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Original Article

Impact of Prematurity and Low Birth Weight on Postoperative Mortality in Neonatal Intestinal Obstruction

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Abstract

Background: Neonatal intestinal obstruction is a common surgical emergency with significant morbidity and mortality. Prematurity and low birth weight are recognized risk factors for adverse postoperative outcomes, but their specific impact in this context requires further evaluation.

Objective: To assess the impact of prematurity and low birth weight on postoperative mortality in neonates undergoing surgery for intestinal obstruction.Methods: This prospective observational study was conducted in the Department of Pediatric Surgery, Sylhet M.A.G. Osmani Medical College Hospital, from December 2017 to November 2019. A total of 108 neonates with intestinal obstruction who underwent surgical intervention were enrolled using purposive sampling. Data were analyzed with SPSS version 25.Results: Among 108 neonates, 47.2% were preterm and 52.8% were term. Low birth weight (<2500g) was observed in 54.63% of patients, including 15.75% very low birth weight. Anorectal malformation (22.3%), Hirschsprung's disease (19.5%), and intestinal atresia (18.5%) were the most common diagnoses. Overall mortality was 13% (14 patients). Preterm neonates had significantly higher mortality (17.6%) compared to term neonates (8.6%). The mean birth weight of survivors (2.6 kg) was higher than that of non-survivors (1.9 kg). Mortality was highest in volvulus (25%), necrotizing enterocolitis (25%), and intestinal atresia (20%). Septicemia (25%) was the leading cause of death.

Conclusion: Prematurity and low birth weight are significant risk factors for postoperative mortality in neonatal intestinal obstruction. Preterm and low birth weight neonates require intensive perioperative care and close monitoring to improve survival outcomes.

Keywords: Intestinal obstruction, Low birth weight, Neonatal, Postoperative mortality, Prematurity.

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Introduction

Neonatal intestinal obstruction represents one of the most common surgical emergencies encountered in the newborn period, encompassing a diverse spectrum of congenital and acquired conditions that impede the normal passage of intestinal contents.[1,2] These obstructions arise from various developmental anomalies, including atresia, malrotation, Hirschsprung's disease, anorectal malformations, and meconium-related pathologies.[3] The clinical presentation typically includes the

classic triad of bilious vomiting, abdominal distension, and failure to pass meconium within the first 24 to 48 hours of life.[4] Despite advances in prenatal diagnosis, neonatal intensive care, and surgical techniques, the management of these conditions continues to pose significant challenges, particularly in resource-limited settings.[5] The global burden of neonatal surgical conditions is substantial, with congenital anomalies now recognized as the fifth leading cause of under-five mortality worldwide.[6] In low- and middle-income countries, the situation is particularly concerning, as 94% of congenital anomalies occur in these regions, where access to timely surgical intervention and adequate perioperative care may be limited.[6,7] Mortality rates associated with neonatal intestinal obstruction in developing countries range from 13% to 33%, with sepsis being the predominant cause of death.[8] Among the myriad factors influencing postoperative outcomes, prematurity and low birth weight have emerged as critical determinants of survival in neonates undergoing surgery.[9,10] Preterm infants, defined as those born before 37 weeks of gestation, exhibit physiological immaturity across multiple organ systems, including impaired thermoregulation, underdeveloped immune responses, and reduced cardiorespiratory reserve.[11] These vulnerabilities are compounded in the perioperative period, where the stress of anesthesia and surgical intervention may precipitate complications such as hypothermia, apnea, and hemodynamic instability.[4] Low birth weight, affecting approximately 15-20% of all live births globally, has been consistently identified as an independent risk factor for adverse surgical outcomes.[6,12] A study from northern Ghana demonstrated that low birth weight neonates with surgical conditions had nearly four times higher odds of mortality compared to their normal birth weight counterparts (OR 3.59, 95% CI 1.4-9.5).[6] Similarly, Alsoufi and colleagues reported that infants weighing ≤2.5 kg undergoing cardiac surgery faced significantly increased hospital mortality (OR 2.15) and diminished late survival.[12] The physiological basis for this increased risk includes limited nutritional reserves, immature organ function, and reduced tolerance to the metabolic demands of surgery and recovery.[10] The interplay between prematurity and low birth weight in the context of neonatal intestinal obstruction is particularly complex. Preterm infants are more susceptible to conditions such as necrotizing enterocolitis and meconium-related obstructions, which themselves carry high mortality rates.[13] Furthermore, the surgical management of intestinal obstruction in these vulnerable neonates requires nuanced decision-making regarding the timing of intervention, the choice of surgical procedure, and the intensity of postoperative support.[5] While previous studies have examined outcomes of neonatal intestinal obstruction, relatively few have specifically quantified the independent contributions of prematurity and low birth weight to postoperative mortality in this population.[3,8] Understanding these relationships is essential for risk stratification, preoperative counseling, and resource allocation in neonatal surgical units. Therefore, this study aimed to assess the impact of prematurity and low birth weight on postoperative mortality in neonates undergoing surgery for intestinal obstruction at a tertiary care hospital in Bangladesh.

