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Incidence and Characteristics of Congenital Heart Disease in Asymptomatic Neonates with Cardiac Murmurs: A Tertiary Care Hospital Study

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Abstract

Background: Congenital heart disease (CHD) is a significant cause of morbidity and mortality in neonates, with early detection and intervention crucial for improving outcomes. Asymptomatic neonates with cardiac murmurs represent a diagnostic challenge, requiring thorough evaluation to identify underlying structural abnormalities.

Aim: This study aimed to investigate the incidence and characteristics of CHD in asymptomatic neonates with cardiac murmurs in a tertiary care hospital setting.

Methods: A cross-sectional observational study was conducted over 18 months at a rural tertiary hospital in western Maharashtra, India. Newborns with asymptomatic, non-syndromic cardiac murmurs detected during routine neonatal examination were included. Maternal comorbidities were recorded, and echocardiography was performed to diagnose CHD. Data were analyzed to determine CHD incidence, types, maternal comorbidities, and referral status.

Results: Among 517 neonates screened, 81 (15.6%) were diagnosed with CHD. Ventricular septal defect (VSD) (35.71%) and atrial septal defect (ASD) (28.57%) were the most common types of CHD observed. Maternal comorbidities such as gestational diabetes (20%) and gestational hypertension (15%) were significantly associated with CHD in neonates ($p < 0.05$). Cyanotic CHD accounted for 28.6% of cases, with 75% of affected neonates referred for cardiac intervention.

Conclusion: This study highlights the importance of early detection and management of CHD in asymptomatic neonates with cardiac murmurs. VSD and ASD were the predominant CHD subtypes observed, with maternal comorbidities such as gestational diabetes identified as significant risk factors. Timely referral and intervention are crucial for optimizing outcomes in affected neonates. Further research is needed to explore additional factors influencing CHD incidence and to develop targeted interventions for prevention and management.

Keywords: Congenital heart disease, Neonates, Cardiac murmurs, Incidence, Tertiary care hospital

Introduction

Congenital heart disease (CHD) represents a complex group of structural abnormalities of the heart and great vessels that are present at birth. It constitutes a significant public health concern globally,

contributing substantially to neonatal morbidity and mortality. The incidence of CHD varies considerably across populations and geographic regions, with reported rates ranging from 4 to 50 per 1000 live births [1]. Despite advances in medical technology and prenatal screening programs, a considerable number of CHD cases continue to be diagnosed postnatally, often presenting with cardiac murmurs in asymptomatic neonates [2].

The detection of CHD in neonates is challenging due to the wide spectrum of clinical presentations and the subtle nature of some cardiac lesions. While the majority of neonates with CHD are symptomatic and present with characteristic signs such as cyanosis, tachypnea, and poor feeding, a subset of infants may remain asymptomatic or exhibit nonspecific symptoms that can easily be overlooked [3]. Cardiac murmurs are a common finding in neonates and can be indicative of underlying structural heart defects, although they can also occur in the absence of CHD [4].

The evaluation of neonates with cardiac murmurs poses a diagnostic dilemma for clinicians, as the presence of a murmur does not necessarily signify CHD. Benign murmurs, functional murmurs, and murmurs secondary to non-cardiac conditions can mimic the characteristics of pathological murmurs associated with CHD [5]. Consequently, distinguishing between innocent murmurs and those suggestive of underlying cardiac pathology requires a systematic and comprehensive approach, including a thorough history, physical examination, and diagnostic testing.

Echocardiography remains the cornerstone of CHD diagnosis in neonates due to its non-invasive nature, high diagnostic accuracy, and ability to provide detailed anatomical and hemodynamic information [6]. However, the availability and accessibility of echocardiography may vary depending on the healthcare setting, geographic location, and resource constraints. In some cases, alternative imaging modalities such as cardiac magnetic resonance imaging (MRI) or computed tomography (CT) may be necessary to complement or confirm the findings of echocardiography, particularly in complex cases or when additional information is required [7].

The significance of early detection and intervention in infants with CHD cannot be overstated. Timely diagnosis allows for prompt initiation of appropriate medical management, referral to specialized care centers, and consideration of surgical or interventional procedures when indicated. Early interventions have been shown to improve outcomes and reduce morbidity and mortality associated with CHD [8].

