

Original Article

Role of anxiety and depression in adolescents with chest pain referred to a cardiology clinic

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Abstract *Background:* We carried out this study in order to evaluate the causes of chest pain in teenagers and the role of anxiety and depression in this age group compared with the normal population. *Methods:* In this prospective case–control study, all patients aged 11–18 years with chest pain and no history of trauma and referred to a paediatric cardiology clinic from March, 2009–April, 2010 were selected. A chest pain protocol including a detailed history, full physical examination, required blood tests, electrocardiography, and echocardiography was performed for all. The presence of depression and anxiety and their severity were assessed by Beck questionnaires. The patients were compared with age- and sex-matched, randomly selected healthy controls. *Results:* In total, 194 patients with a mean age of 14 ± 2 years were selected. The most frequent presentation was idiopathic chest pain (43.3%), followed by the psychological group (29.9%). These groups had no abnormal points in history, physical, and para-clinical tests. Moderate-to-severe depression was found in 45.9% in the patients group, compared with 17.6% of controls, which was statistically significant ($p = 0.016$). Moreover, anxiety was detected in 67.5% of patients versus 15.4% in controls, which is a statistically significant difference ($p = 0.009$). Cardiac chest pain with 9.27% was the most common type of organic causes. *Conclusion:* Chest pain during teenage is more prevalent, but not risky. Undergoing a detailed history and full physical examination can help diagnose the causes in the majority of cases. Given the prevalence of a psychological group as well as role of anxiety and depression in most patients, referring to a psychiatrist is suggested.

Keywords: Chest pain; depression; anxiety; cardiac; psychological

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CHEST PAIN IS THE MOST COMMON REASON FOR AN unscheduled visit to paediatric emergency rooms and the second most common cause for referral to paediatric cardiologists. Chest pain in children usually is not due to a serious disease, in contrast to chest pain in adults, which raises concern about coronary ischaemia.^{1–3}

Paediatric chest pain can be classified into cardiac and non-cardiac ones.⁴ In the former, congenital structural disease, acquired myocardial, pericardial or coronary artery diseases,⁴ and arrhythmia constitute the aetiology. Non-cardiac chest pain^{5–8} is caused by

thoracic cage disease,⁹ sickle-cell anaemia, and gastrointestinal,^{10–12} pulmonary,^{13,14} and psychological problems,^{5,15–17} and are, by far, the most common causes of chest pain in children and adolescents.

In this study, the causes of chest pain and the role of anxiety and depression in developing chest pain in adolescents were evaluated.

Materials and methods

In this prospective case–control study, all patients aged 11–18 years, referred with chest pain to the Pediatric Cardiology Clinic of Hejazi Heart Center, Shiraz, Iran, during March, 2009 to April, 2010 were selected. Any case of trauma-associated chest pain was excluded from the study. Patients with intercurrent

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Table 1. Characteristics of studied groups with and without chest pain.

	Case (194 (100)) (n (%))	Control (194 (100)) (n (%))	p
Age (years, mean \pm SD)	14 \pm 2	14.1 \pm 2.6	0.396
Sex (female, n (%))	92 (47.4)	92 (47.4)	1
Family history of heart diseases (%)	73 (37.6)	10 (5.1)	0.00
Electrocardiographic finding (n (%))	4 (2.1) <ul style="list-style-type: none"> • T-inversion: 1 (0.5) • PVC: 1 (0.5) • LAD+high voltage R in left leads: 1 (0.5) • Short PR interval: 1 (0.5) 	2 (1) <ul style="list-style-type: none"> • PVC: 2 (1) 	0.7
Echocardiographic finding (n (%))	28 (14.4) <ul style="list-style-type: none"> • MVP: 11 (5.6) • PFO: 6 (3.1) • MR: 3 (1.5) • HCM+dilation of aorta: 2 (1) • TVP+moderate TR: 1 (0.5) • MR+TR: 1 (0.5) • TOF: 1 (0.5) • Mild AI: 1 (0.5) 	8 (4.1) <ul style="list-style-type: none"> • PFO: 6 (3.1) • Mild TR: 2 (1) 	0.001

