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Hospitalization Patterns and Surgical Outcomes of Children with Congenital Abdominal Wall Defects: A Population-Based Study

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ABSTRACT

Background: *Congenital abdominal wall defects (AWDs) remain a major cause of neonatal morbidity and mortality, with outcomes varying between gastroschisis and omphalocele. Understanding hospitalization patterns and surgical results is essential for improving care.*

Aim of the study: *To evaluate clinical characteristics, hospitalization trends, surgical outcomes, and predictors of mortality among neonates with AWDs in a tertiary care setting.*

Methods: *A retrospective population-based study was conducted on 160 neonates (96 gastroschisis, 64 omphalocele). Demographic, perioperative, and postoperative variables were analyzed using SPSS version 26. Statistical tests included Chi-square, t-test, Mann–Whitney U, and multivariable logistic regression, with significance set at $p<0.05$.*

Result: *Omphalocele was associated with higher rates of preterm birth ($p=0.02$), low birth weight ($p=0.04$), major anomalies ($p<0.001$), longer TPN use ($p<0.001$), and increased postoperative complications including sepsis ($p=0.01$) and respiratory issues ($p=0.01$). Mortality was higher in omphalocele ($p=0.018$). Independent predictors of mortality included birth weight <2500 g (OR 3.6, $p=0.002$), prematurity (OR 4.5, $p<0.001$), associated anomalies (OR 6.2, $p<0.001$), sepsis (OR 7.8, $p<0.001$), and mechanical ventilation (OR 4.3, $p=0.001$).*

Conclusion: *Omphalocele carries greater clinical complexity, longer hospitalization, and higher mortality than gastroschisis. Early identification of high-risk factors and optimized perioperative support may improve survival outcomes in AWDs.*

Keywords: *Abdominal wall defects, gastroschisis, omphalocele, neonatal surgery, hospitalization patterns, predictors of mortality*

I. INTRODUCTION

Congenital abdominal wall defects (AWDs) are significant birth anomalies that present unique challenges in pediatric healthcare [1]. Gastroschisis is estimated to occur in approximately 1 in 2,400 live births in the United States [2]. In Bangladesh, abdominal wall defects such as omphalocele accounted for about 3.70% of surgically treated congenital anomalies [3]. These defects, mainly omphalocele and gastroschisis, cause abdominal organs to protrude through the abdominal wall, with omphalocele herniating into a sac at the umbilicus and gastroschisis extruding intestines beside the umbilicus without a sac. [1]. Omphalocele results from incomplete abdominal wall development during fetal growth. Normally, the intestines herniate into the umbilical cord between the sixth and tenth weeks and then return to the abdomen. Failure to retract leads to a midline herniation covered by a thin membrane, often associated with other anomalies, including chromosomal defects [4]. Gastroschisis is characterized by a defect in the abdominal wall, usually to the right of the umbilicus, through which abdominal organs, primarily the intestines, protrude. Unlike omphalocele, the exposed organs are not covered by a protective sac, making them susceptible to damage from exposure to amniotic fluid. The exact cause of gastroschisis is unknown, but factors such as young maternal age, substance use during pregnancy, and infections have been identified as potential risk factors [5]. Children with AWDs often face immediate and long-term health challenges. These can include respiratory distress, feeding difficulties, and the need for prolonged hospitalization. Additionally, associated anomalies such as cardiac defects, chromosomal abnormalities, and central nervous system malformations are common, particularly in omphalocele cases. The severity of these conditions can impact the child's developmental milestones and quality of life [6]. Hospitalization for children with AWDs is typically prolonged, often due to the need for surgical interventions, nutritional support, and management of complications. Studies indicate that children with major birth defects are 2.5 times more likely to require hospital care than those without congenital defects. The length of stay can vary based on the severity of the defect, presence of

associated anomalies, and the presence of complications such as infections or organ dysfunction [7]. Surgical intervention is the primary treatment for AWDs, aiming to reposition the exposed organs and close the abdominal wall defect. Advancements in surgical techniques have improved survival rates; however, challenges remain [8]. The advantages of surgical intervention include the potential for survival and improved quality of life. Early and appropriate surgical repair can lead to favorable outcomes. However, disadvantages include the risk of complications, need for intensive postoperative care, and the possibility of long-term health issues [9,10]. The aim of this study was to examine the hospitalization patterns and surgical outcomes of children with congenital abdominal wall defects, providing population-based insights to improve clinical management and long-term care.

