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Diagnostic and therapeutic challenges of chest pain in children: a single center study

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Abstract

Background. Pediatric chest pain is a common reason for Emergency Department (ED) visits, but it is rarely due to serious cardiac issues. The causes are mainly non-cardiac and include musculoskeletal, gastrointestinal, respiratory, and psychogenic origins.

Material and methods. This study aimed to assess the causes of chest pain and their correlations with clinical and demographic factors among children and adolescents from eastern Poland. A retrospective analysis covered 1,849 pediatric chest pain cases from 189,282 emergency department visits at the University Children's Hospital between 2018-2023. Pain characteristics, clinical data, comorbidities, and treatment approaches were evaluated.

Results. The most common causes were idiopathic (60.48%) and musculoskeletal (22.29%). Hospitalizations for pulmonary-related issues accounted for 12.44%. Physical activity often worsened pain, with dyspnea and palpitations as frequent comorbid symptoms. Bronchial asthma was the most common comorbidity (4.04%). Caffeine intake and smoking were linked to increased stabbing pain. Treatment was needed in 26.07% of cases, mostly conservative.

Conclusions. Pediatric chest pain is rarely linked to serious conditions. Most cases are mild and effectively managed conservatively. Factors such as stimulants and psychogenic causes play a role, while cardiac causes remain uncommon.

Keywords: pulmonology, musculoskeletal disorders, chest pain, cardiology, asthma

Introduction

In recent years, there has been an increase in the frequency of patients presenting to primary care and Emergency Departments (ED) for chest pain [1]. The pain has been described as stabbing, burning, dull, or indefinite, sometimes radiating to the shoulder or back [2]. Approximately 1 in 40 children in the United Kingdom seek medical help for chest pain annually [3]. In general, chest pain accounts for 0.3-0.9% of all cases leading to emergency

department visits [4]. Among adult patients, chest pain can herald sudden life-threatening conditions, especially those of cardiac etiology, such as acute coronary syndrome. Such patients require immediate cardiac consultation and often prompt implementation of treatment [5]. Considering the risk of sudden cardiac death in adult patients with chest pain, similar pain complaints in pediatric patients raise great concern among parents. However, in the pediatric population, the vast majority of the intensity of pain is mild and does not carry serious consequences [6]. The most common causes of chest pain in children can be divided into cardiac, respiratory, and other including: musculoskeletal, gastrointestinal, psychogenic, and idiopathic abnormalities [7]. According to available studies, the causes of pain were mostly unknown or related to the musculoskeletal system, accounting for up to 86.4% of cases. Causes related to cardiovascular disease accounted for 0.6% to 8.0%, respiratory problems up to 18.8%, gastroenterological causes from 0% to 8.5%, and psychogenic causes ranged from 5.1% to as high as 83.6% [8].

It is particularly important for clinicians to quickly identify pediatric patients presenting with high-risk chest pain and to rule out cardiac causes. Unfortunately, this can prove challenging, as younger patients are not able to describe and characterize the pain in detail. A well-collected history with the caregiver and patient, as well as a detailed examination, is of great importance. Currently, there are few scientific papers addressing the topic of chest pain in children, resulting in a lack of accurate data on its characteristics and epidemiology. The purpose of our study was to analyze and characterize chest pain with the identification of its causes, aggravating factors, mitigating factors, and their correlation with demographic and clinical data in patients presenting to the ED, as well as analysis of the applied treatment. In our study, the incidence of chest pain in children in the Lublin Voivodeship, Poland, is approximately 1 in 1,000, indicating its significant prevalence in Poland. Therefore, this is an important subject for further research. Analysis of this problem might be important for planning procedures at various levels of pediatric health care.

Aim of the work

The aim of this study was assessment of the causes of chest pain and their correlations with clinical and demographic data among children and adolescents from eastern Poland

Material and methods

The study included a retrospective analysis of the medical records of 189,282 patients presenting to the ED of the University Children's Hospital in Lublin between 2018 and 2023. Patients whose reason for visiting the ED was chest pain were selected. R07 (chest pain) was taken as a search criterion according to the International Classification of Diseases 10 (ICD-10) and expanded to include R07 (pain in throat and chest), R09.1 (pleuritis), J90 (pleural effusion not elsewhere classified), J93 (pneumothorax), S20-S29 (chest trauma), I20 (ischemic heart disease), I21 (acute myocardial infarction), I30 (acute pericarditis), I40 (acute myocarditis), J12-J18 and J67, J69 (pneumonias of various etiologies), and K21 (gastroesophageal reflux disease).

Of all the study participants, 1,849 patients with chest pain were eligible for analysis, of whom 230 were admitted for hospitalization. Due to limited access to the data of 189 patients admitted in 2018, a full analysis was performed on 1,660 patients. Among these 189 patients, complete data was available only for treatment, required hospitalization, and demographic information, while incomplete data were available for imaging and laboratory tests. After analyzing the materials, no qualified patients were excluded from the analysis.

The databases were analyzed by 4 researchers, independently of each other. All necessary information was obtained from the patients' electronic medical records in hospital. The nature and duration of pain, exacerbating and relieving factors, the presence of abnormalities on physical, imaging and laboratory results, the presence of symptoms and comorbidities, consumption of stimulants, and treatment were considered for analysis.

The study was conducted in the only specialist hospital for children in the Lublin district with a pediatric hospital ED; therefore, the data were related to the demographic information of the Central Statistical Office from 2023.

The correlation of demographic and clinical factors was checked, as well as the relationship between the type of pain and stimulants, comorbidities and symptoms, and the mode of treatment.

Data analysis was performed using Statistica 13 software. Pearson's Chi squared test and the Kruskal-Wallis test were used to determine correlation. Statistical significance was assumed at $p<0.05$.

