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CAUSES AND SURGICAL OUTCOMES OF NEONATAL INTESTINAL OBSTRUCTION AT A KENYAN TERTIARY HOSPITAL

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ABSTRACT

Background: **Neonatal intestinal obstruction (NIO) is a major indication for admissions globally with high morbidity and mortality rates. Availability of adequate and contextual data about the causes and surgical outcomes of NIO could inform prevention and management modalities.**

Objective: **To determine aetiology and surgical outcomes among neonates with intestinal obstruction at Moi Teaching and Referral Hospital (MTRH), Eldoret, Kenya.**

Methods: **A hospital-based observational prospective study conducted among sixty-three (63) neonates with NIO who had undergone surgery at MTRH between 10th August 2022 and 9th August 2023. After obtaining parental consent, neonatal clinical characteristics and maternal antenatal profile data were collected. The neonates were then followed for a maximum of seven days post-surgery to determine surgical management and outcomes. A test of associations was conducted between independent variables (etiology and clinical presentation) and surgical outcomes using Fisher exact tests (critical value of ≤0.05) with odds computed at a 95% confidence interval.**

Results: **The mean neonatal age at presentation was 9.75 ± 6.75 days. Forty-one (65.1%) were male and 84.1% had congenital anomalies. The overall mean birthweight and gestation age were 2,670 ± 597.25 grams and 37.19 ± 2.53 weeks respectively. The most common NIO aetiology was anorectal malformation (22.3%; n=16) followed by malrotation (18.4%; n=13). Bowel resection and anastomosis (32.9%; n=24) were the most common type of surgical management offered, followed by colostomy (19.2%; n=14). Mortality was reported among 27% of all neonates enrolled. Prolonged hospitalization was the leading (73%; n=46) secondary surgical outcome with a mean duration of 21.98 ±12.96 days, followed by neonatal sepsis (33.3%; n=21). Elevated platelet count (p=0.016) and**

C-Reactive Protein (p=0.021) at admission were significantly associated with post-surgical mortality.

Conclusion: **The most common cause of NIO was anorectal malformation. About three quarters of the neonates who underwent surgery survived. Post-surgical elevated platelet counts and C-reactive protein values significantly predicted likelihood of mortality.**

INTRODUCTION

Neonatal intestinal obstruction refers to the interruption of the forward movement of abdominal contents in the first twenty-eight days of life (1). Neonatal intestinal obstruction accounts for 20% of all admissions in neonates worldwide (2). Intestinal obstruction often manifests with several signs and symptoms including maternal polyhydramnios, bilious emesis, abdominal distention, and failure to pass meconium in the first 24 hours of life. While the symptoms may not be typical of intestinal obstruction, they should be carefully evaluated to rule out any neonatal cause of intestinal obstruction.

Pediatric surgical emergencies are associated with high mortality among neonates admitted for emergency surgeries compared to elective surgical surgeries in low and middle-income countries. Intestinal obstruction is a common indication for emergency surgical interventions among neonates with varying surgical outcomes across various clinical settings (3). A previous study conducted in the United Kingdom (4) reported an increased mortality rate among neonates undergoing emergency surgical interventions compared to neonates admitted for elective surgical interventions in low and middle-income countries. The poor outcome among neonates with intestinal obstruction has been largely attributed to prematurity, neonatal sepsis, and severity at presentation (5). In Sub-Saharan Africa, a multitude of factors have been highlighted, attributing to the increased mortality rate among neonates with intestinal obstruction such as late presentation, absence of neonatal intensive care unit, and shortage of pediatric surgeons (6). Despite these challenges, there is a paucity of recent data from Sub-Saharan Africa addressing the etiology of intestinal obstruction in neonates, its clinical presentation, and surgical outcomes.

This study described the causes and surgical outcomes of neonatal intestinal obstructions at Moi Teaching and Referral Hospital (MTRH). Specifically, it established the causes of neonatal intestinal obstructions, ascertained surgical outcomes both primary and secondary outcomes among neonates with intestinal obstruction as well as evaluated factors associated with surgical outcomes in neonates with intestinal obstruction at MTRH.

