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PEDIATRICS SURGICAL CASES AND THEIR OUTCOMES IN TERTIARY CARE HOSPITAL

Original Research

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ABSTRACT

Background: Neonatal surgical conditions are a major contributor to infant morbidity and mortality, particularly in resource-constrained settings. The delicate physiology of neonates, coupled with prematurity and low birth weight, increases the complexity of surgical management. Timely identification, appropriate referral, and availability of specialized care are crucial to improving outcomes. Despite technological advancements, neonatal surgical mortality remains high in many developing countries due to systemic limitations and variability in clinical practices.

Objective: To evaluate the clinical spectrum, outcomes, and determinants of survival in neonatal surgical cases managed at a tertiary care hospital.

Methods: This analytical cross-sectional study was conducted at Combined Military Hospital (CMH) Rawalpindi from August 1, 2023, to January 31, 2025. A total of 444 neonates with surgical conditions managed by the pediatric surgery department were enrolled using convenience sampling. Neonates undergoing non-operative procedures or managed by other surgical specialties were excluded. Data were collected on age, gender, gestational age, birth weight, diagnosis, surgical intervention, and outcomes. SPSS version 21 was used for statistical analysis. Associations between clinical variables and outcomes were analyzed using Chi-square tests, with significance set at $p < 0.05$.

Results: Of 444 neonates, 263 (59.2%) were discharged, 167 (37.6%) expired, and 14 (3.2%) were transferred. Digestive system anomalies were most common (109 cases, 24.5%), followed by cardiovascular defects (102, 23.0%) and neurosurgical conditions (86, 19.4%). Preterm neonates (127, 28.6%) and low birth weight infants had significantly higher mortality ($p = 0.001$ *and* $p = 0.000$, respectively). Referred patients (outdoor) had better survival rates ($p = 0.009$), while gender and delivery mode showed no significant impact on outcomes ($p > 0.05$).

Conclusion: The study underscores the high burden and mortality of neonatal surgical cases, particularly among preterm and low birth weight neonates. Strengthening early diagnosis, timely surgical intervention, and expanding specialized neonatal surgical care are critical to improving outcomes in such high-risk populations.

Keywords: Digestive System Abnormalities, Low Birth Weight, Mortality, Neonatal Surgery, Premature Birth, Referral and Consultation, Surgical Outcomes.

INTRODUCTION

Pediatric surgery represents a highly specialized and demanding field within surgical medicine, particularly when it comes to managing neonatal cases. Globally, nearly half of all surgical cases involve pediatric patients, underscoring the substantial burden this population places on surgical care systems (1). The challenges become even more pronounced in neonates, who are still physiologically adapting to life outside the womb. These newborns often present with fragile homeostasis that can be easily disrupted by the stress of disease, surgical intervention, and anesthesia. This clinical vulnerability is even more evident in premature and extremely low birth weight infants, where the risks associated with surgery are compounded by their underdeveloped organ systems and limited physiological reserves. In resource-limited settings, where pediatric surgery is still an evolving specialty, the management of neonatal surgical cases becomes even more complex (2,3). The limited availability of advanced prenatal diagnostics, specialized surgical expertise, pediatric anesthetic care, and neonatal intensive care services directly influences surgical outcomes (4). Nevertheless, advancements in prenatal anomaly scanning, refinement in surgical techniques, improved anesthesia protocols, and better postoperative care have collectively contributed to a notable increase in survival rates for neonatal and pediatric surgical patients in recent years (5).

The spectrum of neonatal surgical indications is broad, ranging from congenital anomalies to acquired pathologies. Among the most frequently encountered congenital malformations are congenital heart disease, cleft lip and palate, diaphragmatic hernia, anorectal malformations, meningomyelocele, duodenal and jejunal atresias, and congenital brain anomalies (6,7). Acquired conditions such as necrotizing enterocolitis, septic ileus, pneumothorax, intestinal obstruction or perforation, and trauma-related neonatal fractures further complicate the clinical landscape. The presence of such pathologies not only necessitates timely surgical intervention but also significantly elevates the risk of morbidity and mortality in this vulnerable population. Outcomes for neonatal surgeries are notably more favorable in high-resource settings, largely due to better antenatal screening, perioperative care, and infrastructure (8,9). However, various factors still influence surgical prognosis regardless of the setting. These include the neonate's age and weight at the time of surgery, gestational maturity, the nature and complexity of the disease, the type of surgical procedure performed, the choice of anesthesia, and the length of hospital stay (10,11). Common surgical interventions span a wide range, including procedures such as trans-anal pull-through, anoplasty, anal dilatation, fistula ligation, hydrostatic reduction, laparotomy, chest tube insertion, excision and drainage, and anatomical repairs (12).

