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Prevalence of Paediatric Heart Disease: A Big Concern Worldwide

Dr Anurag Medatwal[1]*, Dr Pooja Dahiya[2], Dr Ritu (Lal) Medatwal[3]

[1]Assistant Professor, Department of Paediatric Medicine, Amaltas Institute of Medical Sciences, Devas (MP), India

[2]Senior Resident, Department of Paediatrics, Kalpana Chawla Medical College, Karnal, Haryana India

[3]Assistant Professor, Department of Anaesthesia, Amaltas Institute of Medical Sciences, Devas, MP, India

Address for correspondence- Dr Anurag Medatwal, Assistant Professor, Department of Paediatric Medicine, Amaltas Institute of Medical Sciences, Devas (MP), India

Email id- amedatwal@yahoo.co.in

Background: Every year, 15 million children in underdeveloped countries die from heart disease that may have been prevented. The reduction of infectious illness in low and middle-income countries have been the focus of international initiatives to reduce mortality among children under five. Despite these efforts, Congenital heart disease (CHD) and acquired heart disease have got less attention.

Methods: Over 20 months, an extensive health screening initiative was implemented, examining 41,929 children from newborns to 18-year-old. The screening encompassed a broad spectrum, from identifying congenital disabilities to evaluating developmental milestones, using advanced diagnostic methods such as color Doppler, echocardiography, and clinical examinations.

Results: An observed prevalence of 5.3 cases per 1000 population highlighted the incidence of cardiac lesions in the examined cohort. Among these, ventricular septal defect (VSD) emerged as the most prevalent, constituting 31.6% of cases. Following closely were patent ductus arteriosus (PDA) at 25.45% and atrial septal defect (ASD) at 16.81%. Notably, Tetralogy of Fallot stood out as the most common cyanotic heart disease, accounting for 6.06% of cases. The diagnostic landscape revealed that most heart disease cases were identified in the age group from 6 weeks to 6 years. This age bracket encompassed the peak period for the diagnosis of cardiac issues in the examined pediatric population.

Conclusion: In many regions worldwide, access to diagnostic services and healthcare is still restricted. The disparities in reported birth rates between high- and low-income countries are most likely caused by these constraints. Variables related to the environment, genetics, socioeconomic status, or ethnic origin may cause the observed differences. Therefore, further research is needed to customize how this global health issue is handled.

Keywords: Congenital disabilities, Congenital heart defects, Paediatric heart disease

Introduction

The international community has placed significant emphasis on reducing mortality rates among children under the age of five for several decades. This attention has been particularly evident since the establishment of the Millennium Development Goals in 2000, which

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includes a target of reducing the under-5 mortality rate by two-thirds as its fourth goal. The Convention on the Rights of the Child has also contributed to global efforts in this area. The ongoing efforts in this field have been driven by the formation of the SDGs by the UN, with a specific focus on Goal 3. This goal explicitly targets the reduction of preventable deaths among infants and children below the age of five. Each nation endeavoured to decrease mortality rates among children under five and newborns to a maximum of 25 per 1000 live births and 12 per 1000 live births, respectively. [1, 2] These efforts have mainly focused on preventive and treatment methods against infectious diseases. This focus results from the fact that these low-tech, reasonably priced, and experience-accessible therapies have a noteworthy positive impact on children. Enormous strides have been made in reducing global mortality. It is notable, therefore, that non-governmental groups have traditionally been entrusted with managing acquired heart disorders and CHD, both of which have a substantial impact on youth demography. This phenomenon can most likely be attributed to perceived restrictions related to costs, technological limitations, and the availability of individuals possessing the necessary abilities to carry out revolutionary efforts. [3]

