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ORIGINAL ARTICLE

Spectrum and Clinical Outcomes of Birth Defects in Pediatric Surgical Patients – Evidence from a Government Tertiary Hospital

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ABSTRACT

Background: *Birth defects remain a major contributor to pediatric morbidity and mortality in low- and middle-income countries, where limited resources often delay diagnosis and treatment. Data from tertiary hospitals are crucial to understanding the clinical spectrum and outcomes of these anomalies.* ***Aim of the study:*** *To evaluate the spectrum and clinical outcomes of birth defects among pediatric surgical patients in a government tertiary hospital in Bangladesh.* ***Methods & Materials:*** *This prospective study enrolled 310 pediatric patients (≤18 years) with birth defects over one year. Data on demographic characteristics, system-wise distribution of anomalies, surgical interventions, postoperative complications, and clinical outcomes were collected and analyzed using SPSS (version 26).* ***Result:*** *Neural tube defects (23.87%) and gastrointestinal anomalies (21.94%) were the most common anomalies. Emergency surgery was required in 40% of cases, while elective procedures were performed in 47.74%. Postoperative complications occurred in 25.16% of patients, with surgical site infection being the most frequent (9.03%). At follow-up, 69.03% recovered without disability, 15.48% with disability, 5.81% required readmission, and mortality was 9.68%.* ***Conclusion:*** *Birth defects impose a significant clinical and surgical burden, with a considerable proportion of patients experiencing disability and mortality. Improved early diagnosis, timely surgical care, and long-term follow-up strategies are essential to optimize outcomes and reduce the impact of congenital anomalies in resource-limited settings.*

Keywords: *Birth defects, congenital anomalies, pediatric surgery, clinical outcomes, Bangladesh.*

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INTRODUCTION

Birth defects, or congenital anomalies, are structural or functional abnormalities present at birth that can affect nearly every organ system [1]. Globally, birth defects are a significant public health concern and according to the World Health Organization (WHO), approximately 8 million newborns are affected by birth defects annually, with congenital heart defects, neural tube defects, and Down syndrome being among the most common [2]. In Bangladesh, birth defects are a major cause of illness and death among newborns, affecting approximately 7.02% of babies each year at Bangabandhu Sheikh Mujib Medical University (BSMMU) [3]. Birth defects encompass a wide range of conditions, including neural tube defects, congenital heart anomalies, gastrointestinal malformations, and urogenital abnormalities. These conditions may be diagnosed prenatally through imaging or genetic testing, or postnatally through clinical examination and diagnostic procedures [1]. The etiology of birth defects is multifactorial, involving genetic, environmental, and socio-economic factors. Genetic mutations can lead to inherited conditions, while environmental exposures such as maternal infections, malnutrition, and substance use during pregnancy can increase the risk of congenital anomalies [4]. In low- and middle-income countries like Bangladesh, limited access to prenatal care and diagnostic facilities further exacerbates the situation, leading to delayed diagnoses and suboptimal management [5]. The consequences of birth defects are multidimensional. For affected children, anomalies can cause immediate health threats and long-term disabilities, including developmental delays, mobility limitations, and cognitive impairments [6]. Frequent hospitalizations and surgeries may also lead to psychological challenges, such as anxiety and social isolation [7]. Families often bear significant emotional, financial, and social burdens, including stress, reduced income, and exposure to social stigma [8]. At the community and national level, birth defects impose heavy demands on healthcare infrastructure, requiring specialized surgical care, neonatal intensive care, and long-term rehabilitation [9]. Surgical correction of birth defects can significantly improve survival rates and quality of life for affected children. For example, timely surgical interventions for conditions like anorectal malformations, congenital diaphragmatic hernia, and gastroschisis have been associated with favorable outcomes. These procedures not only address the immediate health concerns but also enable children to lead more normal lives, attend school, and integrate into society [10]. Despite the benefits, several challenges hinder the effective management of birth defects in Bangladesh. Limited healthcare infrastructure, shortage of trained pediatric surgeons, and inadequate post-operative care facilities contribute to high

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mortality and morbidity rates [11]. The aim of this study was to analyze the spectrum and clinical outcomes of birth defects among pediatric surgical patients in a government tertiary hospital in Bangladesh to inform better diagnosis, management, and healthcare planning.

