

Cardiovascular Disorders in Adolescents with Chest Pain

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Abstract

Objective: To detect cardiovascular abnormalities in adolescents with chest pain.

Methods: In this cross sectional study, the subjects were 25 adolescents with chest pain who came to the Cardiac Center of Dr. Hasan Sadikin General Hospital, Bandung during the period of January 2008 to January 2011. The presence of established cardiovascular disorders were based on history, physical examination, electrocardiography and echocardiography

Results: It was found that 13/25 adolescents with chest pain had cardiovascular abnormalities. Of the 25 teens that came with chest pain, most of which showed normal electrocardiographic results, only 9/25 of those with dysrhythmias experienced sinus tachycardia and 8 had a first degree AV block. Echocardiography examination showed only four patients with abnormal cardiac anatomy. No correlation between nutritional status and chest pain, and cardiovascular abnormalities and chest pain ($p=0.206$ and $p=0.632$, respectively). There was a positive correlation between sex and cardiovascular abnormalities in adolescents with chest pain ($p=0.007$). Chest pain is a prevalent problem that is usually benign and that it frequently signals underlying cardiac disease.

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Conclusions: Cardiovascular abnormalities in adolescents with symptoms of chest pain are found in some cases. There is no correlation between female and male adolescents with chest pain and cardiovascular abnormalities.

Keywords: Adolescents, cardiovascular, chest pain

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Introduction

Adolescence is a transition period in human life cycle characterized by dynamic changes of physical and psychological status.¹ Adolescents face many complex issues that are associated with changes in physical condition, nutritional adequacy, psychosocial development, emotion and intelligence that may create conflicts in their health. One of the disorders that often trigger teenagers to see the doctor is chest pain.²

Chest pain in children and adolescents is one of the symptoms which often causes concerns among parents that triggers them to bring their children to the pediatrician, pediatric cardiologist, or to the emergency room. Chest pain in adult patients is often associated with serious heart problems, but this situation does not occur in children and adolescent. It

is mainly associated with the problems in the lung as well as the idiopathic, musculoskeletal, gastrointestinal, and psychogenic problems.^{3–8} A careful and an accurate approach, therefore, is necessary to determine the etiology of the chest pain. In most cases, determination of the cause is sufficient by history taking and physical examination. Further diagnostic examination should be selected appropriately to reduce the cost of unnecessary examinations.^{5,9,10} In spite of the low prevalence of chest pain that is associated with cardiovascular abnormalities in children and adolescents, this type of chest pain still need to be considered and appropriate examinations should be selected to reduce unnecessary costs.

The objective of this study was to detect cardiovascular abnormalities in adolescents with chest pain

Methods

This is a cross-sectional study which was conducted at Dr. Hasan Sadikin Hospital, Bandung. Subjects

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were adolescents who visited the Cardiac Centre, Dr. Hasan Sadikin General Hospital, Bandung with chest pain as the primary complaint from January 2008 to January 2011. The presence of established cardiovascular disorders was based on history, physical examination, electrocardiography, and echocardiography. The electrocardiography (ECG) was performed by using the FX-7000 electrocardiograph (Fukuda Denshi Medical Instruments Co., Ltd.) and the electrocardiograms were further interpreted by a pediatric cardiologist. The echocardiography was done by a pediatric cardiologist from the Department of Child Health, Dr. Hasan Sadikin General Hospital, Bandung. This was performed using echocardiography Vivit7 General Electric with 2.4 and 5 MHz transducers. The exclusion criteria were parents of patients who refused to participate in the study. No patient refused to join the study.

All subjects were examined in the supine position, then all subjects were subjected to two-dimensional echocardiography examination, M-mode and M-mode with color Doppler. All test results were printed and stored in a CD. Recorded data on height, weight, body mass index, history taking, physical examination, and the results of echocardiography were grouped into 3 age group: 1) Early adolescence/early (early adolescence), 11–13 years old or junior high school, 2) mid adolescence (adolescence middle); 14–16 years old or senior high school, 3) adolescence-up (late adolescence): 17–20 years old or college.¹¹ The classification of nutritional

status was used for children aged 5–19 years to assess the Z score of the body mass index (BMI) by age and gender according to the WHO reference 2007. The classification of nutritional status is as follow: Z score >2 Standard Deviation (SD): Obesity >1 SD–<1 SD: Overweight >-1 SD–<1 SD: Nutrition normal <-1 SD: Nutrition less.¹²

Results

Data were collected from 25 adolescents with symptom of chest pain who visited the Cardiac Centre, Dr. Hasan Sadikin General Hospital, Bandung, Indonesia. This number of adolescents represented about 2.1% of all children and adolescents who visited the hospital during the study. The characteristics of the subjects are also listed (Table 1).

The subjects consisted of 10 males and 15 females categorized as early adolescence/early (11–13 years; n=9; 3 male and 6 female), middle adolescence (14–16 years; n=11, 6 male and 5 female), and advance adolescence (17–20 years; n= 5, 1 male and 4 female). The nutritional status were obesity 2/25, overweight 16/25, normal nutrition 5/25, and malnutrition 2/25 subjects.

