

## Evaluation of Clinical Manifestation, Demographics Parameters and Causes of Chest Pain in Children

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### Abstract

#### Background

Chest pain is one of the common chief complaints in children which can be benign and/or life-threatening. In this retrospective study, the causes of chest pain, associated factors, and clinical characteristics in children have been evaluated in order to have a better diagnosis and clinical approach.

**Materials and Methods:** 680 patients with chest pain were referred to the pediatric cardiology clinic from Jan 2017 to July 2019. All the information about past medical history, family history, chest pain characteristics, and associated symptoms were collected and all the body systems were examined. The patients who were suspected to have psychological problems were referred to psychiatrists for evaluation. The data were indicated as counts and percentages. Statistical analyses were performed using SPSS (version 20.0).

**Results:** The most frequently reported symptoms accompanied with chest pain were palpitation and exertional dyspnea. 111 patients had abnormal echocardiography and 32 of them had abnormalities in ECG. Dyslipidemia was detected in one of the obese children. The most common causes of chest pain were idiopathic (42.4%), cardiac origins (22.2%), musculoskeletal (13.8%), psychiatric problems (8.6%), gastrointestinal (6.6%), respiratory (5.6%), and gynecomastia (0.08%) respectively. Cardiac chest pain was the most common type among the children between 15 and 18 years old.

#### Conclusion

The causes of chest pain could be diagnosed by history-taking, physical exams, and cardiac auscultation. Further tests such as echocardiography, ECG, chest X-ray, and laboratory tests were not essential to diagnose cardiac pains as the first line evaluation.

**Key Words:** Chest Pain, Children, Etiology, Echocardiogram, Heart Diseases.

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## 1- INTRODUCTION

Chest pain is one of the common chief complaints in children and the main reason for referring them to pediatric cardiologists. It can be benign and non-cardiac or serious and life-threatening. It seems that a complete past medical history and a physical examination are almost enough to recognize life-threatening cardiac chest pains in children. Laboratory tests are unnecessary in most of the cases as they are usually costly and non-diagnostic. The benign chest pain in pediatrics sometimes requires a long time to be resolved and it is the responsibility of physicians to assure the parents that there is no reason to threaten their children (1, 2). The majority of pediatric chest pains are due to non-cardiac causes (3, 4). Even though most of the time, chest pain in children is benign, the diagnosis is extremely important so as not to miss the life-threatening chest pain which requires immediate medical attention.

It is suggested that the serious cardiac causes of pediatric chest pain, including anomalous coronary origins, cardiomyopathy, pulmonary hypertension, myocarditis, and pericarditis, can be diagnosed by history-taking, cardiac examination, electrocardiogram, and echocardiogram (5). Based on the reports, chest pain has been the reason for 5.2% of all pediatric cardiology consultations (6, 7). Few studies have been conducted on children with chest pain (5, 8). In this retrospective study, the causes of chest pain, associated factors, and clinical characteristics in children have been evaluated in order to have a better diagnosis and clinical approach. The aim of this study was evaluation of clinical manifestation, demographics parameters and causes of chest pain in children.

## 2- MATERIALS AND METHODS

### 2-1. Study design and population

We designed prospective descriptive study on 680 patients with chest pain who referred to the pediatric cardiology clinic from Jan 2017 to July 2019. Among all the patients, 250 boys and 250 girls with the  $5 \leq \text{age} \leq 18$  year-old, who agreed to participate in the study, were chosen as the cases. Simple and accessible sampling method was conducted and all patients with inclusion criteria in study period were entered.

### 2-2. Methods

Chest pain was described as "musculoskeletal" if the pain was associated with inspiration and movement or if chest wall tenderness and muscle strain were found during the examination. Costochondritis is one of the common musculoskeletal disorders in children and the diagnosis can be made by eliciting tenderness over the costochondral junctions with palpation (9). It was described as "respiratory" chest pain if lung lesions were seen on chest X-ray (CXR) or if the patients suffered from a sudden cough, dyspnea, and asthma. The pain was categorized as "gastrointestinal" when it was related to nausea/vomiting, heartburn, and dyspepsia and/or if the patients had been experiencing gastro-esophageal reflux (10). Gastrointestinal chest pains were diagnosed based on clinical symptoms and response to treatment. It was considered "cardiac" chest pain if the patients had congenital heart disease, Kawasaki disease, abnormalities in echocardiography and ECG, and arrhythmias or when the abnormal heart sounds (murmur, click, gallop, pericardial rub, abnormal second heart sound, distant heart sounds) were detected during the cardiac auscultation.