Results

Demographic analysis

In this study, we adopted a classification of place of residence based on the definitions of the Central Statistical Office. Rural areas were defined as settlements without municipal status, while towns were classified according to population size: small towns (<3,000 inhabitants), medium towns (3,000-10,000 inhabitants), and large towns (>10,000 inhabitants). The study included data of 1,849 patients aged 2 to 18 years, with a mean age of 12.44±3.77 years (SD) (Figure 1). More than half of the study participants were aged 13 to 18 years, and most of the patients came from large cities (Table 1). Based on data from the Central Statistical Office, the population of children up to 18 years of age living in the Lublin district is approximately 27.5 thousand. However, the University Children's Hospital in Lublin serves as a tertiary referral center for the entire Lublin Voivodeship, including both urban and rural areas, and not exclusively the Lublin district. Therefore, the number of pediatric ED admissions reflects referrals from a substantially larger population than the district alone. The annual number of ED admissions due to chest pain ranged from 212 to 392 patients (Figure 1). When related to the pediatric population of the entire catchment area, this corresponds to an estimated incidence of 0.77-1.42 per 1,000 children per year, rather than the higher values that would be expected if calculations were limited solely to the Lublin district [9]. A noticeable increase in the number of admissions was observed between selected years (e.g. 2018 vs. 2019 and 2019 vs. 2023). This rise may be explained by several factors, including improved accessibility to emergency services, increased parental awareness of chest pain as a potentially serious symptom, post-COVID-19 changes in healthcare-seeking behavior, and a gradual expansion of the hospital's referral base. Additionally, partial incompleteness of documentation from 2018 may have contributed to underestimation of cases in that year.

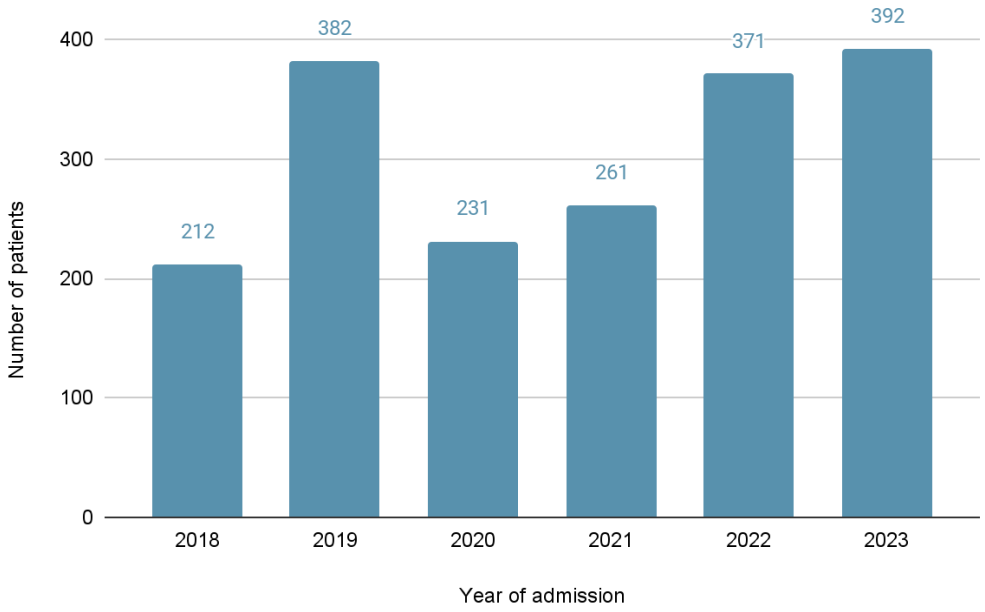

Figure 1. Number of patients in ED due to chest pain by year

Table 1. Demographic data of patients with chest pain in ED

Demographic data	Number of patients n (%)
Gender	
Boys	929 (50.24%)
Girls	920 (49.76%)
Domicile	
Large city	1067 (57.70%)
Medium city	100 (5.41%)
Small city	58 (3.14%)
Village	624 (33.75%)
Age	
2-6 years	154 (8.33%)
7-12 years	690 (37.32%)
13-18 years	1005 (54.35%)

Causes of chest pain

The causes of chest pain were categorized as idiopathic, musculoskeletal, pulmonary, psychogenic, cardiological, gastroenterological, and other (Figure 2). The largest group consisted of patients with pain of idiopathic origin. We defined idiopathic pain as pain for which the cause was not determined during observation and diagnostics in the hospital. The next most common cause was musculoskeletal issues, with chest injuries (360 patients; 21.67%) being the most frequent among them. Pulmonary-related pain was also noted, often resulting from conditions like pneumothorax (20 patients; 1.20%), pneumonia (45 patients;

2.71%), pleurisy (1 patient; 0.06%), or pleural effusion (14 patients; 0.84%). Psychogenic causes were identified when the pain was linked to stress, strong emotions, or depression, after ruling out other diagnoses. Cardiological pain, mainly due to pericarditis (5 patients; 0.30%) and myocarditis (14 patients; 0.84%), was less frequent. Other causes included caffeine overdose (7 patients; 0.42%) or poisoning from harmful substances (5 patients; 0.30%), such as drugs. The least common cases were associated with gastroenterological problems, including gastrointestinal reflux (5 patients; 0.30%), esophagitis (2 patients; 0.12%), dyspepsia (4 patients; 0.24%), or dietary errors (5 patients; 0.30%), particularly in individuals living in large cities (Figure 3, Figure 4).

