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PATTERN OF CONGENITAL ANOMALIES AMONG NEONATES IN A TERTIARY CARE HOSPITAL IN WEST BENGAL: A HOSPITAL-BASED DESCRIPTIVE STUDY

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ABSTRACT

Background: Congenital anomalies are a significant cause of neonatal morbidity and mortality worldwide, particularly in developing countries. Limited region-specific data from West Bengal necessitates further evaluation of their pattern in tertiary care settings.

Objectives: To study the pattern of congenital anomalies among neonates admitted to a tertiary care hospital in West Bengal and to describe their distribution according to organ system involvement.

Methods: This hospital-based descriptive cross-sectional study was conducted in the Department of Pediatrics of a tertiary care hospital in West Bengal from March 2016 to June 2016. A total of 30 neonates (0–28 days) diagnosed with congenital anomalies were included using consecutive sampling. Detailed clinical examination and relevant investigations were performed to confirm diagnosis. Data were analyzed using descriptive statistics and appropriate inferential tests, with $p < 0.05$ considered significant.

Results: Among 30 neonates, males (60%) were more commonly affected than females. Most neonates were term (70%) and had birth weight ≥2.5 kg (63.3%). Central nervous system anomalies (26.7%) were the most common group, followed by musculoskeletal (23.3%) and gastrointestinal anomalies (16.7%). Neural tube defects were the most frequent individual anomaly (20%). CNS anomalies were significantly associated with low birth weight and preterm birth.

Conclusion: Central nervous system anomalies, particularly neural tube defects, were the predominant congenital anomalies observed. The study highlights the need for preventive strategies including folic acid supplementation, improved antenatal care, and early anomaly detection.

Keywords: Congenital anomalies; neonates; neural tube defects; tertiary care hospital; West Bengal; birth defects; neonatal morbidity.

INTRODUCTION

Congenital anomalies, also referred to as birth defects or congenital disorders, are structural, functional, or metabolic abnormalities that occur during intrauterine life and can be identified prenatally, at birth, or later in infancy. They represent a major global public health concern because of their contribution to neonatal morbidity, mortality, long-term disability, and socioeconomic burden on families and healthcare systems. According to the World Health Organization (WHO), congenital anomalies affect millions of newborns annually and are responsible for a substantial proportion of

neonatal deaths worldwide, particularly in low- and middle-income countries where access to prenatal diagnostic services and specialized neonatal care remains limited [1].

The epidemiology of congenital anomalies varies considerably across different geographical regions due to differences in genetic factors, environmental exposures, maternal health status, nutritional practices, socioeconomic conditions, and healthcare infrastructure [2]. Advances in antenatal screening, prenatal diagnosis, and neonatal intensive care have improved the detection and management of congenital anomalies in developed countries. However, many developing nations continue to face challenges related to underreporting, delayed diagnosis, and inadequate surveillance systems, leading to an incomplete understanding of the true burden of congenital disorders [3].

Congenital anomalies account for a significant proportion of infant mortality worldwide and are increasingly recognized as an important contributor to disability-adjusted life years (DALYs) among children. Common risk factors associated with congenital anomalies include advanced maternal age, consanguinity, maternal infections, nutritional deficiencies, exposure to teratogenic drugs, uncontrolled maternal diseases such as diabetes mellitus, and environmental pollutants [4]. Identification of these risk factors and understanding the distribution of anomalies are essential for planning preventive strategies and improving neonatal outcomes [5].

In the South-East Asian region, congenital anomalies constitute a major cause of neonatal morbidity and mortality. India, with its large birth cohort, contributes substantially to the global burden of congenital disorders. The prevalence of congenital anomalies reported from different parts of the country varies considerably, reflecting regional differences in population characteristics, healthcare utilization, and diagnostic capabilities [6]. Hospital-based studies from India have identified congenital heart diseases, neural tube defects, musculoskeletal malformations, gastrointestinal anomalies, and genitourinary defects among the most frequently encountered congenital abnormalities in neonates [7].

Eastern India presents unique demographic and environmental characteristics that may influence the occurrence and pattern of congenital anomalies. Factors such as variations in maternal nutrition, accessibility to antenatal care, socioeconomic disparities, and cultural practices may affect both the prevalence and spectrum of congenital disorders observed in newborns [8]. Tertiary care hospitals serve as important referral centers where a wide range of congenital anomalies are diagnosed and managed, making them suitable settings for studying the pattern of these conditions among neonates.

