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Reduction of Serum Troponin I in Premature Neonates After Closure of Patent Ductus Arteriosus

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Dear Editor,

The ductus arteriosus is a physiological fetal artery that connects the pulmonary artery to the descending aorta. After birth, the ductus arteriosus is expected to close within the first few days of life. Failure of this process in infants results in a condition known as patent ductus arteriosus (PDA). Serum troponin I is a diagnostic marker for cardiac injury and is used to differentiate between children with and without heart disease (1). There are limited studies on serum troponin levels in newborns and its variation during the closure of PDA (1, 2). This study aimed to measure serum troponin levels in premature neonates with PDA and investigate changes in its concentration following PDA closure.

This cross-sectional study was conducted on all preterm newborns with PDA born at Hafez Hospital, affiliated with Shiraz University of Medical Sciences, Iran, from January to July 2018. Echocardiography was performed on the first day after birth and one week after the completion of medical treatment. Twenty-six healthy premature neonates of similar age and from the same geographic region were selected as the control group.

The study was approved by the ethics committee of Shiraz University of Medical Sciences, and informed consent was obtained from the parents of all participants. Newborns were excluded if they had complex heart diseases, ischemic-hypoxic encephalopathy, or arrhythmias. Additionally, newborns with bleeding tendencies or confirmed sepsis were also excluded.

Demographic data, including gestational age, sex, birth weight, and mode of delivery, were collected. Thirty-one preterm newborns with confirmed PDA received medical therapy consisting of intravenous acetaminophen 15 mg/kg every 6 hours for 3 days. Baseline serum troponin I levels were measured at 48 hours of life in all preterm newborns. During treatment, five patients passed away due to acute respiratory distress syndrome, congenital pneumonia, and necrotizing enterocolitis. One week after the completion of medical therapy, the remaining patients underwent a follow-up echocardiogram and troponin test.

To measure troponin I concentration, a 2 mL blood sample was taken from each preterm newborn at 48 hours of life. Plasma troponin was measured using the VIDAS high-sensitivity human cardiac troponin I ultra-assay (BioMerieux, Marcy L'Etoil, France) via the ELFA (Enzyme Linked Fluorescent Assay) technique, which has a detection limit of 1.5 ng/L. Troponin concentrations below 0.0019 μg/dL were considered normal, 0.0019 to 0.010 μg/dL as borderline, and values above 0.010 μg/dL as positive, according to the manufacturer's brochure.

A total of 26 premature newborns with PDA (18 girls and 8 boys) and 26 premature newborns without PDA (20 girls and 6 boys) with a gestational age range of 26 to 36 weeks were enrolled in the study. The characteristic data, including sex, type of delivery, gestational age, and birth weight, showed no significant

differences between newborns with PDA and those without (P > 0.3). However, a significant difference was observed in the serum troponin levels between newborns with PDA and those without (P < 0.001). In the PDA group, serum troponin levels were not correlated with age, sex, type of delivery, gestational age, or birth weight.

All 26 patients with PDA underwent follow-up echocardiography and had their troponin levels measured one week after receiving medical treatment with acetaminophen. Patent ductus arteriosus was completely closed in 21 of the premature newborns. Table 1 presents the echocardiographic findings of these newborns before and after treatment.

Table 1. Echocardiography Measurements and Troponin Level of 26 Premature Newborns with Patent Ductus Arteriosus Before and After Medical Treatment [a]

Characteristics	Before Treatment	After Treatment	P-Value
PDA diameter, mm	3.20 ± 1.89	0.01 ± 0.03	< 0.001
LVEDD diameter, mm	1.26 ± 0.32	1.09 ± 0.28	0.001
LVSF diameter, mm	41.18 ± 6.60	41.42 ± 6.87	0.79
LVEF diameter, mm	73.64 ± 7.18	74.1 ± 8.80	0.74
Serum troponin (µg/dL)	0.017 ± 0.016	0.007 ± 0.004	0.001

Abbreviations: LVEDD, left ventricular end- diastolic diameter; LVEF, left ventricular ejection fraction; LVSF, left ventricular shortening fraction; PDA, patent ductus arteriosus.

[a] Values are expressed as mean ± SD.

The mean serum troponin I level significantly decreased from 0.017 ± 0.016 µg/dL at baseline to 0.007 ± 0.004 µg/dL after PDA treatment in our premature newborns (P = 0.001). There was no significant correlation between the change in troponin levels before and after treatment and the echocardiography findings in the studied newborns.

Various studies suggest that serum troponin can serve as a biomarker for cardiac disease in children (1, 2). This study demonstrated that the mean troponin level was significantly higher in the PDA group (0.017 µg/dL) compared to the control group (0.002 µg/dL) on day 2 after birth. Similarly, Vaisbourd et al. reported elevated cardiac troponin levels in 13 newborns with PDA compared to 12 with non-significant PDA and 18 without PDA (3). In contrast, Tanasan et al. found no significant difference in troponin levels among 22 patients with large PDA, 14 with small PDA, and 25 without PDA (4).

Following the closure of PDA with acetaminophen treatment, the troponin level in our patients significantly decreased to a mean of 0.007 µg/dL (P = 0.001). El-Khuffash et al. also observed that preterm neonates with large PDA who received successful treatment exhibited decreased troponin levels post-treatment (5). No differences in troponin levels were found based on sex, mode of delivery, gestational age, or birth weight in the studied premature newborns.

These findings suggest that monitoring baseline and serial serum troponin levels, particularly observing a declining trend, may provide an indication of successful PDA closure.

Footnotes

Authors' Contribution: Study concept: A. T. and M. R.; literature review and data gathering: A. T. and M. R.; drafting the letter: A. T., M. R. and M. M.; critical revision: A. T., M. R. and M. M.; supervision: A. T., M. R. and M. M.

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