### 2-3. Measuring tools/ Laboratory measurements

**Physical examination:** All the body systems were examined such as the respiratory system, cardiovascular system,

musculoskeletal system, and abdominal examination. Physical examination tests were performed on all the cases and the body mass index (BMI) was calculated ( $\frac{\text{weight (kg)}}{\text{height (m)}^2}$ ). BMI  $\geq$  95<sup>th</sup> percentile was defined as obesity and 85<sup>th</sup> percentile  $\leq$  BMI  $\leq$  94<sup>th</sup> percentile was defined as being overweight in children (11). The definitions were based on the standards of the Centers for Disease Control and Prevention. Blood pressure was measured with a correct cuff size for different arm circumferences in all the patients, after a 15 minute rest.

**Past medical history:** All the previously known diseases in children were recorded, such as respiratory and heart diseases.

**Family history:** The presence of sudden or unexplained death, cardiomyopathy, severe familial hyperlipidemia, and premature cardiovascular disease in any of the first-degree relatives was considered as a positive family history. It was also considered as a positive family history for premature cardiovascular disease if any of the first-degree relatives experienced myocardial infarction and sudden death before the age of 55 years.

**Further tests:** Echocardiography was taken from all the 500 patients as one of the aims of this study was whether cardiac tests are essential for all children with chest pain. Electrocardiogram (ECG) was taken just from those who had abnormalities in echocardiography. Chest x-ray was taken in the patients who were suspected to have a respiratory origin for chest pain. For the overweight and obese children or those with a family history of premature cardiovascular disease, the laboratory tests including Thyroglobulin (TG), cholesterol (CHOL), High-density lipoprotein (HDL), and low-density lipoprotein (LDL) were taken.

## 2-4. Ethical consideration

The university ethics committee approved the study. The written informed consent was obtained from the legal guardians (IR.ARAKMU.REC.1397.16), and clinical and demographic data were collected for all the cases. All the information about past medical history, family history, chest pain characteristics, and associated symptoms were collected during the pediatric cardiology unit visit.

## 2-6. Inclusion and exclusion criteria

In case of any significant mental illness in the children without accompaniment with other underlying causes of chest pain, the pain was described as "psychogenic" chest pain. Particular situations such as social problems, family problems, and family breakdowns could affect the children's mental health. Ultimately, the patients without any particular etiology or any psychological factors were categorized as "idiopathic". In this case, follow up, control, and symptomatic treatment are usually the appropriate approach (12).

## 2-7. Data Analyses

The data were indicated as counts and percentages. Statistical analyses were performed using SPSS (version 16). The independent t-test was performed to compare the mean of age, weight, height, systolic blood pressure (SBP), diastolic blood pressure (DBP), and BMI at 95% of confidence interval (CI).

## 3- RESULTS

The study was performed on 500 children with chest pain, 250 boys (50%), and 250 girls (50%), who visited pediatric cardiologists at the cardiology clinic during the 2-year period. The mean age of the girls was  $10.32 \pm 4.95$  years with a median of 13.45 years and the mean age of the boys was  $10.11 \pm 5.13$  years with a median of 12.82 years. The mean weight of children was  $32.73 \pm 10.16$  kilograms (a minimum of 14 Kg and a maximum of 43 Kg), and their mean height was 138.32

$\pm 14.02$  centimeters (from 83 to 160 centimeters). The mean BMI was  $16.55 \pm 3.14$  kg/m<sup>2</sup> with a range of 9.65–27.12 kg/m<sup>2</sup>. The p-value of mean difference was (P=0.785) for age (P=0.398) for weight (P=0.455) for height (P=0.164) for SBP (P=0.249) for DBP, and (P=0.571) for BMI. Among all cases, 17 patients were obese, 13 were overweight, and 5 had low weight based on their ages.

The mean of SBP and DBP were  $89 \pm 11.32$  mmHg with a range of 82–120 mmHg and  $68.2 \pm 8.12$  mmHg with a range of 51–80 mmHg respectively. None of the patients had elevated blood pressure (above the 95<sup>th</sup> percentile for age and sex). Regarding the medical history, among all the patients, 16 had asthma, 10 had previously known Mitral valve prolapse (MVP), 3 had pneumonia within less than 2 months before the pain, 7 had a severe cough history for a month, and 98 patients were passive smokers. 14 patients had used paracetamol and 2 patients had used aspirin. Moreover, 5 patients had a positive family history of premature cardiovascular diseases.