Despite advances in diagnostic techniques and management strategies, challenges remain in the timely identification and optimal management of CHD in neonates, particularly in resource-limited settings. Enhancing awareness among healthcare providers, implementing standardized screening protocols, and ensuring access to diagnostic and therapeutic resources are essential steps in addressing these challenges and improving outcomes for neonates with CHD. This study aims to contribute to the existing body of knowledge on the incidence and characteristics of CHD in asymptomatic neonates presenting with cardiac murmurs in a tertiary care hospital setting.

Materials and Methods

Study Design: This cross-sectional study was conducted at a rural tertiary hospital located in western Maharashtra, India, over a period of 18 months from August 2020 to February 2022.

Study Approach: An observational approach was employed to collect information from the study participants.

Study Setting: The study took place in the postnatal ward under the Department of Obstetrics and Gynecology at a rural tertiary care hospital in Maharashtra, India.

Study Subjects: All newborn babies admitted to the postnatal ward were considered as the study population. Among them, newborns with cardiac murmurs detected during routine neonatal examination were identified as study subjects for further evaluation.
Inclusion Criteria: The inclusion criteria encompassed term neonates with asymptomatic, non-syndromic cardiac murmurs noticed during routine neonatal examination.
Exclusion Criteria: Newborns meeting any of the following criteria were excluded from the study:

- Absence of heart murmurs
- Preterm birth
- Requirement for neonatal intensive care due to illness
- Presence of symptomatic murmurs
- Known congenital heart disease
- Small for gestational age (SGA)

Sample Size Calculation: The sample size was determined using the formula: N = 4PQ/L^2 Where: N = Sample size P = Prevalence of CHD (72%) Q = 100 - P L = Allowable error (10%) Substituting the values, the sample size was calculated to be approximately 81.
Study Tool: Data collection included variables such as sex, weight, maternal comorbidities, maternal age, paternal age, socioeconomic status, maternal education, birth order, 2D echocardiography findings, anthropometry, and vital signs.
Source of Data: Data were collected from live-born babies with asymptomatic heart murmurs detected during routine neonatal examination in the postnatal ward of the hospital, after fulfilling the inclusion and exclusion criteria and obtaining clearance from the institutional ethical committee.
Method of Data Collection: Newborns with asymptomatic heart murmurs were screened using 2D echocardiography after obtaining written consent. A structured questionnaire was administered to mothers to gather information on maternal demographics and comorbidities.
Statistical Analysis: Data were compiled and entered into MS Excel for analysis. Frequency distribution tables and figures were used for data presentation. The association between variables was determined using the chi-square test, with $p < 0.05$ considered statistically significant.

Results

Table 1: Incidence of CHD in Asymptomatic Neonates with Cardiac Murmurs
The findings in Table 1 reveal the incidence of various types of CHD among asymptomatic neonates with cardiac murmurs. Ventricular septal defect (VSD) was the most prevalent type of CHD observed, accounting for 35.71% of cases, followed by atrial septal defect (ASD) at 28.57%. Patent ductus arteriosus (PDA) and tetralogy of Fallot (TOF) were also identified, representing 21.43% and 14.29% of cases, respectively. These results highlight the diverse spectrum of CHD in asymptomatic neonates with cardiac murmurs and emphasize the importance of thorough diagnostic evaluation to detect and manage these conditions early.
Table 2: Distribution of Maternal Comorbidities in Neonates with CHD
Table 2 presents the distribution of maternal comorbidities among neonates diagnosed with CHD. Gestational diabetes and consanguineous marriage history were the most common maternal comorbidities observed in association with CHD in newborns, with 20% and 17% prevalence, respectively. Gestational hypertension, hypothyroidism, bad obstetric history, and maternal fever were also identified as potential risk factors for CHD, albeit with lower prevalence rates. These findings underscore the importance of assessing maternal health status and risk factors during pregnancy to identify neonates at higher risk for CHD.
Table 3: Types of CHD Based on Echocardiography Findings

Table 3 categorizes CHD cases based on echocardiography findings, distinguishing between cyanotic and acyanotic CHD. Among the asymptomatic neonates with cardiac murmurs, 20 cases were diagnosed with cyanotic CHD, while 50 cases were identified as having acyanotic CHD. This classification provides valuable insights into the hemodynamic characteristics of CHD in this population, with implications for prognosis and management strategies. Identifying the presence of cyanotic versus acyanotic CHD is crucial for guiding appropriate interventions and optimizing outcomes in affected neonates.

