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Original Article

Evaluation of Cardiac Troponin Results in the Pediatric Emergency Department: A Single-Center Experience

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Abstract

Objective: This study aimed to evaluate cardiac troponin levels in pediatric patients presenting with chest pain to the Emergency Department and to analyze their association with demographic and laboratory parameters.

Methods: This retrospective study included 1257 pediatric patients who presented with chest pain to the Emergency Department of Gaziantep City Hospital between 09.10.2023 and 04.10.2024. Data on age, sex, CK-MB, WBC, NEU, LYM, CRP, and troponin levels were analyzed. Patients with missing data were excluded. Statistical analysis was performed using SPSS 25. Depending on data distribution, Mann-Whitney U and Kruskal-Wallis tests were used ($p<0.05$ considered significant).

Results: Of the patients, 52.3% were female and 47.7% male. Troponin levels were within normal limits in 97% of cases, and elevated in 3%. Troponin levels were significantly higher in male patients ($p<0.05$). A statistically significant correlation was found between CK-MB and troponin levels ($p<0.05$). No significant correlation was found between troponin and inflammatory markers such as WBC, NEU, LYM, and CRP ($p>0.05$).

Conclusion: Troponin levels were found to be associated with sex and CK-MB, but not with inflammatory markers. These findings suggest that while troponin testing may help evaluate pediatric chest pain, clinical assessment and other laboratory findings must be considered to avoid unnecessary testing and ensure effective management.

Keywords: Chest Pain, Pediatrics, Cardiac troponin, Creatine Kinase, C-Reactive Protein

INTRODUCTION

Chest pain is a common symptom in childhood and can be a source of concern for both families and healthcare providers. While cardiac causes are more frequent in adults, the vast majority of pediatric chest pain cases are due to non-cardiac etiologies. These include musculoskeletal pain, gastrointestinal issues, psychogenic factors, and pulmonary conditions (1,2). However, although rare, cardiac pathologies such as myocarditis, pericarditis, and arrhythmias may present as serious causes of chest pain in children (3).

In recent years, cardiac troponin testing has become an important diagnostic tool for the early detection of myocardial injury. Troponin is a protein found in myocardial cells and is released into the bloodstream when damage occurs. Interpreting troponin levels in children can be more complex than in adults, as pediatric reference ranges vary by age and sex (4,5). This study aims to evaluate the clinical significance of troponin levels in pediatric patients presenting with chest pain and to examine their relationship with demographic and laboratory parameters.

METHODS

This retrospective study includes data from 1257 pediatric patients who presented with chest pain to the Pediatric Emergency Department of Gaziante City Hospital between October 9, 2023, and October 4, 2024. The study was conducted with approval from the hospital's ethics committee.

Data Collection

Demographic information (age, sex), clinical features, and laboratory findings (CK-MB, WBC, NEU, LYM, CRP, and cardiac troponin levels) were obtained from electronic medical records. Patients with incomplete data were excluded from the study.

Laboratory Analyses

- •Cardiac Troponin: High-sensitivity troponin T (hs-TnT) test was used.
- •CK-MB: Used to assess myocardial damage.
- •Inflammatory Markers: WBC, NEU, LYM, and CRP levels were analyzed.

STATISTICAL ANALYSIS

Normality of data distribution was assessed using the Shapiro-Wilk test. For non-normally distributed data, non-parametric tests (Mann-Whitney U and Kruskal-Wallis) were applied. A p-value <0.05 was considered statistically significant for comparisons between groups. Correlation analyses were performed using the Spearman correlation test.

RESULTS

A total of 1257 pediatric patients were included in the study, of whom 52.3% (n=657) were female and 47.7% (n=600) were male. The age distribution showed that 59.4% (n=747) of the patients were between 13–18 years, 35.3% (n=444) between 7–12 years, and 5.3% (n=66) between 0–6 years (**Table 1**).

