

# Serum Troponin I Level in Children with Diabetic Ketoacidosis

Dear Editor,

Diabetic ketoacidosis (DKA) is the most acute complication of diabetes.<sup>1</sup> Myocardial damage and dysfunction are some of the most lethal complications and are the principal cause of hospitalization and death globally.<sup>2,3</sup>

Elevated troponin levels occur in several patients without ischemic heart issues.<sup>4</sup> Increased cardiac biomarkers in DKA without coronary involvement have been reported in several studies.<sup>5,6</sup> However, there are few case reports regarding myocardial damage in pediatric DKA patients.<sup>7,8</sup> In addition, some investigations have concluded that elevated troponin levels during DKA increase future mortality risk.<sup>9</sup>

We investigated the serum troponin I level as a biochemical marker of myocardial damage in 50 pediatric patients with diabetes aged between 1 and 18 years during DKA and after its treatment. Laboratory tests and vital signs during admission were checked for all cases (Table 1).

Table 1. Laboratory test results and vital signs of the patients during admission

Variables	mean±SD
Blood sugar (mg/dL)	527±172.71
Na (mEq/L)	139.75±5.37
K (mEq/L)	4.47±0.60
BUN (mg/dL)	15.90±5.60
Cr (mg/dL)	0.84±0.23
pH	7.12±0.14
HCO <sub>3</sub> (mEq/L)	7.44±3.78
Systolic blood pressure (mmHg)	111.80±11.06
Diastolic blood pressure (mmHg)	72.40±7.01
Temperature (°C)	36.70±0.40
Heart rate (bpm)	118.04±17.87

Na, Sodium ; K, Potassium; BUN, Blood urea nitrogen; Cr, Creatinine; pH, Potential of hydrogen; HCO<sub>3</sub><sup>-</sup>, Hydrogen carbonate

The mean level of troponin I showed a significant difference between admission (11.56±5.35 ng/mL) and after DKA treatment (2.15±1.21 ng/mL) (P=0.041). Three patients (6.0%) showed an initial troponin I level (first troponin<sub>pt1</sub> =74.20, troponin<sub>pt2</sub> =20.40, and troponin<sub>pt3</sub> =38.00) higher than the normal range with normal heart

function, echocardiography, and electrocardiography. Their troponin level also became normal after DKA recovery (second troponin<sub>pt1</sub> =5.90, troponin<sub>pt2</sub> =2.00, and troponin<sub>pt3</sub> =7.00).

The mean difference in troponin levels showed no significant relationship with pH (P=0.272) and hydrogen carbonate (HCO<sub>3</sub>) (P=0.078) (Figure 1).

Primary and secondary troponin levels did not have a statistically significant relationship with age, diabetes duration, and DKA severity (P>0.050) (Table 2).

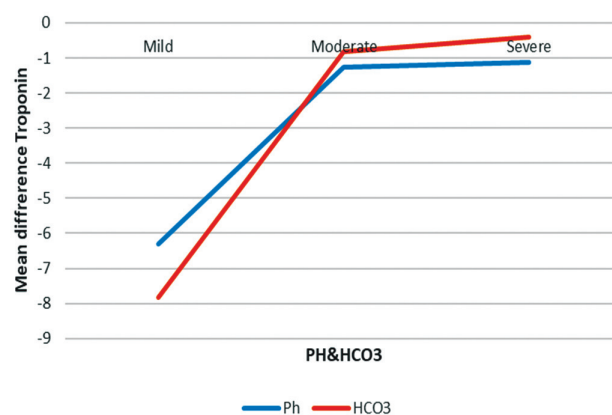


Figure 1. The image depicts the relationships between the mean difference in troponin levels and pH and HCO<sub>3</sub>.

pH, Potential of hydrogen; HCO<sub>3</sub><sup>-</sup>, Hydrogen carbonate

Table 2. Relationships between troponin levels and age groups, duration of diabetes, and DKA severity

	Frequency (%)	P*	
		Primary Troponin	Secondary Troponin
Age Category (y)		0.900	0.999
1-5	3 (6.0)		
6-10	21 (42.0)		
11-15	19 (38.0)		
16-18	7 (14.0)		
Duration of Diabetes (mon)		0.252	0.621
0-36	31 (62.0)		
37-72	12 (24.0)		
73-108	7 (14.0)		
DKA Severity		0.093	0.153
Mild	18 (36.0)		
Moderate	18 (36.0)		
Severe	14 (28.0)		

\*One-way ANOVA, statistical differences: P<0.05

DKA, Diabetic ketoacidosis



Only 1 case had an abnormal T wave due to hyperkalemia ( $K=6.30$  mEq/L). Hyperkalemia can mimic myocardial infarction on the electrocardiogram and exhibit a “pseudoinfarction” pattern.<sup>5</sup> Generally, total body potassium in DKA is low; nonetheless, due to the shift of potassium from the intracellular to extracellular space, acidosis, decreased insulin levels, and hyperosmolality, DKA patients may show elevated potassium levels. However, the follow-up clinical outcomes of our patients were normal after DKA treatment.

Heart and respiratory rates per minute increased more than their expected values, typical findings in DKA, in contrast to the other vital signs. In a study conducted on 1258 children suffering from DKA, hypertension was about 12.2%. They concluded that acute renal failure, severe acidosis, and lower Glasgow Coma Scale scores were the significant risk factors for hypertension.<sup>10</sup>

Some studies have described increased troponin levels as a risk factor for future cardiovascular problems and mortality.<sup>5,11</sup> Al-Mallah et al<sup>9</sup> reported that among 96 adult patients with DKA, 26 patients had elevated troponin levels. After a 2-year follow-up, patients with higher troponin levels had higher mortality. The available studies and case reports on myocardial involvement in the pediatric age group are rare. Shim et al<sup>7</sup> reported a 12-year-old girl with an elevated troponin level and myocardial injury during severe DKA. The changes were entirely resolved after 5 days of supportive care, and she was discharged without sequelae.

In conclusion, although troponin levels in children had significant differences during DKA and after recovery, only 6.0% of our DKA patients had troponin levels higher than the expected value, with the levels normalized after recovery. All our patients were discharged without any sequelae. Since elevated troponin levels are reported as a prognostic factor in DKA and diabetic patients, it is recommended that these patients be followed up for future cardiovascular complications.

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