METHODS & MATERIALS

This study was conducted in the Department of Pediatric Surgery, Bangladesh Shishu Hospital & Institute, Dhaka, Bangladesh. The study spanned 1 year, from July 2024 to June 2025, and included all pediatric patients (≤18 years) who presented with birth defects and required surgical evaluation or intervention. A total of 310 patients were enrolled using a purposive sampling method, ensuring that only clinically and surgically relevant cases were included.

Inclusion Criteria

- Children aged 0–18 years with structural or functional congenital birth defects.
- Patients admitted to the Department of Pediatric Surgery requiring operative or non-operative management.
- Cases with complete demographic, clinical, operative, and follow-up records.

Exclusion Criteria

- Patients older than 18 years.
- Children with acquired anomalies (e.g., trauma, infection, tumor-related conditions).
- Minor anomalies not requiring surgical or hospital-based management.

Data Collection

Data were extracted from hospital records, operative notes, and follow-up registers using a structured data collection sheet. Variables included demographic characteristics (age, sex, residence), spectrum of birth defects, system-wise distribution of anomalies, surgical interventions performed, postoperative complications, and clinical outcomes. Each patient was classified according to system-specific categories of anomalies, and outcomes were assessed at the time of discharge and during follow-up visits.

Statistical Analysis

All data were entered into SPSS software (version 26) for analysis. Categorical variables were expressed as frequencies and percentages. Continuous variables, where relevant, were presented as mean ± standard deviation (SD). Ethical approval was obtained from the institutional review board, and written informed consent was taken from parents or legal guardians prior to data collection.

RESULT

A total of 310 pediatric surgical patients with birth defects were included in the study (Table 1). The majority of patients (40.00%) were infants aged 0–1 year, followed by children aged 2–5 years (27.74%) and 6–10 years (17.42%). Adolescents constituted a smaller proportion, with 10.00% in the 11–15 years age group and only 4.84% above 15 years. Males were more frequently affected than females, yielding a male-to-female ratio of 1.5:1. Regarding residence, nearly two-thirds of the patients (61.94%) came from rural areas, whereas 38.06% were from urban settings. Table 2 provided the distribution of anomalies. Neural tube defects were the most common, accounting for 23.9% of cases, followed by gastrointestinal anomalies (21.94%), genitourinary anomalies (17.42%), and orofacial clefts (16.8%). Musculoskeletal anomalies represented 11.61%, while cardiothoracic anomalies were less frequent (3.87%). A smaller group of patients (4.52%) presented with other congenital anomalies. Detailed categorization of anomalies by system were discussed in Table 3. Central nervous system defects were the most prevalent (23.87%), with spina bifida (32 cases) and hydrocephalus (28 cases) being the most frequent, followed by encephalocele (14 cases). Gastrointestinal anomalies (21.94%) were largely represented by anorectal malformations (36 cases), Hirschsprung's disease (20 cases), and esophageal atresia (12 cases). Genitourinary anomalies (17.42%) included hypospadias (22 cases), undescended testis (18 cases), and posterior urethral valve (14 cases). Orofacial anomalies (16.77%) comprised cleft lip (22 cases), cleft palate (16 cases), and combined clefts (14 cases). Musculoskeletal anomalies (11.61%) were mainly clubfoot (18 cases), polydactyly (10), and syndactyly (8). Cardiothoracic anomalies (3.87%) included congenital diaphragmatic hernia (6 cases) and other cardiac anomalies (6 cases), while 14 patients (4.52%) presented with miscellaneous anomalies. As summarized in Table 4, nearly half of the patients (47.74%) underwent elective surgery, while 40.0% required emergency procedures. Staged surgery was performed in 7.74% of cases, and a small proportion (4.52%) were managed conservatively without operative intervention. Postoperative outcomes were outlined in Table 5. The majority of patients (74.84%) had an uneventful recovery without complications. Among those who developed complications, surgical site infection was the most common (9.03%), followed by wound dehiscence (5.16%), sepsis (4.52%), respiratory complications (3.87%), and urinary complications (2.58%). Table 6 highlighted the clinical outcomes of pediatric surgical patients. Most patients (69.03%) recovered without long-term disability, while 15.48% recovered with some form of disability. Readmission was required in 5.81% of cases, whereas mortality occurred in 9.68% of the study population.

