

**NEONATAL INTESTINAL OBSTRUCTION:
A 3- YEAR REVIEW IN A TEACHING HOSPITAL
ADDIS ABABA, ETHIOPIA**

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Lists of Abbreviations

AAU– Addis Ababa University

SHS- School of health science

A/S/LGA– Appropriate / Small/Large for Gestational age

ARM– Anorectal malformation

CHD- Congenital heart disease

GA– Gestational age

NEC– Necrotizing enterocolitis

NICU– Neonatal Intensive Care Unit

NIO– Neonatal intestinal obstruction

PDA- Patent ductus arteriosus

TASH– Tikur Anbessa specialized Hospital

TEF- Tracheoesophageal fistula

TPN– Total Parenteral Nutrition

SPSS– Statistical Package for social sciences

WHO– World Health Organization

Operational Definitions

Gestational age: calculated from LNMP and or by Ballard score when discrepancy occurs
Ballard score is used¹.

Low birth weight (LBW): neonate weighing less than 2500 grams¹

Neonate: newborn whose age ranges from birth to 28 days¹

Survival: survival to discharge from NICU.

Death: death of neonates in the NICU.

Low ARM: the rectum has descended through the sphincter complex¹

High ARM: the rectum hasn't descended through the sphincter complex¹

Delayed presentation: when a neonate presented after 48 hours of birth¹⁰

Abstract

Background: Intestinal obstruction is the most common surgical emergency in the newborn period. It is a life threatening condition with high mortality especially in developing countries. Neonates with intestinal obstruction require specialized care and facilities for survival.

Objective: We aim to study the etiology, presentation, outcome, and factors associated with mortality in the setting of Tertiary university hospital at Addis Ababa, Ethiopia.

Method: Records of all cases of NIO managed at TASH, NICU during the period of January 1, 2010 to December 31, 2013 were retrospectively reviewed and all the possible factors that may result in mortality were analyzed.

Results: Fifty-one neonates with intestinal obstruction were managed, representing 0.0058% of the neonatal admissions during the study period. Forty-one (80.4%) were males, 9(17.6%) were females (M: F=4.55:1), while one newborn had ambiguous genitalia. All patients presented within the first week of life. Anorectal malformation constituted 56.9% of the causes of NIO, while intestinal atresias including duodenal, jejunal, ileal atresias accounted for 13.7% of cases. Other causes included Hirschsprung's disease, intestinal malrotation, meconium plug, congenital band, paralytic ileus, blind sigmoid colon, and spontaneous gastric perforation. There were 10 deaths, with a mortality rate of 19.6%. Perioperative sepsis was significant determinant of mortality.

Conclusion: Early presentation, prevention and prompt management of sepsis is needed to decrease the high mortality seen in this study. There is a need for improved facilities including Intensive Care Units for pre- and postoperative management of neonatal intestinal obstruction.

Key words: Intestinal obstruction, neonates, anorectal malformation, intestinal atresia...

Introduction

Background:

Neonatal intestinal obstruction occurs 1 in 1500 live births. Common causes of neonatal intestinal obstructions are Anorectal malformation (ARM), Hirschsprung's disease (HD), duodenal and jejunal atresias, meconium ileus, and malrotation of the gut with or without volvulus. (1) Various conditions may cause intestinal atresias, including abnormalities of intestinal rotation during fetal life, leading to a decreased blood supply to the intestines and may result in atresia or stenosis. Neonatal intestinal atresias, especially duodenal atresia, seems to run in families even though responsible genes are not yet identified. Cardiac as well as renal anomalies occur in association with duodenal atresia in half of the cases. Down syndrome is also associated with duodenal atresia in 30-40% of cases. (2)

NIO may present with acute or chronic symptoms. Acute presentation may be from systemic upset due to shock. Neonates, with unrecognized intestinal obstruction deteriorate more rapidly than older ones and show an increased risk of associated morbidity and mortality. Surgical treatment also becomes more hazardous. Early diagnosis of NIO depends largely on the prompt detection of obstructive symptoms by the primary physician. The management of neonatal intestinal obstruction in low income countries remains challenging with poorer outcomes. The mortality rate associated in these countries ranges from 21% up to 45% which is quite large compared to the 15% in Europe. (3) Neonates with intestinal obstruction require specialized care and facilities for survival. (3) Factors attributing to the high mortality in low income countries include prematurity, late presentation, associated severe congenital anomalies and complications of surgery, compounded by lack of basic facilities to perform proper surgical management. (4)

