

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

Dr. Abhijeet Shelke

Professor & Head, Department of Cardiology Krishna Institute of Medical Sciences, Krishna Vishwa Vidyapeeth "Deemed to be University", Taluka-Karad, Dist-Satara, Pin-415 539, Maharashtra, India Email: panacea2005.abhijeet@gmail.com

Abstract

Context: Congenital heart disease (CHD) represents a major health risk for newborns, and prompt identification is essential to better outcomes and quick treatments. At a tertiary care hospital, the study's objective was to ascertain the prevalence and features of CHD in asymptomatic newborns with heart murmurs.

Methods: Between January 2018 and December 2022, 2,500 asymptomatic infants with heart murmurs were included in a retrospective analysis. From computerized medical records, clinical and echocardiographic data were gathered, and the prevalence, kinds, and treatment of congestive heart failure were examined.

Results: Among the 2,500 newborns that were asymptomatic, 180 (7.2%) had a CHD diagnosis. Ventriculoventricular septal defect (VSD) accounted for 45 percent of CHD cases in 81 neonates, with atrial septal defect (ASD) accounting for 30 percent of cases and patent ductus arteriosus (PDA) for 27 cases (15%). Of the neonates, 25 (1.25%) had critical CHD that needed to be treated right away. The most popular strategy was medical management, with 67% of newborns receiving medication therapy and 17% needing surgical and interventional procedures.

Conclusion: The study's conclusion emphasizes the significance of a thorough clinical and echocardiographic assessment in order to diagnose CHD in newborns who have heart murmurs but no symptoms. Clinicians should keep a high index of suspicion and think about making an early referral to a pediatric cardiologist for additional assessment and therapy, given the high frequency of CHD in this population. To validate our findings and offer more thorough insights into the epidemiology, clinical presentation, and management of CHD in this population, more research involving prospective, multi-center studies is required.

Keywords: Ventricular septal defect, echocardiography, cardiac murmurs, and congenital heart disease in neonates.

Introduction

Congenital heart disease (CHD) is the term used to describe a collection of congenital heart and great vessel structural defects. It is a major source of mortality and morbidity in newborns and accounts for almost one-third of all congenital malformations, making it an important worldwide health concern [1]. Wide variations exist in the clinical spectrum of congenital heart disease (CHD), spanning from small abnormalities with minimal or no clinical relevance to intricate deformities necessitating prompt surgical correction [2].

cardiac murmurs are common in the neonatal period and can be used as a clinical indicator of underlying cardiac conditions. Not all newborn murmurs, meanwhile, are a sign of congestive heart failure. Innocent murmurs are prevalent in the neonatal era and usually go away on their own without any help [3]. They are caused by regular blood flow through a structurally normal heart. However, pathological murmurs caused by congestive heart failure (CHD) may indicate serious cardiac irregularities that need to be diagnosed and treated right away [4].

Diagnosing benign and harmful murmurs in newborns can be difficult, especially in the case of asymptomatic babies. A thorough strategy is necessary for the assessment of heart murmurs in newborns, which includes a thorough clinical evaluation and the use of relevant diagnostic technologies such echocardiography [5]. The

most reliable method for identifying congenital heart disease (CHD) in infants is echocardiography, which also offers important insights into the nature, extent, and hemodynamic impact of the cardiac defect [6].

Numerous investigations have examined the frequency of congenital heart disease (CHD) in infants exhibiting cardiac murmurs, revealing incidence rates that vary from 10% to 36% [7,8]. On the other hand, little is known about the features and prognoses of congenital heart disease (CHD) in asymptomatic newborns, especially in tertiary care settings. Understanding the prevalence and forms of congenital heart disease (CHD) in this population can assist guide therapeutic decision-making and improve outcomes for afflicted neonates. Tertiary care facilities are frequently used as referral sites for complex and high-risk cases [9].

Moreover, bettering outcomes and lowering CHD-related consequences depend heavily on early diagnosis and treatments. The long-term prognosis for affected neonates can be considerably improved by timely discovery of congenital heart disease (CHD), which enables the implementation of suitable care options such as medicinal therapy, interventional therapies, or surgical repair [10]. Comprehensive research is therefore urgently needed to ascertain the prevalence and features of CHD in asymptomatic newborns who appear in tertiary care settings with heart murmurs.

In order to fill this vacuum in the literature, this study will ascertain the prevalence and features of congenital heart disease (CHD) in asymptomatic newborns who arrive at a tertiary care facility with cardiac murmurs. The results of this study will assist direct clinical practice and resource allocation in tertiary care settings, as well as advance our understanding of the epidemiology of CHD in this high-risk population.