METHODOLOGY

This study was conducted at the newborn unit (NBU) at Moi Teaching and Referral Hospital (MTRH). It adopted a hospital-based observational prospective study conducted among sixty-three (N=63) neonates with NIO who had undergone surgery at MTRH between 10th August 2022 and 9th August 2023. After obtaining parental consent, neonatal clinical characteristics and maternal antenatal profile data were collected. The neonates were then followed for a maximum of seven days post-surgery to determine surgical management and surgical outcomes which included primary and secondary outcomes. Continuous variables were summarized using mean with corresponding standard deviation. Frequencies and the corresponding

percentages were used to summarize categorical variables. A test of associations was conducted between independent variables (etiology and clinical presentation) and surgical outcomes using the Pearson chi-square and Fisher exact tests (critical value of ≤0.05) with odds computed at a 95% confidence interval. Ethical approval was sought from the Institutional Research and Ethics Committee (IREC) of Moi University School of Medicine (FAN:0004211). A letter authorizing conducting the study at MTRH was obtained from the hospital's CEO. A national research license was obtained from the National Commission for Science, Technology and Innovation (NACOSTI) before commencing the study *(Approval: NACOSTI/P/22/19973)*. Parental consent was sought from the potential participant's parents/caregivers. Privacy and confidentiality were maintained by restricting access to study information and de-identifying participants' records.

RESULTS

A total of 63 participants were enrolled for the study. The mean age at presentation of the 63 neonates enrolled was 9.75 (± 6.746) days, of whom 41 (65.1%) were male while 22 (34.9%) were female. The mean birthweight was 2,670.24 (± 597.253) grams, while the mean APGAR score was 8.72 (± 1.39) minutes, and the mean gestational age was 37.19±2.533 weeks. Fifty-three (84.1%) of the neonates were diagnosed with intestinal obstruction due to a congenital malformation along the gastrointestinal tract. Two thirds (66.7%, n=42) of those enrolled were term babies with the rest (33.3%; n=21) being preterm. Normal birthweight of more than 2500 grams was noted among 42 (66.7%) neonates with the rest having a low birthweight (Table 1).

Table 1

Neonatal Characteristics (N=63)

Neonatal Characteristic	**Mean (SD)**	**n (%)**
Age of presentation (days)	9.75 (±6.746)	
Mean Gestational Age	37.19± 2.53 (weeks)	
	Term (≥37 completed weeks)	42 (66.3)
	Preterm (<37 completed weeks)	21 (33.7)
Gender	Male	41 (65.1)
	Female	22 (34.9)
Birthweight	2670.24 (±597.25) grams	
	Normal birthweight (≥2500 grams)	42 (66.7)
	Low birthweight (< 2500 grams)	21 (33.3)
APGAR Score at 5 minutes	8.72 (±1.39)	
Congenital Abnormalities	Yes	53 (84.1)
	No	10 (15.9)
Referred	Yes	53 (84.1)
Level of referral facility	Level III	6 (9.5)
	Level IV	33 (52.4)
	Level V	8 (12.7)
	Private	6 (9.5)
Referral Note	Yes	49 (92.5)

Anorectal malformation (ARM) was the most common cause of neonatal intestinal obstruction among 16 (21.6%) neonates, followed by malrotation (17.6%, n=13),

jejunal atresia in (16.2%, n=12), duodenal (10.8%, n= 8), ileal atresia (9.5%, n=7) and Hirschsprung's disease (9.5%, n=7), as shown on Table 2.

Table 2

Causes of neonatal intestinal obstruction

Etiology	Frequency	Proportion (%)
Anorectal Malformation	16	21.6%
Malrotation	13	17.6%
Jejunal Atresia	12	16.2%
Duodenal atresia	8	10.8%
Ileal atresia	7	9.5%
Hirschsprung's	7	9.5%

The participants who were scheduled for surgery after admission had a waiting period of less than 3 days in 37 (58.7%) with the rest waiting for three or more days, giving a mean duration of 4.84 days. The common surgical procedures were resection and anastomosis in 24 (32.9%) participants, 14 (19%) underwent colostomy fashioning, 11 (15.1%) Ladd's procedure, 5 (6.8%) anoplasty, 5 (6.8%) full thickness rectal biopsy, 4 (5.8%) ileostomy, 3(4.1%) Kimura procedure, 3(4.1%) rectal washout, 1 (1.4%) adhesiolysis, 1(1.4%) Mini PSARP (Posterior Sagittal Anorectoplasty), 1 (1.4%) herniotomy and 1(1.4%) Herniorrhaphy plus umbilicoplasty as shown on Table 3.

