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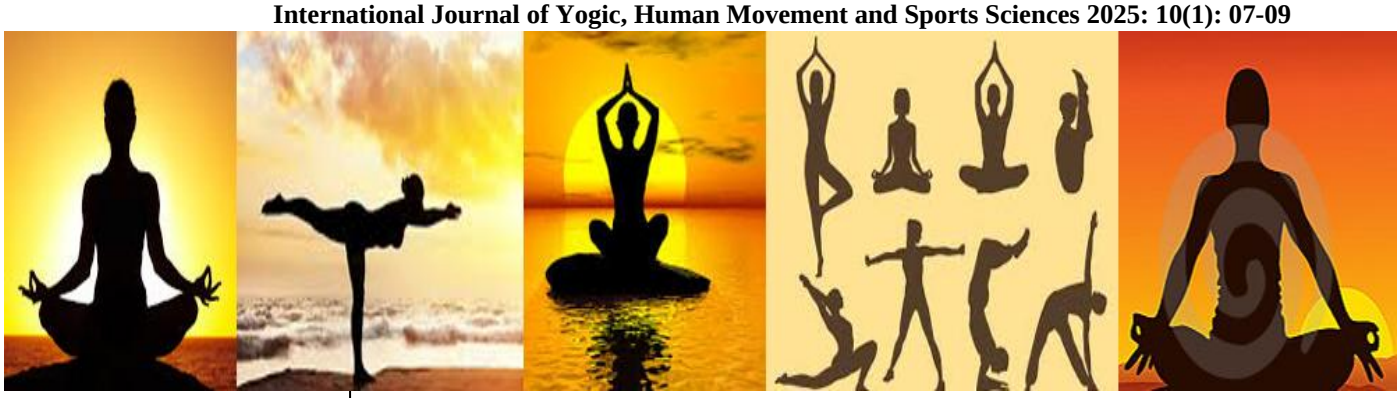

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Complex paediatric case of global developmental delay with critical congenital heart disease and autonomic dysfunction: A case report

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Abstract
Objectives: To report a complex pediatric case presenting with multiple congenital anomalies, including global developmental delay, critical congenital heart disease, and potential neurological complications.
Case Presentation: A 9-year-old boy, Al Ameen, was admitted with a comprehensive medical history characterized by global developmental delay, failure to thrive, microcephaly, critical congenital heart disease (CCHD), micropenis, and growth hormone deficiency. Initial medical interventions included emergency surgical correction of ventricular septal defect and right ventricular outflow tract reconstruction. Neuroimaging revealed bilateral cerebellar hemisphere T_2 hyperintensities and a linear T_2 hyperintensity in the left high parietal lobe, suggesting potential chronic neurological complications.
Conclusions: This case underscores the complexity of multisystem developmental disorders, emphasizing the critical importance of comprehensive multidisciplinary evaluation and management. Further genetic and metabolic investigations are recommended to elucidate potential underlying etiological factors contributing to the patient's diverse clinical manifestations.

Keywords: Developmental delay, congenital heart disease, neurological complications, paediatric multisystem disorder

Introduction
Developmental disorders presenting with multiple systemic involvements represent a challenging clinical scenario, often requiring extensive diagnostic workup and interdisciplinary management. Such complex cases frequently involve intricate interactions between neurological, endocrine, and cardiovascular systems, suggesting potential underlying genetic or metabolic dysregulations [1].
Congenital heart diseases, particularly critical congenital heart defects (CCHD), are associated with significant developmental implications. They can impact neurological development through various mechanisms, including potential perioperative complications, chronic hypoxemia, and associated genetic syndromes [2]. The presence of additional features such as global developmental delay, microcephaly, and endocrine abnormalities further complicates the clinical picture. Neuroimaging findings of bilateral cerebellar hemisphere T_2 hyperintensities and linear T_2 hyperintensity in the parietal lobe suggest potential chronic neurological processes [3]. These findings may indicate early cerebrovascular events, developmental malformations, or progressive neurological conditions that warrant comprehensive neurological and genetic investigations [4]. The multifaceted nature of this case highlights the importance of a holistic approach to pediatric complex medical conditions. Early recognition, systematic evaluation, and coordinated management across multiple medical specialties are crucial for optimizing patient outcomes and understanding the underlying pathophysiological mechanisms.

Case Details
Al Ameen, a 9-year-old boy, was admitted with a complex medical history including global developmental delay, failure to thrive, microcephaly, critical congenital heart disease (CCHD), micropenis, and growth hormone deficiency.

At 18 months of age, he experienced an episode of incessant crying and feeding difficulty, leading to a diagnosis of CCHD and subsequent emergency surgery. The surgical history includes ventricular septal defect (VSD) closure and right ventricular outflow tract (RVOT) patch placement. Previous MRI brain findings revealed bilateral cerebellar hemisphere T_2 hyperintensities without diffusion restriction, and a linear T_2 hyperintensity in the left high parietal lobe, suggesting the possibility of chronic infarct with gliotic changes. This case presents a multifaceted clinical picture combining neurological, endocrine, and cardiac abnormalities, highlighting the need for a comprehensive, multidisciplinary approach to management and further investigation to elucidate potential underlying genetic or metabolic etiologies.