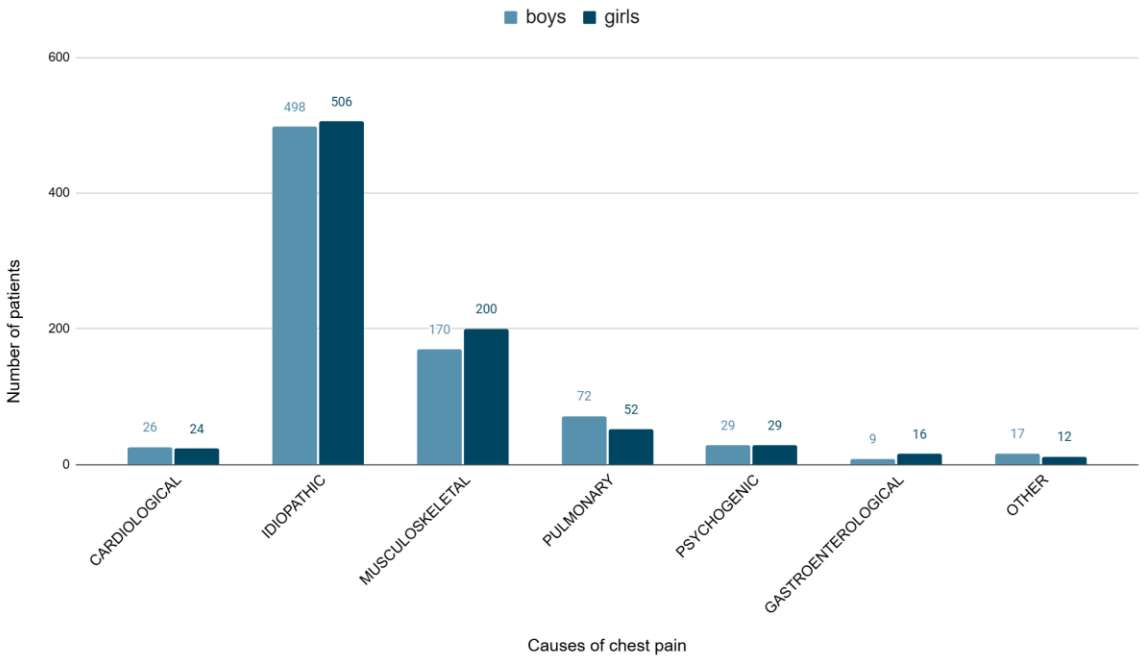

Figure 2. Causes of chest pain

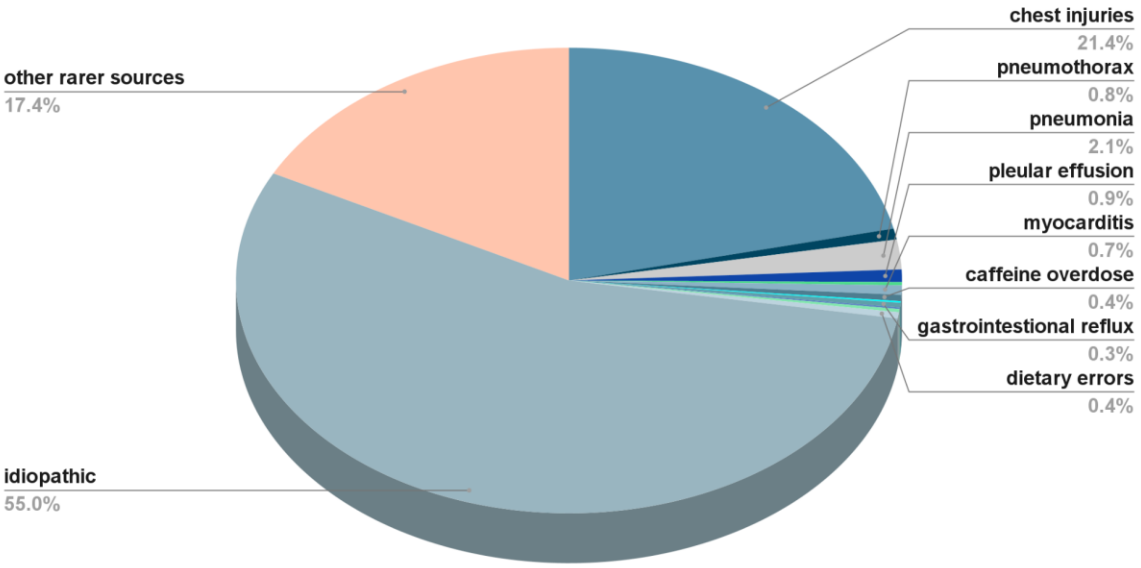

Figure 3. Causes of chest pain in girls

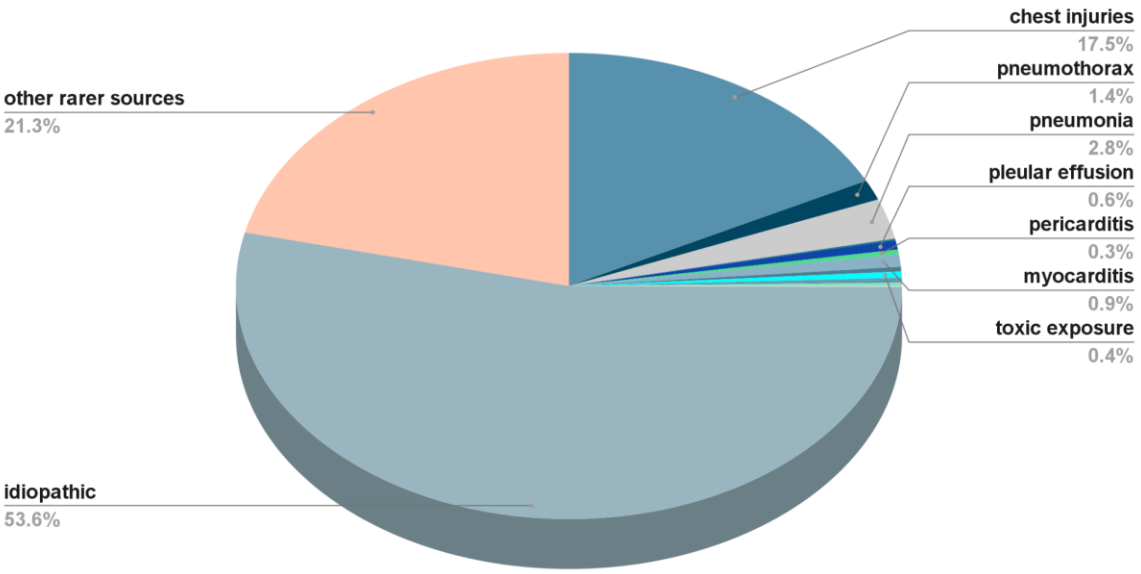

Figure 4. Causes of chest pain in boys

Among 1,849 patients, 230 (12.44%) required hospitalization. More than half of these cases (117; 50.87%) were admitted to the Clinic of Pediatric Cardiology, while 69 patients (30%) were admitted to the Department of Pediatric Pulmonology and Rheumatology. Among patients presenting with chest pain, hospitalization was required for 12.92% of boys and 11.96% of girls. The difference was not statistically significant (p>0.05).