II. METHODOLOGY & MATERIALS

This was a retrospective, population-based 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 included 160 neonates and infants diagnosed with congenital abdominal wall defects, comprising 96 patients with gastroschisis and 64 patients with omphalocele.

Inclusion and Exclusion Criteria

Inclusion Criteria

- Neonates and infants admitted with a primary diagnosis of gastroschisis or omphalocele during the study period.
- Patients with complete medical records including demographic, clinical, and surgical data.

Exclusion Criteria

- Patients with incomplete or missing medical records.
- Neonates referred after initial surgical intervention at another center.
- Infants with major congenital anomalies unrelated to abdominal wall defects.

Data Collection

Demographic, perinatal, and clinical data were extracted from electronic medical records and included gestational age, birth weight, Apgar scores at 5 minutes, gender, maternal age, mode of delivery, associated major anomalies, and type of defect. Hospitalization data collected comprised preoperative stay, neonatal intensive care unit (NICU) admission, requirement for mechanical ventilation, duration of total parenteral nutrition (TPN), time to first and full enteral feeding, and surgical management details (primary versus staged closure).

Surgical Management and Postoperative Care

All patients underwent standardized perioperative care following institutional protocols. Primary closure was attempted whenever feasible, while staged closure with silo placement was performed in patients with large defects or compromised abdominal domain. Postoperative monitoring included assessment for complications such as sepsis, necrotizing enterocolitis (NEC), respiratory complications, and surgical site infections. The duration of postoperative stay and total hospital stay were recorded.

Outcome Measures

The primary outcome was in-hospital mortality. Secondary outcomes included time to first feed, time to full enteral feeding, duration of TPN, length of preoperative and postoperative stay, need for mechanical ventilation, and incidence of postoperative complications. Survivors and non-survivors were compared to identify factors associated with mortality.

Statistical Analysis

Data were analyzed using statistical software, SPSS version 26. Continuous variables were expressed as mean ± standard deviation (SD) or median with interquartile range (IQR), depending on data distribution, and compared using the Student's t-test or Mann–Whitney U test. Categorical variables were summarized as frequencies and percentages and analyzed using the Chi-square test or Fisher's exact test. Multivariable logistic regression was performed to identify independent predictors of in-hospital mortality, with adjusted odds ratios (OR) and 95% confidence intervals (CI) reported. A p-value <0.05 was considered statistically significant.

Ethical Considerations

The study was approved by the Institutional Review Board, waived informed consent due to its retrospective design, adhered to the Declaration of Helsinki, and ensured strict patient confidentiality with anonymized data.

III. RESULT

Among 160 neonates, gastroschisis (n=96) predominated in term infants 66.67% with birth weight ≥2500 g (58.33%) and age at admission 1–10 days 54.17% (Table 1). Omphalocele (n=64) had higher preterm rates 43.75%, p=0.02, birth weight

