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Psychiatric Disorders in Youth with Medically Unexplained Chest Pain vs. Innocent Heart Murmur

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Abstract

Objective—To examine prevalence of DSM-IV psychiatric disorders in youth with chest pain compared with a control sample with innocent heart murmur.

Study design—We assessed youth ages 8–17 years who were evaluated in cardiology settings for medically unexplained chest pain (N=100) or innocent heart murmur (N=80). We conducted semi-structured interviews and assessed medical history, quality of life, and disability.

Results—Youth with chest pain had a higher prevalence of psychiatric disorders compared with those with murmur (74% vs. 47%, $X^2 = 13.3$; $p < .001$). Anxiety disorders predominated, although major depression was also more common in the chest pain group (9% vs. 0%; FET; $p < .01$). Onset of psychiatric disorders generally preceded chest pain. Patterns were similar for boys and girls and for children and adolescents. Chest pain was associated with poorer quality of life and with pain-related disability for youth with comorbid psychiatric disorder.

Conclusions—In childhood and adolescence, medically unexplained chest pain is associated with a high prevalence of psychiatric disorders. Systematic mental health screening may improve detection and enhance management of these patients.

Keywords

Children; adolescents; cardiology; anxiety

Chest pain is a common symptom in childhood and adolescence, affecting about 10% of the population (1). It is a frequent presentation in medical settings, prompting over 600,000 office visits annually in the United States (2). Prior to adulthood, chest pain is only rarely an indication of cardiac disease (3,4). Non-cardiac medical factors are sometimes implicated, including specific musculoskeletal conditions such as costochondritis, pulmonary conditions

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such as asthma or pneumonia, gastrointestinal problems, or other identifiable causes such as cocaine use. However, a large majority is labeled idiopathic or is described as “musculoskeletal,” with no clear etiology (6).

Despite this benign medical picture, chest pain often persists. In a follow-up of 407 youngsters seen in a PED for chest pain, 58% had pain 3–36 months after the evaluation (7). Many experience disability, including school absence, sleep problems, and restriction of activities (7–9). In adults with noncardiac chest pain (NCCP) systematic diagnostic assessment reveals high rates of psychiatric disorders, particularly panic disorder (10). In pediatric populations psychiatric disorders are frequently undetected (11).

In two preliminary studies we identified high rates of psychiatric disorders in youth with unexplained chest pain (12,13). We undertook a case-control study comparing youth seen in outpatient cardiology consultation for medically unexplained chest pain to a control sample of youth with innocent heart murmur. We hypothesized that psychiatric disorders and, specifically anxiety disorders, would be more prevalent in the chest pain group. We examined associations with sex and age in an ethnically diverse sample recruited from multiple clinical settings. We expected that youth with chest pain would have poorer quality of life and greater disability compared with youth who were referred for murmur. Finally, we examined medical history across groups.

Methods

We recruited patients with chest pain and murmur from three pediatric cardiology clinics affiliated with a large university medical center. We recruited sequentially from October 2003 through August 2006. We enrolled youth ages 8–17 who 1) were referred to a pediatric cardiologist for evaluation of chest pain or murmur, 2) showed no evidence of cardiac disease based on minimum of a) medical history, b) physical examination, and c) electrocardiogram, as well as tests (e.g., echocardiogram) if performed based on physician judgment, 3) were able to communicate in English, and 4) showed no evidence of other medical conditions that could explain the chest pain based on the above evaluation. Other specific medical conditions (e.g., costochondritis, peptic ulcer, asthma, upper respiratory infection) were detected in less than ten percent of chest pain cases seen in these settings.

The Institutional Review Board of Columbia University and Weill-Cornell Medical Center approved all procedures. Physicians introduced the study to the family at the time of the medical evaluation and requested written permission for researchers to contact them. Physicians were instructed to approach all medically eligible families, without consideration of appropriateness or motivation. Specially trained clinicians conducted private, in-person interviews with the child and then with a parent. Interviews were conducted in offices in the medical center or, if requested, at the patient’s home. Clinical Interviewers were naïve to study hypotheses and were told that the study’s aim was to assess psychiatric disorders in pediatric cardiology patients. In addition to extensive didactic training, interviewers demonstrated reliability in matching of two independent interviews and rating of audiotaped interviews (see below). Interviews were audiotaped and reviewed to ensure adherence. The interviewer obtained written informed consent from a parent and written assent from the child or adolescent before beginning the evaluation. Evaluations were conducted 1–4 weeks following the cardiology visit at which determination was made of cardiac health. Families were compensated for their time and effort.