Table – I: Demographic Characteristics of Pediatric Surgical Patients with Birth Defects (*n* = 310)

Variables	Frequency (n)	Percentage (%)
Age group (years)		
0–1	124	40.00
2–5	86	27.74
6–10	54	17.42
11–15	31	10.00
>15	15	4.84
Gender		
Male	186	60.00
Female	124	40.00
Residence		
Urban	118	38.06
Rural	192	61.94

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Table – II: Spectrum of Birth Defects among Pediatric Surgical Patients (*n* = 310)

Birth Defect	Frequency (n)	Percentage (%)
Neural tube defects	74	23.87
Orofacial clefts	52	16.77
Gastrointestinal anomalies	68	21.94
Genitourinary anomalies	54	17.42
Musculoskeletal anomalies	36	11.61
Cardiothoracic anomalies	12	3.87
Others	14	4.52

Table – III: System-Wise Distribution of Major Birth Defects (*n* = 310)

System	Specific Anomaly	Frequency (n)	Percentage (%)
Central Nervous System	Hydrocephalus (28), Spina bifida (32), Encephalocele (14)	74	23.87
Gastrointestinal System	Esophageal atresia (12), Anorectal malformation (36), Hirschsprung's disease (20)	68	21.94
Genitourinary System	Hypospadias (22), Posterior urethral valve (14), Undescended testis (18)	54	17.42
Orofacial	Cleft lip (22), Cleft palate (16), Combined (14)	52	16.77
Musculoskeletal	Polydactyly (10), Syndactyly (8), Clubfoot (18)	36	11.61
Cardiothoracic	Congenital diaphragmatic hernia (6), Other cardiac anomalies (6)	12	3.87
Others	Miscellaneous minor anomalies	14	4.52

Table – IV: Surgical Interventions Performed (*n* = 310)

Intervention Type	Frequency (n)	Percentage (%)
Emergency surgery	124	40.00
Elective surgery	148	47.74
Staged surgery	24	7.74
Conservative management	14	4.52

Table – V: Postoperative Complications among Patients with Birth Defects (*n* = 310)

Complication	Frequency (n)	Percentage (%)
Surgical site infection	28	9.03
Wound dehiscence	16	5.16
Sepsis	14	4.52
Respiratory complications	12	3.87
Urinary complications	8	2.58
None	232	74.84

Table – VI: Clinical Outcomes of Pediatric Surgical Patients with Birth Defects (*n* = 310)

Outcome	Frequency (n)	Percentage (%)
Recovered without disability	214	69.03
Recovered with disability	48	15.48
Readmission required	18	5.81
Mortality	30	9.68

