OPERATIVE OUTCOME OF NEONATES WITH INTESTINAL OBSTRUCTION

A ONE YEAR PROSPECTIVE STUDY FROM JANUARY 2020 TO DECEMBER 2020 AT TIKUR ANBESA SPECIALIZED HOSPITAL

ADDIS ABABA, ETHIOPIA

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Table of Contents

Pages

Lists of Abbreviations

AAU–	Addis Ababa University
CHS-	College of health science
A/S/LGA–	Appropriate / Small/Large for Gestational age
ARM–	Anorectal malformation
HSD_	Hirschusprungs Disease
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
DRPC--	Department research and publication committee

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 grams

Neonate: newborn whose age ranges from birth to 28 days

Survival: survival to discharge from NICU/Wards.

Death: death of neonates in the NICU/Wards.

Delayed presentation: when a neonate presented after 48 hours of birth/symptom onset

Intestinal obstruction-presence (in a neonates) of the following cardinal features in various combinations as identified (by a trained clinician) at presentation to hospital or at any point during hospital stay: Abdominal distension, failure to pass meconium or stool, and/or vomiting and with or without supportive radiographic findings.

Management- clinical evaluation, investigations and treatment given to patients

Pattern- etiology and duration

Outcome- the eventual results of management of patients

The **primary** outcome measure was taken to be discharge or death after management, while **secondary** outcome measures was various complications occurring after surgical operations.

Abstract

Background

Neonatal intestinal obstruction (NIO) is one of the most common emergency conditions a pediatric surgeon is called upon to assess during the neonatal period. Successful management of NIO depends on timely diagnosis and referral for therapy**.** In developing countries, like Ethiopia, many challenges are encountered in managing these neonates and the outcomes remain poor. Despite TASH having been offering treatment for neonates with intestinal obstruction for many years, the pattern and outcomes (morbidity and mortality) of these patients remain unknown. This necessitates local research on this disease not only as an audit of our care but also to generate more information on this complex disease process.

The purpose/aim of this study was to review the pattern of intestinal obstruction in the neonatal period, its associated complications and outcome of management in order to determine factors associated with death of these newborns in TASH, Addis Ababa , Ethiopia.

Methodology

A Prospective describtive single-center study of neonates who were operated for intestinal obstruction at TASH were studied. Factors that determine post-operative outcome and associated morbidity and mortalities were analyzed in all patients.

Results: During the twelve months period, One thousand four hundred sixty babies were admitted at the pediatric ward and NICU. Eighty two (5.6%) of these were cases of neonatal intestinal obstruction. There were 59 males and 23 females, with male to female ratio of 2.5:1. The mean weight of the neonates was 2.7kg (range 1.5-4.0kg). The average age at operation was 6.8 days (1-34days), the mean duration of symptoms before presentation was 4.2 days. The major indication for operation was Anorectal malformation53 patients {64.6%}, Hirschsprung's disease11 {11.5%}, Intestinal atresia 15 patients {18.3%) }, malrotation 3 patients (3.6%). The overall mortality recorded in this study due to intestinal obstruction was 20.7% (17 patients). Severe sepsis with multi organ failure was ascribed for the death of 10(58.8%) of neonates.

Conclusion: The morbidity and mortality of neonatal intestinal obstruction in this hospital is due to the problems of late presentation and sepsis at presentation. The findings are at variance with those in developed countries

Introduction

Neonatal intestinal obstruction (NIO) is one of the most common emergency conditions a pediatric surgeon is called upon to assess during the neonatal period. Successful management of NIO depends on timely diagnosis and referral for therapy(6,7,11). The desired goal of healthy survival of neonatal intestinal obstruction requires a coordinated interaction of medical, nursing, and rehabilitative specialties in an organized team(3). Early surgical intervention is paramount and may mean all the difference between intestinal salvage and crippling short gut syndrome. Intestinal obstruction can be complete (atresia, anorectal
malformation (ARM)) or incomplete (stenosis, web)(17). The commonest reported causes of bowel obstruction in order includes anorectal malformations, duodenal atresia, jejunoileal atresia, Hirschsprung's disease, meconium ileus and meconium plug syndrome [1]. Proximal obstruction presents with earlier vomiting and less abdominal distention, whereas distal bowel obstruction lends itself to late emesis and greater abdominal distention(10,17). Through advancements in surgical technique, neonatal anesthesia, neonatal intensive care, and total parenteral nutrition(TPN), significant progress has been made in the management of neonates with intestinal obstruction(17). However, in Africa, late presentations and poor resources lend to a mortality of up to 50%(6). The management of neonatal intestinal obstruction in low income countries remains challenging with poorer outcomes(8,12). The mortality rate associated in these countries ranges from 21% up to 45% which is quite large compared to the 1.5% in Europe(3,14). Despite improvements in care, neonatal intestinal obstruction continues to provide a diagnostic and treatment challenge for clinicians.

Statement of the problem

Neonatal Intestinal obstruction contributes to a sizable proportion of all neonates admitted to pediatric surgical wards and has remained a common diagnosis over the years. The incidence of NIO is approximately 1 in 1500-2,000 live births. The true incidence in Africa is unknown, but a recent report from Nigeria has

shown that it is still the most common neonatal surgical emergency. Samuel et al [3], in Aba, Nigeria emphasized problems of late presentation and poor

neonatal ICU care facilities. The outcomes in these patients vary from centre to centre as demonstrated in various researches and are influenced by patient and institutional factors.

In developing countries, like Ethiopia, many challenges are encountered in managing these neonates and the outcomes remain poor. Despite TASH have been offering treatment for neonates with intestinal obstruction for many years, the **pattern** and **outcomes** (morbidity and mortality) of these patients remain unknown. This necessitates local research on this disease not only as an audit of our care but also to generate more information on this complex disease process.

The purpose of this study is to review the pattern of intestinal obstruction in the neonatal period, its associated complications and outcome of management in order to determine factors associated with death of these newborns in TASH, Addis Ababa , Ethiopia.

Significance of the study

Neonatal Intestinal obstruction is a common surgical emergency in many parts of the world. It leads to significant but variable levels of morbidity and mortality. While the general subject of Neonatal intestinal obstruction has been widely researched and published on in different parts of the world, developing countries have contributed little to this body of knowledge. In line with this, only scanty data is available on the outcomes in such patients managed in TASH which has been the only center in Ethiopia. The causes are multiple, with different parts of the world reporting different patterns of this condition. This variation in patterns may partly explain the variability in outcomes reported in different regions of the world. Furthermore, the patterns of intestinal obstruction keep changing over time and this necessitates periodical studies in each region to evaluate the trend. This study aimed at determining the current patterns, related outcomes and the factors influencing such outcomes in cases of neonatal intestinal obstruction at

the TASH. The information generated will not only be useful to the TASH in its quest to improve patient care but also contribute to the body of knowledge in management of this common and yet challenging surgical emergency.

Research Questions:

What is the pattern, management and outcomes in neonates with intestinal obstruction at TASH?

What are the intervention measures taken and determinants of mortality?