We used the Anxiety Disorders Interview Schedule for DSM-IV: Child and Parent Versions (ADIS-IV-C/P; 18) to assess current psychiatric disorders. The ADIS-IV includes separate interviews for the child and parent (about the child), provides detailed coverage of all

anxiety, mood, and other common disorders, and has good reliability. For each diagnosis, the clinician assigns a composite clinician severity rating (CSR) based on both child and parent reports. When reports were discrepant, the clinician used clinical judgment. The CSR ranges from 0 (absent) to 8 (very severe), with 4 indicating diagnostic threshold. Inter-rater reliability for seven raters was computed based on five audiotaped cases using intraclass correlation coefficients (ICCs) for CSR ratings and kappas (k) for diagnoses. CSR reliability was excellent for all diagnoses (ICCs: .83 for specific phobia to .93 for conduct disorder). Agreement was excellent for all diagnoses (k =.88 for Post traumatic stress disorder to 1.0 for conduct disorder), with the exception of specific phobia, which was good (k = .77).

We used the Child Health Questionnaire, a 28-item parent rated form (CHQ-PF; 19) to evaluate quality of life. The CHQ-28 assesses several domains of functioning and yields two summary scores: physical health and psychosocial health. It has been used in a wide range of medical populations and subscales have good internal consistency and reliability. We used the 15-item Functional Disability Inventory (FDI; 20) to assess pain-specific impairment. Developed for recurrent abdominal pain, we adapted the scale for chest pain. The child rates how much trouble s/he had with each activity (e.g., attending school) in the past two weeks from 0 (no trouble) to 4 (impossible). Youth with murmur were instructed to refer to the problem that brought them to the doctor. Internal consistency (α) was 0.79.

Statistical Analyses

We compared demographic characteristics across chest pain and murmur groups using chi square contrasts and t tests. Diagnostic rates were contrasted using chi square or Fisher's Exact Tests (FET). Odds ratios (OR) and confidence intervals are included as estimates of proportions when appropriate. We further examined degree of difference between chest pain and murmur groups at different thresholds of diagnostic severity (CSR), using relative risk (RR), which better represents degree of difference across high and low prevalence. Sex and age effects were examined using Breslow-Day (BD) tests for homogeneity. Quality of life and disability were contrasted using t tests. Effects sizes were calculated using Cohen d .

Results

Physicians approached a total of 137 eligible patients with chest pain. Sixteen refused permission to be contacted and 21 could not be scheduled or later refused, yielding 100 interviewed (73% of eligible). Of 104 patients with murmur approached, eleven refused permission to contact and thirteen could not be scheduled or refused the interview, yielding 80 interviewed (77% of eligible). There were no differences in demographic characteristics between chest pain and murmur groups (Table I). Children ranged in age from 8.0 to 17.9 years. Mean age did not differ across groups. Sex distribution was also comparable across groups, with boys comprising a somewhat higher percentage. Ethnic composition was also similar with diverse ethnicity in both groups.

Duration of chest pain ranged from one month to 10 years (M =11.8 months; SD =18.8), with 48% indicating duration of six months or more. Lifetime history of most common illnesses and medical events such as hospitalization did not differ across groups (Table II). Youth in the chest pain group were more likely to have seen a physician for other pain complaints (e.g., headaches, abdominal pain) and were more likely to have seen a health professional due to an emotional problem. It was similarly common in both groups for a close relative to have undergone medical treatment for a heart problem in the past year.

Youth with chest pain had higher prevalence of a) any DSM-IV disorder and b) any anxiety disorder compared with youth with a murmur (Table III). Rates of major depression and oppositional defiant disorder also differed across groups. Among specific anxiety disorders,

differences were significant for separation anxiety disorder, panic disorder, generalized anxiety disorder, obsessive compulsive disorder, and specific phobia.