Ideally, surgery on neonates should be done in an organized neonatal surgical unit with facilities of neonatal intensive care unit (NICU) including mechanical ventilator, total parenteral nutrition (TPN), neonatal anesthesia and specialized pediatric nursing care. (4)

Statement of the Problem

The mortality rate of neonates with intestinal obstruction has been reported as high in our setting. Tefera, et al reported in their retrospective study, that (45%) patients had imperforate anus and 37% of these neonates with imperforate anus died. Ninety percent (90%) of the patients who died had high type of imperforate anus. There were 12 neonates with jejunal-ileal atresia's out of which 66.6% died. (5)

There is no single study on the factors associated with this unacceptably high mortality in our setting. Even though NIO has been studied together with tracheoesophageal fistula and other neonatal gastrointestinal emergencies 12 years ago, by Tefera et al, the prevalence of NIO, clinical presentation and factors associated with mortality has not been known since then. In this study we will try to find the base line data together with the risk factors for death of cases.

Significance of the Study:

There is no data on the prevalence and factors associated with mortality of NIO reported from our setting. As reports on intestinal obstruction in neonates are scarce also in the subtropics, this study will give base-line information on demographic, clinical, and intervention characteristics, and factors associated with mortality of neonates with intestinal obstruction at TASH.

Research Questions:

What is the prevalence of NIO?

What is the common clinical presentation of NIO in the NICU of TASH?

What are the causes of NIO?

What are the intervention measures taken?

What are the determinants of mortality?

Literature Review:

Neonatal intestinal obstruction is a common emergency requiring surgical intervention in the newborn. Males are affected more than females, but the ratio is different among different studies. (4,6-8) The risk factor for any neonate with intestinal obstruction is delay in the diagnosis and operative intervention.(9) It was reported from one study that the average duration of presentation is delayed by 4 days.(6)

The most common cause of intestinal obstruction in the western countries as well as the developing countries is anorectal malformation. (6) In most studies, Hirschsprung's disease is the second common cause of NIO. (4-6, 8) Intestinal atresias are the third common cause of NIO. (4, 5, 7, 8) Duodenal and jejunoileal atresias occur in approximately equal numbers¹¹. Evaluating jejunoileal atresias de Lorimier, et al noted 19% type I, 31% type II, and 46% type III. (13) In the study done in Bangladesh type I & II has not been noticed, and type IIIa was the most common (50%). (8) Type IIIb accounts 40% of atresias⁸. Multiple atresia found to occur in about 10-20%. (8, 11) The other causes of intestinal obstruction include meconium plug, Malrotation, NEC, Obstructed hernia, colonic atresia, meconium ileus, and spontaneous perforation.(4,6-8)

Management of NIO includes initial stabilization of the patient followed by usually surgical or medical management. The surgical procedure depends on the type of intestinal obstruction. In the prospective study done by osifo et al, 38% of the neonates had colostomy, 33.8% had laparotomy, and 12.8% had anoplasty, while 15.4% were managed non-operatively. (4) Fifty eight percent neonates required incubator, 36.6% needed total parenteral nutrition, while 21.1% required pediatric ventilator. Financial constraint, late presentation, presence of multiple anomalies, aspiration, sepsis, gut perforation, and bowel gangrene were the main contributors to death. (4) Neonates with lower obstructions had a better outcome compared to those having upper intestinal obstruction. (4)

Ameh et al reported, Postoperative complications occurred in 16.8% of their cases including colostomy or ileostomy complications in 11.5%, wound infection in 3% and anastomotic dehiscence in 2%. The overall mortality was 21.1 %, 70% from overwhelming infection and 30% from respiratory embarrassment; the mortality from the various conditions were attributed for Hirschsprung's disease in 43%, intestinal atresia in 40%, incarcerated exomphalos in 40%, anorectal malformation in 18.5% and the only patient with volvulus died. (6)