AI = aortic insufficiency; HCM = hypertrophic cardiomyopathy; LAD = left anterior descending artery; MR = mitral regurgitation; MVP = mitral valve prolapse; PFO = patent foramen ovale; PVC = premature ventricular contractions; TOF = tetralogy of Fallot; TR = tricuspid regurgitation; TVP = tricuspid valve prolapse

viral or chest infections were not excluded. Hejazi Heart center is a referral centre affiliated with Islamic Azad University, Kazerun Branch, Shiraz, Iran. A chest pain protocol including a detailed history, full physical examination, required blood tests, electrocardiography, and echocardiography was performed for referrals. Exercise stress test was not carried out as a routine evaluation exam. Complete blood count, creatinine phosphokinase, troponin-I, lactate dehydrogenase and sickle-cell prep were requested, if needed. A special questionnaire was filled in by the physician for all patients.

The presence of depression and anxiety and their severity were assessed by Beck Depression Inventory and Beck Anxiety Inventory questionnaires. Each questionnaire contains 21 questions, each with four items, with a score range of 0–63. A total score of 0–13 is considered as normal, 14–19 as mild, 20–28 as moderate, and 29–63 as severe symptoms. The questionnaires were filled by the patients.

The control group was chosen randomly from sex- and age-matched students, from schools in different areas of the city, without chest pain complaint. After complete history and physical examination, electrocardiogram, and echocardiography were performed for the control group as well. They were also asked to fill the depression and anxiety questionnaires. All participants with moderate-to-severe anxiety or depression on Beck tests were assessed by a single mental health professional to confirm the diagnosis.

Statistical analysis was performed using SPSS version 15. Continuous variables are presented as

mean \pm SD and compared using independent samples t-test. Categorical variables are presented as frequencies and corresponding percentages, and their relationships were assessed by Pearson's correlation and analysis of variance test. A p-value < 0.05 was considered to be significant.

Results

In the present study, 194 adolescents each to the case and control groups, aged 11–18 years, were enrolled. Patients had no previous history of thoracotomy or sternotomy. Characteristics of the groups are shown in Table 1. Positive family history of heart disease was present in 37.6% of the participants in the patient group and 5.1% in the control group, the difference being statistically significant (p = 0.00).

Characteristics of their pain are presented in Table 2. As it is clear, the pain was mostly described as a tingling and sharp sensation at rest in the left side of the chest lasting for a few seconds and aggravated with respiration. Patients did not exhibit pleural or pericardial friction rub on physical examination.

As shown in Table 3, organic causes including cardiac, pulmonary, musculoskeletal, and gastrointestinal problems were detected in 25.7% of patients. In 29.9% of them, psychological causes with positive Beck tests indicating sign and symptoms of moderate-to-severe degree of anxiety and depression were identified. The remaining patients (43.3%) with normal physical and para-clinical

Table 2. Characteristics of chest pain in patients referred to the cardiology clinic.

	n	%
Episodes of pain		
At rest	128	66
In activity	66	34
Type of pain		
Tingling or sharp	141	72.7
Vague	53	27.3
Length of pain		
Few seconds	69	35.5
Few minutes	100	51.5
Few hours	25	12.9
Aggravating factors		
Respiration	149	76.8
Change in position	121	62.4
Exercise	66	34
Eating	7	3.6
Tenderness	15	7.73
Redness of the chest cage	5	2.6
Palpitation	42	21.6
Location of pain		
Left sided	171	88.1
Bilateral	0	0
Left hand	37	19.1
Right hand	15	7.7
Epigastric tenderness	8	4.1
Infra-nipple	143	73.7

Table 3. Classification of chest pain (n (%)) in patients referred to the cardiology clinic.

Idiopathic	84 (43.29)
Psychological	58 (29.9)
Organic	50 (25.7)
Cardiac	18 (9.27)
Musculoskeletal	15 (7.7)
Respiratory	9 (4.6)
Gastrointestinal	8 (4.1)
Others	2 (1)
Total	194 (100)

exams and normal or mild degree of anxiety and depression were assigned to idiopathic groups.

It was shown that 45.9% of the patients group had variable degrees of depression compared with 17.6% of the control group, which was statistically significant ($p=0.016$) (Table 4). Moreover, anxiety was detected in 67.5% of the patients group compared with 15.4% in controls, which was statistically significant ($p=0.009$) (Table 5).

