

## PERINATAL PROFILE OF INFANTS DIAGNOSED WITH CONGENITAL HEART DISEASE: A HOSPITAL-BASED COHORT STUDY

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PERINATAL PROFILE OF INFANTS DIAGNOSED WITH CONGENITAL HEART DISEASE: A HOSPITAL-BASED COHORT STUDY (Abstract): Congenital heart disease (CHD) is the most common congenital anomaly worldwide and remains associated with significant neonatal morbidity. Perinatal factors such as prematurity and low birth weight may influence immediate clinical outcomes. This study **aimed** to describe the perinatal characteristics of children diagnosed with CHD in a level I regional hospital. **Materials and methods:** This retrospective descriptive study included children with confirmed CHD diagnosed between 2017-2023. CHD cases were classified into left-to-right shunt lesions, right-to-left shunt lesions, obstructive malformations, and complex CHD. Extracted perinatal variables included sex, gestational age, prematurity categories, birth weight, Apgar scores at 1 and 5 minutes, and mode of delivery. Data are presented as mean  $\pm$  SD or number (percentage). **Results:** A total of 138 children were included, 50.72% of whom were male. The mean gestational age was  $36.37 \pm 2.75$  weeks, with 49 (35.51%) born preterm. Mean birth weight was  $2692.55 \pm 865.11$  g, and low birth weight was observed in 50 (36.23%). Cesarean delivery occurred in 80 (60.10%) of cases. The highest proportions of CHD subtype were observed for complex lesions (28.99%) and right-to-left shunt defects (30.43%). **Conclusions:** This cohort demonstrates a notable burden of prematurity and reduced birth weight in the context of a high proportion of hemodynamically significant CHD. These findings underscore the importance of coordinated perinatal care and highlight the value of regional epidemiological data for informed healthcare planning. **Keywords:** PERINATAL, CONGENITAL HEART DISEASE, COHORT STUDY.

### INTRODUCTION

Congenital heart disease (CHD) is among the most common congenital anomalies, affecting approximately 0.8% to

1.2% of live births worldwide (1, 2). In 2021, over 4.18 million children under five years were living with CHD globally, representing a 3.4% increase since 1990 (3).

Despite significant advances in cardiovascular care and surgery have significantly improved survival, CHD remains the leading cause of mortality among congenital defects and continues to impose a substantial global health burden (1, 4). Early diagnosis and appropriate management are essential, as untreated severe CHD may lead to heart failure, growth impairment, and early death (5, 6), while long-term complications such as arrhythmias or heart failure often require ongoing follow-up (7).

The etiology of CHD is multifactorial, involving genetic and environmental determinants (8, 9). Beyond structural cardiac abnormalities, increasing attention has been directed toward the perinatal profile of affected infants. Previous studies have suggested associations between CHD and adverse perinatal characteristics, including prematurity and reduced birth weight, potentially reflecting altered intrauterine development or shared pathophysiological mechanisms (10, 11).

Most data derive from large international registries, whereas regional evidence remains limited, particularly in Eastern Europe, where socio-economic and parental profiles may differ. Regional analyses are important, as healthcare organization, prenatal screening practices, and obstetric management may influence perinatal patterns.

The **aim** of this study was to describe the perinatal characteristics of children diagnosed with CHD in a level I regional hospital and to examine the distribution of major CHD subtypes within this population.

## MATERIALS AND METHODS

This retrospective descriptive study was conducted in the neonatal unit of a level I regional hospital and included all children

diagnosed with CHD during the study period 2017-2023. The diagnosis of CHD was confirmed by transthoracic echocardiography performed by the same doctor. CHD cases were classified into four major subtypes: left-to-right shunt lesions, right-to-left shunt lesions, obstructive malformations, and complex CHD. Left-to-right shunt lesions included defects such as ventricular septal defect, atrial septal defect, and patent ductus arteriosus. Right-to-left shunt lesions included cyanotic defects associated with reduced pulmonary oxygenation, such as tetralogy of Fallot and transposition physiology. Obstructive lesions included aortic or pulmonary outflow tract obstruction, while complex CHD comprised multiple structural abnormalities with major hemodynamic impact. Perinatal variables extracted from medical records included sex, gestational age at birth, prematurity status, prematurity categories, birth weight, Apgar score at 1 and 5 minutes, and mode of delivery. Low birth weight was defined as <2500 g, and prematurity categories were defined according to standard obstetric criteria. Data were analyzed using descriptive statistics, with continuous variables presented as mean  $\pm$  standard deviation (SD) and categorical variables as number and percentage. The study was approved by both the Ethics Committee of Grigore T. Popa University of Medicine and Pharmacy, Iasi, Romania (approval number: 640/23.09.2025) and Cuza-Vodă Clinical Hospital of Obstetrics and Gynecology, Iași, Romania (approval number: 5/10.02.2025) before the beginning of the study.