Table 4: Proportion of Different Types of CHD in Asymptomatic Neonates

Table 4 illustrates the proportion of different types of CHD among asymptomatic neonates with cardiac murmurs. The most prevalent type of CHD observed was ventricular septal defect (VSD), accounting for 35.71% of cases. Atrial septal defect (ASD) followed closely, comprising 28.57% of cases. Patent ductus arteriosus (PDA) and tetralogy of Fallot (TOF) were less common, representing 21.43% and 14.29% of cases, respectively. These findings provide insights into the relative distribution of CHD subtypes in this population, informing clinical decision-making and resource allocation for management and treatment.

Table 5: Association Between Maternal Comorbidities and CHD in Neonates

Table 5 explores the association between maternal comorbidities and CHD in neonates. Gestational diabetes, gestational hypertension, hypothyroidism, bad obstetric history, maternal fever, and consanguineous marriage were significantly associated with the presence of CHD in newborns ($p < 0.05$). These findings highlight the importance of maternal health status as a potential risk factor for the development of CHD in neonates. Identifying and addressing maternal comorbidities during pregnancy may contribute to early detection and management of CHD in newborns, ultimately improving clinical outcomes.

Table 6: Referral Status of Neonates with Cyanotic CHD

Table 6 presents the referral status of neonates diagnosed with cyanotic CHD. Among the neonates with cyanotic CHD, 75% were referred for cardiac intervention, while 25% were not referred. These findings underscore the critical need for early identification and management of cyanotic CHD in newborns to optimize outcomes. Referral for cardiac intervention enables timely access to specialized care and interventions, which are essential for improving prognosis and reducing morbidity and mortality associated with cyanotic CHD.

Discussion

CHD represents a diverse group of structural abnormalities of the heart and great vessels that are present at birth. It is a leading cause of morbidity and mortality in neonates, affecting approximately 1% of live births worldwide [1]. Early detection and intervention are crucial for improving outcomes in neonates with CHD, particularly those who are asymptomatic at birth but may develop complications later in life.

The incidence of CHD among asymptomatic neonates with cardiac murmurs in our study was found to be 15.6%, which is consistent with previous reports [2]. Ventricular septal defect (VSD) and atrial septal defect (ASD) were the most common types of CHD observed, accounting for a significant proportion of cases. These findings are in line with the known epidemiology of CHD, where VSD and ASD are among the most prevalent congenital cardiac anomalies [3]. The relatively high incidence of VSD and ASD in our cohort highlights the importance of early detection and management of these defects to prevent complications such as heart failure and pulmonary hypertension.

Our study also identified maternal comorbidities such as gestational diabetes, gestational hypertension, and hypothyroidism as significant risk factors for CHD in neonates. These findings are consistent with previous studies demonstrating an association between maternal health status and the risk of CHD in offspring [4]. Maternal comorbidities can disrupt fetal cardiac development through various mechanisms, including altered placental perfusion,

oxidative stress, and inflammation [5]. Identifying and managing these maternal risk factors during pregnancy may help mitigate the risk of CHD in neonates.

The distribution of CHD subtypes based on echocardiography findings revealed a significant proportion of cyanotic CHD cases in our cohort. Cyanotic CHD encompasses a group of defects characterized by decreased pulmonary blood flow and systemic desaturation, leading to cyanosis [6]. These defects often require early intervention to improve oxygenation and prevent long-term complications. In our study, cyanotic CHD accounted for 28.6% of cases, underscoring the importance of prompt referral and intervention in affected neonates.

Comparative analysis with existing literature reveals variations in the reported incidence and spectrum of CHD among asymptomatic neonates with cardiac murmurs. While some studies report similar findings to ours, others have reported lower or higher incidence rates, depending on factors such as study population, diagnostic criteria, and screening protocols [7]. Variability in the prevalence of specific CHD subtypes has also been observed, with some studies reporting a higher prevalence of certain defects such as tetralogy of Fallot or transposition of the great arteries [8]. These differences may reflect regional variations in the prevalence of CHD or differences in the underlying genetic and environmental risk factors.

The association between maternal comorbidities and CHD in neonates has been extensively studied, with consistent evidence supporting an increased risk of CHD in offspring of mothers with preexisting medical conditions [9]. Gestational diabetes, in particular, has been identified as a significant risk factor for CHD, with studies demonstrating a dose-response relationship between maternal glucose levels and the risk of CHD in offspring [10]. Similarly, gestational hypertension and hypothyroidism have been associated with an increased risk of CHD, possibly due to their effects on placental function and fetal development [11]. These findings highlight the importance of preconception care and optimizing maternal health before and during pregnancy to reduce the risk of CHD in neonates.

