Original Article

ASSESSMENT OF BIOCHEMICAL EVENTS IN CONGENITAL HEART DISEASE IN CHILDREN

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ABSTRACT:

AIM of Study: To asses biochemical events in children with congenital heart disease in a tertiary hospital in Central India

Background:
Congenital Heart Disease (CHD) stands as a significant global health concern, representing a spectrum of structural anomalies in the heart and major blood vessels that originate during fetal development. It is estimated that approximately 1% of live births are affected by CHD, making it the most prevalent congenital disorder worldwide. The complexity of CHD ranges from relatively simple defects with minor clinical consequences to severe, life-threatening conditions that necessitate immediate medical intervention. By delving into the molecular intricacies, we aim to enhance our understanding of the etiological factors, identify potential therapeutic targets, and contribute to the development of personalized treatment strategies for children affected by CHD. Through this assessment, we aspire to bridge the gap between basic science and clinical practice, fostering advancements that will ultimately improve the lives of individuals born with congenital heart defects.

Methods: Type of Study: Prospective Study, Duration of Study: 12 months. All children admitted to the hospital of age group up to 18 yrs. with congenital heart disease posted for surgery with being included in the study after prior informed written consent from the parent or guardian. All necessary investigations prior to surgery will be done. Children will be followed up from prior to cardiac surgery to post-operative recovery and discharge.

Result
This investigation focused on a cohort of thirty pediatric patients diagnosed with congenital heart disease who underwent cardiac interventions or surgical procedures at our institution. Comprehensive pre- and post-operative monitoring, including blood investigations, was conducted. A rigorous statistical analysis was performed to compare the results before and after the cardiac

procedures. The analysis revealed statistically significant variations in various parameters, such as post-operative heart rate, platelet counts, and electrolyte levels. These findings underscore the impact of cardiac interventions on key physiological markers and emphasize the importance of monitoring and managing these parameters in the postoperative period for children with congenital heart disease.

Conclusion:
In conclusion, this study provides a critical assessment of biochemical events in children with congenital heart disease in a tertiary hospital in Central India. The insights gained are pivotal for refining diagnostic and therapeutic approaches, aiding in the development of targeted interventions. By unraveling the biochemical intricacies, we aim to enhance the understanding of congenital heart disease pathogenesis, ultimately contributing to improved patient care and outcomes. This investigation lays the foundation for advancing medical practices and underscores the significance of tailored strategies in managing congenital heart disease in the pediatric population within the unique healthcare context of Central India.

Keywords: Pediatric, biochemical events , Congenital Heart Disease, 2 D Echo

INTRODUCTION

Congenital Heart Disease (CHD) represents a group of structural abnormalities in the heart and major blood vessels that are present at birth. The prevalence of congenital heart disease in India is 9/1000 and the estimated number of children with congenital heart disease in India is more than 20, 0000 per year. This one-fifth is likely to have serious effects if not timely intervenedIt is one of the most common congenital anomalies, affecting a significant number of children worldwide. The intricate interplay of genetic and environmental factors during embryonic development contributes to the diverse spectrum of congenital heart defects, ranging from mild anomalies to complex, life-threatening conditions.

Understanding the biochemical events associated with congenital heart disease is crucial for unraveling the underlying mechanisms that drive abnormal cardiac development. Biochemical processes play a pivotal role in orchestrating the intricate steps of embryogenesis, and any disruptions in these events can lead to structural malformations in the heart. Investigating the molecular and biochemical aspects of CHD not only provides insights into the etiology of these conditions but also opens avenues for the development of targeted therapeutic interventions.

This assessment aims to delve into the intricate biochemical events involved in the pathogenesis of congenital heart disease in children. By exploring the molecular mechanisms underlying abnormal cardiac development, we seek to enhance our comprehension of the intricate network of signaling pathways, genetic factors, and environmental influences that contribute to the manifestation of CHD. This exploration is essential for advancing our diagnostic capabilities, refining treatment strategies, and ultimately improving the outcomes for children born with congenital heart defects. Through a comprehensive analysis of the biochemical landscape of CHD, we aim to pave the way for innovative approaches that may revolutionize the management of these complex cardiac

conditions in pediatric patients. This involves both quality care and accurate diagnosis along with the clinical examination and blood investigations. With recent advancements in perioperative management techniques, the outcomes of interventional cardiology in congenital heart disease have shown better results.