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<1500 g (10/64, 15.63%, p=0.04), Apgar <7 at 5 min 25.00%, p=0.05, major anomalies 31.25%, p<0.001, and cesarean delivery (40/64, 62.50%, p<0.001). Mean birth weight was 2600.45 ± 540.22 g vs 2480.33 ± 600.15 g (p=0.05), and maternal age was similar 25.78 ± 5.12 vs 26.51 ± 5.46 years, p=0.41. Gender distribution was comparable (p=0.63). Table 2 shows that NICU admission rates were comparable between gastroschisis 89.58% and omphalocele 87.50%, p=0.67, whereas mechanical ventilation was higher in omphalocele 40.63% vs 22.92%, p=0.02. Omphalocele cases had longer median time to first feed (7 vs 4 days), full enteral feeding (18 vs 11 days), and TPN duration (15 vs 9 days), as well as longer preoperative stay (5.41 ± 2.48 vs 3.02 ± 1.62 days, all p<0.001). Primary closure was more frequent in gastroschisis 79.17%, while silo/staged management predominated in omphalocele 56.25%, p<0.001. Table 3 illustrates that postoperative outcomes indicated that sepsis occurred in 28.13% of omphalocele compared to 11.46% in gastroschisis (p=0.01), and respiratory complications were 25.00% versus 9.38% (p=0.01). Surgical site infection was 15.63% versus 7.29% (p=0.1), NEC 10.94% versus 5.21% (p=0.19), and reoperation 14.06% versus 5.21% (p=0.09). Postoperative stay was longer in omphalocele, mean 21.18 ± 7.52 days versus 13.02 ± 5.49 days, and total hospital stay median 29 days versus 17 days (both p<0.001). Among the population survivors were more often gastroschisis (64.62% vs 40.00%, p=0.018) and non-survivors more often omphalocele (60.00% vs 35.38%, p=0.018) (Table 4). Survivors had higher mean birth weight (2380 ± 510 g vs 1890 ± 460 g, p<0.001) and fewer preterm births (43.08% vs 70.00%, p=0.006) or major anomalies (16.92% vs 56.67%, p<0.001). Sepsis, mechanical ventilation, and failure of primary closure were more frequent in non-survivors (all p<0.001), while hospital stay was longer in survivors (median 18 vs 7 days, p<0.001). Table 5 demonstrates that key predictors of mortality were birth weight <2500 g (OR 3.6, 95% CI 1.62–8.04, p=0.002), preterm birth (OR 4.5, 95% CI 2.02–10.1, p<0.001), associated anomalies (OR 6.2, 95% CI 2.51–15.3, p<0.001), sepsis (OR 7.8, 95% CI 3.18–19.0, p<0.001), mechanical ventilation (OR 4.3, 95% CI 1.82–10.2, p=0.001), and omphalocele (OR 4.0, 95% CI 1.57–10.2, p=0.004). Staged closure was not significant (OR 2.4, 95% CI 1.00–5.58, p=0.06).

Table 1: Baseline demographic and clinical characteristics of the study population (N=160)

Parameter	Gastroschisis (n = 96), n (%)	Omphalocele (n = 64), n (%)	Total (N = 160), N (%)	p-value
Age at admission (days)				
1–10	52 (54.17)	30 (46.88)	82 (51.25)	0.29
11–20	28 (29.17)	18 (28.13)	46 (28.75)	
21–30	16 (16.67)	16 (25.00)	32 (20.00)	
Gender				
Male	50 (52.08)	34 (53.13)	84 (52.50)	0.63
Female	46 (47.92)	30 (46.88)	76 (47.50)	
Birth weight (g)				
<1500 g	10 (10.42)	10 (15.63)	20 (12.50)	0.04*
1500–2499 g	30 (31.25)	22 (34.38)	52 (32.50)	
≥2500 g	56 (58.33)	32 (50.00)	88 (55.00)	
Mean ± SD	2600.45 ± 540.22	2480.33 ± 600.15	2550.18 ± 569.70	0.05*
Gestational age				
Preterm (<37 wk)	32 (33.33)	28 (43.75)	60 (37.50)	0.02*
Term (≥37 wk)	64 (66.67)	36 (56.25)	100 (62.50)	
Apgar <7 at 5 min	12 (12.50)	16 (25.00)	28 (17.50)	0.05*
Associated major anomalies	8 (8.33)	20 (31.25)	28 (17.50)	<0.001*
Cesarean section	26 (27.08)	40 (62.50)	66 (41.25)	<0.001*
Maternal age (years)				
Mean ± SD	25.78 ± 5.12	26.51 ± 5.46	26.08 ± 5.29	0.41

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Table 2: Hospitalization patterns and perioperative parameters among the study population