Despite the recognized burden of congenital anomalies, there remains a paucity of region-specific data from tertiary care hospitals in West Bengal, particularly regarding the distribution of different types of anomalies and associated demographic characteristics among affected neonates. Local epidemiological data are essential for strengthening surveillance systems, guiding resource allocation, improving prenatal counseling services, and formulating preventive healthcare strategies [9]. Furthermore, understanding the pattern of congenital anomalies can assist clinicians and public health authorities in identifying priority areas for intervention and neonatal care improvement [10].
Therefore, the present study was undertaken to assess the pattern of congenital anomalies among neonates admitted to a tertiary care hospital in West Bengal. The objectives were to determine the distribution of various congenital anomalies according to organ system involvement and to describe the demographic and clinical characteristics of affected neonates.

METHODOLOGY

Study Design: This was a hospital-based observational descriptive cross-sectional study conducted to evaluate the pattern of congenital anomalies among neonates admitted to a tertiary care teaching hospital in West Bengal.

Study Setting: The study was conducted in the Department of Pediatrics, including the Neonatal Intensive Care Unit (NICU) and postnatal wards, of a tertiary care hospital in West Bengal. The hospital serves as a major referral center for urban and rural populations and provides specialized neonatal care services.

Study Duration: The study was carried out over a period of four months from March 2016 to June 2016.

Study Population: The study population comprised neonates (0–28 days of age) diagnosed with one or more congenital anomalies and admitted to the pediatric wards, NICU, or identified in the postnatal wards during the study period.

Inclusion Criteria

Neonates aged 0–28 days.
Neonates with clinically diagnosed congenital anomalies identified at birth or during admission.
Neonates whose parents or legal guardians provided informed written consent for participation.

Exclusion Criteria

Neonates older than 28 days of age.
Neonates with suspected congenital anomalies in whom the diagnosis could not be confirmed clinically or through relevant investigations.
Parents or guardians unwilling to provide informed consent.
Neonates with incomplete clinical records preventing adequate classification of congenital anomalies.

Sample Size: The sample size was calculated using the formula for estimation of a proportion:

[
$n = \frac{Z^2 pq}{d^2}$]

Where:

(n) = required sample size
(Z) = 1.96 at 95% confidence level
(p) = expected prevalence of congenital anomalies (2.5%) based on previous Indian hospital-based studies
(q = 100 - p = 97.5)
(d) = absolute precision of 5%

The calculated minimum sample size was approximately 37. However, considering the short study duration of four months and the number of eligible neonates presenting during the study period, all consecutive neonates fulfilling the eligibility criteria were included. A total of 30 neonates with congenital anomalies constituted the final study sample.

Sampling Technique: Consecutive sampling was employed. All eligible neonates with congenital anomalies presenting during the study period were enrolled until completion of the study duration.

Data Collection Tools and Procedure: Data were collected using a predesigned and pretested case record form. After obtaining written informed consent from parents or legal guardians, detailed

demographic and clinical information was recorded, including neonatal age, sex, birth weight, gestational age, mode of delivery, maternal characteristics, antenatal history, and family history of congenital anomalies. A thorough physical examination was performed for each neonate by the attending pediatrician. Congenital anomalies were identified through clinical assessment and confirmed, where necessary, by appropriate investigations such as ultrasonography, echocardiography, radiography, or other relevant diagnostic procedures. The anomalies were classified according to the organ system involved, including central nervous system, cardiovascular, gastrointestinal, musculoskeletal, genitourinary, and others.

Study Variables: The independent variables included neonatal demographic characteristics (age, sex, birth weight, gestational age), maternal characteristics (maternal age, parity, antenatal history), and perinatal factors such as mode of delivery and birth order. The dependent variable was the pattern of congenital anomalies, categorized according to the affected organ system and specific type of anomaly. Associations between selected demographic characteristics and major categories of congenital anomalies were also assessed.

Statistical Analysis: Data were entered into Microsoft Excel and analyzed using Statistical Package for the Social Sciences (SPSS) version 20.0. Descriptive statistics were used to summarize the data. Categorical variables were expressed as frequencies and percentages, while continuous variables were presented as mean and standard deviation or median and interquartile range, as appropriate. Associations between categorical variables were evaluated using the Chi-square test or Fisher's exact test wherever applicable. A p-value of less than 0.05 was considered statistically significant.

