

Original Article

Anxiety, depression, suicidal ideation, and stressful life events in non-cardiac adolescent chest pain: a comparative study about the hidden part of the iceberg

Kayı Eliacik,¹ Ali Kanik,² Nurullah Bolat,³ Hilal Mertek,¹ Baris Guven,⁴ Ulas Karadas,⁴ Buket Dogrusoz,⁴ Ali Rahmi Bakiler⁴

¹*Division of Adolescent Medicine;* ²*Department of Paediatrics;* ³*Department of Child and Adolescent Psychiatry;* ⁴*Department of Paediatric Cardiology, Izmir Tepecik Training and Research Hospital, Izmir, Turkey*

Abstract Chest pain in adolescents is rarely associated with cardiac disease. Adolescents with medically unexplained chest pain usually have high levels of anxiety and depression. Psychological stress may trigger non-cardiac chest pain. This study evaluated risk factors that particularly characterise adolescence, such as major stressful events, in a clinical population. The present study was conducted on 100 adolescents with non-cardiac chest pain and 76 control subjects. Stressful life events were assessed by interviewing patients using a 36-item checklist, along with the Children's Depression Inventory and Spielberger's State-Trait Anxiety Inventory for children, in both groups. Certain stressful life events, suicidal thoughts, depression, and anxiety were more commonly observed in adolescents with non-cardiac chest pain compared with the control group. Moreover, binary logistic regression analysis showed that trouble with bullies, school-related problems, and depression may trigger non-cardiac chest pain in adolescents. Non-cardiac chest pain on the surface may point to the underlying psychosocial health problems such as depression, suicidal ideas, or important life events such as academic difficulties or trouble with bullies. The need for a psychosocial evaluation that includes assessment of negative life events and a better management have been discussed in light of the results.

Keywords: Chest pain; depression; suicidal thoughts; stressful life events; adolescents

Received: 31 July 2016; Accepted: 9 October 2016; First published online: 10 November 2016

CHEST PAIN IS A COMMON SYMPTOM THAT RESULTS IN visits to the emergency department or referral to paediatric cardiologists. Although most cases of chest pain in this age group are non-cardiac and do not require medical treatment, it may cause recurrent hospital admissions, school absences, restriction of activities, and anxiety in adolescents and their parents.^{1–4} Chest pain without any obvious medical organic cause has been labelled with several names such as atypical chest pain, neurocirculatory asthenia, angina-like chest pain, unexplained chest

pain, idiopathic chest pain, and non-cardiac chest pain.^{1,5–7}

Age is a major factor in the aetiology of paediatric chest pain. Young children are more likely to have a cardiorespiratory cause for their pain, such as cough, asthma, pneumonia, or heart disease, whereas adolescents are more likely to have pain associated with stress or a psychogenic disturbance.^{1,8} Therefore, psychosocial evaluation following a comprehensive medical evaluation is of utmost importance for diagnosing non-cardiac chest pain in this age group.

As a general rule, chest pain was categorised as psychological when no organic cause could be identified. Psychogenic chest pain in older children can occasionally result from anxiety or a conversion disorder triggered by recent stressors in personal or

Correspondence to: K. Eliacik, MD, Department of Paediatrics, Division of Adolescent Medicine, Tepecik Training and Research Hospital, Izmir, Yenisehir, Turkey. Tel: 0090 232 4696969/3460; Fax: +90 232 4330756; E-mail: kayieliacik@gmail.com

family life.^{9–11} There have been no published studies, however, on the relationship between non-cardiac chest pain, suicidal ideation, and stressful life events in children or adolescents thus far. This study examined the relationship between state–trait anxiety, depression, suicidal thoughts, stressful events, and non-cardiac chest pain in a clinical sample and aimed to contribute to the management of adolescent chest pain.

Materials and methods

Participants and procedure

The study group comprised 100 adolescents with an age range of 13–18 years, recruited from outpatient paediatric cardiology clinics, and diagnosed with non-cardiac chest pain. After the initial evaluation, routine chest radiography was obtained in all cases, and, if necessary, an echocardiographic examination was performed. Trauma-associated cases as well as cases related to cardiac, musculoskeletal, respiratory, gastrointestinal, and any other organic factors were excluded. The control group consisted of 76 randomly chosen sex- and age-matched volunteer adolescents without chest pain who visited paediatric outpatient clinics for routine control. After a medical evaluation, they were asked to fill in the same questionnaires.