Reoperation, postoperative bleeding and perioperative sepsis were significant determinants of mortality in the report of Adejuyigbe et al from Nigeria. In their review 28.6% of their cases died. (3) Higher mortality were reported in cases of necrotizing enterocolitis, and meconium ileus and delayed presentation and the lack of neonatal intensive care units at the time of the study were as the main factors, that resulted in high mortality in the report of Aljarrah et al. (7)

The pattern of survival of patients with NIO were reviewed at Khulna Shishu hospital Bangladesh, a Total of 172 (84%) cases survived. Overall mortality after initial surgical treatment was 16%. Prognosis of surgical treatment depended on early intervention, expert anesthesia, associated anomaly and complication, gentle handling of delicate tissue and intensive postoperative management. (6)

General Objective:

To study the pattern of admission, outcome, and factors associated with mortality of neonates with intestinal obstruction in Tikur Anbessa Specialized Hospital, neonatal intensive care unit

Specific Objectives:

- To describe clinical presentation of neonatal intestinal obstruction in Tikur Anbessa Specialized Hospital, neonatal intensive care unit
- To describe causes of neonatal intestinal obstruction in Tikur Anbessa Specialized Hospital, neonatal intensive care unit
- To describe the intervention measures taken
- **To assess** factors associated with mortality of neonatal intestinal obstruction in Tikur Anbessa Specialized Hospital, neonatal intensive care unit

Method and Materials

Study Site:

The study was conducted at Addis Ababa University, department of Pediatrics and Child Health, Neonatal ICU. The neonatal unit in TASH is the biggest neonatal center in the country. The unit admits neonates under the age of eight days and admits neonates born in the hospital as well as those from outside. It has two neonatologists and nurses trained in neonatal care. It is equipped with Incubators and CPAP machines. The unit didn't start respiratory support with mechanical ventilation and TPN which are important for neonates with intestinal obstruction. NIO cases are admitted to the unit in consultation with the pediatric surgeons who are operating these cases.

Study design and period:

This is a retrospective chart review of cases.

Study Population:

All Newborns who were admitted to NICU of TASH with intestinal obstruction from January 2011 to December 2013.

Sample size and sampling technique:

According to study done in Nigeria, where neonates with intestinal obstruction account for 24.3% of the neonatal admissions. (5) So P=0.24

Margin of error (d) = 0.05

With 95% confidence level

Formula used to determine the sample size =

$$N = \frac{(z / 2)^2 * P (1-P)}{d^2} = \frac{(1.96)^2 * P (1-P)}{(0.05)^2}$$

Based on the above assumption and using the following formula the sample size is calculated as:

$$n = \frac{(z * \alpha/2)^2 * P(1-P)}{d^2}$$
$$n = \frac{(1.96)^2 * 0.24(1-0.24)}{(0.05)^2}$$
$$n = \frac{3.8416 * 0.1824}{.0025}$$
$$n = 280$$

However, it is difficult to get this much number of cases of NIO with in the specified study period, thus we decided to study all neonates with intestinal obstruction visiting TASH NICU between January 2011 and December 2013.

Inclusion criteria-

All newborns who had intestinal obstruction during the study period with complete records.

Exclusion criteria-

NIO cases with incomplete records

Study variable

Dependent variable:

- Death of neonates with intestinal obstruction.
- Complication.

Independent variable:

Gestational age, birth weight, Sex, age at presentation, age at operation, Clinical Presentation, Type of intestinal obstruction, Type of intervention performed, type of delivery (vaginal/cesarean), type of gestation (singleton/multiple), presence of associated congenital anomaly, obstetric histories e.g.-poly or oligohydraminios etc.

Data collection

Records of cases was retrieved from the record office and their chart reviewed. Data was filled by the principal investigator. A structured questionnaire/checklist was used for data collection.