Literature review

Intestinal obstruction is a common surgical emergency in the neonate and occurs in approximately 1 in 2,000 live births(1). 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)

Causes of Intestinal obstruction is classified as “high anatomic” when the level of obstruction is proximal to the mid portion of the jejunum and “low anatomic” when the level of obstruction is distal to that(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 numbers 11. 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) In Ethiopia, the most common causes of neonatal intestinal obstruction are ARM(56.9%),Intestinal atresias(13.7%),HSD(11.8%) followed by malrotation and volvulus(5.9%).(2)

Clinical presentation in neonatal bowel obstruction may include bilious emesis, failure to pass meconium, and abdominal distension; the sequence of appearance of symptoms varies depending on the level of the obstruction.(1) In a research done in Nigeria,almost all neonates presented with abdominal distension(100%),failure to pass meconium(77%),vomiting(74%),respiratory compromise(55%) and hypermia of abdominal erythema(55%).(3)This findings are comparable to a research done in Ethiopia.(3)

When a bowel obstruction is suspected in a neonate, the initial imaging study of choice is an abdominal radiograph, which may direct further imaging or clinical workup. The classical plain radiological features of multiple air-fluid levels, bowel distension, absent rectal gas, gasless

lower abdomen were diagnostic and suggestive of the sites of obstruction in 40% neonates.(3) Hirschprung's disease required rectal biopsy and histopathological confirmation

When neonatal intestinal obstruction is suspected, management at a tertiary care center with a large volume of neonatal surgery and dedicated pediatric surgical and anesthesia expertise is ideal. A critically ill neonate requiring surgery should be transported emergently by a specialized neonatal transport team after initial resuscitative measures, which may include elective intubation. Most patients also need intravenous fluid and dextrose administration, gastrointestinal decompression with a large-gauge nasogastric suction catheter (replogle), as well as withholding of oral feeds until further evaluation and assessment. Maintenance of temperature is vital in this population, especially if the infant is premature. Constant monitoring of perfusion, blood pressure, blood glucose, electrolytes, and acid–base status should occur, with corrective measures instituted as needed.

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) The major indication for operation was anorectal malformation 32 patients {59.3%}, Hirschsprung's disease 10 {18.5%}, Intestinal atresia 8 patients{14.8%}, obstructed hernia 4 patients{7.4%}.(nigeria) Colostomy fashioning was the commonest procedure performed in 32 (33%) of the patients for high anorectal malformation and Hirschsprungs disease followed by anoplasty for low anorectal malformation in 10,intestinal atresia repair in 8 and herniotomy in 6.(9)

In a research done by Mohammed Ethiopia, Surgical intervention was performed on 92.8% of neonates with intestinal obstruction cases. Colostomy was done in 66. 7% neonates, anoplasty 2%, and laparotomy and resection and end to end anastomosis done in 23.5%. (2)

During a mean follow up of 3months {1week to 9months} procedure related complications occur in 12 patients (22.2%} Infective conditions (peristoma excoriation, surgical site infection, wound breakdown) accounted for the greater number of morbidity (n=10, 83%), followed by anaesthesiarelated complications (n=2, 17%) as shown.(3) Six patients died {mortality of {11.1%}.(3) The following factors contributed to mortality (age at presentation, the body weight

and gestational age). However, the non-survivors had a longer delay before presentation (>48hours), lower body weight (<2 kg) and gestational age <38weeks(2,3)

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 Adejuyibge et al form 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)

Postoperative complications included wound infection in 8.7% neonates, aspiration in 2% and apnea in 2%. One patient (2%) required re-operation. Antibiotics was started in 39.2% neonates for sepsis.(2) 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 1with 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.

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 numbers 11. 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)

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Objectives

General objective

- To evaluate operative outcome of neonates with intestinal obstruction who managed surgically at TASH.

Specific objectives

- To find out different causes and clinical presentations of neonatal intestinal obstruction at TASH.
- To describe intervention measures taken and various outcomes of neonatal intestinal obstruction at TASH.
- To determine factors associated with various outcomes of surgically managed neonatal intestinal obstruction at TASH.

Method and Materials

Study Site:

The study was conducted in Addis Ababa University, department of Surgery, Unit of pediatric surgery at Neonatal ICU and pediatric wards. 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. Those neonates above 8 days old are admitted to pediatric wards. The neonatal ICU 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 neonatal unit and wards after evaluated by pediatric surgery residents after consultation with the pediatric surgeons who are responsible on operating these cases.

Study design and period:

This was a one year prospective study from January 1,2020 to December 30,2020

Study Population:

All Neonates who were admitted to NICU and pediatric wards and operated for intestinal obstruction at TASH from January 2020 to December 2020.

Sample size determination

$$n = \frac{Z^2 P (1-P)}{d^2}$$

Where,

n is the sample size

Z^2 is the abscissa of the normal curve that cuts off an area at the tails (equals the desired confidence level, e.g., 95%),

p is the estimated proportion of an attribute that is present in the population. According to study done in Nigeria, where neonates with intestinal obstruction account for 6.75% of the neonatal admissions. So P=0.0675

Z = 1.96 at α = 0.05d is marginal error

$$n = \frac{(1.96)^2 \times 0.0675(1-0.0675)}{(0.05)^2} = 96.72 \text{ rounded up to } 97$$

Adjusting for non-response by 15% gave sample size of **112** participants.

However a total of 82 neonates who fulfill the inclusion criteria on specified period of time were included in the study

Inclusion criteria-

All neonates who were admitted and operated for a diagnosis of intestinal obstruction at the TASH during the course of the study.

Exclusion criteria-

1. All neonates with intestinal obstruction who were operated on in other hospitals and referred to TASH for further care
2. Parents or care giver who declined to give consent

Study variable

Dependent variable:

- Death of neonates with intestinal obstruction.
- Complication.

Independent variable:

Gestational age, birth weight, Sex, age at presentation, duration of illness, age at operation, Clinical Presentation, Type of intestinal obstruction, delay in surgical intervention,, Intraoperative accidents, Type of intervention performed, type of delivery (vaginal/cesarean), presence of associated congenital anomaly, obstetric histories e.g.-poly or oligohydraminios etc.

Outcome measures

The **primary** outcome measure was taken to be discharge or death after management, while **secondary** outcome measures were various complications occurring after surgical operations.

Data collection

Records of cases were collected at admission, during operation, during hospital stay and at time of discharge from operating surgeon and their charts. Data were 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 23.0. Continuous variables were transformed into categorical variables before they were analyzed. Both descriptive and inferential analysis were done. Chi-square test was used to test statistical significance for categorical variables, and odds ratio and 95% CI was also calculated. To control for confounders, significant variables were 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.

Quality control

The principal investigator checked completeness of data, oriented all other colleagues involved in the study and communicated the progress of the study with advisors at all important steps.

Ethical Consideration

Ethical clearance was obtained from Addis Ababa University, DRPC. In addition permission letter was received from medical director of TASH. To secure the confidentiality of the respondents and participants, names or unique identifiers were 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.

Result

A total of 82 neonates who underwent surgery for the diagnosis of intestinal obstruction were included in the study. Among them 26 were preterm and 56 were term. There were 59(72%) males and 23(28%) females with male to female ratio of 2.5 to 1. Sixty five patients were born vaginally and 12 by cesarean section while 5 patients born assisted with instruments. During ANC follow up only 5 mothers had polyhydraminous on prenatal ultrasound.

The mean gestational age was 37.9±0.27 (range 31-42 wks). The mean gestational ages in those who survived and in those who died were 37.65 and 35.44 respectively (p=0.001).

