Prevalence and Pattern of Congenital Anomalies in Neonates Admitted to the NICU of Uttara Adhunik Medical College & Hospital

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ABSTRACT

Background: Congenital anomalies are structural or functional defects arising during intrauterine life and represent a significant cause of neonatal morbidity and mortality worldwide. Their burden is particularly substantial in low- and middle-income countries where surveillance systems are limited. In Bangladesh, institution-based data remain scarce, especially from neonatal intensive care settings. Understanding local prevalence and patterns is essential for planning preventive and clinical strategies. **Objectives:** This study aimed to determine the prevalence and pattern of congenital anomalies among neonates admitted to a tertiary care NICU and to assess selected associated factors. **Methods & Materials:** This cross-sectional observational study was conducted in the Department of Pediatrics, Uttara Adhunik Medical College & Hospital, Dhaka, from January to December 2025. A total of 440 neonates admitted to the NICU were enrolled. Clinical evaluation and relevant investigations were performed to identify congenital anomalies. Data were analyzed using SPSS version 25.0. **Results:** Congenital anomalies were identified in 44 neonates, yielding a prevalence of 10.0%. Major anomalies accounted for 63.6% of affected cases. Cardiovascular anomalies were most common (68.2%), with atrial septal defect being the predominant lesion (50.0%). Craniofacial, genitourinary and musculoskeletal anomalies were less frequent. No statistically significant associations were found between anomaly status and sex, consanguinity, family history, or preterm birth ($p>0.05$). **Conclusion:** Congenital anomalies constitute a considerable proportion of NICU admissions, with cardiovascular defects predominating. Enhanced antenatal screening and systematic neonatal evaluation are essential for early detection and management.

Keywords: *Congenital anomalies, neonatal intensive care unit, cardiovascular defects.*

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INTRODUCTION

Congenital anomalies, also referred to as birth defects, are structural or functional abnormalities that occur during intrauterine life and can be identified prenatally, at birth, or later in infancy [1]. They constitute a major public health concern worldwide, contributing substantially to neonatal morbidity, long-term disability and mortality [2]. The global burden of congenital anomalies remains significant, particularly in low- and middle-income countries where surveillance systems and preventive strategies are often inadequate [3].

According to the World Health Organization, congenital disorders account for a considerable proportion of neonatal deaths, especially in regions with declining infectious causes of mortality [1]. Systematic reviews indicate that the incidence and prevalence of congenital anomalies vary widely across regions, influenced by genetic, environmental, nutritional and socio-demographic factors [3,4]. Bhide and Kar reported that the pooled birth prevalence of congenital anomalies in India remains substantial, underscoring regional heterogeneity within South Asia [4]. Similarly, Dolk et al. documented considerable variation in prevalence across European countries, reflecting differences in surveillance and reporting systems [5].

Cardiovascular anomalies are frequently reported as the most common group of birth defects globally [6]. Parker et al. demonstrated that congenital heart defects constitute a major proportion of all congenital anomalies in the United States [6]. In low-resource settings, hospital-based studies consistently show cardiovascular, musculoskeletal and craniofacial anomalies as predominant patterns [7,8]. Feldkamp et al. emphasized that the etiology of birth defects is multifactorial, involving complex interactions between genetic susceptibility and environmental exposures [9].

In South Asian countries, several hospital-based studies have reported variable prevalence rates. Sarkar et al. documented notable rates of congenital anomalies in a tertiary care hospital in eastern India, identifying significant associations with maternal risk factors [7]. Podder et al. recently reported the prevalence and pattern of congenital anomalies in a tertiary hospital in Bangladesh, highlighting cardiovascular defects as common findings [10]. Siddika et al. also described patterns and risk factors in a private medical college hospital in Bangladesh, indicating the influence of socio-demographic and prenatal factors [11].

Despite these findings, data from Bangladesh remain limited, particularly regarding NICU-based prevalence and detailed pattern analysis. Most available studies are either retrospective or limited to delivery-room data, which may underestimate anomalies diagnosed after admission. Moreover, variation in methodology and classification hampers comparability across institutions. There is a need for institution-specific data to inform local preventive strategies, prenatal counseling and resource allocation.