Data entry and Analysis

The collected quantitative data was first checked for its completeness and then data was coded, entered, and analyzed using SPSS version 20. Continuous variables will be transformed into categorical variables before they are analyzed. Both descriptive and

inferential analysis will be done. Chi-square test will be used to test statistical significance for categorical variables, and odds ratio and 95% CI will also be calculated. To control for confounders, significant variables will be entered and analyzed using multiple logistic regression. Here, only those variables with $P < 0.005$ in the univariate analysis will be entered for multivariate analysis.

Ethical Consideration

Ethical clearance was obtained from Addis Ababa University, DRPC. To secure the confidentiality of the respondents and participants, names or unique identifiers was not written on the record sheets.

Result disseminations

After conducting the research, the result of this study will be presented in the department's research defense day and also submitted. The results will be presented to the scientific community in the College of Health Science, AAU. The results of the study will also be presented in national and international conferences and also will be given for peer review for publication.

Results

Fifty-one patients presented with neonatal intestinal obstruction during the study period. Within the same period, a total of 8805 neonates were admitted for various conditions, with NIO representing about 0.0058 of the neonatal admissions. Of the 51 neonates who had neonatal intestinal obstruction, 41(80.4%) were males, 9(17.6%) were females, while one newborn had ambiguous genitalia (M: F=4.55:1). Their age group ranged from between 4 hours to 7 days (mean, 73 hrs.) and they weighed between 1620g to 3900g (mean, 2775g).

The gestational age ranged between 34-41 weeks (7 were preterm and 44 were at term). The mean gestational age was (38.24 weeks).

The most common causes of intestinal obstruction in neonates in this series were anorectal malformations, accounting for 56.9% (29 patients) of the cases. Sixteen (55.2%) patients had lower ARM while thirteen patients (44.8%) had upper ARM. The second commonest cause of NIO in this series were intestinal atresias which occurred in 7 (13.72%) patients. Of the seven neonates with intestinal atresias, three (42.28%) patients had jejunal atresia, three (42.28%) patients had ileal atresia, and one (14.28%) patient had duodenal atresia. Two of the jejunal atresias were type 1 and one was type 3A. One of the patients with ileal atresia was type 1, and the other 2 were type 3A and type 4. Other causes of NIO included Hirschprung's disease in six (11.8%) patients, intestinal malrotation and volvulus in three (5.9%), meconium plug in two (3.9%), congenital adhesion in one (2%), colonic atresia in one (2%), paralytic ileus secondary to hypokalemia in one(2%), and spontaneous gastric perforation in one (2%) patient (figure1).

A total of 14(27.5%) neonates presented with in the first 48 hrs. and the rest, 37(72.5%), presented after 48 hrs. but less than 7 days. Clinical presentations [Table 1] include failure to pass meconium in 32(62.7%) neonates, abdominal distension in 31(60.78%), vomiting in 29(56.86%), and fast breathing in 12(23.5%).

The average hospital stay was 9 days. Six (11.8%) patients 3 neonates with lower ARM, 2 with upper ARM, and 1 with duodenal atresia) had associated congenital anomaly. Two patients had Down syndrome and the rest 4 had VACTREL association. Multiple congenital anomalies including tracheoesophageal fistula (in two patients), ambiguous genitalia (in one patient), hypospadias (in one patient), and non-visualized right kidney (in one patient) were the associated congenital anomalies in patients with ARM. One baby with duodenal atresia and another one with high ARM had congenital heart disease (patent ductus arteriosus). [Table 2]

The hematocrit result at admission appeared to be within normal range in 36(70.6%) patients. Eight (15.7%) patients were anemic and of which four required blood transfusion before operation. One baby was polycythemic and the hematocrit result of six (11.8%) patients was not attached with their charts.

Surgical intervention was performed on 47(92.8%) of the 51 cases. Colostomy was done in 34(66.7%) neonates, anoplasty 1(2%), and laparotomy and resection and end to end anastomosis done in 12(23.5%). Four neonates (7.8%) weren't operated because 3 were critically sick and the fourth one was a newborn with meconium plug managed with rectal saline washout and improved. Postoperative complications included wound infection in 4(8.7%) neonates, aspiration in 1(2%) and apnea in 1(2%). One patient (2%) required re-operation. Antibiotics were started in 20(39.2%) neonates for sepsis.