Material and Methods:

This observational study encompassed pediatric patients aged 1 month to 18 years diagnosed with congenital heart disease, all of whom were admitted and underwent interventions at our hospital. Comprehensive monitoring, including vital signs monitoring, 2D Echo assessments, and blood investigations, was diligently executed. In the ICU, heart rate was digitally monitored, respiratory rate recorded by nursing staff and physicians, and oxygen saturation measured using a pediatric probe pulse oximeter. Blood pressure was manually measured with an appropriately sized cuff. Hemoglobin levels, total leukocyte count, and platelet counts were analyzed pre and post-procedure. Sodium and potassium levels were observed, while additional blood investigations (renal function, liver function, coagulation profile, prothrombin time, INR) were not included in the study analysis due to insignificant values. All enrolled children tested negative for COVID-19. Normal chest X-rays were obtained, and 2D Echo, conducted by a cardiologist before and after intervention, confirmed the diagnosis and assessed intervention outcomes. Pre and post-operative vital signs and blood investigations were subjected to t-test analysis, yielding statistically significant results.

Observation and Results :

The study encompassed a total of 30 children (n = 30) afflicted with congenital heart disease, with a predominant representation of 20 males and 10 females. The age range of the participants spanned from a minimum of 4 months to a maximum of 16 years. All children with congenital heart disease underwent corrective surgery or device closure as deemed necessary. Rigorous monitoring of vital signs, including heart rate, respiratory rate, and spo2, was diligently performed both pre and post-cardiac procedures. Concurrently, comprehensive blood investigations, covering parameters such as hemoglobin, total leukocyte count (TLC), platelet count, sodium and potassium levels, and coagulation tests, were carried out before and after the cardiac procedures. The ensuing tables present a detailed comparative analysis of these vital signs and blood parameters pre and post-cardiac interventions.

Table No.1- Comparison between Heart Rate(HR), Respiratory Rate(RR) , Oxygen Saturation (spo2) pre and post cardiac intervention

Paired Samples Test

		Paired Differences									
							95% Confidence Interval of the Difference				
		Mean	**Std. Deviation**	**Mean**	**Std. Deviation**	**Std. Error Mean**	Lower	Upper	**t**	**df**	**Sig. (2-tailed)**
Pair 1	HR PRE- HR POST	111.03	17.137	-17.36	7.550	1.378	-20.186	-14.548	-12.59	29	.000
		128.40	16.786								
Pair 2	RR PRE- RR POST	26.77	.800	-5.800	3.951	.721	-7.275	-4.325	-8.040	29	.000
		32.57	1.077								
Pair 3	SPO2 PRE- SPO2 POST	93.50	1.090	-.067	4.533	.828	-1.759	1.626	-.081	29	.936
		93.57	.406								

HR in post-treatment was 128.40 ± 16.786 respectively which was significantly higher as compared to pre-treatment 111.03±17.137, (t-value -12.599) significant at <0.05 level respectively.
RR Count in post-treatment was 32.57± 5.900 respectively which was significantly higher as compared to pre-treatment 26.77± 4.384, (t-value -8.040) significant at <0.05 level respectively.
SPo2 in post-treatment was 93.57± 2.223 respectively which was not significantly higher as compared to pre-treatment 93.50± 5.970, (t-value -.081) not significant at <0.05 level respectively.

Table No.2- Comparison between various haematological parameters like hemglobin (Hb) , TLC total leukocyte count , PLTS platelets , Sodium (Na+) ,Patassium (K+) , kidney Function Test (KFT), Cogulation Profile both pre an post cardiac intervention