Methodology

This prospective observational study was conducted in the Department of Pediatric Surgery at Sylhet M.A.G. Osmani Medical College Hospital over a two-year period, from December 2017 to November 2019. The study population comprised all neonates admitted with intestinal obstruction during this period.

Inclusion criteria: A total of 108 neonates who presented with intestinal obstruction and underwent surgical intervention were enrolled in this study using non-probability purposive sampling.

Exclusion criteria: Neonates with life-threatening major congenital anomalies requiring NICU support were excluded from the study. Additionally, infants whose parents or guardians refused to provide informed written consent were not included.

Study procedure: Upon admission, all neonates suspected of intestinal obstruction underwent a comprehensive clinical and diagnostic evaluation. Initial resuscitation included warm care, fluid and electrolyte maintenance, nasogastric suction, appropriate antibiotics, and oxygen support when indicated. Diagnostic workup comprised plain abdominal X-rays, contrast studies when necessary, and an invertogram for anorectal malformation cases. Laboratory investigations included serum electrolytes, complete blood count, arterial blood gas, renal function tests, and C-reactive protein. Surgical intervention was performed under general anesthesia once the neonate was stabilized. Postoperative care focused on pain management, volume replacement, temperature maintenance, and complication management. Patients were followed until hospital discharge.

Data analysis: Data were collected through face-to-face interviews using a semi-structured questionnaire. All information was compiled and analyzed using SPSS version 25. Quantitative variables were expressed as mean, range, and standard deviation, while qualitative data were presented as rates, ratios, proportions, and percentages. Written informed consent was obtained from all guardians.

Result

A total of 108 neonates with intestinal obstruction who underwent surgical intervention were enrolled in this study. The majority (75%) presented within the first week of life (mean age 6.53±1.45 days), with a male predominance (60.2%, male:female ratio 1.51:1). Regarding perinatal characteristics, 52.8% were term neonates and 47.2%

were preterm. Prematurity was most prevalent in necrotizing enterocolitis (100%), meconium plug syndrome (100%), and meconium ileus (87.5%). Birth weight analysis revealed 45.37% had normal birth weight, while 38.89% were low birth weight, and 15.75% were very low birth weight (mean 2.4 kg). The most common presenting complaints were abdominal distension (82.4%), vomiting (75%), and constipation (42.6%). Radiological evaluation demonstrated small-gut obstruction in 47.2%, large-gut obstruction in 41.7%, and gastric outlet obstruction in 11.1%. Pneumoperitoneum was present in 7.4% of cases and was associated with significantly higher mortality (62.5% vs. 9%).Anorectal malformation was the most common diagnosis (22.3%), followed by Hirschsprung's disease (19.5%) and intestinal atresia (18.5%). Surgical procedures varied by diagnosis, with laparotomy and resection-anastomosis being the most frequent (22.22%). Early postoperative complications included septicemia (30%), wound infection (25%), apnea (12.5%), and anastomotic leakage (12.5%). Clinical parameters showed progressive improvement through postoperative day 10, though this was not statistically significant.The overall mortality rate was 13% (14 patients). Mortality was highest following TEPT (33.33%), laparotomy with resection-anastomosis (25%), and ileostomy (18.18%), while no deaths occurred after Ramstedt's pyloromyotomy, Bishop-Koop procedure, or rectal irrigation. By diagnosis, mortality was highest in volvulus (25%), necrotizing enterocolitis (25%), and intestinal atresia (20%), with no deaths in infantile hypertrophic pyloric stenosis or meconium plug syndrome. The mean birth weight of survivors (2.6 kg) was higher than that of non-survivors (1.9 kg). Preterm neonates experienced higher mortality (17.6%) compared to term neonates (8.6%). Patients presenting after 3 days of symptom onset had greater mortality (20.45%) than those presenting earlier (7.81%). The leading causes of death were septicemia (25%), shock (20%), and aspiration pneumonia (15%). At follow-up, 57.45% of survivors were asymptomatic at one month, increasing to 85.11% at three months. Overall, 50% of patients recovered without complications, 37% recovered with complications, and 13% died.