Table 3

The surgical procedures performed

Procedure performed	n	(%)
Bowel resection and anastomosis	24	32.9%
Colostomy fashioning	14	19.2%
Ladds procedure	11	15.1%
Anoplasty	5	6.8%
Full-thickness rectal biopsy	5	6.8%
Ileostomy fashioning	4	5.8%
Kimura procedure	3	4.1%
Rectal washout with enema	3	4.1%
Band release	1	1.4%
Mini PSARP	1	1.4%
Herniotomy	1	1.4%
Herniorrhaphy plus umbilicoplasty	1	1.4%

Post-operative mortality occurred in 27% of the neonates (Figure 1).

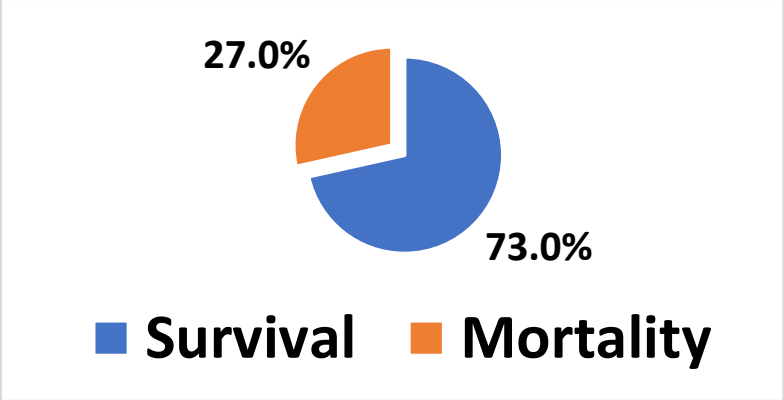

Figure 1: Primary Surgical Outcomes

This study assessed patient-related factors, laboratory findings, etiology of disease, and surgical procedures performed as predictors of survival. When gestational age was compared to the likelihood of survival, preterm neonates were likely (OR=1.067; 95% CI: 0.785, 1.449) to survive, however, this relationship was not statistically significant (p=0.771). Normal birthweight neonates were more likely to survive compared to those admitted with a low birthweight. However, the relationship was not statistically significant. Neonates' likelihood of survival following surgical management of intestinal obstruction was higher among those with normal platelet counts (COR=**1.617; 95% CI: 0.971, 2.691**) and C-reactive protein (CRP) values (COR=**1.423; 95% CI: 1.068, 1.896**). There was no statistically significant difference noted in the likelihood of survival among neonates with normal white blood cell counts, hemoglobin counts, serum urea, creatinine, potassium, sodium, albumin, and total bilirubin levels with survival. Furthermore, the referral status of neonates did not significantly affect their likelihood of survival.

Prolonged hospitalization was reported in 73.0% (n=46) of the participants with a mean duration of 21.98 (±12.96) days. Other secondary outcomes were neonatal sepsis in 21 (33.3%), electrolyte imbalance in 16 (25.4%), anemia in 15 (23.3%) hypoalbuminemia in 10 (15.9%) thrombocytopenia in 6 (9.5%), pulmonary complications in 6 (9.5%), repeat surgery in 3 (4.8%) surgical site infection in 2 (3.2%), stoma complications in 1 (1.6%), peritonitis in 1 (1.6%) and renal failure in 1 (1.6%).