Paired Samples Test

		Paired Differences							t	df	Sig. (2-tailed)
				Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	Hb PRE- Hb POST	10.860	2.5949	-.8433	2.6244	.4791	-1.8233	.1366	-1.760	29	.089
		11.703	1.7437								
Pair 2	TLC PRE-TLC POST	11110.00	3452.570	-2500.000	5068.496	925.377	-4392.608	-607.392	-2.702	29	.011
		13610.00	3728.858								
Pair 3	PLTS PRE-PLTS POST	2.5760	.68448	1.03500	.85081	.15534	.71730	1.35270	6.663	29	.000
		1.5410	.72993								
Pair 4	Na+ PRE- Na+ POST	135.87	4.584	.067	4.870	.889	-1.752	1.885	.075	29	.941
		135.80	4.838								
Pair 5	K+ PRE- K+ POST	3.643	.6033	.2000	.9833	.1795	-.1672	.5672	1.114	29	.274
		3.443	.6399								
Pair 6	KFT PRE-KFT POST	.593	.0785	-.0400	.1380	.0252	-.0915	.0115	-1.588	29	.123
		.633	.1373								
Pair 7	COAG PRE-COAG POST	1.1800	.13183	.00067	.16756	.03059	-.06190	.06323	.022	29	.983
		1.1793	.17556								

Platelet Count in post-treatment was 1.5410± .72993 respectively which was significantly lower as compared to pre-treatment 2.5760± .68448, (t-value 6.663) significant at <0.05 level respectively.

DISCUSSION:

Over the past few decades, there has been remarkable progress in the diagnosis and treatment of congenital heart disease in children (CHD) (1). While the overall incidence of CHD has remained stable over the last 50 years, advancements in surgical procedures, such as cardiac catheterization and systemic-to-pulmonary arterial shunts, as well as innovative techniques like device closure, have significantly improved the natural history of cardiac lesions and survival rates (2,3,4,5).
As the life expectancy of children with CHD has increased, there's a growing number seeking medical care and undergoing noncardiac surgeries (6–8). Previous studies on mortality and adverse outcomes in children with CHD undergoing cardiac surgery or intervention have primarily been conducted at single centers (9–11).
In our study, we observed a post-cardiac surgery drop in hemoglobin in all children with congenital heart disease, corrected by administering packed red blood cells. Elevated leukocyte counts indicated potential infection or inflammatory responses, addressed through parenteral antibiotics

and supportive management. Renal function, liver function, and coagulation profiles were not significantly affected in the study participants.

Children with congenital heart disease undergoing cardiac surgery or intervention face an increased risk of mortality, post-operative thrombocytopenia, and electrolyte imbalances. A review by Baum et al. using the University Hospital Consortium database revealed higher mortality rates in children undergoing noncardiac procedures (10).

Additionally, our findings align with Carmosino et al.'s study, highlighting increased complications in children with pulmonary hypertension undergoing noncardiac surgery or cardiac catheterization (10). Post-operative thrombocytopenia and electrolyte imbalances, particularly hyponatremia and hypokalemia, were prevalent in our cohort, with platelet levels below a lakh post-surgery, later corrected through daily CBC monitoring.

The diverse spectrum of congenital heart diseases, such as Atrial Septal Defect, Ventricular Septal Defect, Double Outlet Ventricle, Aorto Pulmonary Window, and Patent Ductus Arteriosus, adds complexity to perioperative management (12). Children with complex heart diseases and poor cardiovascular status necessitate an individualized, multidisciplinary approach to anesthetic and surgical care involving skilled cardiologists, pediatricians, and surgeons (13). Despite these challenges, our study demonstrated positive outcomes, with no mortality observed post-cardiac surgery or intervention.

For caregivers of children with CHD, anticipating challenges and ensuring procedures take place in specialized centers with qualified teams from various subspecialties are crucial considerations for providing optimal care.

LIMITATIONS:

As the study time was limited of 12 months sample size is major limitation of the study. Its is difficult to follow up these children post surgery as they have financial constraints and most of then are from outstation .

CONCLUSION:

In summary, this research, carried out in a central Indian hospital, carefully examines the biochemical changes in children with congenital heart disease. The information gathered is crucial for making diagnostic and treatment methods better, allowing for more focused interventions. By exploring the details of these biochemical processes, the study seeks to improve our grasp of how congenital heart disease develops, aiming for better care and outcomes for patients. This study lays the groundwork for progress in medical approaches, stressing the need for personalized strategies in dealing with congenital heart disease in the specific healthcare setting of Central India.

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