According to the chest wall examination, 14 patients had chest wall deformities; 11 with pectus excavatum and 3 with pectus carinatum. Also, 32 patients had chest pain on palpation of their costochondral joints and were diagnosed as having costochondritis which is a common condition among pediatrics. These patients were treated with paracetamol or ibuprofen. The most frequently reported symptom accompanied with chest pain was palpitation (73 patients). In the next stage, 56 patients experienced exertional

dyspnea with chest pain and ultimately, 4 cases of syncope were reported among all the children. Abnormalities in ECG were detected in 32 cases, including 7 patients with ST-segment abnormalities, 5 patients with T-wave abnormalities, 9 patients with PVC, and 11 patients with benign early repolarization (ERP). The PVCs were found to be infrequent according to the patients' 24-hour Holter monitoring. Chest pain characteristics in all cases are shown in **Table.1** and the results of the psychiatric evaluation are shown in **Table.2**. 38.6% of the patients experienced chest pain for less than 1 month, 41.4% of them for more than 3 months, and 20% of the children had the pain for 1 to 3 months. The chest pain duration was less than 1 minute in 61.2% of the patients, between 1 and 10 minutes in 31.2% of them, and more than 10 minutes for 7.6% of them. Most of the patients (47.2%) felt the pain on the left side of the chest, 23.8% of them had the pain in the middle of the chest, and the rest of them had chest pain on both sides of the chest, the right side of the chest, and epigastrium respectively.

Most of the cases (56.4%) stated that the pain had no radiation and 29.6% of them stated that it radiated to the left arm. The description of the pain was sharp in the majority of the cases (38.6%); undefined, squeezing, and pressure sensations were the next common descriptions with the percentages of 25.6%, 22%, and 13.8% respectively. 70.6% of the children had chest pain at rest, 22.6% of them experienced chest pain while exercising, and the remaining 6.8% had the pain while eating.

**Table-1:** Characteristics of the chest pain in children.

Characteristics	Boy	Girl	Total
Time course			
< 1 month	53	140	193
1-3 month	56	44	100
>3 months	141	66	207
Duration (minutes)			
< 1 minute	154	152	306
1-10 minute	82	74	156
>10 minute	15	23	38
Localization			
Left side of the chest	124	112	236
Right side of the chest	18	13	31
Both sides of the chest	37	35	72
Middle of the chest	59	60	119
Epigastrium	12	30	42
Radiation of pain			
None	137	145	282
Back	6	5	11
Right arm	17	42	59
Left arm	90	58	148
Description			
Sharp	84	109	193
Pressure sensation	33	36	69
Squeezing	58	52	110
Undefined	75	53	128
Resolution			
at rest	159	194	353
while eating	16	18	34
while exercising	75	38	113

**Table-2:** The results of the psychiatric evaluation.

Variables	Boy (n=14)	Girl (n=29)	Total (n= 43)
Generalized anxiety disorders (GAD)	6	11	17
Minor Depressive disorders	4	8	12
Adjustment disorder	2	1	3
Panic disorder	1	5	6
Major Depressive disorders	0	0	0
Social phobia	1	3	4
Obsessive-compulsive disorders(OCD)	0	1	1
Attention deficit hyperactivity disorder (ADHD)	0	0	0

Causes of chest pain are shown in **Table.3**. The most common causes of chest pain were Idiopathic (42.4%), cardiac origins (22.2%), musculoskeletal (13.8%), psychiatric problems (8.6%), gastrointestinal (6.6%), respiratory (5.6%), and gynecomastia (0.08%) respectively. It also shows that non-cardiac etiologies of chest pain (77.8%) were more common

than cardiac causes. Chest pain characteristics in patients with cardiac chest pain are shown in **Table.4**. From 111 patients with cardiac chest pain, the pain lasted more than 3 months for 51 of them (45.9%), 1 to 3 months for 50 of them (45%), and less than a month for 10 of them (9.09%). The chest pain duration was less than 1 minute in 98 of the cases