Results

Based on the heart rate variability (HRV) parameters presented, this case demonstrates significant autonomic nervous system variations (Table: 1 and Figure: 1). The time domain measurements show elevated values, with a high SDNN (561.6 ms) and RMSSD (750.9 ms), indicating increased heart rate variability. The pNN50 of 77.62% suggests strong parasympathetic activity. In the frequency domain analysis, there is a moderate sympathetic predominance, evidenced by the LF power of 67.57 n.u. compared to HF power of 32.42 n.u., resulting in an LF/HF ratio of 2.084. The nonlinear parameters (SD1: 531.9 ms, SD2: 591.1 ms, SD1/SD2: 1.111) further support the presence of significant heart rate variability.

Table 1: Heart Rate Variability parameters

S. No.	Parameters	Results
1	RR interval	1043 ms
2	SDNN	561.6 ms
3	RMSSD	750.9 ms
4	NN 50 Count	222
5	pNN50	77.62%
6	LF power	67.57 n.u.
7	HF power	32.42 n.u.
8	LF/HF ratio	2.084
9	SD1	531.9 ms
10	SD2	591.1 ms
11	SD1/SD2 index	1.111
12	PNS index	19.64
13	SNS index	-2.01

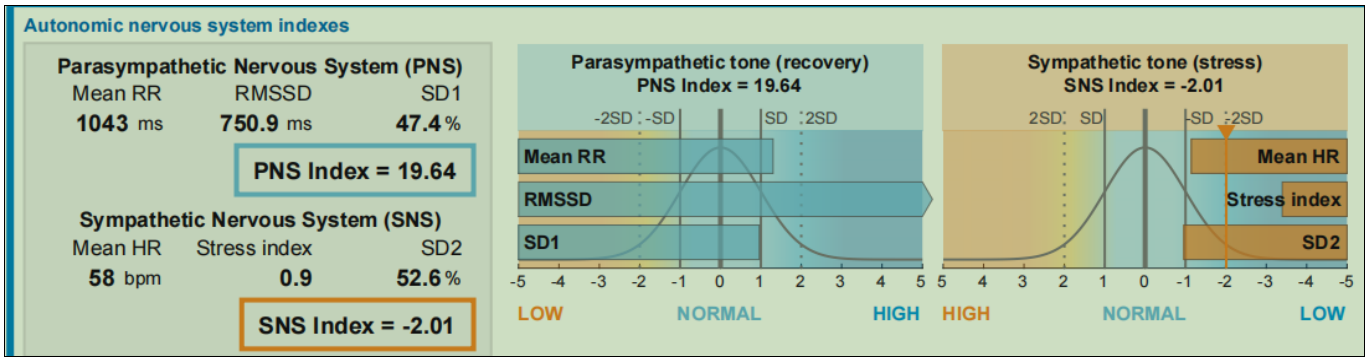

Fig 1: Autonomic nervous system Indices

Discussion

This case presents a unique opportunity to examine autonomic function in a pediatric patient with complex neurological, endocrine and cardiac abnormalities. The time domain parameters SDNN, RMSSD, NN50 and pNN50 were high when compared to the values for that age group, indicating sympathovagal imbalance [5]. In frequency domain, HF (n.u.) value was low, whereas LF (n.u.) and LF/HF ratio value was moderate which is clearly reflecting that the state of moderate sympathetic activity [6]. Both time domain values RMSSD, pNN50 suggests strong parasympathetic activity. The frequency domain values, LF power represents sympathetic nervous system activity. LF/HF ratio shows a moderate sympathetic dominance [7]. The discrepancy between the time domain and frequency domain values may be due to various factors such as respiratory factors, individual variability, and methodological differences or in certain physiological and pathological conditions.

Conclusion

This case highlights the complexities involved in managing pediatric patients with multiple congenital anomalies, such as global developmental delay, critical congenital heart disease, and autonomic dysfunction. The findings, including significant variations in heart rate variability parameters, suggest a state of moderate sympathetic dominance with strong parasympathetic activity, reflecting a sympathovagal imbalance. These observations underscore the necessity of a comprehensive, multidisciplinary approach to diagnosis and management, as well as further genetic and metabolic investigations to identify potential underlying etiologies.

References

1. Lipkin PH, Macias MM, Norwood KW, Brei TJ, Davidson LF, Davis BE. Promoting optimal development: identifying infants and young children with developmental disorders through developmental surveillance and screening. Pediatrics. 2020 Jan 1, 145(1).
2. Sprong MC, Broeders W, van der Net J, Breur JM, de Vries LS, Slieker MG. Motor developmental delay after cardiac surgery in children with a critical congenital heart defect: a systematic literature review and meta-analysis. Pediatric Physical Therapy. 2021 Oct 1;33(4):186-97.
3. Serrallach BL, Orman G, Boltshauser E, Hackenberg A, Desai NK, Kralik SF. Neuroimaging in cerebellar ataxia in childhood: A review. Journal of Neuroimaging. 2022 Sep;32(5):825-51.
4. Basu AP, Low K, Ratnaike T, Rowitch D. Genetic investigations in cerebral palsy. Developmental Medicine & Child Neurology; c2024.

5. Ng CS. The Influence of Age and Gender On Heart Rate Variability (Doctoral dissertation, UTAR).
6. Chen S, Xu K, Zheng X, Li J, Fan B, Yao X. Linear and nonlinear analyses of normal and fatigue heart rate variability signals for miners in high-altitude and cold areas. Computer Methods and Programs in Biomedicine. 2020 Nov 1;196:105667.
7. Banu AS, Nagaveni V. Assessment of Sympathetic and Parasympathetic Activities of Nervous System from Heart Rate Variability Using Machine Learning Techniques. SN Computer Science. 2023 Aug 28;4(5):646.