In the preceding half-century, notable advancements have been made in cardiovascular disease diagnosis and surgical intervention. Infants diagnosed with CHD exhibit improved outcomes in economically prosperous nations. Regrettably, this circumstance is not reflective of the prevailing conditions in numerous middle-class and low-income countries, wherein the financial burdens are most pronounced and the rates of mortality and incapacitation continue to escalate. [4] It is only in recent times that conversations worldwide have turned to the problem of cardiovascular disease among the world's poorest population. Nonetheless, it is critical to acknowledge that behavioural and metabolic risk factors linked to cardiovascular disease have been impacted by globalization. [5] It's vital to remember that the causes of cardiovascular illness differ between high- and low-income nations. In the latter, ischemic heart disease is very uncommon, but hypertensive heart disease, cardiomyopathies, rheumatic heart disease, pericardial disease, and congenital heart disease are prevalent disorders. Additionally, rheumatic heart disease has virtually vanished from high-income countries. Still, it continues to be the leading cause of acquired heart disease and a significant hazard to public health in low- and middle-income countries. [6] As a result, in low- and middle-income countries, paediatric cardiac disease acquired and congenital remains a significant health concern. [7]

The recognition of differences in access to care is becoming more and more apparent with the advent of globalization and the improved accessibility of echocardiography. The data from recent history suggests that these barriers are progressively weakening. One example of how low-cost cardiovascular treatment can produce favourable outcomes in challenging environments is India. [8] Research has shown that some lesions, such as tetralogy of Fallot and atrial and ventricular septal defects, have favourable long-term prognoses. Most of the time, these conditions can be successfully treated without the kind of specialized medical attention and experience in rescue operations that are typical in developed countries. [9] Congenital disabilities are the primary cause of a large percentage of baby fatalities, and many survivors face major life issues. Congenital issues are linked to about 3% of live births. An estimated 302,000 infants (or 6% of all baby deaths) died in 2010 from congenital anomalies, with 96% of those deaths occurring in low- and middle-income countries,

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according to studies on the global burden of sickness, injury, and risk factors. Over 28% of all significant congenital abnormalities are heart issues. [10]

Most worldwide statistics on CHD are derived from high-income nations, and there are few high-quality regional data on the illness from low- and middle-income countries. In addition to refuting the myth that CHD is more common in high-income countries than in low- and middle-income ones, full birth and death records are necessary to impact policy decisions that may have an impact on the type of care that children with heart disease can get. Roughly 10–12 live births per 1000, or 1.35 million live births annually, are affected by CHD. [11] According to a meta-analysis by van der Linde, despite regional variations in reporting on the birth prevalence of CHD, Asia had the highest birth prevalence -9.3 per 1000 live births, while Africa had the lowest -1.9 per 1000 live births.[10] Due to several factors, including a lack of data, poor cardiac care service prioritization, difficulties accessing general care, an absence of medical facilities, a scarcity of skilled specialists, limited resources, and early mortality, the prevalence of CHD is underreported in low- and middle-income countries, particularly in Africa.

Materials and Methods

The research was conducted in the Department of Paediatric Medicine, India 15 Jan 2021 to 15 April 2023. The Operational Guidelines were followed to ensure every kid in the target group had a health screening. A committed group of hospital staff members examined the kids to check for illnesses, deficits, and flaws. All the individuals were questioned regarding a history of (H/O) palpitation/increased precordial activity in the child, any H/O recurring chest infection, or bluish colouring of tongue/lips. During the screening, any suspicious cardiac patient was advised to the department of Paediatric Medicine, Amaltas Institute of Medical Sciences, Devas (MP), India. A thorough cardiovascular assessment was then completed. The children suspected of having CHD underwent additional evaluation, and those suspected of having cardiac disease underwent electrocardiograms (ECGs), chest X-rays, and echocardiograms.

Inclusion criteria

Inclusion criteria for congenital heart disease typically involve relevant symptoms, positive diagnostic tests, and/or specific cardiovascular risk factors.

Exclusion criteria

Exclusion criteria for congenital heart disease studies or diagnoses typically involve factors such as other significant health conditions, medications, or lifestyle factors that may confound or interfere with the study's objectives or the accuracy of the diagnosis.

Statistical analysis

SPPS and MS Excel were used for statistical analysis. The inverse variance approach was used to pool the birth prevalence of total CHD. A chi-square test was used to examine the pooled group estimates and funnel plots, and the Q and I2 statistics and periods were investigated.

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Ethical approval

Every patient's guardian received an explanation of the study protocol and gave their consent. The hospital's ethical committee has approved the research protocol.