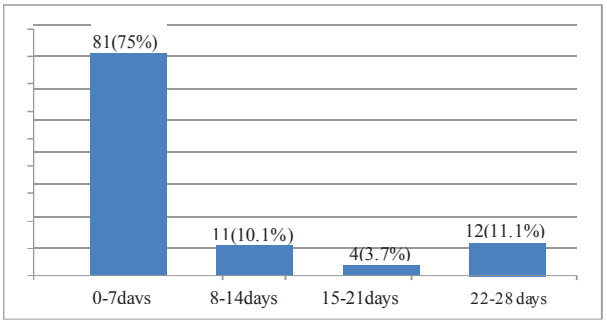

Figure 1: Distribution of patients according to time of presentation

Table 1: Distribution of patients according to gestational age and diagnosis

Diagnosis	Preterm n (%)	Term n (%)	Total (n)
Anorectal malformation	7 (29.2)	17 (70.8)	24
Hirschsprung's disease	3 (14.3)	18 (85.7)	21
Intestinal atresia	12 (60.0)	8 (40.0)	20
IHPS	6 (50.0)	6 (50.0)	12
Volvulus	6 (75.0)	2 (25.0)	8
Meconium ileus	7 (87.5)	1 (12.5)	8
Malrotation	3 (37.5)	5 (62.5)	8
Necrotizing enterocolitis	4 (100.0)	0 (0.0)	4
Meconium plug syndrome	3 (100.0)	0 (0.0)	3
Total	51 (47.2)	57 (52.8)	108

Table 2: Distribution of patients according to diagnosis and surgical procedure performed

Diagnosis n (%)	Surgical procedure	Number
Anorectal malformation 24 (22.3%)		
High ARM 18 (16.66%)	Sigmoid colostomy	18
Low ARM 6 (5.56%)	Anoplasty	6
Hirschsprung's disease 21 (19.5%)		
Types	Transverse colostomy	18
	TEPT	3
Intestinal atresia 20 (18.5%)		
Duodenal atresia 2 (1.15%)	Resection + Anastomosis	2
Jejunal atresia 5 (4.63%)	Resection + Anastomosis	5
Ileal atresia 13 (12.04%)	Resection + Anastomosis	10
	Ileostomy	3
IHPS 12 (11.1%)	Ramstedt's pyloromyotomy	12
Volvulus 8 (7.4%)		
Types	Untwisting	1
	Resection + Anastomosis	5
	Ileostomy	2
Meconium Ileus 8 (7.4%)		
Types	Bishop-koop procedure	4
	Ileostomy	3
	Resection + Anastomosis	1
Malrotation 8 (7.4%)	Ladd's procedure	8
	Resection + Anastomosis	1
NEC 4 (3.7%)	Ileostomy	3
Meconium plug syndrome 3 (2.8%)	Rectal irrigation	3
Total		108

Table 3: Distribution of surgical procedures and their outcomes

Surgical procedure n (%)	Survive n (%)	Death n (%)
Laparotomy and resection & anastomosis 24 (22.22%)	18 (75.00)	6 (25.00)
Transverse colostomy 18 (16.66%)	17 (94.44)	1 (5.66)
Sigmoid colostomy 18(16.66%)	15 (83.33)	3 (16.67)
Ramstedt's pyloromyotomy 12 (11.11%)	12 (100.0)	0 (0.00)
Ileostomy 11 (10.19%)	9 (81.82)	2 (18.18)
Laparotomy and Ladd's procedure 8 (7.40%)	7 (87.50)	1 (12.50)
Anoplasty 6 (5.55%)	6 (100.0)	0 (0.00)
Bishop-Koop procedure 4 (3.70%)	4 (100.0)	0 (0.00)
TEPT 3 (2.77%)	2 (66.66)	1 (33.33)
Rectal irrigation 3 (2.78%)	3 (100.0)	0 (0.00)
Laparotomy and untwisting 1 (0.92%)	1 (100.0)	0 (0.00)
Total 108 (100%)	94 (87%)	14 (13%)

Table 4: Distribution of outcome according to diagnosis, gestational age, and birth weight