Characteristics of chest pain (duration, aggravating and alleviating factors)

Analysis of the documentation showed that nearly one-quarter of patients reported that physical activity and breathing aggravated their chest pain, while in most cases, no alleviating factors could be identified (Table 2). The duration of pain was divided into four categories: <1 day, 1 day, 1-7 days, and >7 days. Most patients had difficulty specifying the exact duration of their discomfort, resulting in many cases where the duration remained undetermined. Among the defined time categories, the majority of patients reported experiencing pain for less than one day. All the characteristics of the pain described above, including its duration and factors that exacerbated or alleviated it, were independent of both genders. Three main types of pain were also examined: squeezing, stabbing, and burning (Figure 5). Most patients (1012; 60.96%) were unable to classify their pain into any of these categories, leading to many cases where the nature of the pain was marked as undetermined. Among the defined types of pain, stabbing pain was the most common in both boys (186; 22.41%) and girls (241; 29.04%). A statistically significant correlation was found between the type of pain and gender (p<0.05).

Table 2. Characteristics of chest pain

Description of pain	Number of patients (n)
Duration	
<1 day	354 (21.33%)
1 day	160 (9.64%)
1-7 days	292 (17.59%)
>7 days	211 (12.71%)
Undetermined	643 (38.73%)
Types of pain	
Squeezing	195 (11.75%)
Undetermined	1012 (60.96%)
Stabbing	427 (25.72%)
Burning	26 (1.57%)
Aggravating factors	
Physical activity	204 (12.29%)
Breathing	194 (11.69%)
Cough	15 (0.90%)

Not occurring	1247 (75.12%)
Alleviating factors	
Rest	24 (1.45%)
Breathing	2 (0.12%)
Physical activity	2 (0.12%)
Not occurring	1632 (98.31%)

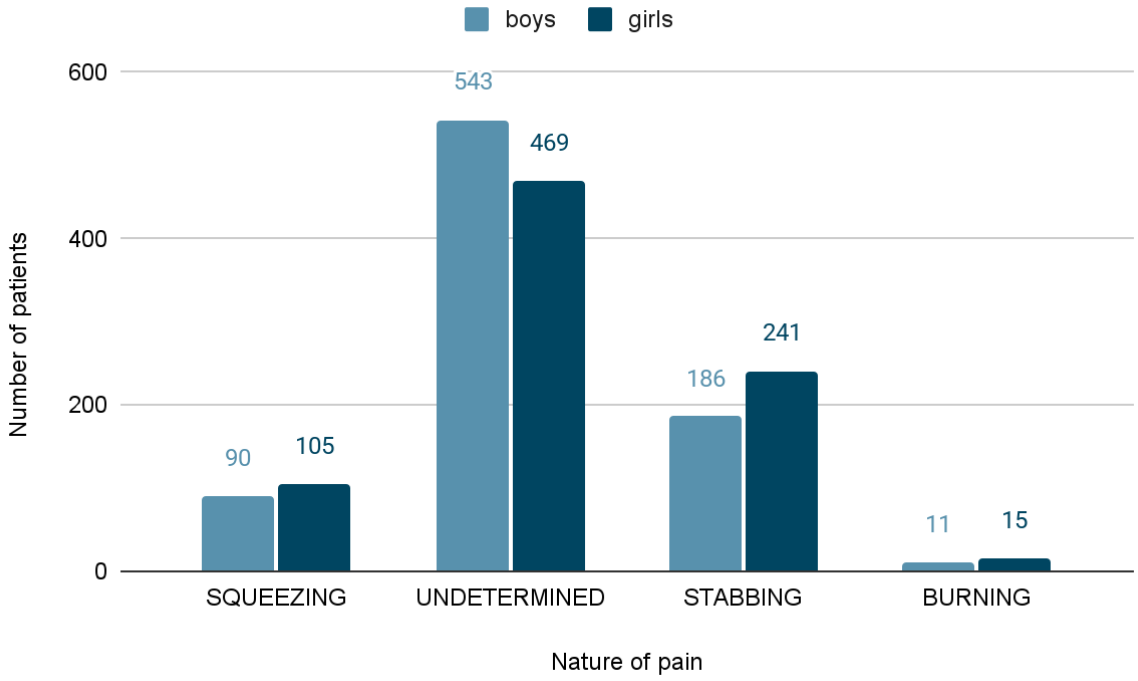

Figure 5. Characteristics of chest pain in boys and girls

Abnormalities in physical examinations, laboratory and imaging tests

Due to incomplete medical documentation for 189 patients, data on physical examinations were analyzed from 1,660, imaging tests from 1,825, and laboratory tests from 1,783. Abnormalities associated with chest pain were most commonly detected during physical examinations (880 cases; 53.01%), followed by laboratory tests (665 cases; 37.30%). The most frequently observed abnormalities in the physical examination included symptoms of upper and lower respiratory tract infections, musculoskeletal abnormalities of the chest and spine, such as pectus excavatum or scoliosis, as well as tenderness on palpation of the abdomen and chest. Additionally, scratches and skin abrasions in the chest area, along with being overweight, were noted. The most common laboratory abnormalities included leukocytosis, elevated inflammatory markers, including CRP, as well as increased CK-MB and D-dimer levels. The

occurrence of abnormalities in both physical examinations and laboratory tests did not differ between genders. Various imaging tests were performed on the patients, including chest X-rays, chest and lung ultrasounds, echocardiography, abdominal ultrasound, and chest CT scans. These tests revealed abnormalities such as pneumothorax (20 patients; 4.74%), pneumonia (45 patients; 10.66%), pleural effusion (14 patients; 3.32%).