Results

The excerpt highlights the disparity in outcomes for children born with CHD between high-income and low- to middle-income countries, emphasizing the challenges faced in regions with limited access to advanced medical treatment, such as India. The article aims to analyze the progress in cardiac care for infants with CHD over the last decade, addressing the considerable burden on families, society, and the healthcare system in the context of the prevalent birth rate of 9 per 1000 in India. The age and gender distribution of the entire population screened is depicted in Figure 1. We screened 21,457 male and 20,472 female minors between the ages of 0 and 18 for the present study out of 41,929 participants. CHD affected a total of 253 infants, of which 220 had acyanotic heart disease and 33 had cyanotic heart disease, as shown in Table 1. The specifics of this prevalence rate of 5.6 per 1000 individuals are illustrated in Figure 2.

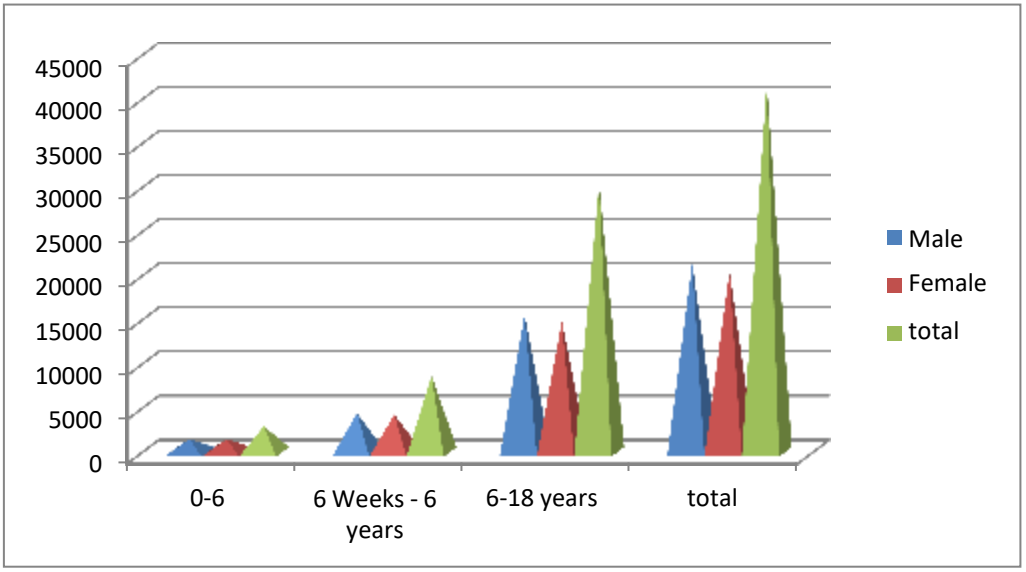

Fig. 1: Age and sex wise distribution of children.

Table 1: Prevalence of congenital heart diseases

Total population N=41929	Female	Male
CHD (N=253)		
Acyanotic congenital heart disease	78	142
Cyanotic congenital heart disease	19	14

According to Figure 2, the prevalence of the most often observed lesion in individuals with acyanotic heart disorders (n=220) was notably greater among patients with ventricular septal

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defects (VSD), patent ductus arteriosus (PDA), and atrial septal defects (ASD). Table 2 presents the distribution of cyanotic cardiac illnesses, consisting of 33 cases. Among these cases, Tetralogy of Fallot (TOF) was observed in 20 patients, followed by transposition of the major vessels in 5 individuals.