Overall, ten (19.6%) of the 51 cases died, while 41(80.4%) cases were discharged improved. The deaths include, 7 with anorectal malformation (4 with upper ARM and 3 with lower ARM), 2 with intestinal atresia (1 with jejunal atresia and 1 with ileal atresia), and 1 with malrotation. Regarding case related outcomes, 7(24.14%) out of 29 cases with ARM died, 2(28.75%) out of the 7 cases with intestinal atresias died, and 1(33.3%) out of the 3 cases with malrotation died.

When subjected to statistical analysis, sex, prematurity, birth weight, duration of symptoms, duration of stay in the hospital, and the presence of congenital anomaly did not significantly influence the outcome but perioperative sepsis was significant contributor to mortality.

Figure 1: Causes of Neonatal intestinal obstruction in TASH, NICU, 2011-2013

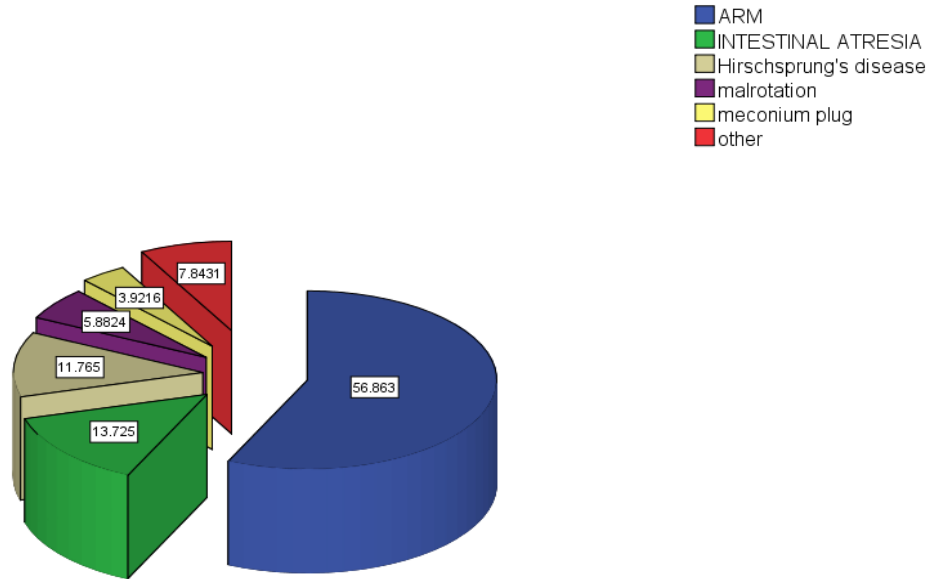


Table 1: clinical features and their relative frequency on arrival in neonates (n=51)

Clinical features	Frequency	Percentage
Failure to pass meconium	32	62.7
Abdominal distension	31	60.78
vomiting	29	56.86
Fast breathing	12	23.5
Congenital anomalies	6	11.8

Table 2. Association with other congenital anomalies in cases with Neonatal intestinal obstruction in TASH, 2011-2013

No.	Type of lesion	Number of cases with other anomalies	Type of associated anomalies
1	Anorectal malformation A. High type(13) B. Low type(16)	2(15.38%) 3(18.75%)	VACTREL association(4): TEF (2), congenital heart disease (PDA and atrial septum aneurysm) (1),ambiguous genitalia (1), hypospadias (1), vertebral anomaly(1), and non-visualized right kidney (1) Trisomy21(1)
2	Duodenal atresia(1)	1(100)	Trisomy 21, congenital heart disease (PDA)

Table 3: Comparison of mortality of the present study (2011-2013) and earlier study (1997-2001)

No.	Type of lesion	Mortality in the present study,2011-2013	Mortality in the earlier study, 1997-2001
1	Anorectal malformation A. High type B. Low type	4/13(30.77%) 3/16(18.75%)	9/17(52.94%) 1/10(10%)
2	Intestinal atresias A. jejunoileal B. duodenal	2/7(28.75%) 0/1	8/12(66.66%)
3	Hirschprung's disease	0/6	
4	malrotation	1/3(33.3%)	
5	Meconium plug	0/2	
6	others	0/4	

Discussion

NIO is a common indication for surgery in the newborn. During the study period in our center, NIO represented only 1 patient for every 167 neonates admitted to the NICU. The small share of neonates with NIO admitted may be because of these neonates are being admitted to the general NICU ward where both surgical and non-surgical patients were admitted, in contrast to other studies where neonates with NIO were admitted to surgical wards.