According to Beck test results, mild, moderate, and severe depression were seen in 18, 14.9, and 12.9% of patients with chest pain, respectively. Among controls, the corresponding rates were 8.7, 5.2, and 3.7%, not significantly different from the rates in patients ($p=0.854$) (Table 6).

Table 4. Prevalence rates of depression in patients with chest pain and controls.

	Case (n (%))	Control (n (%))	p
Depressed	89 (45.9)	34 (17.6)	0.016
Non-depressed	105 (54.1)	160 (82.4)	
Total	194 (100)	194 (100)	

Table 5. Prevalence rates of anxiety in patients with chest pain and controls.

	Case	Control	p
Anxiety	131 (67.5)	30 (15.4)	0.009
Non-anxiety	63 (32.5)	164 (84.6)	
Total	194 (100)	194 (100)	

Table 6. Prevalence of varying degrees of depression in patients with chest pain and controls.

	Case (n (%))	Control (n (%))	p
Mild depression	35 (39.3%)	17 (50%)	0.854
Moderate depression	29 (32.6%)	10 (29.4%)	
Severe depression	25 (29.2%)	7 (20.6%)	
Total	89 (100)	34 (100)	

Different degrees of anxiety – mild, moderate, and severe – were detected in 25.3, 25.3, and 17% of patients and 7.2, 6.2, and 2% of controls, respectively, which were not statistically significant ($p=0.426$) (Table 7).

Discussion

Chest pain accounts for about 13% of visits to paediatric emergency services.¹⁶ It is also the second most common cause of referrals to paediatric cardiology clinics, after heart murmur.^{11,15,16} It occurs at all ages but is seen mostly in the adolescent age group.^{10,18,19}

There are a number of causes for recurrent chest pain, which can be broadly divided into the following categories: cardiac, respiratory, gastrointestinal, and musculoskeletal, known as organic causes, and psychological and idiopathic, known as non-organic causes. The frequency of these causes varies widely between studies, based on the method of evaluation used. Generally, idiopathic pain is the most common cause followed by musculoskeletal pain, whereas cardiac pain is the least common. It is noteworthy to say that patients with organic causes of chest pain may experience different degrees of depression or anxiety as well; however, as a general rule, chest pain

Table 7. Prevalence of varying degrees of depression in patients with chest pain and controls.

	Case (n (%))	Control (n (%))	p
Mild anxiety	49 (37.4%)	14 (46.7%)	0.426
Moderate anxiety	49 (37.4%)	12 (40%)	
Severe anxiety	33 (25.2%)	4 (13.3%)	
Total	131 (100)	30 (15.4%)	

was categorised on a psychological basis when no organic cause could be identified.

Cardiac chest pain due to cardiac conditions accounted for 9.27% of the referral patients in the present study. Chest pain may be the first complaint that points out an unsuspected anatomic heart defect (Table 1). Different studies have reported rates from 6 to <20%.^{1-3,6-8,10,14,18-23} Cagdas et al²⁴ evaluated all the chest pain referrals by electrocardiography 24-hour Holter monitoring and exercise test. The rate of cardiac chest pain was 23.3% in their study. Wang et al used ambulatory 24-hour oesophageal pH monitoring for the evaluation of recurrent chest pain without respiratory or musculoskeletal problems. They found acid reflux diseases as the most frequent cause of chest pain in 58.3% of their referrals,¹² whereas this rate was 4.1% in the present study. Danduran et al²³ performed pulmonary function and exercise test for the evaluation. They revealed that abnormal pulmonary function test was observed in 26% of patients not previously diagnosed with hyperactive airway disease, whereas a pulmonary cause was found only in 4.6% of the present patients.

Chest pain due to myocardial ischaemia may occur in patients who have abnormal coronary artery anatomy including congenital anomalies of the coronary artery, coronary artery fistulas, stenosis, or atresia of the coronary artery ostium. They usually describe their ischaemic chest pain as a squeezing sensation, tightness, pressure, constriction, burning, or fullness in the chest, as well as associated with exertion. Although, in contrast to adults, cardiac chest pain is rare in children and adolescents, patients with characteristic ischaemic chest pain need full and careful evaluation and prompt referral to paediatric cardiologist to diagnose the cause of pain.