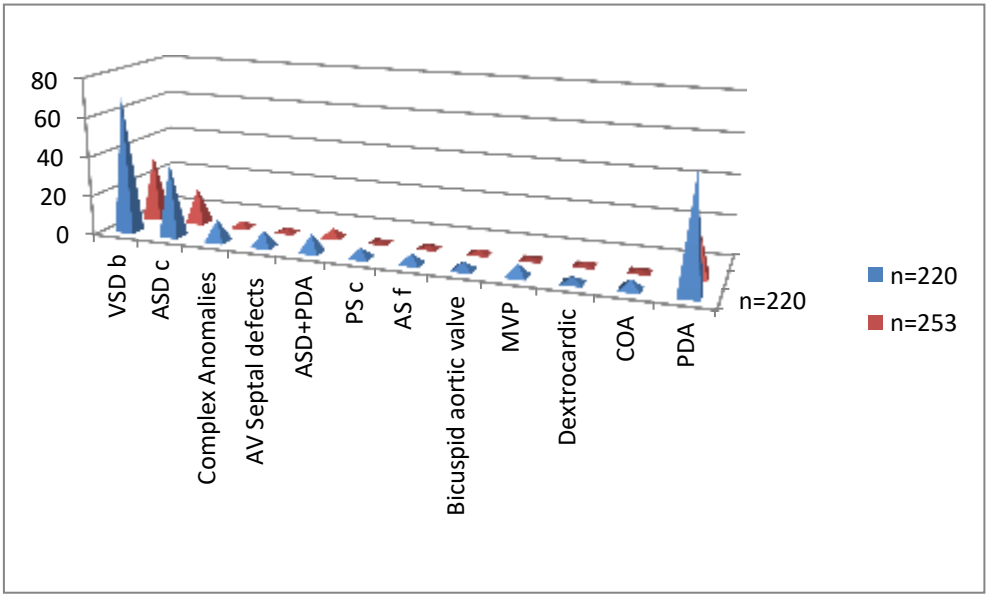

Fig. 2: Occurrence Acyanotic congenital heart disease

Table 2: Occurrence of Cyanotic congenital heart disease

CCHD	**N=33**
TOF	20
TG	05
Truncus ateriosus	2
DORV	1
Tricuspid atresia	2
TAPVC	1
Single ventricle	2

As per the data depicted in Figure 3, individuals were primarily diagnosed with CHD during the age range of 6 weeks to 6 years. Notably, this specific period of 6 weeks to 6 years accounted for the diagnosis of most acyanotic heart disorders. On the other hand, many cyanotic heart problems were identified within the initial 6 weeks of life. This highlights distinctive age patterns in diagnosing acyanotic and cyanotic heart disorders, emphasizing the importance of considering these age-specific trends in understanding and managing congenital heart conditions.

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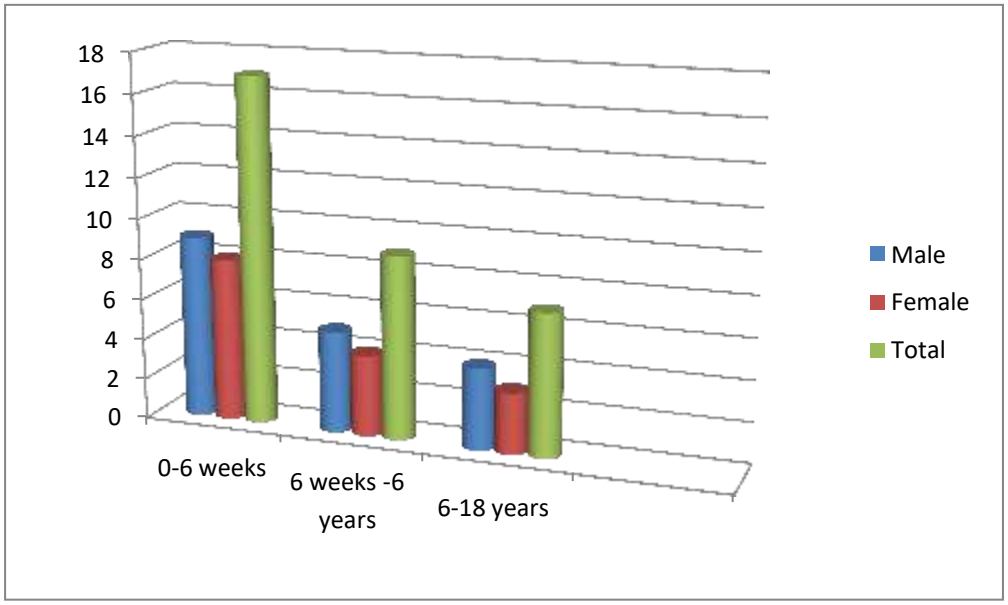

Fig. 3: Age-wise detection of congenital heart diseases.