The mean age at presentation in our series was 5.1 days (range 6 hrs.-26 days). Among those 64(78%) presented in early neonatal period(0-7 days) and the remaining 18(22%) presented after 7 days of age.The mean ages at presentation in those who survived and in those who died was 5.5 days (range 5 hrs. to 26 days) and 3.65 days (range 7 hrs.-12 days) respectively. The mean age at operation was 6.8 days which ranged from 12 hours to 34 days.

The mean weight at presentation in our series was 2747g (range 1500-4000g). The mean weights at presentation in those who survived and in those who died were 2859±64g (range 1900-4000g) and 2318±137g (range 1600-3500g) respectively.

Clinical presentation

Clinical presentation included abdominal distension, absent anal opening, vomiting and failure to pass meconium. Abdominal distention was the most common presenting symptom (Table 1). Mean duration of symptoms in our series was 4.21 days (range 12 hrs-24 days). The mean duration of symptoms in those who survived and in those who died were 4.46±0.59 days (range 1-24 days) and 3.24±0.53 days (range 1-8 days) respectively.

Graph 1 Frequency of Clinical symptoms

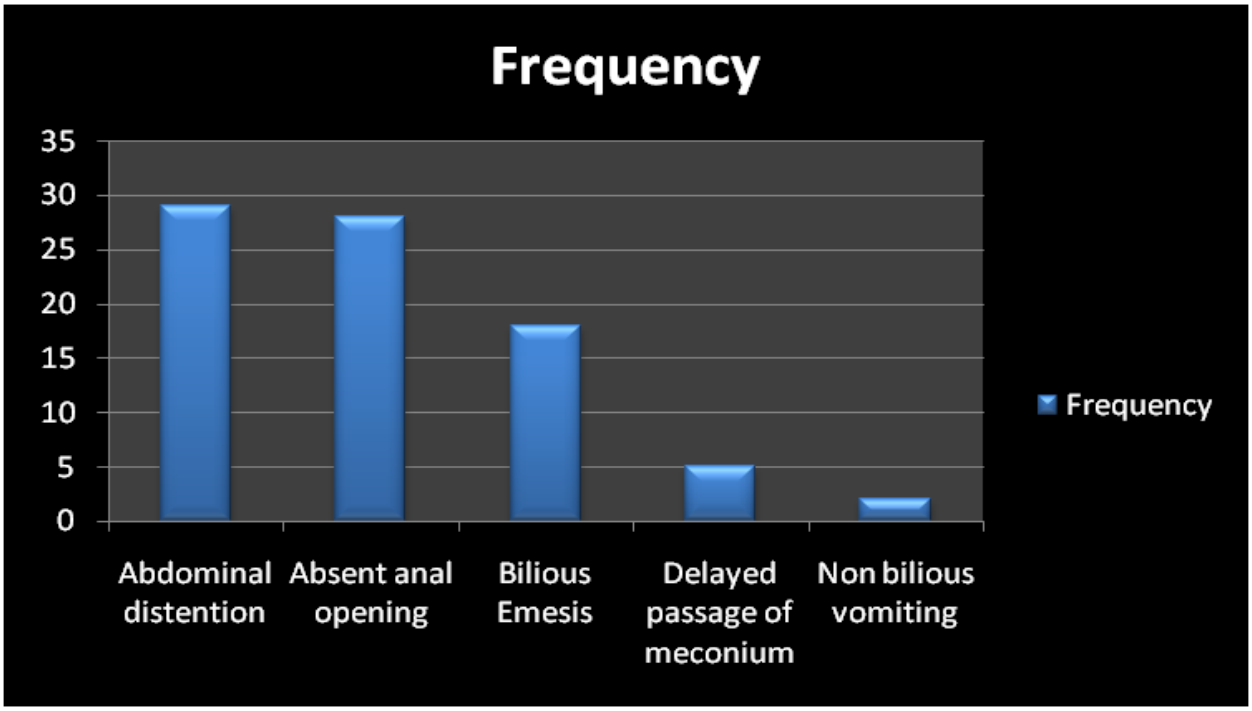


Table 1 frequency of clinical symptoms

Clinical symptoms		Frequency	Percent
1	Bilious emesis	18	22.0
2	Non-bilious emesis	2	2.4
3	Failure to pass me conium	5	6.1
4	Abdominal distension	29	35.4
5	Absent anal opening	28	34.1
	Total	82	100.0

Diagnosis

Thirty six (43.9%) of patients in our study were hypothermic at time of presentation and 10 (12.2%) were febrile. The mean body temperature (axillary skin) at presentation was 36.3^0C with range of 34-39.2^0C. Forty (48.8%) patients from our series were thrombocytopenic less than 150000 out of which 8 (9.8%) were severely thrombocytopenic less than 50000.

From 82 patients,48 (58.5%) patients had baseline serum electrolyte determined at time of presentation. Out of those who had serum electrolyte, the potassium level was normal in 26 (54.2%), hyperkalemic in 19(39.5%) and hypokalemic in 3 (6%) patients.

Serum potassium level and platelet count at presentation had significant association with morbidity and mortality of neonates with intestinal obstruction who underwent surgery from our series with p-value of 0.025 and 0.001 respectively

The combination of clinical and radiologic assessment was required for diagnosis of intestinal obstruction in some of the cases. Thirty one(37.8%) patients had plain radiograph for the diagnosis.

Table 2 Plain abdominal x-ray findings

Findings	Frequency	Percent
Dilated small or large bowel loops	15	48.4
double bubble sign	8	25.8
dilated stomach and proximal small bowel	3	9.7
pneumoperitoneum	1	3.2
other nonspecific feature(coiling of NGT, nonspecific gas pattern)	4	12.9
Total	31	100.0

Ultrasound

Out of 82 patients 50 (61%) had abdominal ultrasound scan for either diagnostic purpose or for search of associated anomalies. Among those who were scanned, 32(64%) had normal scan while hydronephrosis either unilateral or bilateral detected in 9(18%) and 5(10%) one of the kidney not visualized(agenesis). Overall renal anomalies were identified on ultrasound in 15(30.6%) patients with ARM who had abdominal scan. Forty nine (92.5%) of ARM patients had abdominal ultrasound as screening tests before or after surgical intervention for obstruction.

Table 3 Ultrasound finding

Ultrasound finding	**Frequency**	**percent**
Normal	32	64
Hydronephrosis(uni/bilateral)	9	18
Non-visualized one kidney	5	10
Crossed ectopia	1	2
Lower abdominal cystic structure filled with fluid(hydrometrocolpos)	2	4
Whirloop sign with reverse position of SMA and SMV	1	2
Total	50	100

Echocardiography

Among those who deserve screening work up for cardiac anomalies (ARM patients) only 25(47.2%) had pre- or post-operative echocardiography. From those ARM patients who had echocardiography,20(80%) had congenital heart disease diagnosed. The most common cardiac anomalies identified were Patent ductus arteriosus(PDA) which account for 6(24%) followed by Ventricular septal defect 5(20%) and atrial septal defect 4(16%).

