

ORIGINAL ARTICLE

Epidemiology and Surgical Outcomes of Pediatric Congenital Anomalies – A Retrospective Tertiary-Care Study

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ABSTRACT

Background: Congenital anomalies are a significant cause of pediatric morbidity and mortality worldwide. In Bangladesh, data on the epidemiology and surgical outcomes of these anomalies remain limited. Understanding their distribution and outcomes is essential for improving pediatric care and guiding preventive strategies. **Aim of the study:** To evaluate the epidemiology, clinical characteristics, and surgical outcomes of pediatric patients with congenital anomalies in a tertiary-care setting. **Methods & Materials:** This retrospective study included 88 pediatric patients (aged 1–18 years) who underwent surgical intervention for congenital anomalies at [hospital name], Bangladesh, over one year. Data on demographics, type of anomaly, surgical details, hospital stay, postoperative complications, and outcomes were extracted from medical records and analyzed descriptively using SPSS version 26.0. **Result:** Of the 88 patients, 60.23% were male, and the majority (43.18%) underwent surgery between 1–5 years. Term births accounted for 78.41%, and spontaneous vertex delivery for 56.82%. Ano-rectal malformations were most common (22.73%), followed by multiple anomalies associated with Patau syndrome (18.18%) and cleft-lip/palate (13.64%). Emergency surgeries comprised 63.64%, while elective procedures accounted for 36.36%. Hospital stay was <7 days in 39.77% of patients. Postoperative complications occurred in 31.82%, with systemic infections being the most frequent (12.5%). Overall survival was 80.68%, with 19.32% postoperative mortality. **Conclusion:** Pediatric congenital anomalies in this tertiary-care cohort predominantly required emergency surgical intervention, with generally favorable survival despite notable postoperative complications. Early diagnosis, prompt surgical management, and structured perioperative care are critical to improving outcomes. These findings inform strategies for optimizing pediatric surgical care and resource allocation in similar settings.

Keywords: Pediatric congenital anomalies, surgical outcomes, emergency surgery, tertiary-care, Bangladesh

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INTRODUCTION

Congenital anomalies, often referred to as birth defects, are structural or functional abnormalities present at birth that can affect any organ or system in the body [1]. Globally, congenital anomalies are a leading cause of neonatal morbidity and mortality, affecting approximately 7.9 million children each year [2]. In Bangladesh, congenital anomalies affect between 2% and 7% of newborns, with male infants experiencing a slightly higher incidence [3]. They range from relatively minor malformations to severe conditions that can significantly compromise a child's health, development, and quality of life. Understanding these conditions is critical, not only for improving neonatal care but also for guiding public health strategies aimed at reducing the burden of disease [1]. The World Health Organization (WHO) defines congenital disorders as any potential pathological condition arising before birth, whether evident at birth or manifesting later in life [4]. The causes of congenital anomalies are multifactorial, often arising from complex interactions between genetic, environmental, and maternal factors. Genetic contributions may include chromosomal abnormalities, single-gene

mutations, or familial inheritance patterns [5]. Environmental influences can encompass maternal infections, exposure to teratogenic drugs or chemicals, and nutritional deficiencies during pregnancy. Additionally, maternal age, consanguineous marriages, multiple gestations, and socioeconomic factors have been identified as significant risk contributors. Recognizing these factors is essential for designing preventive interventions and providing appropriate counseling to expectant families [6]. The impact of congenital anomalies extends far beyond the physical health of affected children. Severe malformations can result in developmental delays, limited mobility, chronic health problems, and frequent hospitalizations. Families, in turn, may face emotional, social, and financial strain while navigating the complex care needs of their children [7]. The psychological burden of caring for a child with a congenital anomaly can be profound, compounded by societal stigma and limited access to support systems. Addressing these challenges requires a holistic approach that integrates medical, psychosocial, and community resources [8]. Surgical intervention remains the mainstay for managing many congenital anomalies, aiming to

correct structural defects, restore function, and improve long-term outcomes [9]. While surgical interventions offer notable benefits, including enhanced survival, improved physical function, and better quality of life, they are not without challenges. Risks such as anesthesia-related complications, infections, postoperative morbidity, and the potential need for repeated procedures are important considerations [10]. Furthermore, in resource-limited settings, access to specialized surgical expertise, equipment, and postoperative care can be constrained, affecting both short- and long-term outcomes [11]. The aim of this study was to analyze the epidemiology, clinical characteristics, and surgical outcomes of pediatric congenital anomalies in a tertiary-care setting to inform better management strategies and improve patient care.

