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MANAGEMENT OF CHEST PAIN IN PEDIATRIC PATIENTS BY PHYSICIANS AT DIFFERENT LEVELS

ÇOCUK HASTALARDA GÖĞÜS AĞRISI ŞİKAYETİNİN FARKLI BASAMAKLARDAKİ HEKİMLER TARAFINDAN YÖNETİMİ

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ABSTRACT

Objective: We aimed to examine the management of chest pain in pediatric patients by physicians at different levels of care.

Methods:A questionnaire on the management of chest pain in pediatric patients was sent to pediatric specialists, family practitioners, and pediatric residents online. Physicians were asked to answer all questions anonymously between March 2021 and June 2021. A prospective analysis was conducted based on the data obtained from the questionnaire forms.

Results: Physicians in all groups stated that chest pain was most frequently associated with the musculoskeletal system (Pediatricians 86.7%, Pediatric residents 81%, Family practitioners 76.7%). Pediatric patients with chest pain were most frequently referred to pediatric cardiology outpatient clinics; the rate of referral increased in parallel with the level of training in the field of pediatrics (Pediatricians 87.8%, Pediatric residents 84.7%, Family practitioners 70.4%). While cyanosis was the most important cause of referral for family practitioners (95.2%), a family history of early myocardial infarction was the leading cause for pediatricians (95.3%) and pediatric residents (93%). Compared to other groups, the percentage of family practitioners who have access to diagnostic tests was slightly lower. Electrocardiogram (ECG) was the most accessible (Pediatricians 98.4%, Pediatric residents 98.8%, Family practitioners 92.5%) and the most commonly used diagnostic tool in all groups (Pediatricians 95.6%, Pediatric residents 97.6%, Family practitioners 94.2%). The percentage of physicians who believed that they could interpret pediatric ECG very well was low in all groups (Pediatricians 16.3%, Pediatric residents 8.6%, Family practitioners 4.6%).

Conclusion: In this study, the most common cause of chest pain in children was associated with the musculoskeletal system by all physician groups. Although there were no difficulties in accessing diagnostic tools, the referral system is frequently utilized. While the rate of chest pain of cardiac origin is low, the most frequent referral is to cardiology outpatient clinics.

Keywords: Chest pain, electrocardiogram, child, questionnaire

ÖZ

Amaç: Göğüs ağrısı şikayeti olan çocuk hastalarda, farklı basamaklardaki hekimlerin hasta yönetimi konusundaki uygulamalarını incelemeyi amaçladık.

Yöntem: Göğüs ağrısı olan çocuklar için hazırlanan anket formundaki sorular çocuk sağlığı ve hastalıkları uzmanları (ÇSHU), aile hekimi uzmanları (AHU) ve çocuk sağlığı ve hastalıkları asistanlarına (ÇSHA) internet üzerinden ulaştırıldı. Mart 2021-Haziran 2021 tarihleri arasında hekimlerin isim belirtmeden

Bulgular: Bütün gruplardaki hekimlerin göğüs ağrısının en sık kas-iskelet sistemi ilişkili olduğunu düşündükleri belirlendi (ÇSHU %86.7, ÇSHA %81, AHU %76.7). Göğüs ağrısı olan çocukların, hekimler tarafından en sık çocuk kardiyoloji polikliniğine yönlendirildiği ve bu oranının çocuk sağlığı ve hastalıkları alanında eğitim düzeyi arttıkça arttığı belirlendi (ÇSHU %87.8, ÇSHA %84.7, AHU %70.4). Siyanoz AHU için en önemli yönlendirme neden iken (%95.2), ailede erken yaşta miyokard infarktüsü geçirme öyküsü ÇSHU (%95.3) ve ÇSHA (%93) için ilk sırada gelen neden idi. Diğer gruplarla karşılaştırıldığında tanı testlerine ulaşabilen AHU oranlarının biraz daha düşük olduğu belirlendi. EKG tüm gruplar için en ulaşılabilir (ÇSHU %98.4, ÇSHA %98.8, AHU %92.5) ve en çok kullanılan tanı aracıydı (ÇSHU %95.6, ÇSHA %97.6, AHU %94.2). Pediatrik EKG'yi çok iyi değerlendirebildiğini düşünen hekim sayısı oranı tüm gruplarda düşüktü (ÇSHU%16.3, ÇSHA %8.6, AHU %4.6).