Comorbidities and associated symptoms

Comorbid symptoms were observed in about 50% of the study group, with a considerable variety. Most children presented more than one complaint. Most often, chest pain was accompanied by dyspnea. Patients also commonly experienced cough, fever, weakness, difficulty breathing, and palpitations. Among other pain complaints, headaches and abdominal pain were the most prevalent (Figure 6). Less commonly reported symptoms included runny nose, sore throat, nausea, vomiting, dizziness, malaise, and reduced exercise tolerance. The occurrence of accompanying symptoms did not differ between genders ($p>0.05$). An association was found between the type of pain and the presence of comorbid symptoms ($p<0.05$). Dyspnea was most commonly observed with compressive pain, while cough was more frequent with indeterminate pain. A sensation of palpitations accompanied stabbing pain, and burning pain often occurred alongside abdominal pain. Comorbid diseases were found in less than half of the patients (702 cases; 42.29%), with a significant variety of conditions observed. There was no significant correlation between the presence of comorbidities and type of chest pain ($p>0.05$). The most common comorbid condition was bronchial asthma, followed by hypothyroidism, depression, and epilepsy. Among other less frequently reported diseases were atopic dermatitis, allergic rhinitis, and heart defects such as atrial septal defect (ASD) and ventricular septal defect (VSD) (Figure 7). Conditions that occurred less often included supraventricular tachycardia, tricuspid, aortic, and mitral valve defects, scoliosis, anxiety disorders, and neurosis.

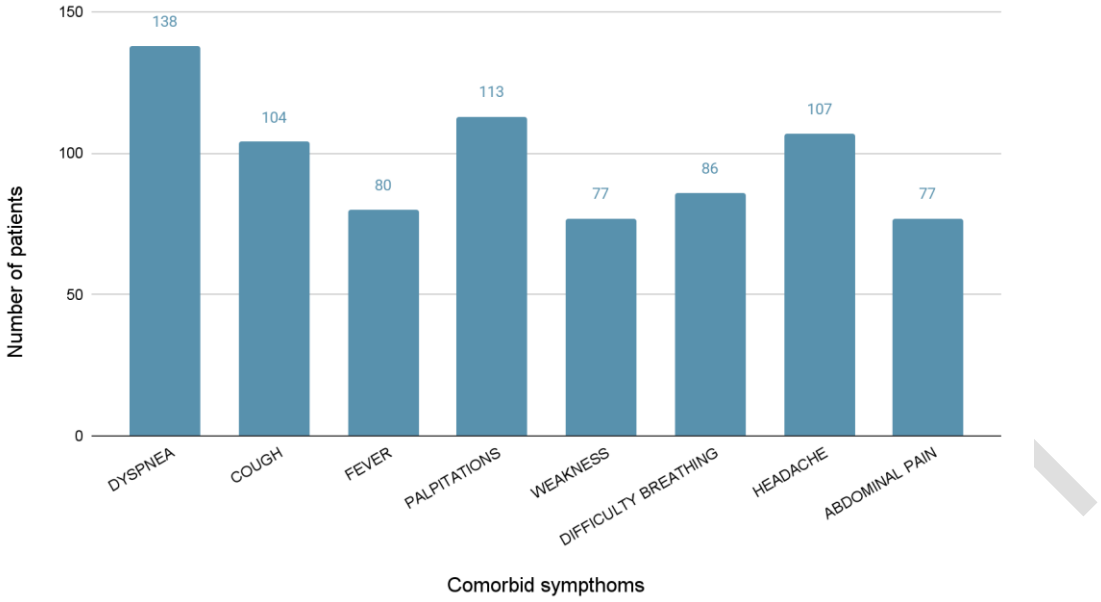

Figure 6. Most common comorbid symptoms reported by patients with chest pain

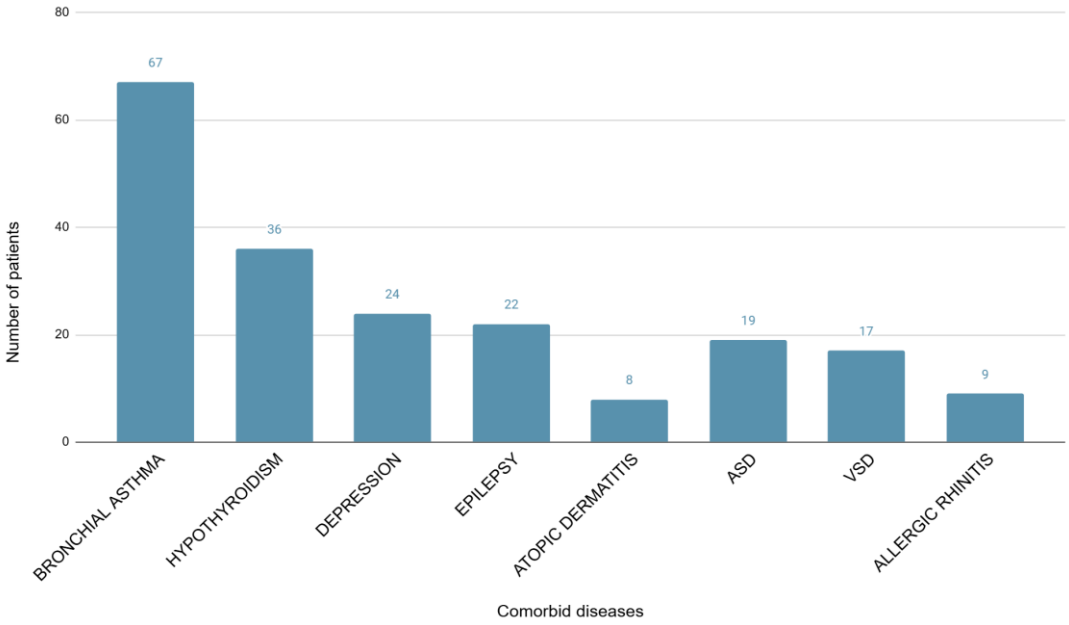

Figure 7. Most common comorbid diseases occurring in patients

Use of stimulants

In the studied group, nearly 4% (68 patients) reported using stimulants. These included cigarettes, caffeine, alcohol, and drugs. Most patients reported using more than one type of stimulant. Caffeine was the most commonly used substance, consumed by 45 individuals

(66.2% of those reporting stimulant use). Drugs were the least frequently used, with only 6 patients (8.8%) reporting their consumption. Alcohol was reported by 16 patients (23.5%), and cigarette smoking by 34 individuals (50%) (Figure 8). There was no statistically significant correlation between the type of pain and the use of psychoactive substances (p>0.05). However, the study indicated that both smoking and caffeine intake were associated with an increased risk of experiencing stabbing pain.