Psychiatric disorders were generally of early onset and long duration. Mean age of onset for any diagnosis was 6.3 years (SD=2.3) and mean duration was 6.0 years (SD=2.8). Average age of onset for some disorders was later (e.g., major depression: M=12.7 years; SD=2.7). Those with shorter duration of chest pain (<6 months) did not differ in rate of psychiatric diagnosis (73%) from those with duration of six months or longer (78%). In most cases (n=67; 90%), onset of psychiatric disorder preceded chest pain by at least one year. In three cases onset of chest pain occurred first (>1 year), in three cases both began in the same year and in one case chronology was not ascertained.

Forty seven percent of youth with chest pain and 21% with murmur had a psychiatric diagnosis of at least moderate (CSR ≥ 5) clinical severity ($X^2=10.7$; df=1; $p<.001$). Diagnoses in 29% of chest pain and 5% of murmur groups reached marked (CSR ≥ 6) clinical severity ($X^2=17.1$; df=1; $p<.001$). Relative risk of diagnosis for chest pain vs. murmur increased in linear fashion from diagnostic threshold to higher severity thresholds (CSR ≥ 4 : RR=1.56[CI 1.2–2.0]; CSR ≥ 5 : RR=2.21[CI 1.4–3.5]; CSR ≥ 6 : RR=5.8[CI 2.1–15.8]; CSR ≥ 7 : RR=6.4[CI 0.8–50.1]). In many cases, more than one psychiatric disorder was diagnosed in the same individual. Among chest pain 56% of youth had more than one diagnosis; among murmur 26% had more than one diagnosis ($X^2=16.1$; $p<.001$).

Patterns of difference for any psychiatric disorder did not differ for boys and girls (BD; $p=0.55$) or for children and adolescents (BD; $p=0.53$). Patterns were similar for any anxiety disorder and for most specific anxiety disorders. However, boys but not girls had higher rate of oppositional defiant disorder in the chest pain group (6% vs. 0%; $p<.05$; FET). Prevalence of major depression differed only among adolescents (18% for chest pain vs. 0% for murmur; $X^2=7.81$; df=1; $p<.005$).

Youth with chest pain had impaired quality of life compared with youth with murmur (Table IV). Most prominent differences were in the areas of bodily pain, mental health, perception of general health, and family factors. Groups did not differ significantly on level of pain-related disability (FDI; M=5.2 vs. 3.8; $t=1.63$, df=177; $p=.10$). However, youth with chest pain and comorbid psychiatric diagnosis (n=74) had greater disability than a) those with murmur (M=6.1; SD=6.5 vs. M=3.8; SD=5.4; $t=2.35$ df=152; $p<.05$) and b) those with chest pain but without psychopathology (M=6.1; SD=6.5; vs. M=2.8; SD=3.2; $t=2.45$; df=98, $p<.05$).

Discussion

Children and adolescents with medically unexplained chest pain had a higher prevalence of DSM-IV psychiatric disorders than a control sample with innocent heart murmur. Onset of psychopathology typically predated onset of chest pain by more than one year, suggesting that psychiatric symptoms are not merely consequences of chest pain. The high prevalence of anxiety disorders in youth with chest pain is consistent with findings in other pediatric somatic syndromes including recurrent abdominal pain (21), headache (22), and juvenile fibromyalgia (23). The specific anxiety diagnosis which seems to distinguish chest pain from some other pediatric somatic syndromes is panic disorder. Anxiety disorders are among the most treatable childhood psychiatric disorders (24). However, when left untreated they tend to run a chronic or recurrent course (25) and cause disability.

Level of pain-related disability overall in the chest pain group was less severe than has been reported in some pain syndromes, possibly due to its episodic nature. Disability was significantly greater only for chest pain with comorbid psychiatric disorder, which supports

the immediate relevance of psychiatric diagnosis. In adults, comorbid psychiatric disorder also predicts more persistent chest pain (26). Follow-up of this and other samples is needed to determine if this is the case for pediatric chest pain. Differences in medical history were noted only for other somatic complaints and emotional problems. Thus data do not support an association between chest pain and early illness experiences (14), but rather point to co-occurrence of chest pain and other somatic symptoms. Despite frequent co-occurrence of somatic symptoms in children, DSM-IV somatization disorder is rarely diagnosed, so absence of this diagnosis is not surprising. Many families in both groups reported that a relative received medical treatment for cardiac illness in the past year. Results therefore do not support cardiac illness in relatives as having a specific etiologic role in pediatric chest pain (27).