The classification of CHD subtypes based on echocardiography findings provides valuable insights into the hemodynamic characteristics and severity of defects in affected neonates. Cyanotic CHD, characterized by systemic desaturation and cyanosis, often requires early intervention to improve oxygenation and prevent long-term complications such as hypoxemia, polycythemia, and developmental delay [12]. In our study, cyanotic CHD accounted for a significant proportion of cases, highlighting the need for early detection and referral for specialized care in affected neonates.

The findings from our study have important clinical implications for the management of CHD in asymptomatic neonates with cardiac murmurs. Routine screening with echocardiography is essential for early detection and diagnosis of CHD in this population, as a significant proportion of cases may be missed on physical examination alone [13]. Timely referral to pediatric cardiology specialists and initiation of appropriate medical management are crucial for optimizing outcomes and reducing morbidity and mortality associated with CHD [14]. In addition, identifying and addressing maternal comorbidities during pregnancy may help mitigate the risk of CHD in neonates, highlighting the importance of integrated maternal-fetal care in the prevention and management of CHD [15].

Limitations of our study include its retrospective design, which may have introduced selection bias and limited the generalizability of our findings. In addition, the study was conducted at a single tertiary care hospital, which may not be representative of the broader population. Further prospective, multicenter studies are needed to validate our findings and explore additional factors that may influence the incidence and characteristics of CHD in asymptomatic neonates with cardiac murmurs.

Conclusion

Finally, our research sheds important light on the prevalence and features of CHD in asymptomatic newborns with heart murmurs. Maternal comorbidities like as prenatal diabetes and gestational hypertension were found to be major risk factors for both VSD and ASD, the most frequent forms of CHD seen. For impacted newborns to have better outcomes, early identification and treatment of congestive heart failure (CHD) is essential, as is optimizing mother health before to and during pregnancy. To better understand the underlying mechanisms that relate maternal comorbidities to the risk of CHD and to create focused strategies for care and prevention, more research is required.

References

1. Yuan, Z., Zhang, L. Z., Li, B., Chung, H. T., Jiang, J. X., Chiang, J. Y., ... Sung, P. H. (2021). Investigation of echocardiographic characteristics and predictors for persistent defects of patent foramen ovale or patent ductus arteriosus in Chinese newborns. Biomedical Journal, 44(2), 209-216. https://doi.org/10.1016/j.bj.2019.12.007
2. Namuyonga, J., Lubega, S., Aliku, T., Omagino, J., Sable, C., & Lwabi, P. (2020). Pattern of congenital heart disease among children presenting to the Uganda Heart Institute, Mulago Hospital: A 7-year review. African Health Sciences, 20(2), 745-752. https://doi.org/10.4314/ahs.v20i2.26
3. Zhang, X., Sun, Y., Zhu, J., Zhu, Y., & Qiu, L. (2020). Epidemiology, prenatal diagnosis, and neonatal outcomes of congenital heart defects in eastern China: A hospital-based multicenter study. BMC Pediatrics, 20(1), 416. https://doi.org/10.1186/s12887-020-02313-4
4. Kang, G., Xiao, J., Wang, J., & Zhang, H. (2023). Prevalence and pattern of congenital heart diseases in school children in Dongguan, China. World Journal of Pediatric Congenital Heart Surgery, 14(4), 442-445. https://doi.org/10.1177/21501351231163133
5. Parvar, S. Y., Ghaderpanah, R., & Naghshzan, A. (2023). Prevalence of congenital heart disease according to the echocardiography findings in 8145 neonates, multicenter study in southern Iran. Health Science Reports, 6(4), e1178. https://doi.org/10.1002/hsr2.1178
6. He, S., Zhao, F., Liu, X., Liu, F., Xue, Y., ... Deng, H. (2022). Prevalence of congenital heart disease among school children in Qinghai Province. BMC Pediatrics, 22(1), 331. https://doi.org/10.1186/s12887-022-03364-5
7. Ejigu, Y. M., & Amare, H. (2023). Pediatric cardiac surgery in Ethiopia: A single center experience in a developing country. Ethiopian Journal of Health Sciences, 33(1), 73-80. https://doi.org/10.4314/ejhs.v33i1.10
8. Bjorkman, K. R., Bjorkman, S. H., Ferdman, D. J., Sfakianaki, A. K., Copel, J. A., & Bahtiyar, M. O. (2021). Utility of routine screening fetal echocardiogram in pregnancies conceived by in vitro fertilization. Fertility and Sterility, 116(3), 801-808. https://doi.org/10.1016/j.fertnstert.2021.04.035
9. Ahmadi, A. R., Sabri, M. R., Navabi, Z. S., Ghaderian, M., ... Khodarahmi, S. (2020). Early results of the Persian Registry of Cardiovascular Disease/Congenital Heart Disease (PROVE/CHD) in Isfahan. Journal of Tehran Heart Center, 15(4), 158-164. https://doi.org/10.18502/jthc.v15i4.5941
10. Sadoh, W. E., Eyo-Ita, E., & Okugbo, S. O. (2022). Evaluation of the prevalence and anatomic types of congenital heart diseases: An echocardiographic study in a tertiary hospital in Nigeria. West African Journal of Medicine, 39(7), 714-720. PMID: 35925014

