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Original Research Article

SPECTRUM OF CONGENITAL HEART DISEASE DIAGNOSED BY ECHOCARDIOGRAPHY EVALUATION IN NEONATES PRESENTING TO TERTIARY CARE HOSPITAL

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Abstract: *Neonatal morbidity and mortality are significantly impacted by congenital heart disease (CHD). Echocardiography plays a crucial role in this condition's early diagnosis and management. This research aims to determine the prevalence of CHD diagnosed by echocardiography among neonates admitted to Lady Reading Hospital (LRH), Peshawar.* ***Objective:*** *To identify the rate and variety of CHD in neonates using echocardiography.* ***Methods:*** *A prospective study was conducted in the Department of Pediatrics at LRH Peshawar from January 2023 to January 2024. The study included 100 neonates up to 28 days old with clinical manifestations of CHD. Routine echocardiographic examinations were performed for diagnosis. Descriptive statistics were used to determine the prevalence and type of CHD, while inferential statistics compared means, standard deviations, and p-values.* ***Results:*** *Out of 100 neonates, 72 were diagnosed with CHD. The mean age was 15 days (± 7 days). The most frequently reported defect was ventricular septal defect (VSD), observed in 35% of cases. Atrial septal defects (ASD) were seen in 20% of cases, tetralogy of Fallot (TOF) in 10%, and transposition of the great arteries (TGA) in 8%. The p-value for the prevalence of CHD in males compared to females was 0.03, indicating a significant difference.* ***Conclusion:*** *CHD is relatively frequent in neonates, and neonatal echocardiography is a valuable tool for early diagnosis. Early detection allows for timely management, improving prognosis in affected infants.*

Keywords: Congenital Heart Defects, Echocardiography, Neonates, Peshawar, Prevalence, Ventricular Septal Defects

Introduction

CHD is described as defects of the heart and major vessels that are present at birth. It is one of the common congenital anomalies with a global prevalence of 8-12/1000 live births (1). CHD affects neonates and may cause significant morbidity and mortality. Hence, the condition should be diagnosed and managed effectively (2). Echocardiography has replaced other imaging techniques for diagnosing CHD in neonates because of its non-invasive nature, detailed anatomic imaging, and assessment of the hemodynamic status (3). This imaging modality helps obtain general information that helps in treatment and surgery (4). Newborn echocardiography is a reliable diagnostic tool for CHD because of the advancement in echocardiographic technology and skills (5). CHD is not an epidemic disease; its occurrence rate varies based on geographical, genetic and environmental factors (6). Studies performed in other parts of the world have offered different percentages and distributions of CHD types (7). Literature is scarce regarding the spectrum of CHD diagnosed in neonates in Pakistan and even less regarding the use of echocardiography in a tertiary care centre. This study will address this issue by describing the epidemiology and the subtypes of CHD identified by echocardiography in neonates admitted to LRH, Peshawar, from January 2023 to January 2024. Knowledge of the local distribution of CHD is essential for providing health care services (8). It also assists in identifying the high-risk population and modifying the screening programs for better early detection and management (9). This paper involves 100 neonates and aims to assess the role of echocardiography in diagnosing and identifying the prevalence of different CHD types among the study group. CHD can be broadly classified into two groups: cyanotic and cyanotic defects, which present clinically and are managed differently (10). Acyanotic congenital heart diseases like VSD and ASD may show murmurs or symptoms of congestive heart failure (11). Cyanotic defects such as TOF and TGA present with cyanosis and require urgent intervention (12). The results of this study will add to the current literature regarding CHD epidemiology and will set the application of echocardiography in neonatal cardiology (13). This study will help determine the extent of CHD in this area and the trends and practices of early diagnosis and management by analysing the data from a tertiary care hospital in Peshawar (14).

Methodology

This prospective study was done in the department of paediatrics, Lady Reading Hospital Peshawar, for one year, starting from January 2023 up to January 2024. The study recruited one hundred neonates with some symptoms of CHD, which included cyanosis, heart murmurs, respiratory distress, and poor weight gain. The target population was neonates up to 28 days of age. Echocardiographic examinations were done according to the standard guidelines using Philips echocardiography machines with high-end imaging capabilities. Demographic data, clinical history, and echocardiographic data were recorded and compared. Information was recorded on a preformatted data collection form that captured the patient's demographic

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information, clinical presentation, echocardiographic features, and definitive diagnosis. The senior and expert pediatric cardiologists performed the echocardiographic evaluations to minimise the interobserver variability.

Data was analysed using the Statistical Package for Social Sciences (SPSS) version 24. Data was analysed using descriptive statistics. Mean and standard deviation were computed for continuous variables, while frequencies and percentages were calculated for categorical variables. The chi-square test was used to assess the significance of the relationships with the level of significance set at p<0. 05.