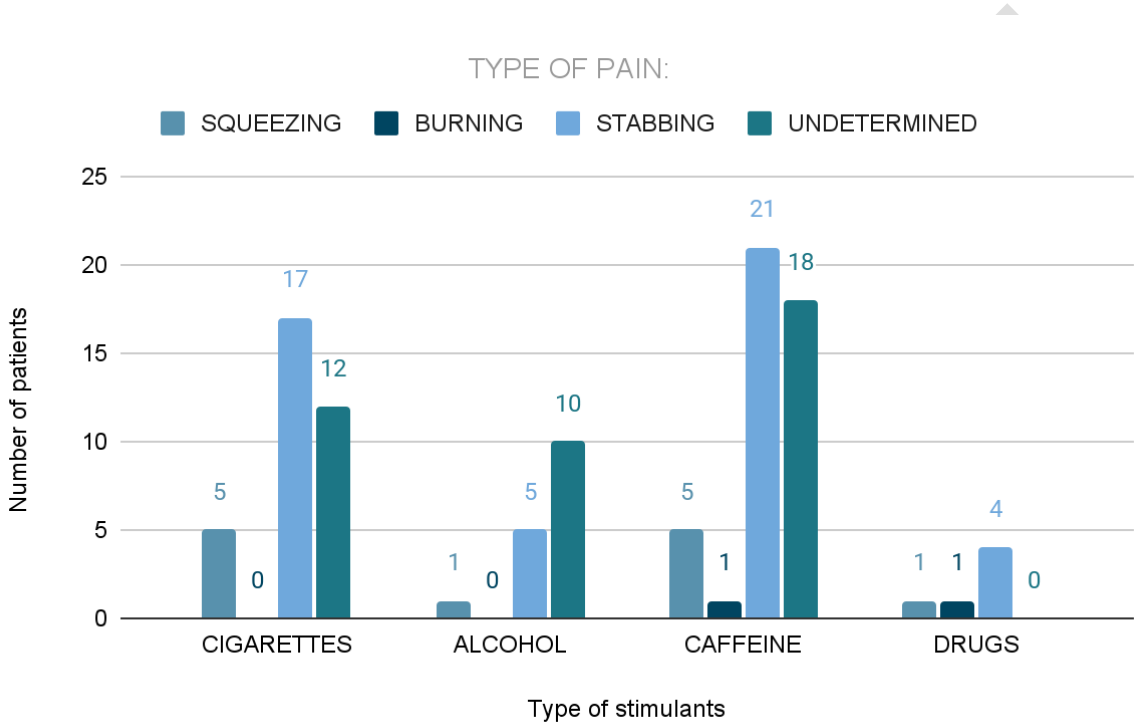

Figure 8. Most commonly used stimulants depending on the type of chest pain

Treatment

Treatment was required for 482 patients (26.07%), confirming that the majority did not need specialist medical intervention. Most patients received multiple forms of therapy. Conservative treatment was sufficient in most cases and included respiratory physiotherapy, dietary modifications, and pharmacotherapy prescribed for home use. The therapy was mainly intended to target musculoskeletal pain (p<0.05). Pain relief therapy was applied in over 16% of cases, utilizing non-steroidal anti-inflammatory drugs and other medications such as acetaminophen, administered intravenously, orally, or topically as ointments and gels. Pain management was more frequently used in boys (17.76%) compared to girls (16.10%) and was predominantly aimed at addressing musculoskeletal pain (p<0.05). Among the procedures

included in the "other" category were such methods as passive oxygen therapy, and administration of rehydration fluids, which was mainly used for pain of pulmonary origin. This type of therapy was administered more often to boys (11.63%) than to girls and was primarily focused on treating pulmonary pain ($p<0.05$). Antibiotics were prescribed to a small percentage of patients, mainly in pulmonary cases such as pneumonia and pleuritis ($p<0.05$). Likewise, single dose administration tranquilizers were predominantly utilized for pain of unknown origin ($p<0.05$). Surgical interventions were the least commonly employed treatment, mainly involving pleural drainage for the management of pneumothorax ($p<0.05$) (Figure 9). Among the diagnoses requiring immediate treatment and hospitalization were pneumothorax, observed in 17 hospitalized patients (7.4%), pneumonia in 37 cases (16.1%), pleural empyema in 2 cases (0.87%), pericarditis in 3 cases (1.3%), and myocarditis in 7 cases (3.04%). There was no statistically significant correlation between the type of pain and the need for treatment ($p>0.05$). However, most treated patients (62.98%) experienced indeterminate pain. Treatment was required by 23.83% of patients with stabbing pain, 11.91% with compressive pain, and 1.28% with burning pain.