Given the evolving demographic transition and improvements in neonatal care in Bangladesh, understanding the current burden and pattern of congenital

anomalies in tertiary care settings is essential. This study aims to determine the prevalence and pattern of congenital anomalies among neonates admitted to the NICU of Uttara Adhunik Medical College & Hospital and to examine selected maternal and neonatal factors associated with these anomalies.

OBJECTIVES

This study aimed to determine the prevalence and pattern of congenital anomalies among neonates admitted to a tertiary care NICU and to assess selected associated factors.

METHODS & MATERIALS

This cross-sectional observational study was conducted in the Department of Pediatrics, Uttara Adhunik Medical College & Hospital, Dhaka, Bangladesh, from January to December 2025. A total of 440 neonates admitted to the Neonatal Intensive Care Unit (NICU) during the study period were included in this study.

Inclusion criteria:

- Neonates aged 0–28 days were admitted to the NICU during the study period.
- Neonates who underwent complete clinical evaluation during admission.
- Neonates with available and adequately documented maternal and perinatal records.

Exclusion criteria:

- Neonates with incomplete or missing essential clinical data.
- Neonates were discharged against medical advice before full evaluation.
- Neonates referred to other institutions before completion of diagnostic assessment.

DATA COLLECTION PROCEDURE

Data were collected using a structured case record form. All admitted neonates underwent comprehensive clinical assessment by qualified pediatricians, including detailed history taking and systematic physical examination. Information regarding demographic characteristics such as age at admission, sex, gestational age and socio-economic status was recorded. Maternal and prenatal data were obtained from hospital records and caregiver interviews, including antenatal check-up status, anomaly scan performance, pregnancy-related complications, folic acid supplementation, consanguinity and family history of congenital anomalies.

Congenital anomalies were identified based on clinical findings and confirmed through appropriate diagnostic investigations when indicated. These included echocardiography for suspected cardiac defects, ultrasonography for abdominal or genitourinary anomalies, radiography for skeletal abnormalities and relevant laboratory or genetic assessments where clinically required. Anomalies were classified as major or minor according to established clinical criteria and system-wise categorization was performed for descriptive analysis. To ensure data accuracy and consistency, all collected information was cross-verified with patient files and investigation reports before entry into the database.

STATISTICAL ANALYSIS

Data were entered and analyzed using Statistical Package for the Social Sciences (SPSS) version 25.0. Continuous variables were summarized as mean ± standard deviation, while categorical variables were presented as frequencies and percentages. The prevalence of congenital anomalies was calculated as a proportion of total NICU admissions. Associations between selected maternal and neonatal variables and congenital anomaly status were assessed using the chi-square test. A p-value of less than 0.05 was considered statistically significant.

RESULTS

Table I shows the baseline characteristics of 440 NICU-admitted neonates. Most neonates (67.3%) were admitted within ≤7 days of life, while 29.1% were admitted between 8–28 days and 3.6% after 28 days. The mean age at admission was 9.7 ± 12.5 days. The mean gestational age was 35.7 ± 2.1 weeks. Males constituted 65.0% and females 35.0%. Regarding socio-economic status, 47.7% belonged to the middle class, followed by 30.5% average, 13.2% lower middle, 4.5% poor and 4.1% upper middle. Consanguinity was present in 30.5% of cases.

Table I

Baseline Characteristics of NICU Neonates (*n* = 440).

Variable	Category	Frequency (n)	Percentage (%)
Age at admission (days)	≤7 days	296	67.3
	8–28 days	128	29.1
	>28 days	16	3.6
	Mean ± SD	9.7 ± 12.5	
Gestational age (weeks)	Mean ± SD	35.7 ± 2.1	
Sex	Male	286	65.0
	Female	154	35.0
Socio-economic status	Upper middle	18	4.1
	Middle	210	47.7
	Lower middle	58	13.2
	Average	134	30.5
	Poor	20	4.5
History of consanguinity	Present	134	30.5
	Absent	306	69.5

Table II presents maternal and prenatal characteristics. Antenatal check-ups were reported in 81.8% of mothers. Anomaly scans were performed in 47.7%, not performed in 40.9% and undocumented in 11.4%. Pregnancy-related complications were noted in 60.9% of cases. Folic acid supplementation was reported in 75.5%, while 24.5% had no or undocumented supplementation. A family history of congenital anomalies was present in 15.5%.

Table II
Maternal and Prenatal Factors (*n* = 440).