Parameter	Survival n (%)	Death n (%)	Total n (%)
Diagnosis			
Anorectal malformation	21 (87.5)	3 (12.5)	24 (100)
Hirschsprung's disease	19 (90.5)	2 (9.5)	21 (100)
Intestinal atresia	16 (80.0)	4 (20.0)	20 (100)
IHPS	12 (100.0)	0 (0.0)	12 (100)
Volvulus	6 (75.0)	2 (25.0)	8 (100)
Meconium ileus	7 (87.5)	1 (12.5)	8 (100)
Malrotation	7 (87.5)	1 (12.5)	8 (100)
Necrotizing enterocolitis	3 (75.0)	1 (25.0)	4 (100)
Meconium plug syndrome	3 (100.0)	0 (0.0)	3 (100)
Gestational age			
Preterm	42 (82.4)	9 (17.6)	51(47.2)
Term	52 (91.2)	5 (8.6)	57(52.8)
Birth weight	Mean ± SD		
Survived (n=94)	2.6 kg (range 1.5-3.8 kg)		
Died (n=14)	1.9 kg (range 1.1-3.2 kg)		

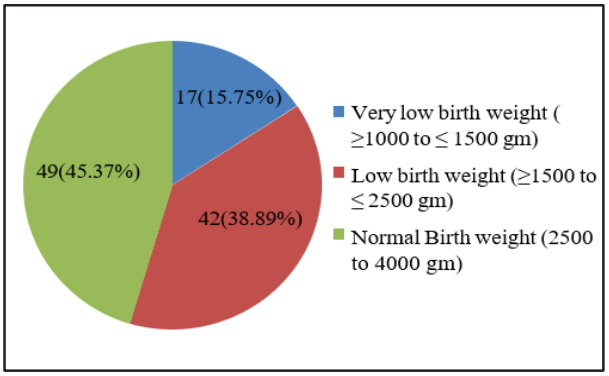

Figure 2: Distribution of patients according to birth weight categories

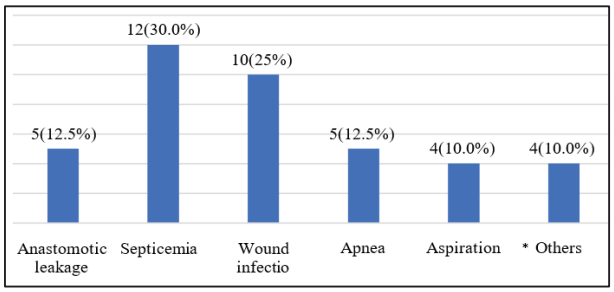

Figure 3: Distribution of patients according to early postoperative complications

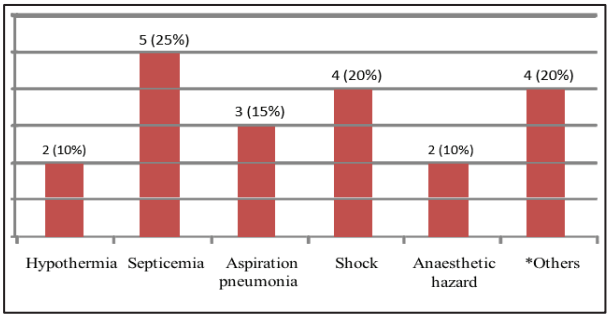

Figure 4: Distribution of patients according to causes of mortality

Discussion

This prospective study of 108 neonates with intestinal obstruction who underwent surgical intervention demonstrates that prematurity and low birth weight are significant determinants of postoperative mortality. The overall mortality rate of 13% observed in our series is consistent with previously reported outcomes from similar settings, which range from 13% to 33%.[1,3] One series from a tertiary care center in India reported a mortality rate of 16.7%, closely aligning with our findings.[14] This relatively favorable mortality figure may reflect standardized perioperative protocols, though it remains higher than rates in developed countries.[15] The demographic profile revealed male predominance