Despite the significant burden posed by neonatal surgical conditions, particularly in tertiary care hospitals of developing countries, there remains a considerable gap in comprehensive documentation and reporting. The scarcity of systematically collected data hinders efforts to assess the full spectrum of pediatric surgical presentations and evaluate outcomes accurately (13). Addressing this gap is crucial not only for improving clinical outcomes but also for guiding policy development and resource allocation. The objective of this study is to evaluate the spectrum of pediatric and neonatal surgical cases and their outcomes—categorized as cured, improved, worsened, withdrawn from support, worsening, or expired—within a tertiary care hospital, thereby contributing valuable data to a currently underreported domain.

METHODS

This analytical cross-sectional study was conducted at Combined Military Hospital (CMH), Rawalpindi, over an 18-month period from August 1, 2023, to January 31, 2025. The study was carried out across the neonatal intensive care unit (NICU), pediatric ward, and surgical ward. CMH Rawalpindi is a tertiary care center that manages a high volume of neonatal and pediatric patients with both medical and surgical conditions, and it also functions as a referral center for complex neonatal surgical cases from across Pakistan. All neonates who underwent surgical intervention and were managed exclusively by the Pediatric Surgery Department within the first 28 days of life were included in the study. Surgical cases that were identified at presentation or during the course of medical treatment were eligible. The sampling strategy employed was non-probability convenient sampling, with continuous enrollment of every eligible surgical neonate during the study period. A total of 444 neonates were enrolled. Exclusion criteria included neonates who underwent only diagnostic or non-operative procedures, such as lumbar puncture, laryngoscopy, aspiration cystostomy, central or peripheral intravenous

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line placement, exchange transfusion, or circumcision (2,3). Additionally, cases managed by other surgical subspecialties, such as neurosurgery or urology outside the scope of pediatric surgery, were not included.

Detailed demographic and clinical information were collected from inpatient medical records, operative notes, admission and discharge summaries, and NICU documentation. Data variables included age at presentation, sex, gestational age (term or preterm), birth weight, weight at time of surgery, mode of delivery (SVD, LSCS), diagnosis, time elapsed between presentation and surgery, duration of hospital stay, and the final outcome. The outcomes were categorized as discharged (improved), expired, or transferred. The conditions included a wide range of congenital and acquired surgical pathologies, including but not limited to congenital heart disease, abdominal wall defects, cleft lip and palate, tracheoesophageal fistula, anorectal malformations, intestinal obstruction, thoracic anomalies, and urogenital and hepatobiliary conditions (14,15). Each case was evaluated postoperatively for clinical outcome and potential complications. Data collection was carried out using a predesigned structured proforma. All data were entered and statistically analyzed using IBM SPSS version 21. Descriptive statistics were used to describe the frequencies and percentages of categorical variables. Crosstabs and Chi-square tests were used to determine associations between variables such as gender, gestational age, birth weight, delivery mode, and patient outcome, with a p-value of less than 0.05 considered statistically significant. Ethical approval was obtained from the Institutional Review Board and Research Ethics Committee of CMH Rawalpindi, and written informed consent was taken from the parents or guardians of all participants. All procedures were conducted in accordance with the principles of the Declaration of Helsinki. The confidentiality and anonymity of participants were strictly maintained throughout the study.

RESULTS

A total of 444 neonates with surgical conditions were included in the study. Among these, 263 (59.2%) were discharged after successful recovery, 167 (37.6%) expired during the course of treatment, and 14 (3.2%) were transferred to other facilities. The most common surgical diagnoses belonged to the digestive system, observed in 109 neonates (24.5%), followed closely by cardiovascular system (CVS) anomalies in 102 cases (23.0%) and neurosurgical conditions in 86 neonates (19.4%). Thoracic and respiratory system-related pathologies were documented in 32 (7.2%) and 31 (7.0%) neonates, respectively. Orofacial anomalies were present in 14 cases (3.2%), while urogenital malformations accounted for 18 cases (4.1%). Less frequently reported conditions included abdominal wall defects (5.9%), hepatobiliary anomalies (1.1%), and miscellaneous conditions grouped under 'Other' (4.3%). Regarding birth characteristics, 304 neonates (68.5%) were delivered via lower segment cesarean section (LSCS), 139 (31.3%) by spontaneous vaginal delivery (SVD), and one case (0.2%) via intrauterine cesarean section (ISCS). Among all neonates, 317 (71.4%) were born at term, while 127 (28.6%) were preterm. Of the total, 273 neonates (61.5%) were male, 169 (38.1%) were female, and 2 (0.5%) had unspecified or ambiguous gender. Concerning birth weight, the majority (306 cases) had normal weight, followed by 131 with low birth weight, 2 with very low birth weight, and 1 with extremely low birth weight.