Variable	Category	Frequency (n)	Percentage (%)
Antenatal check-up	Yes	360	81.8
	No	80	18.2
Anomaly scan performed	Yes	210	47.7
	No	180	40.9
	Not documented	50	11.4
Pregnancy-related complications	Present	268	60.9
	Absent	172	39.1
Folic acid supplementation	Yes	332	75.5
	No / Not documented	108	24.5
Family history of congenital anomaly	Present	68	15.5
	Absent	372	84.5

Table III describes the system-wise distribution among the 44 neonates with anomalies. Cardiovascular anomalies were most common (68.2%). Craniofacial anomalies accounted for 18.2%. Genitourinary and musculoskeletal anomalies each represented 13.6%.

Table III
System-wise Distribution of Congenital Anomalies (*n* = 44).

System Involved	Frequency (n)	Percentage (%)
Cardiovascular	30	68.2
Craniofacial	8	18.2
Genitourinary	6	13.6
Musculoskeletal	6	13.6

Table IV details specific anomalies. Atrial septal defect was the most frequent (50.0%). Patent ductus arteriosus accounted for 18.2% and patent foramen ovale for 13.6%. Cleft lip and/or palate, Down syndrome facies, ambiguous genitalia and polydactyly/syndactyly each represented 9.1%. Undescended testis and amniotic band syndrome each accounted for 4.5%.

Table IV
Specific Types of Congenital Anomalies (*n* = 44).

Specific Anomaly	Frequency (n)	Percentage (%)
Atrial Septal Defect (ASD)	22	50
Patent Ductus Arteriosus (PDA)	8	18.2
Patent Foramen Ovale (PFO)	6	13.6
Cleft lip and/or palate	4	9.1
Down syndrome facies	4	9.1
Ambiguous genitalia	4	9.1
Undescended testis	2	4.5
Amniotic band syndrome	2	4.5
Polydactyly/Syndactyly	4	9.1

Table V shows associations between selected variables and congenital anomaly status. No statistically significant association was observed for sex (p=0.74), consanguinity (p=0.62), family history (p=0.35), or preterm birth (p=0.65).

Table V
Association Between Selected Variables and Congenital Anomaly Status.

Variable	Category	No Anomaly (n=396) n (%)	Anomaly (n=44) n (%)	p-value
Sex	Male	254 (64.1)	30 (68.2)	0.74
	Female	142 (35.9)	14 (31.8)	
Consanguinity	Present	118 (29.8)	16 (36.4)	0.62
	Absent	278 (70.2)	28 (63.6)	
Family history	Present	58 (14.6)	10 (22.7)	0.35
	Absent	338 (85.4)	34 (77.3)	
Preterm birth (<37 weeks)	Yes	176 (44.4)	22 (50.0)	0.65
	No	220 (55.6)	22 (50.0)	

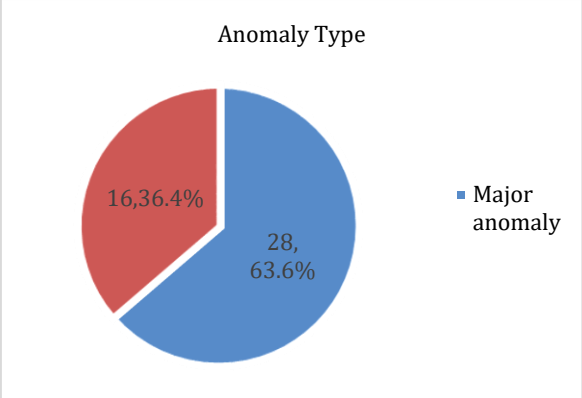

Figure 1 Distribution of Major and Minor Congenital Anomalies (*n*=44).

Figure 1 presents the distribution of anomaly types among affected neonates. Major anomalies accounted for 63.6%, while minor anomalies comprised 36.4%.

DISCUSSION

The present study identified a NICU-based prevalence of congenital anomalies of 10.0%, with major anomalies constituting nearly two-thirds of affected cases. This prevalence aligns with several hospital-based studies from South Asia and other low- and middle-income countries, where reported rates typically range between 5% and 15% among NICU admissions. Sarkar et al. reported a comparable prevalence in a tertiary care center in eastern India, underscoring the continued burden of congenital anomalies in referral hospitals [7]. Similarly, Podder et al. documented a substantial proportion of congenital anomalies among admitted neonates in Bangladesh, reinforcing the relevance of institution-based surveillance [10].