Table 4 Echocardiogram finding

Echo- finding	Frequencies	Percent
Patent ductus arteriosus	6	24
Ventricular septal defect	5	20
Atrial septal defect	4	16
Patent foramen ovale	3	12
Tetralogy of Fallot	1	4
Severe valvular pulmonary stenosis	1	4
Normal	**5**	**20**
Total	25	100

Other associated gross congenital anomalies

Other associated anomalies which were identified include down syndrome(5), Tracheoesophageal fistula(2), Club foot(1), Hypospadia(1) and Hypothyroidism(1)

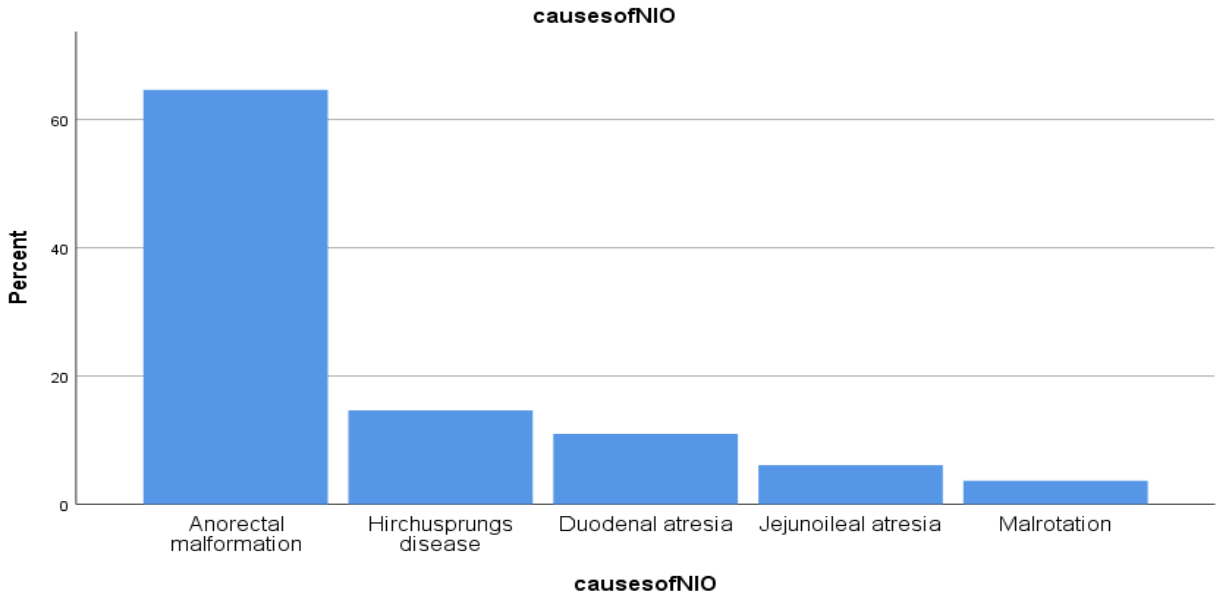
Causes of Obstruction

The causes of NIO in our series are shown in Table . ARM was the most common cause of NIO in our series, present in 53 (64.6%) neonates of which 44 survived and 9 died. Jejuno-ileal atresia (JIA) was seen in 5 (6.1%) and duodenal atresia (DA) in 9(11%) neonates. The commonest type of jejunoileal atresia was type-II 3(60%) while type-IV diagnosed in 2(40%). Type-I duodenal atresia accounts for majority 5(55.5%) while 3(33.3%) were type-II. One patient diagnosed to have annular pancreas with atresia. Malrotation was seen in 3 neonates of which 2 had midgut volvulus at laparotomy. Hirschsprung's disease was seen in 11 neonates out of which 2 presented with features of perforation peritonitis and 9 with large bowel obstruction. Out of 82 patients 6(7.3%) presented with perforation of certain segment of the bowel. From those with perforations 3 were ARM patients, 2 were HSD and remaining 1 patient was ileal atresia

Table 5 Causes of NIO

Causes		Mean		
		Age(d)	GA(wk)	BW(g)
ARM	?without fistula	3.00	38.11	2847
	RUF	4.63	37.00	2595
	Perineal fistula	5.95	38.00	2825
	RVF	8.16	36.67	2633
	Persistent cloaca	3.33	37.67	2603
	Pouch colon	1.41	38.00	2986
	Rectal atresia	3.50	36.00	2800
HSD		10.09	38.73	3204
Duodenal atresia		1.78	34.44	2023
Jejunoileal atresia		5.40	36.60	2760
Malrotation		8.00	37.67	3013
Internal hernia with obstructing band		12.00	38.00	2700
Total		5.18	37.34	2745

Graph 2 Causes of Intestinal obstruction



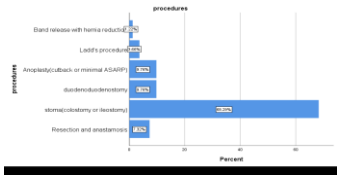
Surgical procedure Done

As regards surgical procedures, stoma formation (colostomy or ileostomy) was done in 56(68.3%) neonates, resection and anastomosis in 6(7.3%), Duodenoduodenostomy in 8(9.8%), Anoplasty 8(9.8%), Ladd's procedure in 3(3.7%) and Band release with hernia reduction done in 1 patient. Division of obstructing omphalo-mesenteric band and excision of meckel's diverticulum done in two patients who under gone stoma construction for ARM.

Table 6 Type of procedure performed

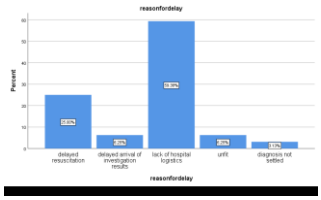
Procedure	Frequency	Percent
stoma(colostomy or ileostomy)	56	68.3
Duodenoduodenostomy	9	11
Anoplasty(cutback or minimal ASARP)	8	9.8
Resection and anastamosis	5	6
Ladd's procedure	3	3.7
Band release with hernia reduction	1	1.2
Total	82	100.0

Graph 3 Type of procedures



The mean time gap between admission and surgical intervention was 1.61±0.195 days (Range from less than 1 day to 9 days). There was a delay in surgical intervention after decision made to operate in 32(39%) of case with the reason behind were lack of hospital logistics in 19(59.4%), delayed optimization of the patient in 10(31.3%) and delay in arrival of investigative results 1n 3(9.3%). The time interval between admission and surgical intervention was not a statistically significant risk factor for mortality in our series.

Graph 4 Reason of delay



Anesthetic related complications

Anesthetic related complications occurred in 28(34.1%) of patients in our series. Intra operative bradycardia and desaturations account for majority of complications accounting for 16 (69.5% of the complications). Delayed awakening more than one hour seen in 5(21.7%) patients. In 76 (92.7%) of patients in our study, surgery performed under GA with ETI while in 6 (7.3%) of cases sedation used to perform the procedures.

Table 7 Anesthetic related complications

Anesthetic related complications			
Complications		**Frequency**	**Percent**
	Aspiration	1	4.4
	Desaturation	8	34.7
	Bradycardia and/or cardiac arrest	8	34.7
	Difficult intubation	1	4.4
	Delayed awakening	5	21.8
	Total	23	100.0

Intra OP events

Nine(11%) patients required intra operative transfusion while 19 (23.2%) needed inotropes intra operatively for stabilization. Steroid administered for 21 (25.6%) of patients in our series. However, on statistical analysis, intraoperative transfusion was not a statistically significant risk factor for mortality in our series but administration of inotropes and steroids intraoperatively had significant association with mortality.