METHODS & MATERIALS

This was a retrospective observational study conducted at the Department of Pediatric Surgery, Bangladesh Shishu Hospital & Institute, Dhaka, Bangladesh. The study spanned 1 year, from July 2024 to June 2025. The study aimed to evaluate the epidemiology and surgical outcomes of pediatric patients with congenital anomalies who underwent surgical intervention. A total of 88 patients met the inclusion criteria and were included in the study.

Inclusion Criteria:

- Pediatric patients aged 1–18 years.
- Diagnosed with one or more congenital anomalies requiring surgical intervention.

Exclusion Criteria:

- Patients who were managed conservatively without surgery.
- Patients referred from other centers after initial surgical intervention.

Ethical Considerations

This study was conducted following the principles outlined in the Declaration of Helsinki. Approval was obtained from the Institutional Ethics Committee. As this was a retrospective review of medical records, informed consent from the participants was waived; however, all patient confidentiality and privacy were strictly maintained. Data were anonymized and coded to prevent identification of individual patients. Access to hospital records was restricted to the investigators only. No interventions were performed, and the study posed no risk to the participants.

Data Collection

Data were collected retrospectively from hospital records, including maternal and perinatal history, neonatal charts, operative notes, and discharge summaries. For each patient, demographic and perinatal characteristics such as age at surgery, gender, gestational age, birth weight, and mode of delivery were recorded. The type of congenital anomaly was categorized based on anatomical location and any associated syndromes. Information regarding surgical interventions, including whether the procedures were performed on an emergency or elective basis, was also documented. Postoperative outcomes were assessed, including the duration of hospital stay, complications such as systemic infection, respiratory complications, surgical wound infection, and

bleeding, as well as the final outcome, categorized as survival or mortality.

Definitions

Emergency surgery: Surgical intervention performed within 24 hours of presentation due to life-threatening conditions.

Elective surgery: Planned surgical intervention scheduled after initial evaluation and optimization.

Complications: Postoperative adverse events documented in patient records.

Outcome: Patient status at discharge, categorized as survival or mortality.

Statistical Analysis

Data were entered into Microsoft Excel and analyzed using SPSS version 26.0. Descriptive statistics were used to summarize baseline characteristics, distribution of congenital anomalies, type of surgery, duration of hospital stay, complications, and outcomes. Categorical variables were presented as frequencies and percentages.

RESULT

A total of 88 pediatric patients with congenital anomalies were included in the study (Table 1). The age at surgery ranged widely, with the majority of patients (43.18%) undergoing surgery between 1 and 5 years of age, followed by 29.55% between 6 and 10 years. Adolescents aged 11–15 years and those above 15 years each constituted 13.64% of the cohort. Gender distribution showed a predominance of males (60.23%) compared to females (39.77%). Regarding gestational age, most children were born at term (37–40 weeks; 78.41%), while preterm births (<37 weeks) accounted for 17.01%, and post-term births (≥40 weeks) were 4.55%. Birth weight data indicated that the majority of patients (84.09%) had a birth weight between 2.5 and 4.0 kg, 13.64% were under 2.5 kg, and 2.27% were over 4.0 kg. Concerning the mode of delivery, more than half were delivered via spontaneous vertex delivery (56.82%), while 43.18% were delivered by caesarean section. The detailed distribution of congenital anomalies was presented in Table 2, highlighting the diversity and relative frequency of conditions managed in our tertiary-care center. Ano-rectal malformations (imperforate anus) were the most common, affecting 22.73% of patients. This was followed by multiple congenital anomalies associated with Patau syndrome (18.18%), left cleft-lip/palate (13.64%), and omphalocele minor (13.64%). Myelomeningocele (ruptured) and occipital cranial bifidum/ruptured each accounted for 9.09%, while occipital encephalocele was observed in 9.09% and myelomeningocele with hydrocephalus/bilateral involvement in 4.55% of patients. Table 3 summarized that regarding surgical management, the majority of procedures were performed on an emergency basis (63.64%), while elective surgeries accounted for 36.36% of cases. The duration of hospital stays varied, with 39.77% of patients discharged within 7 days, 36.36% staying 7–14 days, and 23.86% requiring hospitalization for more than 14 days. Postoperative complications were observed in a subset of patients (figure 1). Systemic infections were the most common, occurring in 12.5% of patients, followed by respiratory complications (9.09%), surgical wound infections (6.82%), and bleeding (3.41%). Figure 2 indicated out of the 88 patients included in the study, the majority, 71 patients (80.68%), survived and were successfully discharged following surgery. In contrast, 17 patients (19.32%) unfortunately succumbed, resulting in postoperative mortality.