DISCUSSION

Birth defects encompass a diverse spectrum of structural and functional anomalies that remain a major contributor to pediatric surgical morbidity and mortality worldwide [12]. This prospective study of 310 pediatric surgical patients with birth defects provides comprehensive insights into demographic characteristics, spectrum of anomalies, management, complications, and clinical outcomes. In our series, infants (0–1 year) constituted the largest proportion (40.00%), followed by preschool children (2–5 years, 27.74 %). This early age predominance reflects the fact that most congenital anomalies manifest in infancy or early childhood, consistent with previous findings, where nearly half of pediatric surgical admissions with anomalies occurred before 1 year of age [13]. A male predominance (60.00%) was observed, aligning with reports by Hossain et al., where boys comprised 62.96% of congenital anomaly surgical cases [14]. The rural majority (61.94%) in our cohort suggests limited access to prenatal care and referral disparities—similar rural–urban imbalances have been reported in other low- and middle-income countries [15]. Neural tube defects (NTDs, 23.87 %) were the most common anomalies, followed by gastrointestinal anomalies (21.94%), genitourinary anomalies (17.42%), and orofacial clefts (16.77%). A similar predominance of NTDs was reported in India and Nigeria [16,17]. In contrast, some neonatal surgical audits in Karnataka, India noted gastrointestinal anomalies as the leading group (50%) [18]. These differences likely reflect variations in referral patterns, prenatal detection, and case mix. Our relatively lower musculoskeletal anomaly share (11.61%) compared to community-based registries may be because many minor orthopedic defects are treated in non-surgical or outpatient settings. Among CNS defects, spina bifida (32 cases) and hydrocephalus (28) were most frequent. Anorectal malformations (36) dominated the gastrointestinal anomalies, while hypospadias (22) was the most common genitourinary anomaly. Similar distributions have been documented in tertiary surgical audits from Pakistan and India, where anorectal malformation and hypospadias consistently rank among the top congenital surgical problems [1,19,20]. Our relatively small proportion of cardiothoracic anomalies (3.87%) is in line with expectations, as many congenital heart diseases are managed in specialized cardiac centers rather than general pediatric surgery units. Nearly half of the patients underwent elective surgery (47.74%), while 40.00% required emergency procedures, 7.74% staged surgeries, and 4.5 % conservative management. These proportions resemble reports from other tertiary pediatric surgical centers, where gastrointestinal emergencies (e.g. intestinal obstruction, anorectal malformation) necessitate urgent intervention, while conditions like cleft lip/palate and hypospadias are scheduled electively [21]. The high emergency rate underscores the need for improved prenatal detection and early referral to reduce acute presentations. One quarter (25.2 %) of our patients experienced postoperative complications, mainly surgical site infection (9.03%) and wound dehiscence (5.16%). Comparable complication rates have been reported in resource-limited settings [22]. Although three-fourths of patients had no complications, the relatively high infection burden highlights areas for improvement in perioperative care, antibiotic prophylaxis, and infection control practices. Most children (69.03 %) recovered without disability, while 15.48 % recovered with disability, 5.81% required readmission, and mortality was 9.68%. Our mortality rate is comparable to Nigerian data (26 % mortality among neonates

with anomalies) [23]. The disability rate (15.48%) is particularly noteworthy, as long-term morbidity is often underreported in pediatric surgical studies. Conditions like spina bifida, anorectal malformation, and Hirschsprung's disease contribute significantly to residual disability, emphasizing the need for rehabilitation and long-term follow-up [24-26].

Limitations of the study: This study has certain limitations. Being a single-center study from a government tertiary hospital, the findings may not be generalizable to all healthcare settings in Bangladesh. The use of purposive sampling and reliance on hospital records may have introduced selection and reporting bias. Long-term outcomes beyond the study period were not assessed, limiting the ability to capture delayed complications or disabilities. Additionally, lack of prenatal and genetic diagnostic data restricted deeper analysis of etiological factors influencing birth defects.

CONCLUSION

This study demonstrates the considerable burden and wide spectrum of birth defects managed in a government tertiary hospital in Bangladesh, with neural tube defects and gastrointestinal anomalies being the most common. Although most patients (69.03%) recovered without disability, a notable proportion experienced residual disability (15.48%) and mortality (9.68%), reflecting ongoing challenges in pediatric surgical care. Postoperative complications, while relatively limited, point to the need for improved perioperative support and structured rehabilitation. Early diagnosis, timely surgical correction, and long-term follow-up are essential to optimize outcomes. These findings provide valuable evidence to inform healthcare planning, strengthen pediatric surgical services, and improve the management of congenital anomalies in resource-limited settings.

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