Discussion

In examining congenital anomalies, both incidence and prevalence serve as distinct attributes; where incidence offers insights into genetic variation and racial disparities, prevalence encapsulates incidence, mortality, disease duration, and societal burden. While CHD prevalence ideally mirrors its incidence, it may be lower, factoring in mortality and patients lost to follow-up. Notably, in India, the predominant focus of prevalence studies has been within school or hospital settings, providing valuable insights into CHD prevalence within specific demographics and healthcare environments.[12]A substantial fraction of CHD lesions had not been considered in school-based studies since many patients with severe CHDs drop out of school due to their low socioeconomic level, and a considerable number of CHD patients below the age of school entrance are not included in these studies. [13] Studies of this kind found a prevalence of 1-2/5/1000 people, insufficient to represent the prevalence rate accurately. [16–14] While community-based research encompassed all social classes, just one study of this kind was conducted in India, with a prevalence of 4.2/1000 people. [17] We discovered a prevalence of 5.6 per 10,000 in the current investigation.

In the category of cyanotic congenital heart diseases, Tetralogy of Fallot (TOF) was the most frequently found type; in the class of acyanotic CHD, the most found types were ventricular septal defect (VSD), patent ductus arteriosus (PDA), and atrial septal defect (ASD). In a study by Misra et al., the most common lesions were ventriculo-ventricular and atrial septal defects; however, their lower prevalence of 1.3 per 1000 children may be explained by the fact that they used a school-based approach and included children as young as 18 years old, as opposed to the current community-based study. [18] As opposed to the community-based strategy utilized in this investigation, Sawant et al.'s technique, which was based on hospital records may have contributed to their finding of a higher frequency of 13.28 per 1000. [19]

According to a meta-analysis of the prevalence of CHD worldwide, ventricular septal defects are the most prevalent type of acyanotic cardiac abnormalities, followed by atrial septal defects and patent ductus arteriosus. Tetralogy of Fallot is the most common cyanotic heart

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disease among these abnormalities. [10] In this study, (TOF) 20 cases of overall CHD anomalies within cyanotic congenital heart diseases were investigated. Although TOF accounts for a very tiny portion of all CHDs, it is the most prevalent cyanotic CHD in Western nations according to claimed prevalence. A study in Atlanta, USA, between 1998 and 2005 states that the frequency was 0.47/1000.[20,21] The EUROCAT study reported 0.2/1000, while the risk in Taiwan was 0.63 per 1000 newborns. A survey carried out in Iceland proposed a limit of 0.5/1000 CHDs. [22, 23] The current investigation found a population frequency of 0.39 /1000, consistent with other reports.

In the present study, a notable gender disparity was observed, with acyanotic congenital heart diseases affecting more males (142) than females (78). In contrast, the opposite trend was noticed in cyanotic CHD, where more females (19) were affected than males (14). Although these differences did not reach statistical significance, they highlight potential variations in the manifestation of congenital heart diseases across genders. Moreover, identifying most congenital heart disease cases within the age group of 6 weeks to 6 years underscores the critical role of hospital and community-based screening programs. This age-specific detection indicates the program's effectiveness in capturing cases that might have remained undiagnosed for a considerable period. The findings emphasize the importance of early screening initiatives in identifying and addressing congenital heart diseases during a crucial developmental phase.

Conclusion

Congenital heart disease (CHD) has become more common over the past century; for the past 15 years, the number of cases per 1,000 live births has remained stable at 9. This corresponds to an estimated annual incidence of 1.35 million cases of CHD, highlighting the significant influence of the disorder on global health. There have been important regional variations in the birth rate of CHD. However, there is still uncertainty over whether these changes are indicative of genuine differences or are a consequence of methodological discrepancies in data gathering. Comprehensive efforts are required to address these issues and enhance our understanding of the aetiology of CHD. It is crucial to build comprehensive congenital disability registries that encompass the entire world population on a prospective basis. Registries of this nature would assume a vital function in precisely ascertaining the precise birth prevalence of CHD, hence enabling more refined epidemiological observations and well-informed public health actions. The continuous endeavour towards these projects exhibits the potential to enhance our understanding of CHD and enhance approaches for its prevention and management worldwide.

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