Sonuç: Bu çalışmada tüm hekim grupları tarafından çocuklardaki göğüs ağrısının en sık nedeni kas-iskelet sistemi olarak düşünülmektedir. Tanı araçlarına ulaşmakta güçlük çekilmediği halde sevk sistemine çok sık başvurulduğu görülmektedir. Kardiyak kökenli göğüs ağrısı oranı düşük olduğu halde, en sık yönlendirme kardiyoloji polikliniklerine olduğu izlenmektedir.

Anahtar Kelimeler: Göğüs ağrısı, elektrokardiyogram, çocuk, anket.

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Introduction

Chest pain is one of the most common causes of presenting to outpatient pediatric cardiology clinics. Centers that use standard clinical evaluation and management algorithms avoid unnecessary tests, minimize the use of financial resources and provide an opportunity for real cardiac patients to be attended to at cardiology outpatient clinics.[1] However, there are no standard clinical evaluation and management algorithms for physicians to follow in Turkey. The incidence of chest pain of cardiac origin in children is low, yet it is a significant cause for concern in families. Therefore, it is one of the frequent causes of admission to the emergency room (ER).[2-8] Chest wall lesions, respiratory and gastrointestinal tract pathologies, and psychological factors are causes of noncardiac chest pain in children. In this study, we aimed to examine the approaches of family practitioners, pediatric residents, and pediatricians in managing chest pain in the pediatric age group, and the difficulties they encounter during evaluation.

Methods

Between March 2021 and June 2021, a questionnaire was sent online to pediatricians, family practitioners, and pediatric residents, who evaluate children with chest pain in outpatient clinics and emergency outpatient clinics. Physicians were asked to answer all questions anonymously. Data obtained were analyzed in a prospective study. Informed consent was obtained from participants. This study was approved by the Ethics Committee of Bezmialem University.

Statistical Analysis

IBM SPSS Statistics 22 (IBM SPSS, Turkey) software was used for the statistical analysis of the results obtained in the study. The conformity of the parameters to the normal distribution was evaluated using the Shapiro-Wilk test. Descriptive statistical methods (mean, standard deviation, frequency) were used while evaluating the study data.

Results

254 pediatricians, 189 family practitioners, and 85 pediatric residents responded to the questionnaire. In all groups, the majority of the physicians identified musculoskeletal pain as the cause of chest pain in children (pediatricians 86.2%, pediatric residents 81%, family practitioners 76.7%) (Table 1). Another etiology that physicians in all three groups frequently associated with chest pain was pain associated with the respiratory system (pediatricians 42%, family practitioners 63%, pediatric residents 53%). 39.4% of pediatricians, 42.3% family practitioners, and 40% of pediatric residents considered the cardiovascular system to be the cause of chest pain. Pediatric patients with chest pain were most frequently referred to pediatric cardiology outpatient clinics; the rate of referral increased in parallel with the level of training in the field of pediatrics (Pediatricians 87.8%, Pediatric residents 84.7%, Family practitioners 70.4%) (Table 1).