Patients with non-cardiac chest pain were referred to the adolescent medicine outpatient clinic after their initial cardiology visit. After receiving diagnostic feedback from their cardiologist, participants were invited to take part in the study. Participants provided their assent after being assured about confidentiality. Informed consent for study participation was requested from the parents and adolescents at the beginning of the study.

Data collection instruments

First, a checklist that contained questions about sex, age, monthly household income, stressful situations, and suicidal ideation in adolescents was filled in by the physician for all cases. Items about stressful events that were used in this study were inspired from the life event instrument of Aggarwal¹² and the Adolescent Life Events Checklist of Wang.¹³ These items were improved by conducting a pilot study on 10 adolescents. Participants were asked by the physician if any of these events had caused significant stress during the past 6-month period to determine the possible stress-causing life events. The 36 items included questions about inability to balance extracurricular activities, school-related problems – for example, failed an examination or had a heavy workload – trouble with bullies, romantic relationships, family-related

problems – for example, poor economy, death of a parent, or parents' divorce – commuting problems, etc.

After the interview, self-report scales were given to the participants, including depression and state–trait anxiety inventories. The Children's Depression Inventory for children was developed by Kovacs on the basis of the Beck Depression Inventory.¹⁴ The Children's Depression Inventory is a commonly used measure of depression symptoms in children; 27 multiple-choice items assessed the severity of depressive symptoms during the last 2-week period. Higher scores represent more severe depression, and scores below 19 are considered to be normal. The scale is widely used and it has been demonstrated to have good concurrent validity and reliability (Cronbach's α 0.80) in Turkish language.¹⁵

The Spielberger's State-Trait Anxiety Inventory for children is a self-reported tool used to measure trait–state anxiety.¹⁶ The form has 20 items for measuring the general tendency to react to situations with anxiety (trait anxiety) and 20 items for assessing the degree of anxiety that the person may be experiencing from moment to moment (state anxiety). Translation to Turkish language and validation were performed by Ozusta et al,¹⁷ and the Cronbach's α coefficients were 0.82 and 0.81, respectively.

Statistical analyses

Statistical Package for Social Sciences Software (SPSS 21, Chicago, Illinois, United States of America) was used for the analysis. The χ^2 test was used to compare proportional data such as differences in gender, suicidal ideation, stressful life events, and the presence of depression. Independent sample Student's t-test was used to compare the means of self-report test scores between the groups. A binary logistic regression analysis was performed to determine the independent effect of state–trait anxiety, depression, gender, trouble with bullies, grades lower than expected, and break-ups on non-cardiac chest pain.

Results

Socio-demographics

A total of 100 adolescents with non-cardiac chest pain participated in the present study, and 76 volunteer adolescents were enrolled into the control group. The members of both groups were predominantly from low-income families, without significant income differences. The average age of the non-cardiac chest pain and control groups was 14.5 ± 1.7 and 14.9 ± 2.1 years, respectively ($p = 0.114$). There were 68 (68%) girls in the non-cardiac chest pain group, whereas there were 53 (69%) girls in the control group ($p = 0.806$).

Recent stressful life events

Among 36 items, trouble with bullies, lower grades than expected, an upcoming examination/interview, break-up with a girlfriend/boyfriend were significantly common in the non-cardiac chest pain group. Sexual assault was detected in two female cases in the non-cardiac chest pain group, and it was not statistically significant, although outstanding (Table 1).

Suicidal ideation

It was observed that 22 (22%) subjects in the non-cardiac chest pain group had suicidal ideas, whereas this number was 4 (5.26%) in the control group ($p < 0.001$).

Anxiety and depression scores

The number of cases with a depression score over the cut-off value was 54 (54%) in the non-cardiac chest pain group, whereas the number of cases was five (6.5%) in the control group ($p < 0.001$). The state-trait anxiety and depression scores were significantly higher in the chest pain group ($p = 0.017$, 0.007 , and < 0.001 , respectively) (Table 1).

Binary logistic regression analysis

Binary logistic regression analysis applied to the entire sample also showed that adolescents with depression were 1.535 times, those with trouble with bullies were 4.321 times, and those having an upcoming examination were 3.560 times more likely to have non-cardiac chest pain when compared with those without such issues ($p < 0.001$, 0.022 , and 0.024 , respectively) (Table 2).