The mean duration of surgery in our study was 1.48 hours (range 0.30 -3.00 hours). The mean duration of surgery in those who survived and in those who died was 1.39 (range 0.30 -3.00 hours) and 1.84 (range 0.40 -3.00 hours) respectively. The duration of surgery was subjected to statistical analysis and statistically significant predictors of mortality in our series.

Most of the surgeries (55(67.1%))performed by junior pediatric surgery resident while senior pediatric surgery residents and fellows involved in 27 (32.9%) of surgeries. However there was no statistical significance on the outcome of the surgeries but the association was statistically significant on post operative complications.

Patient disposition after surgery

After the surgery most neonates transferred to NICU 66(80.5%) while the remaining 16(19.5%) transferred to wards. Those neonates which were transferred to wards are more likely to develop morbidity but the mortality had no association.

The mean duration of NPO time post surgery was 1.90 ± 0.22 days (rang from 4 hours -8 days). All patients were initiated on post OP IV antibiotics with mean duration been 7.86 days(range 2 - 40 days).

Post OP complications

During the hospital stay period 59 (72%) patients developed at least one procedure related or non- procedure related complications. At least one rocedure related complications seen in 40 (48.7%) of patients. The commonest procedure related (surgical) complications developed postoperatively were surgical site infection(wound)in 19(23.2%), parastomal skin excoriation 5 (6.1%), persistent post operative ileus in 7 (8.5%) and colostomy site mucosal ischemia seen in 4 (4.9%). The other procedure related complications identified were Intra abdominal abscess collection in 2(2.4%), anastamotic leak 2(2.4%) and post operative bleeding from colostomy site in 1 and from rectal biopsy site in another 1 patient.

Among non-procedure (medical) related complications sepsis with or without meningitis accounts for majority of the cases which was diagnosed in 43(52.4%) patients. Episodes of post operative apnea seen in 6 (7.3%) patients while hospital acquired infection developed in another 6(7.3%) of patients.

Table 8 Surgical complications

Surgical Complications	Number of patients	Percent
wound infection	19	23.2
persistent ileus	7	8.5
Parastomal skin excoriation	5	6.1
colostomy mucosal ischemia	4	4.9
Intra abdominal abscess	2	2.4
Anastamotic leak	2	2.4
Post OP bleeding	1	1.2
Total	40	48.7%

Table 9 Total Post OP complications

		Frequency	Percent
	yes	59	72.0
	no	23	28.0
	Total	82	100.0

Table 10 Medical complications

Medical complications		Frequency	Percent
	No complication	25	30.5
	Apnea	6	7.3
	Hypothermia	2	2.4
	HAI	6	7.3
	Sepsis with or without meningitis	43	52.4
	Total	82	100.0

Among those who developed post operative complications 8 (9.6% of total) needed re-exploration for different complications they developed after the procedure. Re-exploration performed on 6 (7.2%) while 2 (2.4%) patients were not operated because of their critical clinical status.

Table 11 Reoperation

Reason for reoperation	Number	Percent
anastamotic leak	1	1.2
bleeding from colostomy site	1	1.2
intraabdominal collection	1	1.2
post OP collection	1	1.2
wound dehisence	2	2.4
Total	6	7.2

The mean duration of stay in the hospital in our series was 10.17 days (range 2-42 days). The mean duration of stay in those who survived despite the complications they develop was 12.95 days (range from 4- 37 days) and in those who died was 9.11days (range 2-42 days).

Mortality

The overall mortality recorded in this study due to intestinal obstruction was 20.7% (17 patients) while 79.3%(65) patients discharged improved. The mortality was 82.4% in neonates less than 7 days old and 17.6% among subjects aged >7 days. Majority of neonates who died were males accounting 64.7%(11patients).

The mortality rates among term and pre-term babies were 8.9% (5/56) and 42.3% (11/26) respectively (p=0.07).

Table 12 Eventual outcome

		Frequency	Percent
	alive	65	79.3
	dead	17	20.7
	Total	82	100.0

Table 13 Mortality based on age range

		Frequency	Percent
	less than 7 days	14	82.4
	more than 7 days	3	17.6
	Total	17	100.0

Table 14 Mortality in proportion to Sex of neonates

		Frequency	Percent
	Male	11	64.7
	Female	6	35.3
	Total	17	100.0

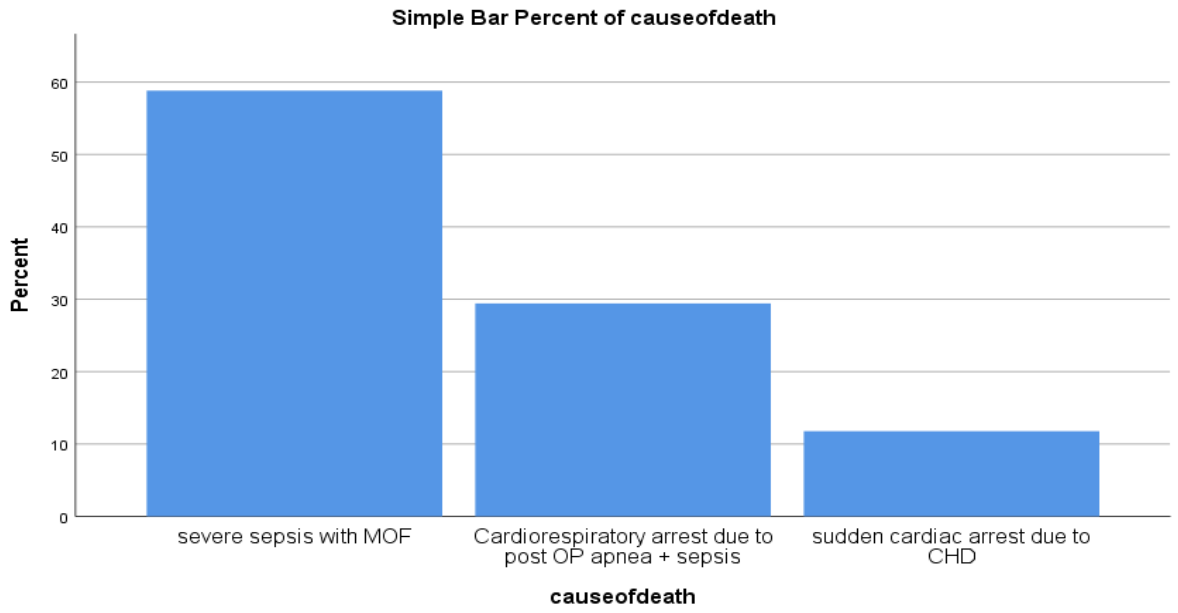
Case specific mortality rate

Sr.	Diagnosis/probable diagnosis	Survived	Died(%)	Total
1	Anorectal malformations	44	9(17%)	53
2	Duodenal atresia	5	4(44.4%)	9
3	Hirschsprungs disease	11	1((8.3%)	12
4	Jejunoileal Atresia	3	2(40%)	5
5	Malrotation	2	1(33.3%)	3

Cause of death

Severe sepsis with multi organ failure was ascribed for the death of 10(58.8%) of neonates and cardiorespiratory arrest as result of post OP apnea on top of sepsis identified in 5(29.4%). Congenital heart diseases were the reasons for the death of 2(11.8%) of neonates who underwent operative intervention for intestinal obstruction.