Variable	Gastroschisis (n = 96), n (%)	Omphalocele (n = 64), n (%)	p-value
NICU admission	86 (89.58)	56 (87.50)	0.67
Mechanical ventilation	22 (22.92)	26 (40.63)	0.02*
Time to first feed (days), median (IQR)	4.00 (3.00–6.00)	7.00 (5.00–10.00)	<0.001*
Time to full enteral feeding (days), median (IQR)	11.00 (8.00–15.00)	18.00 (14.00–24.00)	<0.001*
Duration of TPN (days), median (IQR)	9.00 (6.00–12.00)	15.00 (11.00–21.00)	<0.001*
Preoperative stay (days), mean ± SD	3.02 ± 1.62	5.41 ± 2.48	<0.001*
Primary closure achieved	76 (79.17)	28 (43.75)	<0.001*
Silo/staged management	20 (20.83)	36 (56.25)	<0.001*

Table 3: Surgical outcomes and postoperative complications following repair of abdominal wall defects

Outcome	Gastroschisis (n = 96), n (%)	Omphalocele (n = 64), n (%)	p-value
Surgical site infection	7 (7.29)	10 (15.63)	0.1
Sepsis	11 (11.46)	18 (28.13)	0.01*
Respiratory complications	9 (9.38)	16 (25.00)	0.01*
NEC	5 (5.21)	7 (10.94)	0.19
Reoperation	5 (5.21)	9 (14.06)	0.09
Postoperative stay (days)			
Mean ± SD	13.02 ± 5.49	21.18 ± 7.52	<0.001*
Total hospital stay (days)			
Median (IQR)	17.00 (13.00–22.00)	29.00 (23.00–36.00)	<0.001*

Table 4: Comparison of survivors and non-survivors and factors associated with mortality

Variable	Survivors (n = 130),n (%)	Non-survivors (n = 30), n (%)	p-value
Diagnosis — Gastroschisis	84 (64.62)	12 (40.00)	0.018*
Diagnosis — Omphalocele	46 (35.38)	18 (60.00)	0.018*
Birth weight (g), mean ± SD	2380 ± 510	1890 ± 460	<0.001
Preterm (<37 wk)	56 (43.08)	21 (70.00)	0.006
Associated major anomalies	22 (16.92)	17 (56.67)	<0.001
Sepsis	18 (13.85)	20 (66.67)	<0.001
Mechanical ventilation required	40 (30.77)	22 (73.33)	<0.001
Primary closure achieved	92 (70.77)	8 (26.67)	<0.001
Total hospital stay, median (IQR)	18 (12–27)	7 (4–11)	<0.001

Table 5: Multivariable logistic regression analysis identifying independent predictors of in-hospital mortality

Independent variable	Adjusted OR	95% CI	p-value
Birth weight <2500 g	3.61	1.62–8.04	0.002*
Preterm birth	4.52	2.02–10.10	<0.001*
Associated anomalies	6.21	2.51–15.32	<0.001*
Sepsis	7.78	3.18–18.98	<0.001*
Mechanical ventilation	4.31	1.82–10.21	0.001*
Staged closure	2.39	1.00–5.58	0.06
Omphalocele diagnosis	4	1.57–10.18	0.004*

IV. DISCUSSION

Congenital abdominal wall defects, including omphalocele and gastroschisis, represent a spectrum of structural anomalies where the abdominal contents herniate through an incomplete abdominal wall [11]. Gastroschisis mainly affected term, normal-weight infants (66.7% and 58.3%), while omphalocele was linked to prematurity (43.8%,