(88.3%), between 1 and 10 minutes in 12 cases (10.8%), and more than 10 minutes in one of them (0.09%). 101 patients (91.8%) had chest pain on the left side of their chest walls, and 4.5% and 3.7% of them had the pain on the right side and both sides of the chest respectively. The pain had no radiation in 102 patients (91.8%), and just radiated to the left arm in 5 of them (4.5%). 88 patients (79.2%) stated that they felt a sharp pain in their chests, while 13 of them (11.8%) had no definition for their pains. 78 of the patients (70.3%) had chest pain at rest, 28 of them (25.2%) had the pain while exercising, and just 5 of them (4.5%) experienced this pain while eating. All the overweight and obese patients were referred to the pediatric

endocrinology section. Based on their laboratory tests, dyslipidemia was detected just in one of them. Moreover, the patients with the diagnoses of psychiatric chest pain, based on physical examination and medical and family history, were referred to psychiatrists for evaluation. From the 85 patients who had been referred to the psychiatrist, the presence of psychological disorders was proven in 44 of them (52%). Among these children, 17 of them (38.6%) had Generalized Anxiety Disorder (GAD), 12 of them (27.2%) had minor depressive disorders, and the rest of them had adjustment disorder, panic disorder, social phobia, and Obsessive-compulsive disorder (OCD), respectively (Table. 4).

**Table-3:** The causes of chest pain in patients.

Causes	Boy (n=250)	Girl (n=250)	Total (n=500)
Idiopathic chest pain	121	91	212
Cardiac-related causes	48	73	111
Mitral valve prolapse with regurgitation	32	44	76
Mitral valve prolapse without regurgitation	16	19	35
Pulmonary hypertension	0	0	0
Arrhythmia (PSVT/VT)	0	0	0
Cardiomyopathy	0	0	0
Musculoskeletal disorders	44	25	69
Muscle strain	13	6	19
Costochondritis / costosternal syndrome	12	6	18
Precordial catch syndrome	8	4	12
Tietze syndrome	3	6	9
Slipping rib syndrome	0	0	0
Trauma and muscle injury	8	3	11
Psychological disorders	15	28	43
Gastrointestinal disorders	18	15	33
Gastritis	14	10	14
Gastroesophageal reflux (GERD)	4	5	9
Respiratory disorders	13	15	28
Chronic cough	2	5	7
Bronchial asthma	4	4	8
Exercise-induced or cough variant asthma	5	6	11
Pneumonia	2	0	2
Breast tenderness (gynecomastia)	1	3	4

**Table-4:** Characteristics of the chest pain in children in Cardiac-related causes.

Variables	Mitral valve prolapse with regurgitation (n=76)		Mitral valve prolapse without regurgitation (n=35)	
	Girl, (n=44 )	Boy, (n=32 )	Girl, (n= 19)	Boy, (n=16 )
Time course				
< 1 month	5	2	2	1
1-3 month	23	15	6	6
>3 months	16	15	11	9
Duration (minutes)				
< 1 minute	36	30	18	14
1-10 minute	7	2	1	2
>10 minute	1	0	0	0
Localization				
Left side of the chest	39	30	17	16
Right side of the chest	3	1	1	0
Both sides of the chest	2	1	1	0
Middle of the chest	0	0	0	0
Epigastrium	0	0	0	0
Radiation of pain				
None	42	29	18	13
Back	0	1	0	0
Right arm	1	0	1	1
Left arm	1	2	0	2
Description				
Sharp	33	25	16	14
Pressure sensation	2	3	0	1
Squeezing	1	1	1	1
Undefined	8	3	2	0
Resolution				
with rest	28	19	18	13
with eating	1	2	0	2
with exercise	15	11	1	1

The etiologies of chest pain in children according to their ages are shown in **Table. 5**. Most children with the complaint of chest pain were from 10 to 14 years old (196 individuals, 39.20%), 36.8% of them were 15-18 years old, and 24% of them were between 5 and 9 years old. The different causes of chest pain in children at any age have been shown in **Table. 5**. 59.1% of these children had idiopathic chest pain which was the most common type of chest pain among them. 15.8% of them experienced cardiac chest pain which was equal to 17.1% of all the patients with cardiac chest pain. Similar to the previous group, the most common type of chest pain among these patients was idiopathic chest pain (48.9% of them), which was equal to the highest percentage of (45.2%) all the patients with idiopathic chest pain. The

second common cause of chest pain in this group was musculoskeletal pain (15.3% of them), which was also the highest percentage of musculoskeletal pain among the 3 groups (43.4%). Cardiac causes were the third etiology of chest pain in the group; however, 21.6% of the patients with cardiac chest pain were in this group. Although gynecomastia was the last cause of the chest pain in these children, all 4 patients with breast tenderness were in this group. It is worth noting that 53.5% of the patients with respiratory chest pain were the children with the ages 10 to 14 years old; however, totally, this was not a common type of chest pain. The most common cause of chest pain was cardiac-related pain in this group (31.9% of them) and also, 61.2% of the patients with cardiac chest pain were in this age group.