## RESULTS

**Perinatal characteristics.** A total of 138 neonates with CHD were included in

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the study. Among them, 68 (49.28 %) were female and 70 (50.72%) were male. Regarding the place of residence, 43 (31.61%) of patients originated from urban areas and 95 (68.84%) from rural areas. The mean gestational age at birth was  $36.93 \pm 2.59$

weeks. Mean birth weight was  $2692.55 \pm 865.11$  g, with a low birth weight ( $<2500$  g) was observed in 50 (36.23%) of patients. The mean Apgar score was  $7.05 \pm 1.63$  (1-9) at one minute, increasing to  $7.70 \pm 1.40$  (0-9) at 5 minutes (tab. I).

TABLE I.  
**Perinatal characteristics**

Perinatal characteristics	Female (n=68)	Male (n=70)	Total (n=138)
<b>Environment</b>			
Rural	48 (70.59%)	47 (67.14%)	95 (68.84%)
Urban	20 (29.41%)	23 (32.86%)	43 (31.16%)
<b>Gestational age (w)</b>	$36.37 \pm 2.75$	$37.47 \pm 2.31$	$36.93 \pm 2.59$
<b>Birth weight (g)</b>	$2472.67 \pm 855.42$	$2909.14 \pm 825.54$	$2692.55 \pm 865.11$
<b>Apgar score</b>			
1 minute	$6.76 \pm 1.77$	$7.33 \pm 1.41$	$7.05 \pm 1.63$ (1-9)
5 minutes	$7.44 \pm 1.59$	$7.96 \pm 1.11$	$7.70 \pm 1.40$ (0-9)

n-number; w - weeks, g - grams

Overall, 89 (64.49%) were born at term, while n=49 (35.51%) were born prematurely.

Sex distribution across prematurity categories is detailed in second table.

TABLE III.  
**Prematurity categories**

Prematurity	Female: n=29 (40.8%)	Male n=20 (59.18%)	Total (n=49)
Extremely preterm ( $<28w$ )	1 (3.45%)	0 (0%)	1 (2.04%)
Very preterm (28-32 w)	5 (17.24%)	2 (10.00%)	7 (14.29%)
Moderately preterm (32-34w)	2 (6.90%)	2 (10.00%)	4 (8.16%)
Late preterm (34-37w)	21 (72.41%)	16 (80.00%)	37 (75.51%)

n- number, w- weeks

Delivery occurred by cesarean section in 60.10% of cases (n=80), while 39.9% (n=55) were delivered vaginally. Prenatal diagnosis of CHD was established in 20.29% of cases, at a mean gestational age of 24.1 weeks. Most cases were diagnosed postnatally, highlighting the limited prena-

tal detection rate in the studied population.

**CHD subtype distribution.** Overall, CHD cases were classified as left-to-right shunt lesions, right-to-left shunt lesions, obstructive lesions, or complex CHD (tab. III).

TABLE IIIII.  
Congenital heart disease subtype

CHD subtype	Total
Left-to-right shunt	25 (18.12%)
Right-to-left shunt	41 (30.43%)
Obstructive	32 (23.19%)
Complex CHD	40 (28.99%)

CHD - congenital heart disease

## DISCUSSION

The predominance of complex CHD and right-to-left shunt lesions in our cohort suggests a relatively high burden of hemodynamically significant cardiac pathology. These defects are commonly associated with impaired systemic oxygen delivery, respiratory instability, and increased need for specialized neonatal care. In contrast, left-to-right shunt lesions are often better tolerated during the immediate neonatal transition, depending on defect size and pulmonary vascular adaptation.

This study provides a description of perinatal characteristics among children diagnosed with CHD in a level I regional hospital. Given that CHD affects approximately 0.8-1.2% of live births worldwide (12) and remains a leading contributor to congenital morbidity despite advances in care (3), understanding early-life parameters in affected neonates remains clinically meaningful.

Complex congenital heart defects accounted for 28.99%, of cases in our cohort, while right-to-left shunt lesions represented 30.43%, together comprising a substantial proportion of hemodynamically significant anomalies. Such defects are frequently associated with altered systemic oxygen delivery and increased risk of circulatory instability in the early postnatal period.

This subtype distribution provides a

physiological context for understanding the modestly reduced mean Apgar scores observed at 1 and 5 minutes, which were slightly below values reported in the general neonatal population according to World Health Organization data (WHO) (13).