Neonates who had a babygram done at admission were significantly (p=0.042) less likely (OR=0.718; 95% CI: 0.541, 0.952) to experience prolonged hospitalization compared to those without a babygram at admission. However, those with a normal birthweight at the time of admission were less likely (OR=0.938; 95% CI: 0.690, 1.273) to be hospitalized for more than seven days, a relationship that was not statistically significant (p=0.771). Neonatal sepsis was noted to be higher (OR=1.810; 95% CI: 0.303, 10.800) among newborns who were delivered through spontaneous virginal delivery (SVD) compared to cesarean section, a relationship that was not statistically significant (p=0.650). Neonates with a normal birthweight were less likely (OR=0.583; 95% CI: 0.224, 1.518) to present with anemia compared to their low-birth-weight counterparts, though not statistically significant (p=0.329) relationship was established. Lastly, repeat surgery was not significantly associated with congenital malformation (Table 4).

Table 4

Factors associated with primary and secondary surgical outcomes

Surgical Outcome	Factor	p-value	COR (95% CI:)
PRIMARY OUTCOME			
Gestational Age at Birth	Term	0.771	1.067 (0.785, 1.449)
Laboratory Findings	Normal platelet count	**0.056**	**1.617 (0.972, 2.691)**
	Normal CRP	**0.024**	**1.423(1.068, 1.896)**
SECONDARY OUTCOMES			
Prolonged Hospitalization	Birthweight	0.771	0.938 (0.690, 1.273)
	Babygram at Admission	**0.042**	**0.718 (0.541, 0.952)**
Neonatal Sepsis/ Septicemia	Mode of Delivery (SVD)	0.650	1.810 (0.303, 10.800)
Anemia	Birthweight (normal)	0.329	0.583 (0.224, 1.518)
Repeat Surgery	Presence of Congenital malformations	0.067	-

DISCUSSION

This study enrolled sixty-three neonates with a mean age at presentation of 9.75±6.746 days. A mean age of more than seven days at the time of presentation of a neonate with intestinal obstruction is considered delayed presentation. This finding of delayed presentation of neonates contrasts other studies conducted in Africa (7–9). From the findings of a study conducted at a tertiary hospital in Uganda, the authors reported a mean age of three days for neonates who presented with intestinal obstruction (8). A similar finding was reported in Ethiopia where the neonates presented within seventy-two hours (three days) from the time of delivery (7). In Nigeria, the average time of presentation was 6.86 ± 8.4 days (9). Outside Africa, in Iran, the mean age at presentation was 3.85 ± 8.01 days (10). Delayed presentation could be attributed to the challenges in neonatal referral networks. The first challenge is prompt identification by the parent or caretaker of the neonate, presentation to the primary healthcare facility, diagnosis of neonatal intestinal obstruction, initiation of the referral process, identifying the optimal transportation means for the neonate being referred, adherence to the referral guidelines and eventual reception to the referred facility (11). Such challenges at Moi Teaching and Referral Hospital have been reported in a previously published study (12). Furthermore, majority of the neonates with intestinal obstruction will initially present with classic symptoms such as vomiting, irritability, refusal to feed, abdominal distension, and failure to pass stool. Such classic symptoms may not necessarily raise a high bar alert on the new mother and may go unreported. By the time this is reported, and the neonate presents to the primary healthcare facility, this situation has already been prolonged. Secondly, the majority of the primary healthcare facilities visited by these new mothers are often below level four of care and most healthcare workers may only use suspicion as a way of identifying intestinal obstruction, a method which is neither definite nor objective. They may also institute preliminary management such as the use of fluids, nasogastric tubes for decompression, antibiotics, and analgesics. All these approaches, however supportive, are not specific in nature. Additionally, the ultimate surgical management required may only be offered at advanced-level hospitals (levels five and six) that can access pediatric surgeons (13).

This study categorized the etiologies of neonatal intestinal obstruction as either congenital or acquired. The most common congenital malformations were anorectal

malformations (21.6%), followed by malrotation at 17.6% jejunal atresia at 16.2%, duodenal atresia (10.8%), ileal atresia (9.5%) and Hirschsprung disease (9.5%). The finding on anorectal malformation as the most common cause of NIO concurs with those reported by two other studies conducted in India. In the first prospective study, the authors reported that 63% of the neonates presented with anorectal malformation (14). In a second study, the authors noted that 42% of the neonates enrolled with intestinal obstruction had anorectal malformation (15). Similar findings were reported in a systematic review conducted in Nigeria's Aba State, 59.3% had anorectal malformations (16). This study's findings therefore concur with many studies that reported anorectal malformation to be the main cause of intestinal obstruction among neonates.