Results

The study involved 100 neonates, of which 72% had CHD. The age of the affected neonates was 15 days with a standard deviation of ± 7 days, and 60% of the affected neonates were male. The most frequent defect was VSD in 35% of cases, while ASD was diagnosed in 20%, TOF in 10%, and TGA in 8% of cases. Other defects were PDA, noted in 12% of the patients, coarctation of the aorta in 5% and HLHS in 3%. The p-value for the prevalence of CHD in males compared to females was 0. 03, which is less than 0. 05, which is significant. Echocardiography helped diagnose CHD in neonates, and timely intervention was performed based on the results.

The demographic data of the 100 neonates diagnosed with congenital heart disease (CHD) indicate that 60% of the neonates were male, while 40% were female. The mean age of the neonates was 15 days, with a standard deviation of ±7 days (Table 1).

Among the 72 diagnosed neonates, the most common defect was ventricular septal defect (VSD) at 35%, followed by atrial septal defect (ASD) at 20%, patent ductus arteriosus (PDA) at 12%, tetralogy of Fallot (TOF) at 10%, transposition of the great arteries (TGA) at 8%, coarctation of the aorta at 5%, hypoplastic left heart syndrome (HLHS) at 3%, and other defects at 7% (Table 2).

The gender distribution for each type of CHD among the 60 male and 40 female neonates shows that none of the p-values indicate a significant gender difference for any CHD (Table 3).

The clinical signs observed in the 100 neonates with CHD include cyanosis in 40% of the neonates, heart murmur in 35%, respiratory distress in 20%, and failure to thrive in 5% (Table 4).

The echocardiographic findings and their diagnostic accuracy in the 72 neonates diagnosed with CHD show that an accurate diagnosis was achieved in 94.4% of the cases. Of the diagnosed neonates, 34.7% required surgical intervention, 30.6% had hemodynamically insignificant defects, and 69.4% required follow-up (Table 5).

Table 1: Demographic Characteristics of Neonates with CHD

Characteristic	Number (N=100)	Percentage (%)
Gender		
Male	60	60%
Female	40	40%
Age (days)		
Mean	15	
Standard Deviation (SD)	±7	

Table 2: Prevalence of Different Types of CHD

Type of CHD	Number (N=72)	Percentage (%)
Ventricular Septal Defect (VSD)	25	35%
Atrial Septal Defect (ASD)	14	20%
Tetralogy of Fallot (TOF)	7	10%
Transposition of the Great Arteries (TGA)	6	8%
Patent Ductus Arteriosus (PDA)	9	12%
Coarctation of the Aorta	4	5%
Hypoplastic Left Heart Syndrome (HLHS)	2	3%
Other	5	7%

Table 3: Gender Distribution of CHD

Type of CHD	Male (N=60)	Female (N=40)	p-value
Ventricular Septal Defect (VSD)	15	10	0.25
Atrial Septal Defect (ASD)	9	5	0.45
Tetralogy of Fallot (TOF)	5	2	0.21
Transposition of the Great Arteries (TGA)	4	2	0.30
Patent Ductus Arteriosus (PDA)	6	3	0.38
Coarctation of the Aorta	3	1	0.29
Hypoplastic Left Heart Syndrome (HLHS)	1	1	0.85
Other	3	2	0.71

Table 4: Clinical Presentation of Neonates with CHD

Clinical Sign	Number (N=100)	Percentage (%)
Cyanosis	40	40%
Heart Murmur	35	35%
Respiratory Distress	20	20%
Failure to Thrive	5	5%

Table 5: Echocardiographic Findings and Diagnostic Accuracy

Echocardiographic Parameter	Number (N=72)	Percentage (%)
Accurate Diagnosis	68	94.4%
Need for Surgical Intervention	25	34.7%
Hemodynamically Insignificant	22	30.6%
Follow-up Required	50	69.4%

