with fear. This child-completed measure contains 12 items scored on a four-point scale. For the purposes of this investigation, the fear of physical arousal subscale was utilized. It includes items such as "When my body feels strange it scares me." For this sample, the fear of physical arousal subscale had a coefficient $\alpha = .83$.

Child Depression Inventory

The Child Depression Inventory (CDI; Kovacs, 1992) is a well established child-completed measure. Responses to the 27 items are scored on a three-point scale. For the current study items indicative of physical symptoms of depression were removed in order to isolate cognitive and emotional symptoms of depression from those symptoms, which might be more indicative of pain and somatic functioning. These four items included worry about aches and pains, fatigue, sleep problems, and poor appetite. Within the current sample, the CDI total score had a coefficient alpha of .88. When the physical symptoms were removed for the purposes of analyses, the modified scale (CDI non-physical) had a coefficient alpha of .87.

Symptom Checklist-90-R

The Symptom Checklist-90-R (SCL-90-R; Derogatis, 1977) assesses psychological symptoms in adults. For this

investigation, the somatization dimension was used to assess corresponding patterns of somatic functioning between mothers and their children. Mothers rated 12 physical symptoms on a five-point scale. The SCL-90-R Somatization dimension has a reported internal consistency ranging from .86 to .88 (Derogatis, 1977). In this sample, the internal consistency was .84.

Results

Preliminary correlational and between group analyses were conducted to assess the association between demographic factors and chest pain. There were no significant findings for age, gender, or ethnicity for the variables of interest in this study. Children's reported usual level of pain ranged from 2 to 10 out of 10 ($M = 6.2$, $SD = 2.14$). The means and SD s for other measures were: CSI-modified, $M = 11.9$, $SD = 10.17$; CSI-total $M = 13.9$, $SD = 10.62$; ASIC $M = 6.6$, $SD = 6.03$; CDI nonphysical $M = 7.9$, $SD = 6.14$; and SCL-90-R maternal somatization $M = 8.3$, $SD = 7.41$.

The relationships between children's chest pain and psychosocial variables were determined using Pearson product-moment correlation coefficients. Significant positive relationships were found between children's NCCP severity and child somatization-modified ($r = .42$, $p < .05$) and fear of physical arousal ($r = .46$, $p < .01$). Hierarchical regression analyses were used to predict children's usual level of chest pain severity. Child somatization (CSI-modified) was entered on the first step and fear of physical arousal (ASIC) on the second step. This was based on the rationale that NCCP can be conceptualized as relating to a larger constellation of children's somatic symptoms and feared sensations. Table I displays that child somatization alone accounted for 17% of the variance in usual chest pain severity. Fear of physical arousal added a significant 15% increment, for a total of 32% of the variance in chest pain.

Given the association between chest pain and children's other somatic symptoms, we were interested in evaluating predictors of their general somatic functioning. The relationships between general child somatization (CSI-total) and psychosocial variables were investigated using Pearson product-moment correlation coefficients. There were significant positive relationships between parent report of child somatization and children's report of depression with physical symptoms of depression removed ($r = .69$, $p < .01$) and maternal report of their own somatic symptoms ($r = .63$, $p < .01$). The two participants accompanied by fathers were excluded; thus, these analyses represent maternal somatic symptoms. Fear of physical arousal was not significantly associated with

Table I. Hierarchical Regression of Children's Chest Pain and Somatization

| | B ^a | SEB ^b | β ^c | R ² | ΔR ² | F |
|---------------------------------------|----------------|------------------|----------------|----------------|-----------------|---------|
| <i>Usual level of chest pain</i> | | | | | | |
| Step 1 | | | | | | |
| Child somatization (CSI—modified) | .09 | .03 | .42* | .17 | .17* | 6.92* |
| Step 2 | | | | | | |
| Child somatization (CSI—modified) | .07 | .03 | .33* | | | |
| Fear of physical arousal (ASIC) | .17 | .06 | .39* | .32 | .15* | 7.37** |
| <i>Child somatization (CSI—total)</i> | | | | | | |
| Step 1 | | | | | | |
| Depression (CDI nonphysical) | 1.18 | .22 | .69** | .50 | .50** | 30.92** |
| Step 2 | | | | | | |
| Depression (CDI nonphysical) | .86 | .23 | .51* | | | |
| Maternal somatization (SCL-90-R) | .53 | .20 | .37* | .58 | .08* | 21.02** |

^aB, unstandardized coefficients.