This study defined primary surgical outcome as either survival or death following surgical management of neonatal intestinal obstruction. In this study, about three-quarters (73%) of the neonates survived, with the rest (27%) dying. This proportion of post-surgical survival, which was calculated within seven days after surgery, is comparable to that reported in Pakistan at 78.85% (17). In Bangladesh, it was 83.16% (18). The high proportions of post-surgical survival could imply that the chosen surgical procedures were appropriate to the etiology of intestinal obstruction, and the neonates were well optimized ahead of the surgery. Furthermore, MTRH, the study site selected for the current study, has pediatric surgeons, residents undergoing training in pediatric surgery, neonatologists, residents in pediatrics, neonatal intensive care unit, availability of total parenteral feeding, and an organized referral system. This observation alongside the high proportion of post-surgical survival corroborated the findings of a local study conducted in the same setting at 69% (19). The slight differences in the proportion of neonatal survival could be attributed to the fact that MTRH lacked a neonatal intensive care unit at the time of the study. The presence of neonatal intensive care units is critical in the immediate post-surgical management of neonates and increases their survival likelihood.

The main secondary outcomes of interest in this study was prolonged hospitalization at 73.0%, with a mean duration of 21.95 days. Neonates could experience prolonged post-surgical hospital stay for several reasons. However, this study noted that neonates who underwent babygram at admissions were significantly less likely to experience prolonged hospitalization. This could be attributed to the prompt and objective intervention as their diagnosis of intestinal obstruction was made early.

These range from prematurity and surgical outcomes. Because premature neonates are physiologically delicate, they could experience several post-surgical events such as fluid shifts, metabolic disturbances, and electrolyte imbalances (20).

Study Limitation

Because this study was conducted at a single center, the findings should be interpreted in light of this observation.

CONCLUSION AND RECOMMENDATIONS

The most common cause of neonatal intestinal obstruction in this study was anorectal malformation. This study also reports a post-surgical mortality rate of 27%. About three in four neonates enrolled had prolonged hospitalization following surgery with one-third of them experiencing sepsis. Abnormal platelets count and C-Reactive Protein values at admission significantly increased the likelihood of neonatal post-surgical mortality. With the foregoing, there is need to improve patient transfer systems for neonates with intestinal obstruction, to

improve surgical outcomes. This should be in adherence to patient referral protocols. Furthermore, measures to control post-surgical sepsis when institutionalized can reduce the risk of post-surgical neonatal mortality. A future follow-up study encompassing multiple centers and addressing post-surgical mortality risks should be conducted to generalize this study's findings.

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Credit statement

All the authors contributed equally in conducting and publishing research findings. to this manuscript.

Conflict of interest

The authors declare no conflict of interest associated with conducting this study.