Discussion

To our knowledge, there is no study that clearly articulates suicidal ideation and stressful situations among adolescents with non-cardiac chest pain. The findings of the present study provide evidence that stressful events combined with depression may have an interactive role on non-cardiac chest pain. Therefore, on the basis of the findings of the present study, we suggest that a specific structured psychosocial assessment method, including a negative life event checklist, would be beneficial in the evaluation of non-cardiac chest pain.

The volunteer adolescents in the study group, 68% of which consisted of girls, were selected consecutively. As a group, girls tend to report higher frequency of somatic complaints than boys do. It has been suggested that girls tend to react more with subjective symptoms, whereas boys more often react by behaviour, for example, delinquency or alcohol use.^{18,19}

Table 1. Comparison of stressful life events, anxiety, and depression inventories between the groups.

Events	Chest pain group (n = 100)	Control group (n = 76)	p-Value
New girl friend or boy friend	26	20	0.962*
Outstanding personal achievement	18	10	0.384*
Change in eating habits	21	10	0.176*
Change in social activities	13	13	0.447*
Change in living conditions	23	14	0.460*
Outstanding achievement of siblings	19	11	0.429*
Change in health of a family member	15	10	0.729*
Mother stops or starts working	10	9	0.696*
Change of major subject/branch	26	11	0.063*
Trouble with parents	30	17	0.257*
Trouble with bullies	34	12	0.006*
Parents unemployed	12	12	0.468*
Increased workload at school	33	27	0.726*
Change in financial status of parents	16	7	0.186*
Theft of personal belongings	7	4	–
Dropped more than one class	11	2	–
Lower grades than expected/failed important examination	49	16	<0.001*
Serious argument with a teacher	17	6	0.076*
Lack of attendance	21	23	0.160*
Change of school	17	20	0.133*
Sex problems	3	2	–
Marriage of an emotionally close sibling	2	2	–
Marriage	4	0	–
Excessive alcohol or drug use by family member	4	5	–
Jail term	0	0	–
Serious argument with a close friend	14	15	0.310*
Minor violation of law	6	6	0.621*
Appearing for an examination	46	22	0.021*
Major personal injury or illness	6	4	–
Break-up with a girlfriend/boyfriend	20	6	0.025*
Divorce between parents	7	2	–
Rustication from school	9	3	–
Death of a close friend	3	2	–
Death of a close family member	7	3	–
Sexual assault	2	0	–
Pregnancy	2	0	–
Inventories scores			
State anxiety	38.48 ± 8.87	35.40 ± 7.00	0.017**
Trait anxiety	37.66 ± 5.98	35.31 ± 5.17	0.007**
Depression	19.23 ± 6.16	9.13 ± 4.25	<0.001**

* χ^2 test

**Independent sample t-test; significant p-values are shown in bold

Regarding gender differences in clinical studies, pain problems during adulthood have indicated specific gender distributions; women compared with men report greater pain with the same pathology;²⁰ however, there is a need for future studies for detecting potential or actual differences in how boys and girls develop various pain complaints in adolescents, such as unexplained chest pain.

The results indicate that life events such as bullying and problems related to school were the most serious stressors among adolescents with non-cardiac chest pain. Exposure to bullying may result in an array of negative outcomes such as poor mental health and lower sense of well-being.^{21–23} The stress of being bullied is strongly associated with a higher risk for psychosomatic complaints, suicidal thoughts,

Table 2. Univariate and multivariate analysis: factors independently associated with non-cardiac chest pain.

	Univariate analysis		Multivariate analysis				
	Values	p	B	SE	Wald	p	OR (95% CI)
Gender	0.061*	0.806**	-0.322	0.633	0.259	0.611	0.725 (0.210–2.505)
Depression	12.842***	<0.001****	-0.429	0.070	37.917	<0.001	1.535 (1.339–1.760)
State anxiety	2.728***	0.007****	0.081	0.062	1.694	0.193	1.084 (0.960–1.225)
Trait anxiety	2.476***	0.014****	-0.029	0.042	0.474	0.491	0.972 (0.896–1.054)
Lower grades than expected	14.480*	<0.001**	0.626	0.565	10.231	0.267	1.871 (0.619–5.658)
Appearing for an exam	5.296*	0.021**	1.270	0.562	5.109	0.024	3.560 (1.184–10.658)
Break-up with a girlfriend/boyfriend	5.026*	0.025**	1.109	0.788	1.982	0.159	3.032 (0.647–14.205)
Trouble with bullies	7.418*	0.006**	1.463	0.641	5.207	0.022	4.321 (1.229–15.186)
Constant	–	–	0.610	2.115	0.083	0.773	1.841

When predictors are included in binary logistic regression. Nagelkerke R^2 : 0.710.