Table – I: Baseline characteristics of the study population (n=88)

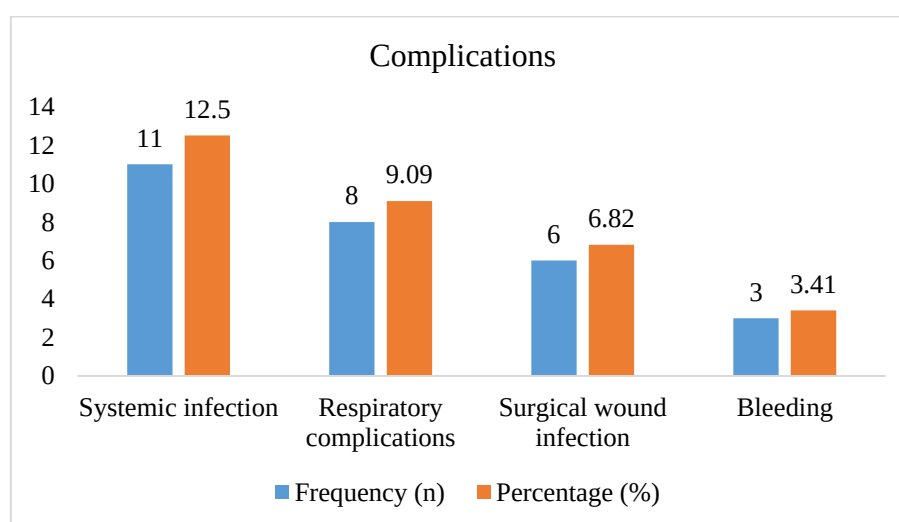
Variables	Frequency (n)	Percentage (%)
Age at surgery (years)		
1-5	38	43.18
6-10	26	29.55
11-15	12	13.64
above 15	12	13.64
Gender		
Male	53	60.23
Female	35	39.77
Gestational age (weeks)		
<37	15	17.05
37–40	69	78.41
≥40	4	4.55
Birth weight (kg)		
<2.5	12	13.64
2.5–4.0	74	84.09
≥4.0	2	2.27
Mode of delivery		
Spontaneous vertex	50	56.82
Caesarean section	38	43.18

Table – II: Distribution of the study population by congenital abnormalities (n=88)

Congenital abnormality observed	Frequency (n)	Percentage (%)
Ano-rectal Malformation (Imperforate Anus)	20	22.73
Left Cleft-lip/Palate	12	13.64
Multiple Congenital Anomaly (Patau Syndrome)	16	18.18
Myelomeningocele (Ruptured)	8	9.09
Myelomeningocele/Hydrocephalus/Bilateral	4	4.55
Occipital Cranial Bifidum/Ruptured	8	9.09
Occipital Encephalocele	8	9.09
Omphalocele minor	12	13.64

Table – III: Surgical interventions and hospital stay of the study patients (n=88)

Variable	Frequency (n)	Percentage (%)
Type of surgery		
Emergency	56	63.64
Elective	32	36.36
Duration of hospital stay (days)		
<7	35	39.77
7–14	32	36.36
>14	21	23.86


Figure – 1: Postoperative complications among patients (n=88)

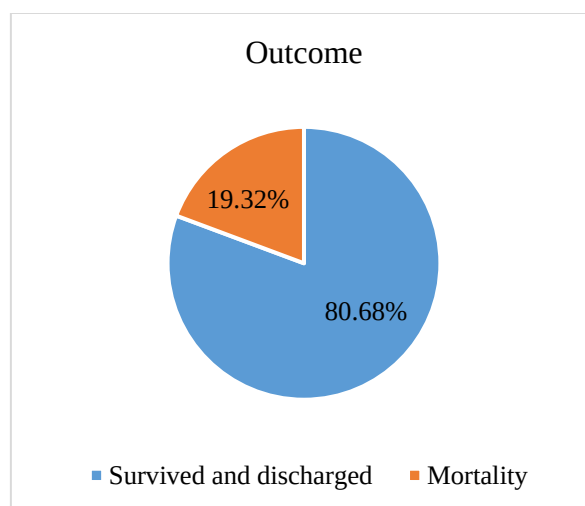


Figure - 2: Surgical outcomes among patients (n=88)