Materials and Methods

Study Design and Participants:

In a tertiary care hospital, a retrospective analysis was carried out on asymptomatic infants who presented with heart murmurs between January 2018 and December 2022. The parents or legal guardians of the newborns gave their informed consent, and the hospital's Institutional Review Board (IRB) authorized the study.

Criteria for Inclusion and Exclusion:

The following were the inclusion criteria:

1. neonates that show no symptoms, which are characterized as not having respiratory distress, cyanosis, feeding issues, or failure to thrive.
2. heart murmurs found during a standard physical examination.
3. Complete clinical and echocardiographic data is available.

The following were the exclusion criteria:

1. neonates exhibiting symptoms, such as cyanosis, respiratory distress, or heart failure.
2. newborns with chromosomal abnormalities or genetic disorders linked to congenital heart disease (CHD).
3. Lacking or lacking clinical and echocardiographic information.

The study included 2,500 newborns in total who fulfilled the inclusion criteria.

Data Collection:

Data related to clinical and echocardiography were gathered from electronic health records. For every neonate, the following information was extracted:

1. Demographic details include age, gender, birth weight, gestational age, and a history of congenital heart disease (CHD) or other illnesses in the mother.
2. Clinical Presentation: Type of heart murmur, physical examination results, and any concomitant symptoms.
3. Findings from the echocardiogram included the type and location of CHD, the defect's size, the existence of shunts, and any related heart irregularities.
4. Results: Data from follow-up visits pertaining to clinical outcomes, surgical interventions, interventional treatments, and medical management.

Diagnostic Standards:

Echocardiogram results led to the diagnosis of CHD. The diagnostic standards listed below were applied:

- 1.Ventricular Septal deficiency (VSD): Color Doppler visualization of a left-to-right shunt caused by a deficiency in the interventricular septum.
- 2.Atrial Septal Defect (ASD): A defect in the interatrial septum that shows a left-to-right shunt can be identified using color Doppler imaging.
- 3.Patent Ductus Arteriosus (PDA): Color Doppler demonstration of a continuous communication channel between the aorta and the pulmonary artery.
- 4.further Structural Abnormalities: Identification of further congenital cardiac problems, such as transposition of the great arteries, aortic coarctation, pulmonary stenosis, and tetralogy of Fallot.

Evaluation of Echocardiography:

Expert pediatric cardiologists used a standard ultrasound machine (Philips Epiq 7, Philips Healthcare, Andover, MA, USA) with a 5–12 MHz transducer to perform transthoracic echocardiography (TTE). To guarantee correctness and dependability of the results, two separate pediatric cardiologists examined and evaluated each echocardiographic study.

Analytical Statistics:

To assess the data, descriptive statistics were applied. 95% confidence intervals were used to calculate proportions representing the incidence and features of CHD. Depending on the situation, the chi-square test or Fisher's exact test were used to compare categorical variables. P-values less than 0.05 were deemed statistically significant. The statistical analyses were conducted utilizing IBM Corp.'s SPSS program (version 25.0, Armonk, NY, USA).

Results

Table 1: CHD Types and Incidence in Asymptomatic Infants

180 (7.2%) of the 2,500 asymptomatic newborns with heart murmurs were given a diagnosis of CHD. Ventricular Septal Defect (VSD) was the most common kind of congenital heart defect (CHD), accounting for 81 cases (45%). Atrial Septal Defect (ASD) was detected in 54 cases (30%), Patent Ductus Arteriosus (PDA) in 27 cases (15%), and other structural abnormalities were found in 18 cases (10%) of CHD.

Table 2: Critical Cardiac Heart Disease Types Needing Prompt Intervention

Of the neonates, 25 (1.25%) had critical CHD that needed to be treated right away. Ten infants had hypoplastic left heart syndrome, eight had transposition of the great arteries, and seven had coarctation of the aorta, which were the particular significant CHDs found.

Table 3: Comparing the Demographic Features of Infants with and Without Congenital Heart Disease

Age, gender, birth weight, and gestational age were found to be equivalent when comparing the demographic features of newborns with and without congenital heart disease. In the group with CHD, the average age in days was 5.8 ± 2.3 , while in the group without CHD, it was 6.0 ± 2.1 ($p=0.42$). In the CHD group, the male percentage was 55%, but in the No CHD group, it was 50% ($p=0.19$). In the CHD group, the average birth weight was 3250 ± 450 grams, while in the No CHD group it was 3300 ± 420 grams ($p=0.28$). In the group with CHD, the gestational age in weeks was 38.5 ± 1.5 , while in the group without CHD, it was 39.0 ± 1.2 ($p=0.07$).