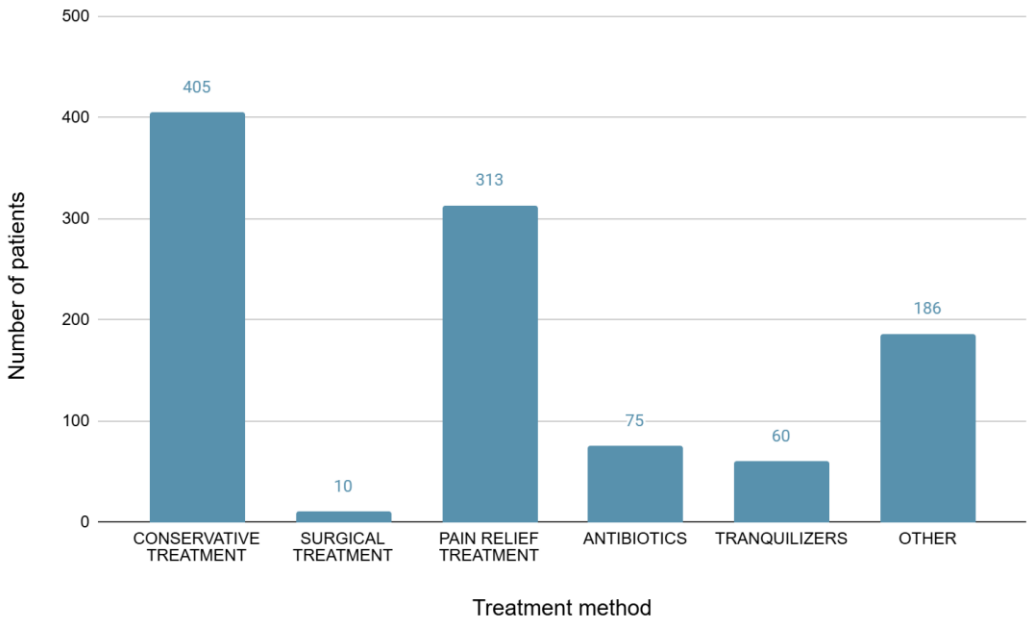

Figure 9. Treatment used in pediatric patients with chest pain

Discussion

Chest pain in children typically is not associated with serious conditions; however, it often raises concerns among parents and prompts them to seek consultation with a primary care

physician or ED [10]. Nevertheless, only a small percentage of pediatric patients experiencing chest pain suffer from significant cardiovascular issues that may pose a life-threatening risk. Previous studies indicate that cardiovascular etiologists account for approximately 1% of such cases [11]. In a study involving 3,700 pediatric patients with chest pain, it was found that cardiac causes are rare. This study also highlighted a connection between sudden cardiac death and chest pain, though no direct relationship was established between the two [7]. In our analysis, we identified a group of patients in whom a correlation was found between the occurrence of chest pain and the use of psychoactive substances. The largest group consisted of patients using tobacco products and energy drinks containing high doses of caffeine.

In recent years, there has been a decline in cigarette smoking among children and adolescents; however, a significant increase in the use of e-cigarettes has been observed. E-cigarettes have become an alternative source of nicotine for most young people, replacing traditional cigarettes [12]. In 2019, it was estimated that nearly 27.5% of high school students in the United States were using tobacco products, highlighting growing concerns about nicotine use among youth. Nicotine, the key substance responsible for addiction, is rapidly absorbed into the bloodstream through the respiratory system. Its half-life is approximately one hour, after which it is metabolized in the liver into cotinine, which has a half-life of 16-20 hours in the body. By stimulating nicotinic receptors, nicotine triggers a range of immediate physiological changes. Studies on young adults have shown that inhaling e-cigarette aerosol, which contains nicotine, leads to an increase in heart rate, blood pressure, and cardiac contractility, as well as a reduction in coronary blood flow. Furthermore, this aerosol negatively affects the vascular endothelium, likely through the indirect induction of oxidative stress, and increases platelet activation, adhesion, and aggregation. Consequently, there is a plausible link between the use of tobacco products and the occurrence of chest pain, caused by increased cardiac workload combined with reduced oxygen and nutrient supply to the heart [13]. Additionally, the components of inhaled aerosol have been shown to exacerbate inflammatory responses in the lungs and contribute to the development of bronchiolitis obliterans, which may also play a role in the onset of chest pain [14].

Caffeine is the most widely used psychostimulant in the world. It has been shown to have a positive impact on the adult population, reducing the incidence of metabolic syndrome, cardiovascular diseases, and cancers. However, the impact of this substance on the pediatric population is not fully understood. After 30-60 minutes of oral ingestion, caffeine reaches its maximum concentration in the blood. It crosses the blood-brain barrier and the placental barrier. Caffeine primarily acts as an antagonist of adenosine receptors in the central nervous

system, leading to an increase in the release of dopamine, norepinephrine, and glutamate. Caffeine may cause a decrease in blood flow to the heart muscle by limiting vasodilation [15]. The main sources of caffeine for children are cola-type soft drinks and energy drinks. A 2013 study of 37,500 youths across 16 European countries found that 18% of children (3-10 years) and 68% of adolescents (10-18 years) had consumed energy drinks in the previous year. Large doses of caffeine cause vasoconstriction, leading to an increase in blood pressure. Additionally, its proarrhythmic nature has been demonstrated. Current research shows both positive and negative effects of caffeine on young individuals. Sleep disturbances and negative emotional states, such as anxiety and depression, are the most frequently reported side effects. However, there is currently an increasing consumption of energy drinks among children and adolescents, which, in addition to caffeine, contain substances such as guarana, sweeteners, and preservatives [16]. Excessive consumption of energy drinks may lead to the development of hypertension and myocardial ischemia, contributing to more frequent visits to healthcare providers by children and adolescents [17]. In a study conducted on a group of 18 patients who abused energy drinks, 45% experienced cardiovascular complications, such as arrhythmias, hypertension, acute coronary vasospasm, and spontaneous coronary artery dissection. All these complications may be accompanied by chest pain. Therefore, during the diagnostic assessment of chest pain in pediatric patients who abuse energy drinks, particular caution should be exercised, as they may suffer from life-threatening complications related to the overdose of these beverages [18].

It is important to consider the psychogenic basis for the occurrence of chest pain in children and adolescents. It is estimated that such an etiology may be present in as many as 83.6% of cases [8]. In our study, only a small percentage (3.35%) of patients were found to have a psychological cause for their chest pain. This low result may be attributed to an overly brief diagnostic pathway, leading to the resolution of symptoms and the discharge of patients with a diagnosis of idiopathic chest pain. In recent years, there has been an observed increase in cases of chest pain in children and adolescents with a psychogenic basis. This trend is associated, among other factors, with a growing awareness among clinicians regarding the mental health of this age group. Pissarra et al. [10] conducted a study involving 798 pediatric patients to investigate the etiology of chest pain. They identified a psychogenic basis for 21.6% of these cases. The most frequently mentioned factors included stress related to challenging life situations, the puberty phase, and a history of mental health issues [10]. In contrast, Nurul Islam et al. [19] identified psychological causes in as many as 83.5% of patients in their study

involving a small group. The three most common causes were anxiety disorders, addiction to gaming and smartphones, and depression [19].