Youth with innocent murmur were recruited from the same settings and completed similar evaluations as youth with chest pain. To date, most studies examining pediatric somatic samples have lacked a control group (23) or have included control groups of healthy patients identified from routine visits (21). However, medical help-seeking is associated with psychological characteristics of parents (28) and children (29) and specialist referral is influenced by parent requests (30). As such, earlier findings of increased psychiatric disorders may not reflect a specific association with the somatic presentation. Current findings in chest pain vs. murmur controls thus bolsters the evidence for a specific association of pediatric pain/somatization and psychiatric disorder. The pattern of increased relative risk for diagnosis in chest pain with increasing clinical severity thresholds suggests that although more severe disorders may be specific to chest pain, milder ones may be linked to non-specific characteristics (e.g., medical help seeking, worry about illness) shared with murmur. Prevalence of psychiatric disorders in the murmur group was higher than rates reported in primary care samples, which are generally around 20% (31). It is possible that the ADIS-IV is more sensitive than interviews commonly used in epidemiologic studies. However, it is also possible that some specialist-referred patients, such as those with murmur, have more psychiatric disorders than those seen in primary care. Unfortunately, we did not include a third, non-patient control group to provide additional context for observed rates.

Some other limitations of the study should be noted. First, the diagnostic assessment was conducted a week or longer after the cardiologist's evaluation and reassurance regarding cardiac health. Pain, distress, and disability may have been greater immediately prior to the cardiology evaluation. Information indicating that psychopathology onset preceded chest pain was based on retrospective reports which may be incomplete or biased. Finally, we did not systematically exclude information related to medical history as this was relevant to psychiatric diagnoses (e.g., panic attack during episode of chest pain). As such, interviewers sometimes became aware of group status in the course of the evaluation.

After ruling out cardiac and other acute medical causes, physicians should consider the possibility of psychiatric disorders in youth with chest pain. A brief screen could improve detection and facilitate timely referral for mental health treatment. When chest pain is persistent and distressing interventions, targeting chest pain itself, should be considered.

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Table 1**Characteristics of Chest Pain and Murmur Groups**

	Chest pain (n=100)	Murmur (n=80)
Sex: N (%)		
Male	57 (57%)	48 (60%)
Female	43 (43%)	32 (40%)
Age in years: M (SD)	12.6 (2.59)	12.2 (2.7)
Children (age 8.0–12.9 years): N (%)	50 (50%)	41 (51%)
Adolescents (age 13.0–17.9 years): N (%)	50 (50%)	39 (49%)
Ethnicity: N (%)		
White	44 (44%)	44 (55%)
African American	15 (15%)	12 (15%)
Hispanic	26 (26%)	12 (15%)
Asian	4 (4%)	2 (2%)
Other/mixed/unknown	11 (11%)	10 (12%)
Number of siblings: M (SD)	1.95 (1.4)	1.90 (1.2)
Parents		
Age: M (SD)		
Mother:	42.7 (6.2)	42.9 (6.0)
Father:	44.5 (7.9)	45.0 (6.0)
Education - years: M (SD)		
Mother:	14.2 (2.9)	14.6 (2.3)
Father:	14.3 (3.5)	14.5 (2.7)
Employed outside of home		
N (%)		
Mother:	62%	66%
Father:	81%	85%

There were no significant group differences for any characteristics

Table 2**Medical History for Chest Pain and Murmur Groups**

	Chest pain %	Murmur %
Consultation for:		
Allergies	39	36
Asthma	25	19
Diabetes	0	0
Seizures	4	0
Headaches	26*	10
Abdominal pain	26*	9
Hypertension	1	0
Irregular heart beat	12	9
Behavioral problems	6	6
Emotional problems	14*	5
Other medical:		
Ever hospitalized overnight	10	7
Surgery	13	14
Fracture (arm leg)	12	20
Concussion/head injury	5	5
Lost consciousness	5	6
Burn	5	2
Needed stitches	27	27
Prescription medication	27	25
Prescription - psychiatric	5	4
Relative treated for heart related problem in past year	48	44