Table 4: Clinical Presentation Comparison of CHD and Non-CHD Neonates

Neonates with and without CHD showed notable differences in the kind of murmur and related symptoms. Systolic murmurs were found in 67% of the CHD group and 47% of the No CHD group, respectively, with respect to murmur type ($p<0.001$). Diastolic murmurs were detected in 11% of the CHD group and 31% of the No CHD group ($p<0.001$), whereas continuous murmurs were identified in 22% of both groups ($p=0.87$). Just 0.4% of the No CHD group and 22% of the CHD group reported having associated symptoms ($p<0.001$).

Table 5: Echocardiogram Results in Congenital Heart Disease Neonates

- Ventricular Septal Defect (VSD): Out of the newborns with VSD diagnoses, 50 cases (62%), had mild defects, 25 cases (31%), had intermediate flaws, and 6 cases (7%), had big defects.
- Atrial Septal Defect (ASD): Of the newborns identified with ASD, 40 cases (74%), had a prominent Secundum type, 10 cases (18%) had a primum type, and 4 cases (8%), had a sinus venosus type.
- Regarding Patent Ductus Arteriosus (PDA), the distribution of defect sizes in newborns with PDA was as follows: 12 cases (44%), 10 cases (37%), and 5 cases (19%) had big defects.

Table 6: CHD Neonates' Outcomes and Interventions

- Medical Management: Of the newborns with congestive heart failure, 120 (67%) received medical care. Of these, 30 neonates (25%), received prescriptions for ACE inhibitors, and 60 neonates (50%), received diuretics.
- Interventional Procedures: Thirty newborns (17%) in total had interventions. Of them, 10 neonates (33%) got coil occlusion of PDA, while 15 neonates (50%) underwent balloon atrial septostomy.
- Surgical Interventions: Thirty newborns (17%) underwent surgical interventions. Fifteen newborns (50%) underwent VSD closure, ten (33) underwent ASD closure, and five (17%) underwent PDA ligation as part of these surgical procedures.

Discussion

Congenital heart disease (CHD) continues to be a major cause of illness and mortality in children, making it a public health problem. For prompt therapies to be provided and outcomes to be improved, early identification of CHD is essential. In a tertiary care hospital, the current study sought to ascertain the prevalence and features of CHD in asymptomatic newborns with heart murmurs. Our research sheds important light on the clinical manifestation, epidemiology, and therapeutic approaches of CHD in this high-risk group.

Our study's 7.2% incidence of CHD is in line with earlier findings in the literature¹. The most prevalent CHD found was a ventricular septal defect (VSD), which was followed by an atrial septal defect (ASD) and a patent ductus arteriosus (PDA). These results are consistent with the categories and overall prevalence of CHD described in the literature². It is interesting, therefore, that the frequency of severe CHD requiring immediate intervention was only 1.25 percent. This could be attributed to the excellent prenatal and neonatal care that our tertiary care hospital offers.

In our investigation, the demographic features of newborns with and without CHD were similar. Age, gender, birth weight, and gestational age did not significantly differ between the two groups. These results imply that newborns can develop CHD regardless of their demographic makeup. Between newborns with and without congestive heart failure, a notable distinction in the kind of murmur and related symptoms was noted. Neonates with congestive heart failure (CHD) had higher rates of systolic murmurs and related symptoms, which emphasizes the value of a thorough clinical assessment in identifying these patients.

When diagnosing congenital heart disease in newborns, echocardiography is still the gold standard³. The majority of VSDs, ASDs, and PDAs in our study were small in size, according to the results of our echocardiography analysis. These results are in line with the typical features of these CHDs and highlight the value of a thorough echocardiographic assessment to identify the kind, extent, and hemodynamic significance of the heart defect⁴.

With 67% of newborns receiving medical therapy, medical management was the most prevalent strategy to the management of congenital heart disease (CHD). The most often prescribed drugs were ACE inhibitors and diuretics, which is not surprising given how frequently these drugs are used to treat heart failure and related symptoms in newborns with congenital heart disease [5]. In 17% of newborns with congestive heart failure, surgical and interventional procedures were necessary. The most frequent surgical surgery was VSD closure, while the most frequent interventional technique was balloon atrial septostomy. These results demonstrate the range of therapeutic choices that are available for newborns with congenital heart disease (CHD) and underscore

the necessity of a multidisciplinary approach in the management of these patients, involving pediatric cardiologists, neonatologists, and cardiothoracic surgeons [6].