* χ^2 value

** χ^2 test

***t-value

****Independent sample t-test

and depression during adolescence.^{24–26} A study conducted in Northern Ireland revealed that being bullied at school was one of the most important stressors among adolescents who survived a suicide attempt.²⁷

School is the workplace of adolescents, where they spend a lot of time and may face severe social and academic challenges.²⁸ This study identified significant associations between school-related stressors and non-cardiac chest pain. The results of the univariate analysis showed that lower grades than expected were associated with non-cardiac chest pain. In addition, the binary logistic regression analysis results showed that an upcoming examination was independently associated with non-cardiac chest pain as a somatic complaint. When adolescents feel that the workload of school is higher than their capacity, physiological activation and somatic complaints may occur.^{29,30} Findings of this study suggest that pressure to get good grades as well as an upcoming examination may be of importance in predicting non-cardiac chest pain among adolescents. Moreover, sexual assault, which was detected in two cases of the study group, was found to be a devastating, distressful event that should be taken into consideration.

The direct relationship between chest pain and anxiety is a known issue in adults.^{31,32} In children and adolescents, chest pain is often associated with anxiety.^{9–11,33} In line with these studies, anxiety scores of the non-cardiac chest pain group were significantly higher in the univariate analysis; however, unlike certain stressful events and depression, anxiety was not found to be an independent predictor of adolescent non-cardiac chest pain according to the binary logistic regression analysis. These findings are in need of further validation to determine the

complex relationship between anxiety, depression, and stressful events and non-cardiac chest pain.

Adolescence is a key period for the development of depressive symptoms.³⁴ It is well shown that first depressive episodes may develop following the occurrence of a major negative life event.³⁵ Previous studies have reported that certain negative events increase the risk of suicidal ideation, suicidal attempts, and major depressive disorder.^{36–38} In addition, adolescents with somatic complaints are more likely to be depressed.^{37,39} Common psychosomatic symptoms are shared risk factors of later suicidal behaviours.⁴⁰ In line with these studies, depression was found to be a predictive factor for the occurrence of non-cardiac chest pain as a psychosomatic complaint in the present study. Moreover, suicidal ideation was more frequent in the study group. The authors suggest that, according to the stress-diathesis model, stressful life events could act as a diathesis that could lead to depression symptoms, associated with non-cardiac chest pain and suicidal behaviours.^{41,42}

Limitations and strengths

The present study has a number of limitations. First, data to measure anxiety and depression were collected from self-report questionnaires, which could be biased and fall short of producing clinical diagnoses. Second, the cross-sectional nature of the study prevented the ability to detect a direct causal relationship between the variables. Third, the interviewers were not blinded during the structured interview, which was held to determine suicidal ideation and negative life events; however, the use of a face-to-face interview could be more appropriate for obtaining correct answers for the “taboo” questions.

Conclusions

Our results suggested that non-cardiac chest pain is a stress-related disorder. Non-cardiac chest pain can be a symptom of a negative life event experience, suicidal ideation, and depression among adolescents. Our findings suggest an important role for paediatricians, paediatric cardiologists, and other clinicians for obtaining additional information about stressful events and the need for psychosocial evaluation in adolescents with non-cardiac chest pain. Screening adolescents for stressful events, suicidal ideation, and a baseline level of other depression symptoms perhaps by using an event checklist may help avoid unnecessary investigations, repeated medical evaluations, and high cost of these procedures to the healthcare system.

The present study revealed that, non-cardiac chest pain can be the unestablished part of an important psychosocial health problem. Adolescents may develop skills to cope with stress caused by bullies or school-related problems. Comprehensive diagnostic assessments and development of new intervention methods are important avenues for future research.

Acknowledgements

None.

Authors' Contributions: K.E., A.K., and N.B. carried out all the statistical analyses and drafted the article; B.G., U.K., B.D., and A.R.B. critically revised and approved the article; H.M. and K.E. collected the data.

Conflicts of Interest

None.

Ethical Standards

The authors assert that all the procedures contributing to this study complied with the ethical standards of the relevant national guidelines on human experimentation and with the Helsinki declaration, and have been approved by the local ethics committee (19.01.2016/17/26).

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