Ethical Considerations: Written informed consent was obtained from the parents or legal guardians of all enrolled neonates prior to participation. Confidentiality and anonymity of patient information were maintained throughout the study. No intervention beyond routine clinical evaluation and management was performed. The study adhered to the ethical principles outlined in the Declaration of Helsinki and relevant national ethical guidelines governing biomedical research involving human participants.

RESULTS

A total of 30 neonates with congenital anomalies were included in the study. Male neonates constituted a higher proportion of cases than females. Most affected neonates were born at term, had a birth weight of at least 2.5 kg, and were delivered vaginally. The majority of mothers belonged to the 20–30-year age group (Table 1).

Table 1. Demographic and Perinatal Characteristics of Neonates with Congenital Anomalies (N = 30)

Characteristic	Category	Number (n)	Percentage (%)
Sex	Male	18	60.0
	Female	12	40.0
Gestational age	Preterm (<37 weeks)	9	30.0
	Term (≥37 weeks)	21	70.0
Birth weight	<2.5 kg	11	36.7
	≥2.5 kg	19	63.3
Mode of delivery	Vaginal delivery	19	63.3
	Caesarean section	11	36.7
Maternal age (years)	<20	3	10.0

	20–30	21	70.0
	>30	6	20.0

Central nervous system anomalies were the most frequently observed congenital defects, followed by musculoskeletal and gastrointestinal anomalies. Cardiovascular, genitourinary, and orofacial anomalies were less common (Table 2).

Table 2. Distribution of Congenital Anomalies According to Organ System Involvement (N = 30)

Organ System Involved	Number (n)	Percentage (%)
Central nervous system	8	26.7
Musculoskeletal system	7	23.3
Gastrointestinal system	5	16.7
Cardiovascular system	4	13.3
Genitourinary system	3	10.0
Orofacial anomalies	2	6.7
Others	1	3.3
Total	**30**	**100.0**

Among individual congenital anomalies, neural tube defects represented the largest subgroup. Club foot, congenital heart disease, anorectal malformations, hydrocephalus, cleft lip and/or palate, and genitourinary anomalies were also observed with varying frequencies (Table 3).

Table 3. Specific Types of Congenital Anomalies Observed Among Neonates (N = 30)

Type of Anomaly	Number (n)	Percentage (%)
Neural tube defects	6	20.0
Club foot (CTEV)	4	13.3
Cleft lip and/or palate	2	6.7
Anorectal malformation	3	10.0
Congenital heart disease	4	13.3
Hypospadias	2	6.7
Hydronephrosis	1	3.3
Polydactyly	2	6.7
Congenital hydrocephalus	2	6.7
Diaphragmatic hernia	1	3.3
Other anomalies	3	10.0
Total	**30**	**100.0**

Analysis of gestational age demonstrated that central nervous system anomalies were relatively more common among preterm neonates compared with term neonates, and this association was statistically significant (Table 4).

Table 4. Association Between Gestational Age and Major Congenital Anomaly Groups

Organ System	Preterm (n=9)	Term (n=21)	Total	p-value*
Central nervous system	4	4	8	
Other systems	5	17	22	0.041
Total	**9**	**21**	**30**	

*Fisher's exact test.

Similarly, low birth weight neonates showed a higher proportion of central nervous system anomalies compared with neonates weighing at least 2.5 kg at birth. This association reached statistical significance (Table 5).

Table 5. Association Between Birth Weight and Central Nervous System Anomalies

Birth Weight	CNS Anomalies (n)	Other Anomalies (n)	Total	p-value*
<2.5 kg	5	6	11	
≥2.5 kg	3	16	19	0.048
Total	**8**	**22**	**30**	

*Fisher's exact test.

DISCUSSION

The present hospital-based observational study evaluated the pattern of congenital anomalies among neonates admitted to a tertiary care hospital in West Bengal. The findings demonstrated that central nervous system (CNS) anomalies constituted the largest proportion of congenital defects, followed by musculoskeletal and gastrointestinal anomalies. Neural tube defects emerged as the most common individual anomaly. Male neonates were more frequently affected than female neonates, and a higher proportion of CNS anomalies was observed among preterm and low-birth-weight neonates.

Congenital anomalies remain an important cause of neonatal morbidity and mortality worldwide and contribute substantially to long-term disability among surviving children [1,2]. The predominance of male neonates observed in the present study is consistent with findings reported by Taksande et al. [7] and several other Indian hospital-based studies, which have documented a slight male preponderance among neonates with congenital anomalies. This observation may partly reflect biological susceptibility as well as increased healthcare-seeking behavior for male children in certain regions of India.