Crosstab analysis revealed a statistically significant association between place of admission (indoor vs. outdoor) and outcome ($p = 0.009$), as well as between gestational term (term vs. preterm) and outcome ($p = 0.001$). Additionally, birth weight was significantly associated with clinical outcomes ($p < 0.001$), with higher mortality in low and very low birth weight categories. No statistically significant association was observed between outcome and mode of delivery ($p = 0.415$) or gender ($p = 0.470$). The analysis of surgical outcomes across specific diagnostic categories revealed marked differences in mortality rates among neonates. Cardiovascular system (CVS) anomalies exhibited the highest case load with 102 patients, of whom 45 (44.1%) expired. Digestive system pathologies, the most prevalent category with 109 cases, showed a mortality rate of 31.2% with 34 deaths. Neurosurgical conditions accounted for 86 patients, of whom 37 (43.0%) expired, indicating a similarly high mortality burden. Abdominal wall defects presented in 26 neonates, resulting in 5 deaths (19.2%), while hepatobiliary anomalies, though less frequent, showed a 20.0% mortality rate. Other categories, including thoracic, respiratory, urogenital, orofacial, and miscellaneous anomalies, varied in outcomes, reflecting the complexity and heterogeneity of neonatal surgical conditions. These subgroup-specific outcomes underscore the importance of tailored surgical care, early diagnosis, and resource-intensive postoperative management to improve survival in high-risk diagnostic categories.

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Table 1: Combined Frequency Distribution of Neonatal Surgical Diagnoses and Outcomes

Diagnosis / Outcome	Frequency	Percent	Valid Percent	Cumulative Percent
Outcome				
Discharged	263	59.2	59.2	59.2
Expired	167	37.6	37.6	96.8
Transferred	14	3.2	3.2	100.0
Total	444	100.0	100.0	
Diagnosis				
Neurosurgery	1	0.2	0.2	0.2
Abdominal Wall Defect	1	0.2	0.2	0.5
Abdominal Wall Defect (total)	26	5.9	5.9	6.3
CVS	102	23.0	23.0	29.3
Digestive System	109	24.5	24.5	53.8
Hepatobiliary	5	1.1	1.1	55.0
Neurosurgery (total)	86	19.4	19.4	74.3
Orofacial	14	3.2	3.2	77.5
Other	19	4.3	4.3	81.8
Respiratory	31	7.0	7.0	88.7
Thorax	32	7.2	7.2	95.9
Urogenital	18	4.1	4.1	100.0
Total	444	100.0	100.0	

Table 2: Gender-wise Distribution and Outcome Crosstab of Neonatal Surgical Cases

Gender	Frequency	Percent	Valid Percent	Cumulative Percent
??	2	0.5	0.5	0.5
F	169	38.1	38.1	38.5
M	273	61.5	61.5	100.0
Total	444	100.0	100.0	
Crosstab				
Outcome	DSD	F	M	P-value
Discharged	2	98	163	0.470
Expired	0	68	99	
Transferred	0	3	11	
Total	2	169	273	

Table 3: Distribution and Outcome Comparison of Neonatal Surgical Cases by Admission Source (Indoor vs. Outdoor)

Admission Source	Frequency	Percent	Valid Percent	Cumulative Percent
Indoor	248	55.9	56.1	56.1
Outdoor	194	43.7	43.9	100.0
Total (Valid)	442	99.5	100.0	
Missing (System)	2	0.5	—	—
Total	444	100.0	—	—
Crosstab				
Outcome	Indoor	Outdoor		P-value
Discharged	133	128		0.009
Expired	109	58		
Transferred	6	8		
Total	248	194		

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Table 4: Mode of Delivery and Its Association with Neonatal Surgical Outcomes

Mode of Delivery	Frequency	Percent	Valid Percent	Cumulative Percent
ISCS	1	0.2	0.2	0.2
LSCS	304	68.5	68.5	68.7
SVD	139	31.3	31.3	100.0
Total	444	100.0	100.0	
Crosstab				
Outcome	LSCS	SVD	P-value	
Discharged	186	77	0.415	
Expired	111	56		
Transferred	8	6		
Total	305	139		

Table 5: Gestational Age Distribution and Its Association with Neonatal Surgical Outcomes