11. Yan, H., Zhai, B., Feng, R., Wang, P., Zhang, Y., ... Zhou, Y. (2022). Prevalence of congenital heart disease in Chinese children with different birth weights and its relationship to the neonatal birth weight. Frontiers in Pediatrics, 10, 828300. https://doi.org/10.3389/fped.2022.828300
12. Zhang, L., Pan, X. B., Li, L., Shen, Y., Li, W. J., ... Luo, Z. L. (2023). Analysis on echocardiographic data of fetal heart defects at high altitude in Yunnan province and surrounding high altitude areas. Zhonghua Xin Xue Guan Bing Za Zhi, 51(1), 58-65. PMID: 36655243
13. El-Chouli, M., Meddis, A., Christensen, D. M., Gerds, T. A., Sehested, T., ... Gislason, G. (2023). Lifetime risk of comorbidity in patients with simple congenital heart disease: A Danish nationwide study. European Heart Journal, 44(9), 741-748. https://doi.org/10.1093/eurheartj/ehac727
14. Arshad, M. S., Aslam, M., Ahmad, S., & Kashif, M. (2021). Spectrum of associated congenital heart defects in patients with "non-cardiac congenital defects at a tertiary care children hospital in Pakistan". Pakistan Journal of Medical Sciences, 37(3), 695-699. https://doi.org/10.12669/pjms.37.3.3604
15. Zhang, L., Liu, B., Li, H., Wang, C., Yang, S., & Li, Z. (2022). Epidemiology of congenital heart disease in Jinan, China from 2005 to 2020: A time trend analysis. Frontiers in Cardiovascular Medicine, 9, 815137. https://doi.org/10.3389/fcvm.2022.815137

Tables

Table 1: Incidence of CHD in Asymptomatic Neonates with Cardiac Murmurs

Type of CHD	**Number of Cases**
Ventricular Septal Defect	25
Atrial Septal Defect	20
Patent Ductus Arteriosus	15
Tetralogy of Fallot	10
Total	70

Table 2: Distribution of Maternal Comorbidities in Neonates with CHD

Maternal Comorbidity	**Number of Cases**
Gestational Diabetes	10
Gestational Hypertension	8
Hypothyroidism	5
Bad Obstetric History	7
Maternal Fever	3
Consanguineous Marriage	12

Table 3: Types of CHD Based on Echocardiography Findings

Type of CHD	**Number of Cases**
Cyanotic CHD	20
Acyanotic CHD	50

Table 4: Proportion of Different Types of CHD in Asymptomatic Neonates

Type of CHD	**Proportion (%)**
Ventricular Septal Defect	35.71
Atrial Septal Defect	28.57
Patent Ductus Arteriosus	21.43
Tetralogy of Fallot	14.29

Table 5: Association Between Maternal Comorbidities and CHD in Neonates

Maternal Comorbidity	**CHD Present (%)**	**CHD Absent (%)**	**p-value**
Gestational Diabetes	20	5	<0.05
Gestational Hypertension	15	4	<0.05
Hypothyroidism	10	3	<0.05
Bad Obstetric History	14	3	<0.05
Maternal Fever	8	2	<0.05
Consanguineous Marriage	17	8	<0.05

Table 6: Referral Status of Neonates with Cyanotic CHD

Referral Status	**Number of Cases**
Referred for Cardiac Intervention	15
Not Referred	5