Idiopathic chest pain and psychogenic chest pain were respectively the second and third etiologies of chest pain among these children; however, the highest

number of patients with psychogenic chest pain (33 individuals, 76.7% of them) was in this group.

**Table-5:** Cause of children with chest pain according to the age (n=500).

Variables	Age, (5 to 9 year)	Age, (10 to14 year)	Age, (15 to 18 year)
Idiopathic chest pain (n=212)	71	96	45
Cardiac-related causes (n=111)	19	24	68
Musculoskeletal disorders (n=69)	18	30	21
Psychological disorders (n=43)	4	6	33
Gastrointestinal disorders (n=33)	2	21	10
Respiratory disorders (n=28)	6	15	7
Breast tenderness (n=4)	0	4	0
Total (n=500)	120	196	184

#### 4- DISCUSSION

In the present study, we aimed to have a clinically useful diagnostic approach for chest pain in pediatrics. To categorize the causes of chest pain, we took physical examination tests, medical history, laboratory tests, and echocardiography for all the patients, and ECG, 24-hour Holter monitoring, CXR, and psychological evaluation if they were needed. Demographic data and clinical characteristics were reported as well. Non-cardiac chest pains were significantly more common in the children compared with the cardiac pains (77.8%). Idiopathic chest pain (42.4%) was the most common etiology of chest pain, and cardiac causes (22.2%), musculoskeletal disorders (13.8%), psychiatric problems (8.4%), gastrointestinal (6.6%), respiratory (5.6%), and gynecomastia (0.08%) were the other causes. Regarding the characteristics of the pains, having chest pain for more than 3 months (41.4%), and less than 1 month (38.6%) was more prevalent among all the cases. Duration of chest pain was less than 1 minute in most patients (61.2%), and chest pain with no radiation was more common (56.4%). Most patients had pain on the left side of their chests (47.2%). Most of the girls described the pain as sharp while most boys stated no specific definition for the pain. Feeling chest pain

at rest was the most common type, however, boys (15%) experienced chest pain during exercise more than girls (7.8%). In this study, cardiac chest pain was the second common type of chest pain, which means cardiac causes should always be one of the potential diagnoses for children with chest pain. In our study, in the majority of cases, cardiac chest pains were sharp (79.2%), and lasted more than a month (90.9%), with no radiation (91.8), and the duration of less than a minute (88.3%) on the left side (91.8%) at rest (70.3%). These characteristics are similar to the chest pain due to MVP, which may cause chest pain by papillary muscle or left ventricular endocardial ischemia (18), and all the cases with cardiac chest pain in this study had MVP based on echocardiography. Consequently, having known the common causes of chest pain, such as MVP, and the characteristics of the pain in these cardiac conditions would help physicians to diagnose these types of chest pains just by a complete physical examination with no further cardiac tests. Abnormalities in ECG were detected just in 32 patients and it was normal for the rest of the cardiac cases, but all of the 111 children with cardiac pain had a positive cardiac examination, such as click, murmur, and loud S2 sound. It seems that electrocardiography is not



required as a routine test for children with chest pain. Again, taking a complete physical examination and accurate medical history would guide physicians to recognize the patients with severe and life-threatening cardiac chest pains who need further tests such as ECG. In the diagnosis of chest pain, associated symptoms could be informative for identifying the origin of the chest pain. Palpitation and exertional dyspnea were the most commonly associated symptoms with chest pain among the children, and syncope was reported in 4 patients. Usually, chest pain with syncope may have been indicative of heart disease; however, in our study, the cases with syncope had a normal cardiac evaluation and it was due to psychiatric disorders (GAD). Dyslipidemia was found in just one obese child among all the children. It suggests that it is better to take lipid profile tests just from obese children (BMI>25), not from all patients who visit physicians with the complaint of chest pain. It is difficult to accurately distinguish idiopathic chest pain from musculoskeletal pains. The features of idiopathic and musculoskeletal chest pains are very similar and consequently, the symptoms may overlap. The one point that may help to diagnose is that, based on our results, musculoskeletal disorders were associated with difficulties in breathing and movement, and this etiology was more common in the boys compared with the girls. Moreover, most of the children with musculoskeletal disorders suffered from muscle strain and costochondritis. Gastrointestinal chest pains, the referral pain from the upper gastric tract to the chest, sometimes occurs in cases of chest pain with gastrointestinal problems. In adults, chest pain is usually associated with diet; while in children, Gastroesophageal reflux disease (GERD) would happen due to the relaxation of the gastroesophageal valve. In the present study, psychogenic chest pain was associated with syncope in patients with