The male predominance in this report agrees with reports from other centers. (3-8)

The causes of NIO in an earlier study from the same Centre, were only ARM and intestinal atresias. (5) In the present study there were diverse cause of NIO including Hirschprung's disease in sixth (11.8%), intestinal malrotation and volvulus in three (5.9%), meconium plug in two (3.9%), congenital adhesion in one (2%), colonic atresia in one (2%), paralytic ileus secondary to hypokalemia in one(2%), and spontaneous gastric perforation in one(2%) patient, in addition to ARM and intestinal atresias which together accounted for 70.58 %(36 patients) of cases of NIO.

Although the present report showed decreased mortality over an earlier report from this center, the mortality rate associated with NIO is still very high in our setting compared with the developed countries. (3) Reasons for the present reduction in this report may be due to the recent establishment of pediatric surgical unit with pediatric surgeons and pediatric surgery fellows' in our center. Sepsis contributed significantly to mortality in this report, similar with the studies done in Nigeria. (3, 5, 6) In other studies, neonates with multiple anomalies, upper intestinal obstruction, and late presentation is associated with poor outcome. (4,6-8) However, it is very difficult to compare and conclude from our study as the number of cases is very small.

Finally, as this data was collected retrospectively from the medical records, some important variables may be missing. There were no follow-up data to indicate subsequent course of the patients who are discharged improved.

In conclusion, this study has shown unacceptably high mortality of neonates with NIO. Sepsis was the major determinant of mortality in neonates with NIO in this study. Early presentation, prevention and prompt management of sepsis is needed to decrease the high mortality seen in this study. In addition effort has to be exerted to improve facilities including Intensive Care Units for pre- and postoperative management of neonatal surgical emergencies. Early diagnosis at antenatal services using ultrasonographic techniques is also needed.

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Annex

**Questioner/Checklist
Part I- neonatal**

Age at admission----- (in hours)

Sex: Male Female

Gestational age: preterm term post term

Birth weight: _____

AGA, SGA, LGA

Singleton / multiple _____

Age at operation _____

Diagnosis

ARM

Upper

Lower

Hirschsprung's disease

Meconium ileus

Intestinal atresia

Duodenal

Jejunal: type _____

Ileal: type _____

Mal rotation

Necrotizing enterocolitis

Others (specify) _____

Presented with

- history of maternal polyhydramnios
- Bilious emesis
- Failure to pass meconium in the first day
- Abdominal distension
- Respiratory distress
- Other (specify) _____

Temperature at admission-----

Duration of symptoms less than 72 hrs more than 72 hrs

Diagnosis was made clinically plain abdominal x-ray Others (specify)

Associated congenital anomalies for Eg- Renal, Cardiac, CNS etc..

(Specify)_____

Hematocrit <45 45-65 >65

Creatinine normal elevated

Fluid/ electrolyte derangement yes no

Re-operation needed yes no

Post-operative bleeding yes no

Perioperative sepsis yes no

Type of operation no operation colostomy definitive surgery (end -to-end anastomosis) Others (specify) _____

Intestinal perforation present yes no

Post op complication

- Anastomotic leak
- Septicemia
- Wound infection
- Apnea
- Aspiration
- Others (specify)_____

Place of delivery in-born out-born

If out born where?

- Health center home
- Other hospital in the town outside the town

If out-born, distance from the hospital-----

If out born, way of transportation the infant:- With parents only with health professionals

Outcome: Survived died

For those who survived: -

Duration of presentation to hospital_____

For those who died: -

Age of death: less than 7days Greater than 7days

Possible cause of death_____

Part II- maternal

Maternal age _____

Parity of the mother _____

ANC: Yes No

Mode of delivery: SVD C/S instrumental delivery