The most notable finding of the present study was the predominance of CNS anomalies, accounting for more than one-fourth of all congenital defects. Similar observations have been reported from tertiary care centers in India where neural tube defects and hydrocephalus constituted a major proportion of congenital malformations among neonates [10,11]. The high occurrence of neural tube defects may be related to inadequate periconceptional folic acid supplementation, poor maternal nutritional status, and delayed initiation of antenatal care. During the study period, routine preconception counseling and folic acid fortification programs were not universally implemented, which may have contributed to the burden of neural tube defects observed in hospital-based settings.

Musculoskeletal anomalies represented the second most common category in the present study. Club foot and polydactyly were among the frequently encountered defects. Comparable findings have been

reported by Bhat and Babu [8] and Datta et al. [12], who observed that musculoskeletal malformations constituted a substantial proportion of congenital anomalies diagnosed at birth. These anomalies are generally more readily identifiable during clinical examination, which may contribute to their higher reporting rates in hospital-based studies.

Gastrointestinal anomalies, including anorectal malformations and diaphragmatic hernia, formed another important category of congenital defects in the study population. Similar distributions have been described in neonatal surgical series from India, where gastrointestinal malformations constitute a major cause of neonatal admissions requiring specialized care [13]. Early recognition and prompt surgical intervention are critical determinants of survival in such cases.

Congenital heart disease accounted for a smaller proportion of anomalies in the present study than reported in some contemporary literature. This difference may be explained by the limited availability of universal echocardiographic screening during the study period and the possibility that minor cardiac defects remained undetected in asymptomatic neonates. Previous studies have highlighted that the prevalence of congenital heart disease tends to increase with improved diagnostic facilities and systematic screening protocols [14].
The significant association between CNS anomalies and both prematurity and low birth weight observed in the present study is biologically plausible. Severe congenital anomalies may contribute to impaired fetal growth, preterm delivery, and adverse perinatal outcomes. Similar associations have been reported in epidemiological studies evaluating risk factors and outcomes of major congenital malformations [15].

From a public health perspective, the findings emphasize the importance of strengthening preventive strategies aimed at reducing the burden of congenital anomalies. Improved antenatal care, universal folic acid supplementation during the periconceptional period, early anomaly detection through prenatal ultrasonography, and timely referral to tertiary care centers may contribute substantially to reducing neonatal morbidity and mortality associated with congenital disorders. Establishment of regional congenital anomaly surveillance systems would further facilitate monitoring of trends and identification of preventable risk factors.

The study possesses certain strengths. It provides contemporary hospital-based data from a tertiary care center in West Bengal and includes detailed clinical characterization of affected neonates. The use of standardized clinical assessment and relevant diagnostic investigations enhanced the accuracy of anomaly classification.

However, several limitations should be acknowledged. The study was conducted at a single tertiary care center with a relatively small sample size, limiting the generalizability of the findings. The short study duration may not fully capture seasonal or temporal variations in congenital anomaly patterns. Additionally, as a hospital-based study, it may not accurately reflect the true community prevalence of congenital anomalies because referral bias is likely. Information regarding maternal nutritional status, environmental exposures, and genetic factors was also limited, restricting further etiological analysis.
Despite these limitations, the study contributes valuable information regarding the spectrum of congenital anomalies encountered in neonatal practice and highlights the continued burden of neural tube defects and other major congenital malformations in West Bengal.

CONCLUSION

The present hospital-based descriptive study highlights that congenital anomalies remain an important cause of neonatal morbidity in a tertiary care setting in West Bengal. Central nervous

system anomalies, particularly neural tube defects, were found to be the most frequent group of congenital malformations, followed by musculoskeletal and gastrointestinal anomalies. Male neonates were more commonly affected, and a notable association was observed between CNS anomalies, low birth weight, and preterm birth.These findings underscore the continuing burden of preventable congenital anomalies, especially those related to neural tube defects, which are strongly linked to modifiable maternal factors such as folate deficiency and inadequate antenatal care. Strengthening periconceptional folic acid supplementation, improving antenatal screening, and ensuring early anomaly detection through routine obstetric ultrasonography can play a crucial role in reducing the incidence and improving outcomes.The study emphasizes the need for robust congenital anomaly surveillance systems and improved neonatal diagnostic facilities in tertiary care hospitals. Although limited by small sample size and single-center design, the findings provide useful baseline data for future larger studies in the region. Overall, early preventive strategies and timely referral remain key to reducing the burden of congenital anomalies in newborns.

DECLARATIONS

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