In our study, 42.3% of patients had comorbidities, with the most common being bronchial asthma. Similar findings can be seen in current literature. In a study by Alnaim et al. [20], 15.5% of patients with chest pain also had chronic illnesses, most frequently pulmonary conditions such as asthma and allergic rhinitis, as well as hematologic disorders. Pissarra et al. [10] identified the most common causes of chest pain in children and adolescents presenting to primary care physicians. The largest group, 33%, had musculoskeletal causes, such as costochondritis and thoracic nerve inflammation. In 24.4% of cases, the cause of the pain could not be identified, while 21.6% were attributed to psychogenic causes, such as anxiety. Among the comorbidities observed in the study population, pulmonary conditions were the most frequent (12.8%), with bronchial asthma being the most common. Pain related to cardiological conditions was noted in only 1.1% of patients [10].

Chest pain complaints are more frequently reported by older children and adolescents. In our study, over half of all the patients presenting with chest pain were aged between 13 and 18 years. Similarly, in a study by Islam et al. [19], the largest group of patients had a mean age of 10.75±2.47 years.

Duration of chest pain was different in available data. In our study, the majority of pediatric patients reported chest pain lasting less than one day or were unable to estimate the duration of pain. In most cases, treatment was not necessary. In our study, 26.07% of patients required treatment. These findings are consistent with results from other studies on this topic. For example, Chen et al. [21] recorded only 0.2% of cases where hospitalization was required for children with chest pain. The most common approach was conservative treatment, including dietary modifications and respiratory physiotherapy. In approximately 64.94% of patients receiving treatment, pain medications were administered, especially for musculoskeletal pain. A similar trend was reported in the study by Pissarra et al. [10], where around 75% of children with chest pain received pain relief or anti-inflammatory therapy. In that study, musculoskeletal causes were also identified as the most frequent source of chest pain in children. This supports the observed correlation between the use of pain medication and the nature of the pain. In this study, only 2.8% of patients with chest pain required urgent hospitalization and treatment. This was most common in patients diagnosed with pneumothorax, myocarditis, or complicated bacterial pneumonia [10].

Previous studies confirm that the majority of children and adolescents presenting to primary care with chest pain do not have life-threatening conditions. Our findings indicate that

most patients do not suffer from severe chronic illnesses, and short-term pain symptoms can be effectively managed with conservative treatment. One study emphasized that a thorough history and physical examination are sufficient to rule out cardiac and other serious causes of chest pain [5]. Pissarra et al. [10] reported that 62.8% of patients presenting with chest pain had no abnormalities on physical examination.

A study of 761 patients compared the recurrence of chest pain within 12 months after the initial visit to the emergency department in two groups: those with cardiological and non-cardiological chest pain. The recurrence rate was similar in both groups, ranging around 30% [22]. It is worth noting that the recurrent nature of pain symptoms tends to affect patients suffering from chronic conditions. Pissarra et al. [10] also emphasize that recurrence is often observed in patients reporting pain with a psychogenic origin. In the referenced study involving 798 patients, 7.1% were re-hospitalized within a year of observation [10]. It is worth emphasizing that only a small percentage of patients required immediate medical intervention.

Among the diagnoses requiring urgent treatment were pulmonary conditions such as pneumothorax, pneumonia, and pleural empyema, as well as cardiac conditions like pericarditis and myocarditis. Some of these diagnoses pose a real threat to life; however, their identification does not always necessitate advanced specialized testing. In cases of pneumothorax or pneumonia, a thorough medical history and physical examination are crucial. The clinical presentation and characteristic symptoms enable an initial diagnosis, which can be confirmed through imaging studies, such as chest X-rays. A similar situation applies to cardiac causes of chest pain, which, as mentioned earlier, are the least common. A detailed medical history and thorough physical examination play a key role in identifying these conditions. For any child with suspected cardiac etiology of chest pain, an electrocardiogram (ECG) is recommended. In cases where heart murmurs are detected on auscultation or hypoxemia is present, referring the patient for a cardiology consultation is warranted [23].

Chest pain in children is a common symptom, often benign, but it requires careful evaluation to rule out life-threatening conditions. Polish data on pediatric ED)admissions for chest pain remain limited. However, available studies support trends similar to those observed in our cohort. A study conducted in eastern Poland found that chest pain accounted for a small percentage of pediatric ED visits and was rarely associated with serious cardiac pathology, with musculoskeletal and idiopathic causes predominating. These findings are consistent with ours and further confirm the low incidence of life-threatening conditions in children presenting with chest pain in this region [24]. A thorough medical history, physical examination, and appropriate diagnostic tests, such as imaging or ECG, are essential for accurate diagnosis and

effective management. Early identification and treatment of serious causes, although rare, are crucial to ensuring patient safety and optimal outcomes.

Conclusions

Our study confirms existing data indicating that chest pain in children is a common reason for visits to the ED, but it is rarely associated with serious cardiac problems. Most cases are mild, and the pain is typically caused by musculoskeletal, gastrointestinal, respiratory, or psychogenic factors. Among the 1,849 patients analyzed in our study, idiopathic and musculoskeletal causes were the most common, with hospitalizations primarily related to respiratory issues. Physical activity often exacerbated the pain, and dyspnea and palpitations were frequent comorbid symptoms. Bronchial asthma was the most prevalent comorbidity, while caffeine consumption and smoking were correlated with increased stabbing pain. Treatment was necessary in 26.07% of patients, mainly in the form of conservative therapy and pain relief, with only a few cases requiring antibiotics, tranquilizers, or surgical interventions. In light of these findings, it is essential for physicians to conduct thorough assessments of patients presenting with chest pain, emphasizing the importance of conservative treatment strategies. Moreover, educating both patients and their parents about risk factors for pain is crucial, particularly focusing on the consumption of substances such as energy drinks containing caffeine and the smoking of tobacco products.

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