(60.2%), consistent with the well-documented male preponderance in congenital anomalies such as Hirschsprung's disease and anorectal malformations.[3] The mean age at presentation of 6.53 days indicates delayed presentation beyond the critical window for optimal outcomes, often due to referral patterns and healthcare accessibility issues in low-resource settings.[6,7] A study from Cameroon similarly identified delayed presentation as a significant predictor of poor outcomes.[21] Our findings demonstrate a clear association between prematurity and postoperative mortality, with preterm neonates experiencing more than double the mortality rate of term infants (17.6% vs. 8.6%). This observation corroborates previous research reporting that premature infants undergoing surgery face significantly increased hospital mortality.[12] The physiological immaturity of multiple organ systems in preterm neonates, including underdeveloped respiratory function and immature immune responses, renders them particularly vulnerable to surgical stress.[4,11] Furthermore, preterm infants in our series were disproportionately affected by high-mortality conditions, including necrotizing enterocolitis (100%) and meconium ileus (87.5%), consistent with reports identifying prematurity as the single most important risk factor for these conditions.[13, 25] The impact of birth weight on postoperative outcomes was equally striking. The mean birth weight of survivors (2.6 kg) was substantially higher than that of non-survivors (1.9 kg), with 54.63% of our cohort falling into low or very low birth weight categories. This finding is consistent with a study from northern Ghana demonstrating that low birth weight neonates with surgical conditions had nearly four times higher odds of mortality.[6] Other investigators have similarly reported that low birth weight infants experience significantly higher perioperative morbidity and mortality.[14] The physiological basis includes limited nutritional reserves, reduced tolerance to fluid shifts, and impaired wound healing.[10, 12] Analysis by specific diagnoses revealed the highest mortality in volvulus (25%), necrotizing enterocolitis (25%), and intestinal atresia (20%). The high mortality in volvulus reflects the potential for catastrophic midgut ischemia and challenges of timely diagnosis in resource-limited settings.[3] Necrotizing enterocolitis, occurring exclusively in preterm infants, carries a well-established poor prognosis due to systemic inflammation and gut vulnerability.[13,15] The 20% mortality in intestinal atresia compares favorably with some developing country series, possibly reflecting improved surgical techniques.[1,14] The presence of pneumoperitoneum on preoperative radiography was associated with markedly elevated mortality (62.5% vs. 9%), underscoring the grave prognosis associated with intestinal perforation and peritonitis in neonates.[4] This finding emphasizes the critical importance of early diagnosis before developing complications that precipitate systemic deterioration.[16] Septicemia emerged as the leading cause of death (25%), followed by shock (20%) and aspiration pneumonia (15%). The predominance of infectious complications reflects immature immune function, prolonged hospitalization, and invasive procedures.[1,8] One study identified sepsis as the primary cause of mortality, accounting for nearly 30% of deaths.[17] All deaths occurred within the first postoperative week, highlighting the critical nature of the immediate perioperative period. Timing of presentation significantly influenced outcomes, with neonates presenting after three days of symptom onset experiencing nearly threefold higher mortality (20.45% vs. 7.81%). This aligns with previous work emphasizing that delayed presentation contributes to poorer outcomes through progression of intestinal compromise and established sepsis.8 Studies examining gastroschisis outcomes in low-resource settings have identified delayed presentation as a critical modifiable factor affecting survival.[18] Surgical procedure-specific mortality analysis revealed the highest rates following TEPT (33.33%), laparotomy with resection-anastomosis (25%), and ileostomy (18.18%). The elevated mortality in resection-anastomosis cases may reflect the severity of underlying pathology requiring extensive resection, while TEPT outcomes may be influenced by challenges of managing Hirschsprung's disease in the neonatal period.[2,24] Conversely, zero mortality following Ramstedt's pyloromyotomy and Bishop-Koop procedure reflects the less critical nature of underlying conditions.[3] The progressive improvement in clinical parameters through postoperative day 10 demonstrates the expected recovery trajectory. The substantial proportion with no complaints at one-month (57.45%) and three-month (85.11%) follow-up is encouraging, suggesting good functional outcomes.[19] However, statistically significant persistence of constipation and perianal soiling highlights the need for ongoing surveillance. Comparison with other centers reveals that mortality in Malawi was nearly ten times higher than in England, primarily attributable to delayed presentation and limited intensive care resources.[20] A systematic review of neonatal surgery outcomes in Africa reported pooled mortality rates of 18-35%, with sepsis and delayed presentation being consistent predictors of poor outcome.[21] Our mortality rate of 13% compares favorably, potentially reflecting dedicated pediatric surgical services.

Limitations

This single-center study with a modest sample size limits generalizability. The non-probability sampling method introduces potential selection bias, and the

absence of long-term follow-up beyond three months precludes assessment of late complications and functional outcomes. Preoperative physiological parameters were not analyzed.

Conclusion

Prematurity and low birth weight are significant independent risk factors for postoperative mortality in neonatal intestinal obstruction. Preterm and low birth weight neonates require intensive perioperative care, including vigilant monitoring for septic complications, optimized nutritional support, and meticulous attention to thermoregulation. Strategies to reduce delayed presentation and strengthen neonatal intensive care capacity in resource-limited settings may improve survival outcomes in this vulnerable population.

Recommendation

Establish standardized protocols for perioperative care of preterm and low birth weight neonates with intestinal obstruction. Implement community education programs to reduce delayed presentation. Strengthen neonatal intensive care units with adequate staffing, equipment, and infection control measures to optimize outcomes in resource-limited settings.

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