Cause of death			
		Frequency	**Percent**
	severe sepsis with MOF	10	58.8
	Cardiorespiratory arrest due to post OP apnea + sepsis	5	29.4
	sudden cardiac arrest due to CHD	2	11.8
	Total	17	100.0

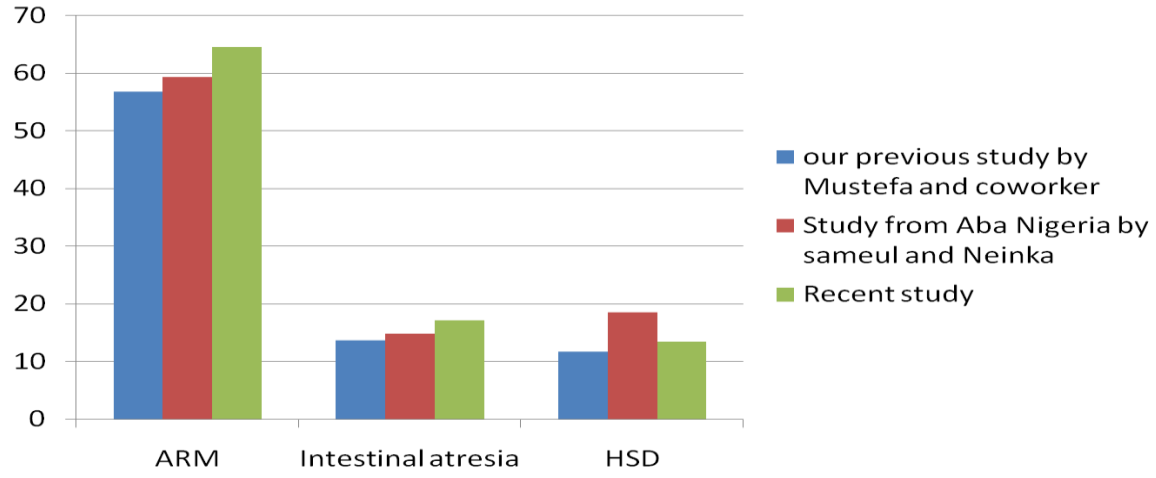


Discussion

Neonatal intestinal obstruction (NIO) is one of the most common emergency conditions a paediatric surgeon is called upon to assess during the neonatal period. Successful management of NIO depends on timely diagnosis and referral for therapy. The diagnosis is based on history (symptoms) and physical examination (signs) confirmed by some investigations such as radiographic and histopathological studies. This series analyzed 82 neonates under 28 days of age who underwent surgery for different causes of intestinal obstruction. Among the causes Anorectal malformation is the most common diagnosis.

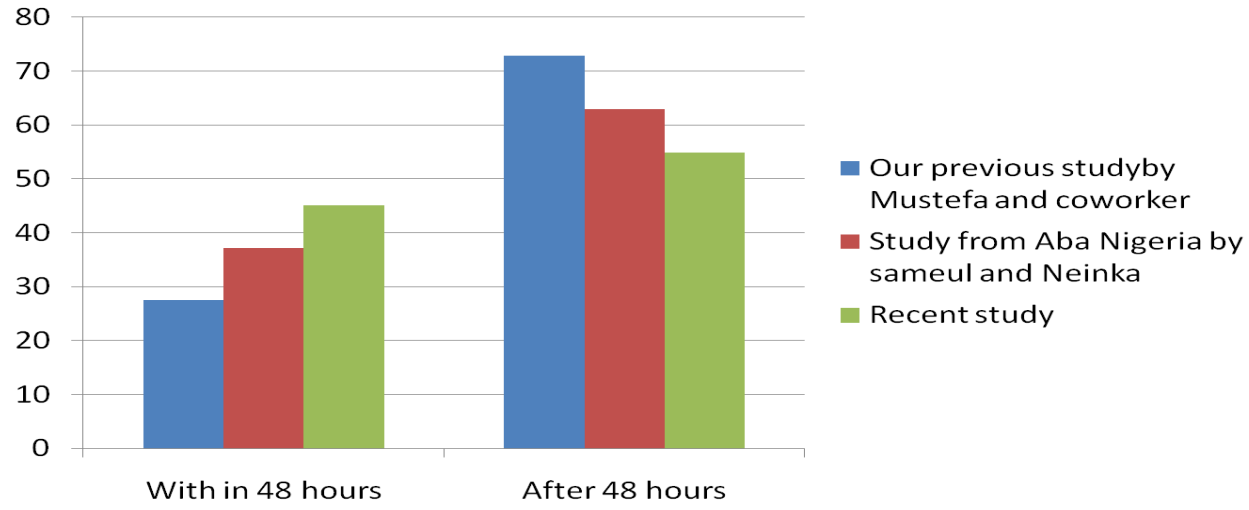
The commonest cause of neonatal intestinal obstruction in this report is anorectal malformations (64.6%) followed by intestinal atresia (17.1%) and Hirschsprung's disease(13.4%), similar findings was noted from the previous study in the same institution by Mustefa Mohammed and co-workers(1) . These findings are in contrast to those by Samuel Chidi Ekpemo1, Nneka Okoronkwo from Aba Nigeria where anorectal malformation, Hirschsprung's disease and intestinal atresia respectively in that order are the common causes. In developed countries, intestinal atresia is a common cause of congenital intestinal obstruction (7-8) and accounted for one third of causes of neonatal intestinal obstructions in one report [8]. However, intestinal atresia accounted for 17.1% in this series while In Zaria, however, only 6.7% of cases of neonatal intestinal obstruction are due to intestinal atresias.

Graph.. Causes of intestinal obstruction compared



The male preponderance, noted in our series, has been observed by other too [7,8, 10]. The mean age at presentation in this report was 5.1 days, and majority of patients with intestinal obstruction presented particularly late. This is similar to other reports from Nigeria (2-5) but less than the previous study by Mustefa Mohammed and co-workers(1) which is probably due to better awareness of primary care physicians about neonatal obstruction and possibly better referral system from previous trend.