In the present study, it was shown that the rate of positive family history of heart disease was different in the patient group compared with the controls (37.6 versus 5.1%). Apart from the prominent role of genetic factors in such families, it can be concluded that chest pain in children growing up in families with positive history of heart diseases may resonate with their parents' concerns too. These parents and

consequently their children could be more anxious about their symptoms and feel more depressed.

Psychogenic chest pain in older children occasionally can result from anxiety or a conversion disorder triggered by recent stressors in personal or family life. It was shown in this study that one-third of the adolescents who presented to the cardiology clinic with a complaint of chest pain were suffering from moderate-to-severe anxiety and depression disorders. Tunaoglu et al conducted unstructured interviews with 74 youngsters with non-cardiac chest pain and found that nearly three-quarters of them had psychiatric symptoms of which anxiety was the most common. Their finding was consistent with diagnostic studies of adults where roughly a third of patients with non-cardiac chest pain had panic disorders.²⁵ Psychological chest pain is a diagnosis by exclusion, and is not necessarily the same as idiopathic pain. It is seen in all ages, but has a higher incidence in teenagers, particularly girls.

The direct relationship of chest pain with anxiety is a known issue in adults. In children and adolescents, unexplainable somatic symptoms are often associated with psychological problems. In fact, these symptoms could be a presentation of underlying psychiatric illnesses.^{16,17,26} Psychological chest pain may be a symptom indicative of a larger constellation of unexplained somatic health complaints as well.²⁶

As observed in the present study, there was a significant difference between patients referred with chest pain and the controls in terms of presence of depression and anxiety ($p=0.016$ and 0.009 , respectively), although we could not find any significant difference regarding severity of symptoms ($p=0.854$ and 0.426 , respectively). This could magnify the importance of stressful situations in adolescents' lives. Emotional stress is very common; adverse life events such as changes in the family structure (births, deaths, divorce, etc.), school problems, and physical or psychological illnesses in the family can often be identified as stressors.^{27,28} In depressed children, an association between severity of chest pain and the presence of one or more somatic symptoms has been reported.²⁹

Cheng et al indicated that these patients are more sensitive to stress and their body conditions. Accordingly, they have problems in adjustment mechanisms and also in interpersonal relations, leading to less social support during stressful situations.²⁷ Anxiety can also enhance tension in thoracic muscles and cause pain. Autonomic and humeral sequel of anxiety can also cause oesophageal and cardiac dysfunctions, resulting in persistent pain.²⁹

Lipsitz et al³⁰ showed higher significant rates of anxiety symptoms and higher levels of anxiety sensitivity in youngsters with non-cardiac chest pain,

compared with those with benign cardiac murmur, but no significant difference regarding depression symptoms was detected.³¹ The inconsistency of the present study results may be due to the mean age of our patients, which was higher, and lends support to the finding that symptoms of depression start from older age.⁵

As it was noted, patients with somatic problems such as chest pain do not refer directly to psychiatrists, but usually to paediatric cardiology clinics or emergency rooms. Although these patients usually have no organic cause for the pain, they often have a significant degree of functional impairment.^{1,2,5,11} In addition to the burden of financial cost, they are neither diagnosed as having psychiatric problems nor treated effectively.¹¹

Conclusion

Chest pain is common in children referred to cardiology clinics. Although most children have benign causes for their pains, a thorough evaluation seems warranted. Usually, detailed history and physical examinations are sufficient to diagnose the causes; however, for those without any organic finding, continuing symptoms and disability, a psychotherapist and sometimes a clinical psychologist need to be involved. Chest pain clinics in referral centres comprising general paediatricians, cardiologists, and psychiatrists are recommended for efficient management and treatment of such patients.

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Conflicts of Interest

None.

Ethical Standards

The study was approved by Research Ethic Committee of Islamic Azad University and Research Ethic Board of the Hospital, and had been conducted according to the principles in the Helsinki Declaration of 1975, as revised in 2008. All participants and their parents provided their written informed assents and consents for participation.

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