DISCUSSION

Congenital anomalies, broadly classified into structural and functional types, encompass a wide range of developmental disorders with substantial clinical and surgical implications in the pediatric population [4]. In the present study, nearly half of the children (43.18%) were aged 1–5 years, followed by 29.55% in the 6–10-year group, while adolescents and older children each accounted for 13.64%. This pattern indicates that most congenital anomalies requiring surgical intervention tend to manifest during early childhood rather than in the neonatal period. Supporting this, Garne et al. reported that 38% of children underwent surgery within their first year of life, with regional variations, and an additional 14% between the ages of 1–4 years across Europe [12]. A male predominance was evident in our study (60.23%), consistent with the findings of Magwesela et al. from northern Tanzania, where males constituted 64% of congenital anomaly cases requiring surgical management [1]. Most of our patients (78.41%) were born at term (37–40 weeks), and 84.09% had normal birth weights (2.5–4.0 kg). Curzon et al. previously demonstrated that infants weighing less than 2.5 kg had significantly higher mortality rates following complex procedures such as the Norwood procedure, arterial switch, systemic-to-pulmonary artery shunt, coarctation repair, and total anomalous pulmonary venous connection repair, compared to those weighing 2.5–4.0 kg. Even after stratification by Aristotle Basic Complexity (levels 2–4) and Risk Adjustment for Congenital Heart Surgery-1 (levels 2–6), low birth weight remained strongly associated with increased mortality risk [13]. Regarding the mode of delivery, 56.82% of the children were delivered via spontaneous vertex delivery, while 43.18% were born by caesarean section. Khasawneh et al. reported a comparable caesarean delivery rate of 50.5% over an 18-month period [14]. Among the anomalies observed, anorectal malformations (ARM) were the most frequent (22.73%), followed by multiple anomalies/Patau syndrome (18.18%), cleft lip/palate (13.64%), and neural tube defects such as myelomeningocele (9.09%) and occipital encephalocele (9.09%). This distribution mirrors findings from both regional and international studies. For example, Xie et al. found that anorectal malformation had the highest birth prevalence among these anomalies, with 3.11 cases (95% CI: 2.77–3.50) per 10,000 births [15]. Similarly, Chowdhury et al. identified congenital inguinal hernia (17.50%) as the most common defect, followed by hypospadias (14.54%) and ARM (13.98%), while Akter et al. reported that orofacial clefts

accounted for approximately 13% of all birth defects [16,17]. Most operations in our study were performed on an emergency basis (63.64%), with elective procedures constituting 36.36%. Landrum et al., in a multicountry study of 3,767 children with gastrointestinal congenital anomalies across 74 nations, demonstrated that delayed presentation defined as occurring more than 24 hours after birth was significantly associated with higher 30-day all-cause mortality and increased postoperative complications [18]. Postoperative hospital stays varied: 39.77% of patients were discharged within 7 days, 36.36% stayed between 7–14 days, and 23.86% remained for more than 14 days. Urhoj et al. similarly found that 24% (95% CI: 20–29%) of EUROCAT children experienced extended hospitalizations lasting ≥ 10 days during their first year of life [19]. Systemic infections (12.5%) were the most common postoperative complication, followed by respiratory complications (9.09%), surgical wound infections (6.82%), and bleeding (3.41%). These findings are closely aligned with those reported by Al Faifi et al. in a Saudi Arabian pediatric surgical study, where systemic infections were observed in 30 patients (12%), respiratory complications in 23 (9%), surgical wound infections in 18 (7%), and bleeding in 8 (3%) [20]. The overall survival rate in our study was 80.68%, while mortality accounted for 19.32%. Although this reflects an improvement compared with some earlier reports from low- and middle-income countries (LMICs), it still highlights a substantial mortality burden. Hossain et al. reported postoperative complications in 16.8% of cases [21], and Hanif et al. observed a mortality rate of 14.09% [22], findings broadly consistent with our results.

Limitations of the study: This study was limited by its retrospective design, which relied on the accuracy and completeness of medical records, potentially introducing information bias. The single-center setting may restrict the generalizability of the findings to other regions or healthcare systems. Additionally, the relatively small sample size constrained the ability to perform detailed subgroup analyses. Long-term follow-up data on functional outcomes, quality of life, and growth were not available. Finally, potential confounding factors, including socioeconomic status and prenatal care variations, could not be fully controlled.

CONCLUSION

This retrospective study provides a comprehensive overview of the epidemiology and surgical outcomes of pediatric congenital anomalies in a tertiary-care setting. Ano-rectal malformations were the most frequent anomalies, followed by multiple congenital anomalies associated with Patau syndrome and cleft-lip/palate. A majority of surgeries were performed on an emergency basis, reflecting the urgent nature of many congenital conditions. Postoperative complications, particularly systemic infections and respiratory issues, were observed in a minority of patients, while overall survival was 80.68%. These findings emphasize the importance of timely surgical intervention, multidisciplinary perioperative care, and structured postoperative monitoring to optimize outcomes. Further research is warranted to develop preventive strategies and enhance surgical and long-term management of congenital anomalies in resource-limited settings.

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Ethical approval: The study was approved by the Institutional Ethics Committee.

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