No adolescent who woke up during sleep due to chest pain was found. Two teenagers with chest pain had fever and the two teenagers showed sinus tachycardia dysrhythmias in ECG. Fever in the two teenagers was caused by an upper respiratory tract infection. Two teenagers experienced chest pain that was accompanied

Table 1 Characteristics of Subjects

Characteristics	Male n = 10	Female n = 15
Age		
Early adolescence/early (11–13 years)	3	6
Middle adolescence (14–16 years)	6	5
Advanced adolescence (17–20 years)	1	4
Body mass index (kg/m²)	22.86 (14.97–32.91)	23.82 (15.62–34.91)
Nutritional status		
Obesity	1	1
Overweight	9	7
Normal nutrition	0	5
Malnutrition	0	2
Systolic pressure (mmHg) (mean SD)	75 (8.49)	80.33 (11.09)
Diastolic pressure (mmHg) (mean SD)	117 (4.83)	114.66 (6.39)

SD: standard deviation

by burning sensation in the epigastric region showing a sinus tachycardia rhythm disturbance on electrocardiography. The serological testing in the two teenagers also show positive results for *Helicobacter pylori*. A teenager was found with chest pain and had previously been identified as having congenital heart disease, i.e. atrial septal defect (Table 2).

Table 2 Characteristics of Chest Pain

Characteristics of Chest Pain	Number
Acute pain	2
Awakened during sleep due to pain	-
Chest pain associated with activity, syncope	2
Chest pain accompanied by fever	2
Chest pain accompanied by intense burning epigastria area	2
A history of congenital heart disease who had been diagnosed previously	1

There were 13/25 adolescents with chest pain who had cardiovascular abnormalities. Of the 25 teenagers that came with chest pain, most of them showed normal electrocardiographic results with only 9 of them experienced dysrhythmias, 8 had sinus tachycardia and a teenager had a first-degree AV block. Echocardiography examination showed that only four patients had anatomic abnormalities of the heart (Table 3).

Table 3 Cardiovascular Abnormalities in Adolescents with Chest Pain

Cardiovascular Abnormalities	Number
Electrocardiography	
Normal	16
Dysrhythmias	
Sinus tachycardia	8
First-degree AV block	1
Echocardiography	
Normal	21
Anatomical abnormalities	
Mitral valve prolapse is mild	1
Small secundum atrial septal defect	2
Large secundum atrial septal defect	1

There was no correlation between nutritional status and adolescents. No correlation was also found between cardiovascular abnormalities and adolescents with chest pain ($p=0.206$ and $p=0.632$). There was a positive correlation between sex and cardiovascular abnormalities in adolescents with chest pain ($p=0.007$) (Table 4).

Table 4 Cardiovascular Abnormality Correlation in Adolescents with Chest Pain

Correlation of Cardiovascular Abnormalities	p
Gender	0.007
Age	0.632
Nutritional status	0.206

Discussion

Adolescence is the transitional period between the childhood and adulthood and is influenced by complex neuroendocrine factors. It is often associated with the myth of morbidity and behavioral aberrations. Adolescents often experience stress due to pressures resulting from the development process and from the outside environment leading to misalignment between emotional disturbance and behavioral disorders.^{2,12} One complaint that is often found in adolescence is chest pain.

In this study we found 25 adolescents with chest pain. Epidemiological data in the United States shows that the percentage of cases of chest pain in children who come to the emergency room is between 0.3 and 0.6% per year with an average age of 12 to 13 years and a ratio of boy to girl of 1:1 to 1.6:1. Among adolescents, this condition is more common in female sex, which is similar to this study that shows chest pain is more common in young women.¹³

Chest pain in children can be caused by various factors. Some of the frequent causes are abnormalities of the chest wall (12–85%), as a secondary condition to respiratory disorders (12–21%), and psychiatric (5–17%) and gastrointestinal (4–7%) causes. Meanwhile, the etiology of congenital heart as the cause of chest pain is only found in 0–6%.¹⁴ In contrast to a recent study, we found anatomical abnormalities in 4 of 25 adolescents with chest pain that include mild mitral valve prolaps and small secundum atrial septal defect. Only a teenager with a large secundumatrial septal defect requiring interventional cardiology was found.

Eight adolescent chest pain in this study presented sinus tachycardia on ECG examination. This condition occurs when the sinoatrial node issues higher impulses that subsequently lead to an increase in heart rate. Increased impulse in the sinoatrial node is due to the lack of oxygen, pain, fever, stress, dehydration, and activities.¹⁴ In this study, 2/25 adolescents with sinus tachycardia also experienced fever, 2/25 had chest pain with burning sensation in the epigastric region and positive serological result for *Helicobacter pylori*. This study did not differ with previous reports stating that the percentage of chest pain due to gastrointestinal disorders is 6.4%.¹⁵

We also found a teenager with chest pain and an electrocardiographic examination that shows an AV block degree. The AV block degree slows the delivery of impulses in the atria, AV node. This block shows the type of conduction disturbances in normal sinus impulse and the ventricular response. ECG shows sinus rhythm, normal QRS segment and a PR interval that extends beyond the upper limit of interval adjusted to age. Single-degree AV block can occur in normal children.

Most patients are asymptomatic and require no further therapy.¹⁴

The National Hospital Ambulatory Medical Care Survey in the United States in 2002–2006 found that chest pain complaints in children is associated with infection (21.1%).¹⁵ In this study, the number of infection-associated chest pain is found to be lower than in previous studies since we only found two teenagers with fever associated with upper respiratory tract infection.

This study shows that only 52% adolescents have chest pain associated with cardiovascular abnormalities. Others have unknown etiology. This is consistent with previous reports stating that the etiology of 40% of chest pain in adolescents is not known.¹⁵

This study only found one male teenager with chest pain that relates to cardiovascular abnormalities. The finding that more girls experience chest pain in this study compared to boys might associate with emotions and stress factors and might not associate with cardiovascular abnormalities.

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