Table 1. Organ systems associated with chest pain and/or subspecialty outpatient clinics to which patients were referred

Organ systems associated with chest pain in children.	
Family Practitioners (n=189)	Frequency (n) (%)
Gastrointestinal system	39 (20.6%)
Cardiovascular system	80 (42.3%)
Musculoskeletal system	145 (76.7%)
Psychological causes	51 (27%)
Respiratory system	119 (63%)
Pediatricians (n=254)	Frequency (n) (%)
Gastrointestinal system	50 (19.7%)
Cardiovascular system	100 (39.4%)
Musculoskeletal system	219 (86.2%)
Psychological causes	71 (5.1%)
Respiratory system	106 (42%)
Pediatric Residents (n=85)	Frequency (n) (%)
Gastrointestinal system	11 (13%)
Cardiovascular system	34 (40%)
Musculoskeletal system	69 (81%)
Psychological causes	20 (23.5%)
Respiratory system	45 (53%)
Subspecialty outpatient clinics to which children with chest pain were referred.	
Family Practitioners (n=189)	Frequency (n) (%)
Pediatric Gastroenterology	3 (1.6%)
Pediatric Pulmonary Diseases	44 (23.3%)
Pediatric Cardiology	133 (70.4%)
Pediatric Psychiatry	3 (1.6%)
Pediatric Rheumatology	1 (0.5%)
Pediatrics	5 (2.6%)
Pediatricians (n=254)	Frequency (n) (%)
Pediatric Gastroenterology	7 (2.8%)
Pediatric Pulmonary Diseases	16 (6.3%)
Pediatric Cardiology	223 (87.8%)
Pediatric Psychiatry	5 (2%)
Pediatric Rheumatology	1 (0.4%)
Orthopedics	2 (0.8%)
Pediatric Residents (n=85)	Frequency (n) (%)
Pediatric Gastroenterology	1 (1.2%)
Pediatric Pulmonary Diseases	9 (10.6%)
Pediatric Cardiology	72 (84.7%)
Pediatric Psychiatry	2 (2.4%)
Pediatrics	1 (1.2%)

When asked about the history and physical examination findings that led to referrals to the pediatric cardiology outpatient clinic, differences were observed between the approaches of the groups. For family practitioners, the most important finding was cyanosis (95.2%), followed by murmur (93.1%), exertional chest pain (89.4%), and family history of early myocardial infarction (MI) (88.3%). Family history of early MI was the most important reason for referral for pediatricians, followed by cyanosis (92.1%). Other significant reasons for pediatricians were exertional chest pain (91.7%), and murmur (89%).
Family history of early MI (93%) and exertional chest pain (93%) was the most important reason, followed by cyanosis (91.7%) and murmur (91.7%) for pediatric residents (Table 2).

Table 2. Physical examination and laboratory findings leading to referral to cardiology outpatient clinic

Family Practitioners (n=189)	**Frequency (n)**	**Percentage (%)**
Variation in pain intensity based on the position of the body	38	201.
Palpation-induced pain	18	9.5
Cyanosis	180	95.2
Tachypnea	89	47
Tachycardia	138	73
Murmur	176	93.1
Family history of early myocardial infarction	167	88.3
Exertional chest pain	169	89.4
Coughing with chest pain	10	5.3
Change in pain intensity with breathing	32	16.9
Pediatricians (n=254)	**Frequency (n)**	**Percentage (%)**
Variation in pain intensity based on the position of the body	49	19.3
Palpation-induced pain	12	4.7
Cyanosis	234	92.1
Tachypnea	100	39.4
Tachycardia	216	85
Murmur	226	89
Family history of early myocardial infarction	242	95.3
Exertional chest pain	233	91.7
Coughing with chest pain	9	3.5
Change in pain intensity with breathing	27	10.6
Pediatric Residents (n=85)	**Frequency (n)**	**Percentage (%)**
Variation in pain intensity based on the position of the body	11	13
Cyanosis	78	91.7
Tachypnea	29	34.1
Tachycardia	65	76.4
Murmur	78	91.7
Family history of early myocardial infarction	79	93
Exertional chest pain	79	93
Coughing with chest pain	5	5.9
Change in pain intensity with breathing	8	9.4
Family Practitioners (n=189)	**Frequency (n)**	**Percentage (%)**
Abnormal ECG results	188	99.5
Abnormal telecardiography results	139	73.5
Elevated ASO	56	29.6
Elevated CK-MB	121	64
Elevated Troponin I	134	70.9
Elevated Troponin T	126	66.6
Pediatricians (n=254)	**Frequency (n)**	**Percentage (%)**
Abnormal ECG results	248	97.6
Abnormal telecardiography results	204	80.3
Elevated ASO	39	15.3
Elevated CK-MB	146	57.5
Elevated Troponin I	210	82.6
Elevated Troponin T	153	60.2
Pediatric Residents (n=85)	**Frequency (n)**	**Percentage (%)**
Abnormal ECG results	82	96.5
Abnormal telecardiography results	69	81.2
Elevated ASO	37	43.5
Elevated CK-MB	63	74.1
Elevated Troponin I	68	80
Elevated Troponin T	57	67