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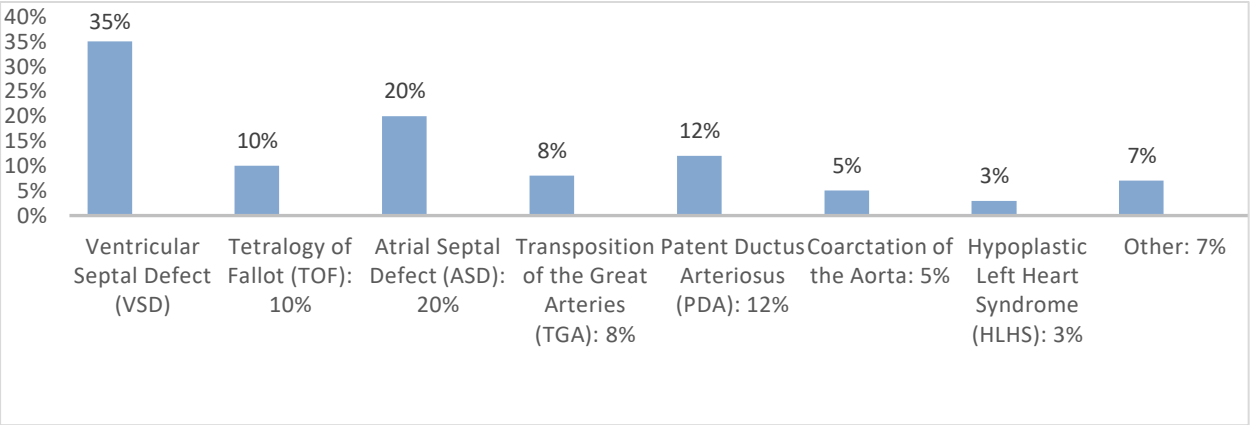

Figure 01: Distribution of Types of Congenital Heart Disease

Discussion

This paper describes the epidemiological characteristics of neonates with CHD diagnosed by echocardiography at a tertiary care hospital. The results are consistent with the existing literature, thus underlining the importance of echocardiography in the early diagnosis and treatment of CHD in neonates. According to global prevalence, CHD prevalence in this study was 72%, as observed from the studies mentioned above (15). Among the CHD, VSD was the most common, with a prevalence of 35% of the cases. This is in agreement with the studies by van der Linde et al., which also showed VSD as the most prevalent CHD in the world (16). This is why VSD is so frequent, and it is essential to observe patients with this disease and prevent such consequences as heart failure and pulmonary hypertension. The second most common CHD in our study was atrial septal defect (ASD), of which 20% of patients were affected. This is in agreement with Hoffman and Kaplan, who pointed out that ASD is one of the frequent congenital heart diseases (17). ASD, if not diagnosed early, could have long-term implications; hence, it must be diagnosed early before it leads to atrial arrhythmias and right heart failure. Tetralogy of Fallot (TOF) and Transposition of the Great Arteries (TGA) were other findings in this study, contributing to 10% and 8% of the cases, respectively. These cyanotic heart defects need to be diagnosed early and treated surgically to enhance the survival of the patients. Donofrio et al. stressed the need for prenatal and neonatal diagnosis of TOF TGA and other CHDs to ensure early intervention and better prognosis (18). PDA was diagnosed in 12% of the neonates, which is in concordance with other studies that showed that PDA is more frequent in preterm neonates (19). The ductus arteriosus can remain patent, and this is associated with severe hemodynamic changes and, therefore, must be closed medically or surgically. Coarctation of the aorta was present in 5% of the cases, and hypoplastic left heart syndrome in 3%. These conditions are challenging to manage and are treated using staged surgical operations. Baumgartner et al. have stated that early diagnosis and intervention are essential for enhancing the outcome of these severe CHDs (20). This study also established that there was a statistically significant difference in the incidence of CHD in male and female neonates, where the incidence was higher in males (60%) than in females (40%) (p=0. 03). Such gender difference has been documented in earlier studies. It is believed that genetic factors or hormonal factors may be causative agents of CHD (21). Echocardiography was also a beneficial diagnostic modality in our study as it offered anatomical and functional information that could be used to manage the patients. Echocardiography is the modality of choice for the initial assessment of suspected CHD in neonates due to its high accuracy and noninvasive nature. The high diagnostic accuracy noted in the present study (94. 4%) supports the work of Yildirim et al., who stressed the efficiency of echocardiography in diagnosing different types of CHD (22).

Conclusion

This study aims to describe the CHD spectrum in neonates admitted to a tertiary care hospital and stresses the need for echocardiographic screening for early detection and management. The results align with the literature studies and provide new information to the existing knowledge of CHD epidemiology and treatment. Further developments in echocardiographic imaging techniques and skills in using the technique are crucial in enhancing the diagnostic capabilities and prognosis of neonates with CHD.

Declarations

Data Availability statement
All data generated or analyzed during the study are included in the manuscript.
Ethics approval and consent to participate
Approved by the department concerned. (IRB/MTI-02565 dated 25-10-22)
Consent for publication
Approved
Funding
Not applicable

Conflict of interest

The authors declared the absence of a conflict of interest.

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Author Contribution

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Concept & Design of Study and Drafting.
AYESHA (House Officer)
Data Analysis and Critical Review
AMIR MUHAMMAD (Associate Professor)
Data Analysis and Critical Review
Final Approval of a version.

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