Gestational Age	Frequency	Percent	Valid Percent	Cumulative Percent
Preterm	127	28.6	28.6	28.6
Term	317	71.4	71.4	100.0
Total	444	100.0	100.0	
Crosstab				
Outcome	Preterm	Term	P-value	
Discharged	58	205	0.001	
Expired	63	104		
Transferred	6	8		
Total	127	317		

Table 6: Association Between Birth Weight and Neonatal Surgical Outcomes

		Birth Weight (kg)				P-value
		Extremely Low	Very Low	Low	Normal	
Outcome	Discharged	1	1	69	189	0.000
	Expired	0	0	62	104	
	Transferred	0	1	0	13	
Total		1	2	131	306	

Table 7: Subgroup Outcome Analysis by Diagnosis

Diagnosis	Discharged	Expired	Transferred	Total	Mortality Rate (%)
Abdominal Wall Defect	20	5	1	26	19.2
CVS (Cardiovascular)	52	45	5	102	44.1
Digestive System	70	34	5	109	31.2
Hepatobiliary	4	1	0	5	20.0
Neurosurgery	47	37	2	86	43.0
Orofacial	8	5	1	14	35.7
Other	10	7	2	19	36.8
Respiratory	18	11	2	31	35.5
Thorax	23	9	0	32	28.1
Urogenital	11	6	1	18	33.3

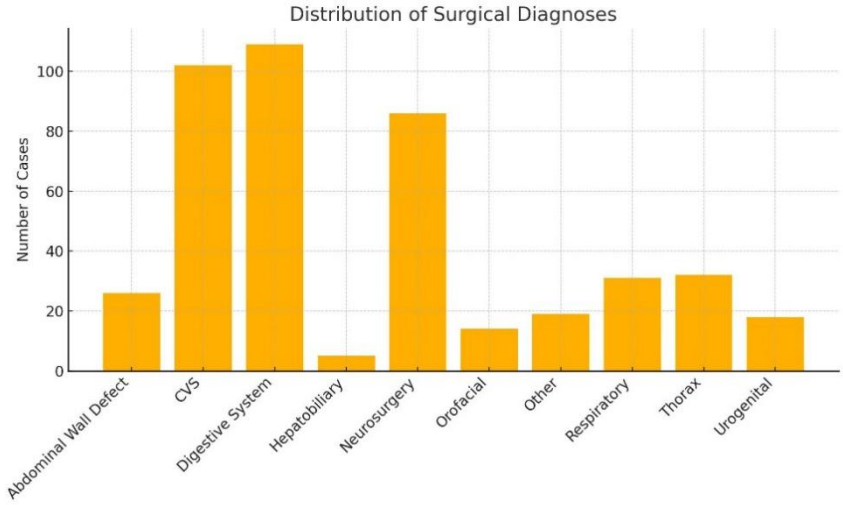

Figure 1 Distribution of Surgical Diagnoses

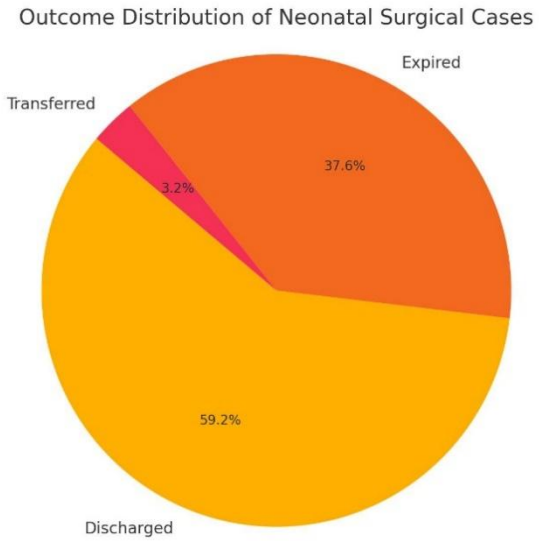

Figure 2 Outcome Distribution of Neonatal Surgical Cases

DISCUSSION

The present study, conducted among 444 neonates, demonstrated a male predominance, with 62% of the participants being male and 38% female. This gender distribution aligns with findings reported in regional studies, including one study, where male neonates accounted for 58.3% and females for 41.7% of the surgical cases (16). The predominance of males in neonatal surgical populations may reflect sociocultural referral biases and biological vulnerability differences between genders. Digestive system anomalies constituted the largest proportion of surgical diagnoses in this study, accounting for 24.5% of all cases, followed by cardiovascular system abnormalities (23%) and neurosurgical conditions (19.4%). Other notable categories included respiratory, thoracic, abdominal wall defects, and orofacial anomalies. These findings are largely consistent with regional and international literature. A comparable study reported gastrointestinal anomalies as the leading cause of neonatal surgeries, contributing 50.7% of total surgical burden (17). The observed distribution in the current study reflects a more diversified surgical profile, which could be attributed to the tertiary care center's referral dynamics and access to specialized pediatric surgical services.