Variation in pain intensity based on the position of the body and fever were factors that led the physicians away from considering the chest pain to be of cardiac origin (Table 3). When the availability of laboratory diagnostic tools was compared, family practitioners had lower levels of access to all diagnostic tools compared to the other groups (Table 4). ECG was the most commonly used diagnostic tool by all physicians (pediatricians 95.6%, family practitioners 94.2%, pediatric residents 97.6%), followed by troponin I/T tests (pediatricians 75.2%,

Table 3. Factors that lead physicians away from considering the chest pain to be of cardiac origin

Family Practitioners (n=189)	**Frequency (n)**	**Percentage (%)**
Variation in pain intensity based on the position of the body	121	64
Fever	91	48.1
Syncope	9	4.7
Palpitations	5	2.6
Chest pain that starts when sitting down	37	19.5
Pediatricians (n=254)	**Frequency (n)**	**Percentage (%)**
Variation in pain intensity based on the position of the body	171	67.3
Fever	110	43.3
Syncope	18	9.5
Palpitations	15	7.9
Chest pain that starts when sitting down	63	33.3
Pediatric Residents (n=85)	**Frequency (n)**	**Percentage (%)**
Variation in pain intensity based on the position of the body	52	61.2
Fever	30	35.3
Syncope	3	3.5
Palpitations	2	2.3
Chest pain that starts when sitting down	17	20

family practitioners 62%, pediatric residents 70.6%) (Table 5). Compared to other groups, pediatricians used chest X-rays less frequently (48.4%).

Table 4. The level of laboratory support in centers where physicians work

Family Practitioners (N=189)	**Frequency (n) (%)**
Chest X-Ray	84 (44.4%)
ASO	119 (63%)
C-Reactive Protein	162 (85.7%)
CK-MB	80 (42.3%)
Electrocardiogram	175 (92.5%)
Hemogram	177 (93.6%)
Creatine kinase	123 (65%)
Sedimentation	71 (37.5%)
Telecardiogram	40 (21.1%)
Troponin I	65 (34.4%)
Troponin T	48 (25.4%)
Pediatricians (N=254)	**Frequency (n) (%)**
Chest X-Ray	243 (95.6%)
ASO	233 (91.7%)
C-Reactive Protein	243 (95.6%)
CK-MB	239 (94.1%)
Electrocardiogram	250 (98.4%)
Hemogram	245 (96.4%)
Creatine kinase	243 (95.6%)
Sedimentation	241 (94.8%)
Telecardiogram	227 (89.3%)
Troponin I	217 (85.4%)
Troponin T	168 (66.1%)
Pediatric Residents (N=85)	**Frequency (n) (%)**
Chest X-Ray	84 (98.8%)
ASO	80 (94.1%)
C-Reactive Protein	84 (98.8%)
CK-MB	84 (98.8%)
Electrocardiogram	84 (98.8%)
Hemogram	84 (98.8%)
Creatine kinase	83 (97.6%)
Sedimentation	81 (95.2%)
Telecardiogram	78 (71.7%)
Troponin I	70 (82.3%)
Troponin T	61 (71.7%)

Contrary to expectations, the use of telecardiography was low in all groups (pediatricians 52.3%, pediatric residents 35.3%), the rate was significantly lower among family practitioners (13.7%).