Graph... proportion of early and late presentation compared

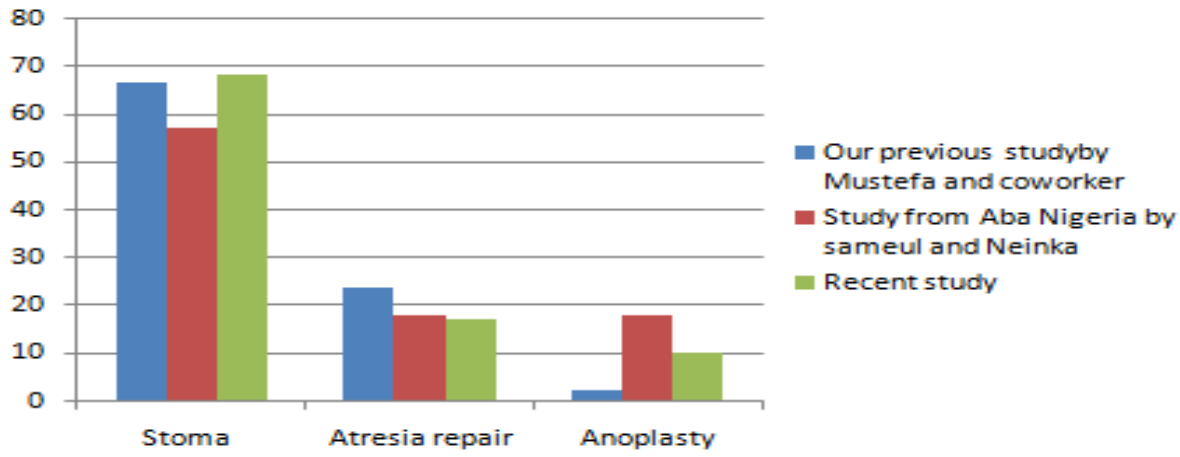


The most common Clinical presentation included abdominal distension, vomiting and failure to pass meconium, which is similar to findings reported by Osifo et al in Benin Nigeria and previous study. Plain supine and erect abdominal radiographs are frequently the only investigations necessary for the confirmation of intestinal obstruction in neonates (11-13), contrast studies being reserved for diagnostic difficulties, and then in the absence of acute peritoneal findings.

Stoma creation (whether colostomy or ileostomy) was the commonest procedure performed in 56 (68.3%) of the patients for anorectal malformation and Hirschsprungs disease followed by intestinal atresia repair in 14(17.1%) and anoplasty for low anorectal malformation in 8 (9.8%) patients in this series as shown in Table . Similarly, Mustefa Mohammed and co-workers [1] in same institutions Surgery performed were Colostomy, anoplasty, resection with end-to-end anastomosis were done in 34 cases (66.7%), 1 (2%) and 12 (23.5%) of the cases, respectively in

their series. There was a delay in surgical intervention after decision made to operate in 32(39%) of case with the reason behind were lack of hospital logistics in 19(59.4%), delayed optimization of the patient in 10(31.3%) and delay in arrival of investigative results 1n 3(9.3%). These avoidable reasons for unnecessary delay in surgery can be addressed thus decreasing morbidity and mortality.

Graph..... Types of procedure done compared

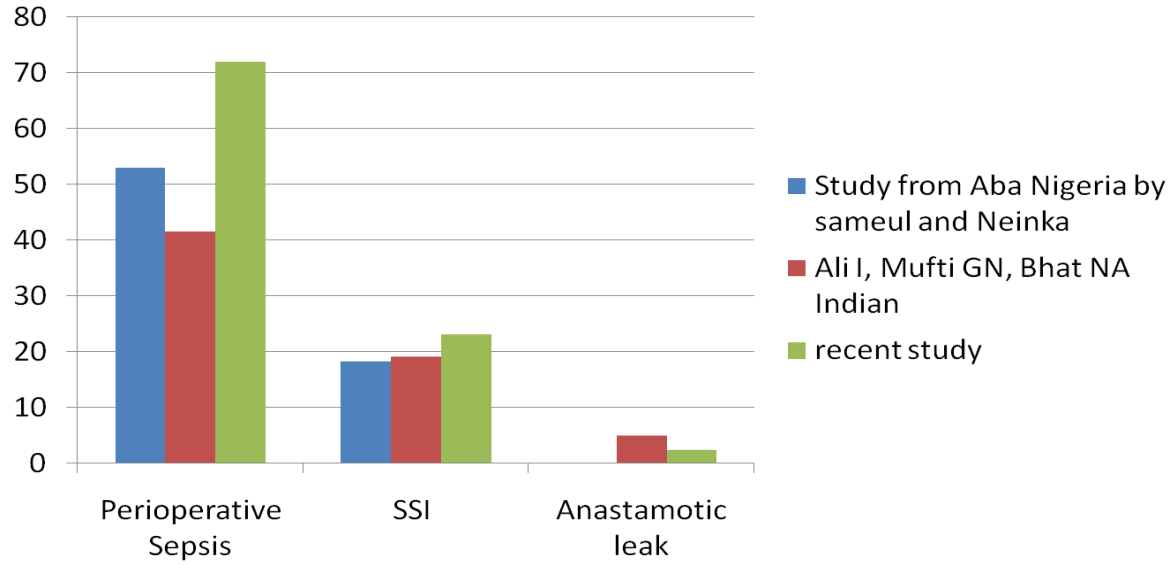


Modern supportive care in the intensive care unit (ICU) with continuing fluid resuscitation, parenteral nutrition, and respiratory support have been the bases for the increased survival rate. In countries where parenteral nutrition is not available, transanastomotic tubes have been tried with indefinite success for the purpose of early feeding. This postoperative management will make all the difference to the survival of neonates in Africa.

The overall morbidity in this report was 48.5%. The commonest procedure related (surgical) complications developed postoperatively were surgical site infection(wound)in 19(23.2%), parastomal skin excoriation 5 (6.1%), persistent post operative ileus in 7 (8.5%) and colostomy site mucosal ischemia seen in 4 (4.9%). Sepsis is a common complication in surgical neonates due to immature immune system, malnutrition, invasive procedures and late presentation

increases the risk of sepsis. 72% of our patients had infective conditions, which accounted for the greatest number of morbidities (Table 4). Sowande et al [10] noted that Sepsis the most common complication and had the worst outcome, followed closely by respiratory and bleeding problems. This agrees with the series reported by Ameh et al [11]. In addition, may be because most of these patients were poorly resuscitated from the referring hospital, coupled with the poor transportation condition they were subjected to predisposed them to such high level of complications.

Graph .... Common post operative complications compared(percent)



The mortality of 20.7% in this series which is similar compared to 21% reported in previous study by Mustefa and co workers. But still it is higher compared to studies from Aba Nigeria which was 11%. The mortality rates among term and pre-term babies were 8.9% (5/56) and 42.3% (11/26) respectively (p=0.04).

The problems of lack of facilities for neonatal intensive care(respiratory support) and total parenteral nutrition however remain are possible contributor in addition to sepsis. This is in contrast to developed countries where mortality from the common causes of neonatal intestinal obstruction has reduced (5, 8, 15, 17), mostly due to earlier presentation and availability of improved neonatal support facilities. It is hoped that the outcome in our environment will improve further as facilities improve and more patients present early.

Conclusion and Recommendation

Early diagnosis and timely intervention, and dedicated neonatal surgical and intensive care are undoubtedly the crucial factors in improving outcome in NIO. The pattern of neonatal intestinal obstruction presentation is not different from other sub Saharan African countries and some Asian nations as well but mortality found out higher than those comparable nations.

As most of the patients are referred from health centers birth attendants are usually the first attending health professionals for early diagnosis in most instances. Education of all birth attendants in recognition of signs of NIO (e.g. bilious vomiting, abdominal distension, failure to pass stools, imperforate anus) and early referral and improvement in facilities may reduce mortality from NIO in developing world.

Intra operative anesthetic incidents identified as adversely affect the outcome so improvement on neonatal anesthesia service with close communication with surgeons should be taken as a priority.

Considering high level of sepsis, under resuscitation and hypothermia at arrival, we recommend nasogastric suction, fluid resuscitation, intravenous antibiotics and warm care should be provided by first contact physician in suspected cases of NIO before referral.

Most referral are outside of Addis Ababa, considering possible constraints of transportation(which are possible reason for delayed presentation, expanding pediatric surgical service closer to the community need to be taken by the government seriously to address the problem.