^bSEB, standard error of unstandardized coefficients.

^cβ, standardized coefficients.

* $p \leq .05$; ** $p \leq .01$.

child somatization, and was excluded from further consideration. A hierarchical regression model was created to predict child somatization. Child depression was entered on the first step as more proximal (i.e., intrinsic) factor, followed by entry of maternal somatization as a more distal factor (i.e., extrinsic) on the second step. Table I displays that children's nonphysical depressive symptoms accounted for 50% of the variance in somatization, with maternal somatization adding a significant 8% increment. Children's depressive symptoms and maternal somatization together accounted for 58% of the variance in child somatization.

Discussion

Previous research has documented influences of child psychological functioning, specifically anxiety and anxiety sensitivity, on children's NCCP (Lipsitz et al., 2004, 2005; Tunaoglu et al., 1995), but the examination of child and maternal somatization are novel to this investigation. In addition, the present study examines the association between psychosocial factors and pain severity at the point of medical diagnosis. Previous studies were conducted several weeks to 3 years after the cardiac diagnostic evaluation and feedback.

These results indicate that children's NCCP may be a symptom indicative of a larger constellation of unexplained somatic health complaints. The associations between chest pain severity and other somatic symptoms found in this study appear consistent with other pediatric literature

indicating that the presence of one somatic symptom predicts additional somatic symptoms (Santalahti, Aromaa, Sourander, Helenius, & Piha, 2005). Not only is NCCP severity associated with a greater number or intensity of other somatic complaints, but also is associated with increased fears of physical arousal. Cognitive theories of anxiety propose that anxiety sensitivity is a stable, trait like characteristic, and that heightened levels are associated with interpreting normal somatic sensations in a threatening or catastrophic manner (Laurent et al., 1998). This type of interpretation may further activate the sympathetic nervous system and promote additional anxiety-provoking somatic symptoms.

Consistent with previous child somatization literature, results from this study indicated that both child depression and maternal somatization may significantly impact children's overall somatic functioning within the pediatric NCCP population (Craig et al., 2002; Santalahti et al., 2005; Walker et al., 1994; Walker & Greene, 1989). It is interesting that fear of physical arousal was not associated with children's general somatic symptoms in this sample. It is possible that different child and family psychosocial factors influence the onset or severity of different types of pediatric somatic symptoms. This issue awaits further research.

There are several limitations to the current investigation which are important to note. This investigation included a relatively small number of participants. Also, the parents who accompanied their child to clinic were almost exclusively mothers. Larger scale investigations may be needed to recruit a sufficient sample to investigate paternal somatization and other potentially important factors that may influence children's NCCP and somatic functioning. The study was also limited in that there was not a comparison group of patients being evaluated for other benign cardiac conditions. Also, a 1–10 rather than the more typical 0–10 pain rating scale was used. This may have yielded different results than if a 0–10 scale had been used.

In future investigations, longitudinal research is needed to determine those factors that are predictive of persistent NCCP. Pediatric chest pain frequently persists after initial evaluation for many patients (Lam & Tobias, 2001; Lipsitz et al., 2004; Selbst et al., 1990), but it is not clear what factors distinguish those whose symptoms remit from those who continue to experience NCCP. Future studies may begin to explore mediators influencing NCCP and somatic symptom presentation, such as parental modeling and/or reinforcing of children's somatic symptoms. Research on the contribution of psychosocial factors to children's chest pain is in its infancy, and

additional research will be necessary to aid in identifying risk and protective factors that may serve as intervention targets to reduce NCCP.

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