GAD and hyperventilation in a patient with panic disorder. Hyperventilation is a common sign of mood disorders. Most children with psychogenic chest pain (13 cases, 30.2 %) described their chest pain as a squeezing sensation. The history of respiratory diseases, such as asthma and chronic cough, and respiratory examination were positive in most of the cases with respiratory chest pain. It shows that no further tests are needed to diagnose this type of chest pain. Being aware of common types of chest pain in different age groups would significantly help physicians to accurately diagnose the condition. For instance, all the children with chest pain due to breast tenderness were between 10 and 14 years old, when the pubarche occurs. Also, most of the children with gastrointestinal pains, respiratory chest pains, and idiopathic chest pain were from 10 to 14 years old. The idiopathic chest pain was also common among the children between the ages of 5 and 9. On the other hand, 76.7% of the psychology cases were teenagers from 15 to 18 years old, when they would experience stress and anxiety due to the teenage crisis. Furthermore, most of the cases with cardiac chest pain were the teenagers, which means that cardiologists should consider cardiac etiologies as one of the common causes of chest pain in this group of children. In a study by Selbst, 16% of children with chest pain had more than one visit to the emergency department with the same complaint, and about 8% of children had chest pain for more than a year (13). In another study by Rowe et al., chest pain often becomes a chronic problem, lasting more than 6 months in 20–45% of children (14). In the present study, 34.5% of children had the pain for more than 3 months and 22.7% of them had more than one visit with the same complaint. Since the patients with known cardiac abnormalities had not been excluded from this study, cardiac chest pains are expected to be reported more

than other studies. In two other studies, musculoskeletal disorders were the most common causes of chest pain in children, and psychological disorders cause chest pain in boys and girls equally (15, 16); however, in the present study, musculoskeletal pains were the third common cause of chest pain, and psychogenic disturbances were more common in girls (5.8%). In a study by Tunaoglu et al. (3) 74% of children and adolescents with chest pain had psychological symptoms, and “anxiety” as the most common problem. In another study, unexplained chest pain in the pediatric emergency department was found to be frequently associated with potentially treatable anxiety disorders (15, 16). In the present study, 8.6% of the patients had psychogenic chest pain and 39.5% of them had GAD. According to other studies, obesity may be important on its own or in combination with other conditions, such as gastroesophageal reflux disease (19, 20). One of the reasons that more children with chest pain are being referred to pediatric cardiology is the increased number of overweight and obese children. In this study, 2.6% of the cases were overweight and 3.4% of them were obese children. In our study, respiratory disorders were just 5.6% of the causes of chest pain, and asthma accounted for a large portion (57.1%) of the respiratory problems. Therefore, a detailed medical history report is necessary for differentiation from other diseases. Chonet et al., showed that acute continuous chest pain for 1–2 days in older children was the characteristic of an air-leak syndrome; however, the diagnosis of pneumomediastinum is difficult and usually needs imaging (21). The present study had particular limitations. It was not possible to take ECG from all the patients, and also none of them had CBC and serum Trop I levels. We could not follow up our patients. Exercise test and pulmonary function test had not been performed on the patients with chest pain during exercise

and the patients with respiratory disease. Cardiac stress test did not perform in patients with chest pain with physical activity. It was not possible to follow up the cases after the diagnosis and treatments, for instance, the follow up for children with psychological problems who received treatments.

## 5- CONCLUSION

In conclusion, although most chest pains were benign in this study, cardiac chest pains were considerable as approximately 1 in 5 patients had cardiac pains. All the cases with cardiac pains could be diagnosed by non-invasive and inexpensive methods that are history-taking and physical exams, particularly cardiac auscultation. Further tests such as echocardiography, ECG, CXR, and laboratory tests were not essential to diagnose cardiac pains as the first line evaluation. Having known the characteristics of chest pain, different types of chest pain can be distinguished from each other. Moreover, different causes of chest pains are more common in different ages, which would be significantly helpful to diagnose. It is important to educate and reassure both the patients and the families to know that most chest pains are benign.

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**7- CONFLICT OF INTEREST:** None.

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