Cardiac troponin values were within normal limits in 97% (n=1219) and elevated in 3% (n=38) of patients. CK-MB values were normal in 98.2% (n=1234) and abnormal in 1.8% (n=23). WBC values were within normal range in 65.5% (n=823), elevated in 33.7% (n=423), and low in 0.9% (n=11). Neutrophil (NEU) values were normal in 80.7% (n=1014), elevated in 18.5% (n=233), and low in 0.8% (n=10). Lymphocyte (LYM) values were within normal limits in 64.4% (n=810) and elevated in 32.7% (n=411). CRP values were within normal range (0–5 mg/L) in 79.8% (n=1003) and elevated (>5 mg/L) in 20.2% (n=254).

Normality of troponin distributions across categories was assessed using both Kolmogorov-Smirnov and Shapiro-Wilk tests. In cases where the sample size was below 50, Shapiro-Wilk was prioritized. All categories violated the assumption of normality; thus, non-parametric tests were used in further analysis (**Table 2**).

The Mann-Whitney U test revealed statistically significant differences in troponin levels based on gender and CK-MB categories ($p<0.05$), but no significant difference was observed with respect to CRP levels ($p=0.171$). Male patients had significantly higher troponin levels compared to females. Patients with abnormal CK-MB levels had significantly higher troponin levels than those with normal CK-MB values (**Table 3**).

The Kruskal-Wallis test was used to analyze troponin distributions across other variables. There were no statistically significant differences in troponin levels based on WBC, neutrophil, lymphocyte, or seasonal categories ($p>0.05$). Although more cases presented during winter, seasonal variation did not significantly affect troponin values.

These findings suggest that while troponin levels are associated with sex and CK-MB, they are not significantly influenced by inflammatory markers (WBC, NEU, LYM, CRP) or seasonal factors.

DISCUSSION

Although chest pain is a common complaint in children, it is mostly of non-cardiac origin. According to the literature, the most frequent causes of chest pain in children include idiopathic, musculoskeletal, respiratory, and psychogenic factors (1,2). In this study, cardiac troponin levels in pediatric patients presenting to the emergency department with chest pain were evaluated in relation to demographic and laboratory findings.

Our study revealed that 52.3% of the patients were female and 47.7% were male, with the highest frequency observed in the 13–18 age group (59.4%).

Table 1. Frequency and Percentage Distribution of Variables

	Category	Frequency	Percentage (%)
GENDER	Male	600	47.7
	Female	657	52.3
AGE	0–6 years	66	5.3
	7–12 years	444	35.3
	13–18 years	747	59.4
CK-MB	Normal	1234	98.2
	Abnormal	23	1.8
WBC	<3.84	11	0.9
	3.84–9.84	823	65.5
	>9.84	423	33.7
NEUTROPHIL	<1.5	10	0.8
	1.5–7	1014	80.7
	>7	233	18.5
LYMPHOCYTE	<0.97	36	2.9
	0.97–3.26	810	64.4
	>3.26	411	32.7
CRP	0–5	1003	79.8
	>5	254	20.2

Table 2. Normality Test Results (Kolmogorov-Smirnov and Shapiro-Wilk)

Variable	Category	K-S Statistic	df (K-S)	p (K-S)	S-W Statistic	p (S-W)
GENDER	Female	0.426	657	0.0	0.081	0.0
	Male	0.466	600	0.0	0.042	0.0
CK-MB	Normal	0.432	1234	0.0	0.075	0.0
	Abnormal	0.477	23	0.0	0.236	0.0
WBC	<3.84	0.44	11	0.0	0.42	0.0
	3.84–9.84	0.442	823	0.0	0.076	0.0
	>9.84	0.469	423	0.0	0.037	0.0
	<1.5	0.394	10	0.0	0.604	0.0
	1.5–7	0.435	1014	0.0	0.076	0.0
	>7	0.472	233	0.0	0.053	0.0
	<0.97	0.418	36	0.0	0.294	0.0
	0.97–3.26	0.467	810	0.0	0.038	0.0
	>3.26	0.375	411	0.0	0.113	0.0
CRP	0–5	0.399	1003	0.0	0.168	0.0
	>5	0.478	254	0.0	0.073	0.0
AGE	0–6 years	0.331	66	0.0	0.467	0.0
	7–12 years	0.38	444	0.0	0.224	0.0
	13–18 years	0.468	747	0.0	0.039	0.0
SEASON	Winter	0.415	410	0.0	0.103	0.0
	Spring	0.415	339	0.0	0.174	0.0
	Summer	0.481	287	0.0	0.047	0.0
	Autumn	0.452	221	0.0	0.093	0.0

These findings are consistent with other studies in the literature. The increased frequency of chest pain during adolescence may be explained by the higher prevalence of psychogenic and idiopathic causes in this age group (3,4). Additionally, the balanced distribution of sex suggests that chest pain occurs with similar frequency in both genders.