Although Apgar score reflects overall neonatal adaptation, rather than isolated cardiac function, transitional challenges are particularly relevant in infants with CHD. The immediate postnatal period requires rapid physiological changes, including functional closure of the ductus arteriosus and *foramen ovale*, a marked decrease in pulmonary vascular resistance, and establishment of effective pulmonary blood flow (14, 15). In neonates with structural cardiac defects, particularly those involving altered shunt physiology or compromised systemic or pulmonary perfusion, these transitional processes may be less efficient. In preterm infants, delayed ductal closure may further aggravate abnormal shunt dynamics, especially when respiratory support such as surfactant therapy or inhaled nitric oxide is required, thereby contributing to transitional hemodynamic instability (10, 16, 17). Impaired systemic oxygen delivery, transient hypoxemia, or reduced cardiac output during this critical transitional period may partially explain the modestly lower early adaptation scores observed in our cohort

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(10). Although the descriptive design of this study does not allow for causal conclusions to be drawn, the slightly reduced mean Apgar values may nonetheless reflect a degree of hemodynamic vulnerability during the immediate neonatal transition in infants with CHD.

Prematurity was observed in 35.51% of the cohort, a proportion considerably higher than rates typically reported in the general neonatal population (18). The association between CHD and preterm birth has been previously described and is thought to be multifactorial, involving placental dysfunction, altered fetal hemodynamics, and shared developmental pathways influencing both cardiac morphogenesis and gestational duration (10, 11). In our cohort, the substantial proportion of complex (30.43%) and right-to-left shunt lesions (28.99%) suggests a predominance of hemodynamically significant defects and even early deliver. Prematurity may, in turn, exacerbate postnatal adaptation challenges, as immature myocardial function, delayed ductal closure, and persistent pulmonary vascular resistance can amplify shunt imbalance and transitional instability (14, 16).

Birth weight patterns also align with this vulnerability profile. Infants with CHD are frequently reported to have lower birth weight compared to the general population (11,19). However, while structural cardiac anomalies can influence fetal hemodynamics, potentially influencing intrauterine growth, the relatively high rate of prematurity in our cohort, may have also contributed to the lower mean birth weight.

The cesarean delivery rate observed in our cohort should be interpreted within the broader context of contemporary obstetric practice. Over recent decades, cesarean section rates have increased globally, in

many settings exceeding the levels considered optimal by the WHO(13). Pregnancies complicated by suspected or confirmed fetal anomalies, including CHD, are more frequently managed through planned cesarean delivery to allow controlled timing of birth and immediate access to specialized neonatal and cardiology care (14). The relatively low prenatal detection rate observed in our cohort may partially explain the elevated proportion of urgent neonatal evaluations and the variability in delivery practices. Limited prenatal screening accessibility, particularly in rural areas, may contribute to delayed diagnosis and reduced opportunities for planned multidisciplinary perinatal management. While cesarean delivery may facilitate coordinated perinatal management in selected high-risk cases, its increased prevalence also reflects broader trends in modern obstetric practice. As such, the elevated cesarean rate in this cohort likely represents a combination of clinical indication and contemporary delivery patterns.

Beyond their direct clinical implications, these findings also carry important health system relevance. The growing lifetime prevalence of CHD has substantial implications for healthcare planning and long-term resource allocation (20). International scientific statements emphasize the importance of structured, regionally coordinated care pathways to reduce morbidity and improve outcomes (21). However, most epidemiological data derive from large registries(2,6), and regional variability in perinatal patterns is often insufficiently characterized.

Regional cohort-based analyses, such as the present study, provide essential context-specific evidence. Differences in prematurity distribution, birth weight pro-

files, and delivery practices may reflect variations in obstetric management, prenatal screening accessibility, or healthcare infrastructure. Integrating such localized data into larger national frameworks can support differentiated health policy development, including targeted maternal-fetal surveillance programs, optimized neonatal intensive care resource allocation, and regionally adapted referral networks. In this regard, regional epidemiological studies represent a critical component of evidence-based CHD planning.

**Strengths and limitations.** The strengths of this study include the evaluation of perinatal parameters in a clearly defined cohort and the classification of CHD subtypes. The high proportion of complex and right-to-left shunt lesions provides an important clinical context for interpreting the observed patterns of perinatal vulnerability, including prematurity and reduced birth weight.

However, the retrospective design limits causal interpretation and does not allow differentiation between the independent effects of prematurity and CHD-related intrauterine growth alterations on birth weight. The absence of a control group limits direct comparison with background population rates.

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## CONCLUSIONS

This study outlines the perinatal profile of children with CHD in a level I regional hospital, highlighting a notable burden of prematurity and reduced birth weight in the context of a high proportion of hemodynamically significant lesions. The coexistence of complex and right-to-left defects with early-life vulnerability parameters suggests increased cardiovascular demands during the immediate neonatal transition. While causal relationships cannot be established, these findings underscore the importance of coordinated obstetric and neonatal management in pregnancies complicated by CHD.

Beyond their clinical implications, regional cohort-based data contribute valuable insight for healthcare planning. As the population living with CHD continues to expand, locally generated epidemiological evidence may support differentiated resource allocation and region-specific perinatal care strategies within broader national health frameworks.

## CONFLICT OF INTEREST AND FUNDING

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