Early diagnosis at antenatal services using ultrasonographic techniques is also needed as some of those causes of neonatal intestinal obstruction can be suspected on prenatal ultrasound. Health education during antenatal visits and health insurance will help to reduce late presentation.

Advocacy to the government on the need of upgrading of facilities and training of workers will enhance the overall outcome.

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APPENDIX I: Participating neonate parents or care givers consent

MRN……

The pupose of this study is evaluate operative outcome of neonates with intestinal obstruction who managed surgically at TASH. The result of this study will help to improve the outcome of neonates operated for intestinal obstruction and prevent subsequent complications.

There is no risk anticipated for participating in the study, but if any complication happens to your baby during the study, optimal treatment will be given you by the most senior surgeon. Ethical clearance has been obtained from surgical department of AAU and hospital ethical committee.

Contact of surgical department, AAU/ respective hospital ethical committee

…….

…….

…….

……

Participant signature/thumb print…….Phone number……

Dr. Ashagre Gebremichael

MD, PSR IV, AAU, Ethiopia

Phone number 0934777348

APPENDIX 2: QUESTIONNAIRE

Surgical Outcome of Neonatal Intestinal Obstruction at TASH.

Part I- neonatal

1.1 Demography Data

1.1.1 MRN----------Date of admission ----------phone no.----------

1.1.2 Place of birth?(Home / Health center / Public hospital / Private hospital / here/)

1.1.3 Age at Admission----------(days) Age at operation_____(days)

1.1.4 Sex Male----- Female --------- Indeterminate ----------

1.1.5 Gestational age at presentation(Weeks)_____(Preterm___ Term___ Post term____)

1.1.6 Birth Weight _____(gram) (SGA____ AGA____ LGA) Weight at presentation_____

1.1.7 Address A) Addis Ababa B) Oromia C) Amhara D) SNNPR E) Others_____

1.1.8 Institution visited first A)Health center B) Private clinic/hospital C) public Hospitals D) From Home

1.2 Clinical Presentation

1.2.1 Duration of illness _____(days) _____(hrs)

1.2.2 Presenting symptoms

□ Bilious emesis Nonbilious emesis

□ Failure to pass meconium in the first day

□ Abdominal distension

□ Respiratory distress

Other (specify) _____

1.2.3 Any other associated symptoms_____

1.2.4 Vital signs at presentation PR_____RR_____T_____BP_____

1.3 Test done to support or confirm the diagnosis and findings

1.3.1 Blood tests

CBC WBC_____HGB_____PLT_____

RFT Cr_____ BUN_____ Not done_____

Serum Electrolyte K+_____ Na+_____ Cl- _____ Ca++_____ Not done_____

Other tests done_____

1.3.2 Imaging studies done

- Plain abdominal x-ray _____ Finding_____
- Ultrasound _____ Finding_____
- CT Scan_____ Finding_____
- Contrast study_____ Finding_____
- others specify_____

1.3.3 Preoperative diagnosis_____

1.3.4 Any co morbidities identified(including associated anomalies renal, cardiac,CNS,,etc)_____

1.4 preoperative Management

1.4.1 Is the patient needed preoperative fluid resuscitation? Yes_____ No_____

1.4.1.1 If yes, what type of fluid given?_____(N/S R/L 10%DW 5%DW or other)

1.4.1.2 If yes , how much fluid given?_____(ml/kg calculated)

1.4.1.3 How much is the urine output before surgery ?(ml/kg/hr calculated)

1.4.2 Is the patient needed preoperative antibiotics? Yes_____ No_____

1.4.2.1 If yes, which antibiotics?_____

1.4.3 Is a trial of conservative management before surgery? Yes_____ No_____

1.4.4 Is fluid and electrolyte derangement corrected before surgery? Yes_____ No_____

1.5 Intraoperative Course

1.5.1 Is the surgery performed as emergency or elective?_____

1.5.2 Time period between admission and operation_____(in days or hours)

1.5.3 Is there any delay after surgery decided? Yes_____ No_____

1.5.3.1 If yes, what are the reasons for delayed intervention?

1. delayed resuscitation
2. delayed arrival of investigations
3. lack of hospital logistics(OR table occupied, lack of medications...)
4. others specify_____

1.5.4 what type of anesthesia given for the patient before surgery?

1. General anesthesia with ET Intubation
2. Regional anesthesia
3. Sedation only
4. Others specify_____

1.5.5 Any anesthetic related complication during intubation and during surgery ? Yes _____No_____

1.5.5.1 If yes what are they?

1. Aspiration of Oropharyngeal or GI contents
2. Progressive desaturation on table
3. Cardiac arrest on table
4. others specify_____

1.5.6 What type of abdominal incision used ?

1. RUQ Transverse
2. LLQ Transverse
3. LUQ Transverse
4. Midline(supraumblical_____ Infraumblical_____)
5. others specify_____

1.5.7 Intraoperative finding (by surgeon)_____

1.5.7.1 Is there bowel perforation? Yes_____ No_____

1.5.7.1.1 If yes , which part of the bowel?

1.5.7.2 Is there gangrenous bowel? Yes_____ No_____

1.5.7.2.1 If yes, which segment of bowel?_____

1.5.8 Intraoperative diagnosis_____

1.5.9 Type of Procedure done_____

1.5.10 A) Intraoperative blood loss_____(ml) B) Any accident during surgery specify_____

1.5.11 Is the patient transfued intraop?_____Is inotrops given?_____Is steroid given?_____

1.5.12 Total duration of surgery_____(min/hr) Total duration of anesthesia_____(min/hr)

1.5.13 Operation performed by (as surgeon)

1. consultant
2. pediatric surgery fellow
3. senior pediatric surgery resident
4. Junior pediatric surgery resident
5. others, specify_____

1.6 Post operative course

1.6.1 Where is the patient taken after surgery?(ICU/Wards/NICU/ Others specify_____)

1.6.2 For how long is the patient kept NPO?_____(Hrs/Days)

1.6.3 Is the patient on IV antibiotics postoperatively? Yes_____ No_____

1.6.3.1 If yes, For how long?_____(days)

1.6.4 Post operative complications developed? Yes_____ No_____

SURGICAL COMPLICATIONS *(tick as appropriate)*		**MEDICAL COMPLICATIONS** *(tick as appropriate)*	
Wound sepsis		Apnea	
Peritonitis/ Abscess		Hypothermia	
Gut necrosis/leak		Pneumonia	
Fistula Formation		UTI	
Persistent ileus		Others specify	
Others (specify			

1.6.5 Is the patient needed reoperation? Yes_____ No_____

1.6.5.1 If yes, for which complications?_____

1.6.5.2 How many times is reoperated?_____

1.6.6 Duration of hospital stay after surgery?_____(days)

1.6.7 Eventual outcome

Alive	ADMISSION DATE	
	DISCHARGE DATE	
Dead	ADMISSION DATE	
	DATE OF DEATH	
	CAUSE OF DEATH	

2 Maternal data

Maternal age _____

Parity of the mother_____

ANC: □ Yes □ No

Any identified problem during pregnancy_____

(DM/polyhydraminos/oligohydraminos/preeclamsia...etc)

Mode of delivery: □ SVD □ C/S □instrumental delivery