The overall discharge rate in this study was 59.2%, while the mortality rate stood at 37.6%, and 3.2% of patients were transferred. These outcomes are broadly comparable to those of other tertiary care studies, where reported mortality rates ranged from 34.8% to 36.2% (18). However, a lower mortality rate of 11% was reported in a study conducted in a tertiary setup, possibly due to a narrower surgical case mix and greater emphasis on gastrointestinal procedures, which tend to have better prognoses compared to cardiovascular or neurosurgical conditions (19). Another study spanning 2015 to 2021 reported a notably higher survival rate of 77%, underscoring the evolving role of bedside neonatal surgeries and improved intensive care practices (20). Comparative data from developed countries indicate a more favorable trend in neonatal surgical outcomes. For example, a study reported a 21.7% mortality rate among neonatal surgical cases, with 44% of these surgeries involving gastrointestinal disorders (21). Although the prevalence of gastrointestinal cases was lower in the current study, the mortality burden was notably higher, highlighting the ongoing challenges faced in resource-limited settings. Over the past three decades, the global survival rate in neonatal surgery has increased from approximately 30% to nearly 65–70%, primarily due to advances in perioperative care and neonatal surgical techniques (22). The survival rate observed in the current study, at 59%, reflects progress while still falling short of international benchmarks.

Low birth weight and prematurity emerged as significant risk factors for adverse outcomes in this study. Among the neonates who expired, 62 had low birth weight, reflecting a 14% mortality rate within that group. Comparatively, other studies have reported an overall neonatal mortality of 23%, which rose to 32% among very low birth weight infants (15,18). Furthermore, preterm neonates in the current study had a 45% mortality rate, substantially higher than term neonates, 64% of whom survived. This trend mirrors the findings of a

recent cohort study, which found a strong association between prematurity and increased surgical complications and mortality (23). The study's strengths include a comprehensive capture of neonatal surgical conditions from a high-volume tertiary care hospital and the inclusion of a wide variety of surgical diagnoses, enabling generalizability across similar healthcare settings. However, the study is limited by its cross-sectional design and lack of follow-up data, which restricts the evaluation of long-term outcomes and postoperative complications. The absence of multivariate analysis to control for confounding variables such as gestational age, comorbidities, and time to surgery further limits causal interpretation. Additionally, data regarding the type and duration of surgical procedures, anesthesia details, and post-operative ICU care were not captured, which could have enriched the analysis and clarified outcome determinants. Future research should focus on prospective, multicenter designs that incorporate long-term follow-up to evaluate survival, morbidity, and quality of life. Emphasis should also be placed on stratified outcome analysis by surgical category, incorporating birth weight, gestational age, and procedural complexity to develop targeted interventions. Investment in neonatal intensive care infrastructure, timely surgical intervention, and strengthening referral systems remain pivotal to improving neonatal surgical outcomes in developing regions.

CONCLUSION

This study highlights the critical burden and complexity of neonatal surgical conditions in a tertiary care setting, underscoring the influence of factors such as gestational age, birth weight, and timely referral on patient outcomes. Cardiovascular and digestive system anomalies emerged as the most frequently encountered surgical challenges. The findings emphasize the importance of early diagnosis, improved perinatal and neonatal care, and the establishment of specialized surgical units tailored to high-risk neonates. Strengthening referral systems and optimizing surgical timing could significantly enhance survival and recovery in this vulnerable population, ultimately contributing to better overall neonatal surgical care.

AUTHOR CONTRIBUTION

Author	Contribution
Muhammad Amir Majeed*	Substantial Contribution to study design, analysis, acquisition of Data Manuscript Writing Has given Final Approval of the version to be published
Arshad Kushdil	Substantial Contribution to study design, acquisition and interpretation of Data Critical Review and Manuscript Writing Has given Final Approval of the version to be published
Sajid Ali Shah	Substantial Contribution to acquisition and interpretation of Data Has given Final Approval of the version to be published
Hafiz Abdul Quddus	Contributed to Data Collection and Analysis Has given Final Approval of the version to be published
Muhammad Ahsan Raza	Contributed to Data Collection and Analysis Has given Final Approval of the version to be published
Saqib Nawaz	Substantial Contribution to study design and Data Analysis Has given Final Approval of the version to be published

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