The significant association between troponin levels and both sex and CK-MB values indicates that elevated troponin is more pronounced in males and in patients with abnormal CK-MB. This finding highlights the importance of troponin testing in identifying myocardial injury and suggests that cardiac pathology may be more prevalent among male children (5). However, the fact that 97% of troponin and 98.2% of CK-MB values were within normal limits indicates that most cases did not involve myocardial damage. This supports the prevailing literature that cardiac causes are uncommon in pediatric chest pain (6).

The lack of significant correlation between troponin levels and inflammatory markers (WBC, NEU, LYM, CRP) suggests that these markers are not directly associated with myocardial injury. While severe infections or sepsis can elevate troponin in some cases, these results suggest that inflammation alone is not a typical cause of troponin elevation in children with chest pain (7). Nevertheless, infectious and inflammatory conditions should still be considered in the differential diagnosis.

Seasonal analysis did not show a significant effect on troponin levels. However, the number of admissions during winter was higher, likely due to increased respiratory infections, reinforcing the need to consider respiratory causes in the evaluation of chest pain (8). Furthermore, the higher troponin levels observed in males may reflect increased myocardial stress in this group, consistent with findings in previous studies (9).

The positive correlation between CK-MB and troponin underscores the clinical utility of evaluating both markers in suspected cardiac-origin chest pain. On the other hand, the absence of association between troponin and inflammatory markers may indicate a limited role for inflammation in the pathophysiology of chest pain in children (10).

CONCLUSION

In conclusion, cardiac troponin testing plays an important

Table 3. Mann-Whitney U Test Results by Variable Categories

Variable	Category	N	Mean Rank	Mann-Whitney U / p
GENDER	Female	657	590.38	0.001
	Male	600	671.29	
CK-MB	Normal	1234	624.87	<0.001
	Abnormal	23	850.52	
CRP	0–5	1003	622.97	0.171
	>5	254	652.83	

Table 4. Kruskal-Wallis Test Results for Troponin Values by WBC, NEU, LYM, and Season Categories

Variable	Category	N	Mean Rank	Kruskal-Wallis H / df	p
WBC	<3.84	11	600.27	H = 0.234 / df = 2	p = 0.890
	3.84–9.84	823	626.91		
	>9.84	423	633.82		
	<1.5	10	642.65	H = 0.925 / df = 2	p = 0.630
	1.5–7	1014	624.88		
	>7	233	646.35		
	<0.97	36	686.1	H = 4.241 / df = 2	p = 0.120
	0.97–3.26	810	616.38		
	>3.26	411	648.88		
SEASON	Winter	410	609.2	H = 3.793 / df = 3	p = 0.285
	Spring	339	652.91		
	Summer	287	633.13		
	Autumn	221	623.69		

role in evaluating pediatric chest pain. However, comprehensive clinical assessment—including medical history, physical examination, ECG, chest radiography, and seasonal factors—should be integrated into decision-making. As non-cardiac causes are more frequent in children, unnecessary testing should be avoided through detailed anamnesis and examination. Troponin testing should be reserved for cases where cardiac pathology is strongly suspected. Inflammatory markers may assist in distinguishing non-cardiac etiologies. This approach may help reduce unnecessary testing and healthcare costs. Future studies should aim to establish age- and sex-specific reference ranges for troponin in pediatric populations.

DECLERATIONS

Ethics Committee Approval: This study was approved by the Clinical Research Ethics Committee of Gaziantep City Hospital Hospital (Decision No: 98/2024).

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