The predominance of major anomalies in this cohort is consistent with findings from Sravani et al., who observed that severe structural defects accounted for most NICU-detected anomalies in the Andaman and Nicobar Islands [8]. Major anomalies often require intensive monitoring and early intervention, which may explain their higher representation in tertiary care settings. Kumar et al., in a 20-year analysis from North India, also demonstrated that clinically significant anomalies formed the bulk of neonatal admissions with congenital defects [12].

Cardiovascular anomalies were the most frequent system involved, accounting for over two-thirds of cases. This pattern mirrors global and regional data indicating congenital heart defects as the leading category of birth defects. Parker et al. demonstrated that congenital heart defects represent the largest subgroup of congenital anomalies in population-based estimates from the United States [6]. Dolk et al. also identified cardiovascular anomalies as predominant across European registries [5]. In the South Asian context, Siddika et al. and Bhalerao and Bhalerao similarly reported cardiovascular defects as the most common anomaly group in tertiary hospitals [11,13].

Atrial septal defect was the most frequent specific anomaly in this study. This finding is comparable to reports by Dursun et al., who observed a high proportion of septal defects among NICU admissions in Turkey [14]. The predominance of septal defects may partly reflect improved availability of echocardiography, enabling early detection of mild to moderate lesions that might previously have remained undiagnosed.

Craniofacial, genitourinary and musculoskeletal anomalies were less frequent but still clinically significant. Studies from Ethiopia by Silesh et al. and Taye et al. have also demonstrated variable distributions of these systems, reflecting heterogeneity in genetic backgrounds, environmental exposures and diagnostic capacities [15,16]. The comparatively lower proportion of neural tube defects in this cohort may be influenced by the relatively high rate of reported folic acid supplementation among mothers, a factor consistently associated with reduced risk of such defects.

Although consanguinity and family history were more common among neonates with anomalies, no statistically significant associations were detected. This lack of significance may be related to the limited number of anomaly cases, reducing statistical power. Mashuda et al. reported significant associations between congenital anomalies and consanguinity in Tanzania, suggesting that larger samples may detect clearer relationships [17]. Similarly, Ameen et al. found correlations between certain maternal characteristics and anomaly patterns in Iraq [18].

Preterm birth did not show a significant association with congenital anomaly status in this study. However, previous research has indicated that congenital anomalies can contribute to preterm delivery and low birth weight. Boyle et al. highlighted that congenital anomalies substantially contribute to neonatal morbidity and mortality across Europe [2]. The absence of statistical association in the present study should therefore be interpreted cautiously.

The high proportion of mothers receiving antenatal care and folic acid supplementation reflects improving maternal health services in urban Bangladesh. Nevertheless, nearly half of the mothers did not undergo a documented anomaly scan, indicating gaps in prenatal detection. Marokakis et al. emphasized that structured prenatal counselling and anomaly detection improve parental preparedness and neonatal outcomes [19]. Strengthening antenatal screening protocols could enhance early diagnosis and referral.

Globally, congenital anomalies remain a persistent contributor to neonatal mortality, particularly as infectious causes decline. The World Health Organization has emphasized the need for improved surveillance, prevention and early management strategies, especially in low-resource settings [1]. Sitkin et al. further noted that congenital anomalies represent a significant but often under-recognized component of the global surgical burden in low- and middle-income countries [20].

Overall, the findings of this study are consistent with regional and international evidence highlighting cardiovascular anomalies as predominant and emphasizing the

continued relevance of NICU-based surveillance. Institutional data such as these contribute to the growing body of evidence necessary for planning preventive strategies, optimizing prenatal care and allocating neonatal resources effectively.

CONCLUSION

Congenital anomalies were identified in one-tenth of NICU admissions, with major anomalies predominating. Cardiovascular defects, particularly atrial septal defects, constituted the most frequent pattern. Although selected maternal and neonatal factors showed higher proportions among affected neonates, no statistically significant associations were demonstrated. These findings underscore the importance of systematic neonatal screening, strengthened antenatal surveillance and early specialist referral in tertiary care settings.

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CONFLICTS OF INTEREST

There are no conflicts of interest.

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