p = 0.02), low birth weight (15.6%, p = 0.04), 5-min Apgar <7 (25.0%, p = 0.05), major anomalies (31.3%, p < 0.001), and cesarean delivery (62.5%, p < 0.001); maternal age and sex were similar. Stoll et al. reported that 55.2% of cases were omphalocele and 44.8% gastroschisis, with prevalence rates of 2.18 and 1.76 per 10,000, respectively. Associated malformations were observed in 74.1% of omphalocele versus 53.2% of gastroschisis; 29.3% of omphalocele cases had abnormal karyotypes and 44.8% had syndromes or recognizable malformation patterns, while 51.0% of gastroschisis cases presented additional anomalies [12]. Another review by Henrich et al. reported that up to 81% of omphalocele infants had additional abnormalities, whereas only 28% of gastroschisis cases exhibited associated defects, predominantly affecting the gastrointestinal system [13]. Corey et al. reported that infants with omphalocele had higher median birth weight than those with gastroschisis (2824 g vs 2370 g, p < 0.001) and were less frequently premature (<37 weeks: 40% vs 65%, p < 0.001) [14]. Infants with omphalocele were born with normal birth size but exhibited reduced height and weight compared with peers through adolescence [15]. Hsu et al. stated that infants with gastroschisis more often experienced intrauterine growth restriction and lower birth weight compared with those with omphalocele [16]. NICU admission was similar for gastroschisis (89.6%) and omphalocele (87.5%), but omphalocele required more mechanical ventilation (40.6% vs 22.9%, p = 0.02) and had longer time to feeds, TPN, and preoperative stay (all p < 0.001). Primary closure was more frequent in gastroschisis (79.2%) versus staged/silo repair in omphalocele (56.3%, p < 0.001). Kosalakorn et al. stated that omphalocele more often required staged repairs, which were associated with longer hospital stays and increased risk of complications [17]. Marques et al. reported survival rates of 92.3% for gastroschisis and 84% for omphalocele, though gastroschisis cases had significantly longer hospital stays and parenteral nutrition, reflecting the influence of case complexity and local care practices [18]. Jyoti et al. reported that implementing a feeding protocol in neonates with gastroschisis significantly reduced time to first enteral (p < 0.0001) and suck feeds (p = 0.002), shortened NICU stay by a median of 11 days, and decreased TPN duration [19]. Low gestational age, staged closure, intestinal atresia, and sepsis independently predicted prolonged hospital stay and extended TPN duration [20]. Omphalocele showed higher postoperative morbidity than gastroschisis: sepsis 28.1% vs 11.5% and respiratory complications 25.0% vs 9.4% (both p = 0.01), with longer postoperative (21.2 ± 7.5 vs 13.0 ± 5.5 days) and total hospital stay (median 29 vs 17 days, p < 0.001). Puri et al. reported that infants undergoing primary closure had superior outcomes, including shorter hospital stays and lower sepsis risk, compared with those requiring staged or silo closure [21]. Conversely, Madazli et al. observed prolonged TPN and hospital stay in gastroschisis compared with omphalocele, especially when bowel compromise was present, underscoring the impact of intestinal versus structural/multisystem pathology on morbidity [22]. Gastroschisis survival (64.6%) exceeded omphalocele (35.4%, p = 0.018), with independent mortality predictors including birth weight <2500 g (OR 3.61), prematurity (OR 4.52), anomalies (OR 6.21), sepsis (OR 7.78), mechanical ventilation (OR 4.31), omphalocele (OR 4.00), and staged closure trending higher (OR 2.39, p = 0.06). Kong et al. reported higher mortality in omphalocele than gastroschisis (OR 2.77), with prematurity, congenital anomalies, and systemic infections identified as major contributors [23]. Tunell et al. noted that isolated omphalocele carries a favorable prognosis: among 94 patients followed for 10–20 years, 83 survived initial treatment, and 80% of survivors reported good long-term quality of life, with most reoperations related to hernia or bowel complications [24]. Henrich et al. reported that primary closure was achievable in 78% of gastroschisis and 58% of omphalocele cases, with long-term physical and intellectual outcomes generally satisfactory [7].

Limitations of the study: This study is limited by its retrospective design, which restricts control over data completeness and introduces potential information bias. Being a single-center analysis, the findings may not fully represent national variability in clinical practice or resource availability. Factors such as prenatal diagnosis, maternal health behaviors, and long-term neurodevelopmental outcomes were not assessed. Additionally, variations in postoperative care over time may have influenced outcomes. These constraints should be considered when interpreting the results.

V. CONCLUSION

This population-based analysis highlights substantial differences in clinical profiles, hospitalization patterns, and surgical outcomes between gastroschisis and omphalocele. Infants with omphalocele experienced higher morbidity, longer nutritional and ventilatory support needs, and greater postoperative complications, contributing to increased mortality. Low birth weight, prematurity, associated anomalies, sepsis, mechanical ventilation, and an omphalocele diagnosis emerged as strong

independent predictors of death. These findings underscore the need for early risk stratification, optimized perioperative care, and improved neonatal support systems to enhance survival. Strengthening multidisciplinary management and prenatal detection may further improve outcomes for children born with abdominal wall defects.

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