Table 5. The most commonly preferred tests by physicians to evaluate chest pain

Family Practitioners (N=189)	**Frequency (n) (%)**
Chest X-Ray	114 (60.3%)
ASO	34 (18%)
C-Reactive Protein	81 (42.8%)
CK-MB	71 (37.5%)
Electrocardiogram	178 (94.2%)
Hemogram	95 (50.2%)
Creatine kinase	40 (21.1%)
Sedimentation	24 (12.7%)
Telecardiogram	26 (13.7%)
Troponin I/T	117 (62%)
Pediatricians (N=254)	**Frequency (n) (%)**
Chest X-Ray	123 (48.4%)
ASO	20 (7.8%)
C-Reactive Protein	77 (30.3%)
CK-MB	116 (45.6%)
Electrocardiogram	243 (95.6%)
Hemogram	114 (44.8%)
Creatine kinase	65 (25.6%)
Sedimentation	52 (20.5%)
Telecardiogram	133 (52.3%)
Troponin I/T	191 (75.2%)
Pediatric Residents (N=85)	**Frequency (n) (%)**
Chest X-Ray	58 (68.2%)
ASO	11 (13%)
C-Reactive Protein	29 (34.1%)
CK-MB	50 (58.8%)
Electrocardiogram	83 (97.6%)
Hemogram	35 (41.2%)
Creatine kinase	28 (33%)
Sedimentation	17 (20%)
Telecardiogram	30 (35.3%)
Troponin I/T	60 (70.6%)

The rate of the number of physicians who thought that they could evaluate pediatric ECG very well was low in all groups (Pediatrician 16.3%, Pediatric resident 8.6%, Family practitioners 4.6%) (Table 6). The number of physicians who can recognize arrhythmias in ECG was higher among pediatric residents than in the other

groups (pediatricians 28.1%, family practitioners 22.5%, pediatric residents 43.1%). The most significant laboratory finding leading to referral to a pediatric cardiology outpatient clinic was abnormal ECG (pediatricians 97.6%, family practitioners 99.5%, pediatric residents 96.5%). For pediatricians, the second most important laboratory test was elevated troponin I (82.6%); for family practitioners and pediatric residents, it was abnormal telecardiography (73.5%, 81.2%).

Table 6. Electrocardiogram Interpreting Skills of Physician Groups

	Family Practitioners	**Frequency (n)**	**Percentage (%)**
Applicable metrics	Recognizing dysrhythmias	69	22.5
	I believe I can interpret pediatric ECG very well.	14	4.6
	I cannot interpret pediatric ECG at all.	61	19.9
	QTc calculation	78	25.5
	ST segment variations	35	11.4
	T wave variations	49	16
	Total	306	100
	Pediatricians	**Frequency (n)**	**Percentage (%)**
Applicable metrics	Recognizing dysrhythmias	98	28.1
	I believe I can interpret pediatric ECG very well.	57	16.3
	I cannot interpret pediatric ECG at all.	11	3.2
	QTc calculation	56	16
	ST segment variations	63	18.1
	T wave variations	64	18.3
	Total	349	100
	Pediatric Residents	**Frequency (n)**	**Percentage (%)**
Applicable metrics	Recognizing dysrhythmias	50	43.1
	I believe I can interpret pediatric ECG very well.	10	8.6
	I cannot interpret pediatric ECG at all.	4	3.4
	QTc calculation	15	12.9
	ST segment variations	17	14.7
	T wave variations	20	17.2
	Total	116	100

For pediatricians, the third most important laboratory test was abnormal telecardiography (80.3%); for family practitioners and pediatric residents, it was elevated troponin I (family practitioners 70.9%, 80% pediatric residents). The most important consideration when referring patients was history including exertional chest pain, change in pain intensity with breathing (pediatricians 26.3%, family practitioners 25.4%, pediatric residents 27.8%), followed by physical examination findings (pediatricians 24.4%, family practitioners 24.2%, pediatric residents 24.1%). Family history was another important consideration when referring patients (pediatricians 17%, family practitioners 17.5%, pediatric residents 18.1%).