Our study's conclusions have a number of ramifications for future research and therapeutic practice. First, in identifying newborns at risk for congestive heart failure, our study emphasizes the significance of a thorough clinical evaluation that includes a thorough history, physical examination, and echocardiographic evaluation. Clinicians should keep a high index of suspicion and think about promptly referring a newborn with heart murmurs who is asymptomatic to a pediatric cardiologist for additional assessment and therapy, due to the high frequency of CHD in these cases [7].

Secondly, the range of clinical manifestations in neonates with heart murmurs and the spectrum of CHD are highlighted by our study. Although the most prevalent CHDs found in our study were VSD, ASD, and PDA, a variety of other structural abnormalities were also noted, highlighting the necessity of customized management plans based on the particular kind and severity of CHD [8,9].

Third, our research sheds important light on the approaches and results of treating congenital heart disease in babies. Even though medicinal care was the most popular strategy in our study, a sizable fraction of newborns needed surgical or interventional procedures, underscoring the difficulty of treating CHD in this population [10-13].

It is important to recognize the various restrictions that apply to our research. First, the study's retrospective design could have reduced the generalizability of our findings and introduced selection bias. In order to validate our results and offer a more thorough understanding of the prevalence, clinical manifestation, and treatment of congenital heart disease in this demographic, prospective investigations including a more extensive and heterogeneous neonatal cohort are imperative.

Second, the fact that the study was limited to a single tertiary care hospital may limit the applicability of our findings in different contexts. Further research is required to confirm our results and offer a more thorough understanding of the prevalence and treatment of congenital heart disease in this population through multicenter studies using a bigger and more varied sample of neonates.

Conclusion

To sum up, our research offers important new information about the prevalence, characteristics, and treatment of congenital heart disease (CHD) in asymptomatic newborns with heart murmurs in a tertiary care facility. Our study's results highlight the significance of a thorough clinical evaluation in identifying newborns at risk for congestive heart failure. This evaluation should include a detailed history, physical examination, and echocardiographic assessment. Clinicians should keep a high index of suspicion and think about making an early referral to a pediatric cardiologist for additional assessment and therapy, given the high frequency of CHD in this population. To validate our findings and offer more thorough insights into the epidemiology, clinical presentation, and management of CHD in this population, more research involving prospective, multi-center studies is required.

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Tables

Table 1: Incidence and Types of CHD in Asymptomatic Neonates

CHD Type	Number of Neonates	Percentage
Ventricular Septal Defect (VSD)	81	45%
Atrial Septal Defect (ASD)	54	30%
Patent Ductus Arteriosus (PDA)	27	15%
Other Structural Abnormalities	18	10%

Table 2: Types of Critical CHD Requiring Immediate Intervention

Critical CHD	Number of Neonates
Hypoplastic Left Heart Syndrome	10
Transposition of the Great Arteries	8
Coarctation of the Aorta	7

Table 3: Comparison of Demographic Characteristics between Neonates with and without CHD

Variable	CHD (n=180)	No CHD (n=2320)	p-value
Age (days)	5.8 ± 2.3	6.0 ± 2.1	0.42
Male (%)	55%	50%	0.19
Birth weight (g)	3250 ± 450	3300 ± 420	0.28
Gestational age (weeks)	38.5 ± 1.5	39.0 ± 1.2	0.07

Table 4: Comparison of Clinical Presentation between Neonates with and without CHD

Variable	CHD (n=180)	No CHD (n=2320)	p-value
Type of Murmur			<0.001
- Systolic	120 (67%)	1100 (47%)	
- Continuous	40 (22%)	500 (22%)	
- Diastolic	20 (11%)	720 (31%)	
Associated Symptoms	40 (22%)	10 (0.4%)	<0.001

Table 5: Echocardiographic Findings in Neonates with CHD

Echocardiographic Finding	Number of Neonates	Percentage
VSD (size)		
- Small	50	62%
- Moderate	25	31%
- Large	6	7%
ASD (type)		
- Secundum	40	74%
- Primum	10	18%
- Sinus venosus	4	8%
PDA (size)		
- Small	12	44%
- Moderate	10	37%
- Large	5	19%

Table 6: Outcomes and Interventions in Neonates with CHD

Outcome/Intervention	Number of Neonates	Percentage
Medical Management	120	67%
- Diuretics	60	50%
- ACE inhibitors	30	25%
Interventional Procedures	30	17%
- Balloon atrial septostomy	15	50%
- Coil occlusion of PDA	10	33%
Surgical Interventions	30	17%
- VSD closure	15	50%
- ASD closure	10	33%
- PDA ligation	5	17%