* Proportion differs from murmur group at $p < .05$

Table 3DSM-IV Psychiatric Diagnoses in Chest Pain and Murmur Groups^a

	Chest pain (N=100) N (%)	Murmur (N=80) N (%)	Odds Ratio (CI)
Any DSM-IV disorder	74 (74)	38 (47)	3.1 (1.7–5.9)***
Any anxiety disorder	70 (70)	33 (41)	3.3 (1.8–6.2)***
Separation Anxiety	22 (22)	8 (10)	2.5 (1.1–6.1)*
Panic Disorder	17 (17)	2 (2)	8.0 (1.8–35.7)***
With Agoraphobia	2 (2)	1 (1)	1.6 (0.1–18.1)
GAD	32 (32)	11 (14)	2.9 (1.4–6.3)**
OCD	6 (6)	0 (0)	NA*
PTSD	2 (2)	2 (2)	0.8 (0.1–5.8)
Social Phobia	37 (37)	20 (25)	1.8 (0.9–3.4)
Specific Phobia	43 (43)	16 (20)	2.8 (1.4–5.4)***
Any depression	9 (9)	0 (0)	NA**
Major Depression	9 (9)	0 (0)	NA**
Dysthymic disorder	0 (0)	0 (0)	NA
Other disorders			
ADHD	13 (13)	7 (9)	1.5 (0.6–4.1)
Conduct Disorder	2 (2)	1 (1)	1.6 (0.1–18.1)
ODD	7 (7)	0 (0)	NA*
Substance Abuse	1 (1)	0 (0)	NA
Enuresis	1 (1)	2 (2)	0.4 (0.0–4.4)
Sleep Terror	1 (1)	0 (0)	NA
Eating Disorder	0 (0)	0 (0)	NA
Somatization Disorder	0 (0)	0 (0)	NA
Learning Disorder	5 (5)	4 (5)	1.0 (0.3–3.8)
School Refusal ^b	11 (11)	2 (2)	4.8 (1.0–22.4)*

GAD: Generalized anxiety disorder; OCD: Obsessive compulsive disorder, PTSD: Post traumatic stress disorder, ADHD: Attention deficit hyperactivity disorder, ODD: Oppositional defiant disorder.

*
p<.05,

**
p<.01,

p<.005

^aDiagnoses are overlapping; some participants had more than one diagnosis.

^bSchool refusal is not a DSM diagnosis, but is relevant to anxiety and impairment.

Table 4

Comparison of Chest Pain and Murmur Groups on Quality of Life (CHQ)

Subscale	Chest pain Mean(SD)	Murmur Mean (SD)	<i>t</i>	Cohen's <i>d</i>
Physical	91.5 (18.7)	95.2 (12.7)	1.5	--
Role/Social	88.8 (24.8)	92.0 (21.5)	0.9	--
Role-Limitations	93.2 (17.3)	94.1 (16.7)	0.4	--
Bodily Pain	63.8 (26.3)	83.5 (18.3)	5.9**	0.87
Family Activities	79.5 (23.5)	88.0 (18.3)	2.7*	0.40
Behavior	69.1 (20.6)	74.1 (18.3)	1.7*	0.26
Global Behavior	78.6 (21.0)	81.2 (20.9)	0.8	--
Mental Health	72.9 (20.1)	81.2 (15.0)	3.1*	0.47
Self Esteem	76.0 (20.8)	81.9 (20.0)	1.9*	0.29
Health Perception	69.7 (21.3)	79.0 (17.1)	3.2**	0.48
Global Health	25.6 (24.6)	21.1 (23.7)	1.2	--
Parental-Emotional	53.6 (32.6)	73.6 (22.8)	4.8**	0.71
Parental-Time	83.3 (23.6)	90.9 (18.6)	2.4*	0.36
Family Cohesion	70.9 (25.0)	71.4 (26.4)	0.1	--
Psychological-Summary	46.0 (11.8)	51.6 (7.8)	3.7**	0.56
Physical-Summary	48.9 (11.1)	54.0 (6.8)	3.6**	0.55

*
P<.05,**
p<.001^a Lower scores on CHQ scales indicate poorer quality of life^b Effect size, Cohen *d*