Discussion

Studies on chest pain in children have shown that pain is mostly associated with the musculoskeletal system, gastrointestinal system, respiratory system; it is idiopathic or due to psychological causes.[2,9,10] Although the rate of chest pain of cardiac origin is low in children, it becomes significant due to the anxiety it causes in parents and children. According to studies, 0.6-1% of chest pain in children who were admitted to the ER was of cardiac origin.[2,11,12] In our study, the most common cause of chest pain in children in all physician groups was the musculoskeletal system (76.7%-86.2%). Pain that was considered to be of cardiovascular origin was the third most common cause (39.4%-42.3%). Pediatric patients with chest pain were most frequently referred to pediatric cardiology outpatient clinics; the rate of referral increased in parallel with the level of training in the field of pediatrics. This may be due to the fact that pediatric outpatient clinics evaluate patients with more complex pathologies. Additionally, in our country, the lack of standardized algorithms that physicians can apply in the national database on this subject may be a reason for more referrals to the pediatric cardiology outpatient clinic.

In recent years, news about sudden death in athletes has aroused concern and anxiety both in parents and physicians. Family history of early myocardial infarction in a child with chest pain is a concern both for parents and physicians. In this study, family history of early MI was found to be the most important driver for pediatricians and pediatric residents for referring the patients to pediatric cardiology outpatient clinics (95.3% and 93% respectively).

Physical examination and laboratory findings provide important information for determining the important causes of chest pain in outpatient clinics and emergency departments. Cyanosis and murmur are two important findings that suggest a cardiac etiology. In our study, cyanosis was the most important factor (95.2%) for family practitioners for referring patients to cardiac evaluation. For the same group, the second was murmur (93.1%). Among laboratory findings, abnormal ECG findings were the most important reason for referral, followed by elevated troponin I and abnormal telecardiography. Variation in pain intensity based on the position of the body and fever were factors that led the physicians away from considering the chest pain to be of cardiac origin.

ECG, troponin T/I, and chest X-ray were the most common tools used for diagnosis. Family practitioners had lower levels of access to all diagnostic tools compared to the other groups. When the groups were compared, it was seen that pediatricians used chest X-rays less frequently than others. Telecardiography was low in all groups, especially in family practitioners. Based on these findings, we believe that increasing laboratory support for family practitioners can both reduce the workload in pediatric cardiology outpatient clinics and allow physicians to evaluate their patients

holistically. Designing training programs on interpreting telecardiography for all physician groups may allow this diagnostic tool to be used more widely and contribute to the early diagnosis of cardiac pathologies. The percentage of those who could interpret the ECG, which is the most frequently used tool for diagnosis, was low in all groups. These rates were slightly higher in the evaluation of arrhythmia (pediatricians 28.1%, family practitioners 22.5%, pediatric residents 43.1%). Based on these data, we believe that systematic and regular ECG trainings for all physicians will increase the quality of health care services for the patients and reduce unnecessary referrals to cardiology outpatient clinics. Patient history provides invaluable information when assessing chest pain in children. All physicians who participated in this study attached the highest importance to patient history when deciding on a referral.

Conclusion

The data obtained from our study shows that physicians face certain difficulties when evaluating chest pain in children and referring their patients to the pediatric cardiology outpatient clinic due to the lack of applicable standard guidelines. The rates of evaluating ECG and using telecardiography for diagnosis were low in all groups. Providing structured education programs on these issues can allow for a more holistic evaluation of the patient and contribute to the earlier diagnosis of serious pathologies. Family practitioners had lower levels of access to all diagnostic tools compared to the other groups. Increasing laboratory support for family physicians may reduce unnecessary referrals and enable easier identification of patients requiring further evaluation.

Compliance with Ethical Standards

Bezmialem University Ethics Comittee approved this study (2021/02.22). Informed consent was obtained from all participants.

Conflict of Interest

The author declares no conflicts of interest.

Author Contribution

All the authors equally contributed to this work.

Financial Disclosure

None

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