REFERENCES

1. Harunani S, Kuremu T. INTESTINAL OBSTRUCTION IN THE PEDIATRIC AGE GROUP. East Afr Med J. 2019 Mar;Volume 96(3).
2. Parihar S, Kumar Y. Neonatal intestinal obstruction. Article in IOSR Journal of Dental and Medical Sciences [Internet]. 2018;17:61–4. Available from: www.iosrjournals.org
3. Wright NJ, Wright N, Ade-Ajayi N, Ademuyiwa A, Ameh E, Davies J, et al. Management and outcomes of gastrointestinal congenital anomalies in low, middle and high income countries: Protocol for a multicentre, international, prospective cohort study. BMJ Open. 2019;9(3):1–10.
4. Ademuyiwa AO, Arnaud AP, Drake TM, Fitzgerald JEF, Poenaru D, Bhangu A, et al. Determinants of morbidity and mortality following emergency abdominal surgery in children in low-income and middle-income countries. BMJ Glob Health. 2016;1(4).
5. Tenge KRobert, Kituyi PW, Kerubo J. Neonatal surgical emergencies at Moi Teaching and Referral Hospital in Eldoret -Kenya. East Cent Afr J Surg. 2007;12(2):36–9.
6. Tefera E, Teka T, Derbew M. Neonatal gastrointestinal surgical emergencies: a 5- year review in a teaching hospital Addis Ababa, Ethiopia. Ethiop Med J. 2007;45(3):251–6.
7. Mohammed M, Amezene T, Tamirat M. Intestinal Obstruction in Early Neonatal Period: A 3-Year Review Of Admitted Cases from a Tertiary Hospital in Ethiopia. Ethiop J Health Sci. 2017;27(4):393–400.
8. Otim P, Elobu EA, Mbiine R, Kakembo N, Komakech D. The etiological spectrum of bowel obstruction and early postoperative outcome among neonates at a tertiary hospital in Uganda. World Journal of Pediatric Surgery. 2022 Jul 1;5(4).
9. Ogundoyin O, Olulana D, Lawal T, Ajao A. Outcome of management of neonatal intestinal obstruction at a tertiary center in Nigeria. Nigerian Journal of Surgery [Internet]. 2019;25(2):163. Available from: https://journals.lww.com/10.4103/njs.NJS_11_19
10. Farrokhkhani P, Farhadi R, Ala S, Mousavi SA. Etiology and Outcome of Intestinal Obstruction in Neonates: A 5-Year Investigation of Admitted Cases From a Tertiary Neonatal Intensive Care Unit in Northern Iran. Clin Med Insights Pediatr. 2023 Jan;17.
11. Saula PW. Outcomes of Newborns with Surgical Conditions at Moi Teaching and Referral Hospital: The Context of a Structured Standard Operating Procedure for Newborn Transport. 2021 Oct 22 [cited 2024 Feb 13]; Available from: http://localhost/xmlui/handle/123456789/5665
12. Njanwe PJ, Marete I, Ayaya S. Adherence to national healthcare referral guidelines and its effect on the management outcomes among children seen at a Teaching Hospital in western Kenya. East Afr Med J [Internet]. 2021 Mar 30 [cited 2024 Feb 21];98(1):3434–43. Available from: https://www.ajol.info/index.php/eamj/article/view/205339
13. pw saula, kombe Y.I, kikuvi G.M. characteristics of newborns with surgical conditions,referred to and seen at a tertiary-level hospital in western kenya. East Afr Med J. 2020;
14. Gupta DS. A Clinicopathological Study of Neonatal Intestinal Obstruction Pattern, Management and Various Outcomes in Babies Admitted in Tertiary Care Centre. Journal of Medical Science And clinical Research. 2018;6(4):1113–9.
15. Bhedi A, Prajapati M, Sarkar A. A prospective study of intestinal obstruction in

paediatric age group. International Surgery Journal. 2017;4(6):1979.
16. Ekenze SO, Ajuzieogu O V., Nwomeh BC. Challenges of management and outcome of neonatal surgery in Africa: a systematic review. Pediatr Surg Int. 2016;32(3):291–9.
17. Rehman S ur, Makki Y, Fazal Z, Babar TSN, Ishtiaq F, Fazal S. Pattern and outcome of neonatal gastrointestinal surgical emergencies: A prospective analysis. The Professional Medical Journal. 2021 Mar 10;28(03):415–21.
18. Nessa M, Khan SUDE, Islam ADMS, Hossein MS. Nessa, M., Khan, S. ud D. E., Islam, A. D. M. S., & Hossain, M. S. (2019). Neonatal Intestinal Obstruction Management Ten Years Experience in Combined Military Hospital, Dhaka. Journal of Armed Forces Medical College, Bangladesh, 14(1), 2. JAFMC. 2019 Jun;
19. Ikol KM, Saula PW, Gisore P, Mvungu E, Mwangi HR. Outcomes of neonates requiring surgical interventions in eldoret. Annals of African Surgery. 2019;16(1):20–5.
20. Deguchi K, Tazuke Y, Matsuura R, Nomura M, Yamanaka H, Soh H, et al. Factors Associated With Adverse Outcomes Following Duodenal Atresia Surgery in Neonates: A Retrospective Study. Cureus. 2022;14(2):1–14.